NEW MEXICO ENVIRONMENT DEPARTMENT
INSPECTION OF PUBLIC RECORD REQUEST FORM

Please fill out the following information:

1. Date: July 19, 2017

2. Requestor's Name: Jaimie Park, New Mexico Environmental Law Center

3. Requestor's Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

4. Phone No.: (505) 989-9022

5. Email: **jpark@nmelc.org**

6. Company Being Represented: New Mexico Environmental Law Center

7. Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

8. Document or File being requested to be reviewed or copied (please describe the records in sufficient detail to enable Department personnel to reasonably identify & locate the records:

I request that you inform me what documents are available within the scope of this request and when I can inspect those documents. I also request that you not make any copies without first informing me of the number of copies and the cost for the copying that are involved. Finally, I request that if you determine that any documents or portions of documents are exempt from disclosure you inform me of that and provide me with citations to the provisions in the Inspection of Public Records Act that indicate that the documents or portions of documents are exempt from disclosure, describe the type of document being withheld, and identify who sent the document being withheld and who received the document being withheld.

Records being requested:

1. NMED's technical completeness determination or additional request for information on New Mexico Copper Corporation's discharge permit application, date range June 28, 2017 through July 19, 2017;

2. NMED determination regarding Copper Flat Copper Mine pit lake being a private water, date range June 28, 2017 through June 19, 2017;

3. Bureau of Land Management request to the Surface Water Quality Bureau to write a letter of concurrence for the Surface Water Quality Bureau's benefit regarding the proposed Copper Flat Copper Mine pit lake and associated patented claims surveys completed and a

finding that the pit lake constitutes a "private water" and is not subject to either surface or groundwater quality standards; and

4. New Mexico Copper Corporation submittals to NMED pertaining to its discharge permit application since June 28, 2017.

9. NMED Bureau where Document/File can be found (if known): Surface Water Quality Bureau, Ground Water Quality Bureau

/s/ Jaimie Park
Signature

The cost for copying by NMED is as indicated on Attachment A. Please send this request to:

Melissa Y. Mascareñas
Inspection of Public Records Officer
1190 St. Francis Drive, Ste. N-4050
Santa Fe, New Mexico 87505
fax: (505) 827-1628 or
email: melissa.mascarenas@state.nm.us

SUSANA MARTINEZ
Governor
JOHN A. SANCHEZ
Lt. Governor

NEW MEXICO ENVIRONMENT DEPARTMENT

Harold Runnels Building
1190 Saint Francis Drive (87505)
PO Box 5469, Santa Fe, NM 87502-5469
Phone (505) 827-2990 Fax (505) 827-1628
www.env.nm.gov

BUTCH TONGATE
Cabinet Secretary
J.C. BORREGO
Deputy Secretary

MEMORANDUM

To: Shelly Lemon, Chief, Surface Water Quality Bureau
Michelle Hunter, Chief, Ground Water Quality Bureau

From: Melissa Y. Mascareñas, Department Public Records Custodian

Date: September 6, 2017

Subject: Request to Inspect Public Records

We have received a request from **Ms. Jaimie Park** asking for information regarding:

SEE ATTACHED REQUEST.

The Inspection of Public Records Act requires a response to a requester of public records within fifteen (15) calendar days from receipt of a request. Please respond to the requestor by no later than **September 21, 2017**.

Your response may take several forms:

a) Provide the requested information; or
b) Notify the requester of a delay; you must give reasons for the delay and the date when the information will be available; or
c) Deny the request or part of it; provide the records that can be released and identify the reason(s) for denial of any records; or
d) Ask for more information or clarification; and
e) Notify the requester of any mailing or photocopy charges.

A copy of my initial response to this request is attached for your records. **Please provide me with a copy of any responses you make to this request and/or notify me when the records have been made available for inspection.**

NEW MEXICO ENVIRONMENT DEPARTMENT
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9. NMED Bureau where Document/File can be found (if known): Surface Water Quality Bureau, Ground Water Quality Bureau

/s/ Jaimie Park
Signature

The cost for copying by NMED is as indicated on Attachment A. Please send this request to:

Melissa Y. Mascareñas
Inspection of Public Records Officer
1190 St. Francis Drive, Ste. N-4050
Santa Fe, New Mexico 87505
fax: (505) 827-1628 or
email: melissa.mascarenas@state.nm.us

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

September 27, 2017

GROUND WATER
SEP 28 2017
BUREAU

Ms. Shelly Lemon, Chief
Surface Water Quality Bureau
New Mexico Environment Department
1190 St. Francis Dr.
P.O. Box 5469
Santa Fe, New Mexico 87502

RE: BLM Review and Concurrence with NMCC-Commissioned Surveys in the Area of the Copper Flat Pit, Sierra County, New Mexico

Dear Ms. Lemon,

I am writing to share with you the results of the Bureau of Land Management (BLM) review of New Mexico Copper Corporation (NMCC)-commissioned land surveys in the area of the current pit at Copper Flat.

Recall that NMCC noted an error in public GIS documents depicting the property boundary between public land and NMCC-owned property at the Copper Pit. This error placed the property boundary over one part of the existing pit lake, while NMCC's surveys placed the boundary approximately 300 feet to the west, which places the existing pit lake entirely on NMCC-owned private property. NMCC met with BLM on this topic and agreed to address this issue by engaging an independent registered land surveyor to prepare a property plat. During discussions, BLM also confirmed NMCC's understanding that the GIS maps available to the public do not necessarily reflect true boundary locations, and BLM thus requires that all boundaries be by survey.

The property plat for the pit area was completed and sealed by a registered land surveyor, recorded with Sierra County, and submitted to BLM for review. A scan copy of the sealed and recorded plat is enclosed for your information. BLM has reviewed the plat and has accepted the survey and platted location of the private property boundaries at the Copper Flat Pit. Please see the enclosed letter from Ida T. Viarreal, Land Law Examiner for the BLM dated September 13, 2017 and the accompanying map. As you will see, BLM has updated their Master Title Plats and have requested updates to the GIS layer for this area to conform to the findings of the NMCC survey.

The survey and plat confirm that the current pit body is entirely on private lands, as shown on the plat submitted to BLM. NMCC has proposed a design that will confine the surface of the water body in the future pit entirely to private lands.

It is our conclusion that the current and future pit water body will meet the exception in 20.6.4.7(S)(5) that excludes "private waters that do not combine with other surface or subsurface water, or any other water under tribal jurisdiction pursuant to Section 518 of the Clean Water Act." We respectfully request that the Surface Water Quality Bureau review BLM's conclusion and issue a determination that the current and future pit water will not be a "surface water of the state". If you have further questions or would like to discuss this matter, please contact me at 520-991-4588 or jsmith@themacresourcesgroup.com.

Best regards,
New Mexico Copper Corporation

J Smith

Jeff Smith
Chief Operating Officer

Attachments:

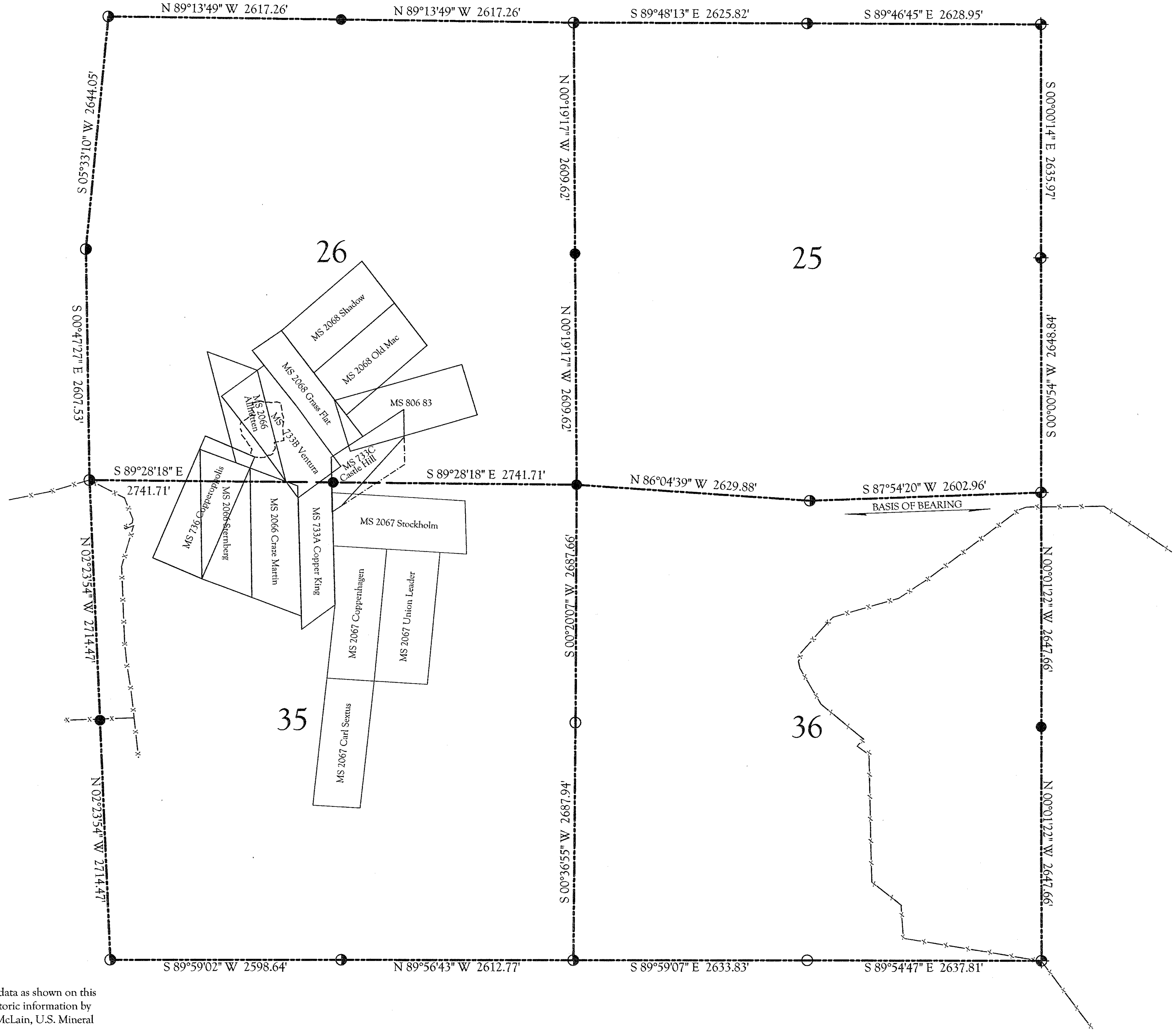
1. Copper Flat Boundary Survey Plat, March 1, 2017
2. BLM letter from Ida Viarreal, September 13, 2017
3. BLM Map Township 15 South, Range 7 West

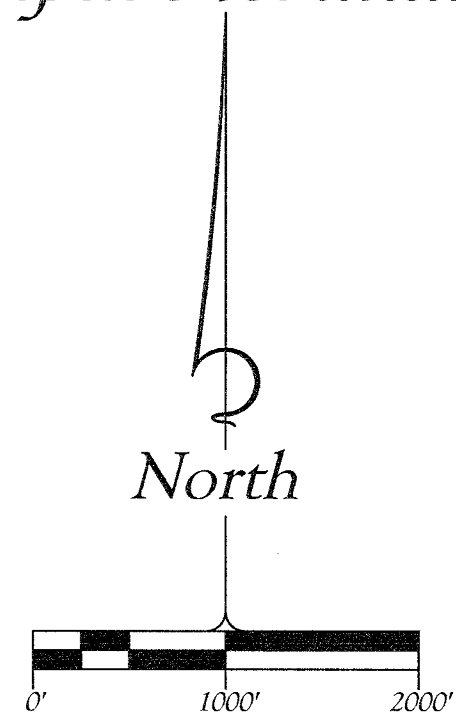
CC: Douglas Haywood, Bureau of Land Management, Lands/Minerals Supervisor
Leighandra Keevan, Bureau of Land Management, Geologist
David Henney, Solv, LLC, Project Manager
Brad Reid, New Mexico Environment Department, Groundwater Quality Bureau
David Ennis, Energy, Minerals & Natural Resources Department, Mining & Minerals Division

BOUNDARY SURVEY PLAT

Book 127
Page 4193

Sections 25, 26, 35, 36 and Mineral Surveys 733A Copper King, 733B Ventura, 733C Castle Hill, 736 Copperoppolis 806 83, 2066 Craze Martin, Sternberg, Allhutten, 2067 Stockholm, Coppenhagen, Union Leader, Carl Sextus, 2068 Grass Flat, Shadow and Old man, Township 15 South, Range 7 West, of the New Mexico Principal Meridian Sierra County, New Mexico





Scale: 1" = 1000 Survey Feet

BASIS OF BEARING:

The South line of the SE ¼ of section 25, T. 15 S., R. 7 W., N.M.P.M. bears S. 87°54'20" W. and is monumented as shown hereon. All other bearings are relative thereto.

LEGEND

- Found 3 ¼" USGLO Brass Cap 1941. Added washer LS 7004.
- Set 2 ½" alum. cap on #6 rebar, 18" long - LS 7004.
- USGLO stone, firmly set and properly marked. Added washer LS 7004.
- Found 1 ½" aluminum cap on a #5 rebar - LS 3516. Added washer LS 7004.
- Found 2" aluminum cap on a ¾" pipe - MS 2317. Added washer LS 7004.
- —X——X— Fence Line
- – – – – – Pit lake edge.

LIST OF REFERENCE PLATS & NOTES:

Original Survey T. 15 S., R, 7 W., N.M.P.M. approved February 3, 1882.
Dependent Resurvey T. 15 S., R. 6 W., N.M.P.M. approved January 1, 1943.
Mineral Survey's 733A, 733B and 733C, approved September 28, 1888.
Mineral Survey 736, approved September 8, 1888.
Mineral Survey 806, approved September 16, 1889.
Mineral Survey 2066, approved September 22, 1937.
Mineral Survey 2067, approved October 11, 1937.
Mineral Survey 2068, approved October 30, 1937.
Mineral Surveys 2312, 2313, 2314, 2315, 2316 and 2317, approved December 28, 1982.

GENERAL NOTES:

All fence lines shown hereon are for graphical purposes only. They may not be relied upon to establish property boundaries.

This survey was performed without the benefit of a title policy or commitment and does not constitute a title search by Southwest Land Surveying & Consulting.

Note:
The Mineral Surveys and sectional data as shown on this plat were re-monumented using historic information by surveys performed by Gordon W. McLain, U.S. Mineral Surveyor and LS 4796.

CERTIFICATE OF SURVEY:

I, Earnest E. Schaaf, New Mexico Professional Land Surveyor No. 7004, do hereby certify that this BOUNDARY SURVEY PLAT and the actual survey on the ground upon which it is based were performed by me or under my direct supervision; that I am responsible for this survey; that this survey meets the Minimum Standards for Surveying in New Mexico; and that it is true and correct to the best of my knowledge and belief. I further certify that this survey is not a land division or subdivision as defined by the New Mexico Subdivision Act and that this instrument is a BOUNDARY SURVEY PLAT of an existing tract or tracts.

Signature
PLS No. 7004
Date 3/1/2017

EARNEST E. SCHAAF NEW MEXICO 7004 REGISTERED PROFESSIONAL SURVEYOR

LAND SURVEY DEPOSIT
Date ____________
Book ________ Page ________
Deposit No. ____________

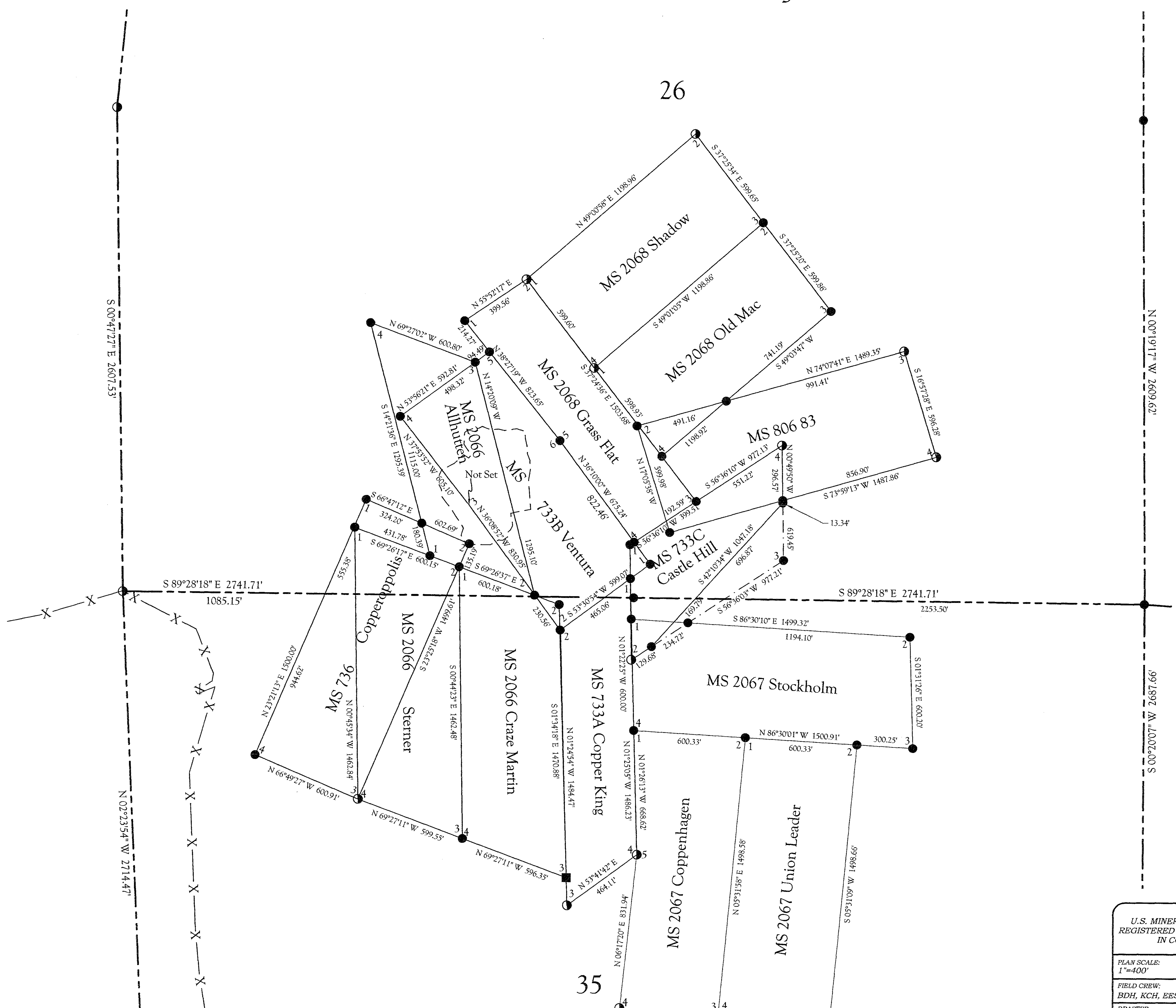
U.S. MINERAL SURVEYORS REGISTERED LAND SURVEYORS IN COLORADO	SOUTH WEST LAND SURVEYING & CONSULTING P.O. Box 563 Delta, CO 81416 (970) 387-0600...Silverton (970) 874-2880...Delta EMAIL: dhatter@itcresources.us	
PLAN SCALE: 1"=1000'	REVISIONS:	
FIELD CREW: BDH, KCH, EES, TTS	Boundary Survey Plat Sections 25, 26, 35, 36 and Mineral Surveys 733A, 733B, 733C, 736, 806, 2066, 2067, 2068 T. 15 S., R. 7 W., N.M.P.M., Sierra County, New Mexico	THEMAC RESOURCES 4053 Montgomery Blvd., NE Suite 130 Albuquerque, New Mexico 87109
DRAFTER: BDH		FW: 1/18/17
SHEET 1 of 3		JOB #: 25-16 NMCC

15701

BOUNDARY SURVEY PLAT

Book 127
Page 4194

Sections 25, 26, 35, 36 and Mineral Surveys 733A Copper King, 733B Ventura, 733C Castle Hill, 736 Copperoppolis 806 83, 2066 Craze Martin, Sternberg, Allhutten, 2067 Stockholm, Coppenhagen, Union Leader, Carl Sextus, 2068 Grass Flat, Shadow and Old man, Township 15 South, Range 7 West, of the New Mexico Principal Meridian Sierra County, New Mexico



North

0' 400' 800'

Scale: 1" = 400 Survey Feet

BASIS OF BEARING:

The South line of the SE 1/4 of section 25, T. 15 S., R. 7 W., N.M.P.M. bears S. 87°54'20" W. and is monumented as shown hereon. All other bearings are relative thereto.

LEGEND

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- Set 2 1/2" alum. cap on #6 rebar, 18" long - LS 7004.
- Found stone, firmly set and properly marked as per USGLO note.
- Found 1 1/2" aluminum cap on a #5 rebar - LS 3516. Added washer LS 7004.
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LAND SURVEY DEPOSIT
Date ________
Book ________ Page ________
Deposit No. ________

U.S. MINERAL SURVEYORS REGISTERED LAND SURVEYORS IN COLORADO

SOUTH WEST LAND SURVEYING & CONSULTING
P.O. Box 563 Delta, CO 81416
(970) 387-0600...Silverton (970) 874-2880...Delta
EMAIL: dhatter@itcresources.us

PLAN SCALE: 1"=400'	REVISIONS:	Boundary Survey Plat	THEMAC RESOURCES 4053 Montgomery Blvd., NE Suite 130 Albuquerque, New Mexico 87109
FIELD CREW: BDH, KCH, EES, TTS		Sections 25, 26, 35, 36 and Mineral Surveys 733A, 733B, 733C, 736, 806, 2066, 2067, 2068 T. 15 S., R. 7 W., N.M.P.M., Sierra County, New Mexico	
DRAFTER: BDH			FW: 1/18/17 JOB #: 25-16 NMCC
SHEET 2 of 3			

15702

BOUNDARY SURVEY PLAT

Book 127
Page 4195

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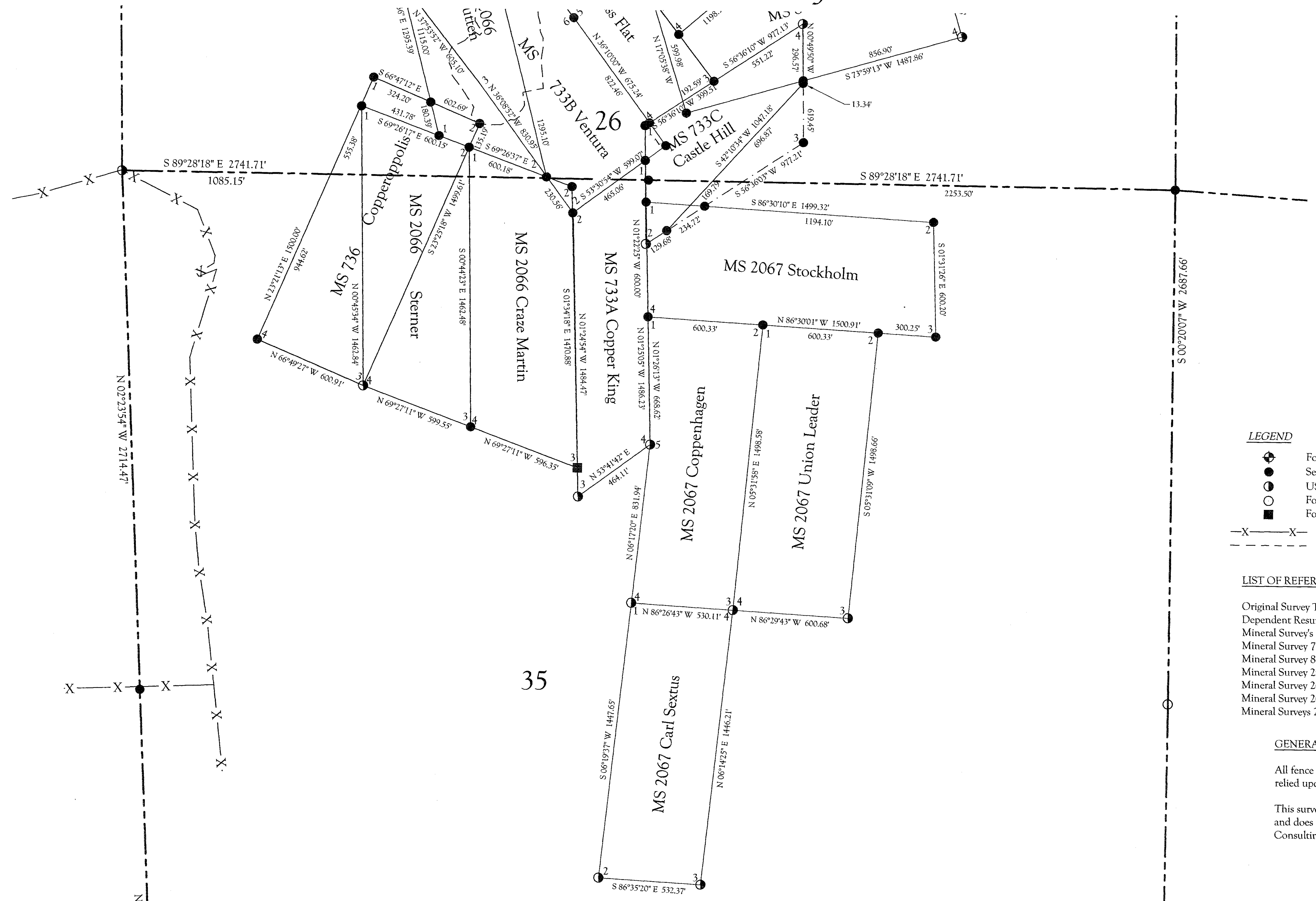

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LAND SURVEY DEPOSIT
Date ____________
Book ________ Page ________
Deposit No. ____________

STATE OF NEW MEXICO } SS
County of Sierra

I HEREBY CERTIFY that this instrument was filed for record on the 8TH day of MAR A.D., 20 17 at 9:24 o'clock A M. and duly recorded in book 127 page 4193-4195
Fee $ 50.00
Shelly K. Trujillo
County Clerk, Sierra County, N.Mex
By Debby Turner
Deputy

U.S. MINERAL SURVEYORS REGISTERED LAND SURVEYORS IN COLORADO	SOUTH WEST LAND SURVEYING & CONSULTING P.O. Box 563 Delta, CO 81416 (970) 387-0600...Silverton (970) 874-2880...Delta EMAIL: dhatter@itcresources.us
PLAN SCALE: 1"=400'	REVISIONS:
FIELD CREW: BDH, KCH, EES, TTS	
DRAFTER: BDH	
SHEET 3 of 3	

Boundary Survey Plat
Sections 25, 26, 35, 36 and Mineral Surveys 733A, 733B, 733C, 736, 806, 2066, 2067, 2068 T. 15 S., R. 7 W., N.M.P.M., Sierra County, New Mexico

THEMAC RESOURCES
4053 Montgomery Blvd., NE
Suite 130
Albuquerque, New Mexico 87109

FW: 1/18/17
JOB #: 25-16 NMCC

15703

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
New Mexico State Office
301 Dinosaur Trail
P.O. Box 27115
Santa Fe, New Mexico 87502-0115
www.blm.gov/nm

TAKE PRIDE® IN AMERICA

In Reply Refer To:
3833 (NM9212-itv)

September 13, 2017

Jeff Smith
Thermac Resources
New Mexico Copper Corp.
4253 Montgomery Blvd. NE suite 130
Albuquerque, NM 87109

Dear Mr. Smith:

Based on your request we have review our records for the area of the Copper Flat Mine which is located in Township 15 S., Range 7 W., Sections 25, 26, 35 and 36.

We reviewed all the mineral surveys in the area and updated our Master Title Plats to insure that the status of the lands was noted correctly. We have also requested updates to the GIS layer for this area.

Enclosed is a revised Master Title Plat. I hope this clarifies the status of the lands in your area. We have also placed the survey completed by your surveyor in the mining claim case files and in the 3809 Plan casefiles.

If you have any questions, please call me at (505) 954-2163; facsimile at (505) 954-2079; or write to the attention of NM9212 at the BLM address above or e-mail to iviarrea@blm.gov.

Ida T. Viarreal

Ida T. Viarreal
Land Law Examiner
Solid Minerals Adjudication

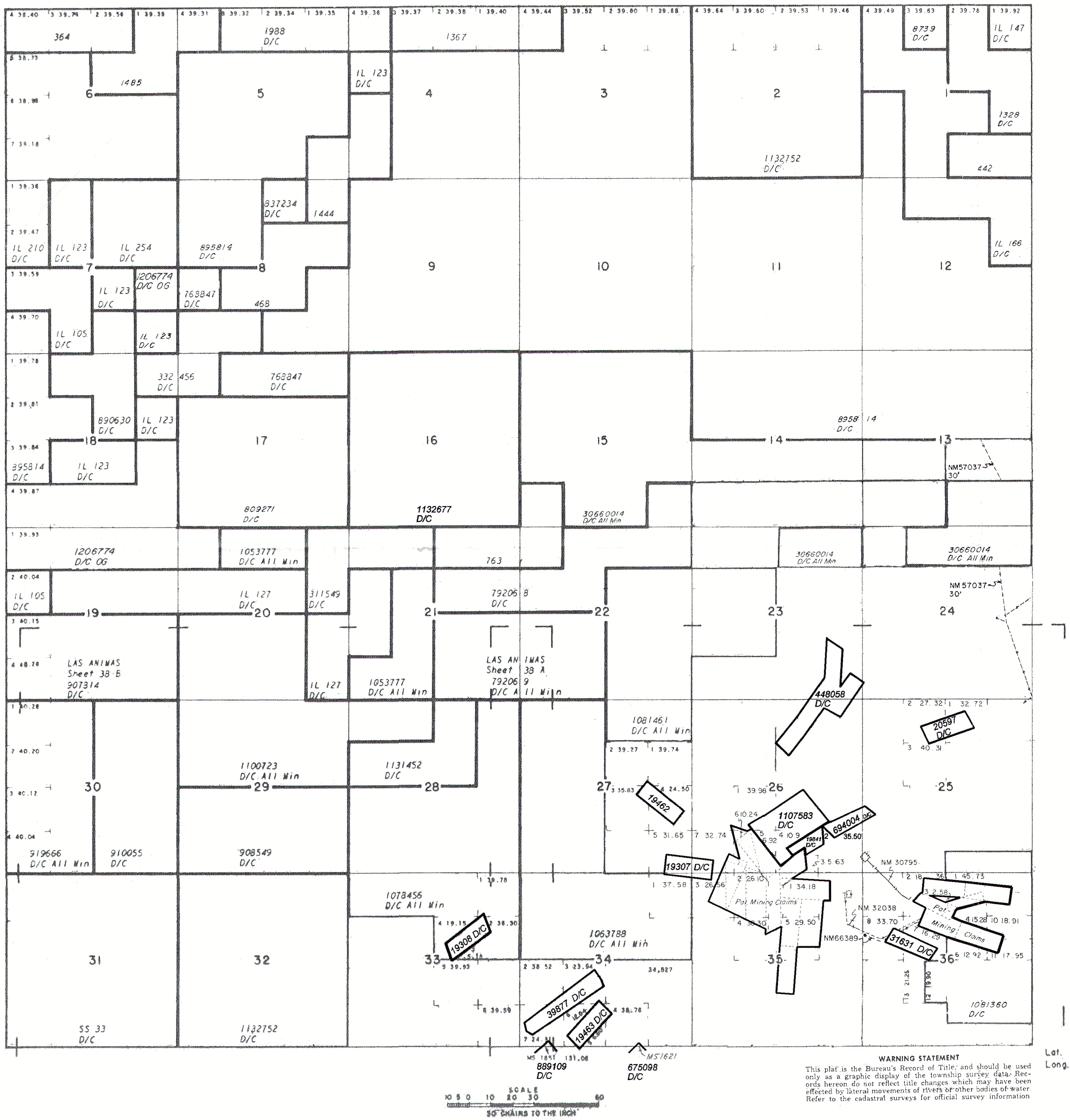
TOWNSHIP 15 SOUTH, RANGE 7 WEST, OF THE NEW MEXICO PRIN. MERIDIAN, NEW MEXICO.

SIERRA COUNTY — 051

NM — 3

STATUS OF PUBLIC DOMAIN
LAND AND MINERAL TITLES

MTP



WARNING STATEMENT

This plat is the Bureau's Record of Title and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

Lat.
Long.

INDEX TO SEGREGATED TRACTS

RESURVEY	ORIGINAL SURVEY			
TRACT NO	T	R	SEC	SUBDIVISION

FOR ORDERS EFFECTING DISPOSAL OR USE OF UNIDENTIFIED LANDS WITHDRAWN FOR CLASSIFICATION, MINERALS, WATER AND/OR OTHER PUBLIC PURPOSES, REFER TO INDEX OF MISCELLANEOUS DOCUMENTS.

Sec. 36 IL Base

CURRENT TO	BY

T. 15 S
R. 7 W
NMPM

15705

Memorandum of Meeting or Phone Conversation

☐ Telephone ☑ Meeting	**Time:** 1:30-2:30 pm	**Date:** 10-03-17

Individuals Involved

Brad Reid, Kurt Vollbrecht, (NMED-MECS)	☐ called	Jeff Smith, Katie Emmer (New Mexico Copper Corporation "NMCC"); Juan Velasquez (NMCC consultant)

Subject:
Discussion regarding DP Application Status

Discussion:
NMED met with representatives from NMCC as well as their consultant that prepared the Discharge Permit Application. NMED requested that NMCC provide additional information regarding the following:

1) Impact of rapid fill on the pit hydrologic evaporative sink and verification that rapid fill will not cause a flow-through pit.
2) Water quality proposed to be used for the rapid fill effort (supply wells?).
3) Need a figure showing pit ground water capture at closure.

Conclusions:

Distribution: DP-1840 folder

Initialed BR

15708

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

October 13, 2017

Mr. David Ennis, P.G.
Reclamation Specialist/Permit Lead
New Mexico Energy, Minerals and Natural Resources Department
Mining and Minerals Division
1220 South St. Francis Drive
Santa Fe, NM 87505

Re: Oct. 5, 2017 Request for Additional Information
Updated MORP Rev.1, 2017
New Mexico Copper Corporation, Copper Flat Mine
Permit Tracking No. S1027RN

Dear Mr. Ennis,

Pursuant to your request of October 5, 2017 New Mexico Copper Corporation (NMCC) hereby submits additional information as follows:

1. Enclosed is a Technical Memorandum from GeoSystems Analysis, Inc. (GSA) to NMCC that provides a literature review of wildlife use of mine pit walls. The enclosed memorandum supports NMCC's statement that the pit walls, post reclamation, will be suitable for achieving a self-sustaining ecosystem appropriate for the life zone of the surrounding area or proposed post-mining land use of steep-canyon wildlife habitat. The GSA memorandum notes that several agencies, including BLM and the US Forest Service, recognize pit walls as nesting and other habitat. Additionally, the GSA memorandum includes as Appendix A, a copy of the New Mexico Department of Game & Fish Habitat Guidance for Mine Operations and Reclamation, which clearly supports the use of pit walls as wildlife habitat. The NMG&F Guidance concludes that vertical habitat diversity is the single-most important factor contributing to avian species diversity and that pit highwalls can provide a vertical habitat feature that mimics natural cliffs or rimrock.
2. Enclosed is NMCC's proposed reclamation/revegetation plan for accessible portions of the dry open pit surface that do not rely on exclusively on self-vegetation. NMCC's plan will reclamation 55 acres of the 129 acre pit shell, and includes 35 acres of revegetated surface area.
3. The information you require to address Sections 19.10.6.602(D)(13)(g)(v)NMAC and 19.10.6.603.C(4) NMAC, i.e., probable hydrologic consequences and hydrologic balance, will be submitted to you under separate cover as soon as it becomes available.

Please contact me at with any questions.

Sincerely,

J Smith

Jeff Smith
Chief Operating Officer
New Mexico Copper Corporation

GeoSystems Analysis, Inc.
Innovative Solutions

TECHNICAL MEMORANDUM

September 25, 2017

TO: Katie Emmer, New Mexico Copper Company

FROM: William Widener, GeoSystems Analysis, Inc.

RE: Literature Review of Wildlife Use of Mine Pit Walls

Literature Review of Wildlife Use of Mine Pit Walls

Large cliff faces are well documented as providing habitat for wildlife species, specifically birds and raptors. Pit walls of reclaimed mine sites can provide similar substrates, and are also known to be used by some species, most notably Peregrine Falcons. For example, Bell (2001) compiled multiple documentations of Peregrine Falcon and other raptors utilizing high walls in rock quarries in Great Britain, Australia and Germany in looking to expand the practice into the lowlands of Western Washington. Ritchie et al. (1998) documented Peregrine Falcons nesting in quarry sites and road cut banks with a similar structure to hard rock pit walls in Alaska.

Dobra (2002) also documents that raptors have utilized high pit walls of at least one Nevada mine operation. Other raptors, such as red-tailed hawks have also been cited as utilizing open pit mines in New Mexico (Garber et al. 2005). The canyon walls of the Snake River in Idaho provide extensive nesting substrate for the densest concentration of noncolonial nesting raptors, with more than 1,500 raptors, consisting of up to 14 different species, nesting annually (Kochert and Pellant 1986). In New Mexico, the abundance of cliff walls of the Upper Rio Grande Gorge, the Orilla Verde Recreation Area, and the Rio San Antonio Gorge provide ideal nesting substrate for many raptor species, including Golden Eagle, Prairie Falcon, Peregrine Falcon, Red-tailed Hawk and Great Horned Owl (Hawks Aloft, Inc. 2011).

Bat use of abandoned underground mines is well documented. Tuttle & Taylor (1994) found that 30% to 80% of 8,000 mines surveyed across North America showed signs of bat use, though, not much information is available regarding specific bat use of pit walls, which could provide roosting habitat for many species, and more permanent habitat for non-colonial bat species.

Multiple federal agencies, including the United States Forest Service and Bureau of Land Management, recognizes that steep pit walls provide habitat for nesting raptors, other cliff dwellings birds, bats and that the associated talus could also be utilized by other rock dwelling animals, such as reptiles. This is often written into the Environmental Impact Statements for mines (USFS 1997, USFS 1997, BLM 1996). This is consistent with the Draft Environmental Impact Statement for the Copper Flat Copper Mine, which states that following reclamation, "the pit walls and benches would become Chihuahuan Desert wildlife habitat,

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providing abundant rock outcroppings, which are regularly utilized by bats for day or night-roosting, or for cliff-dwelling bird species, such as raptors for nesting" (BLM 2015).

In 2004, the New Mexico Department of Game and Fish (NMGF) issued habitat guidelines for mine operations and reclamation. In these guidelines, they recommend that the habitat value of high walls can be "enhanced by design features including an undulating profile, niches or ledges on the face, and placing rubble at the toe of the wall." (NMGF 2004; Appendix A). Norman (1992) suggest the proper blasting of high walls to leave rough surfaces that provide habitat for birds, such as cliff swallows. The Wyoming Department of Environmental Quality/Land Quality Division's Guideline No. 5 states that operators should develop high (pit) walls to simulate natural rimrocks, and Benson (2002) goes into detail on how the Buckskin Mine of Wyoming will incorporate microtopography, aspect, ledges and holes to maximize habitat identified for several raptor and other bird species identified as potentially utilizing reclamation areas.

The Federal Geographic Data Committee maintains a list of official datasets, including the U.S Geological Survey (USGS) Gap Analysis Species Distribution Models & USGS Survey Gap Analysis Program Species Ranges. The New Mexico Department of Game and Fish, with help from other supporting agencies, have developed the Biota Information System of New Mexico (BISON-M), which is an on-line database of wildlife species within New Mexico. BISON-M utilizes the USGS's Gap data, which includes a habitat association category of "Barren: Mines & Quarries". A BISON-M query, returned a total of 51 species in Sierra County that have either "Casual" or "Important" use of the "Barren: Mines & Quarries" habitat association during any season of the year. This includes eight reptiles, six birds, and 37 mammals, 16 of which are bat species (Table 1).

A baseline data report was conducted during the permitting processes at the Copper Flat mine site. Sixteen species, including four bird and 12 bat species were detected in and around the existing pit lake (Intera, 2012) (Table 2). In 2013, an addendum was produced to respond to various agency comments to the original report. Additional surveys were conducted to address agency comments, specifically, waterfowl and other general use of wildlife at the pit lake. An additional 30 bird species, and five mammal species were observed near the pit lake with these new survey efforts. Undoubtedly, many of these species were attracted by the water in the pit lake, and it cannot be ascertained which of these species were utilizing the pit walls. However, the text of the addendum states multiple observations of wildlife utilizing the rock walls surrounding the pit lake. On one occasion, a Great Horned Owl was heard calling from the hills west of the pit lake. Rock wrens, Northern mockingbirds, Northern flickers, Common ravens, Mourning Doves, White-winged doves and Gambel's quail are stated to be the most active species during these additional surveys, and are noted as most frequently "heard calling from the hills surrounding the pit lake, typically from the higher tiers to the north of the lake". Violet-green swallows were observed drinking from the lake before returning to the tiered cliff faces to the northwest of the lake. Chipping sparrows were observed in a bush on the top tier to the south of the pit lake. Additional observations of raptor "white wash" were made on the pit wall west of the lake, indicating raptors perching, though no nesting was confirmed (THEMAC 2013). The closure design will be in similar structure to the baseline conditions, and would expect a similar species composition following reclamation.

Table 1. BISON-M Query Results of Sierra County Wildlife Species Known to Use "Barren: Mines & Quarries" Habitat Association

Life Form	Common Name	Scientific Name
Bird	Bank Swallow	*Riparia riparia*
Bird	Cliff Swallow	*Petrochelidon pyrrhonota*
Bird	Great Horned Owl	*Bubo virginianus*
Bird	N. Rough-winged Swallow	*Stelgidopteryx serripennis*
Bird	Say's Phoebe	*Sayornis saya*
Bird	Turkey Vulture	*Cathartes aura*
Mammal	American Badger	*Taxidea taxus*
Mammal	Black Bear	*Ursus americanus*
Mammal	Bobcat	*Lynx rufus*
Mammal	Brush Mouse	*Peromyscus boylii*
Mammal	Collared Peccary	*Peccari tajacu sonoriensis; angulatus*
Mammal	Common Gray Fox	*Urocyon cinereoargenteus*
Mammal	Common Hog-nosed Skunk	*Conepatus leuconotus*
Mammal	Common Raccoon	*Procyon lotor*
Mammal	Coyote	*Canis latrans*
Mammal	Deer Mouse	*Peromyscus maniculatus*
Mammal	Desert Bighorn Sheep (delisted pops)	*Ovis canadensis mexicana*
Mammal	Mexican Wood Rat	*Neotoma mexicana mexicana*
Mammal	Northern Rock Mouse	*Peromyscus nasutus*
Mammal	Ringtail	*Bassariscus astutus*
Mammal	Rock Pocket Mouse	*Chaetodipus intermedius*
Mammal	Rock Squirrel	*Otospermophilus variegatus grammurus*
Mammal	Striped Skunk	*Mephitis mephitis*
Mammal	Texas Antelope Squirrel	*Ammospermophilus interpres*
Mammal	White-nosed Coati	*Nasua narica*
Mammal	White-throated Wood Rat	*Neotoma albigula*
Mammal	White-toothed woodrat	*Neotoma leucodon*
Mammal (Bat)	Allen's Big-eared Bat	*Idionycteris phyllotis*
Mammal (Bat)	Big Brown Bat	*Eptesicus fuscus*
Mammal (Bat)	Brazilian Free-tailed Bat	*Tadarida brasiliensis*
Mammal (Bat)	California Myotis	*Myotis californicus*
Mammal (Bat)	Canyon Bat	*Parastrellus hesperus*
Mammal (Bat)	Fringed Myotis	*Myotis thysanodes*
Mammal (Bat)	Hoary Bat	*Lasiurus cinereus*
Mammal (Bat)	Long-eared Myotis	*Myotis evotis*
Mammal (Bat)	Long-legged Myotis	*Myotis volans*
Mammal (Bat)	Pale Townsend's Big-eared Bat	*Corynorhinus townsendii*
Mammal (Bat)	Pallid Bat	*Antrozous pallidus*
Mammal (Bat)	Silver-haired Bat	*Lasionycteris noctivagans*
Mammal (Bat)	Southwestern Little Brown Myotis	*Myotis occultus*
Mammal (Bat)	Southwestern Myotis	*Myotis auriculus*
Mammal (Bat)	Western Small-footed Myotis	*Myotis ciliolabrum*
Mammal (Bat)	Yuma Myotis	*Myotis yumanensis*
Reptile	Crevice Spiny Lizard	*Sceloporus poinsettii*
Reptile	Eastern Black-tailed Rattlesnake	*Crotalus ornatus*
Reptile	Eastern Collared Lizard	*Crotaphytus collaris*
Reptile	Great Plains Skink	*Plestiodon obsoletus*
Reptile	Northern Tree Lizard	*Urosaurus ornatus*
Reptile	Prairie Rattlesnake	*Crotalus viridis*
Reptile	Twin-spotted Spiny Lizard	*Sceloporus bimaculosus*
Reptile	Western Diamond-backed Rattlesnake	*Crotalus atrox*

Table 2. Species around Pit Lake at Copper Flat as documented in BDR & Addendum Reports

Life Form	Common Name	Scientific Name
Bird	American Widgeon	*Mareca americana*
Bird	Ash-Throated Flycatcher	*Myiarchus cinerascens*
Bird	Barn Swallow	*Hirundo rustica*
Bird	Black-Throated sparrow	*Amphisipiza bilineata*
Bird	Blue-Winged Teal	*Spatula discors*
Bird	Cactus Wren	*Campylorhynchus brunneicapillus*
Bird	Canvasback	*Aythya valisineria*
Bird	Canyon Wren	*Catherpes mexicanus*
Bird	Chipping Sparrow	*Spizella passerina*
Bird	Cinnamon Teal	*Spatula cyanoptera*
Bird	Common Raven	*Corvus corax*
Bird	Crissal Thrasher	*Toxostoma crissale*
Bird	Eurasian Collared Dove	*Streptopelia decaocto*
Bird	Gambel's Quail	*Callipepla gambelii*
Bird	Great Blue Heron	*Ardea herodias*
Bird	Great Horned Owl	*Bubo virginianus*
Bird	Greater Roadrunner	*Geococcyx californianus*
Bird	Horned Lark	*Eremophila alpestris*
Bird	House Finch	*Haemorhous mexicanus*
Bird	Killdeer	*Charadrius vociferus*
Bird	Loggerhead Shrike	*Lanius ludovicianus*
Bird	Mourning Dove	*Zenaida macroura*
Bird	Northern Flicker	*Colaptes auratus*
Bird	Northern Mockingbird	*Mimus polyglottos*
Bird	Northern Shovelor	*Spatula clypeata*
Bird	Red-tailed hawk	*Buteo jamaicensis*
Bird	Rock Wren	*Salpinctes obsoletus*
Bird	Say's Phoebe	*Sayornis saya*
Bird	Spotted Sandpiper	*Actitis macularius*
Bird	Swainson's Hawk	*Buteo swainsoni*
Bird	Turkey Vulture	*Cathartes aura*
Bird	Violet-Green Swallow	*Tachycineta thalassina*
Bird	Western Scrub-Jay	*Aphelocoma californica*
Bird	White-winged Dove	*Zenaida macroura*
Mammal	Coyote	*Canis latrans*
Mammal	Gray Fox	*Urocyon cinereoargenteus*
Mammal	Mule Deer	*Odocoileus hemionus*
Mammal	Rock Squirrel	*Otospermophilus variegatus*
Mammal	Striped Skunk	*Mephitis mephitis*
Mammal (Bat)	Arizona Myotis	*Myotis occultus*
Mammal (Bat)	Big Brown Bat	*Eptesicus fuscus*
Mammal (Bat)	Brazilian Free-tailed Bat	*Tadarida brasiliensis*
Mammal (Bat)	California Myotis	*Myotis californicus*
Mammal (Bat)	Canyon Bat	*Parastrellus helperus*
Mammal (Bat)	Fringed Myotis	*Myotis thysanodes*
Mammal (Bat)	Pallid Bat	*Antorzus pallidus*
Mammal (Bat)	Silver-Haired Bat	*Lasionycteris noctivagans*
Mammal (Bat)	Southern Hoary Bat	*Lasiurus cinereus*
Mammal (Bat)	Townsend's Big-Eared Bat	*Corynorhinus townsendii*
Mammal (Bat)	Western Small-Footed Myotis	*Myotis ciliolabrum*
Mammal (Bat)	Yuma Myotis	*Myotis yumanensis*

Cited References

Bell, Steve W. 2001. *Reclaiming Abandoned Rock Quarries for Peregrine Falcon Eyries in the Lowlands of Western Washington [master's thesis].* Pullman: Washington State University.

Benson, Scott A. 2002. Paper presented at: 2002 National Meeting of the American Society of Mining and Reclamation. June 9-13, 2002; Lexington KY. http://www.asmr.us/Portals/0/Documents/Conference-Proceedings/2002/0241-Benson.pdf. Accessed September 21, 2017.

[BISON-M] Biota Information System of New Mexico. 2017 September 21 BISON-M home page. http://www.bison-m.org. Accessed 2017 September 21.

[BLM] Bureau of Land Management. 2015. Copper Flat Copper Mine: Draft Environmental Impact Statement. Bureau of Land Management. Sierra County, New Mexico.

[BLM] Bureau of Land Management. 1996. Final Environmental Impact Statement: Twin Creeks Mine. Bureau of Land Management. Winnemucca, Nevada.

Dobra, John L. 2002. The U.S. Gold Industry. 2001. Nevada Bureau of Mines and Geology Publication SP32.

Garber, Gail & S. Young. 2005. Common Raptors and Other Large Birds of New Mexico. Hawks Aloft, Inc. prepared for the New Mexico Avian Protection Working Group.

Hawks Aloft, Inc. 2011. 2011 Breeding Raptor Survey: Bureau of Land Management Taos Field Office Resource Area Final Report. Prepared for the Bureau of Reclamation. Taos, New Mexico.

Intera. 2012. Baseline Data Characterization Report for Copper Flat Mine Sierra County, New Mexico. Prepared for New Mexico Copper Corporation.

Kochert, Michael N. & Mike Pellant. 1986. Multiple Use in the Snake River Birds of Prey Area. *Rangelands* 8(5): 217-220.

[NMGF] New Mexico Department of Game and Fish. 2004. Habitat Guidelines for Mine Operations and Reclamation. http://www.wildlife.state.nm.us/download/conservation/habitat-handbook/project-guidelines/Mining-Guidelines.pdf. Published December 2004. Accessed September 21, 2017.

Norman, David K. 1992. Reclamation of Quarries. *Washington Geology* 20(4):

Ritchie, Robert J., Doyle, T.J. & J. M. Wright. Peregrine Falcons (*Falco peregrinus*) Nest in a Quarry and on Highway Cutbanks in Alaska. *Journal of Raptor Research* 32(3):261-264.

THEMAC. 2013. Copper Flat Mine Baseline Data Report Addendum. Prepared by THEMAC Resources Group, Ltd.

Tuttle, Merlin, D. & D. A. R. Taylor. 1998. Bats and Mines. Bat Conservation International Resource Publication No. 3. 50 pp.

[USFS] United States Forest Service. 1997. Griffon Mining Project White Pine County, Nevada Final Environmental Impact Statement. United States Forest Service, White Pine County, Nevada.

[USFS] United States Forest Service. 1997. Final Environmental Impact Statement: Crown Jewel Mine. United States Forest Service, Okanogan County, Washington.

APPENDIX A – New Mexico Department of Game and Fish Habitat Guidelines for Mine Operations and Reclamation

HABITAT GUIDELINES FOR

MINE OPERATIONS AND RECLAMATION

December 2004

New Mexico Department of Game and Fish

I. Regulation of Mining Impacts

The state Energy, Minerals and Natural Resources Department (EMNRD), Mining and Minerals Division, includes three mine regulation programs. The Coal Mine Reclamation Program administers requirements of the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA). The Abandoned Mine Land Program, authorized by SMCRA, reclaims historic abandoned coal and non-coal mines. The Mining Act Reclamation Program administers requirements of the New Mexico Mining Act of 1994 (NMMA), which applies to hard rock mines. Hard rock mining refers to extraction of most solid minerals other than coal. Phosphate mines and sand and gravel pits are not regulated by EMNRD, although local county regulations may apply. The Bureau of Land Management requires a Mine Plan of Operations for mineral extraction activities on their surface, and the Forest Service issues Special Use Permits. New Mexico Environment Department Discharge Permits are required at all mine sites that may affect a groundwater aquifer. The purpose of the Discharge Permits is to ensure compliance with NM Water Quality Control Commission standards. Projects involving more than one acre surface disturbance are required to obtain National Pollutant Discharge Elimination System permits from US Environmental Protection Agency under the Clean Water Act.

The most extensive Department of Game and Fish (Department) involvement takes place on NMMA regulated hard rock operations. The Act requires EMNRD to consult with the Department on all permit approvals and modifications. We also frequently receive requests for consultation from other agencies for other types of mine projects.

• Impacts and Mitigation

Habitat Loss and Degradation. Proposed new mines, and modifications to existing mines, should be evaluated for their effect on wildlife habitat. Pre-disturbance surveys are useful to establish baseline data for reclamation. Potential effects on listed species of concern should be identified and mitigated. Special habitat values or features should be identified for replacement during reclamation. Stormwater run-off should be controlled to avoid adding sediment to streams. Excessive sediment load affects aquatic organisms by covering up substrate habitat, carrying toxic elements, alteration of water quality or direct fish kill. Mine-related habitat loss may be temporary where mitigated by adequate reclamation practices, or permanent if reclamation is not required or is not properly implemented. The Department encourages the practice of concurrent reclamation, whereby portions of the affected area no longer in use are reclaimed while active operations continue nearby.

Physical and chemical hazards.

Many mining and milling operations involve the use of chemicals or the contamination of water by acid generating drainage. Open water that may present a hazard to wildlife includes stormwater impoundments, tailings ponds, and pit lakes remaining after the cessation of mining. No pits should be located below the ordinary high water mark of any watercourse, lakebed, sinkhole, or playa lake, or in any wetland. Any open water in an arid environment will attract wildlife of all kinds. Wildlife need to be protected from contacting and ingesting harmful liquids.

Where ponds, pits or open-top tanks contain hazardous liquids, they should be netted, fenced or otherwise protected. The US Fish & Wildlife Service provides technical guidance on protective netting on the internet at http://www.r6.fws.gov/contaminants/contaminants1c.htm l . Wildlife exclusion fencing may be appropriate for some situations. Exclusion fences must be a minimum eight feet in height, constructed of chain link or woven or welded wire mesh. They should secured at the ground or preferably buried to prevent animals digging under, and should be wrapped around the base with a durable finer mesh material to deter small mammals and reptiles and amphibians. Fences which are intended to exclude livestock should be designed to minimize potential for causing injury or death to large wildlife attempting to cross over or under. The Department has fence specifications available for a variety of conditions.

Non-toxic ponds, pits and trenches may also present a trapping hazard for wildlife, if they are steep-sided and/or lined with smooth-surfaced material. Textured liner material is available which can be attached to create escape ramps. Depending on the configuration of the trapping hazard, earthen ramps, floating rafts and ladders may also be appropriate solutions. The Department can provide consultation and design specifications on the appropriate technology.

Chemicals stored in containers should be labeled, container integrity maintained in good condition, and secondary containment (berms or sumps) provided around tanks and at points of transfer. Machinery and infrastructure should be maintained in good condition to prevent leaks and spills, and appropriate spill response equipment and procedures should be identified prior to bringing chemicals on site.

Another mine feature which may present a hazard to wildlife is overhead electric supply lines. Please refer to the Department powerline habitat guideline for more information on that subject.

- **Reclamation.**

Cover and Revegetation. Traditional mine reclamation has included grading the reclaimed area to a uniform 3:1 slope for the purpose of minimizing erosion. The Department encourages incorporation of topographic variability reflecting the natural site surroundings and fluvial geomorphology where feasible. Vertical habitat diversity is the single most important factor contributing to avian species diversity. Where substrate integrity is sufficient to prevent erosion or slumping, highwalls may provide a vertical habitat feature that mimics natural cliffs or rimrock. The habitat value of highwalls can be enhanced by design features including an undulating profile, niches or ledges on the face, and placing rubble at the toe of the wall. Habitat enhancement features can also be added to a homogeneous slope to provide vertical diversity and opportunities to hide from predators. Features might include clumps or rows of planted shrubs, brush piles, rock piles or constructed perches or nest platforms. The Department is available to help determine optimal configuration of features given the setting and available materials.

The two main purposes of reclaimed mineland vegetation are to prevent surface erosion, and prevent infiltration of rainwater to the depth of buried material which may cause groundwater contamination. Surface preparation should at a minimum include placement of topsoil, either stockpiled from the site or borrowed from elsewhere, furrowing on contour, and mulching after seed is applied. Soil cover should be designed to minimize uptake of toxic materials by plant roots, and from there into the ecological food chain. Seed mixes are typically specified by the regulating agency and/or the surface owner. The Department encourages the use of native species exclusively. Seed lots and mulch should be weed-free and reclaimed areas should be monitored for noxious weed infestation. Plants which are of value to particular wildlife (for example, deer browse) may be recommended where appropriate.

Water. Wildlife may need protection from contaminated water sources, as detailed above, during and after reclamation. Conversely, provision of clean drinking water should be considered, to mitigate loss or degradation of natural water sources, or other habitat loss. Earthen tanks may be created where infiltration to contaminated subsurface layers is not a concern. Impermeable rainwater catchment drinkers may be a solution in other situations. The Department is available for consultation and specifications for providing wildlife watering facilities.

Underground Features. Many abandoned mine workings, and some active mine sites, have historic underground tunnels, shafts or adits. These features can cause injury or death to people who approach or attempt to enter, so they are often targeted for filling or plugging. However underground features are often used by bats, and some raptors, owls and snakes. Many of the bats are species of concern, because of population declines or simply because there is not enough information to determine their conservation status. Importance of a feature as habitat depends on factors including the particular species present, the type or seasonality of use, and surrounding habitat characteristics. Historic underground mine features should be evaluated by an expert in the field to decide the appropriate method of closure or guarding. Where appropriate, custom bat gates can be installed to protect public safety while maintaining bat access to the interior. In New Mexico, the EMNRD Abandoned Mine Land program has developed a high level of expertise about bat-friendly closures.

References

NM Mining Act Rules, NMAC Title 19 Chapter 10
http://www.nmcpr.state.nm.us/nmac/_title19/T19C010.htm

Coal Mine Reclamation Program Rules, NMAC Title 19, Chapter 8

http://www.nmcpr.state.nm.us/nmac/_title19/T19C008.htm

NM Water Quality Control Commission homepage

http://www.nmenv.state.nm.us/Oots/wqcc.htm#Legislation

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COPPER FLAT
OPEN PIT RECLAMATION/REVEGETATION PLAN
OCTOBER 2017

INTRODUCTION

NMCC submitted its Mine Reclamation Plan for the Copper Flat Mine Project to the New Mexico Mining and Minerals Division (MMD) in July, 2017 (See Appendix E of MORP). Upon its review, on October 5, 2017 the MMD asked NMCC to provide a reclamation/revegetation plan for accessible portions of the open pit as a component of reclamation of the pit so that the NMCC reclamation plan does not rely exclusively on self-vegetation inside the open pit. This proposal is limited to proposed enhancement of the reclamation plan for the open pit to complement the MORP and Reclamation Plan submitted to the MMD in July 2107, including rapid-fill of the bottom of the open pit after mining ceases.

NMCC's proposes to add revegetation of the following three areas within the open pit:

1. The haul road leading from the crest of the pit to the pit water body that will form post-mining as a result of rapid-fill of the pit as described in NMCC's July 17, 2007 MORP Reclamation Plan (approximately 23 acres);
2. The expanded 4900 Catch Bench (approximately 2 acres); and
3. Several pit benches at the pit crest (approximately 10 acres);

Figure 1 illustrates the revised reclamation plan, including the previously described pit water body that NMCC will develop utilizing fresh water rapid fill, and the three areas listed above that will be covered and revegetated. As indicated in Table 1, with this amendment, a total of 55 acres or43% of the 129 acre pit shell, will be covered (35 acres cover and revegetate, 20 acres rapid fill as described in NMCC's MORP and Reclamation Plan). The remaining pit walls represent the steep-walled portion of the post-mining wildlife habitat (PMLU) that will be established as discussed in the MORP and Reclamation Plan.

TABLE 1
PIT SHELL RECLAMATION/VEGETATION ACREAGE

	ACRES	% OF FOTAL
PIT SHELL (Total acreage)	129	
PIT HAUL ROAD	23	18%
4900 EXPANDED CATCH BENCH	2	2%
PIT CREST	10	8%
PIT WATER BODY	20	15%
PIT SHELL RECLAMATION	55	43%

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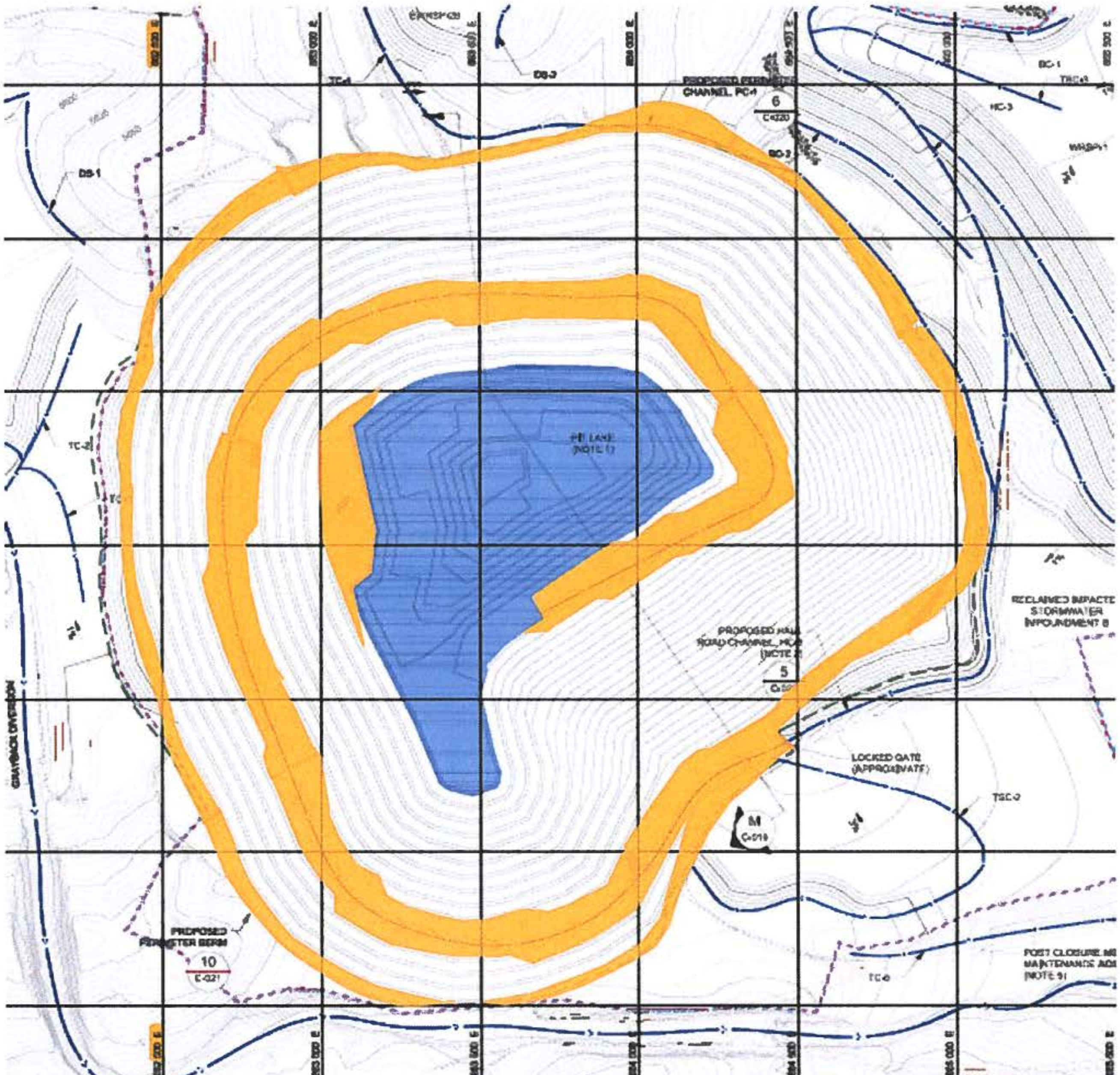
FIGURE 1



Proposed pit sheill reclamation/vegetation area

Proposed rapid-fill water body

Following is a more detailed description of NMCC's proposed revegetation enhancements to reclamation of the pit shell.

PIT HAUL ROAD

The open pit will be mined in benches over a 12 year period, creating a terraced pit wall. As shown in Figure 1 (and Drawing C-014 of Appendix E Reclamation Plan), access into the open pit during mining will be via a 90 foot wide mine haul road left in the pit wall, which will be constructed as mining advances. Also shown in Figure 1 are the locations of several surface water conveyance channels which will be constructed around the northern and eastern pit perimeter, perimeter channel PC-1 which will direct surface runoff from north of the pit shell, haul road channel HC-3 which will direct surface runoff from the reclaimed Waste Rock Stockpile no. 1 (WRSP-1), and Top Surface Channel TSC-2, which will direct surface runoff from reclaimed Existing Waste Rock Stockpile No. 4 (EWRSP-4) into the open pit. The surface water runoff collected by these channels will be routed into the pit through haul road channel HC-5, which will follow the alignment of the open pit haul road as shown in Figure 1.

For reclamation, and where practicable, the haul road will be ripped to a minimum depth of 12 inches and covered with 6 inches of growth media material. In areas where ripping to a 12-inch depth cannot be accomplished, an 18 inch growth media cover will be placed. The reclaimed haul road will include the storm water conveyance ditch and single vehicle access to the bottom of the pit for monitoring.

After grading and contouring to maintain proper drainage and erosion protection, the haul road will be seeded with a seed mix approved by the BLM and MMD. Assistance from the New Mexico Department of Game & Fish (NMDG&F) may also be sought in establishing revegetation in the pit shell in order to take advantage of NMDG&F expertise in establishing appropriate wildlife habitat. The revegetated haul road area represented in Figure 1 is approximately 23 acres in size and includes sections of catch benches on either side of the road that can be safely accessed from the road.

EXPANDED 4900 CATCH BENCH

As shown in Figure 1 (and Drawing C-0013 on Appendix E), the 4900 elevation catch bench will be expanded to approximately 2 acres in size in the northwest corner of the pit. This area will remain above water after rapid-fill is complete.

At closure, and before beginning rapid-fill of the pit, NMCC will construct a ramp from the haul road to access the step-out for revegetation activities. The surface will be ripped to a depth of 12 inches and a 6 inch growth media cover placed or alternatively an 18 inch growth media cover if the bench cannot be ripped. The growth media cover will then be seeded with a seed mix approved by the BLM and MMD. Assistance from the NMDG&F may also be sought in establishing revegetation in the pit shell in order to take advantage of its expertise in establishing appropriate wildlife habitat. The revegetated catch bench area is approximately 2 acres in size.

PIT CREST

Figure 1 identifies areas around the crest of the pit shell that will also be revegetated. These upper benches will be laid back at an approximate 2:1 slope angle at the end of the mine operations in order "soften" the pit edge and to accommodate revegetation. NMCC assumes these benches will require drilling and blasting to accomplish the desired lay back. This area will be blended into the surrounding reclaimed pit perimeter area described in the MORP and Reclamation Plan. Revegetation will be accomplished by ripping the area to a depth of 12 inches and a 6 inch growth media cover placed and re-contoured to blend with reclamation of the pit perimeter area described in the Reclamation Plan. An 18 inch growth media cover will be placed over areas that cannot be ripped. The area will be seeded with a seed mix approved by the BLM and MMD. Assistance from the NMDG&F may also be sought in establishing revegetation in the pit shell in order to take advantage of its expertise in establishing appropriate wildlife habitat. The revegetated area at the pit crest is approximately 10 acres in size. Figure 1 was prepared from Drawing C-014 of the Reclamation Plan. The 10 acres of crest reclamation shown in Figure 1 represents proposed reclamation in addition to the pit perimeter reclamation described in the Reclamation Plan.

PIT SHELL REVEGETATION SUCCESS

This amendment adds a pit revegetation component to its Reclamation Plan in response to MMD's request for further enhancing the wildlife PMLU of the pit. As noted in Section 5.7 of the Reclamation Plan, NMCC proposes to work with the MMD and the BLM to develop appropriate, reasonable and attainable standards applicable to the pit shell. These standards will be in conformance with 19.10.6.603.G.2(c) NMAC.

PIT SHELL POST-MINNG LAND USE

As stated in Appendix E of NMCC's Reclamation Plan, the open pit area will be reclaimed to establish a wildlife habitat post-mining land use. NMCC has taken the MMD's comments regarding reclamation into account in preparing the revisions to it Reclamation Plan in order to further enhance the success of the wildlife PMLU for the pit shell by proposing the revegetation component described herein. NMCC believes that this proposed revision, when considered along with the overall Mine Reclamation Plan in the MORP Appendix E, addresses the MMD's concerns and completes a technically approvable Reclamation Plan for Copper Flat.

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October 13, 2017

RECEIVED
OCT 12 2017
Ground Water Quality Bureau

Brad Reid
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
Harold L. Runnels Building
1190 St. Francis Drive
P.O. Box 5469
Santa Fe, NM 87502-5496

Re: Supplemental Information regarding open pit hydrologic sink, DP-1840
New Mexico Copper Corporation Copper Flat Project

Dear Mr. Reid,

Enclosed for your review and consideration is information prepared in response to your request for further explanation of NMMC's conclusion that the open pit at the proposed Copper Flat project is currently, and will remain a hydrologic sink upon reclamation and closure of the facility.

NMCC submitted an update to its Mining Operations and Reclamation Plan (MORP) on July 17, 2017, to the Mining and Minerals Division (MMD) and at the same time submitted the Reclamation Plan to your office as the required Closure Plan to complete its Discharge Plan Application. Your review of the July 17 submittal generated a request for additional information relating to NMCC's analysis and determination that rapid-fill of the pit at mine closure will not result in development of a groundwater flow-through system at the pit, either on a temporary or permanent basis. The attached technical memorandum prepared by John Shomaker Associates, Inc. (JSAI) addresses this issue and provides the technical rationale for NMCC's conclusions in this regard.

JSAI's technical memorandum documents the analysis and conclusions reached in the documents already provided to NMED in past submittals rather than to redo the analyses. In this memo JSAI documents the past technical reports, analyses and conclusions regarding the existing and future open pit hydraulic sink and provides additional reinforcement of the technical work and conclusions that have been completed. We believe that the information outlined by JSAI provides ample support for NMED to conclude that the pit water body is currently a hydrologic sink and that it will remain such during operations and after post mining rapid-fill operations are completed.

NMCC, JSAI and NMED have visited this subject on a number of occasions. In its March 21, 2016, request for additional information in Comment No. 14, NMED Indicated that it "would likely require additional monitoring wells to verify the area of open pit hydrologic containment initially, and as mining progresses" and that "[A]at a minimum, NMED will require installation of at least one well located at the southeast portion of the open pit in or adjacent to Grayback Arroyo between monitoring wells GWQ11-24 A&B and GWQ96 23 A&B." In our response to this comment, provided to NMED on June 21, 2016, we acknowledged NMED's need to verify the hydrologic sink condition exists and committed to relocate proposed well PGWQ-1 to the location proposed by NMED (see NMCC's response to Comment No. 14, June 21, 2016). NMCC's proposed monitoring program was revised to incorporate this change and remains committed to demonstrating that the hydrologic sink will remain post-mining per its monitoring program.

Relative to the rapid fill, NMED has asked that NMCC confirm that the water quality of the production wells to be utilized as the source of rapid-fill water will meet the New Mexico WQCC standards. JSAI includes a summary table that provides the results of sampling that was conducted in May 2012 at two of the four production wells from which the rapid-fill water will be sourced. As you can see, the water quality of the production wells meets all of the numerical WQCC standards.

The location of the production well field can be seen in Figure 2-12 of NMCC's Updated MORP, a copy which is attached for your convenience. The well field wells are all completed into the same formation, i.e., the Santa Fe Group, all in the same general location. You may recall that the water quality data was generated as a result of the pump test approved by NMED and conducted by NMCC. In conducting the test, NMCC equipped wells PW-1 and PW-3 for pumping and sampling. The data was provided to NMED in May 2012 and is included in JSAI's memorandum.

Additionally, NMED has requested that NMCC provide an analysis of the temporal hydrologic condition that will occur in the underlying formation as a result of the rapid-fill activity. JSAI's technical memorandum describes pit water "push out" into wall rock that will occur as rapid-fill occurs. Certainly some minor amount of water may move into the formation for a short distance as a result of rapid-fill. However, as discussed in detail by JSAI, there is little or no potential for return/flow in the formation to occur through to ground water. Even if it did, which considered entirely unlikely, as shown by the data presented herewith, the water quality of the rapid fill water meets the WQCC standards and, therefore, would not impact the formation water.

Finally, NMED requested that NMCC describe the ground water capture zone of the hydrologic sink, or the Area of open pit hydraulic containment (AOPHC), that will develop as the pit is dewatered during operations separate from the open pit surface area (OPSDA). JSAI's technical memorandum contains the information requested, including a figure depicting the AOPHC in relation to the OPSDA. The referenced figure, developed from JSAI's groundwater model and analysis, clearly demonstrates the presence of a hydrologic sink around the pit following mining.

NMCC hopes that this information satisfies NMED's request for additional information, allowing it determine that NMCC's Discharge Permit application is technically complete and proceeding to a draft DP.

Sincerely,

J Smith

Jeff Smith
Chief Operating Officer
New Mexico Copper Corporation

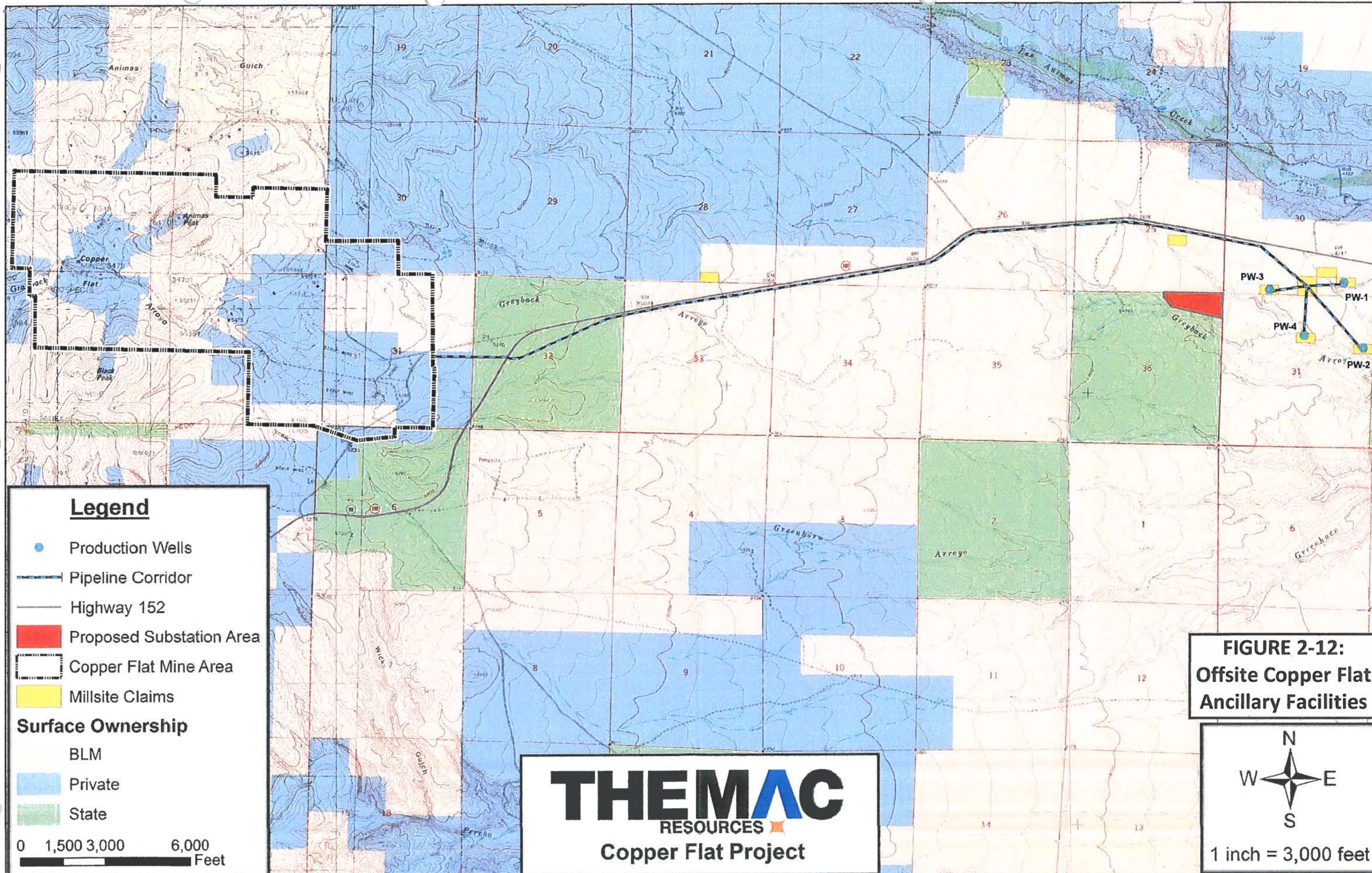


FIGURE 2-12: Offsite Copper Flat Ancillary Facilities

JSAI

TECHNICAL MEMORANDUM

To: Jeffrey Smith jsmith@themacresourcesgroup.com
New Mexico Copper Corporation

From: Steve Finch, Principal Hydrogeologist-Geochemist
Michael A. Jones, Principal Hydrologist

Date: October 12, 2017

Subject: Hydrologic Effects of proposed Rapid Fill Reclamation of Copper Flat Open Pit

The proposed Copper Flat Project includes a mine pit, supply wells, tailings facility, and waste rock facilities located in the Hillsboro Mining District, Sierra County, New Mexico. The proposed operating scenario reflects a processing rate of 30,000 tons of ore per day for 11.5 years, which is "Alternative 2" in the Copper Flat Draft Environmental Impact Statement (BLM, 2015). Figure 1 shows the configuration of the ultimate open pit and Open Pit Surface Drainage Area (OPSDA).

After mining, rapid-fill of the open-pit reclamation is proposed. Clean water from the supply wells will be used to rapid fill the open pit to the steady state elevation that is projected to occur with natural fill. The primary purpose of rapid fill reclamation is to limit time of exposure of open pit bottom to atmospheric conditions (oxidation of sulfides) and to achieve optimum water quality while maintaining a hydraulic sink. The open pit dewatering and rapid fill effects were evaluated using the numerical model of groundwater flow developed by JSAI (2014) and peer reviewed and adopted by the New Mexico Office of the State Engineer (NMOSE).

At the end of mining, groundwater-level drawdown in the bedrock around the open pit reaches a maximum of about 800 ft at the pit (Fig. 2). A permanent cone of depression will form around the pit, with maximum drawdown of about 600 ft at the edge of the pit. The pit, which currently is an evaporative hydrologic sink, will form an evaporative hydrologic sink again in the future. Current and projected final pit water surface elevations and areas are shown on Figure 2. The existing pit currently has a water surface area of about 5.2 acres. The proposed pit water body will have a steady state surface area of about 22 acres.

Existing Open Pit

The existing Copper Flat open pit water body is a hydraulic sink, as evidenced by more than 20 years of data and analysis (SRK, 1997; INTERA, 2012, SRK, 2013; JSAI, 2014a; BLM, 2015). In addition the U. S. Army Corp of Engineers determined the Copper Flat water body is not a water of the U. S. because it is a hydraulic sink disconnected from natural water courses (Leavitt, 2014).

Open-Pit Dewatering

Projected pit water level, pit-area groundwater level, and dewatering rates are summarized on Figure 3. Long-term total inflow ranges between about 35 and 65 gpm (56 and 105 ac-ft/yr) with an initial minimum of about 20 gpm (32 ac-ft/yr) and a maximum of about 70 gpm (113 ac-ft/yr), as the pit bottom approaches final elevation of 4,650 ft above mean sea level (amsl).

Pit Dewatering Effects

The drawdown effect of model-simulated open pit dewatering is shown on Figures 3 and 4. Open pit dewatering during mining creates a 600 ft cone of depression in the bedrock aquifer. Groundwater drawdown due to pit dewatering remains within the bedrock, and formation of the open pit and associated pit dewatering forms a permanent hydraulic sink (Figs.4 and 5). The area of open pit hydraulic containment (AOPHC) for end of mining is illustrated by the drawdown contours on Figure 4.

Post-Mining Open Pit Water Balance

The post-mining pit water level and water balance were simulated assuming the pit geometry and watershed shown on Figure 1. The area within the pit highwall is about 129 acres, and the total OPSDA watershed area is about 314 acres.

Precipitation on the pit area was estimated for each month based on the record at Hillsboro (JSAI, 2014, Sec. 2.0), with annual average precipitation of 12.5 in. Runoff from the highwall was simulated at 20.7 percent of precipitation, and runoff from the haul road at 30.3 percent. Runoff from the remainder of the watershed was simulated at 7.1 percent of precipitation.

Evaporation from the open pit was assumed at 50 in/yr, less than the 65 in/yr estimated potential evaporation (JSAI, 2014, Sec. 2.4) for the existing open pit. The lower rate reflects the wind and sun sheltering effects of the deeper open pit. Monthly evaporation rates based on the record at Hillsboro were scaled to match the annual rate of 50 in/yr.

Open Pit Reclamation

Post-mining reclamation would include use of the water-supply wells PW-1 through PW-4, and a temporary pipeline to the bottom of the pit, to rapidly fill the pit to the expected long-term post-mining equilibrium water level. The post-mining simulation assumes this "rapid fill" scenario. Rapid filling will result in better water quality in the open pit by filling it with clean water and inhibiting oxidation of sulfide by submerging potential acid-generating sections of the pit wall. The water quality from the PW wells has low total dissolved solids content, buffering capacity from bicarbonate ions, and meets all water quality standards (see attached lab report).

After mining is complete, the pit will be rapid filled to the projected steady-state post-mining water level that maintains the hydraulic sink conditions. The volume placed by rapid fill will still be within the cone of depression cause by open pit dewatering, with hydraulic controls caused by the established AOPHC.

A pumping rate of 2,726 gpm is simulated in the model, sufficient to fill the pit to elevation 4,894 ft amsl in 6 months. Total volume pumped from the supply wells will be 2,200 acre feet. Model simulated open pit water-level elevations due to rapid fill reclamation are presented on Fig. 5). The final open pit water body elevation of about 4,894 ft amsl corresponds to a water-surface area of about 22 acres. Water levels will fluctuate around this mean by a few feet, rising and falling seasonally and with wet and dry climatic conditions, but the hydraulic sink conditions will remain in place.

The simulated (annual) pit water balance is presented on Figure 6, showing a final pit water balance of about 93 ac-ft/yr, with about 57 ac-ft/yr from precipitation and runoff, and 36 ac-ft/yr from groundwater inflow, all discharging as evaporation from the pit water surface to maintain the hydraulic sink.

The rapid filling of the pit will not result in pit water discharging to the groundwater system. In the pit bottom, a dewatered space forms between the groundwater levels at the end of the rapid fill and the pit shell (see Fig. 2). Model simulated flow to this dewatered space during rapid fill amounts to 0.74 acre feet for the six month rapid fill event, and 0.00 acre feet for the following 100 year simulation into the future. Rapid fill water will be confined to the open pit and adjacent dewatered space, and the hydraulic force of groundwater discharge at the pit bottom and sides caused by the 600 ft drawdown cone created during dewatering will prevent discharges to groundwater.

Water levels in the open pit and immediate vicinity of the pit wall will change due to rapid fill and natural fluctuations after rapid fill, but groundwater levels adjacent to the pit will remain as a hydraulic sink, before, during, and after rapid filling. After reclamation, groundwater levels in the bedrock around the open pit will remain below pre-mining levels, due to groundwater flowing to the open pit and discharging as evaporation from the hydrologic sink (Fig. 7). The pit water level will fluctuate naturally (by a few feet) according to climate conditions, tending toward a long-term equilibrium level.

The pit will remain as a hydraulic sink during temporary water level fluctuations, because of the large cone of depression caused by dewatering and maintained by water surface evaporation. In order for it to be possible for water to flow from the pit to groundwater, the hydraulic gradient would have to be higher than surrounding groundwater. No conceivable storm event, wet year or even wet decade could possibly add enough water to the pit to reach the water level (>5,100 ft elevation) required to achieve flow-through. Figure 2 is an east-west cross section through the open pit, showing projected water levels in the pit and downstream (5,100 ft elevation).

Attachments

Figure 1. Ultimate open pit and watershed area

Figure 2. West-to-east hydrogeologic cross section E-E' showing water-level profile across existing pit and proposed open pit after rapid fill

Figure 3. Projected pit water level, groundwater level, and pit pumping rate

Figure 4. Projected end-of-mining groundwater drawdown (ft) for Mine area

Figure 5. Model-simulated water level elevation contours and direction of groundwater flow around open pit at end of mining

Figure 6. Projected open-pit water level due to rapid fill reclamation

Figure 7. Projected open-pit water balance during first six months of rapid fill and afterwards

Figure 8. Model-simulated open pit water level elevation, groundwater level elevation contours, and direction of groundwater flow after rapid fill reclamation

PW-1 water quality analysis

References

[BLM] U. S. Bureau of Land Management, 2015, Copper Flat Copper Mine Draft Environmental Impact Statement: BLM/NM/ES-16-02-1793, November 2015.

INTERA, 2012, Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico. Report prepared for New Mexico Copper Corporation, June 2012.

[JSAI] John Shomaker & Associates, Inc., 2014, Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: Consultant report prepared for NM Copper Corporation.

[JSAI] John Shomaker & Associates, Inc., 2014a, Results from first year of Stage 1 Abatement investigation at the Copper Flat Mine Site, Sierra County, New Mexico: Consultant report prepared for NM Copper Corporation.

[JSAI] John Shomaker & Associates, Inc., 2017, Results from first year of Stage 1 Abatement investigation at the Copper Flat Mine Site, Sierra County, New Mexico: Consultant report prepared for NM Copper Corporation.

Leavitt, M., 2015, Letter regarding Approved Jurisdictional Determination – Action No. SPA-2014-00364-LCO, Open Pit Water Body Inclusive of the Associated 230 Acre Watershed at Copper Flat Mine in Sierra County, New Mexico to Katie Emmer, New Mexico Copper Corporation, October 6, 2014

SRK, 1997, Copper Flat Mine Compilation of Pit Lake Studies: Consultant's report prepared by Steffen Robertson and Kirsten, Inc. prepared for Alta Gold Co., December 1997

SRK, 2013, Predictive Geochemical Modeling of Pit Lake Water QWaulity at the Copper Flat Project, New Mexico: Consultant's report prepared by SRK Consulting prepared for TheMAC Resources Group, LTD, September 2013

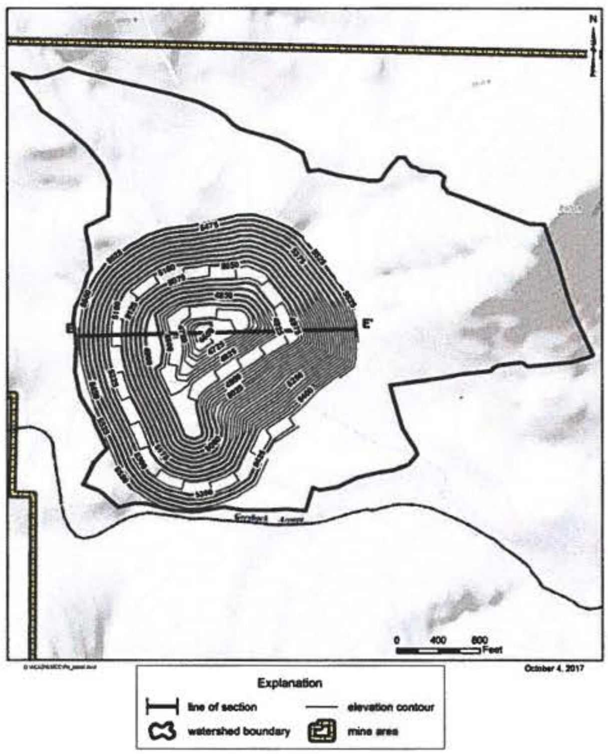


Figure 1. Ultimate open pit and watershed area.

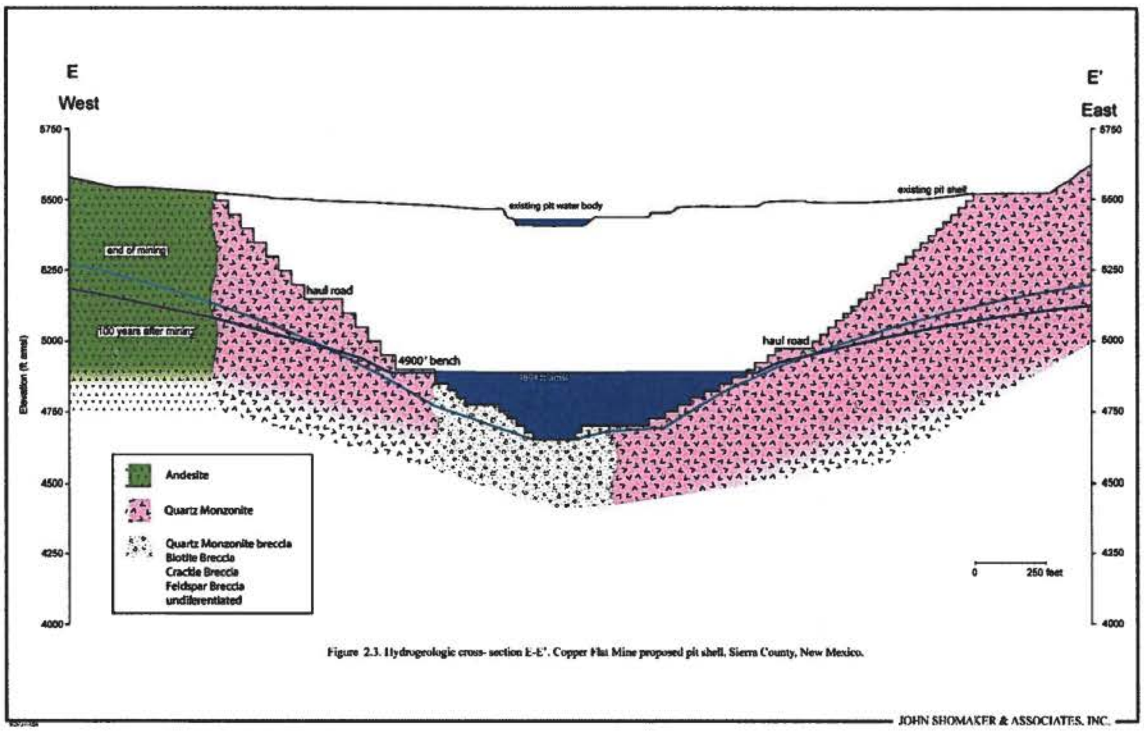


Figure 2. West-to-east hydrogeologic cross section E-E' showing water-level profile across existing pit and proposed open pit after rapid fill.

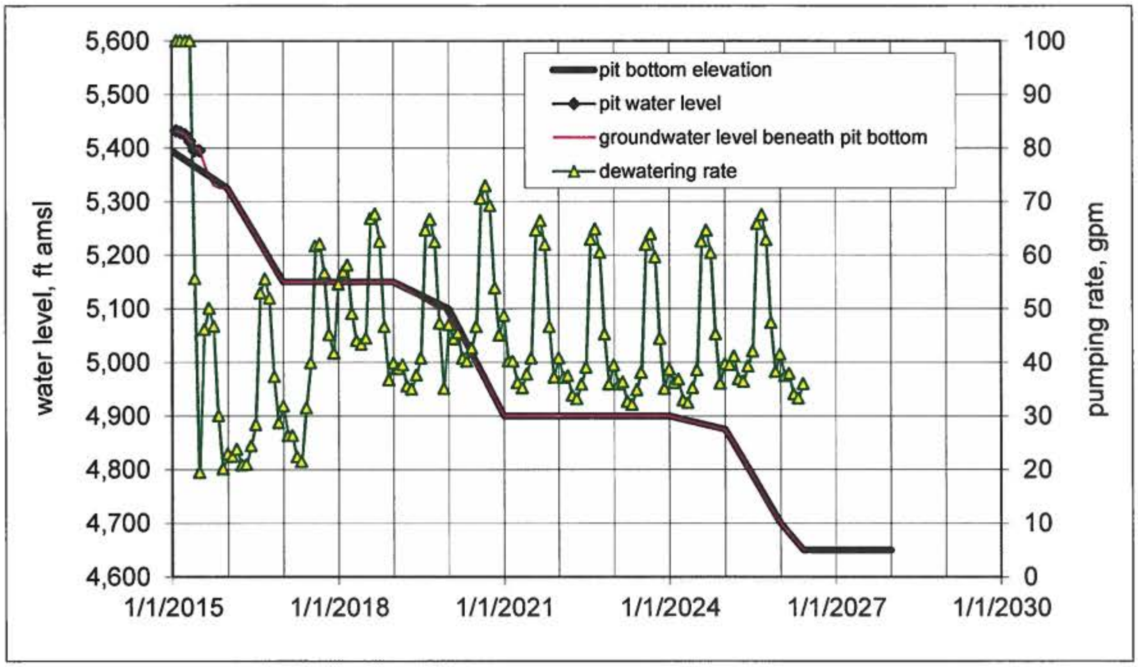


Figure 3. Projected pit water level, groundwater level, and pit pumping rate.

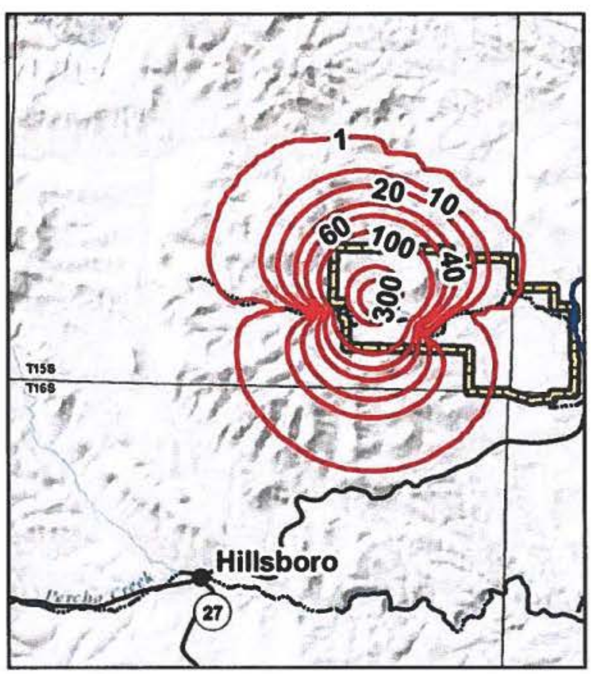


Figure 4. Projected end-of-mining groundwater drawdown (ft) for Mine area.

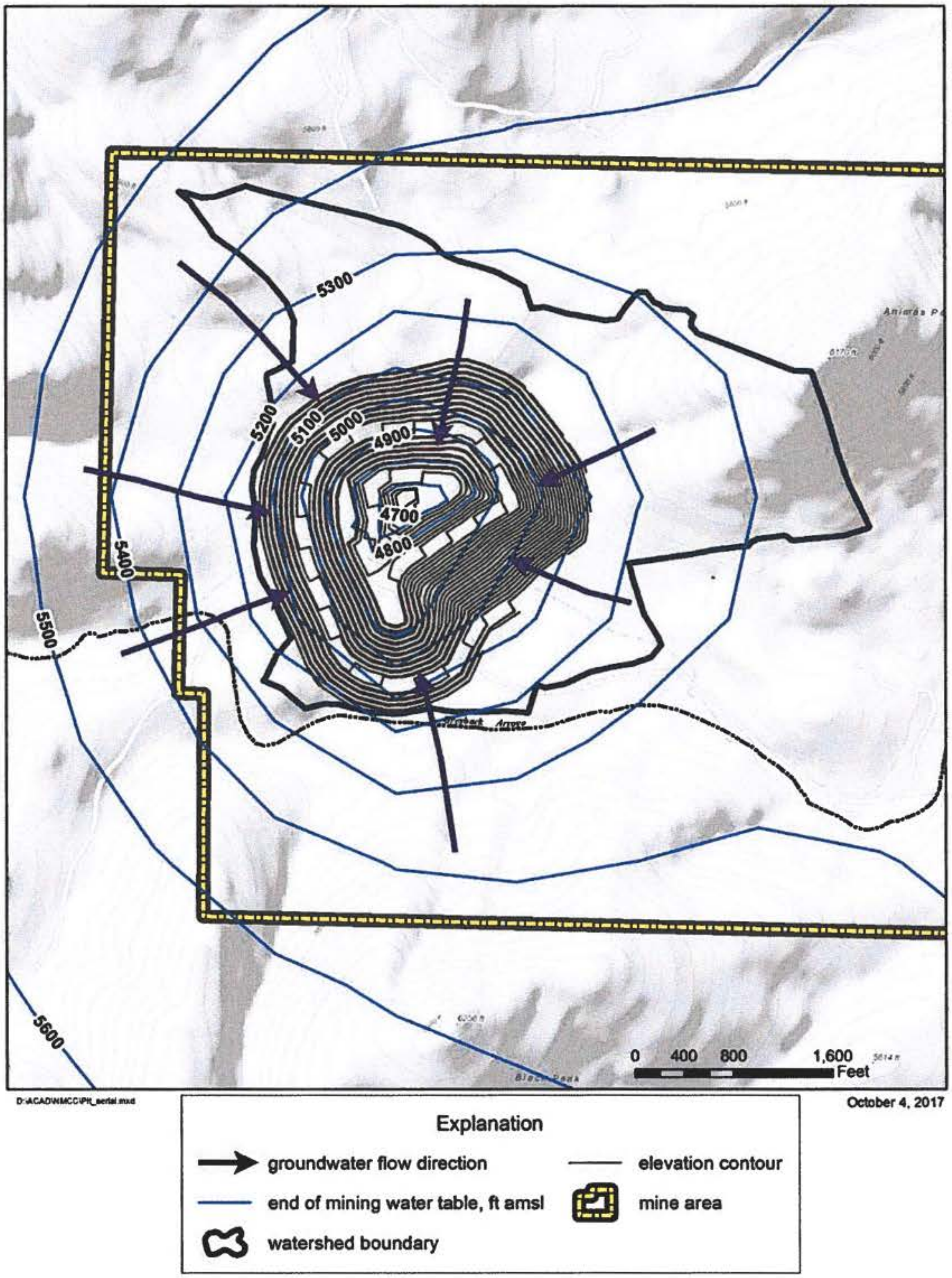


Figure 5. Model-simulated water level elevation contours and direction of groundwater flow around open pit at end of mining

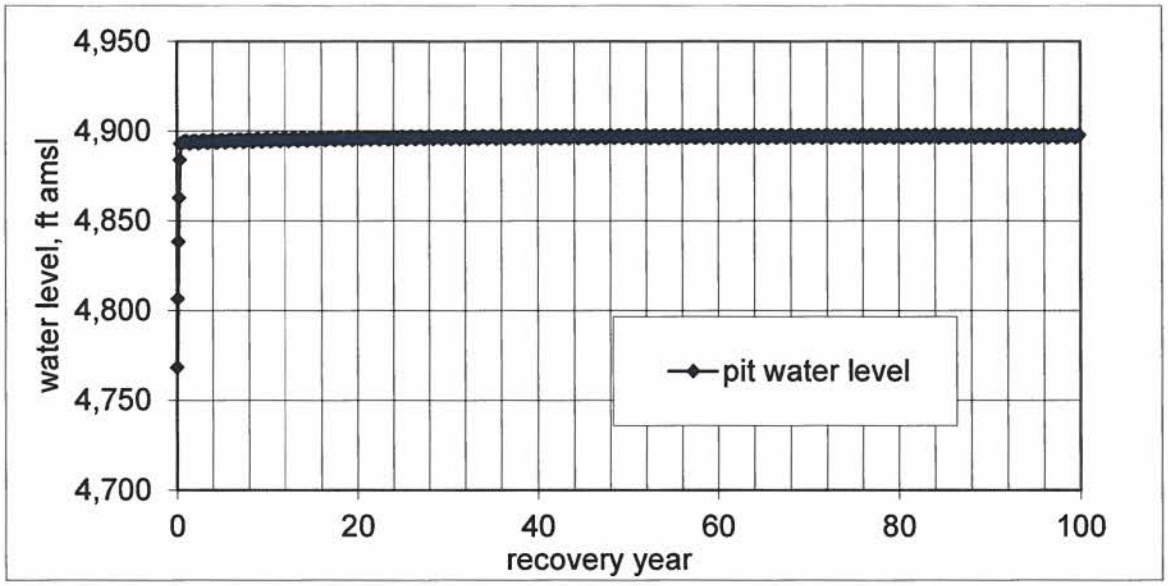


Figure 6. Projected open-pit water level due to rapid fill reclamation

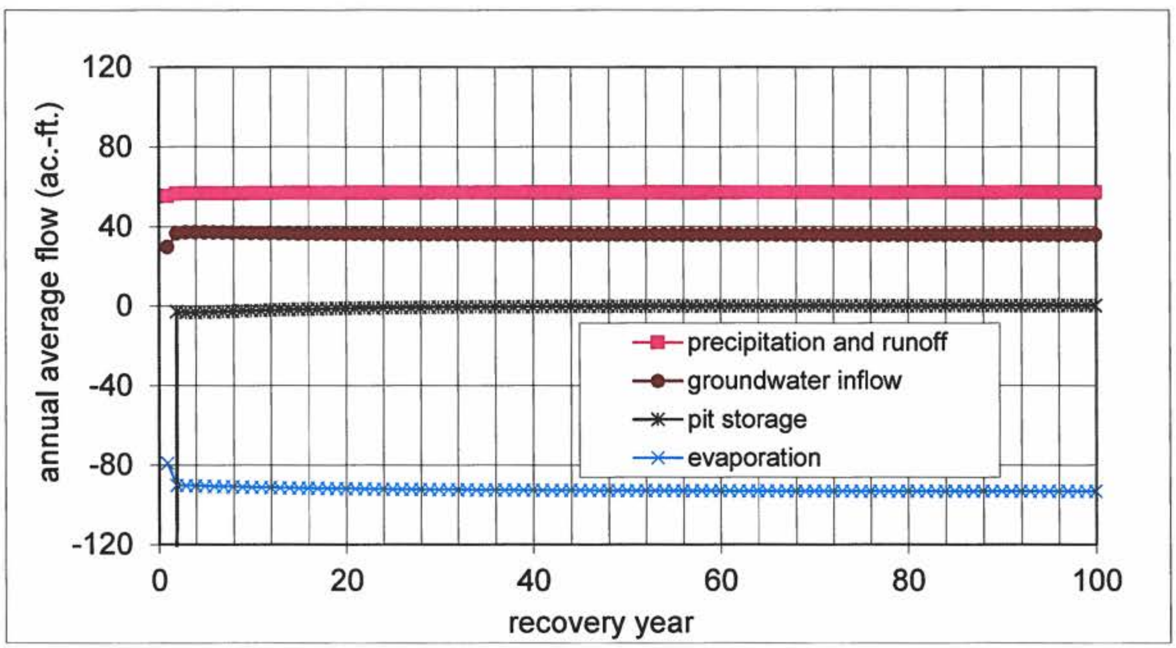


Figure 7. Projected open-pit water balance during first six months of rapid fill and afterwards.

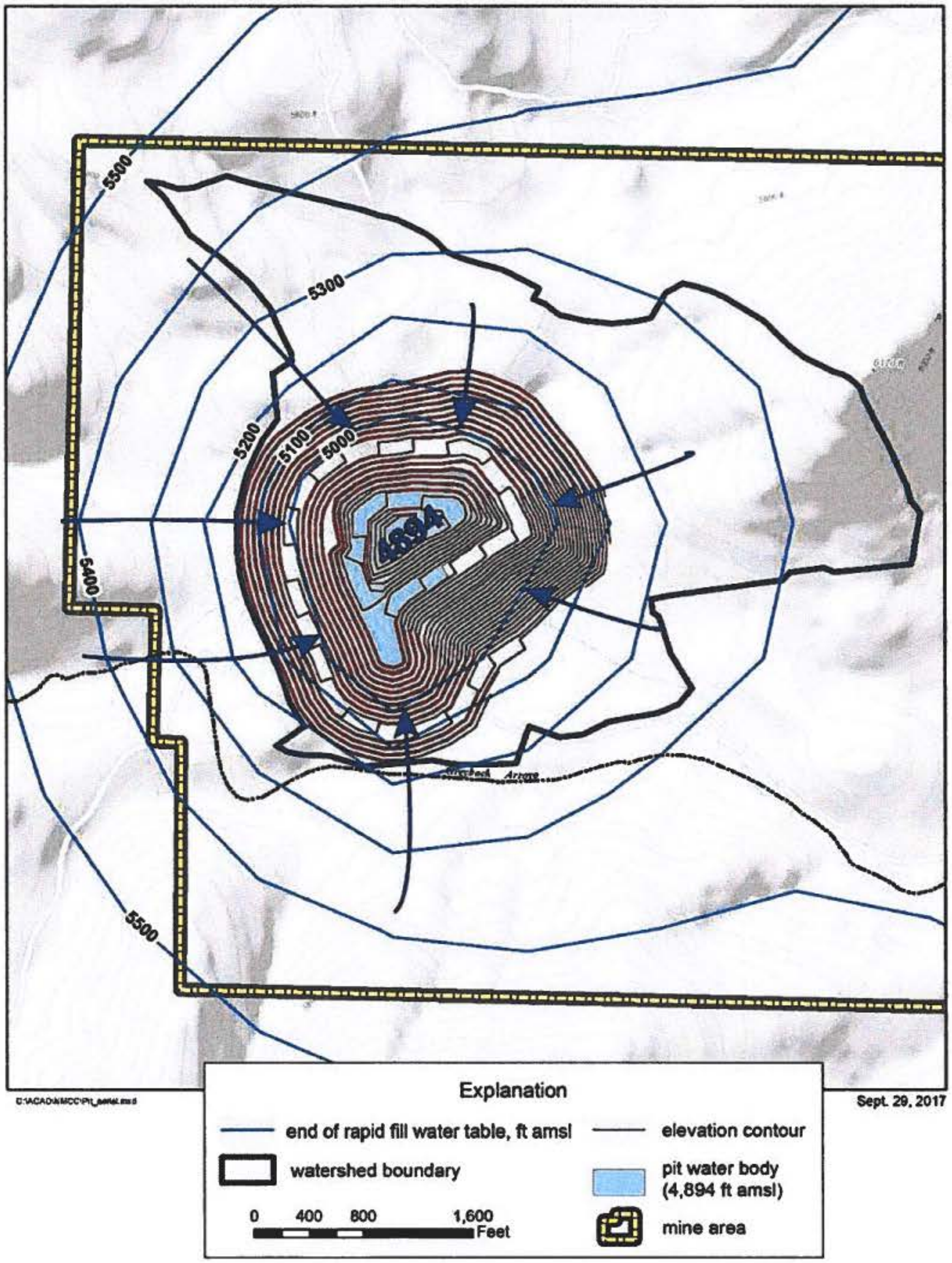


Figure 8. Model-simulated open pit water level elevation, groundwater level elevation contours, and direction of groundwater flow after rapid fill reclamation

COPPER FLAT PRODUCTION WELL WATER QUALITY (2012 Data)[1]					
	NMGWQ			Detection	
Constituent	Numeric Std mg/l	PW-1	PW-3	Limit	
Arsenic	0.1	0.0033	0.0074		Human Health Standard
Barium	1.0	0.011	0.0078		
Cadmium	0.01	ND[2]	ND	0.002	
Chromium	0.05	ND	0.006		
Cyanide	0.2	ND	ND	0.01	
Fluoride	1.6	1.0	1.9		
Lead	0.05	ND	ND	0.005	
Mercury (total)	0.002	ND	ND	0.0002	
Nitrate	10.0	0.59	0.7		
Selenium	0.05	ND	ND	0.001	
Silver	0.05	ND	ND	0.005	
Uranium	0.03	0.0032	0.0013		
Chloride	250	32	50		Domestic Water Supply Standard
Copper	1.0	ND	ND	0.006	
Iron	1.0	0.04	0.065		
Manganese	0.2	0.0024	0.0026		
Sulfate	600	28	26		
TDS	1000	294	303		
Zinc	10.0	0.024	0.021		
pH	6 to 9	8.02	8.03		
Aluminum	5.0	ND	ND	0.02	Irrigation Use Standard
Boron	0.75	0.065	0.095		
Cobalt	0.05	ND	ND	0.006	
Molybdenum	1.0	ND	ND	0.008	
Nickel	0.2	ND	ND	0.01	

[1] 2012 pump test data provided to NMED
[2] ND = none detect, below detection limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

May 14, 2012

Katie Emmer
New Mexico Copper Corp
2425 San Pedro Dr NE Ste 100
Albuquerque, New Mexico 87109
TEL: (505) 400-7925
FAX

RE: Cu Flat OrderNo.: 1205076

Dear Katie Emmer:

Hall Environmental Analysis Laboratory received 1 sample(s) on 5/2/2012 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **5/14/2012**

CLIENT: New Mexico Copper Corp | **Client Sample ID:** PW-1
Project: Cu Flat | **Collection Date:** 5/1/2012 2:00:00 PM
Lab ID: 1205076-001 | **Matrix:** AQUEOUS | **Received Date:** 5/2/2012 7:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 300.0: ANIONS						Analyst: **BRM**
Fluoride	1.0	0.10		mg/L	1	5/2/2012 12:52:03 PM
Chloride	32	10		mg/L	20	5/2/2012 1:03:17 PM
Nitrogen, Nitrite (As N)	ND	0.10		mg/L	1	5/2/2012 12:52:03 PM
Nitrogen, Nitrate (As N)	0.59	0.10		mg/L	1	5/2/2012 12:52:03 PM
Sulfate	28	0.50		mg/L	1	5/2/2012 12:52:03 PM
EPA METHOD 200.7: DISSOLVED METALS						Analyst: **ELS**
Aluminum	ND	0.020		mg/L	1	5/8/2012 8:02:55 AM
Barium	0.011	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Beryllium	ND	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Boron	0.065	0.040		mg/L	1	5/9/2012 8:36:51 AM
Cadmium	ND	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Calcium	36	1.0		mg/L	1	5/9/2012 8:36:51 AM
Chromium	ND	0.0060		mg/L	1	5/8/2012 8:02:55 AM
Cobalt	ND	0.0060		mg/L	1	5/8/2012 8:02:55 AM
Copper	ND	0.0060		mg/L	1	5/8/2012 8:02:55 AM
Iron	0.040	0.020		mg/L	1	5/9/2012 8:36:51 AM
Lead	ND	0.0050		mg/L	1	5/8/2012 8:02:55 AM
Magnesium	3.1	1.0		mg/L	1	5/9/2012 8:36:51 AM
Manganese	0.0024	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Molybdenum	ND	0.0080		mg/L	1	5/8/2012 8:02:55 AM
Nickel	ND	0.010		mg/L	1	5/8/2012 8:02:55 AM
Potassium	3.4	1.0		mg/L	1	5/9/2012 8:36:51 AM
Silicon	17	0.40		mg/L	5	5/8/2012 8:06:09 AM
Silver	ND	0.0050		mg/L	1	5/8/2012 8:02:55 AM
Sodium	58	1.0		mg/L	1	5/9/2012 8:36:51 AM
Vanadium	ND	0.050		mg/L	1	5/8/2012 8:02:55 AM
Zinc	0.024	0.010		mg/L	1	5/8/2012 8:02:55 AM
EPA 200.8: DISSOLVED METALS						Analyst: **SNV**
Antimony	ND	0.0010		mg/L	1	5/8/2012 1:15:26 PM
Arsenic	0.0033	0.0010		mg/L	1	5/8/2012 1:15:26 PM
Selenium	ND	0.0010		mg/L	1	5/10/2012 2:28:58 PM
Thallium	ND	0.0010		mg/L	1	5/8/2012 1:15:26 PM
Uranium	0.0032	0.0010		mg/L	1	5/10/2012 2:28:58 PM
EPA METHOD 245.1: MERCURY						Analyst: **ELS**
Mercury	ND	0.00020		mg/L	1	5/9/2012 11:59:45 AM
SM2340B: HARDNESS						Analyst: **ELS**
Hardness (As CaCO3)	100	6.6		mg/L	1	5/9/2012
EPA 120.1: SPECIFIC CONDUCTANCE						Analyst: **DBD**
Conductivity	450	0.010		µmhos/cm	1	5/7/2012 12:31:49 PM

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- S Spike Recovery outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **5/14/2012**

CLIENT: New Mexico Copper Corp | **Client Sample ID:** PW-1
Project: Cu Flat | **Collection Date:** 5/1/2012 2:00:00 PM
Lab ID: 1205076-001 | **Matrix:** AQUEOUS | **Received Date:** 5/2/2012 7:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM4500-H+B: PH						Analyst: **JLF**
pH	8.02	1.68	H	pH units	1	5/3/2012 1:22:52 PM
SM2320B: ALKALINITY						Analyst: **JLF**
Bicarbonate (As CaCO3)	150	20		mg/L CaCO3	1	5/3/2012 1:22:52 PM
Carbonate (As CaCO3)	ND	2.0		mg/L CaCO3	1	5/3/2012 1:22:52 PM
Total Alkalinity (as CaCO3)	150	20		mg/L CaCO3	1	5/3/2012 1:22:52 PM
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**
Total Dissolved Solids	294	20.0		mg/L	1	5/8/2012 3:12:00 PM
SM 2540D: TSS						Analyst: **KS**
Suspended Solids	ND	4.0		mg/L	1	5/3/2012 5:30:00 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	HALL ENVIRONMENTAL ANALYSIS LAB	**Batch #:**	120503026
Address:	4901 HAWKINS NE SUITE D	**Project Name:**	1205076
	ALBUQUERQUE, NM 87109		
Attn:	ANDY FREEMAN		

Analytical Results Report

Sample Number	120503026-001	**Sampling Date**	5/1/2012	**Date/Time Received**	5/3/2012	12:24 PM
Client Sample ID	1205076-001D / PW-1	**Sampling Time**	2:00 PM	**Extraction Date**		
Matrix	Water	**Sample Location**				
Comments						

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Cyanide	ND	mg/L	0.01	5/11/2012	CRW	EPA 335.4	

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; ID:WA00169; WA:C585; MT:Cert0095

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA Method 200.7: Dissolved Metals**	
Client ID: **PBW**	Batch ID: **R2622**	RunNo: **2622**	
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **72991**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020								
Barium	ND	0.0020								
Beryllium	ND	0.0020								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Cobalt	ND	0.0060								
Copper	ND	0.0060								
Lead	ND	0.0050								
Manganese	ND	0.0020								
Molybdenum	ND	0.0080								
Nickel	ND	0.010								
Silicon	ND	0.080								
Silver	ND	0.0050								
Vanadium	ND	0.050								
Zinc	ND	0.010								

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA Method 200.7: Dissolved Metals**	
Client ID: **LCSW**	Batch ID: **R2622**	RunNo: **2622**	
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **72992**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.52	0.020	0.5000	0	105	85	115			
Barium	0.49	0.0020	0.5000	0	98.9	85	115			
Beryllium	0.52	0.0020	0.5000	0	103	85	115			
Cadmium	0.50	0.0020	0.5000	0	99.2	85	115			
Chromium	0.49	0.0060	0.5000	0	98.5	85	115			
Cobalt	0.47	0.0060	0.5000	0	94.9	85	115			
Copper	0.50	0.0060	0.5000	0	99.9	85	115			
Lead	0.50	0.0050	0.5000	0	99.3	85	115			
Manganese	0.48	0.0020	0.5000	0	96.9	85	115			
Molybdenum	0.49	0.0080	0.5000	0.002030	98.4	85	115			
Nickel	0.47	0.010	0.5000	0	93.9	85	115			
Silicon	2.6	0.080	2.500	0	104	85	115			
Silver	0.094	0.0050	0.1000	0	94.1	85	115			
Vanadium	0.52	0.050	0.5000	0	104	85	115			
Zinc	0.50	0.010	0.5000	0	101	85	115			

Sample ID **1205193-005EMS**	SampType: **MS**	TestCode: **EPA Method 200.7: Dissolved Metals**	
Client ID: **BatchQC**	Batch ID: **R2622**	RunNo: **2622**	
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **73030**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2622** RunNo: **2622**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73030** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.54	0.020	0.5000	0	107	70	130			
Barium	0.52	0.0020	0.5000	0.02182	98.9	70	130			
Zinc	0.54	0.010	0.5000	0.03785	101	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2622** RunNo: **2622**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73031** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.53	0.020	0.5000	0	106	70	130	1.33	20	
Barium	0.51	0.0020	0.5000	0.02182	97.2	70	130	1.71	20	
Zinc	0.53	0.010	0.5000	0.03785	98.0	70	130	2.48	20	

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74182** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	56	1.0	50.00	4.808	102	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74183** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	57	1.0	50.00	4.808	104	70	130	2.44	20	

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74185** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Iron	4.5	0.10	2.500	2.034	99.6	70	130			
Magnesium	390	5.0	250.0	124.9	107	70	130			
Sodium	460	5.0	250.0	192.5	107	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74186** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Iron	4.6	0.10	2.500	2.034	101	70	130	1.03	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**

Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**

Prep Date: Analysis Date: **5/9/2012** SeqNo: **74186** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Magnesium	390	5.0	250.0	124.9	106	70	130	0.684	20	
Sodium	460	5.0	250.0	192.5	106	70	130	0.966	20	

Sample ID **MB** SampType: **MBLK** TestCode: **EPA Method 200.7: Dissolved Metals**

Client ID: **PBW** Batch ID: **R2670** RunNo: **2670**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74215** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	ND	0.040								
Calcium	ND	1.0								
Iron	ND	0.020								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA Method 200.7: Dissolved Metals**

Client ID: **LCSW** Batch ID: **R2670** RunNo: **2670**

Prep Date: Analysis Date: **5/9/2012** SeqNo: **74216** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	0.51	0.040	0.5000	0	101	85	115			
Calcium	54	1.0	50.00	0	107	85	115			
Iron	0.47	0.020	0.5000	0.004190	93.2	85	115			
Magnesium	54	1.0	50.00	0	109	85	115			
Potassium	53	1.0	50.00	0	106	85	115			
Sodium	54	1.0	50.00	0	107	85	115			

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **LCS** | SampType: **LCS** | TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW** | Batch ID: **R2629** | RunNo: **2629**
Prep Date: | Analysis Date: **5/8/2012** | SeqNo: **73283** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	0.023	0.0010	0.02500	0	92.8	85	115			
Arsenic	0.023	0.0010	0.02500	0	93.1	85	115			
Thallium	0.023	0.0010	0.02500	0	92.9	85	115			

Sample ID **MB** | SampType: **MBLK** | TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW** | Batch ID: **R2629** | RunNo: **2629**
Prep Date: | Analysis Date: **5/8/2012** | SeqNo: **73284** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010								
Arsenic	ND	0.0010								
Thallium	ND	0.0010								

Sample ID **LCS** | SampType: **LCS** | TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW** | Batch ID: **R2708** | RunNo: **2708**
Prep Date: | Analysis Date: **5/10/2012** | SeqNo: **75447** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	0.026	0.0010	0.02500	0	104	85	115			
Uranium	0.025	0.0010	0.02500	0	99.2	85	115			

Sample ID **MB** | SampType: **MBLK** | TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW** | Batch ID: **R2708** | RunNo: **2708**
Prep Date: | Analysis Date: **5/10/2012** | SeqNo: **75448** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	ND	0.0010								
Uranium	ND	0.0010								

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**
14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **MB-1862**	SampType: **MBLK**	TestCode: **EPA Method 245.1: Mercury**	
Client ID: **PBW**	Batch ID: **1862**	RunNo: **2669**	
Prep Date: **5/9/2012**	Analysis Date: **5/9/2012**	SeqNo: **74223**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020								

Sample ID **LCS-1862**	SampType: **LCS**	TestCode: **EPA Method 245.1: Mercury**	
Client ID: **LCSW**	Batch ID: **1862**	RunNo: **2669**	
Prep Date: **5/9/2012**	Analysis Date: **5/9/2012**	SeqNo: **74224**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.4	80	120			

Sample ID **1204854-004AMS**	SampType: **MS**	TestCode: **EPA Method 245.1: Mercury**	
Client ID: **BatchQC**	Batch ID: **1862**	RunNo: **2669**	
Prep Date: **5/9/2012**	Analysis Date: **5/9/2012**	SeqNo: **74226**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.2	75	125			

Sample ID **1204854-004AMSD**	SampType: **MSD**	TestCode: **EPA Method 245.1: Mercury**	
Client ID: **BatchQC**	Batch ID: **1862**	RunNo: **2669**	
Prep Date: **5/9/2012**	Analysis Date: **5/9/2012**	SeqNo: **74227**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.1	75	125	0.0957	20	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB** | SampType: **MBLK** | TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW** | Batch ID: **R2544** | RunNo: **2544**
Prep Date: | Analysis Date: **5/2/2012** | SeqNo: **70797** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID **LCS** | SampType: **LCS** | TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW** | Batch ID: **R2544** | RunNo: **2544**
Prep Date: | Analysis Date: **5/2/2012** | SeqNo: **70798** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.47	0.10	0.5000	0	93.8	90	110			
Chloride	4.6	0.50	5.000	0	92.9	90	110			
Nitrogen, Nitrite (As N)	0.93	0.10	1.000	0	92.9	90	110			
Nitrogen, Nitrate (As N)	2.4	0.10	2.500	0	97.4	90	110			
Sulfate	9.5	0.50	10.00	0	94.8	90	110			

Sample ID **1205075-001BMS** | SampType: **MS** | TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** | Batch ID: **R2544** | RunNo: **2544**
Prep Date: | Analysis Date: **5/2/2012** | SeqNo: **70800** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.68	0.10	0.5000	0.1911	98.1	72.9	113			
Nitrogen, Nitrite (As N)	1.0	0.10	1.000	0	101	77.6	111			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	99.9	82.8	116			

Sample ID **1205075-001BMSD** | SampType: **MSD** | TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** | Batch ID: **R2544** | RunNo: **2544**
Prep Date: | Analysis Date: **5/2/2012** | SeqNo: **70801** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.65	0.10	0.5000	0.1911	90.9	72.9	113	5.39	20	
Nitrogen, Nitrite (As N)	0.90	0.10	1.000	0	90.2	77.6	111	10.8	20	
Nitrogen, Nitrate (As N)	2.3	0.10	2.500	0	91.3	82.8	116	8.94	20	

Sample ID **1205079-001AMS** | SampType: **MS** | TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** | Batch ID: **R2544** | RunNo: **2544**
Prep Date: | Analysis Date: **5/2/2012** | SeqNo: **70809** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	1.3	0.10	1.000	0	127	77.6	111			S
Nitrogen, Nitrate (As N)	2.4	0.10	2.500	0	97.8	82.8	116			

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205079-001AMSD** SampType: **MSD** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70810** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	1.2	0.10	1.000	0	122	77.6	111	4.14	20	S
Nitrogen, Nitrate (As N)	2.4	0.10	2.500	0	95.5	82.8	116	2.38	20	

Sample ID **MB** SampType: **MBLK** TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70849** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70850** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.50	0.10	0.5000	0	99.0	90	110			
Chloride	4.7	0.50	5.000	0	94.2	90	110			
Nitrogen, Nitrite (As N)	0.98	0.10	1.000	0	98.0	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	98.3	90	110			
Sulfate	9.6	0.50	10.00	0	95.7	90	110			

Sample ID **1205066-002AMS** SampType: **MS** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70852** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	1.1	0.10	0.5000	0.5616	101	72.9	113			
Nitrogen, Nitrite (As N)	0.93	0.10	1.000	0	92.7	77.6	111			
Nitrogen, Nitrate (As N)	3.3	0.10	2.500	0.5059	111	82.8	116			
Sulfate	48	0.50	10.00	36.66	113	80.5	119			

Sample ID **1205066-002AMSD** SampType: **MSD** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70853** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	1.0	0.10	0.5000	0.5616	93.8	72.9	113	3.52	20	
Nitrogen, Nitrite (As N)	0.79	0.10	1.000	0	78.5	77.6	111	16.5	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID	**1205066-002AMSD**	SampType:	**MSD**	TestCode:	**EPA Method 300.0: Anions**
Client ID:	**BatchQC**	Batch ID:	**R2544**	RunNo:	**2544**
Prep Date:		Analysis Date:	**5/2/2012**	SeqNo:	**70853** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrate (As N)	3.0	0.10	2.500	0.5059	98.7	82.8	116	10.2	20	
Sulfate	47	0.50	10.00	36.66	101	80.5	119	2.50	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205170-001D**		SampType: **DUP**			TestCode: **EPA 120.1: Specific Conductance**					
Client ID: **BatchQC**		Batch ID: **R2646**			RunNo: **2646**					
Prep Date:		Analysis Date: **5/7/2012**			SeqNo: **73516**		Units: **µmhos/cm**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	610	0.010						0	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205076**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205005-001A DUP** SampType: **DUP** TestCode: **SM4500-H+B: pH**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71363** Units: **pH units**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
pH	3.92	1.68						0.762		H

Sample ID **1205120-001B DUP** SampType: **DUP** TestCode: **SM4500-H+B: pH**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71373** Units: **pH units**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
pH	7.73	1.68						0.645		H

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205005-001A MS** SampType: **MS** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71221** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20	80.00	0	0	62.6	110			S

Sample ID **1205005-001A MSD** SampType: **MSD** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71222** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20	80.00	0	0	59.9	111	0	10	S

Sample ID **1205120-001B MS** SampType: **MS** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71242** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	360	20	80.00	299.4	70.9	62.6	110			

Sample ID **1205120-001B MSD** SampType: **MSD** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71243** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	350	20	80.00	299.4	67.1	59.9	111	0.869	10	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **MB-1832** | SampType: **MBLK** | TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **PBW** | Batch ID: **1832** | RunNo: **2634**
Prep Date: **5/7/2012** | Analysis Date: **5/8/2012** | SeqNo: **73329** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID **LCS-1832** | SampType: **LCS** | TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **LCSW** | Batch ID: **1832** | RunNo: **2634**
Prep Date: **5/7/2012** | Analysis Date: **5/8/2012** | SeqNo: **73330** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1,020	20.0	1,000	0	102	80	120			

Sample ID **1205078-002GMS** | SampType: **MS** | TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **BatchQC** | Batch ID: **1832** | RunNo: **2634**
Prep Date: **5/7/2012** | Analysis Date: **5/8/2012** | SeqNo: **73337** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	4,890	20.0	1,000	3,791	110	80	120			

Sample ID **1205078-002GMSD** | SampType: **MSD** | TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **BatchQC** | Batch ID: **1832** | RunNo: **2634**
Prep Date: **5/7/2012** | Analysis Date: **5/8/2012** | SeqNo: **73338** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	4,930	20.0	1,000	3,791	114	80	120	0.733	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **MB-1800** | SampType: **MBLK** | TestCode: **SM 2540D: TSS**
Client ID: **PBW** | Batch ID: **1800** | RunNo: **2570**
Prep Date: **5/3/2012** | Analysis Date: **5/3/2012** | SeqNo: **71656** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0								

Sample ID **LCS-1800** | SampType: **LCS** | TestCode: **SM 2540D: TSS**
Client ID: **LCSW** | Batch ID: **1800** | RunNo: **2570**
Prep Date: **5/3/2012** | Analysis Date: **5/3/2012** | SeqNo: **71657** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	93	4.0	96.60	0	96.3	82.9	110			

Sample ID **1205034-001BDUP** | SampType: **DUP** | TestCode: **SM 2540D: TSS**
Client ID: **BatchQC** | Batch ID: **1800** | RunNo: **2570**
Prep Date: **5/3/2012** | Analysis Date: **5/3/2012** | SeqNo: **71663** | Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0						0	15	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: NEW MEXICO COPPER CORP   Work Order Number: 1205076

Received by/date: AT 05/02/12

Logged By: Anne Thorne   5/2/2012 7:30:00 AM   [signature]

Completed By: Anne Thorne   5/2/2012   [signature]

Reviewed By: AT 05/02/12

Chain of Custody

1. Were seals intact? Yes ☐ No ☐ Not Present ☑
2. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
3. How was the sample delivered? Client

Log In

4. Coolers are present? (see 19. for cooler specific information) Yes ☑ No ☐ NA ☐
5. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
6. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
7. Sample(s) in proper container(s)? Yes ☑ No ☐
8. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
9. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
10. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
11. VOA vials have zero headspace? Yes ☑ No ☐ No VOA Vials ☐
12. Were any sample containers received broken? Yes ☐ No ☑
13. Does paperwork match bottle labels? Yes ☑ No ☐
(Note discrepancies on chain of custody)
14. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
15. Is it clear what analyses were requested? Yes ☑ No ☐
16. Were all holding times able to be met? Yes ☑ No ☐
(If no, notify customer for authorization.)

\# of preserved bottles checked for pH: 1
(<2 or >12 unless noted)
Adjusted? ____
Checked by: AT 05/02/12

Special Handling (if applicable)

17. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: ____ Date ____
By Whom: ____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: ____
Client Instructions: ____

18. Additional remarks:

19. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.4	Good	Not Present			

Chain-of-Custody Record

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Client: New Mexico Copper Corp

Mailing Address: 2425 San Pedro Dr NE Suite 100, ABQ NM

Phone #: 505.400.7925

email or Fax#:

QA/QC Package: ☐ Standard ☐ Level 4 (Full Validation)

Accreditation ☐ NELAP ☐ Other ____

☐ EDD (Type) ____

Turn-Around Time: ☐ Standard ☒ Rush Need Results by May 11 via email

Project Name: CuFlat

Project #: Production Well Sampling

Project Manager: Katie Emmer

Sampler: CMC

On Ice: ☒ Yes ☐ No

Sample Temperature: 3.4

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1205016	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	see enclosed list				Air Bubbles (Y or N)
5.1.12	1400	H_2O	PW-1	500		-001												X				
↓	↓	↓	↓	125	H_2SO_4	-001												↓				
↓	↓	↓	↓	125	HNO_3 + filter	-001												↓				
↓	↓	↓	↓	500	HNO_3	-001												↓				
↓	↓	↓	↓	500	NaOH	-001												↓				

Date:	Time:	Relinquished by:	Received by:	Date	Time
5/1/12	14:30	[signature]	[signature]	May 1 2012	14:30
5/2/12	07:50	[signature]	[signature]	05/02/12	0730

Remarks: Please email results to: Katie Emmer kemmer@themacresourcesgroup.com
Please add Hardness, per Katie. 5/3

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

NM Copper
May 1, 2012

Table 9-3
Analytical Parameters and Analysis Methods for Groundwater Samples

Analytical Parameter	Analysis Method	Lab Detection Limit (mg/L unless noted)
Anions		
Fluoride	EPA Method 300.0	0.1
Chloride	EPA Method 300.0	0.1
Nitrogen, Nitrite (as N)	EPA Method 300.0	0.1
Nitrogen, Nitrate (as N)	EPA Method 300.0	0.1
Sulfate	EPA Method 300.0	0.5
Dissolved Metals		
Aluminum	EPA Method 200.7	0.02
Antimony	EPA Method 200.8	0.005
Arsenic	EPA Method 200.8	0.02
Barium	EPA Method 200.7	0.002
Beryllium	EPA Method 200.7	0.002
Boron	EPA Method 200.7	0.04
Cadmium	EPA Method 200.7	0.002
Calcium	EPA Method 200.7	0.50
Chromium	EPA Method 200.7	0.006
Cobalt	EPA Method 200.7	0.006
Copper	EPA Method 200.7	0.0003
Iron	EPA Method 200.7	0.02
Lead	EPA Method 200.7	0.005
Magnesium	EPA Method 200.7	0.50
Manganese	EPA Method 200.7	0.002
Mercury	EPA Method 7470 CVAA	0.0002
Molybdenum	EPA Method 200.7	0.008
Nickel	EPA Method 200.7	0.01
Potassium	EPA Method 200.7	1.0
Selenium	EPA Method 200.8	0.02
Silicon	EPA Method 200.7	0.08
Silver	EPA Method 200.7	0.005
Sodium	EPA Method 200.7	0.5

NM Copper
May 1, 2012

Analytical Parameter	Analysis Method	Lab Detection Limit (mg/L unless noted)
Thallium	EPA Method 200.7	0.01
~~Titanium~~	~~EPA Method 200.7~~	~~0.005~~
Uranium	EPA Method 200.8	0.01
Vanadium	EPA Method 200.7	0.005
Zinc	EPA Method 200.7	0.005
Solids		
Total Suspended Solids (TSS)	SM 2540D	1.0 µg/L
Total Dissolved Solids (TDS)	SM 2540C	10
Alkalinity		
Alkalinity, total (as $CaCO_3$)	SM 2320B	20
Carbonate	SM 2320B	20
Bicarbonate	SM 2320B	20
Other		
pH	150.1	12.45
Specific Conductance	120.1	0.01 µS/cm
Cyanide	Kelada-01	0.005

Note: NA = not applicable as sample will not be analyzed for a given parameter.

SUSANA MARTINEZ
Governor
JOHN A. SANCHEZ
Lt. Governor

NEW MEXICO ENVIRONMENT DEPARTMENT

Harold Runnels Building
1190 Saint Francis Drive (87505)
PO Box 5469, Santa Fe, NM 87502-5469
Phone (505) 827-2990 Fax (505) 827-1628
www.env.nm.gov

BUTCH TONGATE
Cabinet Secretary
J.C. BORREGO
Deputy Secretary

October 23, 2017

VIA E-MAIL

Jaimie Park
jpark@nmelc.org

Re: Request to Inspect Public Records

Dear Ms. Park:

On October 23, 2017, this office received your request for public information. You request information pertaining to: Copper Flat Copper Mine's pending discharge permit application. (See attached request).

I forwarded your request to the bureaus on October 23, 2017. The bureaus will respond by November 6, 2017.

Should you have any questions, please contact the Ground Water Quality Bureau at (505) 827-2919 and the Surface Water Quality Bureau at (505) 827-2819.

Sincerely,

Melissa Y. Mascareñas
New Mexico Environment Department
Department Public Records Custodian

cc: Andrew Knight, Assistant General Counsel
Michelle Hunter, Chief, Ground Water Quality Bureau
Shelly Lemon, Chief, Surface Water Quality Bureau

NEW MEXICO ENVIRONMENT DEPARTMENT
INSPECTION OF PUBLIC RECORD REQUEST FORM

Please fill out the following information:

1. Date: September 6, 2017

2. Requestor's Name: Jaimie Park, New Mexico Environmental Law Center

3. Requestor's Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

4. Phone No.: (505) 989-9022

5. Email: **jpark@nmelc.org**

6. Company Being Represented: New Mexico Environmental Law Center

7. Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

8. Document or File being requested to be reviewed or copied (please describe the records in sufficient detail to enable Department personnel to reasonably identify & locate the records:

I request that you inform me what documents are available within the scope of this request and when I can inspect those documents. I also request that you not make any copies without first informing me of the number of copies and the cost for the copying that are involved. Finally, I request that if you determine that any documents or portions of documents are exempt from disclosure you inform me of that and provide me with citations to the provisions in the Inspection of Public Records Act that indicate that the documents or portions of documents are exempt from disclosure, describe the type of document being withheld, and identify who sent the document being withheld and who received the document being withheld.

Records being requested:

1. NMED determination regarding Copper Flat Copper Mine pit lake being a private water, date range June 28, 2017 through June 19, 2017;

2. Bureau of Land Management request to the Surface Water Quality Bureau to write a letter of concurrence for the Surface Water Quality Bureau's benefit regarding the proposed Copper Flat Copper Mine pit lake and associated patented claims surveys completed and a finding that the pit lake constitutes a "private water" and is not subject to either surface or groundwater quality standards;

3. New Mexico Copper Corporation submittals to NMED pertaining to its discharge permit application since July 17, 2017; and

4. Copper Flat Copper Mine cooperating agency meeting notes for August 2017 meeting (should be August 30, 2017 meeting date).

9. NMED Bureau where Document/File can be found (if known): Surface Water Quality Bureau, Ground Water Quality Bureau

/s/ Jaimie Park
Signature

The cost for copying by NMED is as indicated on Attachment A. Please send this request to:

Melissa Y. Mascareñas
Inspection of Public Records Officer
1190 St. Francis Drive, Ste. N-4050
Santa Fe, New Mexico 87505
fax: (505) 827-1628 or
email: melissa.mascarenas@state.nm.us

15765

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lt. Governor

NEW MEXICO
ENVIRONMENT DEPARTMENT

Harold Runnels Building
1190 Saint Francis Drive (87505)
PO Box 5469, Santa Fe, NM 87502-5469
Phone (505) 827-2990 Fax (505) 827-1628
www.env.nm.gov

BUTCH TONGATE
Cabinet Secretary

J.C. BORREGO
Deputy Secretary

November 9, 2017

VIA E-MAIL

Jaimie Park
jpark@nmelc.org

Re: Request to Inspect Public Records

Dear Ms. Park:

On November 9, 2017, this office received your request for public information. You request information pertaining to: All drafts of a discharge permit for the Copper Flat Copper Mine and associated staff notes and correspondence pertaining to the drafting of the discharge permit. (See attached request).

I forwarded your request to the bureaus on November 9, 2017. The bureaus will respond by November 27, 2017.

Should you have any questions, please contact the Ground Water Quality Bureau at (505) 827-2919 and the Surface Water Quality Bureau at (505) 827-2819.

Sincerely,

Melissa Y. Mascareñas
New Mexico Environment Department
Department Public Records Custodian

cc: Andrew Knight, Assistant General Counsel
Michelle Hunter, Chief, Ground Water Quality Bureau
Shelly Lemon, Chief, Surface Water Quality Bureau

NEW MEXICO ENVIRONMENT DEPARTMENT
INSPECTION OF PUBLIC RECORD REQUEST FORM

Please fill out the following information:

1. Date: October 21, 2017

2. Requestor's Name: Jaimie Park, New Mexico Environmental Law Center

3. Requestor's Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

4. Phone No.: (505) 989-9022

5. Email: **jpark@nmelc.org**

6. Company Being Represented: New Mexico Environmental Law Center

7. Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

8. Document or File being requested to be reviewed or copied (please describe the records in sufficient detail to enable Department personnel to reasonably identify & locate the records:

I request that you inform me what documents are available within the scope of this request and when I can inspect those documents. I also request that you not make any copies without first informing me of the number of copies and the cost for the copying that are involved. Finally, I request that if you determine that any documents or portions of documents are exempt from disclosure you inform me of that and provide me with citations to the provisions in the Inspection of Public Records Act that indicate that the documents or portions of documents are exempt from disclosure, describe the type of document being withheld, and identify who sent the document being withheld and who received the document being withheld.

Records being requested:

1. NMED determination regarding Copper Flat Copper Mine pit lake being a private water, date range July 2017 through date of this request;

2. Bureau of Land Management letter of concurrence for NMED's/Surface Water Quality Bureau's benefit regarding the proposed Copper Flat Copper Mine pit lake and associated patented claims surveys completed and a finding that the pit lake constitutes a "private water" and is not subject to either surface or groundwater quality standards;

3. New Mexico Copper Corporation submittals to NMED pertaining to its discharge permit application since July 2017;
4. New Mexico Copper Corporation submittals to NMED pertaining to the pit lake since July 2017;
5. Copper Flat Copper Mine cooperating agency meeting notes for September and October 2017 meetings; and
6. NMED's October 2017 determination regarding technical completeness for New Mexico Copper Corporation's discharge permit application.

9. NMED Bureau where Document/File can be found (if known): Surface Water Quality Bureau, Ground Water Quality Bureau

/s/ Jaimie Park
Signature

The cost for copying by NMED is as indicated on Attachment A. Please send this request to:

Melissa Y. Mascareñas
Inspection of Public Records Officer
1190 St. Francis Drive, Ste. N-4050
Santa Fe, New Mexico 87505
fax: (505) 827-1628 or
email: melissa.mascarenas@state.nm.us

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

November 30, 2017

RECEIVED
NOV 30 2017
Ground Water Quality Bureau

Mr. David Ennis
Reclamation Specialist
New Mexico Energy, Minerals and Natural Resources Department
Mining and Minerals Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: NMMC Response to MMD Additional Technical Comments On:
- Updated Mining Operation and Reclamation Plan, Rev. 1, July 2017;
- Response for Additional Information dated October 13, 2017;

Copper Flat Mine, Sierra County, Permit Tracking No. SI027RN

Dear Mr. Ennis:

The Mining and Minerals Division (MMD) provided New Mexico Copper Corporation (NMCC) with additional technical comments on the Company's proposed Mining Operation and Reclamation Plan in a letter dated November 20, 2017. NMCC has reviewed MMD's comments and a response to each is provided herein.

MMD Comment 1:

NMCC's Item #32 response comment states that rip-rap for reclamation may be sourced from EWRSP-2(A) and EWRSP-2B. NMCC's baseline data report shows that EWRSP-2A and EWRSP-2B can contain high sulfide/low paste pH material, therefore MMD has concerns about the proposal to utilize these piles as a source for rip-rap. A detailed material handling plan describing how clean rip-rap would be tested, identified and segregated from these piles would be required as a future permit condition in order to proceed with this proposal. Alternatively, NMCC may wish to eliminate this proposal from the reclamation plan and source rip-rap from the TSF salvaged material and/or proposed andesite breccia quarry at the WRSP-3 location. Please address.

NMCC Response

NMCC acknowledges MMD's concern and agrees to eliminate EWRSP-2A and EWRSP-2B as sources for rip-rap. NMCC will source rip-rap either from material salvaged during TSF construction or from an andesite breccia quarry located within the footprint of the future WRSP-3.

MMD Comment 2

Plan for reclamation/revegetation of the 4900 expanded catch bench. As proposed, this bench will not be contiguous with other reclaimed areas within the pit. Please address the possibility of *performing some additional reclamation to connect the 4900 expanded catch bench to the haul road reclamation.*

NMCC Response

NMCC has considered the potential to connect the 4900 expanded catch bench (expanded bench) with the pit haul road as requested by MMD. NMCC notes that the Copper Flat pit design includes a 38-foot wide safety catch bench left in the final pit wall at the 4900 elevation that will physically connect the expanded bench to the haul road above the re-formed pit lake waterline and that this safety catch bench will allow wildlife movement between the haul road and the expanded catch bench.

Vehicle access from the haul road to the expanded bench would require construction of a land bridge after mining is complete or widening the safety catch bench along the final pit wall. Construction of a land bridge would require importing approximately 200,000 cubic feet of material into the pit after mining is complete. Re-designing the pit wall to provide a safety catch bench with sufficient width for safe access by personnel would result in significant loss of ore. As a result, NMCC concludes that providing enhanced access to the expanded catch bench by either of these two methods beyond that which will exist as a result of the 38-foot safety catch bench is not practical and is unnecessary.

MMD Comment 3 (Reference Appendix E, Section 2.5.2):

a. *Please identify where the land bridge material will be placed at closure when removed from Grayback arroyo.*

NMCC Response:

Material removed from Grayback Arroyo crossings will be used for reclamation grading in the process area. This material will be suitable to meet reclamation needs such as: backfilling foundation excavations and water impoundments; regrading outslopes in the process area; backfilling the tailings pipeline excavation; and backfilling and regrading at the cyclone plant. Excess material, if generated, will be taken and blended into reclamation grading at a mine waste rock stockpiles or at the TSF.

b. *The majority of the plant area is proposed to be covered with 6 inches of growth media, however the slopes along the perimeter of the plant area will be graded to a slope of 3.0H1V and covered with 36 inches of growth media. Please explain why the slopes are proposed to be covered with 36 inches of growth media while majority of the regraded plant area will be covered with 6 inches of growth media.*

NMCC Response:

Bullets 6 and 11 of Section 2.5.2 contain inadvertent typographical errors. The material present in the process area outslopes is non-mine waste that does not require additional cover. The depth of cover discussed therein is intended to be 6 inches to match the proposed cover plan for the general plant area.

MMD Comment 4:
In Appendix E, Table E6, please describe or identify on a map the facility identified as 'West Pit Buildup" and what this buildup entails. Is this buildup associated with EWRSP-1 reclamation?

NMCC Response:
MMD's observation is correct. The West Pit Buildup is associated with EWRSP-1 reclamation and represents material required to contour and grade the area to promote positive drainage away from the pit crest and direct stormwater to proposed toe channels TC-2 and TC-3 as shown in Figure C-002 of the Reclamation Plan.

MMD Comment 5:
The structure(s) to the south of the proposed tailings impoundment currently utilized as the Copper Flat mine office do not appear to be included in the MORP Rev 1. Please address the final disposition of these buildings at closure.

NMCC Response:
Three structures are located south of the proposed tailings impoundment: a wooden barn; an adobe house; and a concrete block building. All three structures are located on private property owned by NMCC. The barn is currently used by a local rancher to store ranch materials and supplies. The house structure is not occupied. NMCC occupies the concrete block building and is currently using the building as a site office, shop, and warehouse. NMCC intends to continue to use the block building during operations and during reclamation of the site. At closure, the future of these structures will be determined by their suitability for ongoing ranching operations that are expected to continue post mining and according to their significance as cultural properties as determined by actions contemplated in the Programmatic Agreement between constituent agencies and interested parties.

MMD Comment 6:
The New Mexico Department of Game and Fish has provided comments on NMCC's October 13, 2017 submittal, which is attached and shall be addressed by NMCC.

NMDG&F-a. *The NM Department of Game and Fish (Department) supports the potential habitat value of pit highwalls as part of the post-mining reclamation plan. However, in order for vertical pit highwalls to provide adequate wildlife habitat they need to contain habitat features that attract wildlife species which utilize cliffs for nesting and shelter. Verticality alone does not create adequate cliff habitat for wildlife. The Department recommends that pit highwalls are enhanced by design features that are of value to wildlife. These would include; creating ledges, niches, alcoves, and horizontal holes on the cliff face for nesting raptors and other bird species that utilize ledges and cavities, and by placing rock piles along the toe of the highwall that mimics talus slopes for small mammals and reptiles.*

NMCC Response:
NMCC acknowledges the Department's expertise with developing wildlife habitat and hereby commits to creating ledges, niches, alcoves, and horizontal holes on the pit wall for nesting raptors and other bird species as suggested in the Department's comment. Furthermore, NMCC commits to further enhance the value to wildlife of the future pit habitat by placing rock piles along the highwall toes to mimic talus slopes for small mammals and reptiles. NMCC believes that many of these desired features will manifest themselves naturally in the course of mine development and operations. Nonetheless, NMCC will take action during mining operations to ensure the features described herein are developed and, as noted in our October 13, 2017 submittal, NMCC will actively pursue the assistance of the NMDG&F to maximize those opportunities.

NMDG&F-b. *The Department suggests extending the "Expanded 4900 Catch Bench" as far as it technically feasible, so that it would gently slope into the pit and be submerged after the rapid-fill process is complete. This would create a littoral zone in the pit lake and allow for the establishment and growth of aquatic plants and would further enhance its value as wildlife habitat.*

NMCC Response:
Extending the expanded 4900 catch bench would result in significant loss of ore and affect project value and therefore this action is not practical. Additionally, developing a littoral zone around the full perimeter of the expanded catch bench as suggested by the Department would require a significant quantity of material to construct and this action is also not practical. However, as NMCC points out in the October 13 submittal to MMD, reclaiming the expanded catch bench will require construction of an access ramp before rapid fill of the pit. That ramp would be left in place after reclamation activities are complete and therefore would become submerged by the future pit lake, thus creating a section of littoral zone as suggested by the Department.

NMCC appreciates the opportunity to continue to work with the MMD in pursuit of approval of Mining Permit No. SI027RN. Please do not hesitate to contact us if you have any questions or require clarification.

Sincerely,

J Smith

Jeff Smith
Chief Operating Officer
THEMAC Resources Group/New Mexico Copper Corporation
Telephone: (520) 991-4588

cc: Brad Reid – New Mexico Environment Department

Reid, Brad, NMENV

From:	Knight, Andrew, NMENV
Sent:	Friday, December 01, 2017 11:35 AM
To:	Vollbrecht, Kurt, NMENV; Reid, Brad, NMENV
Subject:	RE: IPRA Request Copper Flat Copper Mine (October 21, 2017)

Absolutely. Tell NMCC that if they have reason to believe that BLM does not have a problem with the surveys, and it is just a matter of their reluctance to put something in writing, I would be glad to contact BLM on behalf of SWQB.

From: Vollbrecht, Kurt, NMENV
Sent: Friday, December 01, 2017 11:30 AM
To: Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>; Reid, Brad, NMENV <brad.reid@state.nm.us>
Subject: RE: IPRA Request Copper Flat Copper Mine (October 21, 2017)

Ok.

We are meeting with NMCC on the 13th so we will tell them they need to get BLM to send something that indicates concurrence with the surveys.

Once that is provided NMCC can overlay the current and future pit lake (that is the one that matters) onto the plat.

Thanks Andrew.

Kurt Vollbrecht, Program Manager
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
(505) 827-0195

From: Knight, Andrew, NMENV
Sent: Friday, December 1, 2017 11:26 AM
To: Vollbrecht, Kurt, NMENV <kurt.vollbrecht@state.nm.us>; Reid, Brad, NMENV <brad.reid@state.nm.us>
Subject: RE: IPRA Request Copper Flat Copper Mine (October 21, 2017)

Well,
I have a slightly different take on it. As the adjoining landowner whose boundaries are affected by this survey, BLM does need to acknowledge the validity of the surveys in writing, or at least say that they do not plan on contesting them. If the applicant can't get BLM to say either of those things, it indicates to me that BLM has some kind of problem with the surveys, and if that is the case, we cannot make the determination. It is BLM as the affected landowner, not so much as another government agency here. If NMCC can't get BLM to acknowledge the validity of the surveys, we have a big problem.

From: Vollbrecht, Kurt, NMENV
Sent: Thursday, November 30, 2017 4:48 PM
To: Reid, Brad, NMENV <brad.reid@state.nm.us>
Cc: Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>
Subject: RE: IPRA Request Copper Flat Copper Mine (October 21, 2017)

Ok. I'd suggest that if SWQB wants something from BLM they should ask BLM for that.

That is how we would handle that. We would not tell a permittee (or applicant) to get a concurrence from BLM.

BLM may not want to provide it. And it should not fall on the permittee to convince another government agency to provide something we desire. Seems to me that SWQB should call BLM.

Andrew?

Kurt Vollbrecht, Program Manager
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
(505) 827-0195

From: Reid, Brad, NMENV
Sent: Thursday, November 30, 2017 4:04 PM
To: Vollbrecht, Kurt, NMENV <kurt.vollbrecht@state.nm.us>
Subject: FW: IPRA Request Copper Flat Copper Mine (October 21, 2017)

See Bryan's comment that I highlighted in yellow below - seems like he is looking for something else from BLM. Also, pasted in directly below is an excerpt from the 10/21/16 SWQB letter to NMCC with their requests. Note that it does ask BLM to "concur" that the water body is on private lands:

The Department requests that you work with the Bureau of Lar
and document that the land surveys are indeed accurate, and BI
entirely on private lands. If it is found that the current and/or p
entirely on private lands, the water body would be considered a
subject to the surface water quality standards codified in 20.6.4

Here is what BLM says about the matter in their 9/13/17 letter to NMCC:

We reviewed all the mineral surveys in the area and updated ou
the status of the lands was noted correctly. We have also reque
this area.

Enclosed is a revised Master Title Plat. I hope this clarifies the
We have also placed the survey completed by your surveyor in t
the 3809 Plan casefiles.

From: Dail, Bryan, NMENV
Sent: Tuesday, October 24, 2017 10:30 AM
To: Lemon, Shelly, NMENV <Shelly.Lemon@state.nm.us>
Cc: Vollbrecht, Kurt, NMENV <kurt.vollbrecht@state.nm.us>; Reid, Brad, NMENV <brad.reid@state.nm.us>; Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>; Fullam, Jennifer, NMENV <Jennifer.Fullam@state.nm.us>
Subject: RE: IPRA Request Copper Flat Copper Mine (October 21, 2017)

Dear Andrew:

I address (in red) the aspects of the October 21, 2017 IPRA relevant to the Surface Water Quality Bureau ("SWQB") below:

1. NMED determination regarding Copper Flat Copper Mine pit lake being a private water, date range July 2017 through date of this request;

1A: No such determination has been made as of this writing

2. Bureau of Land Management letter of concurrence for NMED's/Surface Water Quality Bureau's benefit regarding the proposed Copper Flat Copper Mine pit lake and associated patented claims surveys completed and a finding that the pit lake constitutes a "private water" and is not subject to either surface or groundwater quality standards;
Revised 6/14/12

2A: The Bureau of Land Management ("BLM") sent correspondence to New Mexico Copper Corporation ("NMCC") which was then sent to the SWQB on September 27, 2017 via email with the following attachments:

1. NMCC letter to SLemon_27Sept2017
2. Copper Flat Boundary Survey Plat, March 2017
3. BLM letter from Ida Viarreal, September 13, 2017
4. BLM Map Township 15 South, Range 7 West

I have attached these to this email, however, I do not consider this BLM letter an unambiguous letter of concurrence, rather, as BLM states; an indication that they have updated their Master Title Plats and intend to update their GIS layer. It would certainly help if there could be an overlay generated of the current and future pit lake maps with the updated GIS layer referenced in the BLM letter dated September 13, 2017. I do not have either sets of maps in a form allowing me to easily do so, or lack the expertise to generate the overlay. Absent that, and concurrence from BLM, NMED is likely not able to make a finding.

3. New Mexico Copper Corporation submittals to NMED pertaining to its discharge permit application since July 2017;

3A: N/A

4. New Mexico Copper Corporation submittals to NMED pertaining to the pit lake since July 2017;

4A: Other than NMCC's correspondence of September 27, the SWQB has no other pit lake related submittals from July to the present.

5. Copper Flat Copper Mine cooperating agency meeting notes for September and October 2017 meetings; and

5A: N/A

6. NMED's October 2017 determination regarding technical completeness for New Mexico Copper Corporation's discharge permit application.

6A: N/A

This, I believe, is a complete listing of all relevant materials from the SWQB.

-Bryan

From: Lemon, Shelly, NMENV
Sent: Monday, October 23, 2017 4:23 PM
To: Dail, Bryan, NMENV <Bryan.Dail@state.nm.us>
Cc: Vollbrecht, Kurt, NMENV <kurt.vollbrecht@state.nm.us>; Reid, Brad, NMENV <brad.reid@state.nm.us>; Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>; Fullam, Jennifer, NMENV <Jennifer.Fullam@state.nm.us>
Subject: FW: IPRA Request Copper Flat Copper Mine

Bryan,

Please work with Brad, Kurt and Andrew to fulfill this IPRA. Let me know if you need anything.

Thanks!
Shelly

From: Mascarenas, Melissa, NMENV
Sent: Monday, October 23, 2017 2:26 PM
To: Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>; Hunter, Michelle, NMENV <Michelle.Hunter@state.nm.us>; Lemon, Shelly, NMENV <Shelly.Lemon@state.nm.us>
Subject: IPRA Request Copper Flat Copper Mine

Please make sure that Andrew Knight reviews all documents prior to release.

From: Jaimie Park [mailto:jpark@nmelc.org]
Sent: Saturday, October 21, 2017 12:16 PM
To: Mascarenas, Melissa, NMENV <melissa.mascarenas@state.nm.us>
Cc: Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>
Subject: IPRA Request Copper Flat Copper Mine

Dear Ms. Mascarenas,

Please find attached an IPRA request pertaining to the Copper Flat Copper Mine's pending discharge permit application.

Kind Regards,

Jaimie Park

Reid, Brad, NMENV

From: Knight, Andrew, NMENV
Sent: Monday, December 04, 2017 8:58 AM
To: Vollbrecht, Kurt, NMENV; Reid, Brad, NMENV
Cc: Dail, Bryan, NMENV
Subject: NMCC - BLM Acknowledgement of Validity of Surveys

OK, that's good to hear. I agree that BLM's opinion about where the surface of the future pit lake will be is not necessary to our analysis, so I would not have NMCC ask BLM for that. All we really needed from BLM was agreement that the boundaries between their land and NMCC's are where NMCC claims they are, and now it appears we have that.

Andrew P. Knight
Assistant General Counsel
New Mexico Environment Department
Office: (505) 222-9540
Cell: (505) 907-8836

From: Vollbrecht, Kurt, NMENV
Sent: Friday, December 01, 2017 5:01 PM
To: Reid, Brad, NMENV <brad.reid@state.nm.us>; Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>
Subject: RE: IPRA Request Copper Flat Copper Mine (October 21, 2017)

So it appears that BLM updated their "Master Title Plat" to match the survey completed by the registered surveyor, so they have acknowledged the validity of the survey.

The missing piece from these documents is the projected outline of the future pit lake. Since that can't be surveyed, NMCC will need to portray it as accurately as possible. Asking BLM to confirm that projected future pit lake is on private land is a little weird, but I guess they can ask BLM for that.

Brad - as part of the NEPA process and OSE review of the hydrologic model of pit lake drawdown did they also review the expected rebound and final lake level following cessation of pumping? If so, then that piece has already been "approved" as well.

The real question is how accurate is the model of the future lake size/elevation, and we won't know that until the future arrives...

Kurt Vollbrecht, Program Manager
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
(505) 827-0195

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

December 13, 2017

RECEIVED
DEC 13 2017
Ground Water Quality Bureau

Mr. David Ennis
Reclamation Specialist
New Mexico Energy, Minerals and Natural Resources Department
Mining and Minerals Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: Copper Flat Mine, Sierra County, Permit Tracking No. SI027RN
New Mexico Copper Corporation Document Transmittal

Dear Mr. Ennis:

Enclosed herewith are two reports required for the Copper Flat New Mine Permit Application:

1. Predictive Geochemistry Modeling of the Copper Flat Pit Lake, and
2. Probable Hydrologic Consequences of the Copper Flat Project.

It is our understanding that with this submittal, New Mexico Copper Corporation has fulfilled all requirements for a New Mine Permit Application outlined under 19.10.6.602 NMAC. Please advise if our understanding is not correct.

Furthermore, we feel that, with these two reports, our application package demonstrates compliance with New Mexico Mining Act regulations for Performance and Reclamation Standards for New Mining Operations found in 19.10.6.603 NMAC, and warrants an Agency conclusion that operation and reclamation of the Copper Flat Mine as proposed by New Mexico Copper Corporation will meet the requirements of the Act.

NMCC appreciates the opportunity to continue to work with the MMD in pursuit of approval of Mining Permit No. SI027RN. Please do not hesitate to contact us if you have any questions or require clarification.

Sincerely,

J Smith

Jeff Smith
Chief Operating Officer
THEMAC Resources Group/New Mexico Copper Corporation
Telephone: (520) 991-4588

cc: Brad Reid – New Mexico Environment Department

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

December 13, 2017

RECEIVED
DEC 13 2017
Ground Water Quality Bureau

Mr. David Ennis, Reclamation Specialist
Mining and Minerals Division
New Mexico Energy, Minerals and Natural Resources Department

Mr. Kurt Vollbrecht, Manager
Mining Environmental Compliance Section
Groundwater Quality Bureau
New Mexico Environment Department

RE: New Mexico Copper Corporation
OSE Application to Repair Existing Copper Flat Tailings Dam Reservoir

Enclosed herewith for your information is a copy of an application to OSE for the breach of the splitter dike behind the Copper Flat Tailings Dam. This action will provide a channel to connect the northern and southern cells of the existing tailings storage facility. This activity will not affect the existing Copper Flat Tailings Dam and is fully contained on patented land owned by NMMC. Details regarding the project are contained in an engineer's report provided with the application.

Please do not hesitate to contact us if you have any questions or require clarification.

Sincerely,

J Smith

Jeff Smith
Chief Operating Officer
THEMAC Resources Group/New Mexico Copper Corporation
Telephone: (520) 991-4588

THE MAC RESOURCES | NEW MEXICO COPPER CORPORATION

December 12, 2017

Charles N. Thompson, P.E.
Office of the State Engineer
Concha Ortiz Y Pino Building
P.O. Box 25102
Santa Fe, NM 87504

Re: OSE File No. D-564
Copper Flat Tailings Dam
Application to Breach Splitter Dike

Dear Mr. Thompson:

Submitted herewith is New Mexico Copper Corporation's application to breach the splitter dike contained within the existing Copper Flat Tailings Storage Facility. The application and accompanying design documents have been prepared in response to the OSE Dam Safety Bureau's requirement to breach the facility splitter dike issued in a letter dated September 18, 2017.

NMCC intends to self-perform the work and estimates cost of construction will total approximately $10,000.

Enclosed with this application is a check in the amount of $45.00 for payment of the $25.00 application filing fee and the $20.00 plan review fee ($2.00 per $1,000 of construction cost).

Please contact me if additional information regarding this application is needed.

Sincerely,

Jeff Smith, COO
New Mexico Copper Corporation

cc: Doug Rappuhn, OSE hydrologist
Kurt Vollbrecht, NMED
DJ Ennis, MMD
Doug Haywood, BLM

OSE Permit Number: D-564

NEW MEXICO OFFICE OF THE STATE ENGINEER
APPLICATION FOR PERMIT
TO ALTER OR REPAIR A DAM AND RESERVOIR

1. OWNER INFORMATION:

I, Jeffrey Smith of New Mexico Copper Corporation

County of Bernalillo, State of New Mexico, owner of Copper Flat Tailings Dam, hereby make application for the approval of plans and specifications for the repair of Copper Flat Tailings Dam or reservoir.

If the owner is a corporation, give name and address of president and secretary:

Jeffrey Smith, Chief Operating Officer
4253 Montgomery Blvd. NE, Suite 130
Albuquerque, NM 87109

2. LOCATION:

A. NE¼ NW¼ SW¼ Section: 31 Township: 15S Range: 6W N.M.P.M. in Sierra County.

or X = ______feet, Y = ____ feet, N.M. State Plane Coordinate System ___ Zone Datum of_____in the _____ Grant.

B. Latitude in decimal degrees: 32.9576°
Longitude in decimal degrees: -107.4976°

3. HAZARD POTENTIAL CLASSIFICATION: Significant

4. DESCRIPTION OF PROPOSED WORK:

A. Type of dam: Earth embankment with internal splitter dike to separate the reservoir into northern and southern cells

B. Description of work contemplated (Use extra sheets or exhibits if necessary.)

Excavate storm water channel through internal splitter dike to allow storm water to flow from northern to southern cells during a flood event. Design details provided in attached technical memo by Golder Associates.

OSE Permit Number: D-564

NEW MEXICO OFFICE OF THE STATE ENGINEER
APPLICATION FOR PERMIT TO ALTER OR REPAIR A DAM AND RESERVOIR

5. DESCRIPTION OF DEFICIENCIES OF DAM WITH DESIGN REQUIREMENTS FOR DAMS (19.25.12. 11 NMAC):

Mine tailings deposited in the northern cell have reduced the water holding capacity of the north cell, which may lead to overtopping of the front embankment during a flood event.

6. Work is commenced by estimate Q1 2018 (dependent on OSE approval) and to be completed by 3 months after OSE approval (estimate Q2 2018)

7. Engineer: Golder Associates **8.** Contractor: New Mexico Copper Corp. Self-Perform

9. ACKNOWLEDGEMENT FOR THE DAM OWNER:

I, Jeffrey Smith affirm that the foregoing statements are true to the best of my knowledge and belief. I fully understand the repair and alteration related to this dam and the responsibility and liability related to dam ownership.

Signed: [signature] Date: Dec 12, 2017

Subscribed and sworn to before me this 12th day of December, 2017

Notary Public: Katharyn Emmer

My commission expires: 14 March 2020

OFFICIAL SEAL
Katharyn Emmer
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 14 March 2020

INSTRUCTIONS

Use this form if the properties of the dam or appurtenant structures *will not* change as a result of the alteration or repair. This form shall be filed with original signatures and accompanied by construction drawings, specifications, design report, etc. and filing fee of $25.00 for the application and plan review fee of $2.00 per $1000 of construction cost for dam and appurtenances. Owners repairing a dam to address a dam safety deficiency may request a waiver of the plan review fee. This form and supporting documentation shall be delivered to the attention of the OSE Dam Safety Bureau, P.O. Box 25102, Santa Fe, New Mexico.

Hit "F1" key for additional instructions for each cell. Cell sizes are limited.

Office of the State Engineer Dam File Number required.
Section 1 Name and address of the representative of the owner making the application. Private owners must enter their name. Public or corporate owners must enter the name of the official authorized to make the application. Name of dam must also be entered.
Section 2 Location of dam is required.
Section 3 Hazard potential classification is required. Refer to 19.25.12.10 NMAC.
Section 4 Items A and B are required.
Section 5 Describe the dam deficiency as it relates to the design requirements in 19.25.12.11 NMAC
Section 6 Dates of estimated start and completion of work are required.
Section 7 Name of Design Engineer.
Section 8 Name of Contractor selected.
Section 9 Dam Owner's printed name and notarized signature are required.

Golder Associates

TECHNICAL MEMORANDUM

Date:	December 11, 2017	**Project No.:**	1789021
To:	Jeffrey Smith, PE	**Company:**	THEMAC Resources Group, Ltd
From:	Sheina Sadza, PE David A. Kidd, PE		
cc:		**Email:**	ssadza@golder.com dkidd@golder.com

DAVID ALAN KIDD NEW MEXICO 13776 REGISTERED PROFESSIONAL ENGINEER 12-11-17

RE: COPPER FLAT TAILINGS STORAGE FACILITY – INTERNAL DIKE BREACH DESIGN

Golder Associates Inc. (Golder) has prepared this Technical Memorandum (TM) for New Mexico Copper Company (NMCC), a wholly owned subsidiary of THEMAC Resources Group Ltd. This TM summarizes the design of a breach to the existing internal splitter dike that divides the North and South Cells of the existing Tailings Storage Facility (TSF) at Copper Flat Mine in Sierra County, New Mexico. In accordance with New Mexico Office of the State Engineer – Dam Safety Bureau (OSE-DSB) guidance, the breach has been designed to safely pass the Probable Maximum Flood (PMF) peak discharge while meeting established freeboard requirements at the existing starter dam along the east side of the TSF.

1.0 BACKGROUND

In 2012, Golder prepared a stormwater storage capacity assessment of the impoundment behind the existing TSF starter dam for New Mexico Copper Corporation (NMCC) (Golder 2012). This assessment looked at runoff volumes due to various durations of general Probable Maximum Precipitation (PMP) events and the 1-hour local storm PMP event.

The TSF catchment area is approximately 500 acres and the existing starter dam is located along the east side of TSF at a minimum crest elevation of 5,240 feet above mean sea level (ft-amsl). The TSF was separated into North and South Cells by the construction of an internal splitter dike with a crest elevation varying between 5,240 ft-amsl and 5,242 ft-amsl.

Tailings deposition during mining operations was limited to the North Cell, with placement such that accumulated water would be forced to the west, away from the starter dam face. The tailings deposition reduced the available stormwater storage capacity in the North Cell to approximately 280 acre-feet at the established 4 feet of freeboard.

As the North Cell would not have sufficient storage capacity for the PMP volumes, the 2012 assessment proposed breaching the internal splitter dike between the North and South Cells to allow runoff volumes to equalize between these two areas. It was determined that the combined storage of the North and South Cells (2,106 acre-feet) was sufficient to contain the runoff volume from all the evaluated PMP events and maintain a dry freeboard of 4 feet below the starter dam crest.

Golder Associates Inc.
4730 N. Oracle Road, Suite 210
Tucson, AZ 85705 USA
Tel: (520) 888-8818 Fax: (520) 888-8817 www.golder.com

In September 2017, OSE-DSB requested that the internal splitter dike be breached in accordance with the 2012 Golder assessment as part of NMCC's request for an extension of a maintenance waiver. Any proposed breach of the dike would need to be designed to pass the peak PMP discharge while still providing sufficient freeboard. OSE-DSB design guidance (NMOSE 2008) recommends evaluation of both the 72-hour general storm and the 6-hour local storm for the design of dams and appurtenant structures. The 2012 assessment looked at the longer duration general storm events, including the 72-hour general storm, to verify that there is sufficient combined storage capacity. However, the 6-hour local storm PMP produces higher peak discharges due to the higher rainfall intensity and controls the design of the breach.

The remainder of this document summarizes the design of the proposed dike breach which involves the development of a flood routing study for the 6-hour PMP in support of a breach design that maintains sufficient freeboard in the TSF.

2.0 SPLITTER DIKE BREACH DESIGN

Per the previous assessment, the breach should be designed to convey the PMF that reports to the north side of the splitter dike while maintaining 4 feet of dry freeboard below the starter dam crest. As noted in Section 1, the breach section should be designed to pass the peak discharge generated by the 6-hour local storm PMP. The breach design involves two main parts:

- Estimation of the 6-hour local storm PMP and controlling peak discharge
- Development of a breach weir configuration that conveys the peak discharge and meets the 4-foot freeboard requirement

2.1 6-Hour Local Storm PMP and Hydrologic Analysis

OSE-DSB's guidance document for the hydrologic analysis of dams (NMOSE 2008) outlines procedures for determining the PMP depths and other basin parameters that contribute to runoff. This document was used as the primary basis for the hydrologic analysis.

The basin areas reporting to the North Cell, North Tailings area and South Cell were verified using existing 2-foot contour interval topography provided by the client in 2011 and review of publicly available aerial imagery. The basin delineations and calculated areas are shown on Figure 1.

Based on the location of the TSF and its total contributing watershed, PMP depths are estimated using Hydrometeorological Report No. 55A (HMR 55A) (US Bureau of Reclamation [USBR] 1988). The estimated 6-hour local storm PMP depth is 16.02 inches. The step-by-step procedures used for the determining this estimate are provided in Attachment 1.

The Hydrologic Engineering Center – Hydrological Modeling System (HEC-HMS, US Army Corps of Engineers [USACE] 2016) software was used for this hydrologic analysis. Using OSE-DSB design guidance and information from Golder's 2012 assessment, the following assumptions were used to develop the hydrologic model:

- Basin Loss Method: Initial and Constant
  - Initial Loss = 0 inches to reflect saturated soil conditions (NMOSE 2008)
  - Constant Loss = 0.025 inches per hour (tailings); 0.075 inches per hour (natural areas) (Golder 2012), (NMOSE 2008)
- Lag Time coefficient, K_n = 0.042 (desert vegetation) (USBR 1989)
- Rainfall Distributions for Comparison (USBR 1988):
  - United States Army Corps of Engineers (USACE)
  - Hydrometeorological Report No. 5 (HMR)
- Unit Hydrograph: Southwest Desert (USBR 1989)

HMR 55A (USBR 1988) recommends the evaluation of two rainfall distributions for the 6-hour local thunderstorm: one from HMR 5 and the other developed by the USACE. The USACE method produces a "late peaking" distribution, while HMR 5 is a "center peaking" distribution. The distribution that generates the higher peak discharge is typically selected for design. Both methods have been analyzed as part of this study. The results of the hydrologic analysis are summarized in Table 1.

Table 1: 6-Hour Local PMP Discharge Summary

Location	HEC-HMS Element ID	Total Area (sq mi)	Peak Discharge (USACE) (cfs)	Peak Discharge (HMR) (cfs)
North Side of Splitter Dike	North-Reservoir	0.438	937	829

Notes:
sq mi = square miles
cfs = cubic feet per second

Based on the results the controlling peak discharge of 937 cubic feet per second reporting to the north side of the splitter dike results from using the USACE rainfall distribution and is the discharge used to design the breach weir section.

2.2 Breach Weir Design

The breach will function similarly to a spillway weir and allow runoff reporting to the north side of the splitter dike to flow into the South Cell. Based on existing topography it is proposed to construct the breach close to the western edge of the North Cell tailings deposition area (See Drawing C-001). This breach location is deemed the most suitable for grading purposes, but also has the added benefit of directing discharges into downstream borrow areas in the South Cell. These borrow areas are isolated from the starter dam face and runoff exiting the North Cell through the breach will flow into the borrow areas and be directed to the west and south, which will help to limit the amount of runoff that could report to the starter dam face.

Golder's 2012 assessment noted that both the splitter dike and the starter dam have elevations that vary between 5,240 ft-amsl and 5,242 ft-amsl; however, the minimum crest elevation of 5,240 ft-amsl was assumed for the capacity assessment and freeboard requirements are also based on that elevation.

The breach design is based on the following assumptions:

- Existing starter dam crest minimum elevation: 5,240 ft-amsl (Golder 2012)
- Maximum water surface elevation to maintain 4-foot dry freeboard: 5,236 ft-amsl
- Stage-storage data for North and South Cells referenced from previous assessment (Golder 2012)
- Weir stage-discharge relationship developed using FlowMaster (Bentley 2009) assuming broad-crested weir configuration

A 40-foot wide breach design was selected to meet conveyance requirements. The stage-discharge relationship for this weir configuration was incorporated into the HEC-HMS model to provide an estimate off the maximum water surface elevation in the North Cell during the 6-hour PMF and to verify that the design meets freeboard requirements. The stage-discharge relationship was developed assuming there is no potential for submergence of the weir. Weir submergence at the outlet can reduce flow conveyed through the structure; however, this was not considered to be a factor in this design as the estimated water surface elevation within the South Cell for the 6-hour PMF is significantly lower than the proposed weir crest elevation even after the volume from the North Cell is added. The design parameters for the proposed breach configuration are summarized in Table 2.

Table 2: 40-Foot Breach Weir – Design Summary

Bottom Width of Breach (ft)	40
Bottom Elevation of Breach (ft-amsl)	5,232
Dike Crest Elevation at Breach (ft-amsl)	5,242
Breach Height (ft)	10
Excavation Side Slope (H:V)	2:1
Estimated Excavation Volume (cubic yards)	3,000
Peak Water Surface Elevation in North Cell	5,235.9

Notes:
ft = feet
ft-amsl = feet above mean sea level

Construction details for the proposed breach design are provided on Drawing C-001. The model results are provided in Attachment 2.

3.0 CONCLUSIONS

A 40-foot wide breach of the existing internal splitter dike has been designed to equalize stormwater runoff volumes between the North and South Cells of the existing TSF. This configuration will convey the peak PMF discharge while maintaining a minimum of 4 feet of freeboard below the starter dam crest. The breach is proposed at a location along the splitter dike such that runoff is directed to existing borrow areas within the South Cell and away from the starter dam face. Please contact Golder Associates if there are any questions or concerns regarding this assessment.

4.0 REFERENCES

Bentley Systems Inc. (Bentley). 2009. FlowMaster [software package]. Version V8i. November 2009.

Golder Associates Inc. (Golder). 2012. Revised Stormwater Storage Capacity Assessment, Existing Copper Flat Tailings Dam Revised January 6, 2012 (Letter Report). January 6, 2012.

New Mexico Office of the State Engineer Dam Safety Bureau (NMOSE). 2008. Hydrologic Analysis for Dams (white paper). August 15, 2008.

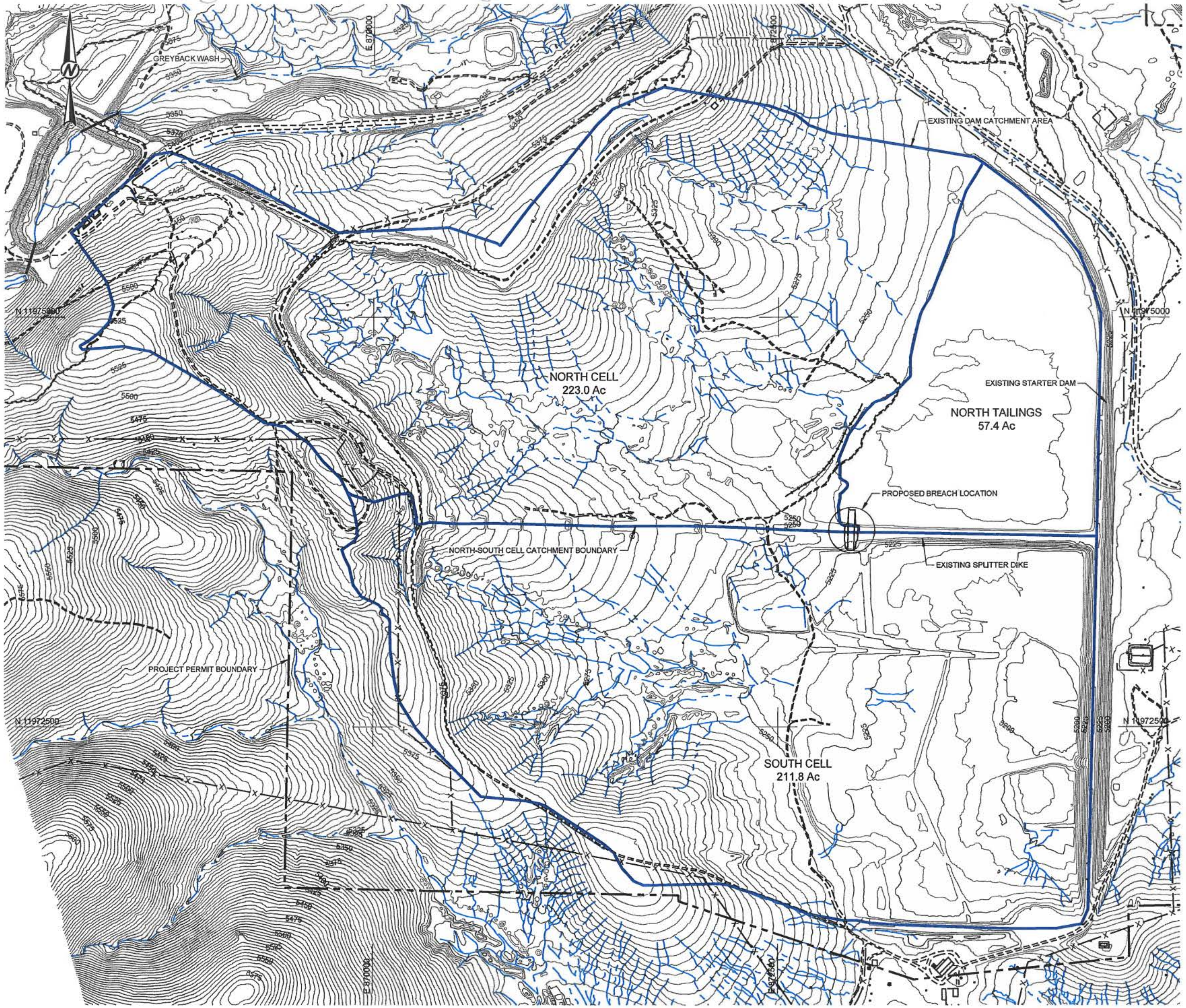
United States Army Corps of Engineers (USACE). 2016. Hydraulic Engineering Center Hydrologic Modeling System (HEC-HMS) [software package]. Version 4.2. August 2016.

United States Bureau of Reclamation (USBR). 1988. Hydrometeorological Report No. 55A (HMR 55A), Probable Maximum Precipitation Estimates – United States Between Continental Divide and the 103rd Meridian. June 1988.

USBR. 1989. Flood Hydrology Manual, First Edition. 1989.

Attachments: Figure 1 – Existing TSF Basin Areas
Drawing C-001 – Proposed Breach Weir Design
Attachment 1 – Local PMP Rainfall Development
Attachment 2 – HEC-HMS Modeling
Attachment 2-1 – TSF Stage-Storage Information (Referenced from 2012 Golder Analysis)
Attachment 2-2 – Basin Lag Time Calculation
Attachment 2-3 – Stage-Discharge Rating
Attachment 2-4 – HEC-HMS Inputs and Outputs

FIGURE 1
EXISTING TSF BASIN AREAS



LEGEND

3600	EXISTING GROUND CONTOURS (ft -MSL)
	EXISTING ROADS
	EXISTING DRAINAGE
— X —	EXISTING FENCELINE
·	EXISTING POWER POLE OR POST
	SUB-BASIN BOUNDARY

REFERENCE(S)

1. 2-FOOT TOPOGRAPHY DEVELOPED BY COOPER AERIAL SURVEY COMPANY BASED ON A JUNE 18, 2011 AERIAL SURVEY AND PROVIDED BY THEMAC RESOURCES.
2. COORDINATE SYSTEM IS UTM ZONE 13, ON THE NAD83 DATUM, U.S. FOOT.

0 300 600
1" = 600' FEET

CLIENT

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

Environmentally Responsible. Community-Minded. Local Opportunities.

PROJECT

COPPER FLAT PROJECT
INTERNAL SPLITTER DIKE BREACH
SIERRA COUNTY, NEW MEXICO

TITLE

EXISTING TSF BASIN AREAS

CONSULTANT

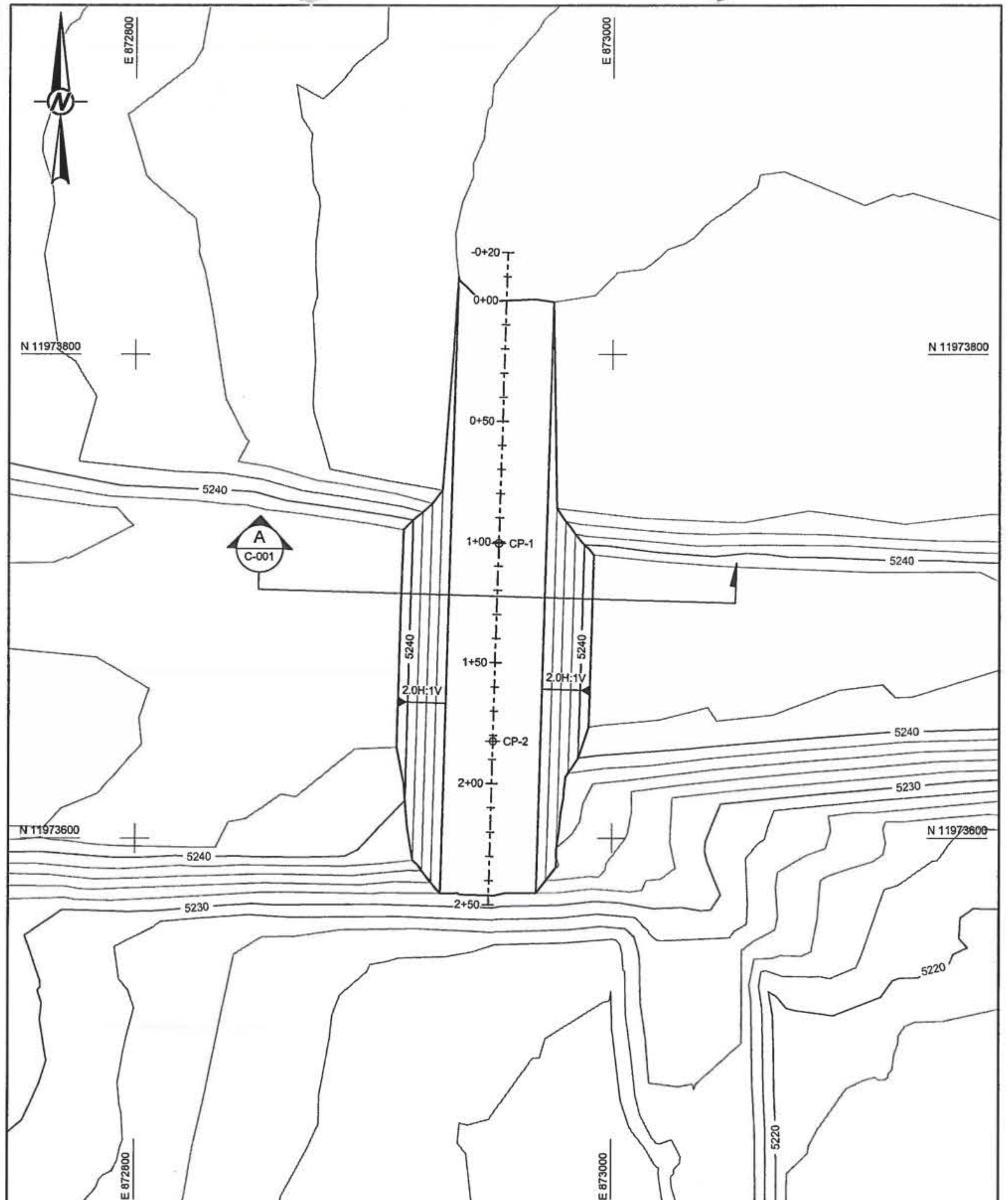
Golder Associates

YYYY-MM-DD	2017-12-11
DESIGNED	SPS
PREPARED	NIL
REVIEWED	CPB
APPROVED	DAK

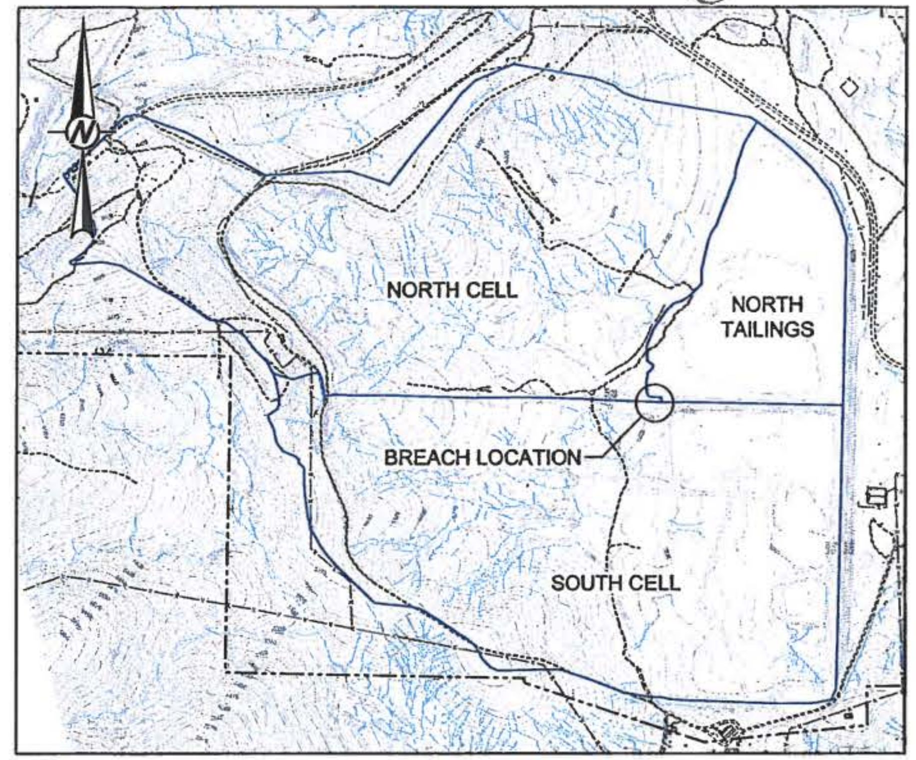
PROJECT NO.	CONTROL	REV.	FIGURE
1789021	1000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

DRAWING C-001
PROPOSED BREACH WEIR DESIGN



BREACH WEIR GRADING PLAN
SCALE 1" = 30'



SITE LOCATION MAP
N.T.S.

LEGEND

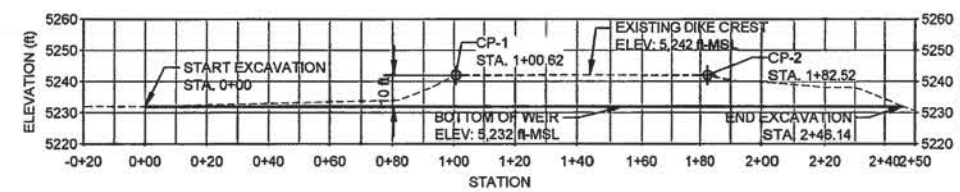
- 3600 — EXISTING GROUND CONTOURS (ft -MSL)
- 3600 — FINAL GRADE CONTOURS (ft -MSL)
- GRADE BREAK
- CP-1 — SURVEY CONTROL POINT
- 2H:1V or 2H/1V — 2 HORIZONTAL TO 1 VERTICAL SLOPE
- A / C-002 — CROSS-SECTION CALLOUT: SECTION ID; DRAWING SHEET LOCATION

NOTE(S)

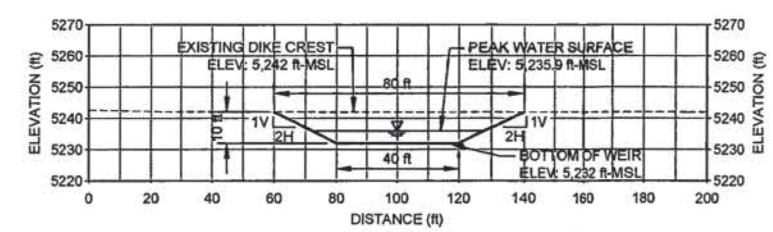
1. PROPOSED BREACH WEIR CONFIGURATION RESULTS IN APPROXIMATELY 3,000 CY OF EXCAVATION.

REFERENCE(S)

1. 2-FOOT TOPOGRAPHY DEVELOPED BY COOPER AERIAL SURVEY COMPANY BASED ON A JUNE 18, 2011 AERIAL SURVEY AND PROVIDED BY THEMAC RESOURCES.
2. COORDINATE SYSTEM IS UTM ZONE 13, ON THE NAD83 DATUM, U.S. FOOT.



WEIR EXCAVATION PROFILE
SCALE 1" = 30'



SCALE 1" = 30' A / C-001 **TYPICAL WEIR CROSS-SECTION**

SURVEY CONTROL POINT TABLE

ID	STATION	UTM83-13F NORTHING (ft)	UTM83-13F EASTING (ft)	LATITUDE	LONGITUDE	CREST ELEVATION (ft)
CP-1	1+00.62	11973721.8	872952.3	N032° 57' 34.61"	W107° 30' 09.54"	5242.0
CP-2	1+82.52	11973639.9	872950.0	N032° 57' 33.80"	W107° 30' 09.54"	5242.0

0 30 60
1" = 30' FEET

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2017-12-11	ISSUED FOR CONSTRUCTION	HNL	NIL	SPS	DAK
B	2017-12-07	ISSUED FOR CLIENT REVIEW	HNL	NIL	SPS	DAK
A	2017-12-05	ISSUED FOR INTERNAL REVIEW	HNL	NIL	SPS	DAK

SEAL

DAVID ALAN KIEL, NEW MEXICO, 15776, REGISTERED PROFESSIONAL ENGINEER, 12-11-17

CLIENT

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CONSULTANT

Golder Associates

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4730 N. ORACLE ROAD, SUITE 210
TUCSON, ARIZONA
UNITED STATES OF AMERICA
[+1] (520) 888 8818
www.golder.com

PROJECT
COPPER FLAT PROJECT
INTERNAL SPLITTER DIKE BREACH
SIERRA COUNTY, NEW MEXICO

TITLE
BREACH WEIR DESIGN

PROJECT NO.	CONTROL	REV.		DRAWING
1789021	1000	0	1 of 1	C-001

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

ATTACHMENT 1
LOCAL PMP RAINFALL DEVELOPMENT

Golder Associates

CALCULATIONS

Date:	17-Nov-17	**Made by:**	SPS
Project No.:	1789021	**Checked by:**	CPB
Subject:	Local PMP Determination	**Reviewed by:**	DAK
Project Short Title:	COPPER FLAT TSF - INTERNAL SPLITTER DIKE		

Objective: Determine 6-Hour Local PMP Thunderstorm Depth using Procedure in HMR 55A

TSF Watershed Properties

Watershed Area: 0.769 square miles
Watershed Centroid: 32.9598 Latitude, -107.5071 Longitude
Average Basin Elevation: 5,385 feet

Step 1 - Determine 1-hr, 1 mi^2 PMP at 5,000 foot elevation using Plates VIa-c

Project watershed located on Plate VIc

	1 mi^2 PMP (inches)
1-hr	11.75

Step 2 - Adjust Index PMP Value to Mean Watershed Elevation if Elevation is >5,000 feet

Step 2.1 - Determine Maximum Persisting 12-Hour Dew Point

Using Figure 4.12 (month of August)
Maximum Dew Point (°F): 78.6

Step 2.2 - Use Maximum Dew Point and Mean Elevation to Determine Adjusted PMP Depth

Using Figure 14.3
Elevation Adjustment: 1.00%

	Adjusted 1 mi^2 PMP (inches)
1-hr	11.87

Step 3 - Depth-Duration Relations for 1mi^2 PMP

Refer to Table 12.4 for depth factors for durations up to 6 hour

Duration	% of 1-Hour Depth	Total Depth (inches)
15 min	0.68	8.07
30 min	0.86	10.21
45 min	0.94	11.16
1 hour	1.00	11.87
2 hour	1.16	13.77
3 hour	1.23	14.60
4 hour	1.28	15.19
5 hour	1.32	15.67
6 hour	1.35	16.02

Step 4 - Apply Any Areal Reductions to PMP Estimate from Step 2

As the project watershed area is less than 1 square mile, no areal adjustment is required. Use values in Step 3 table.

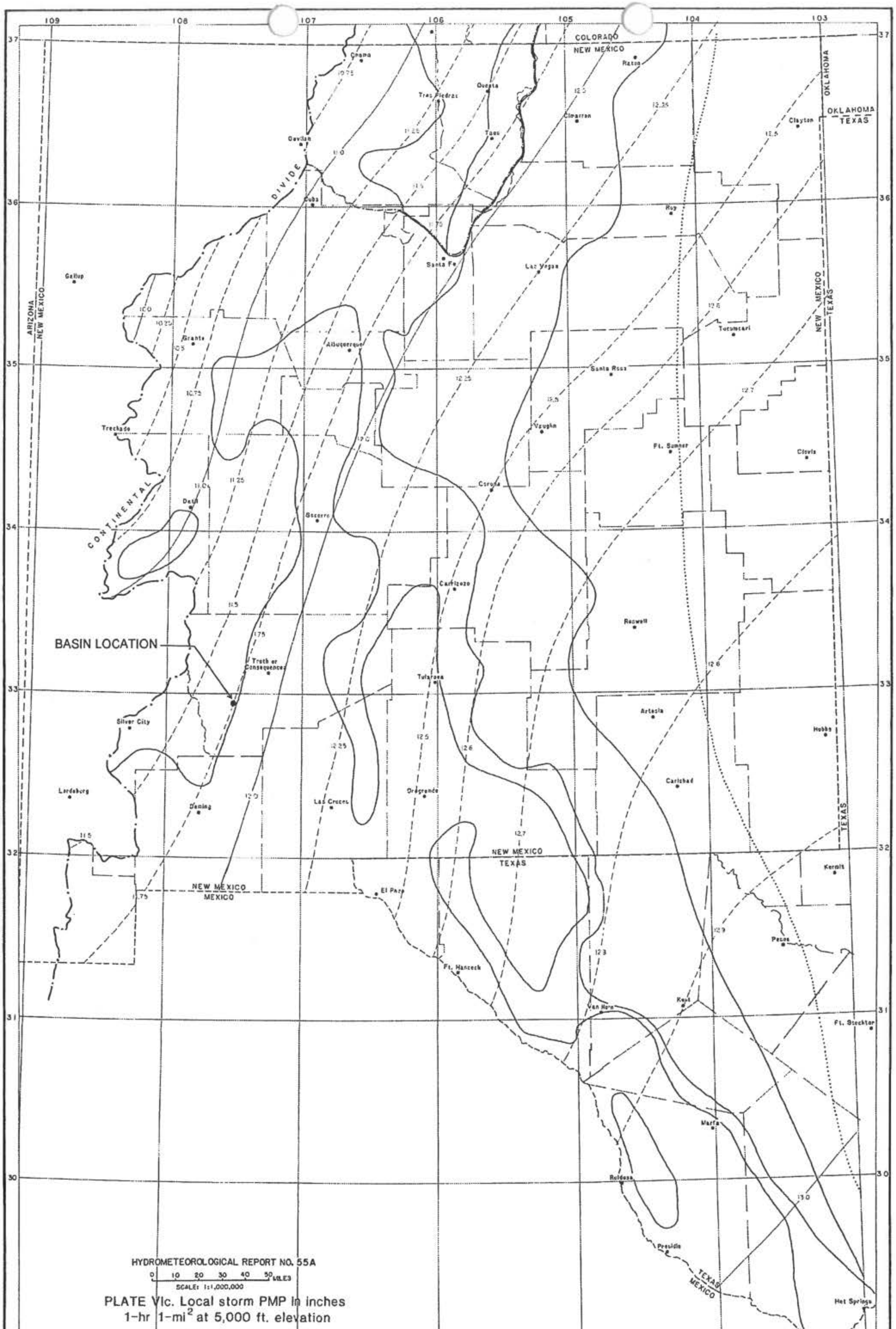


PLATE VIc. Local storm PMP in inches 1-hr 1-mi^2 at 5,000 ft. elevation

Revised 1987

15799

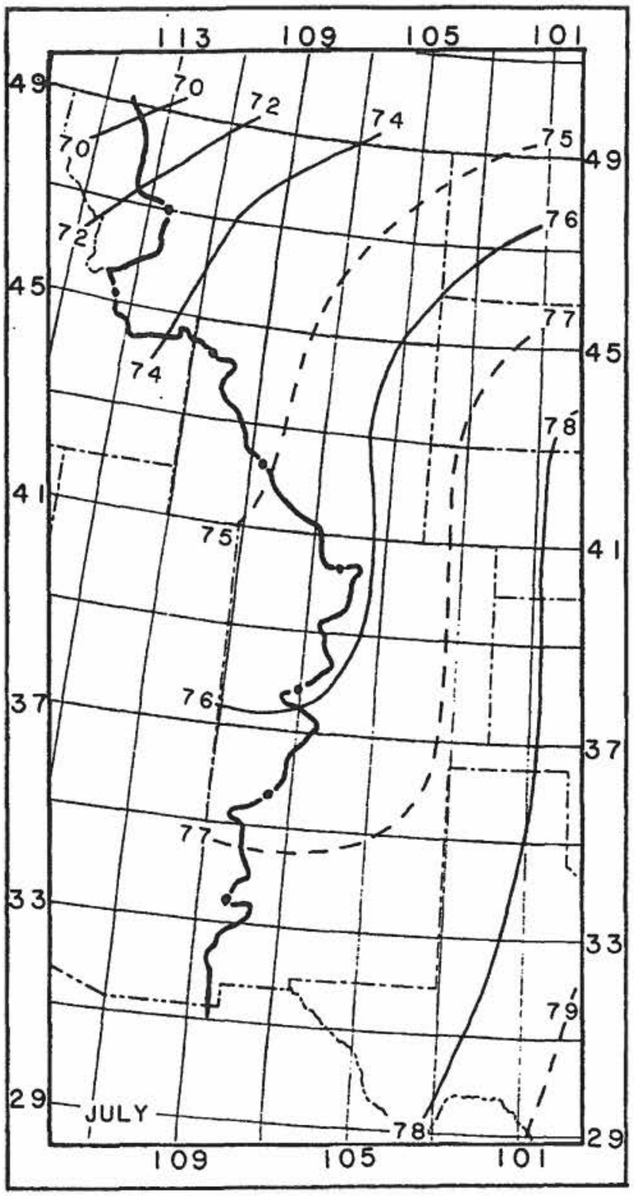


Figure 4.11.--Maximum persisting 12-hr 1000-mb dew points (°F) for July.

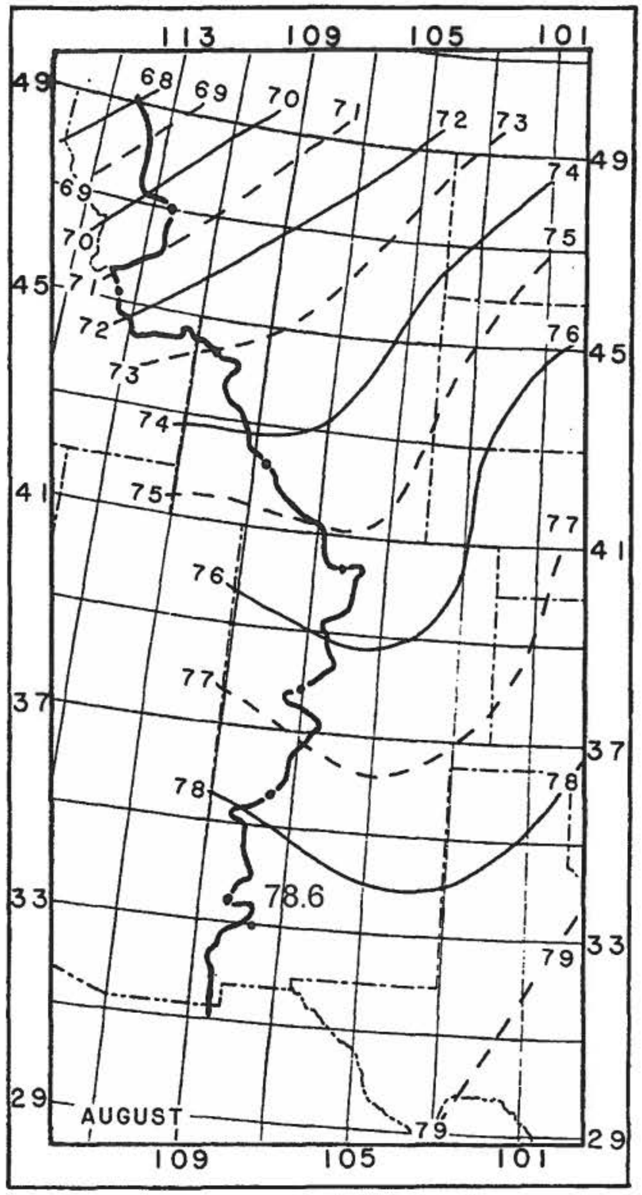


Figure 4.12.--Maximum persisting 12-hr 1000-mb dew points (°F) for August.

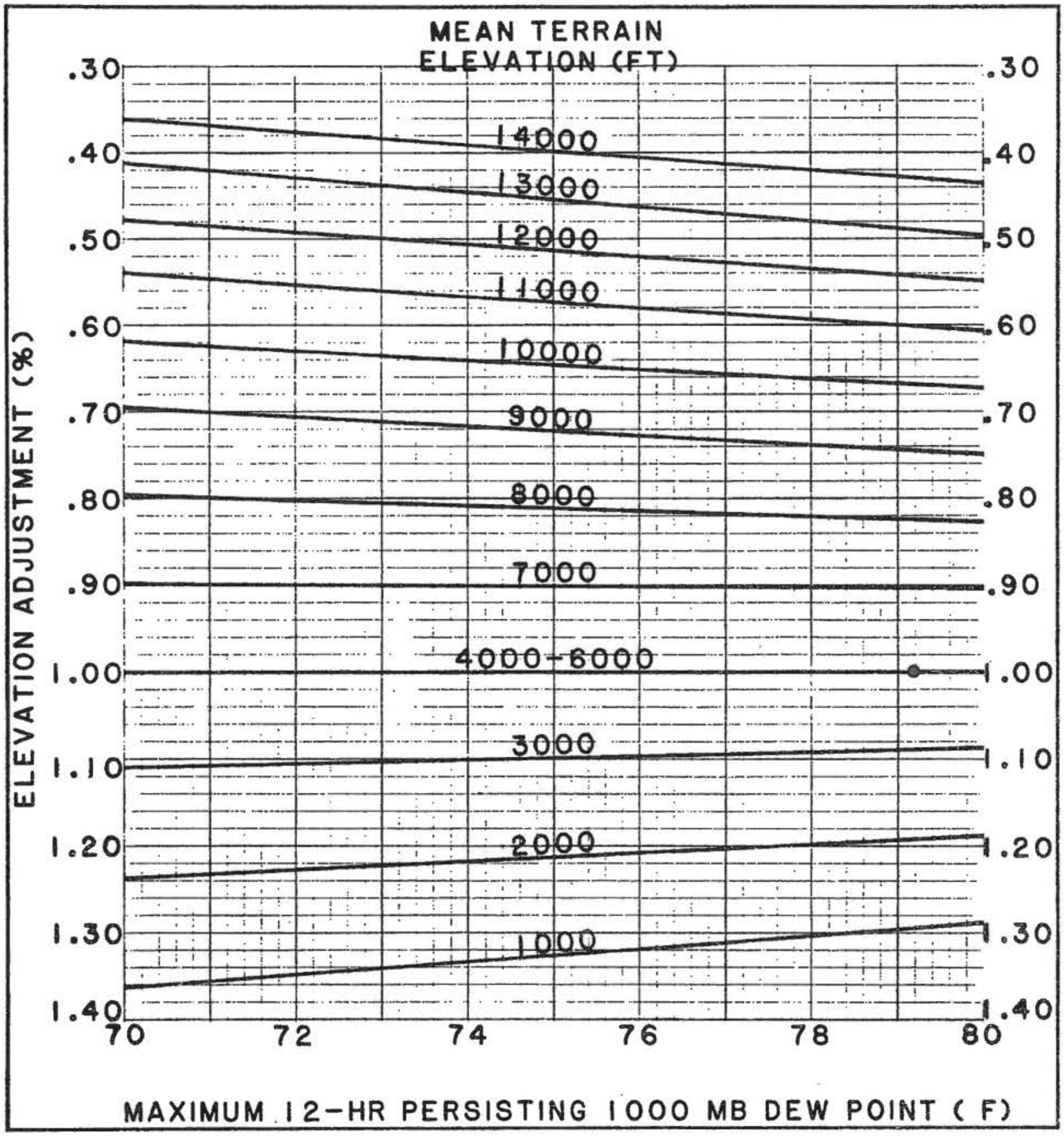


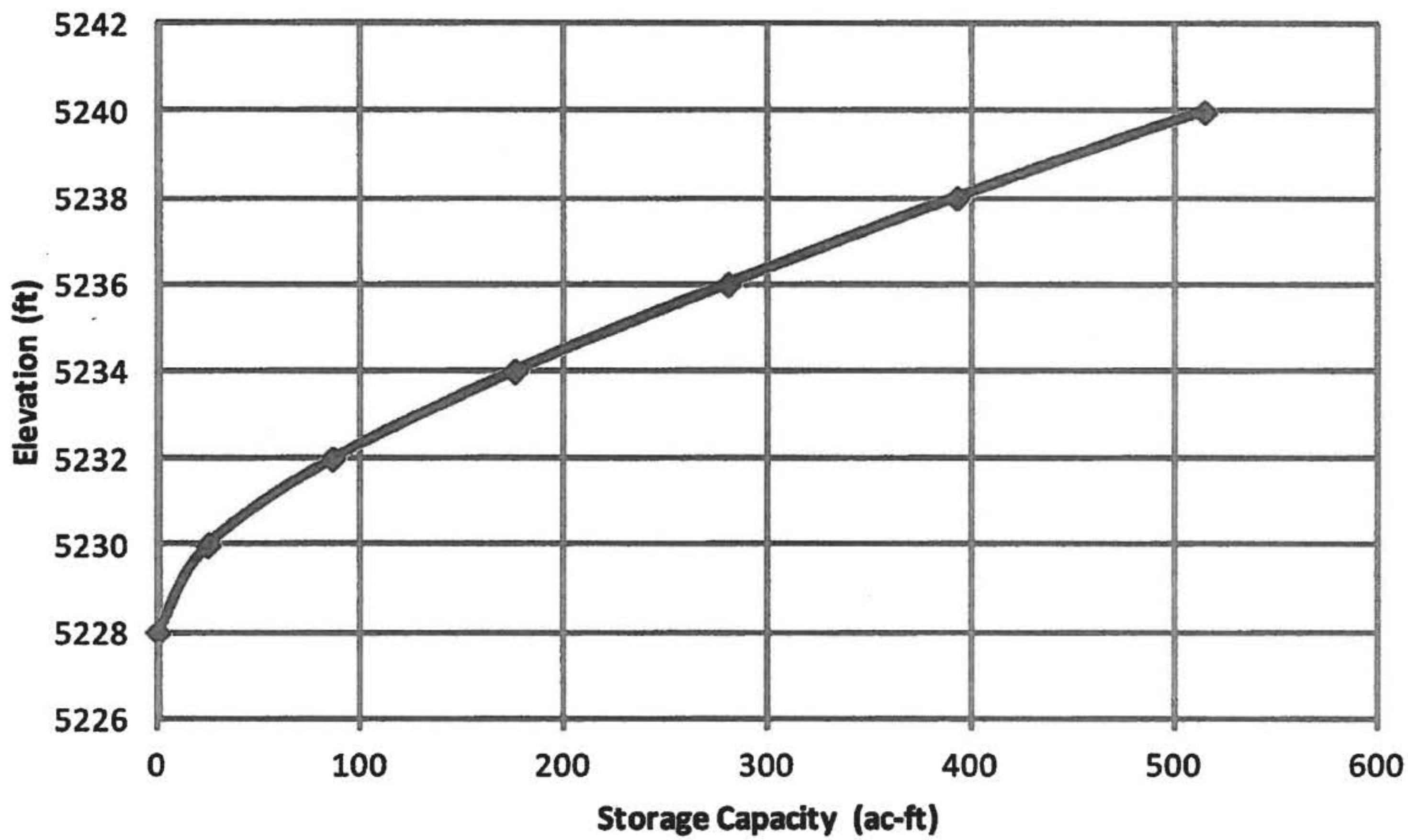
Figure 14.3.--Adjustment for elevation for local-storm PMP based on procedures developed in the report and maximum persisting 12-hr 1000-mb dew point (F).

6-Hour Local Storm Recommended Rainfall Distributions

Distributed Increments		
Hour	6-Hour Local PMP (COE)	6-Hour Local PMP (HMR)
0	0	0
1	0.36	0.36
2	0.59	0.83
3	1.9	11.87
4	11.87	1.9
5	0.83	0.59
6	0.47	0.47

ATTACHMENT 2
HEC-HMS MODELING

ATTACHMENT 2-1
TSF STAGE-STORAGE INFORMATION
(REFERENCED FROM 2012 GOLDER ANALYSIS)



PROJECT

New Mexico Copper Corporation

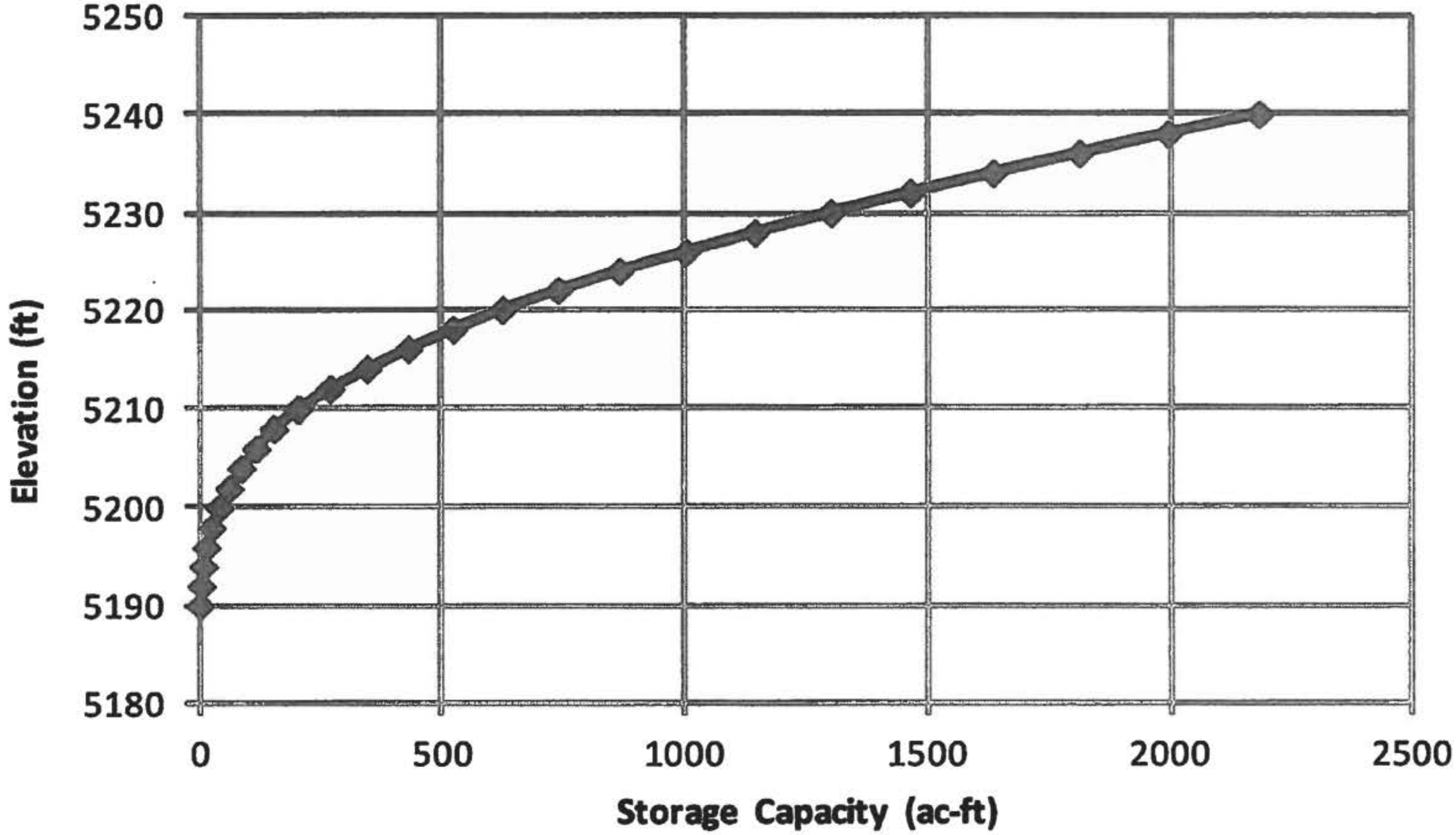
COPPER FLAT PROJECT
STORMWATER STORAGE
CAPACITY ANALYSIS
SIERRA COUNTY, NEW MEXICO

TITLE

EXISTING TAILINGS IMPOUNDMENT NORTH CELL
ELEVATION VS. STORMWATER STORAGE CAPACITY

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557E002
DESIGN	WK	10/18/11	SCALE	NOT APPLICABLE
CADD	NIL	10/20/11		
CHECK	WK	10/20/11	**FIGURE 2**	
REVIEW	GM	10/20/11		



PROJECT

New Mexico
Copper Corporation

COPPER FLAT PROJECT
STORMWATER STORAGE
CAPACITY ANALYSIS
SIERRA COUNTY, NEW MEXICO

TITLE

EXISTING TAILINGS IMPOUNDMENT SOUTH CELL
ELEVATION VS. STORMWATER STORAGE CAPACITY

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557E002
DESIGN	WK	10/18/11	SCALE	NOT APPLICABLE
CADD	NIL	10/20/11	**FIGURE 3**	
CHECK	WK	10/20/11		
REVIEW	GM	10/20/11		

ATTACHMENT 2-2
BASIN LAG TIME CALCULATION

Golder Associates

CALCULATIONS

Date:	18-Oct-17	**Made by:**	SPS
Project No.:	1789021	**Checked by:**	CPB
Subject:	Hydrology Input Parameters	**Reviewed by:**	DAK
Project Short Title:	COPPER FLAT - INTERNAL SPLITTER DIKE		

BASIN LAG TIME CALCULATIONS FOR LOCAL THUNDERSTORM
(USBR BASIN CENTROID METHOD)

Basin	Area (ft²)	Area (acres)	Area (mi²)	Kn	C = 26*Kn	L (ft)	L (mi)	Lca (ft)	Lca (mi)	Δ El. (ft)	S (ft/ft)	S (ft/mi)	N	(L*Lca)/(S^.5)	Lg (hr)	Lg (min)
North Cell	9714067	223.0	0.3484	0.042	1.09	6160	1.1667	2455	0.4650	296	0.048	254	0.33	0.03	0.36	21
North Tailings	2499113	57.4	0.0896	0.042	1.09	1955	0.3703	755	0.1430	14	0.007	38	0.33	0.01	0.23	14
South Cell	9225823	211.8	0.3309	0.042	1.09	4895	3.0416	1800	1.1185	262	0.054	283	0.33	0.20	0.64	39

USBR BASIN CENTROID METHOD EQUATION:

$$L_g = C\left(\frac{LL_{ca}}{S^{0.5}}\right)^N$$

Where:

Lg = Unit hydrograph lag time, in hours
C = Constant
L = The length of the longest watercourse from the point of concentration to the boundary of the drainage basin, in miles. The point of concentration is the location on the watercourse where a hydrograph is desired.
Lca = the length along the longest watercourse from the point of concentration to a point opposite the centroid of the basin, in miles.
S = The overall slope of the longest watercourse (along L), in feet per mile.
N= exponent, typically 0.33

ATTACHMENT 2-3
STAGE-DISCHARGE RATING

North Cell - 40-Ft Wide Breach

Project Description

Solve For	Discharge

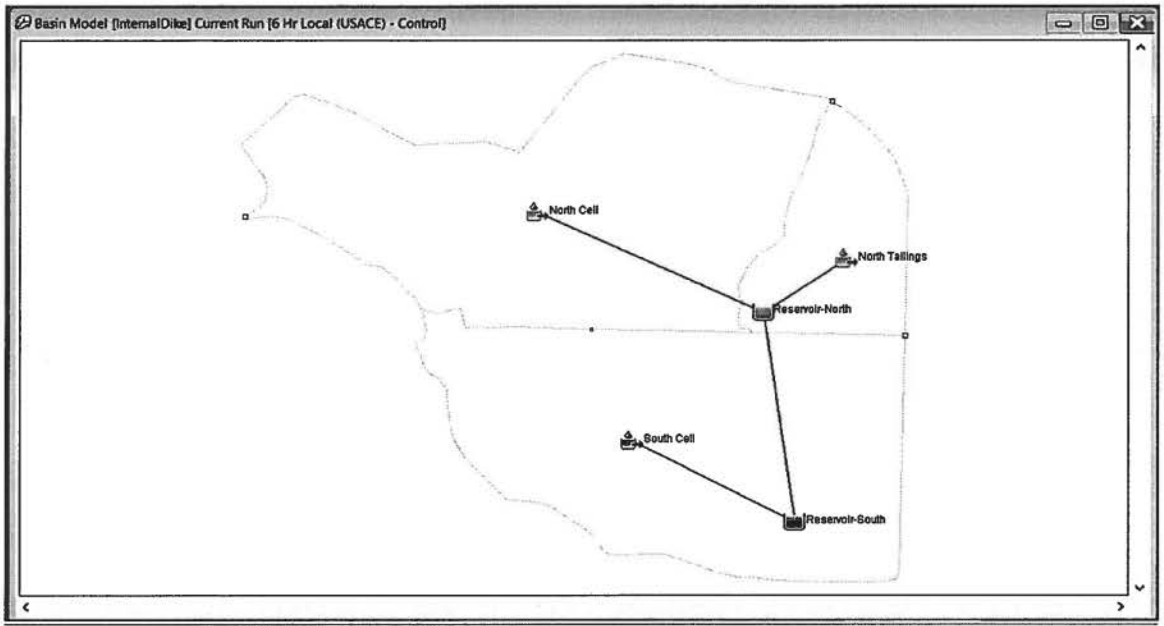
Input Data

Headwater Elevation		5236.00	ft
Crest Elevation		5232.00	ft
Tailwater Elevation		5228.00	ft
Crest Surface Type	Gravel		
Crest Breadth		82.00	ft
Crest Length		40.00	ft

Headwater Elevation (ft)	Discharge (ft^3/s)	Velocity (ft/s)
5232.00		
5234.00	336.81	4.21
5236.00	972.80	6.08
5238.00	1787.15	7.45
5240.00	2751.49	8.60

ATTACHMENT 2-4
HEC-HMS INPUTS AND OUTPUTS

HEC-HMS Basin Model Schematic



Sub-Basin Parameters

Subbasin Area [InternalDike]

Show Elements: All Elements — Sorting: Alphabetic

Subbasin	Area (MI2)
North Cell	0.3484
North Tailings	0.0896
South Cell	0.3309

Apply | Close

Initial Constant Loss [InternalDike]

Show Elements: All Elements — Sorting: Alphabetic

Subbasin	Initial Loss (IN)	Constant Rate (IN/HR)	Impervious (%)
North Cell	0	0.075	0.0
North Tailings	0	0.025	0.0
South Cell	0	0.075	0.0

Apply | Close

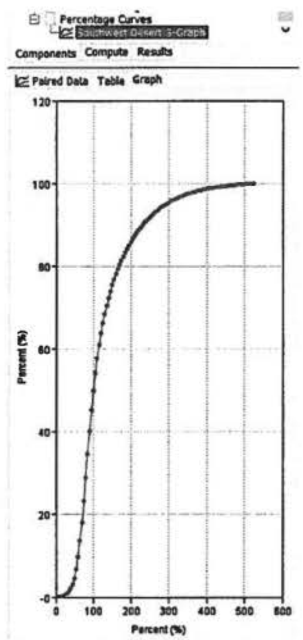
Lag Data and Unit Hydrograph Transform

User Specified S-Graph Transform [InternalDike]

Show Elements: All Elements — Sorting: Alphabetic

Subbasin	S-Graph Table	Lag Time (HR)
North Cell	Southwest Desert S-Graph	0.36
North Tailings	Southwest Desert S-Graph	0.23
South Cell	Southwest Desert S-Graph	0.64

Apply | Close



USACE Rainfall Distribution

- North Cell
- North Tailings
- Reservoir-North
- South Cell
- Reservoir-South
- Meteorologic Models
- Control Specifications
- Time-Series Data
  - Precipitation Gages
    - 6-Hr Local PMP (HMR)
    - 6-Hr Local PMP (USACE)
      - 01Jan2050, 12:00 - 01Jan2050, 18:00

Components Compute Results

Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:...	Precipitation (IN)
01Jan2050, 12:00	
01Jan2050, 13:00	0.36
01Jan2050, 14:00	0.59
01Jan2050, 15:00	1.90
01Jan2050, 16:00	11.87
01Jan2050, 17:00	0.83
01Jan2050, 18:00	0.47

HMR Rainfall Distribution

- InternalDike
  - North Cell
  - North Tailings
  - Reservoir-North
  - South Cell
  - Reservoir-South
- Meteorologic Models
- Control Specifications
- Time-Series Data
  - Precipitation Gages
    - 6-Hr Local PMP (HMR)
      - 01Jan2050, 12:00 - 01Jan2050, 18:00

Components Compute Results

Time-Series Gage | Time Window | Table | Graph

Time (ddMMMYYYY, HH:...	Precipitation (IN)
01Jan2050, 12:00	
01Jan2050, 13:00	0.36
01Jan2050, 14:00	0.83
01Jan2050, 15:00	11.87
01Jan2050, 16:00	1.90
01Jan2050, 17:00	0.59
01Jan2050, 18:00	0.47

North Cell - Elevation vs. Storage

Elevation-Storage Functions
North Cell
South Cell
Components Compute Results
Paired Data Table Graph

Elevation (FT)	Storage (AC-FT)
5228.0	0.0
5230.0	25.0
5232.0	86.0
5234.0	176.0
5236.0	281.0
5238.0	393.0
5240.0	515.0

Storage vs. Discharge - 40-Foot Wide Weir

Storage-Discharge Functions
North Cell-40 ft Weir
South Cell
Elevation-Storage Functions
Percentage Curves
Components Compute Results
Paired Data Table Graph

Storage (AC-FT)	Discharge (CFS)
0.0	0.00
25.0	0.00
86.0	0.00
176.0	336.81
281.0	972.80
393.0	1787.15
515.0	2751.49

South Cell - Elevation vs. Storage

Elevation-Storage Functions
North Cell
South Cell
Components Compute Results
Paired Data Table Graph

Elevation (FT)	Storage (AC-FT)
5190.0	0.0
5192.0	2.9
5194.0	7.1
5196.0	13.3
5198.0	23.9
5200.0	39.9
5202.0	60.7
5204.0	85.8
5206.0	116.0
5208.0	152.6
5210.0	202.6
5212.0	267.9
5214.0	343.3
5216.0	428.4
5218.0	521.7
5220.0	624.4
5222.0	738.2
5224.0	864.4
5226.0	1002.9
5228.0	1144.9
5230.0	1300.9
5232.0	1464.5
5234.0	1635.4
5236.0	1812.8
5238.0	1995.1
5240.0	2182.8

South Cell - Storage vs. Discharge

Paired Data
Storage-Discharge Functions
North Cell-40 ft Weir
South Cell
Elevation-Storage Functions
Percentage Curves
Components Compute Results
Paired Data Table Graph

Storage (AC-FT)	Discharge (CFS)
0.0	0.0
2.9	0.0
7.1	0.0
13.3	0.0
23.9	0.0
39.9	0.0
60.7	0.0
85.8	0.0
116.0	0.0
152.6	0.0
202.6	0.0
267.9	0.0
343.3	0.0
428.4	0.0
521.7	0.0
624.4	0.0
738.2	0.0
864.4	0.0
1002.9	0.0
1144.9	0.0
1300.9	0.0
1464.5	0.0
1635.4	0.0
1812.8	0.0
1995.1	0.0
2182.8	0.0

HEC-HMS Global Summary - HMR Rainfall Distribution

Global Summary Results for Run "6Hr Local (HMR)"

Project: CopperFlatTSF Simulation Run: 6Hr Local (HMR)

Start of Run: 01Jan2050, 12:00 Basin Model: InternalDike
End of Run: 02Jan2050, 12:00 Meteorologic Model: 6-Hr Local PMP (HMR)
Compute Time: 11Dec2017, 10:24:52 Control Specifications: 24hr, 1min

Show Elements: All Elements Volume Units: IN (●) AC-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
North Cell	0.3484	2528.1	01Jan2050, 15:05	289.3
North Tailings	0.0896	680.0	01Jan2050, 15:01	75.8
Reservoir-North	0.4380	828.9	01Jan2050, 15:44	278.7
Reservoir-South	0.7689	0.0	01Jan2050, 12:00	0.0
South Cell	0.3309	2125.2	01Jan2050, 15:16	274.8

HEC-HMS Global Summary - USACE Rainfall Distribution (Controls - Higher Peak Qs)

Global Summary Results for Run "6 Hr Local (USACE) - Control"

Project: CopperFlatTSF Simulation Run: 6 Hr Local (USACE) - Control

Start of Run: 01Jan2050, 12:00 Basin Model: InternalDike
End of Run: 02Jan2050, 12:00 Meteorologic Model: 6-Hr Local PMP (USACE)
Compute Time: 11Dec2017, 10:21:55 Control Specifications: 24hr, 1min

Show Elements: All Elements Volume Units: IN (●) AC-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
North Cell	0.3484	2537.9	01Jan2050, 16:05	289.3
North Tailings	0.0896	680.4	01Jan2050, 16:01	75.8
Reservoir-North	0.4380	936.6	01Jan2050, 16:31	278.6
Reservoir-South	0.7689	0.0	01Jan2050, 12:00	0.0
South Cell	0.3309	2149.7	01Jan2050, 16:15	274.8

Flow Results

Summary Results for Reservoir "Reservoir-North"

Project: CopperFlatTSF Simulation Run: 6 Hr Local (USACE) - Control

Reservoir: Reservoir-North

Start of Run: 01Jan2050, 12:00 Basin Model: InternalDike
End of Run: 02Jan2050, 12:00 Meteorologic Model: 6-Hr Local PMP (USACE)
Compute Time: 11Dec2017, 10:21:55 Control Specifications: 24hr, 1min

Volume Units: IN (●) AC-FT

Computed Results

Peak Inflow: 3213.7 (CFS) Date/Time of Peak Inflow: 01Jan2050, 16:04
Peak Discharge: 936.6 (CFS) Date/Time of Peak Discharge: 01Jan2050, 16:31
Inflow Volume: 365.1 (AC-FT) Peak Storage: 275.0 (AC-FT)
Discharge Volume: 278.6 (AC-FT) Peak Elevation: 5235.9 (FT)

ENVIRONMENT DEPARTMENT INTERNAL MEMORANDUM

TO: Brad Reid, Mining Environmental Compliance Section
John Moeny, Surface Water Quality Bureau

FROM: Jeff Lewellin, NMED Mining Act Team Leader

DATE: December 15, 2017

SUBJECT: **Request for Comments, Regular New Mine, New Mexico Copper Corporation, Copper Flat Mine, Review of Documents, Sierra County, MMD Permit No. SI027RN**

Attached is a copy of a cover letter received from the Mining Act Reclamation Program (MARP) by the New Mexico Environment Department (NMED) requesting comments regarding the Copper Flat Mine. This is designated as a regular new mine and assigned permit tracking No. SI027RN. Pursuant to §19.10.6.605.C NMAC, NMED has 30 days to provide comment. Please have any comments back to me by January 9, 2017. The documents for review are:

Probable Hydrologic Consequences of the Copper Flat Project, New Mexico by John Shoemaker & Associates, Inc. December 2017;

Predictive Geochemical Modeling of Pit Lake Water Quality, Copper Flat Project, New Mexico by SRK Consulting, December 11, 2017.

Both documents can be found on the Mining and Minerals Division webpage at:

http://www.emnrd.state.nm.us/MMD/MARP/PermitSI027RN.html

Please send all responses to Jeff Lewellin, NMED Mining Act Team Leader.

Attachments:
December 14, 2017, MARP, DJ Ennis, Request for Comments

xc: Richard Goodyear, Chief, AQB
Shelley Lemon, Acting Chief, SWQB
Abe Franklin, Program Manager, SWQB
Michelle Hunter, Chief, GWQB
Kurt Vollbrecht, Program Manager, GWQB, MECS
Holland Shepherd, Program Manager, MMD
DJ Ennis, Lead Staff, MMD

Susana Martinez
Governor

Ken McQueen
Cabinet Secretary

Matthias Sayer
Deputy Cabinet Secretary

Fernando Martinez, Director
Mining and Minerals Division

December 14, 2017

Mr. Jeff Lewellin
NMED Ground Water Quality Bureau
P.O. Box 5469
Santa Fe, NM 87502-5469

Re: Request for Agency Comments, Copper Flat Mine, Sierra County, New Mexico, Permit Tracking No. SI027RN:

- **Probable Hydrologic Consequences, Dec. 2017**
- **Predictive Geochemical Modeling of Pit Lake Water Quality, Dec. 2017**

Dear Mr. Lewellin,

On December 13, 2017, the Mining and Minerals Division ("MMD") of the New Mexico Energy, Minerals, and Natural Resources Department received two documents as addendums to the Copper Flat mine application, permit tracking no. SI027RN. The two documents received are:

- *Probable Hydrologic Consequences of the Copper Flat Project, Sierra County, New Mexico* by John Shomaker & Associates, Inc., December 2017
- *Predictive Geochemical Modeling of Pit Lake Water Quality, Copper Flat Project, New Mexico* by SRK Consulting, December 11, 2017

These documents are a portion of the overall Permit Application Package being reviewed by MMD in relation to the proposed Copper Flat mine located in Sierra County, New Mexico.

Pursuant to §19.10.6.605.C of the New Mexico Administrative Code, MMD is requesting comments from your agency regarding these two addendums, which can be downloaded from MMD's website at http://www.emnrd.state.nm.us/mmd/MARP/PermitSI027RN.html. Please provide any comments your agency may have within 30 days from the date of receipt of this letter.

If you have any questions, please contact me at (505) 476-3434 or by email at david.ennis@state.nm.us.

Sincerely,

David J. (DJ) Ennis, P.G., Permit Lead
Mining Act Reclamation Program (MARP)

cc: Mine File (SI027RN)

Reid, Brad, NMENV

From: Lemon, Shelly, NMENV
Sent: Tuesday, December 19, 2017 10:32 AM
To: Vollbrecht, Kurt, NMENV; Dail, Bryan, NMENV
Cc: Reid, Brad, NMENV
Subject: RE: Copper Flat Pit geochem

Thank you!

From: Vollbrecht, Kurt, NMENV
Sent: Tuesday, December 19, 2017 9:32 AM
To: Lemon, Shelly, NMENV <Shelly.Lemon@state.nm.us>; Dail, Bryan, NMENV <Bryan.Dail@state.nm.us>
Cc: Reid, Brad, NMENV <brad.reid@state.nm.us>
Subject: FW: Copper Flat Pit geochem

FYI-we'll talk to Pat about coordinating with SWQB.

Kurt Vollbrecht, Program Manager
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
(505) 827-0195

From: Reid, Brad, NMENV
Sent: Tuesday, December 19, 2017 9:00 AM
To: Vollbrecht, Kurt, NMENV <kurt.vollbrecht@state.nm.us>; Lewellin, Jeffrey, NMENV <Jeffrey.Lewellin@state.nm.us>
Subject: Copper Flat Pit geochem

I gave Pat the updated SRK model of the Copper Flat Pit Lake - he seems excited. He will bill his hours to Copper Rule and expects to get started next week. I told him we are primarily interested in the model of the reclaimed pit since he has reviewed the other two already.

Brad Reid, Geologist
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502
Phone: 505.827.2963; Fax: 505.827.2965

15821

Reid, Brad, NMENV

From: Knight, Andrew, NMENV
Sent: Tuesday, January 02, 2018 1:05 PM
To: Vollbrecht, Kurt, NMENV; Reid, Brad, NMENV; Dail, Bryan, NMENV
Subject: FW: Copper Flat Inter Se Decision Put Out on December 28, 2017
Attachments: Judge Wechsler letter to Parties Copper Flat Inter Se.pdf; Court Findings of Fact and Conclusions of Law 12.28.17.pdf

Fyi,
I guess this is in their water rights case, but looks like it may have implications for the waters of the state determination. I assume THEMAC will appeal this decision.

Andrew P. Knight
Assistant General Counsel
New Mexico Environment Department
Office: (505) 222-9540
Cell: (505) 907-8836

From: Jai Par [mailto:peimiaj@gmail.com]
Sent: Tuesday, January 02, 2018 12:22 PM
To: Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>
Subject: Copper Flat Inter Se Decision Put Out on December 28, 2017

Good morning and Happy New Year, Andrew! I'm not sure if you're aware of the recent decision issued by Judge Wechsler in the Copper Flat Inter Se proceeding, but here it is for your review. Of interest is the Court's finding of fact on page 61 regarding the Copper Flat Copper Mine's open pit: LRG-4652-S-17, the open pit, "is hydrologically connected to groundwater and evaporates at an amount of 34.45 afy", and cites to an exhibit offered by the Office of the State Engineer in support of that fact. Under the private waters exemption, the open pit cannot be determined to be a private water if it is hydrologically connected to groundwater. We now have the Third Judicial District Court upholding the NM Office of the State Engineer's assertion that the open pit is hydrologically connected to groundwater.

Judge Wechsler also went on to find that the mine has only around 900 afy of water rights, which is not enough to operate the mine. Look at pages 70-71 for the amount of water right in each well.

Kind Regards,

Jaimie Park

From:	Ennis, David, EMNRD
To:	Lewellin, Jeffrey, NMENV
Cc:	Vollbrecht, Kurt, NMENV; Lemon, Shelly, NMENV; Reid, Brad, NMENV
Subject:	RE: Copper Flat Mine - NMED Comments - Request for Extension
Date:	Monday, January 08, 2018 8:45:39 AM

NMED's request for an extension of time is approved until February 12, 2018.

Thanks
DJ

From: Lewellin, Jeffrey, NMENV
Sent: Friday, January 5, 2018 3:50 PM
To: Ennis, David, EMNRD <David.Ennis@state.nm.us>
Cc: Vollbrecht, Kurt, NMENV <kurt.vollbrecht@state.nm.us>; Lemon, Shelly, NMENV <Shelly.Lemon@state.nm.us>; Reid, Brad, NMENV <brad.reid@state.nm.us>
Subject: Copper Flat Mine - NMED Comments - Request for Extension

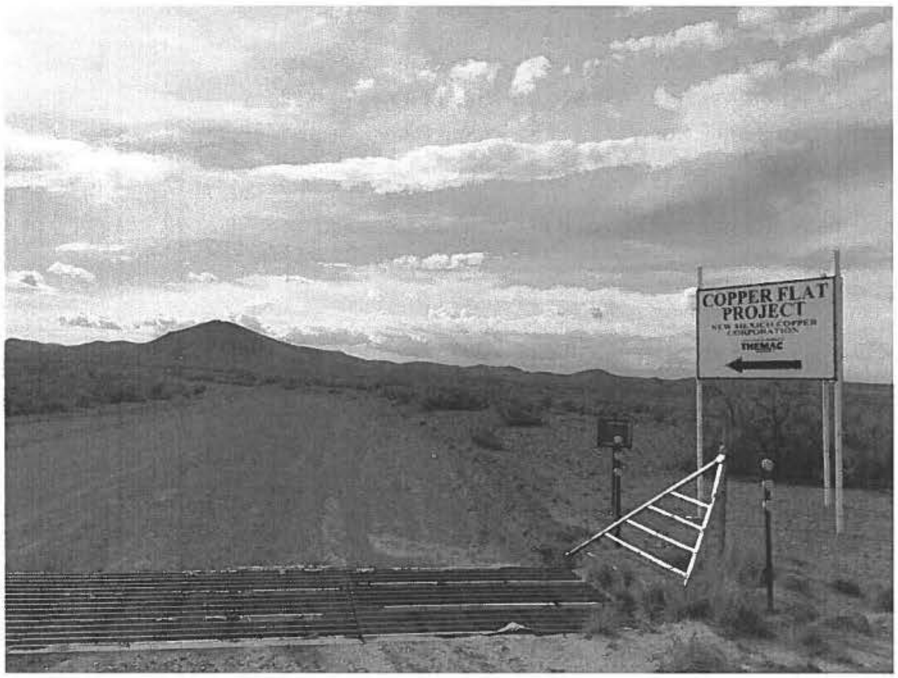
DJ – We are requesting an extension until February 12, 2018 to provide comment on the two reports sent to NMED on December 14, 2017 related to Copper Flat. Please let us know if the request is granted. Thanks, Jeff

Jeff Lewellin, Mining Act Team Leader
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
(505) 827-1049

ENVIRONMENT January 8, 2018

Judge tosses out water rights mining company was banking on for Copper Flat

By **Laura Paskus**



Laura Paskus

The Copper Flat mine near Hillsboro operated briefly in the early 1980s.

At the end of last year, a state judge chipped away at a company's plans to reopen a long-abandoned copper mine near Hillsboro. On Dec. 28, New Mexico Third Judicial District Court Judge James J. Wechsler found that most of the water rights claimed by the company are not valid.

New Mexico Copper Corporation (NMCC) (http://nmpoliticalreport.com/146649/questions-remain-as-company-seeks-to-re-open-long-defunct-copper-mine/) planned to use groundwater rights that two men purchased after operations were abandoned at Copper Flat Mine in 1982. William Frost and Harris Gray, along with NMCC and its attorneys, tried to show that those rights were still valid, even though the water hadn't been put to use over the past four decades—or even when the mine operated.

Under the New Mexico Constitution, water is owned by the public. People or entities must put water to "beneficial use" to maintain their rights, whether to surface water from rivers and streams or water pumped from below the ground.

Wechsler found that the combined water right of Frost, Harris and NMCC is only 861.84 acre feet per year, or about 281 million gallons.

"Certainly, we were disappointed in the outcome, in the judge's decision, and we're considering our options now," said Jeff Smith, chief operating officer of NMCC, a subsidiary of the Canada-based company, THEMAC Resources. Smith said it was premature to discuss other options for obtaining water rights for the mine, but added he is confident the project will move f[illegible]rd.

Each year, the mine will require about 6,000 acre feet of water, Smith said, and is expected to operate for at least 12 years while employing between 275 and 300 people.

"We have done a tremendous amount of work on planning our operation and planning for and analyzing what potential effects may be of the operation and then putting into place elements for environmental protection or groundwater protection, or offsetting effects that our pumping might have," he said. "We have in place now agreements and plans for other water users in the area that we have discussed with the state to offset any negative effects we might have."

In its 2017 financial report, the company noted it was working with the New Mexico Office of the State Engineer to "incorporate the use of the Jicarilla water into the terms of the State pumping permit for the mine."

That refers to the company's agreement to lease about 3,000 acre-feet of San Juan-Chama water from the Jicarilla Apache Nation in northwestern New Mexico. The tribe has rights to water that is piped in tunnels from the San Juan River and into the Chama River, which flows into the Rio Grande north of Española.

According to that 2015 agreement, that water wouldn't be used at the mine, but would "offset" water depletions in the Lower Rio Grande. That is, it would replace the water that is lost to the river because of groundwater pumping.

Decades of plans and deals, just months of operations

The Copper Flat Mine operated for just a few months before being closed in July 1982. In 1984, when the state was evaluating how much water was being used in the Lower Rio Grande Basin, the company tallied up its water rights for each of its 18 groundwater wells and the open pit and declared it had rights to 6,462 acre feet of water annually.

But during the mine's brief life, the company had put less than 900 acre feet of water to beneficial use for mining, milling, reclamation, dust control, wash water and employee use.

A few years later, the owners tried to sell the water rights to the City of Las Cruces, which declined. At that time, Phelps Dodge, which operated the area's other copper mines near Silver City, also declined to buy its liquidated mine assets. In 1986, Copper Flat Partnership (owned by a Delaware corporation, Quintana and Phibro) and its financial partner, the Canadian Imperial Bank of Commerce, sold all the removable physical assets of the mine to a Papua New Guinea-based mining company. And in 1987, the company notified the state of New Mexico that the mine was permanently closed and would not be restarted.

It was during that time that Frost and Gray, a real estate agent and an accountant, bought the mine's water rights, 6,462 acre feet, for $20,000. During the 1990s, the mine's new owners—Gold Express and Alta Gold—paid the two men about $400,000 in total for their consent to use the water rights from previously-drilled groundwater wells.

In 2009, NMCC bought Copper Flats from Hydro Resources Corporation, another new owner, and the following year Frost and Gray entered into an option agreement with the company for the sale of those declared water rights.

But the state pointed out that those water rights hadn't been put to beneficial use for years, and were no longer valid. And now, Wechsler has agreed.

Hillsboro resident Max Yeh, a local opponent of the mine, said he hopes the judge's decision will prompt the owners to reconsider reopening Copper Flat. "There are initial, emotional reactions to this kind of thing, locally," Yeh said. "But it is fairly clear from this decision that in this arid environment, this mine might do great damage."

Yeh and other Hillsboro residents worry about local impacts from the mine—from the mine itself and its tailings, as well as from dust. But the bigger problem, Yeh said, is how groundwater pumping could affect water resources not just in the immediate area, but within the Lower Rio Grande Basin.

And Yeh likely isn't the only one worried about possible impacts to the Lower Rio Grande Basin.

Texas sued New Mexico and Colorado (http://nmpoliticalreport.com/784640/rio-woes-en/) over water issues in the Lower Rio Grande, alleging that by allowing farmers in the southern part of the state to pump groundwater, New Mexico violated the Rio Grande Compact and didn't send enough water downstream. The U.S. Bureau of Reclamation also joined the suit, saying that New Mexico is allowing people to use more water than they legally should. If New Mexico loses the case, which is being heard in the U.S. Supreme Court, southern farmers could be forced to curtail groundwater pumping, and the state would likely have to pay out billions of dollars in damages.

EIS in the pipeline, other questions remain

Opening a new mine is no easy task, and the company still must find water and procure federal and state permits.

In 2010, NMCC started working to line up permits and perform baseline studies on wildlife and water. And in 2015, the U.S. Bureau of Land Management released a draft Environmental Impact Statement for how the proposed open pit mine, its mill, waste rock pile, stockpile and other facilities might affect things like local wildlife, water supplies and vegetation.

Hillsboro residents, environmental groups, Turner Ranch Properties—which owns the nearby Ladder Ranch—and New Mexico's two U.S. senators all submitted comments pointing out problems in the analyses from the mine and the federal government. At that time, the New Mexico Interstate Stream Commission noted that BLM didn't adequately consider the project's impacts on New Mexico's ability to meet its Rio Grande water delivery requirements to Texas. And the Elephant Butte Irrigation District and the New Mexico Pecan Growers commented that pumping groundwater for the mine could affect water rights owned by its members along the Rio Grande.

Next, the BLM will issue a final EIS and, eventually, a decision on whether the mine can proceed. Opponents of the mine, meanwhile, asked the BLM to require that the company complete a supplemental EIS, which is required under federal law if a project changes substantially or new information arises.

According to the BLM, the agency will release an answer on that issue as soon as this week.

There were also questions as to whether the mine's pit lake would be on federal or private land, which would affect which water quality regulations would apply to the company. According to the company's plans, the existing pit would be enlarged from 102 to 169 acres.

Last year, the company commissioned surveys to determine the land status of the existing pit, which was believed to cross both federal and private land owned by the company. The BLM agreed with the new survey, concluding that the existing pit lake is on private land, and the company says its design for the future pit will be limited to private lands.

If the New Mexico Environment Department, which did not respond to requests for information for this story, agrees that the pit is "private water" it would not be subject to surface or groundwater quality standards under the federal Clean Water Act.

The company will also need a new mine permit from the New Mexico Mining and Minerals Division.

Regardless of the options NMCC chooses to find water, the company will need state approval. Any groundwater pumping will require a permit from the Office of the State Engineer, for instance. And the agreement to offset water depletions with the Jicarilla Apache Nation's water isn't a done deal yet, either.

Conversations about Copper Flat made their way to the Office of the Governor, as well. In an April 2017 email to State Engineer Tom Blaine requesting a meeting about NMCC's permit application, Deborah Peacock, a board member of NMCC and THEMAC, noted she spoke recently with Gov. Susana Martinez's Chief of Staff Keith Gardner about Copper Flat. Peacock, a patent attorney and regent of New Mexico Tech, copied Gardner on the message, noting she wanted to "keep him in the loop."

For now, however, Wechsler's decision has many wondering how the project can realistically go forward without Frost and Gray's water rights.

In an emailed statement to *NM Political Report*, the attorney for Turner Ranch Properties, Tessa Davidson, said the group was pleased with the judge's decision.

"In the case, New Mexico Copper Corporation took the position that its water rights claims were exempt from New Mexico's constitutional requirement of beneficial use," wrote Davidson on behalf of her client. "The judge's decision confirms that beneficial use is the basis of all rights to use water in the state, and that no particular water user, or type of industry, is exempt from the law."

New Mexico Copper Corp. water rights decision (https://www.scribd.com/document/368434685/New-Mexico-Copper-Corp-water-rights-decision#from_embed) by New Mexico Political Report (https://www.scribd.com/user/284030527/New-Mexico-Political-Report#from_embed) on Scribd

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(http://nmpoliticalreport.com/792260/judge-tosses-out-water-rights-mining-company-was-banking-on-for-copper-flats-en/?share=email)

G+ (http://nmpoliticalreport.com/792260/judge-tosses-out-water-rights-mining-company-was-banking-on-for-copper-flats-en/?share=google-plus-1)

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More (#)

Related

15829

Reid, Brad, NMENV

From:	Knight, Andrew, NMENV
Sent:	Monday, January 22, 2018 4:53 PM
To:	Reid, Brad, NMENV; Vollbrecht, Kurt, NMENV
Subject:	FW: IPRA Request Regarding Copper Flat Copper Mine
Attachments:	Emails - ELC 01 08 18.pdf; DP-1840 DraftDP.pdf

From: Knight, Andrew, NMENV
Sent: Monday, January 22, 2018 4:44 PM
To: 'Jaimie Park' <jpark@nmelc.org>
Subject: RE: IPRA Request Regarding Copper Flat Copper Mine

Ms. Park,
This email responds to your IPRA request of January 8, 2018. You requested the following documents:

1. All documents pertaining to a Use Attainability Assessment ("UAA") for the proposed Copper Flat Copper Mine submitted or generated since December 14, 2017;
2. All documents pertaining to the Copper Flat Mine's existing uses for its current pit lake;
3. All documents pertaining to Copper Flat cooperating agency meetings held in December 2017, January 2018 or to be held in January 2018 through March 2018;
4. All draft discharge permits for NMCC's draft discharge permit application; Revised 6/14/12
5. All documents pertaining to NMED's technical completeness determination regarding NMCC's discharge permit application;
6. The preliminary final environmental impact statement prepared by BLM and/or its contractor;
7. The draft mining permit prepared by MMD;
8. The preliminary final Biological Assessment prepared by BLM and any comments on the final draft submitted by cooperating agencies.

The attached documents were identified as being responsive to your request. The Department did not have any documents responsive to requests numbered 1, 3, 6, 7, or 8. There are no new UAA documents and there have been no recent cooperating agency meetings. Since there is no date limitation for item #2 this would include documents that have been previously provided through prior ELC IPRAs regarding pit lake existing uses as it relates to the pit jurisdictional (waters of the state) issue. We have not duplicated documents that were previously provided on this subject. Although the application has not been deemed technically complete, I have included the draft DP-1840 in its current form. Note there may be additional changes to this document before it is released for public notice. Please let me know if you have any questions regarding this response.

Andrew P. Knight
Assistant General Counsel
New Mexico Environment Department
Office: (505) 222-9540
Cell: (505) 907-8836

From: Jaimie Park [mailto:jpark@nmelc.org]
Sent: Monday, January 08, 2018 5:39 PM

To: Mascarenas, Melissa, NMENV <melissa.mascarenas@state.nm.us>
Cc: Knight, Andrew, NMENV <Andrew.Knight@state.nm.us>; Reid, Brad, NMENV <brad.reid@state.nm.us>
Subject: IPRA Request Regarding Copper Flat Copper Mine

Dear Ms. Mascarenas,

Please find attached an IPRA request regarding the proposed Copper Flat Copper Mine.

Kind Regards,

Jaimie Park

NEW MEXICO ENVIRONMENT DEPARTMENT
INSPECTION OF PUBLIC RECORD REQUEST FORM

Please fill out the following information:

1. Date: January 8, 2018

2. Requestor's Name: Jaimie Park, New Mexico Environmental Law Center

3. Requestor's Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

4. Phone No.: (505) 989-9022

5. Email: **jpark@nmelc.org**

6. Company Being Represented: New Mexico Environmental Law Center

7. Address: 1405 Luisa Street, Suite 5, Santa Fe, NM 87505

8. Document or File being requested to be reviewed or copied (please describe the records in sufficient detail to enable Department personnel to reasonably identify & locate the records:

I request that you inform me what documents are available within the scope of this request and when I can inspect those documents. I also request that you not make any copies without first informing me of the number of copies and the cost for the copying that are involved. Finally, I request that if you determine that any documents or portions of documents are exempt from disclosure you inform me of that and provide me with citations to the provisions in the Inspection of Public Records Act that indicate that the documents or portions of documents are exempt from disclosure, describe the type of document being withheld, and identify who sent the document being withheld and who received the document being withheld.

Records being requested:

1. All documents pertaining to a Use Attainability Assessment ("UAA") for the proposed Copper Flat Copper Mine submitted or generated since December 14, 2017;
2. All documents pertaining to the Copper Flat Mine's existing uses for its current pit lake;
3. All documents pertaining to Copper Flat cooperating agency meetings held in December 2017, January 2018 or to be held in January 2018 through March 2018;
4. All draft discharge permits for NMCC's draft discharge permit application;

5. All documents pertaining to NMED's technical completeness determination regarding NMCC's discharge permit application;

6. The preliminary final environmental impact statement prepared by BLM and/or its contractor;

7. The draft mining permit prepared by MMD;

8. The preliminary final Biological Assessment prepared by BLM and any comments on the final draft submitted by cooperating agencies.

For purposes of this request, the term "document" means any record in written, graphic, photographic, or other form kept or memorialized on paper, microfilm, microfiche, or electronic media; and includes each non-identical original or copy of a draft or final record, whether the original or copy is not identical because of notes on the original or copy or otherwise.

For purposes of this request, the term "pertaining to" means addressing, concerning, focusing on, mentioning, relating to, or relevant to in any manner.

For purposes of this request, "existing uses" means "a use actually attained in a surface water of the state on or after November 28, 1975, whether or not it is a designated use". Section 20.6.4.7.E(3) NMAC.

9. NMED Bureau where Document/File can be found (if known): Surface Water Quality Bureau, Ground Water Quality Bureau

____
Signature

The cost for copying by NMED is as indicated on Attachment A. Please send this request to:

Melissa Y. Mascareñas
Inspection of Public Records Officer
1190 St. Francis Drive, Ste. N-4050
Santa Fe, New Mexico 87505
fax: (505) 827-1628 or
email: melissa.mascarenas@state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lt. Governor

NEW MEXICO ENVIRONMENT DEPARTMENT

Harold Runnels Building
1190 Saint Francis Drive (87505)
PO Box 5469, Santa Fe, NM 87502-5469
Phone (505) 827-2990 Fax (505) 827-1628
www.env.nm.gov

BUTCH TONGATE
Cabinet Secretary

J.C. BORREGO
Deputy Secretary

January 9, 2018

VIA E-MAIL

Jaimie Park
jpark@nmelc.org

Re: Request to Inspect Public Records

Dear Ms. Park:

On January 9, 2018, this office received your request for public information. You request information pertaining to: Copper Flat Copper Mine. (See attached request).

I forwarded your request to the bureaus on January 9, 2018. The bureaus will respond by January 22, 2018.

Should you have any questions, please contact the Ground Water Quality Bureau at (505) 827-2919 and the Surface Water Quality Bureau at (505) 827-2819.

Sincerely,

Melissa Y. Mascareñas
New Mexico Environment Department
Department Public Records Custodian

cc: Andrew Knight, Assistant General Counsel
Michelle Hunter, Chief, Ground Water Quality Bureau
Shelly Lemon, Chief, Surface Water Quality Bureau

Reid, Brad, NMENV

From:	Juan Velasquez <jvelasquez@vemsinc.com>
Sent:	Monday, January 29, 2018 5:01 PM
To:	Reid, Brad, NMENV
Cc:	Jeff Smith; 'Katie Emmer'
Subject:	Compliance with 20.6.7.22(A)1
Attachments:	DP Andesite Plant Figures for Coarse Ore and Run-of- mine Stockpiles.pdf

Brad,

You asked that I provide you with further explanation of the rationale we used in determining how the coarse ore stockpile at Copper Flat will meet the requirements of 20.6.7.22.A(1) which requires that the it be designed such that all materials containing water contaminants that have the potential to migrate to ground water be contained and managed on concrete or low permeability surfaces.

Information contained in NMCC's DP, Revision 1, August 2017 contains the following information that shows how we will meet this requirement. Figure 11K-2a of the application (page 110), a copy of which is attached, is a geologic map of the Copper Flat Mine area. It contains among other things, certain features as explained below, specific to addressing this issue.

1. It depicts the location of the andesite bedrock, quartz monzonite and Santa Fe group formations in relation to the site;
2. It depicts the location of several cross-section lines, the most relevant of which is to this discussion is Cross-section PA-PA'.

I have also attached a couple of other figures important to explaining how NMCC will meet the 22.A.(1) requirement, Figure 11K-4 Hydrogeologic Cross-Section PA-PA', from the DP Application, Revision 1 (page 114) and a figure titled "Plant Area Geology".

The Plant Area Geology figure is not in the DP application. It is an inset that I have added to Figure 11K-2a. This figure shows plant area details including the location of temporary storage of run-of-mine ore (see page 68 of the DP, Rev. 1) and the coarse ore or crushed ore stockpile (see pages 72, 82, 83 and Figure 11J-16 of the DP, Rev. 1).

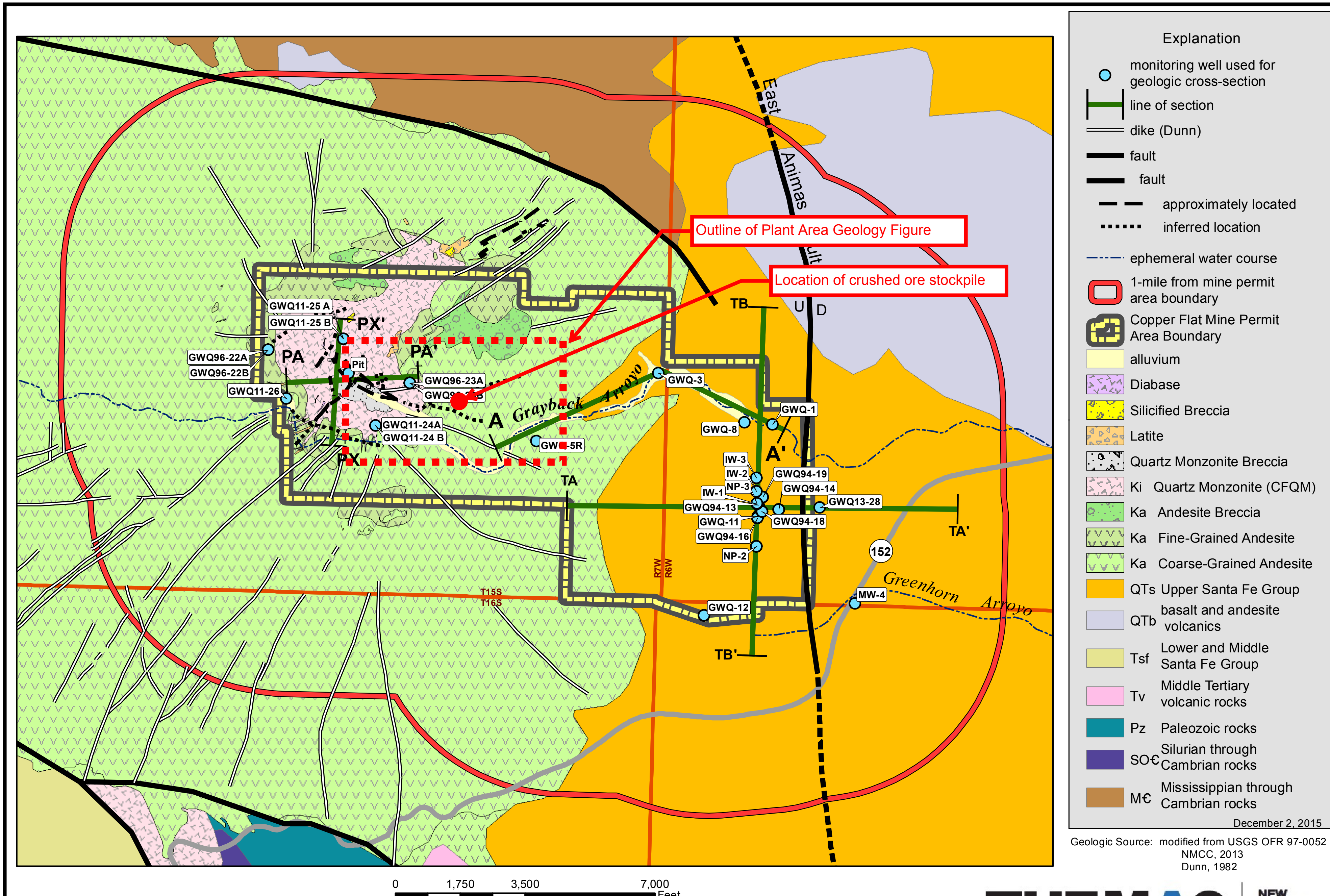
Figure 11K-4, is included to help orient the more detailed plant area figure to Figure 11K-2a. Figure 11K-4 shows the cross-section line of PA-PA' from the western edge of the site beginning approximately at Well GWQ 96-22 in the andesite across the quartz monzonite (i.e., the pit location) to a point to the east past Well GWQ 96-23, also in the andesite formation. It is important to note from the cross-section that the andesite bedrock formation is over 500 ft. thick, continuing to the east under the plant area.

The presence and location of the andesite bedrock formation is important on these figures. The Plant Area Geology figure shows that the andesite bedrock formation underlies the entire plant site, including the coarse ore and run-of-mine stockpiles. The andesite formation is the same formation that will underlay the waste rock stockpiles. NMCC has determined that the andesite bedrock has a very low permeability of less than 10^{-6} cm/sec. as discussed in the DP, Revision 1, at pages 64 and 65.
Therefore, the requirement of 20.6.7.22.A.(1) is met at these stockpile locations because this low permeability andesite bedrock also underlies them.

I trust that information provides the explanation you requested. Please let me know it you require additional clarification of have other question.

Juan

In printing the figures you might need to choose "document and markups" from the comments and forms drop-down box.



Geologic Source: modified from USGS OFR 97-0052
NMCC, 2013
Dunn, 1982

THEMAC RESOURCES
NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

Figure 11K-2a. Geologic map within 1-mile of the Copper Flat Mine Area permit boundary, Sierra County, New Mexico.

JOHN SHOMAKER & ASSOCIATES, INC.
15839

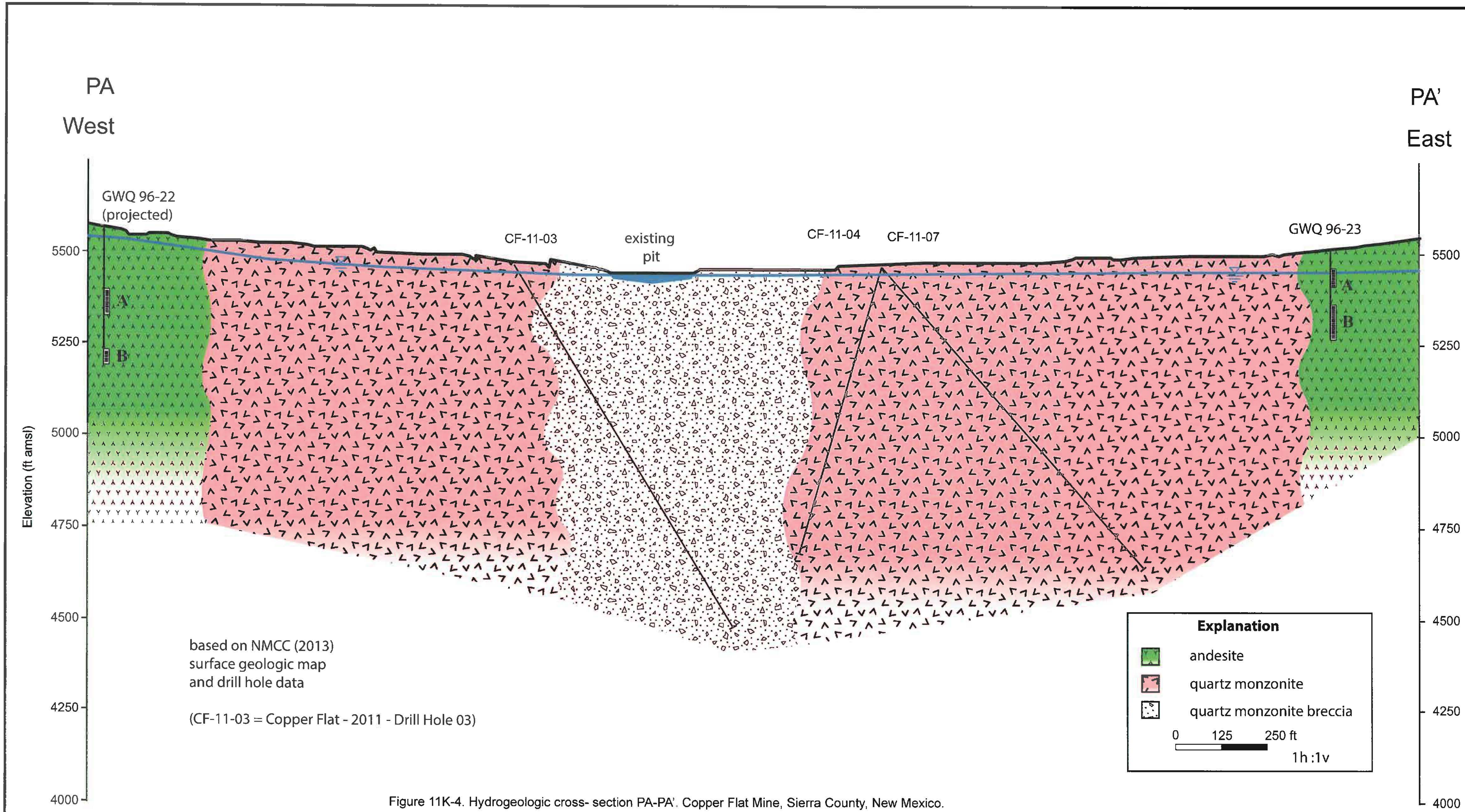
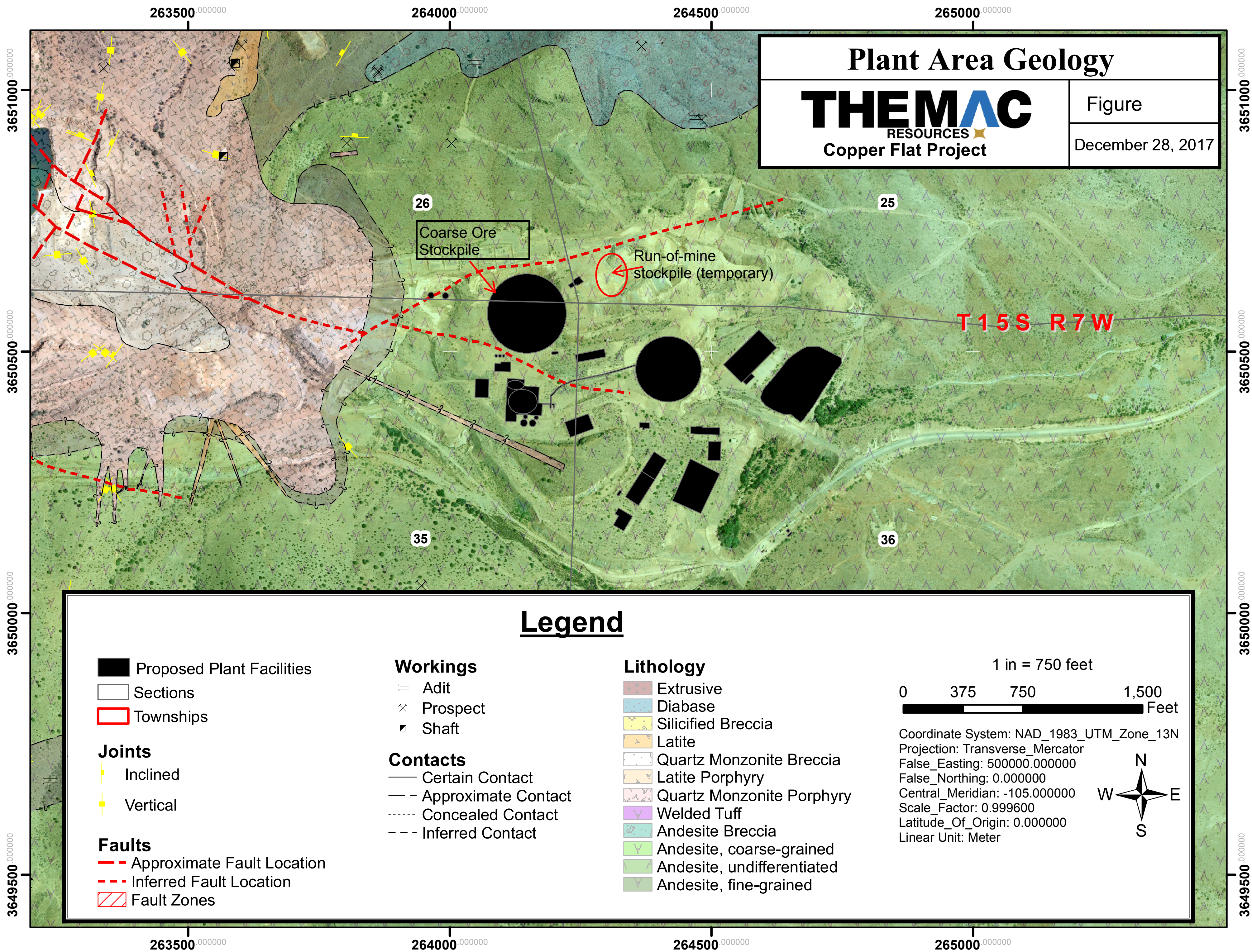


Figure 11K-4. Hydrogeologic cross- section PA-PA'. Copper Flat Mine, Sierra County, New Mexico.

5/5/2014; DA


Plant Area Geology
THEMAC RESOURCES
Copper Flat Project
Figure
December 28, 2017
263500 000000
264000 000000
264500 000000
265000 000000
3651000 000000
3650500 000000
3650000 000000
3649500 000000
26
25
35
36
Coarse Ore Stockpile
Run-of-mine stockpile (temporary)
T 1 5 S R 7 W
Legend
Proposed Plant Facilities
Sections
Townships
Joints
Inclined
Vertical
Faults
Approximate Fault Location
Inferred Fault Location
Fault Zones
Workings
Adit
Prospect
Shaft
Contacts
Certain Contact
Approximate Contact
Concealed Contact
Inferred Contact
Lithology
Extrusive
Diabase
Silicified Breccia
Latite
Quartz Monzonite Breccia
Latite Porphyry
Quartz Monzonite Porphyry
Welded Tuff
Andesite Breccia
Andesite, coarse-grained
Andesite, undifferentiated
Andesite, fine-grained
1 in = 750 feet
0 375 750 1,500 Feet
Coordinate System: NAD_1983_UTM_Zone_13N
Projection: Transverse_Mercator
False_Easting: 500000.000000
False_Northing: 0.000000
Central_Meridian: -105.000000
Scale_Factor: 0.999600
Latitude_Of_Origin: 0.000000
Linear Unit: Meter
N
W
E
S

Reid, Brad, NMENV

From:	Reid, Brad, NMENV
Sent:	Friday, January 26, 2018 11:07 AM
To:	'Katie Emmer'; Mascarenas, Melissa, NMENV
Subject:	RE: NMCC IPRA
Attachments:	DP-1840 DraftDP.PDF

Katie,

Here is the draft DP-1840 as of 1/22/18.

Melissa, this IPRA request has been fulfuilled.

Brad Reid, Geologist
Mining Environmental Compliance Section
Ground Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502
Phone: 505.827.2963; Fax: 505.827.2965

From: Katie Emmer [mailto:kemmer@themacresourcesgroup.com]
Sent: Friday, January 26, 2018 10:43 AM
To: Mascarenas, Melissa, NMENV <melissa.mascarenas@state.nm.us>
Cc: Reid, Brad, NMENV <brad.reid@state.nm.us>
Subject: NMCC IPRA

Greetings Ms. Mascareñas,

Attached please find a request for inspection of public records on behalf of New Mexico Copper Corporation. If you have any questions or need anything further from me, please let me know.

Best regards,

Katie Emmer | Permitting & Environmental Compliance Manager

M: +1 505.400.7925| **F:** +1 505.881.4616
A: 4253 Montgomery Blvd. NE, Suite 130, Albuquerque, NM 87109
W: themacresourcesgroup.com | **E:** kemmer@themacresourcesgroup.com

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

NEW MEXICO ENVIRONMENT DEPARTMENT
INSPECTION OF PUBLIC RECORD REQUEST FORM

Please fill out the following information:

1. Date: 26 January 2018
2. Requestor's Name: Katie Emmer
3. Requestor's Address: 4253 Montgomery Blvd, NE, Suite 130
   Albuquerque, NM 87109
4. Phone No.: (505)400-7925
5. Email: **kemmer@themacresourcesgroup.com**
6. Company Being Represented: New Mexico Copper Corporation
7. Address: See above
8. Document or File being requested to be reviewed or copied (please describe the records in sufficient detail to enable Department personnel to reasonably identify & locate the records:

   Draft Discharge Permit 1840 for Copper Flat - Brad Reid Permit Lead

9. NMED Bureau where Document/File can be found (if known): GWQB

Katie Emmer
Signature

The cost for copying by NMED is as indicated on Attachment A. Please send this request to:

Melissa Y. Mascareñas
Inspection of Public Records Officer
1190 St. Francis Drive, Ste. N-4050
Santa Fe, New Mexico 87505
fax: (505) 827-1628 or
email: melissa.mascarenas@state.nm.us

Revised 6/14/12

Reid, Brad, NMENV

From:	Katie Emmer <kemmer@themacresourcesgroup.com>
Sent:	Monday, January 29, 2018 5:19 PM
To:	Reid, Brad, NMENV
Cc:	Juan Velasquez; Jeffrey Smith
Subject:	Copper Flat Monitoring Plan Figure 2
Attachments:	MonitoringPlan_Fig2_28Jan2018.pdf

Greetings Brad,

Per our discussion, a revised version of Figure 2 for Appendix E Rev 1, *Water-Quality Monitoring Plan for the Copper Flat Mine Discharge Permit Pursuant to 20.6.7.11.R and 20.6.7.28 NMAC,* June 2016 by JSAI, Part of NMCC's Discharge Permit Application, is attached.

This revised Figure 2 includes surface-water sampling locations.

Best regards,

Katie Emmer | Permitting & Environmental Compliance Manager

M: +1 505.400.7925| **F:** +1 505.881.4616

A: 4253 Montgomery Blvd. NE, Suite 130, Albuquerque, NM 87109

W: themacresourcesgroup.com | **E:** kemmer@themacresourcesgroup.com

THE MAC RESOURCES | NEW MEXICO COPPER CORPORATION

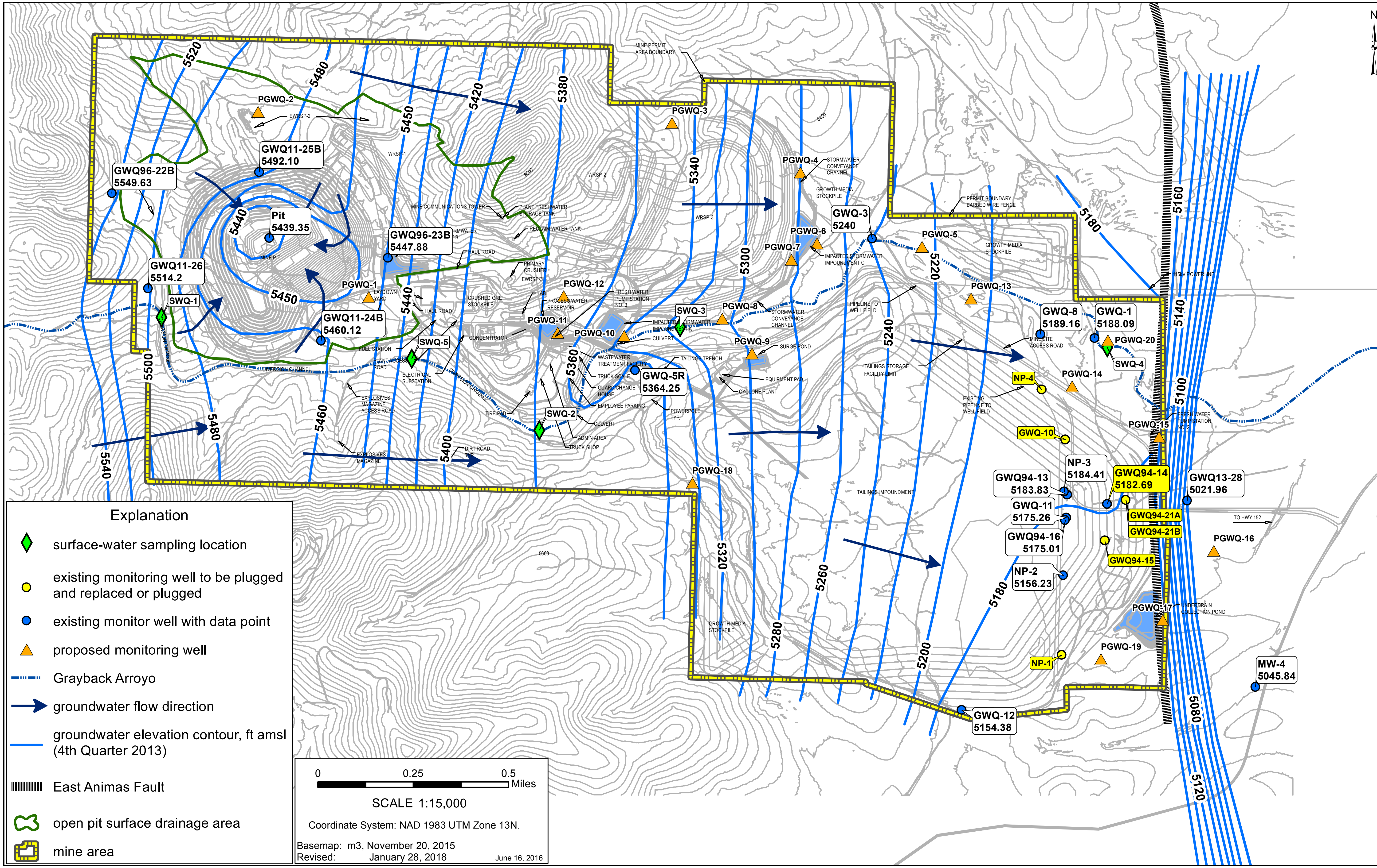


Figure 2. Groundwater flow direction.

15847

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

RECEIVED
JAN 30 2018
Ground Water Quality Bureau

January 25, 2018

Mr. Bryan Dail
Surface Water Quality Bureau
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502

Re: Private Land Status of Open Pit Lake
New Mexico Copper Corporation

Dear Mr. Dail,

This letter provides additional information regarding the location of New Mexico Copper property at Copper Flat.

As you may recall, NMCC identified an error with a property boundary on land status maps being used by State and Federal agencies; specifically maps showing private property lines in Sections 25, 26, 35, and 36, Township 15S, Range 7W, N.M.P.M. As I researched this matter, I learned that the maps in question are based on GIS records maintained by the BLM. As described in my September 27, 2017 letter to Ms. Shelley Lemon, Chief of the Surface Water Quality Bureau, the maps using BLM GIS information for this area erroneously show the NMCC property line crossing the existing pit lake. The correct location of the property line is approximately 300 feet west of the existing pit lake, which places the existing pit lake completely within the NMCC owned property.

This matter was raised with BLM in early 2017 in a meeting at BLM's State Office in Santa Fe, which was attended by representatives from BLM cadastral, land legal, and GIS departments, NMCC's registered land survey consultant, and NMCC. During this meeting, and in subsequent discussions, BLM pointed out that maps sourced through their GIS department are not precise and advised that property owners are responsible to prepare and document surveys to establish correct locations for property boundaries. As further evidence to the possibility for error, the following disclaimer appears when accessing BLM GIS information online:

> *"The geographic coordinates and their associated products are NOT legal land survey records. These coordinates can NOT be used as a substitute for a legal land survey."*

Following our discussions with BLM, NMCC completed a boundary plat of NMCC property in the aforementioned area. The field work and plat were prepared according to New Mexico Land Survey Statutes and BLM standards, which require physical location and tagging of section and property corners by a registered land surveyor. The plat was sealed by a New Mexico registered land surveyor, recorded with Sierra County, and submitted to the BLM Cadastral Survey Department. A copy of the sealed and recorded plat was provided to your office with my September 2017 letter. The plat shows the outline of the current pit water body and shows the existing water body is fully confined to private property owned by NMCC. Figure 1 attached to this letter is page 1 of the boundary plat with NMCC property and the existing pit lake highlighted for clarity.

Figure 2 was developed by Mr. Stephen Beyerlein, a land surveyor in BLM's cadastral survey office in Santa Fe. To create this figure, Mr. Beyerlein overlaid the NMCC property plat onto BLM property maps that are maintained by the BLM cadastral survey department. This figure confirms that the private property boundaries mapped by NMCC align with BLM survey information. Mr. Beyerlein states in his October 12 email (provided with figure 2) that "this [overlay] should be evidence for the State or anyone else that you are in the proper location." On December 12, Mr. Beyerlain further clarified that regarding this figure "it was our (i.e. BLM's) intention to show that the claims are on private land."

Figure 3 shows the future pit design described in our Mine Reclamation and Closure Plan with NMCC property lines. This figure clearly shows the proposed future pit lake is fully contained within the boundaries of private land owned by NMCC.

NMCC believes that this additional information provides further confirmation to demonstrate that the future NMCC pit lake will be located on private land and that the BLM concurs with this conclusion. Please do not hesitate to contact me should you require any additional information.

Sincerely,

J Smith

Jeff Smith
Chief Operating Officer
New Mexico Copper Corporation

cc: Leighandra Keeven, BLM Geologist
David Henney, Solv, LLC, Project Manager
Brad Reid, NMED Ground Water Bureau Permit Lead
David Ennis, MMD Permit Lead

Figure 1. NMCC Boundary Plat
w/ NMCC Property and Existing Pit Lake Highlighted

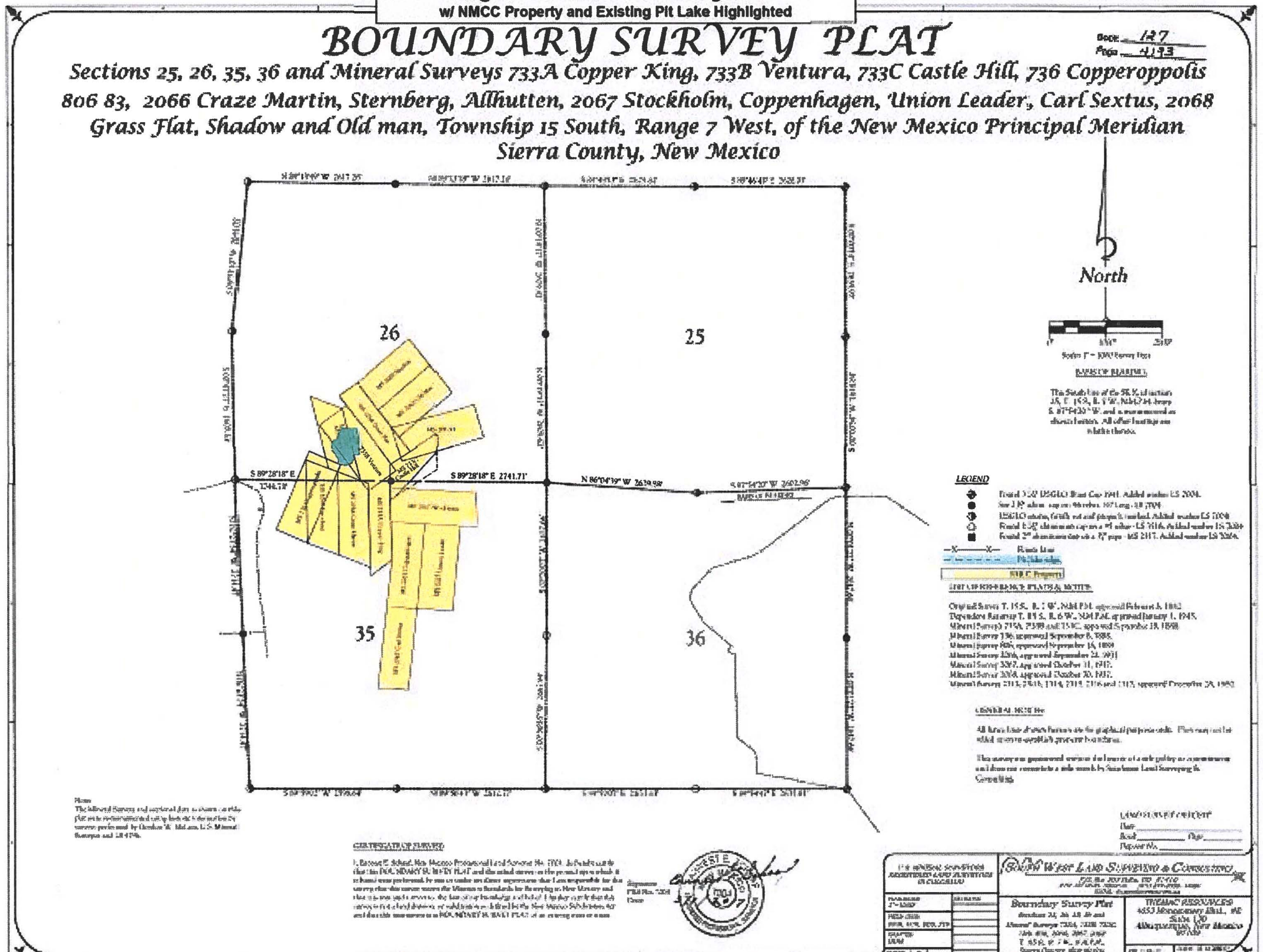
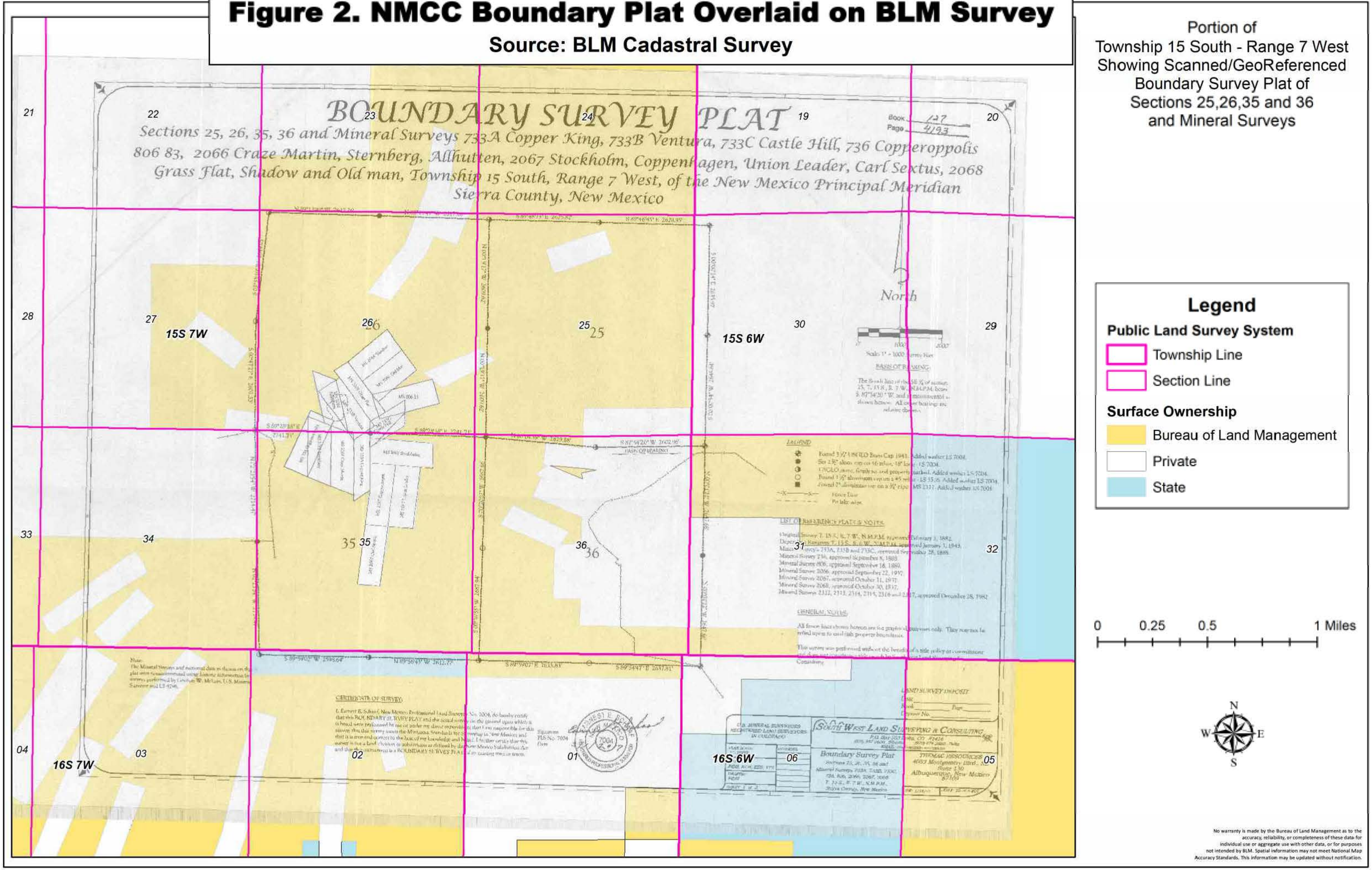


Figure 2. NMCC Boundary Plat Overlaid on BLM Survey

Source: BLM Cadastral Survey



No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data, or for purposes not intended by BLM. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.

Jeffrey Smith

From: Beyerlein, Stephen <sbeyerle@blm.gov>
Sent: Tuesday, December 12, 2017 7:46 AM
To: Jeffrey Smith
Subject: Re: Copper Flat Boundary Survey Plat

Good morning Jeff. To clarify, it was our intention to show that the claims were made on BLM land and are now private. Many are surrounded by BLM and are not in conflict with the State lands. Hoope this helps.

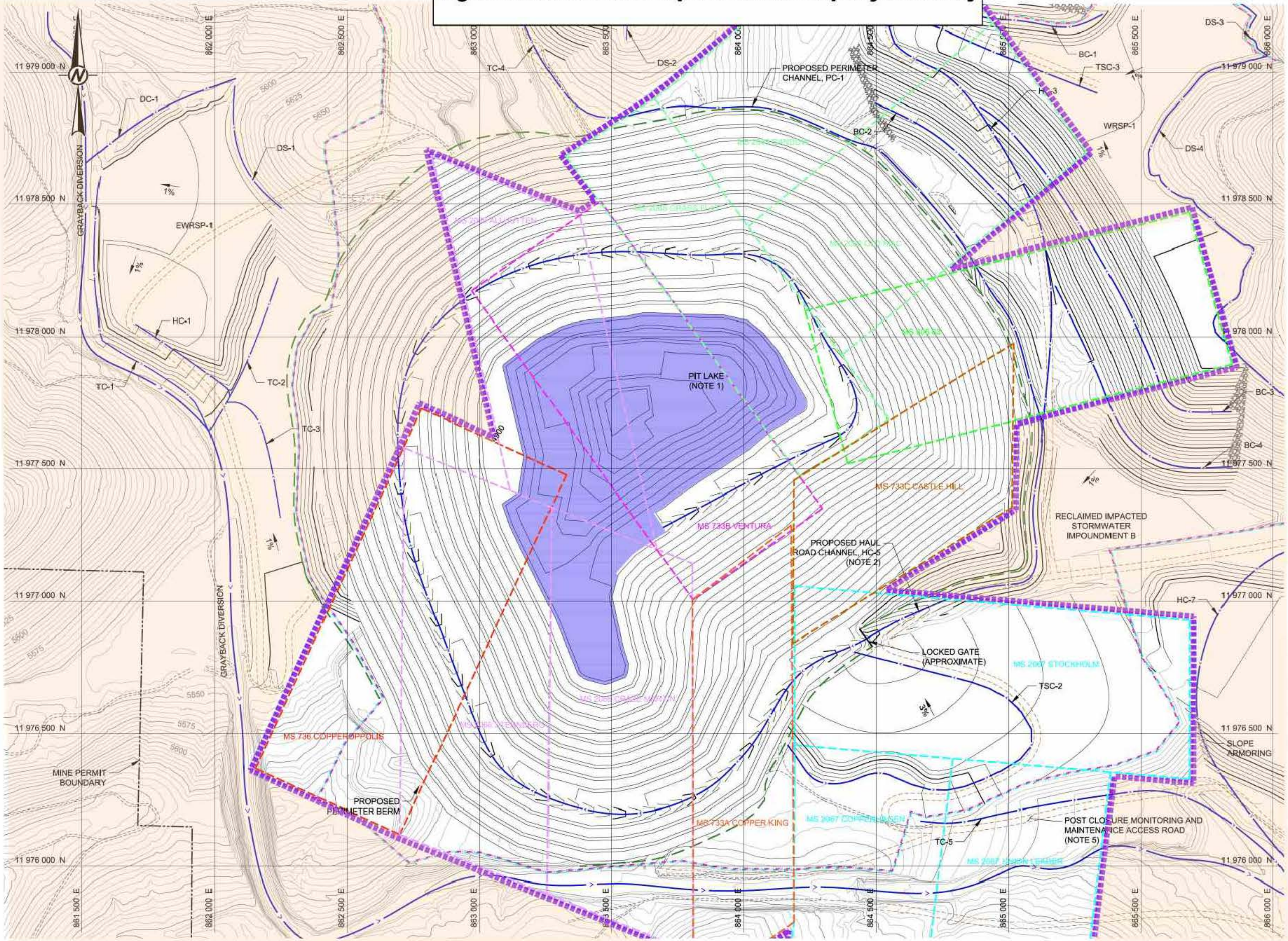
Steve

From: Beyerlein, Stephen [mailto:sbeyerle@blm.gov]
Sent: Thursday, October 12, 2017 12:05 PM
To: Jeffrey Smith
Subject: Re: Copper Flat Boundary Survey Plat

Jeff. Attached is our GIS overlay showing our survey, your survey and the land status. It shows your claims are all on BLM lands. This should be evidence for the State or anyone else that you are in the proper location. Let us know if we can be of further help.

Steve

Figure 3. NMCC Future Open Pit with Property Boundary



LEGEND

- 5400 — EXISTING GROUND CONTOURS - 5 ft INTERVAL (ft-MSL)
- 5400 — PROPOSED DESIGN CONTOURS - 5 ft INTERVAL (ft-MSL) (NOTE 4)
- MINE PERMIT BOUNDARY
- RECLAMATION WATERSHED BOUNDARY
- OPEN PIT SURFACE DRAINAGE AREA (OPSDA)
- EXISTING DIVERSION OR ARROYO
- PROPOSED CHANNEL CENTERLINE (APPROXIMATE)
- POST CLOSURE MONITORING AND MAINTENANCE ACCESS ROAD (NOTE 5)
- PROPOSED PERIMETER BERM
- 1% GRADE INDICATOR
- WRSP WASTE ROCK STOCKPILE
- EWRSP EXISTING WASTE ROCK STOCKPILE
- PIT LAKE (NOTE 1)
- SLOPE ARMORING
- MINING CLAIM MS 806 83
- MINING CLAIM MS 733A COPPER KING
- MINING CLAIM MS 733B VENTURA
- MINING CLAIM MS 733C CASTLE HILL
- MINING CLAIM MS 736 COPPEROPPOLIS
- MINING CLAIM MS 2066 STERNBERG
- MINING CLAIM MS 2067 UNION LEADER
- MINING CLAIM MS 2068 SANDOW
- PRIVATE PROPERTY PERIMETER

NOTES

1. FINAL BUILDOUT TOPOGRAPHY FOR THE PIT, WRSPs, AND GMSPs WAS DEVELOPED BY OTHERS AND PROVIDED BY NMCC. PIT LAKE ELEVATION PROVIDED BY NMCC.
2. THE PLANNED HAUL ROADS SHALL BE UTILIZED FOR STORMWATER CONVEYANCE TO THE PIT.
3. DISTURBANCE AREAS AROUND THE PERIMETER OF THE PIT ARE TO BE RECLAIMED WHERE THEY OCCUR. FOR PLANNING PURPOSES, IT IS ASSUMED THAT AN AVERAGE 100 FOOT WIDTH OF DISTURBANCE FROM THE PIT BOUNDARY WILL OCCUR DURING MINING OPERATIONS. THE ACTUAL WIDTH WILL VARY; IN SOME AREAS THE DISTURBANCE MAY BE GREATER THAN A 100 FOOT WIDTH FROM THE PIT BOUNDARY AND IN OTHER AREAS THERE MAY BE LITTLE OR NO DISTURBANCE.
4. PROPOSED DESIGN CONTOURS REPRESENT THE RECLAMATION SUBGRADE, PRE-COVER PLACEMENT TOPOGRAPHY.
5. POST CLOSURE MONITORING AND MAINTENANCE ACCESS ROAD LOCATIONS ARE APPROXIMATE AND WILL BE FIELD FIT TO MINIMIZE EROSION AND ACCOMMODATE OTHER FIELD CONDITIONS.

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
A	2017-12-07	ISSUED FOR CLIENT REVIEW	HNL	HNL	TS	TS

SEAL

PRELIMINARY
FOR AGENCY REVIEW

CLIENT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

CONSULTANT

Golder Associates
TUCSON OFFICE
4730 N. ORACLE ROAD, SUITE 210
TUCSON, ARIZONA
UNITED STATES OF AMERICA
[+1] (520) 888 8818
www.golder.com

PROJECT
COPPER FLAT PROJECT
MINE RECLAMATION AND CLOSURE PERMIT

TITLE
NMCC PRIVATE PROPERTY IN MINE PIT AREA (PATENTED MINING CLAIMS)

PROJECT NO. 1531453 | REV. A | 1 of 1 | FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

NEW MEXICO ENVIRONMENT DEPARTMENT
GROUND WATER QUALITY BUREAU

GROUND WATER DISCHARGE PERMIT APPLICATION

Instructions for completing the application are included in the form itself and in the Supplemental Instructions found at the back of the application. You may fill out the application manually, or a Microsoft Word version may be downloaded from www.env.nm.gov (Ground Water Quality) and filled out electronically. Timely processing of this application is contingent upon the technical completeness of the submission. Failure to provide all of the information pursuant to Section 20.6.2.3106 NMAC, following notice of technical deficiency, may result in denial of the application.

Send two complete paper copies AND one electronic copy of this application, with the filing fee to:
Program Manager
Ground Water Pollution Prevention Section
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502

Introduction

Facility Name: Copper Flat Mine

GWQB – Date of Receipt
(Department use only)

For Existing Discharge Permits:
DP Number: DP-01
Expiration Date: N/A

Type of Discharge (*check one*):

☐ Domestic
☐ Industrial
☐ Agricultural
☒ Mining

Type of Application (*check appropriate box*)

☐ New – new facility
☐ New – existing (unpermitted) facility
☐ Renewal only
☐ Modification only
"modification" includes a change in the location of a discharge, and/or increase in the quantity of the discharge, and/or a change in the quality of the discharge.
☒ Renewal and Modification

Part I only
per NMED Instruction
Pages 1 through 9

If this application is to *modify* or *renew and modify* a Discharge Permit, what is the reason for modification of the Discharge Permit? Describe the proposed changes that would result in modification, meaning a change in the location of a discharge, and/or an increase in the quantity of the discharge, and/or a change in the quality of the discharge.

The reason for modification of the Discharge permit is that NMCC proposes to recommence operation of the Copper Flat mine. The mine has not operated since 1982 and all of the mine facility will be reconstucted per NMCC's application. The proposed changes are described in detail in the attached application. Briefly, NMCC proposes to rebuild all of the processing facilities, recommence the mining operation and construct a new tailings disposal facility and waste rock stockpiles. While the location of the discharges is generally the same, the quantity of the discharge will change

Fees Included with Application

All applicants are required to submit a **$100 Application Filing Fee**. An additional fee will be assessed prior to permit issuance. Permit fees are listed in section 20.6.2.3114 NMAC. **Make checks payable to: NMED-Ground Water Quality Bureau**

Application Checklist

The following checklist has been provided to assist in ensuring that the application is complete prior to submission (*check all that apply*):

☐	Part I. Administrative Completeness ☐ $100 Application Filing Fee $1,000 fee per Copper Rule ☒ A. General Information ☒ B. Public Notice Information ☒ C. Public Notice Preparation
☒	Part II. Technical Completeness ☒ A. Discharge Volume and Description ☒ B. Identification and Physical Description of Facility ☒ C. Flow Metering ☒ D. Ground Water Monitoring ☒ E. Engineering and Surveying (electronic copies) ☐ F. Land Application Area
☒	Part III. Site-Specific Proposals
☒	Part IV. Electronic (PDF) format of Maps and Logs is required (additional paper copies of maps and logs are optional and may be requested by the Department if required for review) ☒ A. Surface Soil Survey and Vadose Zone Geology ☒ B. Location Map ☒ C. Flood Zone Map

Copies of Application

An applicant applying for a Discharge Permit shall submit **two paper copies of the signed application, and an electronic copy of the signed application including all supporting documentation**, to the address listed below.

☒ Two paper copies – completed and signed

☒ Electronic copy in portable document format (PDF) of the signed application and all supporting documentation (designs, maps, logs), on the following media *(choose one)*:

☒ Compact disc (CD)/DVD ☐ Flash drive

Send application and fees to the following address:
Program Manager
Ground Water Pollution Prevention Section
New Mexico Environment Department
P.O. Box 5469
Santa Fe, NM 87502

Applicant's Signature

Signature must be that of the person listed as the legally responsible party on this application (Part I, 2a).

I, the applicant, attest under penalty of law to the truth of the information and supporting documentation contained in this application for a Ground Water Discharge Permit.

Signature: J Smith Date: 12/9/2015

Printed Name: Jeff Smith Title: COO

Part I. Administrative Completeness

General Information

1. Facility Information

See Supplemental Instructions to determine what constitutes a "facility." The physical address must be provided. If the facility does not have an address, the location can be described by road intersections, mile posts, or landmarks, as appropriate. See Supplemental Instructions for additional information.

Facility Name	New Mexico Copper Corporation Copper Flat Mine
Discharge Permit #	DP-01
Physical Address	85 Copper Rock Rd., Hillsboro NM 88042
County	Sierra
Type of Facility	Open pit copper mine and concentrate production facility
Driving Directions	South from Albuquerque on Interstate 25 165 miles to Exit 63 onto to NM State Highway 152 toward Hillsboro, west on NM 152 for 10.3 miles, turn right on Gold Dust Road (marked with a Copper Flat Project sign) to enter the mine site. Follow signs to the mine project office.

2. Contact Information

a) Applicant Information The applicant is the person or entity (e.g., corporation, partnership, organization, *municipality*, etc.) legally responsible for the discharge and for complying with the terms of the Discharge Permit. If the applicant is an entity, then the name and title of a contact person must be provided. This application must be signed by the applicant or contact person named here.

Applicant Name	Jeff Smith			Title	Chief Operating Officer	
Mailing Address	4253 Montgomery Blvd. NE					
	City	Albuquerque	State	NM	Zip	87109
Contact Person	Jeff Smith			Title	Chief Operating Officer	
	Office Number	505-382-5770		Fax Number		
Contact Information	Cell Number	520-991-4588		E-mail	jsmith@themacresourcesgroup.com	

b) Facility Operator/Manager Information Provide the contact information for the facility operator or manager below. If the facility is required to have an operator certified by the State of New Mexico, please include the certification level of the operator named here.

Name	Same as above			Title		
Mailing Address						
	City		State		Zip	
Contact Information	Office Number			Fax Number		
	Cell Number			E-mail		

	Cell Number		E-mail
Certification Level (if applicable)			

c) Consultant's Information (if applicable) If the consultant is a company or organization, then the name and title of a contact person must be provided here.

Company Name (1)	Velasquez Environmental Management Services, Inc.				
Company Contact	Juan R. Velasquez				
Mailing Address	12912 Sand Cherry Pl. NE				
	City Albuquerque	State	NM	Zip	87111
Contact Information	Office Number	505-239-3728	Fax Number		
	Cell Number	505-239-3728	E-mail	jvelasquez@vemsinc.com	

Company Name (2)					
Company Contact					
Mailing Address					
	City	State		Zip	
Contact Information	Office Number		Fax Number		
	Cell Number		E-mail		

d) Permit Contact Information (if applicable) If someone other than the contacts listed above is a primary contact for this application and/or facility, list here.

Name	Same as Applicant		Title		
Mailing Address					
	City	State		Zip	
Contact Information	Office Number		Fax Number		
	Cell Number		E-mail		
Facility Affiliation					

3. Ownership and Real Property Agreements [20.6.2.7HH NMAC]

The applicant owns (check as appropriate):

☒ The facility

☒ All discharge sites

☒ Some discharge sites

If someone other than the applicant owns the facility or any of the discharge sites, provide ownership information below. For any portion of the facility where the applicant is not the owner of record, the applicant shall submit a copy of any lease agreement or other agreement which authorizes the use of the real property for the duration of the term of the requested permit (typically five years). Lease prices or other prices may be redacted.

- If more than one person has ownership interest, or a partnership exists, list all persons with an ownership interest.
- If a corporate entity holds an ownership interest, provide the name of the corporate entity and the entity's registered agent as filed with the New Mexico Public Regulation Commission.

Name: See Information provided in Application Section 20.6.7.11.C Ownership of the Facility is mixed. Some land is fee land owned by the applicant and other land is either patented land and/or unpatented land owned by the federal government and administered by the US BLM — Title: ______

Mailing Address: ______

City ______ State ______ Zip ______

Contact Information: Office Number ______ Fax Number ______

Cell Number ______ E-mail ______

Owns: ☐ The facility ☐ A discharge site

☐ Attached – lease (or other authorized use) agreement

Name ______ Title ______

Mailing Address: ______

City ______ State ______ Zip ______

Contact Information: Office Number ______ Fax Number ______

Cell Number ______ E-mail ______

Owns: ☐ The facility ☐ A discharge site

☐ Attached – lease (or other authorized use) agreement

4. Public Notice Information

a) Proposed Maximum Daily Discharge Volume: 25,264,000 gallons per day

Note: Use the information from Part II.A.2 following its completion.

b) Depth-to-Most-Shallow Ground Water: 42 feet

Note: Use the information from Part II.A.2 following its completion.

c) Pre-Discharge Total Dissolved Solids Concentration in Ground Water

[Subsection C of 20.6.2.3106 NMAC]

Provide the concentration of total dissolved solids (TDS) in ground water prior to discharging from the facility. *Note: This information is likely the same as that submitted in the first application for a Discharge Permit for this facility.*

- Pre-discharge TDS concentration in ground water: 500-800 (See Section.6.7.11.G of application) mg/L (ppm)
  - ☐ Attached – Copy of laboratory analysis report (if available)
- From what source was the sample collected (e.g., upgradient monitoring well, on-site supply well, nearest well within a one-mile radius of the facility)?
  See Section 6.7.11.G of application

5. Facility Location

In the table below, describe the location for the entire facility by listing the Township, Range, and Section, and/or latitude and longitude for the locations of all components of the processing, treatment, storage, and/or disposal system. See Supplemental Instructions for additional information. [Paragraph (2) and (5) of Subsection C of 20.6.2.3106 NMAC]

Component[1] ID	Town ship	Range	Section(s)	Latitude	Longitude
See Section 20.6.7.11.E of application					

[1] Components include: septic tanks, impoundments, treatment systems, irrigation sites, leachfields, monitoring wells, mine stockpiles, etc. Additional examples are listed in the Supplemental Instructions. Each component should have a unique ID, for example septic tank-1, monitoring well-3, etc.

6. Processing, Treatment, Storage, and Disposal System

Briefly describe how wastewater, sludge, etc. is processed, treated, stored, and/or disposed of at your facility. Include each component listed in the table above.

Process water, storm water, tailings will be stored and/or disposed of in lined impoundments as described in the attached application

7. Public Notice Preparation [20.6.2.3108 NMAC]

Once NMED has determined that your application is administratively complete, you must complete the applicant's public notice requirements of Section 20.6.2.3108 NMAC. Language for notifications will be mailed to you with an administratively complete determination. Note: Guidance and instructions for completion of applicant's public notice can also be found at the following link: *https://www.env.nm.gov/gwb/NMED-GWQB-PublicNotice.htm*. The information requested below will be used by NMED to approve or reject the proposed public notice newspaper and signage posting locations in accordance with Subsection A of 20.6.2.3108 NMAC. Note: Other requirements of Section 20.6.2.3108 NMAC not listed here, such as certified mailings to nearby landowners, may also apply.

a) Public Notice Posting Locations

Select the type of application you are submitting and provide the requested information. Language to be used in the required notifications will be included in the administratively complete packet.

☐ Renewal Application

1. Following receipt of an administrative completeness determination from NMED, the applicant is required to provide public notice of this application by placing a 2 inch by 3 inch display ad (classified or legal sections are not acceptable) in a newspaper of general circulation in the location of the proposed discharge. Indicate the newspaper in which you intend to place the ad. [Subsection C of 20.6.2.3108 NMAC]

Newspaper: ______________________________

☒ New Application, Modification Application, or Renewal with Modification Application

1. Following receipt of an administrative completeness determination from NMED, the applicant is required to provide public notice of this application by placing a display ad (classified or legal sections are not acceptable) in a newspaper of general circulation in the location of the proposed discharge. Indicate the newspaper in which you intend to place the ad. [Paragraph (4) of Subsection B of 20.6.2.3108 NMAC]

Newspaper: Sierra County Sentinel

2. Following receipt of an administrative completeness determination from NMED, the applicant is required to post a sign(s) (2 feet x 3 feet in size) for 30 days in a location conspicuous to the public at or near the facility. One sign must be posted for each 640 contiguous acres or less. NMED may require additional postings for facilities of more than 640 acres or when the discharge site(s) is not located on contiguous properties. Indicate the location(s) where you intend to display the sign(s). [Paragraph (1) of Subsection B of 20.6.2.3108 NMAC]

Note: Conspicuous location means a location where the sign is visible and legible to the public and the public has access (e.g., at facility entrance on public road).

- Is the entire facility (including all components and discharge sites) contained within **less than** 640 acres, <u>and</u> is the acreage contiguous?

  ☐ Yes - Indicate a sign location below.
  ☒ No – Indicate **two** sign locations below.

Sign Location(s): To be placed at the road pull-out on the souteast side of NM Highway 152 near Geronimo Trail Scenic Highway sign and another at a location to be determined, if necessary.

3. Following receipt of an administrative completeness determination from NMED, the applicant is required to post an additional notice (a flyer 8.5" X 11" or larger) for 30 days at an off-site location conspicuous to the public (e.g., public library). Indicate the location where you intend to display the flyer. [Paragraph (1) of Subsection B of 20.6.2.3108 NMAC]

Note: The U.S. Postal Service no longer allows the posting of flyers in post offices.

Flyer Location: Hillsboro Community Center

b) Mailing Instructions

a) The administrative completeness determination letter, including public notice instructions, should be sent to:

☒ Applicant ☐ Consultant

Copper Flat Mine
Discharge Permit Application
Pursuant to
20.6.7 NMAC

Prepared for:
New Mexico Environment Department
Ground Water Quality Bureau

And

New Mexico Copper Corporation

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

Prepared by:

VEMS INC

Velasquez Environmental Management Services, Inc.

December 2015

Revision 1
August 2017

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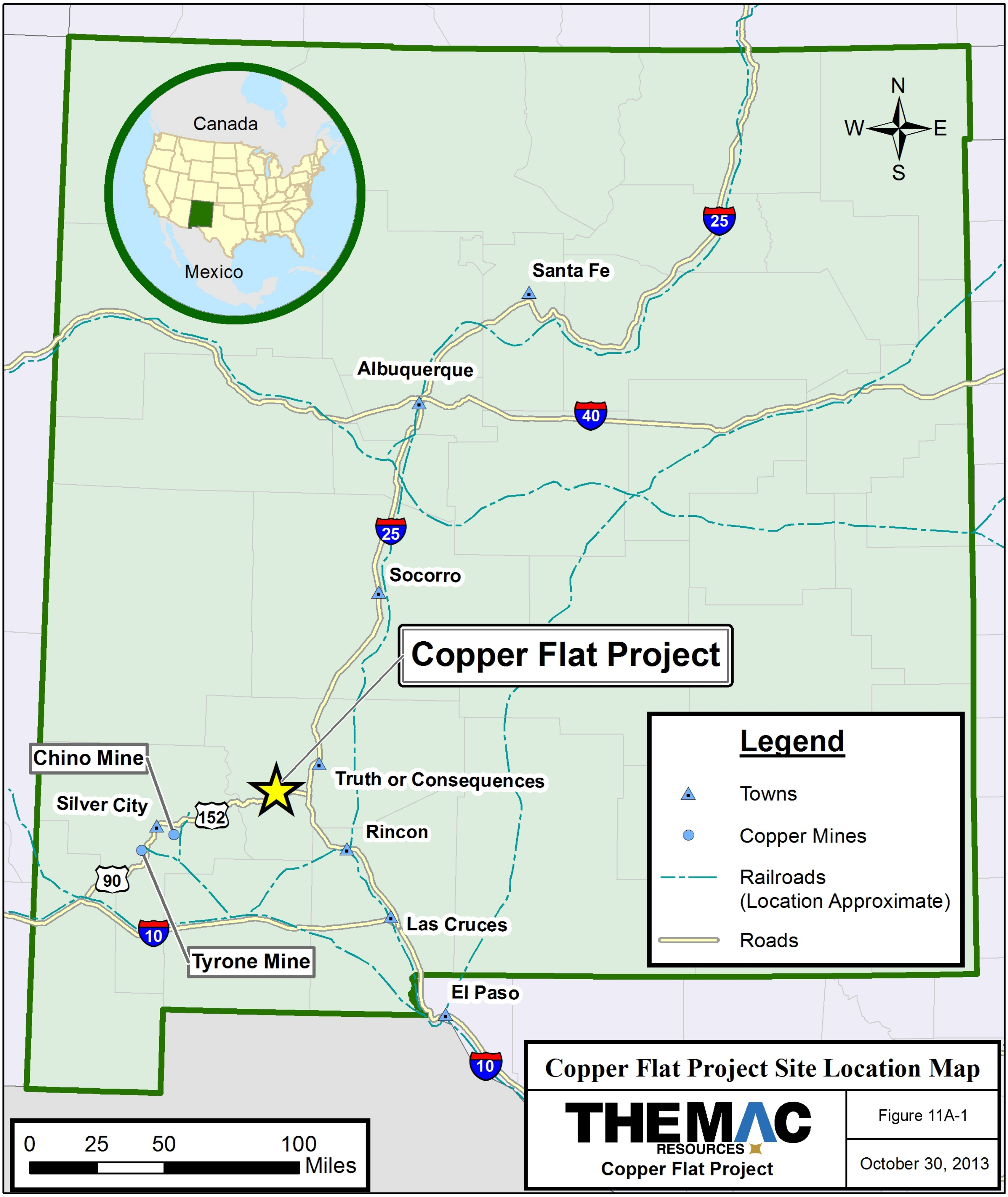
20.6.7.11.A INTRODUCTION

An application for a new discharge permit or a renewal of an existing discharge permit shall include the applicable information in this section. An application for a modification of an existing discharge permit shall include the information in this section relevant to the proposed modification but need not include information listed in this section if the information was submitted to the department in the prior discharge permit application and the information has not changed since the discharge permit was issued. The department may require separate operational and closure discharge permits, or may combine operational and closure requirements in the same permit.

New Mexico Copper Corporation (NMCC) is developing the Copper Flat Mine located approximately 150 miles south of Albuquerque, New Mexico and 20 miles southwest of Truth or Consequences, NM, north of NM state highway 152 between the communities of Caballo to the east and Hillsboro to the west in Sierra County, as shown on Figure 11A-1.

This Discharge Permit application provides the specific information required by Section **20.6.7.11 NMAC** of the New Mexico Ground Water Protection Regulations and is organized in a manner that presents all pertinent sections of the regulations followed by a discussion of the manner in which NMCC proposes to comply with the regulation. NMED has determined that this Discharge Permit Application for the Copper Flat project is an application for a new Discharge Plan and has assigned it the identification no. of DP-1840. NMCC anticipates that approval of this Discharge Plan will address the issues pending with the NMED regarding abatement of certain existing site conditions that occurred as a result of previous operation of this facility. Further, NMCC recognizes its obligations to address abatement and closure of the site in accordance with the NMED ground water regulations regardless of the outcome of this application. It is NMCC's desire to proceed with future operation of the Copper Flat mine in a manner proposed herein while incorporating mitigation procedures that will ultimately address existing conditions at the site.

NMCC proposes to mine approximately 125 million tons of copper ore including low-grade ore. Over the life of the mine it will produce approximately 113 million tons of ore, 33 million tons of waste rock and 12 million tons of low-grade ore, defined by NMCC as mined material containing less than 0.20 percent copper. The low-grade ore maybe processed during operations during the operating life of the mine. Low grade material will be stockpiled along with the other waste rock produced until such time it is suitable for milling and processing. Annually, the mining operation will supply approximately 11 million tons of copper ore (an average of approximately 30,000 tons per day) to the mill for processing. Waste rock production is estimated to average approximately 3 million tons per year (ranging from 0 to 7 million tons annually). The mine life for the current reserve is estimated at 11 to 12 years.


Canada
Mexico
N
W
E
S
25
Santa Fe
Albuquerque
40
25
Socorro
Copper Flat Project
Legend
Towns
Copper Mines
Railroads
(Location Approximate)
Roads
Chino Mine
Silver City
152
Truth or Consequences
Rincon
90
10
Las Cruces
Tyrone Mine
El Paso
10
0
25
50
100
Miles
Copper Flat Project Site Location Map
THEMAC
RESOURCES
Copper Flat Project
Figure 11A-1
October 30, 2013

15872

20.6.7.11.B CONTACT INFORMATION

An application shall include:

(1) *Applicant's name, title and affiliation with the copper mine facility, mailing address, and telephone number.*

Jeff Smith
Chief Operating Officer
New Mexico Copper Corporation
4253 Montgomery Blvd. NE
Suite 130
Albuquerque, NM 87109
(505) 382-5770

(2) *The name, mailing address and telephone number of each owner and operator of the copper mine facility.*

The owner and operator of the mine is New Mexico Copper Corporation. The address is that stated above.

(3) *If different than the applicant, the application preparer's name, title and affiliation with the copper mine facility, mailing address, telephone number and signature.*

Juan R. Velasquez, President of Velasquez Environmental Management Services, Inc. has prepared the application under a consulting contract with NMCC. VEMS Inc.'s address is:

12912 Sand Cherry Pl. NE

Albuquerque, NM 87111

505-239-3728

Juan R. Velasquez — Date: Dec 9, 2015

(4) *The mailing address and telephone number of any independent contractor authorized to assist the copper mine facility with compliance with the Water Quality Act and 20.6.2 NMAC and 20.6.7 NMAC; and*

NMCC has not authorized any independent contractor(s) to assist with compliance with the Water Quality Act and 20.6.2 and 20.6.7.

(5) *If the person submitting the application is not the owner or operator of the copper mine facility, a certification that the person is duly authorized to submit the application on behalf of the owner or operator.*

NMCC is the owner of the mine and is the person submitting the application.

20.6.7.11.C OWNERSHIP AND REAL PROPERTY AGREEMENTS

(1) *An application shall include the copper mine facility owner's name, title, mailing address and phone number.*

- ***a)*** *If more than one person has an ownership interest in the copper mine facility or a partnership exists, then the applicant shall list all persons having an ownership interest in the copper mine facility, including their names, titles, mailing addresses and telephone numbers.*
- ***b)*** *If any corporate entity holds an ownership interest in the copper mine facility, the applicant shall also list the name(s), as filed with the New Mexico public regulation commission, of the corporate entity, and the corporate entity's registered agent's name and address*.

The Copper Flat facility is owned by New Mexico Copper Corporation (NMCC), a wholly-owned subsidiary of THEMAC Resources Group Limited, (THEMAC) a Canadian corporation.

NMCC's mailing address and telephone number are:

4253 Montgomery Blvd. NE
Suite 130
Albuquerque, NM 87109
505-382-5770

NMCC's registered agent is:

Mark Adams, Esq.
P.O. Box 1357
Santa Fe, NM 87504

THEMAC's mailing address and telephone number are:

700-510 West Hastings Street
Vancouver, British Columbia, Canada V6B, 1L8
(+1) 604-495-6723

(2) *If the applicant is not the owner of the real property upon which the copper mine facility is or will be situated, or upon which the discharge will occur, the applicant shall submit the name, address and telephone number of the owner(s), and a notarized statement from the owner which authorizes the use of the real property for the duration of the term of the requested permit. In the event the property is under federal or state ownership the applicant shall provide other evidence of authorization to enter public lands for mining.*

NMCC owns and/or controls all of the real property upon which the mine facility will be situated through a combination of fee ownership, and federal government patented and unpatented mining claims administered by the Bureau of Land Management (BLM) managed by the Las Cruces District Office of the BLM located at:

1800 Marquess Street
Las Cruces, NM 88005-3370
505-525-4300

The proposed mining will be conducted on unpatented lode, placer, and mill-site claims owned and controlled by NMCC. Claim names and BLM serial numbers are provided in Table 11C-1.

The Copper Flat mine will be situated within a 2190 acre parcel of property identified in the various maps and figures contained herein as the Mine Permit Area Boundary. While the NMED groundwater regulations are not structured in terms of a site boundary, Discharge Plan approval is one of several permissions that must be obtained as part of the New Mexico Mining Act permitting process and much of the information required by the Mining Act with respect to groundwater protection is contained in the Discharge Permit documentation. The mine permit requires designation of a permit area boundary. As such, the designated mine permit area boundary is incorporated into much of this document.

TABLE 11C-1 NMCC Mining Claims and Fee Lands	
Unpatented Mining Claims	
Claim Name	**BLM Serial Number**
Graveyard Placer	NMMC 60021
Old Cabin Placer	NMMC 60022
Rainey Season Placer	NMMC 60027
Desert Gold Placer	NMMC 60043
Gray Back Placer	NMMC 60044
Black Sand Group 9 No. 1 Placer (amended)	NMMC 60045
Black Sand Group 10 No. 3 Placer (amended)	NMMC 60046
Surprise No. 1 Lode	NMMC 60052
Surprise No. 2 Lode	NMMC 60053
Dutch-1 Lode	NMMC 60054
Olympia (amended)	NMMC 60057
Gluck Auf	NMMC 60058
Taurus (amended)	NMMC 60059
Hercules	NMMC 60060
El Oro No. 3	NMMC 60063
Saint Louis Republic	NMMC 60069
Dolores, aka Delores	NMMC 60070
Highland No. 1	NMMC 60071
Highland No. 2	NMMC 60072
Highland No. 3	NMMC 60073
The Wellington	NMMC 60074
Three Boys No. 1 (amended)	NMMC 60080
Blue Moon (amended)	NMMC 60081
The Leone	NMMC 60082
Dolores Placer (amended)	NMMC 60083
Jones Hill Placer	NMMC 60084
Duke No. 1	NMMC 60085
Duke No. 2	NMMC 60086
Renew No. 1	NMMC 106464
Renew No. 2	NMMC 106465
M.S. #1	NMMC 60093
M.S. #2	NMMC 60094
M.S. #3	NMMC 60095

TABLE 11C-1 NMCC Mining Claims and Fee Lands	
M.S. #4	NMMC 60096
M.S. #5	NMMC 60097
M.S. #6	NMMC 60098
M.S. #8	NMMC 60099
M.S. #10	NMMC 60101
M.S. #11	NMMC 60102
M.S. #12 (amended)	NMMC 60103
M.S. #13 (amended)	NMMC 60104
M.S. #14	NMMC 60105
M.S. #15	NMMC 60106
M.S. #16	NMMC 60107
M.S. #17	NMMC 60108
M.S. #18	NMMC 60109
M.S. #20	NMMC 60110
M.S. #21	NMMC 60111
M.S. #22	NMMC 60112
M.S. #23	NMMC 60113
M.S. #25	NMMC 60114
M.S. #26	NMMC 60115
M.S. #29	NMMC 60118
M.S. #33	NMMC 60122
M.S. #38	NMMC 60123
M.S. #48 (amended)	NMMC 60129
M.S. #49	NMMC 60130
M.S. #53 (amended)	NMMC 60131
M.S. #102	NMMC 60138
M.S. #104 (amended)	NMMC 60139
M.S. #105	NMMC 60140
M.S. #106	NMMC 60141
M.S. #107	NMMC 60142
M.S. 222 (amended)	NMMC 60170
M.S. 223 (amended)	NMMC 60171
M.S. 224 (amended)	NMMC 60172
M.S. 225 (amended)	NMMC 60173
M.S. 228 (amended)	NMMC 60176
M.S. 264 (amended)	NMMC 60194
M.S. 282 (amended)	NMMC 60210

TABLE 11C-1 NMCC Mining Claims and Fee Lands	
M.S. 288 (amended)	NMMC 60216
M.S. 289 (amended)	NMMC 60217
M.S. 290 (amended)	NMMC 60218
M.S. 291 (amended)	NMMC 60219
M.S. 292 (amended)	NMMC 60220
M.S. 293 (amended)	NMMC 60221
M.S. 316 (amended)	NMMC 60240
M.S. 320 (amended)	NMMC 60244
M.S. 322 (amended)	NMMC 60246
M.S. 329 (amended)	NMMC 60253
M.S. 330 (amended)	NMMC 60254
M.S. 331 (amended)	NMMC 60255
M.S. 337 (amended)	NMMC 60261
M.S. 338 (amended)	NMMC 60262
M.S. 339 (amended)	NMMC 60263
M.S. 340 (amended)	NMMC 60264
M.S. 341 (amended)	NMMC 60265
M.S. 342 (amended)	NMMC 60266
M.S. 345 (amended)	NMMC 60267
M.S. 346 (amended)	NMMC 60268
MS. 347 (amended)	NMMC 60269
M.S. 438	NMMC 60312
M.S. 439	NMMC 60313
M.S. 440	NMMC 60314
M.S. 441	NMMC 60315
M.S. 452	NMMC 60318
M.S. 453	NMMC 60319
M.S. 454	NMMC 60320
M.S. 455	NMMC 60321
M.S. 456	NMMC 60322
M.S. 458	NMMC 60324
M.S. 460	NMMC 60326
M.S. 461	NMMC 60327
M.S. 462	NMMC 60328
M.S. 463	NMMC 60329
M.S. 464	NMMC 60330
M.S. 465	NMMC 60331

TABLE 11C-1 NMCC Mining Claims and Fee Lands	
M.S. 467	NMMC 60333
M.S. 468	NMMC 60334
M.S. 469	NMMC 60335
M.S. 470	NMMC 60336
M.S. 471	NMMC 60337
M.S. 472	NMMC 60338
M.S. 473	NMMC 60339
M.S. 474	NMMC 60340
M.S. 475	NMMC 163361
M.S. 476	NMMC 163362
M.S. 477	NMMC 163363
M.S. 478	NMMC 163364
Animas #1 Placer	NMMC 60341
Animas #2 Placer	NMMC 60342
The Betsy Ross	NMMC 60344
Wicks Extension No. 1 (amended)	NMMC 60346
Anderson Extension No. 2	NMMC 60348
Crescent 101	NMMC 60349
Wicks Extension 100	NMMC 60350
Betsy Ross 101	NMMC 60351
Portland 101	NMMC 60352
Ready Pay Apex 100	NMMC 60353
Anderson Extension 101	NMMC 60354
Greer No. 2	NMMC 72821
Chatfield	NMMC 72822
Chatfield No. 3	NMMC 72823
Chatfield No. 4	NMMC 72824
Chatfield No. 5	NMMC 72825
Chatfield No. 6	NMMC 72826
Chatfield No. 9	NMMC 81353
Chatfield No. 10	NMMC 81354
Chatfield No. 25	NMMC 100695
Golden 1	NMMC 190838
Golden 2	NMMC 190839
Golden 3	NMMC 190840
Golden 4	NMMC 190841
Golden 5	NMMC 190842

TABLE 11C-1
NMCC Mining Claims and Fee Lands

Golden 6	NMMC 190843
Golden 7	NMMC 190844
Golden 8	NMMC 190845
Golden 9	NMMC 191032
Golden 10	NMMC 191039
Golden 11	NMMC 191033
Golden 12	NMMC 191034
Golden 13	NMMC 191035
Golden 14	NMMC 191036
Golden 15	NMMC 191037
Golden 16	NMMC 191038
CU 1	NMMC 189246
CU 2	NMMC 189247
CU 3	NMMC 189248
CU 4	NMMC 189249
CU 5	NMMC 189250
CU 6	NMMC 189251
CU 7	NMMC 189252
CU 8	NMMC 189253
CU 9	NMMC 189254
CU 10	NMMC 189255
CU 11	NMMC 189256
CU 12	NMMC 189257
CU 13	NMMC 189258
CU 14	NMMC 189259
CU 15	NMMC 189260
CU 16	NMMC 189261
CU 17	NMMC 189262
CU 18 (amended)	NMMC 189263
CU 19 (amended)	NMMC 189264
CU 20 (amended)	NMMC 189265
CU 21 (amended)	NMMC 189266
CU 22	NMMC 189267
CU 23	NMMC 189268
CU 24	NMMC 189269
CU 25	NMMC 189270
CU 26	NMMC 189271

TABLE 11C-1
NMCC Mining Claims and Fee Lands

CU 27	NMMC 189272
CU 28	NMMC 189273
CU 29	NMMC 189274
CU 30	NMMC 189275
CU 31	NMMC 189276
CU 32	NMMC 189277
CU 33	NMMC 189278
CU 34	NMMC 189279
CU 35	NMMC 189280
CU 36	NMMC 189281
CU 37	NMMC 189282
CU 38	NMMC 189283
CU 39	NMMC 189284
CU 40	NMMC 189285
CU 41	NMMC 189286
CU 42	NMMC 189287
CU 43	NMMC 189288
CU 44	NMMC 189289
CU 45	NMMC 191058
CU 46	NMMC 191059
CU 47	NMMC 191060
CU 48	NMMC 191061
CU 49	NMMC 191062
CU 50	NMMC 191063
CU 51	NMMC 191064
CU 52	NMMC 191065
CU 53	NMMC 191066
CU 54	NMMC 191076
CU 55	NMMC 191077
CU 56	NMMC 191078
CU 57	NMMC 191079
CU 58	NMMC 191080
CU 59	NMMC 191081
CU 60	NMMC 191082
CU 61	NMMC 191083
CU 62	NMMC 191084
CU 63	NMMC 191085

TABLE 11C-1 NMCC Mining Claims and Fee Lands	
CU 64	NMMC 191086
CU 65	NMMC 191087
CU 66	NMMC 194880
CU 67	NMMC 194881
CU 68	NMMC 194882
CU 69	NMMC 194883
CU 70	NMMC 194884
CU 71	NMMC 194885
CU 72	NMMC 194886
CU 73	NMMC 194887
CU 74	NMMC 194888
CU 75	NMMC 194889
CU 76	NMMC 194890
CU 77	NMMC 194891
CU 78	NMMC 194892
CU 79	NMMC 194893
CU 80	NMMC 194894
CU 81	NMMC 194895
CU 82	NMMC 194896
CU 83	NMMC 194897
CU 84	NMMC 194898
CU 85	NMMC 194899
End Unpatented Mining Claims	

TABLE 11C-1
NMCC Mining Claims and Fee Lands

Patented Mining Claims	
Claim Name	**Mineral Survey**
Feeder	M.S. 943C
Chance	M.S. 945A
Xmas	M.S. 945B
Extension	M.S. 945D
Smokey Jones	M.S. 1024
Little Jewess	M.S. 1715
Wisconsin	Lot No. 805
Copper King	Lot No. 733A
Ventura	Lot No. 733B
Castle Hill	Lot No. 733C
Copperopolis	Lot No. 736
83	Lot No. 806
Soudan	Lot No. 807
Stenberg	M.S. 2066
Allhutten	M.S. 2066
Craze Martin	M.S. 2066
Coppenhagen	M.S. 2067
Carl Sextus	M.S. 2067
Union Leader	M.S. 2067
Stockholm	M.S. 2067
Grass Flat	M.S. 2068
Sandow	M.S. 2068
Old Mac	M.S. 2068
End Patented Mining Claims	

TABLE 11C-1
NMCC Mining Claims and Fee Lands

Township, Range, Section	Lot
Fee Lands	
Township 15 South, Range 7 West	
Section 36	Part of Lot 1 (Parcel N)
Section 36	Part of Lot 4 (Parcel M)
Section 36	Part of Lot 6 (Parcel J)
Section 36	Lot 10 (Parcel L)
Section 36	Lot 11 (Parcel K)
Section 36	Part of N1/2SE1/4 (Parcel I)
Section 36	Part of N1/2S1/2SE1/4 (Parcel H)
Township 15 South, Range 6 West	
Section 31	Lot 3 (Parcel D)
Section 31	Lot 6 (Parcel G)
Section 31	Lot 7 (Parcel C)
Section 31	Part of NE1/4SW1/4 (Parcel E)
Section 31	N1/2SE1/4SW1/4 (Parcel B)
Section 31	Part of S1/2SE1/4NW1/4 (Parcel F)
Section 31	Part of SE1/4 (Parcel A)
Township 16 South, Range 6 West	
Section 6	Part of Lot 3 (Parcel P)
Section 6	Part of Lot 4 (Parcel 0)
End Fee Lands	

20.6.7.11.D SETBACKS

An application for a new copper mine facility shall include a scaled map of the proposed copper mine facility layout demonstrating that the copper mine facility meets the setback requirements of 20.6.7.19 NMAC.

20.6.7.19 SETBACK REQUIREMENTS FOR A COPPER MINES FACILITY APPLYING FOR A DISCHARGE PERMIT

20.6.7.19.E.(1) *requires that leach stockpiles, waste rock stockpiles, tailings impoundments, process water impoundments or impacted stormwater impoundments shall be located;*

- ***(a)*** *greater than 500 feet from a private domestic water well or spring that supplies water for human consumption; and*
- ***(b)*** *greater than 1000 feet from any water well or spring that supplies water for a public water system as defined by 20.7.10 NMAC, unless a wellhead protection program established by the public water system requires a greater distance.*

20.6.719.E.(4) *requires that setback distances shall be measured from the toe of the outer edge of a leach stockpile, waste tock stockpile, tailing impoundment, process water impoundment ore impacted stormwater impoundment as its final design build out.*

NMCC proposes to construct new waste rock stockpiles, a new tailings impoundment, new process water impoundments and impacted storm water impoundments. NMCC does not propose any leach stockpiles at the Copper Flat project. Figure 11D-1 is a scaled map of that shows the footprint of NMCC's proposed Copper Flat Mine Project Mine Permit Area Boundary, as defined by NMCC pursuant to the New Mexico Mining Act regulations for the New Mexico Mining and Minerals Division (MMD). All of the Copper Flat facilities, with the exception of the company's water supply wells and the pipeline that provides fresh water to the site, are otherwise located within the mine permit area boundary. Figure 11D-1 shows the location of private domestic water wells for human consumption and water wells that supply water for a public water system as defined by **20.7.10 NMAC**, in relation to the facility boundary. It shows that the closest private and public water supply wells are all located over three miles from the mine permit area boundary. Figure 11D-1 also shows the location of springs in the area of the project. However, none of the springs are sources of water for human consumption.

As shown on Figure 11D-1, the Smith Well, located along Percha Creek 3.5 miles southeast of NMCC's facilities, and the Chatfield Well, located along Las Animas Creek 3.8 miles northeast of NMCC's facilities, are the closest known private domestic water wells that supply water for human consumption. Figure 11D-1 also shows the location of the town of Hillsboro relative to the NMCC facilities, 3.2 miles from the mine site.

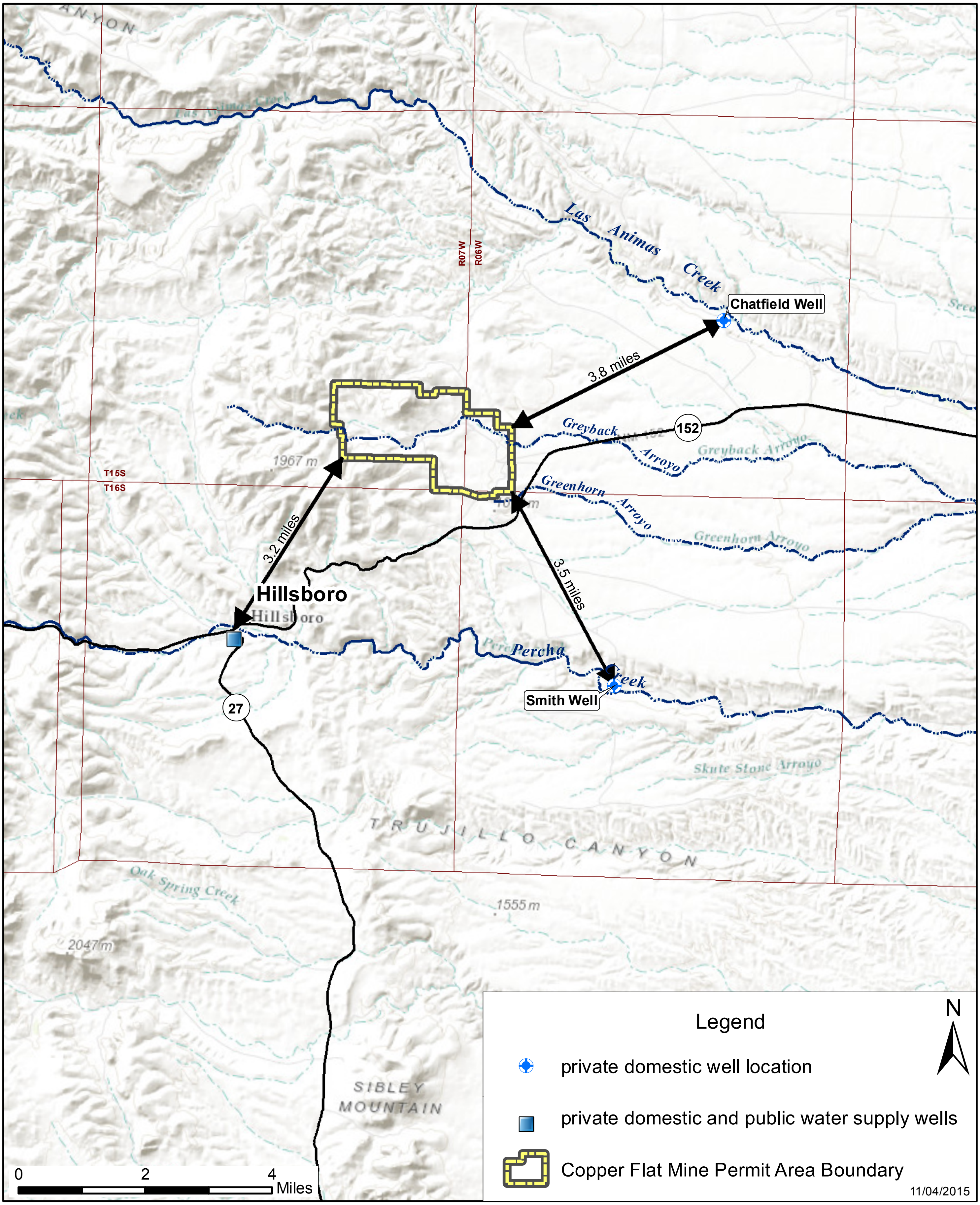


Figure 11D-1. Domestic and Public Water Supply Well Locations

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There are known to be a number of private water supply wells in the vicinity of Hillsboro, some of which are assumed to provide water for human consumption, although none have been specifically identified.

Figure 11D-1 demonstrates that the proposed NMCC mine facility meets the setback requirements of **20.6.7.19.E.(1) through (4)** of the Copper Rules. All of NMCC's proposed waste rock stockpiles, its tailings impoundment, process water impoundment and impacted storm water impoundments are located within the Mine Permit Area Boundary.

NMCC has not identified any springs within 500 ft. of the facility that supply water for human consumption nor any springs within 1000 ft. of the facility that supply water for a public water supply.

With respect to **20.6.7.19.E.(1).(b)** of the Copper Rules, as shown on Figure 11D-1, that the town of Hillsboro has a water well, or group of water wells, that supply water for a public water system. The system well(s) are over 3 miles from the southwestern edge of the NMCC facility Mine Permit Area Boundary. NMCC has not identified any springs within its area of data collection that supply water for a public water system.

With respect to **20.6.7.19.E.(4)** of the Copper Rules, all of the Copper Flat facilities are located within the mine permit area boundary and the toe of the outer edge of the proposed waste rock stockpiles, tailings impoundment, process water impoundments, and impacted storm water impoundments are all within the mine permit area boundary identified by NMCC for the MMD. All of the wells subject to the setback requirements are further than 500 ft. and 1000 ft. from the boundary. Therefore, the setback requirements are met. There are, of course, a number of other wells located throughout the site as well as others in the vicinity of the site. However, all of these wells serve a purpose other than to supply water for domestic and/or public consumption. Some are water quality monitoring wells. Others are livestock wells. As such, they have not been included herein. Information on those wells can be found in documentation previously submitted to the NMED by NMCC, such as the Baseline Data Report, and others.

20.6.7.11.E COPPER MINE FACILITY INFORMATION AND LOCATION

An application shall include:

(1) *the copper mine facility name, physical address and county;*

The facility name is the Copper Flat mine. Its physical address is:

85 Copper Rock Rd.
Hillsboro, New Mexico 88042

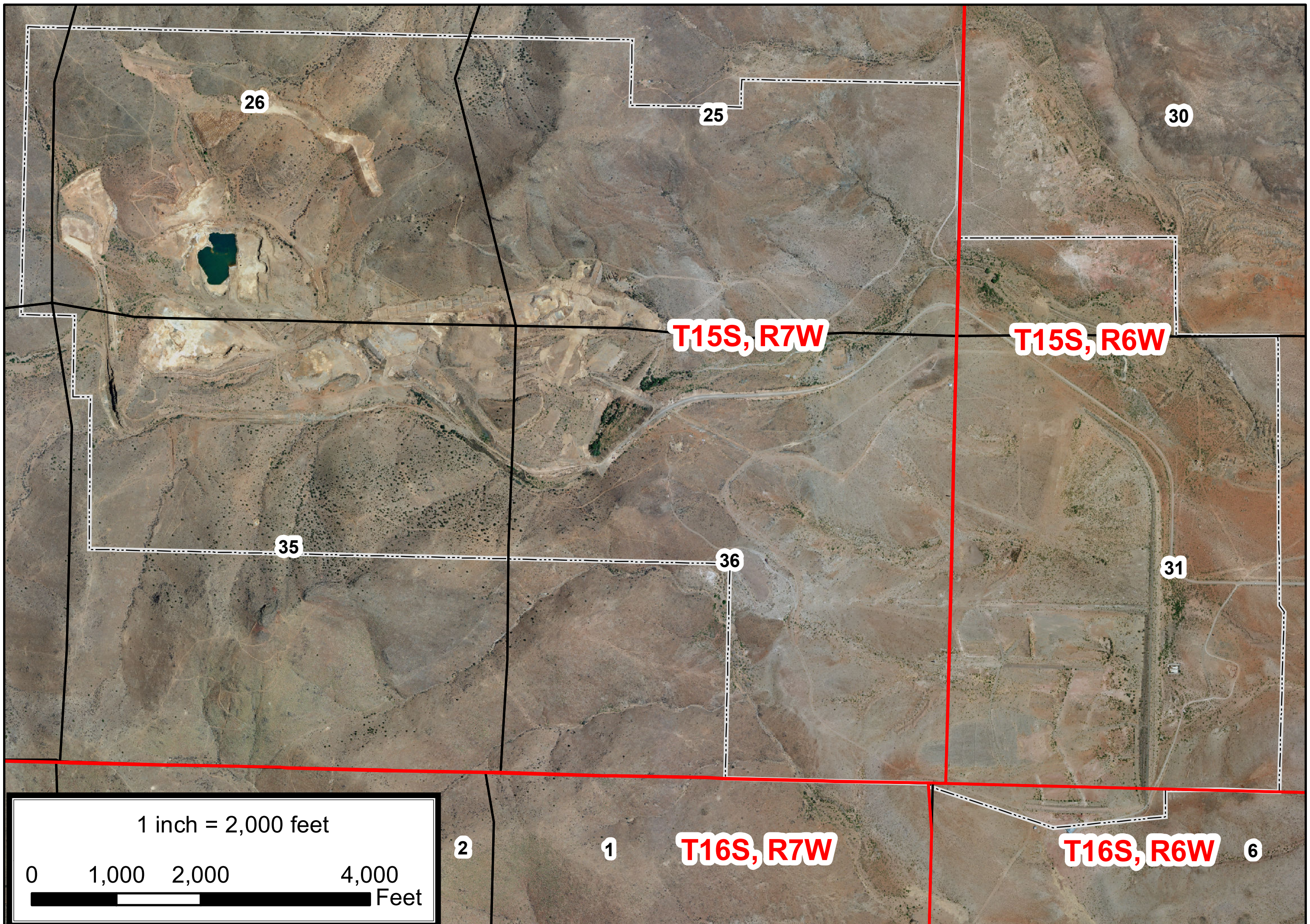
It is located north of NM state highway 152 between the communities of Caballo to the east and Hillsboro to the west in Sierra County, NM as shown on Figure 11E-1.

(2) *the township, range and section for the entire copper mine facility; and*

The facility is located in all or parts of Sections 30 and 31, Township 15 South, Range 6 West; Sections 25, 26, 35 and 36, Township 15 South, Range 7 West, New Mexico Principal Meridian, and Section 6, Township 16 South, Range 6 West, as shown on Figure 11E-1.

(3) *the total acreage of the copper mine facility.*

The total number of acres within the facility area is 2190.



Permit Boundary Area: 2,190 US Acres

Copper Flat Mine Address:
85 Copper Rock Rd.,
Hillsboro, Sierra County,
New Mexico 88042

Legend

- Populated Areas
- Interstates
- Highway
- Copper Flat Mine Permit Area Boundary
- Township Boundary
- Section Boundary

T16S	Township
R6W	Range
31	Section

Copper Flat Mine Facility Information and Location

THEMAC RESOURCES
Copper Flat Project

Figure 11E-1

August 6, 2015

20.6.7.11.F PUBLIC NOTICE PREPARATION

(1) *An application for a new, modified or renewed and modified discharge permit shall include the name of a newspaper of general circulation in the location of the copper mine facility for the display advertisement publication, the proposed public location(s) for posting of the 2-foot by 3-foot sign, and the proposed off-site public location for posting of the additional notice, as required by Subsection B of 20.6.2.3108 NMAC.*

(2) *An application for a renewed discharge permit that does not seek a discharge permit modification shall include the name of a newspaper of general circulation in the location of the copper mine facility for the future display advertisement publication as required by Subsection C of 20.6.2.3108 NMAC.*

Public notice will be provided in the Sierra County Sentinel. The required 2-foot by 3-foot sign will be placed at the road pull-out on the southeast side of New Mexico Highway 152 near the Geronimo Trail Scenic Highway sign and at a second location to be determined, if necessary. An off-site public notice flyer will be posted at the Hillsboro Community Center.

20.6.7.11.G PRE-DISCHARGE TOTAL DISSOLVED SOLIDS CONCENTRATIONS IN GROUND WATER

An application shall include the pre-discharge total dissolved solids concentration, or range of concentration, from analytical results of ground water obtained from on-site test data from the aquifer(s) that may be affected by discharges from the copper mine facility. A copy of the laboratory analysis stating the pre-discharge total dissolved solids concentration shall be submitted with the application.

NMCC has identified three aquifers and associated sub-aquifers that may be affected by discharge from the Copper Flat mine facility. They are the;

1. Quaternary Alluvial aquifer associated with Grayback Arroyo and the alluvial fan and fluvial deposits in the Santa Fe Group
2. Santa Fe Group aquifer
3. Crystalline bedrock aquifer including the andesite and quartz monzonite

The range of pre-discharge total dissolved solids (TDS) concentrations in groundwater for these aquifers at the mine site is presented below. The data was summarized from several reports prepared for Quintana Minerals Corporation and New Mexico Copper Corporation as shown in Table 11G-1. All of these reports have been previously submitted to NMED. The laboratory reports associated with this data are incorporated into the reports. The data indicates that the results are generally consistent with the preoperational results provided to NMED by Quintana.

TABLE 11G-1
Source Reports Used For Pre-Discharge TDS Analysis

Report Title	Report Prepared By	Date
Tailings Dam and Disposal Area, Quintana Mineral Corporation, Copper Flat Project, Gold Dust, New Mexico	Sargent, Hauskins, and Beckwith (SHB 1980)	October 1980
Geohydrologic Evaluation For Submission of Discharge Plan, Copper Flat Project, Quintana Mineral Corporation, Sierra County, New Mexico	SHB (SHB 1981)	June 1981
Baseline Data Characterization Report, Copper Flat Mine, Sierra County, New Mexico	Intera et al. (Inter 2012)	June 2012
Results from the First Year of the Stage 1 Abatement Investigation at the Copper Flat Mine Site Near Hillsboro, New Mexico	John Shomaker and Associates (JSAI May 2014b)	May 2014

Table 11G-2 provides a summary of the pre-discharge TDS concentrations in groundwater for each aquifer.

TABLE 11G-2
Pre-Discharge TDS Concentrations

Aquifer	Sub-Aquifer	Pre-Discharge Concentration (mg/l)	Wells Sampled	Sample Date (m/yr)	Well Locations
Quaternary Alluvial	Grayback Alluvial Up-gradient of Ore	317-905	GWQ11-26	4/2013-10/2013	Up-gradient of the ore body
	Grayback Alluvial Down-gradient of Ore	868-1,260	GWQ-3[1] GWQ-5[2]	9/1976-2/1982	Down-Gradient of the ore body
	Alluvial Fan and Fluvial deposits in the Upper Santa Fe Group	354-840	SHB-27[3] SHB-28[3] SHB-29[3] SHB-30[3] NP-5	9/1976-2/1982	In the vicinity of the current TSF
Santa Fe Group	NA	350-650	GWQ-1 GWQ-2 GWQ-7 GWQ-8 GWQ-9 GWQ-10 GWQ-11 NP-1 NP-2 NP-3	6/1976-2/1982	In the vicinity of the current TSF down-gradient of the ore body
Crystalline Bedrock	Andesite	500-798	GWQ96-22A GWQ96-22B GWQ-4	6/1981-1/2013	Up-gradient of the ore body;
	Andesite	496-920	GWQ-5R GWQ96-23A GWQ96-23B	7/1996-10/2013[6]	Down-gradient of ore body
	Quartz Monzonite[4,5]	2,280-4,400	GWQ11-24A GWQ11-24B GWQ11-25B	1/2010-10/2013[6]	

1. GWQ-3 is a 33 ft. deep concrete lined well, 40 inches by 43 inches perforated from 10 to 33 feet.
2. GWQ-5 is a 20 ft. deep rock lined well located in Grayback Arroyo downstream of the Quintana Plant Site. Well was destroyed during construction of the Quintana Mine.
3. SHB 1981 SHB (1980) indicates that water samples were collected from geotechnical borings SHB-29, 30, 31, 33, and 34 and the water samples were submitted to "Controls for Environmental Pollution, Inc." for analysis. SHB (1981) describes these as "wells" SHB-27, 28, 29, 30, and 34. The relationship between soil borings and "wells" is not documented in either report. However, using the laboratory data reports from SHB-1980 and SHB 1981, the relationship between borings and wells can be established.
4. Quartz Monzonite TDS data from Well GWQ11-25A was not included as representative of the Quartz Monzonite because JSAI (2013) describes the groundwater chemistry samples from that well as "completely different from all other samples in the pit area". This well is completed in a localized zone of sulfide mineralization and the water source is suspected to be from oxygenated water infiltrating through sulfide bearing fractures with limited storage. TDS samples from GWQ-25A range from 11,300 to 27,700 mg/L.
5. Quartz Monzonite hosts the ore body
6. No pre-Quintana mining data exists

Figures 11G-1 through 4 are scatter-plot diagrams of the data reprented in Table 11G-2. Figure 11G-1 shows the pre-discharge TDS concentrations in the Grayback Alluvial Aquifer up gradient and down-gradient of the Copper Flat ore body. Even though monitoring well GWQ11-26 was recently installed in 2011, it is upgradient of the mine and the ore body; therefore, it is representative of pre-discharge conditions in that area. The TDS concentration in GWQ11-26 has been analyzed to be 905 mg/L or less. TDS samples collected from wells GWQ-3 and GWQ-5 in 1981 and 1982 represent pre-discharge TDS concentrations downgradient or the ore body. TDS concentration from GWQ-3 and GWQ-5 range from 868 mg/L to 1,260 mg/L suggesting that the ore body is naturally influenceing TDS concentrations in the Grayback Alluvial Aquifer downstream.

Figure 11G-2 shows consistent pre-discharge TDS concentrations for the Quaternary Alluvial and Fluvial deposits in the Upper Santa Fe Group Aquifer. More than 90 percent of the available pre-discharge data shows a consistent TDS concentration between about 380 and 580 mg. One outlier shows a TDS concentration of 840 mg/L.

Figure 11G-3 shows consistent pre-discharge TDS concentrations for the Santa Fe Group Aquifer. The TDS concentrations are consistently between 350 and 650 mg/L.

Figure 11G-4 shows that, in general, the TDS concentration in the Crystalline Bedrock Aquifer ranges from 500 mg/L to 920 mg/L. This is the case for groundwater within the hydrologic pit created by the pit and down-gradient of the pit. TDS concentration in groundwater sampled from wells within the ore body ranges from 2,280 to 4,400 mg/L. This illustrates the influence that the sulfide ore body has on the local groundwater quality.

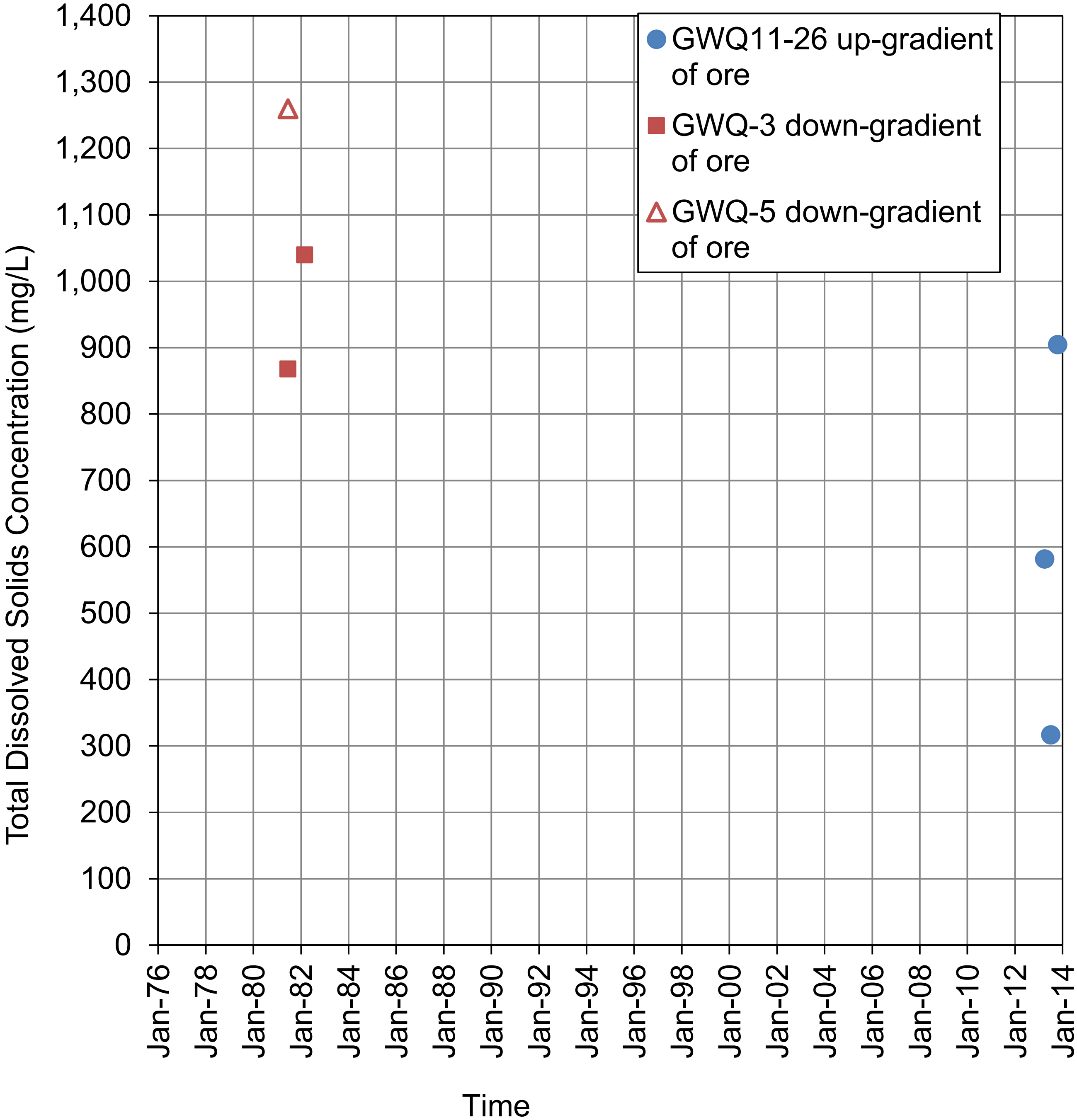


Figure 11G-1
Quaternary Grayback Alluvial Aquifer TDS Concentration

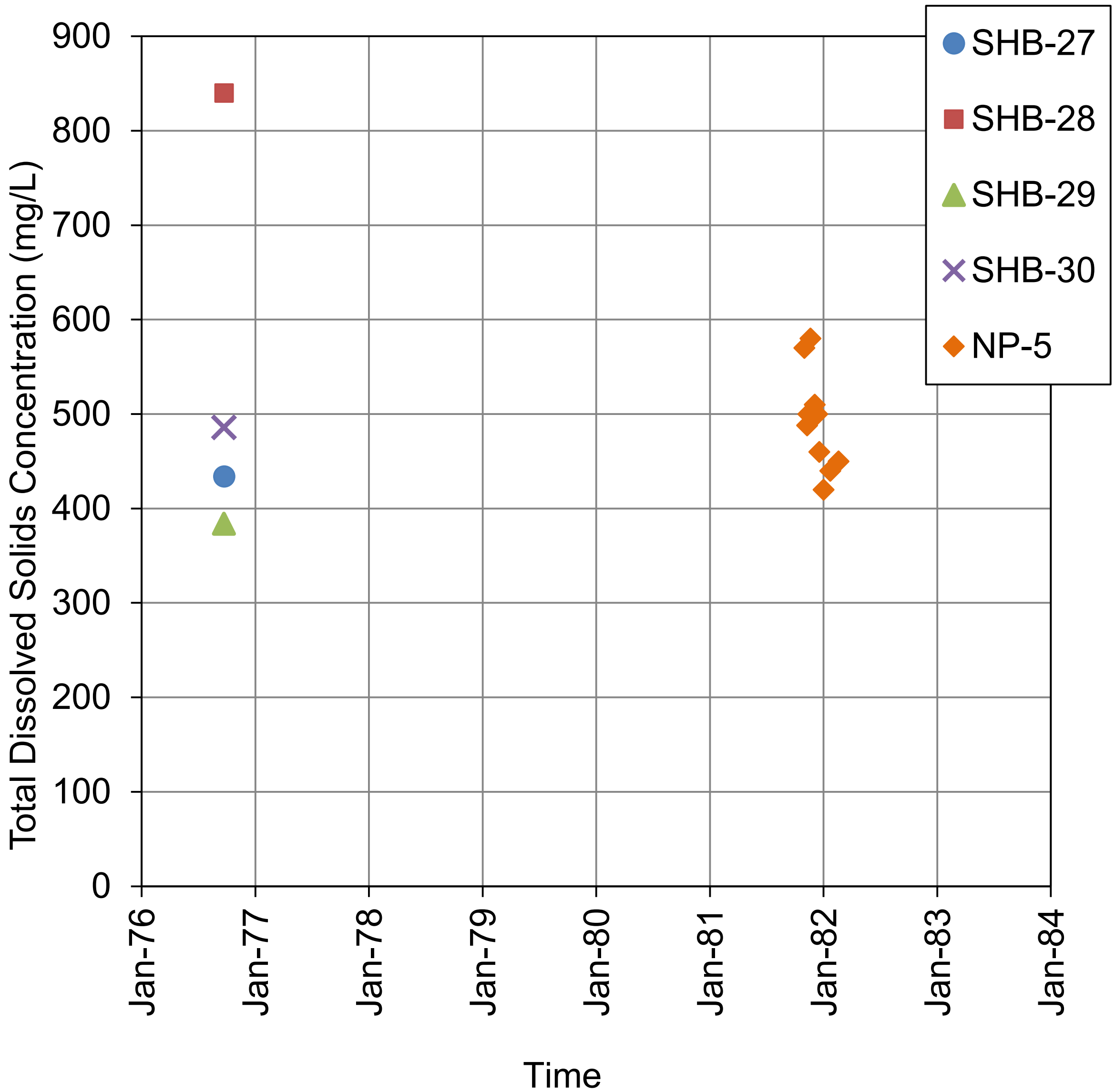


Figure 11G-2
Quaternary Alluvial & Fluvial Deposits in Upper Santa Fe Group TDS Concentration

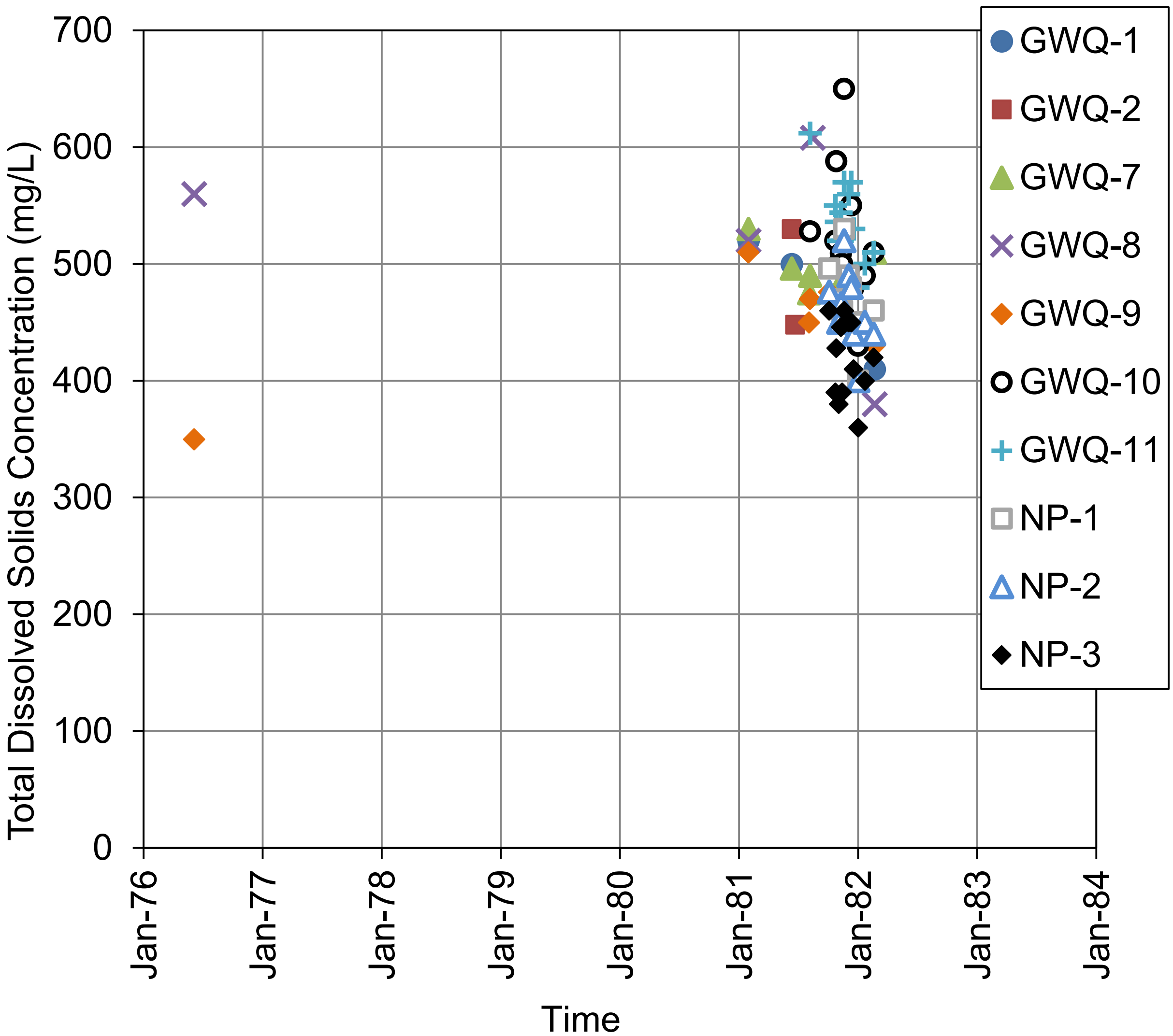


Figure 11G-3
Santa Fe Group Aquifer TDS Concentration

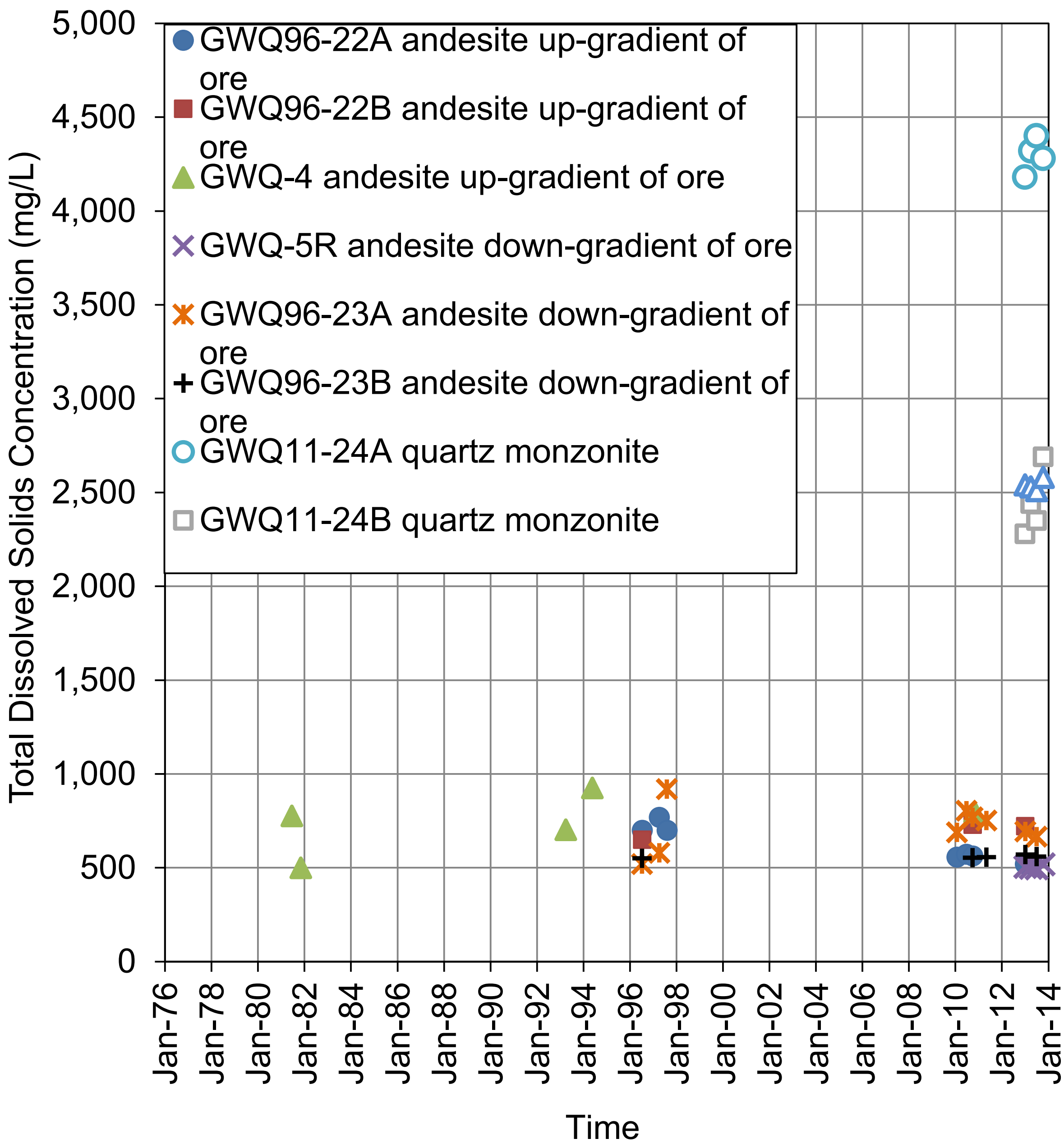


Figure 11G-4
Crystalline Bedrock Aquifer TDS Concentration

20.6.7.11.H DETERMINATION OF MAXIMUM DAILY DISCHARGE VOLUME

An application shall include the following information:

20.6.7.11.H.(1) *The proposed maximum daily discharge volume of process water and tailings for each discharge location and a description of the discharge locations and the methods and calculations used to determine that volume.*

Table 11H-1 presents the anticipated maximum daily discharge volume of process water and tailings for the various discharge locations containing mill process and tailings effluents.

TABLE 11H-1
Maximum Daily Discharge Volume of Process Water and Tailings

Location	Point of Measure	Process Water Gallons per Day	Tailings Tons per Day
Concentrator Tailings	Concentrator Tailings Sump	25,264,000	38,000
Tailings Storage Facility Water Recycle System	Recycle Water Return to Process Water Reservoir	21,236,000	0
Process Water Reservoir	Reservoir Return to Concentrator	24,300,000	0
Pit Bottom	Pit Water Sump	34,560	0

The basis for these estimates is as follows:

1. Process engineering and flow sheets prepared for NMCC by M3 Engineering and Technology Corp (M3) for the Copper Flat Feasibility Study;
2. Concentrator processing rate increased 20% over plan average to provide for operating peaks (plan average provided below in Subsection 20.6.7.11.H.(3);
3. Concentrator processes 1,600 tons of ore per hour;
4. Concentrator operates at 100% utilization (average 24 hours per day);
5. Design maximum flow rate of tailings under-drain collection system (see Appendix A); and
6. Pit discharge volume based on anticipated seepage rate into pit of 24 gpm.

20.6.7.11.H.(2) *The identification of all sources of process water and tailings*

Table 11H-2 summarizes the sources of process water and tailings at the Copper Flat Mine.

TABLE 11H-2 Sources of Process Water and Tailings			
Location	**Point of Measure**	**Process Water**	**Tailings**
Concentrator Tailings	Concentrator Tailings Sump	Yes	Yes
Tailings Storage Facility	Reclaim Water Return to Process Water Reservoir	Yes	No
Process Water Reservoir	Reservoir Return to Concentrator	Yes	No
Pit Water	Pit Water Sump	Yes	No

Mineral recovery at Copper Flat will be accomplished at the Copper Flat concentrator facility by standard crushing, grinding, and flotation processes only. There are no plans for leaching mine rock stockpile or ore heaps at Copper Flat.

Concentrator tailings will be piped from the concentrator as a slurry comprised of process water and flotation tailings, i.e., whole tailings, to the Copper Flat tailings storage facility. In route to the tailings storage facility, the slurry will pass through a cyclone classification plant to separate the whole tailings into coarse and fine fractions to facilitate ongoing construction of the impoundment and distribution of tailings within the storage facility. When the cyclone plant is not operating, concentrator tailings will bypass the plant for direct deposit at the tailings storage facility. In addition, tailings may be diverted to the surge water pond directly from the whole tailings pipeline or from the cyclone process plant in the event of upset conditions, not under normal operating conditions.

Process water will be collected from two locations at the tailings storage facility, i.e., the supernatant pond that will form on top of the stored tailings impoundment and the under-drain collection pond constructed at the base of the tailings impoundment. Water from these ponds will be combined into a single pipeline and returned to the process water storage reservoir for reuse in the mineral recovery process. The volume of process water shown in Tables 11H-1 and 11H-2 for the Tailings Storage Facility reflects the total volume from both of these sources.

The process water reservoir will hold water recycled from tailings facility and in-process dewatering points and will also serve as the entry point for fresh water addition to the mineral recovery process. The reservoir will be located in the vicinity of the concentrator facility. Water from the process water storage reservoir will be pumped to a process water head tank for gravity distribution to the concentrator.

There are no plans for further treatment of the mineral concentrate at Copper Flat.

As described in subsection **20.6.7.11.J.(4)**, water from all concentrate produced at the mine will be removed using pressure filters before packaging and the concentrate will transported off-site for smelting and refining at a separate location.

Water produced from seepage into the open pit will be used for dust control within the open pit surface drainage area. NMCC anticipates that approximately 24 gallons per minute will be generated from seepage into the pit. All of this water will be easily consumed in the operations activities.

20.6.7.11.H.(3) *The estimated daily volume of process water and tailings generated*

Table 11H-3 summarizes estimated daily volumes of process water and tailings for each of the sources identified in Subsection **20.6.7.11.H.(2)**, above.

TABLE 11H-3
Daily Volume of Process Water and Tailings – Average

Location	Point of Measure	Process Water Gallons per Day	Tailings Tons per Day
Concentrator Tailings	Concentrator Tailings Sump	19,475,000	30,000
Tailings Storage Facility	Recycle Water Return to Process Water Reservoir	16,370,000	0
Process Water Reservoir	Reservoir Return to Concentrator	18,731,000	0
Pit Bottom	Pit Water Sump	34,560	0

The Basis of these estimates is as follows:

1. Process engineering and flow sheets prepared by M3 Engineering;
2. Concentrator processes 1,333 tons of ore per hour;
3. Concentrator operates at 92.5% utilization (average 22.2 hours per day); and
4. Pit discharge volume based on anticipated seepage rate into pit of 24 gpm.

20.6.7.11.H.(4) *Information regarding other waste discharges (i.e., domestic or industrial) at the copper mine facility. Permit identification numbers shall be submitted for those discharges that are already permitted.*

Disposal of domestic wastes generated at the Copper Flat Mine will be accomplished through a combination of a single packaged wastewater treatment plant serving the majority of employees and visitors at the mine and individual portable toilet facilities for outlying areas of the operation. The packaged wastewater treatment plant will receive and treat domestic wastes from buildings located in the administration, concentrator, and mine shop areas. The packaged system is sized for a load based on the number of mine employees and visitors expected at the mine during a 24-hour period and applying an average water use of 50 gallons per day per person.

Breaking down the employee headcount for the mine by the planned rotation schedule indicates 160 employees per day will be using facilities connected to the package plant. In addition to mine employees, an additional 40 persons per day are assumed to account for visitors and contractors. Based on these figures, a 10,000 gallon per day plant has been selected for Copper Flat Mine. The design criteria for this facility will be revisited during final design to ensure that the packaged plant capacity is appropriate for the size of the facility.

The plant will be located on a pre-existing concrete slab near the main gate. The plant will generate effluent treated to secondary treatment levels. Treated effluent from the plant will be piped to the tailings storage facility for reuse as process water. System specifications and installation will conform to State and local regulations. Manufacturer information describing a type of packaged system that may be used at the Copper Flat Mine is attached as an example; final specifications and selection will be developed as the project advances to construction.

Individual portable toilet facilities will be provided for employees working in outlying areas of the operation that will not be connected to the packaged wastewater treatment plant (the pit, mine stockpile areas, the primary crusher, and the TSF). The portable toilets will be maintained by a licensed contractor on a regular basis.

20.6.7.11.I PROCESS WATER AND TAILINGS QUALITY

An application shall include estimated concentrations of process water and tailings slurry quality for the constituents identified in 20.6.2.3103 NMAC including the basis for these estimations.

An estimate of the concentrations of dissolved constituents identified in **20.6.2.3103 NMAC** in process water and tailing slurry pore water per **20.6.7.11.I NMAC** are provided in Table 11I-1. The basis used to develop the table is largely on information provided by SRK Consulting U.S. Inc., as presented in their "Geochemical Characterization Report for the Copper Flat Project New Mexico, May 2013" (SRK 2013). This report has been previously submitted to NMED and is included in this Discharge Plan application by reference. It is also based on an understanding of the chemicals used in the milling process and the geochemical processes and water-rock reactions expected to occur as part of the management of the tailing slurry and associated process waters. SRK (2013) provides solution constituent concentrations that were utilized to estimate anticipated pore water and process water chemistries as input to the geochemical modeling of the tailing storage facility at the proposed Copper Flat Project. The sources of this data included information from:

- averaged analytical data of the analyses of pore water extracts from the tailing humidity cell tests (HCT) of samples prepared in the laboratory;
- analyses of composite of extracted samples of tailing pore water from the flotation tails analyzed during operation of the Quintana facility between 1981 and 1982; and
- analyses of pore water extracted during meteoric water mobility testing of a single weathered tailing grab sample collected from the historic tailing facility.

While SRK's results are meant to be representative of anticipated tailing and process water chemistry, they are not an exact duplicate of what will actually be encountered during operations and should be viewed as such. Table 11I-1 presents an estimated range of concentrations based on SRK's data.

TABLE 11I-1 Estimated Constituent Concentrations in Process Water & Tailings	
20.6.2.3103 NMAC Constituent [a]	**Estimated Concentration Range (mg/l [a])**
Arsenic	Less than 0.01 to 0.005
Barium	Less than 0.05 to 0.2
Cadmium	Less than 0.001 to 0.005
Chromium	Less than 0.005 to 0.005
Cyanide	Not analyzed for by SRK
Fluoride	Less than 1.96 to 2.0
Lead	Less than 0.002 to 0.02
Total Mercury	Less 0.0001 to 0.001
Nitrate (as N)	Less than 1 to 5.49
Selenium	Less than 0.005 to 0.01
Silver	Less than 0.01 to 0.02
Uranium	Less than 0.04 to 0.19
Radioactivity: combined Ra-226 & Ra-228	Not analyzed for by SRK
Volatile Aromatic and Chlorinated Hydrocarbons, PAHs and PCBs in items (14) through (33) 20.6.2.3103	Not analyzed for by SRK as these compounds are not expect to be used at or produced as part of the ore processing or tailing and water management processes
Chloride	Less than 5.25 to 28
Copper	Less than 0.05 to 0.58
Iron	Less than 0.01 to 0.04
Manganese	Less than 0.03 to 0.18
Phenols	Not analyzed by SRK as these compounds are not expect to be used or produced as part of the ore processing or tailing management processes
Sulfate	Less than 75 to 2400
Total Dissolved Solids	Less than 270 to 3,700
Zinc	Less than 0.01 to 0.05
pH	7.5 to 8.1 (std. units)
Aluminum	Less than 0.01 to 0.06
Boron	Less than 0.1 to 0.11
Cobalt	Less than 0.01 to 0.02
Molybdenum	Less than 0.06 to 3.5
Nickel	Less than 0.01 to 0.05

a. except as noted

20.6.7.11.J IDENTIFICATION AND PHYSICAL DESCRIPTION OF THE COPPER MINE FACILITY

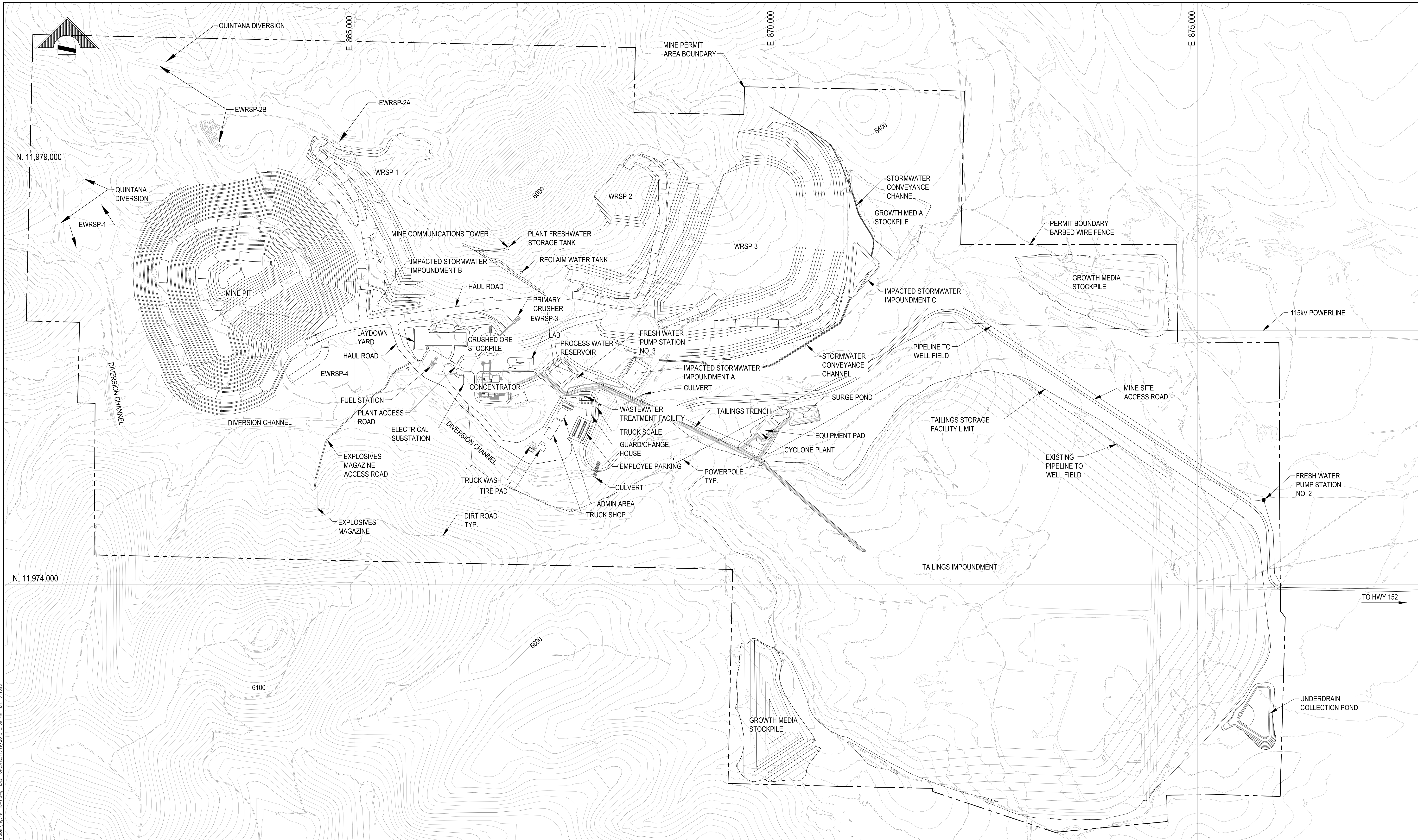
An applicant shall provide the following information;

The following subsections **20.6.7.11.J.(2) through (11)** provide the information required. They describe the proposed Copper Flat mine facility in detail showing the location and features of the facility as required by the Copper Rules, including the impoundments and waste rock stockpiles, the open pit mine facility, sumps,, tanks, pipelines and wash units, storm water management, water wells and monitoring wells, flow meters, surface waters, sampling locations, and waste treatment facility.

The infrastructure supporting the project is discussed in various places in this application. For example, under normal operating conditions electrical power is provided to the site by the Sierra Electric Cooperative, a reliable provider of residential and commercial electrical power throughout the region. However, recognizing the need to ensure that emergency power is available for critical operating systems for the protection of personnel safety, as well as protection of human health and the environment, the Copper Flat facilities will be equipped with sufficient backup power systems to provide emergency power. An on-site diesel powered generator designed to provide sufficient emergency power to the facility in the event of a power failure will be installed. All critical systems, including pumps, sumps, process areas, tailings impoundment pipelines and other areas that have dedicated process water handling equipment that must remain operational during disruption of the normal power supply, will be tied into the site emergency power grid to ensure that unauthorized discharges to ground water do not occur. The emergency generator will start automatically whenever power a disruption is detected and will be tested monthly to ensure dependable response and operation.

20.6.7.11.J.(1) *a scaled map of the entire existing or proposed copper mine facility showing the location of all features identified in Paragraphs (2) through (11) of this subsection; the map shall be clear and legible, and drawn to a scale that all necessary information is plainly shown and identified; the map shall show the scale in feet or metric measure, graphical scale, a north arrow, and the effective date of the map; multiple maps showing different portions of the copper mine facility may be provided using different scales as appropriate; documentation identifying the means used to locate the mapped objects (i.e., global positioning system (GPS), land survey, digital map interpolation, etc.) and the relative accuracy of the data (i.e., within a specified distance expressed in feet or meters) shall be included with the map; any objects that cannot be directly shown due to its location inside of existing structures, or because it is buried without surface identification shall be identified on the map in a schematic format and identified as such;*

Figure 11J-1 provides a map of the entire site facility showing the location of the various features identified in paragraphs (2) through (11) of this subsection. Figure 11J-2 is a map of the site as it currently exists, showing the various existing facilities as constructed by Quintana when it operated the mine in the early 1980's. This map is provided so that the reviewer can differentiate between what currently exists as a disturbance on-site as compared to NMCC's proposed activities. Figure 11J-3 is a map of the site depicting the various watersheds that will be developed at the mine site in order to manage surface water runoff. These three maps contain the essential information required by **20.6.7.11.J.(1).** There are also additional maps included within each subsection as each feature is described in more detail.



EWRSP = EXISTING WASTE ROCK STOCKPILE
WRSP = WASTE ROCK STOCKPILE

SITE PLAN
SCALE: 1:500

500' 250' 0' 500' 1000'
1" = 500'
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 500'		DATE
DESIGNED BY	SAM	DEC12
DRAWN BY	SAM	DEC12
CHECKED BY	TDL	JAN13
PROJECT MGR	RKZ	
CLIENT APPR.		

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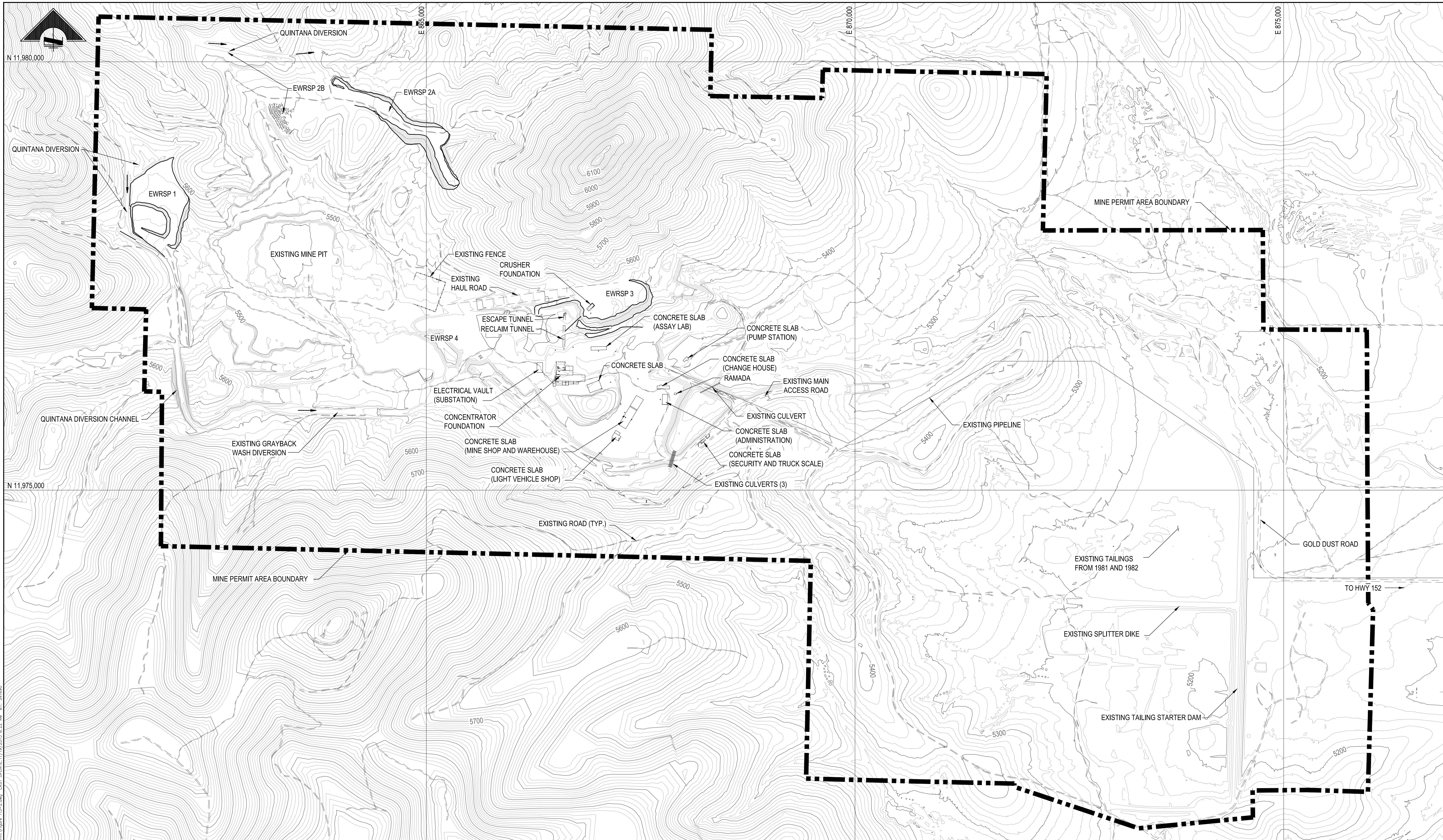
COPPER FLAT PROJECT

JOB NO. M3 PN-120085

SITE GENERAL CIVIL PROJECT AREA PROPOSED SITE PLAN

DWG NO. FIGURE 11J-1
REV NO. P18
DATE 16 NOV 15



NOTES:

CONCRETE FOUNDATIONS SHOWN REFLECT PLANS BY QUINTANA MINERALS CORPORATION FROM 1981 AND MOST RECENT SURVEY CONDUCTED.

SITE PLAN

SCALE: 1" = 500'

500 250 0 500 1000

SCALE IN FEET

CONTOUR INTERVAL = 10'

DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY

FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1"= 500'	DATE
DESIGNED BY JPN	OCT 15
DRAWN BY JPN	OCT 15
CHECKED BY	
PROJECT MGR RKZ	
CLIENT APPR.	

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COPPER FLAT PROJECT

SITE GENERAL
CIVIL
MINE SITE
EXISTING CONDITIONS

JOB NO. M3 PN-120085

DWG NO. **FIGURE 11J-2**

REV NO.	DATE
P2	20 NOV 15

NOTES

1. EXISTING GROUND TOPOGRAPHY WAS DEVELOPED BY COOPER AERIAL SURVEYS BASED ON JUNE 18, 2011 AERIAL SURVEY AND PROVIDED BY THEMAC RESOURCES.
2. FINAL BUILDOUT TOPOGRAPHY FOR THE PIT, WRSPs, AND GMSPs WAS DEVELOPED BY OTHERS AND PROVIDED BY NEW MEXICO COPPER CORPORATION (NMCC).
3. WS D IS THE SURFACE WATERSHED EXPRESSION OF THE OPEN PIT SURFACE DRAINAGE AREA (OPSDA) DURING OPERATIONS, AND WS B PLUS WS D IS THE SURFAECC WATERSHED EXPRESSION OF THE OPSDA AFTER RECLAMATION.

0 400 1600
FEET

GENERAL LEGEND

5400	EXISTING GROUND CONTOURS - 20 ft INTERVAL (ft-MSL)
5400	PROPOSED DESIGN CONTOURS - 20 ft INTERVAL (ft-MSL)
	MINE PERMIT BOUNDARY
	WATERSHED BOUNDARY (BY OTHERS)
<	EXISTING DIVERSION OR ARROYO
	EXISTING ROAD
WRSP	WASTE ROCK STOCKPILE
EWRSP	EXISTING WASTE ROCK STOCKPILE
TSF	TAILING STORAGE FACILITY
GMSP	GROWTH MEDIA STOCKPILE
WS	WATERSHED

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
C	2017-07-10	ISSUED FOR AGENCY REVIEW	HNL	HNL	TS	JC
B	2017-06-21	ISSUED FOR CLIENT REVIEW	HNL	HNL	TS	TS
A	2017-06-21	ISSUED FOR INTERNAL REVIEW	HNL	HNL	TS	TS

SEAL

PRELIMINARY
FOR AGENCY REVIEW

CLIENT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

CONSULTANT

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UNITED STATES OF AMERICA
[+1] (520) 888 8818
www.golder.com

PROJECT
COPPER FLAT PROJECT

TITLE
DEVELOPED WATERSHED AREAS

PROJECT NO.	CONTROL	REV.		FIGURE
1531453	0500	C	1 of 1	11J-3

20.6.7.11.J.(2) *a description of each existing or proposed tailing impoundment, leach stockpile, process water and impacted stormwater impoundment, waste rock stockpile, and slag including information about its location, purpose, liner material, storage or disposal capacity, and the methods proposed or used to prevent pollution of ground water;*

I. 20.6.7.11.J.(2) DESCRIPTION OF THE PROPOSED TAILINGS IMPOUNDMENT, UNDERDRAIN COLLECTION SYSTEM, AND WATER RECLAIM SYSTEM

NMCC proposes to construct a new tailings storage facility (TSF) which will include a lined tailings impoundment with an associated underdrain collection system and underdrain collection pond for the impoundment and the dam as well as a water reclaim or recycle system to maximize water reuse. The TSF also includes a cyclone plant to separate the tailings coarse and fine fractions and a surge pond to handle potential upset conditions at its Copper Flat project.

Appendix A, Feasibility Level Design, 30,000 TPD Tailings Storage Facility and Tailings Distribution and Water Reclaim Systems, Copper Flat Project, Sierra County, New Mexico, November, 2015, Revised June 2016, prepared by Golder Associates, Inc., provides the technical design detail for the TSF. This document is made part of NMCC's Discharge Permit application by reference herein.

Location

The location of the proposed new TSF is shown in Figure 11J-1 provided herein in response to **20.6.7.11.J.(1).**

Purpose

The purpose of the TSF and the tailings impoundment is to handle, store and contain the tailings materials produced from processing of copper ore.

The purpose of the underdrain collection system and pond is to collect and store water that is captured by the blanket drain constructed under the tailings dam and the underflow drain system constructed under the tailings impoundment. The dam blanket drain will provide the mechanism that will drain water within the dam out of the structure and allows the dam to become consolidated and stable as it is continually constructed during operations as the sand fraction of tailings is emplaced on the dam. The tailings impoundment underdrain system will allow free water in the impoundment to be drained out of the impoundment from underneath the impoundment and be recycled to the processing facility. The underdrain, together with the impoundment synthetic liner, will provide significant mitigation against the potential for seepage from the impoundment. It will also contribute to the ability to recycle water from the system to the process facility while contributing to the stability of the TSF. The TSF underdrain collection pond will also serve to capture surface water runoff routed from the downstream face of the tailings dam via runoff control ditches to the pond.

The purpose of the water reclaim system is to provide a mechanism by which as much water as possible can be pumped from the inner surface of tailings impoundment and recycled back to the processing facility. The water reclaim system will consist of a floating barge located within the tailings impoundment containing pumps to remove water from the impoundment, a pipeline to transport the reclaimed water to the process water reservoir, and the reservoir itself. The reservoir will be located at the process facility areas shown in Figure 11J-1and 11J-3. Pumping water out of the tailings impoundment will also provide the capacity needed for tailings disposal.

The TSF will also have an associated surge pond that will be part of the cyclone plant located at the TSF. The cyclone plant will receive whole tailings slurry from the process circuit and separate the sand fraction from the slimes fraction. The purpose of the surge pond, located at the cyclone plant, will be to capture and temporarily retain tailings materials in the event of a temporary upset in the cyclone plant. It will also provide temporary storage in the event that an upset occurs in the process circuit.

Liner material

The tailings impoundment will be lined with an 80-mil high density polyethylene (HPDE), or equivalent liner, placed on a minimum 12-inch thick liner bedding fill material. In the initial phases of construction the bedding material will consist of recovered sand from the old Quintana starter dam. Later phases of construction will require the use of selected crushed and screened native materials or selected local soil be utilized.

The TSF underdrain collection pond will be double-lined with a 60 mil, or equivalent, HDPE geomembrane liner. An HDPE geonet will be placed between the liners to serve as the leak collection and recovery system (LCRS) and to minimize pressure on the lower pond liner.

The surge pond liner will consist of a compacted liner bedding fill layer, overlain with a 60 mil HDPE geomembrane or equivalent. The liner bedding will be a minimum of six inches of sand or fine soil.

Storage or disposal capacity

The tailings impoundment is designed to store 113 million tons of tailings produced over approximately 11 years. Tailings deposition will occur at a rate of approximately 32,000 tons per day (tpd).

The TSF Underdrain collection pond will be sized to contain 24 hours of underdrain flow at maximum estimated drainage rates from the dam and impoundment underdrains, as well as runoff from the 100-year, 24-hour storm event of 3.73 inches incident on the downstream dam face. The pond capacity will be approximately 12.22 million gallons with 2 feet of freeboard.

The surge pond is designed to retain tailings from the cyclone plant and other process water from the plant site not diverted directly to the tailings impoundment in the event of temporary upset conditions. Under normal operating conditions the surge pond will be empty. The surge pond is designed with a feasibility level design capacity of 1.6 million gallons, sufficient to handle the volume of upset conditions plus direct precipitation from a 100-year 24-hour precipitation event with at least 2 feet of freeboard. The design capacity conservatively assumes that an upset would occur during a maximum precipitation event and that the processing facility is running at maximum design rates. Given these assumes, the pond would reach its capacity in approximately one half hour. The pond will be equipped with dedicated pumps to automatically begin pumping materials to the TSF when the fluids in the pond reach a predetermined level. These pumps will be tied into the site's emergency power grid described earlier herein. The process control room will be equipped with emergency alarms that notify the operator of an upset condition allowing the operator to make necessary adjustments in the process, as needed. Section 7.4 of Appendix A describes the management of flows in more detail.

Methods proposed to prevent pollution of groundwater

The primary method to prevent pollution of groundwater at the tailings impoundment, the surge pond, the TSF underdrain collection pond and the process water reservoir will be through the use of engineered systems to control and manage water. These systems include the use of liners, installation of a tailings dam and impoundment underdrain system, where appropriate, installation of a leak collection system, and construction of appropriate run-off and run-on control structures. Storm water will be diverted away from and around these facilities to the maximum extent possible to minimize the potential for contact of storm water with materials that have the potential to impact ground water. Run-on to these facilities will be minimized to the maximum extent possible so as to reduce the volume of water that enters these facilities, thus mitigating the potential for impact to groundwater.

The tailings dam and impoundment will be constructed with underdrain systems that will collect water from the dam and the impoundment and capture it in the underdrain collection pond. The tailings impoundment will be lined with an 80 mil HDPE geomembrane, or equivalent, material.

The underdrain collection pond will be double-lined with a 60 mil HDPE geomembranes, or equivalent, and be equipped with a leak collection system to protect groundwater. In addition, the water in the pond will be continually evacuated from collection pond to the process water reservoir where it will be recycled into the process circuit.

Storm water that falls onto the down-stream face of the tailings dam will be captured in run-off control ditches. The ditches will be constructed at the outside toe of the dam and routed to the underdrain collection pond. The surge pond will also be lined with a 60 mil HDPE geomembrane, or equivalent, to protect groundwater.

In addition to the mitigation measures identified above to protect groundwater, all of the pipelines that transport tailings, impacted storm water or reclaimed water will be conveyed within lined channels designed to direct leaks and spills to impoundments so as to protect ground water. The ground surface surrounding the surge pond will be graded in a manner to direct surface runoff away from the pond.

NMCC's significant proactive approach to maximally and proactively managing and recycling water, in and of itself, provides a means of protecting groundwater.

II. 20.6.7.11.J.(2) DESCRIPTION OF PROPOSED LEACH STOCKPILES

NMCC does not propose to construct or operate any leach stockpiles at the Copper Flat project.

III. 20.6.7.11.J.(2) DESCRIPTION OF PROCESS WATER IMPACTED STORM WATER IMPOUNDMENTS

NMCC proposes to construct a process water reservoir and three (3) storm water impoundments. The process water reservoir will hold water from several sources including the reclaimed water from the TSF, captured storm water, and fresh make-up water from the off-site well field. The storm water impoundments will capture surface water runoff from the waste rock stockpile areas and the plant area. Appendix B, Impoundment Design Report, Copper Flat Project, November 2015 (M3 2015), prepared by M3 Engineering & Technology Corporation, provides the technical design details for the impoundments and the process water reservoir. This document is made part of NMCC's Discharge Permit application by reference herein.

NMCC has determined that it will address the three storm water impoundments as if they were impacted storm water impoundments as defined in Section **20.6.7.7.B.(29) and (30)** of the Copper Rule, although there is some uncertainty as to whether or not one or more, in fact, meet the definition because of the quality of the water that they are intended to capture. NMCC will work with the NMED as the detailed designs become more definitive to determine the applicability of the impacted storm water requirements to each of these impoundments.

Figure 11J-3 shows the various watershed areas that will be developed on-site by grading and contouring the areas to control and capture surface water runoff. The developed watershed areas shown are as follows:

- Watershed area A (WS A) wherein the process facilities and ancillary plant areas, including the ore stockpile, will be located. An existing waste rock stockpile, EWRSP-3, as shown in Figure 11J-1, 2 and 3, also called the low-grade ore stockpile in earlier documents, is also located within WS A;

- Watershed area B (WS B) is a portion of the open pit surface drainage area wherein the proposed new Waste Rock Stockpile no. 1 (WRSP-1) will be located. An existing waste rock stockpile, EWRSP-2A, as shown in Figure 11J-1, 2 and 3, (also called the north waste rock disposal facility in earlier documents) is located at the northern edge of WS B;
- Watershed area C (WS C), wherein the proposed new Waste Rock Stockpiles no. 2 and 3 (WRSP-2 and WRSP-3) will be located; and
- Watershed area D (WS D) is a portion of the open pit surface drainage area wherein the mine pit is located. Existing waste rock stockpiles EWRSP-1 (also called the west waste rock disposal facility in earlier documents), EWRSP-2B (also called the north waste rock stockpile in earlier documents), and EWRSP-4 (also called the south waste rock stockpile in earlier documents) shown in figures 11J-1, 2 and 3 are also located within WS D. EWRSP-1 will no longer be part of the WS D after it is reclaimed.

As noted above, developed WS B and D are sub-watersheds of the larger open pit surface drainage area. The entire area naturally drains to the mine pit. NMCC has opted to develop these two sub-watersheds separately in order to provide control of the amount of surface water that will report to the mine pit under normal operating conditions. Surface water runoff from WS D will flow directly to the bottom of the pit as shown in Figure 11J-3. Surface runoff from WS B will be diverted to flow into Impacted Storm water Impoundment B as shown on Figures 11J-1 and 3.

As described in more detail in Appendix B, Impacted Storm water Impoundment B will be constructed at the lower southwestern corner of developed WS B to capture runoff from the proposed new WRSP-1 under normal operating conditions. However, should overflow from this impoundment occur as a result of an extraordinary precipitation event, it will flow over the spillway and into the open pit via a culvert, as shown in Figure 11J-3 and discussed in Appendix B. This will allow NMCC to control the flow of surface runoff into the pit while maximizing the harvesting of water for use as process water.

In addition to the developed watershed areas described above, there is also a small developed watershed area E (WS E), shown in Figure 11J-3. WS E represents the footprint of the process water reservoir, the impoundment that holds process water prior to it being introduced into the process circuit. WS E is depicted as a watershed to indicate that the reservoir will not collect any storm water runoff from the plant site. Only precipitation the falls directly on the reservoir will be collected therein. The details of design of the process water reservoir are contained in Appendix B.

Developed watersheds A, and C will each have a storm water impoundment associated with them, as shown in Figures 11J-1 and 3. The purpose of these impoundments will be to capture and manage storm water runoff. Appendix B provides the technical design details for these impoundments.

Location
The location of the process water reservoir and the impoundments is shown in Figures 11J-1 and 11J-3, provided herein in response to **20.6.7.11.J.(1)**. Impacted Storm water impoundment A will be located at the southeastern edge of developed WS A wherein the process facilities, administrative building and associated mine infrastructure will be located and where EWRSP-3 is located. Storm water impoundment B will be located at the bottom of developed WS B at the southwestern corner of watershed. Storm water impoundment C will be located at the southeastern corner of developed WS C wherein WRSP 2 and 3 will be located.

The process water reservoir is designed to hold all of the water recycled from the tailings storage facility, water transferred from the impacted storm water impoundments and any required fresh make-up water from the off-site well field prior to introduction into the process circuit. Impacted storm water impoundment A is designed to capture and manage surface water runoff from WS A, i.e., the plant area. Impacted storm water impoundment B is designed to capture and manage storm water runoff from WS B which contains WRSP 1. Impacted storm water impoundment C is designed to capture and manage storm water runoff from WS C which contains WRSP 2 and WRSP-3.

Purpose
The purpose of the Impacted Storm water Impoundments is to capture and manage storm water run-off from watershed (WS) areas WS A, B and C. The water captured in these impoundments will be transported to the process water reservoir within 30 days for use as an additional source of make-up process water.

NMCC recognizes, as the NMED has noted, that there is an area along the western edge of developed WS D, south of EWRSP-1 that could drain into the Grayback Arroyo instead of the mine pit. As discussed later herein, NMCC has corrected this condition by repairing the breach to re-establish the integrity of the open pit surface drainage area so that all surface water runoff in WS D will flow into the mine pit. EWRSP-1 will be reclaimed early in the operation such that upon reclamation this area will drain to Grayback Arroyo

Similarly, NMCC has determined that the northernmost edge of EWRSP-2A, shown on Figure 11J-2, is at the extreme northern limit of the open pit surface drainage area in developed WS B. The natural topography of the area in that location forms a natural hydrologic surface divide forming the northern edge of the open pit surface drainage area so that surface water runoff would naturally flow south. However, there is the possibility that the topographic configuration of the existing waste rock stockpile placed in that area by the previous operation is such that limited surface water runoff could flow north, out of the open pit surface drainage area. Recognizing that condition, as discussed in more detail in subsection **20.6.7.11.J.(2)**, Description of Waste Rock Stockpiles, below, NMCC's design of proposed new Waste Rock Stockpile no. 1 (WRSP-1), will correct this situation. That is, construction of proposed new WRSP-1 will envelop and subsume EWRSP-2A during operations at Copper Flat. Any existing waste rock identified to potentially be located outside of the open pit surface drainage area will be move back into the open pit surface drainage area. WRSP-1 will be constructed over the top of EWRSP-2A early in the operations phase of the project. The design of WRSP-1, as described below, will ensure that both EWRSP-2A and WRSP-1 remain entirely within the open pit surface drainage area.

The purpose of the process water reservoir is to provide a holding structure for recycled water from the TSF, storm water from the storm water impoundments, and fresh make-up water from the off-site wells for use as process water in the concentrator.

Liner material

The impacted storm water impoundment liners will consist of a compacted liner bedding fill layer, overlain with a 60 mil HDPE geomembrane or equivalent, as specified in Appendix B. The liner bedding will be a minimum of six inches of sand or fine soil.

The process water reservoir will be double-lined with a lower 60 mil, or equivalent, HDPE geomembrane and a 60 mil, or equivalent, upper HDPE geomembrane liner. An HDPE geonet will be placed between the liners to serve as the seepage collection pond leak collection and recovery system (LCRS) and to minimize pressure on the lower pond liner.

Storage or disposal capacity

The design storage capacity for each of the impacted storm water impoundments is driven by the size of the watershed. Table 11J-1 provides the storage capacity for each storm water impoundment and the process water reservoir.

TABLE 11J-1
Impoundment Storage Capacity

Impoundment	Size (Acres)	Capacity (Gal)
Impacted storm water impoundment A	1.98	7,306,464
Impacted storm water impoundment B	2.12	5,513,140
Impacted storm water impoundment C	6.37	10,513,140
Process Water Reservoir	1.8	5,433,472

Design capacity of the impoundments is based on anticipated normal operating conditions at the site plus prevention of overflow resulting from a 100-year, 24-hour return interval storm event while maintaining two feet of freeboard. The process water reservoir is sized to contain the water that will be pumped from the water reclaim system and the underdrain collection pond at the TSF plus additional capacity for adding makeup water for the process from other sources including the freshwater off-site well field and the impacted storm water impoundments.

Methods proposed to prevent pollution of groundwater
The primary method to prevent pollution of groundwater at the storm water impoundments and the process water reservoir is through the use of engineered systems to control and manage surface water runoff in combination with the use of liners. Surface water runoff up-gradient from the mine site location was diverted around the site during previous operations. Existing diversion structures will be kept in place as they eliminate the potential for contact of storm water runoff up-gradient from the site with materials on-site that may have the potential to impact ground water.

The process area and the proposed waste rock stockpiles will be graded and contoured to route storm water runoff through storm water conveyances such as drainage ditches, storm drains, culverts and swales to direct and capture storm water in the impacted storm water Impoundments. The impoundments are designed to store the captured water from a 100 year storm with 2 feet of freeboard. As described above, the impoundments will be lined with a 60 mil HPDE liner or equivalent. Captured water will be held in the impacted storm water impoundments for less than thirty days and will be pumped to the process water reservoir for use as process make-up water. Each impacted storm water impoundment will be designed to have a spillway per the requirements of Section **20.6.7.17.D.(7)** of the Copper Rule.

The process water reservoir will be designed such that only precipitation that falls directly upon the footprint of the reservoir will be captured by it. Surface water runoff from the area will be routed to Impacted Storm Water Impoundment A. The process water reservoir will be double-lined with a 60 mil HDPE geomembranes, or equivalent, and be equipped with a leak collection and recovery system, to protect groundwater.

In addition to the mitigation measures identified above to protect groundwater, all of the pipelines that transport tailings, impacted storm water or reclaimed water will be conveyed within lined channels designed to direct leaks and spills to impoundments so as to protect ground water.

NMCC's significant proactive approach to maximally and proactively managing and recycling water, in and of itself, provides a means of protecting groundwater. Maximally recycling water from the TSF and harvesting water from waste rock stockpiles lessens the pressure on the hydrologic cycle by conserving as much water as possible.

IV. 20.6.7.11.J.(2) DESCRIPTION OF WASTE ROCK STORAGE PILES

NMCC proposes to construct three new waste rock stockpiles (WRSP) in conjunction with operation of its Copper Flat project. The material contained in these stockpiles will meet the definition of "waste rock" as stated in Section **20.6.7.B.(65)**, i.e., "all material excavated from a mine facility that is not ore or clean topsoil."

Ore is an economic term. That is, mineralized material only becomes ore when it can be economically processed to extract the commodity to sell at a profit. As such, the proposed new waste rock stockpiles, i.e., material not deemed to be ore by NMCC, will be constructed as units segregated by the grade of copper contained in the waste rock material so as to maximize its potential to be processed as ore in the future. New proposed Waste Rock Stockpile no. 1 (WRSP 1) will contain the highest non-ore grade material. New proposed Waste Rock Stockpile no. 2 (WRSP 2) will contain the next highest non-grade material. New proposed Waste Rock Stockpile no. 3 (WRSP 3) will contain all the remaining material.

The proposed waste rock stockpiles will be built generally to a configuration of 3 horizontal to 1 vertical slope angles (18.4 degrees). This configuration will help facilitate reclamation at the end of the mine life as provided for in Section **20.6.7.33.C.(3)**. Each lift within the stockpile will be maximally 75 ft. high and be placed at angle of repose (35.54 degrees) with 120 ft. setbacks left between lifts to maintain the 3 to 1 overall angle for the stockpile. Surface water run-off collection trenches will be constructed, as needed, to collect and route run-off and/or flowing seeps from the proposed stockpiles to the storm water impoundments describe above. These trenches will be constructed in a manner to maximizing positive flow while minimizing the potential for ponding and erosion.

As shown in Figure 11J-2, there are also four existing waste rock stockpiles from previous operations at the site. They are;

- EWRSP-1 located at the western end of the site within the open pit surface drainage area. EWRSP-1 is identified in previous reports as the “existing west waste rock disposal facility” (WRDF);
- EWRSP-2A and 2B located at the northwest side of the site within the open pit surface drainage area. EWRSP-2A and B are identified in previous reports as the “existing north waste rock disposal facility” (WRDF);
- EWRSP-3 located next to the primary crusher. EWRSP-3 is identified in previous documents as the “low grade ore stockpile”; and
- EWRSP-4 located southeast of the mine. EWRSP-4 is identified in previous documents alternatively as the “lean ore stockpile” and the “south waste disposal facility”.

EWRSP-1 and EWRSP-2B will be reclaimed as discussed in more detail later herein in conformance with an approved MORP and Closure Plan. EWRSP-2A will be incorporated into the larger new proposed WRSP-1 constructed during operations. It will be enveloped and covered over by the new stockpile as WRSP-2 being developed over time.

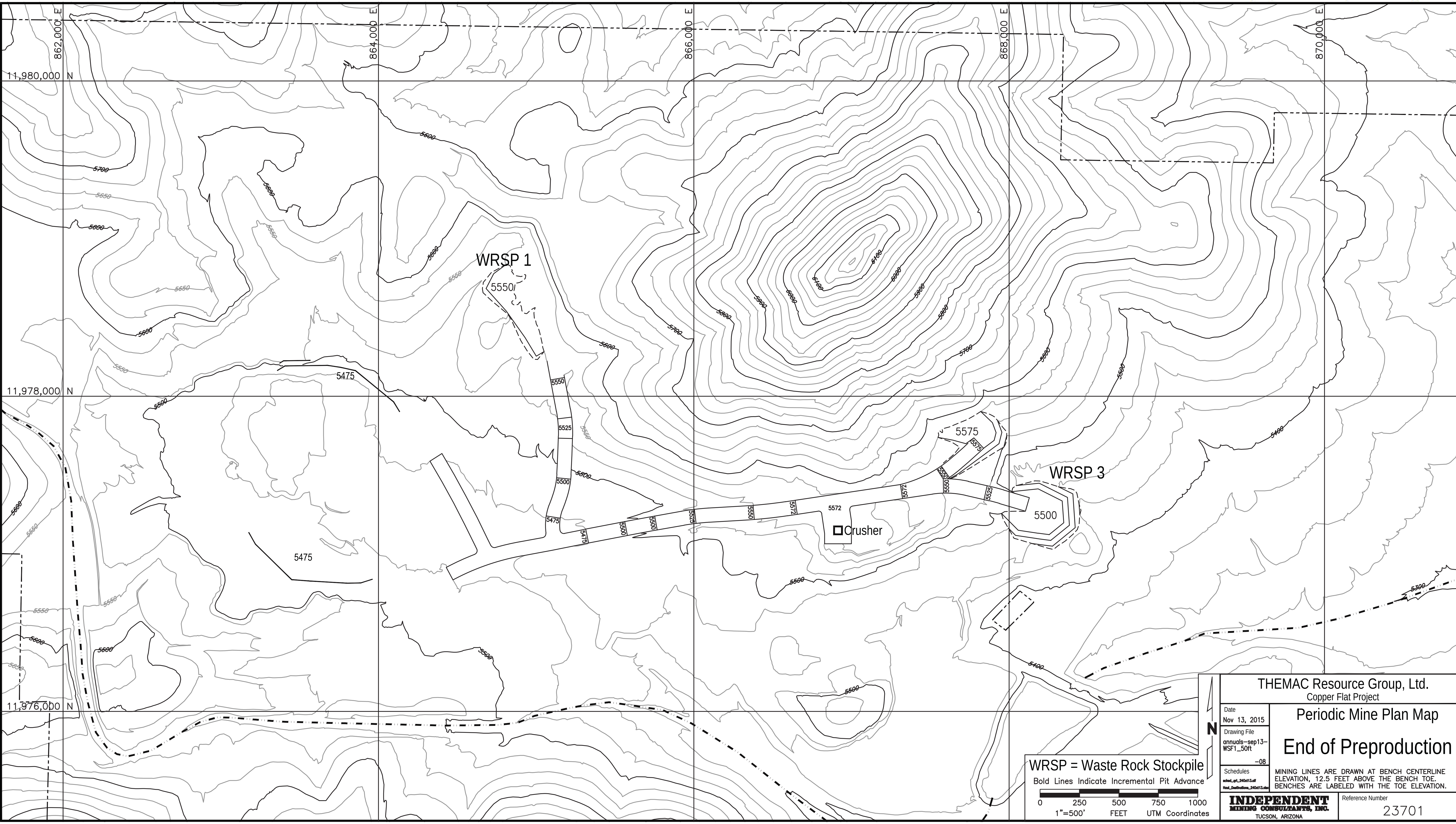
EWRSP-3 is located to the east of the primary crusher as shown on Figure 11J-2. Some of this material will be fed into the processing circuit in the early stages of process operations to “condition” the circuit. “Conditioning” refers to the process of feeding new equipment, first with water, followed by some waste rock and then to “line” the new machinery and prepare it for full operations. The material at EWRSP-3 may also be blended over time into the process if economic conditions warrant. The area containing EWRSP-3 will be the staging or holding area for rock that is too large to be fed directly into the crusher that has to be broken down with a pneumatic hammer.

EWRSP-4 will be graded and re-contoured as discussed later herein to direct surface water flow to the mine pit. The southern edge of the stockpile will be reclaimed in conformance with the approved MORP and Closure Plan during operations to protect against potential surface water impacts to Grayback Arroyo from the EWRSP. The graded and contoured area will be utilized during operations as an additional equipment storage and lay-down area and will be reclaimed at the end of the mine life in accordance with the reclamation and closure plan.

This section, together with section **20.6.7.11.N.(1), Engineering, Design, Construction and Surveying, Waste Rock Stockpiles, 20.6.7.11.O, Material Characterization and Material Handling Plan, and 20.6.7.11.P, Hydrologic Conceptual Model,** of NMCC's Discharge Permit application, contain the design plans for the proposed new waste rock stockpiles (WRSPs) located outside the open pit surface drainage area pursuant to **20.6.7.21.B.(1).(d).** The proposed areal extent and configuration of these new proposed WRSPs and the topography of the site where they will be located is shown in Figures 11J-4 through 11J-15. The geology of the site is described in detail later in this application in section **20.6.7.11.K, Soils, Geology and Hydrology.**

Figures 11J-4 through 11J-15 show the design and construction sequencing for the mine pit and the new proposed WRSPs beginning at the preproduction stage through the life of the mine. Their design and configuration is based on consideration of site-specific conditions as discussed in more detail below and in the sections of the application cited above. For example, the material characterization work performed by NMCC as described in section **20.6.7.11.O** that follows provides the basis for controlling surface run-off and seepage from the stockpiles using run-off collection trenches to capture it and routing it to impacted surface water impoundments. Similarly, the information presented in sections **20.6.7.11.K and P** regarding site geology and hydrology conditions provides the basis for placing the waste rock stockpiles over low permeability andesite bedrock.

Section **20.6.7.11.J.(6)** of this application provides a discussion and analysis of the storm water diversion structures present at the site that will minimize the contact between storm water run-on and the waste rock material.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WRSP = Waste Rock Stockpile
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Figure 11J-4

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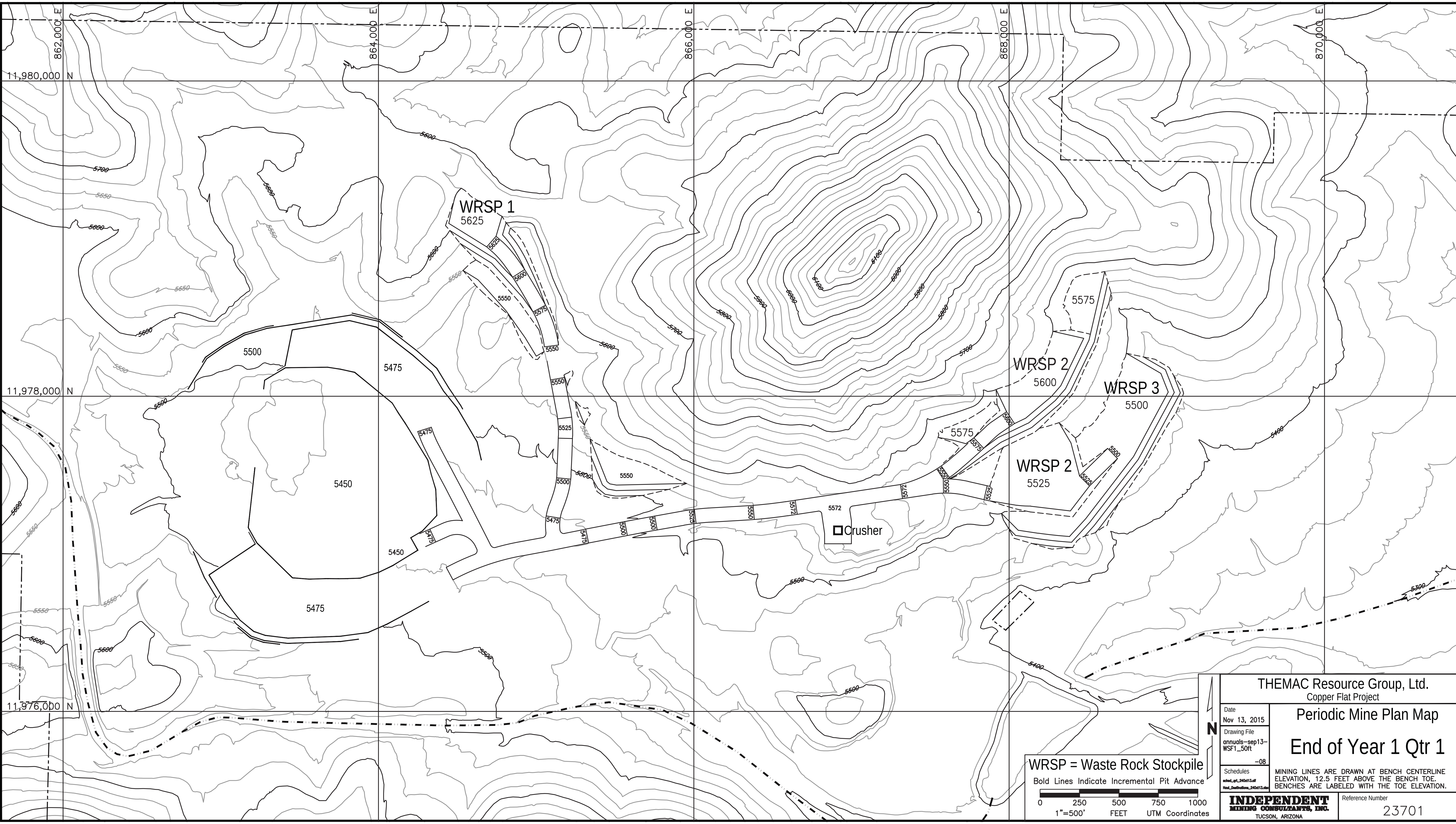
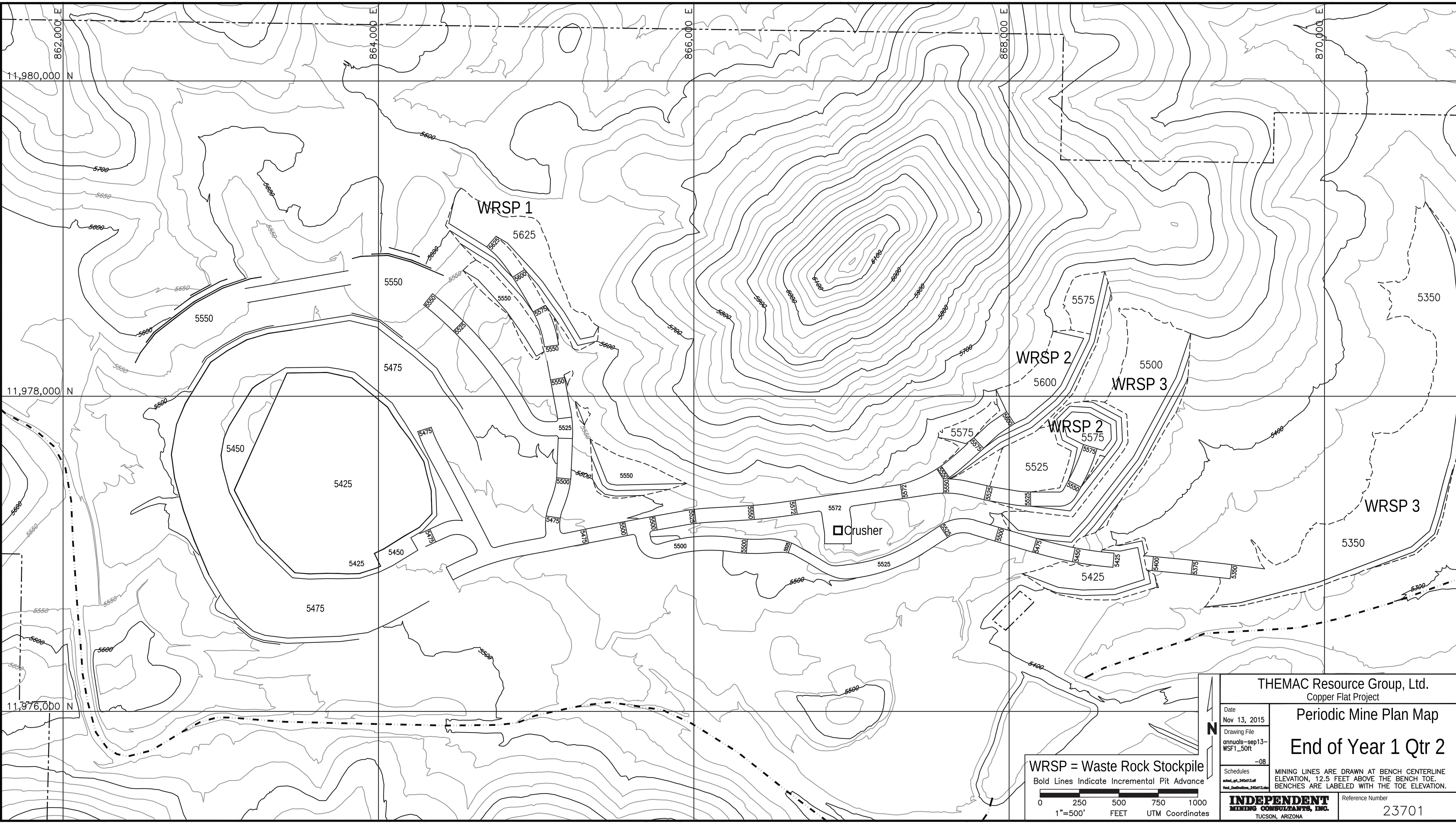


Figure 11J-5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WRSP = Waste Rock Stockpile
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Figure 11J-6

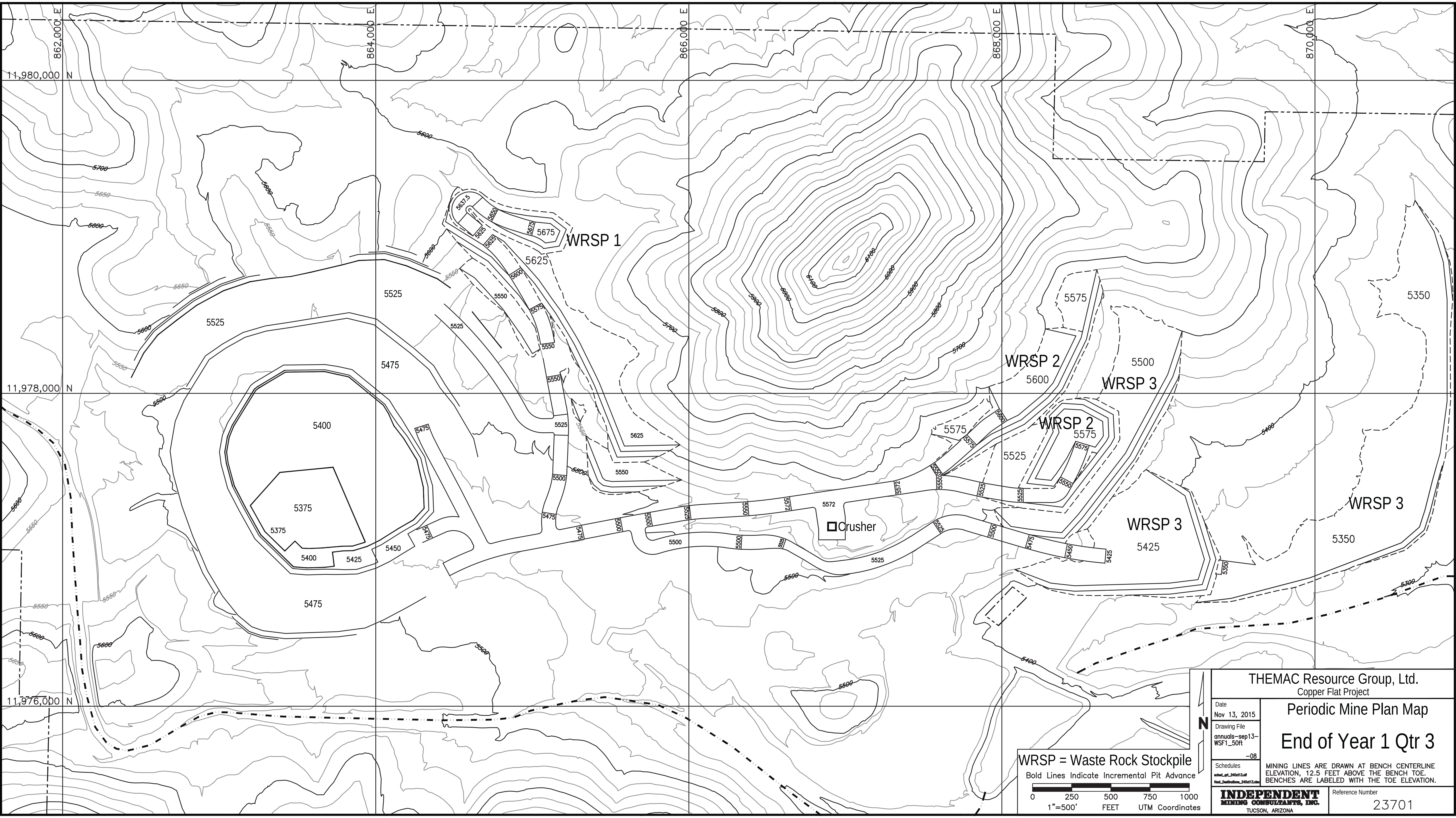
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Figure 11J-7

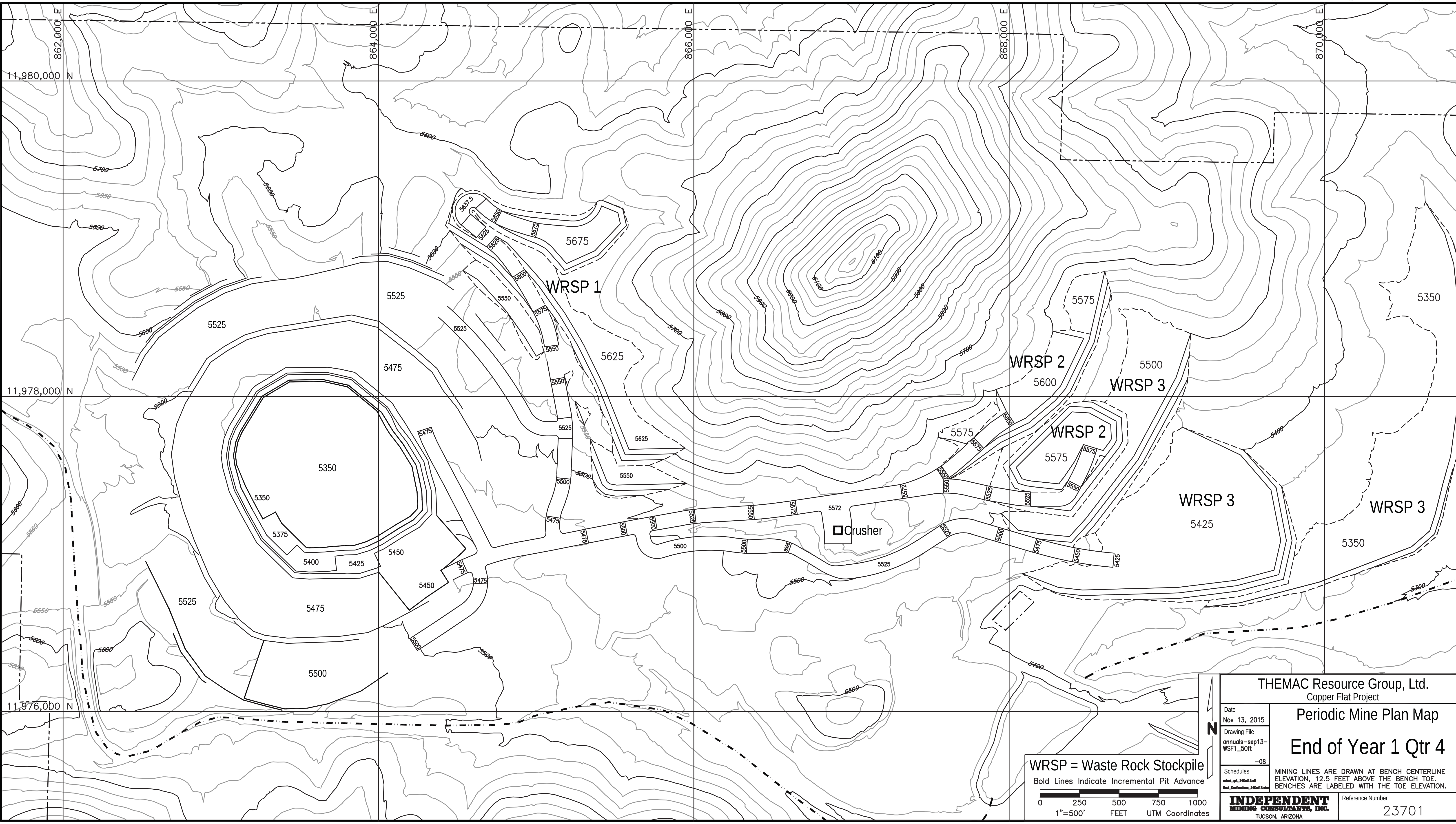
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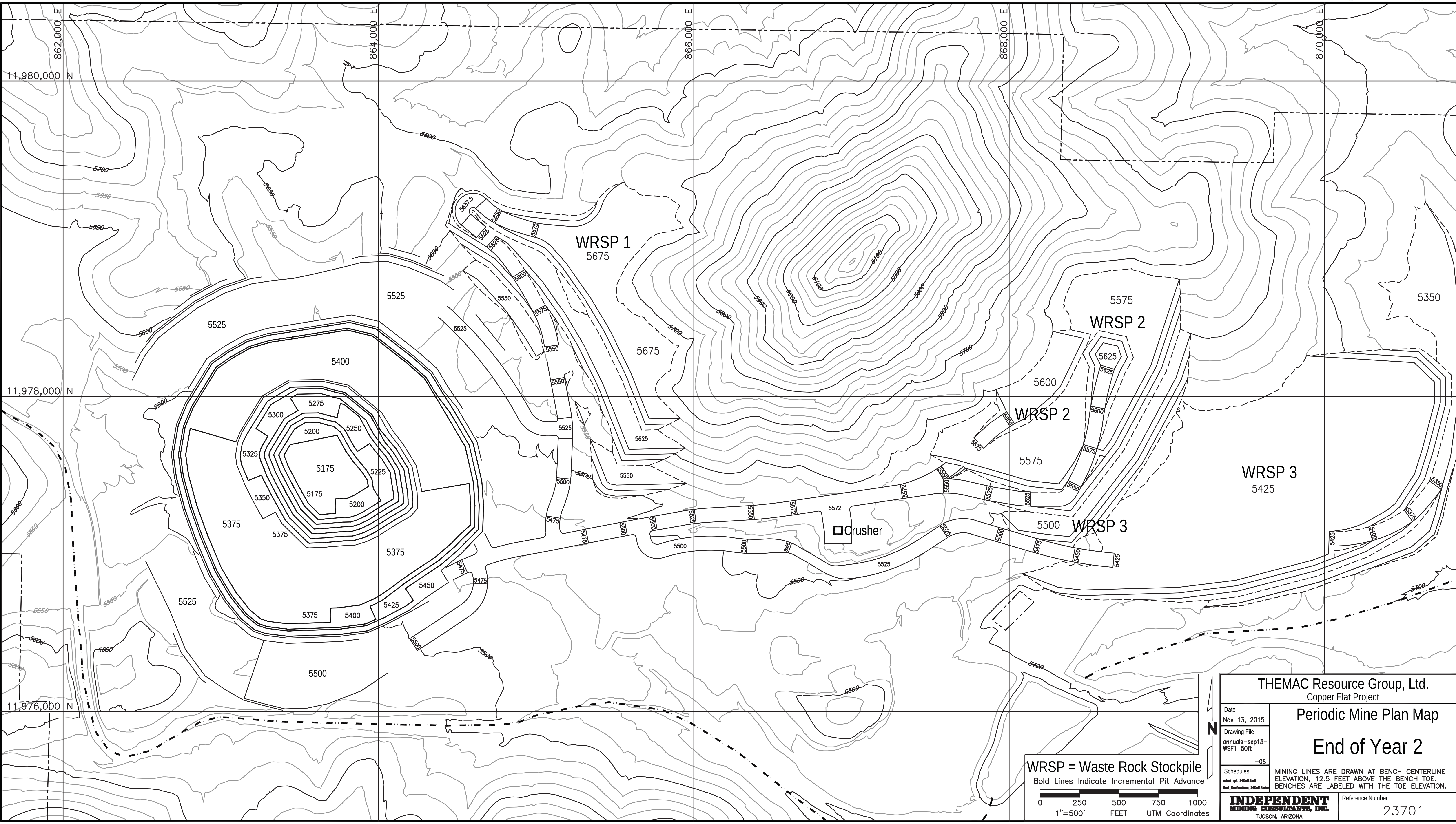
Figure 11J-8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Copper Flat Project
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0 250 500 750 1000
1"=500' FEET UTM Coordinates
N

Figure 11J-9

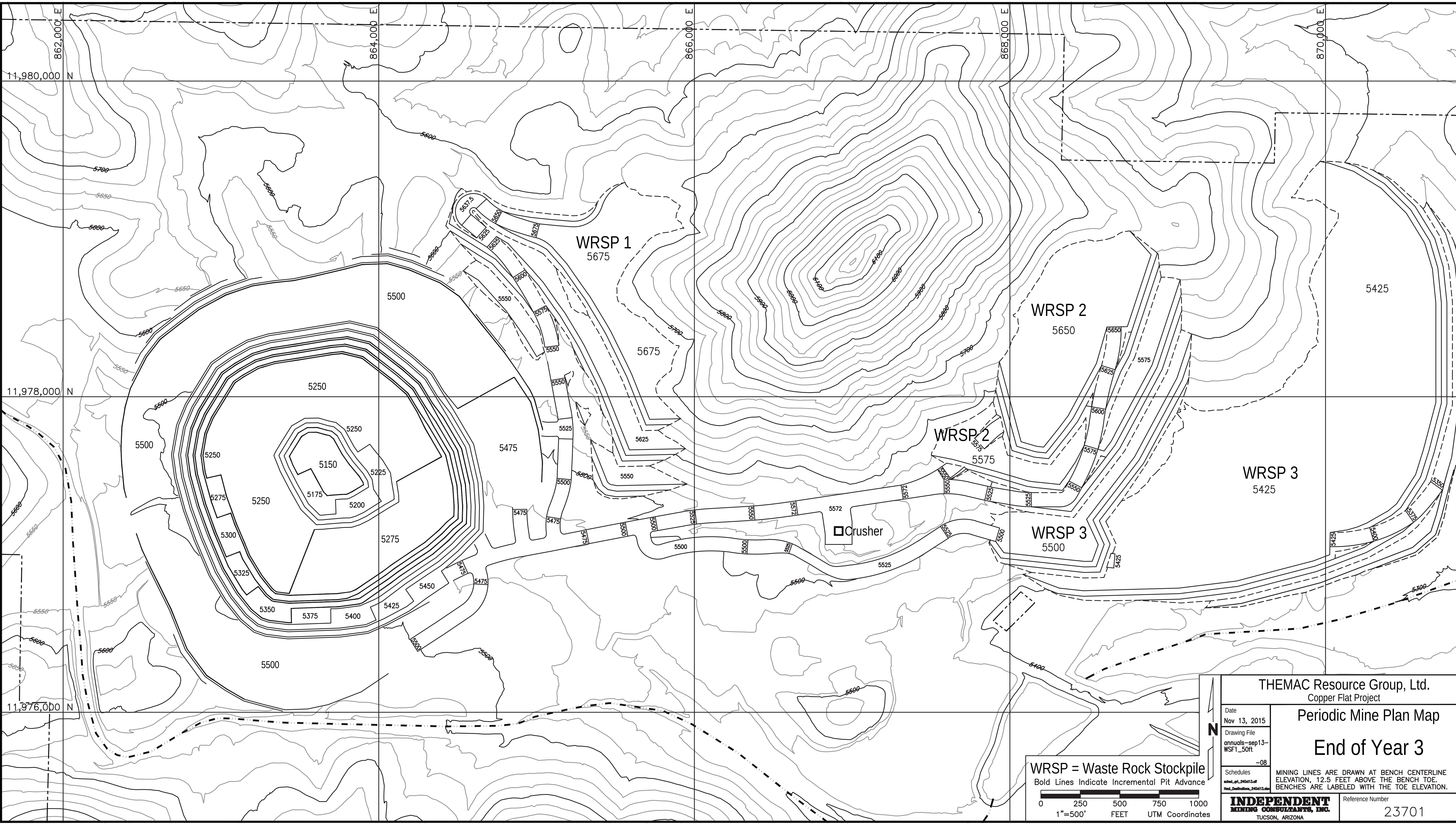

Figure 11J-10

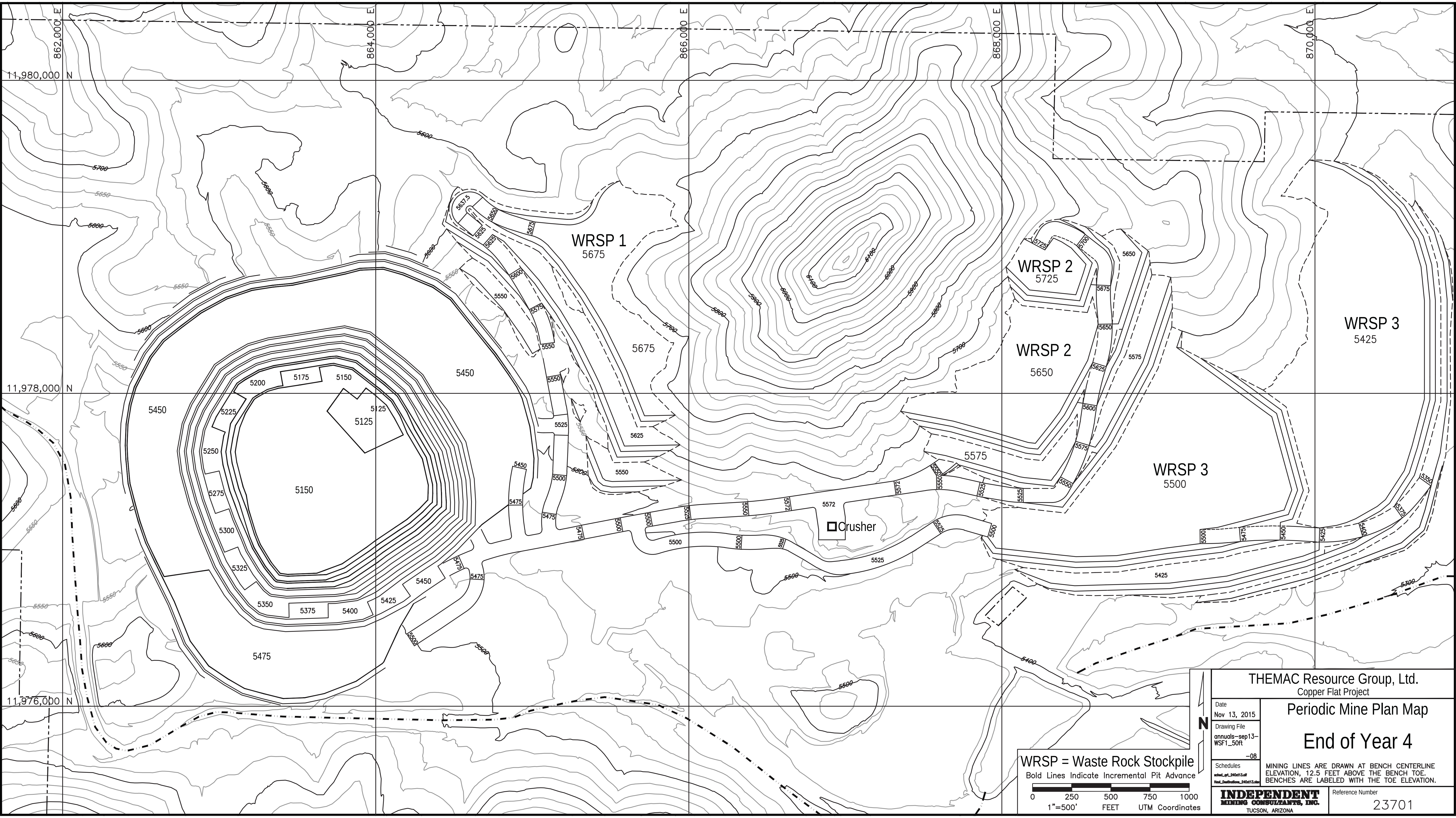

Figure 11J-11

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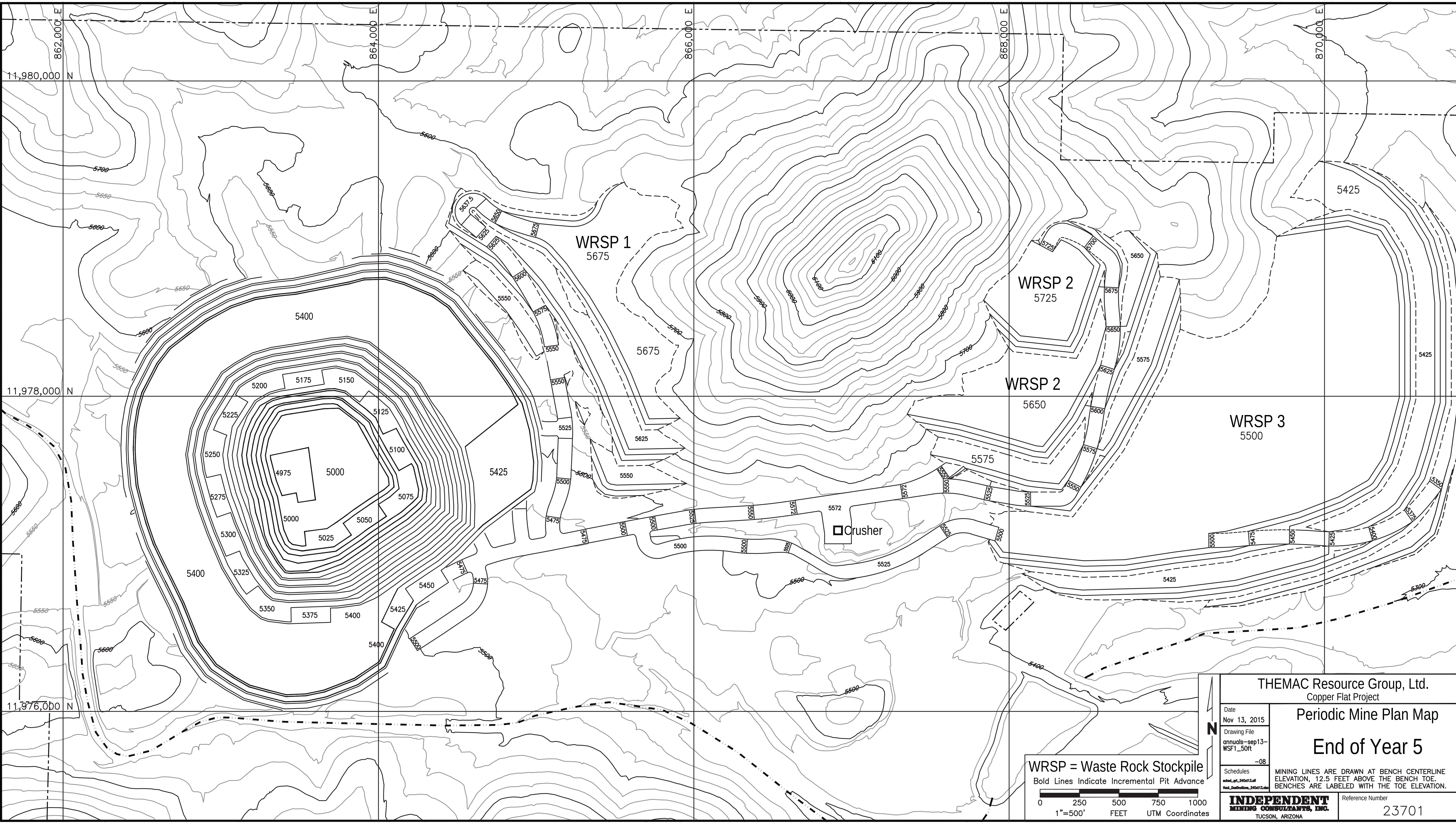


Figure 11J-12

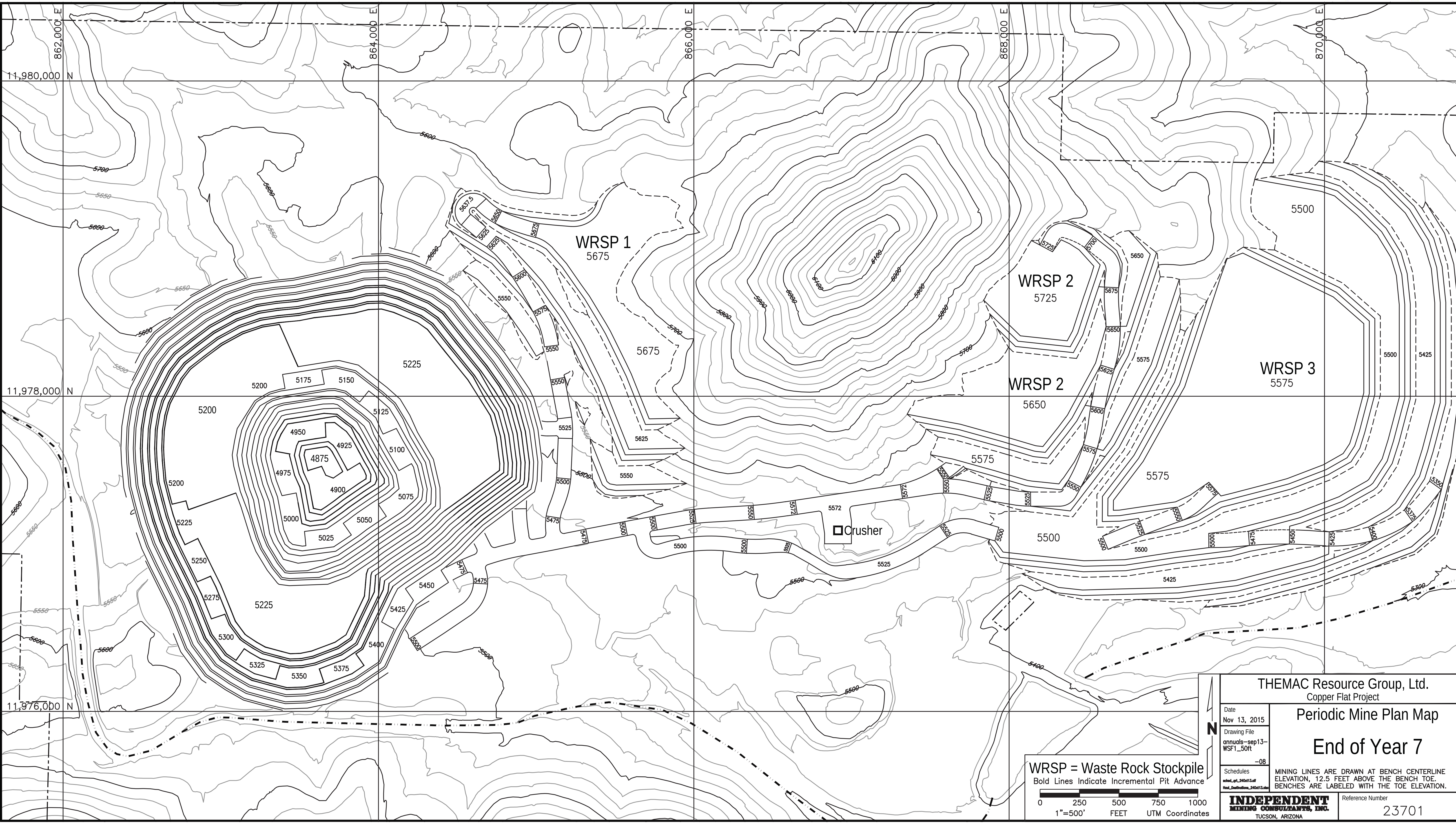


Figure 11J-13

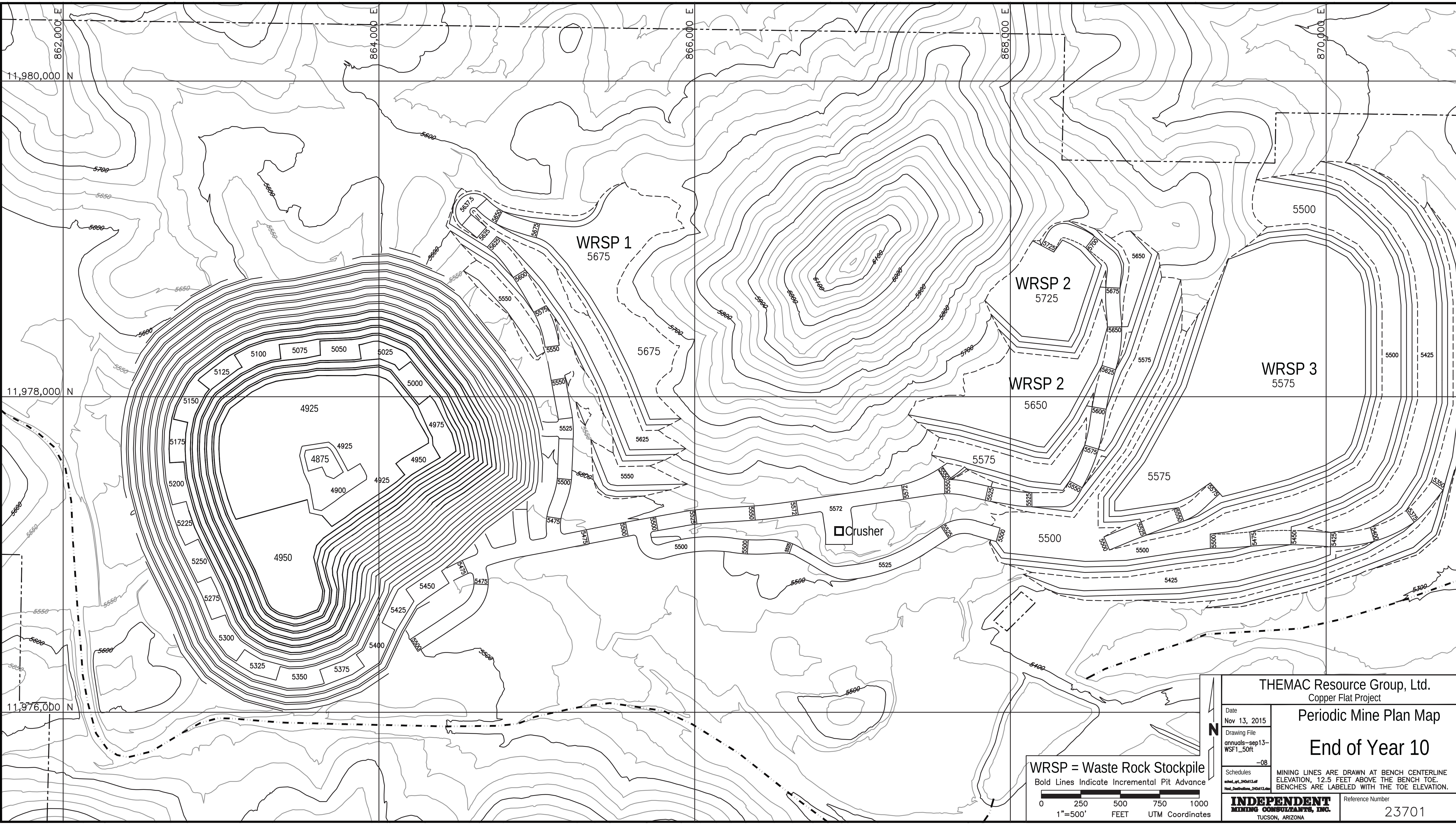


Figure 11J-14

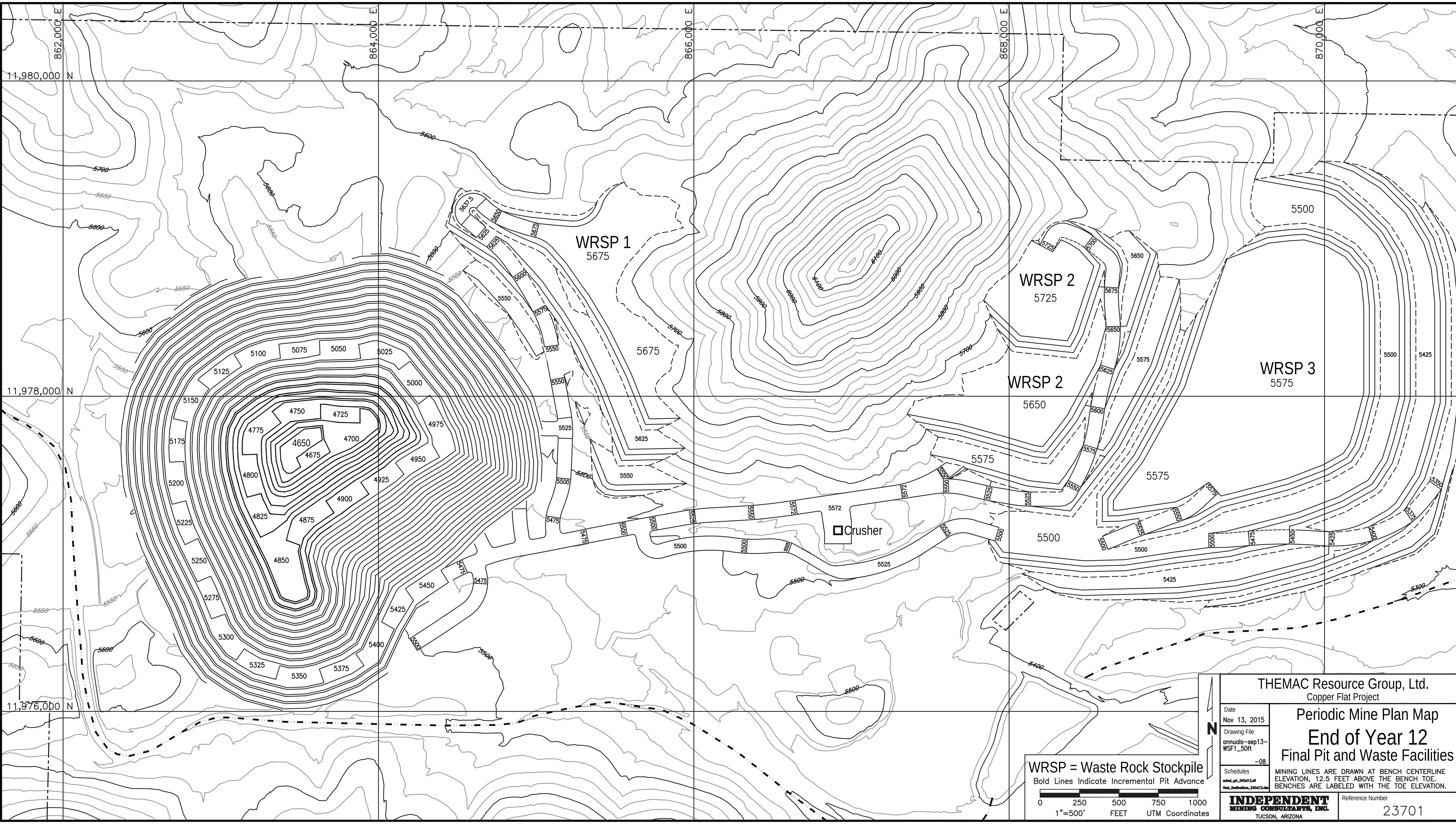


Figure 11J-15

Location
The location of the existing and proposed new waste rock stockpiles is shown in Figure 11J-1 provided herein in response to **20.6.7.11.J.(1)** and Figures 11J-2 and 3. Figures 11J-4 through 15 provide additional design detail of how the proposed new WRSP's will be constructed over time.

- Proposed new WRSP 1 will be located along the western edge of developed watershed (WS) B;
- Proposed new WRSP 2 will be located in the western third of developed WS C;
- Proposed new WRSP 3 will be located in the remainder of developed WS C;
- EWRSP-1 is located at the western end of the site within the open pit surface drainage area. EWRSP-1 is identified in previous reports as the "existing west waste rock disposal facility" (WRDF);
- EWRSP-2A and 2B are located at the northwest side of the site within the open pit surface drainage area. EWRSP-2A and B are identified in previous reports as the "existing north waste rock disposal facility" (WRDF);
- EWRSP-3 is located next to the primary crusher in WS A. EWRSP-3 is identified in previous documents as the low grade or stockpile; and
- EWRSP-4 located southeast of the mine pit. EWRSP-4 is identified in previous documents alternatively as the "lean ore stockpile" and the south waste disposal facility.

Purpose
The purpose of the waste rock stockpiles is to store the all of material excavated from the mine that is not ore or clean topsoil, i.e., growth media, in conformance with the definition of "waste rock" in **20.6.7.7.B.(65)**.

Liner material
The proposed new stockpiles will be constructed over andesite bedrock, a very low permeability formation that provides a natural liner protective of groundwater. Andesite at the site has a permeability of less than 10^{-6} centimeters per second (cm/sec) (SRK, May 2013). Alluvial fans may exist, such as may be the case underlying a portion of proposed WRSP-3, as indicated in the New Mexico Bureau of Geology Draft Open-File Map 242 (Jochems, et al., 2014). The stormwater collection channels constructed along the toe of the new proposed stockpiles will also serve as collection galleries for potential seepage that may occur along the interface between the alluvial material and the andesite. Alluvial materials that may exist along the toe of the stockpiles will be removed and the collection channels constructed into the andesite. The channels will follow the land surface contours for positive drainage to the lined impacted stormwater impoundments. NMCC also proposes monitoring wells directly down-gradient of the channels in the drainages as discussed in Appendix E of the Discharge Plan application to monitor for any potential discharges.

Draft Open-file Map 242 indicates fan deposits (Qaf1 and Qaf2) exist in the area of proposed WRSP-3 at an estimated maximal thickness of approximately 3 to 4 meters. However, there are no drill data or measured sections to support these estimates. As such, a field reconnaissance was performed by JSAI on May 25, 2016 to correlate the information mapped in Draft Open-file Map 242 and site conditions. JSAI concluded, based on visual observation, that the thickness of the alluvial cover in that area is a minimal thin veneer overlying the andesite, not a wedge-shaped mass of alluvium thickening towards Grayback Arroyo as might be assumed from simply interpreting the map. Looking at the location of proposed WRSP-3 from the entrance road along the south side of Grayback Arroyo to the north toward the location, JSAI observed outcrops of andesite visible on the north side of Grayback Arroyo that were not mapped by Jochems et al (2014). Exposure of andesite was also seen in a small drainage channel near or at the toe of the proposed WRSP-3, also not mapped by Jochems et al. (2014). These observed andesite outcrops in the area of mapped units Qaf1 and Qaf2 (Jochems et al., 2014) indicate that the alluvial fans are much thinner than the map tends to indicate.

SRK Consulting (U.S.), Inc. conducted a mine waste characterization program for the Copper Flat project. SRK's waste characterization investigations were undertaken in the midst of formulation of the Copper Rules and the report was submitted in advance of their promulgation in December 2013. Nonetheless, every effort was made to conduct the investigation in a manner consistent with Section **20.6.7.21.A.(1).(a), (b), (c) and (d)** of the Copper Rules. Further, the results of the testing demonstrated that the waste rock produced at Copper Flat will not be acid generating or generate a leachate containing water contaminants. The results of SRK's investigations have been previously presented to NMED (SRK May 2013). Notwithstanding SRK's conclusions that the waste materials at Copper Flat are acid generating, SRK's report also concluded that migration of seepage from the waste rock stockpiles is not expected as the stockpiles will be placed on low permeability ($<10^{-6}$ cm/sec) andesite bedrock which will function as a liner (SRK, May 2013, page 79). NMCC believes that this low permeability condition constitutes a "natural liner system" underlying materials that have been and will be placed outside of the open pit drainage area.

NMED and NMCC have worked closely in the intervening time through meetings, written comments, responses, and comment resolution to ensure that the characterization conducted by SRK satisfies those requirements. As such, this Geochemical Characterization Report, the Geochemical Modeling Report of Pit Lake Water Quality and associated documents for the Copper Flat project are incorporated into this Discharge Plan application by Reference. In correspondence in this regard in a February 23, 2015 letter from NMED to NMCC wherein NMED recommends that the results of the geochemical characterization work be incorporated into the Discharge Permit application (NMED 2105).

The geochemical testing of mine waste rock provided the characterization required to evaluate the potential for it to generate acid and to release contaminants in excess of the standards of **20.6.2.3103** NMAC. This information, in turn, allowed for a quantitative risk assessment and evaluation of the options for design, construction and closure of the tailings and waste rock stockpiles.

Storage or disposal capacity
The storage or disposal capacity of the proposed new waste rock stockpiles is as follows;

- Proposed new WRSP-1 is designed to stockpile up to 3.16 million tons of material over the life of the mine.
- Proposed new WRSP-2 is designed to stockpile up to 8.64 million tons of material over the life of the mine.
- Proposed new WRSP-3 is designed to stockpile up to 32.89 million tons of material over the life of the mine.

The existing waste rock stockpiles have the following approximate amount of material associated with them;

- EWRSP-1 contains approximately 512,000 tons of material.
- EWRSP-2A and 2B contain approximately 913,000 tons of material. About half of this material, i.e., EWRSP-2A, will be enveloped into proposed new WRSP-1.
- EWRSP-3 contains approximately 523,000 tons of material. Approximately 123,000 tons of this material consists of unprocessed ore remaining on-site at the end of Quintana's operations. Of this, 24,000 tons is the small amount of unprocessed run-of-mine ore, 44,000 tons of crushed ore stockpiled around the semi-autogenous (SAG) grinding mill and 55,000 tons utilized to backfill the process building foundations.
- EWRSP-4 contains approximately 1.2 million tons of material.

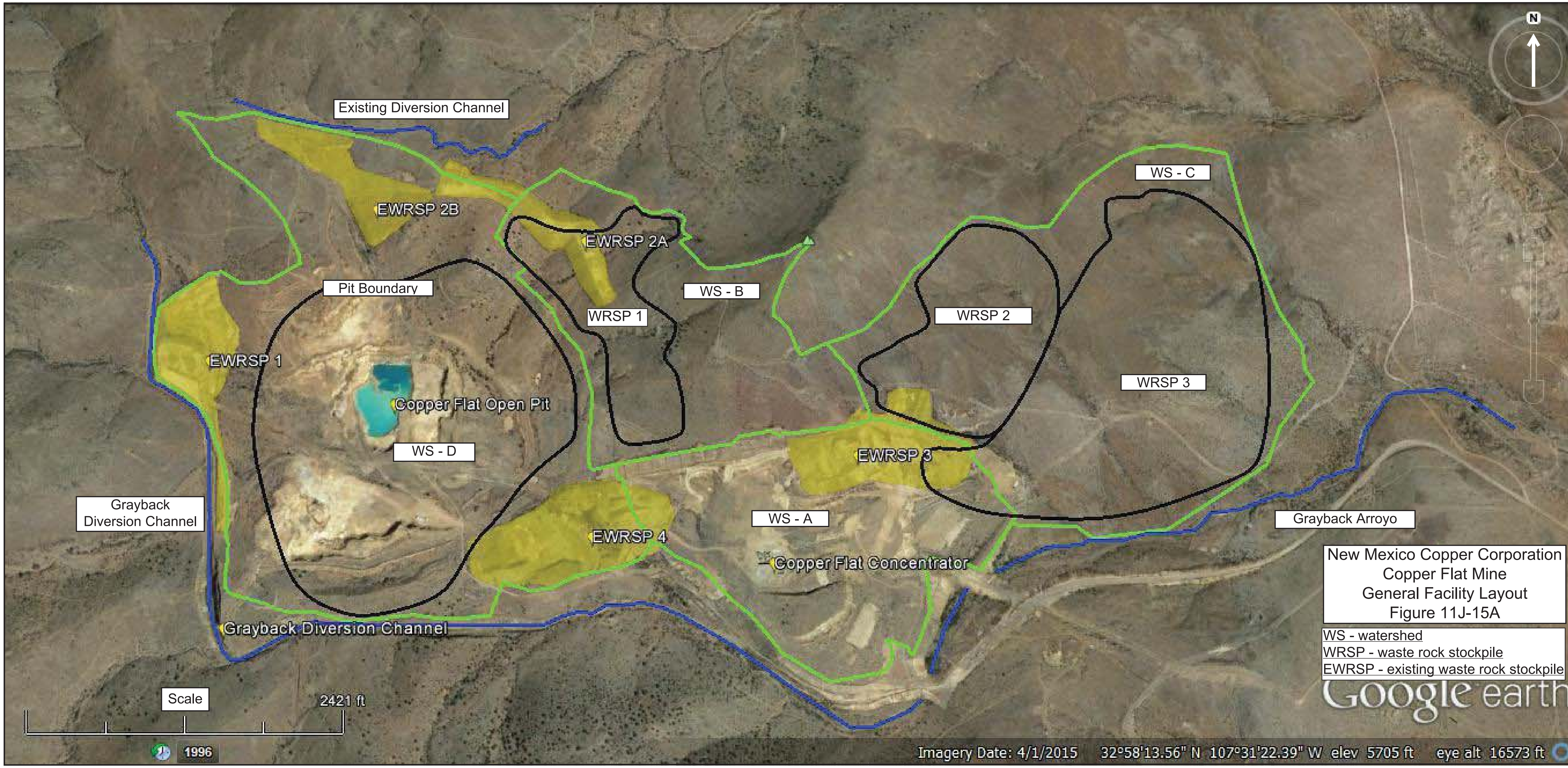
Methods proposed to prevent pollution of groundwater
NMCC's proposed method to prevent pollution of groundwater from the proposed new and existing waste rock stockpile involves the use of natural site conditions, i.e., the low permeability of the andesite bedrock and the open pit surface drainage area in combination with the use of engineered systems to control and manage water. The location of the stockpiles themselves allows the use natural conditions to protect groundwater from the waste rock materials. The use of liners in the storm water impoundments for surface water runoff control and management at the proposed new stockpile areas during the operational life of the mine will provide a significant measure of protection of groundwater in these areas. Prevention of pollution of groundwater from the waste rock stockpiles in the long-term will be provided in the reclamation and closure phase after the end of the life of the mine by re-grading, contouring and covering the waste rock stockpiles with sufficient cover material to minimize the potential for infiltration of precipitation once the facility is reclaimed.

As indicated above, the existing waste rock stockpiles are placed over the andesite bedrock and the proposed new waste rock stockpiles will also be placed on andesite bedrock. Andesite has been demonstrated to have a very low permeability, thus providing protection of groundwater. The conclusions that SRK made in their report (SRK, May 2013) were based on the 2012 conceptual hydrologic model report prepared for NMCC by John Shoemaker and Associates, Inc., Conceptual Model off Groundwater Flow in the Animas and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, May, 2012, (JSAI 2012) which has previously been submitted to NMED. NMCC has since that time also submitted to NMED two comprehensive follow-on documents titled "Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, August 22, 2013", and "Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, March, 2014". These reports confirm that the permeability of the andesite bedrock is less than 10^{-6} cm/sec. and the mine pit is a hydrologic sink. The above cited documents are incorporated into NMCC's Discharge Plan Application by reference.

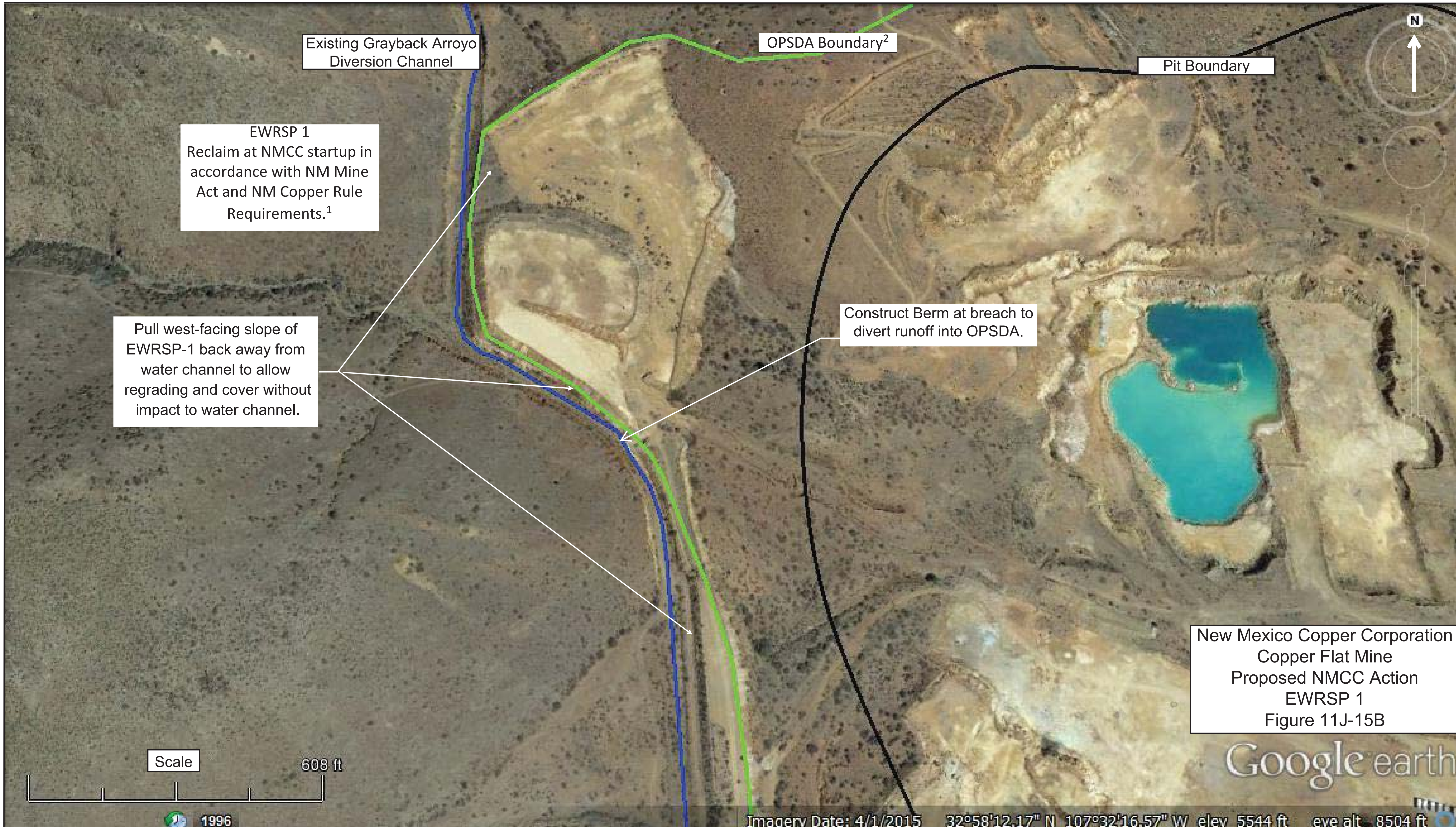
Surface water runoff will be diverted away from and around the proposed new waste rock stockpiles and processing area to the maximum extent possible to minimize the potential for contact of storm water with materials that have the potential to impact ground water. Precipitation directly onto to these stockpiles will be controlled and managed through construction of runoff control and conveyance structures leading to impacted storm water impoundments. As described above, Appendix B provides a detailed description of the design and construction of the impoundments and conveyance structures. The impoundments will be lined per the requirements of **20.6.7.17.D**. The impoundments are designed to capture all of the water that runs off from the WRSP from a 100 year return interval precipitation event with a minimum 2 ft. of freeboard. The water captured will be retained in the impoundments less than thirty days and transported to the process water reservoir for use in the process circuit. As described above, the process water reservoir will be double-lined and equipped with a leak collection and recovery system.

NMCC recognizes NMED's concerns regarding the existing waste rock stockpiles EWRPs) at the site. Section **20.6.7.21.C.(2)** allows the existing stockpiles to continue to "operate" as previously permitted. Figures 11J-3 and 11J-15A show that EWRSP-1, EWRSP-2A and EWRSP-2B are located within the open pit surface drainage area. The mine pit acts as a natural drainage sink for surface and ground water at this location. EWRSP-3 is located at the north end of developed watershed A (WS A) within the plant site. EWRSP-4 is located southeast of the mine pit. NMCC proposes the following plan to address how each of the existing waste rock stockpiles will be managed during operations. The details of the plan are described in the Updated MORP submittal and are generally discuss herein. NMCC will conduct some interim maintenance and reclamation at these locations to ensure that all surface water drainage at the EWRSP's is appropriately managed.

EWRSP-1 and EWRSP-2B will be reclaimed during the operations phase of the project. This will allow NMCC to establish test-plots to test a variety of vegetation scenarios, thus aiding NMCC in determining successful reclamation and revegetation alternatives to implement at closure. At EWRSP-1, as shown in Figure 11J-15B, a berm was constructed immediately



Existing Diversion Channel
EWRSP 2B
EWRSP 2A
WS - C
Pit Boundary
WS - B
WRSP 1
WRSP 2
EWRSP 1
WRSP 3
Copper Flat Open Pit
WS - D
EWRSP 3
Grayback
Diversion Channel
WS - A
Grayback Arroyo
EWRSP 4
Copper Flat Concentrator
New Mexico Copper Corporation
Copper Flat Mine
General Facility Layout
Figure 11J-15A
WS - watershed
WRSP - waste rock stockpile
EWRSP - existing waste rock stockpile
Grayback Diversion Channel
Scale
2421 ft
Google earth
1996
Imagery Date: 4/1/2015 32°58'13.56" N 107°31'22.39" W elev 5705 ft eye alt 16573 ft



1. See detail in Updated MORP Reclamation and Closure Plan
2. See Figure 11J-3 and Updated MORP for OPSDA boundary after reclamation complete

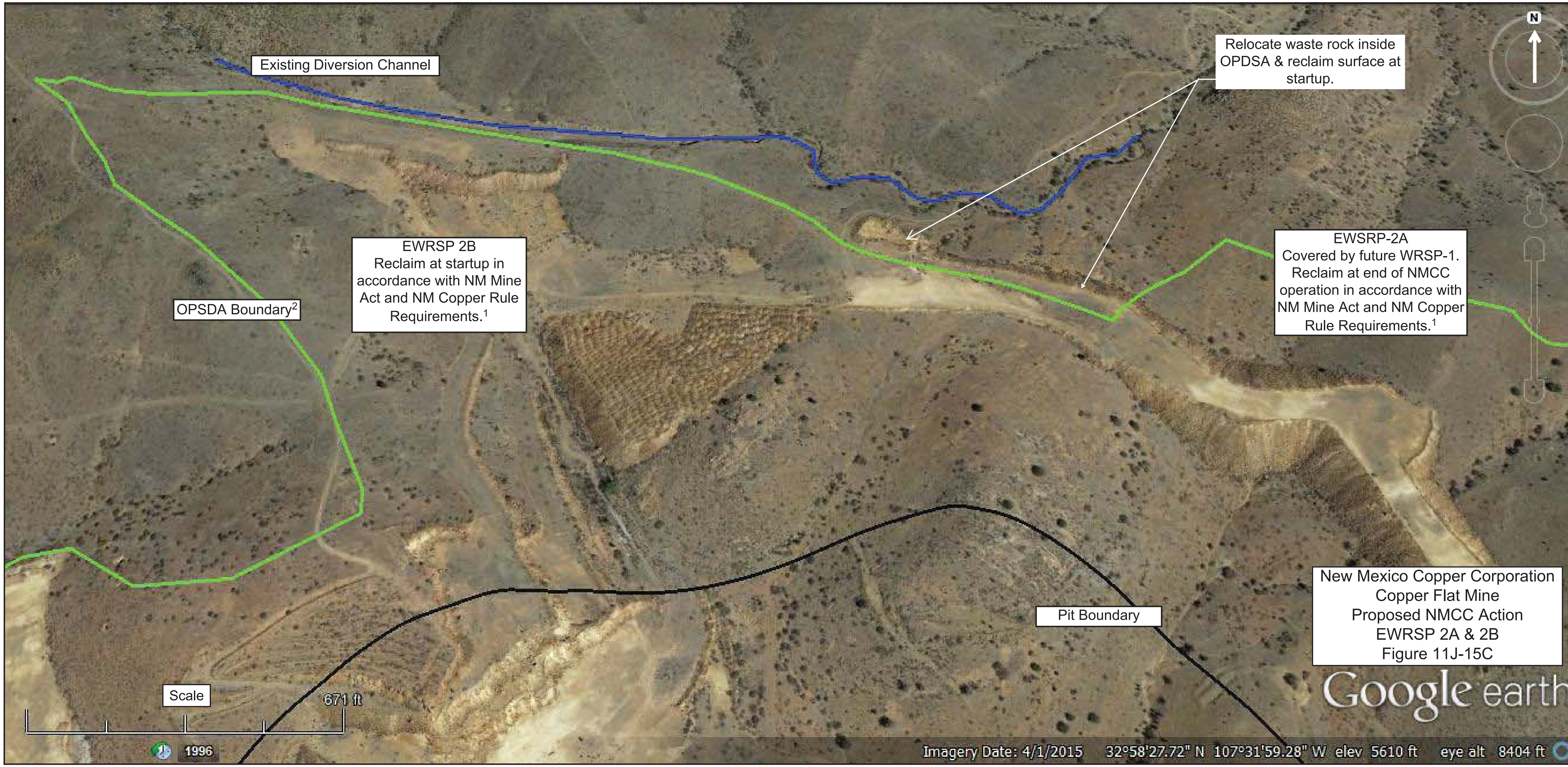
downstream of the location of the breach that currently exists to divert surface water drainage back into the OPSDA so that it no longer enters Grayback Arroyo. This work was performed in the summer of 2016. In addition, during operations, NMCC will reclaim EWRSP-1 as described in the approved MORP. At reclamation, surface run-off will be routed to Grayback Arroyo diversion. This will result in the reclaimed EWRSP-1 to be located outside of the OPSDA. Detailed plans for reclaiming EWRSP-1 are provided in Section 2.1 of the Mine Reclamation and Closure Plan of the Updated MORP. In summary, waste rock adjacent to the diversion channel on the west side of EWRSP-1 will be moved onto the waste rock pile to separate the east bank of the channel from the reclaimed surface. Otslopes will be graded to a 3H:1V interbench slope and the top graded at minimum 1% slope to drain. Storm water controls will be constructed for erosion control.

At EWRSP-2B, as shown in Figure 11J-15C, the wastes will be re-graded and reclaimed during operations in accordance with the approved MORP. At EWRSP-2A, a small amount of waste at the northernmost edge of the stockpile may be just outside of the OPSDA as is shown on Figure 11J-15C. NMCC will remove and redeposit that waste onto the portion of EWRSP-2A located within the OPSDA, as discussed in Section 2.1 of the Updated MORP, during the site preparation phase of the project prior to the commencement of construction of Waste Rock Stockpile 1 (WRSP-1). As shown Figures 11J-4 through 15, EWRSP-2B will be covered over time with the waste rock deposited in WRSP-1 during operations and will simply become part of WRSP-1 over the life of the mine.

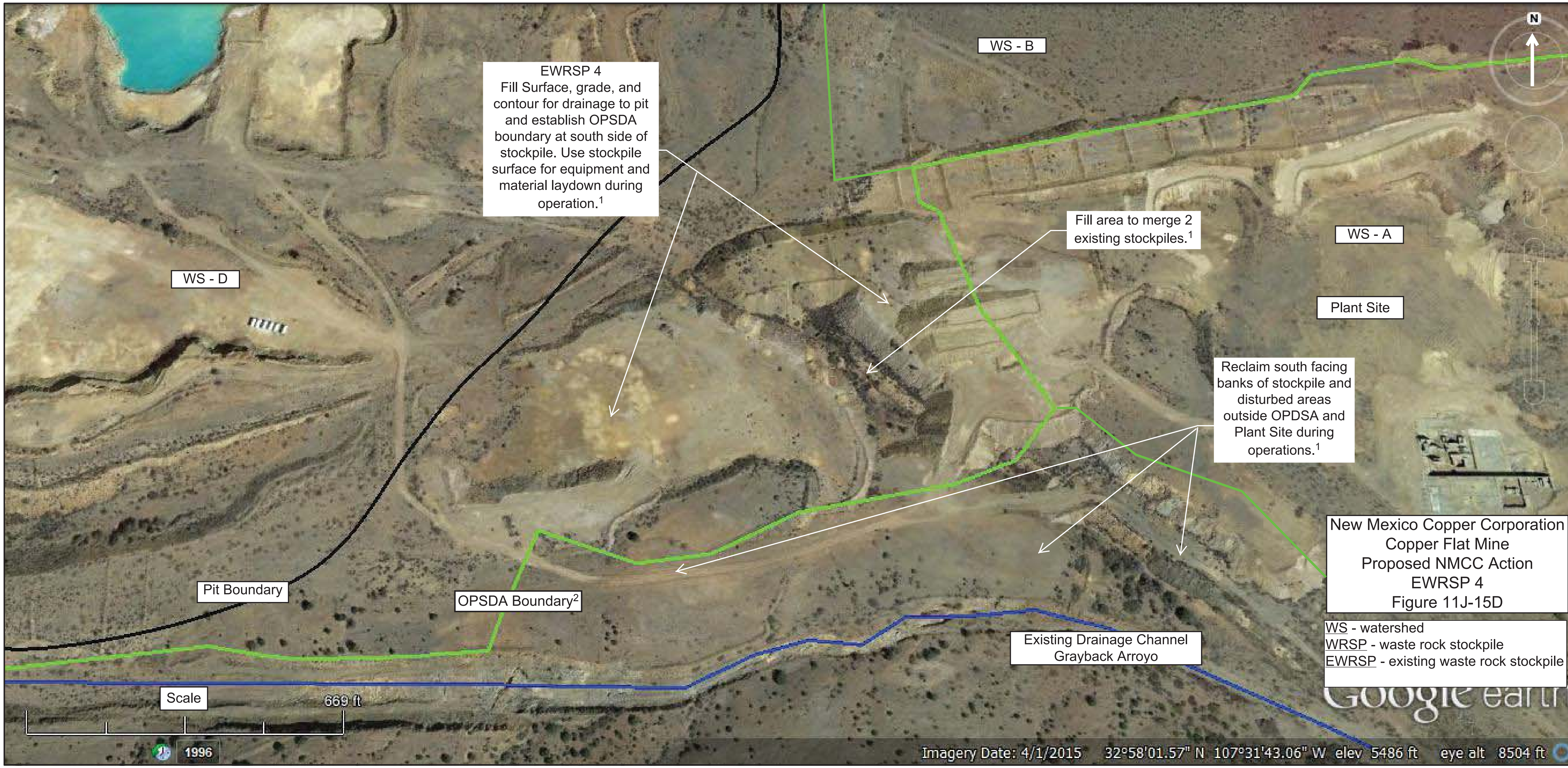
NMCC has chosen to manage surface water runoff from the eastern one-third of the OPSDA by developing a sub-watershed, i.e. developed WS B (see Figure 11J-3). The purpose of this sub-watershed is to manage runoff from the proposed new waste rock stockpile WRSP-1 to be constructed within the watershed. Impacted storm water impoundment B will be constructed at the southwest corner of developed WS B as a surface water runoff control measure to manage surface water inflow to the mine pit. The captured surface water runoff will be utilized as process make-up water.

EWRSP-3 represents the last vestiges of ore and low grade materials left from the Quintana operation at shut-down. As discussed earlier herein, early in the operation some of this material will be processed through the new processing equipment as a circuit “conditioning” activity. During subsequent operations some of this waste rock stockpile may also be blended with run-of-mine ore and fed into the process if economic conditions warrant. The EWRSP-3 area is part of the processing site (see Figure 11J-3 and 11J-15A). During operations it will be utilized as the area of temporary storage of run-of-mine ore transported from the mine not immediately fed into the primary crusher. During operations storm water runoff from this area will be captured in impacted storm water impoundment A.

EWRSP-4 will be re-graded and contoured during the site preparation and construction phase of the project for use as an equipment storage and laydown area during operations as shown in Figure 11J-15D. Detailed grading and reclamation plans for EWRSP-4 are



1. See detail in Updated MORP Reclamation and Closure Plan
2. See Figure 11J-3 and Updated MORP for OPSDA boundary after reclamation complete



1. See detail in Updated MORP Reclamation and Closure Plan
2. See Figure 11J-3 and Updated MORP for OPSDA boundary after reclamation complete

provided in Section 2.1 of Appendix E, Mine Reclamation and Closure Plan the Updated MORP. Impacted stormwater runoff from the area will be managed by grading the top surface such that runoff from the area will be routed into the open pit away from Grayback Arroyo. Fill material will be added to the top surface for grading to minimum 1% slope. The southern facing outslope of the stockpile will be reclaimed by grading to a 3H:1V interbench slope, covering with 3 feet of growth media material and revegetating. Storm water controls will be constructed for erosion control. Final reclamation of the area will be completed at the end of operations.

The cost of reclamation of all the existing waste stockpiles will be included in the financial surety calculations provided in the MORP. At the end of the life of the mine, the Copper Flat facility will be reclaimed in accordance with an approved reclamation plan/closure plan. All of the waste rock stockpiles will be reclaimed by contouring and grading the piles to prevent run-on, control run-off and minimize infiltration of precipitation. Three feet of soil cover will be placed over the stockpiles and out-slopes. The cover will promote evapotranspiration, further reduce infiltration and facilitate re-vegetation. NMCC believes that the steps described above contribute significantly to protection of groundwater.

V. 20.6.7.11J.(2) DESCRIPTION OF PROPOSED SLAG

New Mexico Copper does not propose to produce slag at the Copper Flat project inasmuch as the proposed facility does not include a smelter.

20.6.7.11.J.(3) *a description of each existing or proposed open pit and underground mine within the proposed copper mine facility and information about its location, depth, size, and acreage;*

DESCRIPTION OF THE OPEN PIT MINE FACILITY

NMCC proposes to construct an open pit mine at its Copper Flat project. This new facility will entail the expansion of an existing open pit previously developed and operated for a short time in 1982 by Quintana Minerals. A portion of the ore body at Copper Flat is exposed at and near the surface and will be mined by conventional truck and shovel open pit methods.

Existing Open Pit

NMCC's Copper Flat mine facility will expand the existing open pit shown in Figure 11J-2. Quintana Minerals created this existing open pit in 1982 when they brought the property into production as an open pit mine and mineral processing plant. The initial mine excavation needed to expose the ore body occurred during the four- to six-month period immediately preceding startup of the mineral processing plant. Following startup of processing, the open pit and processing plant were in commercial production for three and a half months. At that time, all operations were halted due to a significant decline in copper prices. Approximately 3 million tons of overburden material and 1.2 million tons of ore were mined from the open pit by Quintana. No mining has occurred at this open pit since 1982.

The location of the open pit is shown on Figures 11J-1 and 11J-3, provided herein in response to **20.6.7.11.J.(1).** The floor of the existing pit is 5,400 feet above sea level, which is approximately 100 feet beneath the original pre-mining ground surface. The existing open pit encompasses approximately 102 acres. A 5.2-acre lake is located in the existing pit. The depth of the pit lake water is approximately 35 - 40 feet. The existing pit lake contains approximately 20 to 28 million gallons (61 to 86 AF) of water.

Proposed Open Pit

NMCC's proposed open pit will be created through the expansion of the existing open pit. A multiple bench, open pit mining method will be used to mine the Copper Flat ore body. Figures 11J-4 through 11J-15 depict the expansion of the pit over time. Over the 11-year life of the proposed project, approximately 125 million tons of copper ore and 33 million tons of waste rock will be mined and removed from the open pit. The proposed mining activities will enlarge the open pit over time to a diameter of approximately 2,800 feet. In accordance with **20.6.7.24.A**, **REQUIREMENTS FOR OPEN PITS,** the open pit will remain within the area identified in the discharge permit. The floor of the proposed open pit will reach a depth of approximately 4,650 feet above sea level, which will be approximately 900 feet beneath the original pre-mining ground surface. The area of the pit will be expanded to approximately 161 acres. The existing diversions of Grayback Arroyo constructed by Quintana during its operation of the mine will not be altered by the proposed pit expansion. No underground mining is proposed.

Ore material from the pit will be drilled and blasted, loaded, and hauled to the primary crusher and then conveyed to the mill as described below. Waste rock will be placed in designated stockpile areas as described earlier herein.

MINE OPERATION WATER MANAGEMENT PLAN

This Mine Operation Water Management Plan is submitted in accordance with **20.6.7.24.C** of the Copper Rule. Water use and water conversation are amongst the most important aspects of operating a copper mine after employee safety and protection of human health and the environment. The water demands for the Copper Flat operation are such that it is very important that all water conservation measures possible are taken to maximize water harvesting and recycling of water wherever possible.

On average, approximately 13,000 gpm of water will be required to operate the facility. The source of water will come largely from recycling approximately 9,200 gpm from the tailings storage facility. The remaining made-up water will come from an off-site well field and whenever possible, make-up water provided from capture and management of surface water runoff.

Appendix A contains the detail design of the Copper Flat tailings storage facility water recycling system which includes a water reclamation barge and an underdrain collection system. The water reclaim barge located within the water pond of the tailings impoundment will be equipped with pumps that will pump free water back to the process circuit for reuse in the process. The barge pumps will operate 24 hours per day continuously providing the greatest majority of the water required by the process at a design capacity of 13,000 gpm, though as noted above, the average rate of pumping will be 9,200 gpm.

In addition, as indicated, the tailings facility will be equipped with an underdrain collection system that will allow water to drain from bottom of the tailings impoundment and from underneath the dam. This underflow water will be captured in an underdrain collection pond located at the outside toe of the tailings impoundment. In addition to the water harvested by the tailings underdrain system, precipitation that falls on the outer surface of the tailings dam will also captured by lined runoff collection galleries or trenches that will divert the water to the underdrain collection pond. The underdrain collection pond will be equipped with a pump station capable of pumping a design capacity of 4,000 gpm, though the average rate of pumping is anticipated to be approximately 1,700 gpm.

The water from the TSF water recycling system will be transported via a pipeline to the process water reservoir where it will be held for introduction to the process. The pipeline from the TSF recycling system will be placed within a trench that is lined for secondary containment such that any leaks that may occur in the line will be transported back either to the underdrain collection pond or the tailings impoundment, thus minimizing potential loss of water.

In addition to the water tailings storage facility recycling system, NMCC will harvest as much runoff water as possible. Section **20.6.7.11.J.(2)**, above, describes the various impacted storm water collection impoundments proposed at Copper Flat. These impoundments are designed to maximize the capture and retention of runoff through trenches and ponds. Water captured in these impoundments will be retained for less than thirty day before being evacuated to the process water reservoir. While the amount of water harvested from these areas is entirely dependent upon the amount of precipitation received, any water captured and utilized in the process represents an amount less that has to be produced from the freshwater wells.

Water that is captured within the crushing, grinding and process area sumps will all be routed back to the into the process as described in more detail in section **20.6.7.11.J.(5).** Water produced from the packaged wastewater treatment plant will be piped to the tailings storage facility and become subject to recycling at the point.

Approximately 73 percent of the water required for processing ore will be provided by recycling water back from the TSF through the designed water collection and recycle system described above. Approximately 23 percent of the water used for processing ore will remain entrained within the tailings. The remaining 4 percent will be lost to evaporation or as moisture in the product concentrates. The amount of water in the concentrates will be less than 1 percent of the total water used for processing ore. Table 11J-2 lists the amount of water required for processing ore as well as the amount that would result from collection and recycle from the TSF.

TABLE 11J-2
Ore Processing Water Use and Recycling

Water Use	Acre-Ft per Year			Percent of Total
	Recycled	Non-recycled	Total	
Ore Processing:				
Reclaimable TSF water	15,504	0	15,504	73%
Water retained in tailings	0	4,973	4,973	23%
Evaporation	0	752	752	4%
Concentrates	0	13	13	<1%
Ore Processing Total	**15,504**	**5,738**	**21,242**	**100%**

It is NMCC's goal to maximize the use of recycled and harvested water and minimize its waste. As such all of the water impoundments, except the mine pit, including the tailings storage facility, underdrain collection pond, storm water impoundments, process water reservoir, and the surge pond will be lined to minimize the loss of water. However, even while maximizing water recycle, there will be some water loss, mainly to entrained water in the tailings themselves, some to evaporation, and a small amount entrained in the product. As such, there will be some make-up water required to be provided by the off-site well field. NMCC hopes to keep the use of freshwater to a minimum.

Pit dewatering

Dewatering of the mine pit and the pit lake will be necessary prior to mining and continuously throughout the life of the mine. The water contained in the pit lake prior to operations will be used for dust control during construction and operations. NMCC understands that use of the water produced from the mine pit must meet NMCC water quality standards if it is to be used for dust control purposes at locations outside of the OPSDA. NMCC will utilize all of the water produced from the open pit during operations for dust suppression on the haul roads, working areas, and waste rock stockpiles only within the OPSDA. NMCC will also utilize excess water from the OPSDA as an additional source of process water whenever possible. NMCC will utilize water produced from the mine pit for dust suppression outside of the OPSDA only if the quality of water meets limits placed on the discharge permit.

NMCC anticipates that during operations, groundwater will continue to seep into the pit at an annual average rate of approximately 24 gpm (39 AFY). In addition, storm water runoff will contribute an average of approximately 68 AFY to the pit. Water removal from the pit will continue over the operational life of the mine through a sump or series of sumps located within the pit. Water removal will end once mining of the pit is completed.

20.6.7.11.J.(4) *a description of each existing or proposed material handling and processing unit including crushing, milling, concentrating, smelting and SX/EW units within the copper mine facility, and information about its location and proposed methods of process water handling and disposal;*

DESCRIPTION OF PROPOSED MATERIAL HANDLING AND PROCESSING

The ore processing facilities will be constructed at the site of the original Quintana Minerals processing plant site which is located southeast of the existing open pit as shown in Figure 11J-1, provided herein in response to **20.6.7.11.J.(1)**. Ore processing will consist of a conventional sulfide flotation plant to extract copper, a molybdenum processing circuit, and a gravity gold recovery circuit. No smelting, refining or SX/EW operations will be conducted at the Copper Flat site. The plant will produce copper and molybdenum concentrates as well as a small amount of coarse gold concentrate. Figure 11J-16 is a conceptual flow diagram of the process. Figures 11J-17, 18, 19 and 20 are preliminary isometric drawings that provide an overview of the process area to aid the reader in visualizing how the ore is processed. As discussed in more detail in Section **20.6.7.11.J.(5),** all of the processing units are in containment designed to capture operational spills.

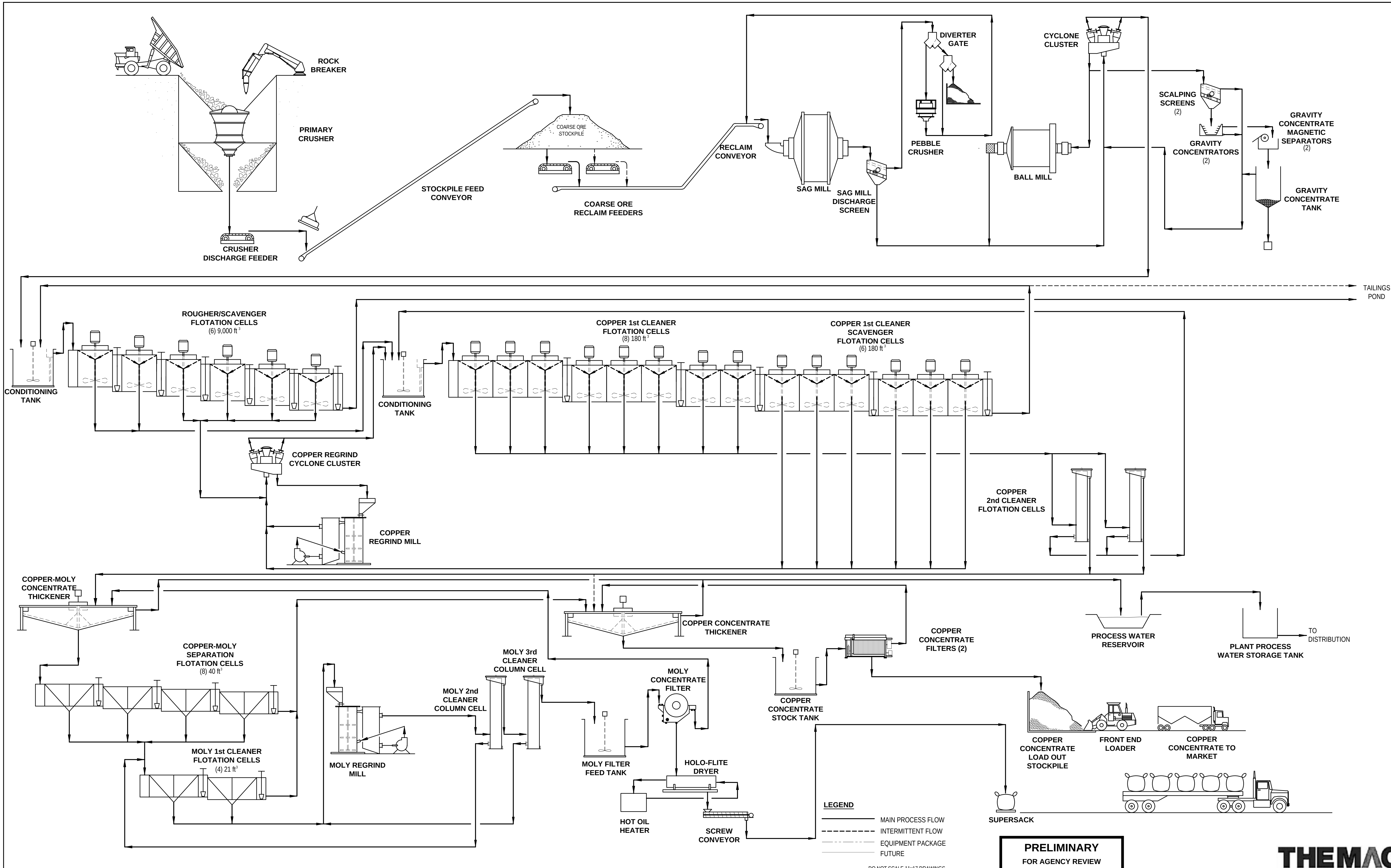
The ore will be crushed and ground to a fine particle size and then processed through mineral flotation circuits. Ore processing activities will continue 24 hours per day, seven days per week, 365 days per year. The plant will process approximately 11 million tons per year at an average rate of 30,000 tons per day or over the life of the project. The major equipment for the mineral processing plant will consist of the following:

Primary Crushing and Coarse Ore Stockpile:

- One 42- x 65-inch gyratory crusher;
- One crusher discharge feeder;
- One 48-inch x 454-foot-long stockpile feed conveyor with stacker;
- Two coarse ore reclaim feeders; and
- One 48 inch X 470-foot-long reclaim conveyor.

Crushing and Grinding:

- One 32-foot-diameter x 14-foot-long SAG mill, 11,000 horsepower;
- One 12X16-foot double deck SAG mill discharge vibrating screen;
- One 4.5-foot cone crusher, 300 horsepower (pebble crusher);
- One 24-foot-diameter X 35 foot-long ball mill, 1500 horsepower;
- One primary cyclone cluster with eight 33-inch-diameter cyclones; and
- Two gravity gold concentrators with scalping screens.



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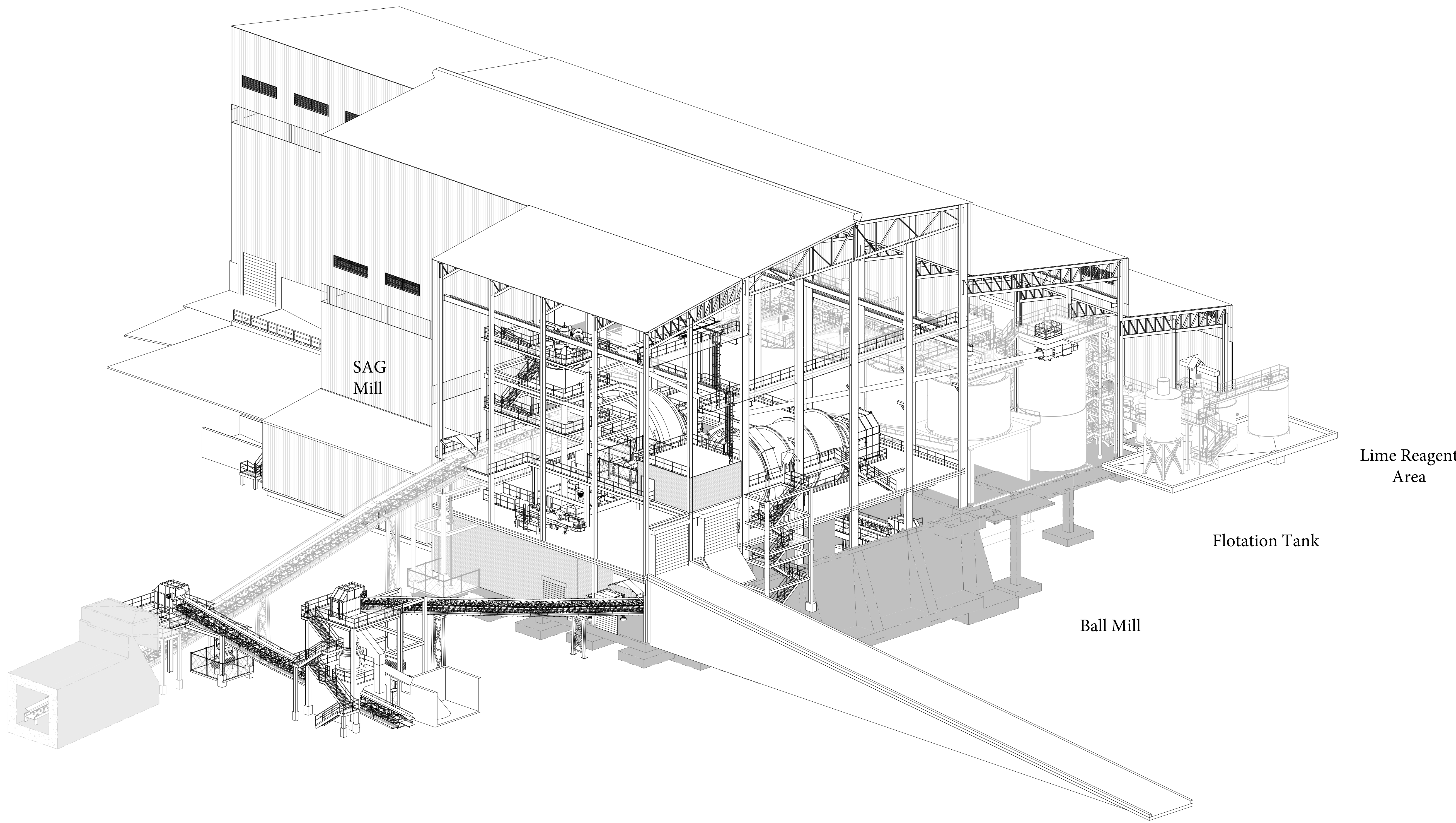
COPPER FLAT PROJECT

PROCESSING PLANT OVERALL FLOW SHEET 30,000 TPD CONVENTIONAL TAILINGS

JOB NO. M3 PN-120085

DWG NO. FIGURE 11J-16

REV NO. P6 DATE 18 MAR 13



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COPPER FLAT PROJECT

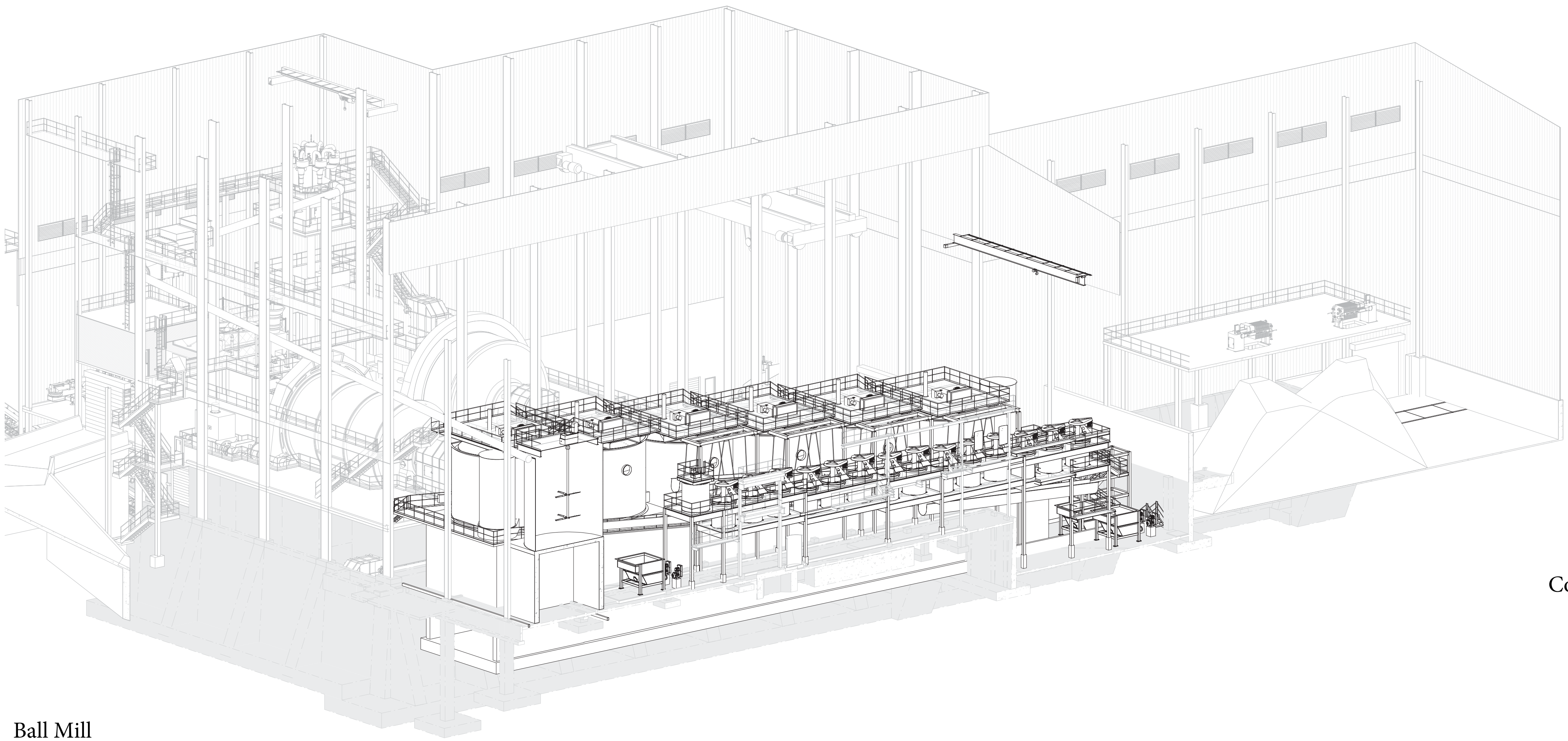
GRINDING GENERAL ARRANGEMENT CONCENTRATOR ISOMETRIC

PROJECT NO. M3-PN120085

DWG NO. **3015-GA-000**

REV NO. P2 DATE 26 MAR 13

Figure 11J-17



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FLOTATION GENERAL ARRANGEMENT CONCENTRATOR ISOMETRIC

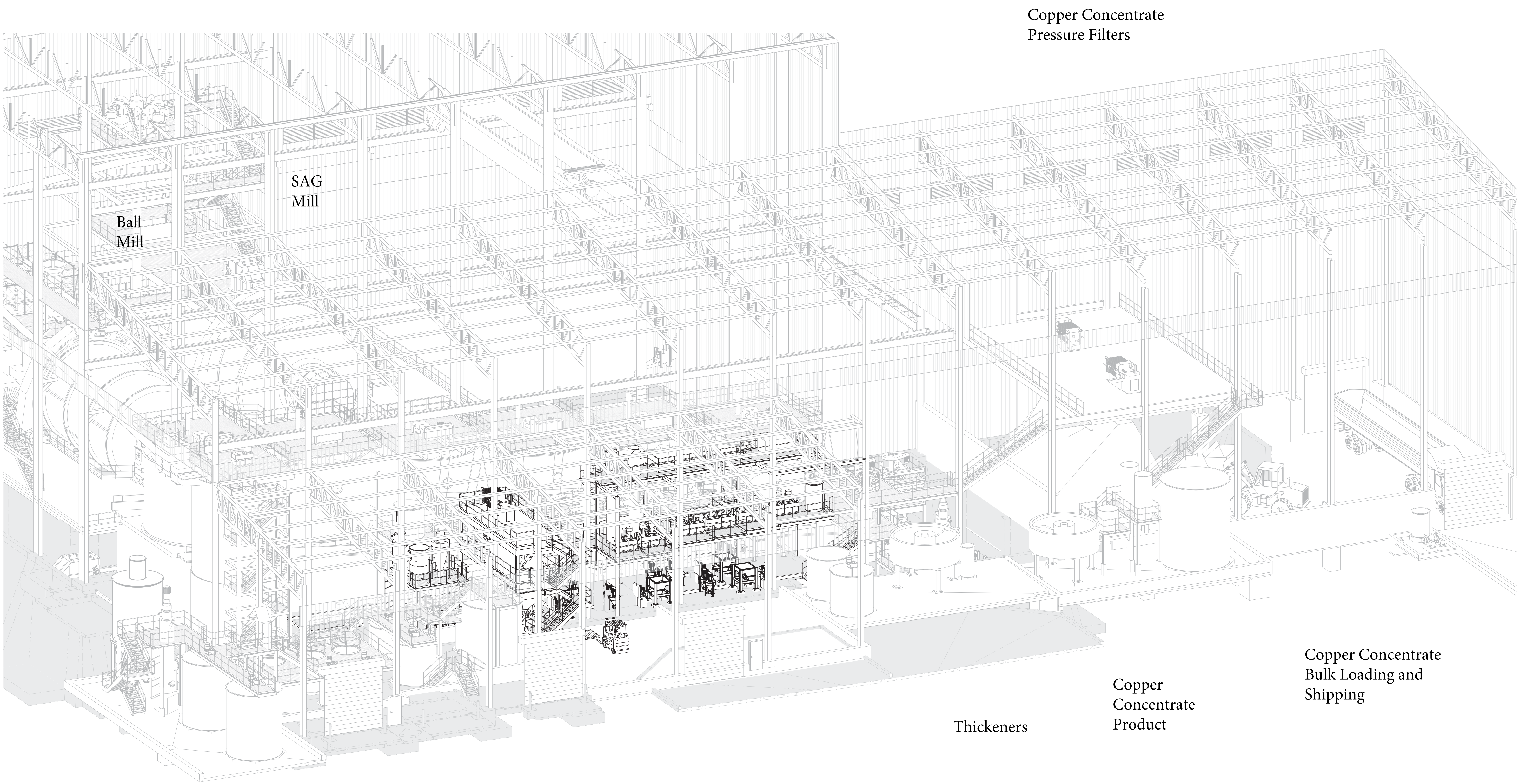
PROJECT NO. M3-PN120085

DWG NO. 3016-GA-000

REV NO. P3

DATE 06 MAY 13

Figure 11J-18



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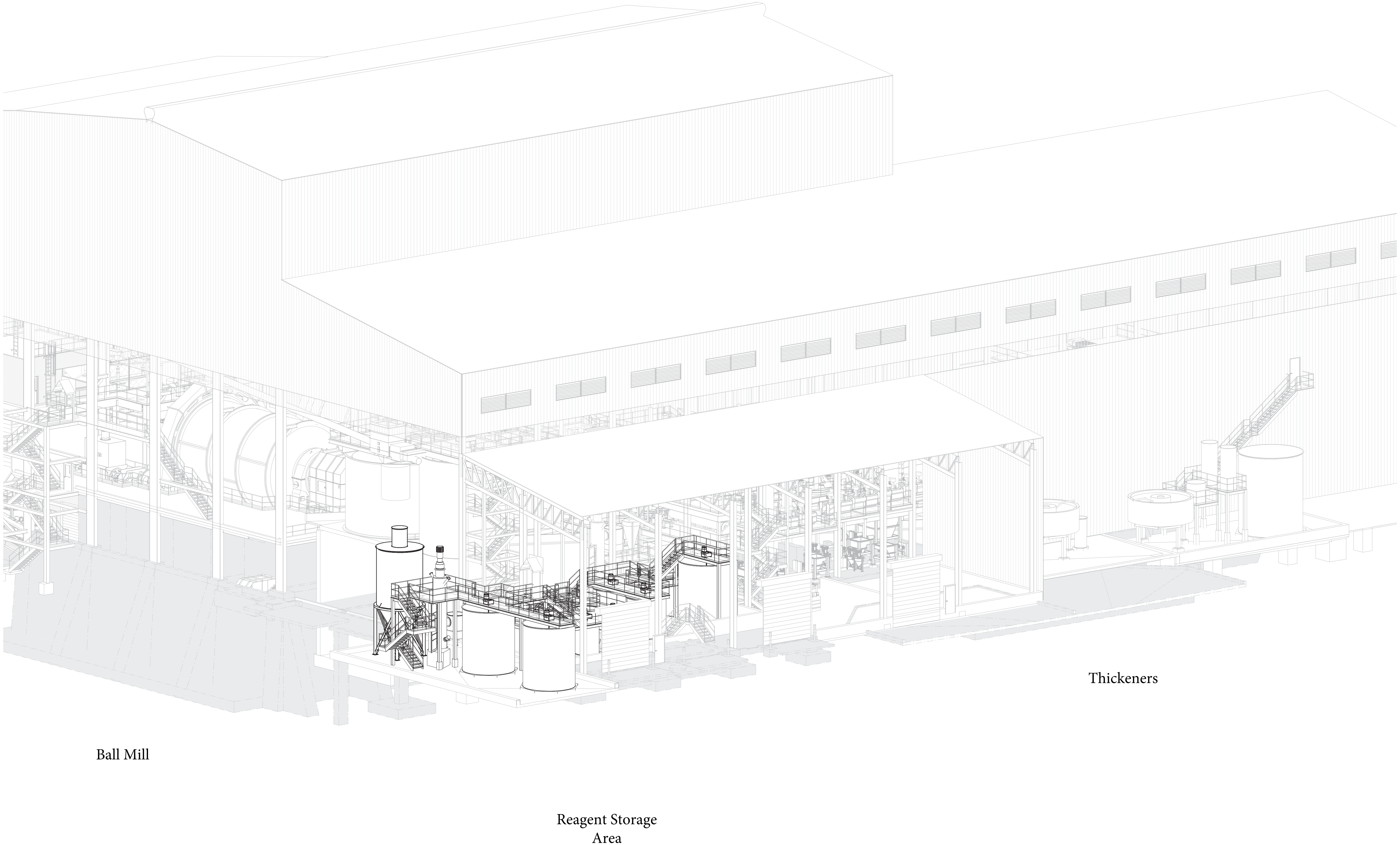
COPPER FLAT PROJECT

MOLY PROCESS GENERAL ARRANGEMENT CONCENTRATOR ISOMETRIC

PROJECT NO. M3-PN120085	
DWG NO. 3017-GA-000	
REV NO. P2	DATE 26 MAR 13

Figure 11J-19



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THEMAC RESOURCES

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COPPER FLAT PROJECT

REAGENTS GENERAL ARRANGEMENT CONCENTRATOR ISOMETRIC

PROJECT NO. M3-PN120085
DWG NO. 3014-GA-000
REV NO. P2
DATE 26 MAR 13

Figure 11J-20

Flotation and Concentration:

- Six 9,000-ft^3 bulk rougher flotation machines (copper/moly);
- Fourteen 180-ft^3 cleaner flotation machines (copper);
- Two 800-ft^3 column flotation machines (copper);
- Eight 25-ft^3 separation flotation machines (moly);
- Four 10-ft^3 cleaner flotation machines (moly);
- Two 40-ft^3 column flotation machines (moly);
- One 16-foot-diameter bulk concentrate high rate thickener (copper/moly);
- One 16-foot-diameter concentrate high rate thickener (copper);
- Two automatic filter presses (copper); and
- One 4-dstph disk filter (moly).

Primary Crushing and Coarse Ore Stockpile Facilities

As shown on Figure 11J-16, ore will be hauled from open pit in trucks and fed to the primary crusher for the first stage of crushing. The crusher will size the run-of-mine rock to a nominal 8 inches in diameter or less. The crushed rock will be fed by an apron feeder onto the stockpile feed belt conveyor for transport to the coarse ore stockpile where it will be temporary stored prior to being fed into to the grinding mill. The belt conveyor will include a stacker for placing the coarse ore into the stockpile as seen on Figure 11J-16. The coarse ore stockpile will have a maximum capacity of 75,000 tons.

Ore will be fed from the coarse ore stockpile through the reclaim tunnel located beneath the stockpile onto a conveyor system to feed the SAG mill in the grinding circuit. The conveyor system will be equipped with two variable speed apron feeders that will feed the reclaim conveyor.

Ore handled through this part of the process will be relatively dry. Water associated with this part of the process will include:

- Moisture associated with the ore;
- Water spray used to control dust within the primary crusher pocket and at the stockpile feed stacker; and
- Water used for housekeeping purposes.

The primary crusher and the coarse ore reclaim equipment will be located below ground level in reinforced concrete structures. These concrete structures are existing structures from the Quintana operation and have concrete sumps built into the structures to contain excess water. Water collected in these sumps will be reused within the ore processing circuit via a pumping and recycling system that will be installed during the construction phase of the project. Water used for housekeeping purposes will be confined to use within the concrete structures where it will be contained and recycled via the sump collection and recycle system.

Water spray used for dust control at the stockpile feed stacker will be exterior to the concrete structures. The sprays will only be used when necessary to control dust and will be controlled to minimize excess moisture. During normal operations, water from these sprays will evaporate once the ore reaches the coarse ore stockpile. In the event of an upset condition, any excess water from these sprays will be contained similarly to storm water runoff from this area.

Crushing and Grinding

Ore from the coarse ore stockpile fed through the reclaim tunnel as shown on Figure 11J-17 to the SAG mill will be ground up as a result of impact between the rock entering the mill and five-inch steel grinding balls fed to the mill along with the rock. The walls of the building have been removed in this drawing to allow a view of the equipment and interior.

Material handling from this point in the process will become a wet process as water and various reagents will be added to the SAG mill feed to start the conditioning of the ore pulp for subsequent stages of treatment. Rock from the SAG mill will discharge onto the double-deck SAG mill discharge vibrating screen for sizing.

The double-deck vibrating screen will size the rock in the following manner:

- Rock staying on top of the upper screen deck (oversize) will be taken by belt conveyor to the cone crusher (pebble crusher) where it will be crushed to less than 0.75-inch diameter and returned by belt conveyor to the SAG mill.
- Rock passing through the upper screen deck but not passing through the bottom screen deck will return directly to the SAG mill by conveyors for further crushing and grinding.
- Rock passing through both screen decks will travel to the cyclone feed sump for additional sizing.

Rock collected at the cyclone feed sump will be pumped to the primary cyclone cluster where the eight cyclones will be used to separate the finer ground material (overflow slurry) from the more coarse material (underflow slurry). The overflow slurry will be sent to the first stage of flotation. Most of the underflow slurry will return to the ball mill for further grinding, but a portion of the underflow will be taken through a Knelson-type gravity concentrator circuit to collect gravity recoverable gold. The gravity separation circuit will consist of two concentrators each of which will have an upstream scalping screen to remove oversize material. The gravity concentrates will pass through magnetic separators for removal of tramp iron, i.e., steel introduced from worn liners, and broken grinding media. The reject from the gravity concentrators will be pumped back to the cyclone feed sump.

The majority of this part of the process will be constructed on an existing Quintana foundation. This reinforced concrete foundation is constructed with stem walls and sloped to drain to internal sumps that will contain spills. Finer material and all solutions will be collected in the internal sumps and pumped to the cyclone feed sump for further processing. The cyclone feed sump will be a large reinforced concrete tank built on and attached to the foundation of the building. Coarser material will be collected in piles on the foundation floor and allowed to drain into the sump so that there is no free water associated with this material. Mobile equipment will be used to place the drained material in the coarse ore stockpile for reprocessing.

The pebble crusher will be located outside and adjacent to the existing Quintana foundation. The feed material for the pebble crusher will be large, free-draining, pebble-like material that will be free of water except for small amounts of residual surface moisture. This pebble crusher feed will be collected off the upper screen of the SAG mill discharge vibrating screen. This upper screen will have screen openings of approximately 0.75 inches or larger ensuring the dewatering of this material. Multiple inclined belt conveyors will be used to transport the feed from the SAG mill discharge screen to the pebble crusher.

Flotation and Concentration

Cyclone overflow slurry, which is the final product of the grinding circuit, will flow by gravity to the rougher flotation conditioning tank located ahead of the rougher flotation cells. The overflow slurry will be sampled and analyzed for metallurgical control prior to flotation. The flotation process begins when the cyclone overflow enters from the conditioning tank to the first in a series of six flotation cells (see Figure 11J-17 and 18). Flotation reagents will be added to the overflow and the tanks agitated, creating forth or bubbles, which will allow the reagents to react with the ore particles. Molybdenum and Copper-bearing sulfide mineral particles will concentrate and adhere to bubbles created by the induced air and frothing agents. The copper/molybdenum concentrate will be floated off and concentrated through a series of flotation cells. Cyclones and a regrind mill will be used for further cleaning and concentration.

The final underflow from the flotation process will be a tailings and water mixture, i.e., whole tailings that will be transported to the TSF via pipeline. The final overflow of the flotation process will be a wet copper/molybdenum concentrate mixture that will report to the copper/molybdenum concentrate thickener. The copper/molybdenum concentrate thickener will be used to dewater the concentrate prior to separating the molybdenum concentrate from the copper concentrate. The overflow of the copper/molybdenum concentrate thickener (primarily process water) will be pumped via pipeline to the process water reservoir located near the plant. The underflow (a dewatered copper/molybdenum concentrate mixture) will report to the molybdenum plant.

Flotation cells within the molybdenum plant will be used to separate the molybdenum concentrate from the copper concentrate. Reagents will be added to cause the copper minerals to remain in solution while the molybdenum minerals will adhere to bubbles and float to the top of the flotation solution. Once floated, the wet molybdenum concentrate will be collected and further cleaned and concentrated using a regrind mill and column flotation cells. The molybdenum concentrate will then be dewatered, dried, and packaged. Dewatering will be accomplished with disk filters. Filtrate from the filters will be returned to the copper/molybdenum concentrate thickener. Drying will be accomplished with a hydro-flite dryer, which will use heat to evaporate excess water in the molybdenum concentrate. The molybdenum concentrate will be packaged for transport to off-site facilities for further processing. The packaging area is located generally in the area shown on Figure 11J-19 in front of the forklift shown in the figure. The molybdenum concentrate will be approximately 50% molybdenum sulfide.

The underflow from the molybdenum flotation plant will be a wet copper concentrate. The copper concentrate will be dewatered in the copper concentrate thickener. Overflow from the copper concentrate thickener (primarily process water) will be pumped to the process water reservoir. The underflow from the copper concentrate thickener (dewatered copper concentrate) will report to pressure filters for further dewatering. Filtrate from the pressure filters will be collected and returned to the copper concentrate thickener. Once pressure filtered, the copper concentrate will be stored for transport to off-site smelting and refining facilities. The copper concentrate will average approximately 28% copper.

The flotation and concentration processes will be contained within a structure utilizing a reinforced concrete foundation and floor with sumps incorporated into the floor. Spillage caused by any upset event will be contained within the foundation area, collected in sumps and reintroduced into the process.

Process Water Handling and Disposal

All water used in the processing of ore will be either be contained within the ore processing circuit, discharged into a lined impoundment (TSF), or be in the copper and molybdenum concentrates as moisture content. The Mine Operation Water Management Plan provided above in Section **20.6.7.11.J.(3)** provides more detailed on water handling and disposal.

The plant water system will consist of a lined process water reservoir and a plant process water storage tank. Both will be located near the plant site. Water will be delivered to the reservoir via pipelines. Water reporting to the reservoir includes the following:

- Recycled process water from the TSF;
- Copper/molybdenum concentrate thickener and copper concentrate thickener overflows;
- Storm water from the Impacted storm water impoundments; and
- Makeup water from the fresh water tank (water from the well field).

Water from the process water reservoir will be pumped to the plant process water tank. The tank will deliver water the processing areas for use as needed a via gravity-flow pipeline. As indicated above, in Table 11J-1, approximately 73 percent of the water required for processing ore will be provided by recycling water back from the TSF through the designed water collection and recycle system described above. Approximately 23 percent of the water used for processing ore will remain entrained within the tailings. The remaining 4 percent will be lost to evaporation or as moisture in the concentrates. The amount of water in the concentrates will be less than 1 percent of the total water used for processing ore.

20.6.7.11.J.(5) *a description of existing or proposed sumps, tanks, pipelines and truck and equipment wash units, including information for each unit regarding its location, purpose, construction material, dimensions and capacity; for portable tanks or pipelines or those subject to periodic relocation, identify the areas within which they may be used;*

DESCRIPTION OF SUMPS, TANKS, PIPELINES and TRUCK and EQUIPMENT WASH UNITS

Figures 11J-20A and 11J-20B are scaled maps that display the location of proposed pipelines. Table11J-5 provides information describing the location of each pipeline and providing information regarding the purpose, construction materials, dimension and capacity of each pipeline. This information supplements the Process Facility Containment Report prepared by M3 that provides the sump, tank, pipeline and truck and equipment wash unit information requested. The report is included in this DP application as Appendix C. The purpose of this report is, in part, to identify and describe the proposed sumps, tanks, pipelines and truck and wash units, including their purpose, construction material, dimensions and capacity. This report also provides information regarding the form and design of the containment structures that will be incorporated into the process to contain and manage materials containing water contaminants that have the potential to migrate to groundwater and cause and exceedance of applicable groundwater standards and meet the requirements of **20.6.7.22**, **23 and 26 NMAC**.

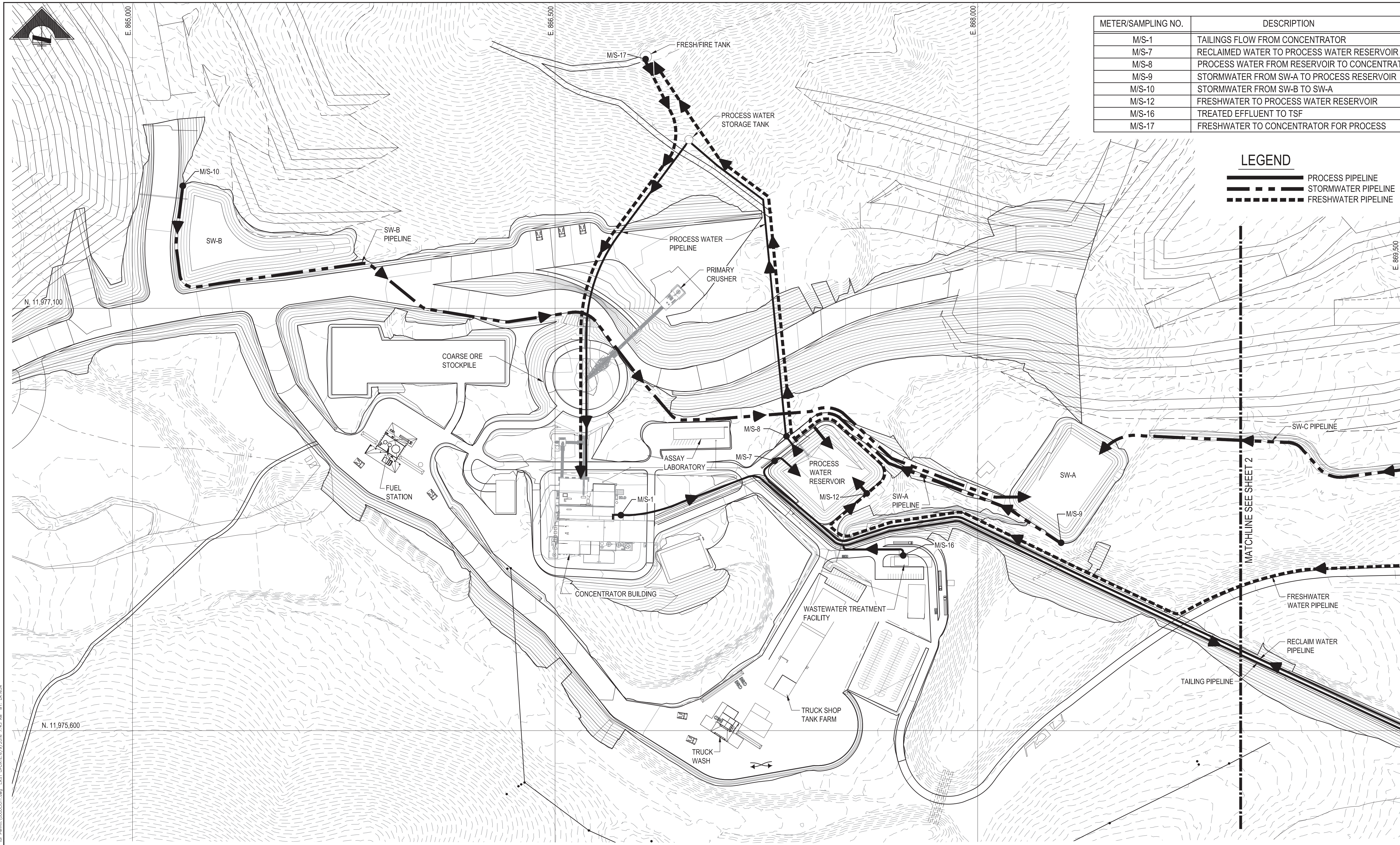
Drawing no. 0000-CI-008 in Appendix C is a scaled map of the location of the various process facility containment areas. Drawing no. 0000-GA-050 is a scaled map of the concentrator area identifying the containment arrangement for all of the process tanks, including the locations of the sumps and tanks. Drawing no. 1010-AR-012 is a scaled map of the truck shop tank farm showing the location of the tanks and sump. Drawing no. 1010-GA-010 is a scaled map of the fuel station showing the location of the tanks and sumps. Drawing no. 1010-GA-001 is a scaled drawing showing the location of the Truck Wash and its sumps or settling tanks.

With respect to the requirements of **20.6.7.23.C.(6)** for a pipeline evaluation plan for existing pipelines, NMCC will not be utilizing any existing pipelines at the Copper Flat mine with the exception of the freshwater pipeline providing water from the off-site well field. As such not pipeline evaluation plan is necessary.

METER/SAMPLING NO.	DESCRIPTION
M/S-1	TAILINGS FLOW FROM CONCENTRATOR
M/S-7	RECLAIMED WATER TO PROCESS WATER RESERVOIR
M/S-8	PROCESS WATER FROM RESERVOIR TO CONCENTRATOR
M/S-9	STORMWATER FROM SW-A TO PROCESS RESERVOIR
M/S-10	STORMWATER FROM SW-B TO SW-A
M/S-12	FRESHWATER TO PROCESS WATER RESERVOIR
M/S-16	TREATED EFFLUENT TO TSF
M/S-17	FRESHWATER TO CONCENTRATOR FOR PROCESS

LEGEND

- PROCESS PIPELINE
- STORMWATER PIPELINE
- FRESHWATER PIPELINE



SITE PLAN

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SITE GENERAL
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PIPELINES AND FLOWMETER LOCATIONS
SHEET 1

JOB NO. M3 PN-120085
DWG NO. **Figure 11J-20A**
REV NO. P2 — DATE 09 JUN 16

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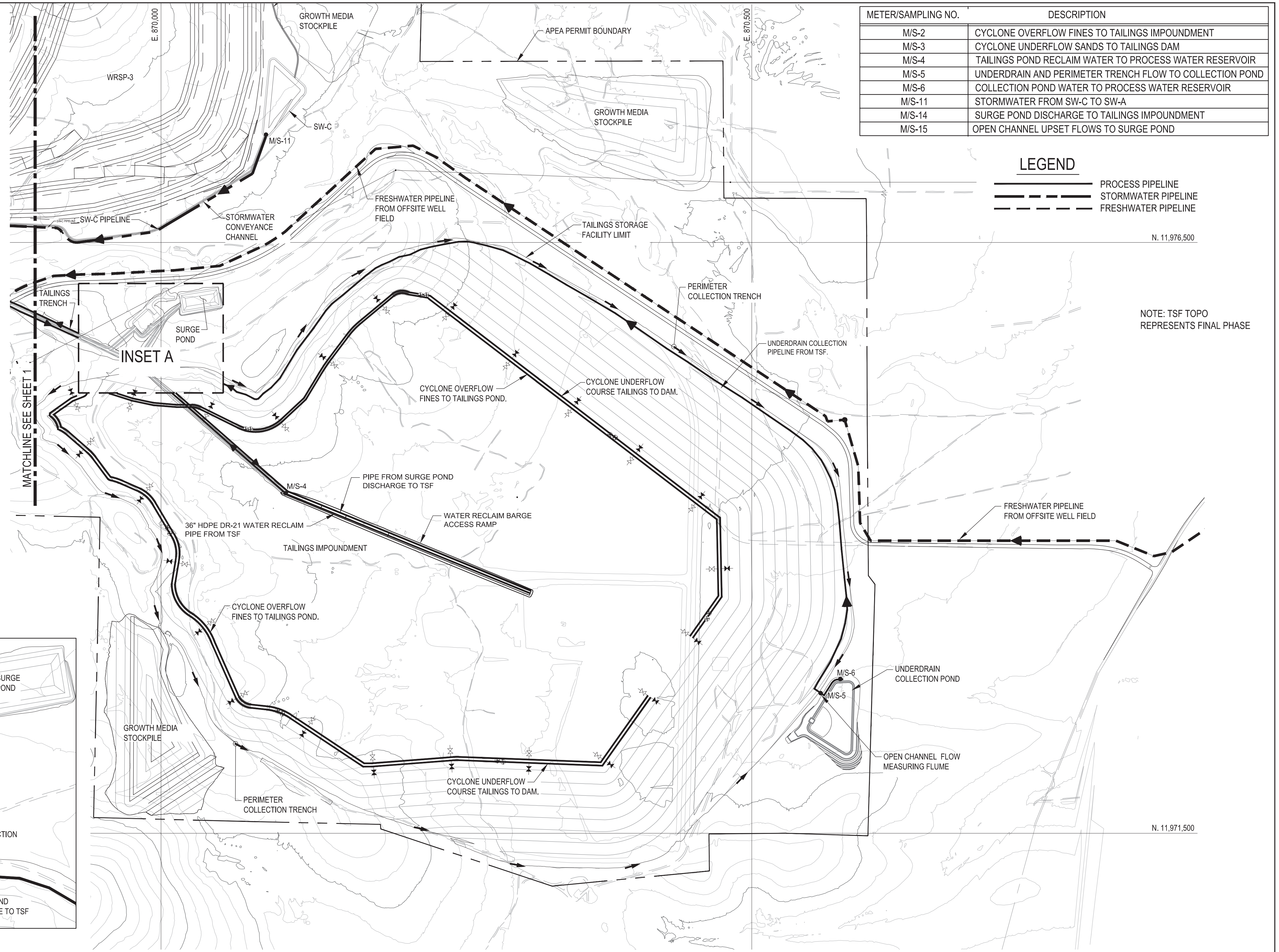
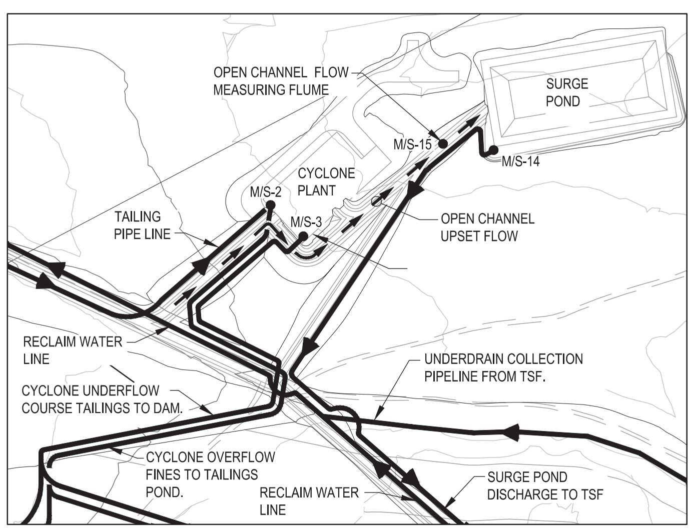
METER/SAMPLING NO.	DESCRIPTION
M/S-2	CYCLONE OVERFLOW FINES TO TAILINGS IMPOUNDMENT
M/S-3	CYCLONE UNDERFLOW SANDS TO TAILINGS DAM
M/S-4	TAILINGS POND RECLAIM WATER TO PROCESS WATER RESERVOIR
M/S-5	UNDERDRAIN AND PERIMETER TRENCH FLOW TO COLLECTION POND
M/S-6	COLLECTION POND WATER TO PROCESS WATER RESERVOIR
M/S-11	STORMWATER FROM SW-C TO SW-A
M/S-14	SURGE POND DISCHARGE TO TAILINGS IMPOUNDMENT
M/S-15	OPEN CHANNEL UPSET FLOWS TO SURGE POND

LEGEND

- PROCESS PIPELINE
- STORMWATER PIPELINE
- FRESHWATER PIPELINE

NOTE: TSF TOPO REPRESENTS FINAL PHASE





INSET A

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SITE PLAN

400 200 0 400 800 SCALE IN FEET

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COPPER FLAT PROJECT

SITE GENERAL
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SHEET 2

JOB NO. M3 PN-120085
DWG NO. Figure 11J-20B
REV NO. P2
DATE 09 JUN 16

TABLE 11J-3
PROCESS & IMPACTED STORM WATER PIPELINE DETAILS

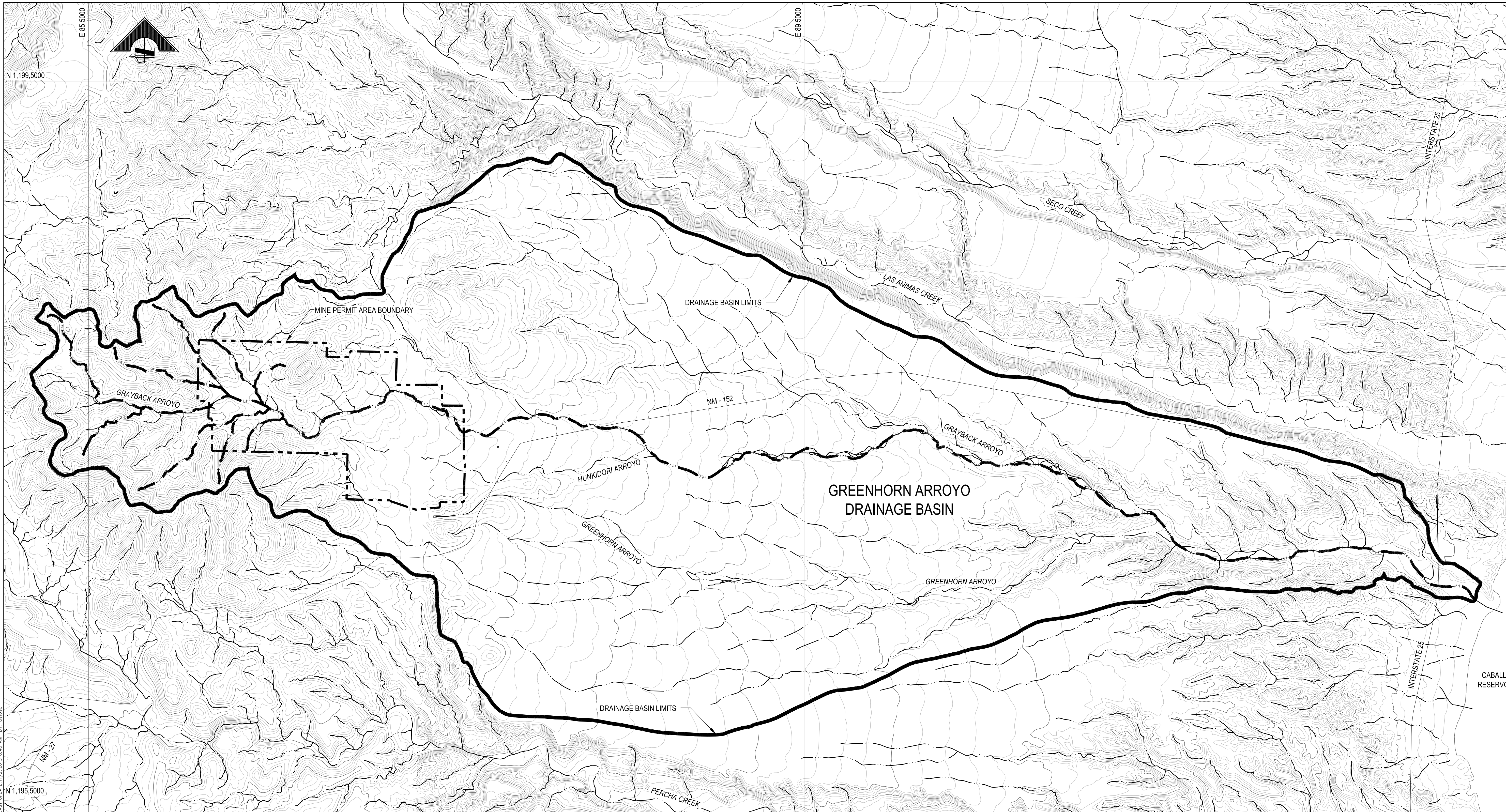
Description	Location	Purpose	Construction Material	Pipe Diameter	Pipe Capacity (gpm)
Whole Tailings Transport	Concentrator Bldg to Cyclone Plant	Transport tailings to TSF via Cyclone Plant	HDPE SDR 17	30 in.	15,000
TSF Barge Water Reclaim	TSFimpoudment to Process Water Reservoir	Transport reclaimed water for re-use in process	HDPE SDR 21	36 in.	13,000
Underdrain collection to reclaim	Underdrain collection pond to intersect and join TSF barge reclaim pipeline	Transport reclaimed water for re-use in process	HDPE SDR 21	20 in.	4,000
Cyclone Overflow	Cyclone Plant to TSF Impoundment	Transport tailings fines to TSF impoundment	HDPE SDR 17	30 in.	13,100
Cyclone Underflow	Cyclone Plant to TSF Dam	Transport tailings sands to TSF dam	HDPE SDR 9	12 in.	1,990
Surge Pond	Surge pond to TSF	Transport upset condition fluids to TSF impoundment	HDPE SDR 17	12 in.	2,000
Impacted Stormwater Impoundment C	Impoundment C to Impoundment A	Transport runoff water from WRSP-2 and 3 to Impoundment A	HDPE SDR 21	10 in.	2,000
Impacted Stormwater Impoundment B	Impoundment B to impoundment A	Transport runoff water from WRSP-1to impoundment A	HDPE SDR-21	6 in.	700
Impacted stormwater impoundment A	Impoundment A to Process Water Reservoir	Transport runoff water from plant area and impoundments B and C to Process water reservoir	HDPE SDR 21	12 in.	3,500
Process Water Reservoir	Process water reservoir to process water tank to concentrator bldg	Transport re-use water to process water tank	HDPE SDR 21	24 in.	15,000
Process Water Tank	Process Water Tank to Concentrator bldg..	Transport re-use water to Concentrator bldg..	HDPE SDR 21	30 in.	50.000
Wastewater treatment	Wastewater treatment plant to intersect with and tap into Tailings Transport pipeline	Transport and dispose of waste water from treatment plant	HDPE SDR 17	2 in.	50

20.6.7.11.J.(6) *a description of the proposed method(s) to manage stormwater runoff and run-on to minimize leachate that may be discharged;*

NMCC proposes to utilize some existing water diversion structures as discussed in more detail below and construct other storm water management structures to manage run-on and run-off at the Copper Flat mine to minimize the potential for the discharge of leachate. M3 performed a peak discharge and volume analysis of the drainage areas contributing to Grayback Arroyo at the site. The purpose of the analysis was to evaluate the existing diversions and water conveyance features existing at the Copper Flat site as their adequacy in conveying flows from storm events and protecting the site from flooding. The return periods analyzed were the 100-year, 200-year, and 500-year, 24 hour storms. The capability of certain existing culverts within Grayback Arroyo to safely pass those storms without overtopping the proposed facility roadway or pipeline corridor was also analyzed. Appendix D contains the results of the analysis. Following is a synopsis of the results.

Figure 11J-21 shows the location of the Copper Flat mine permit area boundary within the Greenhorn Arroyo drainage basin watershed. It shows the Greenhorn Arroyo watershed as it existed prior to any mining. As shown in Figure 11J-21, the site is located in the head of the basin. Figure 11J-22 provides a closer view of the headwater drainage of the watershed in relation to the mine permit area boundary. Grayback Arroyo and its tributaries naturally begin as the headwaters of the drainage basin and converge at the western side of the site, transecting the mine permit area draining from west to east. The main-stem of Grayback Arroyo enters the western boundary of the site and several small unnamed arroyos, tributary to Grayback Arroyo, enter the site at the northwest and southwest corners of the site. As seen on Figure 11J-21, Hunkidori Gulch begins at the western edge of the site down-gradient of the operations, and drains to the east away from the site. Greenhorn Arroyo begins off of the southeast corner of the site down-gradient from the operations and also drains east. Hunkidori and Greenhorn Arroyos have no impact upon the Copper Flat facility as they are located down-gradient of the mine. Only Grayback Arroyo and its unnamed arroyos, which enter the site from the west, need be the subject of consideration with respect to surface water run-on and runoff management.

Pre-production site preparation activities conducted by Quintana Minerals in the early 1980's included the construction of diversion structures to Grayback Arroyo and unnamed arroyos to divert drainage around the site. These structures are shown in Figure 11J-23. Diversion structures were constructed to divert the headwaters of Grayback arroyo and its western tributaries as they entered the western site boundary to the south and east around the mine pit and the processing area. Another diversion structure, similar in purpose but smaller in size, was constructed at the northwest corner of the site to divert drainage from two small tributaries to Grayback Arroyo, diverting them to the east around Animas Peak away from the site into a sub-watershed that joins Grayback Arroyo east of the of the site boundary.



LEGEND

DRAINAGE BASIN BOUNDARY	
MINE PROPERTY BOUNDARY	
GRAYBACK ARROYO	
FLOWLINE	

SITE PLAN

SCALE: 1" = 2500'

2500 1250 0 2500 5000

SCALE IN FEET
CONTOUR INTERVAL = 50'
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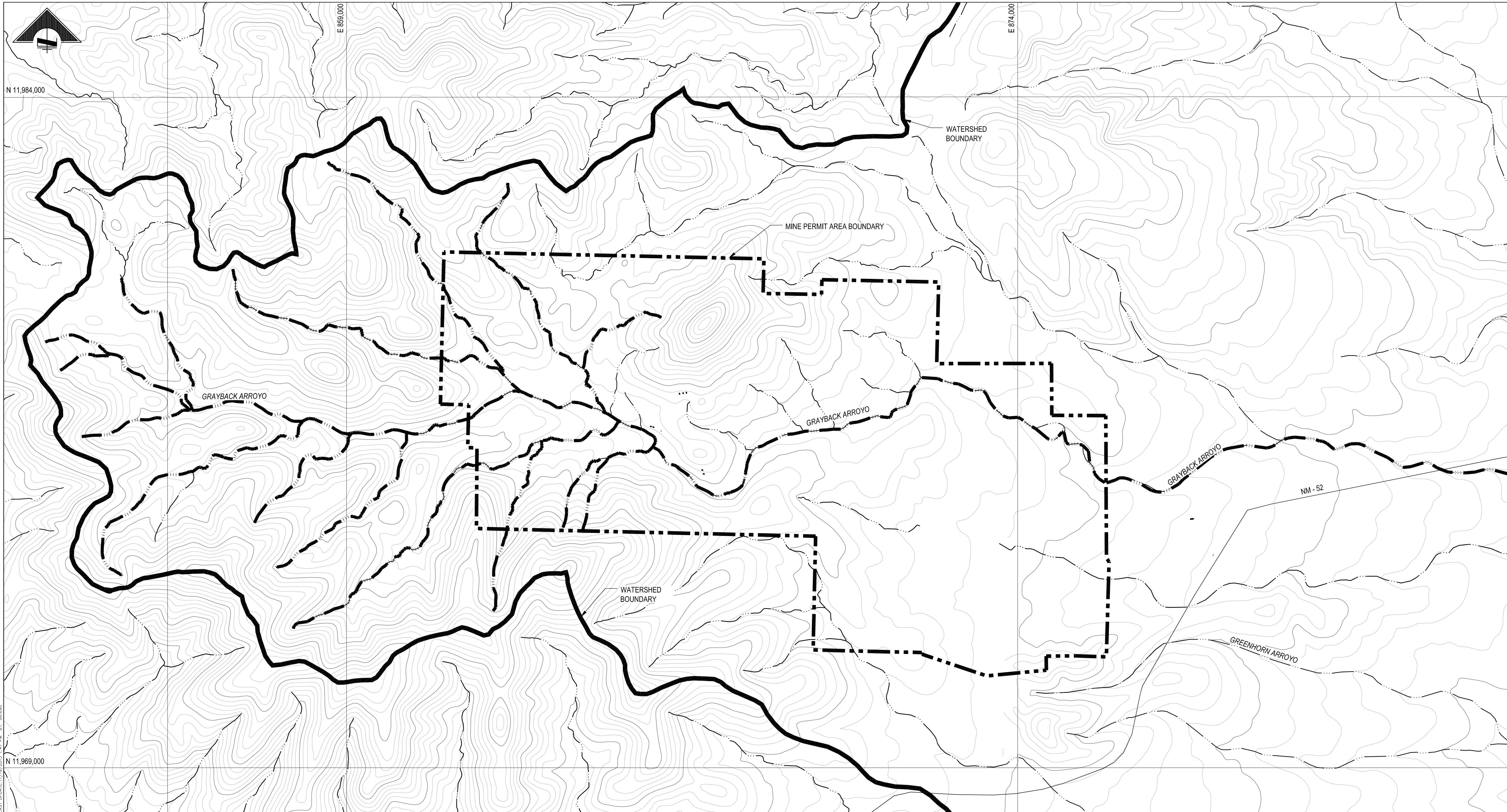
GENERAL SITE
CIVIL
GREENHORN ARROYO
PRE-MINING WATERSHED BASIN

JOB NO. M3 PN-120085
DWG NO. **0000-CI-100**
REV NO. P2 DATE 20 NOV 15

Figure 11J-21



LEGEND

DRAINAGE BASIN BOUNDARY	
MINE PROPERTY BOUNDARY	
GRAYBACK ARROYO	
FLOWLINE	

SITE PLAN

SCALE: 1" = 1000'

1000 500 0 1000 2000
SCALE IN FEET
CONTOUR INTERVAL = 20 FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 1000'		DATE
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DRAWN BY	JPN	OCT 15
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PROJECT MGR		
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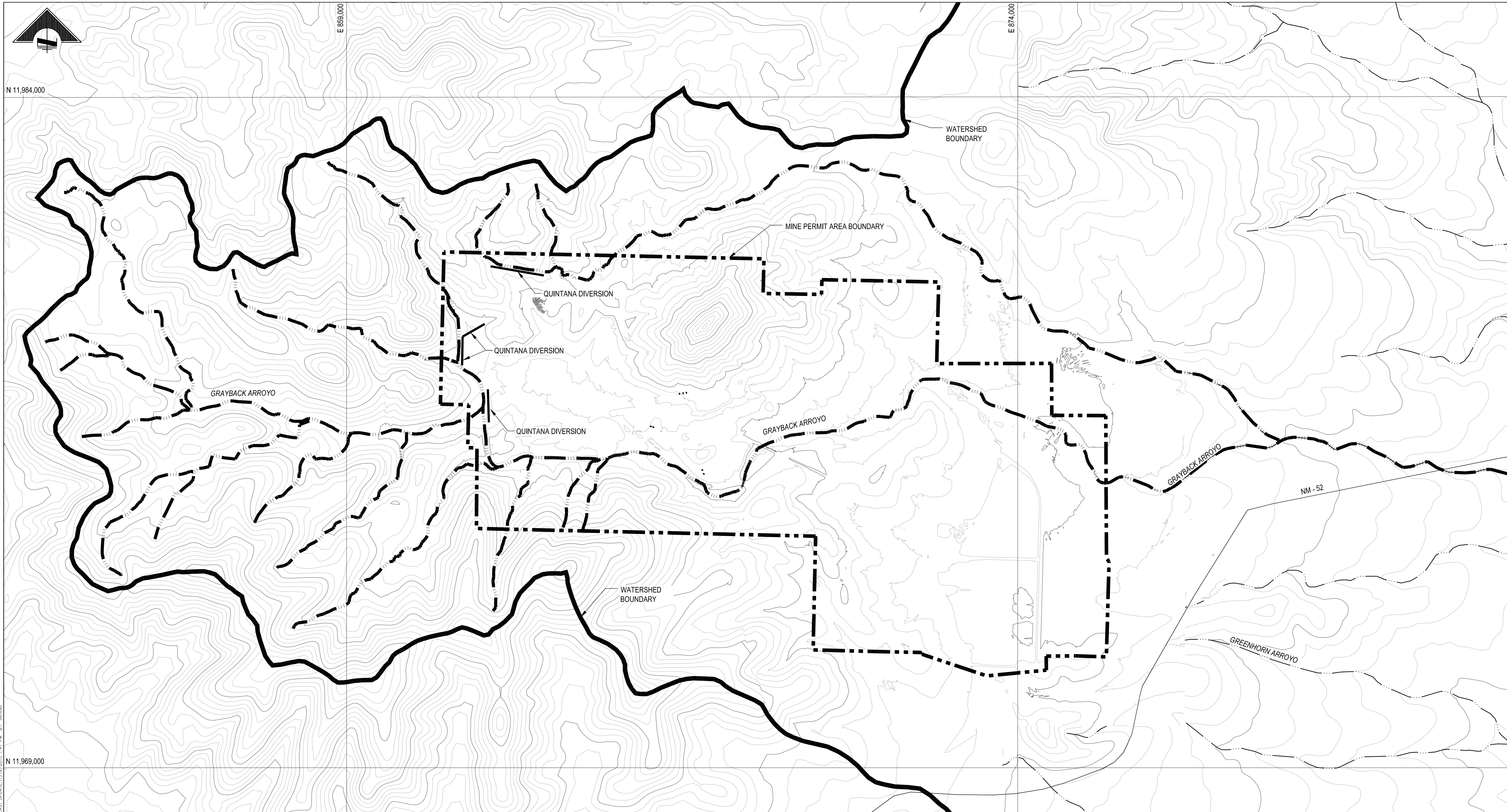
COPPER FLAT PROJECT

GENERAL SITE
COPPER FLAT SITE
EXISTING HYDROLOGY
PRE-QUINTANA MINING

JOB NO. M3 PN-120085
DWG NO. **0000-CI-101**
REV NO. P1
DATE 20 NOV 15

Figure 11J-22



LEGEND

DRAINAGE BASIN BOUNDARY	
MINE PROPERTY BOUNDARY	
GRAYBACK ARROYO	
FLOWLINE	

SITE PLAN

SCALE: 1" = 1000'

1000 500 0 1000 2000
SCALE IN FEET
CONTOUR INTERVAL = 20 FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

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COPPER FLAT PROJECT

GENERAL SITE
COPPER FLAT SITE
EXISTING HYDROLOGY
POST QUINTANA MINING

JOB NO. M3 PN-120085
DWG NO. **0000-CI-102**
REV NO. P1
DATE 20 NOV 15

Figure 11J-23

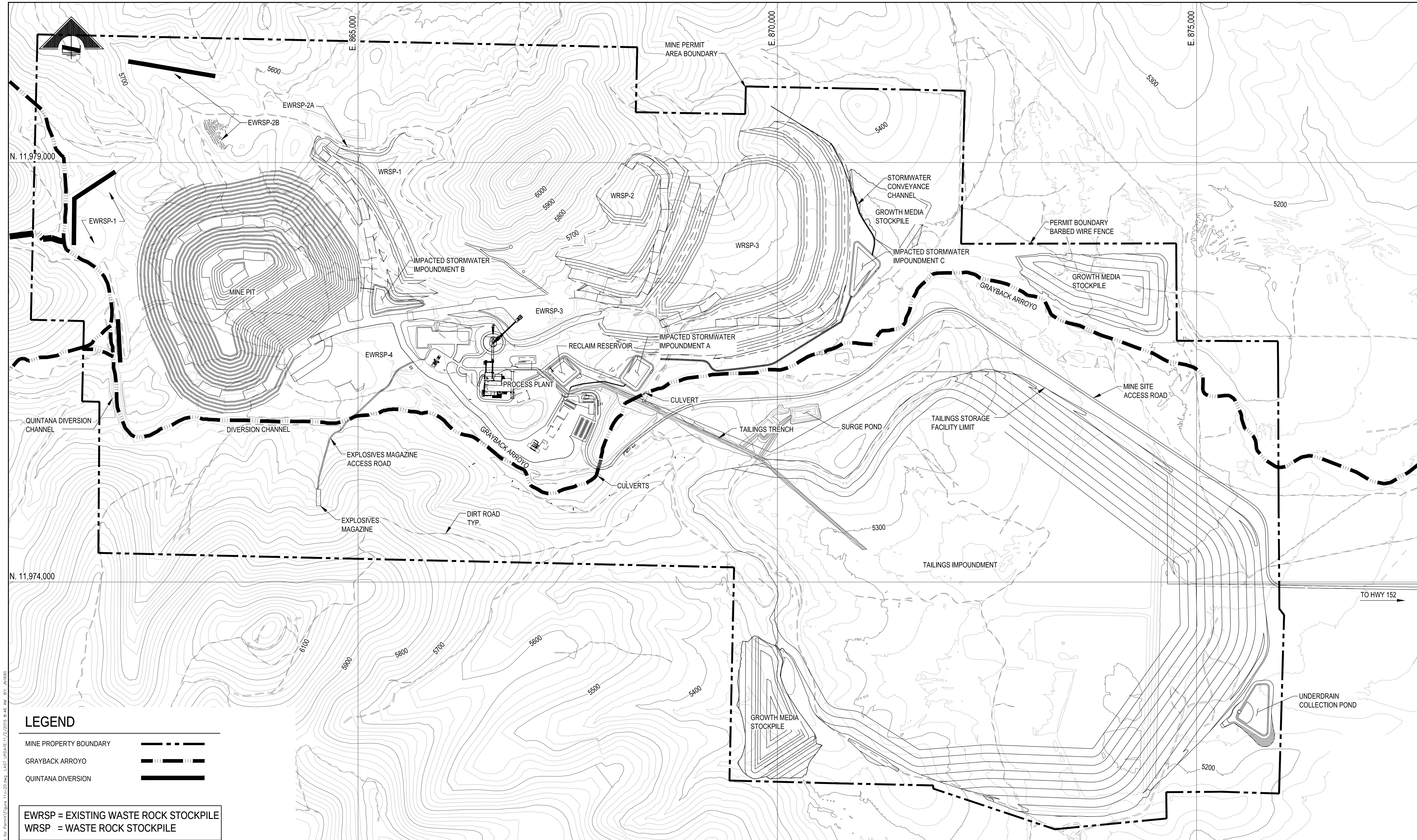
In addition to the diversion structures, Quintana installed large diameter culverts, as shown on Figure 11J-24, where the tailings transport pipeline and where the access road cross-over Grayback Arroyo. These structures are still in place and will be used to control storm water passing through the site. Figure 11J-24 also shows these structures in relation NMCC's proposed Copper Flat mine facilities. The pre-mine development natural topography and drainage pattern of the site is shown in Figure 11J-25. Sixteen sub-basin watersheds naturally contributed to Grayback Arroyo. The upstream drainages merged in the central portion of the current Copper Flat Project area and passed through to the eastern boundary via Grayback Arroyo.

M3's analysis evaluated the diversions and culverts to determine their adequacy in conveying flows from storm events and protecting the site from flooding. Peak discharge and volume analysis for a 100-year, 200-year and 500 year 24-hour storm event was performed for drainage areas contributing to Grayback Arroyo located within the Copper Flat site area. Culvert and channel capacity analysis for the two culvert crossings was conducted for Grayback to determine water surface elevations during the design storm events. Peak flows were analyzed for each sub-basin contributing flow upstream of the site. Figure 11J-26 shows the upstream sub-basins in relation to the site.

Diversion of surface drainages away from the mining area was accomplished by Quintana when they developed the site by constructing the diversions described above. Future development of the site by NMCC will result in watersheds changes to those shown on Figure 11J-25. Watershed areas no. 15 and 16 will be completely within open pit surface drainage area and will be eliminated as tributaries to Grayback Arroyo. Portions of watersheds 1, 2, 3 and 14 will be incorporated into the site storm water control area of the site and will no longer contribute directly to Grayback Arroyo. These differences can be seen by comparing Figure 11J-25 to 11J-26.

M3 evaluated the storm flows in the Grayback Arroyo drainage for the 100-year, 200-year, and 500-year 24-hour storm events for the pre-Quintana, i.e., natural conditions in comparison to Post-Quintana NMCC proposed site conditions. The results demonstrate that the existing diversion structures and culverts provide appropriate surface water management of the drainage that is protective of the site.

As NMCC has indicated earlier, it recognizes that there is an area along the western edge of developed WS D, and south of EWRSP-1, that could drain into the diversion of Grayback Arroyo instead of the mine pit. NMCC has corrected this condition in June 2016 by repairing the breach by constructing a rock and earth berm across the top of the breach and an upstream diversion swale to direct stormwater back to the open pit, to re-establish the integrity of the open pit surface drainage area. Otherwise, this diversion remains in place and functioning today. In order to manage run-on of storm water at the site, NMCC will continue to maintain the integrity of the diversion structure during and operating life of the mine and take it into consideration as part of reclamation and closure of the project.



SITE PLAN
SCALE: 1:500

500' 250' 0' 500' 1000'
1" = 500'
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

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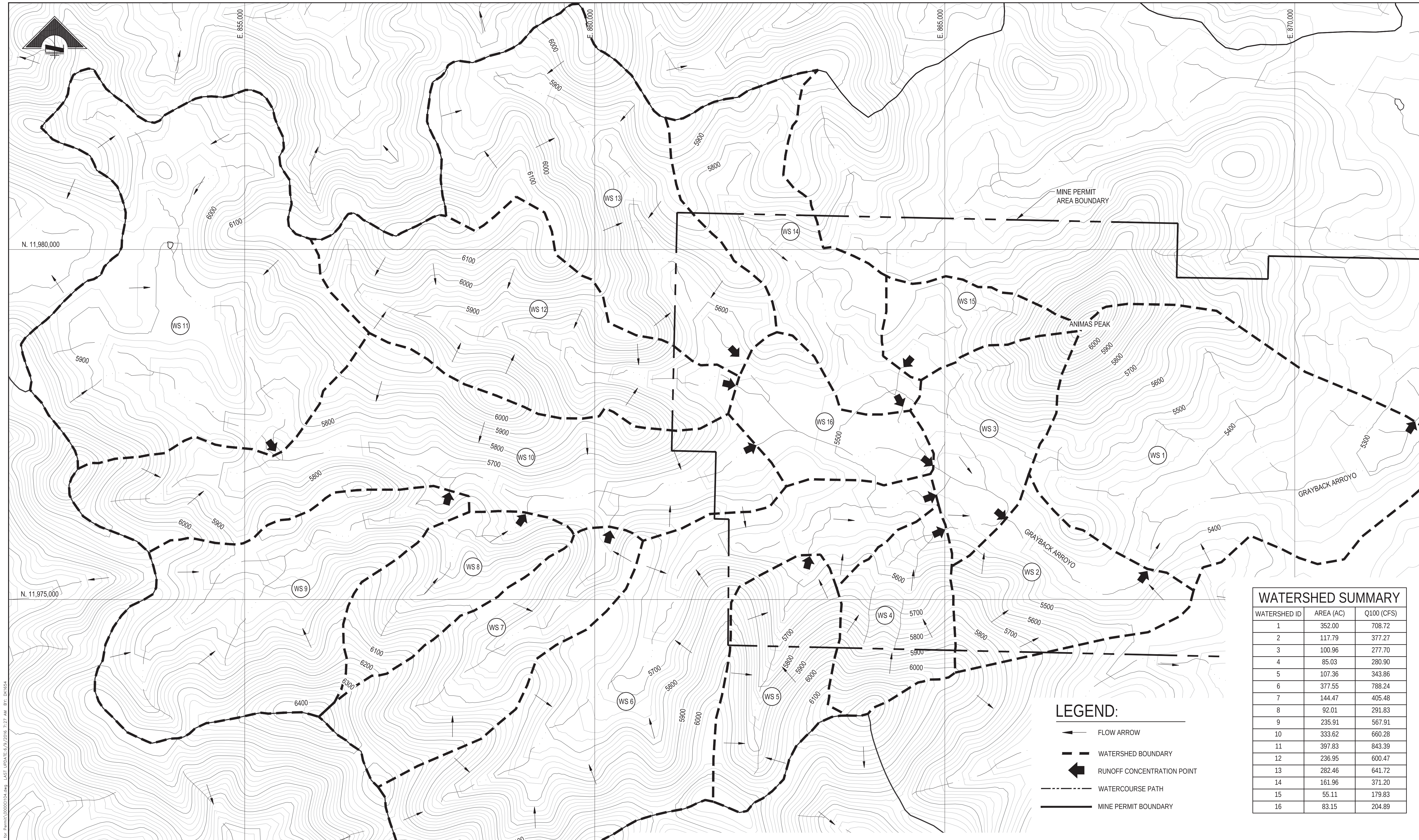
COPPER FLAT PROJECT
SITE GENERAL
CIVIL
GRAYBACK ARROYO DIVERSION THROUGH NMCC PROJECT SITE

JOB NO. M3 PN-120085
DWG NO. 000-CI-103
REV NO. P1
DATE 20 NOV 15

File: P:\2012\120085\CIVIL (544)\544.2 Dwgs\Figures for Permit\Figure 11J-20.dwg LAST UPDATE: 11/2/2015 8:46 AM BY: JN1690

Figure 11J-24



WATERSHED SUMMARY		
WATERSHED ID	AREA (AC)	Q100 (CFS)
1	352.00	708.72
2	117.79	377.27
3	100.96	277.70
4	85.03	280.90
5	107.36	343.86
6	377.55	788.24
7	144.47	405.48
8	92.01	291.83
9	235.91	567.91
10	333.62	660.28
11	397.83	843.39
12	236.95	600.47
13	282.46	641.72
14	161.96	371.20
15	55.11	179.83
16	83.15	204.89

LEGEND:

- FLOW ARROW
- WATERSHED BOUNDARY
- RUNOFF CONCENTRATION POINT
- WATERCOURSE PATH
- MINE PERMIT BOUNDARY

PLAN VIEW
SCALE: 1" = 600'

600 300 0 600 1200
SCALE IN FEET
CONTOUR INTERVAL = 25FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

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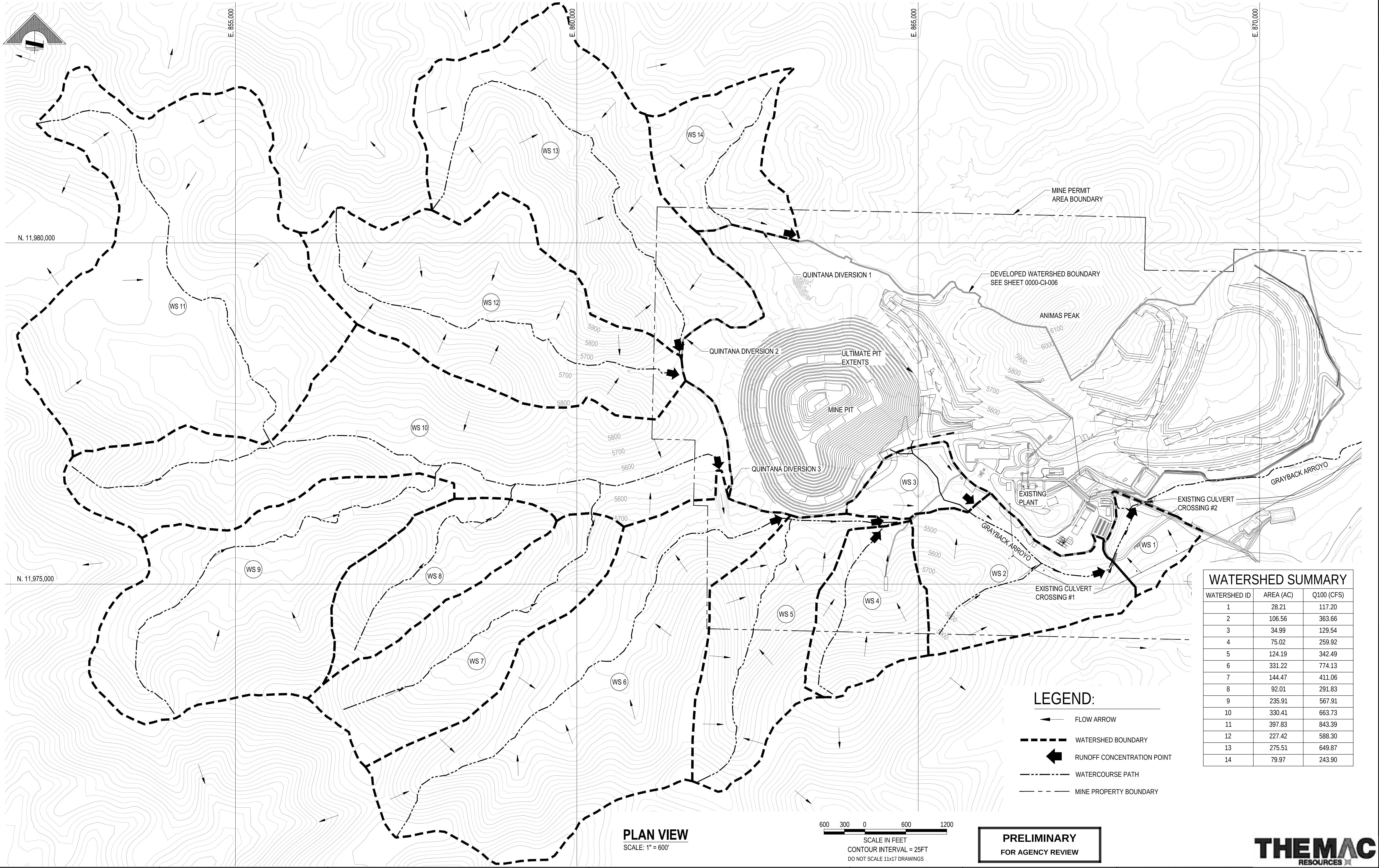
COPPER FLAT PROJECT

GENERAL SITE
CIVIL
PRE QUINTANA
EXISTING WATERSHED AREAS

JOB NO. M3 PN-120085
DWG NO. **Figure 11J-25**
REV NO. P2
DATE 09 JUN 16



WATERSHED SUMMARY

WATERSHED ID	AREA (AC)	Q100 (CFS)
1	28.21	117.20
2	106.56	363.66
3	34.99	129.54
4	75.02	259.92
5	124.19	342.49
6	331.22	774.13
7	144.47	411.06
8	92.01	291.83
9	235.91	567.91
10	330.41	663.73
11	397.83	843.39
12	227.42	588.30
13	275.51	649.87
14	79.97	243.90

LEGEND:

- FLOW ARROW
- WATERSHED BOUNDARY
- RUNOFF CONCENTRATION POINT
- WATERCOURSE PATH
- MINE PROPERTY BOUNDARY

PLAN VIEW
SCALE: 1" = 600'

600 300 0 600 1200
SCALE IN FEET
CONTOUR INTERVAL = 25FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-006	DEVELOPED WATERSHED AREAS		

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COPPER FLAT PROJECT

GENERAL SITE
CIVIL
POST QUINTANA
EXISTING WATERSHED AREAS

JOB NO. M3 PN-120085
DWG NO. 0000-CI-104
REV NO. P1
DATE 20 NOV 15

Figure 11J-26

Also, as indicated in the Conclusions section of M3's Appendix D report, NMCC will repair the upstream inlets to the culverts and to remove vegetation at the culvert inlets and outlets to ensure safe passage of water.

Storm water runoff from the various areas at the site where it need be considered will be managed at the Copper Flat mine in a manner appropriate for that location. At Copper Flat there are four areas of the site that require storm water management;

- open pit mine
- process area, administration and buildings ancillary facilities, parking areas
- waste rock stockpile areas
- tailings storage facility

Open Pit Mine

The open pit mine is located at the top of the watershed area for Grayback Arroyo. The small amount of watershed area located up-gradient from the pit is diverted around and away so that it cannot contribute any run-on into the mine. Only precipitation that falls directly onto the open pit surface drainage area contributes run-on to the pit. As discussed previously, a portion of the open pit drainage area, i.e., the surface water from the open pit surface drainage area where WRSP-1 will be located, will be managed by diverting runoff into an impoundment in order to limit the amount of surface water entering the mine pit and to assist in water harvesting.

Water collected in the mine pit during operation will be pumped out and either utilized for dust control or in the process circuit. At closure, the water will be allowed to collect in the pit and contribute to the volume of the pit lake as described in the Reclamation and Closure Plans.

Processing Facility

The processing facility, including crushing and grinding, milling, flotation, concentrating, drying and packaging, administration, parking and all other ancillary support facilities will be located as shown on Figure 11J-1. This area will be graded and berms and other retainment structures constructed to eliminate storm water run-on such that there will be no run-off from this watershed area released. The area will be graded and contoured to collect all precipitation in storm water impoundment A. As discussed previously, details of the design of this impoundment are contained in Appendix B. Water captured in the impoundment will be transferred to the process water reservoir and utilized as make-up water in the process.

At closure, the impoundment will be filled, re-contoured, re-graded and covered as described in the Reclamation and Closure Plans so that water is no longer retained.

Waste Rock Stockpiles

The new proposed waste rock stockpiles will be located as shown in Figure 11J-1 and 11J-3. Berms and drain ditches will be constructed around the toe of the stockpile to eliminate storm water run-on through the stockpile area. As the areal extent of the stockpile expands over time the location of the berms and ditches will moved to continue to provide run-on control. The surface of each waste rock stockpile will be contoured and graded in a manner to control and divert run-off from each stockpile to an impacted storm water impoundment. Storm water control ditches will be constructed, as necessary, to control run-off and minimize the potential for ponding and erosion while allowing water to move quickly and easily to the impoundment thus minimizing the opportunity for infiltration and leaching. Water captured in the impoundments will be transferred to the process water reservoir and utilized as make-up water in the process. At closure, the waste rock stockpiles and the impoundments will be re-contoured, re-graded and covered as described in the Reclamation and Closure Plans.

Tailings Storage Facility

The Tailings Storage Facility will be located as shown in Figure 11J-1. The area is naturally protected from storm water runoff passing through Grayback Arroyo by the natural topography. As such, there will only be run-on and runoff from precipitation that falls directly on the on the footprint of the TSF to manage.

The tailings dam will be constructed in phases as discussed in detail in Appendix A. Surface water run-on will be controlled during operations by grading and contouring the area to minimize the amount of water contributed into the tailings impoundment. Several run-on diversion ditches will be constructed at the up-gradient perimeter of the tailings impoundment to divert run-on around it per the requirements of the NM Office of the State Engineer. These diversion ditches will be reconstructed for each phase of dam construction, as needed, as the dam expands in size until it reaches its ultimate height.

Runoff from the exterior face of the dam will be managed by constructing drainage ditches to control and direct runoff into the underdrain collection pond located at the southeastern toe of the dam. These drainage ditches will be constructed in a manner that minimizes the opportunity for ponding yet moves water in a controlled fashion to control erosion. The ditches on the face of the dam will enter a lined water conveyance ditch located at the toe of the dam. That ditch will also contain the water recycle pipeline leading from the underdrain collection pond to the process facility. Runoff water from the downstream face of the dam will join the water collected from the tailings underdrains in the pond and will be transported to the process water reservoir for use as make-up water in the process.

The surface area of the cyclone plant, immediately adjacent to the TSF, as shown on Figure 11J-1, will be contoured and graded to route runoff from the area into the lined water conveyance ditch at the toe of the dam. It will drain to the underdrain collection pond.

At closure the TSF and its attendant runoff diversion structures will be re-contoured, re-graded, filled and a cover will be placed over the entire area in accordance with the Reclamation and Closure Plans.

20.6.7.11.J.(7) *a description of water wells and monitoring wells, including information for each well regarding its location, construction material, dimensions and capacity;*

NMCC has prepared and submitted a number of documents and reports containing the information requested regarding a description of water wells which include information regarding location, construction material, dimensions and capacity, to the extent possible. These documents include;

- Baseline Data Report, June 2012 and Supplements, (Intera 2012)
- Discharge Permit Application and Abatement Plan, March 2011 (Intera 2011)
- Abatement Plan Amendment, October 2011, (JSAI 2011)
- Results From 1st year Stage 1 Abatement Investigation, (JSAI 2014b)
- Mine Plan of Operations, December 2010 and amendments, (NMCC 2010)
- Model of Groundwater Flow, August 2014, (JSAI 2014c)

These documents have been incorporated into this Discharge Permit Application by reference and are available at NMED.

With regard to monitoring wells, the Baseline Data Report, Abatement Plan and Model of Groundwater Flow all contain monitoring data that was compiled at the site and surrounding environs. In addition, NMCC has developed a proposed groundwater Quality Monitoring Plan, as required by **20.6.7.11.R and 20.6.7.28 NMAC** that incorporates some of the wells contained in these reports in combination with proposed installation of others to monitor site conditions prior to and during operation of the mine. The details of this plan, including the location, construction material (existing and proposed), dimensions, and capacity, are included in Appendix E of this application.

20.6.7.11.J.(8) *a description of flow meters required pursuant to the copper mine rule or a discharge permit and fixed pumps for discharge of process water, tailings and impacted stormwater;*

Subsection **20.6.7.11.S** of this application as required by the Copper Rule contains the information requested in this subsection.

20.6.7.11.J.(9) *a description of any surface water(s) of the state and any other springs, seeps, ditch irrigation systems, acequias, and irrigation canals and drains located within the boundary of the copper mine facility;*

The only surface water that exists within the boundary of the Copper Flat mine permit area is Grayback Arroyo. Grayback is an ephemeral arroyo that transects the mine permit area from the west to the east, roughly through the middle of the area as shown on Figure 11J-21 through 26 and 11K-8.

There is one seep that occasionally generates water in response to significant precipitation located on the sidewall of the existing open pit. The pit lake itself may or may not be considered a water of the state. However, it will be completely dewatered during the operating life of the mine.

There are no springs, ditch irrigation systems, acequias, irrigation canals or drains located within the boundary of the Copper Flat mine permit area.

20.6.7.11.J.(10) *a description of proposed sampling locations;*

The proposed sampling locations for tailings and process water will be coincident with the locations identified in Subsection **2.6.7.11.S** for the location of the flow metering devices. The other sampling locations are identified in the Water Quality Monitoring Plan required by **20.6.7.11.R and 20.6.7.28 NMAC** of the Copper Rule.

20.6.7.11.J.(11) *a description of all septic tanks and leach fields used for the disposal of domestic wastes;*

NMCC will not use a septic tank and leach field treatment systems for disposal of domestic wastes at the Copper Flat Mine. Disposal of domestic wastes generated will be accomplished by installing a single packaged wastewater treatment plant to serve the majority of employees and visitors at the mine. Individual portable toilet facilities for outlying areas of the operation will also be utilized, as needed.

The packaged wastewater treatment plant will receive and treat domestic wastes from buildings located in the administration, concentrator, and mine shop areas. The packaged system will be sized for a load based on the number of mine employees and visitors expected at the mine during a 24-hour period and applying an average water use of 50 gallons per day per person. Breaking down the employee headcount for the mine by the planned rotation schedule indicates 160 employees per day will be using facilities connected to the package plant. In addition to mine employees, an additional 40 persons per day are assumed to account for visitors and contractors. Based on these figures, a 10,000 gallon per day plant has been selected for Copper Flat Mine.

The plant will be located on a pre-existing concrete slab near the main gate as shown in Figure 11J-1. The plant will generate effluent treated to secondary treatment levels. Treated effluent from the plant will be piped to the tailings storage facility for disposal in the impoundment and recycling to the process water reservoir. System specifications and installation will conform to State and local regulations.

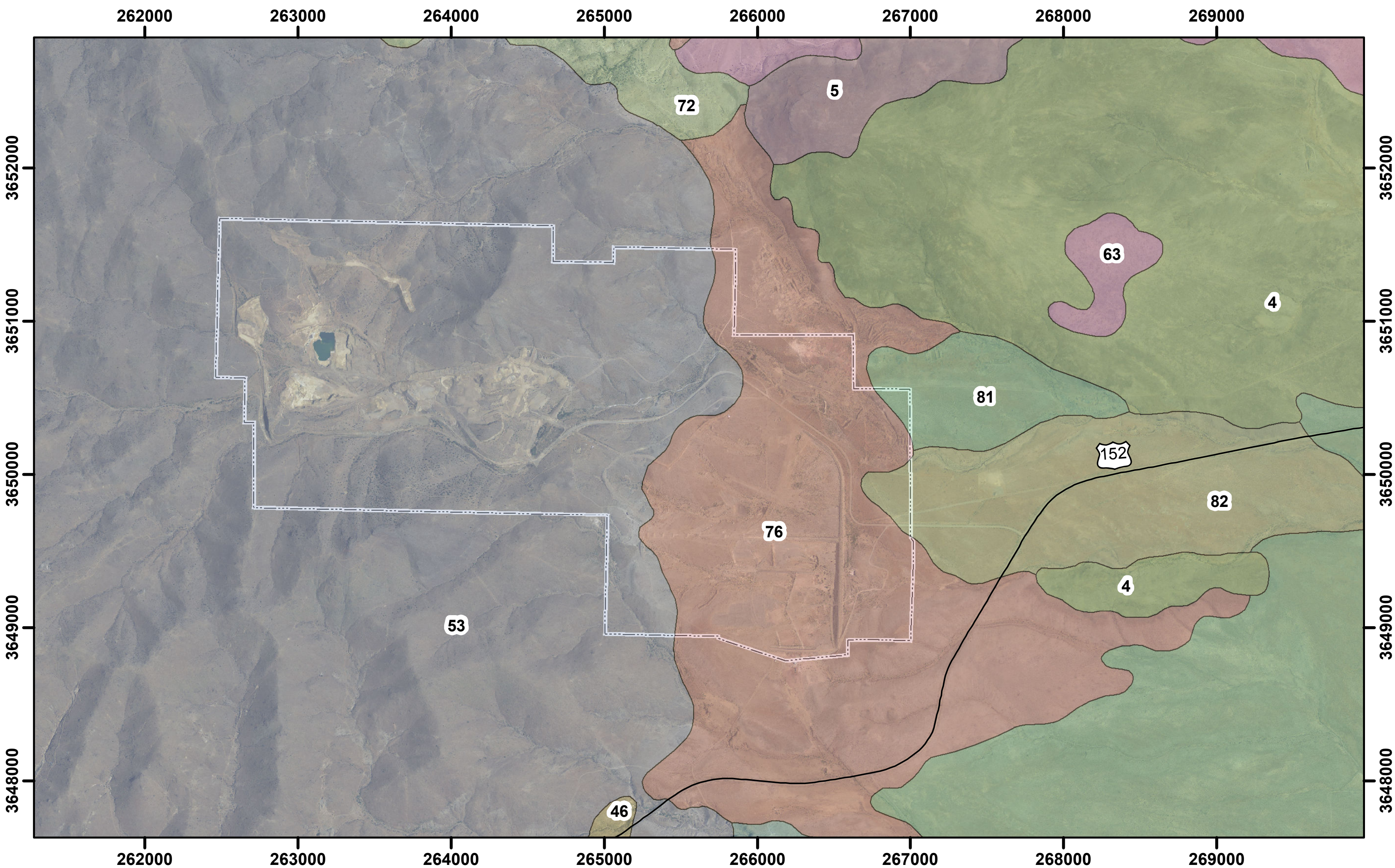
Individual portable toilet facilities will be provided for employees working in outlying areas of the operation such the pit, mine stockpile areas, the primary crusher, and the TSF. The portable toilets will be maintained by a licensed contractor on a regular basis.

20.6.7.11.K SURFACE SOIL SURVEY, GEOLOGY, AND HYDROLOGY

An application shall include:

20.6.7.11.K.(1) *the most recent regional soil survey map and associated descriptions identifying surface soil type(s);*

Figure 11K-1 is a soil survey map of soils in the mine permit and surrounding area. The map includes a description identifying the surface soil types present. In addition, Section 6.0 of the Baseline Data Report (Intera 2012) contains more detailed information regarding soils in the area.



Map Scale: 1:38,000 If printed on 8.5" x 11" sheet

0 500 1,000 2,000 Meters

0 2,000 4,000 8,000 Feet

N

Legend

- Roads
- Copper Flat Mine Permit Area Boundary
- 4 Akela very gravelly loam, moderately rolling
- 5 Akela-Rock outcrop association, very steep
- 46 Ildefonso-Scholle association, hilly
- 53 Luzena-Rock outcrop association, very steep
- 63 Nickel-Chamberino association, gently sloping
- 72 Rock outcrop-Deama association, extremely steep
- 76 Scholle-Ildefonso association, moderately rolling
- 81 Tres Hermanos gravelly fine sandy loam, gently sloping
- 82 Tres Hermanos-Hap association, gently sloping

Soil Survey

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Figure 11K-1

June 24, 2015

Source: Baseline Data Characterization Report for Copper Flat Mine, June 2012, prepared by Intera et al., and Stetson Engineers.

20.6.7.11.K.(2) *a geologic map covering the area within a one-mile radius of the copper mine facility and geologic and lithological information which provides a geologic profile of the subsurface conditions beneath the copper mine site, including the thickness of each geologic unit, identification of which geologic units are water bearing, cross sectional diagrams and sources of all such information; and*

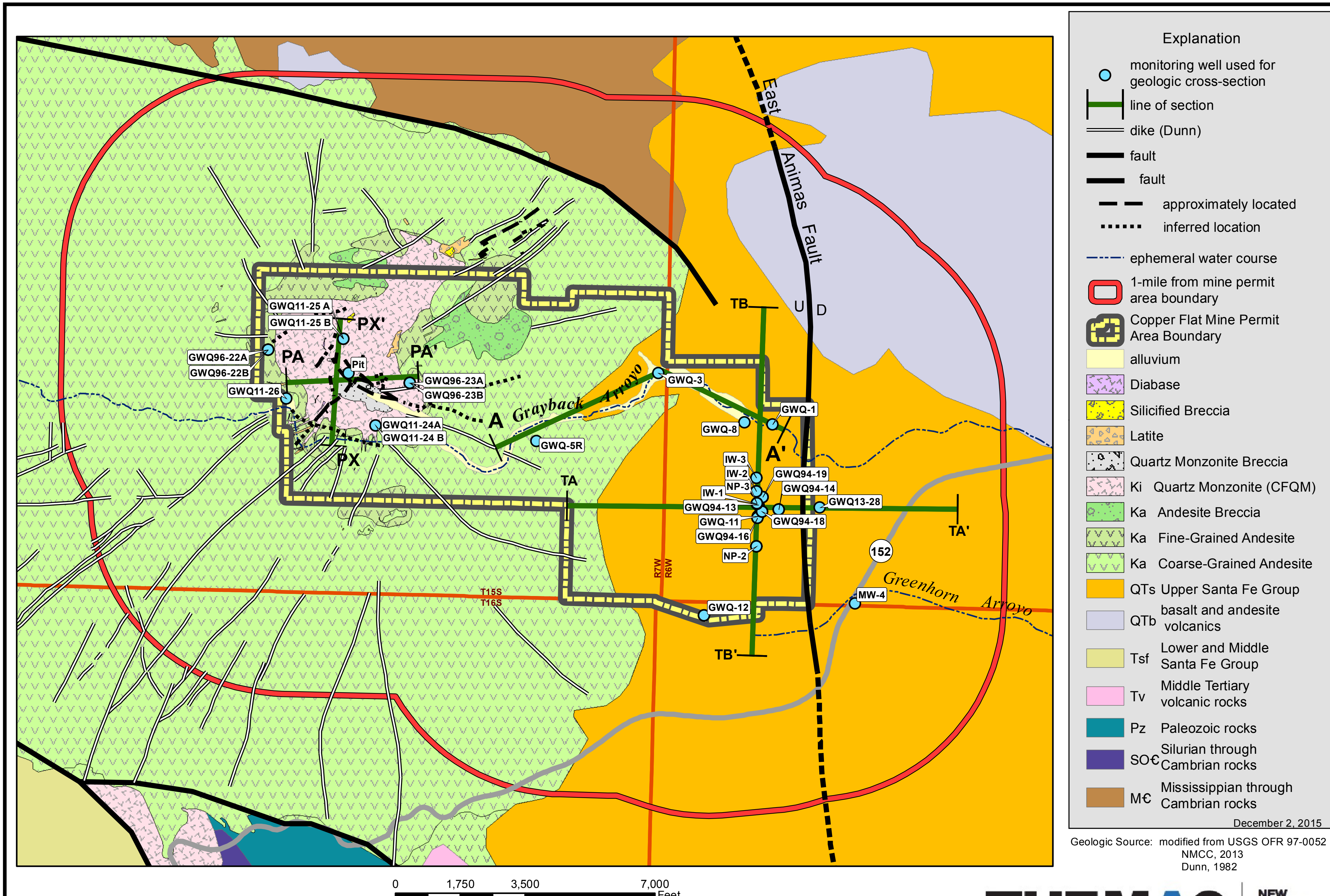
Figure 11K-2a is a geologic map of the area within a one-mile radius of the Copper Flat mine permit area boundary. A prominent feature on this map, as well as other geologic maps prepared by JSAI on behalf of NMCC, is the East Animas Fault. Some discussion has occurred between NMCC, its' consultant JSAI, and the regulatory agencies with respect to the most accurate location of this feature. A correct interpretation of the data generated over time is necessary in order to have a correct understanding of the geology of this area. NMCC offers the following interpretation, which it believes represents the most accurate information available.

The East Animas Fault Trend is a north-south normal fault that forms boundary a between the Animas Uplift and Palomas Basin. Figure 11K-2b shows the various locations the East Animas Fault has been mapped as presented in various published documents. All previous researchers identify the East Animas Fault as trending south to north and down thrown on east side. The difference in its location near the Copper Flat mine permit boundary has been with respect to position in longitude, i.e., east to west position.

Key references for the East Animas Fault include Kelley et al. (1979), Seager et al. (1982), Harrison et al.(1993), Beaumont (2011), Hawley (2012), JSAI (2013), JSAI (2014), JSAI (2014a), and Koning et al. (2015). Kelly mapped the fault further to the east than more recent mapping has shown it to be. As such the Kelly location is not depicted on Figure 11K-2b. The East Animas Fault was mapped as an inferred fault in slightly different longitude by Seager et al. (1982) than by Hawley (2012) as shown on Figure 11K-2b.

Work performed by Beaumont (2011) and JSAI (2013) was based on analysis of well logs and lineaments identified from aerial photographs. During the 2013 evaluation, the East Animas Fault was known to exist between wells GWQ94-21(A,B) and MW-4, which narrowed the longitude position to an approximate 1,800 ft. wide zone. In 2013, monitoring well GWQ13-28 was drilled as part of Stage 1 abatement Investigation (JSAI, 2014a) to further define the longitude position of the East Animas Fault. GWQ13-28 was determined to be located on the east side of the fault, as determined by the lithologic differences between GWQ94-21(A,B) and GWQ13-28 and the 150 ft. drop in water levels between GWQ94-21(A,B) and GWQ13-28. The longitude position of the East Animas Fault provided by Beaumont (2011) was slightly east of GWQ13-28, so JSAI adjusted the longitude position to half way between GWQ94-21 and GWQ13-28 in JSAI (2014) and JSAI (2014a) to more accurately reflect the new data. Koning et al. (2015) consulted with JSAI on the most current well drilling data and geologic analysis of faults for the Skute Stone Quadrangle map, and at the time were given the East Animas Fault as mapped by Beaumont (2011) and presented in JSAI (2013). Koning et al. (2015) has not updated the longitude location of the East Animas Fault to reflect the results of GWQ13-28 as reported in JSAI (2014) and JSAI (2014a).

Figures 11K-3a and 3b through 11K-7a and 7b provide lithological information showing a profile of the subsurface conditions beneath the site at cross-sections identified in Figure 11K-2a. These cross sections provide information regarding the thickness of each geologic unit, identification of which geologic units are water bearing, as well as the source of the information. Figures 11K-3a, 6a and 7a depict the cross-sections in vertical exaggeration to provide the reviewer with more detail. Figures 11K-3b, 6b and7b provide a 1:1 vertical to horizontal depiction of the same cross-sections.



Geologic Source: modified from USGS OFR 97-0052
NMCC, 2013
Dunn, 1982

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Figure 11K-2a. Geologic map within 1-mile of the Copper Flat Mine Area permit boundary, Sierra County, New Mexico.

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15980

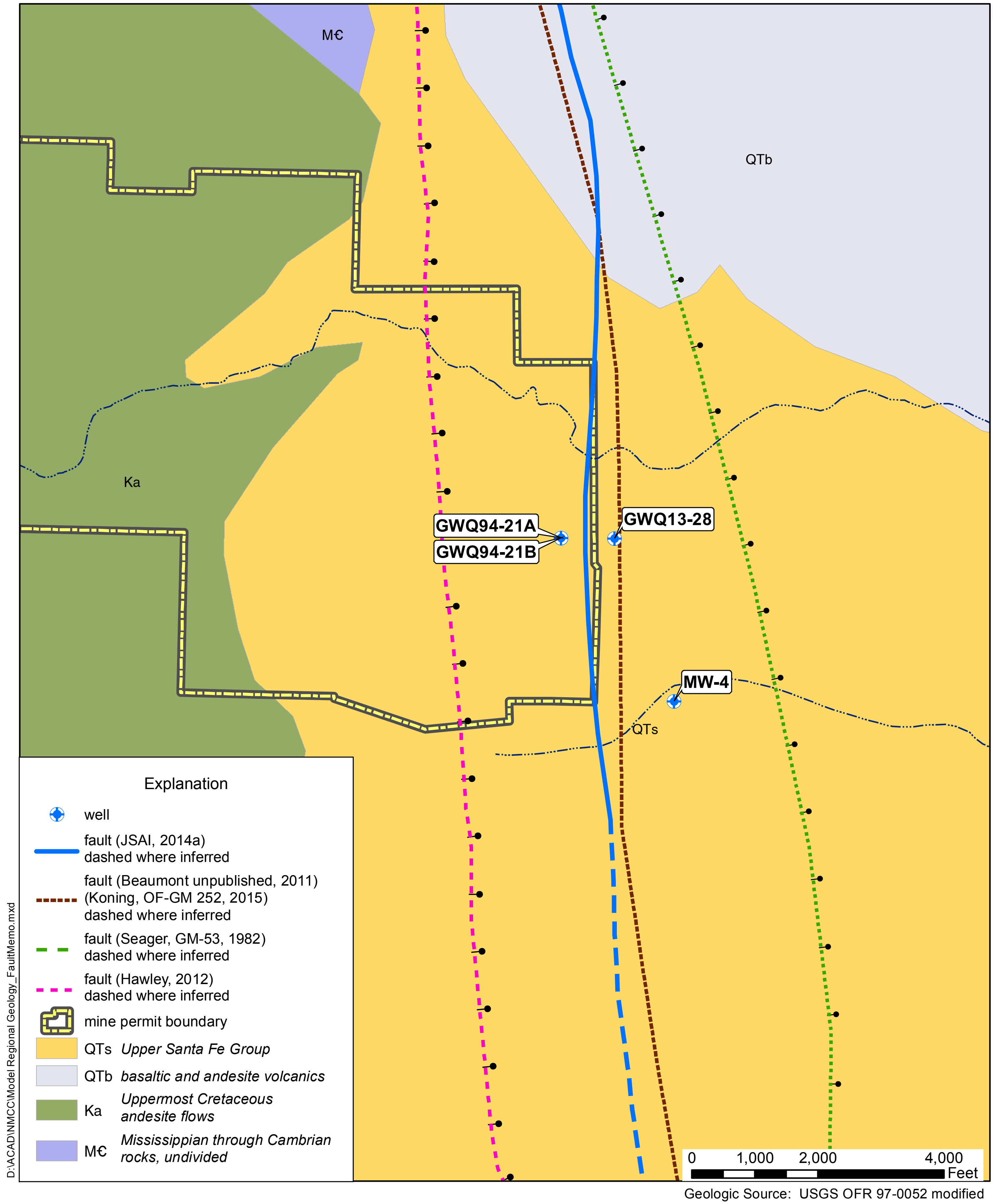

Figure 11K-2b. Regional surface geology and location of East Animas Fault as reported by various investigations.

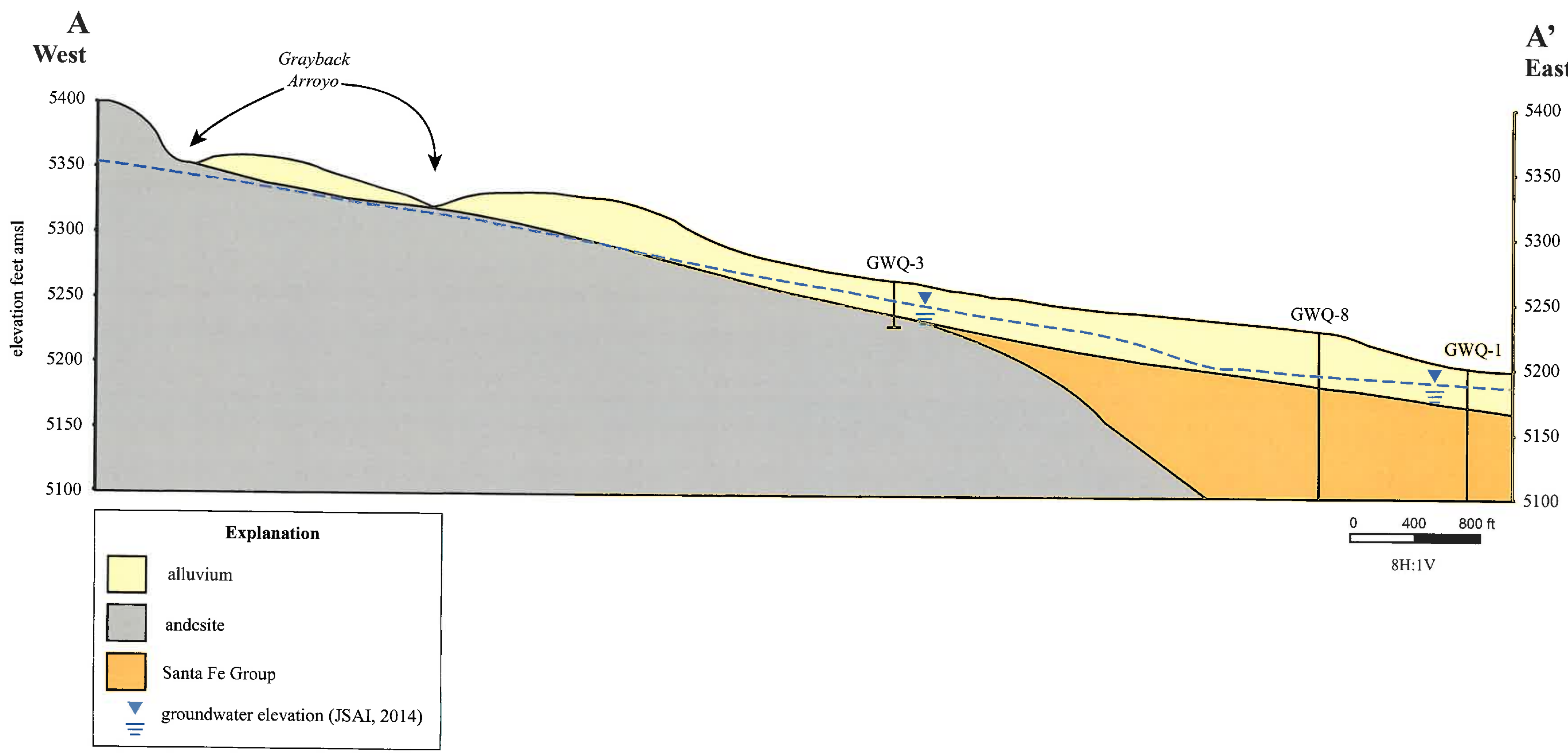

Figure 11K-3a. West to east geologic cross-section along Grayback Arroyo, Copper Flat Mine, Sierra County, New Mexico.

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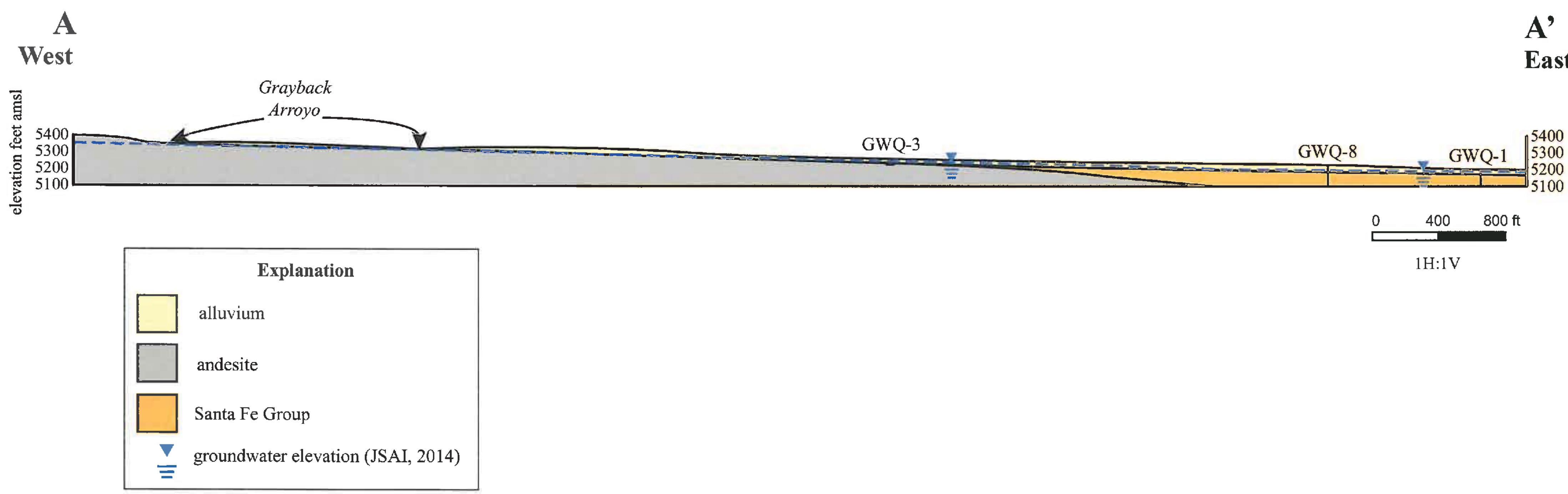

Figure 11K-3b. West to east geologic cross-section along Grayback Arroyo, Copper Flat Mine, Sierra County, New Mexico.

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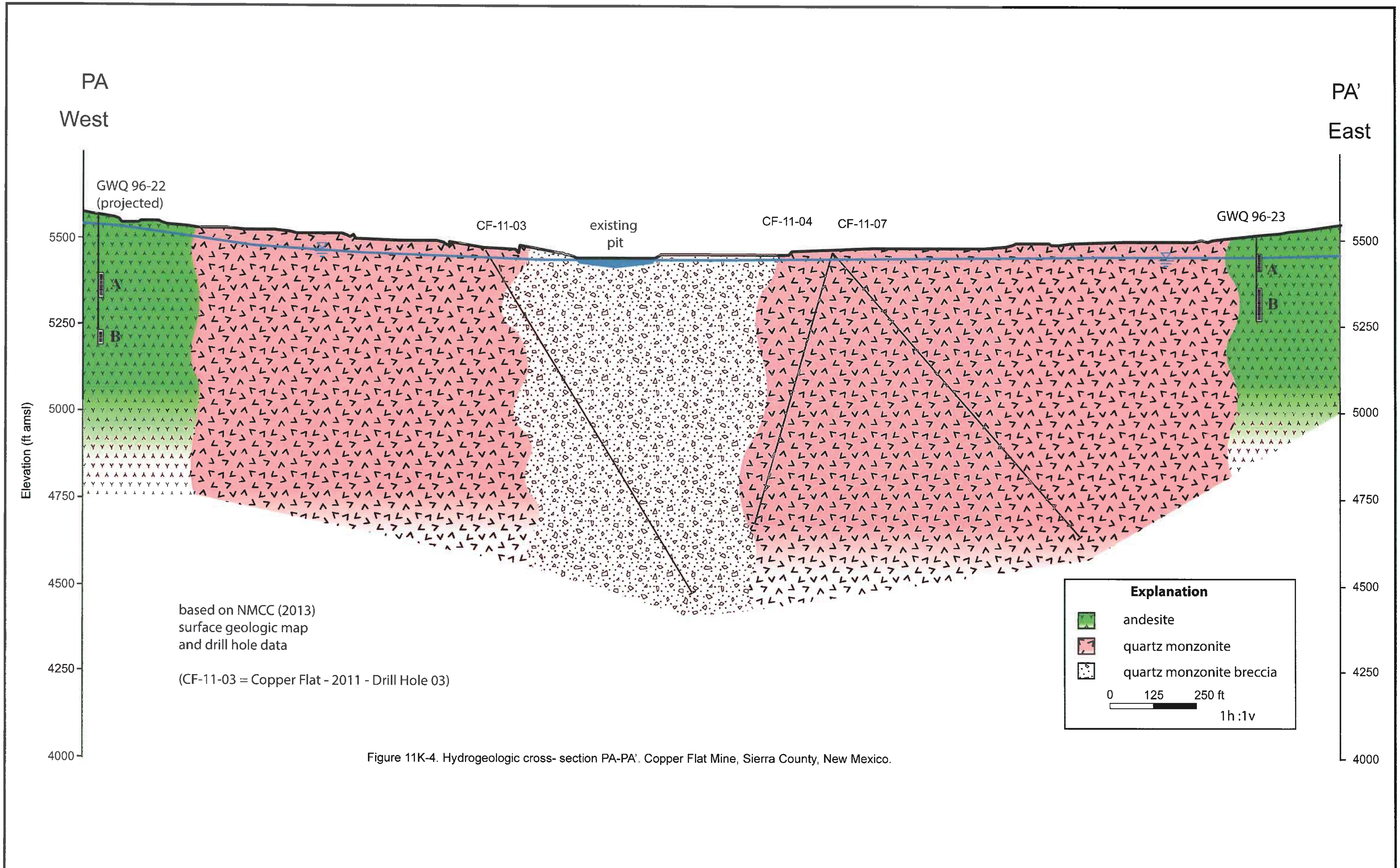

Figure 11K-4. Hydrogeologic cross- section PA-PA'. Copper Flat Mine, Sierra County, New Mexico.

5/5/2014; DA

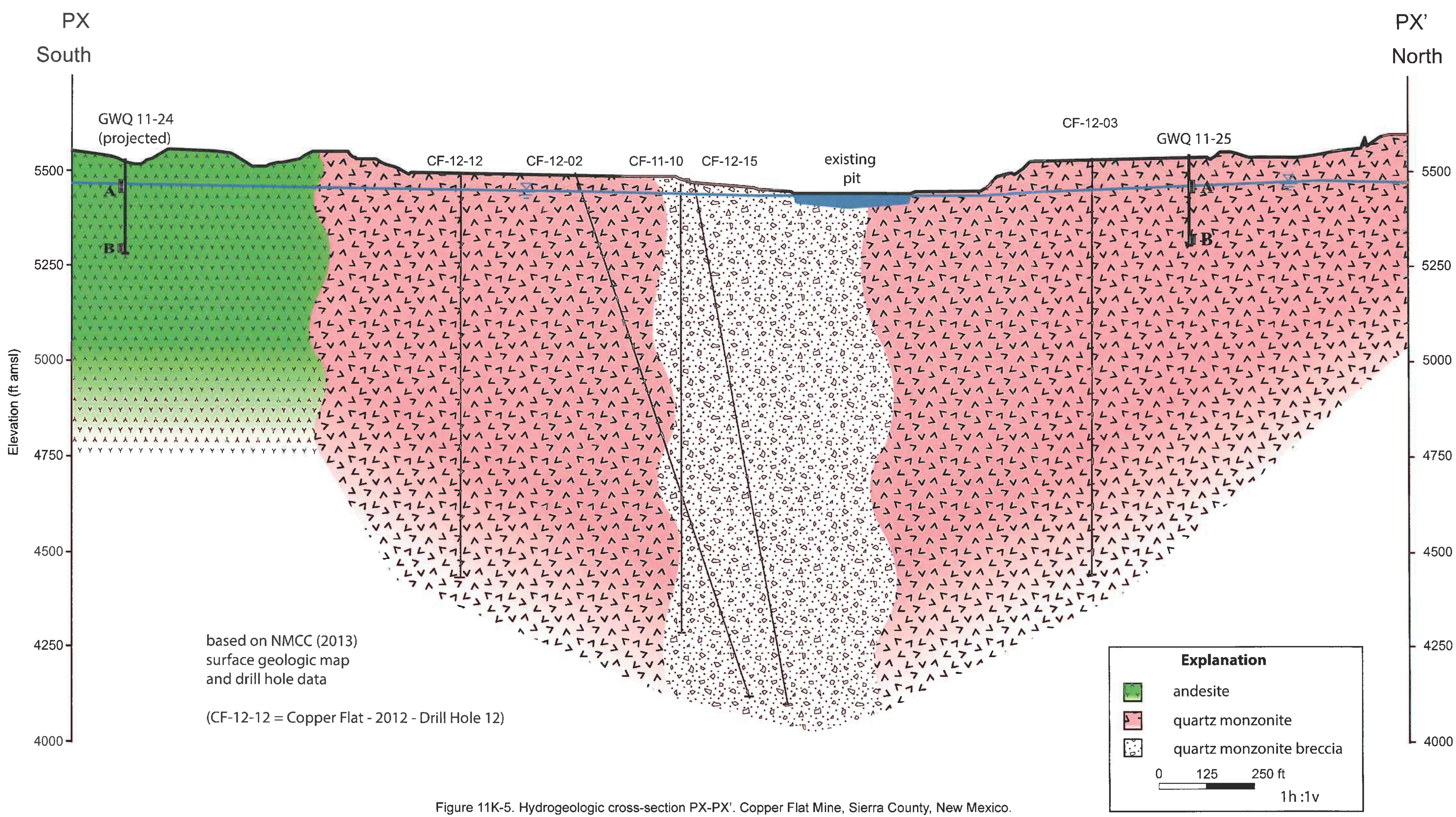

Figure 11K-5. Hydrogeologic cross-section PX-PX'. Copper Flat Mine, Sierra County, New Mexico.

5/5/2014; DA

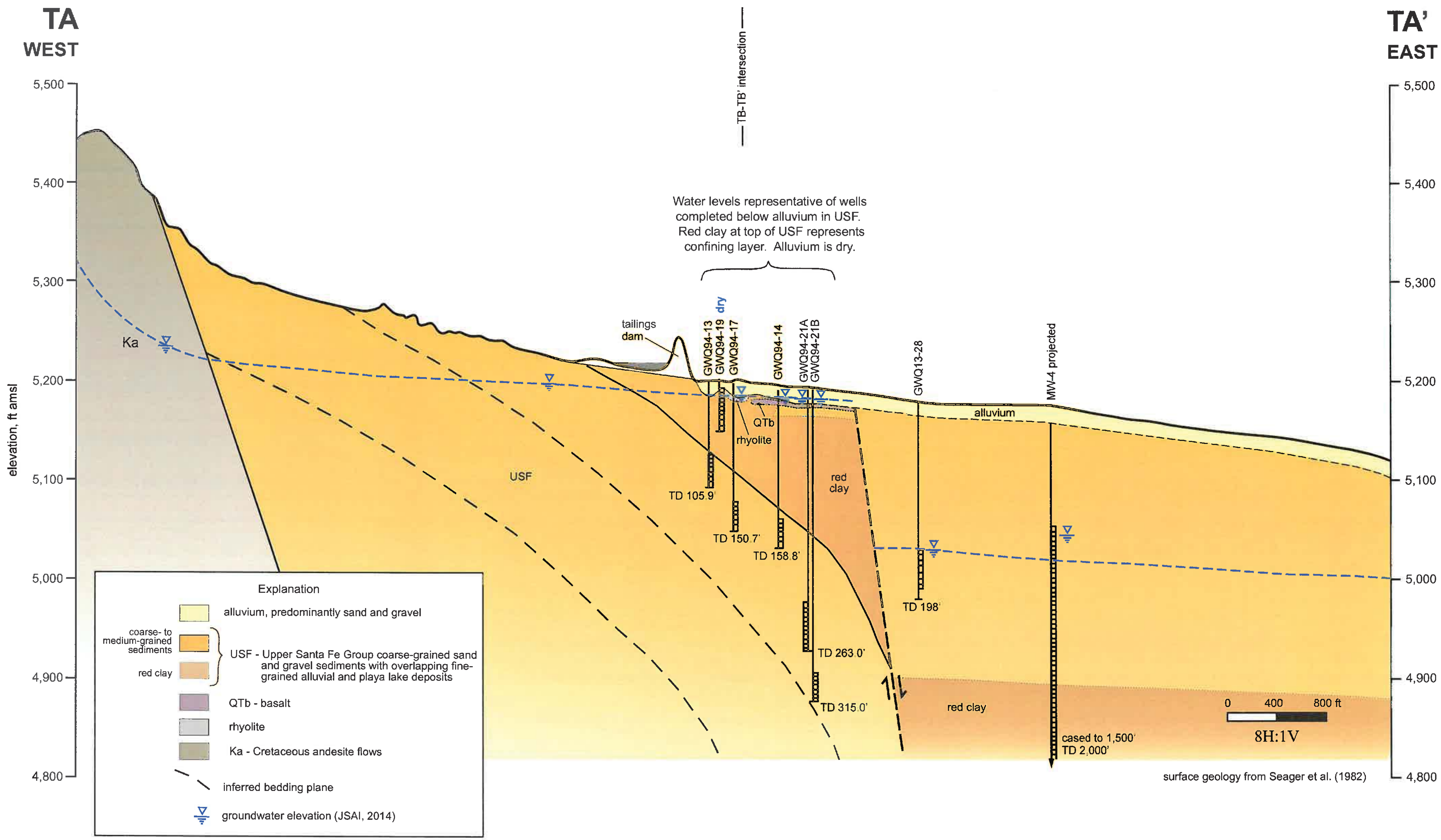

Figure 11K-6a. West to east geologic cross-section TA-TA' through the tailings storage facility (TSF) area, Copper Flat Mine, Sierra County, New Mexico.

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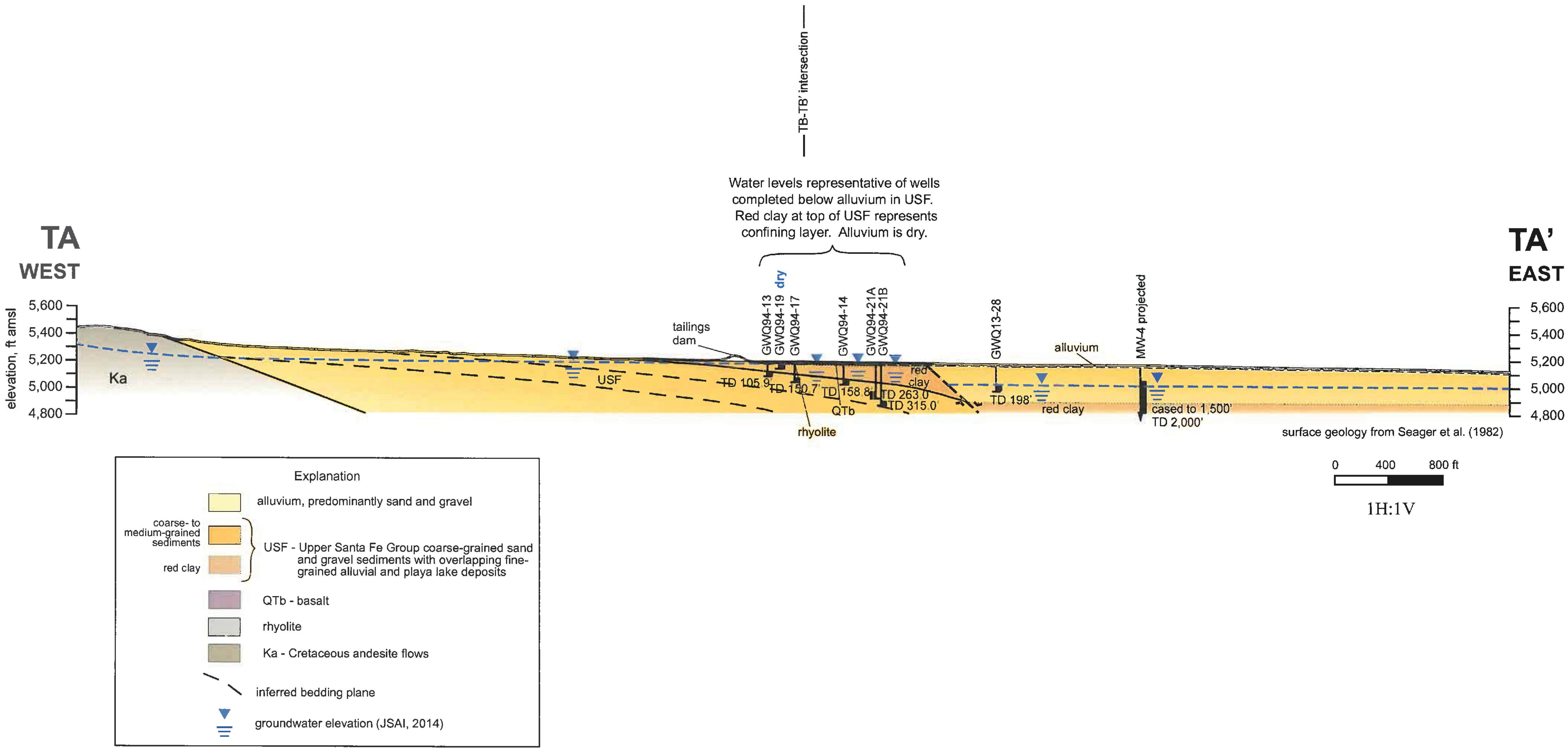

Figure 11K-6b. West to east geologic cross-section TA-TA' through the tailings storage facility (TSF) area, Copper Flat Mine, Sierra County, New Mexico.

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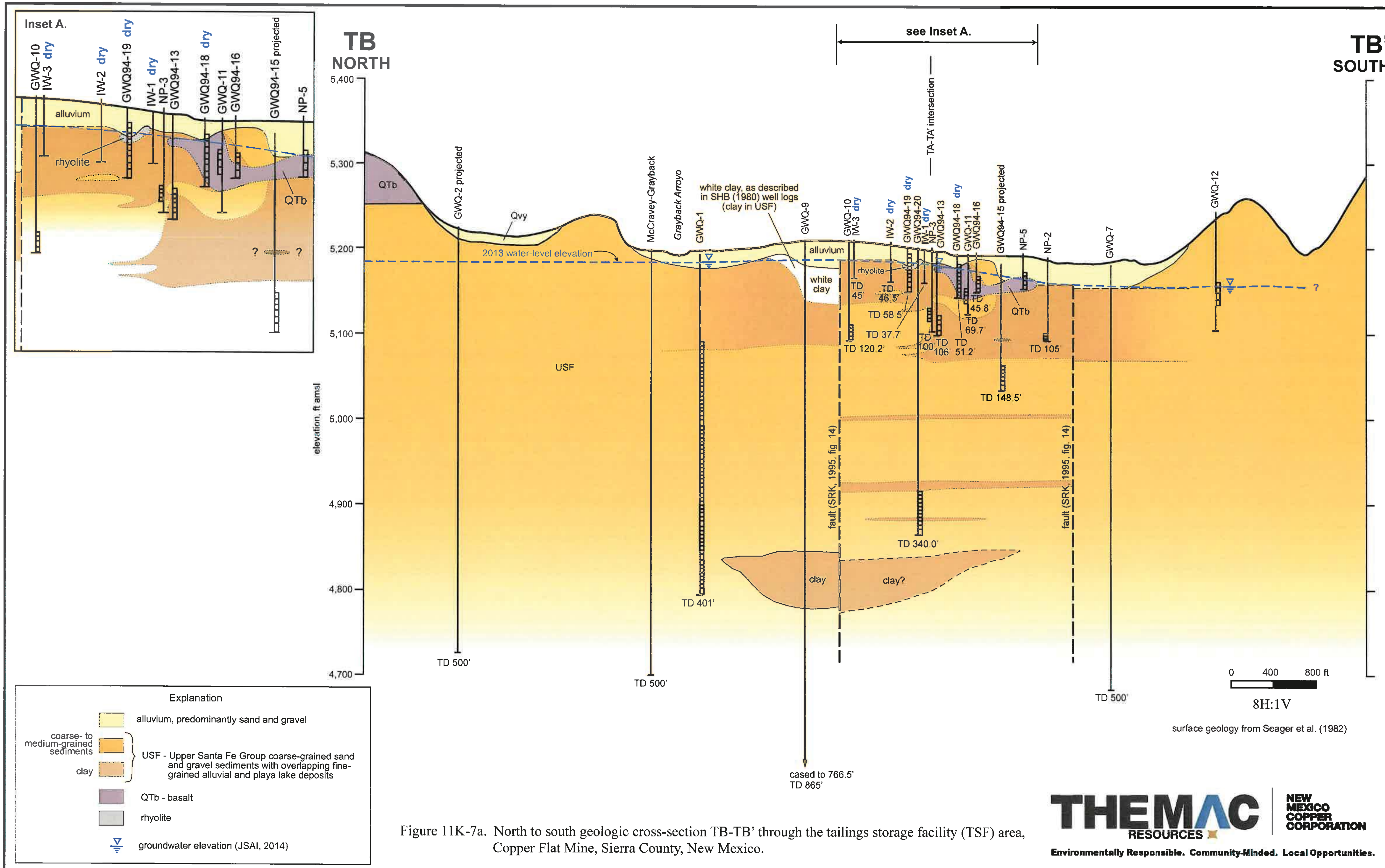

Figure 11K-7a. North to south geologic cross-section TB-TB' through the tailings storage facility (TSF) area, Copper Flat Mine, Sierra County, New Mexico.

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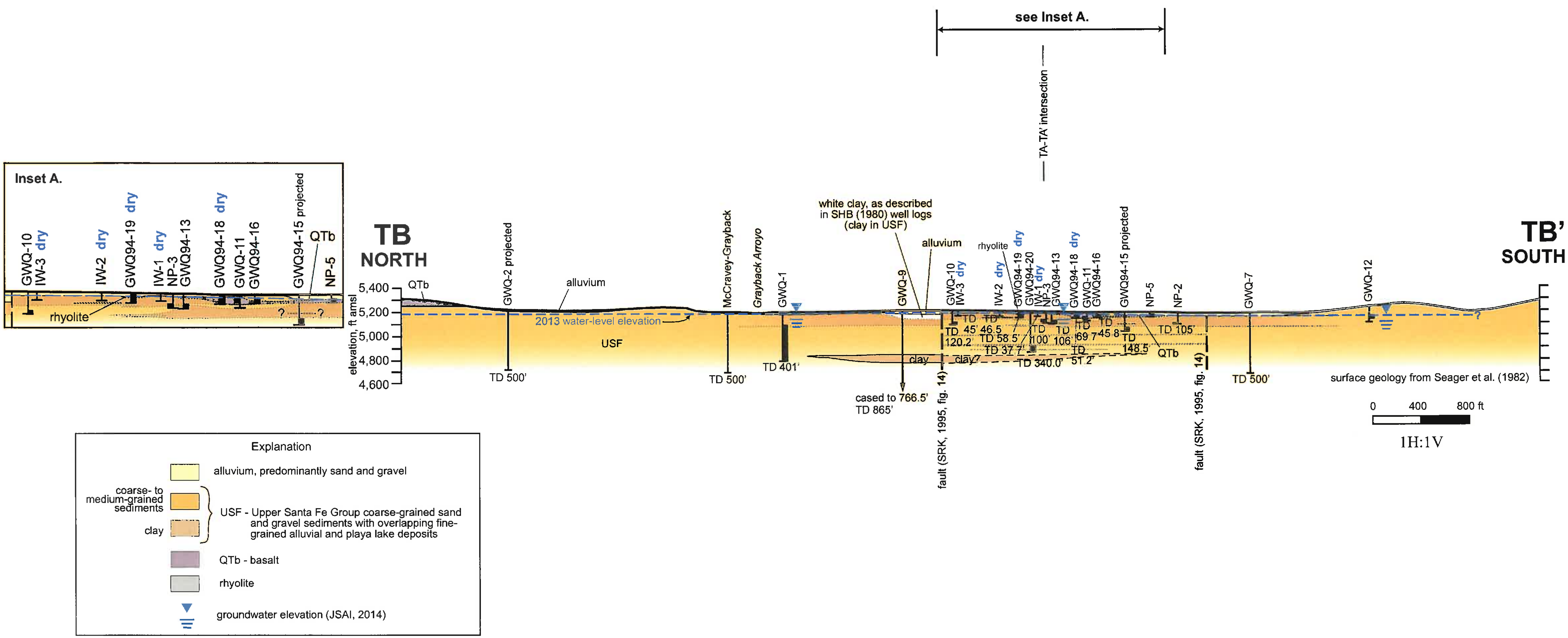

Figure 11K-7b. North to south geologic cross-section TB-TB' through the tailings storage facility (TSF) area, Copper Flat Mine, Sierra County, New Mexico.

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20.6.7.11.K.(3) *hydrologic information on any surface waters of the state within one-half mile of the boundary of the copper mine facility, and of subsurface conditions for all water bearing zones beneath the copper mine facility including maximum and minimum depths to ground water, direction of ground water flow, hydrologic gradients shown by potentiometric maps, transmissivity and storativity, and ground water quality; the sources of all such information shall be provided with the application.*

NMCC has been actively engaged in water related baseline data studies since 2010 and Stage 1 Abatement activities since 2011. All of the hydrologic information submitted previously to NMED in this regard is incorporated into this application by reference. Relevant information from those activities has been reviewed by NMCC and its consultants to provide the following summary hydrologic information. Source reports consulted in the preparation of this hydrologic summary are presented in Table 11K-1.

Table 11K-1
Source Reports Cited

Report Title	Report Prepared By	Date
Baseline Data Characterization Report, Copper Flat Mine, Sierra County, New Mexico	Intera et al.	June 2012
Results from the First Year of the Stage 1 Abatement Investigation at the Copper Flat Mine Site Near Hillsboro, New Mexico	John Shomaker and Associates	May 2014
Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico	John Shomaker and Associates	August 2014

Surface waters of the state
Figure 11K-8 is a map that shows the surface waters of the state within one-half mile of the Copper Flat Mine Permit Area Boundary. Grayback Arroyo is an ephemeral arroyo that enters the area from the west and exits to the east.

Water bearing zones beneath the facility
NMCC has identified three water bearing zones or aquifers beneath the Copper Flat Mine facility. They are the:

1. Quaternary alluvium associated with Grayback Arroyo and the alluvial fan and fluvial sediments in the Upper Santa Fe Group
2. The Santa Fe Group
3. Crystalline bedrock including the Andesite volcanic flows and the Quartz Monzonite intrusive

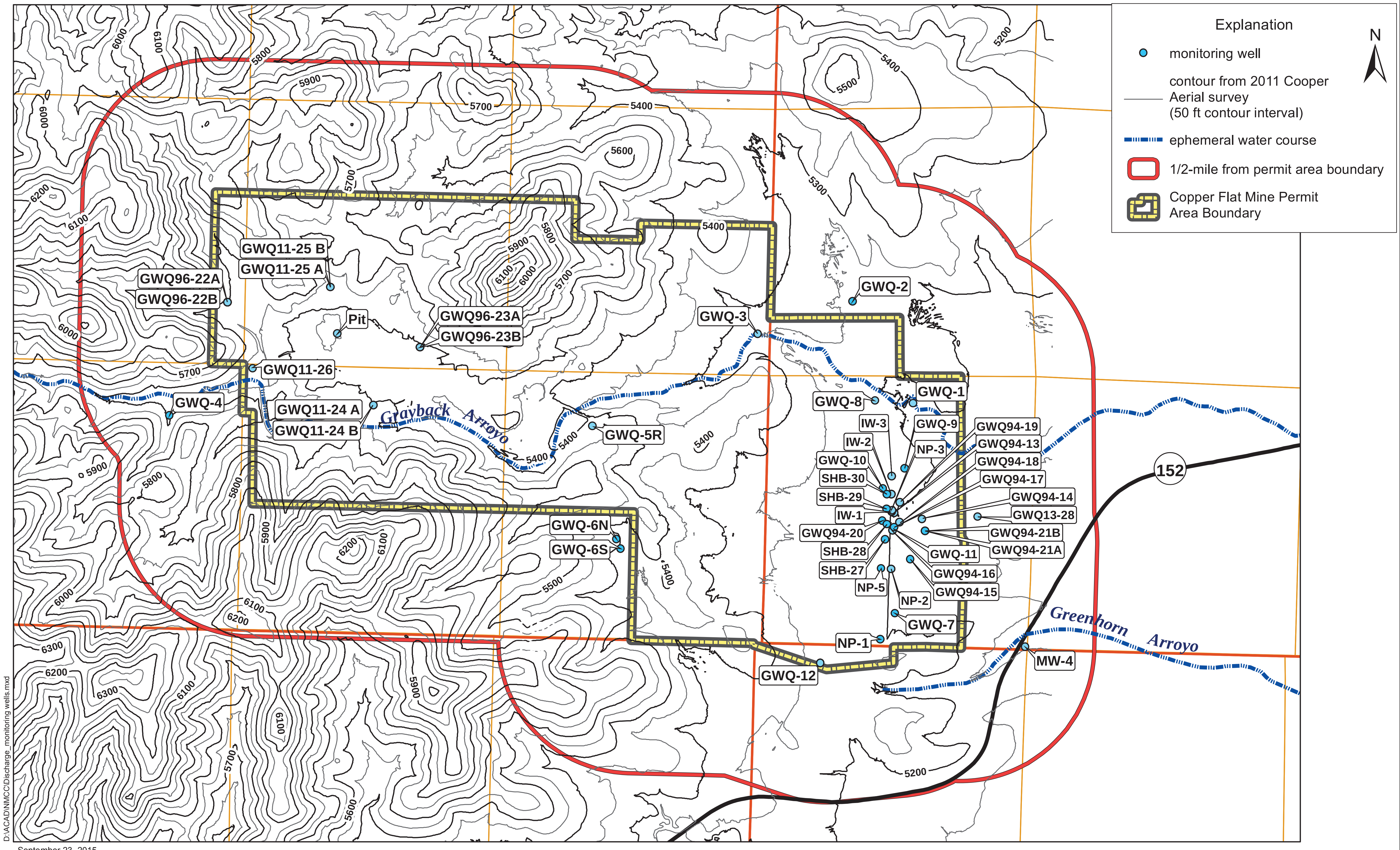

Figure 11K-8. Surface water within 1/2-mile from Copper Flat Mine Permit Area Boundary.

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Figure 11K-2a, which shows the geology of the area in plan-view, and Figures 11K-3a and 3b through 11K-7a and 7b, which show the cross sections, demonstrate the sectional spatial relationships of these water bearing units beneath the mine permit area.

The crystalline bedrock is beneath the western portion of the mine permit area. The crystalline bedrock is composed of Cretaceous age volcanic andesite flows, quartz monzonite intrusive porphyry and quartz monzonite breccia. The Copper Flat ore body is within the quartz monzonite porphyry and breccia. The quartz monzonite porphyry intruded the vent of a strato-volcano, then dikes of and mineralized veins radiated out from the porphyry into fault and fracture controlled zones in the surrounding andesite. The depth of the crystalline bedrock is over 3,000 feet deep (Intera, et. al, 2012).

The Santa Fe Group is present in the eastern portions of the mine permit area and is over 500 feet deep below the existing tailings facility. The Santa Fe group is composed of stratified sediments with a variety of grain sizes consisting of silts, clays, sand and gravel. The strata dip generally to the east (Intera et. al, 2012).

The Quaternary alluvial water bearing zones are sediments to the east of the andesite or deposited in the Grayback Arroyo. These sediments are composed of Alluvial fan deposits and fluvial sands of the Santa Fe Group and saturated alluvium in the drainages. Alluvium is found in Grayback Arroyo and is primarily composed of sand and gravel that ranges in thickness from 5 to 50 feet (Intera et. al, 2012).

The most significant water bearing zones are the Crystalline Bedrock and the Santa Fe Group that underlie the east and west portions of the Copper Flat Mine Permit Area. The Quaternary alluvial fan and fluvial water bearing units are located along the east side of andesite-upper Santa Fe Group contact in the vicinity of the existing tailings disposal facility. This shallow water bearing zone lies on top of a low permeability red clay and does not extend east of the large normal fault located east of the Mine Permit Area Boundary as shown on the Geologic Map (Figure 11K-2a) and the east-west Geologic Cross-section TA-TA'(see Figures 11K-6a and 6b).

Generally, the wells in this water bearing zone are screened to 60 feet or less (Intera et al., 2012, JSAI 2014b). In the alluvial sediments of the Grayback Arroyo overlying the crystalline bedrock, groundwater flow follows the stream channel. East of the andesite, the groundwater in the Grayback arroyo seeps into and recharges the Santa Fe Group. Within the Mine Permit Area, two wells are screened into the Grayback Alluvium, GWQ11-26 west of the pit and GWQ-3 downstream of the pit. The locations of both wells are shown on Figure 11K-2a.

Maximum and minimum depth to groundwater

Table 11K-2 provides information regarding the minimum and maximum depths to water for each water-bearing zone. It identifies the well from which the water level was collected and the date that the water level was collected. Figure 11K-8 shows the location of the wells measured. The source of this data is from recent groundwater measurements taken during the Stage 1 Abatement Investigations conducted 2013 at the site.

TABLE 11K-2
Minimum & Maximum Depth to Groundwater

Water Bearing Zone	Minimum Depth (ft.)	Well/Date	Maximum Depth (ft.)	Well /Date
Crystalline Bedrock	19.0	GWQ11-25A/Oct 2013	75.34	GWQ11-25B/Jul 2013
Santa Fe Group	7.26	GWQ-1/Jan 2013	156.20	GWQ13-28/Oct 2013
Quaternary Alluvium, Upper Santa Fe Group	22.40	GWQ94-16/Oct 2013	46.50	IW-1/Jul 2013
Quaternary Alluvium, Grayback Arroyo Alluvium	12.60	GWQ-3/Oct 2013	41.58	GWQ11-26/Jul 2013

Aquifer Transmissivity and Storativity

Tested hydraulic conductivities are summarized in Table 11K-3. Transmissivity is conductivity multiplied by thickness, which is dependent on the saturated screened interval, which varies.

TABLE 11K-3
Properties of the Water Bearing Units Beneath the Copper Flat Mine Permit Area

Water Bearing Zone	Range of Hydraulic Conductivity (ft/day)	Range of Transmissivity (ft^2/day)	Storativity	Wells included in Test Range	Source of Information
Crystalline Bedrock Aquifer (Andesite)	0 to 0.0027	NA(1)	NA(2)	GWQ96-22, GWQ96-23, GWQ-5R	JSAI May 2014, JSAI August 2014
Crystalline Bedrock Aquifer (Quartz Monzonite)	0.02 to 0.14	NA(1)	NA(2)	GWQ11-24, GWQ11-25	JSAI May 2014, JSAI August 2014
Santa Fe Group	1.0 to 4.7	187 to 1,710	$2.5X10^{-4}$ (3)	GWQ-1,GWQ-7, GWQ-9, GWQ94-17, GWQ13-28,	JSAI May 2014, JSAI August 2014
Quaternary Alluvial Aquifer	3.8	87	NA(4)	GWQ94-16	JSAI May 2014, JSAI August 2014

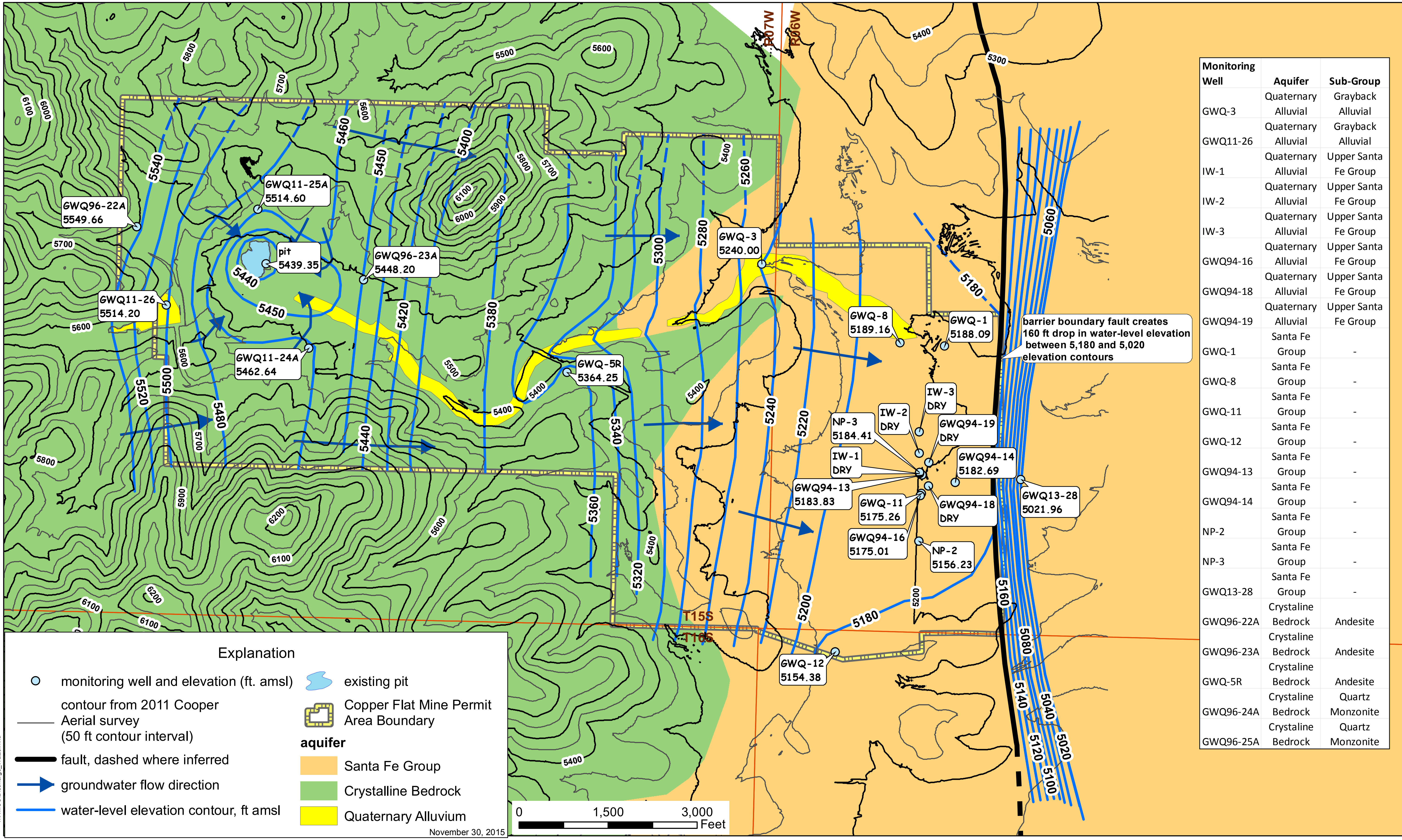
(1)Transmissivity is more appropriate for aquifers with fairly uniform inter-granular permeability and less appropriate for fractured rocks because of spatial variability and limited spatial influence (JSAI, Personal Communication July 30, 2015).
(2)Storage coefficient for a system of fractures in an otherwise nearly impermeable crystalline rock is not approachable with a short term pressure injection test because of the lack of rock volume information into which water is injected (JSAI, Personal Communication July 30, 2015).
(3)Transmissivity and storage coefficient was derived from a 78 hour pumping test on GWQ94-17 by Adrian Brown Consultants in 1994 (Appendix C of JSAI August 2014).
(4)There is no pumping test data for the alluvial aquifer system, hydraulic conductivities were estimated from water level measurement during pumping for sample collection (JSAI, May 2014).

Direction of Groundwater Flow

The general direction of groundwater flow is from the west to the east. The exception to this is in the vicinity of the existing mine pit, which acts as a hydraulic sink. Groundwater flow direction and hydraulic gradients are shown on Figure 11K-9. The water level elevation contours in shown are derived from data from wells around the perimeter of the mine pit.

Figure 11K-10 provides hydrographs that illustrate water levels in the existing pit water body and from monitoring wells installed around the pit from 2009 through 2013. The water levels show that water in the pit has been consistently lower than the water levels in the surrounding wells, indicating that the pit is and has been a hydrologic sink. The water-level elevation in the pit after mining operations have ceased is projected to be at approximately 4900 ft. While the water levels surrounding the mine pit may be lower after mining operations have ceased than shown in Figure 11K-10, they would be expected to be higher than the pit.

NMCC provided the BLM and its contractor a response to an inquiry as to the possibility of water flowing from the pit lake into groundwater after large short-term precipitation events which can occur during the summer. In the response of June 25, 2015 JSAI explained that projected water levels in the pit and downstream derived from the JSAI groundwater model indicates that the water level down-gradient of the pit will always above 5,100 ft. elevation. Filling the pit from 4,900 ft. elevation to 5,100 ft. elevation would require about 250 inches of water over the entire 327-acre pit catchment and watershed or about 6,800 acre-feet of water in order to create a flow-through system and overcome the sink that the mine pit creates. The wettest year on record in the Hillsboro area is 21 inches of water over an entire year, i.e., 1941. That would have generated about 82 acre-feet of precipitation and runoff to the pit (JSAI 2015). As such, it Is reasonable to conclude that the mine pit will continue to be a hydrologic sink.



Monitoring Well	Aquifer	Sub-Group
GWQ-3	Quaternary Alluvial	Grayback Alluvial
GWQ11-26	Quaternary Alluvial	Grayback Alluvial
IW-1	Quaternary Alluvial	Upper Santa Fe Group
IW-2	Quaternary Alluvial	Upper Santa Fe Group
IW-3	Quaternary Alluvial	Upper Santa Fe Group
GWQ94-16	Quaternary Alluvial	Upper Santa Fe Group
GWQ94-18	Quaternary Alluvial	Upper Santa Fe Group
GWQ94-19	Quaternary Alluvial	Upper Santa Fe Group
GWQ-1	Santa Fe Group	-
GWQ-8	Santa Fe Group	-
GWQ-11	Santa Fe Group	-
GWQ-12	Santa Fe Group	-
GWQ94-13	Santa Fe Group	-
GWQ94-14	Santa Fe Group	-
NP-2	Santa Fe Group	-
NP-3	Santa Fe Group	-
GWQ13-28	Santa Fe Group	-
GWQ96-22A	Crystaline Bedrock	Andesite
GWQ96-23A	Crystaline Bedrock	Andesite
GWQ-5R	Crystaline Bedrock	Andesite
GWQ96-24A	Crystaline Bedrock	Quartz Monzonite
GWQ96-25A	Crystaline Bedrock	Quartz Monzonite

Figure 11K-9. Geologic map showing water level elevations from 4th Quarter 2013, Copper Flat Mine, Sierra County New Mexico.

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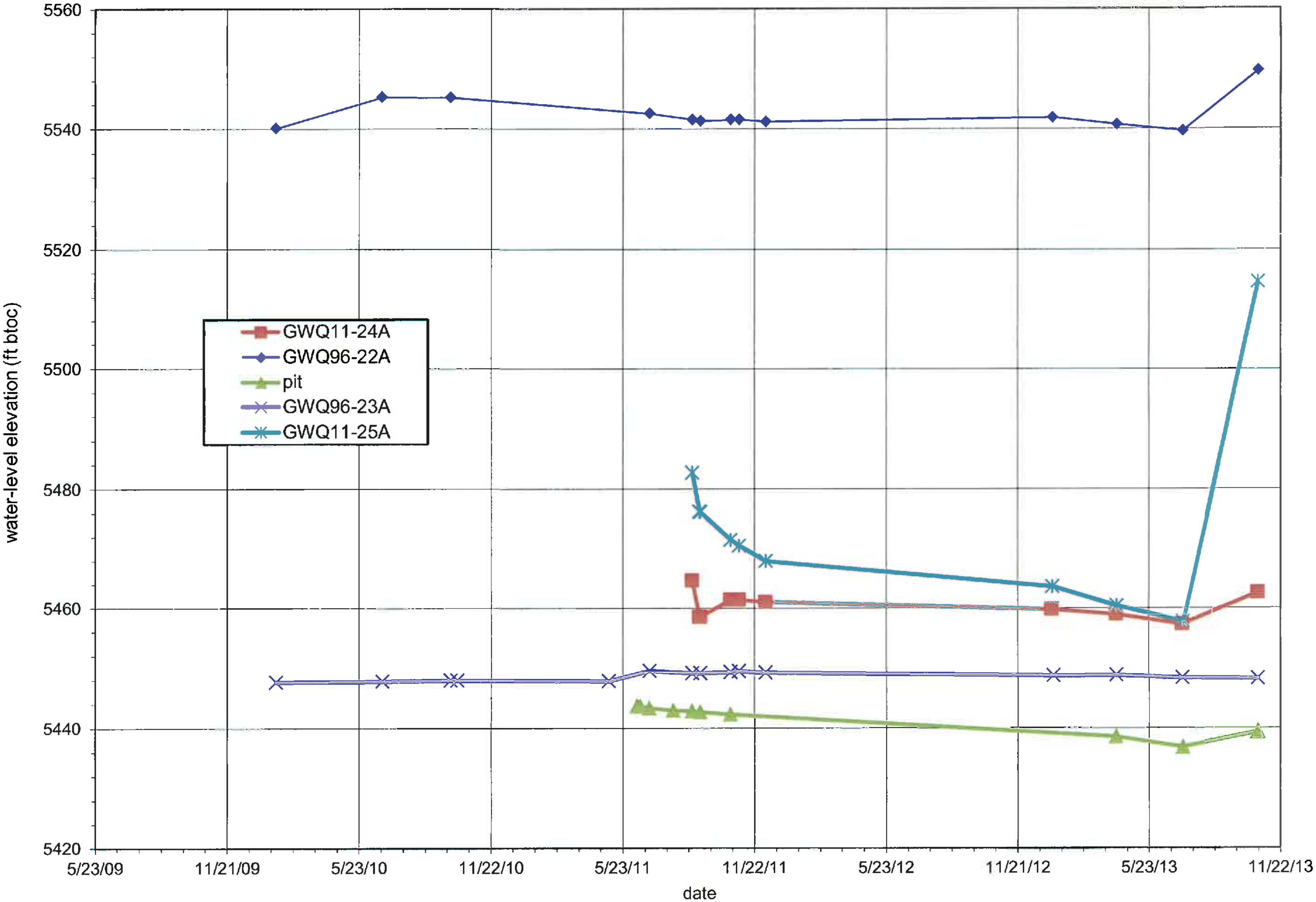

Figure 11K-10. Hydrograph of pit area wells and pit water levels.

Groundwater Quality

This section presents groundwater quality for the water bearing zones at the Copper Flat Mine project. The data was summarized from several reports prepared for Quintana Minerals Corporation and New Mexico Copper Corporation. Table 11K-4 presents the reports that were cited in this analysis. The laboratory reports associated with this data are incorporated into the cited reports in Table 11K-4.

TABLE 11K-4
Source Reports Cited in Groundwater Quality Analysis

Report Title	Report Prepared By	Date
Tailings Dam and Disposal Area, Quintana Mineral Corporation, Copper Flat Project, Gold Dust, New Mexico	Sargent, Hauskins, and Beckwith (SHB)	October 1980
Geohydrologic Evaluation For Submission of Discharge Plan, Copper Flat Project, Quintana Mineral Corporation, Sierra County, New Mexico	SHB	June 1981
Baseline Data Characterization Report, Copper Flat Mine, Sierra County, New Mexico	Intera et al.	June 2012
Results from the First Year of the Stage 1 Abatement Investigation at the Copper Flat Mine Site Near Hillsboro, New Mexico	John Shomaker and Associates (JSAI)	May 2014

Table 11K-5 presents groundwater results from samples collected prior the initiation of mineral processing by Quintana Minerals, which initiated in March, 1982. These water quality results represent the pre-discharge conditions at the Copper Flat Mine based on for some constituents the data available from that time. The results have been categorized by the wells the samples that were collected from the aquifers or water bearing units that the wells were screened in. The well locations are presented on Figure 11K-8.

Table 11K-6 presents groundwater data collected by NMCC and its consultants during baseline data characterization and Stage 1 Abatement monitoring activities conducted from 2010 to 2013. The results from this table represent the current water quality conditions beneath the Copper Flat Mine Area Permit Boundary. For the Quaternary Alluvial Aquifer in Grayback Arroyo and the Crystalline Bedrock Aquifer, the wells screened in the up-gradient and down-gradient of the Copper Flat ore body have been segregated. In Grayback Arroyo, well GWQ11-26 is up-gradient of the ore body and is also representative of a pre-discharge condition. In the Crystalline Bedrock Aquifer, wells GWQ96-22A and B, GWQ-24A and B, and GWQ-25B have all been completed since the existing Copper Flat Mine pit was excavated; therefore, these wells have been within the influence of the evaporative hydraulic sink caused by the pit. Given these wells are within the cone of depression caused by the pit, they are effectively up-gradient and are representative of pre-discharge conditions. This is not the case for the Quaternary Alluvium (upper Santa Fe Group) Aquifer and the Santa Fe Group Aquifer as these aquifers are both down-gradient of the Copper Flat ore body. Groundwater quality sample results from Well GWQ11-25A was not included as representative of the Crystalline Bedrock

TABLE 11K-5 Water Quality Samples Collected Prior to 1982				
Water Bearing Units beneath the Copper Flat Mine Area Permit Boundary				
Constituent	**Quaternary Alluvial Aquifer (Grayback) (mg/L)**	**Quaternary Alluvium (Upper SFG) (mg/L)**	**Santa Fe Group (mg/L)**	**Crystalline Bedrock (mg/L)**
	Wells Sampled	**Wells Sampled**	**Wells Sampled**	**Wells Sampled**
	GWQ-3[1], GWQ-5[2]	**NP-5, SHB-27[3], SHB-28[3], SHB-29[3], SHB-30[3]**	**GWQ-1, GWQ-2, GWQ-7, GWQ-8, GWQ-9, GWQ-10, GWQ-11, NP-1, NP-2, NP-3**	**GWQ-4, GWQ-6[4]**
Arsenic	0.004 to <0.01	<0.005 to 0.02	<0.002 to 0.024	<0.01
Barium	<0.2	<0.2 to 0.218	<0.02 to 0.25	<0.2
Cadmium	<0.005	<0.001 to <0.005	<0.001 to 0.006	<0.005
Chromium	<0.01	0.002 to <0.02	<0.005 to <0.05	<0.01
Cyanide	<0.01	0.001 to <0.01	<0.001 to 0.36	<0.01
Fluoride	0.6 to 1.03	0.77 to 1.3	0.3 to 1.9	0.68 to 1.1
Lead	<0.02 to 0.073	<0.001 to <0.02	<0.005 to 0.033	<0.02
Total Mercury	<0.001	<0.0004 to <0.001	<0.0005 to 0.0064	<0.001
Nitrate	0.1 to 5.5	<0.1 to 4.1	<0.05 to 60	0.5 to 3.3
Selenium	0.0037 to 0.0062	<0.005 to <0.02	<0.0005 to 0.029	0.0046 to <0.005
Silver	<0.02	<0.001 to <0.02	<0.001 to 0.023	<0.02
Uranium	NA	NA	NA	NA
Chloride	32 to 56	21 to 51	17 to 100	22 to 102
Copper	<0.05	0.002 to <0.1	<0.02 to 0.48	<0.02 to <0.05
Iron	<0.1	0.007 to 0.52	<0.01 to 3.8	<0.1
Manganese	<0.05	0.036 to 0.42	0.001 to 1.4	<0.05 to 0.11
Sulfate	383 to 575	145 to 353	34 to 220	41 to 270
TDS	868 to 1,260	384 to 840	350 to 650	400 to 810
Zinc	0.064 to 0.32	0.004 to 0.4	<0.05 to 5.3	<0.025 to 0.28
pH	7.0 to 7.9	7.6 to 8.0	7.0 to 8.6	7.2 to 8.3
Aluminum	<0.01	<0.01 to 0.239	<0.01 to 10.2	<0.01
Boron	<0.1 to 0.108	0.07 to 0.1	<0.004 to 0.77	<0.1 to 0.135
Cobalt	<0.05	<0.001 to <0.02	<0.02 to <0.05	<0.02 to <0.05
Molybdenum	<0.05	0.002 to <0.1	<0.01 to 0.26	<0.05
Nickel	<0.05	0.019 to <0.05	<0.01 to <0.05	<0.05

[1]GWQ-3 33 ft. deep concrete line well, 40 inches by 43 inches perforated from 10 to 33 feet.

[2]GWQ5 20 ft. deep rock lined well located in Grayback Arroyo downstream of the Quintana Plant Site. Well was destroyed during construction of the Quintana Mine.

[3]SHB 1981 SHB (1980) indicates that water samples were collected from geotechnical borings SHB-29, 30, 31, 33, and 34 and the water samples were submitted to "Controls for Environmental Pollution, Inc." for analysis. SHB (1981) describes these as "wells", SHB-27, 28, 29, 30, and 34. The data from SHB-34 was not used because the concentration data was not realistic; which are more representative of a QA blank sample. The relationship between soil borings and "wells" is not documented in either report. However, using the laboratory data reports from SHB-1980 and SHB 1981, the relationship between borings and wells can be established.

[4]GWQ-6 Old well located near an old windmill site west of the existing tailings facility. No well construction details are available and depth is unknown. Subsurface conditions in this area are andesite flows and/or volcanic debris flows. The well is currently unusable. GWQ-6 corresponds to GWQ-6N on NMCC current survey files.

TABLE 11K-6
Water Quality Samples from 2010 to 2013

Water Bearing Units Beneath the Copper Flat Mine Area Permit Boundary						
Constituent	Quaternary Alluvial Aquifer (Grayback) (mg/L)		Quaternary Alluvium (Upper SFG) (mg/L)	Santa Fe Group (mg/L)	Crystalline Bedrock (mg/L)	
	Wells Sampled	Wells Sampled	Wells Sampled	Wells Sampled	Wells Sampled	Wells Sampled
	GWQ-3 (down-gradient of ore body)	GWQ11-26 (up-gradient of ore body)	NP-5, IW-2, GWQ94-16	GWQ-1, GWQ-8, GWQ-11, GWQ-12, GWQ13-28, GWQ94-13, GWQ94-14, GWQ94-15, GWQ94-17, NP-1, NP-2, NP-3, NP-4	GWQ-5R, GWQ96-23A, GWQ96-23B (down-gradient of ore body)	GWQ11-24A, GWQ11-24B, GWQ11-25B, GWQ-4, GWQ96-22A, GWQ96-22B (up-gradient of ore body)
Arsenic	NA	NA	<0.001 to 0.0092	<0.001 to 0.0042	<0.001 to 0.0027	<0.001 to 0.0057
Barium	NA	NA	0.018 to 0.039	0.03 to 0.059	0.078 to 0.13	0.057 to 0.11
Cadmium	NA	<0.002	<0.002	<0.002	<0.0012 to <0.002	<0.0012 to 0.256
Chromium	NA	NA	<0.006	<0.006	<0.006	<0.006
Cyanide	NA	NA	<0.005 to <0.01	<0.005 to 0.012	<0.005	<0.005 to <0.01
Fluoride	NA	0.4 to <1.0	0.6 to 0.7	<0.1 to 0.6	1.3 to 2.1	0.73 to 24.4
Lead	NA	NA	<0.005	<0.005	<0.005	<0.005
Total Mercury	NA	NA	<0.0002 to 0.00048	<0.0002 to 0.00026	8.94E-07 to <0.0002	8.94E-07 to <0.0002
Nitrate	NA	NA	1.7 to 4.1	1.4 to 7.5	<0.1 to <1.0	<1.0 to 2.1
Selenium	NA	0.0015 to 0.0062	0.0021 to 0.037	<0.001 to 0.028	<0.001 to 0.0016	<0.001 to 0.0566
Silver	NA	NA	<0.005	<0.005	<0.005	<0.005
Uranium	NA	NA	0.0013 to 0.0062	0.0013 to 0.0023	<0.001 to 0.0037	<0.001 to 0.0037
Chloride	63 to 75	14 to 32	79 to 600	20 to 290	12 to 19	26 to 110
Copper	NA	0.00265 to <0.006	<0.001 to <0.006	<0.001 to <0.006	0.00087 to <0.006	<0.001 to 137
Iron	NA	NA	<0.02 to 1.3	<0.02 to 0.10	0.04 to 1.4	0.02 to 9.3
Manganese	NA	0.0168 to 0.0437	<0.002 to 3.6	<0.002 to 0.19	0.29 to 0.63	0.029 to 13.7
Sulfate	1,210 to 1,750	96.5 to 179	170 to 1,200	5 to 830	1.4 to 140	6.2 to 2,730
TDS	2,410 to 3,060	317 to 905	623 to 2,770	360 to 1,740	496 to 804	521 to 4,400
Zinc	NA	<0.01 to 0.013	<0.01 to 0.29	<0.01 to 1.85	0.0065 to 0.07	<0.01 to 8.65
pH	7.3 to 7.5	6.8 to 7.5	7.0 to 8.0	6.4 to 8.8	6.9 to 8.2	3.7 to 8.0
Aluminum	NA	<0.02 to 0.153	<0.02 to 0.13	<0.02 to 0.14	<0.0053 to 0.0314	0.0097 to 56.6
Boron	NA	NA	<0.04 to 0.081	<0.04 to 0.04	0.068 to 0.14	<0.04 to 0.28
Cobalt	NA	<0.006	<0.006 to 0.017	<0.006	0.0018 to <0.006	0.002 to 0.439
Molybdenum	NA	NA	<0.008 to 0.024	<0.008	<0.008	<0.008
Nickel	NA	NA	<0.01	<0.01	<0.01	<0.01

Aquifer because JSAI (2014) describes the groundwater chemistry samples from that well as "completely different from all other samples in the pit area…." This well is completed in a localized zone of sulfide mineralization and the water source is suspected to be from oxygenated water infiltrating through sulfide bearing fractures with limited storage.

The well locations for this time period are also presented on Figure 11K-8. Groundwater elevations from the 4th Quarter 2013 are presented on Figure 11K-9.

20.6.7.11.L LOCATION MAP

An application shall include a location map with topographic surface contours identifying all of the following features within a one-mile radius of the copper mine facility:

- ***(1)*** *watercourses, lakebeds, sinkholes, playa lakes, seeps and springs (springs used to provide water for human consumption shall be denoted);*
- ***(2)*** *wells supplying water for a public water system and private domestic water wells;*
- ***(3)*** *irrigation and other water supply wells; and*
- ***(4)*** *ditch irrigation systems, acequias, irrigation canals and drains.*

Figure 11L-1 provides the information requested. With respect to water courses, all are ephemeral, flowing only in response to significant precipitation events. Grayback Arroyo transects the site from west to east, Greenhorn Arroyo begins at the southeast corner just outside of the mine permit boundary area and runs east, and Hunkidori Gulch begins at the eastern edge just outside of the mine permit area boundary and runs east. The only lakebed in the area requested is the pit lake attendant to the existing open pit on the site. There are no playa lakes within a one-mile radius of the facility. One seep exists on the high wall of the existing open pit. There are no springs located within a one-mile radius of the facility.

With respect to water supply wells for a public system or domestic water wells, there are none within a one-mile radius of the facility.

With respect to irrigation and other water supply wells, there are several wells within a one-mile radius of the facility. Some are useable. Others are not currently useable. And other are known to exist but could not be verified as useable or not useable because access by NMCC to these wells has been denied.

With respect to ditch irrigation systems, acequias, irrigation canals and drains, there none within a one-mile radius of the facility.

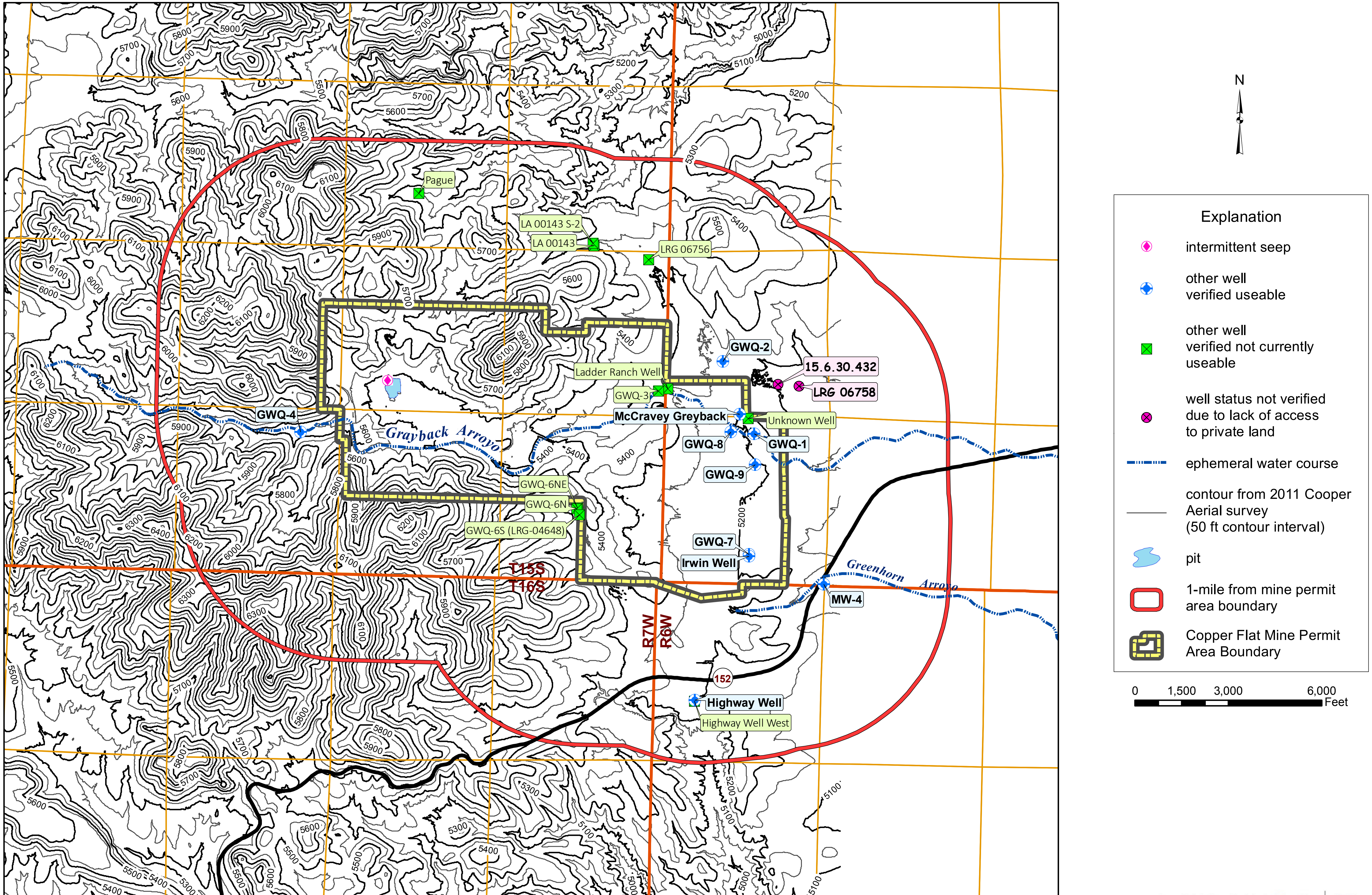

Figure 11L-1. Copper Flat Mine Location Map

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20.6.7.11.M FLOOD ZONE MAP

An application shall include, if available, the most recent 100-year flood zone map developed by the federal emergency management administration (FEMA), flood insurance rate map or other flood boundary and floodway map with the copper mine clearly identified along with all 100-year frequency flood zones for the copper mine facility, and a description of any engineered measures used for flood protection.

Figure 11M-1 is a 100-year flood insurance rate map (FIRM) flood zone map for the Copper Flat project area. All of the project site area is located in Zone C, Areas of Minimal Flooding. There are no engineered measures used in the project site area used for flood protection.

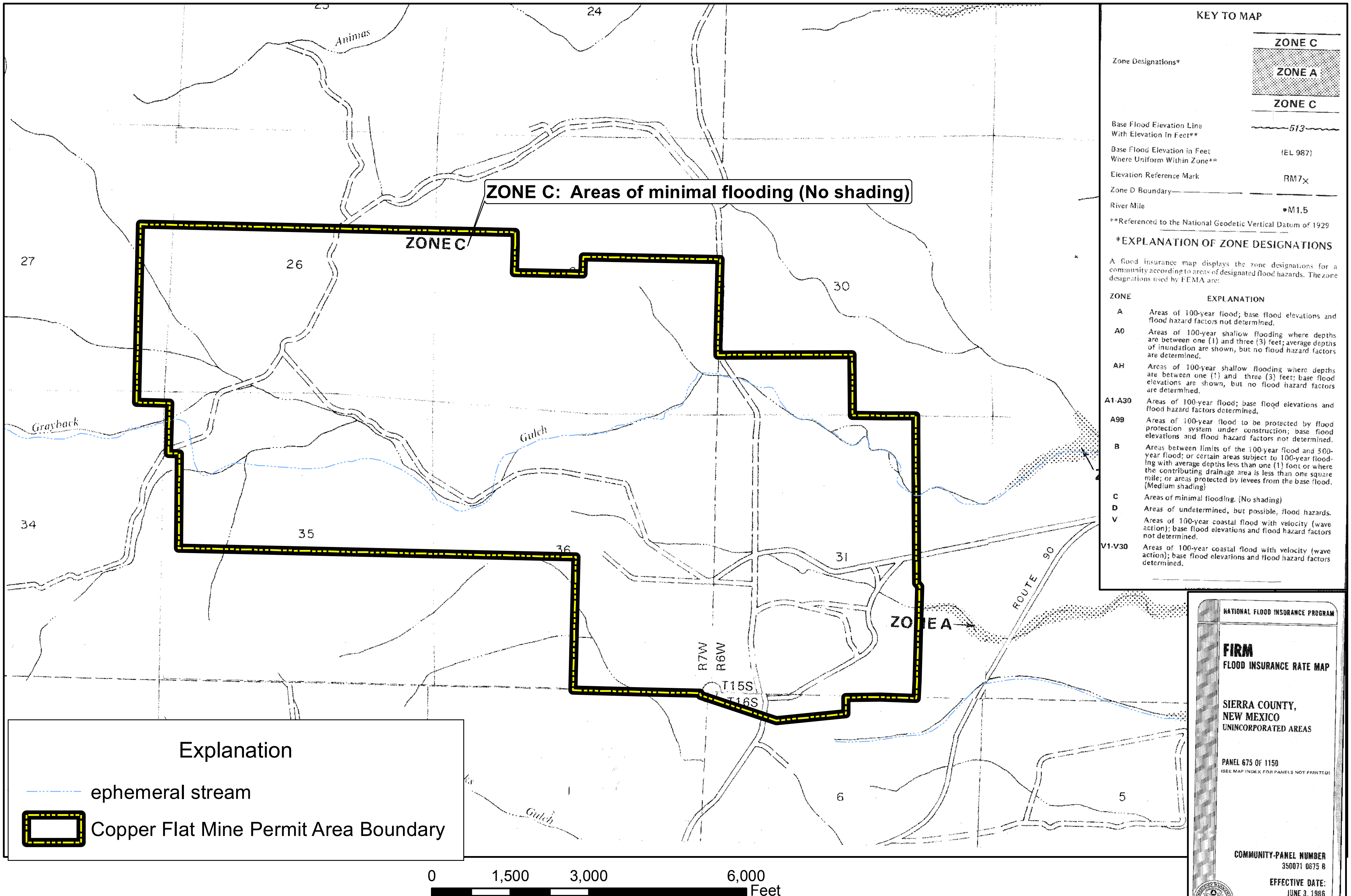

Figure 11M-1. FEMA 100-year flood zone map, Copper Flat Mine, Sierra County, New Mexico.

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20.6.7.11.N ENGINEERING DESIGN, CONSTRUCTION AND SURVEYING

Pursuant to 20.6.7.17, 20.6.7.18, 20.6.7.20, 20.6.7.21, 20.6.7.22, 20.6.7.23 and 20.6.7.26 NMAC an application shall include:

- ***(1)*** *plans and specifications for proposed new or modified tailings impoundments, leach stockpiles, waste rock stockpiles, and process water and impacted stormwater impoundments and associated liners;*
- ***(2)*** *plans and specifications for proposed new or modified tanks, pipelines, truck and equipment wash units and other containment systems; and*
- ***(3)*** *a stormwater management plan.*

20.6.7.11.N.(1) TAILINGS STORAGE FACILITY

Plans and specifications for Copper Flat project new tailings storage facility, including associated liners are contained in Appendix A. These plans and specifications are prepared at the Feasibility grade level. NMCC believes that the information contained therein is sufficient to allow the NMED to evaluate the liner design and construction for these facilities pursuant to the Copper Rules.

Sections 1 through 5 of the design document present the various parameters and site condition considerations that were analyzed in preparing the design, including site topography, climate, subsurface geology and other site observations. The design document discusses the results of the extensive site-specific soils and geotechnical exploration and testing programs that were conducted in the field as well as the tailings test and materials classification and consolidation tests conducted in the laboratory. It also presents consolidation modeling results for the tested tailings materials.

Section 6, Feasibility Level Design, presents the design of the tailings impoundment, the seepage collection pond and related facilities, i.e., the TSF, beginning with Table 6 which summarizes the key design criteria for the design of the TSF including regional design factors, impoundment-specific design factors, water storage and storm water diversion design factors.

Sections 7 and 8 present tailings delivery and distribution system and the water reclaim system designs and their related liner systems.

20.6.7.11.N.(1) WASTE ROCK STOCKPILES

The plans and specifications for the waste rock stockpiles are also at a feasibility level of design. In general, the stockpiles will be built to a configuration of 3 horizontal to 1 vertical slope angels (18.4 degrees). This configuration will help facilitate reclamation at the end of the mine life as provided for in Section **20.6.7.33.C.(3)**. Each lift within the stockpile will be maximally 75 ft. high and be placed at angle of repose (35.54 degrees) with 120 ft. setbacks left between lifts to maintain the 3 to 1 overall angle for the stockpile.

20.6.7.11.N.(1) PROCESS WATER AND IMPACTED STORM WATER IMPOUNDMENTS

The Plans and Specifications for the process water and impacted storm water impoundments and associated liners are contained in Appendix B. As with the plans and specifications for the TSF, these plans and specifications are also prepared at the Feasibility grade level. NMCC believes that the information contained therein is sufficient to allow the NMED to evaluate the liner design and construction for these facilities pursuant to the Copper Rules.

20.6.11.N.(2) TANKS, PIPELINES, TRUCK AND EQUIPMENT WASH UNITS

As indicated above, M3 has prepared a Process Facility Containment Report that provides the plans and specifications for the tanks, pipelines and truck and equipment wash and other containment units. The report is included herein as Appendix C. As with the plans and specifications for the TSF, these plans and specifications are also prepared at the Feasibility grade level. NMCC believes that the information contained therein is sufficient to allow the NMED to evaluate the liner design and construction for these facilities pursuant to the Copper Rules.

The report identifies and describes the proposed sumps, tanks, pipelines and truck and wash and other containment units, including their purpose, construction material, dimensions and capacity. This report also provides information regarding the form and design of the containment structures that will be incorporated into the process to contain and manage materials containing water contaminants that have the potential to migrate to groundwater and cause and exceedance of applicable groundwater standards and meet the requirements **of 20.6.7.22, 23 and 26 NMAC**.

Certain foundations, sumps and other containments originally constructed by Quintana for previous operation of the Copper Flat mine exist and may be utilized, where appropriate. Specifically, the primary crusher, the coarse ore stockpile, the reclaim tunnel and the concentrator processing area are areas that have the certain structures that may be utilized by NMCC's operations. Sumps and containment structures exist in certain areas of the existing footprint that may be located and may be of sufficient size to be utilized in the NMCC operations. If they can be utilized, each of these existing sumps and containment areas will be tested to ensure that they do not leak. They will be sealed with approved water stops, coatings or liners, and/or will be reconstructed, as necessary, to meet the requirements of **20.6.7.22, 23, and 26 NMAC** prior to use. All new sumps and containments will be constructed to meet the requirements of **20.6.7.22.B.(1) NMAC**.

Sumps that and other existing containment structures that cannot be utilized in NMCC's operations will be decommissioned in a manner to prevent them from becoming conduits for potential release of contaminants to surface or groundwater. Unutilized sumps will be filled with grout and/or concrete. Unutilized containment areas will be removed so that they cannot retain water.

NMCC proposes to install new tanks and pipelines for its operations, with the exception of the freshwater pipeline that will provide water to the operation from the off-site well field. Therefore, with respect to the requirements of **20.6.7.23.C.(6) NMAC** for a pipeline evaluation plan for existing pipelines, NMCC believes that no pipeline evaluation plan is necessary. All new pipelines and tanks will be constructed in accordance with the requirements of **20.6.7.23.B.(1) NMAC.** All containment system structures, pipelines, tanks and secondary containment structures will be inspected at least monthly per **20.6.7.22.C.(3).b and 20.6.7.23.(C).(2) NMAC**, respectively.

NMCC proposes to have two (2) areas specifically designed for equipment and truck washing. One area will be located within the concentrator area, designated as the "Wheel Wash Area". The purpose of this area is to provide a location where the wheels of the located with the copper concentrate will be washed to remove any concentrate product that adheres to the truck wheels prior to leaving the concentrator area. This activity will be conducted in a containment area as described in Section 4.1.9 of Appendix C. The second area, designated as the "Truck & Equipment Washing Unit" will be constructed in the plant site along the haulage road from the mine to the truck shop as described in more detail in Section 4.4 of Appendix C. Both of these units have been designed and will be constructed and operated in conformance with **20.6.7.26 NMAC** as discussed in Appendix C.

20.6.7.11.N.(3) STORM WATER MANAGEMENT PLAN

Storm water will be managed using a series of engineering and best management practices to ensure that storm water is controlled in a manner in conformance with applicable state and federal requirements. The purpose of the plan is to control surface storm water flows to minimize contact with mine disturbances and activities so as to prevent impacts to surface water and ground water quality.

NMCC's overall storm water management and impact mitigation strategies will include actions such as;

- Grading and contouring all site facilities to maximize the opportunities to route surface drainage around and away from the mining activity;
- Eliminating and/or minimizing run-on and run-through routes;
- Controlling run-off velocity to control erosion;
- Constructing run-off control ditches wherever needed to divert run-off and control and capture impacted storm water;
- Collecting run-off water that has been potentially impacted by mining activities in the mine pit and/or lined impoundments as necessary and minimizing potential for release;
- Reusing captured water as make-up process water whenever possible.

As described in Section **20.6.7.11.J.(6)**, NMCC proposes to construct several storm water management structures to manage run-on and run-off at the Copper Flat mine. Figure 11J-21 shows that the Copper Flat mine permit area boundary lies within the Greenhorn Arroyo drainage basin. The site is located in the top or head of the basin. As such, storm water drainage at and through the site is limited. Grayback Arroyo, an ephemeral watercourse, and a small unnamed arroyo tributary to Grayback Arroyo are the only drainage-ways that enter the site. Grayback Arroyo transects the site from west to east beginning at the top of the basin. The unnamed arroyo enters the site at the northwest corner of the site. Mining activities undertaken by Quintana Minerals in the early 1980's resulted in construction of diversion structures to Grayback Arroyo and the unnamed arroyo to divert drainage around the site. NMCC has conducted an analysis of the capability of the structures to safely pass a 100- year 24 hour storm event through the site. This analysis has determined that Grayback Arroyo will safely handle such an event while keeping all of the water within its banks. As such, a primary feature of NMCC's storm water management strategy incorporates the existing diversion structures to eliminate run-on from all areas of the site. These structures have worked very well over time and remain in place and functioning today. NMCC will continue to maintain the integrity of the diversion structure during and operating life of the mine as part of its storm water management plan during operations and as part of reclamation and closure of the project.

Site Drainage Management

Storm water runoff from the various areas at the site will be managed at the Copper Flat mine in a manner appropriate for that location. The Copper Flat site has four areas where storm water management will be especially important;

- Open pit mine
- Process area, administration building, parking and other ancillary facilities
- Waste rock stockpile areas, and
- Tailings storage facility

NMCC will develop watershed areas within the site for each of these four areas by grading and contouring the areas and constructing the structures in a manner to control storm water. Figure 11J-3 identifies the developed watersheds in association with surface water drainage management.

Mine Pit Management

As describe previously, developed watershed D (WS D) will be located at the westernmost edge of the site. It contains the mine pit and existing waste rock stockpiles (EWRSP-1 and EWRSP-2A) constructed by the Quintana Mining operation. All precipitation that falls onto the footprint of the developed watershed D will be captured in the mine pit. Drainage ditches will be constructed, as necessary, to move run-off as efficiently as possible while taking care not to cause erosion or to allow ponding and infiltration. Water collected in the mine pit during operation will be pumped out and utilized for dust control within the open pit surface drainage area or as make-up water in the process. When applying water for dust control, care will be taken to not over-water to prevent ponding or erosion from occurring. At closure, the water will be allowed to collect in the pit and contribute to the volume of the pit lake as described in the Reclamation and Closure Plans.

Plant Area Management

Developed watershed A (WS A) will be located in the south-central portion of the site as shown in Figure 11J-3. It will control storm water from the processing facility, including crushing and grinding, milling, flotation, concentrating, drying and packaging, the administration building, parking and other ancillary support facilities. WS A also contains an area which includes an existing waste rock stockpile (EWRSP-3). As described earlier, a portion of this existing stockpile includes the small volume of ore that was not processed by Quintana before shutting down. This ore material will be utilized by NMCC to feed the process circuit early in the operations phase. The remaining existing waste rock stockpile will utilized as a temporary holding area to store oversized ore rock that cannot be fed directly into the crusher and must be reduced in size using pneumatic hammers.

Watershed A will be graded and berms constructed, as necessary, to eliminate storm water run-on. The area will be graded and contoured to direct and collect precipitation to a lined storm water impoundment as shown in Figure 11J-3. Details of the design of this impoundment are contained in Section **20.6.7.11.J.(2)** of this application and Appendix B. The impoundment will be designed to capture the water produced from a 100-year 24 hour storm event and will have a minimum of two feet of free-board. Captured water will be transferred to the process water reservoir, also located within WS A (see Figure 11J-3), and utilized as make-up water in the process.

The storm water impoundment will be constructed with a spillway designed to safely pass overflow water in the event of the occurrence of an extraordinary storm event that exceeds NMED design specifications. Overflow water from the spillway will be routed Grayback Arroyo.

The process water reservoir will also be located in within developed watershed A. The reservoir is designed such that no surface water runoff from the watershed will enter it. Only precipitation that falls directly on the footprint of the reservoir will be retained therein. The process water reservoir will not have a spillway, per **20.6.7.17.D.(7) NMAC,** that empties onto the ground surface. In the unlikely event of overtopping of the reservoir as a result of a significant storm event larger than the design storm (which has been designed per NMED requirements) the water will be directed through a weir into a lined conveyance ditch designed to route water to the tailings storage facility. The primary purpose of this conveyance ditch will be to function as the secondary containment structure for the pipeline from the process circuit to the tailings facility and the recycled water pipeline from the tailings facility to the process water reservoir. However, it is also designed to provide a means whereby overflow from the process water reservoir can be managed in conformance with **20.6.7.17.D.(7) NMAC**.

At closure, these impoundments will be re-contoured, re-graded and covered as described in the Reclamation and Closure Plans so that water in no longer retained.

Waste Rock Stockpile Management

Developed watersheds B and C will be located at the north-central portion of the site as shown in Figure 11J-3. Developed watershed B is the area that will contain proposed new waste rock stockpile (WRSP-1) described in section **20.6.7.11.J.(2)**. This area also contains existing waste rock stockpile EWRSP-2A. This existing stockpile will be enveloped and covered by construction of proposed new stockpile WRSP-1. Developed watershed C will contain proposed new waste rock stockpiles WRSP-2 and WRSP-3.

These developed watersheds and proposed waste rock stockpiles will be constructed, graded and contoured in a manner to direct precipitation runoff to lined storm water impoundments as shown in Figure 11J-3. Berms, swales and other conveyance structures will be constructed in the area and on the stockpiles, as needed, to provide controlled conveyance of storm water while preventing erosion and minimizing ponding.

The storm water impoundments will be designed and constructed to safely retain the volume of water generated from a 100-year 24-hour storm event and have a minimum 2 feet of freeboard. Details of the design of the impoundments are contained in section **20.6.7.11.J.(2)** and Appendix B.

Captured water from these storm water impoundments will be transferred to the process water reservoir in the process area for use as make-up water in the process. The storm water impoundments will be designed with a spillway structure to safely pass overflow water from an extraordinary event in excess of NMED design specifications.

Developed WS B is part of the open pit surface drainage area as shown on Figure 11J-3 and discussed in more detail above. As such, water released from the spillway at storm water impoundment B will pass via a culvert to the mine pit. In the case of storm water impoundment C, water released from the spillway will be released to the land down-gradient and adjacent to the impoundment. The water may find its way to Grayback Arroyo.

At closure, the waste rock stockpiles and the impoundments will be re-contoured, re-graded and covered as described in the Reclamation and Closure Plans.

Tailings Storage Facility Management

The Tailings Storage Facility will be located as shown in Figure 11J-1. The area is naturally protected from storm water runoff passing through Grayback Arroyo by the natural topography of the site. As such there is only runoff from precipitation that falls directly on the TSF location to manage. The tailings dam will be constructed in phases as discussed in detail in Appendix A. Surface water run-on will be controlled during operations by grading and contouring the area to minimize the amount of water contributed into the tailings impoundment. Several run-on diversion ditches will be constructed at the up-gradient perimeter of the tailings impoundment to divert run-on around it per the requirements of the NM Office of the State Engineer. These diversion ditches will be reconstructed in each subsequent phase, as needed, as the dam expands in size until it reaches its ultimate height.

Runoff from the exterior face of the dam will be managed by constructing drainage ditches to control and direct runoff into the underdrain collection pond located at the southeastern toe of the dam (See Figure 11J-1). These drainage ditches will be constructed in a manner that minimizes the opportunity for ponding yet moves water in a controlled fashion to control erosion. The ditches on the exterior face of the dam will enter the lined water conveyance ditch that also holds the water recycle pipeline leading from the underdrain collection pond to the process facility. Runoff water will join the water collected from the tailings underdrains in the pond and will be transported to the process water reservoir for use as make-up water in the process.

The surface area of the cyclone plant, located immediately adjacent to the TSF as seen on Figure 11J-1, will also be contoured and graded to route runoff from the area into the lined water conveyance ditch and drained to the underdrain collection pond.

At closure the TSF and its attendant runoff diversion structures will be re-contoured, re-graded, filled and a cover will be placed over the entire area in accordance with the Reclamation and Closure Plans.

20.6.7.11.O MATERIAL CHARACTERIZATION AND MATERIAL HANDLING PLAN

An application shall include a material characterization plan and, if applicable, a material handling plan for all waste rock excavated at the copper mine facility pursuant to Subsection A of 20.6.7.21 NMAC.

NMMC submitted a proposed Mine Plan of Operations (MPO) for the Copper Flat mine in December, 2011 to the Las Cruces, NM office of the Bureau of Land Management (NMCC 2010). This document, revised in June, 2011, was also provided to the NMED for review and comment as part of the process of preparation of an Environmental Impact Statement (EIS) by the BLM. Appendix C of the MPO contains a Mine Waste Management Plan for the waste rock which included a plan for waste characterization and handling. This plan provides the information as required by **20.6.7.11.O and 20.6.7.21.A NMAC.** Appendix C also contains results of waste characterization work performed by SRK in 1997 in support of an EIS that was being prepared for mining activities proposed by Alta Gold Corporation.

In the intervening time since the MPO was first proposed by NMCC in 2010, the waste characterization portion of the plan was implemented. The results of this work has been submitted and discussed with the NMED and is utilized in various sections of this DP application. NMCC will initiate the materials handling plan contained in Appendix C as contained in the MPO assuming that it is ultimately approved by the BLM, NMED and other constituent agencies.

MATERIAL CHARACTERIZATION

As cited previously herein, SRK has performed extensive geochemical characterization studies in support of NMCC's proposed Copper Flat mine (SRK 2013). The resulting report and additional documentation requested by NMED upon review of SRK's report represent NMCC's material characterization efforts to date and are incorporated into this application by reference. As such, NMCC believes that its material characterization program and material handling plan are in conformance with the requirements of **20.6.7.21 NMAC**.

In brief, SRK conducted a mine waste characterization program for the Copper Flat project. The geochemical testing of mine waste materials provided the characterization required to determine the potential for Acid Rock Drainage and Metal Leaching (ARDML) from mining facilities. This provided the basis for a quantitative risk assessment and evaluation of the options for design, construction and closure of the tailings and waste rock disposal facilities.

The Copper Flat mine waste characterization program was designed to investigate the potential for ARDML due to exposure and oxidation of sulfide minerals, such as pyrite, that are unstable under atmospheric conditions. Upon exposure to oxygen and water, sulfide minerals will oxidize, releasing metals, acidity and sulfate. SRK's geochemical characterization investigated the potential for rock that will be exposed in the Copper Flat waste rock disposal facility and pit walls to generate acid and leach when exposed to the atmosphere. The results of the characterization program were used in quantitative numerical predictions to assess the potential future leachate chemistry associated with the mine facilities, specifically the waste rock stockpiles and the TSF.

SRK's investigation concluded that with respect to waste rock, acid generation is not anticipated to occur for most of the un-weathered waste rock materials during operations. SRK concluded that the acid generating potential of the Copper Flat materials is largely dependent on the sulfide mineral content and that the sulfide concentrations in the material varied from less than analytical detection limits to a maximum of 2.52 weight percent (wt%) that was highest in the transitional waste material. Transitional material is the oxidized and partially oxidized surface rock material that overlies the fresh rock material below the surface. Where oxidation of this overlying material is complete, waste rock produced from it will be inert with respect to acid generation. Partially oxidized material occurs in a transition zone beneath the oxidized cover and the underlying un-oxidized material. This transitional material has been exposed to oxidizing conditions over geologic time. Such material will typically exhibit a low paste pH and high paste conductivity, and will be generally acid generating. Examples of this condition can be found in the exposed pit walls and where transitional waste material was deposited on the existing waste rock stockpiles.

SRK determined that 96% of waste rock that will be produced at Copper Flat will consist of sulfide, non-oxidized Quartz Monzonite/Breccia waste, which typically exhibited either non-acid forming characteristics or a low potential for acid generation. However, samples collected from the surface of the existing waste rock stockpiles and pit walls indicated that there is potential for acid generation from material mined by previous mining operations and exposed to natural weathering conditions.

With respect to tailings, SRK concluded that, based on tailings samples collected as part of the characterization program, that there is generally low potential for ARDML generation.

MATERIAL HANDLING PLAN

NMCC's proposed material handling plan is based, in part, on SRK's recommendations to minimize the potential for acid leaching from the waste rock stockpiles and tailings. Based on SRK's findings the materials that will be generated will have only a low potential for acid leaching, NMCC anticipates that it will, generally, not be necessary segregate waste rock. As described in Appendix C of the MPO, most of the waste rock produced by the operation will be low and high sulfide material with only small amounts of oxide and transitional material produced near the surface of the proposed pit expansion. Additionally, it should be noted that the terms "high sulfide" and "low sulfide" are terms relative to specific conditions at Copper Flat and, therefore, to each other. That is, at Copper Flat low sulfide material is defined as material having less than 0.5% sulfide and high sulfide material will have 0.5% sulfide or more.

The waste will be primarily quartz monzonite and andesite and the ore will be primarily breccia. NMCC will implement a waste material classification program as described in Section 2.5 of the MPO. It is anticipated that the waste rock generated will oxidize very slowly and may potentially produce acid over some period of time. The ARD potential associated with un-oxidized waste rock is relative in the long-term. SRK determined that the waste rock can be considered as being inert with respect to ARD for a timeframe in the order approximately 20 years. Therefore, the vast majority of the waste material, i.e., about 96%, that will be generated will generally have a low ARD potential. As indicated above, the transitional materials that have been exposed to oxidizing conditions over time have the most potential for acid generation.

WASTE MATERIAL CLASSIFICATION

Section 2.6.2 of the MPO generally describes the general waste classification approach the will be implemented at Copper Flat. The subsequent work conducted by SRK and presented in its May, 2013 Geochemical Characterization Report confirms the approach to be utilized. However, while the approach is generally the same as described in Appendix C of the MPO, there will be some aspects of material handling that may differ from the information provided therein as supported by the later findings of SRK's material characterization studies. The overarching approach to waste rock material handling to control ARD will be to control the movement of water through the waste rock stockpiles in combination with continual diligent monitoring and characterization of the waste materials produced to confirm SRK's conclusion that the majority of the material has a low ARD potential. As discussed in more detail below, NMCC believes that depositing the small amounts of material with high ARD potential waste materials, i.e., the transitional waste, when encountered, along with the large amounts of non-ARD materials will further reduce the potential for the ARD materials to create acid. The buffering capacity of the large volume non-transitional waste will neutralize the small volume transitional waste. Should field characterization reveal that more ARD materials than anticipated are being generated the materials handling plan will be adjusted to consider isolation, encapsulation and other means of treatment to mitigate the potential for acid generation. The non-transitional waste will be used as base material in any areas where it has been determined in the field that transitional material should be segregated. However, as a practical matter, under normal circumstances large volumes of non-transitional waste will typically be placed below, above and all around the transitional waste produced.

SRK recommended in its May 2013 report that, during proposed operations, specific controls would be needed to collect storm water runoff from the waste rock stockpiles and that storm-water diversions would be required to prevent run-on. SRK also recommended that covering the waste rock stockpiles with a re-vegetated 36-inch cover at the end of mine life would reduce infiltration of water and flux of oxygen into the facility, and thus, limit oxidation of sulfide minerals. SRK also noted that migration of seepage from the waste rock stockpiles into the underlying bedrock would be anticipated to be very small, or nil, because of the low permeability of the andesite underlying the area. These recommendations have been incorporated into NMCC's design of its waste rock stockpiles.

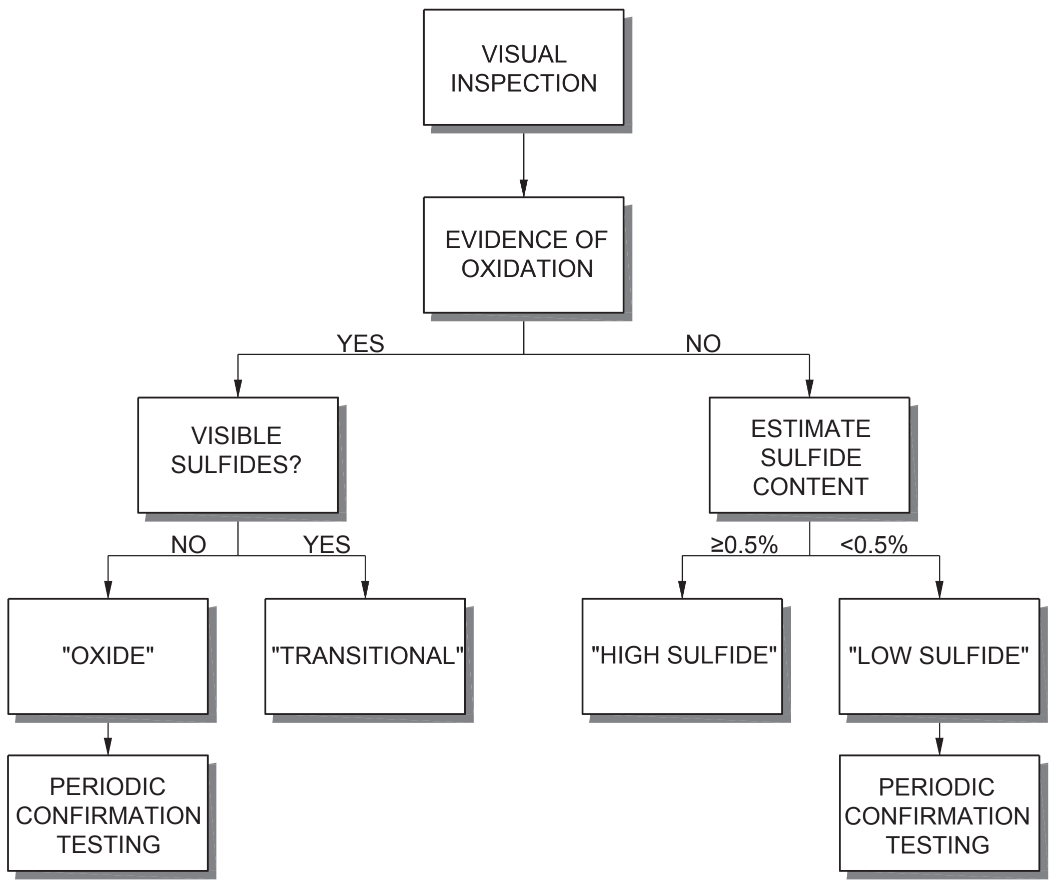
Figure 11O-1 describes process that will be utilized in the NMCC's proposed waste classification program during operations. Following the evaluation path shown in Figure 11O-1, a determination will be made as to classification, and periodic confirmation testing will be conducted. Confirmation testing will include a field testing program for representative samples of the cuttings, as determined by the qualified geologist or technician. The tests conducted will include paste pH, saturated paste conductivity, and acid base accounting testing (total sulfur, sulfate sulfur, and NP testing).

As described in more detail in Section 2.6.2.5 of Appendix C of the MPO, prior to blasting active benches in the open pit, the drill cuttings from each drill blast hole will be inspected. Blast-hole drill cuttings will be visually inspected by a qualified geologist or trained technician prior to blasting and removal of the material from the pit. The rock type, color, degree of oxidation, sulfide content and other pertinent features will be noted and transferred to the bench plan maps. All materials characterized as oxide or low sulfide waste will be sampled for confirmation testing. Material classified as low sulfide waste rock will be subject to periodic confirmation testing at a frequency initially of one confirmation test for each five blastholes designated as oxide waste rock. This frequency will adjusted as ongoing testing and field observation continues to demonstrate consistent reproducible results supporting visual waste classification. NMCC anticipates a frequency of confirmation testing in the longer term to be one test for every 20 holes. Confirmation testing will be performed on-site using a Leco Furnace to evaluate the classification determinations made.

WASTE ROCK FLAGGING AND ROUTING

Waste rock from the open pit will be examined as benches are mined to identify sulfide bearing transition material that may represent ARD potential. Specific procedures will be established by the mine operations team when preparing for start-up; however it is anticipated that the procedures employed by the operation will be similar to the following description, which follows standard mine geology practices and methods. The operations team will develop full details after the team is assembled to begin startup of the mine. As requested by NMED, NMCC will meet with NMED staff as plans develop to discuss the plan and receive input prior to implementation.

The mine waste rock identification, flagging, and routing process will be similar to mine ore control procedures and the two processes will be completed simultaneously. Identification, digging plan design, field identification for operations, determination of destination and placement, and routing of ore and waste materials will be the responsibility of the mine technical services team, which typically includes geology engineering, and surveying disciplines. The mining and ore/waste classification cycle begins with blasthole drilling. At Copper Flat, all benches mined will require blasting; therefore all areas mined will be drilled on a regular grid pattern across the full width and length of each bench. Each blasthole will be assigned a unique identification number (ID) for data tracking, and each will be surveyed and plotted onto a blasthole location map that is spatially tied to a three dimensional (3D) model of the mine geology. As holes are



CLIENT

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CONSULTANT

Golder Associates

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REVIEW	TS
APPROVED	XXX

PROJECT

NEW MEXICO COPPER CORPORATION
COPPER FLAT PROJECT
SIERRA COUNTY, NEW MEXICO

TITLE

OPERATIONAL WASTE CLASSIFICATION FLOWCHART

PROJECT No.	PHASE	Rev.	FIGURE
153-1453	0006	1	11O-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A drilled and surveyed, the ID and survey coordinates of each blasthole will be logged into a blast hole data base. After drilling, and before blasting, the geology of the bench surfaces and exposed mine faces will be examined for key geologic parameters and the geology mapped to the same scale as the blast hole maps. The blasthole cuttings will be visually examined to determine rock type, sulfide content, and oxidation level and samples taken for laboratory analysis. Data from field examinations will be logged into the blasthole data base and plotted onto the blasthole map, with the analytical results added to the maps and the database upon receipt from the laboratory. When the geologic and analytical data for a specific area is complete, the technical services team will develop ore and waste zone boundaries and identify material types that are subject to a specific routing plan, such as for ore transport or transport of potential ARD material to the WRSP. The boundaries and material designations will be transferred back to the blasthole maps and survey coordinates produced for identifying material boundary lines in the field.

After blasting, and before excavation begins, the material boundary lines will be established on the top of the broken rock by survey, and the broken rock visually examined again to determine if any field adjustment in classification is needed; field adjustments will be transferred to the blasthole maps for record keeping. Even after having been blasted, the area will be closed to excavation and material removal until all data is received and the “dig plan” is finalized by the technical services team. When an area is opened for excavation of material, the specific ore and waste boundary lines will be visually identified on the top of the broken rock and specific material types designated with color coded flagging. Copies of the blasthole maps showing the corresponding material types and boundaries will be provided to the mine equipment operators for reference during material removal.

As excavation proceeds, the loader operators will selectively excavate specific ore or waste material types following the dig plan established by the technical services team. Each haul truck will be loaded with only the one type of material designated. After loading, the loader operator will communicate the material type to the truck operator through an established signal system. The material type loaded into the truck will designate a pre-determined destination for the load. The truck operator will track loads by material type and destination and the load information will be compiled and maintained by mine staff for reporting.

TRANSITIONAL WASTE MATERIAL DISPOSAL

Section 2.6.2.2 of Appendix C of the MPO provides that material classified as “transition waste” will be isolated in a waste rock stockpile area and covered with a minimum of six feet of “non-transition” material. SRK’s investigation determined that the transitional material to be excavated will be less than 4% of the total volume of waste produced from the operation. SRK’s analysis was performed prior to development of the most recent mine plan for Copper Flat which is reflected in this DP application. Even so, the most recent mine plan indicates that transitional material will still be produced at the same relative ratio as compared to non- transition waste. NMCC anticipates that the transitional waste will be produced in the first 8 years of operation (approximately 5.4 million tons), with about half of it produced in the first 2 years. Some of this material will be disposed of in WRSP-1, which located in the OSPDA. The remainder will be disposed of in WRSP-2 and 3. During the same two years as much as 5.2 million tons of non-transitional acid neutralizing waste material, will also be produced. Some of this acid neutralizing material will be used as neutralizing material for those areas where transitional material may be deposited. NMCC will lay a minimum 10 ft. of base of non-transitional waste underlying the area where transitional material will be deposited in the WRSPs and ensure that at least 10 feet of non-transitional waste surrounds the transitional waste in such a manner that the transitional waste is not exposed to oxidation.

The remaining approximate 2.6 million tons of transitional material will be produced over years 3 through 8 at an average rate of approximately 433 thousand tons per year while at the same time about 27.6 million tons, an average of 4.6 million tons of acid neutralizing non-transitional waste will be produced. As such, the greatest volume of waste material generated, by far, will be classified as un-oxidized high sulfide and/or un-oxidized low sulfide waste. As confirmed by SRK's waste rock characterization investigations, this material poses negligible short-term risk of ARD. While NMCC considers it unnecessary, and perhaps to some extent, contrary to the desire to minimize potential acid generation, to isolate and concentrate that material in one area, NMCC will continue to identify potential ARD generating waste during operations and take steps to establish disposal areas within the WRSPs for this material ensuring that a minimum of 10 ft. of non-transitional acid-neutralizing waste surrounds the transitional waste within the WRSPs where the potential ARD generating material will be deposited. As a practical matter, NMCC will ensure that non-transitional material is placed below, above and all around the transitional material wherever possible, providing a thick neutralizing "blanket" around the transitional material.

Quality assurance testing will also be performed in addition to the daily field sampling. Up to 10 archived blast-hole samples will be randomly selected and subjected to paste pH, saturated paste conductivity, and acid base accounting testing (total sulfur, sulfate sulfur, and NP testing). The testing will be performed by a third-party independent state approved laboratory. The samples will be classified with respect to ARD potential on the basis of NP/AP ratio. The samples will be located on the appropriate bench plan maps and the quality assurance test classifications will be compared to the operational waste classification designations.

At the end of the mine life the waste rock stockpiles will be reclaimed in accordance with the approved reclamation and closure plan. The waste rock stockpiles will be covered with a minimum of 3 ft. of soil completely mitigate the potential for acid generation and impacts to groundwater.

SRK has performed significant kinetic testing of waste materials since the time of submittal of the MPO. Humidity cell testing results were first reported to NMED in SRK's May, 2013 report. Continued and more extensive humidity cell results were reported to NMED in February, 2014 in an SRK report titled “Humidity Cell Termination Report for the Copper Flat Project, New Mexico”. These documents are included in this Discharge Plan application by reference. As indicated before, these documents provide the basis for NMCC’s mine waste characterization and handling plans.

20.6.7.11.P HYDROLOGIC CONCEPTUAL MODEL

An application for a discharge permit for a new copper mine facility shall include a site hydrologic conceptual model providing:

20.6.7.11.P.(1) *a description of the hydrogeologic setting at the copper mine facility including ground water potentiometric maps, surface water drainages and flows, types of ground water and surface water recharge and its distribution, and hydrologic boundary conditions and divides;*

NMCC and its water resource consultant, John Shoemaker & Associates (JSAI) have conducted extensive hydrologic investigation of the Copper Flat site and the surrounding area in support of NMCC's permitting activities for the project. These activities include supplementing the NMCC Abatement Plan previously submitted to NMED and the BDR submitted to NMED and NM MMD, providing detailed analysis for the BLM Environmental Impact Statement (EIS) and supporting various requests for information by the NM Office of the State Engineer (OSE).

NMCC has previously submitted to the various agencies, including NMED, JSAI's document titled "Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, August 2014" (JSAI 2014c). This document, and the subsequent review documentation provided by NMCC and JSAI, is therefore, incorporated into this DP application by reference. The following information is a synopsis of the volumes of information already provided in the groundwater model documentation in an effort to provide specifics as required by the Copper Rule.

Hydrogeologic Setting

The Copper Flat facility will be located in area that includes the following water-bearing formations within the Animas Uplift: crystalline bedrock (andesite and quartz monzonite) in the western part of the mine permit area, Santa Fe Group sedimentary deposits in the eastern part of the mine permit area, and alluvium of upper Grayback Arroyo overlying the crystalline bedrock and Santa Fe Group in the mine permit area. Figure 11K-9 Provided in subsection **20.6.7.K.(3)** presents the water-bearing formations at the facility, potentiometric surface contours and direction of groundwater flow, selected monitoring wells, and topography. Figure 11K-2a, provided in subsection **20.6.7.K.(2)** of the application, presents a geologic map of the facility and surrounding area, and transects of hydrogeologic cross-sections.

Groundwater flow is mainly from west to east in the mine permit area, with groundwater discharging from the crystalline bedrock as subsurface flow across the contact with the Santa Fe Group, and as evaporation from the open pit. The potentiometric surface contours shown in Figure 11K-9 in the vicinity of the existing open pit indicate that the open pit is a hydraulic sink. Cross-sections PA-PA' and PX-PX' presented in Figures 11K-2a, 11K-4 and 11K-5 show groundwater flow in the crystalline bedrock in the vicinity of the open pit.

Monitoring wells designated as "dry" in Figure 11K-9 are shallow wells installed to depths of less than 60 ft. in the Upper Santa Fe Group. Hydrogeologic cross-sections presented as Figures 11K-6a and 6b and 11K-7a and 7b depict the Upper Santa Fe Group in the mine permit area.

The crystalline bedrock at the facility is relatively impermeable and groundwater recharge from local precipitation to the crystalline bedrock is limited by low hydraulic conductivity. The groundwater system at the facility conducts little water, and the eastern mine permit boundary generally coincides with the East Animas Fault, shown in Figures 11K-2a and b and 11K-9, which acts as a barrier to groundwater flow.

A portion (approximately 230 acres) of the original Grayback Arroyo watershed within the mine permit area now drains to and includes the open pit. Grayback Arroyo is an ephemeral drainage in the mine permit area. However, groundwater levels are close to the surface, and there can be base flow discharge to Grayback Arroyo following wet periods. The cross-section A-A', presented in Figures 11K-2a and 11K-3a and 3b, show the alluvium of upper Grayback Arroyo overlying the crystalline bedrock and Santa Fe Group in the mine permit area.

20.6.7.11.P.(2) *the site hydrogeologic setting relative to both local and regional hydrology and geology including appropriate cross-sectional diagrams depicting major geologic formations and structures, aquifers, and ground water depths;*

The Copper Flat porphyry copper-molybdenum deposit is hosted by the Cretaceous quartz monzonite in the western part of the mine permit area (Fig. 11K-2a). The quartz monzonite intruded andesite of similar age. Faults to the north and south of the mine permit boundary juxtapose the andesite with older, Paleozoic sedimentary rocks. The eastern mine permit boundary generally coincides with the East Animas Fault, which defines the eastern edge of the Animas Uplift. The Santa Fe Group deposits in the mine permit area are located west of the East Animas Fault. As indicated in the section above, Figures 11K-3a and 3b through 11K-7a and 7b present hydrogeologic cross-sections showing geologic formations, water-bearing formations, and groundwater depths.

Most of the precipitation that recharges the groundwater system at the facility originates in the upper part of the watersheds to the west of the mine permit area. The main groundwater systems in the region are found in Santa Fe Group sedimentary deposits downstream of the mine permit area, with groundwater conveyed through more permeable Paleozoic sedimentary rocks located to the north and south of the facility. Runoff from Grayback Arroyo infiltrates the Santa Fe Group sedimentary deposits downstream of the mine permit area.

20.6.7.11.P.(3) *potential sources of water constituents including discharge types and their locations;*

Table 11P-1 presents a summary of the potential sources of water constituents, discharge types, and locations. Figures 11J-1 and 11J-3 show the locations of the various potential sources.

TABLE 11P-1
Potential Sources of Water Constituents, Discharge Types, and Locations

Potential Source	Discharge Type	Source Location
Tailings Storage Facility (TSF)	Tailings, process water and impacted storm water	Southeast area of site
TSF cyclone plant surge pond	Tailings	Southeast area north of TSF
Tailings slurry pipeline conveyance	Tailings	Process Area to TSF Permit Area Boundary
TSF water recycle system-under-drain collection pond	process water and impacted storm water	Eastern edge of site
TSF water recycle system pipeline conveyances	Process water and impacted storm water	TSF area to process water reservoir
Process water reservoir	Process water and impacted storm water	East-central area of plant site
Impacted storm water impoundment A	Impacted storm water and process water	Plant site Area
Impacted storm water impoundment B	Impacted storm water	Southwest corner of WS B
Impacted storm water impoundment C	Impacted storm water	Southeast corner of WS C
Waste Rock Stockpile (WRSP)-1	Impacted storm water	Western side of Watershed (WS) A
WRSP-2	Impacted storm water	Western portion of WS B
WRSP-3	Impacted storm water	Eastern portion of WS B
Open Pit	Impacted storm water, mine water	Western side of site
Material handling and processing-primary crushing	Process water	Central portion of site within WS A
Material handling and processing-crushing and grinding	Process water	Central portion of site within WS A
Material handling and processing-flotation and concentration	Process water	Central portion of site within WS A
Plant site sumps, tanks, pipelines and truck and equipment wash units	Process water	Central portion of site within WS A
Packaged water treatment plant	Influent sanitary waste, treated effluent water to the TSF	Central portion of site within WS A
Mobile Equipment Fuel Station	Petroleum Products-Diesel, Gasoline, Oil	Central portion of site within WS A

20.6.7.11.P.(4) *potential pathways for migration of water constituents to ground water and surface water;*

The potential pathways for migration of constituents to ground water from the sources identified in Table 11P-1 could be either from direct infiltration into the water bearing formations, release of fluids to the ground surface, or run-on and runoff of precipitation through and off of the site.

All of the impoundments, ponds, and reservoirs will be lined with synthetic liner materials as described in more detail above. Similarly, the conveyance ditches for the tailings to the TSF and convey process water from the TSF and other impoundments for reuse in the process will also be lined. As such, the potential for these structures being a pathway for migration is minimal and would only occur in the event of unanticipated events such as improper installation or operation, faulty materials, or exceedance of the design limits of each structure. All of the impoundments, ponds, and reservoirs and conveyance ditches are all designed to eliminate run-on and capture run-off to the maximum extent possible and contain storm events in accordance with the requirements of the Copper Rule. Therefore, the potential for these sources be sources of migration of constituents to ground water or surface water is further reduced.

As discussed in more detail above, the waste rock stockpiles will be constructed over bedrock that has a permeability of 10^{-6} cm/sec. As such, these areas will not require lining. While the waste rock stockpiles represent a potential source of migration on constituents to ground water, that potential is significantly mitigated by the natural barrier to migration that exists.

The waste rock stockpiles also represent sources of potential pathways to migration of constituents to surface water. However, as discussed in detail above, each of the waste rock stockpile areas will be constructed within a developed watershed designed to eliminate run-on, control and capture runoff in a lined impoundment. Surface water diversion ditches and swales will be constructed within the waste rock stockpile areas to divert water to the impoundments at a controlled rate while reducing the potential for ponding and infiltration.

The process area also represents a source of potential migration of constituents to ground water and surface water. With respect to ground water, the potential pathways to migration exist largely in the form of process water handling within the process, in particular at sumps that hold and transfer water from one part of the process to another. The sumps in the process area, including the crushing and grinding and flotation and concentrating areas, are designed and will be constructed using techniques such as water-stops and single monolithic pours to reduce the likelihood of release.

With respect to the potential for release to surface water, the process area will be constructed within a developed watershed that will be graded such that run-on will be eliminated and runoff will be controlled and captured in a lined impoundment. Water from all of the process facilities, material handling areas, parking areas, storage areas, chemical and fuel inventory areas and pipeline surface areas will be routed to the impoundment.

The open pit mine also represents a source of potential migration of constituents to ground water and surface water. With respect to ground water, the mine pit will receive nominal amounts of ground water inflow because the mine is a hydrologic sink, as discussed in more detail in section 20.6.7.11.K.(3), above. Because it is a sink migration will all be inward to the mine and not away from the mine.

With respect to surface water, the mine pit will be constructed in a manner within a watershed area such that all surface water within the watershed will run into the bottom of the mine pit. The water will be pumped out of the pit and used for dust control on the site and as process water whenever possible. The water will be applied in a manner that controls dust but minimizes the potential for infiltration and ponding.

20.5.7.11.P.(5) *any surface waters of the state that are gaining because of inflow of ground water that may be affected by water constituents discharged from the copper mine facility.*

Grayback Arroyo does not flow perennially in the mine permit area, but groundwater levels are close to the surface, and there can be occasional base-flow of ground water to Grayback Arroyo following wet periods. This occasional surface water has the potential to be affected by water constituents discharged from the facility.

20.6.7.11.Q WASTE MINIMIZATION PLAN

An application shall include a waste minimization plan to implement, as practicable, best management practices for minimization and recycling of process water and wastes generated at the copper mine facility to reduce the potential for impacts to ground water.

NMCC will implement best management practices with respect to the handling of water at the Copper Flat mine in a manner that maximizes the opportunity to recycle process water wherever possible and minimize the generation of wastes and reduce the potential impacts to ground water. The largest volume of waste generated at Copper Flat, by far, will be from the open pit mine and from the processing of ore. NMCC anticipates producing approximately 33 million tons of waste rock over the life of the mine to be stockpiled as described above. Processing of ore will result in the disposal of approximately 113 million tons of tailings at the Tailing Disposal facility.

The opportunity for waste minimization at the waste rock stockpiles is limited by the amount of non-ore material that must be removed from the mine in order to maximize the amount of ore mined and processed. Similarly, the opportunity for waste minimization of the tailings is limited by the amount of copper, molybdenum, and other produced that can be economically removed from the ore. However, there exists significant opportunity to minimize the amount of water that will be utilized at the facility by capturing and recycling maximal amounts of water from the stockpile areas and the tailings disposal facility.

As described in more detail above, NMCC has designed the Copper Flat facility to maximize water use and reuse. The tailings disposal facility is designed with a liner system and underdrain system that will remove water from the bottom of the tailings impoundment, capture it in a lined underdrain collection pond, and return it to the process facility for reuse. The tailing dam itself is also designed with a dam underdrain system that will capture water from the sand fraction of the tailings used to construct the dam, route it to the underdrain collection pond and then to the process for reuse. The outside face of the dam will also be designed so that water run-off from the dam will be captured, directed to the underdrain pond and then to the process for reuse.

In addition, the tailings facility will be equipped with a “water reclaim barge”, a system of pumps attached to a floating barge within the surface of the ponded water in the interior of the tailings disposal facility. Free water from the impoundment will be pumped from the impoundment to a process water reservoir located in the process area in order to maximally reuse water from the tailings facility in the process. The pipelines through which the water from the reclaim barge and the underdrain collection pond will be transported will lie in a conveyance trench that is also lined to prevent possible releases from impacting groundwater. Similarly, the run-off conveyance structures will be lined as they are routed to the pond.

The average water recovery rate from these systems is anticipated to be approximately 9200 gallons per minute which represents about 73% of the water needed for the process. This represents a huge reduction in the potential to impact ground water.

In addition to this significant amount of water recycle, as described in more detail above, the waste rock stockpiles will be designed such that water run-off from them will routed through lined trenches into lined impacted storm water impoundments. The captured water will be pumped to the process water reservoir for use in the process. Similarly, the process area will be contoured and graded to route run-off into a lined impacted storm water impoundment that will, in turn, be pumped to the process water reservoir for use in the process. All of these systems are designed to minimize the production of waste and recycle of water to reduce the potential for impacts to ground water.

Other waste management and minimization activities to reduce the potential for impacts to groundwater include the installation of a packaged wastewater treatment plant to capture and treat domestic wastes generated at the site. Treated water from the plant will be piped to the tailings storage facility to join the water in the impoundment and ultimately recycled along with the other water in the impoundment.

Mine operations will result in the generation of small amounts of non-hazardous and hazardous waste materials. With respect to non-hazardous wastes generated, including such items as waste paper, wood, scrap metal and other domestic trash, NMCC does not expect that these types of wastes pose potential impacts to ground water. However, NMCC will recycle such materials to the maximum extent possible or be disposed of in a permitted on-site Class III land fill.

With respect to hazardous and other chemical wastes, NMCC anticipates that the Copper Flat mine will be classified as a "small quantity generator" of such wastes. All such wastes will be managed and transported off-site by a licensed contractor for disposal in accordance with state and federal regulations.

20.6.7.11.R GROUNDWATER MONITORING WELLS

An application shall include the location of all existing and proposed ground water monitoring wells pursuant to 20.6.7.28 NMAC.

Appendix E, "Water Quality Monitoring Plan for the Copper Flat Mine Discharge Permit, Pursuant to 20.6.7.11.R and 20.6.7.28 NMAC", November 2015, prepared by JSAI provides the information requested.

20.6.7.11.S FLOW METERING SYSTEM

An application shall describe a copper mine facility's flow metering system pursuant to Paragraph (5) of Subsection C of 20.6.7.17 NMAC, Subsection E of 20.6.7.18 NMAC, and Subsections C and E of 20.6.7.29 NMAC, including:

- **(1)** *the method(s) (i.e., pumped versus gravity flow) of process water discharge and stormwater transfer and handling;*
- **(2)** *the proposed flow measurement devices for each flow method and information about its type and capacity; and*
- **(3)** *the location of all existing and proposed flow meters required pursuant to the copper mine rule or a discharge permit.*

The flow of process water at the Copper Flat facility is a closed loop. Process water and tailings will be handled using a combination of transfer methods, including gravity flow and mechanical pumps. Figure 11S-1 is a schematic diagram that shows the sources of water and the metering locations. Figures 11J-20A and 11J-20B (see Section 20.6.7.11.J.(5) above) are scaled maps that identify the locations of the flow meters and fixed pumps. The source of water to the process will be from the fresh water well field and the process water reservoir which will contain a combination of water pumped from the off-site fresh water well field, recycled water pumped from the tailings impoundment and captured storm water, pumped to the process water reservoir, when available.

As shown on Figure 11S-1, fresh intake water will be pumped from an off-site well field on-site to the freshwater tank and/or the process water reservoir and metered at these locations. Process make-up water will be pumped and metered from the process water reservoir into the process facility through the process water tank. Maximal utilization of recycled water will minimize the need for freshwater to the extent possible.

Mine ore fed to the SAG mill will be ground and pulped for the concentration and flotation process. The flotation overflow materials will be directed to the remaining steps of the product concentration process. The underflow material from the flotation circuit will be discharged from the sump and transported as whole tailings materials via gravity flow to the cyclones at the tailings storage facility. Outflow from the flotation sump will be metered as shown on Figure 11S-1.

The cyclones will separate the sand or coarse fraction from the slimes or fines fraction of the tailings. The cyclone underflow or sand fraction will be pumped and metered to the tailings area where it will be used as the material to construct the dam. The cyclone overflow or slimes fraction will be pumped and metered to the interior of the tailings storage facility behind the dam where it will be deposited and allowed to separate as free water which will form a pool of water, and sludge which will separate from the free water and line the inside of the impoundment.

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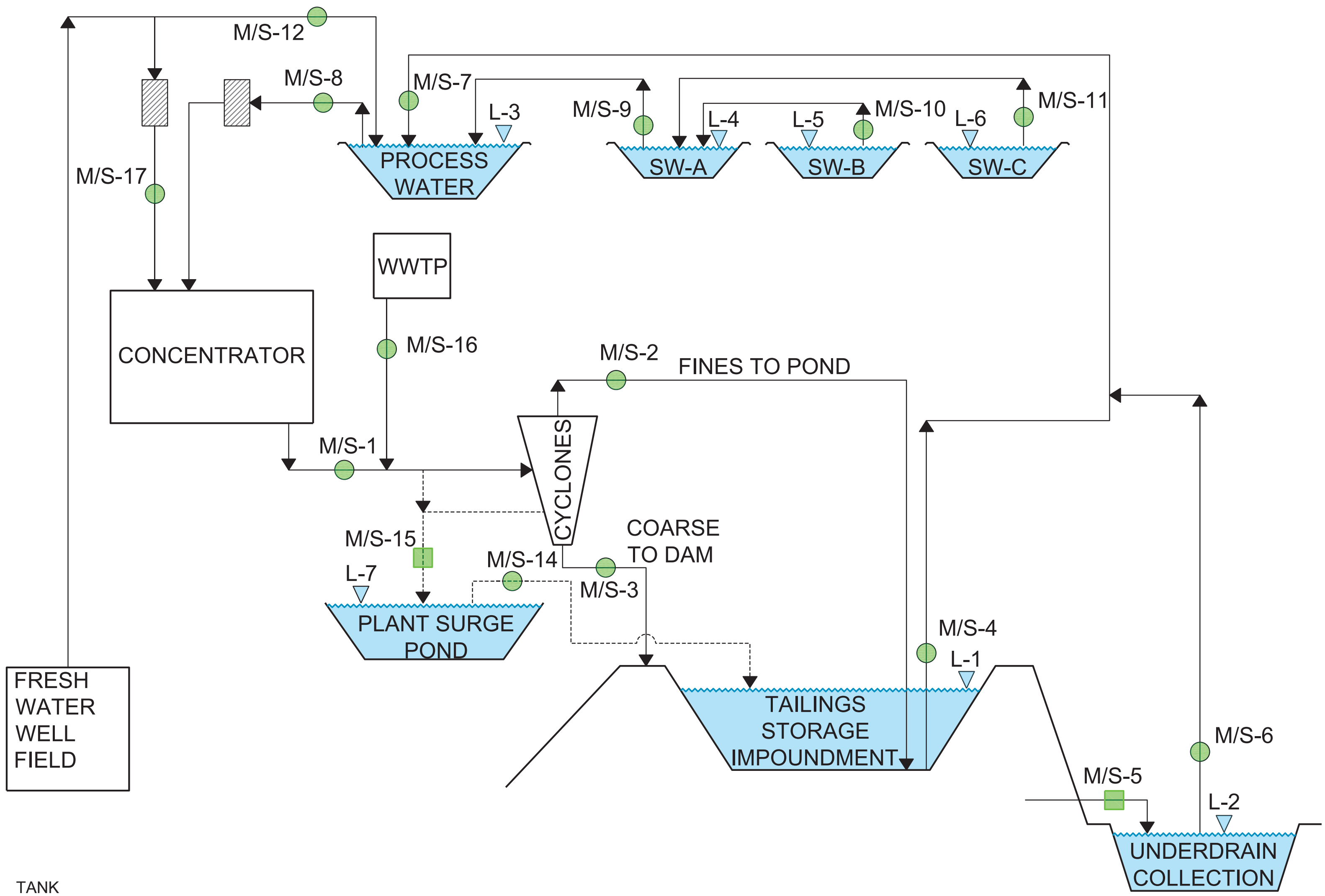

Symbol	Meaning
(hatched box)	TANK
(green square)	WEIR BOX/SAMPLING
(green circle)	FLOW METER/SAMPLING
(blue triangle)	WATER LEVEL
(arrow)	FLOW DIRECTION
WWTP	WASTE WATER TREATMENT PLANT
SW-A	STORMWATER POND A

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COPPER FLAT PROJECT
SIERRA COUNTY, NEW MEXICO

TITLE
FLOW METER AND SAMPLING LOCATIONS

PROJECT No.	PHASE	Rev.	FIGURE
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The free water will be pumped off of the surface of the impoundment using a floating pump barge located within tailings pond. The water will be pumped and metered at the barge outflow back to the process area, through a recycle water pipeline to the process water reservoir for reuse back in the process.

An underflow drain system will be installed beneath the dam and at the bottom of the lined tailings impoundment. The underflow drain system will collect water from the bottom of the impoundment and the bottom of the dam. This water will be directed to an underdrain collection pond constructed immediately down-gradient from the tailings impoundment. The underdrain collection pond will also be utilized as the impacted storm water impoundment for storm water runoff captured off of the downstream face of the dam. Water produced from the underdrain collection gallery and the storm water collection ditches will be measured at a weir box installed at the inflow point of the ditch into the underdrain collection pond. The water in the underdrain pond will be pumped and metered at the pond pump discharge into the underdrain recycle water pipeline which will join the recycle water pipeline and pumped to the process water reservoir where it, too, will be utilized as process make-up water. Recycle water from the tailings impoundment and underdrain water from the underdrain collection pond in the pipeline will also be metered upstream of union between the barge recycle water stream and the underdrain pond water stream as shown in Figure 11S-1.

NMCC will also construct three impacted storm water impoundments to capture runoff from the Copper Flat site facilities. The water collected therein will also be pumped metered at each impoundment pump outlet to the process water reservoir as shown in Figure 11S-1 a used as process make-up water.

As indicated in Subsection **20.6.7.11.J.(11)** of this application, NMCC will utilize a packaged wastewater treatment plant for domestic wastes. The treated water will be pumped and metered as it joins the tailings slurry that is pumped to the TSF.

The processing facility will be designed with contingency mechanisms that will allow diversion of process water from the process area and the cyclone plant directly to the surge pond in the event of upset conditions. Transport of these flows will be accomplished using the pumps in the process and by gravity in the secondary containment ditch which is designed to route upset flows to the surge pond. The contingency pipelines will also be metered as shown in Figure 11S-1. A weir box will be installed at the secondary containment ditch entrance to the surge pond to measure inflow.

20.6.7.11.T CLOSURE PLAN

An application shall include a closure plan for all portions of a copper mine facility pursuant to Subsection A of 20.6.7.18 NMAC, 20.6.7.33 NMAC, 20.6.7.34 NMAC and 20.6.7.35 NMAC unless closure of the copper mine facility is covered, or will be covered, by a separate closure discharge permit.

This section describes NMCC's Closure Plan per the requirements of the Copper Rule. In November 2012 NMCC submitted its Mine Operation and Reclamation Plan (MORP) (NMCC 2012) to the New Mexico Mining and Minerals Division. In 2010 NMCC had also submitted its MPO to the BLM. These documents are currently under review by the respective agencies and will be incorporated into this Discharge Plan upon approval. The 2012 MORP, including the reclamation plan, was reviewed by MMD, was determined administratively complete and underwent technical review by MMD and other agencies, including the NMED. A series of comments and requests for additional information and NMCC responses followed, including submittal of various documents that have since modified the original 2012 submittal. All of this documentation is considered as part of the application documentation for the MORP, and, therefore, for this DP application as well.

An Updated MORP was prepared by NMCC in late 2016 to provide more detailed information regarding NMCC's proposed mine operation and reclamation plans. The Updated MORP was submitted to the MMD and NMED in October 2016. Comments were received from the MMD in April 2017 and responded to by NMCC in July 2017. Revisions to the Updated MORP are included herein, where applicable.

The Reclamation and Closure Plan component of the Updated MORP contains information required by the Discharge Plan application. In effect, the approved MORP and the approved Discharge Permit will be one and the same as they relate to groundwater protection and closure as one cannot be approved without obtaining approval of the other. NMCC's MORP documentation contains an Appendix E, Mine Reclamation and Closure Plan, which fulfills the requirements of subsection **20.6.7.11.T, Closure Plan,** of the Copper Rule. The information provided in this Discharge Permit Application more generally addresses the closure requirements. However, the Reclamation and Closure Plan, in Appendix E of the Updated MORP, contains the detailed reclamation/closure design and implementation required.

20.6.7.18 General Operational Requirements

In accordance with subsection **20.2.6.7.18.A** of the Copper Rule, Planning for closure, NMCC has designed and will operate its mine facility units in a manner that considers implementation of its Closure Plan.

In accordance with subsection **20.6.7.18.A.(1)** NMCC has identified material on-site that is suitable for use to construct the necessary covers. The suitability of soils for reclamation purposes will relate to physical or chemical parameters. Steep slopes limit harvesting topdressing materials due to increased erosion potential and the difficulty in establishing vegetation to re-stabilize the slope, whereas chemical parameters can affect how well a soil provides nutrients to plants during the re-vegetation process. Soil texture, the relative amount of sand, silt, and clay, affects water available to plants (available water holding capacity, AWHC), rate of water movement into and through the soil, and seed-soil contact during germination. The relative size of soil particles can also affect the total porosity and water holding capability of the soil. Larger cobbles and stones can effectively decrease porosity and thus the water holding capability of the soil.

Chemical components of soils, such as the amount of calcium carbonate present, the pH, sodium, and salinity can impact various aspects of the soil. Calcium carbonate can affect the availability of nutrients, affect the hydraulic properties of the soil, and can limit root growth in high concentrations. The pH can affect the availability of nutrients. Salinity will compete with plant roots for water in the soil, and sodium, although it has little effect on plants, can act as a dispersing cation and degrade soil structure which can alter water movement into and through the soil.

Topdressing, for the purposes of reclamation, refers to soil and/or geological material used as growth media or soil cover that will sustain vegetation and reduce infiltration of precipitation through the underlying material. The topdressing or cover materials required to support re-vegetation and reclamation efforts will be obtained from within the footprint of the new TSF, WRSP-2 and WRSP-3. The amount of growth media to be removed has been estimated on the basis of the soil survey included in the BDR. In response to agency comments NMCC submitted an addendum to the BDR (THEMAC 2013), which contains a Technical Memorandum (Insert C), prepared by Golder Associates which, includes a Supplemental Soils Investigation Report providing additional characterization and suitability assessment. The report provides a detailed description of the soil resources at the site to support reclamation planning. A borrow investigation was performed to assess the range of available soil materials. The suitability criteria provided in the original BDR document were revised based on the new information. QA/QC salvage procedures will be implemented in the field to identify and segregate suitable growth media, including performing soil water characteristic curve analyses to achieve the water holding capacity as required by **20.6.7.33 NMAC**. Section 3.4 of Golder's Supplemental Soils Investigation report discusses the suitability of the soils for us as cover material. Section 4.0 provides estimates of the volume of cover material available on-site and the amount that will be required to meet the cover requirements. Reclamation cover is further discussed in Section 4.5 of the Updated MORP and Sections 3.1 and 5.5 of the Reclamation and Closure Plan. In general, the soil materials identified by Golder are suitable for use in the primary or secondary root zone and acceptable for use as soil cover. The Updated MORP further refines these volume estimates.

Salvaged topdressing materials will be stored in the growth media stockpiles shown in Figure 11J-1. It will be stockpiled so as not to be disturbed by mining operations. The side-slopes of these stockpiles will be shaped with overall slopes of 3H:1V or shallower to minimize soil loss. To further minimize erosion and the establishment of undesirable weeds, the stockpiles will be seeded with an interim seed mix. Diversion ditches will be constructed up-gradient of the stockpiles, where necessary, to minimize run-on erosion. BMPs such as silt fences or staked straw bales will be used as necessary to capture sediment and reduce soil loss.

In accordance with subsection **20.6.7.18.A.(2) NMAC,** NMCC has considered the grading and drainage plans in its design of the facility, including its waste rock stockpiles and tailings impoundment (See subsection **20.6.711.J.(2)** above).

20.6.7.33 Closure Requirements for Copper Mine Facilities

In accordance with **20.6.7.33.A NMAC** all permanent storm water conveyances, ditches, channels and diversions have been designed to convey the peak flow generated by the 100-year return storm event. NMCC has used the same techniques in designing the water management aspects of the Closure Plan, including selection of the duration and maximum peak flow generated from the 100-year storm, as it has for the operation design components of the mine.

With regard to slope stability at closure, the tailings storage impoundment is regulated by the New Mexico OSE. As such, subsection **20.6.7.33.B** of the Copper Rule does not apply to the TSF. NMCC's proposed new waste rock stockpiles have been designed and will be constructed in a manner that promotes long-term stability at closure. There are no critical or non-critical structures as defined **in 20.6.7.7.B.(16) NMAC** at the Copper Flat project. At closure an analysis will be conducted of those structures or units to which **20.6.7.33.B** applies that will include an evaluation for static and seismic liquefaction.

Tailings Storage Facility
Surface re-grading of the tailings impoundment at closure will be performed that will provide a stable configuration to minimize ponding and promote conveyance of surface water per subsection **20.6.7.33.C NMAC**. The final grade of the top surface of the re-contoured impoundment will be at least 0.5% after accounting for the magnitude and location of large-scale settlement of tailings.

Re-grading and contouring of the TSF to its post-mining configuration will begin at the end of the project life only after it has been determined that sufficient water has been removed from the tailings impoundment by the underdrain system. Because the Copper Flat TSF will be constructed with an engineered underdrain system, prior to conducting final grading activities NMCC will ensure that adequate drainage of the impoundment has occurred to ensure that large-scale settlement following grading is minimized. Consolidation drainage into the underdrain system is anticipated to continue at declining rates for an indefinite period following the cessation of tailings discharge operations. Underdrain water collected will be pumped from the underdrain collection pond and applied to the surface of the TSF using water sprays or other evaporation enhancement systems to facilitate evaporation. When underflow is reduced to an acceptably low rate, the underdrain pipes beneath the embankment will be sealed with grout and the underdrain collection pond will be decommissioned.

The embankment out-slopes of the TSF will be will be graded to establish erosion controls and control water surface drainage. The out-slope inter-bench slopes will be 3H:1V and the out-slope angle for the composite, including benches will be about 3.22H:1V. The maximum bench width will be 23 ft. and the maximum inter-bench slope length will be 100 ft. The top surface slope will be not less than 0.5 percent and the bench cross and bench longitudinal slopes will be 2 percent and 2 percent, respectively. Cross bench drainages will be trapezoidal and constructed to safely convey storm water off reclaimed slopes for a 100-year precipitation event that results in the peak discharge.

A 36-inch topdressing soil cover will be placed on the top surfaces of the tailings impoundment and embankment out-slopes unless NMCC can demonstrate a thinner cover will resist erosion, sustain vegetation and be equally protective of groundwater considering site-specific reclamation plans for the facility. The cover area will then be seeded. Riprap and other erosion control structures will be placed as necessary in the drainage channels.

Waste Rock Stockpiles

The waste rock stockpiles will be re-graded and reclaimed to blend into the surrounding topography to the extent practicable. Waste rock will be managed based on NMCC's operations material characterization program and predictive geochemical modeling. Concurrent reclamation to the extent practicable, materials management and surface water control measures will be used to maximize runoff, reduce infiltration, and reduce contact with the air, thus minimizing the potential for acid generation. The top surfaces of the waste rock stockpiles will be designed and constructed to a minimum final grade of 1%. The potential for ponding on the final surface will be reduced by careful contouring of the surface.

During operations the waste rock stockpiles will be constructed to facilitate re-grading during reclamation such that inter-bench slope faces will be 3H:1V or flatter and shaped to enhance run-off and prevent infiltration and ponding. Inter-bench slopes lengths will be no longer than 200 ft. The composite overall slope, which includes the inter-bench slopes and benches, will be 3H:1V or flatter.

The waste rock stockpiles will be reclaimed at the end of the life of the main by re-grading re-contoured, as necessary and a the 36-inch soil cover will be placed over the stockpiles, unless NMCC can demonstrate a thinner cover will be resist erosion, sustain vegetation and be equally protective of groundwater considering site-specific reclamation plans for the facility. The cover area will be seeded thereafter as soon as practicable.

The top surfaces of the stockpiles will be graded to promote positive drainage to storm water conveyance channels. These channels, in conjunction with perimeter berms, and hydraulic structures, will be designed to control erosion on the top surfaces and out-slopes and safely convey storm-water off of the stockpile areas. Cross bench drainages will be trapezoidal and constructed to safely convey storm-water off reclaimed slopes for a 100-year precipitation event that results in the peak discharge. Longitudinal slopes for these drainages will be 1 to 5 percent. Energy-dissipation structures will be constructed at channel outlets to reduce erosive velocities where necessary. Where possible, channels will be constructed to incorporate existing topography, grade controls and exposed inert bedrock, which will promote long-term integrity of the structures. The final designs will be adjusted for local conditions.

Temporary erosion control measures will be provided during the reclamation construction and early vegetation establishment periods. These control measures include mulch, straw bales, silt fences and minor corrective re-grading, as necessary.

Open Pit

The documents cited herein provide the detailed information required in subsection **20.6.7.33.D.(1) and (2) NMAC** that the open pit is currently, and is expected to remain a hydrologic sink capturing groundwater flowing from all directions during operations and post-closure (JSAI 2011, JSAI 2012, JSAI 2013, JSAI 2014, JSAI 2014b, JSAI 2014c, JSAI 2015). These documents have been previously submitted to the NMED and are incorporated into the Discharge Plan application by reference.

The water level elevation of the pit lake once mine dewatering and operations have ceased is anticipated to reach an average steady-state condition of approximately 4895 ft. above MSL over the long-term. NMCC will conduct rapid filling of the mine pit with water provided from the off-site well field. This will provide a source of good quality water and provide a mechanism by which the mineralized rock walls of the pit will be more quickly submerged under water, thus limiting mineral oxidation. Rapid refill with approximately 2200 acre-feet of water will bring the pit water to a steady-state in about 6 months.

Stable pit walls will be left in place. Any unstable pit walls will be stabilized by blasting or using other safe methods to ensure stability of the walls. In areas that can be safely accessed, benches above the projected 4900 water level elevation will be graded, sufficient soil cover placed on the benches and seeded to promote vegetation and limit erosion. Roads will be ripped and water bars constructed to control surface water runoff. Disturbed areas around and adjacent to the pit will be graded, soil materials placed and seeded to promote vegetation. Access to the mine site will be limited with a locked gate access roads blocked as appropriate, with physical barriers to discourage trespass. The access ramp into the pit will be graded and other ramps constructed, as necessary to provide escape routes for wildlife. The pit area and high walls will be barricaded with physical barriers and fences and posted in accordance with state and federal requirements.

Reclamation of disturbed areas in the open pit surface drainage areas surrounding the mine pit will be performed to minimize infiltration and promote vegetative growth. This will create a store and release cover, minimize infiltration of storm water around the pit perimeter, and limit water/rock interaction in the upper pit walls.

Limited open pit haul road reclamation within the pit will be accomplished by removing loose materials, installing a storm water conveyance channel into the pit, placing soil as needed to promote vegetation, and seeding. Vehicle access will be limited as much as possible during the rapid fill process and ultimately restricted after rapid fill has been completed through the construction of berms and other such physical barriers.

Surface Water Management

Section **20.6.7.11.J**, above, contains a detailed discussion of the surface water control systems that NMCC has designed and will construct at the Copper Flat mine facility to manage surface water. All of those same structures and best management practices will be maintained during the reclamation and closure phase of the project to ensure compliance with subsection **20.6.7.33.E NMAC**.

In brief, there are five surface watershed areas within the mine facility that will be managed; the open pit area, the two waste rock stockpile areas outside of the open pit surface drainage area, the plant site and the tailings storage facility area. In addition, the entire surface area of the mine facility footprint is managed through surface water diversion structures that were installed by previous operations at the site, i.e., Quintana. These existing diversion channels will remain in place during and after reclamation and closure to ensure the long-term integrity of the reclaimed mine site.

Each of the surface water management areas or watersheds noted above has an engineered water retention structure associated with it to provide capture of run-off. During operation of the mine, surface water run-off from within the open pit surface drainage area watershed area will be captured in the mine pit, except that surface water from proposed new WRSP-1, also in the open pit drainage area, will be captured in a storm water impoundment. Surface water run-off from the plant site area and the two waste rock stockpile watershed areas outside of the open pit surface drainage area will be captured in storm water impoundments. Water that falls directly onto the tailings storage impoundment will be captured within the impoundment. Run-off from out-slopes of the tailings dam will be captured in the underdrain collection pond.

All of these surface water management structures will remain in place and functioning during the reclamation and closure phase of the project until they are no longer needed. Each of the impacted storm water impoundments will be decommissioned, re-contoured and re-graded so as to no longer hold water as each of the coincident areas are reclaimed. The open pit surface drainage area watershed will be re-graded to ensure that run-off water is routed to the pit. Impacted Storm Water Impoundment B will be removed and the area regarded to ensure that surface drainage from developed watershed B, which is naturally part of the open surface drainage area, will report to the mine pit after reclamation.

The underdrain collection pond will be incorporated into the passive evaporation system of the TSF described in the Reclamation and Closure Plan (Appendix E) of the Updated MORP.

Cover System
NMCC has identified the waste rock stockpiles and the tailings storage impoundment as the units at the Copper Flat mine that will require the cover system required by subsection **20.6.7.33.F NMAC**. As indicated above, the reclaimed tailings storage impoundment and the waste rock stockpiles will be covered with 36 inches of soil unless NMCC can demonstrate a thinner cover will resist erosion, sustain vegetation and be equally protective of groundwater considering site-specific reclamation plans for the facility. The source of this soil will be the stockpiled top-dressing or growth media material inventoried and stored during construction of the mine facilities. The cover system will be a store and release/evapotranspiration cover designed to provide erosion control, sustain vegetation and reduce infiltration of storm water through the underlying materials. Other areas of the site will also receive a cover of growth media materials varying in thickness, but on less than 6 inches, to promote vegetation growth and minimize the potential for erosion as part of the site reclamation process.

In order to properly place the cover materials it will first be necessary to re-grade and re-contour the areas that will receive the cover. Grading will be performed in order to achieve positive drainage, optimize constructability, provide efficient conveyance of water, limit slope length and gradient and minimize soil erosion. An aesthetic component of grading is also to blend disturbed areas, to the extent possible, with the natural topography.

Prior to cover placement, top surfaces will require minor grading to fill rills, enable the construction of surface water control features and ensure that the final grade is between 1 and 5 percent. More extensive grading will be required on the slopes to achieve the desired slope configuration, smooth the bed materials and accommodate surface water control features. Areas that have become compaction will be ripped or disked to a depth sufficient to ensure good contact between the soil cover materials and sub-soils.

Once facilities are re-graded to an acceptable configuration, cover materials will be hauled from growth media stockpiles and placed on the top surface and slopes using a variety of equipment including scrapers or haul trucks. Bulldozers and motor graders will be used to facilitate the cover placement. Cover material will be left in a somewhat “roughened” condition in order to provide small micro sites where seed and moisture can collect thereby lending itself to better re-vegetation establishment. Required cover material estimates are contained in Appendix E of the Updated MORP.

The demand for process water will lessen as production slows. As such, the quantity of process water in storage will far exceed the process water in circulation at the end of production. The water in circulation at the end of production will be essentially that water used to flush out and clean the process units. That water will be disposed of in the tailings impoundment. However, until all of the water has been placed into the tailings facility, the operational water management units, i.e., the impacted storm water impoundments (one at the plant site and two at the waste rock stockpile areas), the process water reservoir, the surge pond, and the underdrain collection pond will remain functional, providing water storage capacity. At the end of production each of these units will retain differing amounts of process water in inventory.

The impacted storm water impoundments will likely have only limited amounts of water inventoried as they are designed to hold water for less than thirty days. Any water inventoried in these ponds will be pumped to the process water reservoir or directly to the tailings pond during their use in the reclamation phase of the project. Each impoundment will eventually be decommissioned as the area they service is reclaimed.

At the end of production the process water reservoir inventory will be limited as its purpose will no longer be to retain water recycled from the tailings impoundment for use in the process. All water in inventory in this impoundment will be quickly utilized in flushing operations at the plant. Fresh water from the well field will quickly replace recycle water as the source of water used for flushing and cleaning the processing plant. All of that water will be routed to tailings impoundment.

The surge pond, located near the cycle plant at the tailing storage facility, under normal conditions remains empty and only retains process water as a result of upset conditions during operations. In addition, the surge pond is designed such that it retains any water that it receives for less than thirty days before being transferred to the tailings impoundment. At the end of production the surge pond will likely not have any inventory of process water. To the extent it does, that water will be evacuated into the tailings impoundment.

The underdrain collection pond is an integral part of the process water recycling system as described earlier herein in Section **20.6.7.11.J**. It is designed to capture water that is drained from the underdrain system installed in the tailings impoundment and the dam as well as storm water run-off from the exterior face of the dam. At the end of production, the underdrain collection pond will contain process water and will continue to do so during all phases of reclamation and closure as it will continue to be an operating component of the closure water management system discussed below.

NMCC does not propose any significant modifications to any of the water management system constructed during operations in order to create a more efficient process water reduction. Each unit will simply continue to function as designed and constructed and will be decommissioned when it is no longer needed as part of the reclamation and closure phase.

Closure Water Management and Water Treatment Plan

The Closure water management and treatment plan as required in subsection **20.6.7.33.H NMAC** for the Copper Flat mine has three fundamental aspects to it that make it somewhat unique for this site and for the State of New Mexico copper mining projects. First with respect to the water in the open pit, NMCC has demonstrated that the open pit is a hydrologic sink (see JSAI, 2011; JSAI, 2014). Second, closure water management as it pertains to the waste rock stockpiles and the plant site area involves the continued use of the impacted storm water impoundments to capture run-off from those areas while reclamation actions are being undertaken and ensuring that water from those impoundments is removed from them in less than thirty days. The water may be utilized for dust suppression or simply may be transferred into the tailings storage impoundment.

Third, closure water management of the water inventoried in the tailing impoundment actually begins at design and approval of NMCC's proposed water recycling and underdrain system. A fundamental aspect of the water management plan for closure is design and implementation of an efficient water recycling program at the tailings storage impoundment during operations. A water recycling barge and underdrain system as described in detail in section **2.6.7.11.J** of this application and in Appendix A is proposed for the TSF that maximizes use of water during operations. Over 70% of the process water utilized in the mill operations will be provided by recycled water from the TSF. As such less water will have to be drained from the TSF before the TSF can be permanently reclaimed and closed.

At the end of production some water will remain in the TSF impoundment and embankment. At end of operation the TSF will enter a "drying out" or "draining" period. Section 6.5.2, of Appendix A indicates that the maximum down-drain flow rate at final buildout of the dam is anticipated to be approximately 448 gpm from the dam underdrain and 66 gpm from the impoundment underdrain. As such, the dam will drain more quickly than the impoundment and is, therefore, anticipated to undergo reclamation sooner than the impoundment surface. The underdrain systems will continue to operate after cessation of operations. An "active" underdrain water management program will commence thereafter, including pumping captured water from the underdrain collection pond back to the impoundment surface and using forced evaporation equipment to reduce the volume of water. The TSF embankment is expected to drain quickly, allowing its reclamation to begin within 3 to 5 years after ceasing operations. It is anticipated that some reclamation of the impoundment may begin within 3 to 5 years of ceasing operation as the impoundment continues to drain and dry, allowing construction equipment to be utilized to commence cover placement. The duration of continued operation of the "active" water management system will be driven by the volume of water that continues to drain from the impoundment. NMCC has planned for 5 to 10 years of operation of the active program followed by a longer period of "passive" drain-down water management. After decommissioning of the active program and full reclamation of the TSF, any water that may continue to drain from the TSF (at ever decreasing rates for an estimated 20 years) will be captured in an evaporation cell that will be constructed below the toe of the TSF. The underdrain collection pond will be incorporated into the cell. The details of its design, operation and reclamation, the TSF drain-down assumptions and calculations are discussed in Attachment E2 of the Updated MORP Reclamation and Closure Plan. Estimates for drain-down flow are based on industry experience and comparative drain-down curves from industry sources. The costs for this system will be included in the financial surety calculations.

Impoundments

All of the impoundments at the Copper Flat mine will be closed in accordance with the requirements of subsection **20.6.7.33.I NMAC**. The three impacted storm water impoundments and the surge pond will all have a 60 mil HPDE liner, or equivalent. All of these impoundments will hold water for less than thirty days. Captured water will be transferred to the tailings storage impoundment for disposal. As such, the likelihood of leaks occurring at those locations is small. Sediments contained in the impoundments will also be disposed of in the tailings impoundment. The liners will be removed and disposed of in the tailings impoundment. The impoundments berms will be pushed into the impoundment using earth-moving equipment contoured and graded to create positive drainage. A 36-inch soil cover will be placed over them, depending on their location, and subsequently seeded.

The process water reservoir and the underdrain collection pond will be constructed with a double liner and leak collection system. Upon completion of the closure and reclamation activities at their respective locations any water remaining in these impoundments will be transferred to the tailings storage impoundment for disposal. Sediments will, similarly, be removed and transferred to the tailings storage impoundment for disposal. The liners will also be removed and disposed of in the tailings disposal facility.

Because these two impoundments will have been equipped with a leak collection system, it will be possible to determine based on the operating records of the facility to determine whether or not any leaks occurred during operation. If it is determined that a leak occurred during operations that was not remediated during operations, the materials below the liner will be characterized to determine if remediation actions are required. If so, those actions will be initiated in consultation with NMED to implement the appropriate actions.

The process water impoundment is located in an area of the plant site where NMCC anticipates placing a minimum 6-inch soil cover. The underdrain collection pond is part of the tailings storage facility the will receive a 36-inch soil cover.

Pipelines, Tanks and Sumps

As discussed above, at the end of production the entire processing facility, including the attendant pipelines, tanks and sumps will be flushed with clean water and disposed of in the tailings storage facility in accordance with subsection **20.6.7.33.J NMAC**. Pipelines will be either be removed and disposed of or cleaned and buried in place, as appropriate. Sumps will either be removed for disposal or cleaned and broken up and buried in place, as appropriate. The Pipeline, sump and tank areas will be inspected at the time of decommissioning for evidence of spills not detected and remediated during operations. Corrective actions pursuant to **20.6.2.1203 NMAC** will be pursued, as appropriate. NMCC has no plans to use bedding material that has the potential to generate acid. Therefore, no such removal actions will be required at closure.

Crushing, Milling, Concentrating and Smelting

At closure, all surface facilities, including crushing, milling, and concentrating areas, equipment, and buildings will be removed from the area in a manner in conformance with subsection **20.6.7.33.K NMAC**. All concrete foundations footings and slabs will be broken up and buried in place or alternatively, excavated and disposed of in the tailing storage impoundment or at some other agency authorized location. The crushing, milling and concentrating areas will be characterized to determine if there are any potential water contaminants caused by the processing Copper Flats processing activities that could result in an exceedance of applicable standard in groundwater. All fuel tanks and reagent storage facilities and their contents will be removed from the site and disposed of in accordance with applicable federal and state laws. The plant site area will then be graded and contoured for surface drainage control and covered with a minimum of 6 inches of soil cover to conform to the surrounding topography to the extent practicable and seeded.

Closure Monitoring and Maintenance

During closure NMCC will continue to conduct its operational monitoring program as required by subsection **20.6.7.33.L NMAC**. The monitoring plan will be modified, as appropriate, to reflect the need to monitor conditions associated with closure. All such modifications will be made only after obtaining approval from NMED.

Exceptions to Design Criteria

NMCC will seek approval from the NMED for any modifications it may propose to make to the closure design criteria. NMCC acknowledges the role and jurisdiction of the New Mexico State Engineer with respect to jurisdictional impoundments.

20.6.7.11.U FINANCIAL ASSURANCE

An application shall include a proposal for financial assurance for those portions of a copper mine facility to be reclaimed in accordance with a closure plan submitted pursuant to Subsection A of 20.6.7.18 NMAC, 20.6.7.33 NMAC, 20.6.7.34 NMAC and 20.6.7.35 NMAC.

Financial assurance will required by the BLM and State of New Mexico to guarantee the completion of Project reclamation. Following regulatory review and approval of the NM MMD Mine Operations Plan (MORP), the Discharge Plan (DP) and the Mine Plan of Operations (MPO) and the reclamation techniques presented therein, NMCC will prepare a detailed estimate of cost to fully reclaim the operations as required by the **19.10.12 NMAC and the CFR § 3809.552**.

The reclamation plan will be consistent with the requirements of **Subsection A of 20.6.7.18 NMAC, 20.6.7.33 NMAC, 20.6.7.34 NMAC and 20.6.7.35 NMAC** and will be administered by the New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division (MMD) and the New Mexico Environment Department, Mining Environmental Compliance Section.

The estimated costs are based on projected third-party costs to reclaim the site assuming that all reclamation will occur following operations without the benefit of contemporaneous reclamation. Prior to commencement of operations, financial assurance in the amount of the estimated costs to reclaim the disturbance which would occur during the first five years of operations will be posted with the MMD.

The Nevada Standardized Reclamation Cost Estimator (SRCE) software that was developed in a cooperative effort between the Nevada Division of Environmental Protection, Bureau of Mining Regulation and Reclamation, the U.S. Department of Interior, Bureau of Land Management (BLM) and the Nevada Mining Association. This approach facilitates accuracy, completeness and consistency in the calculation of costs for mine site reclamation.

The estimate utilized current, i.e., 2013, feasibility economic model labor rates and equipment rates except where specific equipment were required, in which case rental rates were utilized and mobilization/demobilization costs were included.

Studies completed to date identified both the need for longer-term, post-closure water management for the tailings impoundment as well as the potential to develop pit lake chemistry that may not meet surface water limitations for wildlife. The cost estimate, therefore, incorporated costs for management of long-term tailings solution management, including an active and passive phase of management. In addition, estimated costs for pit water treatment have been included to account for closure liabilities that will exist until regulatory approval of the pit lake water at closure can be obtained and/or mitigation strategies are developed and closure alternatives can be identified. To allow closure cost calculation at this stage of the project, 30 years of active pit water management to arrive at a regulatory acceptable solution was assumed. The 30-year timeframe for post-closure pit lake management was selected to represent a realistic time frame for demonstration that acceptable pit-lake water quality (i.e., that satisfies NMED post-closure chemistry requirements), could be passively achieved (i.e., after cessation of treatment). This would be achieved by evaluating periods of treatment followed by periods of non-treatment of the water column.

The un-inflated and un-discounted direct closure costs, excluding the contingency costs for the Copper Flat Project range from $30.3 to $42.5 million, including all physical reclamation activities, pit water and tailings solution management. With indirect costs for engineering and permitting, project and construction management, procurement and insurances, the estimated total reclamation and closure cost is anticipated to be as much as $44.5 million. This amount is assumed to be spent over a 4-year period.

20.6.7.11.V VARIANCES

An application shall identify any issued or proposed variances for the copper mine facility pursuant to 20.6.2.1210 NMAC and the sections of the copper mine rule affected by the variance(s).

NMCC does not propose to request variances pursuant to **20.6.1210 NMAC** for any of activities proposed at the Copper Flat project.

20.6.7.11.W METEOROLOGICAL DATA

An application shall include a plan to measure meteorological data at sites throughout the copper mine facility including precipitation, temperature, relative humidity, solar radiation, wind speed and wind direction.

NMCC established its on-site meteorological monitoring station and installed a 10-meter meteorological tower in August 2, 2010, with full data collection beginning September 1, 2010. NMCC submitted a Sampling and Analysis Plan (SAP) for the proposed Copper Flat Mine to the New Mexico Mining and Minerals Division (MMD) on September 3, 2010 (Intera, September 2010). The SAP was prepared to develop the BDR required by the MMD as part of the permitting process for the proposed mine. The SAP contained a description of the meteorological monitoring station installed by NMCC and outlined the proposed monitoring activities. The MMD approved NMCC's SAP on January 11, 2011.

Subsequently, NMCC submitted the BDR to the MMD meteorological monitoring results including precipitation, temperature, relative humidity, solar radiation, wind speed and wind direction as required by this subsection. The SAP and BDR submitted by NMCC are incorporated into this Discharge Permit application by reference.

Table 11W-1 presents the meteorological data collected and instrumentation used. The location of the meteorological monitoring station is shown on Figure 11W-1. Its' location was selected prior to development of the many of the subsequent site development plans. As such, NMCC anticipates that the tower may be moved in the future as its current location may conflict with the constructed site facilities.

TABLE 11W-1
Meteorological Data Collected

Parameter	Tower Level (meters above ground surface)			Equipment Manufacturer and Model
	0	2	10	
Horizontal Wind Direction			X	Climatronics F460
Horizontal Wind Speed			X	Climatronics F460
Ambient Temperature		X	X	Climatronics 100093 Motor Aspirated
Temperature Lapse (2-10 m)		X	X	Climatronics 100093 Motor Aspirated
Pan Evaporation	X			NovaLynx
Relative Humidity		X		Climatronics 100098 Motor Aspirated
Net Radiation		X		Kipp and Zonen
Precipitation	X			Climatronix Tipping Bucket
Barometric Pressure		X		Setra

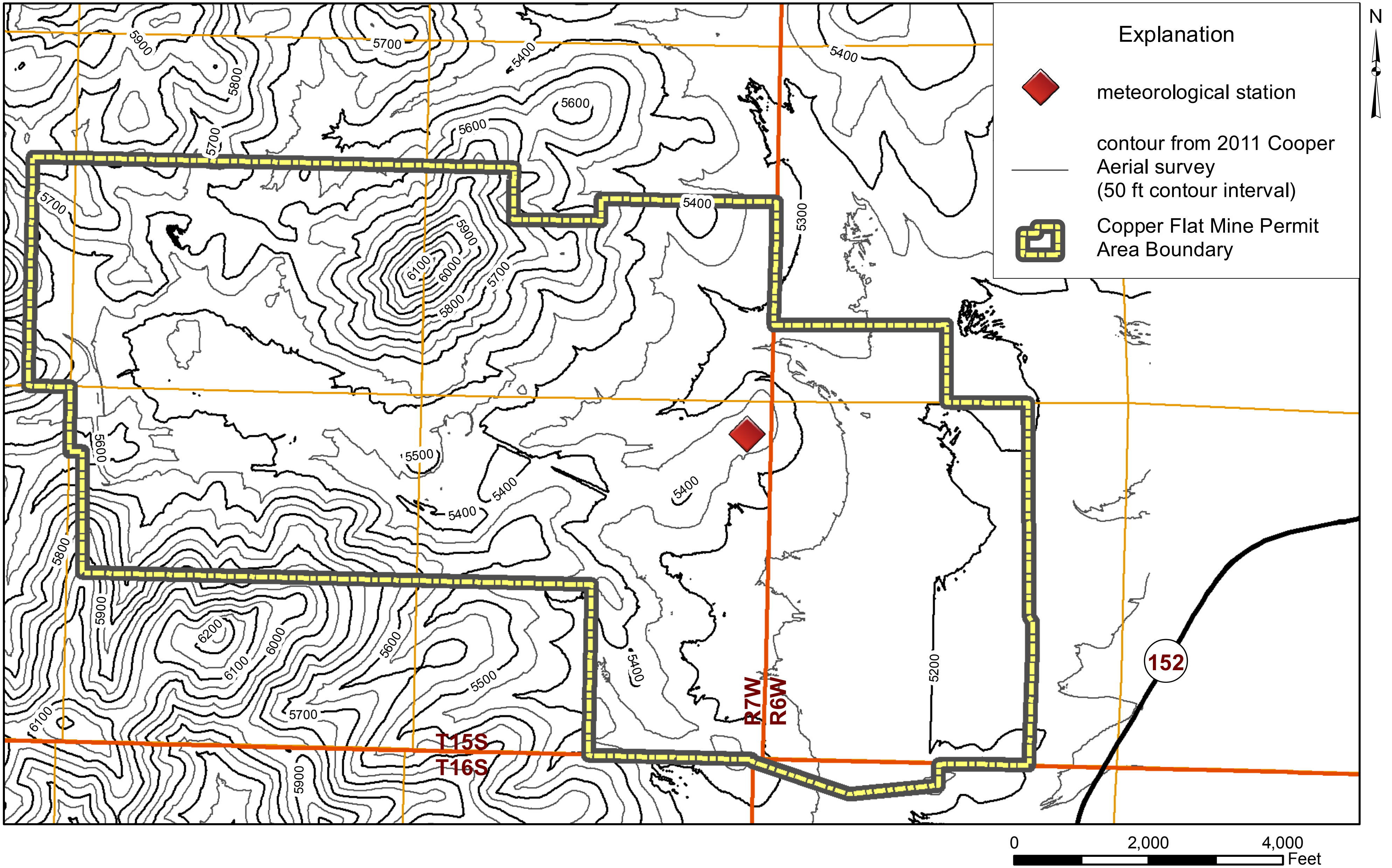

Figure 11W-1. Copper Flat Meteorological Station Location.

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The meteorological monitoring program operated for one year to collect baseline climatological data representative of the Site. The meteorological data provided input to characterize the climatological factors listed in Table 11W-1 on a quarterly and annual basis. NMCC has continued to operate the meteorological station for some time beyond the one-year BDR collection period for the purpose of supplementing the long-term record. NMCC will reinstate operation of the station as part of its operational monitoring program for the facility.

REFERENCES

Beaumont, E. B., 2011, unpublished aerial photograph lineament analysis of the East Animas Fault Trend.

Harrison, R. W., Lozinsky, R. P., Eggleston, T. L., and McIntosh, W. C., 1993, Geologic Map of the Truth or Consequences 30X60 Minute Quadrangle (1:100,000 scale): New MexicoBureau of Mines and Mineral Resources, Open File Report 390.

Hawley, J. W., 2012, unpublished geologic map of the Skute Stone Arroyo 7.5 Minute Quadrangle near Hillsboro, New Mexico.

Intera, Sampling and Analysis Plan for Copper Flat Mine, September 3, 2010, (Intera 2010).

Intera, Discharge Permit Application for the Copper Flat Mine, March 31, 2011, (Intera 2011).

Intera et al., Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico, June 2012 (Intera 2012).

Jochems, A. P., Kelley, S. A., Seager, W. R., Cikoski, C. T., and Koning, D. J., 2014, Geologic map of the Hillsboro 7.5-Minute Quadrangle, Sierra County, New Mexico: New Mexico Bureau of Geology and Mineral Resources, Open-file Geologic Map 242, DRAFT, June, 2014 (Jochems, et al., 2014

John Shomaker and Associates, Amendment to the Stage I Abatement Plan Proposal for the Copper Flat Mine, October, 14, 2011, (JSAI 2011).

John Shomaker and Associates, Conceptual Model off Groundwater Flow in the Animas and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, May, 2012 (JSAI 2012).

John Shomaker and Associates, Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, August 22, 2013, (JSAI 2013).

John Shomaker and Associates, Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, March, 2014 (JSAI 2014).

John Shomaker and Associates (JSAI), Results From First Year of Stage 1 Abatement Investigation at the Copper Flat Mine Site Near Hillsboro, New Mexico, May 2014 (JSAI 2104b).

John Shomaker and Associates, Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico, August 22, 2014 (JSAI 2014c).

John Shomaker and Associates letter to NMCC, "Response to questions regarding the rapid-fill scenario for post mining reclamation of proposed Copper Flat open pit, June 25, 2015 (JSAI 2015).

Kelley, R, Seager, W. R., Clemons, and Hawley, J. W., 1979, unpublished geology map of the Skute Stone Arroyo 7.5 minute Quadrangle near Hillsboro, New Mexico.

Koning, D. J., Jochems, A. P., and Cikoski, C.T. 2015, Geologic map of the Skute Stone Arroyo 7.5-Minute Quadrangle, Sierra County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 252, June, 2015.

New Mexico Environment Department letter to NMCC, "Comment Resolution Response: Geochemical Characterization Report, Geochemical Modeling of the Pit Lake and associated documents for the Copper Flat Project, Copper Flat Mine, DP-1", February 23, 2015 (NMED 2015).

New Mexico Copper Corporation, Copper Flat Mine Plan of Operations, December 2010 and Revisions (NMCC 2010).

New Mexico Copper Corporation, Mine Operations and Reclamation Plan, Copper Flat Project, July 2012 (NMCC 2012).

Sargent, Hauskins, and Beckwith (SHB), Tailings Dam and Disposal Area, Quintana Mineral Corporation, Copper Flat Project, Gold Dust, New Mexico, October 1980 (SHB 1980).

Sargent, Hauskins, and Beckwith (SHB), Geohydrologic Evaluation for Submission of Discharge Plan, Copper Flat Project, Quintana Mineral Corporation, Sierra County, New Mexico, June 1981 (SHB 1981).

Seager, W. R., Clemons, R. E., Hawley, J. W., and Kelley, R. E., 1982, Geology of northwest part of Las Cruces 1x2 sheet (Scale 1:125,000), New Mexico: New Mexico Bureau of Mines & Mineral Resources Geologic Map 53.

SRK Consulting U.S. Inc., as presented in their "Geochemical Characterization Report for the Copper Flat Project New Mexico, May 2013" (SRK 2013).

SRK Consulting U.S. Inc., Humidity Cell Termination Report for the Copper Flat Project, New Mexico, February, 2014 (SRK 2014).

Appendix A

Feasibility Level Design, 30,000 TPD Tailings Storage Facility
And
Tailings Distribution and Water Reclaim Systems

Copper Flat Project

Sierra County, New Mexico

Golder Associates Inc.,

Revised, June 2016
Revised, November 2016

Appendix A is contained in a separate volume binder as it is too voluminous to be included herein.

Appendix B

Impoundment Design Report

M3 Engineering & Technology Corp.

November, 2015

Appendix C

Copper Flat

Process Facility Containment Report

M3 Engineering & Technology Corporation

December, 2015

Appendix D

Copper Flat

Site Diversion Analysis

M3 Engineering & Technology Corporation

Revised, June 2016

Appendix D is contained in a separate volume binder as it is too voluminous to be included herein.

Appendix E

Water Quality Monitoring Plan
For the
Copper Flat Mine Discharge Permit
Pursuant to 20.6.7.11.R and 20.6.7.28

John Shomaker Associates, Inc.

Revised, June 2016

Appendix A

Feasibility Level Design, 30,000 TPD Tailings Storage Facility
And
Tailings Distribution and Water Reclaim Systems

Copper Flat Project

Sierra County, New Mexico

Golder Associates Inc.,

Revised, June 2016
Revised, November 2016

FEASIBILITY LEVEL DESIGN REPORT

FEASIBILITY LEVEL DESIGN, 30,000 TPD TAILINGS STORAGE FACILITY

COPPER FLAT PROJECT
SIERRA COUNTY, NEW MEXICO

Submitted To: New Mexico Copper Corporation
THEMAC Resources Group Ltd.
4253 Montgomery Blvd NE, Suite 130
Albuquerque, NM 87110

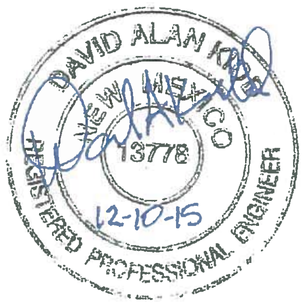
Submitted By: Golder Associates Inc.
5200 Pasadena Ave. NE, Suite C
Albuquerque, NM 87113

November 30, 2015

1531453

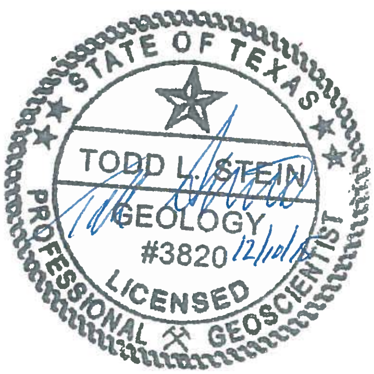
Golder Associates

This report documents the feasibility level design of the tailings storage facility (TSF) for the Copper Flat Project, located near Hillsboro, New Mexico in Sierra County. The design included herein was developed at a level consistent for agency review. Development of this report and associated TSF design was conducted under the oversight of the following Golder staff:



12-10-2015

David A. Kidd, PE — Date
(Feasibility Design Drawings and Associated Engineering Calculations)



12-10-15

Todd Stein, PG — Date
(Preparation of Feasibility Level Design,
30,000 TPD Tailings Storage Facility Report)

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List of Acronyms

1D	one dimensional
3D	three dimensional
ASTM	American Society of Testing and Materials
cm/sec	centimeters per second
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FOS	factor of safety
ft-bgs	feet below the ground surface
ft-msl	feet above mean sea level
gpm	gallon per minute
HDPE	high density polyethylene
HSA	hollow stem auger
kg	kilograms
LCRS	leakage collection and recover system
MAG	Mineral Advisory Group
MDE	Maximum Design Earthquake
mm	millimeter
NMCC	New Mexico Copper Corporation
NMDSB	Dam Safety Bureau
NMED	New Mexico Environment Department
NOAA	National Oceanic and Atmospheric Administration
OSE	New Mexico Office of the State Engineer
PCPE	polyethylene pipe
pcf	pounds per cubic foot
PGA	peak ground acceleration
PI	plasticity index
PMP	probable maximum precipitation
PSD	particle size distribution curve
psi	pound per square inch
SPT	standard penetration test
TPD	tons per day
TPH	tons per hour
TPY	tons per year
TSF	tailing storage facility
USCS	Universal Soil Classification System
wt%	percent by total weight
yd^3	cubic yard

1.0 INTRODUCTION

1.1 Scope

Golder Associates Inc. (Golder) has been contracted by the New Mexico Copper Corporation (NMCC) and its parent company THEMAC Resources Group Ltd (THEMAC), to complete the feasibility level design of the tailings storage facility (TSF) for the Copper Flat Project, located near Hillsboro, New Mexico in Sierra County. The TSF design presented herein has been completed in support of an overall Copper Flat project feasibility study as well as to support the various regulatory processes leading to permit approval of NMCC's project.

The TSF feasibility study report addresses geotechnical aspects of the project and presents the feasibility-level design of the TSF and tailings distribution and water reclaim systems. The individual components of the TSF feasibility study include: (1) the TSF design; (2) whole tailings delivery and distribution systems from the process plant and cyclone plant areas; (3) tailings delivery systems on the TSF; (4) underdrain collection system beneath the TSF; (5) TSF underdrain collection pond designs; (6) surge pond designs; (7) tailings reclaim water collection and delivery systems; and (8) systems for handling potential upset flow conditions (including secondary containment).

The location of the proposed facility is shown on Drawing 1 (Appendix J). Copper Flat is a proposed porphyry copper mining operation at a property that was briefly operated by Quintana Resources in 1981 and 1982. During the former mining operation, open pit pre-stripping was completed and a TSF with a design capacity of approximately 60 million tons was constructed and operated. Shortly after mining operations started, the mine was closed due to adverse economic conditions and depressed copper prices. In Drawing 2, which shows existing site conditions, the remains of the starter dam and splitter dike from the Quintana mining operation can be seen.

A new TSF will be constructed at Copper Flat in the same location as the former (old) Quintana Resources facility. The new TSF will extend approximately 1,000 feet to the east of the old starter dam (the tailings expansion area) as shown on Drawing 2.

A centerline construction method using cycloned tailings sand (cyclone underflow) for tailings dam construction will be utilized. A starter dam will be constructed using borrow material to provide initial storage capacity and to provide a location for initial discharge of tailings. The centerline approach allows construction of a stable, drained tailings dam using the cyclone underflow (i.e., tailings sand), while reducing the quantity of fill material required for dam construction. Tailings slimes (cyclone overflow) will be discharged into the interior of the TSF impoundment. The use of sand tailings for dam construction are such that the cyclone plant will be operated continually to produce the construction material.

The new TSF design will comply with the design and dam-safety guidelines and regulations of the New Mexico Office of the State Engineer (OSE) Dam Safety Bureau (NMDSB, 2010). Stormwater that cannot be diverted will be accommodated inside the impoundment by maintaining a dam crest elevation that provides adequate freeboard for containment of direct precipitation and run on.

The Mining and Environmental Compliance Section of the Ground Water Quality Bureau of the New Mexico Environment Department (NMED) will be the permitting authority for the groundwater discharge permit. NMED has provided guidance on anticipated design requirements for the TSF's liner system, which have been incorporated in this feasibility level design. Golder has also provided the feasibility level design of the tailings distribution and water reclaim systems.

Design drawings (Appendix J) to be read in conjunction with this report include the following:

Drawing 1	Title Sheet and Location Map
Drawing 2	Existing Conditions and Proposed Facilities Plan
Drawing 3	Site Exploration Plan and Geologic Cross Section Locations
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Drawing 28	Water Reclaim System Details
Drawing 29	Secondary Containment Details and Sections

1.2 Terminology/Definitions

In this report, the TSF is described as consisting of the impoundment and the tailings embankment or dam. The impoundment refers to the interior tailings storage area located upstream of the embankment or dam. Tailings with different gradations will be placed inside the impoundment and on the dam.

Whole tailings refer to the process tailings delivered to the cyclone plant from the flotation plant outlet. At the cyclone plant, the tailings will be separated into cyclone underflow and cyclone overflow. The cyclone underflow, which consists primarily of the coarse sand fraction of the tailings, will be used to construct the dam. The cyclone overflow, which consists primarily of the fine fraction of the tailings, will be placed in the impoundment. Each of these tailings products will be transported and discharged as a slurry, with varying concentrations of tailings solids suspended in process water.

The cyclone overflow discharged into the impoundment will form a surface that gently slopes away from the point of discharge. The beach refers to the area near the point of discharge where the coarsest particles in the cyclone overflow will tend to settle. The slimes refer to the finer fraction of the cyclone overflow, which will flow down the beach with the majority of the process water to the distal portion of the impoundment surface and settle in the vicinity of the free water pond.

The TSF will have two separate underdrain systems. The dam underdrain will underlie the dam and overlie the dam liner and collect drainage from the cyclone underflow. The impoundment underdrain will overlie the impoundment liner and will collect drainage from the tailings beach and slimes (cyclone overflow).

2.0 SITE DESCRIPTION

2.1 Topography

Existing surface conditions at Copper Flat are shown on Drawing 2. The starter dam, splitter dike, and approximately 1.2 million tons of tailings from the Quintana Resources operation remain on the property.

The TSF site consists of a broad, shallow basin located at the head of a natural drainage that discharges to Grayback Arroyo. Elevation ranges from 5,170 to 5,435 feet above mean sea level (ft-msl) within the proposed TSF footprint. Topography is gently sloping over most of the site with the steepest slopes located around the west and southwest periphery of the facility. Because the site is near the head of a natural basin, requirements to divert water from upstream catchment areas will be minimal. Surface water diversion is discussed in Section 6.6.

2.2 Climate

The property is located within an arid, high desert area in the Basin and Range physiographic province subject to hot summers and relatively mild winters. Maximum summer temperatures can exceed 100 degrees Fahrenheit (F) while the average maximum daily temperature during winter months is approximately 40 degrees F. Average annual rainfall is approximately 13 inches and the property receives snow periodically.

Most rainfall occurs in July through September and is associated with high intensity, short duration, convective storms and moisture from the Gulf of Mexico. Winter precipitation is associated with west to east moving Pacific frontal storms. These storms typically produce less intense precipitation over a longer duration.

Based on the National Oceanic Atmospheric Administration Atlas 14 (NOAA, 2006), the 100-year, 24-hour storm event is estimated to be approximately 3.73 inches. Hydrometeorological Report 55A (US Department of Commerce, 1988), which provides probable maximum precipitation (PMP) estimates for areas located between the continental divide and the 103rd meridian, indicates a 72-hour PMP depth of 26 inches.

2.3 TSF Area Subsurface Conditions

2.3.1 Geology

The proposed TSF site is located in Sierra County, within the southern Basin and Range physiographic province (Parsons, 1995). The Basin and Range province is described as a broad, highly extended terrain that extends from Canada, through the western United States, and across much of Mexico (Parsons, 1995). The name is derived from the type of extensional block-faulting that left the characteristic pattern of alternating basins and ranges across the province.

The site lies near the eastern edge of the Black Range, on the Piedmont slopes of the Palomas Basin. The Black Range is a Late Cretaceous to early Tertiary (Laramide) volcanic-plutonic arc (Oniell et al, 2002). The Basin and Range province in this region is cut by the Rio Grande Rift zone. The property sits in the westernmost basin of the Rio Grande rift zone, which is made up of three parallel north-trending basins separated by intra-rift horsts (Chapin, 1971).

The Palomas Valley is a relatively narrow flood plain flanked on the east by the piedmont slopes of the Caballo Mountains and on the west by the long gentle slopes ascending to the base of the Hillsboro-Animas Hills (Hawley, 1965).

Detrital material derived from the erosion of the adjacent slopes fills the Rio Grande valley to a depth of up to 9,000 feet (Harley, 1934). Much of this material is gravel, which consists of boulders and pebbles of quartzite, limestone, granite, rhyolite, andesite, and basalt, derived from the surrounding rock complex. They are coarser along the valley sides, grading to finer material toward the middle of the basins. In the higher regions, as in the sides of the valley between Fairview and Hillsboro and at Hermosa and elsewhere, alluvial deposits of Quaternary age are comprised of boulders and pebbles in a finer matrix of the same material, loosely cemented into a firm hard conglomerate known as Palomas gravel (Harley, 1934). Younger sand and gravel deposits, which form some of the intermediate terraces, represent a filling of channels eroded in the older deposits of Santa Fe and Palomas age (Harley, 1934).

The principal fan in the district is that formed by the drainage toward the east out of Copper Flat, principally through Grayback Arroyo, but in part through Dutch Gulch. The basal part of the original fan is composed of fine to coarse fragments of rhyolite derived from the late flows that once covered the Animas Hills. The intermediate part of the fan is composed principally of andesite and latite fragments. The topmost portion of the fan is composed of basalt, andesite, and latite fragments (Harley, 1934).

The Animas Hills consists predominantly of andesite flows and breccias of Late Cretaceous age with minor interbeds of sandstone. The andesites and sandstone are intruded by a stock of quartz monzonite of Late Cretaceous age centered at Copper Flat, and by quartz latite dikes radial to the stock (Segerstrom et al, 1975).

Upper Cenozoic basin fill in the Rio Grande rift is generally referred to as the Santa Fe Formation or Group. The Santa Fe Group (middle Pleistocene to uppermost Miocene), is comprised of multiple formations including the Camp Rice, Fort Hancock, Palomas, Sierra Ladrones, Arroyo Ojito, Ancho, Puye, and Alamosa Formations.

The Santa Fe consists of basal conglomerate and interbedded sand and clay beds. The cobbles and boulders are mainly andesite. Thickness is variable but generally in tens of feet in the subject area. Two facies in the study area include: 1) the piedmont facies consisting of brown, poorly sorted, weakly stratified fanglomerates and fan gravels and brown sandy silt, conglomerate and clay; and 2) the axia-river facies of cross-stratified sandstone, sand, pebble conglomerate, gravel, and clay lenses. The piedmont facies comprises the major portion of the Palomas Formation. It rests in angular unconformity on bedrock of varying lithologies along the major uplifts bordering the basins. However, in many central basin areas the piedmont facies appears to grade downward into coarse-grained deposits of the lower Santa Fe Group (Lozinsky, 1986).

2.3.2 Site Observations

The site geotechnical investigation program details are shown on Drawing 3. Drawings 4 through 9 contain TSF area geologic cross-sections developed on the basis of the recent drill holes and test pits, supplemented with subsurface information reported by Sergent, Hauskins, and Beckwith (SHB,1980).

Drill hole logs indicate that the foundation in the tailings area consists primarily of alluvial deposits that includes silt, sand and gravel underlain by clay. In the northwestern waste rock stockpile area, borings indicated the presence of gravelly silts and sands overlying conglomerate consisting primarily of andesite. The conglomerate is underlain by unweathered andesite.

Silts, sands, and gravels that occur in the proposed TSF area have been identified as piedmont alluvium and the older deposits of the Santa Fe Group (SHB, 1980) on which the piedmont alluvium was deposited. The Santa Fe Group is reported to consist of interfingered alluvial fan (gravel) and clay facies. Basalt flows are reported to occur in channels and arroyos cut into the piedmont and Santa Fe sediments. Basalt outcrops have been identified in an arroyo in the center of the TSF and locally around the site.

Drilling logs and geologic cross-sections indicate a high degree of variability in near surface materials both vertically and laterally, within the impoundment area and beneath the proposed dam. Silty/clayey horizons alternating with gravelly sand layers could potentially represent either the interfingering of the Santa Fe Group facies, or the more recent effects of local erosion and deposition.

In general, the interior of the impoundment is underlain by silty, clayey and gravelly sand, and cemented gravelly sand with a near surface layer of silty, wind-blown material. Eastward, toward the future dam site, interbedded clays and silts occur at depths typically greater than 20 feet; however, the composition of the foundation remains highly variable with interfingered, silty, sandy and clayey gravel units.

Groundwater is typically encountered at depths greater than 50 feet below ground surface (ft-bgs) in the vicinity of the TSF. A small zone of perched water has been identified in the vicinity of the old Quintana dam; however, recent drill holes completed in the perched water area to a depth of 50 ft-bgs did not intercept water. Groundwater and local perched water are not anticipated to impact the design and operation of the TSF.

3.0 SITE INVESTIGATIONS

3.1 Previous Site Studies

Portions of the TSF site were investigated by Sergent, Hauskins, and Beckwith (SHB, 1980) prior to construction of the Quintana Resources TSF. The SHB investigation focused on the dam alignment for a 60 million ton facility, which does not coincide with the alignment currently proposed for the over 1 million ton facility. SHB coverage of the potential borrow areas in the impoundment interior was relatively extensive.

3.2 Site Geotechnical Investigation Program Description

Golder conducted a site geotechnical investigation between December 2012 and January 2013 to expand the coverage of the former SHB site investigation to include the new dam alignment. The field investigation consisted of 31 test pit excavations and 28 drill holes. Drawing 3 illustrates test pit and drill hole locations, and the location of geologic cross-sections developed to show the geology of the dam foundation.

Test pits were excavated with a Case CX210B or Terex 7606 hydraulic backhoe to depths up to 20 feet. Test pits were logged and photographed. Soil samples collected from test pits included bulk 5-gallon bucket and bag grab samples. Bulk samples are suitable for geotechnical soil classification, strength, consolidation, compaction and permeability testing. Bag samples are suitable for soil classification and moisture content testing. Test pit logs are contained in Appendix A.1.

Most of the drilling was completed with a track mounted CME 75 drill rig using hollow stem augers (HSA). The rig was equipped for conversion to diamond core drilling if bedrock was encountered. The drill hole target depth was 50 ft-bgs. Due to the presence of cemented gravels that were not amenable to drilling by either HSA or diamond core methods, down-hole percussion (Tubex) equipment was also used.

Standard penetration testing (SPT) was carried out at 5-foot intervals during HSA drilling. When percussion drilling was required, SPT test frequency was reduced to about 10 feet. Samples collected during drilling included bulk 5-gallon bucket cuttings samples from auger drilling, bagged Tubex rig cuttings samples, and bagged samples recovered from the SPT split-spoon sampler. Drill hole logs are contained in Appendix A.2.

3.3 Geotechnical Testing

Bulk and bag samples collected during site exploration were shipped to Golder's geotechnical laboratory in Lakewood, Colorado for soil classification, compaction, permeability, consolidation, and strength testing. Laboratory reports for the various tests are contained in Appendix A.3. Soils were classified according to the Universal Soil Classification System (USCS). All geotechnical tests were completed in accordance with applicable American Society of Testing and Materials (ASTM) standards. No undisturbed samples were collected during the site exploration. Geotechnical strength, consolidation, and permeability tests were conducted on remolded samples.

3.3.1 Soil Classification

3.3.1.1 Tailings Impoundment Interior

Within the interior, central and western portions of the impoundment area, site soils consist predominantly of clayey sand with gravel (SC), well-graded silty sand with gravel (SW-SM) with lesser clayey and well-graded silty gravel (GC, GW-GM). Silty and clayey soils (CL-ML) also occur locally. The fine fraction (finer than 75 microns or the material passing the No. 200 standard sieve) in sandy samples from the impoundment interior ranges from 8 to 29 percent and averages 20 percent. Plasticity indices (PI) average 17 percent. The specific gravity of interior area soils ranged from 2.67 to 2.75.

Four composite samples of near surface sandy, gravelly soils were prepared to evaluate materials potentially available for the construction of processed (crushed and screened) drainage material. Each composite sample was composed of two to three 5-gallon bucket samples of near surface materials. Composite samples were initially crushed to 100 percent finer than 1 inch to simulate material that would be suitable for placement against a geomembrane liner. Three of the four composites were classified as clayey sand (SC), while the other was classified as well graded silty gravel (GW-GM). The fine fraction in the crushed composite samples ranged from 8 to 20 percent and the average PI was 17 percent. It is anticipated that screening will be required to reduce the fines content of this material if it is to be used for highly permeable, manufactured drain fill adjacent to critical drainage pipes.

3.3.1.2 North Cell Tailings

The north cell of the old Quintana TSF contains tailings from mining conducted in the early 1980s. Old tailings samples were classified as silty sand (SM) and low plasticity silt (ML). The sample classified as sand was located adjacent to the old dam and presumably, near the point of discharge. It contained a minus 75-micron fine fraction of 49 percent and was non plastic. The silty sample was obtained from the center of the north cell and had a minus 75-micron fraction of 71 percent and a PI of 5 percent. Differences in old tailings properties are presumed to be the result of tailings segregation on the former tailings beach. Moisture content in the old tailings samples ranged from 6.0 to 11.3 percent.

3.3.1.3 Tailings Dam Footprint

Soils encountered in the footprint of the proposed dam are highly variable. Clayey sand and gravel (SC,GC) generally occur at shallow depth with interbedded high and low plasticity clays (CH,CL) and silts (ML,MH) occurring at depths below 20 ft-bgs. Clay intercepts indicate that the clay occurs in discontinuous lenses or in eastward dipping strata. The fine fraction in the sandy and gravelly soils ranges from 17 to 39 percent and the PI averages 17 percent.

3.3.2 Foundation Strength Testing

Foundation samples were subjected to consolidated undrained triaxial testing with pore pressure measurement to determine effective shear strength for use in supporting stability analyses. Confining pressures were selected to represent anticipated foundation pressures associated with tailings embankment construction. Granular foundation materials are assumed to be cohesionless. Strength data reported below represent the effective internal friction angle. Triaxial test reports are contained in Appendix A.3.

It is anticipated that the old tailings will be placed beneath the new TSF geomembrane liner as a liner bedding fill layer. A 12-inch by 12-inch direct shear test was conducted to evaluate the interface friction at the TSF liner interface. The direct shear set-up included a layer of compacted old tailings from Test Pit 10 in the center of the north cell, a textured 80-mil high density polyethylene (HDPE) geomembrane, and a layer of material from the drainage composite samples 1 through 4. Tailings underlying the liner were placed at optimum moisture content based on ASTM D698 compaction testing and maintained in an unsaturated state during shearing. The over-liner drainage materials were wetted prior to testing but maintained in an unsaturated state during the test. The test was conducted in a manner that allows the failure through the lower strength interface (i.e., liner against old tailings or liner against drain fill). Direct shear test results are contained in Appendix A.3.

Table 1 summarizes the strength test samples, test objectives and strength test results.

Table 1: Summary of Strength Test Results

Sample	Material, Objective, Test Method	Internal Friction Angle
TP-10-3-13	Old tailings, strength of liner bedding triaxial CU(1)	34 degrees
TP-10-3-13	Old tailings, liner interface shear strength, direct shear(2)	26.5 degrees
Composite 1-4	TSF Interior borrow for structural fill and drain material, triaxial CU	40 degrees
BH-16-0-8.5	Clayey Gravel, structural fill borrow and embankment foundation strength, triaxial CU	28 degrees(3)
BH-25-0-12.5	Clayey Gravel, structural fill borrow and embankment foundation strength, triaxial CU	43.5 degrees
BH-10-0-14.5	Clayey sand, structural fill and embankment foundation strength, triaxial CU	32 degrees

Notes:
(1) CU = consolidated, undrained
(2) Liner interface testing included old tailings and drain material in contact with textured, 80-mil HDPE geomembrane.
(3) Sample was 91 percent finer than ¾ inch. Represents a matrix shear strength and does not account for interlocking of the coarse fraction.
No undisturbed samples were collected during site exploration. Tests were conducted on remolded samples.

3.3.3 Drainage Material Permeability Testing

Drainage material permeability testing was performed to support the design of the impoundment and dam underdrains. Testing was completed on composite samples 1 through 4, which represent the near surface materials that will be available for preparation of drainage material. Equal volumes of composite samples 1 through 4 were blended to prepare a sample for permeability testing. Samples were tested in a 10-inch diameter rigid wall cell with a 150-pound-per-square-inch (psi) load applied to simulate loading under field conditions. Permeability test reports are contained in Appendix A.3.

Two drainage materials are considered in the TSF design. These include crushed and screened materials with reduced fines content for the dam underdrain and primary drains in the impoundment interior (primary drain fill), and material obtained from selective borrowing of sandy soils within the TSF footprint (select native drain fill). Processing of the select native drain fill is anticipated to be limited to crushing to reduce the maximum particle size. No washing to reduce the fines content is anticipated to be required to produce suitable drainage materials.

3.3.3.1 Primary Drain Fill

A primary drain fill sample was prepared for testing the performance of the dam underdrain. The minus No. 40 standard sieve fraction of the sample was removed to simulate a prepared drainage material with low fines content that is filter compatible with the cyclone underflow sand. The hydraulic conductivity of the primary drain fill sample was 9.1×10^{-2} centimeters per second (cm/sec).

3.3.3.2 Select Native Drain Fill

The composite sample was tested without additional modification to estimate the permeability of the sandy site soils. As tested, the minus 75-micron fraction in the composite samples was 9 percent. The hydraulic conductivity of the select native drain fill sample was 3.8×10^{-5} cm/sec.

3.3.4 Foundation Sample Consolidation Testing

Selected foundation samples were subjected to conventional one-dimensional consolidation testing to support estimation of settlement potential in the proposed dam foundation. Samples were selected to evaluate silty and clayey horizons where changes in loading conditions could result in additional consolidation. Samples were remolded to dry densities ranging from 88 to 95 pounds per cubic foot (pcf) at natural moisture content to reflect in-situ density estimated from standard penetration tests. Foundation sample consolidation test reports are contained in Appendix A.3. Foundation settlement potential is discussed in Section 11.0.

4.0 TAILINGS TESTING

4.1 Program Description

The TSF embankment proposed in this feasibility study is to be constructed by the centerline raise method using cyclone underflow. Whole tailings from the flotation plant will be routed to a cyclone plant where the tailings will be separated into underflow (sand) and overflow (slimes) fractions. The cyclone underflow will be routed to the dam centerline and used to construct the tailings dam. The overflow will be discharged into the impoundment interior.

Primary considerations for effective centerline sand dam construction include adequate drainage and compaction of the cyclone underflow sand. Drainage requirements are typically met by:

- Producing a relatively free draining sand material. This is usually achieved when the minus 75-micron fraction of the underflow does not exceed 20 percent by weight.
- Having the hydraulic conductivity of the material placed in the dam two orders of magnitude greater than the material placed in the impoundment.

These two conditions generally result in a well-drained structure. A fixed cyclone station maintains optimum and consistent conditions at all cyclones and facilitates meeting gradation objectives. A blanket drain will be placed beneath the embankment to facilitate collection of cyclone sand drainage and minimize saturated conditions at the base of the embankment.

Industry experience at operating mines utilizing cyclone sand for dam construction indicates that hydraulic placement and self-weight compaction is generally sufficient to minimize liquefaction potential in cyclone sand dams located in regions with low seismic risk, such as at Copper Flat. Where it is required, compaction to a relative density of 60 percent (equivalent to approximately 90 percent of ASTM D698 maximum dry density) will result in low potential for liquefaction under static and seismic loading conditions (CANMET, 1977). At Copper Flat, tailings placed on the dam crest will be compacted. Some compaction of tailings placed on the dam out-slope will occur as a result of dozer spreading operations.

An initial cyclone test was conducted on a 55-kilogram (kg) tailings sample to determine the quantity and quality of sand available for dam construction, and produce samples of future tailings products for geotechnical testing. The initial cyclone test sample was produced by Metcon Research in September 2011. The sample was run through a 4-inch cyclone at the FL Smidth-Krebs (Krebs) facility in Tucson, Arizona. On the basis of the initial 4-inch cyclone test, Krebs, utilizing proprietary software, predicted that a gMAX15U-20 (15-inch) cyclone could recover 46 percent of the whole tailings stream with a minus 75-micron fraction of less than 20 percent. The quantity and quality of the cyclone underflow predicted on the basis of the 4-inch cyclone test were consistent with industry guidelines for sand dam construction. The quantity of sand recovered met anticipated construction requirements.

An additional pilot scale metallurgical study was conducted by the Mineral Advisory Group (MAG). Approximately 255 kg of tailings solids (whole tailings) were provided by MAG in five sealed 55-gallon steel drums. Drums were delivered to Krebs in July 2012 and the tailings were passed through a gMAX15U-20 cyclone in the Krebs laboratory on August 4, 2012. The sand recovery was 41 percent and the minus 75-micron fraction was under 16 percent. Cyclone underflow, and cyclone overflow produced during the test, and residual whole tailings were shipped to Golder's geotechnical laboratory in Lakewood, Colorado for testing.

Appendix B.1 contains Krebs analysis of the August 2012 cyclone run and the simulation (prediction) of full field scale cyclone performance. The cyclone plant is estimated to have a recovery of 45 percent with a minus 75-micron fraction of 18 percent.

4.2 Tailings Test Program Description

Table 2 contains a test matrix for the tailings products produced during the cyclone test. Gradation analyses were completed on the cyclone underflow, cyclone overflow and whole tailings. The cyclone overflow and whole tailings were subjected to flume testing to simulate discharge into the impoundment. Flume testing involves the discharge of tailings slurry at the field anticipated solids content into a 12-inch flume at low velocity. The tailings flow down and settle in the flume. Samples are collected at various flume locations to evaluate changes in gradation and solids content. Gradation and slurry consolidation tests were conducted on samples from the head and tail of the flume to evaluate the characteristics of tailings found on the beach and in the interior of the impoundment (slimes). Laboratory data sheets for tailings tests are contained in Appendix B.

Table 2: Test Matrix for Cyclone Underflow, Cyclone Overflow and Whole Tailings

Test Method	Underflow	Overflow	Whole Tailings
Gradation and Atterburg Limits (ASTM D4221, D4318)	1	2 (1)	2 (2)
Specific Gravity (ASTM D854)			1
Compaction Test (ASTM D-698)	1		
One-Dimensional Consolidation (ASTM D2435)	1		
Flume Test (flumes samples taken from head and tail of flume to evaluate segregation and settling) (specialty test)		1	1
Column Settling Test (single drain) (specialty test)		1	1
Slurry Consolidation Test (specialty test)		2 (1)	2 (2)
Permeability (ASTM D2434)	1		
Triaxial Shear Strength, Consolidated-Undrained (ASTM D2850)	1	1	

Notes:

(1) Testing completed on head and tail section samples from the flume to simulate properties of the beach and slimes fraction of the cyclone overflow.

(2) Testing completed on head and tail section samples from flume to simulate properties of the beach and slimes fraction of the whole tailings.

4.3 Test Results

4.3.1 Material Classification

Table 3 summarizes the characteristics of the tailings prior to and following cyclone separation. Gradation test results for the whole tailings cyclone feed, cyclone underflow and cyclone overflow are contained in Appendix B.2.

Table 3: Summary of Tailings Properties, Pre- and Post-Cyclone Separation

Material	P_{80} (microns)[1]	Minus 75-micron Fraction (percent)[2]	USCS Classification
Whole Tailings (feed)	110	59	SM (silty sand)
Underflow (sand)	150	17.9	SM (silty sand)
Overflow (slimes)	5.7	90	ML (low plasticity silt)

Notes:
[1]P_{80} is the particle size for which 80 percent of the material is finer
[2]The minus 75-micron fraction is the percentage of clay and silt sized particles

Based on the gradation test results, the whole tailings sample produced in the MAG metallurgical study is slightly coarser than the flotation tailings that will be produced during operations (P_{80}=110 microns versus the design P_{80} of 105 microns).

4.3.2 Cyclone Underflow Testing

Cyclone underflow sand will be delivered to the dam at a solids content of approximately 70 percent based on cyclone test results and cyclone performance predictions. Cyclone underflow sand discharged on the dam crest will be spread and compacted. Moisture density testing (ASTM D698) indicates a cyclone underflow maximum dry density of 97 pcf and an optimum moisture content of 16.8 percent. The moist weight of the compacted cyclone underflow will be on the order of 110 pcf. Underflow compaction test data are contained in Appendix B.2.

Cyclone underflow samples were subjected to one-dimensional consolidation and consolidated-undrained triaxial shear strength testing. A cyclone underflow sample compacted to within 5 percent of maximum dry density exhibited an effective internal friction angle of 40 degrees. Consolidation and triaxial test reports are contained in Appendix B.3.

4.3.3 Cyclone Overflow and Whole Tailings Testing

Flume tests were conducted on cyclone overflow and whole tailings in a 12-inch wide by 24-foot long test flume. The primary purpose of the flume tests is to provide data to support estimation of post deposition density. Samples were collected from the head and tail sections of the flume for gradation, settling and slurry consolidation testing. Test data were used to develop input parameters for one-dimension numerical consolidation modeling and impoundment filling rate studies. Flume test gradation, settling and slurry consolidation test reports are contained in Appendix B.4. Tailings consolidation modeling is discussed in Section 5.0.

To support stability analyses, a sample of cyclone overflow collected from the head of the test flume (beach material) was subjected to consolidated-undrained triaxial shear strength testing. The sample was tested at a dry density of approximately 94 pcf and a moisture content of 27 percent. The measured effective internal friction angle was 37 degrees. The triaxial test report is contained in Appendix B.4.

5.0 TAILINGS CONSOLIDATION ANALYSES

5.1 Approach

Consolidation calculations were performed using the computer program FSConsol (GWP Software, 1999). FSConsol performs a one-dimensional (1D), large-strain consolidation analysis using finite strain consolidation theory as presented in Gibson (1967). For modeling purposes, the non-linear relationships used to express permeability and compressibility are those proposed by Abu-Hejleh and Znidarcic (1994 and 1996), and defined by Equations 5.1 and 5.2, which are used in the consolidation and desiccation numerical model.

$$k = C e^{D}$$ Equation 5.1

$$e = A(\sigma' + Z)^{B}$$ Equation 5.2

When using FSConsol model, Equation 5.1 remains the same; however, Equation 5.2 is rewritten by the modified power law form to represent compressibility, as shown in Equation 5.3.

$$e = A(\sigma')^{B} + M$$ Equation 5.3

Where:
e = void ratio of the tailings
σ’ = the effective confining stress
k = the hydraulic conductivity of the tailings
A, B, M (or Z), C, and D are material parameters determined from laboratory slurry consolidation and column settling tests

Five material parameters, *A, B, C, D,* and *M,* were determined by fitting constitutive relationships to laboratory data, as shown in Figures 1 and 2. Fitted parameters are shown in Tables 4 and 5. Data are based on slurry consolidation testing of cyclone overflow samples derived from the head and tail sections of the test flume discussed in Section 4.3.3.

Table 4: Permeability Input Parameters for Cyclone Overflow

Sample	C (centimeters per second)	D (dimensionless)[1]
Slimes	1.380×10^{-7}	3.353
Overflow Beach	1.523×10^{-6}	3.035

Table 5: Compressibility Input Parameters for Cyclone Overflow

Sample	A (1/kilopascals)^{B}	B (dimensionless)[1]	M (dimensionless)[1]
Slimes	3.144	-0.1952	-0.1424
Overflow Beach	1.787	-0.2983	0.5224

Note:
[1] B, D, and M are dimensionless and valid for English, International, and centimeter-gram-second units

The tailings impoundment was modeled by running analyses on single tailings columns or volumes filled with materials representing either the beach or slimes components of cyclone overflow. Under the proposed mining plan, the operator will be required to maximize use of the cyclone plant to generate sufficient sand to construct the dam. Therefore, whole tailings discharge will have little impact on the filling rate of the TSF or the characteristics of tailings placed in the TSF.

In each model run, the modeled component is assumed to represent 100 percent of the inflow to the model storage volume. Models were run until the modeled storage volume reached capacity, or the entire mass of tailings was input. The storage volume requirement for the TSF impoundment is estimated by applying FSConsol (1999) calculated densities (adjusted for errors as discussed in Section 5.3) from the final void ratio profile of each tailings component to obtain an overall dry density that is weighted based on laboratory grain size distribution mass balance results, as discussed in Section 5.2.

5.2 Tailings Beach versus Tailings Slimes Split

Grain size distribution tests were performed by the Golder soils laboratory in the Denver, Colorado, on beach and slimes samples from laboratory flume tests and on a cyclone overflow head sample discharged into the test flume. From the grain size distributions, the percent by weight of sand versus fines (silt and/or clay) can be used to approximate the weight or mass percentage of the beach and slimes that will report to the respective areas within the TSF impoundment. To determine the split, the percentage summation of sand and fines from the beach and slimes samples should equate to the percentage of sand and fines in the original cyclone overflow head sample. Table 6 depicts the results of the laboratory gradation tests and the split calculation, which results in an approximate ratio of 60:40 (beach versus slimes) by weight or mass.

Table 6: Laboratory Grain Size Distribution and Beach to Slimes Split Calculation

Sample	Grain Size Distribution		Split Calculation		
	Sand (%)	Fines (%)	% Solids Recovered	% Sand recovered from overflow	% Fines recovered from overflow
Beach	15.64	84.36	59.7	9.33	50.34
Slimes	0.74	99.26	40.3	0.3	40.03
Cyclone Overflow Head Sample	9.63	90.37	100	9.63	90.37

5.3 Consolidation Modeling Results

FSConsol model output and a detailed description of modeling procedures and interpretation are contained in Appendix C. If 100 percent of the inflow into the TSF impoundment is represented by the tail section flume sample (i.e., the finest fraction of the tailings), FSConsol predicts that the final dry density of the slimes fraction over the modeled profile will average approximately 33.5 pcf. With 100 percent of the inflow representative of tailings overflow beach materials, FSConsol predicts a final average tailings dry density of 78.6 pcf

The consolidation model constructed in FSConsol is 1D, and does not accurately take into account the overall bowl shaped geometry of the TSF, and the fact that the mass and volume quantities are larger towards the top than at the bottom of the TSF. The average dry density of each tailings component is corrected based on the average of the calculated percent error between 1D checks of the height of solids, the volume of solids, and the mass of solids. Based on the TSF geometry, calculated material properties, and the anticipated rate of rise, Golder calculated the 1D modeling error to range between 1 to 14 percent with an average error ranging between 2.7 and 5.4 percent. Based on Golder's experience, 1D analyses resulting in less than a 15 percent average error reasonably depict expected consolidation in the field; therefore, the three-dimensional (3D) impoundment geometry can be accounted for by reducing the 1D results of estimated average dry density values by the average percent error calculated for the following checks: height of solids, volume of solids, and mass of solids.

In addition, the FSConsol results were submitted to error checking to determine that solids and water inputs calculated by FSConsol were consistent with the delivery rates of the various components. After accounting for 3D characteristics of the impoundment geometry and errors, the predicted dry density of the beach and slimes components are 74.6 and 31.7 pcf, respectively.

5.4 TSF Capacity

Based on model results and corrections based on error checking, 31.7 and 74.6 pcf have been assumed, respectively, for the average dry density of the cyclone overflow slimes and beach at the end of filling. The capacity of the TSF interior is 96.9 million cubic yards (yd^3) with a crest elevation of 5,460 ft-msl and a maximum tailings surface elevation of 5,450 ft-msl. While the beach and slimes components are predicted to represent 60 and 40 percent, respectively, of the mass of cyclone overflow to be discharged into the TSF interior based on the mass balance as discussed in Section 5.2, these components will represent approximately 40 and 60 percent, respectively, of the storage volume. At the estimated densities predicted with FSConsol, the required storage capacity is 93.4 million yd^3. This assumes near constant operation of the cyclone plant. With approximately 96.5 percent utilization of the cyclone plant, available storage capacity will equal required storage capacity.

Without consideration of managed deposition effects, there is a small excess in available storage volume. The estimated weighted dry density of tailings within the TSF impoundment is 48.4 pcf, which is low in comparison to copper industry experience. Managed deposition such as cycling discharge locations to promote desiccation and controlling the size of the free water pond can be expected to increase the post deposition dry density and reduce storage volume requirements. In addition, the FSConsol modeling runs for slimes inflow were run for a time period of 7.9 years. The slimes can reasonably be expected to continue to consolidate and increase in dry density through the remainder of the 11.1-year mine life. Only a slight increase in the dry density of the slimes over the remainder of the mine life will result in an increase in storage capacity.

The inflow rate for cyclone overflow assumes near constant operation of the cyclone plant to produce sufficient sand to construct the dam to the elevation of 5,460 ft-msl. As such, the mill should not be operated unless the cyclone plant is operating, and maintenance of the cyclone plant should be performed concurrently with mill maintenance. The cyclone overflow distribution system has two operating legs that will facilitate near constant operation. During operations, filling rates and tailings post deposition dry density should be regularly monitored to evaluate consolidation characteristics. If the rate of consolidation is better than predicted, utilization of the cyclone plant could potentially be reduced, the final dam crest could be lowered, and a corresponding reduction in the amount of sand required to construct the dam could be realized.

6.0 FEASIBILITY LEVEL DESIGN

Table 6 summarizes key design criteria assumed in feasibility level design of the new TSF.

Table 6: Feasibility Study Design Criteria

Regional Design Factors	
Precipitation/ Evaporation	Based on NOAA weather data for Hillsboro and Caballo Dam, New Mexico
Design Storm Events	100 percent of the 72-hour general storm probable maximum precipitation (PMP), 26 inches
Stability FOS	Minimum 1.5 for static conditions and 1.1 for seismic loading conditions
Seismicity PGA	USGS MDE, 2475-year return period, 0.13 times gravitational acceleration (0.13g)
TSF Design Factors	
Storage Capacity	112 million tons (THEMAC)
Production/Delivery Schedule	1,333 tons per hour (TPH) net tailings to the TSF year 1-5, 1,222 TPH years 6 to 11.1, 125,000 tons per year (TPY) (THEMAC), post concentrate recovery
Mill utilization	92.5 percent (M3)
Operating Life	11.1 years (THEMAC)
Tailings Specific Gravity	2.64 (Golder test)
Tailings Solids Content (wt%)	29.2 percent solids by weight (whole tailings to cyclone plant). Tailings diluted in outlet sump as needed to optimize cyclone performance.
Production Rate	Varies, Net tailings to the TSF from 9,182 to 10,704 kiltons per year (25,156 to 29,326 tons per day) (NMCC)
Tailings post-deposition dry density	31.7 and 74.6 pounds per cubic foot (pcf) dry weight assumed for post-deposition cyclone overflow slimes and beach, respectively, 92 pcf dry weight for the cyclone underflow fraction. (Golder estimate)
Embankment Construction	Phase 1 earthen starter dam to an elevation of 5,250 ft-msl. Post Phase 1 peripheral earthen dam extension constructed to 10 feet above grade. Centerline raise construction using cyclone underflow sand. Cyclone underflow on dam crest compacted to minimum of 90 percent of American Society for Testing and Materials (ASTM) D698, relative density > 60 percent
Liner System	From bottom to top: Prepared foundation, 12-inch liner bedding fill, 80-mil HDPE geomembrane, overliner drainage collection layer with internal drainage pipe network beneath the tailings embankment and continuous beneath impoundment

TSF Design Factors (cont.)	
Earthworks Slopes (assumed)	Soil cut slopes = 1.5H:1V (1.5 horizontal to 1 vertical) Rock cut slopes = 1H:1V Fill slopes = 2H:1V Lined slopes = 3H:1V to 2.5H:1V max Embankment out-slope = 3H:1V nominal Starter Dam, 2.5H:1V inner, 2H:1V outer
Drainage/TSF Underdrain Collection Pond	Double-lined pond with LCRS to contain dam and impoundment under drainage and surface water runoff. Pond to be constructed as an OSE non-jurisdictional facility.
Collection Pond Reclaim	Submersible turbine pumps with 4,000-gallon per minute (gpm) capacity
Collection Pond Capacity	Normal inventory, 24 hours reserve capacity for underdrain for reclaim pump system upset, 100-year, 24-hour event (3.73 inches) stormwater storage capacity for runoff contributing areas
Tailings Management	Tailings routed through eighteen 15-inch cyclones at 83 TPH feed rate per cyclone. 45.2 to 45.6 percent underflow solids recovery (Krebs), 18.2 to 18.4 minus 200 fraction in underflow (Krebs). Cyclone overflow discharged from the dam crest into the impoundment interior.
Supernatant Reclaim	Floating barge with 12,978-gpm capacity
TSF Water Storage and Stormwater Diversion Design Factors	
Dam Safety Hazard Ranking	Significant, due to environment risks associated with a release of tailings (OSE)
TSF Pond Design Freeboard	As required to accommodate wave run-up and provide minimum freeboard for design storm
TSF Pond Required Stormwater Storage	Contain flows from 1.0 times the 72-hour PMP storm event plus normal inventory of supernatant water
Hydrology Runoff Curve Numbers	100 - Impounded tailings and lined areas 50 - Tailings embankment sand shell 92 - Native ground surfaces
Stormwater Diversion	Divert runoff from undeveloped areas inside ultimate footprint where feasible. Divert exterior area runoff where feasible.
Underdrain System	Continuous underdrain layer beneath dam and TSF interior. Collected water will be returned to the process via TSF underdrain collection pond reclaim pump system
TSF Water Pond Surface Area	40 percent of tailings impoundment interior or a maximum of 40 acres assumed for feasibility level water balance calculations
TSF Water Pond Surface Evaporation	75 percent of average Pan evaporation
Tailings Surface Evaporation	50 percent of average Pan evaporation

Notes:
FOS = factor of safety
MDE = maximum design earthquake
PGA = peak ground acceleration
HDPE = High density polyethylene

The following sections describe the various construction components of the TSF feasibility level design.

6.1 Earthworks

TSF construction activities will require borrowed structural fill for starter dam and toe berm construction, drain fill for constructing underdrain layers, and liner bedding fill material. Due to permit boundary and land ownership conditions, the majority of the construction materials must be derived from within the TSF footprint. Meeting fill, reclamation topdressing salvage, and reclamation cover material requirements for construction will necessitate stockpiling selected materials early in the life of the TSF because the borrow sources for these materials will be buried as the TSF footprint expands. Initial Phase 1 grading and liner installation will cover approximately 60 percent of the ultimate TSF footprint and much of the area available for borrowing construction material and reclamation cover.

The Phase 1 liner bedding fill material will be derived from the existing tailings produced during the Quintana Resources operation. All existing tailings lie within the Phase 1 construction footprint. Liner bedding fill needed for Phase 2 through Phase 5 construction will be derived from soil borrow areas.

Drain fill material will be produced by crushing and screening native soils and gravels. Drain fill material will be placed in contact with geomembrane liners. To meet drainage and liner compatibility requirements, a minus 1-inch gradation is assumed. The fine rejects (undersized) from drain fill material production will be suitable for liner bedding fill. Because Phase 1 liner bedding fill requirements will be met by using the existing tailings, the undersized materials produced in Phase 1 will be stockpiled for use as liner bedding fill in Phases 2 and 3. Liner bedding fill stockpiled in Phase 1 will be supplemented with additional material produced during construction. Approximately 100,000 cy^3 of undersized material will be stockpiled in Phase 1.

6.1.1 Site Grading

The TSF grading plan for Phases 1 through 5 is illustrated on Drawing 10. The topographic surface shown on the grading plan reflects the over-excavation/removal of borrow materials required for cover material stockpiling and TSF construction. The approximate construction limits by phase are also indicated on Drawing 10. Drawing 11 illustrates the Phase 1 grading plan and Phase 1 construction. Site grading will include removal of the old starter dam and splitter dike for use as structural fill in the new starter dam and toe berm. Additional structural fill and drainage material will be borrowed from within the TSF footprint. In general, gravelly sands suitable for drain material lie on the interior impoundment slopes to the west of the dam. Materials suitable for structural fill are exposed on the surface over most of the TSF footprint. Borrow areas developed during phased construction will extend across construction phase limits but will lie within the ultimate TSF footprint.

6.2 Toe Berm and Starter Dam

The Phase 1 toe berm and starter dam are illustrated on Drawing 11. The TSF at final build-out is shown on Drawing 12, and the toe berm and dam sections and details are shown on Drawings 13 and 14.

A temporary toe berm will be constructed around the downslope TSF periphery in Phase 1. The temporary toe berm will be removed and reconstructed as the liner is extended outward and downslope in Phases 2 through 4. In Phase 5, a permanent toe berm will be constructed.

The primary purpose of the temporary toe berm is to contain runoff and sediment from the dam face, and direct dam drainage to the underdrain collection system and then to the TSF underdrain collection pond. Both the temporary toe berms and permanent toe berm will be constructed with structural fill and a geomembrane “flap” draped over the perimeter berm. The temporary berm liner flap will be anchored in a temporary perimeter anchor trench on the top of the berm. To relocate the temporary toe berm, the geomembrane flap will be folded inward over sandbags to divert drainage away from the temporary berm while it is removed. Once the temporary toe berm is removed, the liner extension will be installed and the original liner will be laid back over the liner extension. The seam between the two liners will then be extrusion welded in accordance with industry standards. This method will ensure that the liner seam is located in the downgradient flow direction for tailing drainage. At final build-out, a permanent toe berm will be constructed to contain runoff and sediment, buttress the dam toe and establish the limit for reclamation cover placement. The return water pipeline from the TSF underdrain collection pond will also run along the upstream side of the toe berm and above the geomembrane liner. The return water pipeline will be relocated in conjunction with the reconstruction of the temporary toe berms during Phases 2 through 4. In Phase 5, the return water pipeline will be placed in its final location along the upstream side of the permanent toe berm and above the geomembrane liner.

The Phase 1 starter dam will be constructed to an elevation of 5,250 ft-msl, with a 2.5H:1V inner slope and a 2H:1V outer slope. The purpose of the starter dam is to provide initial containment of tailing material, and to aid in tailings distribution from the dam crest. In the early stages of the operation, impounded water may periodically come in contact with the upstream face of the starter dam. The upstream face of the Phase 1 starter dam will be lined with an extension of the TSF geomembrane liner. The purpose of the liner extension is to prevent tailing drainage into the starter dam fill. The liner extension is illustrated on Drawing 13.

The starter dam will be constructed over the impoundment liner and underdrain collection systems. In Phases 2 through 5, starter dam extensions will be constructed to a height of 10 feet over the liner surface along the south, west and north boundaries.

6.3 TSF Liner System

Liner system details are shown on Drawing 14. The liner will consist of an 80-mil HPDE liner placed on a 12-inch thick liner bedding fill layer. In Phase 1, the liner bedding fill will consist of a minimum of 12 inches of tailings recovered from the north cell of the old starter dam. After Phase 1, liner bedding fill will consist of a 12-inch layer of crushed and screened native material, or selected local soil.

6.4 Tailings Drainage

Drainage from future tailings will be collected in two separate underdrain systems and transported to the TSF underdrain collection pond. Drainage from the TSF impoundment interior will be collected in a continuous underdrain (impoundment underdrain) constructed over the geomembrane liner. A separate blanket drain will underlie the tailings dam (dam underdrain). The layout of the underdrain systems is shown on Drawing 15. Underdrain details are shown on Drawings 16 and 17.

6.4.1 Drain Description

The impoundment underdrain system will consist of a system of primary 10-inch diameter drainage pipes placed in drainage channels, and a system of 4-inch diameter lateral drain pipes that cover the remainder of the TSF interior floor. Two types of drain fill will be used for the impoundment underdrain. These include primary drain fill placed as an envelope around primary drain pipes, and a continuous minimum 18-inch thick layer of selected native drain material that covers the impoundment liner and contains the lateral pipe network. The primary drain fill will be produced by processing native gravelly sand to reduce its content of fine sand, silt and clay sized particles. The native drain fill material will consist of selected site soils (gravelly sand).

Scour protection will be placed at points of cyclone overflow discharge to protect the impoundment underdrain system. The scour protection will consist of locally derived coarse material cover over the underdrain, or the incorporation of energy dissipation measures on discharge spigots. Scour protection details are provided in Drawing 29. The specific number and type of scour protection required will be determined based on estimated cyclone overflow discharge volumes and flow velocities.

The dam underdrain system will consist of a minimum 18-inch thick layer of primary drain fill material and a network of 4-inch diameter internal drainage pipes.

6.4.1.1 Impoundment Underdrain

Pipes in the impoundment and dam underdrains will be placed at a spacing that maintains minimum hydraulic head on the geomembrane liner and reduces the potential for leakage through the geomembrane liner. Pipe spacing is a function of the rate at which tailings drainage reports to the underdrain and the hydraulic conductivity of the drain fill.

Tailings placed in contact with the impoundment underdrain can be expected to rapidly consolidate and form a low permeability layer over the drain fill. Slurry consolidation tests indicate that the cyclone overflow that will be deposited in the impoundment interior will exhibit post-consolidation hydraulic conductivities ranging from $5x10^{-7}$ cm/sec for material deposited on the tailings beach, to $5x10^{-8}$ cm/sec for cyclone overflow slimes. Assuming a unit hydraulic gradient and an average tailings beach and slimes hydraulic conductivity of $2.75x10^{-7}$ cm/sec ($9x10^{-9}$ feet/second), the rate of drainage through the tailings and into the drain layer will be on the order of $7.8x10^{-4}$ feet/day/ft^2. At final build-out with an impoundment floor area of 321 acres, total drainage collected in the impoundment underdrain will be on the order of 66 gallons per minute (gpm).

The drain pipe spacing is set to maintain a drain layer water depth and liner head that is less than the drain layer thickness of 1.5 feet. Because drainage into the impoundment underdrain will occur at a very low rate, the drain layer fill hydraulic conductivity can be relatively low and still maintain drainage and low liner head. Using the mound equation (Masada, 1988) and a hydraulic conductivity of $3.8x10^{-5}$ cm/sec for the native material drain fill layer, a spacing of 35 feet between impoundment lateral drain pipes will result in a maximum liner head of 1.33 feet. The spacing calculation assumes a 1 percent grade between drain pipes, which is the minimum grade on the TSF floor. Steeper slopes between drain pipes will reduce the head on the liner. Drainage mound and pipe spacing calculations are contained in Appendix D.1.

6.4.1.2 Dam Underdrain

The dam underdrain constructed beneath the cyclone underflow sand fill will be subject to different conditions. The sand will be relatively permeable and the drainage rate will be variable because sand deposition locations will change frequently. The water in the cyclone underflow will be delivered to the dam at an average flow rate of approximately 1,042 gpm. In order to determine dam underdrain pipe spacing, the following assumptions were used to estimate drain inflow rates:

- Approximately 42 percent of the water deposited with the cyclone overflow will be retained in the tailings pore space. The remainder (approximately 58 percent) will either drain through the sand dam and report to the drain, or be lost to evaporation. Approximately 15 percent of the underflow water is assumed to be lost to evaporation. The resulting maximum flow of approximately 448 gpm will report to the dam underdrain.
- Dam construction is assumed to occur over an area of approximately 100 by 600 feet (60,000 square ft^2).
- The slope between drain pipes is one percent.
- The dam underdrain fill (primary drain fill) will be a relatively clean fill, with approximately 20 percent finer than the No. 4 standard sieve, produced by crushing and/or screening of native gravelly sand. It is assumed to have a hydraulic conductivity of $1x10^{-1}$ cm/sec. A permeability test of prepared drain fill material with 50 percent finer that the No. 4 sieve exhibited a hydraulic conductivity of $9.1x10^{-2}$ cm/sec.

Based on these assumptions, the rate of application of cyclone drainage to the dam underdrain will be approximately 5.42×10^{-4} cm/sec (1.5 feet/day/ft^2). Using the mound equation, a pipe spacing of 45 feet will result in a maximum head of 1.41 feet on the geomembrane liner. Drain layer thickness will be a minimum of 1.5 feet.

6.4.2 Drain Fill and Tailings Filter Compatibility

6.4.2.1 General Requirements for Drain Fill

Drain fill materials shall meet hydraulic conductivity and stability requirements. The dam underdrain fill (primary drain fill) shall be capable of retaining the cyclone underflow sand while allowing the transfer of drainage, i.e., without clogging. Inside the impoundment, the primary drain fill shall also be compatible with the underdrain pipe slot size and shall be capable of retaining the select native drain fill material while allowing tailing drainage to pass.

The select native drain fill layer shall meet a number of conditions, including:

- It shall be erosion resistant to control the potential for scour while temporarily exposed on impoundment slopes.
- It shall be compatible with the drain pipe slot size.
- It shall be capable of retaining the cyclone overflow slimes.
- It shall be retained by the primary drain fill.

6.4.2.2 Dam Underdrain Fill/Primary Drain Fill

Figure 3 shows the particle size distribution curve (PSD) for the cyclone underflow that will be used to construct the TSF embankment and will be in contact with the dam underdrain. The cyclone underflow filter envelope defines the range of drain fill gradations that are filter compatible with the cyclone underflow, i.e., materials that will restrict the migration of the cyclone underflow sand into the drain fill. It is assumed that this material will be prepared on site by reducing (screening out) a portion of the fine fraction of the native gravelly sand. A drain material with a minus 150-micron (No. 100 standard sieve) fraction of less than 10 percent and a minus 75-micron (No. 200 standard sieve) fraction of less than 5 percent is anticipated.

Figure 3 shows the estimated average PSD for the native soil composite samples following removal of the fine fraction with approximately 10 percent finer 425 microns (approximately 10 percent passing the No. 40 sieve). The modified gradation falls within the filter envelope for the cyclone underflow.

Type N-12 dual wall perforated, corrugated pipes have 3-millimeter (mm) wide slots for pipe diameters up to 10 inches. For broadly graded drain fill, Federal Emergency Management Agency (FEMA) (2007) recommends that the ratio of the D_{85} particle size (the particle size for which 85 percent is finer) to the drain pipe slot width be greater than 4. To satisfy this condition, a D_{85} of at least 12 mm is recommended.

Gravelly sand composite samples that were collected to represent materials available for drain construction meet the D_{85} requirement. When screened to remove fine particles, the D_{85} particle size will increase and the material will continue to meet the D_{85} size recommendation.

The primary drain fill that will be placed as an envelope around the primary drain pipes in the TSF interior will meet the same D_{85} size requirements for compatibility with the drain pipe slot size. The gravelly sand processed for the dam underdrain will also meet the requirements for primary drain fill.

For field production of the dam drain fill and primary drain fill during TSF construction, the minus 0.19 inch fraction (material finer than the No. 4 sieve) will be screened out to produce a granular drainage material. Table 7 presents the specification for the primary drain fill.

Table 7: Primary Drain Fill Specification

Particle Size (inch) or Sieve Size	Percent Passing
1	100
3/8	100-40
No. 4	0-20
No. 100	<10
No. 200	<5

Based on review of native soil gradation test results, a primary drain fill recovery rate of 40 to 60 percent is estimated during processing of available gravelly-sand soils. Fine rejects will be suitable for liner bedding fill material.

6.4.2.3 Select Native Drain Fill

The cyclone overflow slimes represent the finest material that will be discharged into the impoundment and placed in contact with the impoundment underdrain. Figure 4 shows the PSD of slimes and the gradation of the filter envelope required to retain the slimes. The SD of the composite gravelly sand samples that are anticipated to be used for the select native material drain fill are also shown. The PSD intercept the slimes filter band in the critical D_{15} range. The select native drain fills will be capable of retaining the slimes. Some local clogging could be anticipated because the native material fines content is higher than required; however, the material is expected to function as needed because the drainage rate into the filter layer will be very low. Table 8 presents the gradation specifications for the select native drain fill.

Table 8: Select Native Drain Fill Specification

Particle Size (inch) or Sieve Size	Percent Passing
1	100
3/8	90-60
No. 4	80-40
No. 10	70-30
No. 100	10-30
No. 200	>10

If the native soils are crushed to minus 1 inch, the recovery of select native drain fill should be 100 percent during field processing for construction.

6.4.2.4 Primary and Select Native Drain Fill Compatibility

The primary drain fill shall be capable of retaining the select native drain fill, while allowing tailing drainage to pass from the select native fill into the primary drains. Figure 5 shows the filter envelope for the select native drain fill and the estimated PSD for the primary drain. The primary drain fill in the critical D_{15} to D_{50} range of the PSD falls within the select native drain material filter envelope and the two drain materials are expected to be filter compactible, i.e., the select native drain fill will not migrate into the primary drain fill.

6.4.3 Drain Piping

The primary drainage pipes in the impoundment underdrain will be 10-inch diameter Type N-12 dual wall perforated, corrugated polyethylene pipe (PCPE). The 10-inch PCPE pipe will be plain-end and joined with soil tight split couplings.

The lateral drain piping in the impoundment and dam underdrain will be 4-inch diameter Type N-12 PCPE pipe with plain ends and soil tight split couplings.

6.4.4 Pipe Placement

The primary drain pipes will be placed in a constructed channel or drainage swale that is a minimum of 16 inches deep and inside an envelope of primary drain fill as shown in Drawings 16 and 17. After the primary drain fill is placed, the lateral drain pipes will be placed on the liner surface and oriented to drain into the primary drain pipe channel. In the primary pipe channel, lateral pipes will lie in select native fill and run parallel to the primary drain fill envelope for a length of at least 4 feet. The select native drain material fill will be placed over and around the primary drain fill and lateral drainage pipes. The final cover of primary and select native drain fill placed over the primary pipes will be a minimum of 24 inches thick. Pipe placement is such that collapse or damage of an individual lateral drain pipe will not result in the transfer of tailings or select native drain fill into the primary drain pipes. The cover of select native drain fill over the primary drain fill will prevent the transfer of soil or tailings from the lateral to primary pipe network.

Dam underdrain pipes will be placed within the drain fill and oriented to discharge outside the toe of the dam in the dam underdrain and runoff collection channel. As the dam is raised, the dam underdrain and runoff collection channel will be relocated and the dam underdrain pipes will be extended to the new perimeter collection channel.

6.4.5 Drain Pipe Deflection

Deflection analyses were conducted to evaluate the performance of the underdrain pipes under the loads imposed by a tailings cover of approximately 240 feet. The Type N-12, dual walled PCPE pipes used for the underdrain collection system are considered to be flexible and can resist damage by distorting sufficiently to shed overburden loads to the surrounding underdrain fill.

As pressure on the top of the pipe is increased through an increase in tailings height, an increasing proportion of the vertical pressure on the pipe is transferred to the surrounding fill. This process is commonly called bridging. Therefore, the key parameter in assessing deflection of the underdrain collection system is the stiffness (modulus) of the fill in contact with the pipe. This bridging phenomenon was first accurately modeled by Burns and Richards in the paper *Attenuation of Stress for Buried Cylinders* (Burns and Richards, 1964). Golder has analyzed the pipe stresses and deformations based on the work of Burns and Richards and Hoeg (1968), with modifications to the closed-form, plane strain solutions by Lupo (2001). The closed form equations were modified to allow an incremental stress approach and non-linear material compression.

Golder analyzed the worst-case scenario with an entire column of tailings underflow cyclone sand of maximum height placed over the underdrain collection system. Based on Golder laboratory test results for the tailings underflow cyclone sand, a friction angle of 39 degrees and soil density of 120 pcf was used to model the tailings properties used in the analysis. The supporting fill was assumed to consist of the select native drain fill material with a similar stress versus strain relationship for a silty sand compacted to 80 percent of maximum dry density. The primary drain fill used beneath the dam and in the impoundment primary drains will have a reduced fines content compared to the select native drain fill, and will exhibit a strength that is at least that of the select native drain fill. Modeling deflection based on the select native drain fill is conservative.

Drain fill properties, along with pipe dimension and properties, were used to determine the maximum deformation that may be expected for the pipes. The maximum vertical pipe deflections are estimated to be between 11 and 14 percent. Golder's observations have been that pipe deflections greater than 15 to 20 percent often result in plastic deformation of the pipe at the springline. A vertical deformation of 15 percent is assumed as the maximum limiting deflection for flexible pipe. Therefore, the estimated deformations of 11 to 14 percent are within the acceptable performance criteria established by Golder. Detailed data worksheets and calculations are provided in Appendix D.2.

6.4.6 Drainage Outlet Works

Tailing drainage from the impoundment underdrain will be routed beneath the tailings starter dam and cyclone sand dam to the TSF underdrain collection pond. Drainage outlet works details are shown on Drawings 16 and 17. The primary drain pipe network in the impoundment underdrain will be reduced to three pipes to transmit drainage to the outlet works. Three primary drainage pipes will be routed into a 12-inch diameter Type N-12 PCPE manifold at the upstream toe of the starter dam, which will in turn be connected to a 14-inch diameter, Schedule 80 carbon steel drain pipe. The steel drain pipe will be routed from the upstream toe of the starter dam to the TSF underdrain collection pond in a 42-inch deep by 42-inch wide ditch that will be backfilled with concrete.

The steel outlet pipe will pass through a valve vault. The valve vault will consist of a 72-inch diameter prefabricated concrete manhole base unit placed on an 18-inch thick reinforced concrete foundation mat. The manhole base unit will be fabricated with inlet and outlet openings for the steel drain pipe. Prefabricated manhole riser sections will be used to extend the valve vault vertically to a maximum height of 100 feet, to an elevation of approximately 5,300 ft-msl.

A 14-inch diameter, hydraulically actuated knife gate valve will be installed on the steel outlet pipe in the valve vault. The hydraulic actuator lines will be 100 feet long and will be routed up through the riser sections to the top surface of the dam for connection to a portable hydraulic power pack. As the manhole riser sections are added, the outlet valve hydraulic lines will be secured to the man-way ladder steps cast into the manhole riser sections. This arrangement will enable valve operation without manhole entry.

The purpose of the outlet valve is to prevent the drainage of excess water into the TSF underdrain collection pond in the early stages of impoundment operation (i.e., before the impoundment underdrain is covered with cyclone overflow). As positioned, the valve will be upstream of the main body of the dam, and its use will not result in pressurization of the underdrain pipe inside the dam. Once the underdrain is covered with cyclone overflow, the flow into the impoundment underdrain will be limited by the low hydraulic conductivity of the tailings slimes overlying the drain. When the dam reaches a height of 100 feet (approximately 5,300 ft-msl), the outlet valve will be fully opened and the valve vault will be backfilled with cement grout and granular fill materials.

6.5 TSF Underdrain Collection Pond

6.5.1 Pond Description

The location of the TSF underdrain collection pond is shown on Drawings 2, 10, 11, and 12. TSF underdrain collection pond details and sections are shown on Drawings 13, 18, 19 and 20. Figure 6 illustrates total TSF underdrain collection pond capacity, the maximum operating water required to preserve upset and stormwater storage capacity, and the maximum stormwater storage level.

The TSF underdrain collection pond will be double-lined with minimum 60-mil HDPE geomembrane liners. An HDPE geonet will be placed between the liners to serve as the collection pond leakage collection and recovery system (LCRS) and minimize the head on the lower pond liner. The pond will be fitted with a primary drain material filled sump and LCRS pump to recover any leakage through the upper geomembrane.

TSF underdrain collection pond reclaim pumps will be submersible, vertical turbine pumps supported in a reinforced concrete sump and headwall structure. The sump will allow the water level in the pond to be drained to the pond floor level and no dead storage will be required. The use of submersible turbine pumps mounted in a concrete sump will eliminate the potential for liner damage associated with a barge mounted pump coming to rest on the pond floor. The reinforced concrete sump is shown in cross section on Drawing 19.

Impoundment underdrain flows will be transported to the pond via a buried steel pipe. Runoff and dam underdrainage will be routed to the pond via an HDPE lined open ditch constructed at the toe of the dam.

6.5.2 TSF Underdrain Collection Pond Sizing

The TSF underdrain collection pond will contain drainage water from the TSF impoundment and dam underdrains, as well as runoff from the downstream face of the tailings dam. The pond is sized to contain 24 hours of tailing drainage flow at maximum estimated drainage rates, runoff from the 100-year, 24-hour storm event of 3.73 inches (National Oceanic and Atmospheric Administration [NOAA] 2006) incident on the downstream dam face, and an additional minimum 2-feet of freeboard. Underdrain flow rate calculations and runoff estimates are contained in Appendix E.

Underdrain flow rate estimates are based on the assumption that materials representative of the consolidated, cyclone overflow will be in contact with the impoundment underdrain and will control the rate of tailing drainage reporting to the TSF underdrain collection pond. The hydraulic conductivity of materials representative of beach and slimes samples are 5.0×10^{-7} and 5.0×10^{-8} cm/sec, respectively. If it is assumed that the more permeable beach-like material cover 60 percent of the impoundment underdrain at final build-out, the maximum underdrain flow rate will be on the order of 66 gpm.

Approximately 1,042 gpm of water will be delivered to the dam in cyclone underflow with a moisture content of approximately 30 percent. An estimated 42 percent of the water will be permanently bound or entrained within the pore space of the sand fill, and an additional 15 percent is estimated to be lost to evaporation. The remaining 28 percent (448 gpm) is assumed to report to the dam underdrain and TSF underdrain collection pond.

A storage allowance is provided for potential inflows associated with the free water pond coming in direct contact with the impoundment underdrain system. In this case, the drainage rate will be controlled by the hydraulic conductivity of the select native drain fill material that will cover the impoundment floor and drain pipe network. Permeability testing of a representative sample of select native drain fill indicated a hydraulic conductivity of 3.8×10^{-5} cm/sec. If it is assumed that a 20-acre area of impoundment drain will be inundated to an average depth of 2.5 feet, the estimated drainage rate will be on the order of 1,220 gpm.

The maximum contribution of stormwater runoff to the TSF underdrain collection pond will be from the combination of dam out-slope area and exposed toe area liner and underdrain occurring in Phase 4. The 100-year, 24-hour storm event incident on this area is estimated to produce a runoff volume of 3.94 million gallons.

Table 9 summarizes the TSF underdrain collection pond storage capacity requirements. The pond capacity is approximately 12.24 million gallons with 2 feet of dry freeboard below the crest of the pond (top of pond liner). The pond has the capacity to store up to approximately 5.8 million gallons of process water for facilitating process water make-up or storage of extra water during wet periods. A maximum water surface elevation of 5,157 should be maintained in order to provide sufficient storage for stormwater associated with the 100-year, 24-hour storm event and a coincident 24-hour upset period.

Table 9: TSF Underdrain Collection Pond Storage Capacity Requirements

Source	Type of Inflow	Volume (gal)
Dam Face Runoff	Storm Event Runoff	3,942,528
Dam Underdrainage	24-hour upset volume	645,206
Impoundment Underdrainage	24-hour upset volume	95,074
Free water pond direct drainage	24-hour upset volume	1,754,857
Total		**6,437,666**

6.6 Surface Water Management

6.6.1 Control of Impoundment Runon

The TSF will be required to contain inflows and direct precipitation associated with the 72-hour PMP of 26 inches. Diversion ditches constructed for impoundment runon control have been sized to carry the peak discharge associated with the prescribed PMP event using a rainfall intensity versus time distribution defined in Hydrometeorological Report 55A (US Department of Commerce, 1998). Runoff estimation and ditch sizing calculations are contained in Appendix F.1.

Diversion ditches will be constructed to divert runon away from the impoundment where possible. Peripheral catchment and runoff contributory areas are limited because the TSF lies in the head of a hydrologic catchment area. The Phase 1 grading plan (Drawing 11) indicates the location of diversion ditches. The Phase 1 ditches are located outside the Phase 2 construction area and will be functional during Phases 1 and 2. In Phase 3, a permanent diversion ditch will be constructed on the west periphery of the TSF as shown on Drawing 11. Table 10 summarizes peak discharge estimates for the Phase 1 and 3 diversion ditches.

Table 10: Summary of Impoundment Runoff Diversion Ditch Capacity and Size Requirements

Phase/Location	Peak Discharge (cfs)	Ditch Width (ft)	Ditch Depth (ft)[3]
Phase 1, TSF northeast	525	10 [1]	5.5
Phase 1, TSF southwest	340	10 [2]	5.1
Phase 3/ TSF southwest periphery	205	10 [2]	4.2

Notes
(1) 2H:1V side slopes assumes on the downslope side, slope on upstream side varies
(2) 2H:1V slopes
(3) Depth at the lowest channel slope, includes 1 foot of freeboard.

6.6.2 Dam and TSF Underdrain Collection Pond Surface Water Management

Surface water management facilities other than impoundment diversions are designed to contain and transport flows associated with the appropriate 100-year storm event. Hydrologic calculations for the dam and TSF underdrain collection pond surface water management facilities are contained in Appendix F.2.

Runoff from the downstream face of the dam will be routed to the TSF underdrain collection pond. The time of concentration (T_c) for the toe ditch catchment area is estimated to be three hours. The dam underdrain and runoff collection channel at the toe of the dam has been sized to carry the peak discharge associated with the 100-year, 3-hour storm. The 100-year, 3-hour storm will produce the peak 100-year storm runoff of 71 cubic feet per second. The flow depth at peak discharge is estimated to be a maximum of 0.5 feet. The perimeter toe berm height will be 3 feet (temporary berms) to 4 feet (permanent berms) high and will provide 2.5 to 3.5 feet of dry freeboard in the toe area dam underdrain and runoff collection channel.

6.7 Cyclone Plant Area

Excavation and site preparation will be required for the cyclone plant pad, the pump equipment pad and the surge pond. The cyclone plant general arrangement plan and site grading plan are shown on Drawing 21. The purpose of the cyclone plant is to separate whole tailings into sand and slimes fractions. Its' design and purpose are described in more detail in Section 7.0.

Surge pond cross sections and details are shown on Drawing 22. The purpose of the surge pond is to contain discharges (tailings, process, and reclaim water) from various processing locations under upset conditions, due to a pipe failure or shutdown of the cyclone plant. Upset flows from the cyclone plant will discharge by gravity to the surge pond within a secondary containment ditch lined with a minimum 60-mil HDPE geomembrane liner placed over 6 inches of liner bedding fill. Further details of the secondary containment ditch are provided below in Section 7.4.

7.0 TAILINGS DELIVERY AND DISTRIBUTION SYSTEM DESIGN

7.1 General System Description

The tailings delivery and distribution system design consists of pipeline system that delivers whole tailings from the processing plant to the tailings storage facility. Whole tailings will be separated into fine material and sand material in the cyclone plant. The sand fraction will be transported to the TSF and used for dam construction while fine material will be deposited into the TSF. The tailings surge system is designed for tailings management in case of unanticipated shutdown of any of the tailings stations or surges or overflows from station sumps. Return or reclaim water will be collected from the TSF surface pond and TSF underdrain water collection pond and transported back to the process plant. A general process flow diagram for the tailing delivery and distribution system is provided on Drawing 23.

Process equipment for the tailings delivery and distribution system will be located in four main stations as listed below:

- Cyclone Station: including the cyclone cluster, slurry pumps, slurry transfer sumps, gland seal water system, and electrical equipment;
- Surge Discharge System: including the surge pond evacuation pumps and lined secondary containment ditches;
- TSF Return Water Pond Barge Station: including a floating barge and barge mounted vertical turbine pumps and electrical equipment; and
- TSF Underdrain Collection Pond Pump Station: including vertical turbine pumps in a permanent structure and electrical equipment.

Tailings distribution will include whole tailings transport from the process area to the cyclone station and sand and fine tailings transport to the TSF. Return water will include tailing drainage water and TSF return water transported to the process plant. The major pipelines are listed below, and their interactions are shown in the overall system process flow diagram on Drawing 23.

- Cyclone Feed Line
- Cyclone Overflow Line
- Cyclone Underflow Line
- Cyclone Whole Tailings Bypass Line
- TSF Return Water Line
- TSF Underdrain Collection Return Water Line
- Main Surge Discharge Line

The major pipelines will be installed within secondary containment ditches lined with a minimum 60-mil HDPE geomembrane liner placed over six inches of liner bedding fill. The secondary containment ditches and associated pipelines will be constructed in accordance with the requirements listed in 20.6.7.23

NMAC, and will include secondary containment. Further details of the secondary containment ditches are provided below in Section 7.4.

The arrangement of the major components of the tailings delivery and distribution system is shown on Drawings 21 and 24. Drawings 25 and 26 present the tailings delivery and distribution system plan and profile. Whole tailings produced at the flotation plant will be transported via a 30-inch HDPE DR17 pipeline to the cyclone plant at the northwest side of the TSF. The cyclone plant will separate the sands fraction, which represents approximately 45 percent of the whole tailings stream, from the slimes fraction, which represents approximately 55 percent of the whole tailings stream. The sands fraction or the “underflow” of the cyclone plant will produce an underflow slurry which will be transported to the TSF in a separate 12-inch HDPE DR9 pipeline and discharged on the dam. The cyclone underflow sand placed on the dam crest will be then be spread, graded and compacted, as necessary to push sand down the dam out-slope and continually build the dam.

The cyclone overflow (slimes) from the cyclone plant will be routed to the TSF in a separate 30-inch HDPE DR17 pipeline and discharged into the impoundment. The cyclone overflow water will be returned to the process water reservoir at a rate of up tom 13,000 gpm. The cyclone plant will operate continuously to produce the sand material needed for continuous construction of the dam. In the event of upset conditions when the cyclone plant is not in operation, whole tailings will be discharged via gravity into the surge pond through a lined secondary containment ditch (see Section 7.4).

7.2 Tailings Delivery

7.2.1 Underflow Sand

The cyclone underflow pipeline will deliver sand to the top of the embankment for tailings dam construction. Two underflow pipelines will be used. The east leg will be routed around the north side of the TSF, and the south leg will be routed around the south side of the TSF as shown on Drawing 24. Each leg is sized to transport 100 percent of the cyclone underflow at up to 45.6 percent sand recovery. This allows for 100 percent availability of sand delivery to the dam.

Cyclone underflow will be discharged through 4-inch spigots placed every 333 feet. Each spigot will include one 4-inch manual pinch valve. The underflow pipelines will also have in-line knife-gate isolation valves every 2,000 feet to allow for isolation and relocation of the pipe as the dam rises. The knife-gate isolation valves will be quick-disconnect with hydraulic actuators powered by a mobile hydraulic power unit mounted on a pick-up truck.

The north and south cyclone underflow pipelines will be operated independently. When one is in operation, the other can be serviced or broken down and relocated. Cyclone underflow pipes will be flanged each 500 feet to facilitate breakdown and relocation.

7.2.2 Cyclone Overflow

Two cyclone overflow delivery pipelines, one leg to the north side and one leg to the south side of the TSF, will transport the cyclone overflow to the TSF interior (impoundment interior) as shown on Drawing 24. The cyclone overflow will be discharged via spigots placed every 667 feet. Each spigot will include a manual pinch valve. Each pipe is sized to carry 100 percent of the cyclone overflow to permit pipeline relocation without interrupting operation as the TSF elevation rises. One leg will remain active while the other is serviced or relocated.

The cyclone overflow pipelines will also have knife-gate isolation valves placed every 2,000 feet to allow for isolation and relocation of the pipe as the impoundment rises. The knife-gate isolation valves will be quick-disconnect with hydraulic actuators powered by a mobile hydraulic power unit mounted on a pickup truck. The cyclone overflow delivery pipelines will be flanged every 500 feet to allow for breaking down and relocating the pipe.

7.3 Deposition Management

7.3.1 Dam Construction

Figure 7 illustrates height versus capacity and surface area relationships and rate of rise for the tailings impoundment. Near continuous operation of the cyclone plant will be required to produce sufficient sand to construct the dam to the ultimate elevation of 5,460 ft-msl. The difference in elevation between the dam crest and the head of the cyclone overflow impoundment beach will be maintained at 10 feet. Maintenance of this elevation difference will place the transition between the cyclone underflow sand dam fill and the interior cyclone overflow a distance of approximately 30 feet upstream of the inside dam crest. The elevation differential of 10 feet will be maintained in order to maintain adequate freeboard for stormwater storage. Maintaining this elevation differential also allows for maximum storage capacity for cyclone overflow, and thus maximum production of sand needed for dam construction.

In the early stages of operation, there will be more sand available than needed to maintain the elevation differential between the dam crest and the head of the beach. Excess sand will be pushed down the out-slope of the dam and used to construct the dam base. In the later stages of operation, the sand previously used to construct the dam base will reduce the sand requirements for raising the dam crest, and facilitate maintaining the crest to beach elevation differential.

7.3.2 Cyclone Overflow Discharge

The storage volume for the cyclone overflow will be maximized through managing deposition and practicing sub-areal, thin lift deposition. Discharge spigot locations will be frequently cycled so that a thin lift of tailings is placed on the tailings beach. Exposure to evaporation prior to burial with a subsequent lift of tailings will allow the tailings to desiccate and consolidate. The degree to which thin lifts can be placed and consolidation can occur under managed deposition is primarily a function of rate of tailings rise. It is also influenced by tailings properties, climatic conditions, surface water management, and operator effort.

7.4 Management of Upset Flows

Potential upset flows from the process area, cyclone plant, and TSF will be controlled through a series of secondary containment ditches, the surge pond, and the TSF underdrain collection pond (see Section 6.5). The secondary containment ditches and associated pipelines will be constructed in accordance with the requirements listed in 20.6.7.23 NMAC. The secondary containment ditches will run from the process area to the TSF (the main ditch), from the main ditch to the cyclone area, and from the cyclone area to the surge pond. The secondary containment ditches are designed to contain and transport flows via gravity that are related to potential upset conditions and direct precipitation onto the ditches associated with the 25-year 24-hour storm event (2.88 inches). Maximum upset flow conditions would be associated with overtopping of the process water reservoir (as estimated by M3, the design contractor for the process water reservoir). This maximum upset flow was assumed to be 18,000 gpm over a 30-minute period, at which point the process area pumps would be shut down. The secondary containment ditches are designed for these maximum upset flows, direct precipitation, and an additional 2 feet of freeboard. The main ditch is designed to flow to the TSF by gravity for the first six years. After year six, gravity flow to the TSF is no longer possible because of the increased height of the TSF and upset flows will then discharge to the surge pond via gravity in a lined ditch through year 11.1. The alignment of the secondary containment ditches is shown on Drawings 2, 3, 10, 11, 12, 21, and 24 through 26. Details of the secondary containment ditches are provided in Drawing 29.

Surge pond cross sections and details are shown on Drawing 22. The surge pond liner system will consist of a liner bedding fill layer overlain with a minimum 60-mil HDPE geomembrane liner. The surge pond is located at an elevation of 5,340 feet and is sized for a surge retention time of half an hour with and additional reserve capacity of over one million gallons. The pond is sized for the retention of approximately 1,610,000 gallons of slurry with an additional 2 feet of freeboard. The use of the surge pond will be intermittent and temporary and the pond will be empty under normal operating conditions. The pond will be equipped with dedicated hard-wired pumps that will automatically evacuate its contents. Emergency power for the pumps will be provided by the emergency diesel power generation system located on-site in the event of a power outage. The process facility control room will be equipped with emergency alarms that notify the operator of an upset condition allowing the operator to make necessary adjustments in the process, as needed. The pumps at the surge pond will be automatically activated upon the pond reaching a predetermined level. Water and solids collected from the surge pond will be discharged through a 12-inch HDPE DR17 pipeline to the top of the TSF. The solids handling pump is designed to evacuate the surge pond within 12 hours.

8.0 WATER RECLAIM SYSTEM DESIGN

The water reclaim system is a significant part of NMCC's water conservation program. It will provide approximately 75 percent of the water used in the process in the form of recycled water. The purpose of the water reclaim system is to recycle supernatant water stored in the TSF and water captured in the underdrain collection gallery and stored in the TSF underdrain collection pond. The TSF water reclaim system will recover water released as the cyclone overflow consolidates within the TSF. The underdrain water collection system will recover water from the bottom of the tailings impoundment through the TSF underdrains into the TSF underdrain collection pond. The underdrain pond will also store water captured by the dam underdrains from the downstream side of the dam as sand is deposited and compacted as well as precipitation run-off water from the face of the dam. All of this water will be transported from the TSF and TSF underdrain collection pond to the process water reservoir located at the plant via a 20-inch HDPE variable DR return water pipeline. Water from the TSF underdrain collection pond may also be pumped back directly to the TSF. The major components of the water reclaim system are shown on Drawing 27. Water reclaim system details are shown on Drawing 28.

The TSF reclaim system will be a barge-mounted pump station in the impoundment equipped with four pumps (three operating and one spare) with a design flow from this station of 13,000 gpm. This is equal to the maximum design rate at which water will be delivered to the TSF from the cyclone plant during normal operation.

The TSF underdrain collection pond system will be a pump station of two pumps (one operating and one spare) installed in a sump within the pond. The design flow from this station will be 4,000 gpm. This is the maximum design flow of the TSF underdrain collection gallery. It is anticipated that up 4000 gpm of flow will be captured by the underdrains in the initial stages of operation of the TSF. This flow rate will become less over time as the tailings impoundment fills and the underdrains become overlain with tailings materials.

The water reclaim barge in the TSF impoundment will be accessed from a ramp constructed over the impoundment liner as shown on Drawing 28. The ramp will be approximately 35 feet wide and initially constructed to a height of 10 feet above the impoundment floor. As the tailings level rises during operations, the position of the barge will migrate up the ramp northwestward along the reclaim pipeline alignment. In each construction phase, ramp construction will be completed with borrowed structural fill material.

9.0 WATER BALANCE

Water balance calculations are included in Appendix G. Figure 8 summarizes the results of a water balance analysis of the proposed TSF for average rainfall conditions. The water balance model incorporates water input from slurry water inflow, direct precipitation on the impoundment surface and runon from un-diverted upgradient areas. On-site meteorological data collection at Copper Flat was initiated in August 2010. Due to the short duration of record keeping and recording gaps, NOAA data from Hillsboro and Caballo Dam, New Mexico, were used in conjunction with Copper Flat data to estimate monthly precipitation and evaporation rates. The ratio of site evaporation to Hillsboro evaporation for months where data are available from both sites was used to estimate site evaporation for months where data were not collected at the site.

Water balance model losses include entrainment of water within the tailings solids, evaporation from the TSF supernatant pool, evaporation from the exposed tailings beach, and evaporation of water from the dam. Entrainment represents the most significant water loss and is calculated on the basis of the estimated final post-deposition dry density of the cyclone underflow and cyclone overflow. An average post-deposition dry density of 57 pcf is assumed for the cyclone overflow. Over the life of the facility, approximately up to 49 million tons of cyclone underflow will be produced assuming near constant operation of the cyclone plant and mill.

The water balance model does not identify reclaim rates from specific locations because operation of the impoundment will impact where water accumulates. Water that is not lost to evaporation or bound within the tailings is assumed to be recovered from either the impoundment free water pond or the TSF underdrain collection pond.

The impoundment underdrain will be equipped with a shutoff valve at its inlet during the initial years of operation so that when the water level in the TSF underdrain collection pond exceeds the normal operating level, the underdrain will be closed to utilize the TSF supernatant pool for storage and the TSF undergrain collection pond will be pumped down.

A total process water inflow of 12,978 gpm is estimated based on average operating conditions. This inflow includes water contained in the cyclone overflow slurry and water delivered to the dam with the cyclone underflow. As shown in Figure 8, the estimated process water reclaim rate averages 9,215 gpm. The average make-up water requirement, calculated as the difference between the process water delivered and the water reclaimed, is estimated to be 3,169 gpm or approximately 152 gallons per ton of tailings placed in the TSF. The maximum estimated make-up water rate is 3,676 gpm.

The water balance examines water reclaim rates for average rainfall conditions. If the site experiences precipitation that is less than or exceeds average conditions, water reclaim rates and make-up water requirements can also be expected to vary. The water reclaim system is capable of recovering water at a rate adequate to account for all water in the tailings slurry discharged from the flotation plant. Maximum reclamation of water following storm events can temporarily reduce demand on external water sources. The water balance does not consider additions from the open pit or waste rock stockpile stormwater ponds. Water available from other on-site sources is not expected to be significant.

10.0 TAILINGS DAM STABILITY ANALYSIS

10.1 Methods

Slope stability analyses were performed in support of the feasibility design of the Copper Flat TSF with an ultimate crest elevation of 5,435 ft-msl. The analyses were performed using limit-equilibrium slope stability software and Spencer's (Spencer, 1967) method of slices to compute the theoretical factors of safety (FOS) for various potential failure surfaces. Material properties used in the stability calculations for native soil and tailings materials were based on laboratory geotechnical testing performed in Golder's in Denver, Colorado laboratory and discussed previously in Sections 3.3 and 4.3.

Slope stability analyses were conducted to determine the FOS against failure for the critical stability section along the highest embankment section and most adverse subsurface topography on the downstream slope. The critical factors of safety assumed for stability analysis are 1.5 for static conditions and 1.1 for pseudo-static conditions, according to NMAC 19.25.12.11.12. Stability analyses were performed for static (steady-state) and dynamic (pseudo-static) loading conditions. Steady-state loading conditions represent the long-term stability of the TSF and pseudo-static loading conditions represent the stability of the TSF during the design earthquake loading event.

The computer package SLIDE™ (Version 6.021) was used to conduct the stability analyses (Rocscience, 2013). An arcuate (circular) failure mode was used to analyze the critical section with the shear surface failing through the tailings and/or foundation materials. A block failure mode was used to analyze the critical section with a potential failure at the liner interface. Both methods are based on the principle of limit equilibrium, i.e., the method calculates the shear strengths that would be required to maintain equilibrium, and then calculates the FOS by dividing the available shear strength by the shear strength required to maintain stability.

Analyses were limited to the investigation of global failures that can affect the full height of the embankment, are deeper seated, and may result in lowering the embankment crest and loss of containment. Local stability analyses associated with shallow slope failures were not investigated.

A pseudo-static analysis approach was used for the seismic loading case. With this method, a lateral force is added to a potential failure mass, with magnitude equal to some fraction of the weight of the sliding mass. The fraction is defined in the form of a pseudo-static coefficient and is expressed as a percentage of gravity. Selection of the pseudo-static coefficient is discussed below. Stability analysis supporting data and computer-generated outputs are contained in Appendix H.

10.2 Seismic Design Criteria

According to the regulations set by the NMDSB, the TSF can be classified as having a significant hazard potential. Dams assigned the significant hazard potential classification are those where failure results in no probable loss of human life but can cause economic loss, environmental damage, and/or disruption of lifeline facilities. The NMDSB requires that structures such as the Copper Flat TSF be designed to withstand the seismic loading from the Maximum Design Earthquake (MDE) with a 2 percent probability of exceedance in 50 years (approximately 2,475-year return frequency). The peak ground acceleration (PGA) for the Copper Flat property was obtained using the US Seismic “Design Maps” Web Application developed by the United States Geological Survey (USGS) Geologic Hazards Science Center (USGS, 2011). Considering the 2009 National Earthquake Hazards Reduction Program provisions for a Site Class C and a site location of 32.96° North latitude and 107.5° West longitude, the resulting PGA for the 2,475-year return MDE is approximately 0.13 times gravitational acceleration (0.13g).

The method developed by Hynes-Griffin and Franklin (1984) and Jansen (1985) was used to evaluate pseudo-static loading conditions, as outlined by the NMDSB guidelines (2010). This method recommends that the pseudo-static coefficient selected for analysis must be at least 50 percent of the predicted PGA, but not less than 0.05g, and the FOS under pseudo-static analysis should be 1.1 or greater. A coefficient of 0.087g, corresponding to two-thirds of the design PGA, was conservatively used for the analyses.

The results of the previous seismic liquefaction potential evaluation of the Copper Flat TSF by SHB (1980) indicated that the probability of liquefaction affecting the Quintana TSF was extremely remote based on the seismic hazard potential of the site and empirical data derived from case histories of tailings dams and natural, saturated, loose sandy deposits subject to earthquake-induced ground motions. Golder anticipates that a drained response to seismic loading will dominate the pore water conditions in the TSF during and following its active life based on the material permeabilities, boundary drainage conditions, and construction practices. Given the seismic hazard potential of the site and the proposed TSF construction and operating practices, the liquefaction potential of the new TSF is also considered low.

10.3 Tailing Drainage and Phreatic Conditions

The primary source of tailing drainage is drain-down water associated with the centerline-constructed cycloned underflow tailings portion of the embankment, with a minor contribution from consolidation and drainage of the impounded cyclone overflow upstream of the embankment crest. The drainage control system consists of a continuous granular fill blanket drain beneath the cyclone underflow sand embankment and toe area, with lateral underdrain pipes spaced at 45-foot centers across the embankment footprint. Lateral drain pipes will connect to an open channel, which gravity drains to the HDPE-lined TSF underdrain collection pond.

The phreatic surface was assigned to be coincident with the drainage control system at the base of the final embankment, based on performance of similar structures. Because of the large difference in the hydraulic conductivity of the cyclone underflow and cyclone overflow, a near vertical phreatic surface is assumed at the dam/beach interface. This condition will result in the main body of the dam being well-drained and unsaturated.

10.4 Pore Pressure Conditions and Liquefaction Potential

The response of tailings material to loading can be either drained or undrained, and is associated with the development of pore water pressures. For stability analyses, a phreatic surface was assumed at the beach material surface level upstream of cycloned underflow tailings embankment and an undrained response was evaluated. Undrained analyses were performed by applying an undrained strength to the cyclone overflow on and beneath the beach.

Susceptibility to liquefaction potential is assumed to be limited to the saturated beach areas upstream of the dam. Steady-state (residual) undrained strength was applied to the tailings beach upstream of the cyclone sand dam fill to evaluate post-liquefaction stability.

The risk of static and seismic liquefaction triggering will likely be low if appropriate control over embankment construction and the phreatic-surface elevation is exercised, and the cyclone underflow sand behaves as anticipated. Sand placed on the dam crest will be spread and compacted. Operating experience at mine sites utilizing cyclone underflow fill indicates that self-weight compaction of sand on the tailings out-slope is typically adequate for minimizing liquefaction potential. At Copper Flat, some compaction will be realized on the dam out-slope as a result of dozer spreading operations.

10.5 Material Properties

The material properties used in the stability analyses are based on a review of the properties used in previous site studies (SHB 1980), new data derived from testing of samples collected during the site geotechnical investigation, and from tests conducted on tailings characterization study samples. The components of the slope stability model include:

- Foundation Materials
- Liner Interface Zone
- Cyclone Underflow sand
- Cyclone overflow (beach material)
- Structural Fill

Table11 summarizes the strength parameters used in the preliminary slope stability analyses.

Table 11: Summary of Properties Used in Stability Analyses

Component	Unit Weight (pcf)	Drained Strength		Undrained Strength (S_u/σ'_v)
		Cohesion (psf)	ϕ' (degrees)	
Foundation Materials	120	150	29	NA
Liner Interface Zone	120	0	26.5	NA
Cyclone Underflow	113	0	39	NA
Cyclone overflow	108	NA	NA	0.05
Structural Fill	120	0	29	NA

Notes:
pcf = pounds per cubic foot
psf = pounds per square foot
ϕ' = Effective stress friction angle
S_u/σ'_v = Residual undrained shear strength normalized by the effective overburden stress
NA = Not applicable

10.5.1 Foundation Materials

The foundation underlying the proposed TSF embankment has been characterized as an alluvial deposit comprised of predominately silty and clayey sands and gravels. Foundation material strength test results ranged from 28 to 32 degrees (effective friction angle). Based on the results of consolidated-undrained triaxial tests completed by Golder, an effective stress friction angle (ϕ') of 29 degrees and effective cohesion of 150 pounds per square foot were applied for the shear strength of the foundation materials.

10.5.2 Liner Interface Zone

The shear strength of the cycloned underflow tailings/geomembrane liner/liner bedding interface will be the controlling factor for possible sliding block-type failure surfaces along the base of the TSF embankment. The interface shear strength was evaluated in a direct shear test performed by Golder. Old (Quintana) tailings, and drain fill materials were placed in contact with a sample of textured, 80-mil HDPE geomembrane. The composition of the test sample is representative of the Phase 1 interface, when the old tailings will be utilized for liner bedding fill. The use of coarser, higher strength materials (crushed and screened native gravelly sand) is anticipated in later construction phases. The direct shear test indicated an interface friction of 26.5 degrees. This strength was assigned to the interface zone comprised of liner bedding, geomembrane and drainage materials.

10.5.3 Cyclone Underflow

The sloping, cyclone underflow embankment was considered to be fully drained and cohesionless because of the anticipated low phreatic-surface elevation and the high permeability of the cyclone underflow in the embankment, and the effect of the drainage control system. Mittal and Morganstern (1975) evaluated the ϕ' for cycloned copper tailings sands. The effects of particle crushing and sand dilatancy were most pronounced at stresses up to 40 psi, while at higher stresses ϕ' remained relatively constant and approximately equal to 34 degrees. Volpe (1975) reported ϕ' values for copper sands and slimes between 33 to 37 degrees. A consolidated-undrained triaxial test conducted by Golder on a cyclone underflow sample indicated an internal friction angle of 40 degrees. An effective friction angle of 39 degrees was assumed in stability analyses.

10.5.4 Cyclone Overflow

Cyclone overflow in the impoundment is assumed to exhibit a drained response for most loading conditions except for the conditions occurring after static or seismic liquefaction. However; for conservatism, an undrained shear strength behavior was assumed for the cyclone overflow upstream of the embankment.

Undrained shear strength implicitly accounts for the effects of shear-induced pore pressures. Based on experience from similar mining projects and published data (Mittal and Morganstern 1975, Vick 1990), the peak undrained shear strength normalized by the effective overburden stress (S_u/σ'_{vo}) was estimated to be 0.20 for the impoundment area extending upstream from the embankment crest.

Residual undrained shear strengths were used in a static analysis to evaluate embankment stability following liquefaction in the beach area. Similar to that for peak shear strength, the residual undrained shear strength normalized by the effective overburden stress (S_u/σ'_{vo}) was estimated to be 0.05 for the tailings upstream of the cyclone underflow dam.

10.5.5 Structural Fill

Strength parameters for the starter dam structural fill are based on testing of representative materials recovered from the TSF borrow areas during the site exploration. Foundation material strength test results ranged from 28 to 32 degrees. The material was conservatively classified as cohesionless with a ϕ' of 29 degrees with a moist unit weight of 120 pcf.

10.5.6 Liner Material

The liner interface direct shear test was conducted with a sample of textured geomembrane. The use of un-textured geomembrane may be feasible, but testing of interface strength with un-textured liner has not been performed. To evaluate the potential for use of smooth liner, the interface strength was varied to find the interface friction angle required to meet the minimum pseudostatic FOS of 1.1. This analysis was performed for the block failure mode.

10.5.7 Fissured Clay Foundation Analysis

Stability analyses presented in Section 10.6 for the maximum embankment section address the embankment, the cyclone underflow beach and the liner interface zone on a maximum height embankment section. Additional sections corresponding to geology sections B-B' and D-D' were evaluated to determine the effects of clay foundation soils on the stability of the TSF.

Drill holes in the vicinity of these sections intercepted a clay layer that appears to be dipping to the eastward based on the first high plasticity clay intercepts identified during drilling. At several locations in the TSF expansion area, the top of this clay layer exhibited characteristics of a softened clay, with locally high moisture content and corrected SPT blow counts, in the range of 12 to 25, that were lower than those in overlying and underlying soils.

Stark and Eid (1977) state that fissured clays in first time slides (or first time slope failures) may exhibit a mobilized shear strength that is lower that the strength of fully softened clay, and suggest the use of the average of the fully softened and residual (large strain) clay strength in evaluating stability. Clay shear strength was estimated based on an empirical method presented by Mesri and Shahien (2003) that relates shear strength under varying normal stress to plasticity index. The method provides a non-liner shear strength envelope used to estimate the fully softened, residual and average strength of hard, fissured clays. The resulting shear strength versus normal stress envelope is used for clay strength input in the slope stability model.

The highest plasticity index (I_p) of 42 percent in Copper Flat samples, which was associated with a softened clay sample recovered from drill hole BH-18 at a depth of 43 feet, was assumed for estimating the strength of the high plasticity clay layers. In section B-B', clay interbedded clay and granular soil layers were modeled. In Section D-D', the clay layer was assumed to extend from the first high plasticity clay intercept to the base of the model section.

10.6 Stability Analysis Results

The results of stability analyses for static and pseudo-static loading conditions are summarized in Table 12.

Table 12: Calculated Slope Stability Factors of Safety

Failure Mode	Method	Static FOS (Global)	Pseudostatic FOS (Global)
Maximum Section Circular	Spencer	2.53	1.92
Maximum Section Block	Spencer	2.24	1.69
Maximum Section Circular, Post Liquefaction	Spencer	2.53	NA
Maximum Section Block, min required interface strength = 13.6 degrees	Spencer	1.53	1.1
Fissured Clay Section B-B' Circular	Spencer	1.56	1.12
Fissured Clay Section B-B' Block	Spencer	2.50	1.90
Fissured Clay Section D-D' Circular	Spencer	1.53	1.13
Fissured Clay Section D-D' Block	Spencer	2.48	1.87

Notes:
FOS = factor of safety
NA = not applicable
Min = minimum

The conservative assumptions applied in the stability analyses suggest that the Copper Flat TSF will be stable. All factors of safety meet or exceed the minimum NMDSB requirements of 1.1 and 1.5 for static and pseudostatic conditions. The residual strength analysis suggests if liquefaction of saturated tailings upstream of the dam occurs, the embankment will remain stable. The evaluation of the sensitivity of pseudostatic stability to the friction angle of the liner interface indicates a relatively low interface friction angle is required to maintain stability, and that the required interface strength is likely to be achievable with an un-textured geomembrane liner.

11.0 TAILINGS DAM FOUNDATION SETTLEMENT POTENTIAL

11.1 Analysis Approach

The TSF will consist of an earthen starter dam constructed to a height of approximately 50 feet with the remainder of the dam constructed with sand recovered from the cyclone plant. A geotechnical investigation was performed in the embankment footprint, which included standard penetration testing and sample collection from the surface to a depth of 50 feet. Drilling indicated that in general, the tailings embankment foundation consists primarily of alluvial deposits that include silt, sand and gravel, which are underlain by clay.

Representative samples of the foundation strata were analyzed in Golder's geotechnical laboratory for index properties, gradation, and Atterberg limits. Selected samples were remolded in the laboratory, and the remolded samples were subjected to one-dimensional consolidation testing.

Settlement calculations were developed for the post-construction embankment, which represents the worst-case condition. Staged settlement was not analyzed because settlement of the embankment will be adequately mitigated by continuous fill placement during ongoing embankment construction. Settlement calculations were performed using the computer model SETTLE3D v. 2.0, a computer program developed by Rocscience, Inc., for the analysis of settlement and consolidation under foundations and embankments.

A detailed description of the settlement potential investigation, settlement calculations and supporting information are contained in Appendix I.1. Drill holes and the location of cross-sections used to evaluate subsurface conditions are shown on Drawing 3. Drawings 5 and 7 present geologic cross sections B-B' and D-D', respectively, which were developed to evaluate settlement perpendicular to the dam axis. The cross-sections also include information derived from the former geotechnical study conducted on behalf of Quintana by Sergent Hauskins and Beckwith (SHB, 1980). Drill hole logs are contained in Appendix A.2.

A differential settlement and geomembrane strain analysis was subsequently conducted by Golder and is included in Appendix I.2. Cross sections were developed to intercept the various geologic materials underlying the TSF site. The engineering properties of the foundation materials were derived from the 1980 Sargent, Hauskins and Beckwith (SHB) geotechnical study, the geotechnical investigation conducted as part of the TSF design report and experience with similar foundation materials.

11.2 Settlement Potential Analysis Results

Laboratory consolidation testing was conducted on remolded specimens of the fine fraction of samples recovered from the embankment foundation. As such, the settlement prediction does not account for the presence of the coarse fraction in the foundation soils, and associated inter-particle contact and support of foundation loads. Settlement predictions based on the laboratory consolidation tests are therefore conservative.

Results of the settlement potential analysis are shown graphically on geologic sections B-B' and D-D'. The maximum calculated settlement beneath the embankment is approximately 2.1 feet in the area of the maximum dam (and tailings beach) foundation loads. Settlement decreases at a relatively uniform rate as the weight of post-construction loading decreases towards the outer toe of the embankment.

Settlement prediction based on the laboratory consolidation testing of the fine fraction of foundation samples is conservative. SPT testing conducted during drilling showed the foundation strata to generally be very dense to hard. On the basis of SPT test results, actual post-construction consolidation settlement of less than 1 foot is anticipated.

Dam construction will be more or less continuous during the life of the facility. The effects of foundation settlement include the potential for the loss of dry freeboard for stormwater storage. The potential loss of freeboard can be mitigated by elevating the dam crest with managed/targeted placement of cyclone underflow sand.

The analyses did not indicate the potential for differential settlement that could impact the integrity of the TSF geomembrane liner. Sections B-B' and D-D' indicate predicted settlement varies uniformly across areas subject to changing foundation loads.

The impoundment underdrain will pass beneath the dam in a steel pipe placed in a ditch backfilled with concrete near section F-F' (Drawing 9). The settlement will not adversely impact the impoundment underdrain outlet pipe. There is adequate grade and elevation change along the outlet pipe alignment to accommodate predicted settlement.

A basalt outcrop identified by SHB (SHB, 1980) may lie beneath or in the vicinity of the impoundment underdrain pipe inlet near the upstream toe of the dam. The outcrop occurred in an area that was disturbed during Quintana dam construction activities, and was not observed during the recent site exploration. If the inlet to the underdrain pipe bears on basalt, local differential settlement could occur along the pipe alignment, which could induce stress on the outlet pipe. If, during construction, a basalt outcrop is identified at the location of the inlet, an alignment change may be warranted to avoid the pipe bearing on basalt.

It should be noted that the settlement potential investigation was performed for a previously completed design study, and evaluated an embankment geometry that differs from that presented in this report. The new embankment is higher and the depth of embankment fill overlying the foundation is greater for this 30,000 tons per day design; however, the original analyses assumed a higher, more conservative embankment moist unit weight of 130 pcf. Tailings testing completed after the settlement potential study was conducted indicates a post embankment fill placement moist unit weight of approximately 113 pcf. The foundation loads imposed by the higher embankment fill, when corrected for the moist unit weight determined by laboratory testing, are lower than those used in the settlement potential analysis. Therefore, the results of the settlement investigation presented above are conservative relative to the current design. As part of future detailed engineering studies, settlement calculations will be updated for final design conditions; however, the conclusions are anticipated to be consistent with those presented herein.

The results of the differential settlement and geomembrane strain analysis indicates that, in general, settlement potential across the TSF is predicted to be limited. As such, the potential for tearing of the HDPE liner due to potential differential settlement within the entire area of the TSF is considered to be low. The maximum settlement is estimated to be 0.72 feet, while the maximum tensile strain on the HDPE liner due to differential settlement is estimated to be 0.02 percent. The allowable tensile strain on an 80 mil HDPE geomembrane liner is 10 percent and the predicted tensile strain is well within acceptable conditions. Therefore, Golder does not expect tearing of the HDPE liner due to differential settlement to be an issue.

12.0 USE OF THIS REPORT

This feasibility level design report has been prepared by Golder exclusively for the use of THEMAC and NMCC. No third-party engineer or consultant shall be entitled to rely on any of the information, conclusions, or opinions contained in this report without the written approval of Golder, THEMAC or NMCC.

The conclusions and recommendations in this report have been prepared in a manner consistent with the level of care and skill ordinarily exercised by engineering professionals practicing under similar conditions, subject to the time limits and financial and physical constraints imposed on or otherwise applicable to the work.

13.0 REFERENCES

Bray, J. and T. Travasarou, 2007. Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements. Journal of Geotechnical and Geoenvironmental Engineering, April, pp. 381-392.

Canadian Centre for Mineral and Energy Technology (CANMET), 1977. Pit Slope Manual (Chapter 9, Waste Embankments).

Chapin, C.E., 1971. "THE RIO GRANDE RIFT, PART I: MODIFICATIONS AND ADDITIONS." *New Mexico Geological Society Guidebook of San Luis Basin, 22nd Field Conference.* (1971): 191-201.

FEMA, 2007. Technical Manual: Plastic Pipe Used in Embankment Dams. Best Practices for Design, Construction, Problem Identification and Evaluation, Inspection Maintenance Renovation and Repair, U.S. Department of Homeland Security, November, 2007.

Gibson, R.E., England, G.L. and Hussey, M.J.L. (1967). “The Theory of One-Dimensional Consolidation of Saturated Clays”, Geotechnique, Vol. 17, pp. 261-273.

Golder Associates Inc., 2012. Prefeasibility Level Design, Tailings Storage Facilities, Copper Flat Project, Sierra County, New Mexico. Report prepared for THEMAC Resources Group Ltd., September 5, 2012.

GWP Software, 1999. *FSConsol User’s Manual*, GWP Sofware Inc.

Harley, G.H., 1934. "The Geology and Ore Deposits of Sierra County, New Mexico." *New Mexico State Bureau of Mines and Mineral Resources, Bulletin 10*. (1934): 1-217.

Hawley, J.W., 1965. "GEOMORPHIC SURFACES ALONG THE RIO GRANDE VALLEY FROM EL PASO, TEXAS TO CABALLO RESERVOIR, NEW MEXICO ." *New Mexico Geologixal Society Sixteenth Field Conference.* pp. 188-198.

Hynes-Griffin, M. and A. Franklin, 1984. Rationalizing the Seismic Coefficient Method. Report No. GL-84-13. U.S. Army Engineers Waterways Experiment Station, Vicksburg, Miss.

(IMC) Independent Mining Consultants, 2011. Annual Pit and Dump Map.

Kavazanjian, E., 1999. Seismic Design of Solid Waste Containment Facilities. Proceedings of the Eighth Canadian Conference on Earthquake Engineering, pp.51-89.

Lozinsky, R.P. and J.W. Hawley, 1986. "UPPER CENOZOIC PALOMAS FORMATION OF SOUTH-CENTRAL NEW MEXICO." *New Mexico Geological Society Guidebook, 37th Field Conference.* pp. 239-247.

Masada, T., 1998, "Leachate Flow Mound Equations for Steady-State Flow Over a Landfill Geosynthetic Bottom Liner", Geosynthetics International, Vol. 5, No. 4, pp. 383-397.

Mesri, G., Shahein, A.M., 2003. Residual Strength mobilized in First Time Slope Failures, Journal of Geotechnical Engineering, January 2003.

METCON Research, 2011. Copper Flat Feasibility Study.

Mittal, H. and N. Morgenstern, 1975. Parameters for the Design of Tailings Dams. Canadian Geotechnical Journal, 12(2), pp. 235-261.

Morgenstern, N. and A. Kopper, 1988. Hydraulic Fill Structures - A Perspective, Hydraulic Fill Structures, American Society of Civil Engineers (ASCE), New York, pp. 1-31.

NMDSB (New Mexico Office of the State Engineer [OSE] Dam Safety Bureau), 2010. Rules and Regulations Governing Dam Design, Construction and Dam Safety. December 31, 2010.

NOAA (National Oceanic and Atmospheric Administration), 2006. Precipitation-Frequency Atlas of the United States, Atlas 14, Volume 1, Version 4.0, Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, and Utah. G. M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley. National Weather Service, Silver Spring, Maryland. 2004, revised October 4, 2006.

O'Neill, J.M., D.A. Lindsey D.A., D.C. Hedlund, C.J. Nutt, and J.C. Ratte, 2002. "Geologic Investigations in the Lake Valley Area, Sierra County, New Mexico." *USGS Professional Paper 1644-A.* pp. 1-17.

Parsons, T, 1995. "The Basin and Range Province." *Continental Rifts: Evolution Structure and Tectonics.* Amsterdam: Elsevier, pp. 277-324.

Poulos, S., 1981. The Steady-State of Deformation. Journal of the Geotechnical Engineering Division, ASCE, 107, pp. 553-562.

Poulos, S., 1988. Strength for Static and Dynamic Stability Analysis. Hydraulic Fill Structures, ASCE. New York, pp. 452-474.

Rocscience, 2011. Slide, 2D Limit Equilibrium Slope Stability for Soil and Rock Slopes. Version 6.014.

Segerstrom, K. and J.C. Antweiller, III, 1975. "Placer-gold Deposits of the Las Animas District, Sierra County, New Mexico." *Unites States Department of the Interior Geological Survey, Open File report.*

SHB (Sergent, Hauskins and Beckwith), 1980. Tailings Dam and Disposal Area - Quintana Minerals Corporation - Copper Flats Project - Golddust, New Mexico. October 14, 1980.

Spencer, E. 1967. A Method of Analysis of Stability of Embankments Assuming Parallel Inter Slice Forces. Geotechnique, Vol. 17, No. 1, pp. 11-26.

Stark, T.D., Eid, H.T., 1997. Slope Stability Analyses in Stiff Fissured Clays. Journal of Geotechnical Engineering, April, 1997.

Stetson Engineers Inc., 2011. Copper Flat Mine, Order 1 Soil Survey of Permit Area. Report prepared for THEMAC Resources Group Ltd., September 14, 2011.

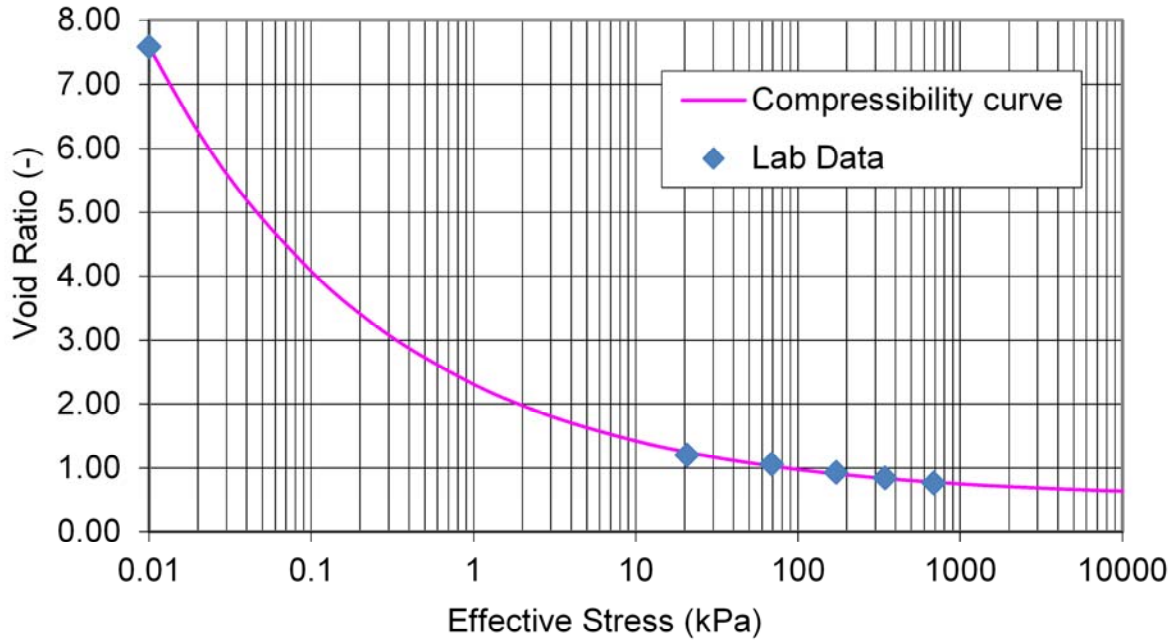
USGS (US Geological Survey), 2011. Geologic Hazards Science Center U.S. Seismic "DesignMaps" Web Application. From: https://geohazards.usgs.gov/secure/designmaps/us/.

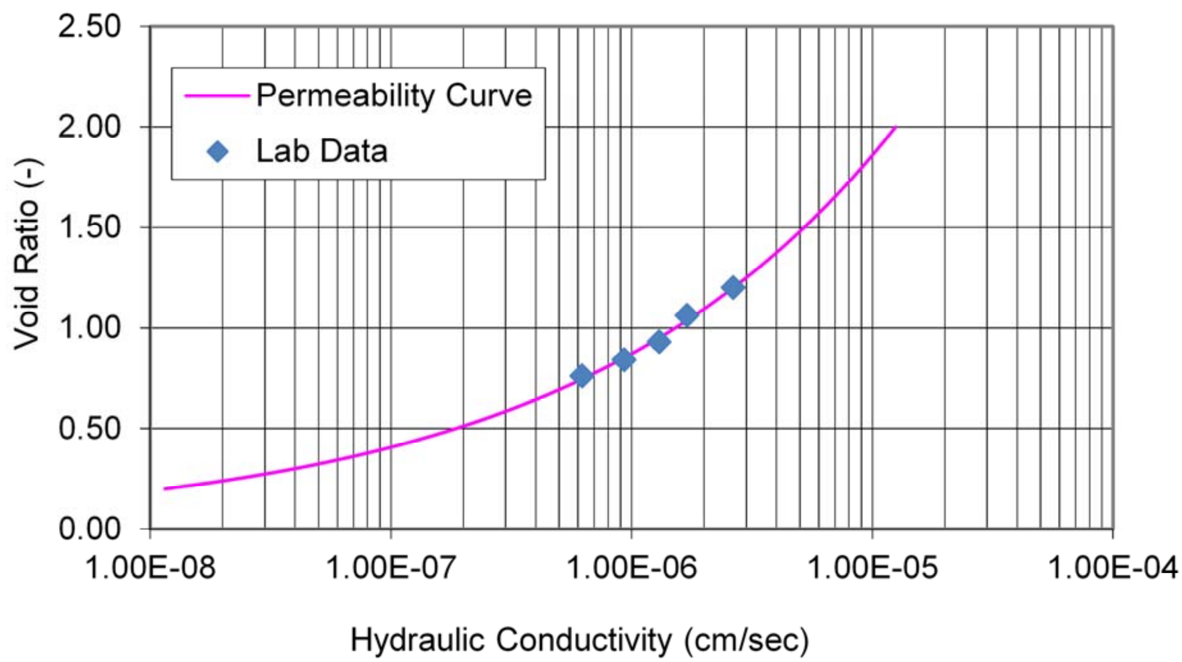
U.S, Department of Commerce, 1998. Hydrometeorolgical Report 55a, Probable Maximum Precipitation Estimates-United States between the Continental Divide and the 103rd Meridian.

Vick, S., 1990. Planning, Design, and Analysis of Tailings Dams. Bitech Publishers.

Volpe, R. 1975. Geotechnical Engineering Aspects of Copper Tailings Dams. American Society of Civil Engineers.

FIGURES





PROJECT

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

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DRAFT COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE
FACILITY FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

COMPRESSIBILITY AND PERMEABILITY VS. VOID RATIO THICKENED OVERFLOW- BEACH

Golder Associates

PROJECT No.		153-1453	FILE No. 10392557K101_10232015
DESIGN	DMW	2013-04-30	SCALE NTS
CADD	JHR	2013-07-11	FIGURE
CHECK	GM	2013-07-12	1
REVIEW	DAK	2013-07-12	

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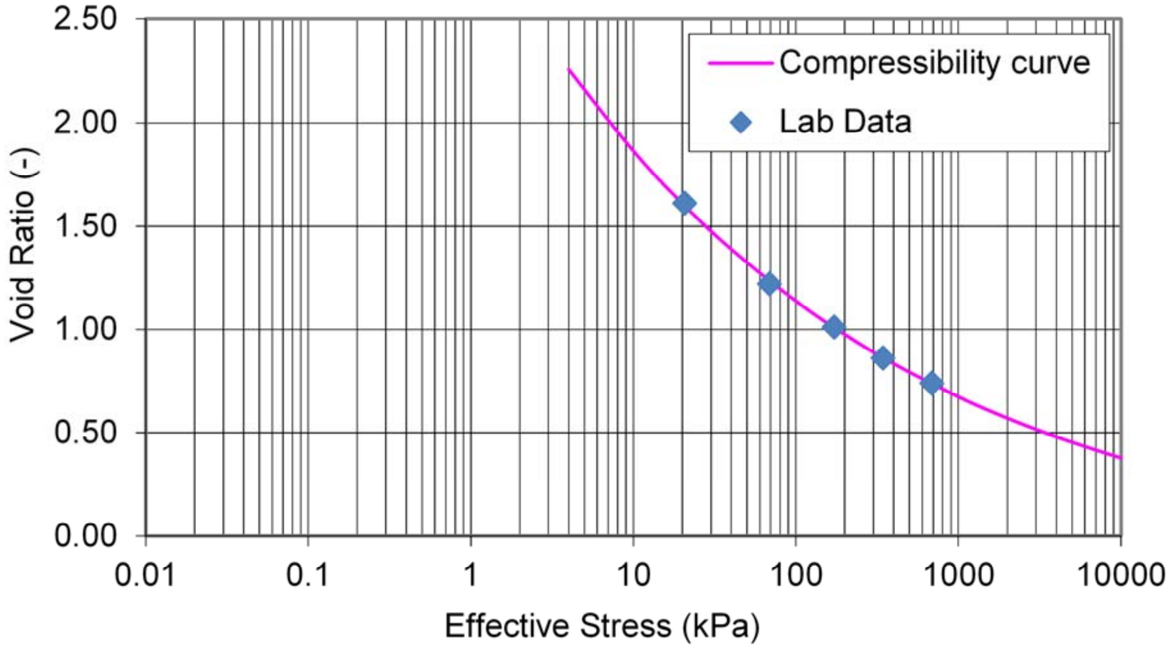

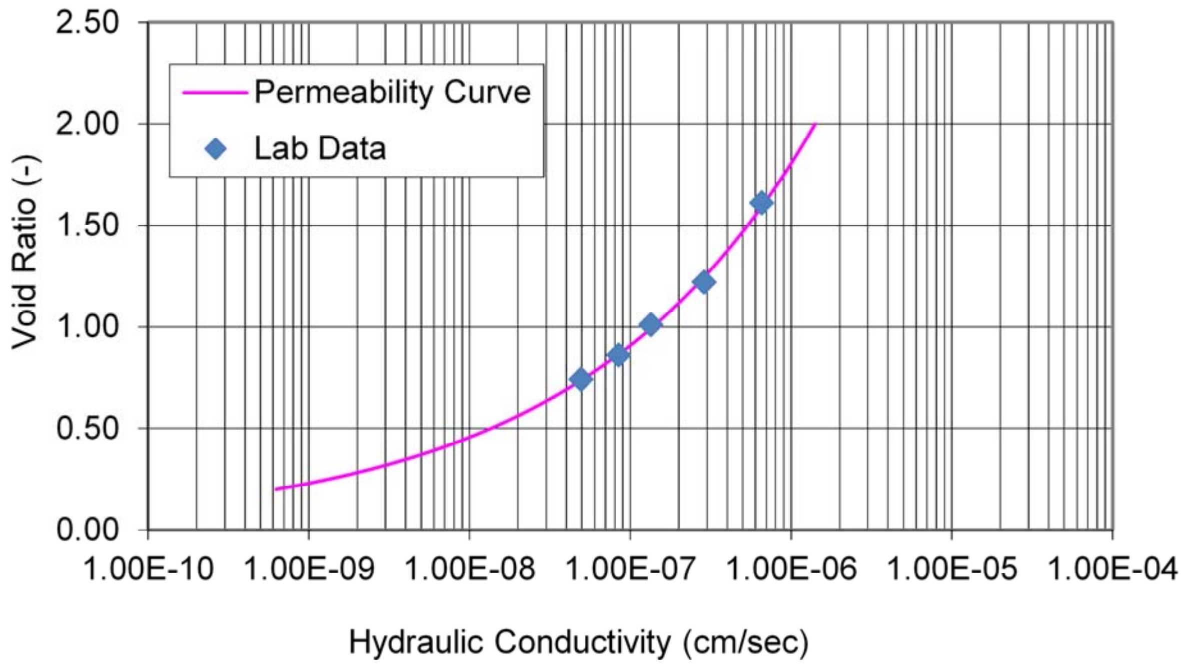

PROJECT

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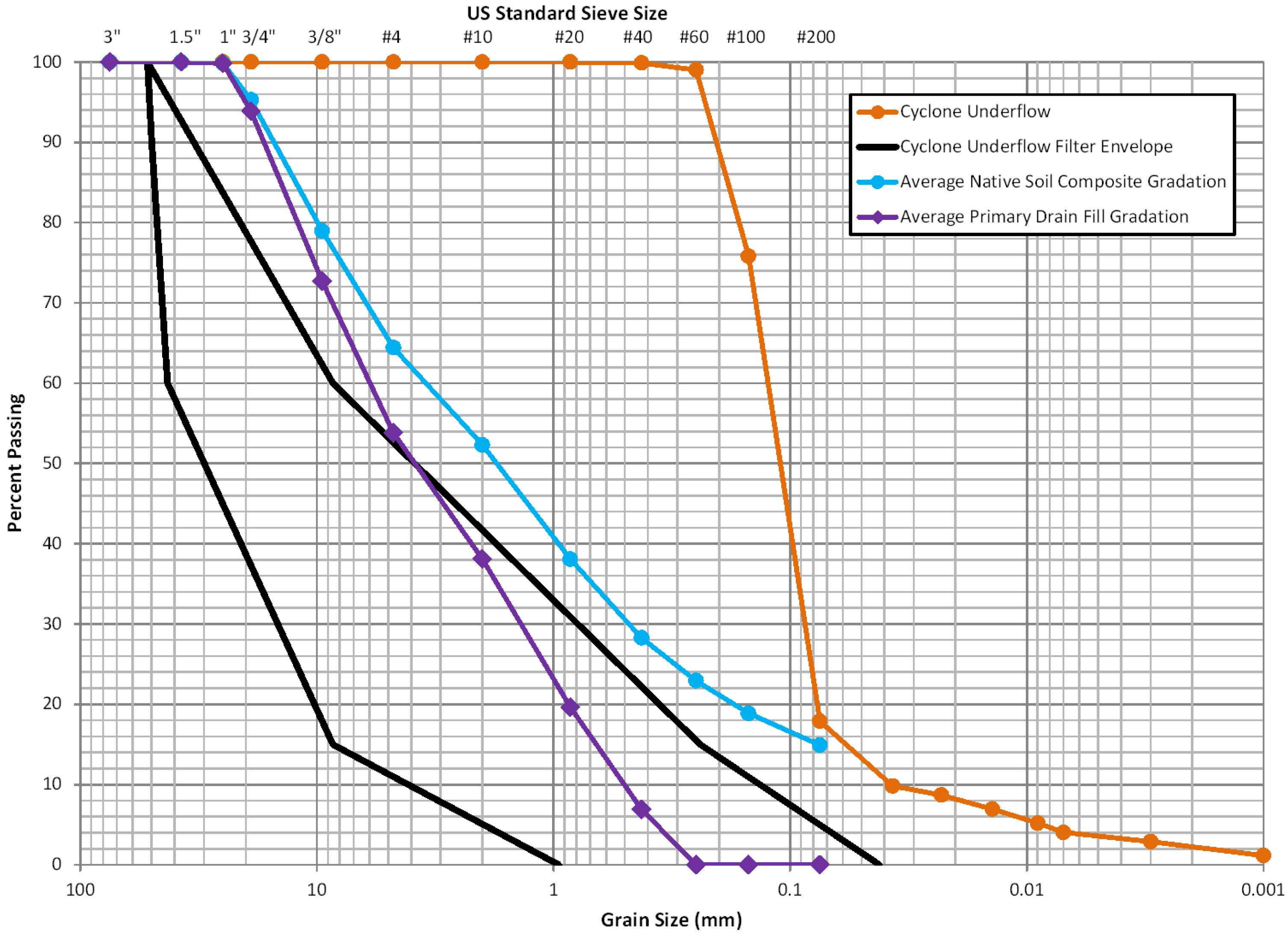
DRAFT COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE
FACILITY FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

COMPRESSIBILITY AND PERMEABILITY VS VOID THICKENED OVERFLOW SLIMES

Golder Associates

PROJECT No.		153-1453	FILE No.	10392557K101_10232015
DESIGN	DMW	2013-04-30	SCALE	NTS
CADD	JHR	2013-07-11	FIGURE	
CHECK	GM	2013-07-12		2
REVIEW	DAK	2013-07-12		

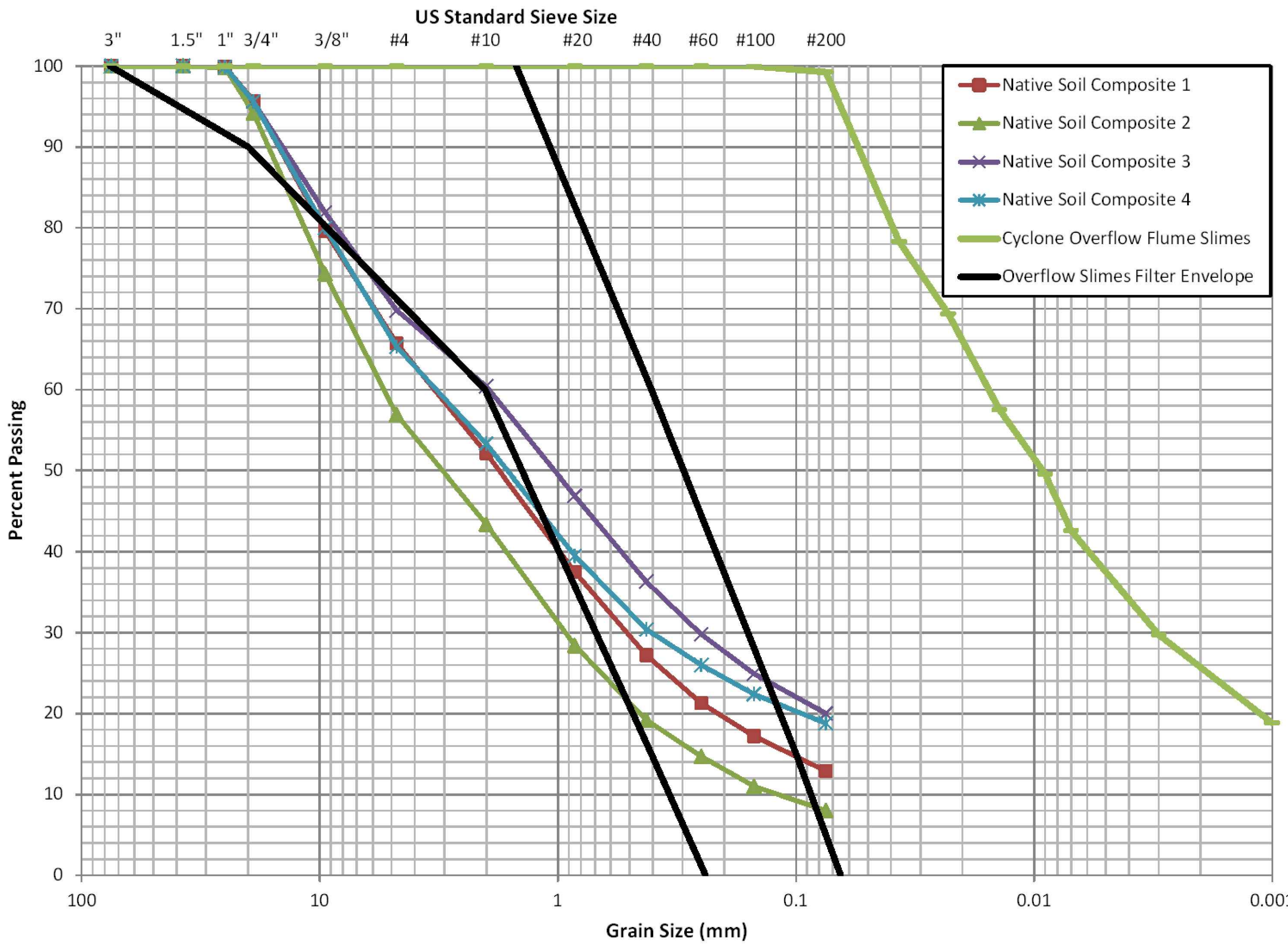


PROJECT THEMAC RESOURCES / NEW MEXICO COPPER CORPORATION — Environmentally Responsible. Community-Minded. Local Opportunities.	DRAFT COPPER FLAT PROJECT 30K TPD TAILINGS STORAGE FACILITY FEASIBILITY DESIGN SIERRA COUNTY, NEW MEXICO

TITLE

CYCLONE UNDERFLOW PARTICLE SIZE DISTRIBUTION AND FILTER ENVELOPE

Golder Associates				
PROJECT No.		153-1453	FILE No.	10392557K101_10232015
DESIGN	DMW	2013-04-30	SCALE	NTS
CADD	JHR	2013-07-11	FIGURE	
CHECK	GM	2013-07-12		3
REVIEW	DAK	2013-07-12		



PROJECT

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DRAFT COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE
FACILITY FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

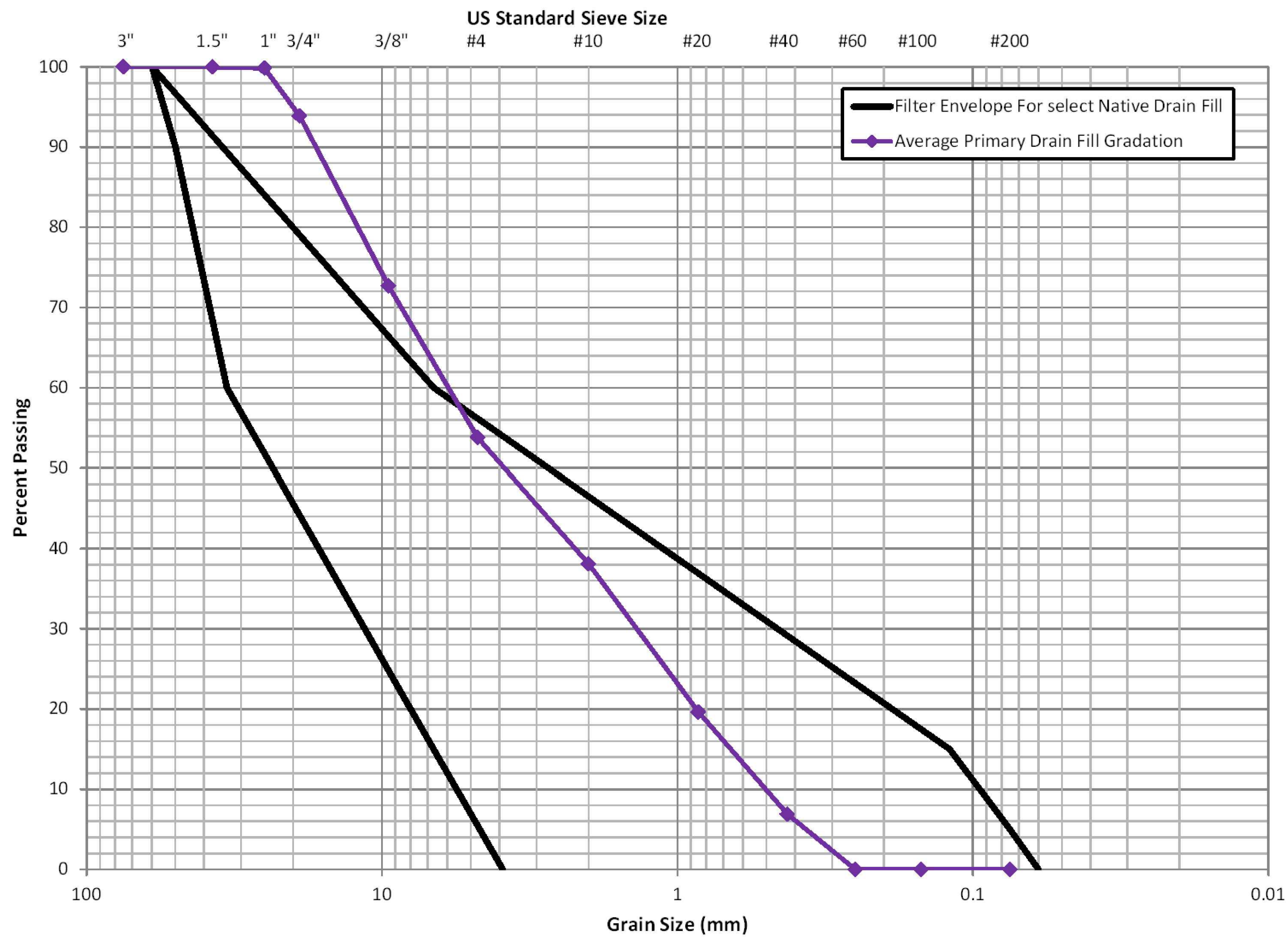
TITLE

CYCLONE OVERFLOW SLIMES PARTICLE SIZE DISTRIBUTION AND FILTER ENVELOPE

Golder Associates

PROJECT No.		153-1453	FILE No.	10392557K101_10232015
DESIGN	DMW	2013-04-30	SCALE	NTS
CADD	JHR	2013-07-11	FIGURE	
CHECK	GM	2013-07-12		4
REVIEW	DAK	2013-07-12		

P:\ABQ Projects\2015 Projects\1531453 THEMAC DP Permit Support\Supporting Documentation\Vol 1\K-Feasibility Design\10392557K101_10232015.dwg | Layout: 5 FILTER ENVELOPE FOR NATIVE SOIL | Modified: CMONTOYA 11/12/2015 3:17 PM | Plotted: CMONTOYA 11/13/2015



PROJECT THEMAC RESOURCES / NEW MEXICO COPPER CORPORATION — Environmentally Responsible. Community-Minded. Local Opportunities.			DRAFT COPPER FLAT PROJECT 30K TPD TAILINGS STORAGE FACILITY FEASIBILITY DESIGN SIERRA COUNTY, NEW MEXICO		
TITLE					
FILTER ENVELOPE FOR NATIVE SOIL COMPOSITES ESTIMATE PRIMARY DRAIN FILL GRADATION					
Golder Associates	PROJECT No.		153-1543	FILE No.	10392557K101_10232015
	DESIGN	DMW	2013-04-30	SCALE	NTS
	CADD	JHR	2013-07-11	FIGURE	
	CHECK	GM	2013-07-12		5
	REVIEW	DAK	2013-07-12		

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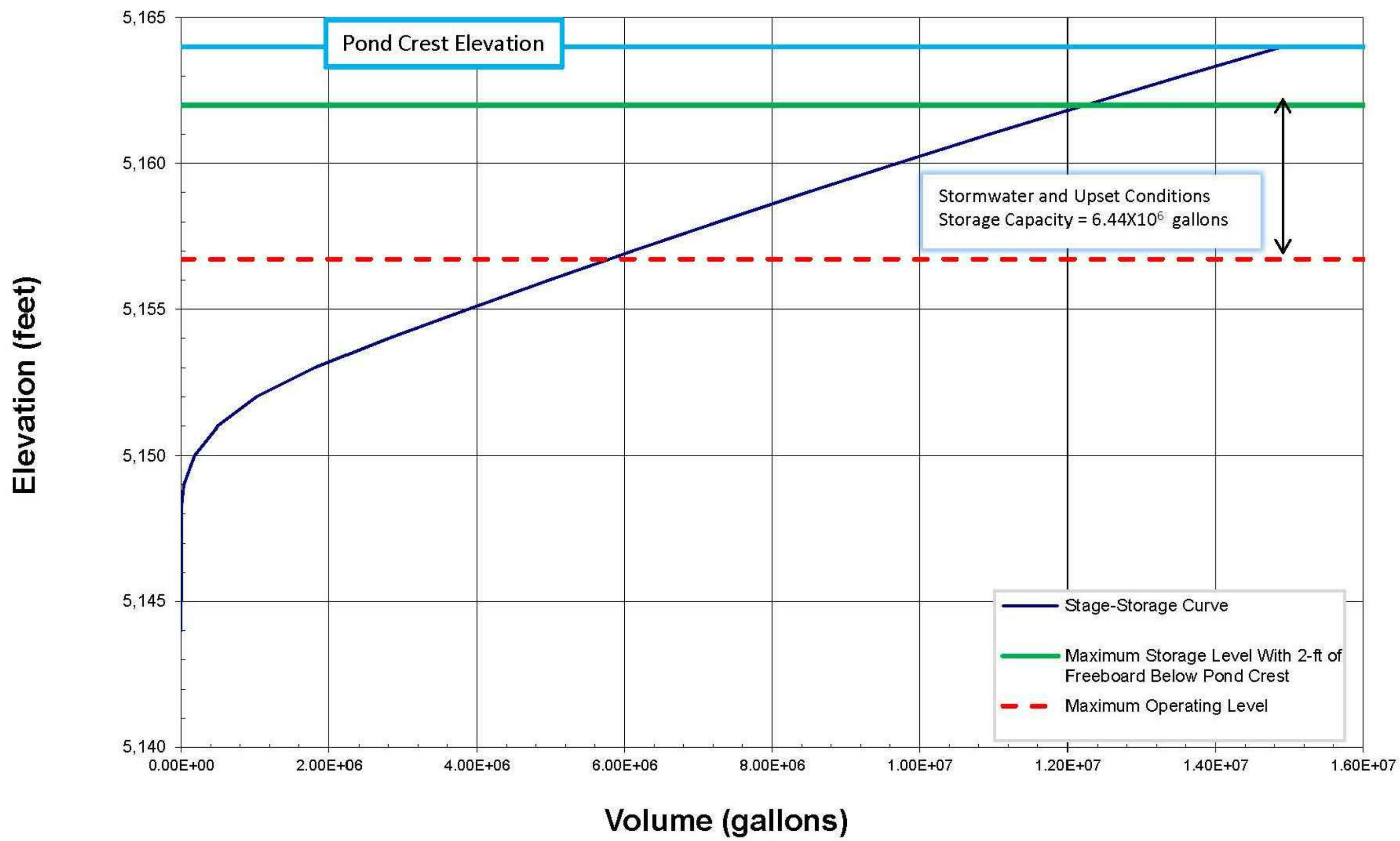

PROJECT

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DRAFT COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE
FACILITY FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

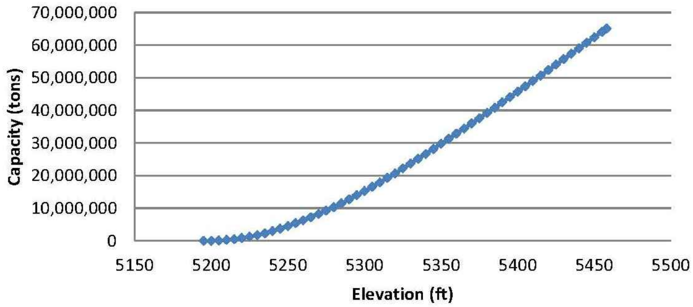
TITLE

STAGE-STORAGE CURVE
TSF UNDERDRAIN COLLECTION POND

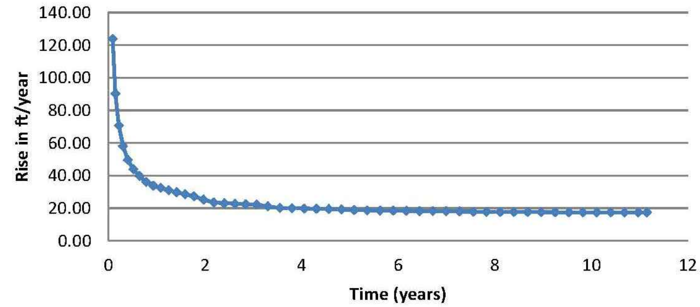
Golder Associates

PROJECT No.		153-1453	FILE No. 10392557K101_10232015
DESIGN	DMW	2013-04-30	SCALE NTS
CADD	JHR	2013-07-11	FIGURE
CHECK	GM	2013-07-12	6
REVIEW	DAK	2013-07-12	

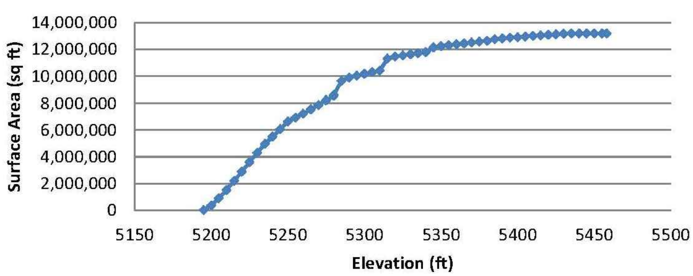
Impoundment Capacity vs. Elevation



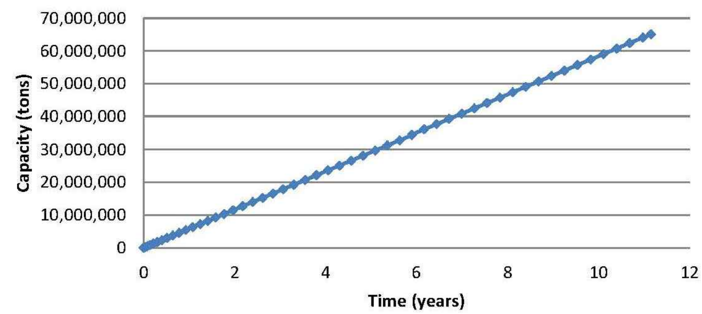
Rate of Rise (ft/yr)



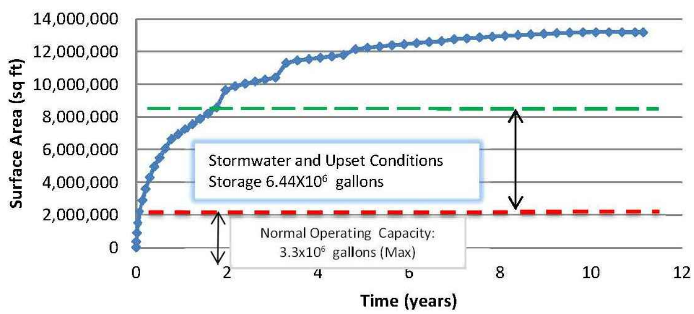
Impoundment Surface Area vs. Elevation



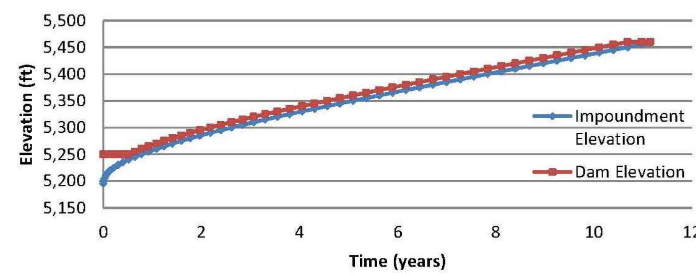
Impoundment Cumulative Storage



Impoundment Surface Area vs. Time



Dam & Impoundment Elevation vs. Time



PROJECT

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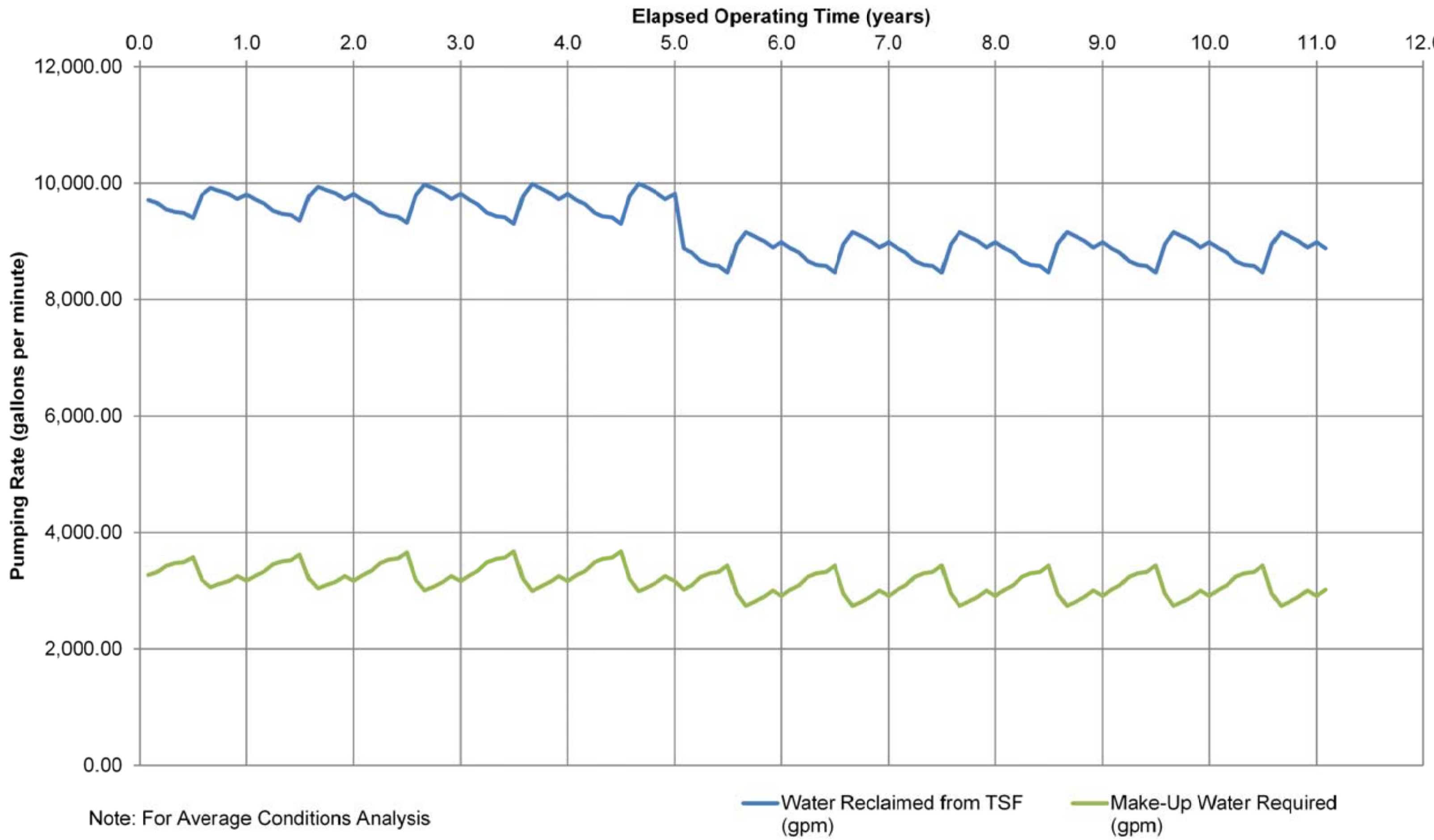
DRAFT COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE
FACILITY FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

TAILINGS STORAGE FACILITIES ELEVATION, SURFACE AREA, CAPACITY AND RATE OF RISE RELATIONSHIPS

Golder Associates

PROJECT No.		153-1453	FILE No.	10392557K101_10232015
DESIGN	DMW	2013-04-30	SCALE	NTS
CADD	JHR	2013-07-11	FIGURE	
CHECK	GM	2013-07-12		7
REVIEW	DAK	2013-07-12		



Note: For Average Conditions Analysis

PROJECT	THEMAC RESOURCES / NEW MEXICO COPPER CORPORATION — Environmentally Responsible. Community-Minded. Local Opportunities.		DRAFT COPPER FLAT PROJECT 30K TPD TAILINGS STORAGE FACILITY FEASIBILITY DESIGN SIERRA COUNTY, NEW MEXICO		
TITLE	**WATER BALANCE ANALYSIS RESULTS**				
Golder Associates	PROJECT No.		153-1453	FILE No.	10392557K101_10232015
	DESIGN	DMW	2013-04-30	SCALE	NTS
	CADD	JHR	2013-07-11	FIGURE	
	CHECK	GM	2013-07-12		8
	REVIEW	DAK	2013-07-12		

APPENDIX A
SITE EXPLORATION

APPENDIX A.1
TEST PIT LOGS

TEST PIT LOG: TP-1

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/3/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11977739.46 **E:** 867983.49

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	GM	sandy SILTY GRAVEL, medium, sub-angular, 35% coarse sub-rounded sand, 20% medium plasticity fines, 30% sub-angular cobbles (3-10"); pinkish gray (7.5YR 6/2), weak $CaCO_3$ cementation; non-cohesive, dry, dense.
2 - 4 ft.	GP	GRAVEL, medium, and SAND fine to coarse, poorly graded, 10% non-plastic fines; 25% angular to sub-angular cobbles (3-10"), light brown (7.5YR 6/3), $CaCO_3$ as cemented masses and disseminated; non-cohesive, dry, very dense.
4 - 8 ft.	SP	Friable/weathering rock (andesite); gravelly SAND, coarse, sub-rounded, 20% fine to medium sub-angular gravels; 10% non-plastic fines; 50% angular to sub-angular cobbles and boulders (3-20"), light brown (7.5YR 6/3), $CaCO_3$ coating rock fragments and fractures.

Samples:
None.

Special Notes:
Archaeologist present during excavation.
Pit located in road; top 2 ft. of original surface removed for road cut.
Native hillslope has ~70% surface rocks; with weathered/friable boulders exposed along road cut.
Test pit location immediately adjacent to existing waste rock disposal facility.

TEST PIT LOG: TP-2

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/21/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11976945.00 **E:** 869820.78

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 15% fine to coarse sub-rounded to sub-angular gravel, 40% low plasticity fines; 5% sub-rounded cobbles (3-6"), brown (7.5YR 4/3), blocky; cohesive, slightly moist, soft.
1 - 2 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 20% fine to coarse sub-rounded to sub-angular gravel, 35% low plasticity fines; 5% sub-rounded cobbles (3-6"), pinkish white (7.5YR 8/2), moderate $CaCO_3$ cementation, blocky to platy; non-cohesive, dry, dense.
2 - 6 ft.	GM	SILTY GRAVEL, fine to coarse, sub-rounded to sub-angular and SAND, fine to coarse, sub-rounded, 15% low to no plasticity fines; 20% sub-angular to sub-rounded cobbles and boulders (3-15"), pinkish gray (7.5YR 7/2), strong RXN with HCl, dry, dense.
6 - 7 ft.	GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 10% non-plasticity fines; 25% sub-angular cobbles and boulders (3-15"), light brown (7.5YR 6/3), strong RXN with HCl; non-cohesive, dry, very dense.
7 - 9 ft.	GW	Friable/weathering rock (andesite); GRAVEL, fine to coarse, angular, 10% coarse sand, 5% non-plastic fines; 50% angular cobbles and boulders (3- 15"), weak RXN with HCl.

Samples:
2-6 ft., bag
6-7 ft., bag

Special Notes:
7 to 9 feet moderately strong rock, slightly weathered. Can slowly excavate with excavator (hard digging).

TEST PIT LOG: TP-3

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/21/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11977450.61 **E:** 869805.07

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	SM/ML	gravelly sandy CLAYEY SILT, low plasticity, 30% fine to coarse sub-rounded to sub-angular gravels, 20% fine to coarse sub-rounded sand; 20% sub-angular cobbles and boulders (3-15");\, brown (7.5YR 4/3), blocky, strong RXN with HCl; cohesive, moist, soft.
1 - 2 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine to coarse sub-angular gravel, 20% low to non-plastic fines: 15% sub-angular cobbles, pinkish white (7.5YR 8/2), moderate $CaCO_3$ cementation; non-cohesive, dry, dense.
2 - 7 ft.	GM	SILTY GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 15% low plasticity fines; 25% sub-angular cobbles and boulders (3-20"), pink (7.5YR 7/3), strong RXN with HCl; non-cohesive, dry, dense.
7 - 9 ft.	GC	CLAYEY GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 15% medium plasticity fines; 30% sub-angular cobbles and boulders (3-20"); brown (7.5YR 5/3), $CaCO_3$ disseminated and as coatings on rocks; non-cohesive, dry, dense.
9 - 11 ft.	GW	sandy GRAVEL, fine to coarse, sub-angular, 30% fine to coarse sub-rounded sand, 10% low to non-plastic fines; 15% sub-angular cobbles (3-6"), brown (7.5YR 5/4), $CaCO_3$ as cemented masses, disseminated and coatings on rocks; non-cohesive, dry, very dense.

Samples:
BMI samples all layers (bag samples)

Special Notes:
Refusal at 11 ft., hit andesite. Fracturing andesite above.

TEST PIT LOG: TP-5

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/3/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11977574.94 **E:** 868955.59

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	SM	gravelly SILTY SAND, fine to coarse sub-rounded, 20% fine to coarse sub-angular gravel, 25% low plasticity fines; 25% sub-angular cobbles (3-8"), yellowish brown (10YR 5/4), friable, strong RXN with HCl; non-cohesive, dry, loose.
1 - 3 ft.	SM	SILTY SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, sub-angular, 20% low plasticity fines; 5% sub-angular cobbles (3-8"), light brown (7.5YR 6/3), $CaCO_3$ as masses, weakly cemented in places, blocky; non-cohesive, dry, compact.
3 - 7 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, sub-angular, 10% non-plastic fines; 5% sub-angular cobbles, light brown (7.5YR 6/3), moderate $CaCO_3$ cementation in places (large plates excavated), clay fingering at 3 to 4 ft.; non-cohesive, dry, very dense.

Samples:
1-3 ft. bag, bucket
3-7 ft. bag, bucket
BMI samples (0-1ft, 1-3ft, 3-7ft)

Special Notes:
Refusal at 7 ft., hit bedrock (andesite).

TEST PIT LOG: TP-6

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/4/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11978206.72 **E:** 871778.25

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	SW	gravelly SAND, fine to coarse, sub-rounded, 25% fine to coarse poorly graded gravel, 20% non-plastic fines; 35% sub-rounded to sub-angular cobbles, brown (10YR 4/3), friable, strong RXN with HCl; non-cohesive, dry, loose.
1 - 3 ft.	GM	sandy SILTY GRAVEL, fine to coarse, sub-angular, 25% fine to coarse sub-rounded sand, 35% low plasticity fines; 15% sub-rounded to sub-angular cobbles (3-5"), very pale brown (10YR 7/3), blocky, $CaCO_3$ as masses and disseminated; non-cohesive, dry, compact.
3 - 5 ft.	CL/GC	gravelly sandy SILTY CLAY, medium plasticity, 30% fine to coarse sub-rounded gravel, 25% fine to coarse sub-rounded sand; 5% sub-rounded to sub-angular cobbles (3-5"), strong brown (7.5YR 5/6), blocky, clay fingering, $CaCO_3$ as masses and moderately cementation in places, large blocky plates excavated; non-cohesive, dry, stiff.
5 - 7 ft.	GM	sandy SILTY GRAVEL, fine to coarse, sub-rounded, poorly graded, 20% fine to coarse sub-rounded sand, 15% medium plasticity fines; 15% sub-angular cobbles (3-7"), light brown (7.5YR 6/4); non-cohesive, dry, dense.
7 - 13 ft.	SM	gravelly SAND, fine to coarse, sub-rounded, 35% fine to coarse sub-angular gravel, 25% med. plasticity fines; 45% sub-angular to angular cobbles and boulders (3-12"); light brown (7.5YR 6/4), $CaCO_3$ coatings on rocks; non-cohesive, dry, very dense.

Samples:
1-3 ft. bag
3-5 ft. bag
5-7 ft. bag, bucket
7-13 ft. bag, bucket

Special Notes:
At 7 feet excavator broke through large boulder.

TEST PIT LOG: TP-7

Golder Associates

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/17/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974576.20 **E:** 872338.77

Lithology:

Depth	*USCS*	*Description*
0 - 1.5 ft.	CL	SILTY CLAY and SAND, medium plasticity, 40% medium to coarse sub-rounded sand, 5% fine to coarse poorly graded gravel; trace cobbles (3-4"), brown (7.5YR 4/4), friable; cohesive, dry, soft.
1.5 - 4 ft.	CH	CLAY and SAND, high plasticity, 45% medium to coarse poorly graded subrounded sand, 5% fine to coarse poorly graded gravels; reddish brown (5YR 4/4), blocky, some $CaCO_3$ masses and disseminated; cohesive, dry, very stiff.
4 - 6 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to coarse poorly graded gravel, 20% low plasticity fines; trace sub-angular cobbles (3-5"), pinkish gray (7.5YR 7/2), moderate $CaCO_3$ cementation; non-cohesive, dry dense.
6 - 8 ft.	SW-SM	SILTY SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, poorly graded, 10% non-plastic fines; 5% sub-angular cobbles (3-5"), pinkish gray (7.5YR 6/2), $CaCO_3$ masses and disseminated; non-cohesive, dry, very dense.
8 - 10 ft.	GP	GRAVEL, fine, poorly graded, and SAND, poorly graded, fine to coarse, 5% non-plastic fines; trace cobbles (3-4"), brown (7.5YR 5/3), $CaCO_3$ coating on rocks; non-cohesive, dry, very dense.
10 - 12 ft.	GP-GM	SILTY GRAVEL, fine to coarse, poorly graded, and SAND fine to coarse, sub-rounded, 10% low plasticity fines; 10% sub-angular cobbles (4-5"), brown (7.5YR 5/3), $CaCO_3$ coating on rock fragments; non-cohesive, dry, dense.

Samples:

0-1.5 ft. bag } 0-4ft. Bucket
1.5-4 ft. bag }
4-6 ft. bag
6-10 ft. bag, bucket
10-12 ft. bag, bucket
BMI bag samples all layers

Special Notes:

TEST PIT LOG: TP-8

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/18/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974106.85 **E:** 872357.94

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	CL	sandy SILTY CLAY, medium plasticity, 40% fine to coarse sub-rounded sand, 10% fine to coarse sub-angular gravel; trace cobbles (3-6"), brown (7.5YR 4/2), disseminated $CaCO_3$, platy; cohesive, moist, firm.
2 - 5 ft.	CI	sandy gravelly SILTY CLAY, high plasticity, 30% fine to coarse sand, 20% fine to coarse poorly graded gravel; trace cobbles (3-4"), brown (7.5YR 4/3), $CaCO_3$ masses and weakly cemented in places, platy; cohesive, dry, stiff.
5 - 7 ft.	SC/CI	CLAYEY SAND, fine to coarse, sub-rounded, 45% medium plasticity fines, 5% fine to coarse poorly graded gravels; dark brown (7.5YR 3/4), $CaCO_3$ masses, platy; cohesive, dry, stiff.
7 - 13 ft.	SC	gravelly CLAYEY SAND, fine to coarse, sub-rounded, 30% medium plasticity fines, 15% fine to coarse poorly graded gravels; trace cobbles (3-4"), reddish brown (5YR 5/4), moderate $CaCO_3$ cementation, large plates excavated; cohesive, dry, hard.
13 - 16 ft.	GW	GRAVEL, fine to coarse, sub-rounded, and SAND, fine to coarse, sub-rounded, 15% low plasticity fines; 5% sub-rounded cobbles (3-4"), light brown (7.5YR 6/3); CaCO3 coatings on rock fragments; non-cohesive, dry, compact to dense.

Samples:
0-2 ft. bag
2-5 ft. bag
5-7 ft. bag
7-13 ft. bag
13-16 ft. bag

Special Notes:

TEST PIT LOG: TP-9

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/17/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974362.19 **E:** 873288.54

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	SC	FILL. gravelly CLAYEY SAND, fine to coarse, sub-rounded, 45% high plasticity fines, 15% fine to coarse poorly graded gravel; 5% sub-angular cobbles (3-6"), brown (7.5YR 4/3), blocky, strong RXN with HCl; cohesive, dry, firm.
2 - 6 ft.	SP	TAILINGS. poorly graded SAND, medium, sub-rounded, 5% non-plastic fines; pale yellow (2.5Y 7/3), no RXN with HCl; non-cohesive, dry, loose. Tailing thickness in pit is tapered east to west: lower depth 6 ft. (east) and 4 ft. (west).
6 - 8 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine poorly graded gravel, 15% medium plasticity fines; 5% sub-angular cobbles (3-4"); very pale brown (10YR 7/3), $CaCO_3$ masses; non-cohesive, dry, dense.
8 - 10 ft.	GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 10% non-plastic fines; 5% angular cobbles (3-6"), pale brown (10YR 7/3), $CaCO_3$ coatings on coarse fragments and disseminated; non-cohesive, dry, dense.
10 - 11 ft.	GM	sandy SILTY GRAVEL, poorly graded, fine, sub-rounded, 35% fine to coarse sand, 15% medium plasticity fines; 10% angular cobbles (3-4"), pinkish gray (7.5YR 6/2), moderate SiO_2/$CaCO_3$ cementation; non-cohesive, dry, very dense.
11 - 14 ft.	GP-GM	sandy SILTY GRAVEL, poorly graded, fine to coarse, sub-angular, 35% fine to coarse sub-rounded sand; 10% medium plasticity fines; pinkish gray (7.5YR 6/2), strong SiO_2/$CaCO_3$ cementation; non-cohesive, dry, very dense.

Samples:

6-8 ft. bag } 6-10 ft. bucket
8-10 ft. bag
10-11 ft. bag } 10-14 ft. bucket
11-14 ft. bag

BMI bag samples: 6-8 ft., 8-10ft, 10-11 ft.

Special Notes:

Reclaimed area on tailing dam.

TEST PIT LOG: TP-10

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/17/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974364.43 **E:** 873777.16

Lithology:

Depth	*USCS*	*Description*
0 - 0.5 ft.	ML	FILL. CLAYEY SILT and SAND, medium plasticity, 40% fine to coarse sub-rounded sand, 5% medium sub-angular gravel; trace sub-angular cobbles (3-6"), dark yellowish brown (10YR 4/4), friable, strong RXN with HCl; cohesive, slightly moist, soft.
0.5 - 3 ft.	SC	FILL. gravelly CLAYEY SAND, fine to coarse, sub-rounded, 40% high plasticity fines, 15% fine to coarse poorly graded gravel; 5% sub-angular cobbles (3-6"), dark brown (10YR 3/3), blocky, disseminated $CaCO_3$; cohesive, dry, firm.
3 - 6 ft.	SP	TAILING. poorly graded SAND, medium, rounded, 5% non-plastic fines; pale yellow (2.5Y 7/4), platy, no RXN with HCl; non-cohesive, dry, compact.
6 - 12 ft.	SP	TAILING. poorly graded SAND, medium, rounded, 5% non-plastic fines; pale yellow (2.5Y 8/4), no RXN with HCl; non-cohesive, dry, loose.
12 - 13 ft.	SC	gravelly CLAYEY SAND, fine to coarse, sub-rounded, 25% medium plasticity fines, 25% fine to coarse sub-rounded gravels; 15% sub-rounded cobbles (3-10"), pale brown (10YR 6/3), $CaCO_3$ masses and coatings on rock fragments, mixing with tailing at horizon contact; non-cohesive, dry, dense.

Samples:
0.5-3 ft. bag
3-6 ft. bag, bucket
6-12 ft. bag, bucket
12-13 ft. bag, bucket

Special Notes:
Reclaimed area on tailing dam.
Stop at 13 feet due to limit of backhoe, but appear to be on top of a layer of more gravels.

TEST PIT LOG: TP-11

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/17/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974375.04 **E:** 874235.34

Lithology:

Depth	*USCS*	*Description*
0 - 0.83 ft.	ML	FILL. CLAYEY SILT and SAND, medium plasticity, 40% fine to coarse sub-rounded sand, 5% fine to coarse poorly graded gravel; 5% sub-angular cobbles (3-10"), brown (10YR 4/3), friable, strong RXN with HCl; cohesive, moist, soft.
0.83 - 5 ft.	SP	TAILING. poorly graded SAND, medium, rounded, 5% non-plastic fines; light gray (2.5Y 7/2), platy, weak RXN with HCl; non-cohesive, dry, compact.
5 - 11 ft.	SP	TAILING. poorly graded SAND, medium, rounded, 5% non-plastic fines; brownish yellow (10YR 6/8), no RXN with HCl; non-cohesive, dry, loose to compact.
11 - 13 ft.	SP	TAILING. poorly graded SAND, medium, rounded, 5% non-plastic fines; grayish brown (2.5Y 5/2), no RXN with HCl; non-cohesive, dry, loose.

Samples:
0-1 ft. bag
1-5 ft. bag, bucket
5-11 ft. bag, bucket
11-13 ft. bag, bucket

Special Notes:
Reclaimed area on tailing dam.
Stop at 13 feet due to limit of backhoe.

Golder Associates

TEST PIT LOG: TP-12

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/2/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974885.17 **E:** 875173.88

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	ML	SILT and SAND, low plasticity, 45% poorly graded fine sand, 5% medium gravel; trace cobbles (4-6"), strong brown (7.5YR 4/6), blocky; cohesive, dry, firm.
1 - 3 ft.	CL	sandy SILTY CLAY, medium plasticity, 35% fine to coarse sub-rounded sand, 5% medium gravel; trace sub-rounded to sub angular cobbles (4-6"), pink (7.5 YR 7/3), clay fingering, $CaCO_3$ masses and cemented in places, blocky; cohesive, dry, stiff.
3 - 7 ft.	GM	SILTY GRAVEL, fine to coarse, sub-rounded, and SAND, fine to coarse, sub-rounded, 15% low plasticity fines; 40% sub-rounded to sub-angular cobbles and boulders (3-20"), light brown (7.5YR 6/3), $CaCO_3$ coatings on rock fragments; non-cohesive, dry, dense.
7 - 8 ft.	SM/GM	SILTY SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, sub-rounded; 20% low to medium plasticity fines; 10% cobbles (3-10"), pink (7.5YR 7/4), blocky, strong $CaCO_3$ cementation; non-cohesive, dry, very dense.
8 - 11 ft.	SM	SILTY SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, sub-rounded, 10% non-plastic fines; 5% cobbles (3-10"), pale brown (10YR 6/3), weak to moderate SiO_2 cementation, $CaCO_3$ trace masses and disseminated; non-cohesive, dry, dense.
11 - 13 ft.	SM	SILTY SAND, fine to coarse, sub-rounded and GRAVEL, fine to coarse, sub-rounded; 20% low plasticity fines; trace cobbles (3-4"), yellowish brown (10YR 5/4), platy, moderate $SiO_2/CaCO_3$ cementation, $CaCO_3$ visible in pores and disseminated; non-cohesive, dry,
13 - 15 ft.	SW	SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, sub-rounded, 10% low to non-plastic fines; 15% cobbles (3-10"), yellowish brown (10YR 5/4), CaCO3 coatings on rock fragments; non-cohesive, dry, dense.

Samples:

BMI bag samples: 0-1 ft., 1-3 ft., 3-7 ft., 8-11 ft., 11-13 ft.

Special Notes:

Surface reworked by wind, small dunes around shrubs (*Flourensia cernua*, tarbush and *Prosopis glandulosa*, honey mesquite).

TEST PIT LOG: TP-13

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/2/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974438.98 **E:** 875447.89

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	ML	SILT, non-plastic, 10% fine to coarse sub-rounded sand, 5% fine to coarse sub-rounded gravel; trace cobbles (3-6"), brown (7.5YR 4/4), friable; cohesive, dry, soft.
1 - 3 ft.	ML	sandy CLAYEY SILT, low plasticity, 30% fine to coarse sub-rounded sand, 5% fine to coarse sub-rounded gravel; trace cobbles (3-6"), light yellowish brown (10YR 6/4), blocky, clay fingering, $CaCO_3$ as masses and weakly cemented in places; cohesive, dry, soft.
3 - 5 ft.	CL	sandy SILTY CLAY, low to medium plasticity, 30% fine to coarse sub-rounded sand, 5% fine to coarse sub-rounded gravel; light brown (7.5YR 6/4), blocky, $CaCO_3$ as masses and disseminated; cohesive, dry, firm.
5 - 8 ft.	CL	sandy SILTY CLAY, medium plasticity, 30% fine to coarse sub-rounded sand, 5% fine to coarse sub-rounded gravel; trace cobbles (3-6"), light brown (7.5YR 6/4), strong angular blocky, $CaCO_3$ along pores, weak RXN with HCl; cohesive, dry, stiff.
8 - 10 ft.	SM	SILTY SAND, fine to coarse, subrounded, and GRAVEL, fine to coarse, sub-rounded, 15% low plasticity fines; 15% sub-rounded to sub-angular cobbles and boulders (3-15"), brown (7.5YR 5/4), strong $SiO_2/CaCO_3$ cementation, strong RXN with HCl; non-cohesive, dry, dense.
10 - 18 ft.	GW	sandy GRAVEL, fine to coarse, sub-rounded, 25% fine to coarse sub-rounded sand, 10% non-plastic fines; 30% sub-rounded to sub-angular cobbles and boulders (3-20"), dark yellowish brown (10YR 4/4), weak RXN with HCl; non-cohesive, dry, very, dense.

Samples:
5-8 ft. bag, bucket
5-10 ft. bag, bucket
10-18 ft. bag, bucket

Special Notes:

TEST PIT LOG: TP-14

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/2/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974366.80 **E:** 874917.98

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	CI	gravelly sandy SILTY CLAY, high plasticity, 20% fine to coarse sub-angular gravel, 15% fine to coarse sub-rounded sand; 20% sub-angular cobbles (3-12"); dark reddish brown (5YR 3/4), blocky, no RXN with HCl; cohesive, dry, firm.
1 - 4 ft.	CL	gravelly sandy SILTY CLAY, moderate plasticity, 25% fine to coarse sub-angular gravel, 25% fine to coarse sub-rounded sand; 15% sub-angular cobbles (3-12"); pink (7.5YR 7/3), blocky, $CaCO_3$ masses and weak cementation in places, strong RXN with HCl clay fingering; cohesive, dry, firm.
4 - 7 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% non-plastic fines, 15% fine to coarse poorly graded gravels; trace cobbles (3"), pinkish white (7.5YR 8/2), strong $CaCO_3$ cementation (large plates excavated); non-cohesive, dry, dense.
7 - 12 ft.	ML	sandy SILT, non-plastic, 20% fine to medium poorly graded sand, trace fine poorly graded gravels; brown (7.5YR 5/4), platy, $CaCO_3$ lining pores and some masses, weak RXN with HCl; cohesive, dry, soft.
12 - 14 ft.	GM	sandy SILTY GRAVEL, fine to coarse, sub-angular, 35% fine to coarse sub-rounded sand, 15% non-plastic fines; 15% sub-angular cobbles (3-6"), pinkish white (7.5YR 8/2), strong $SiO_2/CaCO_3$ cementation, strong RXN with HCl; non-cohesive, dry, dense.
14 - 16.5 ft.	GM	sandy SILTY GRAVEL, fine to coarse, sub-angular, 40% fine to coarse sand, 15% non-plastic fines; trace sub-angular cobbles (3-6"), pinkish white (7.5YR 8/2), weak SiO_2 cementation, $CaCO_3$ coatings on rocks, strong RXN with HCl; non-cohesive, dry, dense.

Samples:
0-1 ft. bag
1-4 ft. bag
4-7 ft. bag
7-12 ft. bag
12-14 ft. bag
14-16.5 ft. bag

Special Notes:
Offset pit location approximately 25 feet to the west to keep disturbance on tracked road.

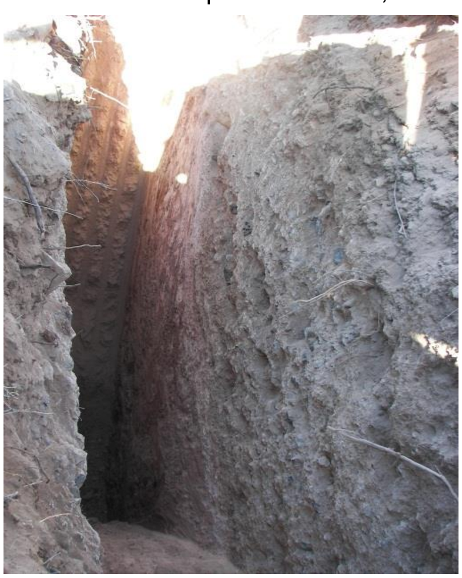
TEST PIT LOG: TP-15

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/20/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973832.93 **E:** 874871.54

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	ML	sandy CLAYEY SILT, low plasticity, 30% fine to coarse sub-rounded sand, 5% fine to medium poorly graded gravels; dark brown (7.5YR 3/3), friable, strong RXN with HCl; cohesive, dry, soft.
2 - 4 ft.	SM	SILTY SAND, fine to coarse, sub-rounded, 20% low plasticity fines, 10% fine to coarse sub-angular gravels; 5% sub-angular cobbles (3-10"), pink (7.5 YR 7/4), blocky, strong RXN with HCl; cohesive, dry, firm.
4 - 8 ft.	CI	sandy SILTY CLAY, medium plasticity, 30% fine to coarse sub-rounded sand, 10% fine to medium poorly graded gravel; light reddish brown (5YR 6/4), angular blocky (breaking to fine aggregates), $CaCO_3$ nodules and masses; cohesive, dry, firm.
8 - 10 ft.	CH	sandy CLAY, high plasticity, 15% fine poorly graded sand, trace gravels; dark reddish brown (2.5YR 3/4), angular blocky (breaking to gravel sized aggregates), weak RXN with HCl, clay pressure faces; cohesive, moist, firm.
10 - 20 ft.	CH	CLAY, high plasticity, 5% fine poorly graded sand, trace gravels; dark reddish brown (2.5YR 3/3), angular blocky (rock structure), weak RXN with HCl, clay pressure faces; cohesive, moist, stiff.



Samples:
8-10 ft. bag, bucket
10-20 ft. bag, bucket

Special Notes:
Excavator leaves slick sidewalls at 8+ feet. Clays formed in place (not illuvial) from weathering primary minerals.

TEST PIT LOG: TP-16

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/20/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973732.56 **E:** 875481.72

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	ML	sandy CLAYEY SILT, low plasticity, 30% fine to coarse sub-rounded sand, 5% fine to medium poorly graded sub-angular gravels; 10% sub-angular cobbles (3-6"), brown (7.5YR 4/3), friable, strong RXN with HCl; cohesive, moist, soft.
2 - 4 ft.	ML	sandy CLAYEY SILT, low plasticity, 20% fine to coarse sub-rounded sand, 5% fine to medium poorly graded sub-angular gravels; trace sub-angular cobbles (3-6"), brown (7.5YR 5/4), blocky, strong RXN with HCl; cohesive, dry, stiff.
4 - 7 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% non-plastic fines, 20% fine poorly graded sub-angular gravels; brown (7.5YR 5/3), friable, $CaCO_3$ as masses and disseminated, strong RXN with HCl; cohesive, dry, firm.
7 - 10 ft.	ML	sandy SILT, non-plastic, 30% fine to coarse sub-angular sand, 5% fine poorly graded sub-angular gravels; light brown (7.5YR 6/3), blocky, $CaCO_3$ as masses and disseminated, strong RXN with HCl, thin layer (<1ft) of moderate cementation; non-cohesive, dry, hard.
10 - 17 ft.	GW	sandy GRAVEL, fine to coarse, sub-angular, 30% fine to coarse sub-rounded sand, 5% non-plastic fines; 20% sub-rounded cobbles (3-12"); brown (7.5YR 5/3), weak to strong $CaCO_3$ cementation (stratified), weak to strong RXN with HCl; non-cohesive, dry, very dense.

Samples:

0-2 ft. bag
2-4 ft. bag
4-7 ft. bag, bucket
7-10 ft. bag, bucket
BMI bag samples same as above

Special Notes:

10 to 17 foot interval has varying degrees of $CaCO_3$ cementation (none to strong), but grouped together due to particle size similarities.

TEST PIT LOG: TP-17

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/18/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973205.01 **E:** 873937.67

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	ML	sandy SILT, low plasticity, 40% fine to coarse sub-rounded sand, trace fine poorly graded gravels; trace sub-angular cobbles (3-6"), yellowish brown (10YR 5/4), platy, weak RXN with HCl; cohesive, dry, soft.
1 - 2 ft.	CH	sandy CLAY, high plasticity, 35% fine to coarse poorly graded sand, 5% fine to coarse poorly graded gravels; trace cobbles (3"), reddish brown (5YR 4/4), blocky, disseminated $CaCO_3$ and masses, strong RXN with HCl; cohesive, moist, stiff.
2 - 4 ft.	SC	CLAYEY SAND, fine to coarse, sub-rounded, 40% medium plasticity fines, 5% fine to coarse poorly graded gravel; trace cobbles (3-4"), pink (7.5YR 7/3), blocky, moderate $CaCO_3$ cementation and masses, strong RXN with HCl; cohesive, dry, very stiff.
4 - 6 ft.	SM	gravelly SILTY SAND, fine to coarse, poorly graded, 25% low plasticity fines, 25% fine poorly graded gravels; trace cobbles (3-6"), brown (7.5YR 5/3), blocky, $CaCO_3$ masses and coating rock fragments, strong RXN with HCl; cohesive, dry, firm.
6 - 14 ft.	GW	sandy GRAVEL, fine to coarse, poorly graded, 40% fine to coarse sub-rounded sand, 5% non-plastic fines; 5% cobbles (3-6"), light brown (7.5YR 6/3), stratified, thickly bedded, some weak $CaCO_3$ cementation at 8 feet moderate cementation at 14 feet, $CaCO_3$ masses, strong RXN with HCl; non-cohesive, dry, dense

Samples:
0-2 ft. bag
2-4 ft. bag
4-6 ft. bag
6-14 ft. bag
BMI bag samples: 0-2 ft., 2-4 ft., 4-6 ft., 6-10 ft.

Special Notes:
Disturbed surface, pit located in depression on tailing dam (cow lay-down area). Salt cedar (*Tamarix chinensis*) and seep willow (*Baccharis salicina*) stand.

TEST PIT LOG: TP-18

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/20/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973182.90 **E:** 874892.73

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	GM/SM	sandy SILTY GRAVEL, poorly graded, fine to medium, sub-angular, 25% fine to medium poorly graded sub-rounded sand, 45% low plasticity fines; trace sub-angular cobbles (3-4"), brown (7.5YR 4/4), blocky, strong RXN with HCl; cohesive, moist, soft.
2 - 3 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine to medium poorly graded gravel, 25% low plasticity fines; trace sub-angular cobbles (3-4"), light brown (7.5YR 6/3), blocky, moderate $CaCO_3$ cementation, strong RXN with HCl; non-cohesive, dry, dense.
3 - 5 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to coarse poorly graded gravel, 30% low plasticity fines; pink (7.5YR 7/3), blocky, moderate to weak $CaCO_3$ cementation in places, disseminated, and coatings on rocks; non-cohesive, dry, dense.
5 - 7 ft.	SM/GM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine to medium poorly graded gravel, 25% low plasticity fines; reddish brown (5YR 5/3), large plates excavated, moderate SiO_2 cementation, strong reaction with HCl; non-cohesive, dry, dense.
7 - 9 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to medium poorly graded gravel, 30% low plasticity fines; reddish brown (5YR 5/4), large plates excavated, strong SiO_2 cementation, weak reaction with HCl; non-cohesive, dry, very dense.
9 - 15 ft.	SP	SAND, poorly graded, medium, sub-rounded, 5% fine poorly graded gravel, 5% non-plastic fines; reddish brown (5YR 5/4), large plates excavated, moderate SiO_2 cementation, weak reaction with HCl; non-cohesive, dry, very dense.

Samples:
7-9 ft. bag, bucket
9-15 ft. bag, bucket

Special Notes:

TEST PIT LOG: TP-19

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/19/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973045.18 **E:** 875451.64

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	GC	Disturbed/FILL. sandy CLAYEY GRAVEL, fine to coarse, sub-rounded, 45% high plasticity fines, 20% fine to coarse sub-rounded sand; 15% sub-rounded cobbles (3-6"), reddish brown (5YR 4/4), blocky, no RXN with HCl; cohesive, moist, firm.
2 - 3 ft.	GC	sandy CLAYEY GRAVEL, fine to coarse, poorly graded, sub-rounded, 40% high plasticity fines, 30% fine to coarse sub-rounded sand; 5% sub-rounded cobbles (3-6"), yellowish red (5YR 4/6), blocky, no RXN with HCl; cohesive, dry, hard.
3 - 5 ft.	SW	SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, sub-angular, 5% non-plastic fines; 10% sub-angular cobbles (3-6"), light brown (7.5YR 6/4), strong $CaCO_3$ cementation, strong RXN with HCl; non-cohesive, dry, dense.
5 - 10 ft.	GW	GRAVEL, fine to coarse, subangular, and SAND, fine to coarse, sub-rounded, 5% non-plastic fines; 15% sub-angular cobbles (3-6"), brown (7.5YR 5/3), $CaCO_3$ as masses, disseminated and weak cementation in places; non-cohesive, dry, dense.
10 - 11 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% medium poorly graded gravel, 25% low to medium plasticity fines; trace cobbles (3-10"), white (7.5YR 8/1), blocky, $CaCO_3$ as masses, disseminated and moderate cementation in places; non-cohesive, dry, dense.
11 - 14 ft.	GM-GC	sandy GRAVEL, fine to coarse, sub-angular, 35% fine to coarse sub-rounded sand; 25% low to medium plasticity fines; 5% sub-angular cobbles (3-6"), brown (7.5YR 5/3), $CaCO_3$ as masses, disseminated and strong cementation in places; non-cohesive, dry, dense.

Samples:
None.

Special Notes:
stratified gravels and sands, thickly bedded, from 5 to 14 feet.

Golder Associates

TEST PIT LOG: TP-20

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/19/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972549.21 **E:** 875734.91

Lithology:

Depth	*USCS*	*Description*
0 - 0.5 ft.	ML	sandy SILT, non-plastic, 45% fine to coarse sub-rounded sand, 5% fine to medium poorly graded gravels; brown (7.5YR 4/2), friable, no RXN with HCl; cohesive, dry, soft.
0.5 - 2 ft.	CH	CLAY and SAND, high plasticity, 40% fine to coarse sub-rounded sand, 5% fine to medium poorly graded gravels; yellowish red (5YR 4/6), blocky, no RXN with HCl; cohesive, moist, stiff.
2 - 4 ft.	SC-SP	gravelly CLAYEY SAND, fine to coarse, poorly graded, 30% fine to coarse sub-rounded gravels, 15% medium plasticity fines; 10% sub-rounded cobbles (3-7"), brown (7.5YR 5/4), $CaCO_3$ as masses and disseminated; strong RXN with HCl; non-cohesive, dry, compact.
4 - 5 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 20% medium plasticity fines, 15% fine to coarse poorly graded sub-rounded gravels; trace sub-rounded cobbles (3"), white (7.5YR 8/1), blocky, weakly cemented ($CaCO_3$); non-cohesive, dry, very dense.
5 - 7 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 20% fine to coarse sub-rounded gravels, 15% medium plasticity fines; 5% sub-rounded cobbles (3-6"), brown (7.5YR 5/3), blocky, $CaCO_3$ as masses and disseminated; non-cohesive, dry, dense.
7 - 11 ft.	GP	GRAVEL, fine to coarse, poorly graded, and SAND, fine to coarse, sub-round SAND, 5% non-plastic fines; 5% sub-rounded cobbles (3-6"), brown (7.5YR 5/3), weakly cemented ($CaCO_3$); non-cohesive, dry, dense.
11 - 18.5 ft.	SW-SM	SILTY SAND fine to coarse, sub-rounded, and GRAVEL, fine to coarse, sub-rounded, 15% non-plastic fines; 10% sub-rounded cobbles (3-6"), grayish brown (10YR 5/2), blocky, $CaCO_3$ as masses, disseminated and coatings on rock fragments; non-cohesive, dry, dense to compact.

Samples:
0-2 ft. bag, 2-4 ft. bag } 0-4 ft. bucket
4-5 ft. bag, 5-7 ft. bag } 4-7 ft. bucket
7-11 ft. bag, bucket
11-18.5 ft. bag, bucket

Special Notes:
Surface disturbed.

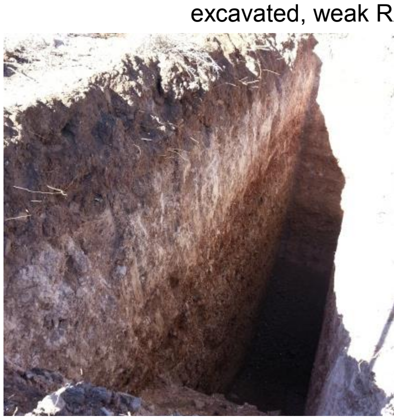
TEST PIT LOG: TP-21

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/19/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972274.72 **E:** 875755.12

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	ML	CLAYEY SILT and SAND, low plasticity, 45% fine to coarse sub-rounded sand, 5% coarse poorly graded sub-angular, gravels; 5% sub-angular cobbles (3-4"), brown (7.5YR 4/3), blocky, strong RXN with HCl; cohesive, moist, soft.
2 - 3 ft.	SC/SM	gravelly CLAYEY SAND, fine to coarse, sub-rounded, 35% medium plasticity fines, 30% medium poorly graded sub-angular gravels; trace cobbles (3"), white (7.5YR 8/1), blocky, weak $CaCO_3$ cementation, strong RXN with HCl; cohesive, dry, firm.
3 - 5 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% medium plasticity fines, 25% fine to medium poorly graded sub-angular gravels; trace cobbles (3"), brown (7.5YR 5/3), blocky, $CaCO_3$ as masses and disseminated, strong RXN with HCl; cohesive, dry, stiff.
5 - 7 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to medium poorly graded sub-angular gravels, 25% medium plasticity fines; 5% sub-rounded cobbles (3-5"), brown (7.5YR 4/3), disseminated $CaCO_3$, masses and coatings on rock fragments, strong RXN with HCl; cohesive, dry, stiff.
7 - 11 ft.	GC	sandy CLAYEY GRAVEL, fine to coarse, sub-angular, 35% fine to coarse sub-rounded sand, 20% medium plasticity fines; 10% sub-angular cobbles (3-6"), brown (7.5YR 5/4), weak RXN with HCl, moderate SiO_2 cementation; non-cohesive, dry, very dense.
11 - 14 ft.	GM	sandy SILTY GRAVEL, fine to coarse, poorly graded, sub-angular, 40% fine to coarse sub-rounded sand, 15% low plasticity fines; 5% sub-rounded cobbles (3-6"); brown (7.5YR 5/4), weak RXN with HCl, weak SiO_2 cementation; non-cohesive, dry, dense.
14 - 18 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine to coarse poorly graded gravels, 20% low plasticity fines; trace cobbles (3-4"); light brown (7.5YR 6/4), large plates excavated, weak RXN with HCl, weak SiO_2 cementation; non-cohesive, dry, dense.



Samples:
7-11 ft. bag, bucket
11-14 ft. bag, bucket
14-18 ft. bag, bucket
BMI bag samples: 7-11 ft., 11-14 ft., 14-18 ft.

Special Notes:
$CaCO_3$ masses and cementation confined to upper layers (2-7 ft.). Disseminated $CaCO_3$ and coatings on coarse fragments at 7+ feet. SiO_2 cementation/conglomerate at 7-18 feet.

TEST PIT LOG: TP-22

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/20/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972597.58 **E:** 875051.00

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	CL	sandy gravelly SILTY CLAY, medium plasticity, 25% fine to coarse sub-rounded sand, 20% fine to coarse sub-angualr gravel; 5% cobbles (3-5"), brown (7.5YR 4/3), blocky, strong RXN with HCl; cohesive, dry, soft.
2 - 3 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% low to medium plasticity fines, 25% fine to coarse sub-angular gravel; 5% cobbles (3-5"), pinkish white (7.5YR 8/2), weak $CaCO_3$ cementation, strong RXN with HCl; cohesive, dry, firm.
3 - 5 ft.	SW	gravelly SAND, fine to coarse, sub-rounded, 35% fine to coarse sub-angular gravel, 10% non-plastic fines; 10% cobbles (3-12"), light brown (7.5YR 6/3), $CaCO_3$ as masses and disseminated, strong RXN with HCl; non-cohesive, dry, compact.
5 - 8 ft.	GW	sandy GRAVEL, fine to coarse, sub-angular, 40% fine to coarse sub-rounded sand, 10% non-plastic fines; 20% cobbles and boulders (3-15"), brown (7.5YR 5/4), $CaCO_3$ as masses and disseminated, strong RXN with HCl; non-cohesive, dry, compact.
8 - 11 ft.	GM	sandy SILTY GRAVEL, fine to coarse, sub-angular, 35% fine to coarse sub-rounded sand, 25% medium plasticity fines; 20% cobbles and boulders (3-15"), reddish brown (5YR 4/4), $CaCO_3$ as masses and disseminated, strong RXN with HCl; non-cohesive, dry, dense.
11 - 13 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine to coarse poorly graded gravels, 25% medium plasticity fines; trace cobbles (3-4"), reddish brown (5YR 5/4), $CaCO_3$ as masses and disseminated, strong RXN with HCl; non-cohesive, dry, dense.
13 - 16 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, 10% fine to medium poorly graded gravels, 10% low plasticity fines; yellowish red (5YR 5/6), weak RXN to HCl, moderate cementation (SiO_2), large plates excavated; non-cohesive, dry, very dense.

Samples:
None.

Special Notes:
Stratified gravels at 5 to 11 feet, thickly bedded.
Disturbed surface; A horizon has been removed.

TEST PIT LOG: TP-23

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/20/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972621.41 **E:** 874709.99

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	ML	sandy CLAYEY SILT, low plasticity, 35% fine to medium poorly graded sub-rounded sand, 5% fine to medium poorly graded sub-angular gravel; trace sub-angular cobbles (3-5"), brown (7.5YR 4/3), blocky, strong RXN with HCl; cohesive, dry, soft.
2 - 3 ft.	ML	CLAYEY SILT and SAND, medium plasticity, 40% fine to coarse sub-rounded sand, 10% fine to medium poorly graded sub-angular gravel; pink (7.5YR 7/3), blocky, weak $CaCO_3$ cementation, strong RXN with HCl; cohesive, dry, very stiff.
3 - 5 ft.	ML-SM	CLAYEY SILT and SAND, low to medium plasticity, 45% fine to coarse sub-rounded sand, 5% fine to medium poorly graded sub-angular gravel; light brown (7.5YR 6/3), blocky, $CaCO_3$ as masses and disseminated, strong RXN with HCl; cohesive, dry, stiff.
5 - 8 ft.	SM	SILTY SAND, fine to coarse, sub-rounded, 20% low to non-plastic fines, 5% fine to medium poorly sub-angular graded gravel; pink (7.5YR 7/4), moderate $CaCO_3$ cementation and coatings on rock fragments, strong RNX with HCl; non-cohesive, dry, dense.
8 - 11 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 25% low plasticity fines, 25% fine to medium poorly graded sub-angular gravel; pink (7.5YR 7/4), strong $CaCO_3$ cementation and coatings on rock fragments, strong RXN with HCl; non-cohesive, dry, very dense.
11 - 12 ft.	GM	sandy SILTY GRAVEL, fine to coarse, sub-angular, 30% low plasticity fines, 30% fine to coarse sub-rounded sand; 5% cobbles (3-5"), brown (7.5YR 5/2), strong $SiO_2/CaCO_3$ cementation and coatings on rock fragments, strong RXN with HCl; non-cohesive, dry, very dense.

Samples:
None.

Special Notes:
very hard digging at 10 feet. Refusal at 12 feet.

TEST PIT LOG: TP-24

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/18/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972670.75 **E:** 873699.23

Lithology:

Depth	*USCS*	*Description*
0 - 3 ft.	CL	SILTY CLAY and SAND, medium plasticity, 40% fine to coarse sub-rounded sand, 10% fine to coarse poorly graded sub-rounded gravel; 20% cobbles (4-10"), brown (7.5YR 4/4), blocky, strong RXN with HCl; cohesive, dry, firm.
3 - 5 ft.	SC	CLAYEY SAND, fine to coarse, sub-rounded sand, 30% medium plasticity fines, 10% fine to coarse poorly graded sub-angular gravel; 5% sub-angular cobbles (3-5"); brown (7.5YR 5/4), blocky, $CaCO_3$ as masses and disseminated, strong RXN with HCl; cohesive, dry, firm.
5 - 10 ft.	SM/SC	SILTY SAND, fine to coarse, well graded, sub-rounded, 25% medium plasticity fines, 10% fine to medium poorly graded sub-angular gravel; trace cobbles (3-5"); light brown (7.5YR 6/3), large blocky plates excavated, $CaCO_3$ as masses and weakly cemented (SiO_2/$CaCO_3$) in places, strong RXN with HCl; non-cohesive, dry, dense.
10 - 14 ft.	SW-SM	SILTY SAND, fine to coarse, sub-rounded, and GRAVEL, fine to coarse, poorly graded, sub-rounded, 10% low plasticity fines; 15% sub-angular cobbles; brown (7.5YR 5/3), $CaCO_3$ coatings on rock fragments and masses, strong RXN with HCl; non-cohesive, dry, dense.
14 - 16 ft.	GP-GM	sandy SILTY GRAVEL, fine to coarse, poorly graded, 30% fine to coarse well graded sand, 10% low plasticity fines; 20% sub-angular cobbles (3-10"), brown (7.5YR 5/3), $CaCO_3$ coatings on rock fragments and masses, strong RXN with HCl; non-cohesive, dry, dense.

Samples:
0-3 ft. bag
3-5 ft. bag, bucket
5-10 ft. bag, bucket
10-14 ft. bag, bucket
14-16 ft. bag, bucket
BMI samples all layers (bag samples)

Special Notes:
Disturbed surface.

TEST PIT LOG: TP-25

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/13/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972408.78 **E:** 872794.31

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	SC	FILL. gravelly CLAYEY SAND, fine to coarse, sub-rounded, 35% fine to medium poorly graded sub-rounded gravel, 20% medium plasticity fines; 5% sub-angular cobbles (3-6"), brown (7.5YR 4/4), blocky; cohesive, dry, firm.
2 - 5 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine to coarse poorly graded gravel, 10% low plasticity fines; 20% cobbles and boulders (3-15"), light brown (7.5YR 5/4), $CaCO_3$ as masses and disseminated; non-cohesive, dry,
5 - 6 ft.	GP	sandy GRAVEL, fine to coarse, poorly graded, sub-angular, 25% fine to coarse sub-rounded graded sand, 5% non-plastic fines; 15% cobbles and boulders (3-12"), light brown (7.5YR 6/4), large blocky plates excavated, strong SiO_2/$CaCO_3$ cementation (conglomerate); non-cohesive, dry, very dense.
6 - 7 ft.	GP	sandy GRAVEL, fine to coarse, poorly grades, sub-angular, 30% fine to coarse sub-rounded sand, 5% non-plastic fines; 15% cobbles (3-10"), light brown (7.5YR 6/3), large blocky plates excavated, moderate SiO_2/$CaCO_3$ cementation (conglomerate); non-cohesive, dry, very dense.

Samples:
0-2 ft. bag
2-5 ft. bag
5-6 ft. bag
6-7 ft. bag

BMI sample: 2-5 ft.

Special Notes:
Pit located in old borrow area. Hard to dig with backhoe at 5+ feet.

TEST PIT LOG: TP-26

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/13/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973262.64 **E:** 872782.60

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	SM	FILL. gravelly SILTY SAND, fine to coarse, sub-rounded sand, 40% medium plasticity fines, 20% fine to coarse sub-rounded gravel; 5% sub-angular cobbles (3-4"), brown (10YR 5/3), friable; cohesive, dry, soft.
1 - 3 ft.	CL/SM	gravelly sandy SILTY CLAY, medium plasticity, 30% fine to coarse sub-rounded sand, 20% fine to coarse sub-rounded gravel; trace cobbles (3-4"), brown (7.5YR 4/3), blocky, $CaCO_3$ as masses and disseminated; cohesive, dry, stiff.
3 - 4 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to coarse sub-rounded graded gravel, 15% low plasticity fines; 10% sub-angular cobbles (3-6"), light brown (7.5YR 6/4), large blocky plates excavated, moderate $SiO_2/CaCO_3$ cementation (conglomerate); non-cohesive, dry, very dense.
4 - 5 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 20% fine to coarse sub-angular gravel, 15% low plasticity fines; 5% sub-angular cobbles (3-5"), light brown (7.5YR 6/4), large blocky plates excavated, strong $SiO_2/CaCO_3$ cementation (conglomerate); non-cohesive, dry, very dense.

Samples:
0-3 ft. bag
3-4 ft. bag
4-5 ft. bag

Special Notes:
Pit located in old borrow area. Hard to dig with backhoe; refusal at 5 feet.

TEST PIT LOG: TP-27

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/19/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11972823.18 **E:** 871169.18

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	SM	SILTY SAND, fine to coarse, sub-rounded, 20% low plasticity fines, 10% fine to coarse poorly graded sub-angular gravel; trace cobbles (3-5"), dark brown (10YR 3/3), friable, strong RXN with HCl; cohesive, moist, soft.
2 - 3 ft.	SC	gravelly CLAYEY SAND, fine to coarse, sub-rounded sand, 40% medium plasticity fines, 20% fine to coarse poorly graded sub-angular gravel; 10% sub-angular cobbles and boulders (3-20"); brown (7.5YR 4/3), blocky, $CaCO_3$ as masses and disseminated, strong RXN with HCl; cohesive, dry, firm.
3 - 7 ft.	GP	GRAVEL, fine to coarse, poorly graded, sub-angular, 45% fine to coarse sub-rounded sand, 5% non-plastic fines; 5% sub-angular cobbles (3-10"), pinkish gray (7.5YR 7/2), $CaCO_3$ coatings on rock fragments, weak RXN with HCl, moderate SiO_2 cementation at 5 feet; non-cohesive, dry, dense.
7 - 13 ft.	GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 5% non-plastic fines; 15% cobbles and boulders (3-20"), pinkish gray (7.5YR 6/2), moderate SiO_2 cementation, $CaCO_3$ coatings on rock fragments, weak RXN with HCl; non-cohesive, dry, very dense.
13 - 14 ft.	GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 5% non-plastic fines; 10% sub-angular cobbles (3-10"), pinkish gray (7.5YR 6/2), strong SiO_2 cementation (conglomerate), $CaCO_3$ coatings on rock fragments, weak RXN with HCl; non-cohesive, dry, very dense.

Samples:
0-2 ft. bag, bucket
2-3 ft. bag, bucket
3-7 ft. bag, bucket
7-13 ft. bag, bucket
13-14 ft. bag
BMI samples all layers (bag samples)

Special Notes:
Hard digging due to oversize at 7 feet and cemented conglomerate at 13 feet.

TEST PIT LOG: TP-28

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/3/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11973129.48 **E:** 871528.89

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	ML	CLAYEY SILT and SAND, low plasticity, 40% fine to coarse sub-rounded sand, 10% fine to coarse sub-rounded gravel; 10% sub-angular cobbles (3-8"), brown (7.5YR 4/2), blocky, weak RXN with HCl; cohesive, dry, soft.
2 - 4 ft.	SM/CL	gravelly SILTY SAND, fine to coarse, sub-rounded, 40% medium plasticity fines, 30% fine to coarse sub-rounded gravel; trace sub-angular cobbles (3-8"), pinkish gray (7.5YR 6/2), blocky, weak $CaCO_3$ cementation in places and masses strong RXN with HCl; cohesive, dry, firm.
4 - 6 ft.	GP	GRAVEL, fine to coarse, poorly graded, sub-rounded and SAND, fine to coarse, poorly graded, sub-rounded, 10% low plasticity fines; trace cobbles (3-8"), brown (7.5YR 5/2), $CaCO_3$ coatings on rock fragments, strong RXN with HCl; non-cohesive, dry, dense.
6 - 9 ft.	GW	GRAVEL, fine to coarse, sub-rounded, and SAND, fine to coarse, sub-rounded, 5% non-plastic fines; 15% cobbles and boulders (3-20"), light brown (7.5YR 6/4), moderate SiO_2 cementation, very weak RXN with HCl; non-cohesive, dry, very
9 - 14.5 ft.	GM	SILTY GRAVEL,fine to coarse, sub-rounded, and SAND, fine to coarse, sub-rounded, 15% low plasticity fines; 20% sub-angular cobbles (3-8"), light brown (7.5YR 6/4), strong SiO_2 cementation (conglomerate), very weak RXN with HCl; non-cohesive, dry, very dense.

Samples:
None.

Special Notes:
Difficult to excavate at 9 feet. Archaeologist present during excavation.

Golder Associates

TEST PIT LOG: TP-29

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/18/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974098.42 **E:** 871178.07

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	CL	sandy SILTY CLAY, medium plasticity, 30% fine to coarse sub-rounded sand, 5% fine to coarse poorly graded sub-angular gravel; trace cobbles (3-12"), dark brown (7.5YR 3/3), friable, strong RXN with HCl; cohesive, dry, firm.
1 - 2 ft.	CI	gravelly sandy SILTY CLAY, medium to high plasticity, 25% fine to coarse sub-angular gravel; 20% medium to coarse poorly graded sub-rounded sand; 5% cobbles (3-12"), reddish brown (5YR 4/4), blocky, disseminated $CaCO_3$, strong RXN with HCl; cohesive, dry, stiff.
2 - 4 ft.	SC	gravelly CLAYEY SAND, fine to coarse, sub-rounded, 30% medium plasticity fines, 15% fine to coarse sub-angular gravels; 5% cobbles (3-6"), pinkish gray (7.5YR 6/2), $CaCO_3$ as masses and disseminated, strong RXN with HCl; cohesive, dry, very stiff.
4 - 7 ft.	SP	gravelly SAND, fine to coarse, poorly graded, sub-rounded, 25% fine to coarse poorly graded gravels, 5% non-plastic fines; trace sub-angular cobbles (3-6"), light brown (7.5YR 6/3), $CaCO_3$ as masses, disseminated and coatings on rock fragments, stong RXN with HCl; non-cohesive, dry, compact.
7 - 12 ft.	SW-GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 10% non-plastic fines; 10% sub-angular cobbles (3-8"), light brown (7.5YR 6/3), strong SiO_2 cementation (conglomerate) at 11 feet, strong RXN with HCl, $CaCO_3$ as masses, disseminated and coatings on rock fragments; non-cohesive, dry, very dense.

Samples:
0-2 ft. bag, bucket
2-4 ft. bag
4-7 ft. bag, bucket
7-12 ft. bag, bucket

Special Notes:
Refusal at 12 feet due to cementation and oversized.

TEST PIT LOG: TP-30

Checked GM 1/29/2013

Client: THEMAC **Date:** 12/18/2012
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11974680.06 **E:** 871571.56

Lithology:

Depth	*USCS*	*Description*
0 - 2 ft.	CL	sandy gravelly SILTY CLAY, medium plasticity, 25% fine to coarse sub-rounded sand, 20% fine to coarse poorly graded sub-angular gravel; trace cobbles (3-10"), dark brown (7.5YR 3/3), friable, strong RXN with HCl; cohesive, dry, firm.
2 - 4 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 40% fine to coarse poorly graded sub-angular gravel, 15% low plasticity fines; 10% sub-angular cobbles and boulders (3-20"), light brown (7.5YR 6/3), disseminated $CaCO_3$ and masses, strong RXN with HCl; non-cohesive, dry, compact.
4 - 5 ft.	SW	gravelly SILTY SAND, fine to coarse, sub-rounded, 35% fine poorly graded sub-angular gravels, 5% non-plastic fines; pinkish gray (7.5YR 6/2), $CaCO_3$ as masses and coatings on gravels, moderate SiO_2 cementation, strong RXN with HCl; non-cohesive, dry, dense.
5 - 12 ft.	GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, sub-rounded, 5% non-plastic fines; 30% sub-angular cobbles and boulders (3-20"), light brown (7.5YR 6/3), disseminated $CaCO_3$ and coatings on rock fragments, strong RXN with HCl; non-cohesive, dry, dense.

Samples:
None.

Special Notes:

Golder Associates

TEST PIT LOG: TP-31

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/3/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11975597.72 **E:** 872172.62

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	CL	gravelly sandy CLAYEY SILT, medium to high plasticity, 30% fine to coarse sub-rounded sand, 25% fine to coarse sub-angular gravel; 10% sub-angular to sub-rounded cobbles (3-6"), brown (7.5YR 5/4), blocky, strong RXN with HCl; cohesive, dry, soft.
1 - 2 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to coarse sub-angular gravel, 30% medium plasticity fines; 15% cobbles (3-9"), brown (7.5YR 5/3), blocky, $CaCO_3$ masses, disseminated and weak cementation in places, clay fingering, strong RXN with HCl; cohesive, dry, stiff.
2 - 5 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, poorly graded, sub-angular, 10% low plasticity fines; trace cobbles (3-5"), light brown (7.5YR 6/3), platy, weak SiO_2 cementation, weak RXN with HCl, $CaCO_3$ coatings on rocks; non-cohesive, dry, dense.
5 - 8 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, poorly graded, sub-angular, 5% non-plastic fines; trace cobbles (3-5"), light brown (7.5YR 6/3), platy, mod. SiO_2 cementation, no RXN with HCl; non-cohesive, dry, very dense.
8 - 13 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, poorly graded, sub-angular, 10% low plasticity fines; 5% cobbles (3-6"), brown (7.5YR 5/4), platy, weak SiO_2 cementation, no RXN with HCl; non-cohesive, dry, dense.
13 - 16 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, poorly graded, sub-angular, 10% low plasticity fines; 5% cobbles (3-6"), light brown (7.5YR 6/3), platy, strong SiO_2 cementation, no RXN with HCl; non-cohesive, dry, very dense.

Samples:
1-2 ft. bag
2-5 ft. bag
5-8 ft. bag
8-13 ft. bag
13-16 ft. bag
BMI bag samples all layers

Special Notes:
Surface disturbed- placer mining location. Pit located in drainage.

TEST PIT LOG: TP-32

Checked GM 1/29/2013

Client: THEMAC **Date:** 1/3/2013
Project: Copper Flat
Project No.: 103-92557
Location: Sierra County, NM
NAD 83: **N:** 11975136.61 **E:** 872876.80

Lithology:

Depth	*USCS*	*Description*
0 - 1 ft.	CL-ML	sandy CLAYEY SILT, medium plasticity, 30% fine to coarse sub-rounded sand, 10% fine to coarse sub-angular gravel; trace sub-angular cobbles (3-6"), brown (7.5YR 4/4), blocky, strong RXN with HCl; cohesive, dry, soft.
1 - 3 ft.	SM	gravelly SILTY SAND, fine to coarse, sub-rounded, 30% fine to coarse sub-angular gravel, 25% medium plasticity fines; 20% cobbles (3-10"), pinkish gray (7.5YR 7/2), blocky, $CaCO_3$ masses, coatings on rock fragments and weak cementation in places, stron RXN with HCl; non-cohesive, dry, compact.
3 - 5 ft.	SM	SILTY SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, sub-angular, 15% low plasticity fines; 5% cobbles (3-4"), light brown (7.5YR 6/3), weak $SiO_2/CaCO_3$ cementation, strong RXN to HCl; non-cohesive, dry, dense.
5 - 10 ft.	GW	GRAVEL, fine to coarse, sub-angular, and SAND, fine to coarse, poorly graded, sub-rounded sand, 10% low plasticity fines; 20% cobbles and boulders (3-12"), pinkish gray (7.5YR 6/2), weak SiO2 cementation, $CaCO_3$ coatings on rock fragments, weak RXN to HCl; non-cohesive, dry, very dense.
10 - 14 ft.	SP	SAND, fine to coarse, poorly graded, sub-rounded, and GRAVEL, fine to coarse, sub-angular, 5% low plasticity fines; 15% cobbles (3-8"), light brown (7.5YR 6/3), large platy blocks excavated, strong SiO_2 cementation, $CaCO_3$ masses, weak RXN to HCl; non-cohesive, dry, very dense.

Samples:
3-5 ft. bag, bucket
5-10 ft. bag, bucket
10-14 ft. bag, bucket

Special Notes:
Hard

APPENDIX A.2
DRILL HOLE LOGS

REPORT OF BOREHOLE: SOIL KEY

Golder Associates

SHEET: 1 OF 1

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/24/13
CHECKED: DP DATE: 2/21/13

LOCATION: Copper Flat
XY COORDINATES: N , E
ELEVATION: ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer, Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0														
										Blows Per Six Inches Number of sample hammer blows required to drive the sampler six inches, or recorded number of blows to drive the sampler the specified distance (e.g. 50/4" = 50 hammer blows to drive the sampler four inches).				
5										Blows Per Foot Number of sample hammer blows required to drive the sampler twelve inches. Resolved using the final twelve inches of the sample or the amount of penetration upon sample refusal (50 blow counts).				
10														
			SS1		4 5 6	11	17 / 18			Sample Types Standard Penetration Test - Full penetration with 17 of 18 inches recovered.				
15														
			SS2		7 50/4"	R	7 / 10			Standard Penetration Test - Refusal at 10 inches, 7 of 10 inches recovered.				
			AUGER3							Auger Bag/Bulk Sample - Bulk grab from auger cuttings to become a collective bag sample over an interval.				
20														
25														
		▽								Depth at which water was encountered during drilling operations.				
30										Core				
35														
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

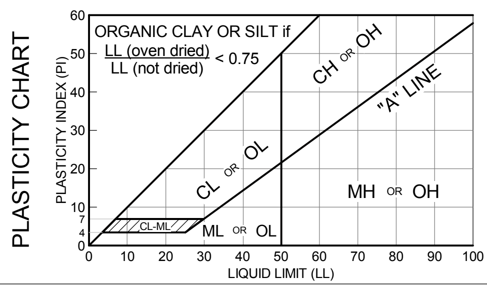
RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:7/16/13

Golder Associates

SOIL CLASSIFICATION / LEGEND

UNIFIED SOIL CLASSIFICATION (ASTM D 2487-00)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES AND GROUP SYMBOLS USING LABOARATORY TESTS			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND	
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	$C_U > 4$ AND $1 < C_C < 3$	GW	WELL-GRADED GRAVEL	If soil contains >15% sand, add "with sand"
			$C_U > 4$ AND/OR $1 > C_C > 3$	GP	POORLY-GRADED GRAVEL	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL	
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL	
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	$C_U > 6$ AND $1 < C_C < 3$	SW	WELL-GRADED SAND	If soil contains >15% gravel, add "with gravel"
			$C_U > 6$ AND/OR $1 > C_C > 3$	SP	POORLY-GRADED SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	SILTY SAND	
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	PLASTICITY CHART (see below)		CL	LEAN CLAY	If soil contains coarse-grained soil from 15% to 29%, add "with sand" or "with gravel" for whichever type is prominent, or for >30%, add "sandy" or "gravelly"
				ML	SILT	
				OL	ORGANIC CLAY OR SILT	
	SILTS AND CLAYS LIQUID LIMIT>50			CH	FAT CLAY	
				MH	ELASTIC SILT	
				OH	ORGANIC CLAY OR SILT	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT	



$C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

Gravels or sands with 5% to 12% fines require dual symbols (GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC) and add "with clay" or "with silt" to group name. If fines classify as CL-ML for GM or SM, use dual symbol GC-GM or SC-SM.

DESCRIPTIVE TERMINOLOGY FOR PERCENTAGES (ASTM D 2488-00)

DESCRIPTIVE TERMS	RANGE OF PROPORTION
TRACE	0 - 5%
FEW	5 - 10%
LITTLE	15 - 25%
SOME	30 - 45%
MOSTLY	50 - 100%

LABORATORY TEST ABBREVIATIONS

AL	Atterberg Limits	**HY**	Hydrometer	**SG**	Specific Gravity
CI	Chloride Content	**PT**	Proctor	**SP**	Swell Potential
CO	Consolidation	**pH**	Soil pH	**UC**	Unconfined Compression
CP	Collapse Potential	**RS**	Restivity	**UU**	Triaxial Unconsolidated, Undrained
CU	Triaxial Consolidated Undrained	**RV**	R-Value		
DD	Dry Density	**SA**	Sieve Analysis		
DS	Direct Shear	**SC**	Soluble Sulfate Content		

CRITERIA FOR DESCRIBING MOISTURE CONDITION (ASTM D 2488-00)

DRY	Absence of moisture, dusty, dry to the touch
MOIST	Damp but no visible water
WET	Visible free water, usually soil is below water table

COMPONENT DEFINITIONS BY GRADATION

COMPONENT	SIZE RANGE
BOULDERS	Above 12 in.
COBBLES	3 in. to 12 in.
GRAVEL	3 in. to No. 4 (4.76 mm)
COARSE GRAVEL	3 in. to 3/4 in.
FINE GRAVEL	3/4 in. to No. 4 (4.76 mm)
SAND	No. 4 (4.76 mm) to No. 200 (0.074 mm)
COARSE SAND	No. 4 (4.76 mm) to No. 10 (2.0 mm)
MEDIUM SAND	No. 10 (2.0 mm) to No. 40 (0.42 mm)
FINE SAND	No. 40 (0.42 mm) to No. 200 (0.074 mm)
SILT AND CLAY	Smaller than No. 200 (0.074 mm)
SILT	0.074 mm to 0.005 mm
CLAY	Less than 0.005 mm

RELATIVE DENSITY / CONSISTENCY ESTIMATE USING STANDARD PENETRATION TEST (SPT) VALUES

COHESIONLESS SOILS (GRAVEL, SAND, NONPLASTIC SILT)			COHESIVE SOILS (PLASTIC SILT, CLAY)		
DENSITY	N_1 (BLOWS /FOOT)*	RELATIVE DENSITY (%)	CONSISTENCY	N_1 (BLOWS /FOOT)*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	0 - 15	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	15 - 35	SOFT	2 - 4	0.25 - 0.50
COMPACT	10 - 30	35 - 65	FIRM	4 - 8	0.50 - 1.0
DENSE	30 - 50	65 - 85	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	> 85	VERY STIFF	15 - 30	2.0 - 4.0
			HARD	OVER 30	OVER 4.0

*Refer to ASTM D 1586-99 for a definition of N. Values shown are based on N values corrected for overburden pressures (N_1). N values may be affected by a number of factors including material size, depth, drilling method, and borehole disturbance. N values are only an approximate guide for consistency of cohesive soil.

GENERAL NOTES

Report of Borehole logs present material classifications, test data, and observations from subsurface explorations at the subject site as reported by the field geologist, engineer, or scientist. In some cases, the classifications may be made based on laboratory test data when available. It should be noted that the investigation methods only recover a small part of the subsurface materials at the exploration location. Therefore, actual conditions between borings and sampled intervals may differ from those presented on the Report of Borehole logs.

This key and Report of Borehole logs must be read together with the attached report. The information presented on the logs and in this key provide only a basis for an evaluation of the subsurface conditions. Any evaluation of the conditions reported on the Report of Borehole logs must be performed by Professional Engineers or Geologists.

RPT:TUC SOIL LEGEND PROJ:103-92557 COPPER FLAT.GPJ TMPL: LIB:GLDR_TUC_V1.GLB DATE:7/16/13

Golder Associates

REPORT OF BOREHOLE: BH-01

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/17/12
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-1 43.5 feet west
XY COORDINATES: N 11,973,679, E 871,432
ELEVATION: 5,298.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						GM	Compact, light gray, SILTY GRAVEL (GM) with sand, dry, some cobbles.				
			SS1		18 17 32	49	18 / 18			Becomes dense, gray.				
5			Bulk											
			SS2		4 40 45	85	18 / 18			Becomes very dense.				
10			Bulk											
			SS3		13 32 50	82	18 / 18							
15			Bag											
	5280.5 17.5		Bulk						ML	Hard, brown, GRAVELLY SILT (ML), dry, some cobbles.				
			SS4		26 50/5"	R	11 / 11							
20			Bulk											
			SS5		45 30/2"	R	8 / 8							
25			Bag											
			SS6		40 40/3"	R	3 / 6							
			Bag											
30	5267.0 31.0		SS7		10 10/0"	R	0 / 0			Refusal at 31'. Backfilled with cuttings. No groundwater encountered in boring.				
35														
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-02

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/18/12
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-2 2 feet east
XY COORDINATES: N 11,973,762, E 870,444
ELEVATION: 5,361.8 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			B/Bag						GC	Compact, light gray, CLAYEY GRAVEL WITH SAND (GC), dry, some cobbles.				
	5358.3 / 3.5		SS1		17 16 23	39	18 / 18		SM	Dense, light gray, SILTY SAND (SM), little gravel, dry.				
5			B/Bag							Becomes light brown, some gravel, occasional cobbles.				
			SS2		16 29 50	79	6 / 18							
	5352.3								GW	6" lens of very dense, gray, GRAVEL (GW), dry.				
10	5351.8 / 10.0		Bulk						ML	Hard, brown, SANDY SILT and gravel (ML), dry, occasional cobble.				
			SS3		17 50/6"	R	12 / 12							
15			Bulk											
	5343.3 / 18.5		SS4		26 47 50/3"	R	15 / 15		SM	Very dense, brown and gray, SILTY SAND (SM), some gravel, dry.				
20			Bulk											
	5340.3 / 21.5									Refusal at 21.5'. Backfilled with cuttings. No groundwater encountered in boring.				
25														
30														
35														
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-03

Golder Associates

SHEET: 1 OF 1

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/25/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-3 5 feet south
XY COORDINATES: N 11,977,597, E 868,520
ELEVATION: 5,468.6 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						SW	Very dense, gray, WELL-GRADED SAND WITH GRAVEL (SW), trace fines, dry.				
8.0	5460.6 8.0		SS1 Bulk		50/0"	R	0 / 0			Slightly weathered, dark gray, strong rock.	Becomes rock.			
			Core											
15.0	5453.6 15.0									Refusal at 8'. Bottom of borehole at 15'. Backfilled with cuttings. No groundwater encountered in boring.				

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-04

SHEET: 1 OF 1

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/5/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,977,281, E 870,076
ELEVATION: 5,355.3 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Diamond Coring
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						SW-SM	Compact, gray/light gray, SILTY SAND (SM), some gravel, cobbles, dry, cementation.				
4.0	5351.3		SS1		14 23 19	42	18 / 18		ML	Dense, gray, SANDY SILT (SM), dry, some cementation.				
5			Bag											
9.0	5346.3		SS2 Core		25/0"	R	0 / 0			Weathered, dark gray, fragmented ROCK, trace cementation, trace silty sand.	Becomes rock. Switch to Diamond Coring.			
										Becomes moderate cementation				
15			Core											
			Core							Become strong cementation. [CONGLOMERATE]				
18.0	5337.3									Refusal of Hollow Stem Auger at 9'. Core from 9' to 18'. Bottom of borehole at 18'. Backfilled with cuttings. No groundwater encountered in boring.				

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-05

Golder Associates

SHEET: 1 OF 1

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/7/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,977,243, E 869,166
ELEVATION: 5,385.6 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Diamond Coring
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description (consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.)	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						SW-SM	Compact, gray/ light gray, SILTY SAND and gravel (SW-SM), dry, trace cementation, cobbles.				
					12 24 41	65	18 / 18			Becomes very dense.				
5			Bulk											
	5379.6 6.0		Core							Weathered, dark gray, fragmented ROCK, some sandy silt, strongly cemented.	Become rock. Switch to Diamond coring.			
10														
	5372.6 13.0									Refusal of Hollow Stem Auger at 6'. Diamond coring from 6-13'. Bottom of borehole at 13'. Backfilled with cuttings. No groundwater encountered in boring.				
15														
20														
25														
30														
35														
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-06

Golder Associates

SHEET: 1 OF 1

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/25/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,976,597, E 870,667
ELEVATION: 5,308.1 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer, Diamond Coring
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						SW-SM	Very dense, brown, SILTY SAND and gravel (SW-SM), dry.				
			Bulk							Becomes gray.				
8.0	5300.1		SS1 Bulk		50/0"	R	0 / 0			Slightly weathered, dark gray, strong ROCK.	Becomes rock.			
18			Core								Switch to Diamond Coring.			
25.0	5283.1									Diamond coring from 18-25'. Bottom of borehole at 25'. Backfilled with cuttings. No groundwater encountered in boring.				

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-07

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/18/12
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,976,181, E 871,532
ELEVATION: 5,372.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Diamond Coring
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0	5371.5 0.5		Bag Bag						SM	Loose, brown, SILTY SAND (SM), little gravel, dry.				
									GP	Compact, light gray, SANDY GRAVEL (GP), dry.				
			SS1		14 28 33	61	18 / 18			Lens of brown/white, SILTY SAND, trace gravel, dry. Becomes very dense.				
5	5367.0 5.0		Bag							Becomes well-graded gravel.				
									SW-SM	Very dense, gray, SILTY SAND and gravel (SW-SM), dry.				
			SS2		12 39 50/5"	R	17 / 17							
10			Bag											
			SS3		11 37 50/2"	R	14 / 14							
15	5357.0 15.0		Bag Bag						GW-GM	Very dense, gray, GRAVEL and silty sand (GW-GM), dry, few cobbles.				
			SS4		25 30/2"	R	10 / 10							
20			Bag											
			SS5		23 32/3"	R	9 / 9							
25	5347.5 24.5		Bag						SW-SM	Very dense, brown, SILTY SAND and gravel (SW-SM), dry, few cobbles.				
			SS6		36/5"	R	5 / 5							
30	5342.0 30.0		SS7 Core		50/0"	R	0 / 0			Weathered, dark gray, fractured ROCK, strong cementation.	Becomes Rock. Switch to Diamond Coring.			
			SS8 Core		20 50/0"	R	6 / 6							
35														
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-07

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/18/12
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,976,181, E 871,532
ELEVATION: 5,372.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Diamond Coring
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	**Sample Description** consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40										Weathered, dark gray, fractured ROCK, strong cementation. *(continued)*				
45														
	5324.0 48.0									Refusal of Hollow Stem Auger at 30'. Diamond coring from 30-48'. Bottom of borehole at 48'. Backfilled with cuttings. No groundwater encountered in boring.				
50														
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-08

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/19/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,971,703, E 873,489
ELEVATION: 5,218.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						SW-SM	Dense, brown, SILTY SAND (SW-SM), some gravel, slightly cohesive, trace cementation, trace clayey silt, dry.				
			SS1		18 19 23	42	18 / 18							
			Bulk							Becomes very dense.				
			SS2		50 53 30	83	18 / 18							
			Bulk											
	5200.0 18.0		Bulk						ML	Hard/very dense, brown, SANDY SILT and gravel (ML), some clayey silt (low plasticity), dry, trace cementation.				
			SS3 Bulk		50/5"	R	5 / 5							
	5190.0 28.0		Bag						SW-SM	Very dense, gray/brown, SILTY SAND and gravel (SW-SM), some clayey silt, dry.				
	5185.0 33.0		SS4 Bulk		50/5"	R	5 / 5		SW	Very dense, gray, SAND and gravel (SW), dry.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-08

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/19/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,971,703, E 873,489
ELEVATION: 5,218.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	**Sample Description** consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									SW	Very dense, gray, SAND and gravel (SW), dry. *(continued)*				
	5175.0 43.0								GW	Very dense, gray, GRAVEL and sand (GW), trace clayey silt, dry.				
45														
			SS5		50/0"	R	0 / 0							
50	5168.0 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-09

Golder Associates

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/21/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-9 2 feet east
XY COORDINATES: N 11,972,261, E 875,052
ELEVATION: 5,176.7 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						ML	Hard, brown, SANDY SILT (ML), trace gravel, dry.				
			SS1		20 34 40	74	18 / 18							
5			Bulk											
	5170.7 6.0		SS2 Bag(2)		20/0"	R	0 / 1		SW	Dense to very dense, light gray/brown, SAND and gravel (SW), dry.				
			SS3		20 25 24	49	18 / 18							
10			Bag(2)											
	5165.7 11.0		Bag						ML	Hard, light brown, SILT (ML), trace gravel, dry, slightly cohesive, trace cementation.				
			SS4		16 25 27	52	18 / 18			Becomes light reddish brown, little gravel.				
15			Bulk											
			SS5		4 14 24	38	18 / 18							
20	5156.7 20.0		Bulk						MH	Hard, reddish brown, CLAYEY SILT (MH), dry, cohesive.				
			SS6		22 14 19	33	18 / 18							
25			Bulk											
	5150.7 26.0		B/Bag						CL-ML	Hard, red SILTY CLAY (CL-ML), dry, cohesive, moderate plasticity.				
			SS7		16 15 19	34	18 / 18							
30			B/Bag											
			SS8		6 4 13	17	18 / 18							
35	5141.7 35.0		Bulk						CL	Hard, red, CLAY (CL), dry.				
			SS9		14 21 31	52	18 / 18							
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-09

SHEET: 2 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/21/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-9 2 feet east
XY COORDINATES: N 11,972,261, E 875,052
ELEVATION: 5,176.7 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			Bulk						CL	Hard, red, CLAY (CL), dry. *(continued)*				
	5133.2 / 43.5		SS10		13 20 32	52	18 / 18		CL-ML	Hard, red, SILTY CLAY (CL-ML), dry.				
45	5131.7 / 45.0		Bulk						CH	Hard, red, CLAY, dry.				
			SS11		9 15 24	39	18 / 18							
50	5126.7 / 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-10

Golder Associates

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/12/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,513, E 874,813
ELEVATION: 5,182.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			B/Bag						SC	Compact, light gray, CLAYEY SAND WITH GRAVEL (SC), dry, few cobbles.				
			SS1		17 6 5	11	18 / 18							
5			B/Bag											
			SS2		9 12 18	30	18 / 18							
10			B/Bag											
			SS3		20 16 14	30	18 / 18							
	5167.5 14.5								MH	Very stiff, red/light brown, CLAYEY SILT (MH), dry, little gravel.				
15			Bag											
	5163.0 19.0		SS4		8 15 20	35	18 / 18		CL	Very stiff-hard, red, LEAN CLAY (CL), some sand, dry, trace gravel, cohesive, low plasticity.				
20			B/Bag											
			SS5		3 10 17	27	18 / 18							
25			B/Bag											
			SS6		10 19 41	60	18 / 18							
30			B/Bag											
										Becomes moderate plasticity				
			SS7		8 11 17	28	18 / 18							
35			B/Bag							Becomes slightly moist, moderate plasticity.				
			SS8		4 6 19	25	18 / 18							
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-10

Golder Associates

SHEET: 2 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/12/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,513, E 874,813
ELEVATION: 5,182.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			B/Bag						CL	Very stiff-hard, red, LEAN CLAY (CL), some sand, dry, trace gravel, cohesive, low plasticity. *(continued)*				
	5138.5 43.5		SS9		4 7 14	21	18 / 18		CH	Very stiff, red, CLAY (CH), slightly moist, high plasticity.				
45														
			SS10		7 10 16	26	18 / 18							
50	5132.0 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

Golder Associates

REPORT OF BOREHOLE: BH-11

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/3/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,894, E 874,891
ELEVATION: 5,180.5 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag(2)						ML	Stiff-very stiff, brown, SILT (ML), trace sand and gravel, dry.				
	5178.0 / 2.5		Bulk						SW	Dense, white/light gray, GRAVELLY SAND (SW), dry.				
			SS1		9 13 27	40	18 / 18							
5			Bulk											
	5172.0 / 8.5		SS2		12 27 23	50	18 / 18		SW-SM	Very dense, light brown, SILTY SAND and gravel (SW-SM), dry.				
10														
	5167.0 / 13.5		SS3		5 11 16	27	18 / 18		MH	Very stiff, brown, CLAYEY SILT (MH), dry, low plasticity.				
15			Bulk											
	5162.0 / 18.5		SS4		7 12 23	35	18 / 18		CL-ML	Hard, reddish brown, SILTY CLAY (CL-ML), white and black inclusions, dry.				
20			B/Bag							Becomes red, trace gravel, moderate plasticity, slightly moist.				
			SS5		24 16 23	39	18 / 18							
25			B/Bag											
			SS6		7 15 25	40	18 / 18							
30			B/Bag											
	5147.0 / 33.5		SS7		11 13 18	31	18 / 18		CH	Hard, red/light brown, CLAY (CH), slightly moist, moderate plasticity.				
35			Bulk											
			SS8		12 18 30	48	18 / 18							
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-11

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/3/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,894, E 874,891
ELEVATION: 5,180.5 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									CH	Hard, red/light brown, CLAY (CH), slightly moist, moderate plasticity. *(continued)*				
			SS9		11 13 18	31	18 / 18							
45														
			SS10		11 12 21	33	18 / 18							
50	5130.5 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

Golder Associates

REPORT OF BOREHOLE: BH-12

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/4/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,981, E 875,148
ELEVATION: 5,179.5 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	**Sample Description** consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag(2)						ML	Stiff, brown, SANDY SILT (ML) and gravel, dry.				
	5175.5 4.0		SS1		5 12 15	27	18 / 18		GW	Compact, light gray, GRAVEL AND SAND (GW), dry.				
5	5174.5 5.0		Bulk						GW-GM	Compact, gray/light brown, GRAVEL and silty sand (GW-GM), dry, few cobbles.				
			SS2		39 43 50	93	17 / 17			Becomes very dense, trace cobbles.				
10			Bulk											
			SS3		13 33 50	83	16 / 16							
15	5164.5 15.0		Bulk Bag						ML	Hard, brown, SANDY SILT and gravel (ML), dry.				
			SS4		7 18 24	42	18 / 18							
20	5160.0 19.5		B/Bag						CL-ML	Hard, red, SILTY CLAY (CL-ML), trace gravel, dry, low plasticity.				
			SS5		7 10 20	30	18 / 18							
25			B/Bag											
			SS6		12 15 26	41	18 / 18							
30			B/Bag											
	5146.0 33.5		SS7		12 14 24	38	18 / 18		CH	Hard, red, CLAY (CH), slightly moist, trace gravel, high plasticity.				
35			Bulk											
			SS8		12 16 26	42	18 / 18							
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

Golder Associates

REPORT OF BOREHOLE: BH-12

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/4/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,981, E 875,148
ELEVATION: 5,179.5 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			Bulk						CH	Hard, red, CLAY (CH), slightly moist, trace gravel, high plasticity. *(continued)*				
			SS9		10 11 18	29	18 / 18			Becomes very stiff-hard.				
45			Bulk											
			SS10		10 12 20	32	18 / 18							
50	5129.5 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

Golder Associates

REPORT OF BOREHOLE: BH-13

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/17/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,776, E 875,471
ELEVATION: 5,169.8 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						ML	Very stiff, light gray, SANDY SILT and gravel (ML), dry, slightly cohesive.				
			SS1		12 11 13	24	18 / 18							
5			Bulk											
			SS2		28 28 33	61	18 / 18			Becomes hard, light brown, trace cementation.				
10			Bag											
			SS3		13 29 35	64	18 / 18							
15			Bag											
			SS4		21 30 31	61	18 / 18							
20			Bulk											
	5146.3 23.5		SS5		28 50/3"	R			GW-GM	Very dense, brown, GRAVEL and sandy silt (GW-GM), dry, slightly cohesive fines.				
25			Bulk											
			SS6		21 50/4"	R				Lens of reddish brown clayey silt encountered at 34'.				
30			Bulk											
			SS7		27 49 50/2"	R								
35			Bulk											
	5131.3 38.5		SS8		13 24 33	57	18 / 18		CL-ML	Hard, reddish brown, SILTY CLAY (CL-ML), slightly moist, cohesive, trace gravel.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-13

Golder Associates

SHEET: 2 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/17/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,776, E 875,471
ELEVATION: 5,169.8 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			Bag						CL-ML	Hard, reddish brown, SILTY CLAY (CL-ML), slightly moist, cohesive, trace gravel. *(continued)*				
			SS9		9 14 14	28	18 / 18			Becomes very stiff, red, dry.				
45			Bulk											
			SS10		25 32 28	60	18 / 18							
50	5119.3 50.5									Bottom of borehole at 50.5'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

REPORT OF BOREHOLE: BH-14

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/22/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,766, E 875,868
ELEVATION: 5,158.2 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						ML	Very stiff, brown, SILT (ML), some gravel, dry.				
			SS1		23 44 30	74	18 / 18			Becomes hard, brown, some gravel, cementation at 4-5 ft.				
5			Bulk											
	5149.7 8.5		SS2		15 19 23	42	18 / 18		GW-GM	Dense, light brown/gray, GRAVEL and sandy silt (GW-GM), dry, slightly cohesive fines, few cobbles.				
10			Bulk											
			SS3		22 20 25	45	18 / 18							
15			Bulk											
			SS4		17 50/3"	R	9 / 9		GW	Becomes very dense, light brown/gray, GRAVEL and silty sand.				
			Bag(2)											
20														
	5134.7 23.5		SS5		18 35 50/4"	R	16 / 16		ML	Hard, light gray, SANDY SILT and gravel (ML), dry.				
25			Bulk											
	5129.7 28.5		SS6		25 50/6"	R	12 / 18		SW-SM	Very dense, brown/gray, SILTY SAND and gravel (SW-SM), dry.				
30			Bulk											
			SS7		33 32 50/5"	R	17 / 17							
35			Bulk											
			SS8		16 50/5"	R	11 / 11							
40			Bulk											

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-14

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/22/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,972,766, E 875,868
ELEVATION: 5,158.2 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									SW-SM	Very dense, brown/gray, SILTY SAND and gravel (SW-SM), dry. *(continued)*				
			SS9 Bulk		50/1"	R	1 / 1							
45														
			SS10		31 29 44	73	18 / 18							
50	5108.2 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-15

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/4/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,973,609, E 875,724
ELEVATION: 5,176.4 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk				ML	Hard, light gray/light brown, SILT (ML), little gravel, dry.				
			SS1	9 15 26	41							
5			Bulk									
	5168.4 / 8.0		SS2	38 50/6"	R	12 / 12	GW	Very dense, brown, SANDY GRAVEL (GW), dry.				
10	5166.4 / 10.0		Bag				SW	Very dense, gray, SAND and gravel (SW), dry.				
	5164.4 / 12.0		SS3	17 23 50	73		GW	Very dense, gray, SANDY GRAVEL (GW), dry.				
			Bulk									
15			SS4	30 50/3"	R	6 / 9						
	5158.9 / 17.5		Bulk				SW	Very dense, light gray, SAND and gravel (SW), dry.				
20	5154.9 / 21.5		SS5 / Bag(2)	28 50/4"	R	10 / 10	ML	Hard, light gray, SANDY SILT and gravel (ML), dry.				
25			SS6	22 50/6"	R	11 / 12						
	5148.9 / 27.5		Bag(2)				SW	Very dense, gray, SAND and gravel (SW), dry.				
30	5144.9 / 31.5		SS7 / Bag(2)	20/0"	R		SW-SM	Very dense, light gray, SILTY SAND (SW-SM), some gravel, dry.				
35	5139.9 / 36.5		Bag(2)				SW	Very dense, light gray, SAND and gravel (SW), dry.				
40												

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-15

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/4/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,973,609, E 875,724
ELEVATION: 5,176.4 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	**Sample Description** consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									SW	Very dense, light gray, SAND and gravel (SW), dry. *(continued)*				
	5134.9 / 41.5		SS8 Bag(2)		50/2"	R			ML	Very dense, gray/brown, SANDY SILT (ML), and gravel, dry, slightly cohesive.				
45														
50	5126.4 / 50.0								MH	Hard, reddish brown, CLAYEY SILT (MH), some gravel, slightly moist, slightly cohesive.				
			SS9		24 54 38/3"	R								
55	5122.1 / 54.3									Bottom of borehole at 54.25'. Backfilled with cuttings. No groundwater encountered in boring.				
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-16

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/22/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-16 4 feet north
XY COORDINATES: N 11,973,973, E 875,187
ELEVATION: 5,191.7 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						GC	Very dense, brown, CLAYEY GRAVEL with sand (GC), dry.				
			SS1		9 32 30	62	18 / 18							
5			Bulk											
	5183.2 8.5		SS2		26 18 19	37	18 / 18		GP-GM	Very dense, gray, GRAVEL and sandy silt (GP-GM), dry.				
10			Bulk											
	5178.2 13.5		SS3 B/Bulk		50/3"	R	3 / 3		GW	Very dense, light brown, GRAVEL and silty sand (GW), dry, trace CaCO3.				
15														
			SS4 B/Bulk		26 50/4"	R	10 / 10							
20														
			SS5 B/Bulk		48 50/3"	R	9 / 9							
25														
	5162.7 29.0		SS6 Bulk		21 50/3"	R	9 / 9		SC	Very dense, gray, CLAYEY SAND with gravel, trace CaCO3, dry, some cementation.				
30														
	5157.7 34.0		SS7 Bulk		13 8 12	20	18 / 18		MH	Very stiff, light reddish brown, CLAYEY SILT (MH), dry.				
35														
	5153.2 38.5		SS8		14 9 11	20	18 / 18		CL-ML	Very stiff, reddish brown, SILTY CLAY (CL-ML), slightly moist.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-16

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/22/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-16 4 feet north
XY COORDINATES: N 11,973,973, E 875,187
ELEVATION: 5,191.7 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			Bulk						CL-ML	Very stiff, reddish brown, SILTY CLAY (CL-ML), slightly moist. *(continued)*				
			SS9		17 11 13	24	18 / 18							
45			Bulk											
			SS10		4 2 4	6	18 / 18			Becomes firm, caliche and little gravel.				
50	5141.7 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-17

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/5/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,974,131, E 875,734
ELEVATION: 5,186.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						ML	Very stiff, gray/light brown, SANDY SILT and gravel (ML), dry.				
			SS1		10 13 12	25	18 / 18							
5			Bulk											
	5177.5 8.5		SS2		4 45 50/4"	R	12 / 16		GW	Very dense, gray, SANDY GRAVEL (GW), dry. Becomes brown/gray.				
10			Bulk											
15														
			SS3		7 28 39	67	18 / 18							
20			Bulk											
	5163.0 23.0								SW	Very dense, light brown, SAND and gravel (SW), dry.				
25										Becomes light gray/ light brown.				
	5158.0 28.0		SS4		24 50 50/4"	R	16 / 16		SW-SM	Very dense, brown, SILTY SAND and gravel (SW-SM), dry, slightly cohesive fines.				
30														
	5154.0 32.0		Bulk							Very dense, white/gray CALICHE, dry.				
35														
			SS5 Bulk		25/0"	R	0 / 0							
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-17

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/5/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,974,131, E 875,734
ELEVATION: 5,186.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	**Sample Description** consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40										Very dense, white/gray CALICHE, dry. *(continued)*				
										very dense, white/gray CALICHE, dry, little gravel, seam of light brown silt at 44-45'				
45														
50	5136.0 50.0		SS6		25/0"	R	0 / 0			Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-18

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/23/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-18 2 feet east
XY COORDINATES: N 11,974,701, E 874,701
ELEVATION: 5,207.3 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						ML	Stiff, light brown, SANDY SILT (ML), some gravel, dry.				
	5205.3 2.0		Bulk						GC	Dense, light brown, CLAYEY GRAVEL with sand (GC), dry.	Switch to Air Rotary drilling at 6'.			
			SS1		9 23 20	43	18 / 18							
5			Bulk											
	5199.3 8.0		Bulk						GW	Very dense, light brown/gray, GRAVEL and sand (GW), dry, little CaCO3.				
10														
			SS2 Bulk		50/4"	R								
15														
	5189.3 18.0		Bag(2)						ML	Hard, light reddish white, SANDY SILT (ML), some gravel, dry, some CaCO3.				
20														
	5184.3 23.0		SS3		24 31 31	62	18 / 18		CL	Hard, light reddish brown, sandy LEAN CLAY (CL), trace gravel, dry.				
25			Bulk											
			SS4		13 8 12	20	18 / 18							
30			Bulk											
	5173.8 33.5		SS5 Bulk		38 50/3"	R	9 / 9		CL-ML	Hard, reddish brown, CLAY (CL-ML), some silty clay, little gravel, moderate plasticity, dry.				
35														
	5168.8 38.5		SS6		11 21 24	45	18 / 18		CL	Hard, reddish brown, CLAY (CL), moderate plasticity, slightly moist.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-18

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/23/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-18 2 feet east
XY COORDINATES: N 11,974,701, E 874,701
ELEVATION: 5,207.3 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			Bulk						CL	Hard, reddish brown, CLAY (CL), moderate plasticity, slightly moist. *(continued)*				
	5163.8 43.5		SS7		5 6 9	15	18 / 18		CH	Stiff-hard, reddish brown, CLAY (CH), high plasticity, slightly moist, blocky.				
45			Bag											
			SS8		10 19 28	47	18 / 18							
50	5157.3 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-19

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/10/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,974,564, E 875,328
ELEVATION: 5,196.4 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0									ML	Soft, brown, SANDY SILT (ML), little gravel, dry.				
	5193.4 3.0		SS1		11 21 22	43	18 / 18		SW-SM	Dense, light brown, SILTY SAND and gravel (SW-SM), dry.				
5			Bulk											
			SS2		19 38 50/5"	R	17 / 17							
	5187.4 9.0		Bulk						GW	Very dense, brown/gray, SANDY GRAVEL (GW), dry.				
10														
15			Bag							Becomes dark gray.				
			Bag(2)							Becomes brown/gray.				
			SS3		27 40 23	63	18 / 18							
20														
	5174.4 22.0		B/Bag							Very dense, light gray/white, CALICHE, little gravel, dry.				
25														
			SS4 B/Bag		50/0"	R	0 / 0							
30														
35														
			SS5 Bulk		25/0"	R	0 / 0			Seam of brown sandy silt at 41' - 42', dry.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-19

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/10/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,974,564, E 875,328
ELEVATION: 5,196.4 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40										Very dense, light gray/white, CALICHE, little gravel, dry. *(continued)*				
	5153.4 43.0		Bulk						CL-ML	Very stiff, red, SILTY CLAY (CL-ML), slightly moist, cohesive				
45														
			Bag											
50	5146.4 50.0		SS6		5 13 14	27	18 / 18			Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

REPORT OF BOREHOLE: BH-20

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/20/13
CHECKED: DP DATE: 2/21/13

LOCATION: BH-20 on top of waste rock pile, moved BH-20 25 feet east
XY COORDINATES: N 11,975,241, E 871,714
ELEVATION: 5,292.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag(2)						SM	Compact, brown, SILTY SAND (SM), little gravel, dry.				
5			Bag							Becomes compact to dense, light gray, slightly cohesive, trace clayey silt.				
	5284.0 8.0		SS1		16 29 31	60	18 / 18		GW	Very dense, gray, GRAVEL (GW), some silty sand, dry, trace clayey silt lenses.				
10			Bulk											
15														
	5274.0 18.0		SS2 Bulk		50/3"	R	3 / 3		SW-SM	Very dense, light brown/gray, SILTY SAND and gravel, (SW-SM) dry, slightly cohesive, some light reddish brown clayey silt.				
20														
25														
			SS3 Bulk		50/3"	R	3 / 3							
30														
			Bulk											
35														
			SS4 Bulk		15 50/3"	R	9 / 9							
40	5252.0													

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-20

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/20/13
CHECKED: DP DATE: 2/21/13

LOCATION: BH-20 on top of waste rock pile, moved BH-20 25 feet east
XY COORDINATES: N 11,975,241, E 871,714
ELEVATION: 5,292.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40	40.0		Bulk						SM	Very dense, light brown, SILTY SAND (SM), some gravel, slightly moist, slightly cohesive.				
45														
			SS5		21 36 50/2"	R	14 / 14							
50	5242.0 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-21

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/24/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,975,236, E 874,685
ELEVATION: 5,214.2 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						SW-SM	Very dense, brown/gray, WELL-GRADED SAND with silt and gravel (SW-SM), dry.				
8			SS1		21 36 47	83	18 / 18							
10			Bulk											
18.0	5196.2 18.0		SS2		25 30 38	68	18 / 18		SW-SM	Very dense, light brown/reddish white, SILTY SAND and gravel (SW-SM), trace clayey silt, cementation, dry.				
28			SS3		50/0"	R	0 / 0							
30.0	5184.2 30.0		Bag(2)						MH	Hard, light reddish brown, CLAYEY SILT and silty clay (MH), trace gravel, dry.				
35			SS4		15 26 39	65	18 / 18							
36.5	5177.7 36.5									Bottom of borehole at 36.5'. Backfilled with cuttings. No groundwater encountered in boring.				

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-22

Golder Associates

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/21/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,974,757, E 873,750
ELEVATION: 5,232.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag Bulk						CL-ML	Loose, dark brown, SANDY SILTY CLAY (CL-ML), some gravel, dry. Becomes very stiff, yellowish/orange, trace gravel, dry (old tailings).				
			SS1		16 8 8	16	18 / 18							
5			Bulk							Becomes orange/brown, slightly moist, cohesive, (old tailings).				
			SS2		5 4 6	10	18 / 18			Becomes stiff, greenish-gray, moist, cohesive, (old tailings).				
10			Bulk											
			SS3		9 10 50/3"	R	15 / 15							
15	5217.5 14.5		Bag						GW	Very dense, light gray-gray, GRAVEL and sand (GW), dry, CaCO3 inclusions.				
20														
	5210.0 22.0		Bag(2)						ML	Hard, light gray/yellowish, SILT (ML), some gravel, slightly moist, slightly cohesive.				
			SS4		23 50/3"	R	9 / 9							
			Bag(2)											
25			Bag							Becomes brown, SANDY SILT, some clayey silt, trace gravel, moist, cohesive fines.		10.4		
30	5202.0 30.0		Bulk						CL-ML	Very stiff, reddish brown, SILTY CLAY (CL-ML), moist, cohesive.				
			SS5		7 11 13	24	18 / 18							
35	5197.0 35.0		Bulk Bulk						CL	Hard, reddish brown, CLAY (CL), dry, moderate plasticity.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-22

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/21/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,974,757, E 873,750
ELEVATION: 5,232.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									CL	Hard, reddish brown, CLAY (CL), dry, moderate plasticity. *(continued)*				
	5188.5 43.5		SS6		20 45 50/3"	R	15 / 15		SM	Hard, gray/brown, SILTY SAND (SM), slightly moist.				
45			Bulk											
	5186.0 46.0								CL-ML	Hard, brown, SILTY CLAY (SM), slightly moist, little gravel.				
			SS7		10 17 50/5"	R	17 / 17							
50	5182.0 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-23

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/20/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-23 20 feet southwest
XY COORDINATES: N 11,974,757, E 873,750
ELEVATION: 5,230.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						SP	Loose, brown, SAND and gravel (SP), dry.				
	5228.0 2.0		SS						ML	Very stiff, yellowish, SILT (ML), trace gravel, dry (old tailings).				
			Bulk							Becomes slightly cohesive.				
5														
	5221.0 9.0		SS1		13 38 36	74	18 / 18		GM	Very dense, gray/brown, GRAVEL and silt (GM), dry, slight cementation.				
10	5220.5 9.5		Bag						ML	Hard, white, SANDY SILT (ML), little gravel, dry.				
			SS2		13 16 14	30	18 / 30							
15	5216.0 14.0		Bulk						SM	Dense, gray, SILTY SAND and gravel (SM), dry, CaCO3 inclusions, slight cementation.				
20														
			SS3		16 18 50/2"	R	14 / 14							
25			Bag(2)							Becomes very dense.				
			Bulk							Becomes slightly moist.				
30														
35														
			SS4 Bulk		50/6"	R	6 / 4			Becomes brown, some blocky and cohesive clayey silt (low plasticity), slightly moist.				
40														

REPORT OF BOREHOLE: BH-23

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/20/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-23 20 feet southwest
XY COORDINATES: N 11,974,757, E 873,750
ELEVATION: 5,230.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									SM	Dense, gray, SILTY SAND and gravel (SM), dry, CaCO3 inclusions, slight cementation. *(continued)*				
45		▽												
	5182.0 48.0		SS5		50/4"	R	4 / 5		ML	Very dense, brown, SANDY SILT (ML), wet, little gravel.				
50	5180.5 49.5									Bottom of borehole at 49.5'. Backfilled with cuttings and bentonite. Groundwater encountered in boring at 45'.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-24

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/19/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,975,910, E 872,908
ELEVATION: 5,267.1 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag(2)						SP	Dense, gray/brown, SAND and gravel (SP), dry, trace CaCO3.				
2.5	5264.6 2.5		Bulk						SW-SM	Very dense, gray, WELL-GRADED SAND with silt and gravel (SW-SM), dry.				
			SS1 Bulk		50/4"	R	4 / 4							
			SS2 Bulk		50/3"	R	3 / 3							
28	5239.1 28.0		SS3 Bulk		41 50/3"	R	9 / 9		ML	Hard/very dense, brown, SANDY SILT and gravel (ML), trace clayey silt, dry.				
33	5234.1 33.0		Bulk						SM	Very dense, gray/brown, SILTY SAND (SM), some gravel, trace clayey silt, dry.				
			SS4		44 50/3"	R	9 / 9							
40	5227.1													

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-24

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/19/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,975,910, E 872,908
ELEVATION: 5,267.1 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40	40.0		Bulk						ML	Hard, light reddish brown, SANDY SILT (ML), some gravel, trace clayey silt, dry, slightly cohesive.				
45														
			SS5		50/1"	R	1 / 1							
50	5217.1 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-25

Golder Associates

SHEET: 1 OF 2

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/18/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,971,726, E 874,570
ELEVATION: 5,212.2 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						GC	Dense to very dense, gray/brown, CLAYEY GRAVEL with sand (GC), well graded, dry.				
5			SS1		22 28 29	57	18 / 18							
			Bulk											
10			SS2		39 26 16	42	18 / 18							
			Bulk											
	5199.7 12.5		Bulk						ML	Hard, brown, SANDY SILT and gravel (ML), dry, slightly cohesive fines, trace CaCO3.				
15			SS3		18 21 20	41	18 / 18							
			Bulk											
20			SS4		15 15 33	48	18 / 18							
			Bulk											
	5190.2 22.0		Bulk						SC	Very dense, light reddish brown, CLAYEY SAND (SC), dry, trace gravel, trace CaCO3.				
25			SS5		10 27 31	58	18 / 18							
			Bulk											
30			SS6		5 22 35	57	18 / 18							
			Bulk											
			SS7		6 9 16	25	18 / 18							
35	5177.2 35.0		Bulk						CL-ML	Very stiff, red, SILTY CLAY (CL-ML), dry, cohesive.				
40			SS8		8 8	25	18 / 18							

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-25

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/18/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,971,726, E 874,570
ELEVATION: 5,212.2 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40					17				CL-ML	Very stiff, red, SILTY CLAY (CL-ML), dry, cohesive. *(continued)*				
			Bulk											
			SS9		11 10 25	35	18 / 18							
45	5167.2 45.0		Bulk						CH	Hard, red, CLAY (CH), dry, sand seam at 44' to 44.5'.				
			SS10		10 18 26	44	18 / 18							
50	5161.7 50.5									Bottom of borehole at 50.5'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-26

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/18/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-26 2 feet south
XY COORDINATES: N 11,971,618, E 872,048
ELEVATION: 5,312.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag(2)						GW	Dense, brown, GRAVEL (GW), some sand, dry.				
2.0	5310.0		Bulk						SW	Very dense, gray/brown, SAND and gravel (SW), dry, sheen.				
8.0	5304.0		SS1 Bulk		27 50/3"	R	9 / 9		GW	Very dense, dark gray, GRAVEL (GW), some sand, dry.				
15.0	5297.0		Bag(2)						SW	Very dense, brown/dark gray, SAND and gravel (SW), dry.				
			SS2 Bulk		50/4"	R	4 / 4			Becomes gray/light brown, trace CaCO3.				
			SS3 SS		25 50/2"	R	8 / 8							
33.0	5279.0		Bag(2)						SW-SM	Very dense, gray/light brown, SILTY SAND (SW-SM), some gravel, dry, slightly cohesive, trace clayey silt.				
			SS4 Bulk		21 50/5"	R	11 / 4							
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

Golder Associates

REPORT OF BOREHOLE: BH-26

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/18/13
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-26 2 feet south
XY COORDINATES: N 11,971,618, E 872,048
ELEVATION: 5,312.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40									SW-SM	Very dense, gray/light brown, SILTY SAND (SW-SM), some gravel, dry, slightly cohesive, trace clayey silt. *(continued)*				
45														
			SS5		50/2"	R	2 / 5							
50	5262.0 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-27

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/23/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,973,983, E 874,918
ELEVATION: 5,198.1 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bulk						SM	Dense, brown, SILTY SAND and gravel (50%) (SM), dry, trace CaCO3, some cementation.				
			SS1		17 16 15	31	18 / 18							
			Bulk											
	5186.1 12.0		Bulk						ML	Hard, light brown/white-gray, SANDY SILT (ML), some gravel, dry, some CaCO3, cementation.				
			SS2		30 58/6"	R	12 / 12							
			Bulk											
	5175.1 23.0								SW	Very dense, brown, SAND and gravel (SW), dry.				
	5172.1 26.0		SS3		20 24 33	57	18 / 18		CH	Hard, reddish brown, CLAY (CH), dry.				
	5170.6 27.5		Bulk						MH	Very stiff, light reddish brown, CLAYEY SILT (MH), some clay, dry, trace gravel.				
			SS4		10 7 13	20	18 / 18							
			Bulk											
	5159.6 38.5		SS5		12 24 30	54	18 / 18		CL-ML	Very stiff-hard, reddish brown, SILTY CLAY (CL-ML), dry, low plasticity, trace CaCO3 inclusions.				
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

RPT:TUC GEOTECH SOIL PROJ:103-92557 COPPER FLAT - COPY.GPJ TMPL:GLDR_TUC2.GDT LIB:GLDR_TUC_V1.GLB DATE:12/16/13

REPORT OF BOREHOLE: BH-27

Golder Associates

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 1/23/13
CHECKED: DP DATE: 2/21/13

LOCATION:
XY COORDINATES: N 11,973,983, E 874,918
ELEVATION: 5,198.1 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: HSA, Air Hammer
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
40			Bulk						CL-ML	Very stiff-hard, reddish brown, SILTY CLAY (CL-ML), dry, low plasticity, trace CaCO3 inclusions. *(continued)*				
			SS6		10 12 17	29	18 / 18							
45			Bulk											
			SS7		14 20 27	47	18 / 18							
50	5148.1 50.0									Bottom of borehole at 50'. Backfilled with cuttings. No groundwater encountered in boring.				
55														
60														
65														
70														
75														
80														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

Golder Associates

REPORT OF BOREHOLE: BH-28

SHEET: 1 OF 1

PROJECT: Geotech Investigation, Tailings Storage Facility
PROJECT NO.: 103-92557
CLIENT: New Mexico Copper Corp.
LOGGED: CMT DATE: 12/18/12
CHECKED: DP DATE: 2/21/13

LOCATION: Moved BH-28 2 feet east
XY COORDINATES: N 11,975,241, E 870,785
ELEVATION: 5,388.0 ft.

DRILLING CONTRACTOR: Yellow Jacket
DRILL RIG: CME-1250
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Auto Hammer
HOLE DIAMETER: 8.25

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0			Bag						GW	Dense, light gray, SANDY GRAVEL (GW), dry, few cobbles.				
			SS1		9 13 18	31								
5	5383.0 5.0		Bulk and Bag						GP	Dense, light gray, SANDY GRAVEL (GP), dry.				
			SS2		22 32 50	82				Becomes very dense, white inclusions, sheen, dry.				
10	5378.0 10.0		Bag						GW	Very dense, light gray, SANDY GRAVEL (GW), dry, few cobbles.				
	5377.0 11.0		Bulk and Bag						SM	Very dense, light brown and gray, gravelly SILTY SAND (SM), dry.				
	5374.5 13.5		SS3 Bulk and Bag		30 30/3"	R			SW	Very dense, light brown and gray, gravelly SAND (SW), sheen, dry.				
	5369.0 19.0		SS4 Bulk and Bag Bag		50/4"	R			GW	Seam of very dense, light gray, SANDY GRAVEL (GW), dry. Becomes light brown.				
	5367.0 21.0								SW	Very dense, light brown and gray, gravelly SAND, (SW) sheen, dry.				
	5366.0 22.0		SS5		50/0"	R				Refusal at 22'. Backfilled with cuttings. No groundwater encountered in boring.				
25														
30														
35														
40														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

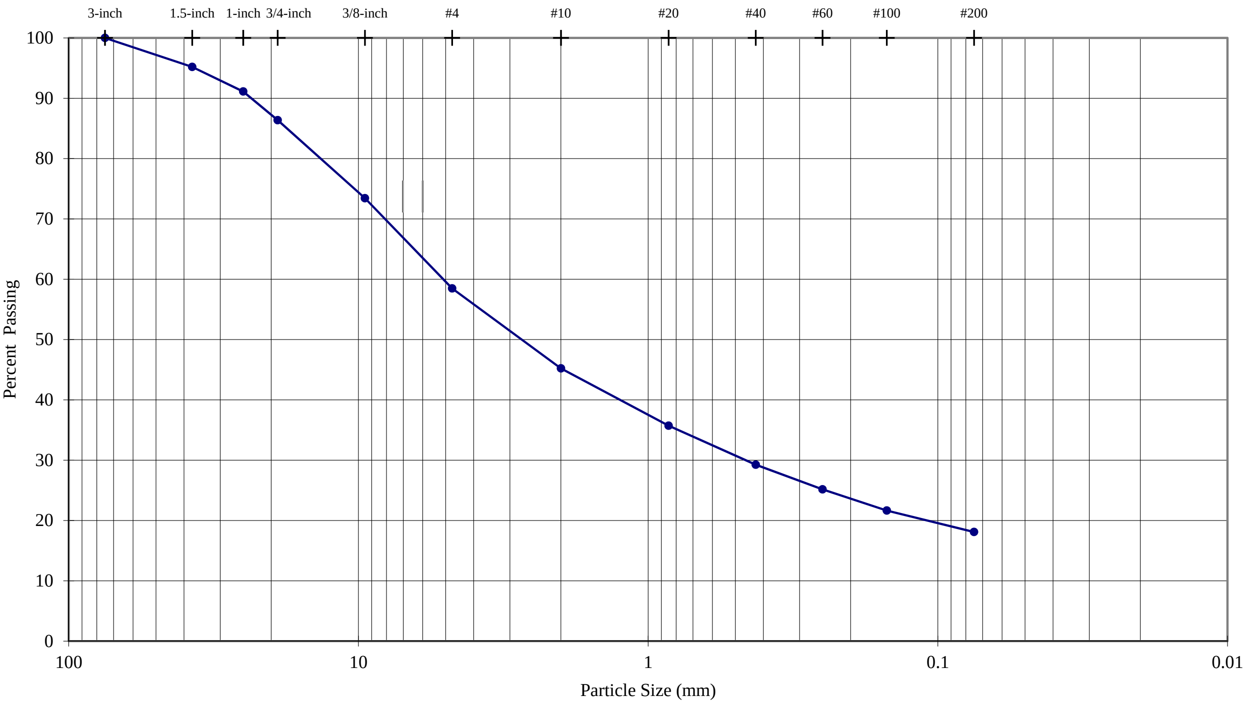
APPENDIX A.3
GEOTECHNICAL TEST RESULTS

APPENDIX A.3.1
GRADATION MOISTURE/DENSITY TEST REPORTS

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

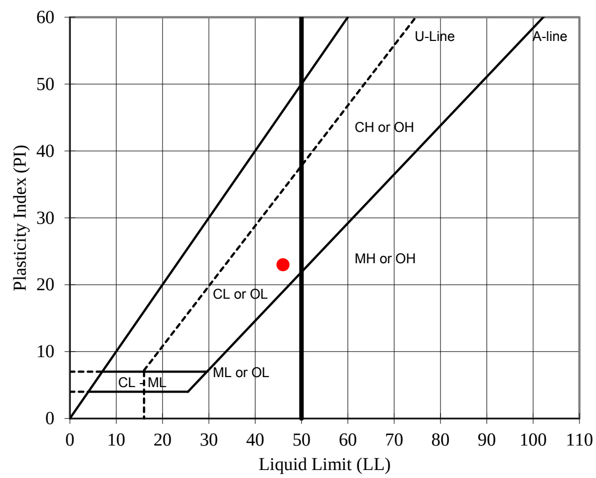
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-2** DEPTH (ft): **0-3.5**
TYPE: **Pail/Bag**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**95.2**
1-inch	25.0	**91.1**
3/4-inch	19.0	**86.4**
3/8-inch	9.5	**73.4**
#4	4.8	**58.5**
#10	2.00	**45.2**
#20	0.85	**35.7**
#40	0.43	**29.2**
#60	0.25	**25.2**
#100	0.15	**21.7**
#200	0.075	**18.1**

Description	Percentage
Coarse Gravel	**13.63**
Fine Gravel	**27.89**
Coarse Sand	**13.26**
Medium Sand	**15.98**
Fine Sand	**11.15**
Silt or Clay Fines	**18.10**



USCS Description (ASTM D 2487):

Clayey gravel with sand, olive brown, dry

LL	PL	PI
46	**23**	**23**

As-Received Moisture Content (%): --

USCS Group Symbol: GC

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

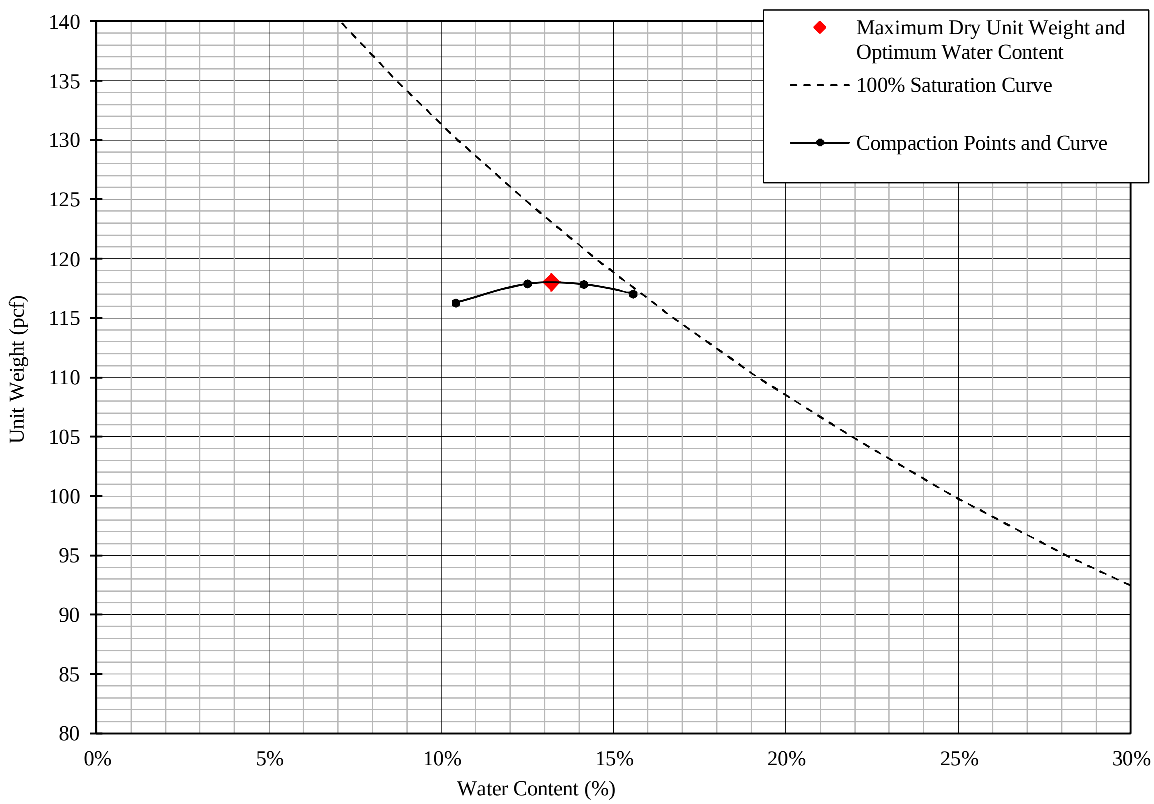
TECH	MGC
DATE	2/22/2013
REVIEW	MB

February-13 | 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method C

Manual Rammer	Dry Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-2** DEPTH (ft): **0-3.5**
TYPE: **Pail/Bag**



% Test Fraction Passing 3/4-inch Sieve	**87%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.67**

Maximum Dry Unit Weight (pcf)	**118.0**
Optimum Water Content (%)	**13.2**
Corrected Maximum Dry Unit Weight (pcf)	**122.4**
Corrected Optimum Water Content (%)	**11.5**

USCS Description (ASTM D 2487): Clayey gravel with sand, olive brown, dry

USCS GC

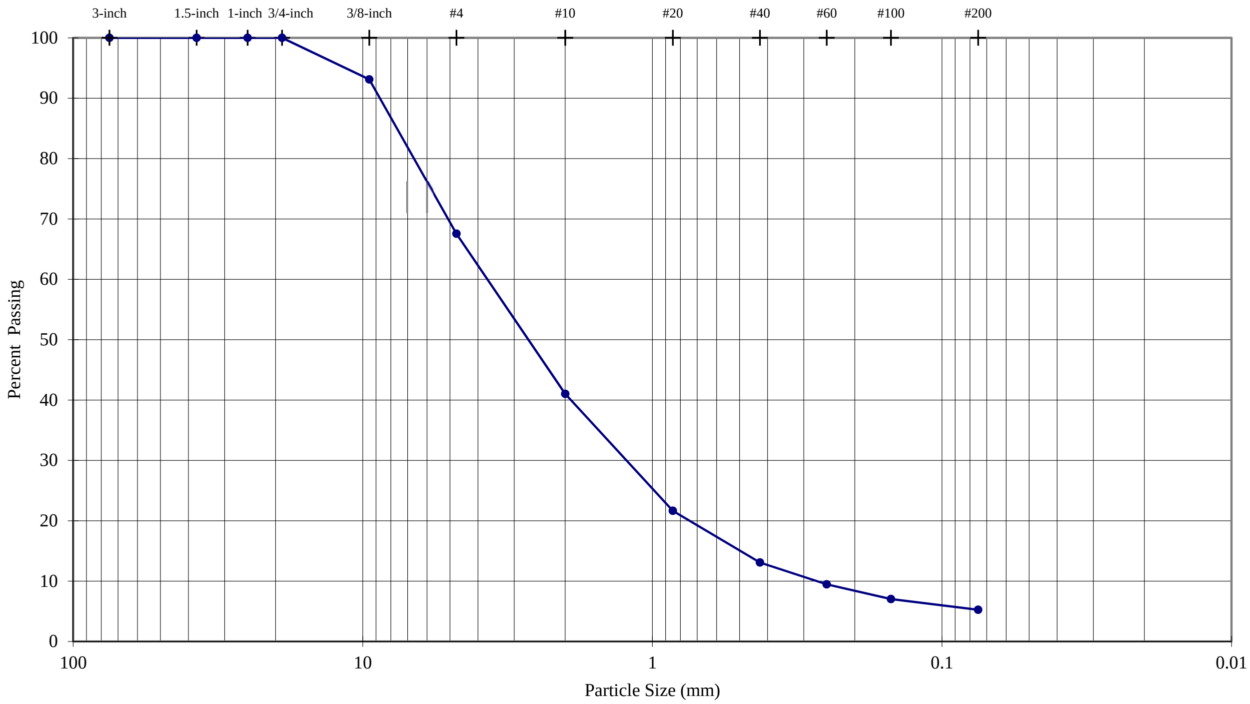
TECH	MGC
DATE	2-26-13
REVIEW	MB

February-13 103-92557

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

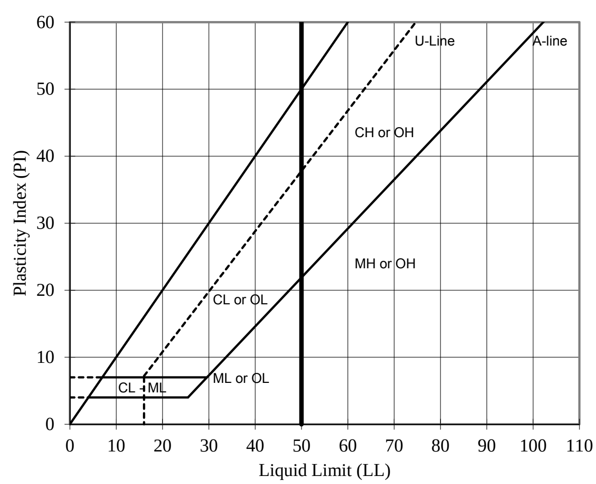
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-3** DEPTH (ft): **0-8**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**100.0**
3/8-inch	9.5	**93.1**
#4	4.8	**67.6**
#10	2.00	**41.0**
#20	0.85	**21.6**
#40	0.43	**13.1**
#60	0.25	**9.5**
#100	0.15	**7.0**
#200	0.075	**5.3**

Description	Percentage
Coarse Gravel	**0.00**
Fine Gravel	**32.44**
Coarse Sand	**26.53**
Medium Sand	**27.93**
Fine Sand	**7.83**
Silt or Clay Fines	**5.26**



LL	PL	PI
--	--	--

Visual Description (Golder Procedure):

Gravelly SAND, some fines, greenish gray, dry

As-Received Moisture Content (%)	USCS Group Symbol
--	--

Notes: 0g of particles up to 19.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed

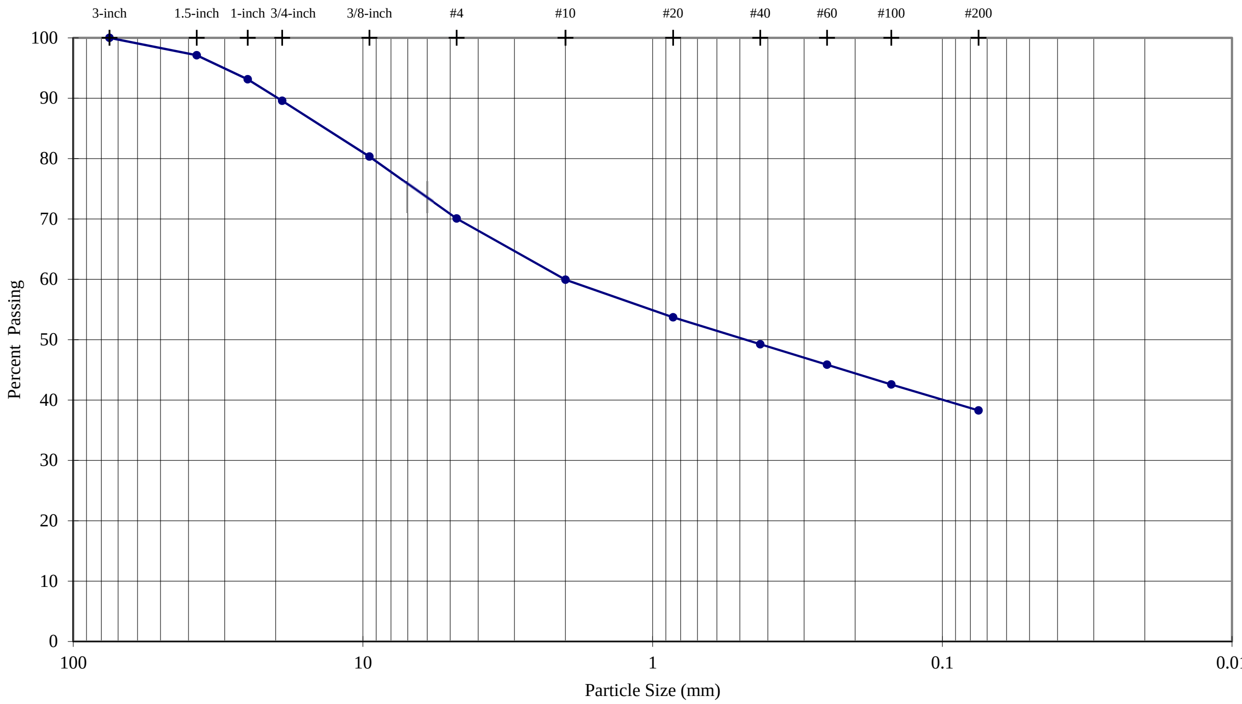
TECH	MGC
DATE	2/22/2013
REVIEW	MB

February-13 | 103-92557.006

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

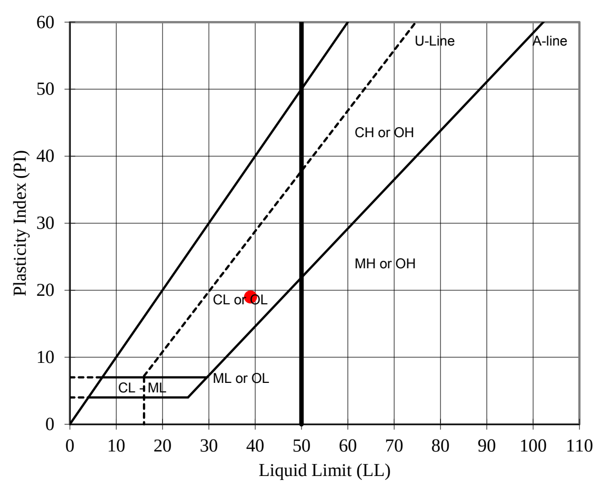
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-10** DEPTH (ft): **0-14.5**
TYPE: **Pail/Bag**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**97.1**
1-inch	25.0	**93.1**
3/4-inch	19.0	**89.6**
3/8-inch	9.5	**80.3**
#4	4.8	**70.1**
#10	2.00	**59.9**
#20	0.85	**53.7**
#40	0.43	**49.2**
#60	0.25	**45.9**
#100	0.15	**42.6**
#200	0.075	**38.3**

Description	Percentage
Coarse Gravel	**10.43**
Fine Gravel	**19.50**
Coarse Sand	**10.14**
Medium Sand	**10.69**
Fine Sand	**10.96**
Silt or Clay Fines	**38.28**



USCS Description (ASTM D 2487):
Clayey sand with gravel, light yellowish brown, dry

LL	PL	PI
39	**20**	**19**

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

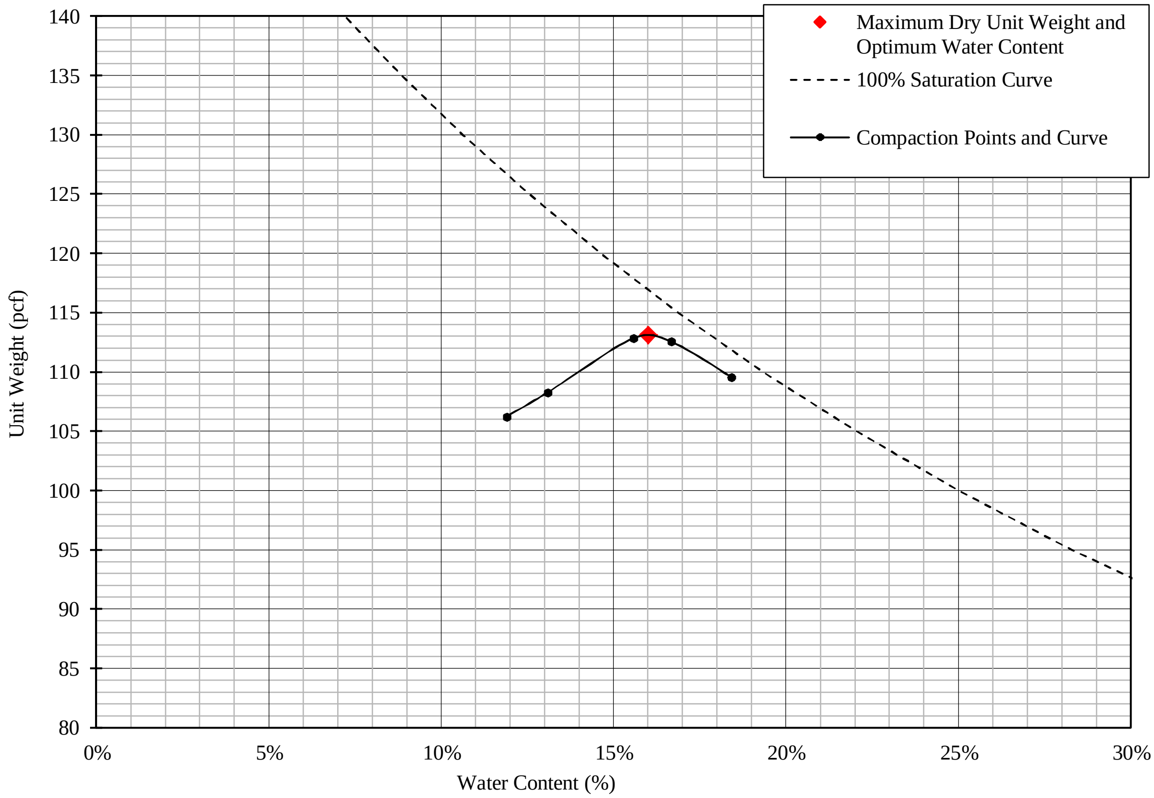
TECH	AMS/MGC
DATE	2/25/2013
REVIEW	MB

February-13 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method B

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-10** DEPTH (ft): **0-14.5**
TYPE: **Pail/Bag**



% Test Fraction Passing 3/8-inch Sieve	**81%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.68**

Maximum Dry Unit Weight (pcf)	**113.1**
Optimum Water Content (%)	**16.0**
Corrected Maximum Dry Unit Weight (pcf)	**120.0**
Corrected Optimum Water Content (%)	**13.2**

USCS Description (ASTM D 2487): Clayey sand with gravel, light yellowish brown, dry

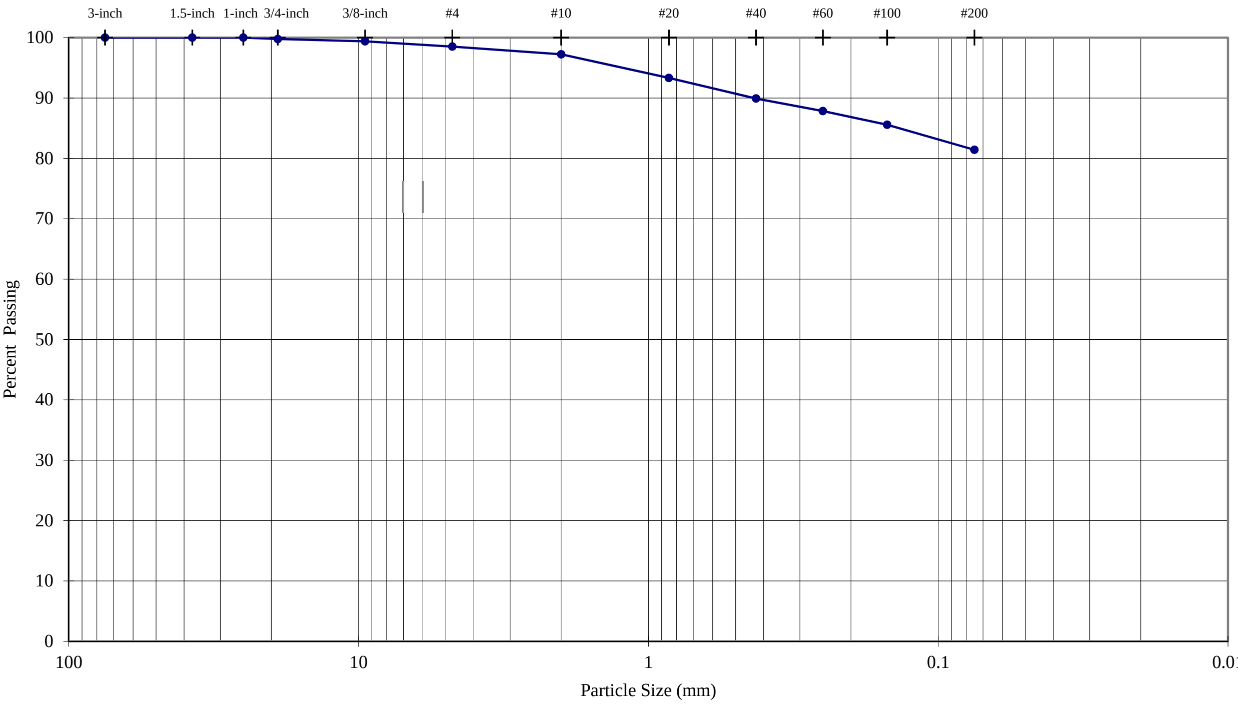
USCS SC

TECH	AMS
DATE	2-27-13
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

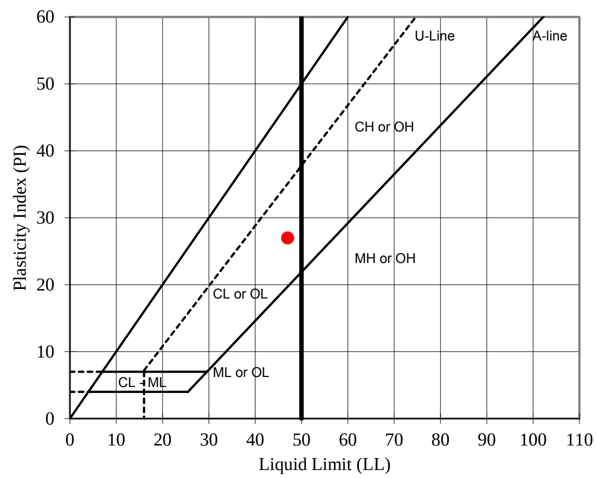
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-10** DEPTH (ft): **19-33**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**99.8**
3/8-inch	9.5	**99.4**
#4	4.8	**98.5**
#10	2.00	**97.2**
#20	0.85	**93.3**
#40	0.43	**89.9**
#60	0.25	**87.8**
#100	0.15	**85.6**
#200	0.075	**81.4**

Description	Percentage
Coarse Gravel	**0.23**
Fine Gravel	**1.25**
Coarse Sand	**1.28**
Medium Sand	**7.32**
Fine Sand	**8.49**
Silt or Clay Fines	**81.42**



USCS Description (ASTM D 2487):
Lean clay with sand, yellowish red, dry

LL	PL	PI
47	**20**	**27**

As-Received Moisture Content (%): **14.4**

USCS Group Symbol: CL

Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/25/2013
REVIEW	MB

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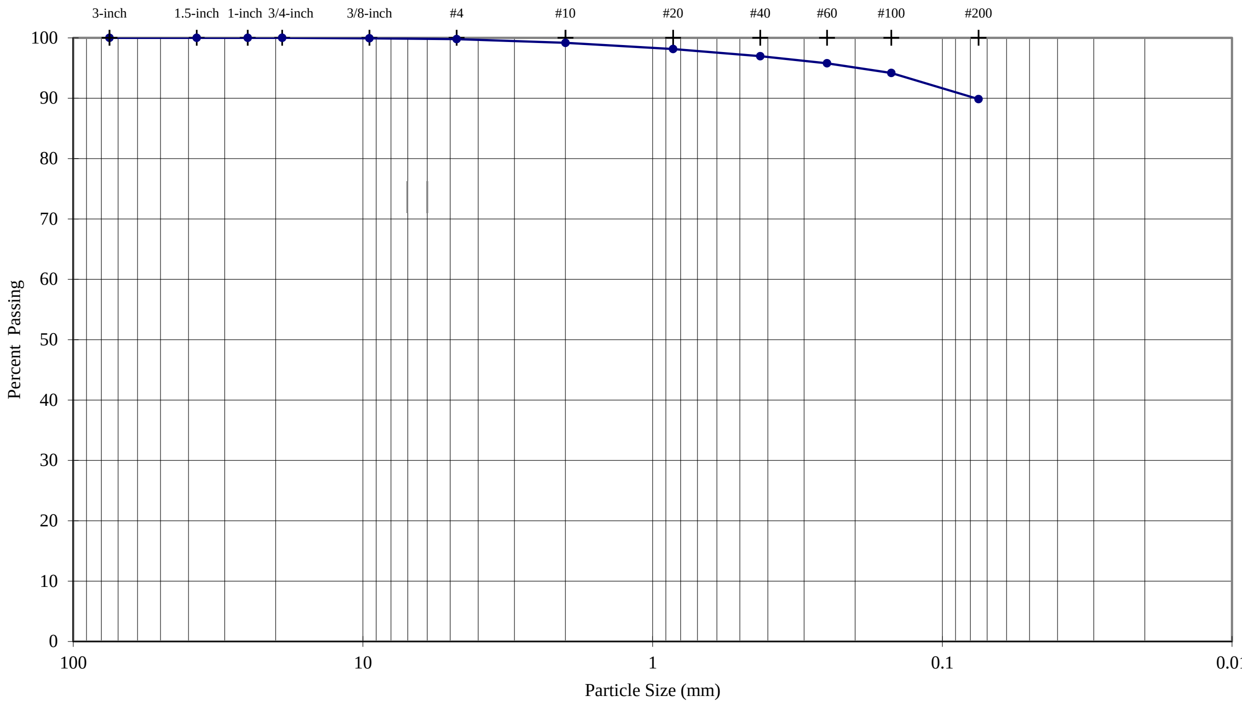
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

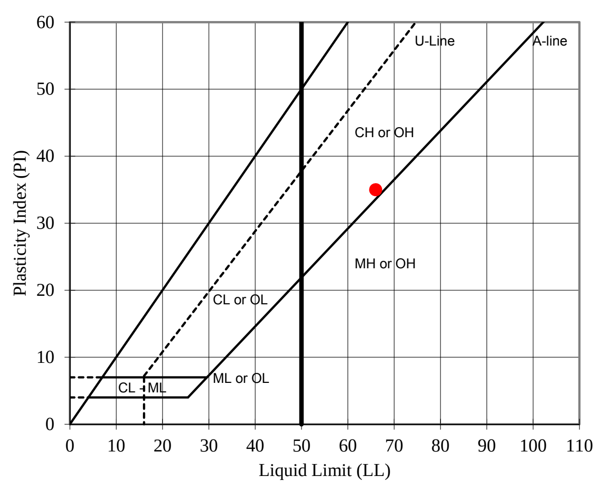
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-12** DEPTH (ft): **33.5-48.5**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**100.0**
3/8-inch	9.5	**99.9**
#4	4.8	**99.8**
#10	2.00	**99.2**
#20	0.85	**98.1**
#40	0.43	**97.0**
#60	0.25	**95.8**
#100	0.15	**94.2**
#200	0.075	**89.9**

Description	Percentage
Coarse Gravel	**0.00**
Fine Gravel	**0.21**
Coarse Sand	**0.62**
Medium Sand	**2.21**
Fine Sand	**7.10**
Silt or Clay Fines	**89.86**



LL	PL	PI
66	**31**	**35**

USCS Description (ASTM D 2487):

Fat clay, dark red, moist

As-Received Moisture Content (%): --

USCS Group Symbol: CH

Notes: 0g of particles up to 19.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

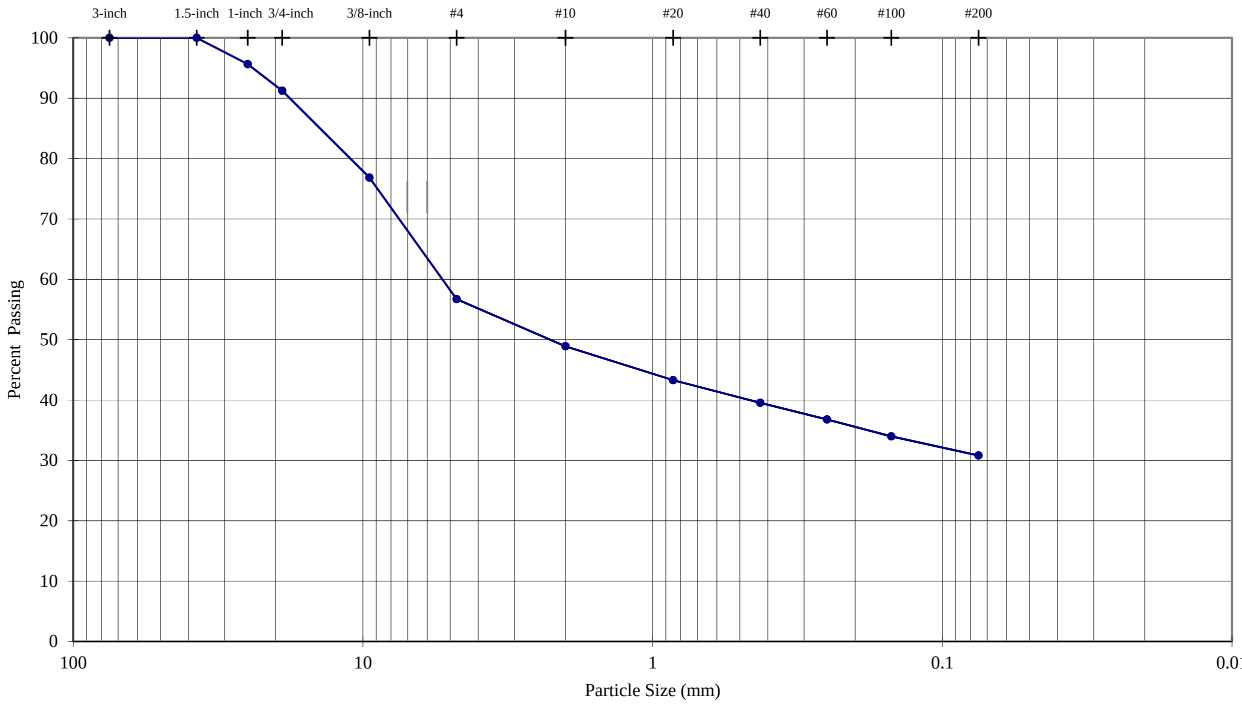
TECH	AM
DATE	2/26/2013
REVIEW	MB

February-13 **103-92557.006**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

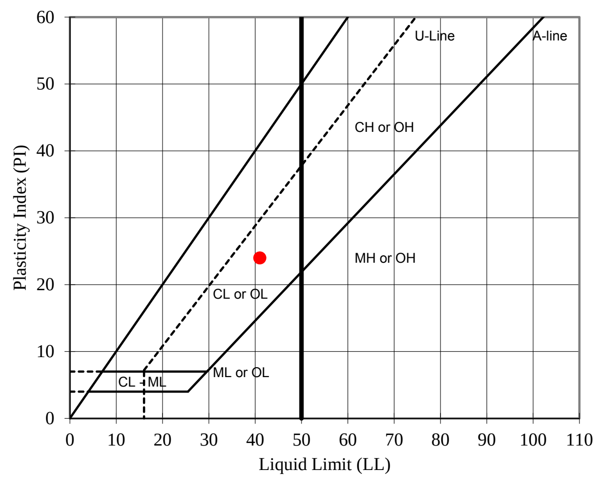
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-16** DEPTH (ft): **0-8.5**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**95.7**
3/4-inch	19.0	**91.2**
3/8-inch	9.5	**76.9**
#4	4.8	**56.7**
#10	2.00	**48.9**
#20	0.85	**43.3**
#40	0.43	**39.5**
#60	0.25	**36.8**
#100	0.15	**34.0**
#200	0.075	**30.8**

Description	Percentage
Coarse Gravel	**8.75**
Fine Gravel	**34.54**
Coarse Sand	**7.80**
Medium Sand	**9.36**
Fine Sand	**8.73**
Silt or Clay Fines	**30.81**



LL	PL	PI
41	**17**	**24**

USCS Description (ASTM D 2487):
Clayey gravel with sand, reddish brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: GC

Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

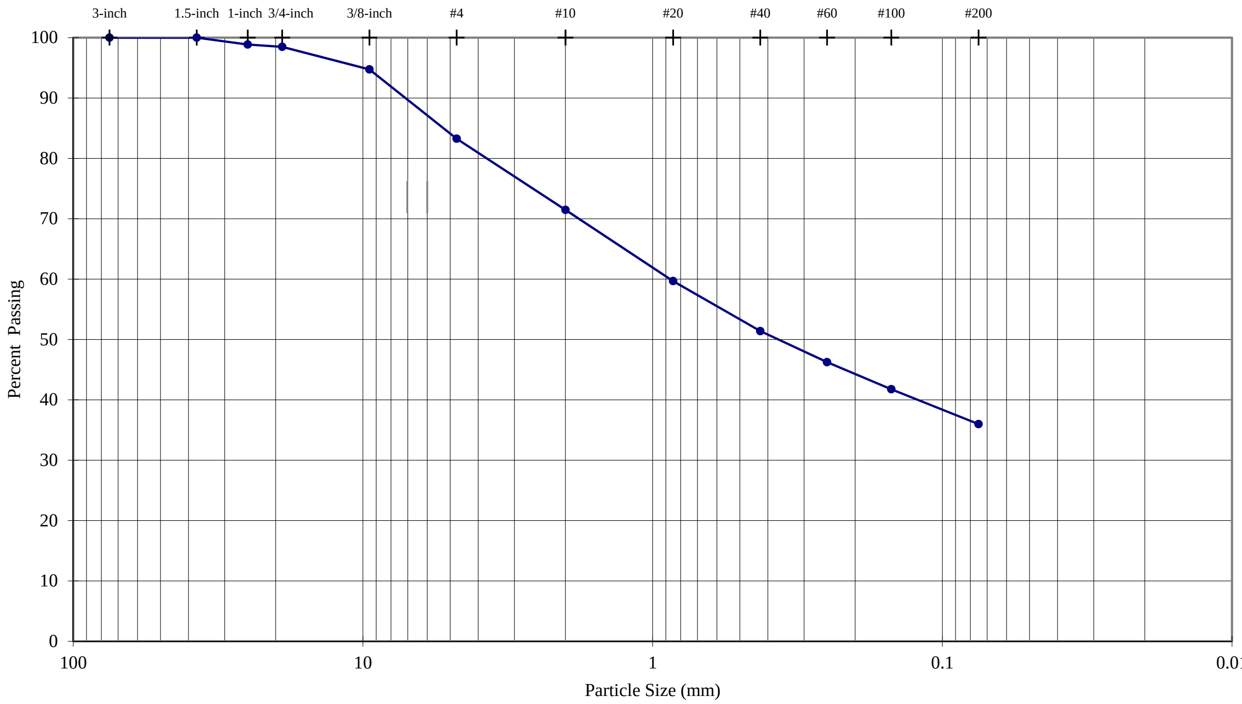
TECH	AMS
DATE	2/27/2013
REVIEW	MB

February-13 103-92557.006

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

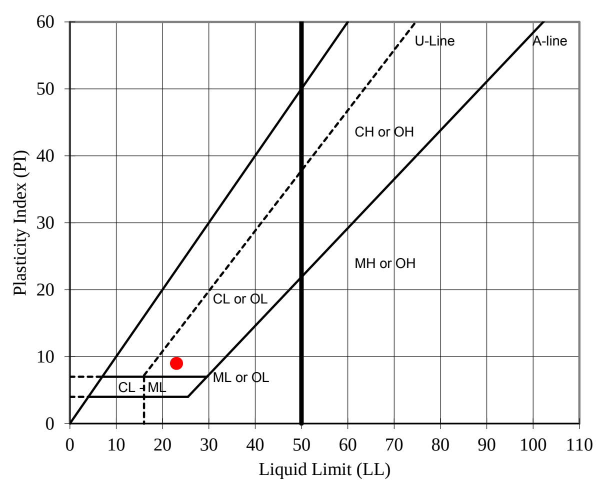
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-16** DEPTH (ft): **29-34**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**98.9**
3/4-inch	19.0	**98.5**
3/8-inch	9.5	**94.7**
#4	4.8	**83.3**
#10	2.00	**71.5**
#20	0.85	**59.7**
#40	0.43	**51.4**
#60	0.25	**46.2**
#100	0.15	**41.8**
#200	0.075	**36.0**

Description	Percentage
Coarse Gravel	**1.52**
Fine Gravel	**15.22**
Coarse Sand	**11.79**
Medium Sand	**20.08**
Fine Sand	**15.41**
Silt or Clay Fines	**35.98**



LL	PL	PI
23	**14**	**9**

USCS Description (ASTM D 2487):

Clayey sand with gravel, yellowish brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	EH
DATE	2/26/2013
REVIEW	MB

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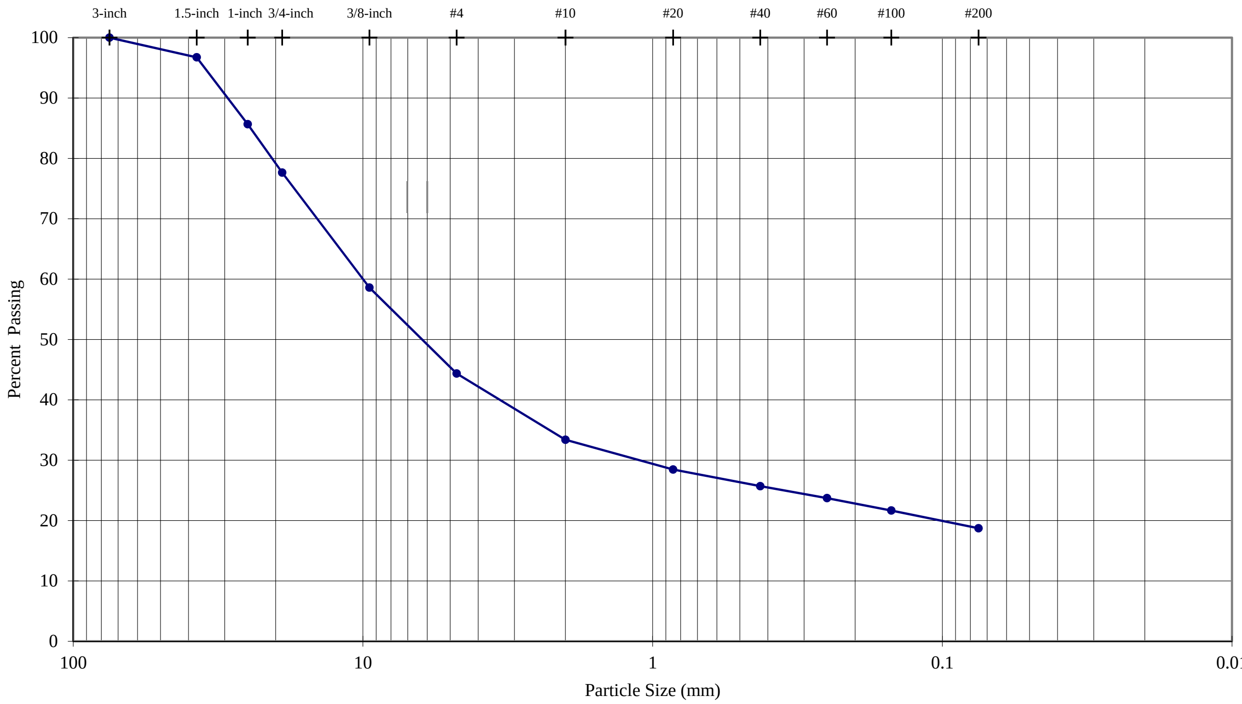
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**

SAMPLE ID: **BH-18** DEPTH (ft): **2-8**

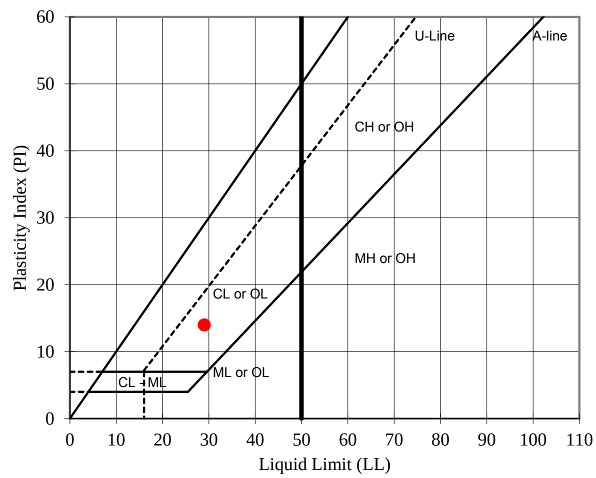
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**96.7**
1-inch	25.0	**85.7**
3/4-inch	19.0	**77.6**
3/8-inch	9.5	**58.6**
#4	4.8	**44.4**
#10	2.00	**33.4**
#20	0.85	**28.5**
#40	0.43	**25.7**
#60	0.25	**23.7**
#100	0.15	**21.7**
#200	0.075	**18.7**

Description	Percentage
Coarse Gravel	**22.35**
Fine Gravel	**33.28**
Coarse Sand	**10.98**
Medium Sand	**7.68**
Fine Sand	**6.98**
Silt or Clay Fines	**18.73**



USCS Description (ASTM D 2487):

Clayey gravel with sand, yellowish brown, dry

LL	PL	PI
29	**15**	**14**

As-Received Moisture Content (%): --

USCS Group Symbol: GC

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/28/2013
REVIEW	MB

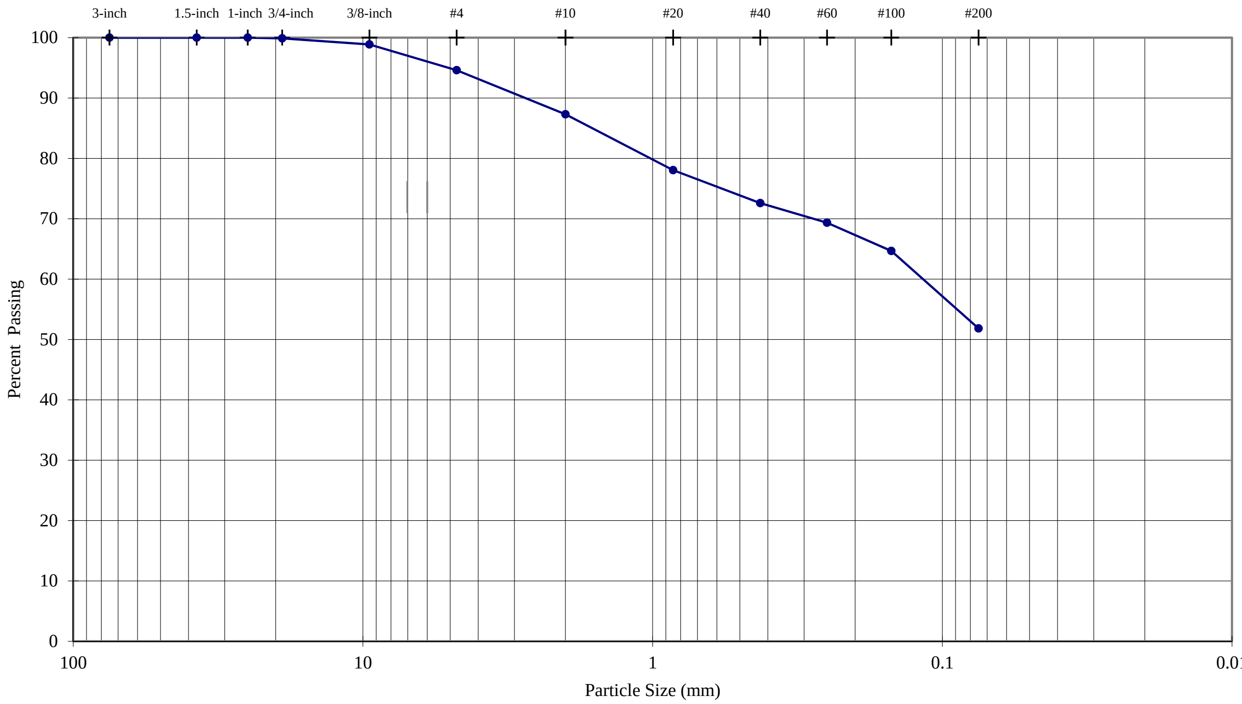
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**

SAMPLE ID: **BH-18** DEPTH (ft): **23-33.5**

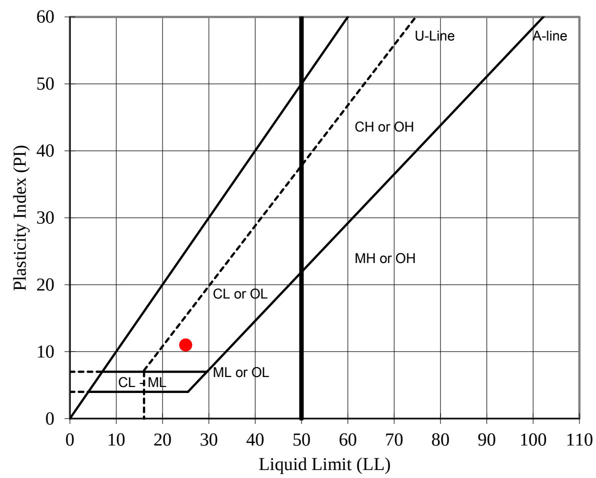
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**99.9**
3/8-inch	9.5	**98.9**
#4	4.8	**94.6**
#10	2.00	**87.3**
#20	0.85	**78.1**
#40	0.43	**72.6**
#60	0.25	**69.3**
#100	0.15	**64.7**
#200	0.075	**51.8**

Description	Percentage
Coarse Gravel	**0.12**
Fine Gravel	**5.27**
Coarse Sand	**7.30**
Medium Sand	**14.72**
Fine Sand	**20.76**
Silt or Clay Fines	**51.84**



USCS Description (ASTM D 2487):

Sandy lean clay, reddish brown, moist

LL	PL	PI
25	**14**	**11**

As-Received Moisture Content (%): **#DIV/0!**

USCS Group Symbol: CL

Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

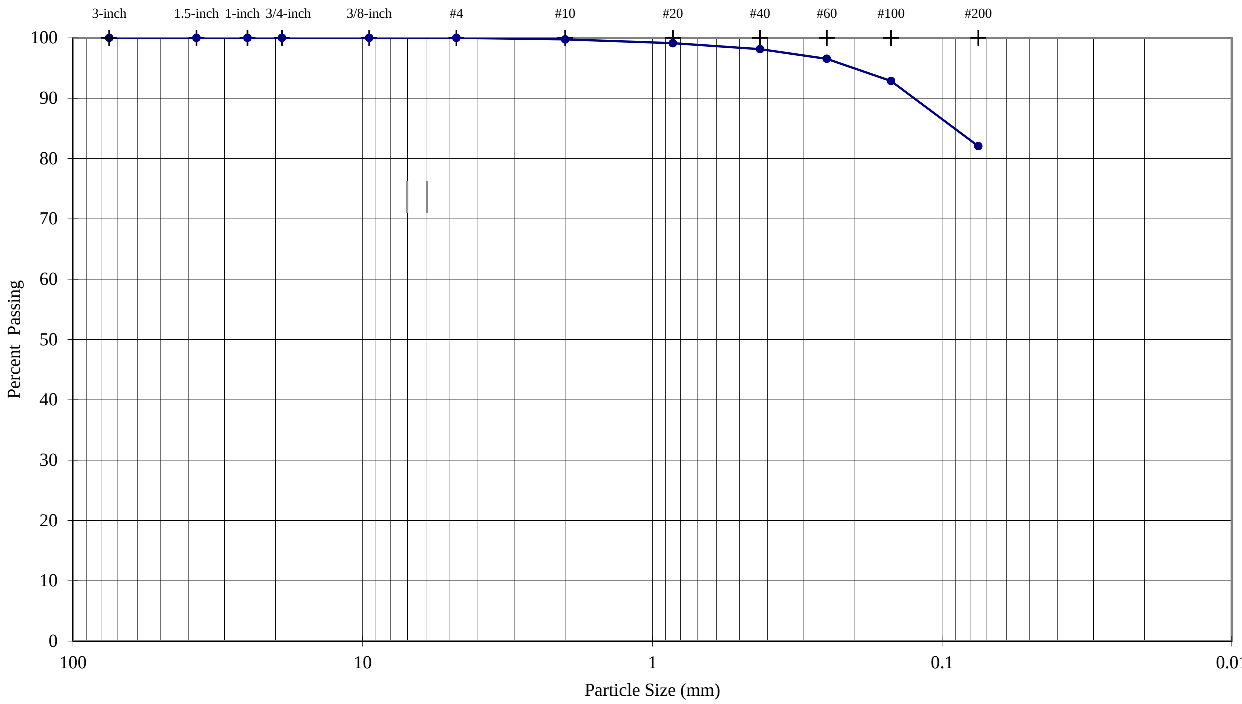
TECH	AMS
DATE	2/25/2013
REVIEW	MB

February-13 103-92557.006

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

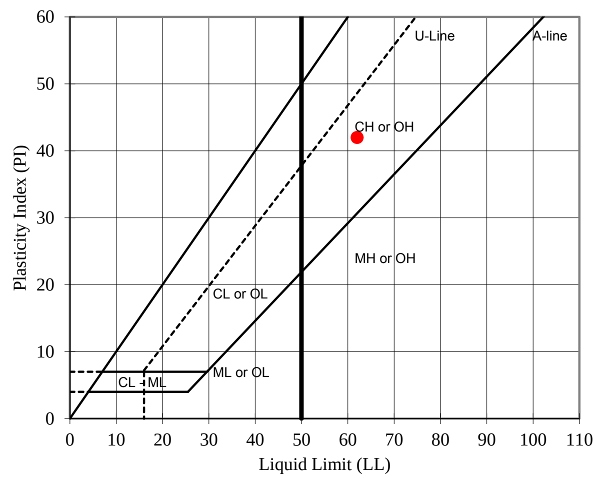
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-18** DEPTH (ft): **43.5-48.5**
TYPE: **Bag**



Sieve Analysis

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**100.0**
3/8-inch	9.5	**100.0**
#4	4.8	**100.0**
#10	2.00	**99.7**
#20	0.85	**99.1**
#40	0.43	**98.1**
#60	0.25	**96.5**
#100	0.15	**92.9**
#200	0.075	**82.1**

Description	Percentage
Coarse Gravel	**0.00**
Fine Gravel	**0.00**
Coarse Sand	**0.25**
Medium Sand	**1.61**
Fine Sand	**16.07**
Silt or Clay Fines	**82.06**



LL	PL	PI
62	**20**	**42**

USCS Description (ASTM D 2487):
Fat clay with sand, dark red, wet

As-Received Moisture Content (%): **29.6**

USCS Group Symbol: CH

Notes: 0g of particles up to 4.8mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the wet method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/25/2013
REVIEW	MB

February-13 | 103-92557.006

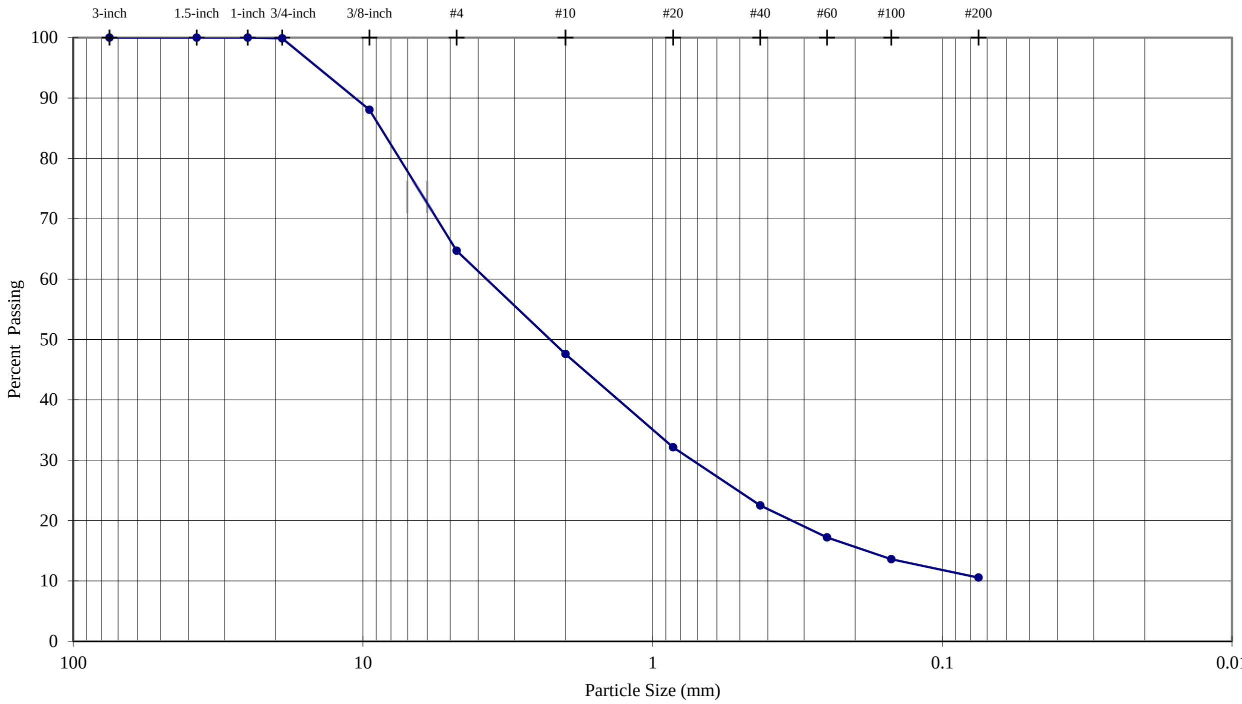
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**

SAMPLE ID: **BH-21** DEPTH (ft): **0-18**

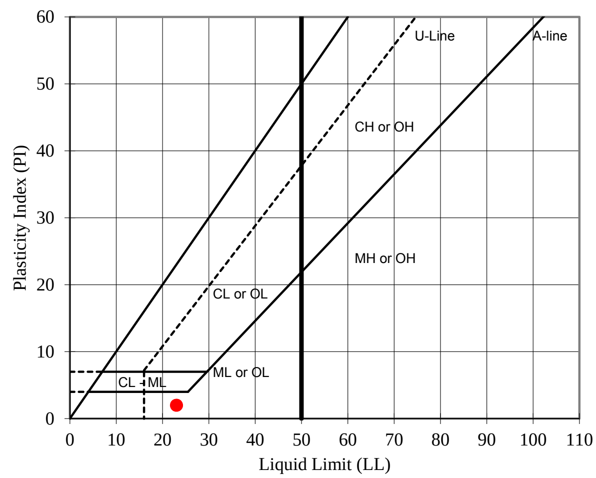
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**99.9**
3/8-inch	9.5	**88.1**
#4	4.8	**64.7**
#10	2.00	**47.6**
#20	0.85	**32.1**
#40	0.43	**22.5**
#60	0.25	**17.2**
#100	0.15	**13.6**
#200	0.075	**10.6**

Description	Percentage
Coarse Gravel	**0.12**
Fine Gravel	**35.18**
Coarse Sand	**17.11**
Medium Sand	**25.09**
Fine Sand	**11.95**
Silt or Clay Fines	**10.55**



LL	PL	PI
23	**21**	**2**

USCS Description (ASTM D 2487):

Well-graded sand with silt and gravel, yellowish red, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SW-SM

Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

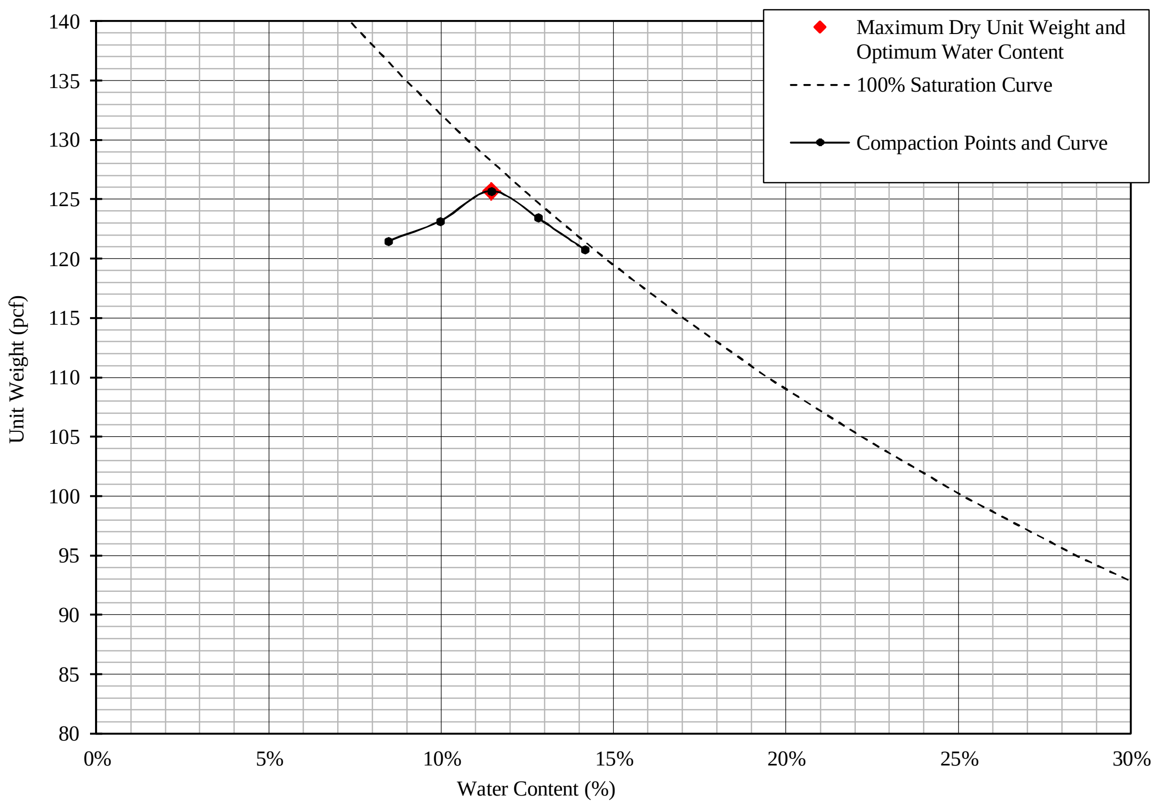
TECH	AMS
DATE	2/26/2013
REVIEW	MB

February-13 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method B

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-21** DEPTH (ft): **0-18**
TYPE: **Pail**



% Test Fraction Passing 3/8-inch Sieve	**88%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.69**

Maximum Dry Unit Weight (pcf)	**125.7**
Optimum Water Content (%)	**11.4**
Corrected Maximum Dry Unit Weight (pcf)	**129.2**
Corrected Optimum Water Content (%)	**10.1**

USCS Description (ASTM D 2487): Well-graded sand with silt and gravel, yellowish red, dry

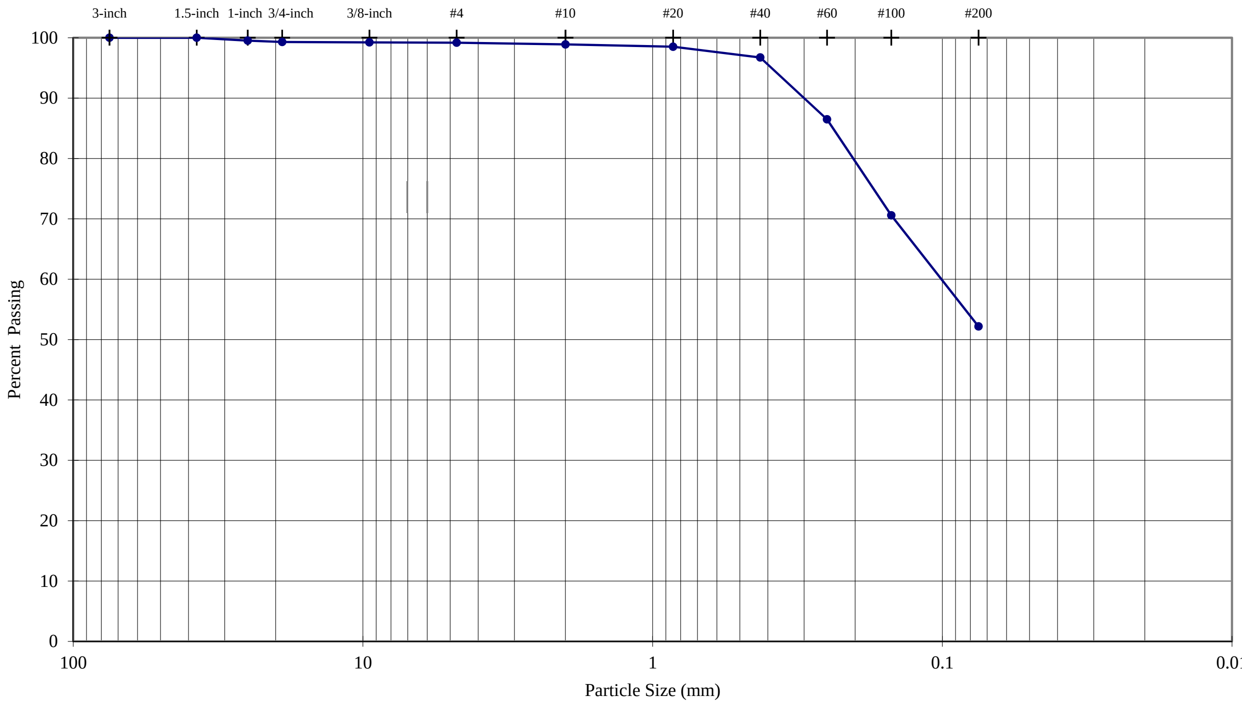
USCS SW-SM

TECH	AMS
DATE	2-27-13
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

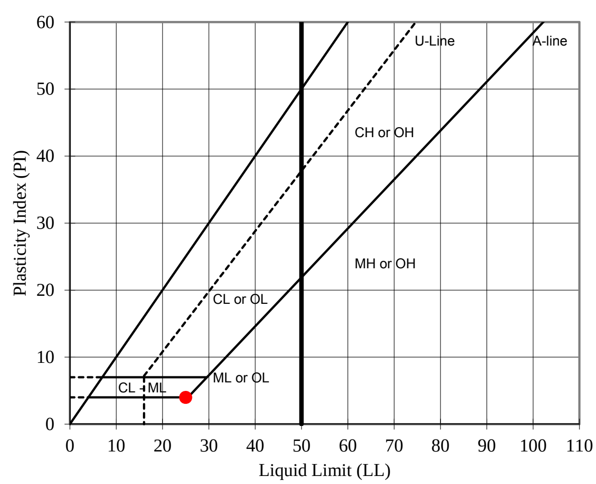
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-22** DEPTH (ft): **5-8.5**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**99.5**
3/4-inch	19.0	**99.3**
3/8-inch	9.5	**99.2**
#4	4.8	**99.2**
#10	2.00	**98.9**
#20	0.85	**98.5**
#40	0.43	**96.7**
#60	0.25	**86.5**
#100	0.15	**70.6**
#200	0.075	**52.2**

Description	Percentage
Coarse Gravel	**0.70**
Fine Gravel	**0.12**
Coarse Sand	**0.28**
Medium Sand	**2.17**
Fine Sand	**44.55**
Silt or Clay Fines	**52.18**



LL	PL	PI
25	**21**	**4**

USCS Description (ASTM D 2487):
Sandy silty clay, brownish yellow, moist

As-Received Moisture Content (%): --

USCS Group Symbol: CL-ML

Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

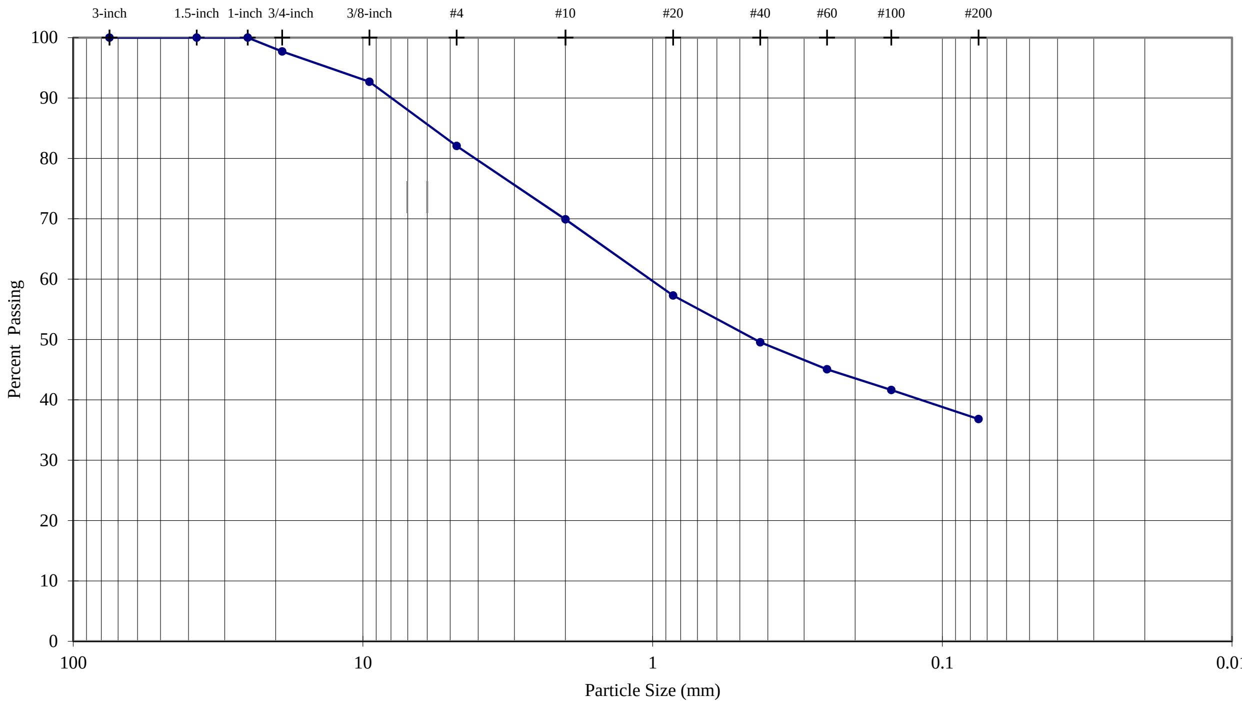
TECH	EH
DATE	2/26/2013
REVIEW	MB

February-13 | 103-92557.006

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

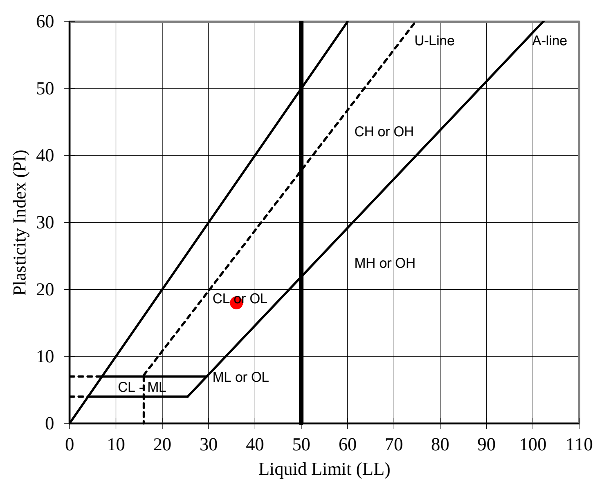
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-22** DEPTH (ft): **28-30**
TYPE: **Bag**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**97.7**
3/8-inch	9.5	**92.7**
#4	4.8	**82.1**
#10	2.00	**69.9**
#20	0.85	**57.3**
#40	0.43	**49.5**
#60	0.25	**45.1**
#100	0.15	**41.6**
#200	0.075	**36.8**

Description	Percentage
Coarse Gravel	**2.29**
Fine Gravel	**15.65**
Coarse Sand	**12.16**
Medium Sand	**20.36**
Fine Sand	**12.71**
Silt or Clay Fines	**36.82**



LL	PL	PI
36	**18**	**18**

USCS Description (ASTM D 2487):

Clayey sand with gravel, reddish brown, moist

As-Received Moisture Content (%): **10.4**

USCS Group Symbol: SC

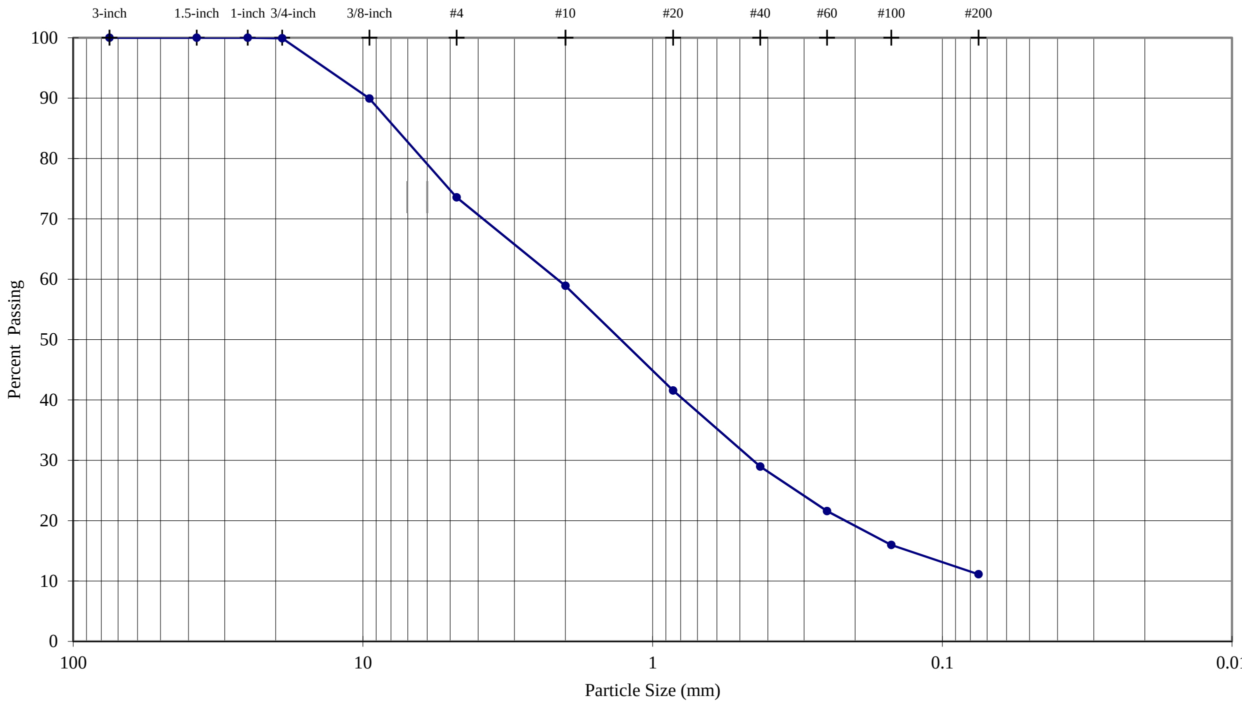
Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/25/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

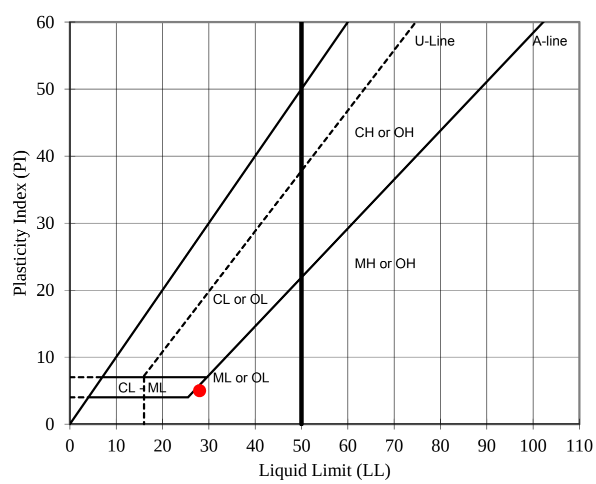
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-24** DEPTH (ft): **2.5-18**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**99.9**
3/8-inch	9.5	**89.9**
#4	4.8	**73.6**
#10	2.00	**58.9**
#20	0.85	**41.6**
#40	0.43	**29.0**
#60	0.25	**21.6**
#100	0.15	**16.0**
#200	0.075	**11.1**

Description	Percentage
Coarse Gravel	**0.09**
Fine Gravel	**26.35**
Coarse Sand	**14.65**
Medium Sand	**29.96**
Fine Sand	**17.83**
Silt or Clay Fines	**11.12**



LL	PL	PI
28	**23**	**5**

USCS Description (ASTM D 2487):
Well-graded sand with silt and gravel, weak red, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SW-SM

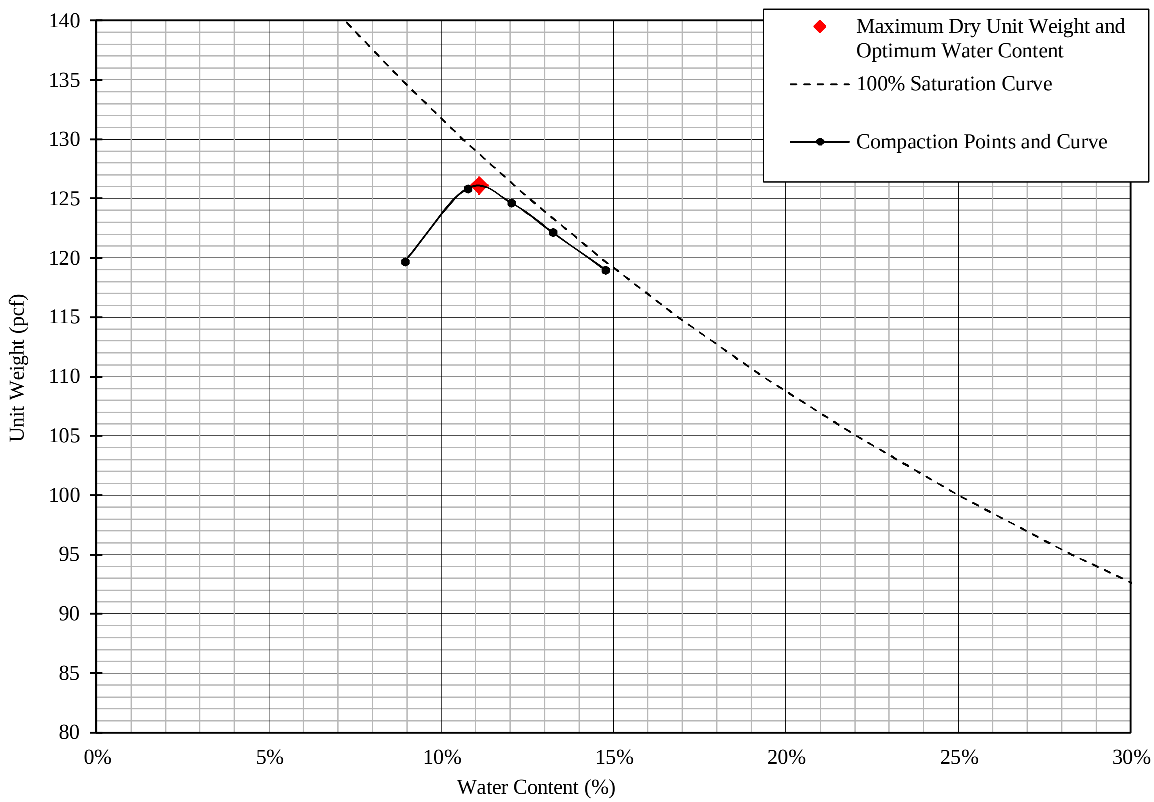
Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/27/2013
REVIEW	MB

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method B

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-24** DEPTH (ft): **2.5-18**
TYPE: **Pail**



% Test Fraction Passing 3/8-inch Sieve	**90%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.68**

Maximum Dry Unit Weight (pcf)	**126.1**
Optimum Water Content (%)	**11.1**
Corrected Maximum Dry Unit Weight (pcf)	**128.9**
Corrected Optimum Water Content (%)	**10.0**

USCS Description (ASTM D 2487): Well-graded sand with silt and gravel, weak red, dry

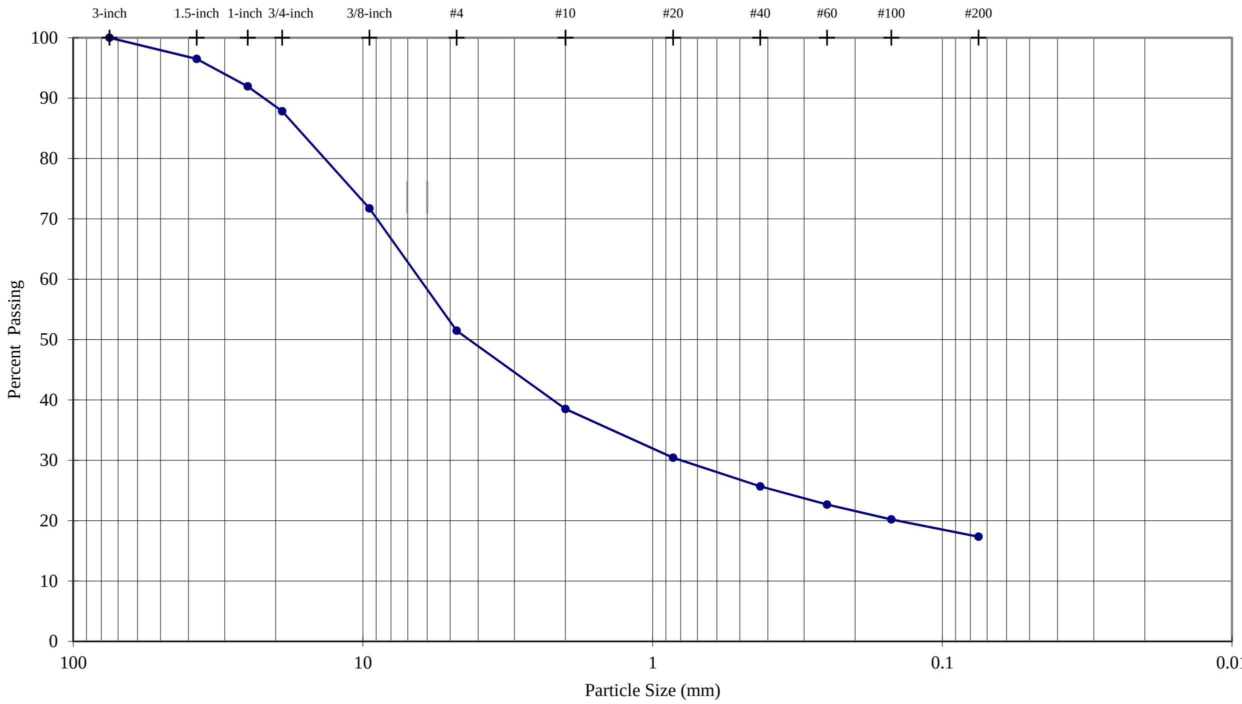
USCS SW-SM

TECH	AMS
DATE	2-27-13
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

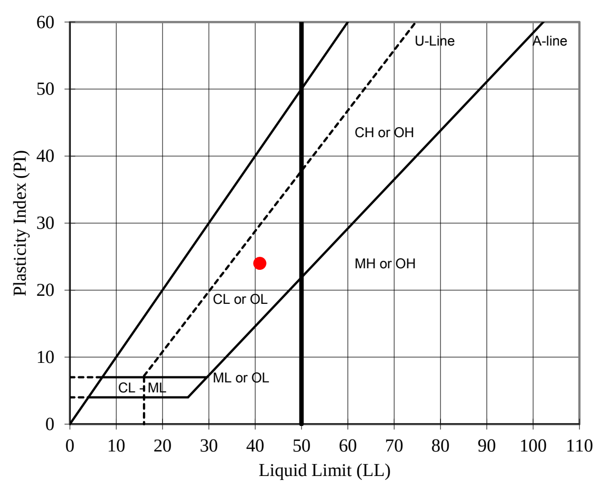
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-25** DEPTH (ft): **0-12.5**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**96.5**
1-inch	25.0	**91.9**
3/4-inch	19.0	**87.8**
3/8-inch	9.5	**71.7**
#4	4.8	**51.5**
#10	2.00	**38.5**
#20	0.85	**30.4**
#40	0.43	**25.7**
#60	0.25	**22.7**
#100	0.15	**20.2**
#200	0.075	**17.3**

Description	Percentage
Coarse Gravel	**12.17**
Fine Gravel	**36.36**
Coarse Sand	**12.97**
Medium Sand	**12.83**
Fine Sand	**8.33**
Silt or Clay Fines	**17.34**



USCS Description (ASTM D 2487):
Clayey gravel with sand, dark yellowish brown, dry

LL	PL	PI
41	**17**	**24**

As-Received Moisture Content (%): --

USCS Group Symbol: GC

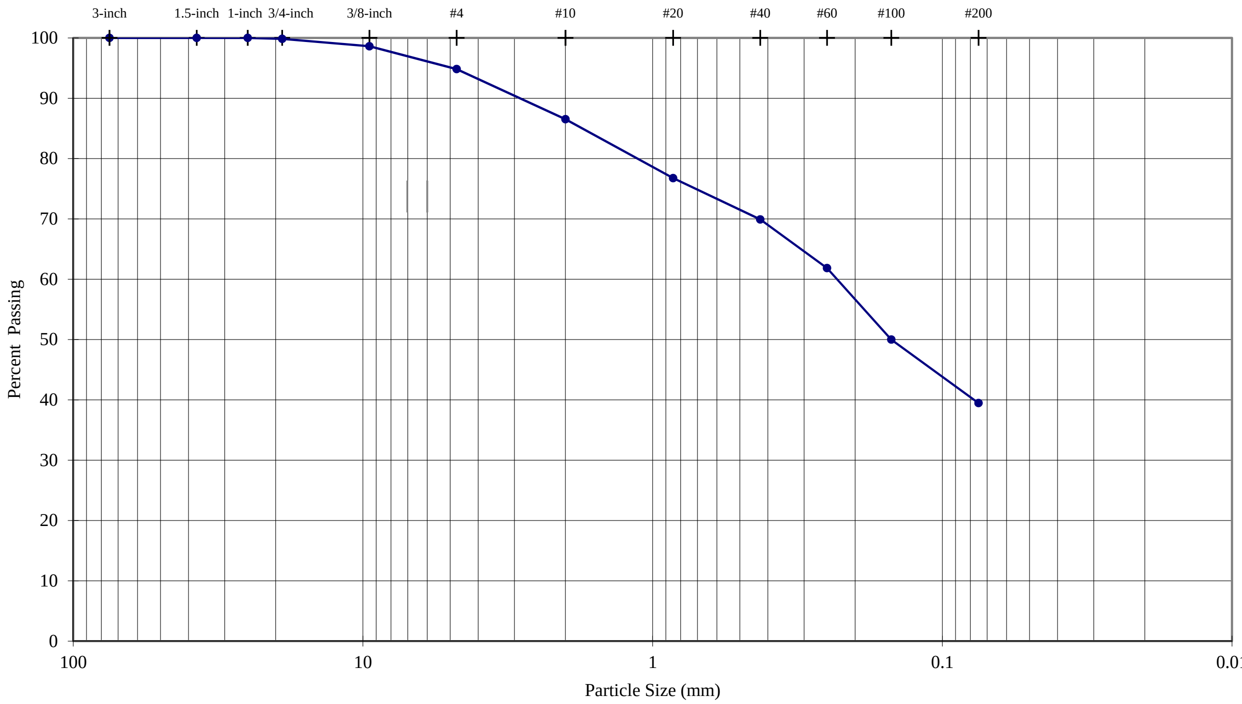
Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/27/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

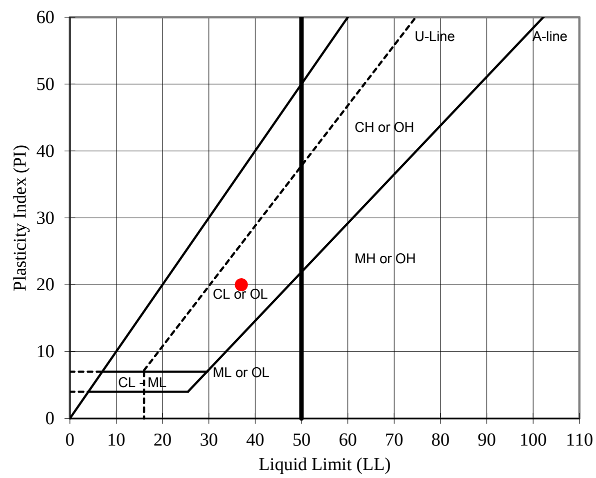
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **BH-25** DEPTH (ft): **22-34**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**99.8**
3/8-inch	9.5	**98.6**
#4	4.8	**94.8**
#10	2.00	**86.5**
#20	0.85	**76.8**
#40	0.43	**69.9**
#60	0.25	**61.8**
#100	0.15	**50.0**
#200	0.075	**39.5**

Description	Percentage
Coarse Gravel	**0.16**
Fine Gravel	**5.01**
Coarse Sand	**8.31**
Medium Sand	**16.62**
Fine Sand	**30.43**
Silt or Clay Fines	**39.47**



LL	PL	PI
37	**17**	**20**

USCS Description (ASTM D 2487):
Clayey sand, reddish brown, moist

As-Received Moisture Content (%): **#DIV/0!**

USCS Group Symbol: SC

Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/26/2013
REVIEW	MB

February-13 | 103-92557.006

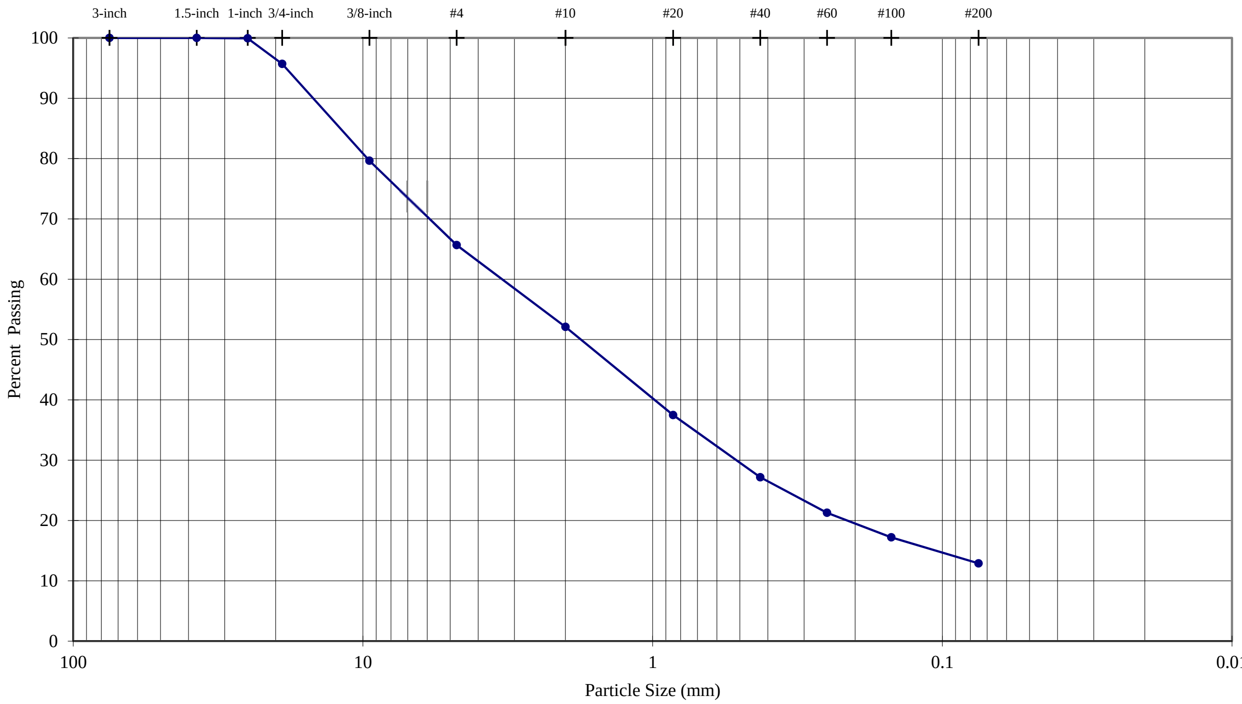
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**

SAMPLE ID: **Composite #1** DEPTH (ft): **5-13**

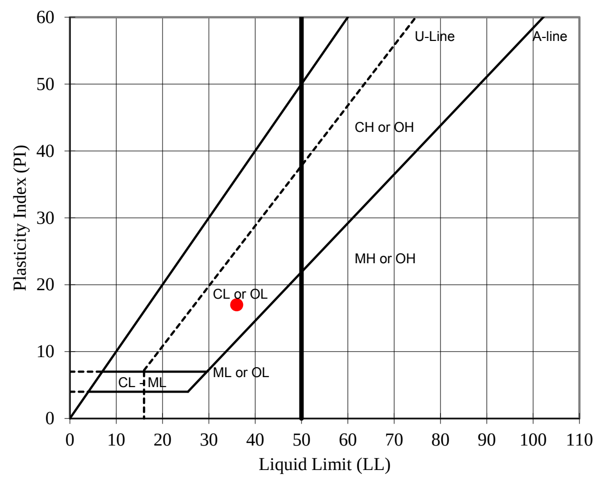
TYPE: **Pails**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**99.9**
3/4-inch	19.0	**95.7**
3/8-inch	9.5	**79.6**
#4	4.8	**65.7**
#10	2.00	**52.1**
#20	0.85	**37.5**
#40	0.43	**27.2**
#60	0.25	**21.3**
#100	0.15	**17.2**
#200	0.075	**12.9**

Description	Percentage
Coarse Gravel	**4.30**
Fine Gravel	**30.03**
Coarse Sand	**13.57**
Medium Sand	**24.93**
Fine Sand	**14.27**
Silt or Clay Fines	**12.90**



LL	PL	PI	SpG
36	**19**	**17**	**2.75**

USCS Description (ASTM D 2487):

Clayey sand with gravel, brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SC

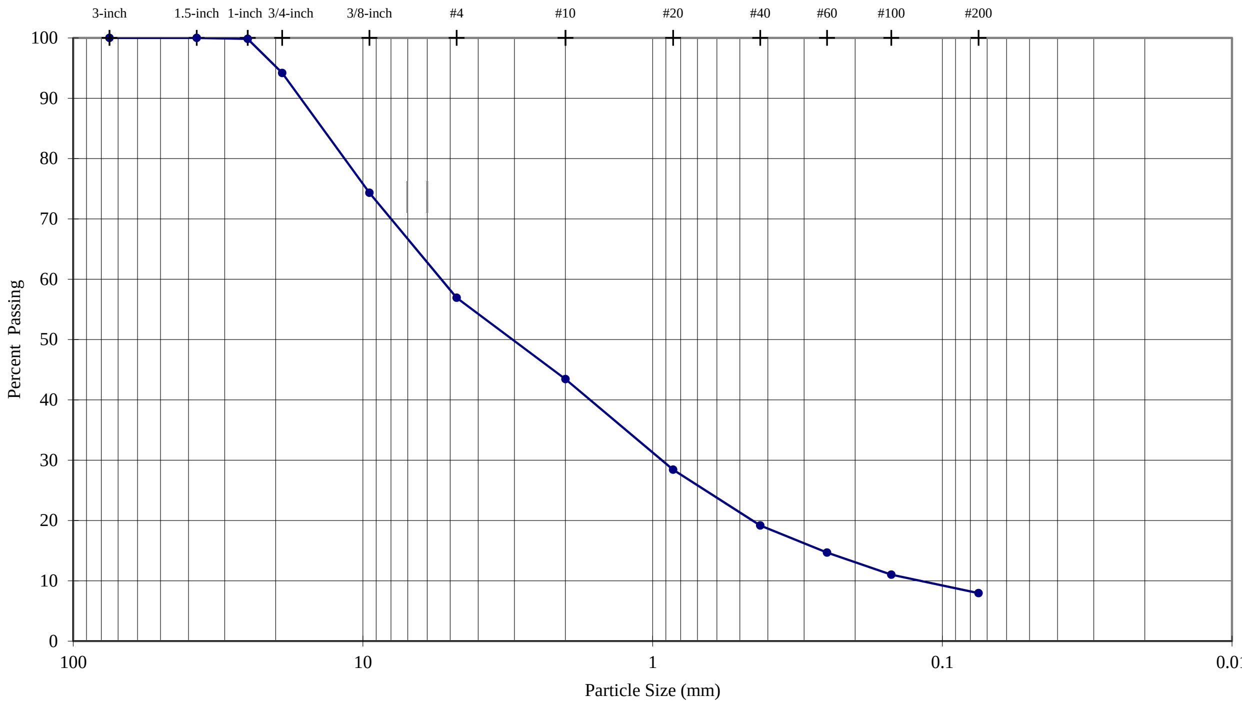
Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	3/4/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

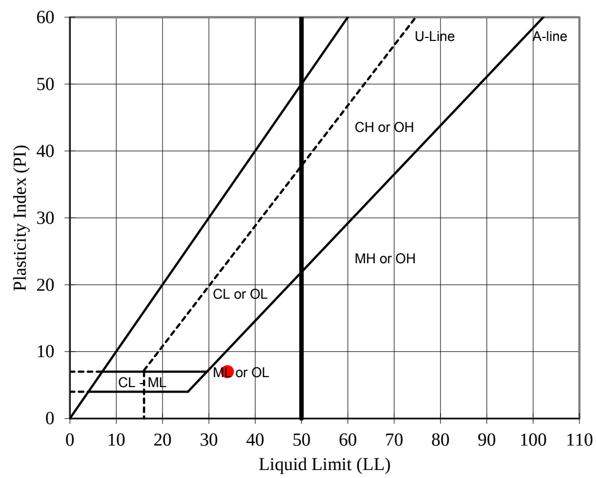
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Composite #2** DEPTH (ft): **5-14**
TYPE: **Pails**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**99.8**
3/4-inch	19.0	**94.2**
3/8-inch	9.5	**74.3**
#4	4.8	**56.9**
#10	2.00	**43.4**
#20	0.85	**28.4**
#40	0.43	**19.2**
#60	0.25	**14.7**
#100	0.15	**11.0**
#200	0.075	**8.0**

Description	Percentage
Coarse Gravel	**5.81**
Fine Gravel	**37.27**
Coarse Sand	**13.48**
Medium Sand	**24.28**
Fine Sand	**11.20**
Silt or Clay Fines	**7.96**



USCS Description (ASTM D 2487):
Well-graded sand with silt and gravel, brown, dry

LL	PL	PI	SpG
34	**27**	**7**	**2.74**

As-Received Moisture Content (%): --

USCS Group Symbol: GW-GM

Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

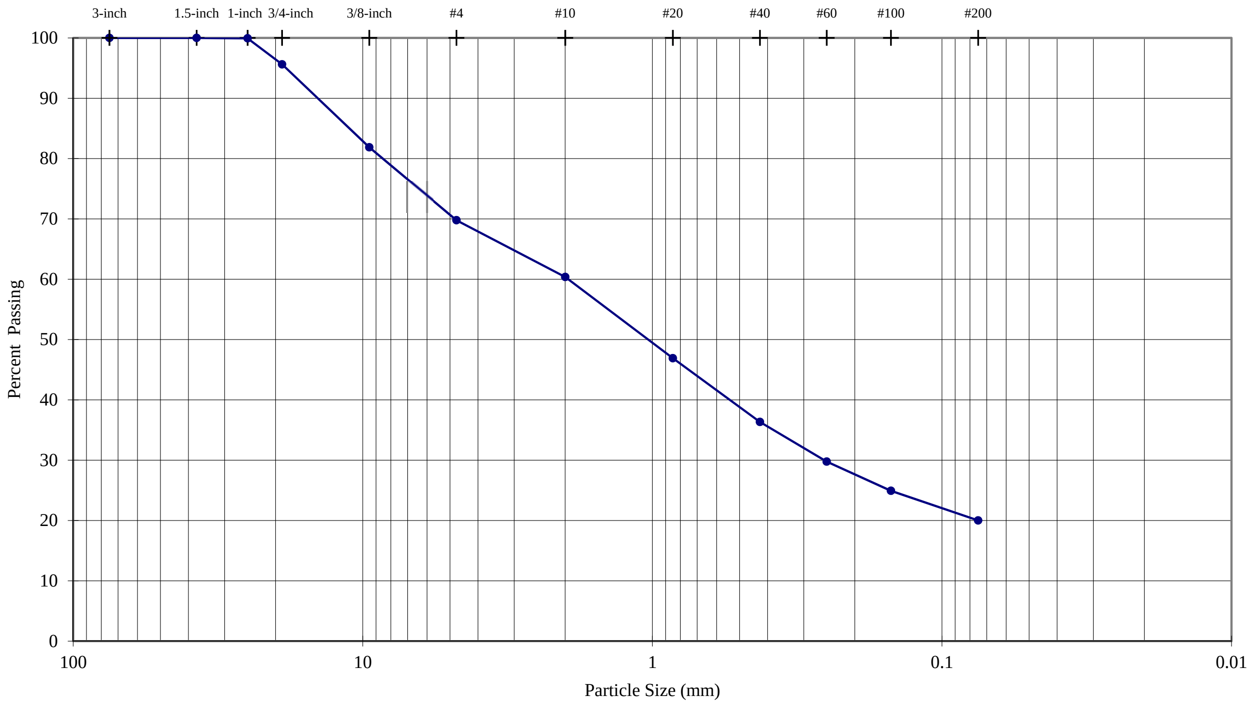
TECH	AMS
DATE	3/4/2013
REVIEW	MB

February-13 103-92557.006

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

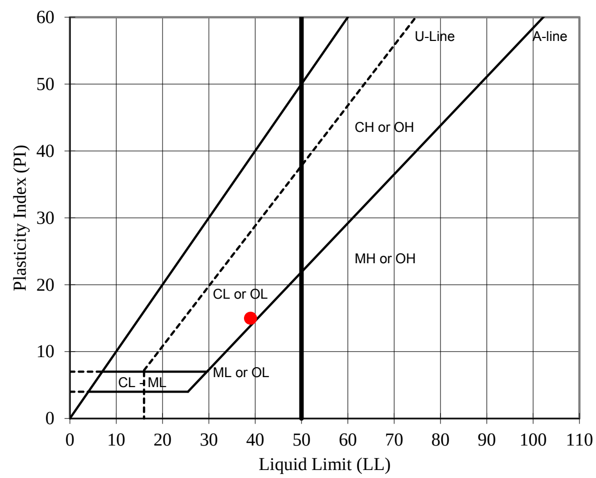
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Composite #3** DEPTH (ft): **2-3**
TYPE: **Pails**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**99.9**
3/4-inch	19.0	**95.6**
3/8-inch	9.5	**81.9**
#4	4.8	**69.8**
#10	2.00	**60.4**
#20	0.85	**46.9**
#40	0.43	**36.3**
#60	0.25	**29.8**
#100	0.15	**24.9**
#200	0.075	**20.0**

Description	Percentage
Coarse Gravel	**4.38**
Fine Gravel	**25.84**
Coarse Sand	**9.40**
Medium Sand	**24.04**
Fine Sand	**16.32**
Silt or Clay Fines	**20.01**



LL	PL	PI	SpG
39	**24**	**15**	**2.67**

USCS Description (ASTM D 2487):

Clayey sand with gravel, brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SC

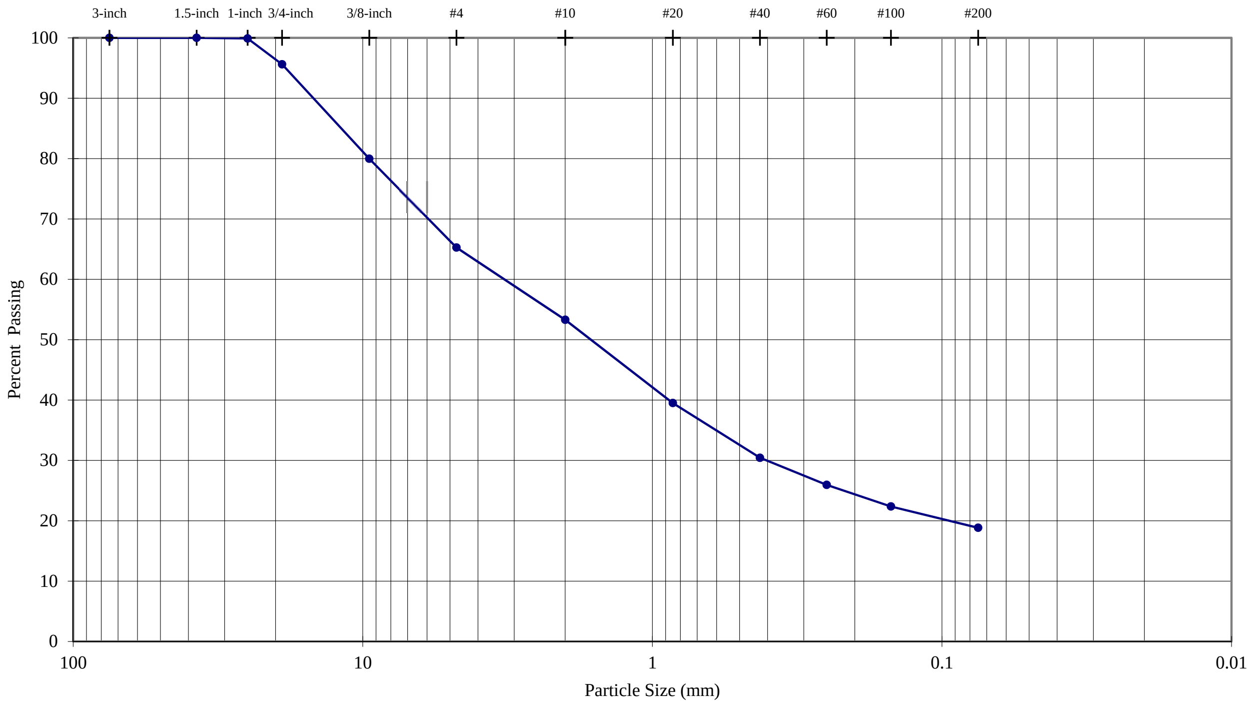
Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	3/4/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

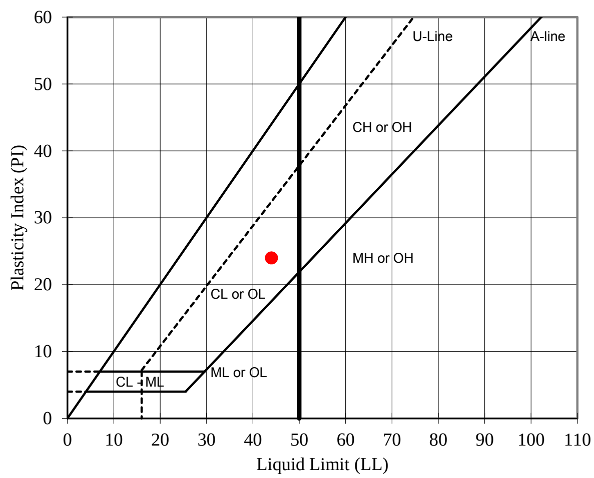
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Composite #4** DEPTH (ft): **0-10**
TYPE: **Pails**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**99.9**
3/4-inch	19.0	**95.6**
3/8-inch	9.5	**80.0**
#4	4.8	**65.3**
#10	2.00	**53.3**
#20	0.85	**39.5**
#40	0.43	**30.4**
#60	0.25	**26.0**
#100	0.15	**22.4**
#200	0.075	**18.8**

Description	Percentage
Coarse Gravel	**4.38**
Fine Gravel	**30.35**
Coarse Sand	**11.97**
Medium Sand	**22.86**
Fine Sand	**11.60**
Silt or Clay Fines	**18.84**



LL	PL	PI	SpG
44	**20**	**24**	**2.70**

USCS Description (ASTM D 2487):
Clayey sand with gravel, brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SC

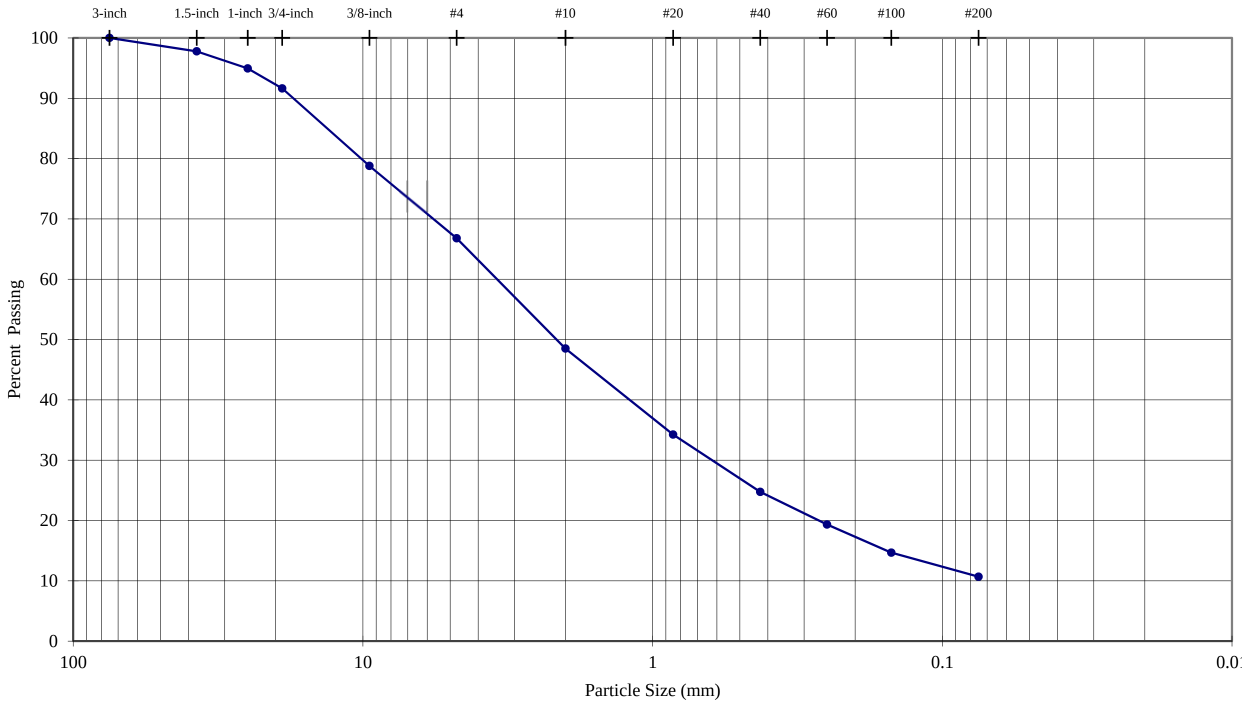
Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	3/4/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

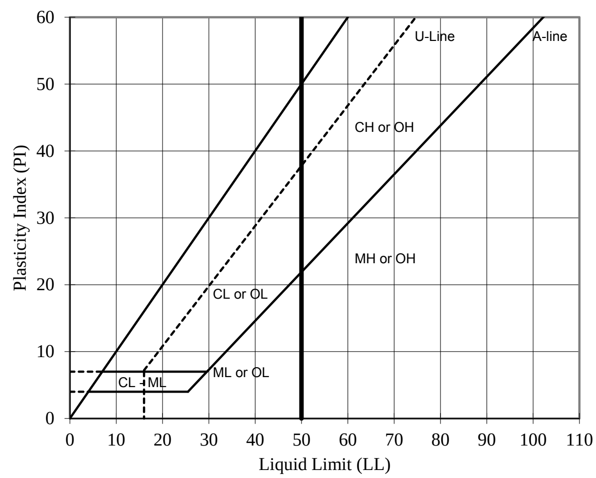
PROJECT NAME:	**Copper Flat Tailings Design Study**
SAMPLE ID:	**TP-5** DEPTH (ft): **3-7**
TYPE:	**Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**97.8**
1-inch	25.0	**94.9**
3/4-inch	19.0	**91.6**
3/8-inch	9.5	**78.8**
#4	4.8	**66.8**
#10	2.00	**48.5**
#20	0.85	**34.2**
#40	0.43	**24.7**
#60	0.25	**19.3**
#100	0.15	**14.7**
#200	0.075	**10.7**

Description	Percentage
Coarse Gravel	**8.37**
Fine Gravel	**24.84**
Coarse Sand	**18.28**
Medium Sand	**23.77**
Fine Sand	**14.07**
Silt or Clay Fines	**10.68**



LL	PL	PI
#VALUE!	**#DIV/0!**	**#VALUE!**

Visual Description (Golder Procedure):

gravelly SAND, some non-plastic fines, yellowish brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: --

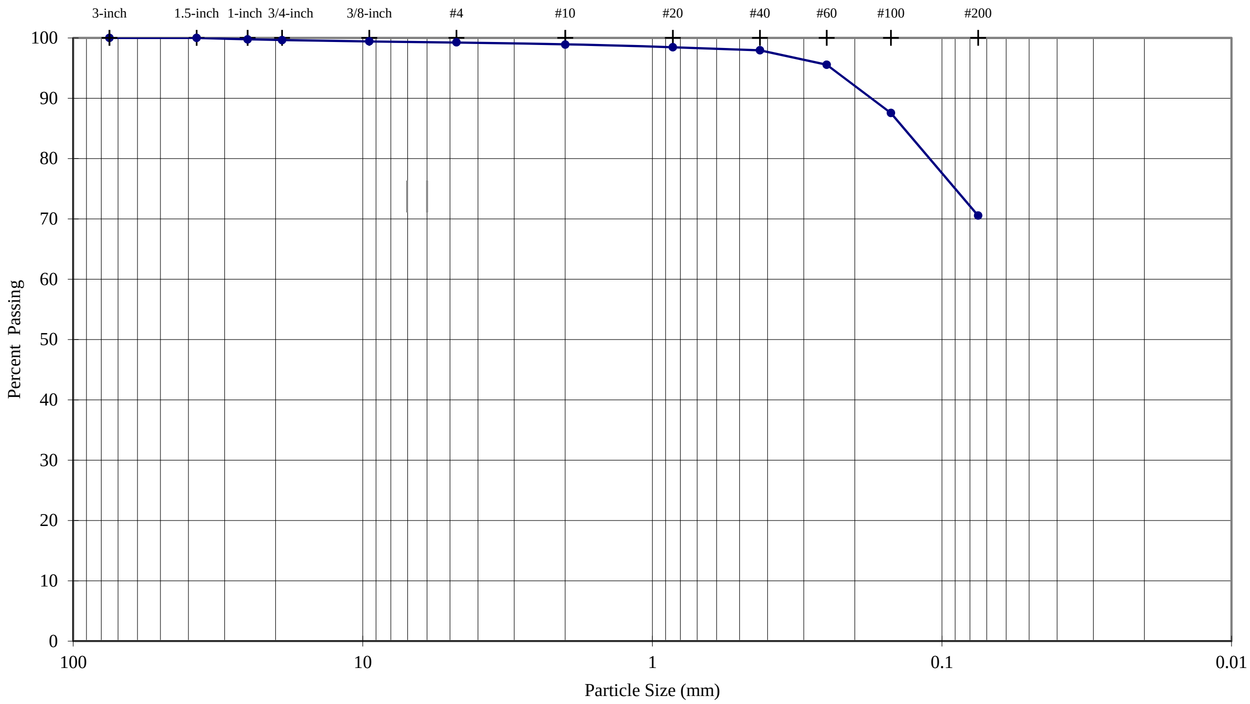
Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed

TECH	AMS
DATE	2/27/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

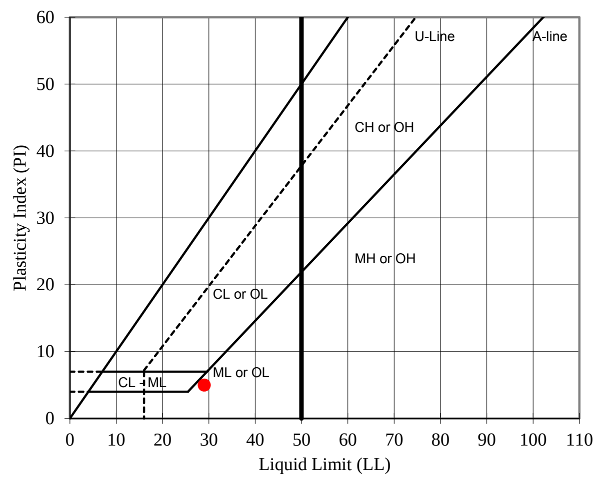
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-10** DEPTH (ft): **3-5(12)**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**99.8**
3/4-inch	19.0	**99.6**
3/8-inch	9.5	**99.4**
#4	4.8	**99.3**
#10	2.00	**98.9**
#20	0.85	**98.5**
#40	0.43	**97.9**
#60	0.25	**95.6**
#100	0.15	**87.6**
#200	0.075	**70.6**

Description	Percentage
Coarse Gravel	**0.37**
Fine Gravel	**0.36**
Coarse Sand	**0.38**
Medium Sand	**0.95**
Fine Sand	**27.39**
Silt or Clay Fines	**70.55**



USCS Description (ASTM D 2487):

Silt with sand, yellowish brown, dry

LL	PL	PI
29	**24**	**5**

As-Received Moisture Content (%): --

USCS Group Symbol: ML

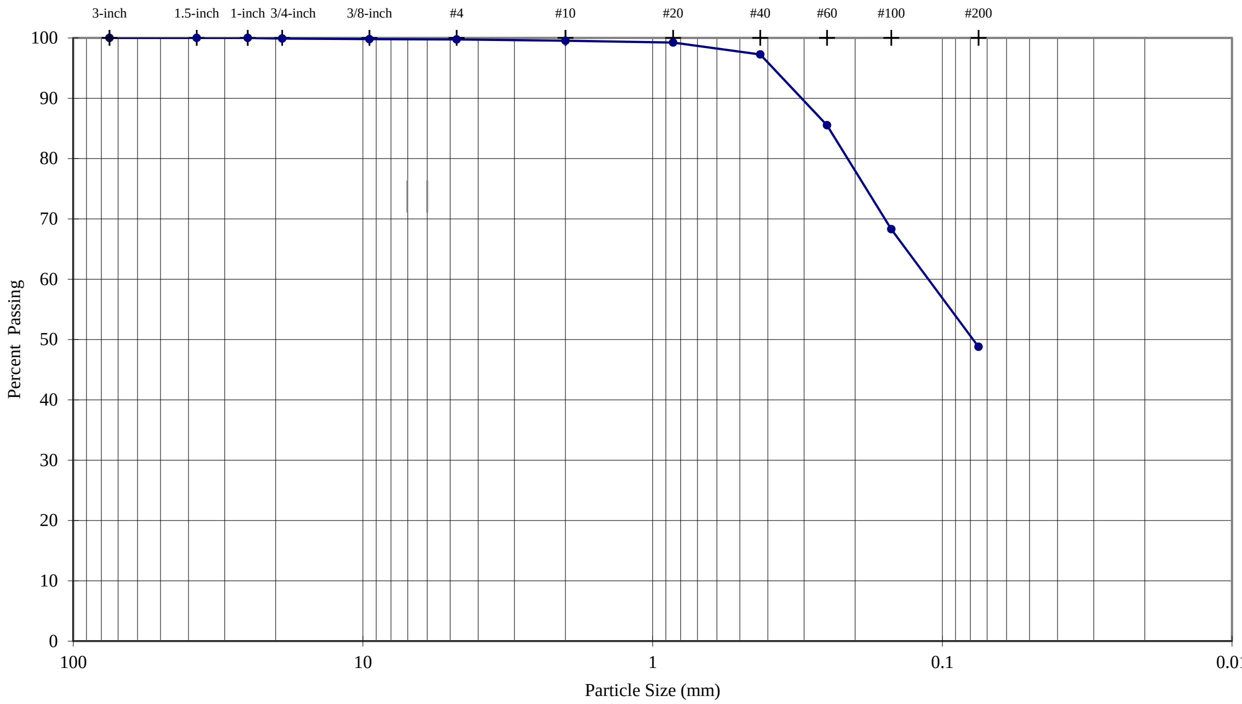
Notes: 0g of particles up to 37.5mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	3/1/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

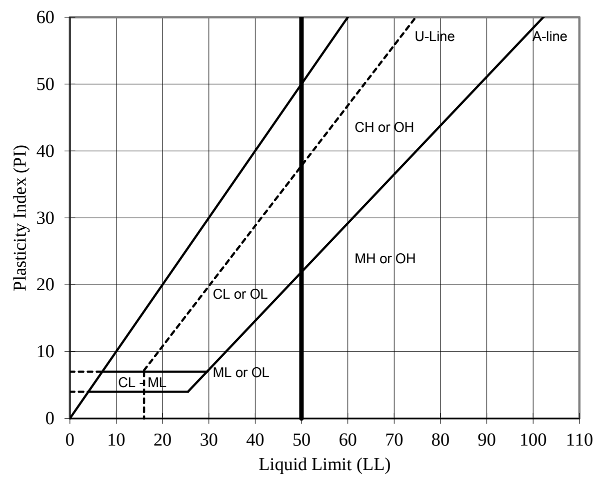
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-11** DEPTH (ft): **3-11**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**99.9**
3/8-inch	9.5	**99.8**
#4	4.8	**99.8**
#10	2.00	**99.5**
#20	0.85	**99.2**
#40	0.43	**97.3**
#60	0.25	**85.5**
#100	0.15	**68.3**
#200	0.075	**48.8**

Description	Percentage
Coarse Gravel	**0.11**
Fine Gravel	**0.14**
Coarse Sand	**0.22**
Medium Sand	**2.27**
Fine Sand	**48.47**
Silt or Clay Fines	**48.80**



USCS Description (ASTM D 2487):

Silty sand, brownish yellow, moist

LL	PL	PI	SpG
NP	**NP**	**NP**	**2.74**

As-Received Moisture Content (%): --

USCS Group Symbol: SM

Notes: 0g of particles up to 25.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

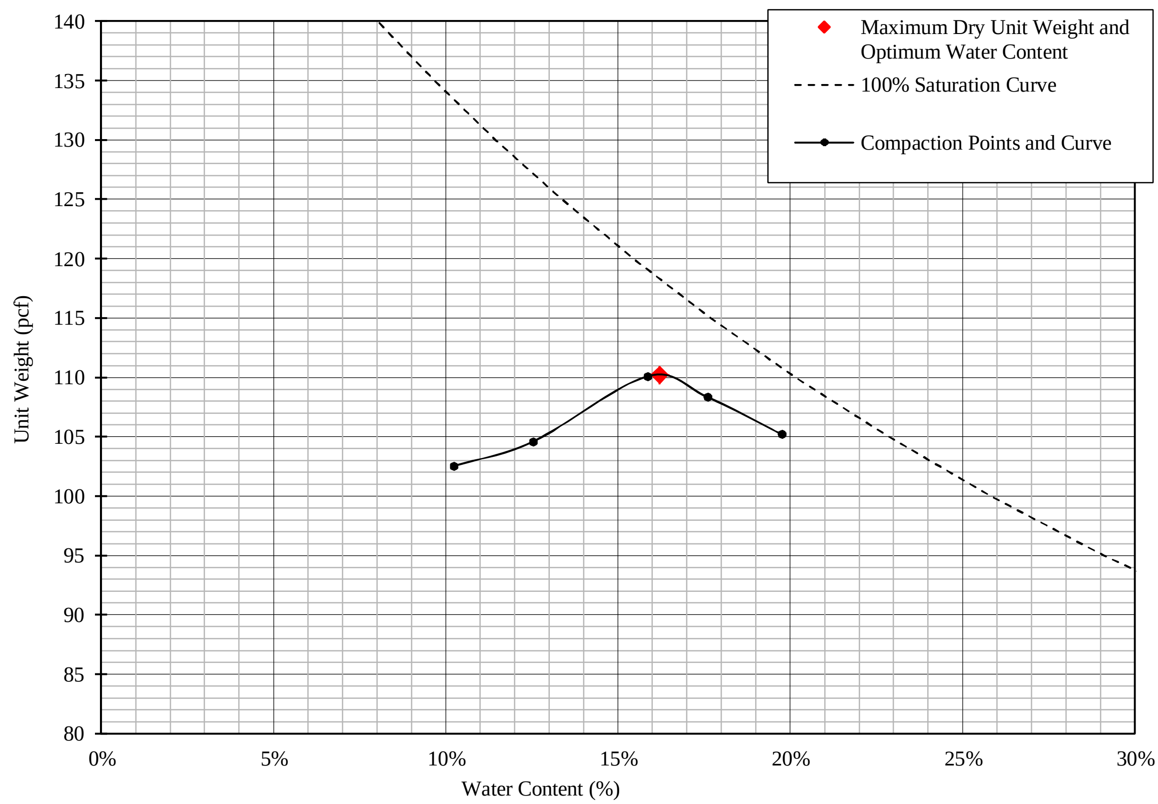
TECH	AM
DATE	2/20/2013
REVIEW	MB

February-13 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Dry Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-11** DEPTH (ft): **3-11**
TYPE: **Pail**



% Test Fraction Passing #4 Sieve	**100%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM D854)	**2.74**

Maximum Dry Unit Weight (pcf)	**110.2**
Optimum Water Content (%)	**16.2**

USCS Description (ASTM D 2487): Silty sand, brownish yellow, moist

USCS SM

TECH	EH
DATE	2-22-2013
REVIEW	MB

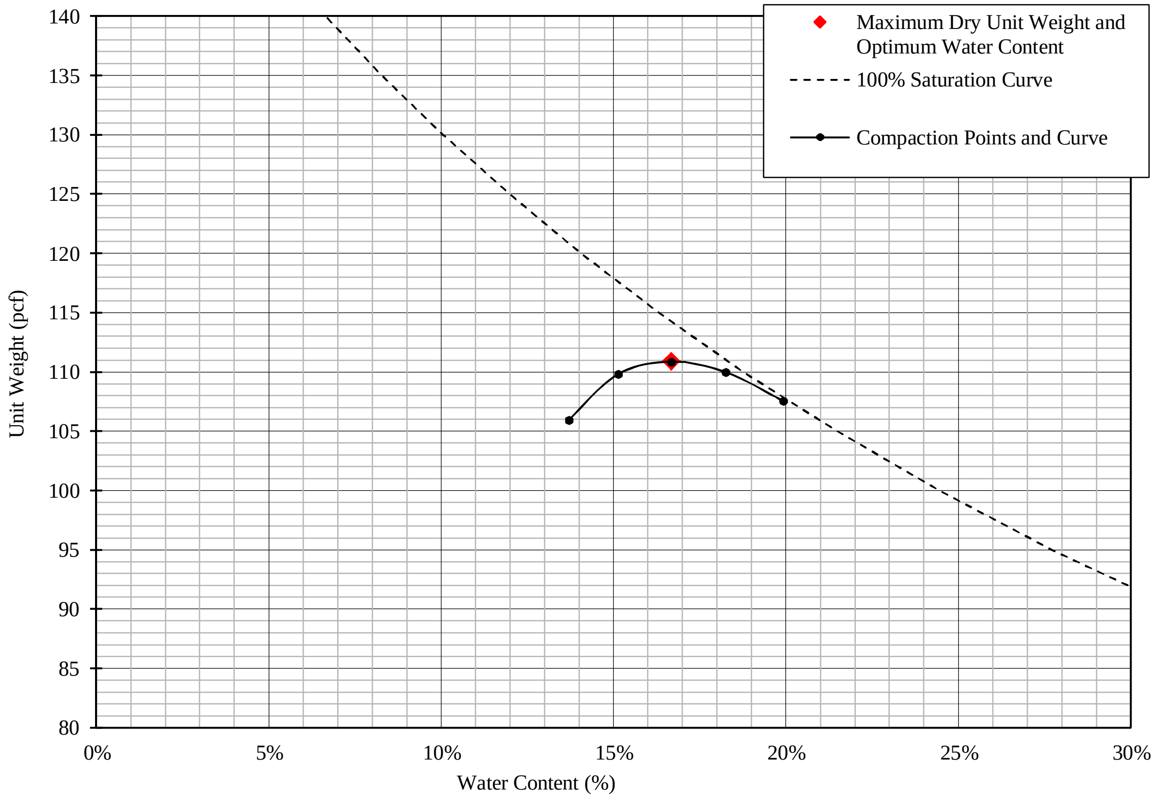
X:\Tucson\Projects\10proj\103-92557\Phase 011\Feasibility Report\Appendix A.3 Geotechnical Test Results\1 Gradation Test Results\TP-11 @ 3-11 (ASptP).xlsxProctor Results

Golder Associates

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-20** DEPTH (ft): **0-4**
TYPE: **Pail/Bag**



% Test Fraction Passing #4 Sieve	**82%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.64**

Maximum Dry Unit Weight (pcf)	**110.9**
Optimum Water Content (%)	**16.7**
Corrected Maximum Dry Unit Weight (pcf)	**116.9**
Corrected Optimum Water Content (%)	**13.9**

USCS Description (ASTM D 2487): Clayey sand with gravel, strong brown, wet

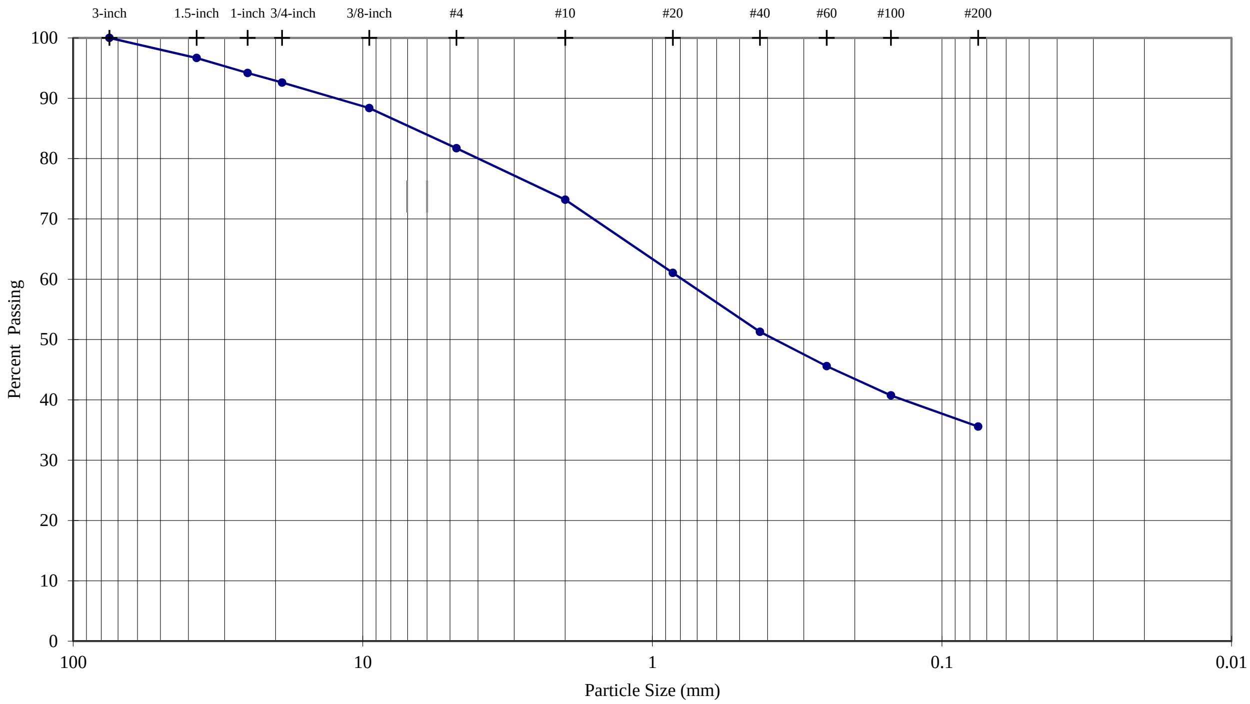
USCS SC

TECH	AM
DATE	2-27-13
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

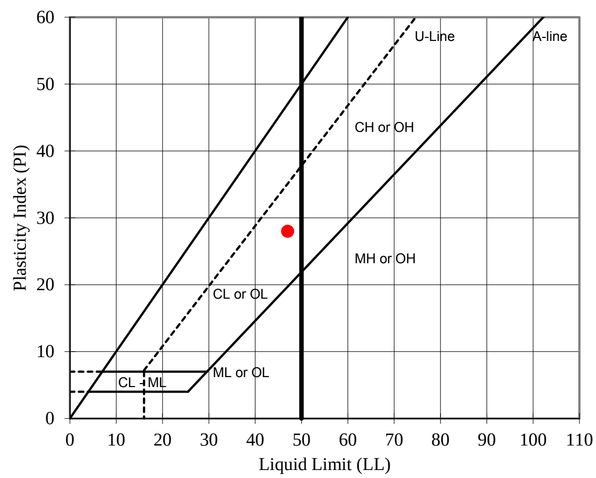
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-20** DEPTH (ft): **0-4**
TYPE: **Pail/Bag**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**96.7**
1-inch	25.0	**94.2**
3/4-inch	19.0	**92.6**
3/8-inch	9.5	**88.4**
#4	4.8	**81.7**
#10	2.00	**73.2**
#20	0.85	**61.0**
#40	0.43	**51.3**
#60	0.25	**45.6**
#100	0.15	**40.7**
#200	0.075	**35.6**

Description	Percentage
Coarse Gravel	**7.40**
Fine Gravel	**10.89**
Coarse Sand	**8.53**
Medium Sand	**21.90**
Fine Sand	**15.70**
Silt or Clay Fines	**35.57**



LL	PL	PI
47	**19**	**28**

USCS Description (ASTM D 2487):

Clayey sand with gravel, strong brown, wet

As-Received Moisture Content (%): --

USCS Group Symbol: SC

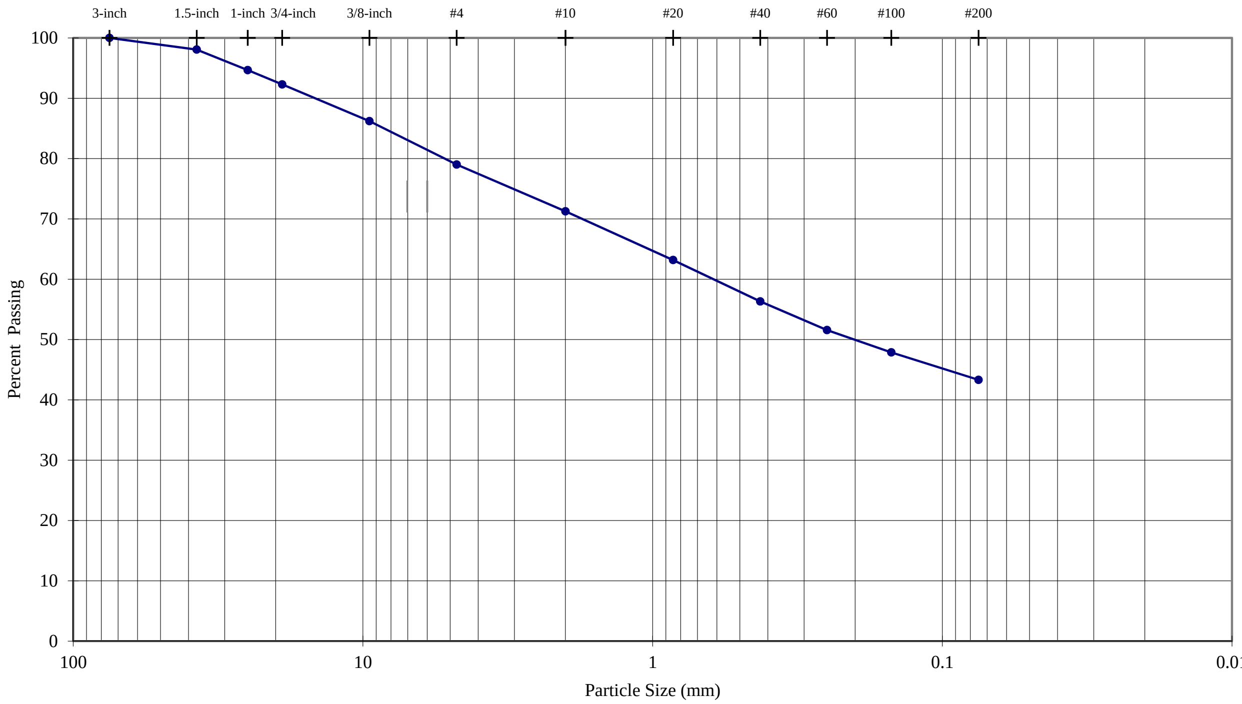
Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AMS
DATE	2/25/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

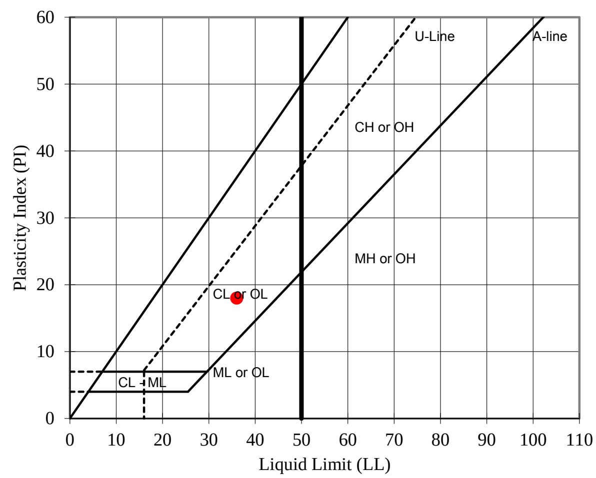
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-20** DEPTH (ft): **4-7**
TYPE: **Pail/Bag**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**98.1**
1-inch	25.0	**94.7**
3/4-inch	19.0	**92.3**
3/8-inch	9.5	**86.2**
#4	4.8	**79.0**
#10	2.00	**71.3**
#20	0.85	**63.2**
#40	0.43	**56.3**
#60	0.25	**51.6**
#100	0.15	**47.9**
#200	0.075	**43.3**

Description	Percentage
Coarse Gravel	**7.71**
Fine Gravel	**13.28**
Coarse Sand	**7.75**
Medium Sand	**14.95**
Fine Sand	**12.99**
Silt or Clay Fines	**43.32**



USCS Description (ASTM D 2487):
Clayey sand with gravel, brown, dry

LL	PL	PI
36	**18**	**18**

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

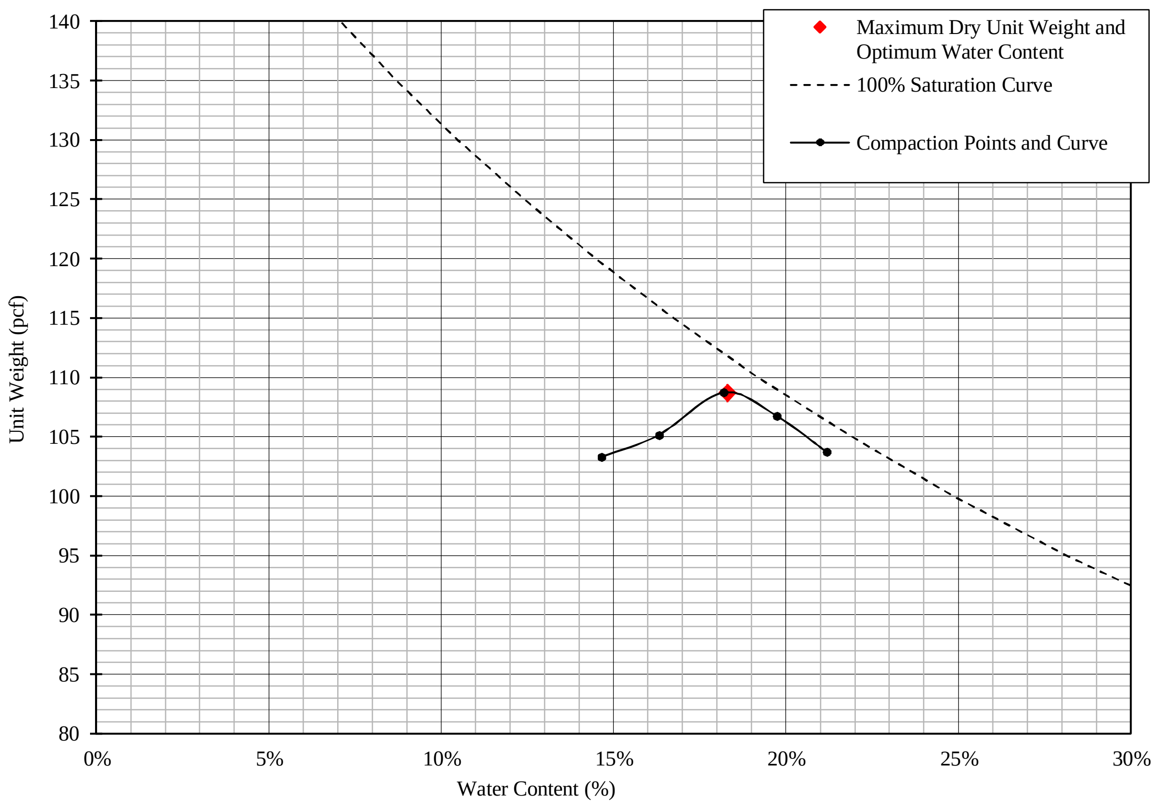
TECH	AMS
DATE	2/25/2013
REVIEW	MB

February-13 | 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-20** DEPTH (ft): **4-7**
TYPE: **Pail/Bag**



% Test Fraction Passing #4 Sieve	**79%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.67**

Maximum Dry Unit Weight (pcf)	**108.7**
Optimum Water Content (%)	**18.3**
Corrected Maximum Dry Unit Weight (pcf)	**116.1**
Corrected Optimum Water Content (%)	**14.8**

USCS Description (ASTM D 2487): Clayey sand with gravel, brown, dry

USCS SC

TECH	AMS
DATE	2-28-13
REVIEW	MB

X:\Tucson\Projects\10proj\103-92557\Phase 011\Feasibility Report\Appendix A.3 Geotechnical Test Results\1 Gradation Test Results\TP-20 @ 4-7 (ASptP).xlsxProctor Results

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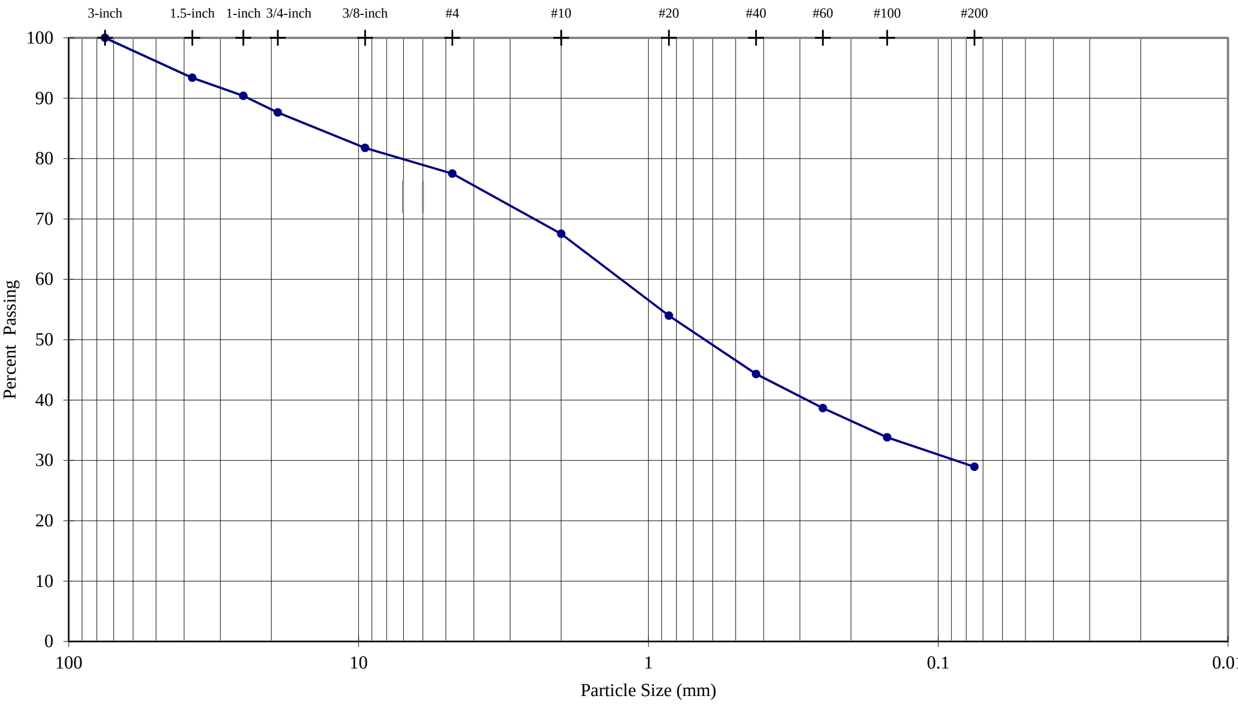
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

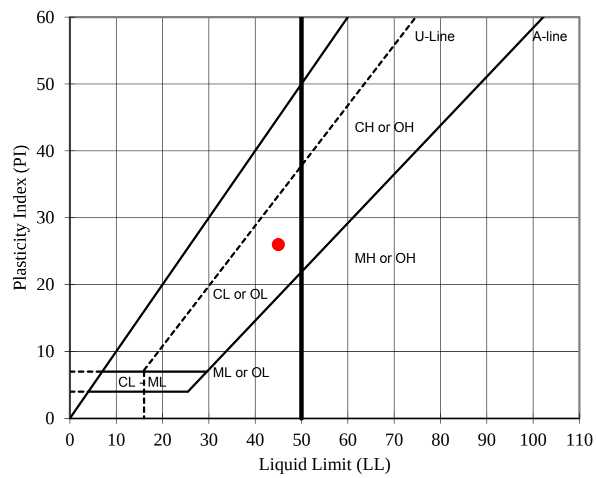
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-24** DEPTH (ft): **3-5**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**93.4**
1-inch	25.0	**90.4**
3/4-inch	19.0	**87.6**
3/8-inch	9.5	**81.8**
#4	4.8	**77.5**
#10	2.00	**67.5**
#20	0.85	**54.0**
#40	0.43	**44.3**
#60	0.25	**38.7**
#100	0.15	**33.8**
#200	0.075	**28.9**

Description	Percentage
Coarse Gravel	**12.37**
Fine Gravel	**10.12**
Coarse Sand	**9.97**
Medium Sand	**23.23**
Fine Sand	**15.37**
Silt or Clay Fines	**28.94**



LL	PL	PI
45	**19**	**26**

USCS Description (ASTM D 2487):
Clayey sand with gravel, yellowish brown, dry

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

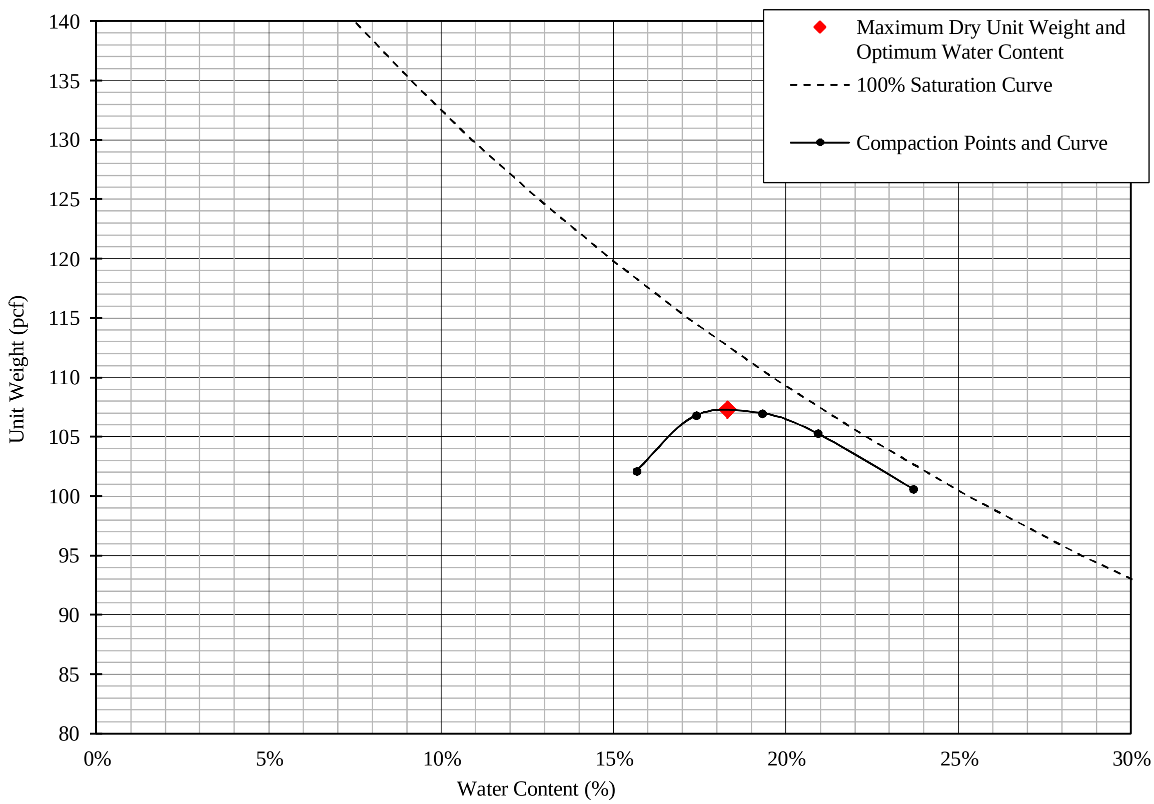
TECH	AM
DATE	2/20/2013
REVIEW	MB

February-13 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Dry Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-24** DEPTH (ft): **3-5**
TYPE: **Pail**



% Test Fraction Passing #4 Sieve	**79%**
As-Received Moisture Content	**NA**
Specific Gravity (estimated)	**2.70**

Maximum Dry Unit Weight (pcf)	**107.3**
Optimum Water Content (%)	**18.3**
Corrected Maximum Dry Unit Weight (pcf)	**114.7**
Corrected Optimum Water Content (%)	**14.4**

USCS Description (ASTM D 2487): Clayey sand with gravel, yellowish brown, dry

USCS SC

TECH	EH
DATE	2-22-2013
REVIEW	MB

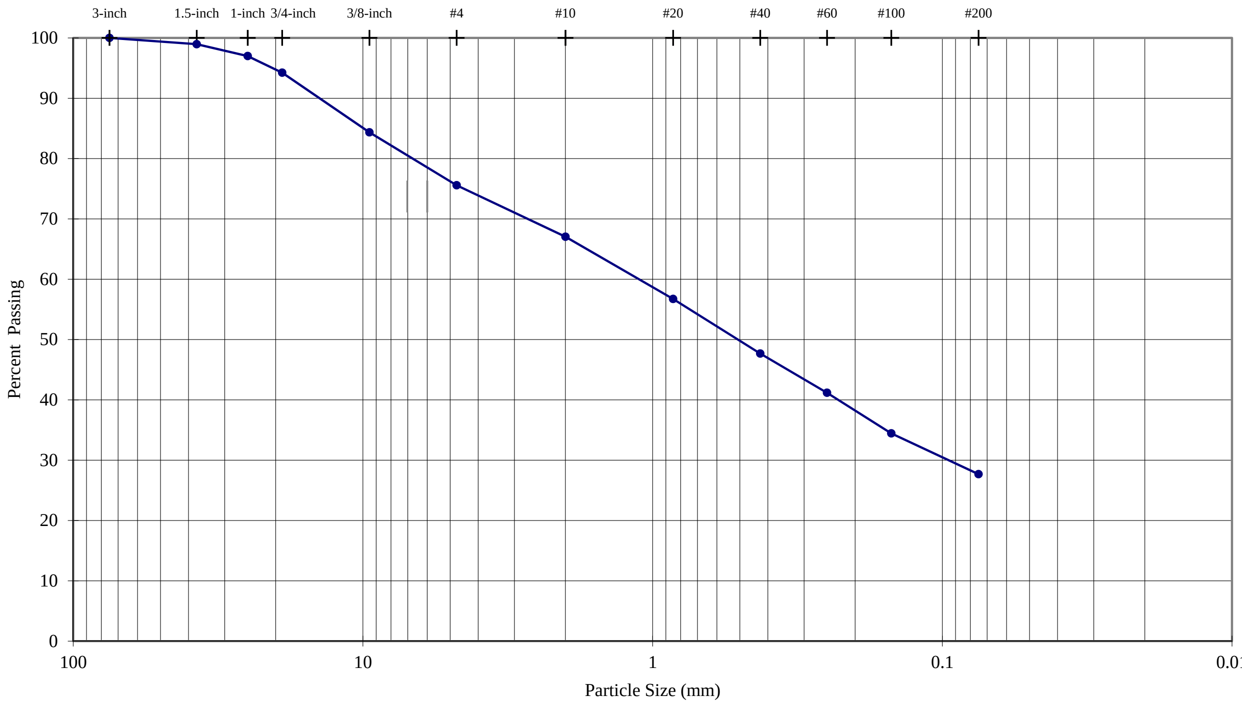
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**

SAMPLE ID: **TP-27** DEPTH (ft): **0-2**

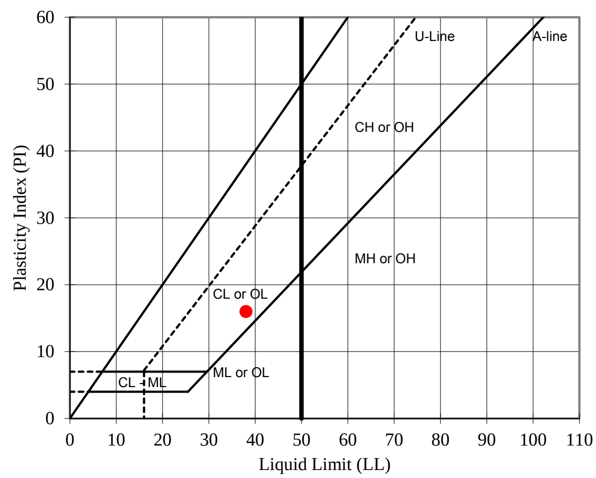
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**99.0**
1-inch	25.0	**97.0**
3/4-inch	19.0	**94.2**
3/8-inch	9.5	**84.4**
#4	4.8	**75.6**
#10	2.00	**67.0**
#20	0.85	**56.7**
#40	0.43	**47.7**
#60	0.25	**41.2**
#100	0.15	**34.4**
#200	0.075	**27.7**

Description	Percentage
Coarse Gravel	**5.76**
Fine Gravel	**18.67**
Coarse Sand	**8.53**
Medium Sand	**19.37**
Fine Sand	**19.99**
Silt or Clay Fines	**27.69**



USCS Description (ASTM D 2487):

Clayey sand with gravel, dark yellowish brown, dry

LL	PL	PI
38	**22**	**16**

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

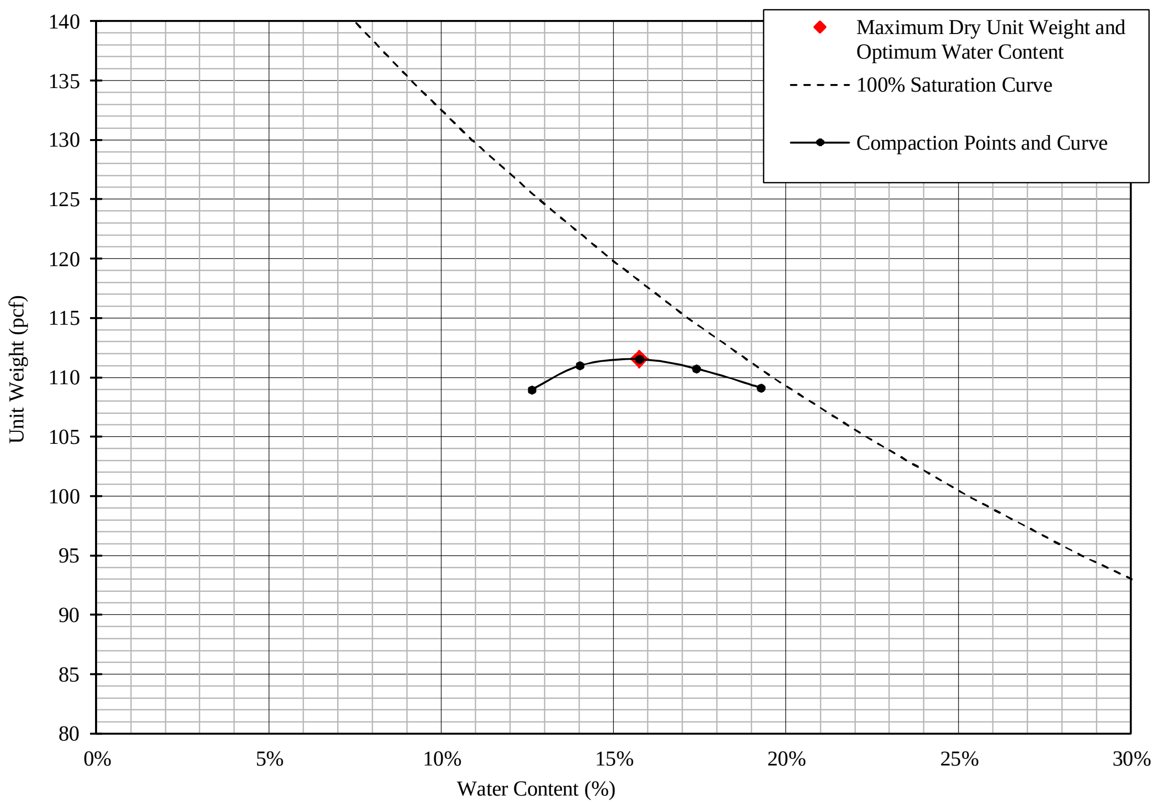
TECH	MGC
DATE	2/22/2013
REVIEW	MB

February-13 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Dry Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-27** DEPTH (ft): **0-2**
TYPE: **Pail**



% Test Fraction Passing #4 Sieve	**76%**
As-Received Moisture Content	**NA**
Specific Gravity (estimated)	**2.70**

Maximum Dry Unit Weight (pcf)	**111.5**
Optimum Water Content (%)	**15.7**
Corrected Maximum Dry Unit Weight (pcf)	**119.9**
Corrected Optimum Water Content (%)	**12.2**

USCS Description (ASTM D 2487): Clayey sand with gravel, dark yellowish brown, dry

USCS SC

TECH	MGC/AMS
DATE	2-26-2013
REVIEW	MB

February-13 | 103-92557.006

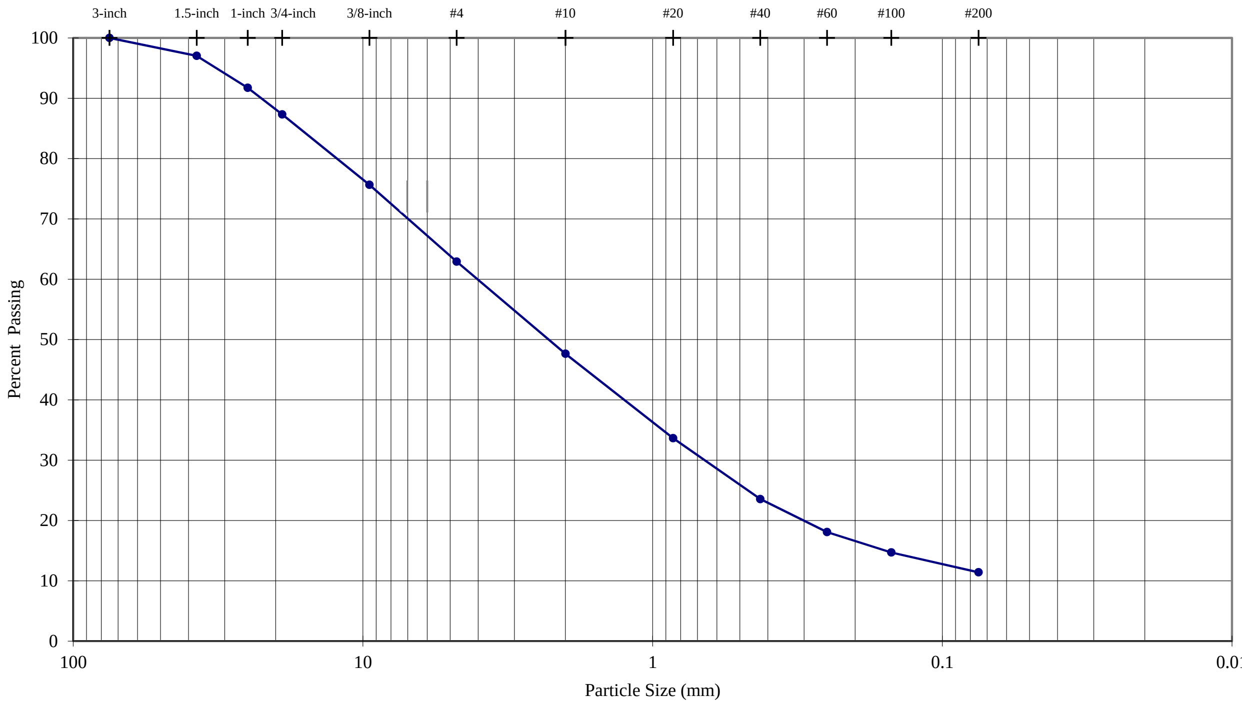
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**

SAMPLE ID: **TP-27** DEPTH (ft): **3-7**

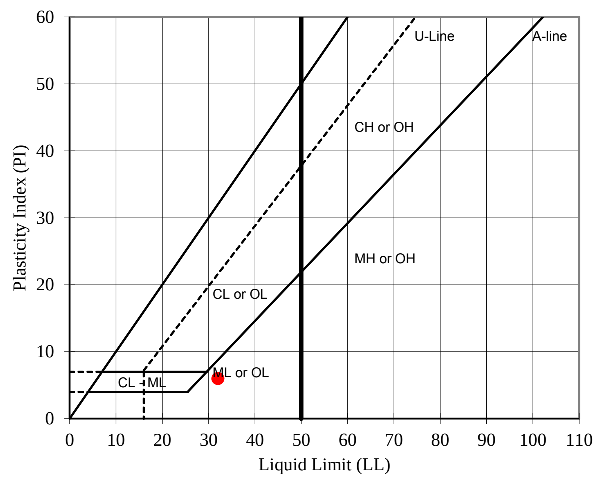
TYPE: **Bag/Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**97.0**
1-inch	25.0	**91.7**
3/4-inch	19.0	**87.3**
3/8-inch	9.5	**75.6**
#4	4.8	**62.9**
#10	2.00	**47.6**
#20	0.85	**33.7**
#40	0.43	**23.6**
#60	0.25	**18.1**
#100	0.15	**14.7**
#200	0.075	**11.4**

Description	Percentage
Coarse Gravel	**12.68**
Fine Gravel	**24.40**
Coarse Sand	**15.27**
Medium Sand	**24.09**
Fine Sand	**12.14**
Silt or Clay Fines	**11.42**



USCS Description (ASTM D 2487):

Well-graded sand with silt and gravel, dark yellowish brown, dry

LL	PL	PI
32	**26**	**6**

As-Received Moisture Content (%): --

USCS Group Symbol: SW-SM

Notes: 0g of particles up to 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

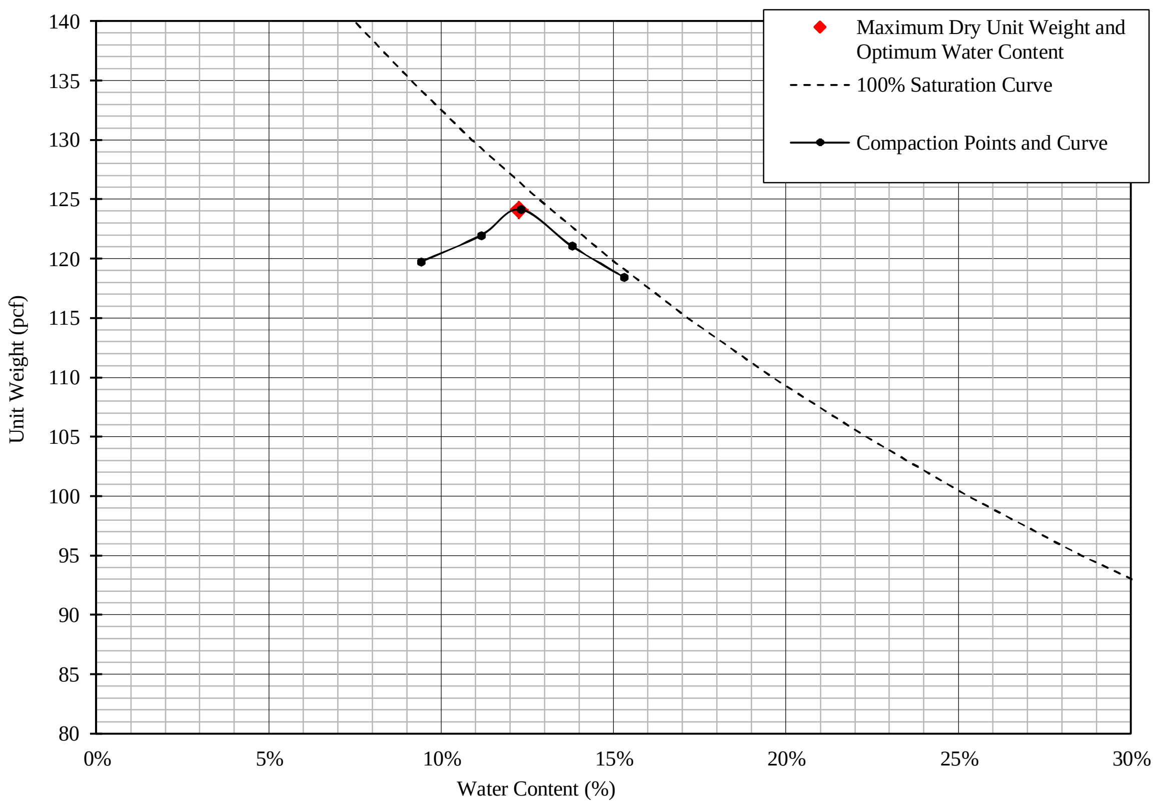
TECH	EH
DATE	2/20/2013
REVIEW	MB

February-13 103-92557.006

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method B

Manual Rammer	Dry Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-27** DEPTH (ft): **3-7**
TYPE: **Bag/Pail**



% Test Fraction Passing 3/8-inch Sieve	**76%**
As-Received Moisture Content	**NA**
Specific Gravity (estimated)	**2.70**

Maximum Dry Unit Weight (pcf)	**124.1**
Optimum Water Content (%)	**12.3**
Corrected Maximum Dry Unit Weight (pcf)	**130.5**
Corrected Optimum Water Content (%)	**9.6**

USCS Description (ASTM D 2487): Well-graded sand with silt and gravel, dark yellowish brown, dry

USCS SW-SM

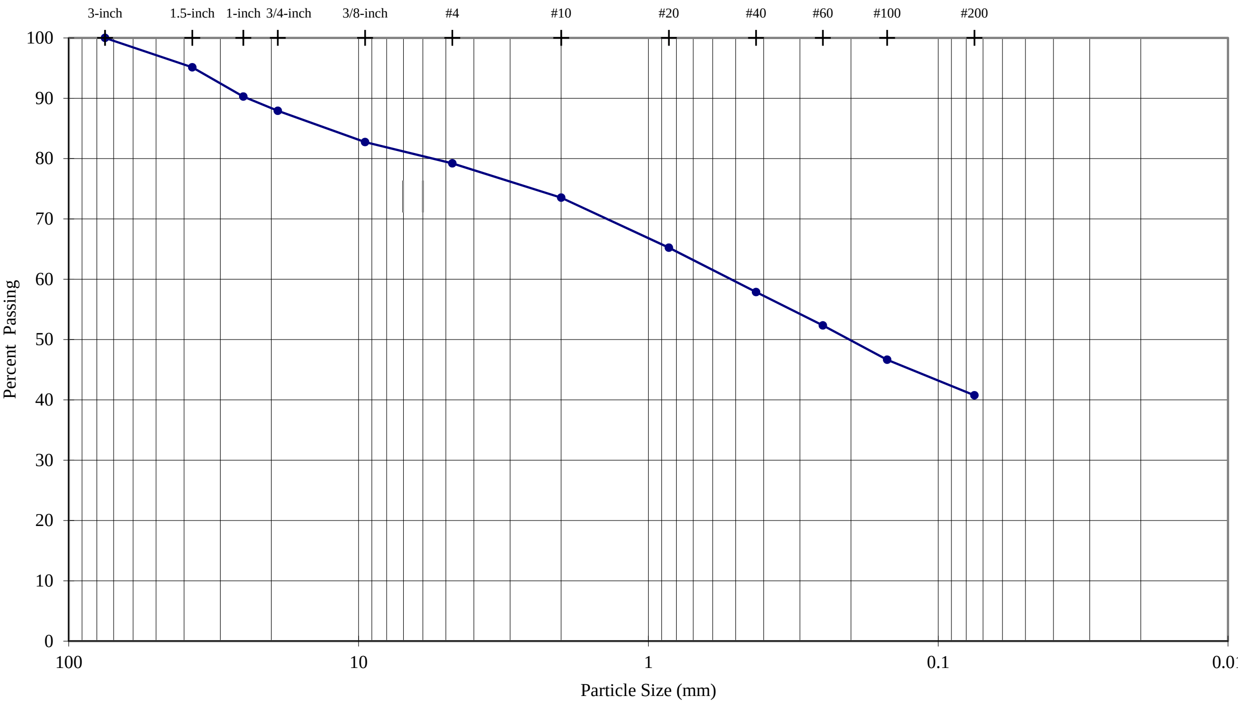
TECH	EH
DATE	3-8-2013
REVIEW	MB

February-13 **103-92557.006**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

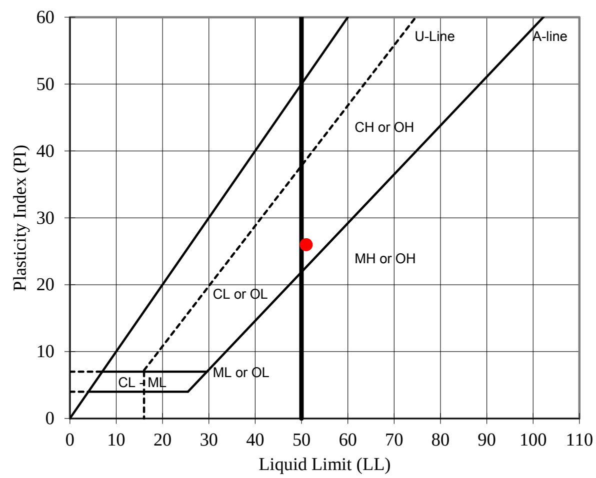
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-29** DEPTH (ft): **0-2**
TYPE: **Pail**



Sieve Analysis (Initial Separation on No. 4 Sieve)

Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**95.1**
1-inch	25.0	**90.3**
3/4-inch	19.0	**87.9**
3/8-inch	9.5	**82.7**
#4	4.8	**79.2**
#10	2.00	**73.5**
#20	0.85	**65.2**
#40	0.43	**57.9**
#60	0.25	**52.3**
#100	0.15	**46.7**
#200	0.075	**40.8**

Description	Percentage
Coarse Gravel	**12.08**
Fine Gravel	**8.71**
Coarse Sand	**5.68**
Medium Sand	**15.66**
Fine Sand	**17.10**
Silt or Clay Fines	**40.76**



USCS Description (ASTM D 2487):

Clayey sand with gravel, strong brown, dry

LL	PL	PI
51	**25**	**26**

As-Received Moisture Content (%): --

USCS Group Symbol: SC

Notes: 0g of particles up to plus 75.0mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample was not mechanically dispersed; hydrometer test was not performed
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

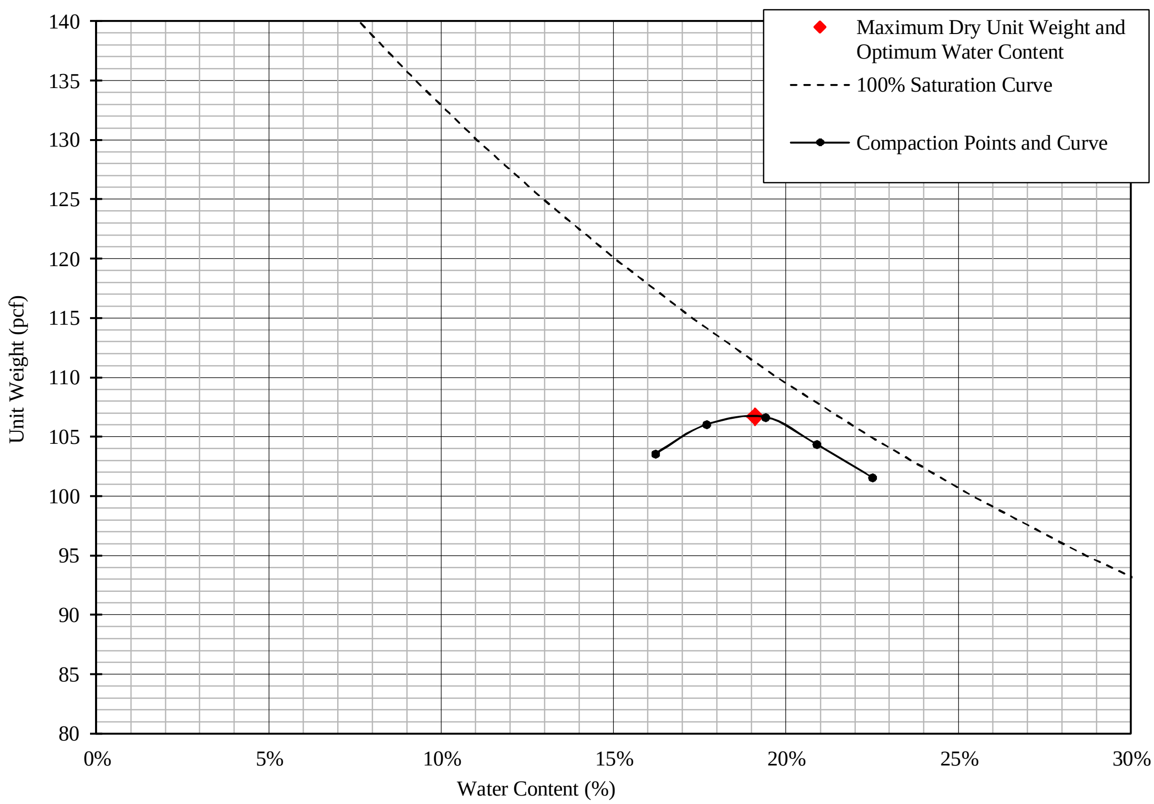
TECH	AM
DATE	2/21/2013
REVIEW	MB

February-13 **103-92557.006**

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **TP-29** DEPTH (ft): **0-2**
TYPE: **Pail**



% Test Fraction Passing #4 Sieve	**80%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM C127)	**2.71**

Maximum Dry Unit Weight (pcf)	**106.7**
Optimum Water Content (%)	**19.1**
Corrected Maximum Dry Unit Weight (pcf)	**114.4**
Corrected Optimum Water Content (%)	**15.5**

USCS Description (ASTM D 2487): Clayey sand with gravel, strong brown, dry

USCS SC

TECH	AM
DATE	2-25-2013
REVIEW	MB

X:\Tucson\Projects\10proj\103-92557\Phase 011\Feasibility Report\Appendix A.3 Geotechnical Test Results\1 Gradation Test Results\TP-29 @ 0-2 (ASptP).xlsxProctor Results

Golder Associates

APPENDIX A.3.2
TRIAXIAL TEST REPORTS

	Point 1		Point 2		Point 3	
Boring or Test Pit:	--		--		--	
Sample:	Comp 1-4		Comp 1-4		Comp 1-4	
Depth:	--	ft	--	ft	--	ft
Point No.:	1		2		3	
Initial						
Length =	9.250	in	9.250	in	9.250	in
Diameter =	4.001	in	4.001	in	4.001	in
Wet Mass =	8.517	lb	8.506	lb	8.506	lb
Area =	12.573	in^2	12.573	in^2	12.573	in^2
Volume =	116.297	in^3	116.297	in^3	116.297	in^3
Specific Gravity =	2.64	(Provided)	2.64	(Provided)	2.64	(Provided)
Dry Mass of Solids =	7.355	lb	7.332	lb	7.377	lb
Moisture Content =	15.8%		16.0%		15.3%	
Wet Unit Weight =	126.6	pcf	126.4	pcf	126.4	pcf
Dry Unit Weight =	109.3	pcf	108.9	pcf	109.6	pcf
Void Ratio =	0.51		0.51		0.50	
Percent Saturation =	83%		83%		81%	
After Consolidation						
Length =	9.173	in	9.094	in	9.057	in
Diameter =	3.814	in	3.821	in	3.799	in
Area =	11.424	in^2 (Method B)	11.465	in^2 (Method B)	11.333	in^2 (Method B)
Volume =	104.789	in^3	104.264	in^3	102.647	in^3
Moisture Content =	13.5%		13.4%		12.3%	
Wet Unit Weight =	137.7	pcf	137.8	pcf	139.5	pcf
Dry Unit Weight =	121.3	pcf	121.5	pcf	124.2	pcf
Void Ratio =	0.36		0.35		0.32	
Percent Saturation =	100%		100%		100%	
B Parameter =	0.97		0.98		0.96	
Shear Rate =	0.071%	/min.	0.083%	/min.	0.027%	/min.
t_{50} =	5.6	min.	1.8	min.	14.5	min.
Strain at Failure =	5.0%		5.0%		5.0%	
Cell Pressure =	75	psi	100	psi	150	psi
Back Pressure =	50	psi	50	psi	50	psi
Confining Pressure =	25	psi	50	psi	100	psi

Notes:

Sample description: Clayey sand with gravel, yellowish brown, moist

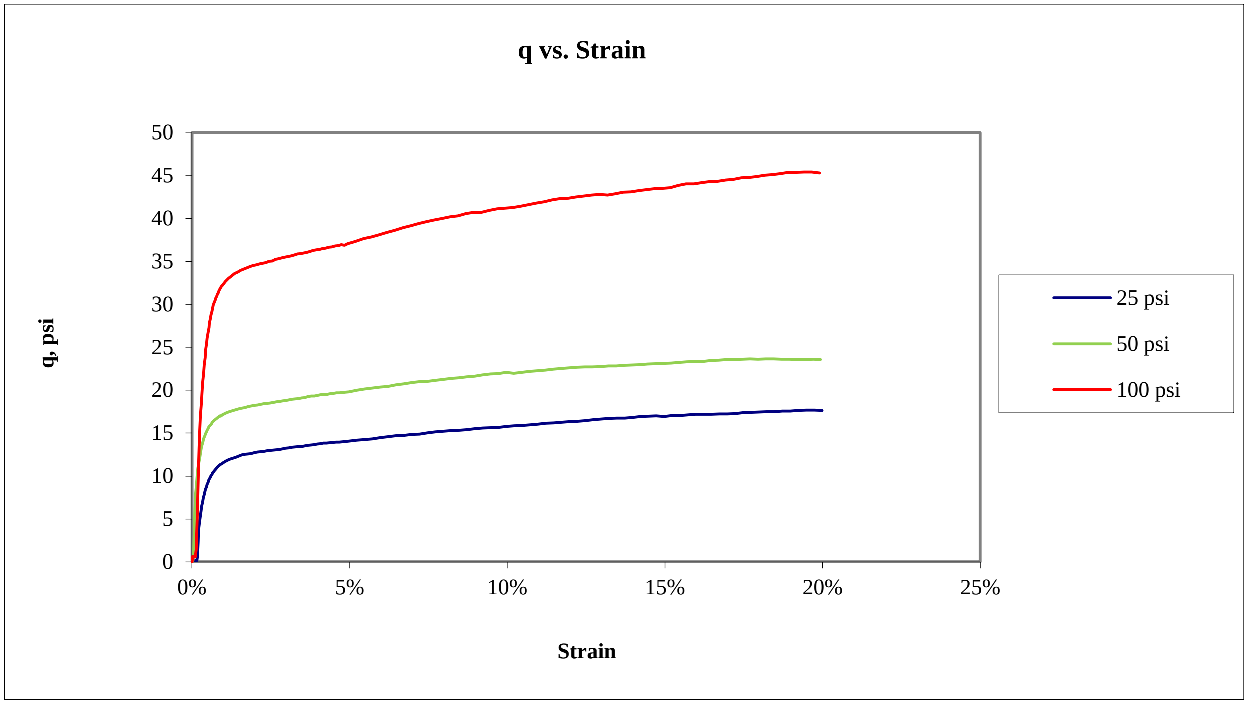
Atterberg limits: LL = -- PL = -- PI = -- (-- indicates test was not performed)

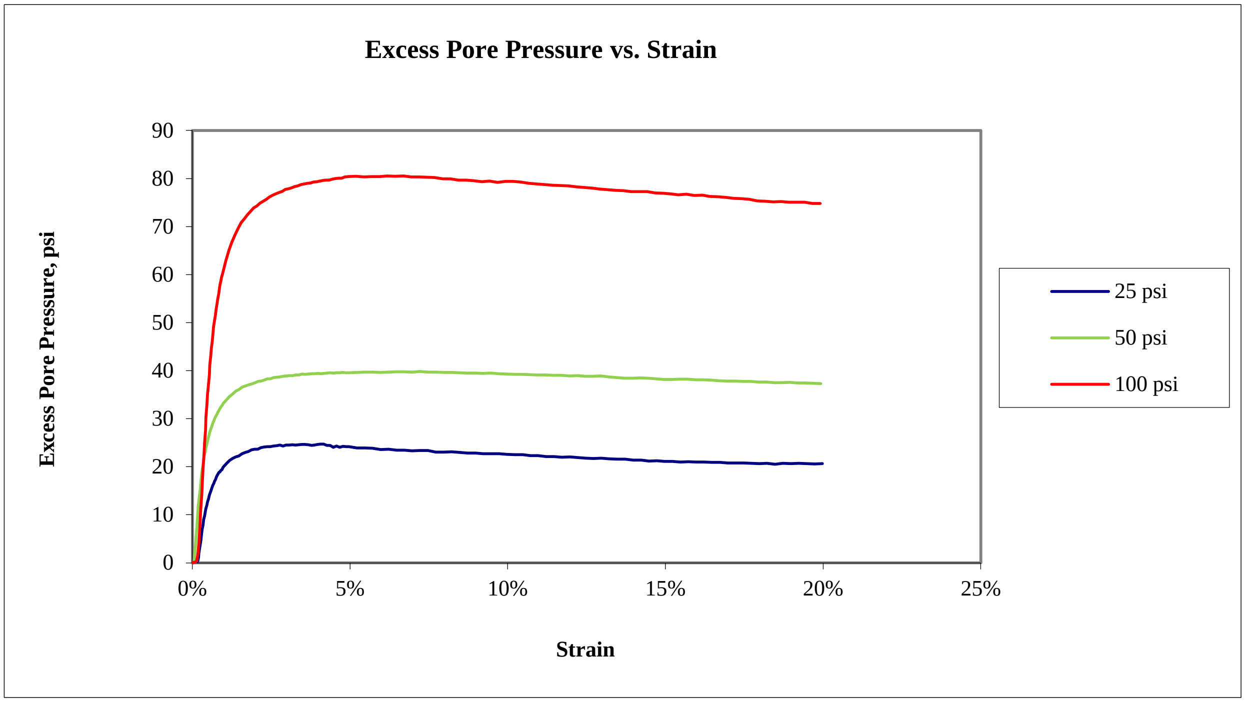
Percent finer: 3/4 in. = -- No. 4 = -- No. 200 = -- (-- indicates test was not performed)

Specimen type:		Intact	X	Reconstituted		Remold targets: 110.0 pcf (dry) at 16.0% moisture
Moisture from:	X	Cuttings		Entire specimen		
Saturation method:	X	Wet		Dry		
Failure criterion:		$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$	5	% strain
Membrane effect:	X	Corrected		Not Corrected		

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**
Job Short Title: **Copper Flat Tailings Design Study**	

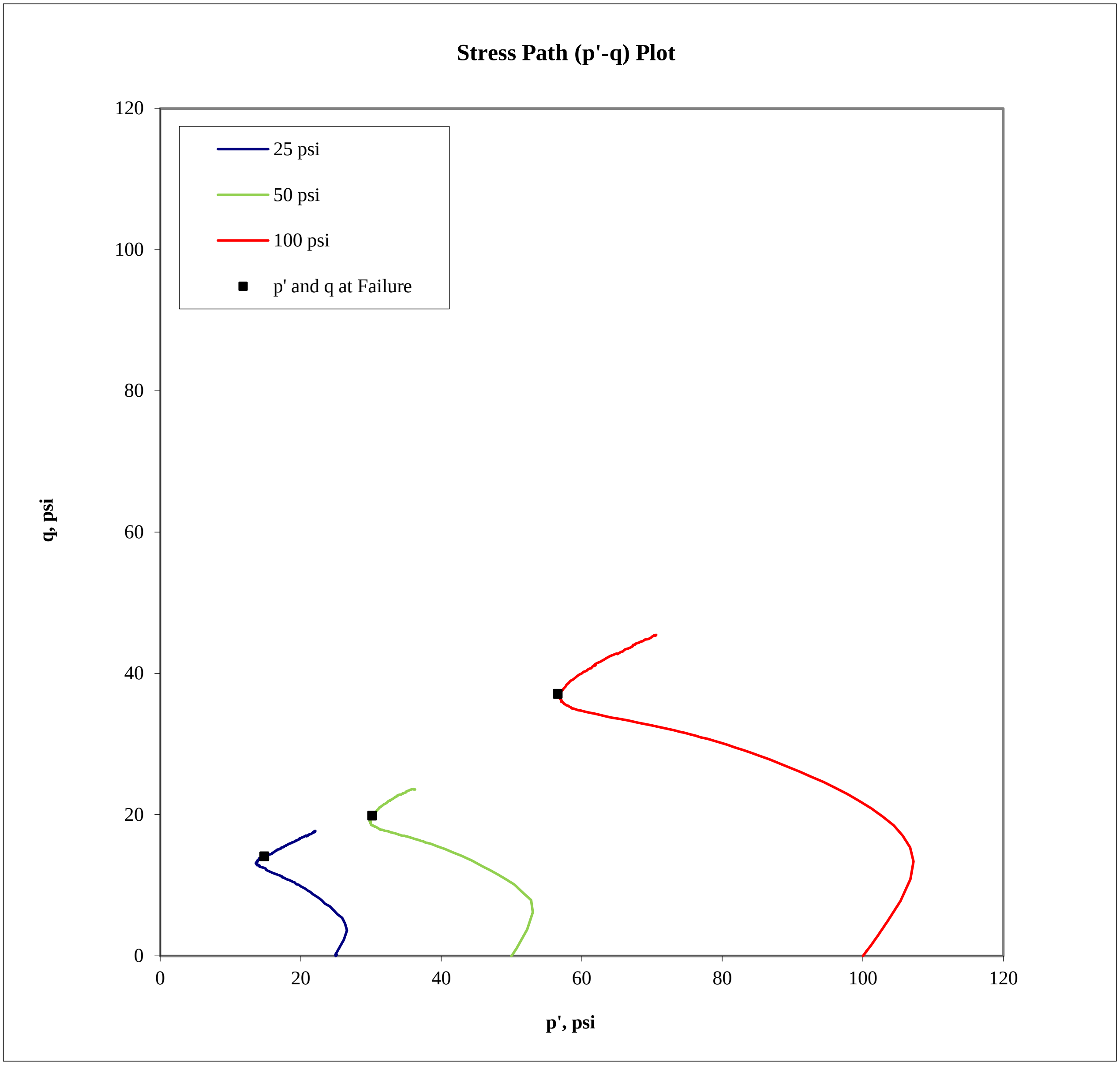
Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
Composite 1-4	**RJM**	**CCS**	**5/3/2013**	**103-92557.006**	**1**





Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
Composite 1-4	**RJM**	**CCS**	**5/3/2013**	**103-92557.006**	**2**

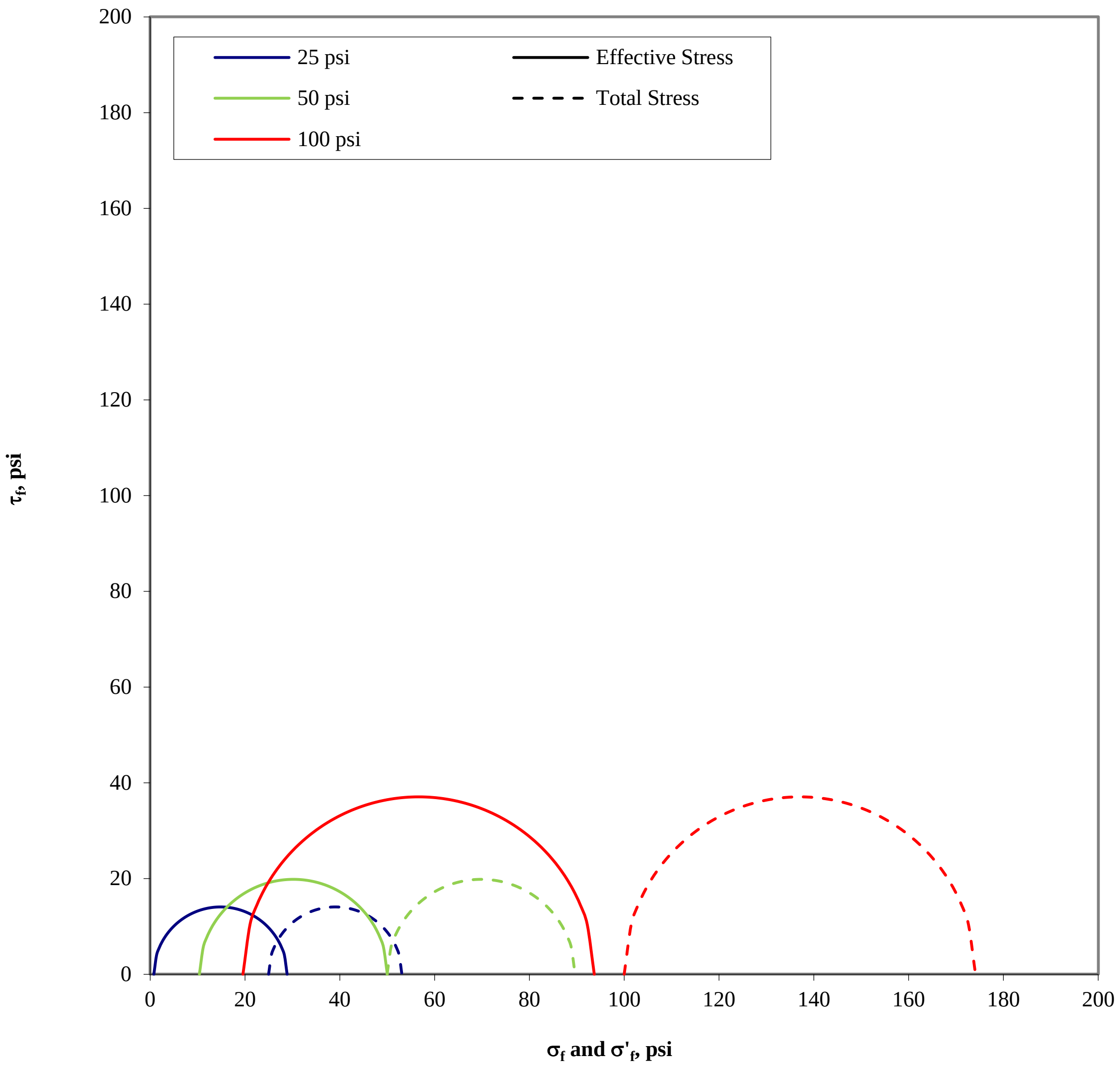


Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
25	39.1	14.8	14.1
50	69.8	30.2	19.8
100	137.0	56.6	37.0

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
Composite 1-4	**RJM**	**CCS**	**5/3/2013**	**103-92557.006**	**3**

Mohr's Circle Diagram



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
25	28.9	0.8	53.1	25.0
50	50.0	10.4	89.6	50.0
100	93.7	19.6	174.1	100.0

Golder Associates Inc. Denver, Colorado	**Title:** ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT MOHR'S CIRCLE DIAGRAM				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Composite 1-4	**Technician:** RJM	**Reviewed:** CCS	**Date:** 5/3/2013	**Job Number:** 103-92557.006	**Figure:** 4

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 25 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Composite 1-4	Technician: RJM	Reviewed: CCS	Date: 5/3/2013	Job Number: 103-92557.006	Figure: 5

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 50 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Composite 1-4	Technician: RJM	Reviewed: CCS	Date: 5/3/2013	Job Number: 103-92557.006	Figure: 6

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 100 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Composite 1-4	Technician: RJM	Reviewed: CCS	Date: 5/3/2013	Job Number: 103-92557.006	Figure: 7

	Point 1	Point 2	Point 3
Boring or Test Pit:	--	--	--
Sample:	BH-16	BH-16	BH-16
Depth:	0.0 - 8.5 ft	0.0 - 8.5 ft	0.0 - 8.5 ft
Point No.:	1	2	3
Initial			
Length =	5.751 in	5.785 in	5.764 in
Diameter =	2.882 in	2.812 in	2.877 in
Wet Mass =	2.743 lb	2.734 lb	2.724 lb
Area =	6.523 in^2	6.210 in^2	6.501 in^2
Volume =	37.516 in^3	35.927 in^3	37.471 in^3
Specific Gravity =	2.74 (Provided)	2.74 (Provided)	2.74 (Provided)
Dry Mass of Solids =	2.371 lb	2.367 lb	2.348 lb
Moisture Content =	15.7%	15.5%	16.0%
Wet Unit Weight =	126.3 pcf	131.5 pcf	125.6 pcf
Dry Unit Weight =	109.2 pcf	113.8 pcf	108.3 pcf
Void Ratio =	0.56	0.50	0.58
Percent Saturation =	76%	85%	76%
After Consolidation			
Length =	5.697 in	5.692 in	5.579 in
Diameter =	2.772 in	2.760 in	2.731 in
Area =	6.035 in^2 (Method B)	5.984 in^2 (Method B)	5.859 in^2 (Method B)
Volume =	34.380 in^3	34.058 in^3	32.690 in^3
Moisture Content =	15.8%	15.4%	13.7%
Wet Unit Weight =	138.0 pcf	138.6 pcf	141.2 pcf
Dry Unit Weight =	119.2 pcf	120.1 pcf	124.1 pcf
Void Ratio =	0.43	0.42	0.38
Percent Saturation =	100%	100%	100%
B Parameter =	0.95	0.98	0.95
Shear Rate =	0.083% /min.	0.083% /min.	0.083% /min.
t_{50} =	2.8 min.	-- (not computed)	0.8 min.
Strain at Failure =	5.0%	5.0%	5.0%
Cell Pressure =	75 psi	110 psi	150 psi
Back Pressure =	50 psi	60 psi	50 psi
Confining Pressure =	25 psi	50 psi	100 psi

Notes:

Sample description: Clayey gravel with sand, reddish brown, moist

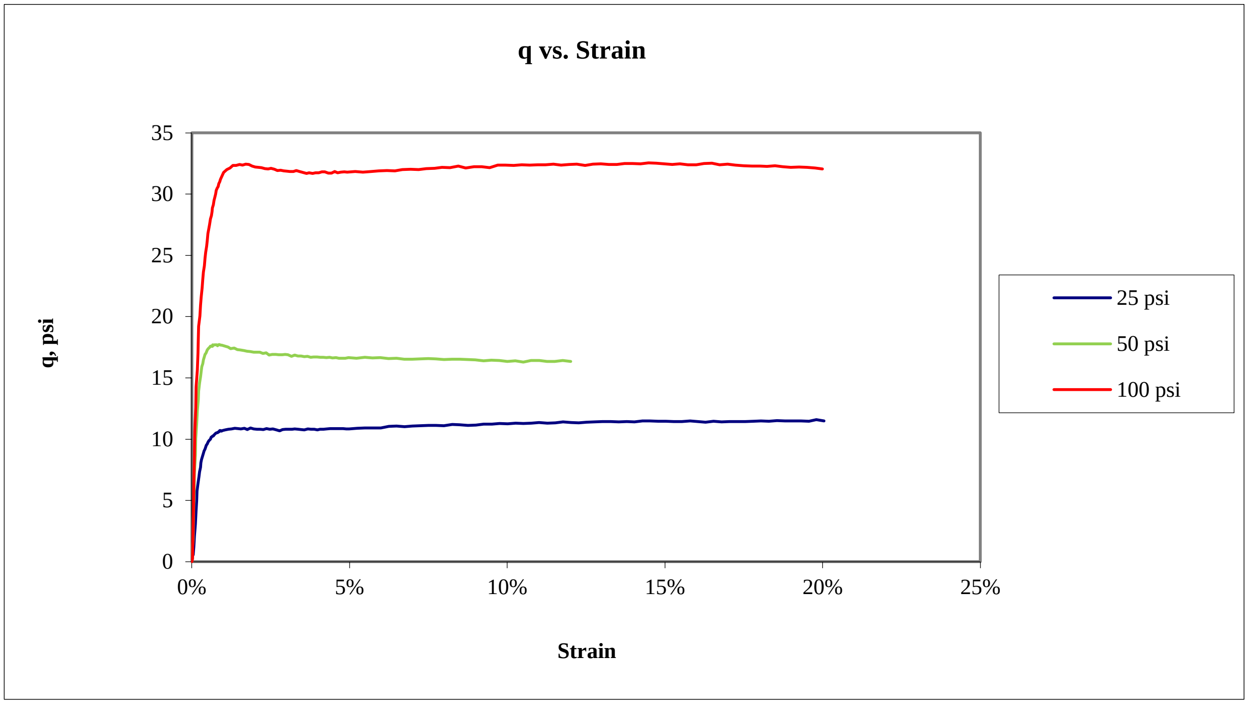
Atterberg limits: LL = 41 PL = 17 PI = 24 (ASTM D4318)

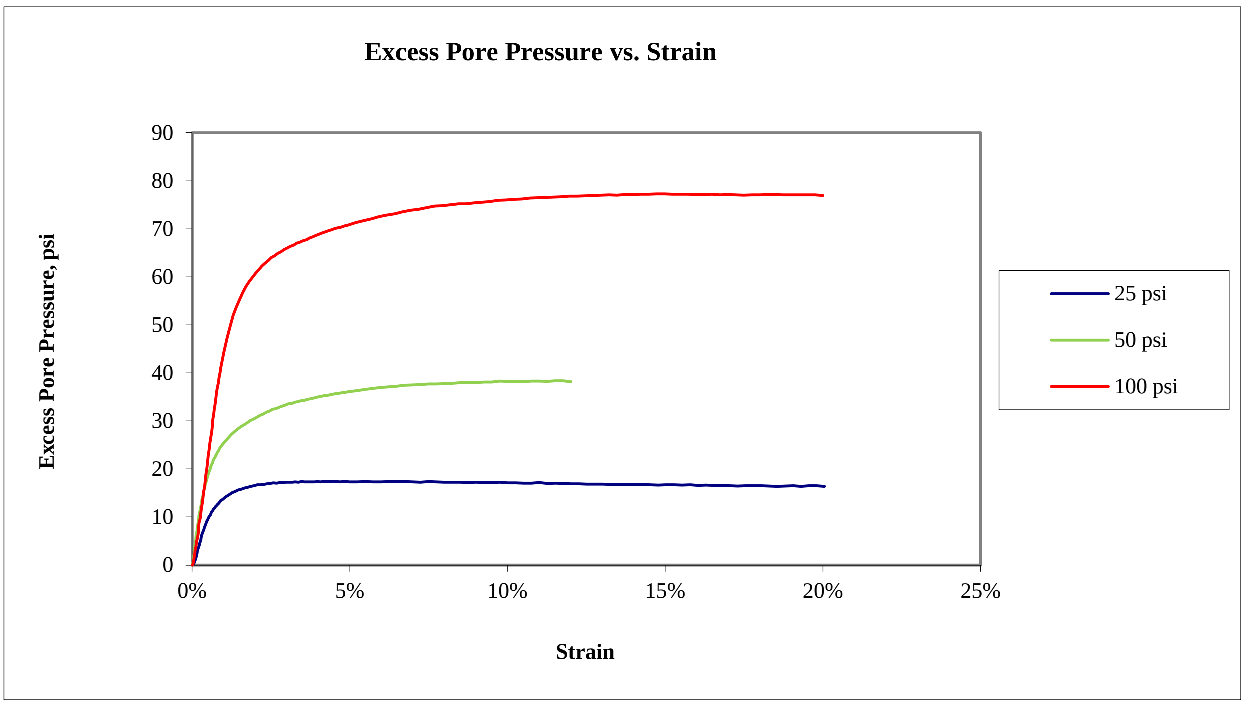
Percent finer: 3/4 in. = 91% No. 4 = 57% No. 200 = 31% (ASTM D422, refer to separate report for gradation curve)

Specimen type:		Intact	X	Reconstituted	Remold targets: 110.0 pcf (dry) at 16.0% moisture	
Moisture from:	X	Cuttings		Entire specimen		
Saturation method:	X	Wet		Dry		
Failure criterion:		$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$	5	% strain
Membrane effect:	X	Corrected		Not Corrected		

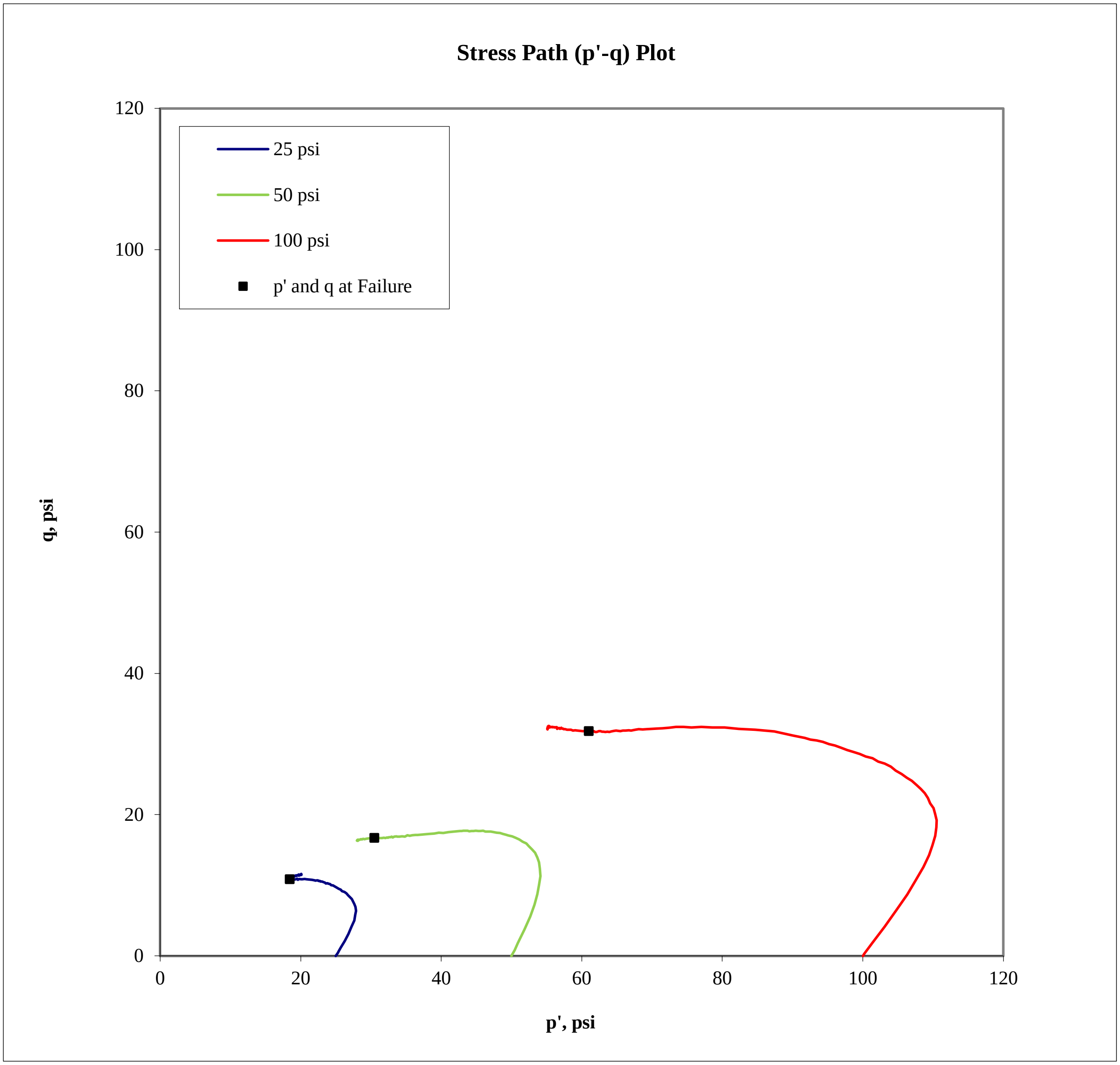
Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
BH-16 @ 0.0 - 8.5 ft	**RJM**	**CCS**	**3/26/2013**	**103-92557.006**	**1**



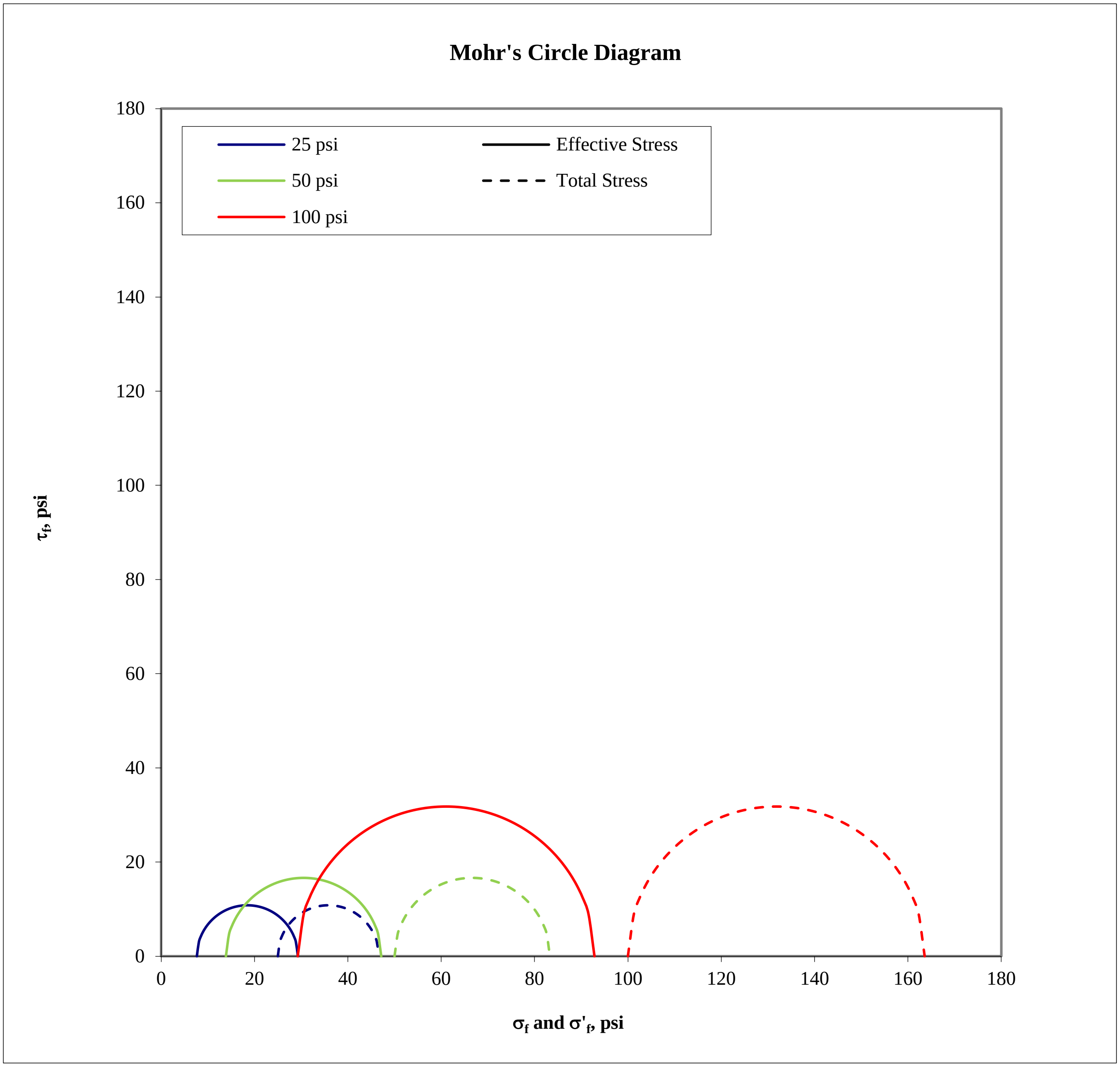


Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-16 @ 0.0 - 8.5 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Date:** **3/26/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
25	35.8	18.5	10.8
50	66.6	30.5	16.6
100	131.8	61.1	31.8

Golder Associates Inc. Denver, Colorado	**Title:** ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT STRESS PATH PLOT				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-16 @ 0.0 - 8.5 ft	**Technician:** RJM	**Reviewed:** CCS	**Date:** 3/26/2013	**Job Number:** 103-92557.006	**Figure:** 3



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
25	29.3	7.6	46.7	25.0
50	47.2	13.9	83.3	50.0
100	92.8	29.3	163.6	100.0

Golder Associates Inc.
Denver, Colorado

Title:
ASTM D4767
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT
MOHR'S CIRCLE DIAGRAM

Job Short Title: Copper Flat Tailings Design Study

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
BH-16 @ 0.0 - 8.5 ft	RJM	CCS	3/26/2013	103-92557.006	4

Golder Associates Inc. **Denver, Colorado**	**Title:** ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 25 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-16 @ 0.0 - 8.5 ft	**Technician:** RJM	**Reviewed:** CCS	**Date:** 3/26/2013	**Job Number:** 103-92557.006	**Figure:** 5

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 50 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-16 @ 0.0 - 8.5 ft	Technician: RJM	Reviewed: CCS	Date: 3/26/2013	Job Number: 103-92557.006	Figure: 6

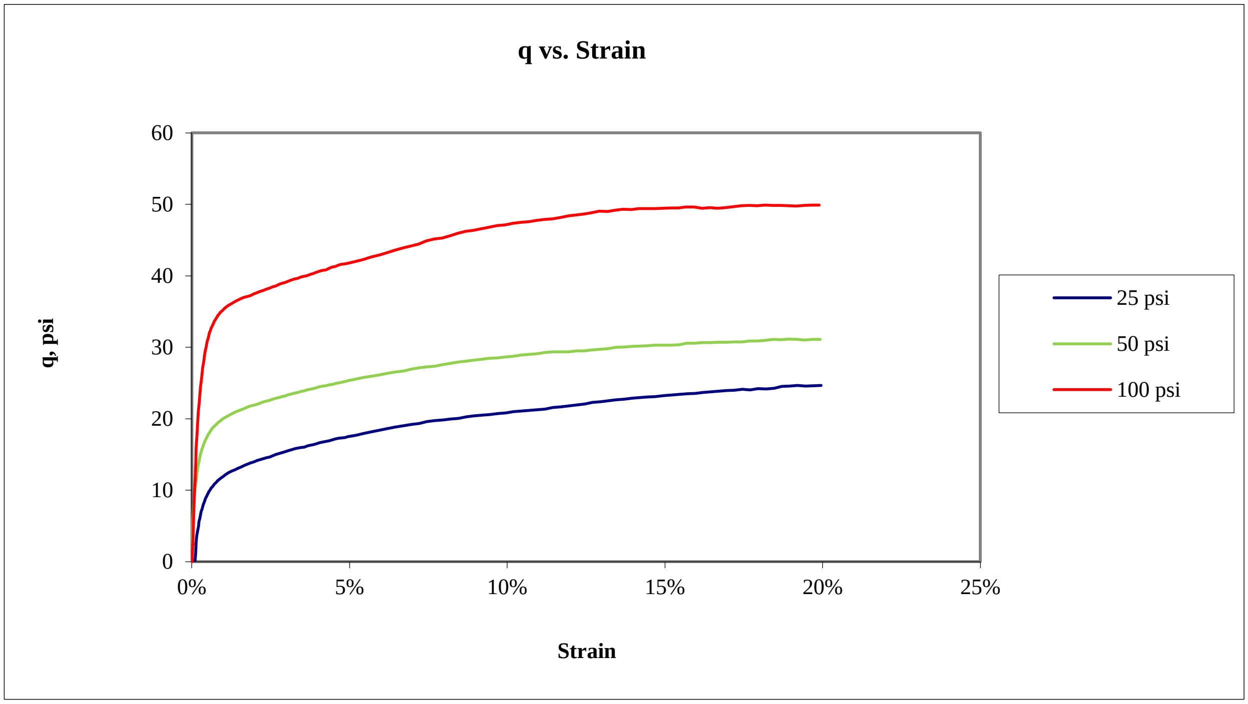
Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 100 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-16 @ 0.0 - 8.5 ft	Technician: RJM	Reviewed: CCS	Date: 3/26/2013	Job Number: 103-92557.006	Figure: 7

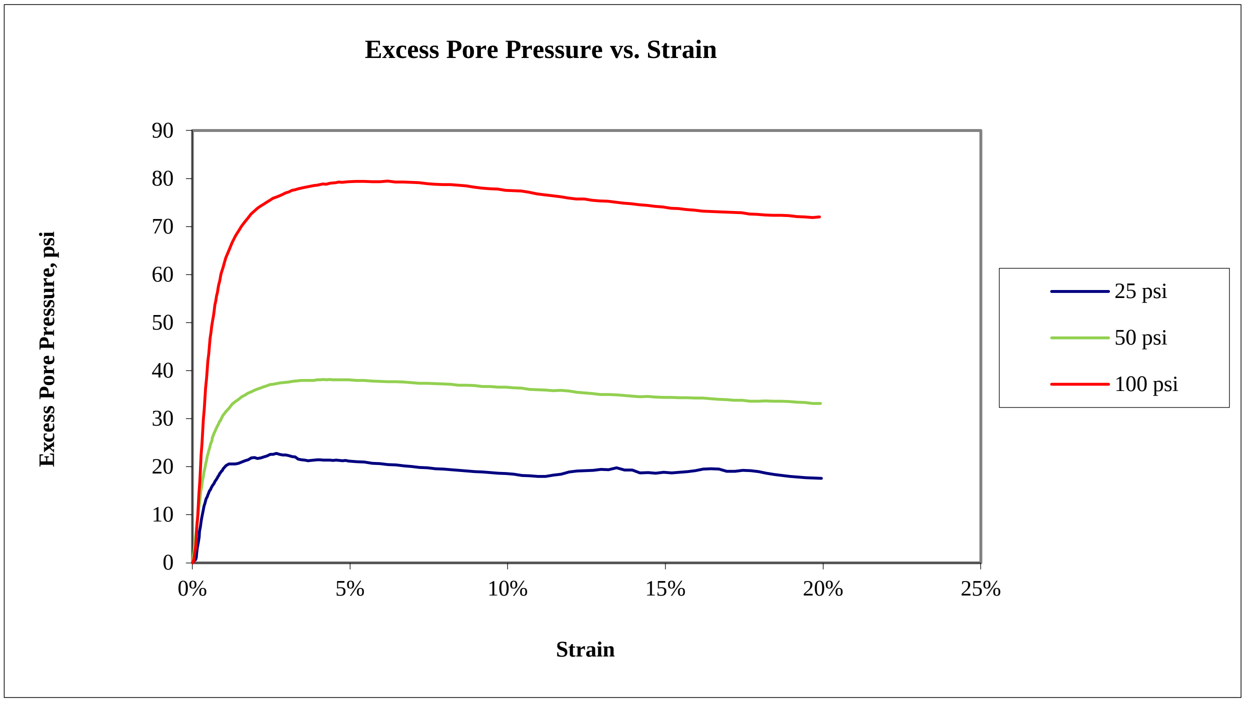
	Point 1	Point 2	Point 3
Boring or Test Pit:	--	--	--
Sample:	BH-25	BH-25	BH-25
Depth:	0.0 - 12.5 ft	0.0 - 12.5 ft	0.0 - 12.5 ft
Point No.:	1	2	3
Initial			
Length =	9.250 in	9.250 in	9.250 in
Diameter =	4.001 in	4.001 in	4.001 in
Wet Mass =	8.589 lb	8.601 lb	8.587 lb
Area =	12.573 in^2	12.573 in^2	12.573 in^2
Volume =	116.297 in^3	116.297 in^3	116.297 in^3
Specific Gravity =	2.74 (Provided)	2.74 (Provided)	2.74 (Provided)
Dry Mass of Solids =	7.443 lb	7.421 lb	7.416 lb
Moisture Content =	15.4%	15.9%	15.8%
Wet Unit Weight =	127.6 pcf	127.8 pcf	127.6 pcf
Dry Unit Weight =	110.6 pcf	110.3 pcf	110.2 pcf
Void Ratio =	0.54	0.55	0.55
Percent Saturation =	78%	79%	79%
After Consolidation			
Length =	9.195 in	9.131 in	9.054 in
Diameter =	3.788 in	3.765 in	3.749 in
Area =	11.267 in^2 (Method B)	11.133 in^2 (Method B)	11.037 in^2 (Method B)
Volume =	103.604 in^3	101.651 in^3	99.932 in^3
Moisture Content =	13.7%	12.9%	12.1%
Wet Unit Weight =	141.2 pcf	142.4 pcf	143.7 pcf
Dry Unit Weight =	124.1 pcf	126.2 pcf	128.2 pcf
Void Ratio =	0.38	0.35	0.33
Percent Saturation =	100%	100%	100%
B Parameter =	0.95	0.98	0.96
Shear Rate =	0.010% /min.	0.033% /min.	0.047% /min.
t_{50} =	38.0 min.	12.0 min.	8.4 min.
Strain at Failure =	5.0%	5.0%	5.0%
Cell Pressure =	65 psi	90 psi	145 psi
Back Pressure =	40 psi	40 psi	45 psi
Confining Pressure =	25 psi	50 psi	100 psi

Notes:
Sample description: Clayey gravel with sand, yellowish brown, moist
Atterberg limits: LL = 41 PL = 17 PI = 24 (ASTM D4318)
Percent finer: 3/4 in. = 88% No. 4 = 51% No. 200 = 17% (ASTM D422, refer to separate report for gradation curve)

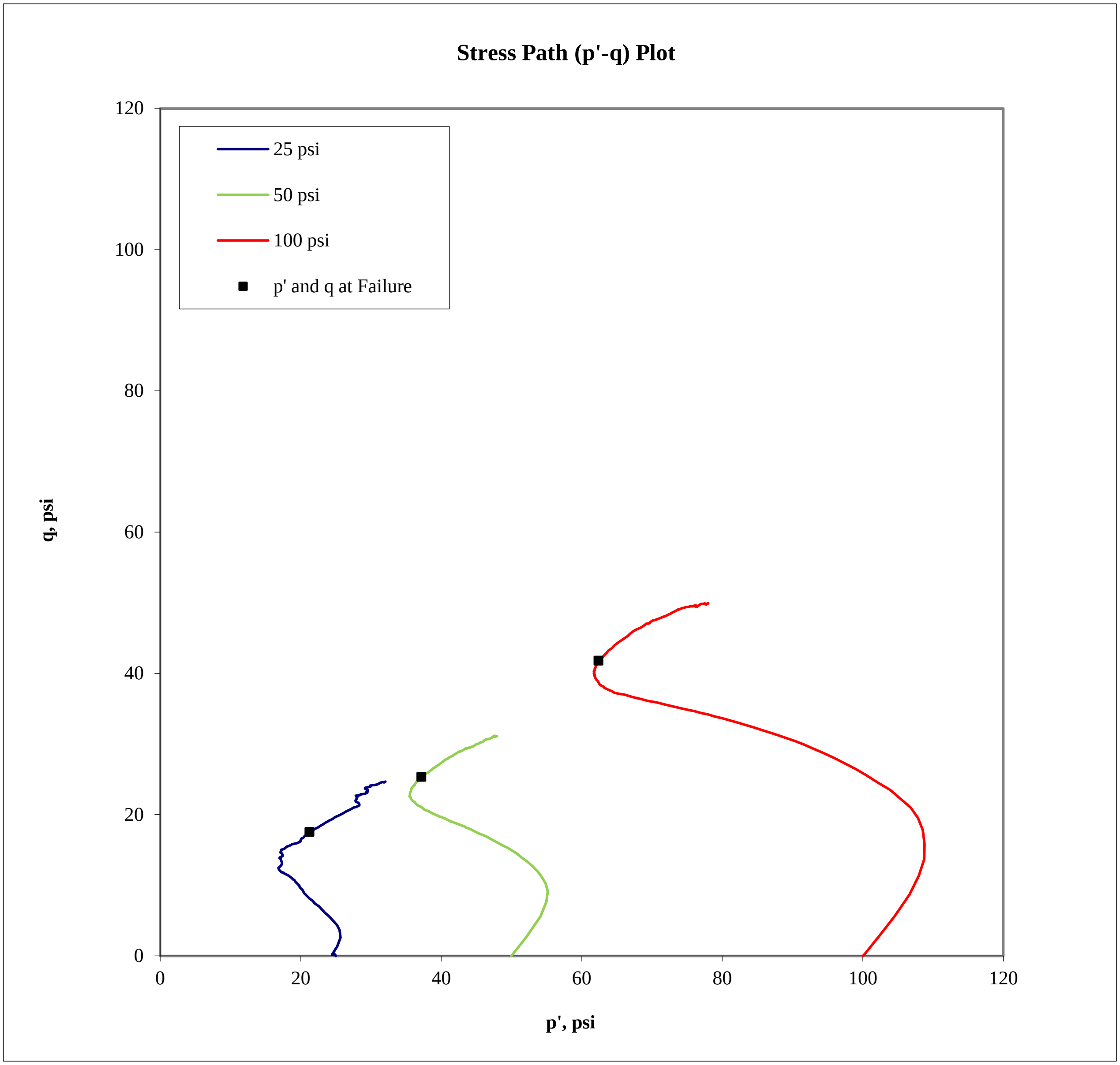
Specimen type:		Intact	X	Reconstituted	Remold targets: 110.0 pcf (dry) at 16.0% moisture	
Moisture from:	X	Cuttings		Entire specimen		
Saturation method:	X	Wet		Dry		
Failure criterion:		$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$	5	% strain
Membrane effect:	X	Corrected		Not Corrected		

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-25 @ 0.0 - 12.5 ft.**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Date:** **5/1/2013**	**Job Number:** **103-92557.006**	**Figure:** **1**





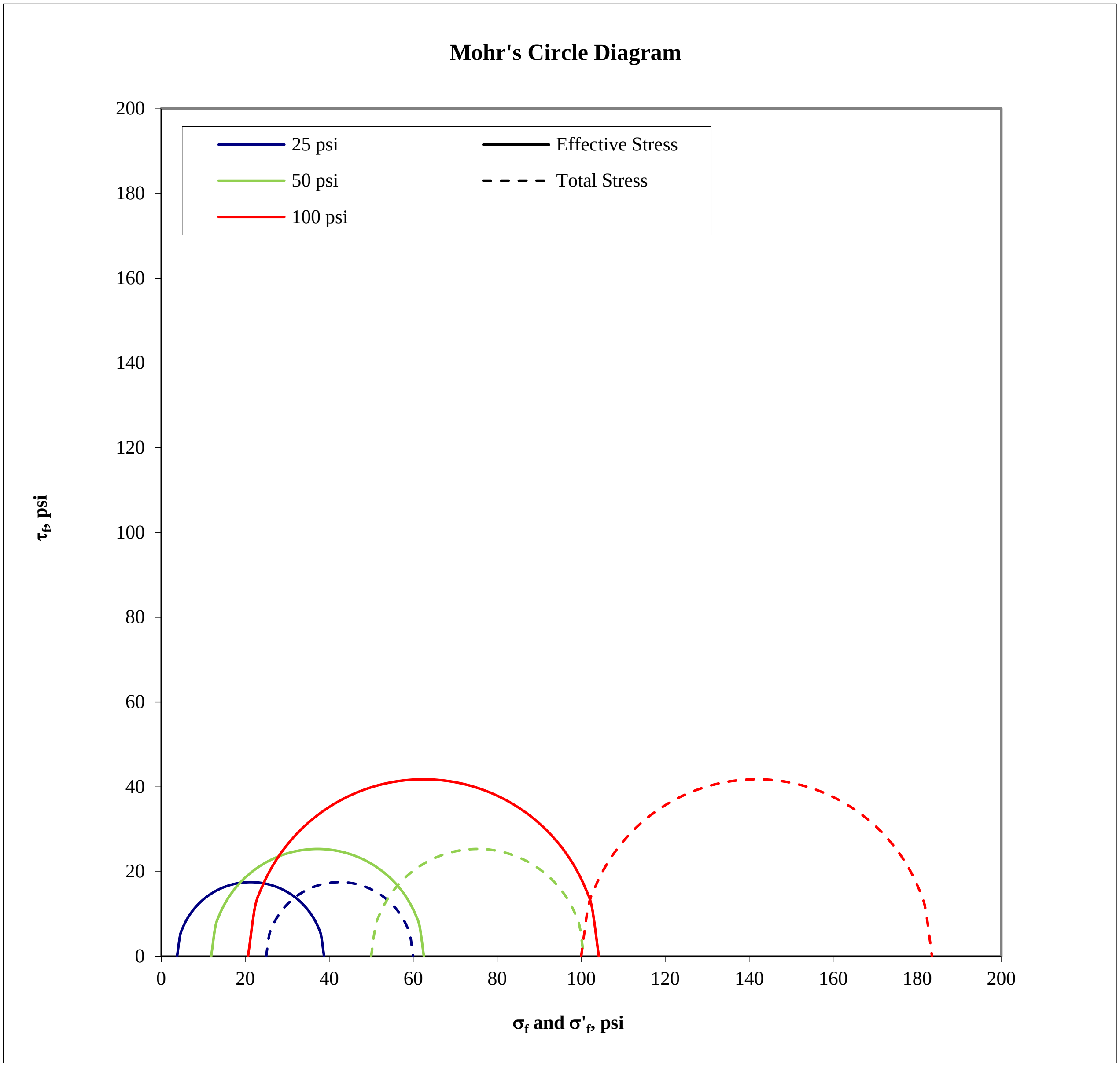
Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-25 @ 0.0 - 12.5 ft.**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Date:** **5/1/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
25	42.5	21.3	17.5
50	75.3	37.2	25.3
100	141.8	62.4	41.8

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
BH-25 @ 0.0 - 12.5 ft.	**RJM**	**CCS**	**5/1/2013**	**103-92557.006**	**3**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
25	38.8	3.8	60.0	25.0
50	62.5	11.9	100.6	50.0
100	104.2	20.7	183.5	100.0

Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **MOHR'S CIRCLE DIAGRAM**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
BH-25 @ 0.0 - 12.5 ft.	**RJM**	**CCS**	**5/1/2013**	**103-92557.006**	**4**

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 25 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-25 @ 0.0 - 12.5 ft.	Technician: RJM	Reviewed: CCS	Date: 5/1/2013	Job Number: 103-92557.006	Figure: 5

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 50 psi
Job Short Title: Copper Flat Tailings Design Study	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
BH-25 @ 0.0 - 12.5 ft.	RJM	CCS	5/1/2013	103-92557.006	6

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 100 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-25 @ 0.0 - 12.5 ft.	Technician: RJM	Reviewed: CCS	Date: 5/1/2013	Job Number: 103-92557.006	Figure: 7

	Point 1		Point 2		Point 3	
Boring or Test Pit:	--		--		--	
Sample:	TP-10		TP-10		TP-10	
Depth:	3.0 - 12.0 ft		3.0 - 12.0 ft		3.0 - 12.0 ft	
Point No.:	1		2		3	
Initial						
Length =	5.786	in	5.784	in	5.796	in
Diameter =	2.886	in	2.886	in	2.886	in
Wet Mass =	2.610	lb	2.611	lb	2.607	lb
Area =	6.542	in^2	6.542	in^2	6.542	in^2
Volume =	37.850	in^3	37.836	in^3	37.915	in^3
Specific Gravity =	2.74	(Provided)	2.74	(Provided)	2.74	(Provided)
Dry Mass of Solids =	2.256	lb	2.247	lb	2.240	lb
Moisture Content =	15.7%		16.2%		16.4%	
Wet Unit Weight =	119.2	pcf	119.2	pcf	118.8	pcf
Dry Unit Weight =	103.0	pcf	102.6	pcf	102.1	pcf
Void Ratio =	0.66		0.66		0.67	
Percent Saturation =	65%		67%		67%	
After Consolidation						
Length =	5.747	in	5.724	in	5.667	in
Diameter =	2.842	in	2.855	in	2.884	in
Area =	6.345	in^2 (Method B)	6.400	in^2 (Method B)	6.532	in^2 (Method B)
Volume =	36.467	in^3	36.631	in^3	37.016	in^3
Moisture Content =	21.8%		22.3%		23.1%	
Wet Unit Weight =	130.2	pcf	129.6	pcf	128.7	pcf
Dry Unit Weight =	106.9	pcf	106.0	pcf	104.6	pcf
Void Ratio =	0.60		0.61		0.63	
Percent Saturation =	100%		100%		100%	
B Parameter =	0.96		0.95		0.95	
Shear Rate =	0.083%	/min.	0.083%	/min.	0.083%	/min.
t_{50} =	0.5	min.	0.6	min.	0.4	min.
Strain at Failure =	5.0%		5.0%		5.0%	
Cell Pressure =	95	psi	130	psi	190	psi
Back Pressure =	70	psi	80	psi	90	psi
Confining Pressure =	25	psi	50	psi	100	psi

Notes:

Sample description: Silty sand, brownish yellow, moist

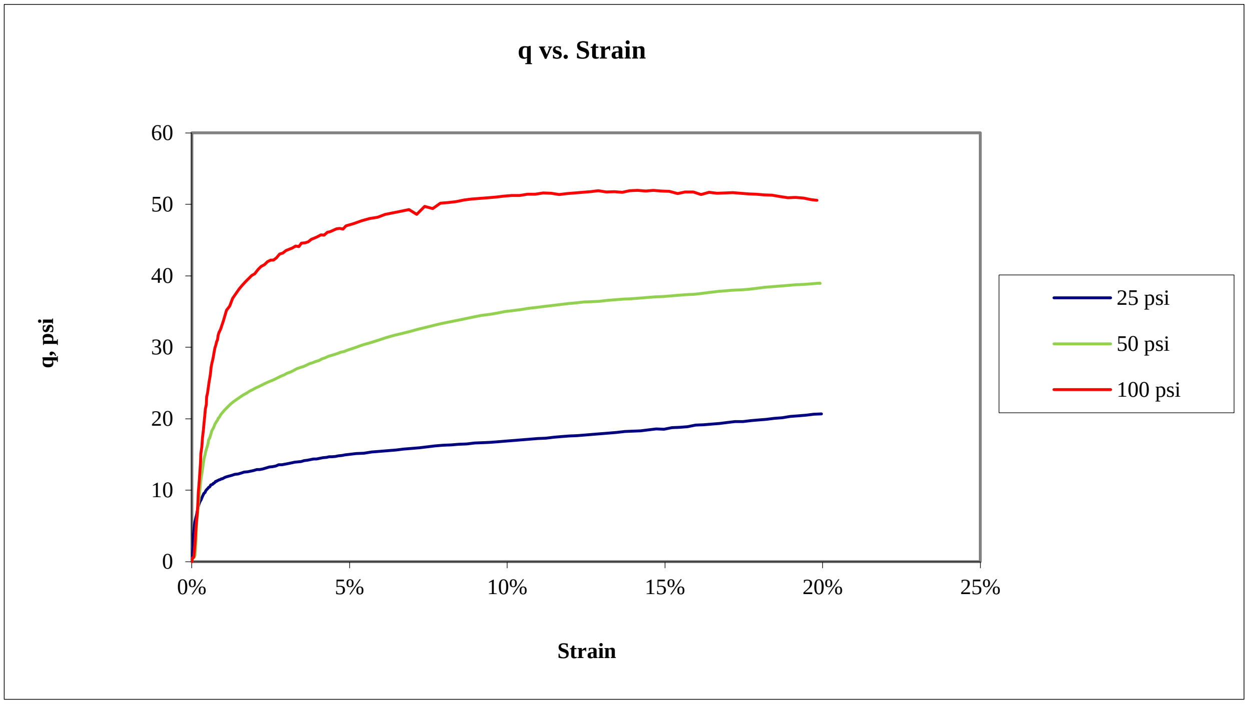
Atterberg limits: LL = NP PL = NP PI = NP (ASTM D4318)

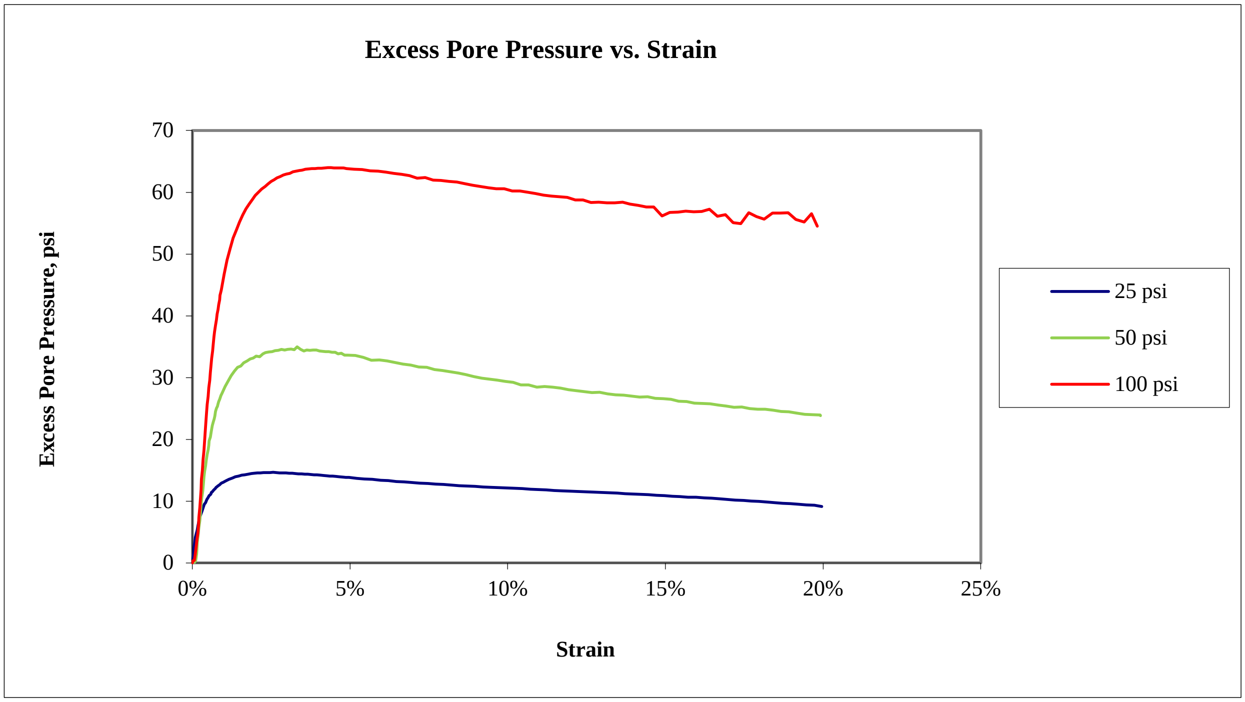
Percent finer: 3/4 in. = 100% No. 4 = 100% No. 200 = 49% (ASTM D422, refer to separate report for gradation curve)

Specimen type:		Intact	X	Reconstituted	Remold targets: 104.7 pcf (dry) at 16.2% moisture
Moisture from:		Cuttings	X	Entire specimen	
Saturation method:	X	Wet		Dry	
Failure criterion:		$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$	5 % strain
Membrane effect:	X	Corrected		Not Corrected	

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**
Job Short Title: **Copper Flat Tailings Design Study**	

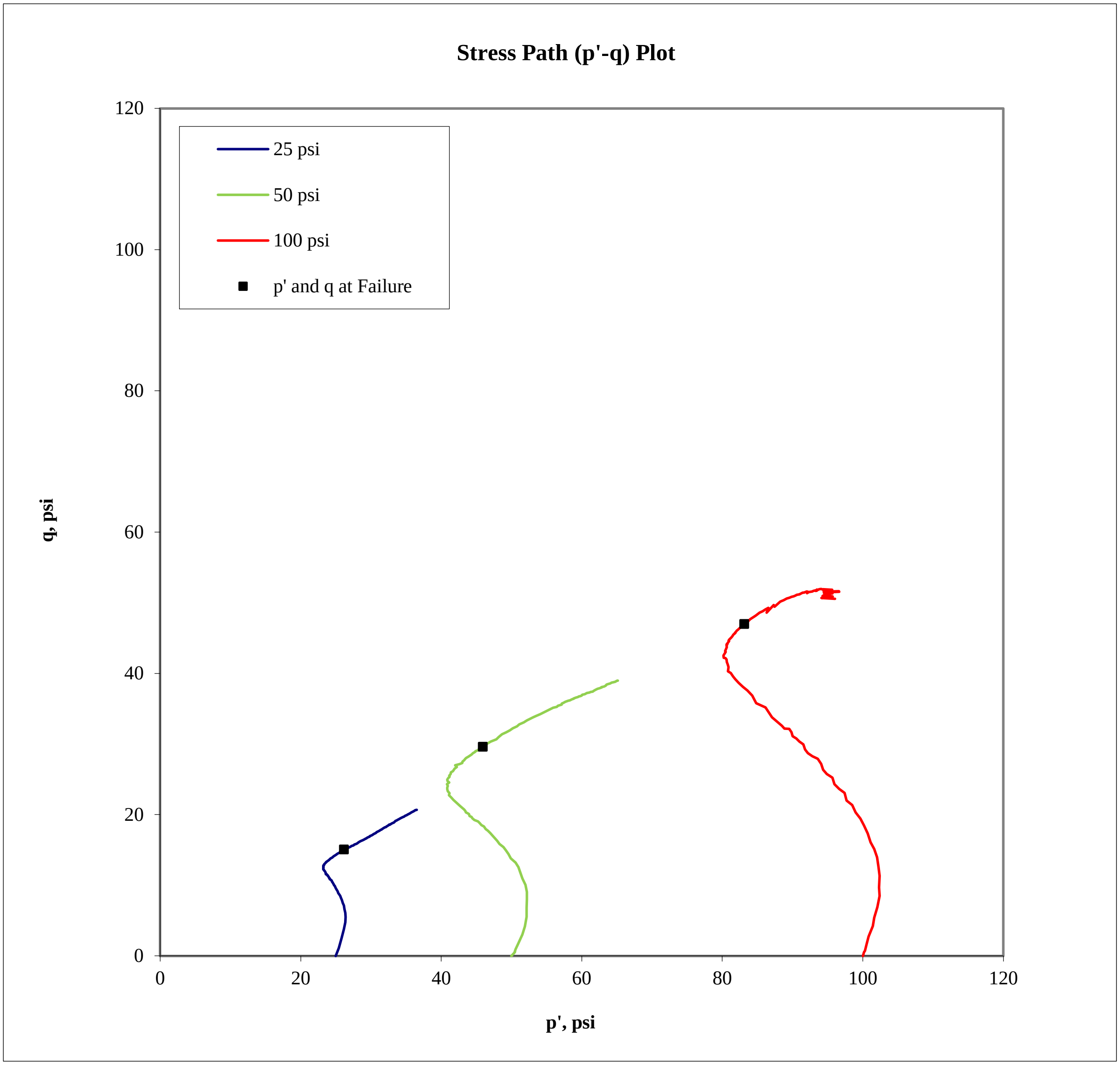
Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
TP-10 @ 3 - 12 ft	**RJM**	**CCS**	**4/8/2013**	**103-92557.006**	**1**





Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **TP-10 @ 3 - 12 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Date:** **4/8/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**

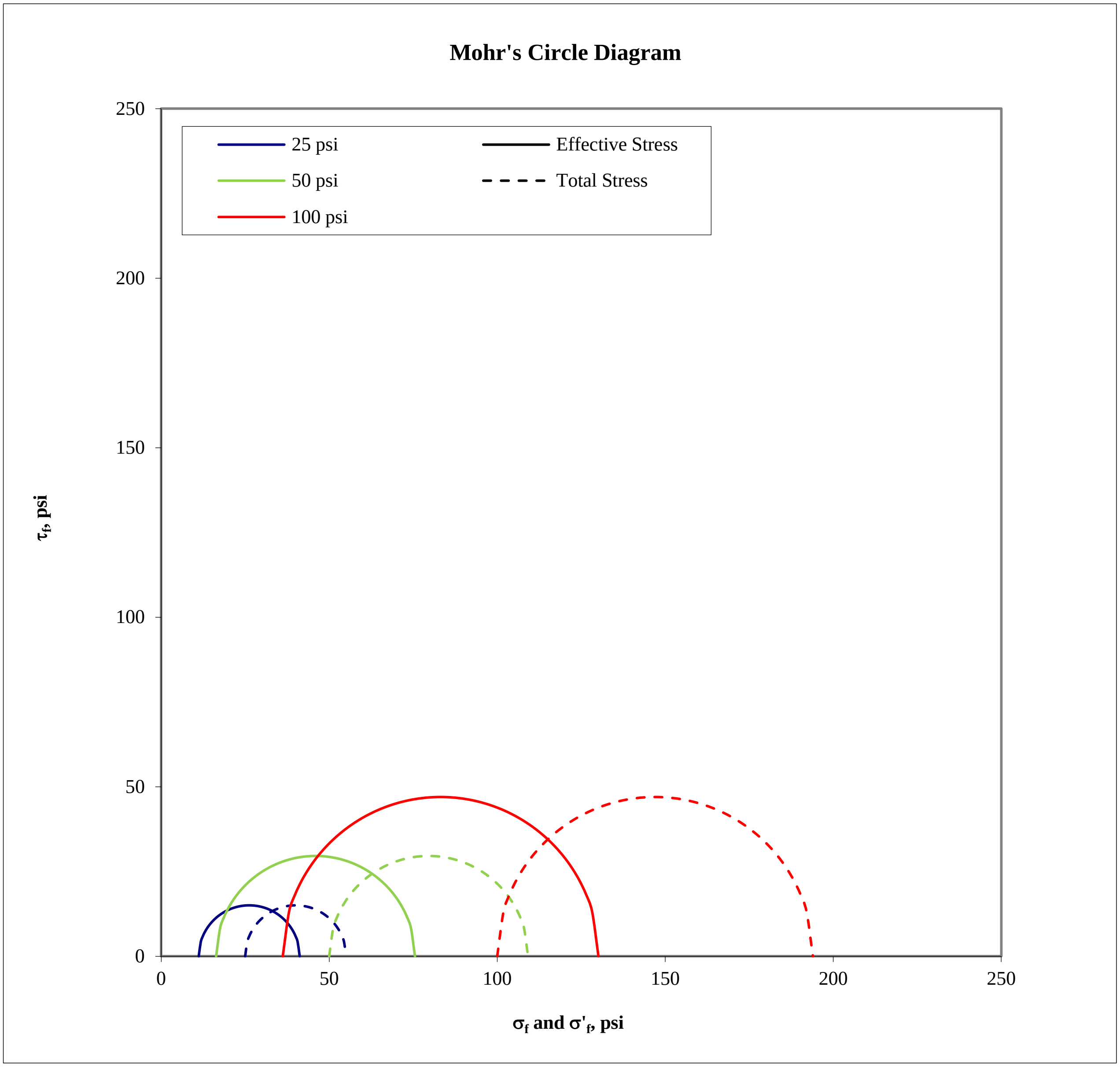
Stress Path (p'-q) Plot



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
25	40.0	26.2	15.0
50	79.6	45.9	29.6
100	147.0	83.2	47.0

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
TP-10 @ 3 - 12 ft	**RJM**	**CCS**	**4/8/2013**	**103-92557.006**	**3**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
25	41.2	11.2	55.0	25.0
50	75.5	16.4	109.2	50.0
100	130.1	36.2	193.9	100.0

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **MOHR'S CIRCLE DIAGRAM**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
TP-10 @ 3 - 12 ft	**RJM**	**CCS**	**4/8/2013**	**103-92557.006**	**4**

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 25 psi
Job Short Title: Copper Flat Tailings Design Study	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
TP-10 @ 3 - 12 ft	RJM	CCS	4/8/2013	103-92557.006	5

Golder Associates Inc. Denver, Colorado					Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 50 psi
Job Short Title: Copper Flat Tailings Design Study					
Sample: TP-10 @ 3 - 12 ft	Technician: RJM	Reviewed: CCS	Date: 4/8/2013	Job Number: 103-92557.006	Figure: 6

Golder Associates Inc.
Denver, Colorado

Job Short Title: Copper Flat Tailings Design Study

Title:
ASTM D4767
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT
SPECIMEN PHOTOGRAPH - 100 psi

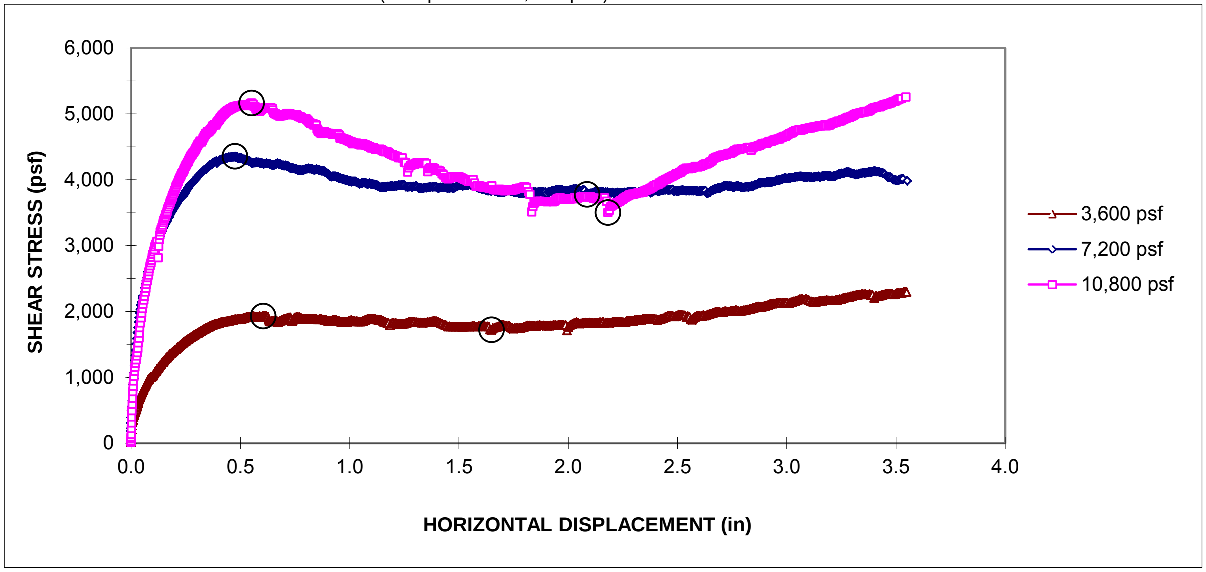
Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
TP-10 @ 3 - 12 ft	RJM	CCS	4/8/2013	103-92557.006	7

DIRECT SHEAR TEST RESULTS

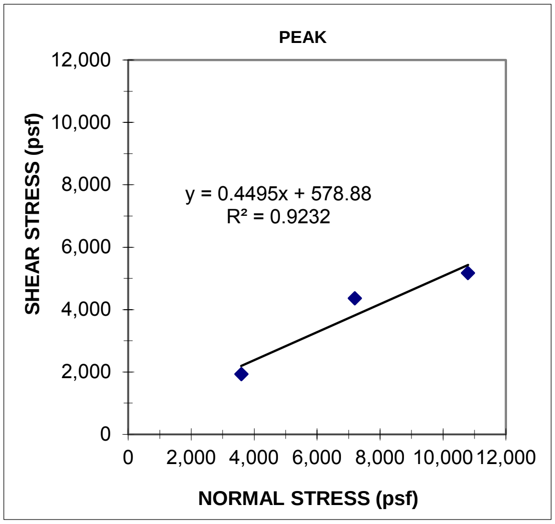
ASTM D5321

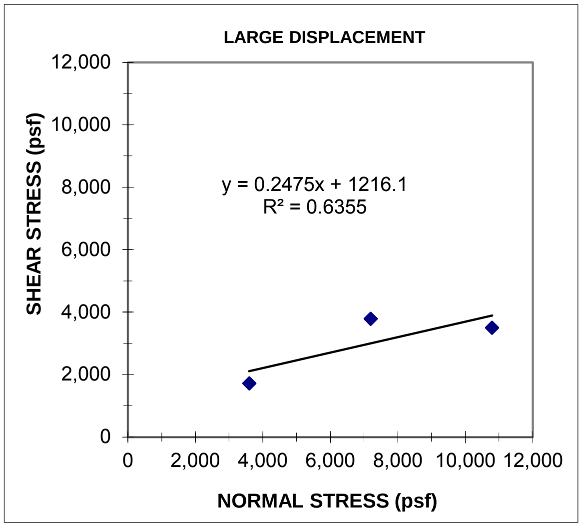
PROJECT NAME: Copper Flat Tailings Design Study
SAMPLE NUMBER: Tailings / 80-mil Textured Geomembrane / Drain Rock

APPARTUS: 12.0 inch by 12.0 inch shear box; air bladder used to apply normal loads.
INTERFACE TESTED: Top: Tailings (remolded to 104.7 pcf @ 15.7% moisture content)
Bottom: GSE 80-mil HDPE double-sided textured geomembrane
TEST CONDITIONS: Drain Rock inundated; consolidated overnight at normal load; Floating geomembrane
SHEAR RATE: 0.04 in/min
SUBSTRATE: Drain Rock (Composites 1-4, scalped)



Normal	Shear Stress		Peak		Large Displacement	
Stress (psf)	Peak[1] (psf)	Lg. Displ. (psf)	Friction Angle	Adhesion[2] (psf)	Friction Angle	Adhesion[2] (psf)
3,600	1,927	1,717				
7,200	4,354	3,778	24.2	578.9	13.9	1216.1
10,800	5,164	3,500				





Observations After Test

Peak and residual shear strengths were chosen based on testing observations. Shear stresses measured at greater horizontal displacements than those chosen for the large-displacement shear strength appeared to have been affected by gravel particles pushing against the end of the bottom shear box.

3,600 psf: Primary failure occurred at Geomembrane-Drain Rock interface; some displacement at Geomembrane-Tailings interface
7,200 psf: Primary failure occurred at Geomembrane-Drain Rock interface; some displacement at Geomembrane-Tailings interface
10,800 psf: Primary failure occurred at Geomembrane-Drain Rock interface; some displacement at Geomembrane-Tailings interface
Drain Gravel interfered with shear boxes at approximately 2.2 inches displacement and may have affected

Tech: PRH
Review: CCS

(1) Peak shear stresses for 3,600 psf, 7,200 psf, and 10,800 psf normal stresses were chosen at 0.606, 0.476, and 0.552 inches horizontal displacements, respectively.
(2) Interface shear parameters are based on the "best-fit" line per ASTM D5321. Interpretation of the test data by a qualified professional for the specific application is required.

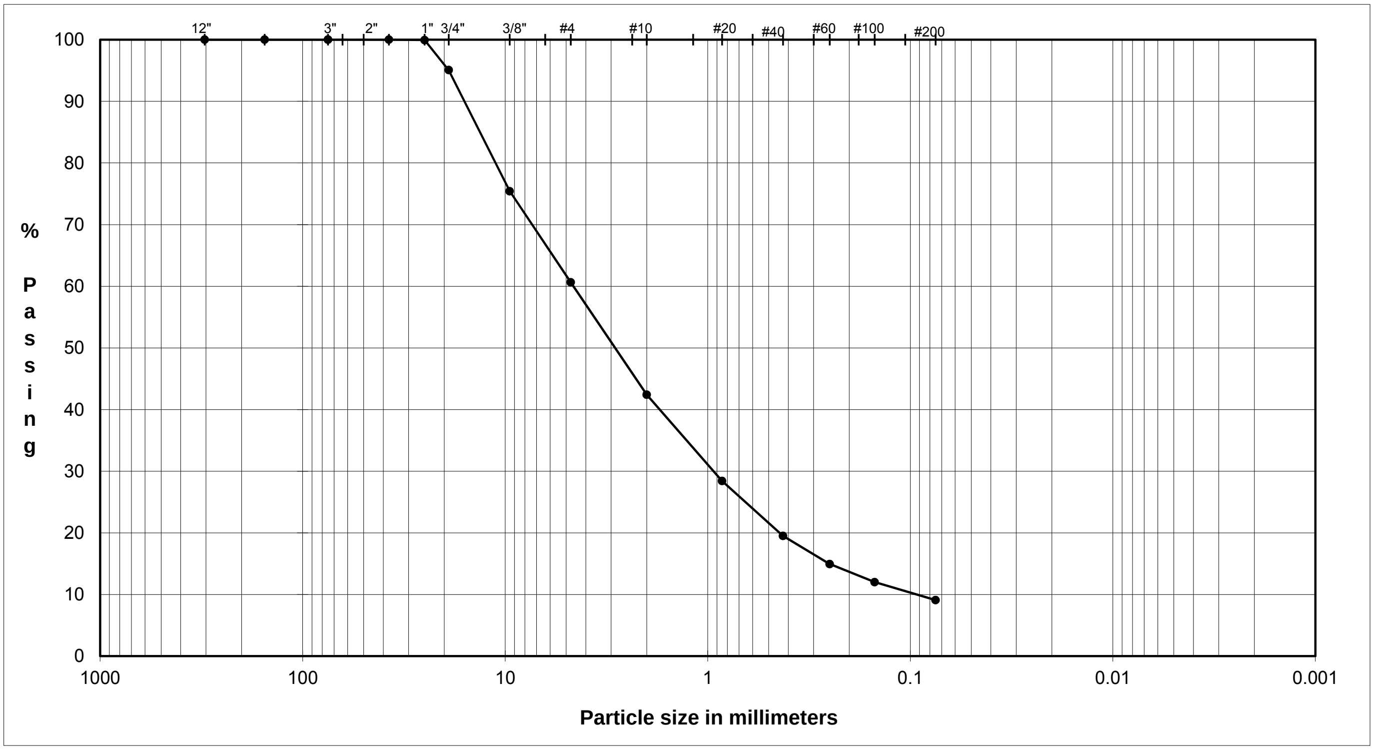
Golder Associates Inc.

APPENDIX A.3.3
PERMEABILITY TEST REPORTS

PRE-PERM PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Compostie 1-4** Depth (ft) --
TYPE: **Pail**

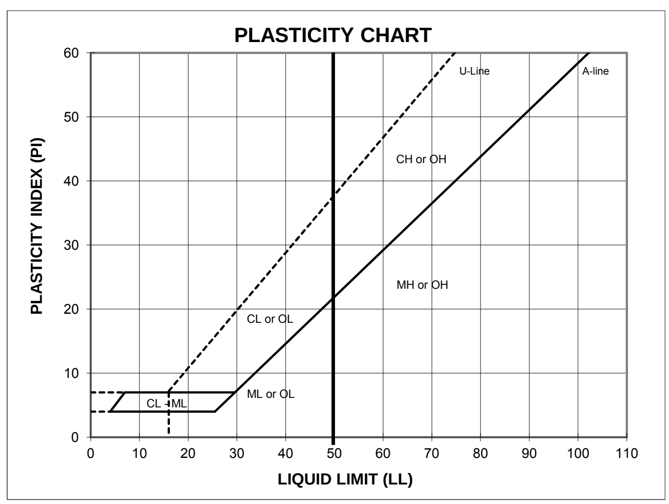


	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

PRE-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**99.9**		
0.75"	19.0	**95.1**	Coarse Gravel	**4.93**
0.375"	9.5	**75.4**		
#4	4.8	**60.7**	Fine Gravel	**34.42**
#10	2.0	**42.4**	Coarse Sand	**18.25**
#20	0.9	**28.4**		
#40	0.4	**19.5**	Medium Sand	**22.89**
#60	0.3	**14.9**		
#100	0.2	**12.0**		
#200	0.1	**9.1**	Fine Sand	**10.42**
			Fines	**9.09**



ATTERBERG LIMITS

M_c	LL	PL	PI	SG
--	--	--	--	--

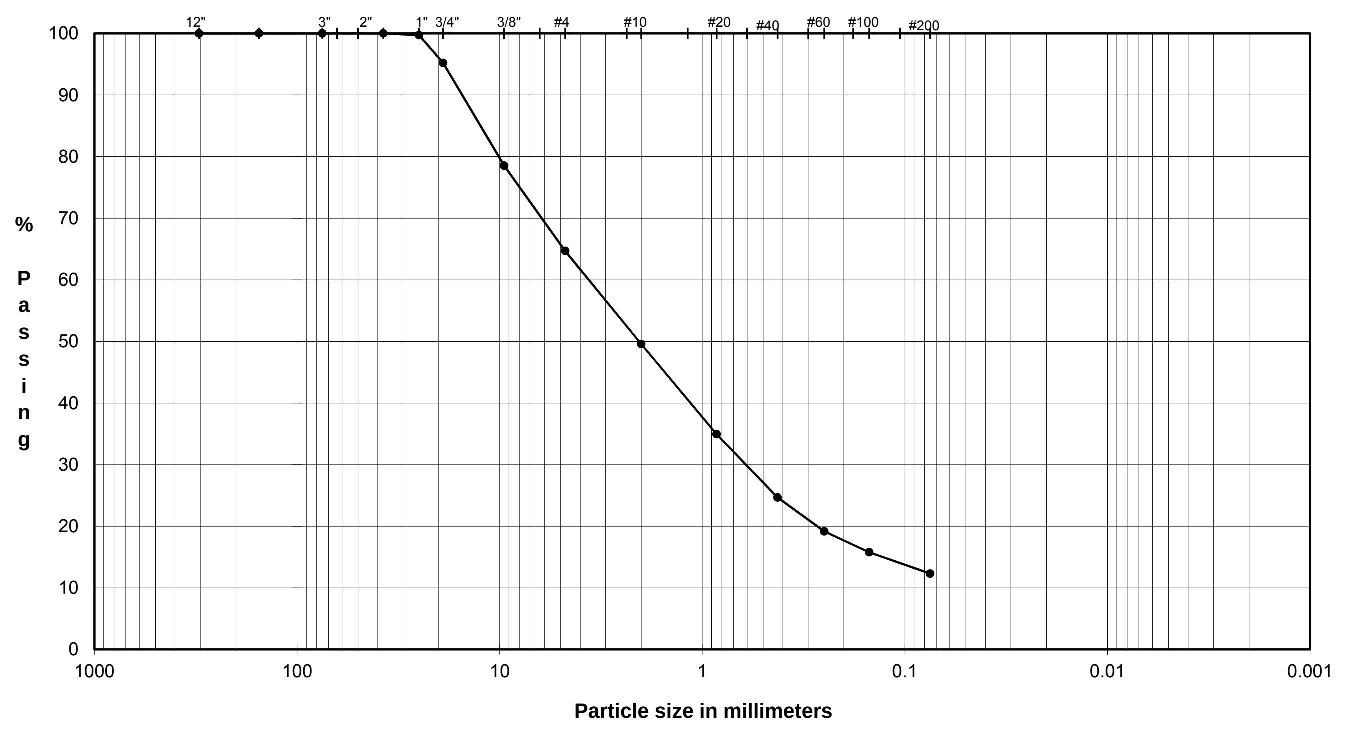
Visual Description (Golder Procedure): silty clayey SAND and GRAVEL, yellowish brown, dry

USCS: --

TECH	EH
DATE	4/10/13
REVIEW	MB

POST-PERM PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Compostie 1-4** Depth (ft) --
TYPE: **Pail**

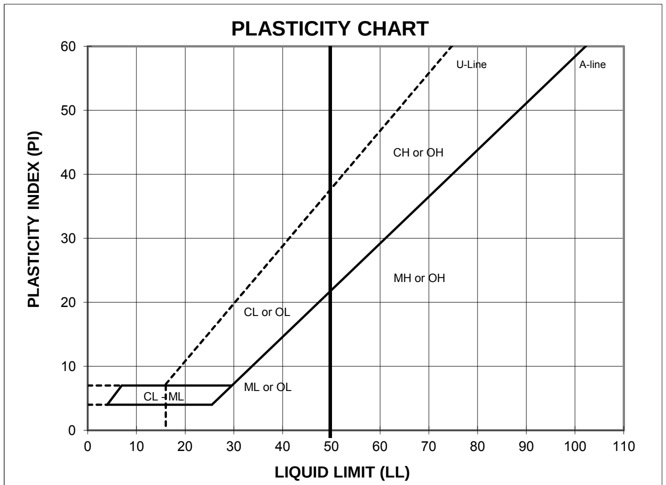


	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

POST-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**99.7**		
0.75"	19.0	**95.2**	Coarse Gravel	**4.79**
0.375"	9.5	**78.5**		
#4	4.8	**64.7**	Fine Gravel	**30.52**
#10	2.0	**49.6**	Coarse Sand	**15.12**
#20	0.9	**34.9**		
#40	0.4	**24.7**	Medium Sand	**24.90**
#60	0.3	**19.2**		
#100	0.2	**15.8**		
#200	0.1	**12.3**	Fine Sand	**12.36**
			Fines	**12.31**



ATTERBERG LIMITS

M_c	LL	PL	PI	SG
--	--	--	--	--

Visual Description (Golder Procedure): silty clayey SAND and GRAVEL, yellowish brown, dry

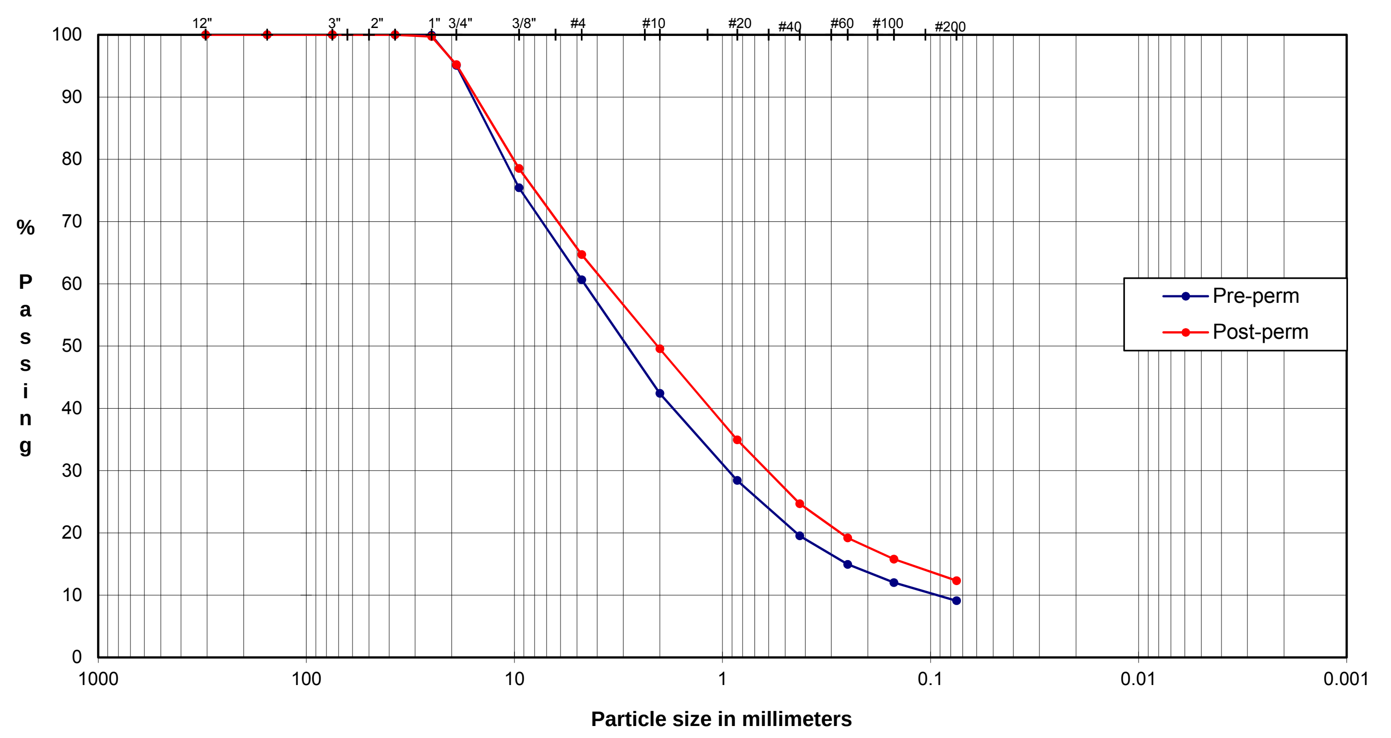
USCS: --

TECH	EH
DATE	4/16/2013
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Compostie 1-4** Depth (ft) --
TYPE: **Pail**



COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

PRE-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**99.9**		
0.75"	19.0	**95.1**	Coarse Gravel	**4.93**
0.375"	9.5	**75.4**		
#4	4.8	**60.7**	Fine Gravel	**34.42**
#10	2.0	**42.4**	Coarse Sand	**18.25**
#20	0.9	**28.4**		
#40	0.4	**19.5**	Medium Sand	**22.89**
#60	0.3	**14.9**		
#100	0.2	**12.0**		
#200	0.1	**9.1**	Fine Sand	**10.42**
			Fines	**9.09**

POST-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**99.7**		
0.75"	19.0	**95.2**	Coarse Gravel	**4.79**
0.375"	9.5	**78.5**		
#4	4.8	**64.7**	Fine Gravel	**30.52**
#10	2.0	**49.6**	Coarse Sand	**15.12**
#20	0.9	**34.9**		
#40	0.4	**24.7**	Medium Sand	**24.90**
#60	0.3	**19.2**		
#100	0.2	**15.8**		
#200	0.1	**12.3**	Fine Sand	**12.36**
			Fines	**12.31**

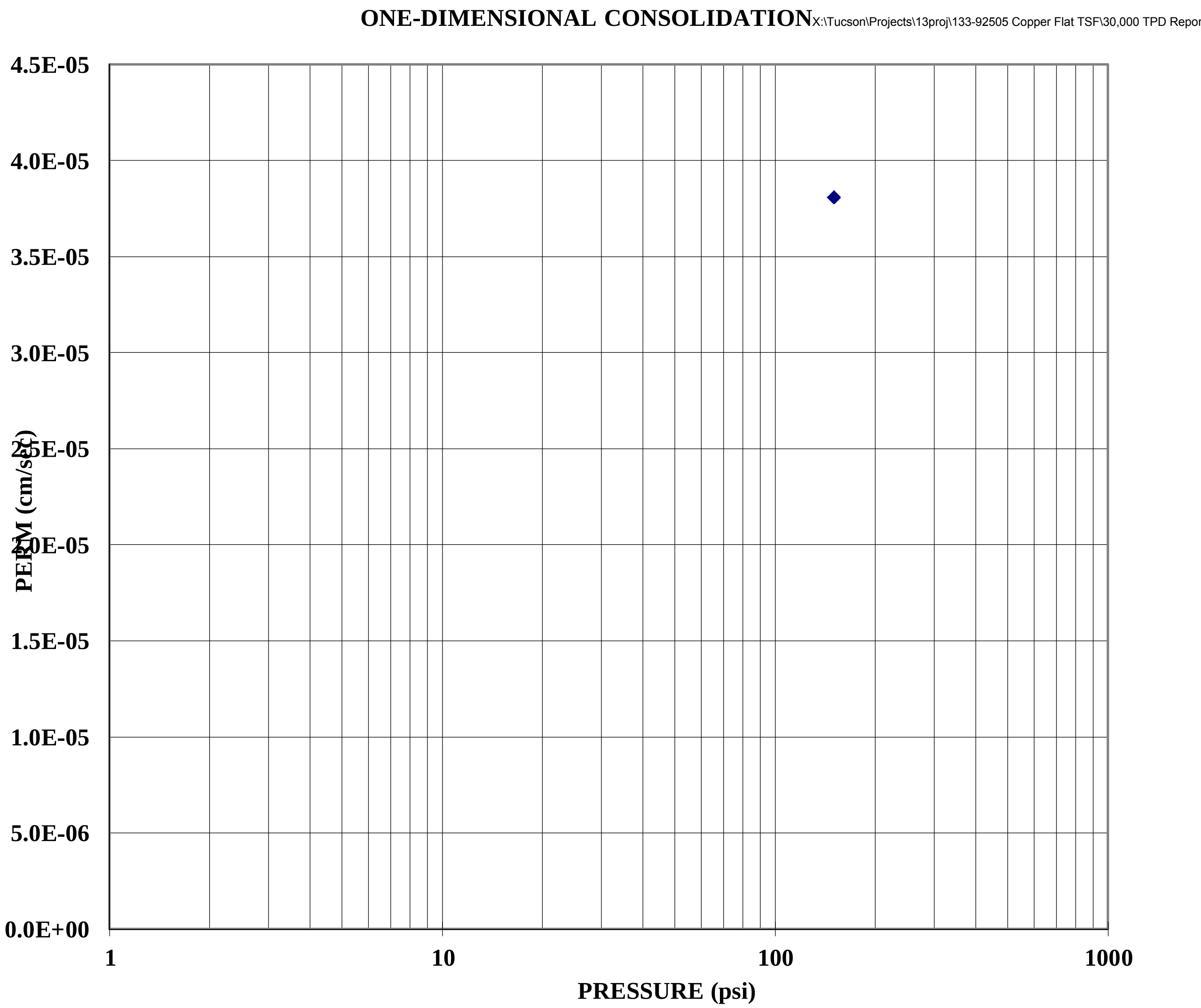
ATTERBERG LIMITS

M_c	LL	PL	PI	SG
--	--	--	--	**--**

Visual Description (Golder Procedure): silty clayey SAND and GRAVEL, yellowish brown, dry

USCS: --

TECH	EH
DATE	4/10/13
REVIEW	MB



SAMPLE #:	Composite 1-4
Visual Description (Golder Procedure):	silty clayey SAND and GRAVEL, yellowish brown, dry

DATE	4/11/2013
TECH	MGC
REVIEW	MB

103-92557.006

Copper Flat Tailings Design Study

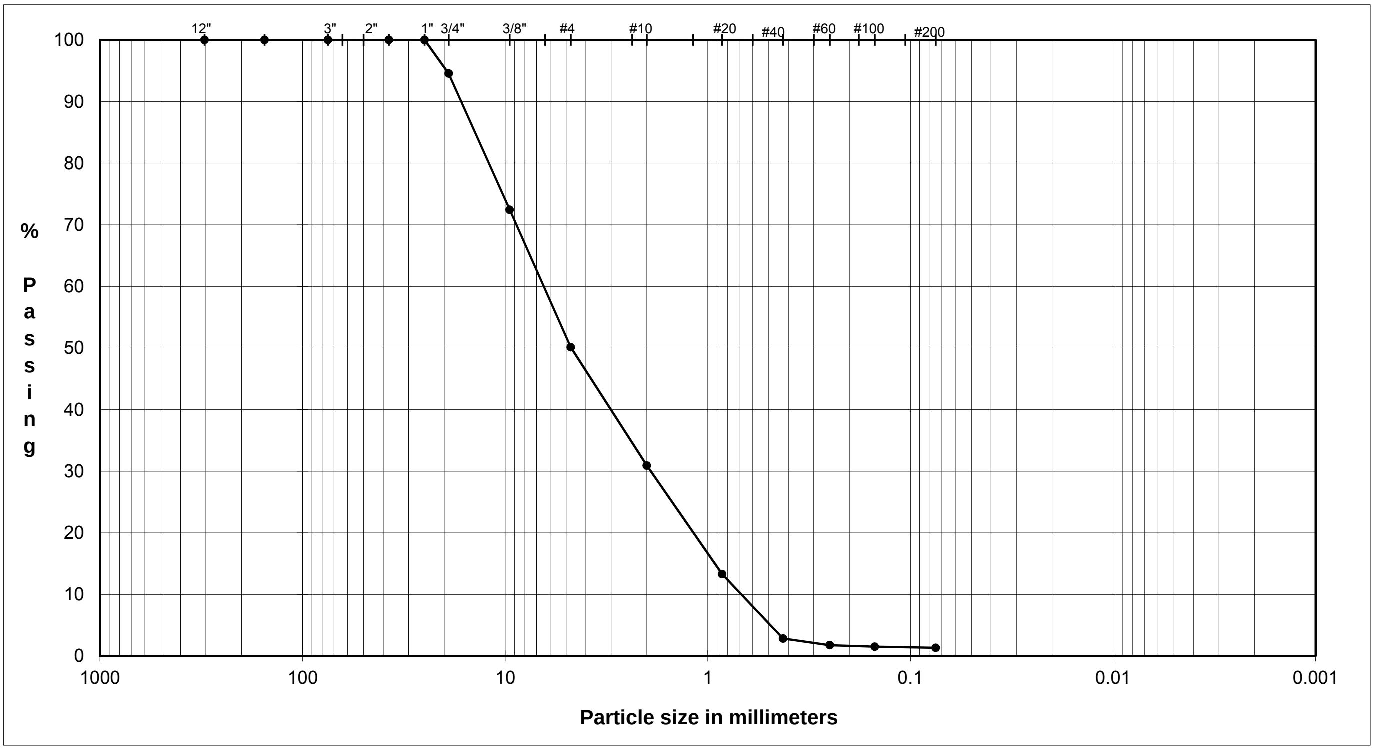
GOLDER ASSOCIATES INC.

LAKEWOOD, COLORADO

April-13 103-92557.006

PRE-PERM PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Comp 1-4 SCALPED** Depth (ft) --
TYPE: **Pail**

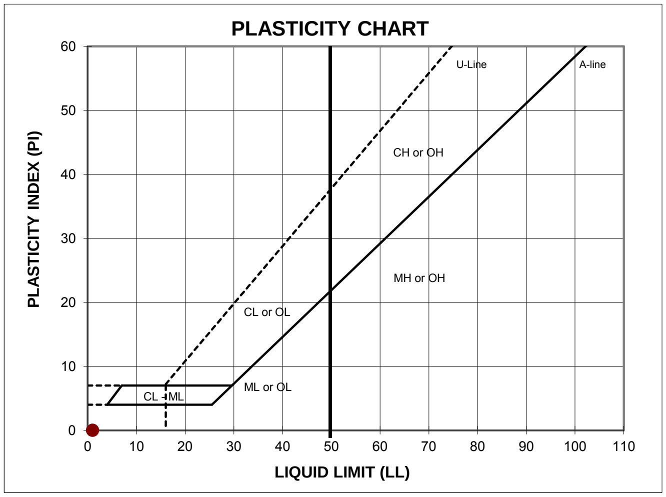


	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

PRE-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**94.5**	Coarse Gravel	**5.45**
0.375"	9.5	**72.4**		
#4	4.8	**50.1**	Fine Gravel	**44.42**
#10	2.0	**30.9**	Coarse Sand	**19.22**
#20	0.9	**13.3**		
#40	0.4	**2.8**	Medium Sand	**28.06**
#60	0.3	**1.8**		
#100	0.2	**1.5**		
#200	0.1	**1.3**	Fine Sand	**1.51**
			Fines	**1.33**



ATTERBERG LIMITS

M_c	LL	PL	PI	SG
--	--	--	--	--

DESCRIPTION: SAND and GRAVEL, yellowish brown

USCS: --

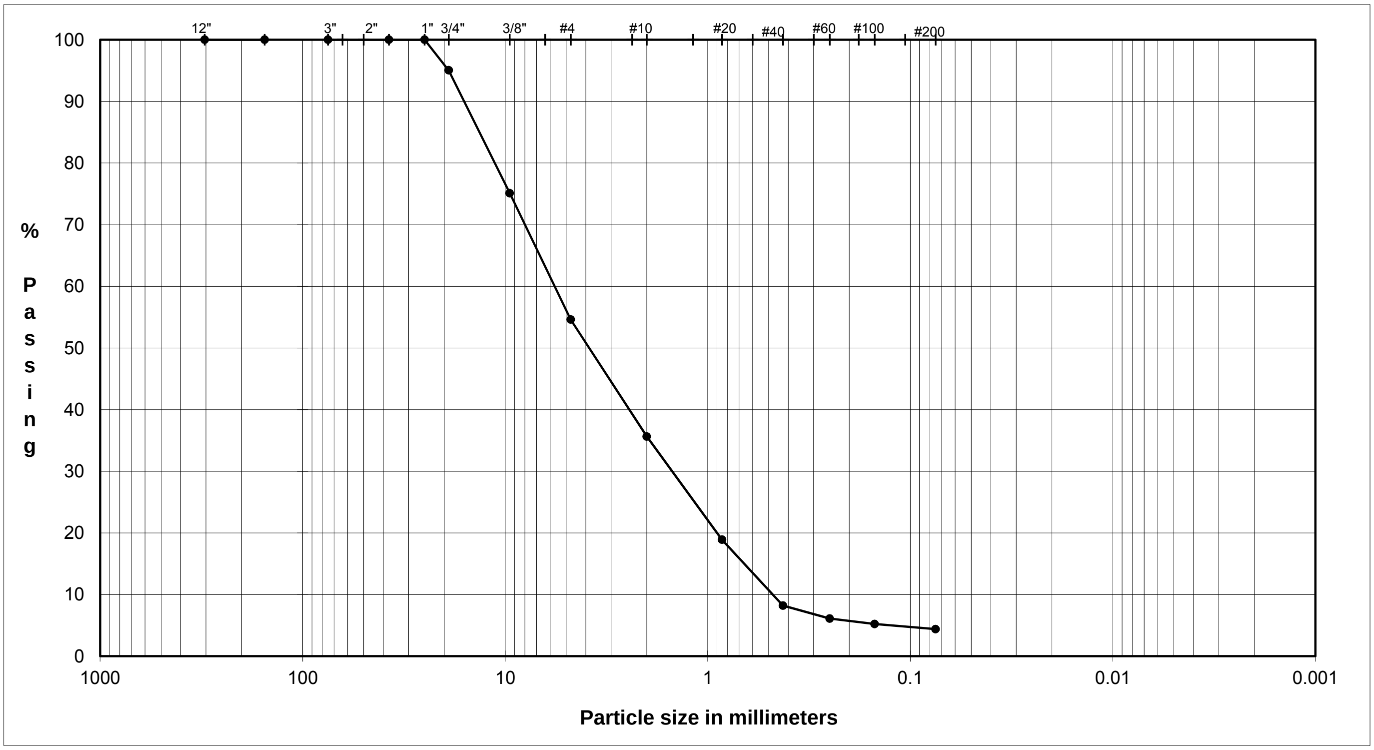
TECH	AM
DATE	4/22/13
REVIEW	PRH

April-13 103-92557.006

POST-PERM PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Comp 1-4 SCALPED** Depth (ft) --
TYPE: **Pail**

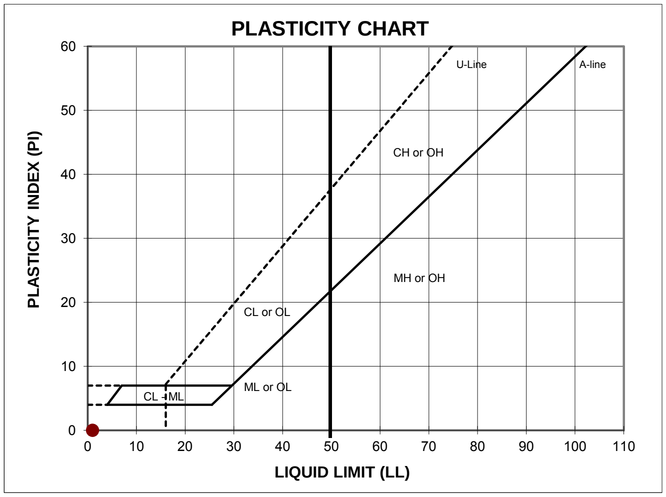


	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

POST-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**95.0**	Coarse Gravel	**4.96**
0.375"	9.5	**75.1**		
#4	4.8	**54.6**	Fine Gravel	**40.43**
#10	2.0	**35.6**	Coarse Sand	**18.97**
#20	0.9	**18.9**		
#40	0.4	**8.2**	Medium Sand	**27.43**
#60	0.3	**6.1**		
#100	0.2	**5.2**		
#200	0.1	**4.4**	Fine Sand	**3.82**
			Fines	**4.39**



ATTERBERG LIMITS

M_c	LL	PL	PI	SG
--	--	--	--	--

DESCRIPTION: SAND and GRAVEL, yellowish brown

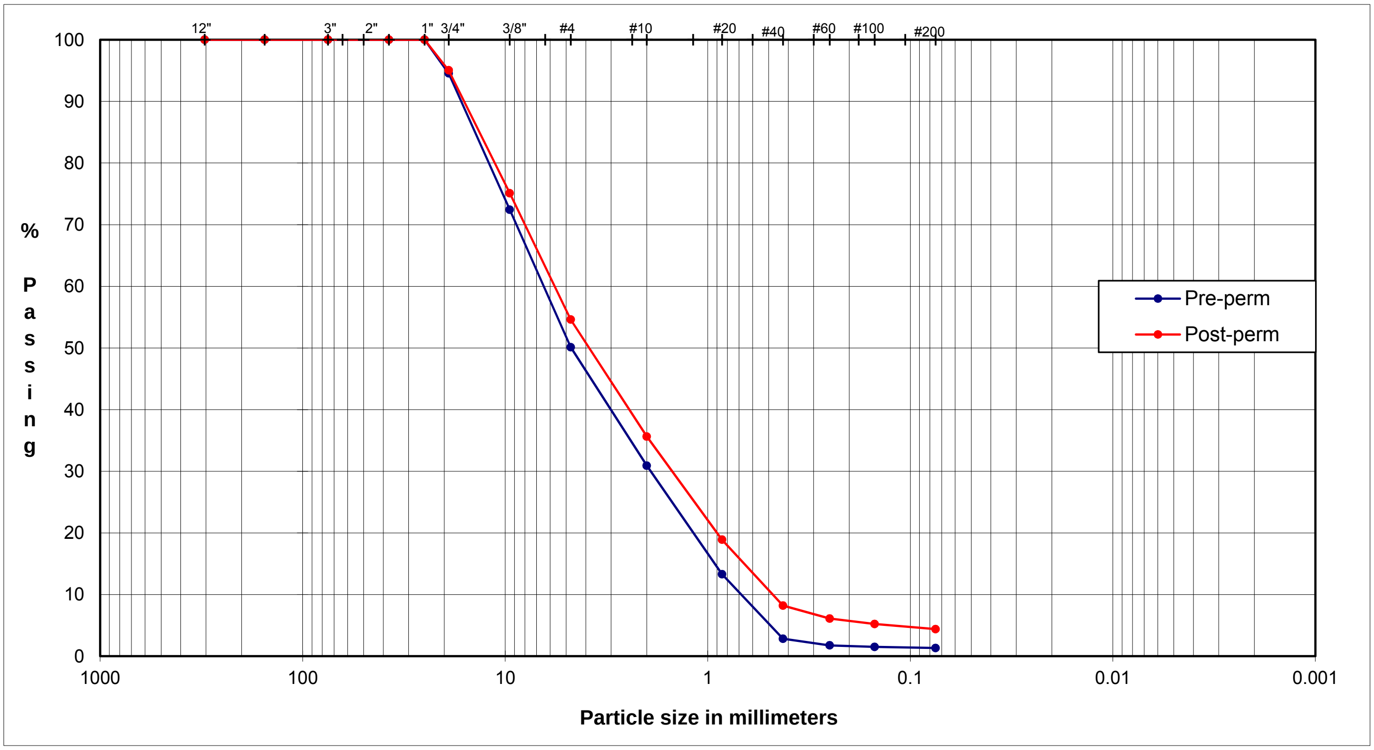
USCS: --

TECH	EH
DATE	5/1/2013
REVIEW	PRH

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Comp 1-4 SCALPED** Depth (ft) --
TYPE: **Pail**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

PRE-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**94.5**	Coarse Gravel	**5.45**
0.375"	9.5	**72.4**		
#4	4.8	**50.1**	Fine Gravel	**44.42**
#10	2.0	**30.9**	Coarse Sand	**19.22**
#20	0.9	**13.3**		
#40	0.4	**2.8**	Medium Sand	**28.06**
#60	0.3	**1.8**		
#100	0.2	**1.5**		
#200	0.1	**1.3**	Fine Sand	**1.51**
			Fines	**1.33**

POST-PERM

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**95.0**	Coarse Gravel	**4.96**
0.375"	9.5	**75.1**		
#4	4.8	**54.6**	Fine Gravel	**40.43**
#10	2.0	**35.6**	Coarse Sand	**18.97**
#20	0.9	**18.9**		
#40	0.4	**8.2**	Medium Sand	**27.43**
#60	0.3	**6.1**		
#100	0.2	**5.2**		
#200	0.1	**4.4**	Fine Sand	**3.82**
			Fines	**4.39**

ATTERBERG LIMITS

M_c	LL	PL	PI	SG
--	--	--	--	--

DESCRIPTION: SAND and GRAVEL, yellowish brown

USCS: --

TECH	AM
DATE	4/22/13
REVIEW	PRH

Copper Flat Tailing Design Study
Table 1 - Rigid Wall Compression
Falling Head Permability - 10 inch diameter cell

Project Title:	Copper Flat Tailings Design Study	**Boring:**	--
Project Number:	103-92557.006	**Sample:**	Comp 1-4 SCALPED
Dates Tested:	4/26/2013 To: 4/29/2013	**Depth (ft):**	--

Sample Setup

Initial Sample Height, in	9.194
Mold Diameter, in	10.00
Sample Area, in^2	78.54
Wet Sample Weight, g	19,998.9
Wet Sample Weight, lb	44.10
Dry Sample Weight, g	19,416.3
Dry Sample Weight, lb	42.81

Initial Sample:
Moisture Determination

Tare	PGC
Wet Weight and Tare, g	663.26
Dry Weight and Tare, g	647.65
Tare Weight, g	127.37
Moisture Content, %	3.0

Initial Sample Density and Void Ratio

Specific Gravity[1]	2.70
Initial Sample Volume, ft^3	0.418
Initial Wet Density, lb/ft^3	105.5
Initial Dry Density, lb/ft^3	102.5
Initial Void Ratio	0.64

Final Sample Density and Void Ratio

Final Sample Height, in	8.330
Final Sample Volume, ft^3	0.379
Final Dry Density, lb/ft^3	113.1
Final Void Ratio	0.49

Load (psi)	Height (in)	Dry Density (pcf)	Void Ratio	Flow Rate (ml/sec)	Gradient	Permeability (cm/sec)	Porosity
150	8.330	113.1	0.49	10.62	0.23	9.1E-02	0.33

NOTES: [1]Specific Gravity = Assumed Value

CONSTANT-HEAD PERMEABILITY
(RIGID-WALL)

JOB NUMBER:	103-92557.006	BORING NUMBER:	--
JOB NAME:	Copper Flat Tailings Design Study	SAMPLE NUMBER:	Comp 1-4 SCALPED
DATE TESTED:	04/26/13	SAMPLE DEPTH:	--

Initial Moisture Content

Tare:	PGC
Wet Weight & Tare, g:	663.26
Dry Weight & Tare, g:	647.65
Tare Weight, g:	127.37
Moisture, %:	**3.0**

Final Moisture Content

Tare:	J11
Wet Weight & Tare, g:	662.43
Dry Weight & Tare, g:	607.20
Tare Weight, g:	82.33
Moisture, %:	**10.5**

Initial Height Determination (Inches)

(Height from mold rim to plate on sample

1.	3.447
2.	3.442
3.	3.404
4.	3.379
5.	3.404
6.	3.365
Average	3.406
Cell Height	12.600
Sample Height[1]	9.194

Density

Wet Weight:	19,998.90	g		
Dry Weight:	19,416.35	g		
Diameter:	10.000	in	25.40	cm
Area:	78.540	in^2	506.71	cm^2
Initial Height:	9.194	in	23.35	cm
Final Height[2]:	8.330	in	21.16	cm
Initial Volume:	0.418	ft^3	11,832.48	cm^3
Final Volume:	0.379	ft^3	10,721.13	cm^3
Initial Wet Density:	105.6	pcf		
Final Wet Density:	116.5	pcf		
Initial Dry Density:	102.5	pcf		
Final Dry Density:	113.1	pcf		

TRIAL	TIME	OUTFLOW	BURRETTE	Q	i	k
	seconds	ml	(mm)	(cm^3/sec)		cm/sec
01	240	1704.9	35	7.1	0.165	8.48E-02
02	240	1704.5	35	7.1	0.165	8.47E-02
03	240	1705.2	35	7.1	0.165	8.48E-02
04	240	2513.2	48	10.5	0.227	9.11E-02
05	240	2508.93	48	10.5	0.227	9.09E-02
06	240	2507.75	48	10.4	0.227	9.09E-02
07	240	3436.38	62	14.3	0.293	9.64E-02
08	240	3434.01	62	14.3	0.293	9.64E-02
09	240	3435.08	62	14.3	0.293	9.64E-02
10						
Average	240.0	2549.996	48.3	10.6	0.228	9.07E-02

NOTES: [1]Sample Height = Cell Height - Average distance to rim of mold

[2]Final Height = Initial Height - Displacement of Final Reading *Before* Running Perm Test

CONSTANT-HEAD PERMEABILITY
(RIGID-WALL)

JOB NUMBER:	103-92557.006	BORING NUMBER:	--
JOB NAME:	Copper Flat Tailings Design Study	SAMPLE NUMBER:	Comp 1-4 SCALPED
DATE TESTED:	04/26/13	SAMPLE DEPTH:	--

DATE	TIME	LOAD	DIAL	DIAL	AVERAGE	DISPLACEMENT
		(psi)	(Left)	(Right)		
INITIAL	10:10 AM	0	0.005	0.004	0.005	--
SATURATE	10:25 AM	0	0.021	0.044	0.033	0.028
LOAD	12:40 PM	150	0.775	0.742	0.759	0.754
	8:55 AM	150	0.880	0.844	0.862	0.858
PERM	7:55 AM	150	0.886	0.850	0.868	0.864
END PERM	12:10 PM	150	0.887	0.851	0.869	0.865

APPENDIX A.3.4
CONSOLIDATION TEST REPORTS

	Initial		Final	
Height =	0.994	in	0.960	in
Diameter =	2.499	in	2.499	in
Area =	4.905	in^2	4.905	in^2
Volume =	4.875	in^3	4.709	in^3
Water Content =	14.4%		4.8%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5641	in	0.5641	in
Void Ratio =	0.762		0.702	
Degree of Saturation =	51.1%		18.5%	
Wet Mass =	0.308	lb	0.282	lb
Dry Mass =	0.269	lb	0.269	lb
Wet Unit Weight =	109.3	pcf	103.6	pcf
Dry Unit Weight =	95.5	pcf	98.9	pcf

Notes

USCS description (ASTM D2487):	Lean clay with sand, yellowish red, moist					
Atterberg Limits (ASTM D4318):	LL = 47		PL = 20		PI = 27	
Percent Finer (ASTM D422):	3/4 in. = 100%		No. 4 = 99%		No. 200 = 81%	
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture		
Water Content of Trimmings (ASTM D2216):	14.6%					
Trimming Procedure:	Specimen remolded in ring					
Inundation:	X	Not inundated		Inundated		
Test Method:		A	X	B		
Apparatus:	Frame No.	1	(Wykeham Farrance 24251)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	-0.0158	in				
Estimated Preconsolidation Stress:	Not Computed					

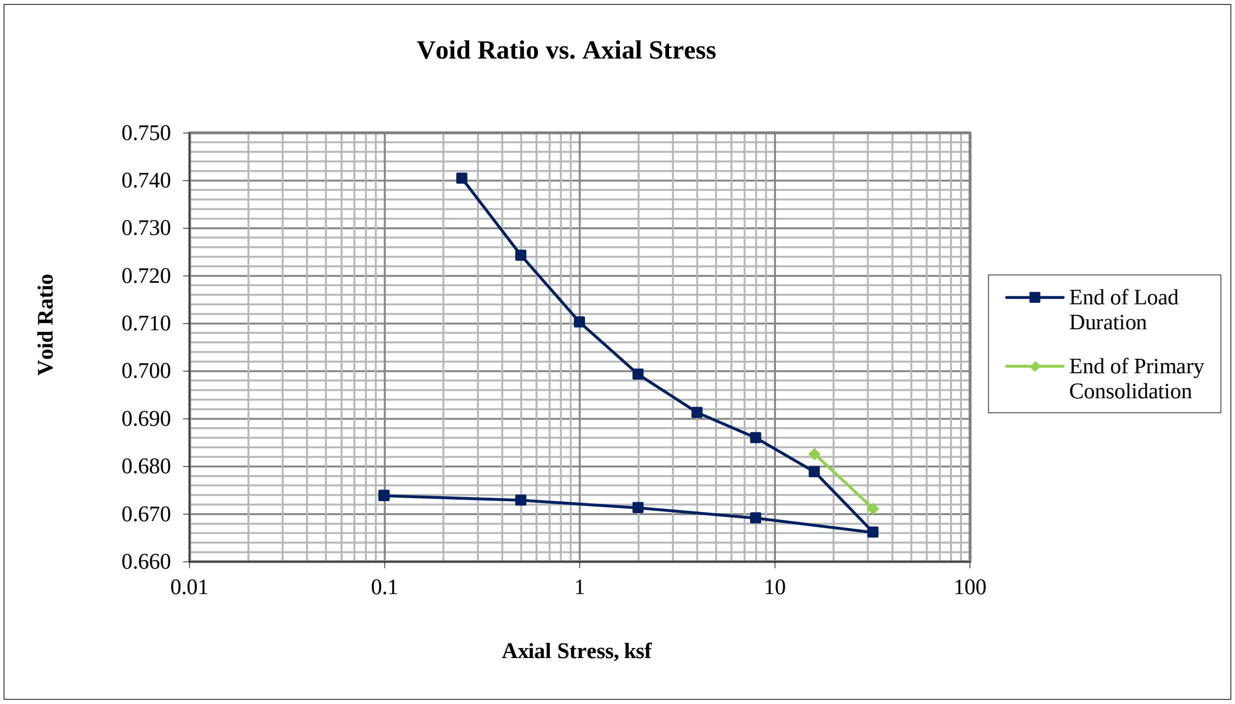
			At End of Primary Consolidation				At End of Load Duration							
	Axial Stress (ksf)	Load Duration (min)	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1058					0.0000	0.9901	0.00	0.755				
1	0.25	1410					0.0083	0.9818	0.84	0.740				
2	0.50	1410					0.0174	0.9726	1.75	0.724				
3	1.00	1440					0.0254	0.9647	2.55	0.710				
4	2.00	1470					0.0315	0.9585	3.17	0.699				
5	4.00	1425					0.0361	0.9540	3.63	0.691				
6	8.00	1425					0.0390	0.9510	3.93	0.686				
7	16.00	1425	0.0410	0.9491	4.12	0.683	0.0431	0.9470	4.33	0.679	2 (Root time)	0.683	3.650	0.5
8	32.00	1440	0.0474	0.9426	4.77	0.671	0.0502	0.9398	5.05	0.666	2 (Root time)	0.672	2.520	0.5
9	8.00	95					0.0485	0.9415	4.88	0.669				
10	2.00	120					0.0473	0.9427	4.76	0.671				
11	0.50	95					0.0464	0.9436	4.67	0.673				
12	0.10	70					0.0459	0.9442	4.62	0.674				

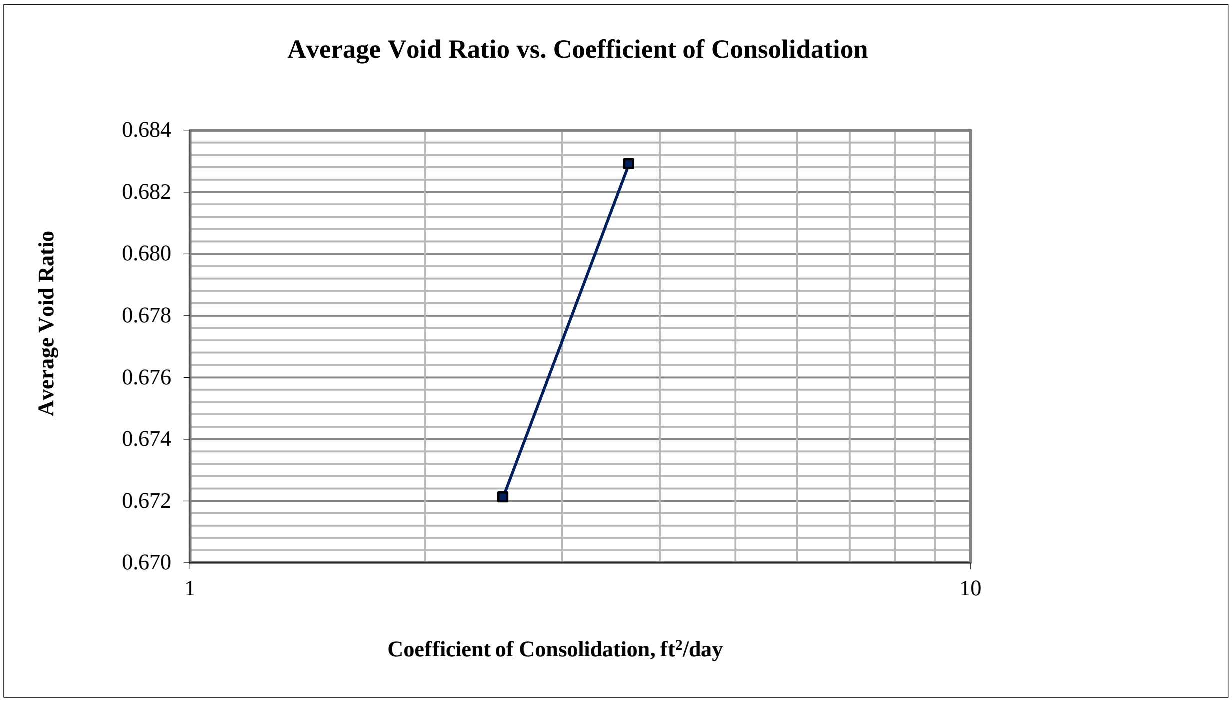
Golder Associates Inc.
Denver, Colorado

Job Short Title: Copper Flat Tailings Design Study

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

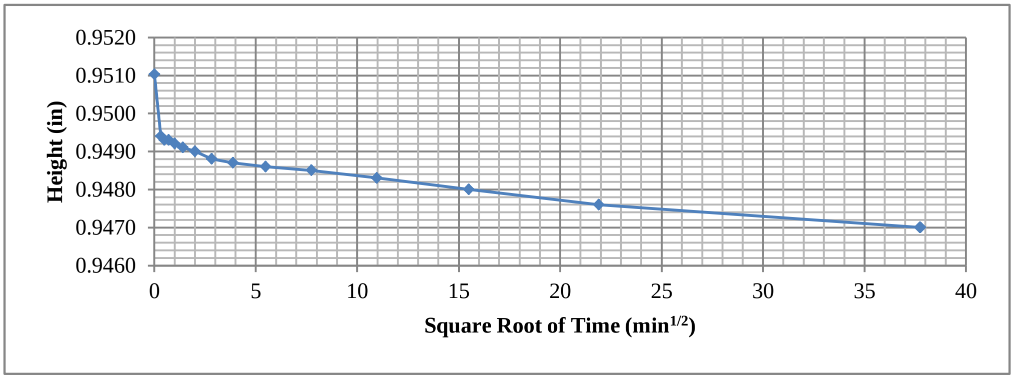
Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-10 @ 19-33 ft	RJM	CCS	3/11/2013	103-92557.006	1



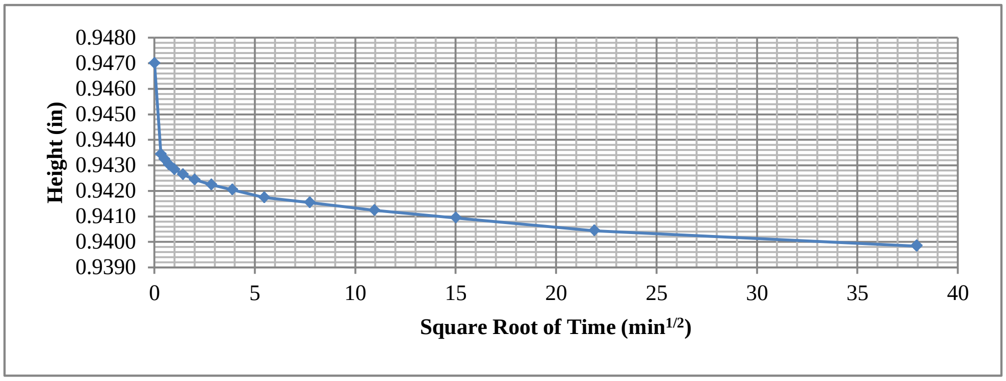


Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-10 @ 19-33 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/11/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**

16.00 ksf



32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **TIME-DEFORMATION PLOTS**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Start Date:**	**Job Number:**	**Figure:**
BH-10 @ 19-33 ft	**RJM**	**CCS**	**3/11/2013**	**103-92557.006**	**3**

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports

	Initial		Final	
Height =	0.997	in	0.905	in
Diameter =	2.496	in	2.496	in
Area =	4.893	in^2	4.893	in^2
Volume =	4.878	in^3	4.428	in^3
Water Content =	25.9%		6.4%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5215	in	0.5215	in
Void Ratio =	0.912		0.735	
Degree of Saturation =	76.7%		23.5%	
Wet Mass =	0.313	lb	0.264	lb
Dry Mass =	0.248	lb	0.248	lb
Wet Unit Weight =	110.8	pcf	103.2	pcf
Dry Unit Weight =	88.0	pcf	97.0	pcf

Notes

USCS description (ASTM D2487):	Fat clay, dark red, moist					
Atterberg Limits (ASTM D4318):	LL = 66		PL = 31		PI = 35	
Percent Finer (ASTM D422):	3/4 in. = 100%		No. 4 = 100%		No. 200 = 90%	
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	86.0	pcf (dry) at	29.0%	moisture		
Water Content of Trimmings (ASTM D2216):	28.8%					
Trimming Procedure:	Speciment remolded in ring					
Inundation:	X	Not inundated		Inundated		
Test Method:		A	X	B		
Apparatus:	Frame No.	4	(ELE C-320A)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	-0.0304	in				
Estimated Preconsolidation Stress:	Not Computed					

			At End of Primary Consolidation				At End of Load Duration							
	Axial Stress (ksf)	Load Duration (min)	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1019					0.0000	0.9822	0.00	0.883				
1	0.25	1410					0.0197	0.9625	1.98	0.845				
2	0.50	1410					0.0385	0.9437	3.86	0.809				
3	1.00	1430					0.0579	0.9242	5.81	0.772				
4	2.00	1470					0.0764	0.9057	7.66	0.737				
5	4.00	1415					0.0968	0.8853	9.71	0.698				
6	8.00	1420					0.1023	0.8798	10.26	0.687				
7	16.00	1425					0.1074	0.8747	10.77	0.677				
8	32.00	1440					0.1123	0.8699	11.26	0.668				
9	8.00	90					0.1109	0.8712	11.13	0.670				
10	2.00	115					0.1099	0.8722	11.02	0.672				
11	0.50	100					0.1089	0.8733	10.92	0.674				
12	0.10	70					0.1076	0.8746	10.79	0.677				

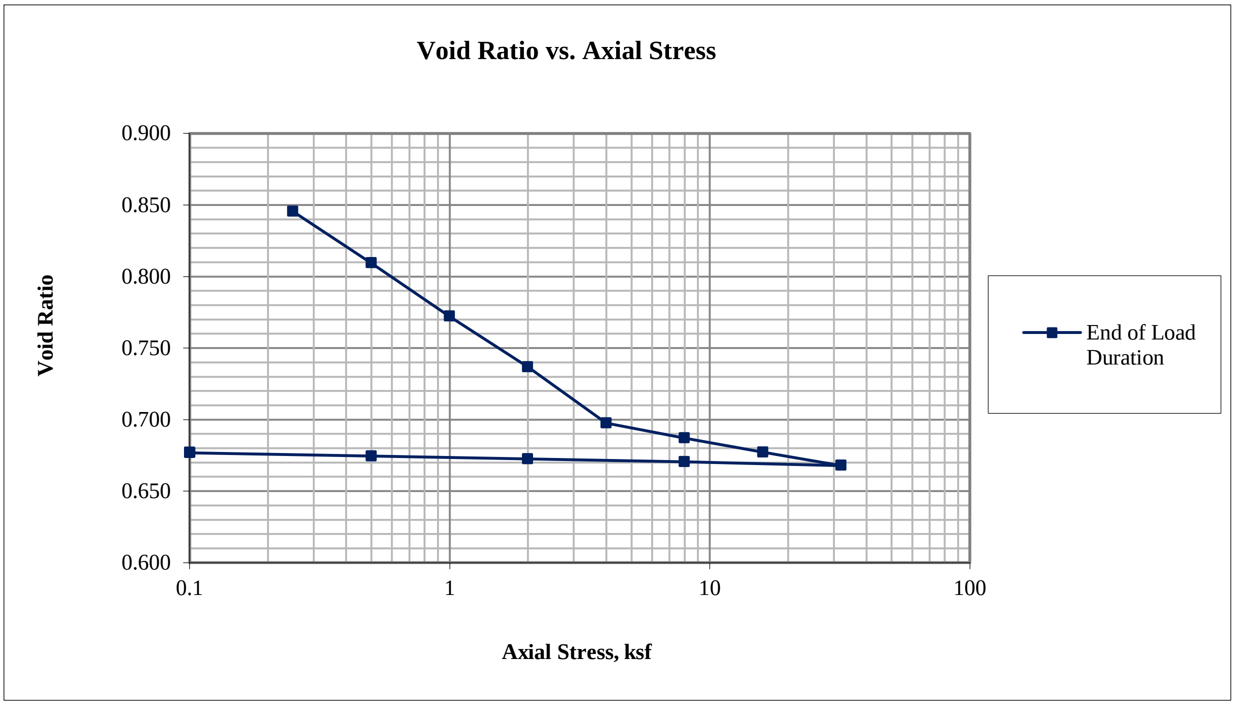
Golder Associates Inc.
Denver, Colorado

Job Short Title: **Copper Flat Tailings Design Study**

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-12 @ 33.5-48.5 ft	RJM	CCS	3/11/2013	103-92557.006	1

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports



Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-12 @ 33.5-48.5 ft	**RJM**	**CCS**	**3/11/2013**	**103-92557.006**	**2**

	Initial		Final	
Height =	0.993	in	0.887	in
Diameter =	2.500	in	2.500	in
Area =	4.909	in^2	4.909	in^2
Volume =	4.874	in^3	4.354	in^3
Water Content =	14.1%		1.7%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5636	in	0.5636	in
Void Ratio =	0.762		0.574	
Degree of Saturation =	49.8%		8.0%	
Wet Mass =	0.307	lb	0.274	lb
Dry Mass =	0.269	lb	0.269	lb
Wet Unit Weight =	108.9	pcf	108.7	pcf
Dry Unit Weight =	95.5	pcf	106.9	pcf

Notes

USCS description (ASTM D2487):	Clayey sand with gravel, yellowish brown, dry				
Atterberg Limits (ASTM D4318):	LL = 23		PL = 14		PI = 9
Percent Finer (ASTM D422):	3/4 in. = 98%		No. 4 = 83%		No. 200 = 36%
Specimen Type:		Intact	X	Reconstituted	
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture	
Water Content of Trimmings (ASTM D2216):	14.7%				
Trimming Procedure:	Specimen remolded in ring				
Inundation:	X	Not inundated		Inundated	
Test Method:		A	X	B	
Apparatus:	Frame No.	1	(Wykeham Farrance 24251)		
Final Water Content Specimen:	X	Entire		Partial	
Final Differential Height:	0.0528	in			
Estimated Preconsolidation Stress:	16.4	ksf			

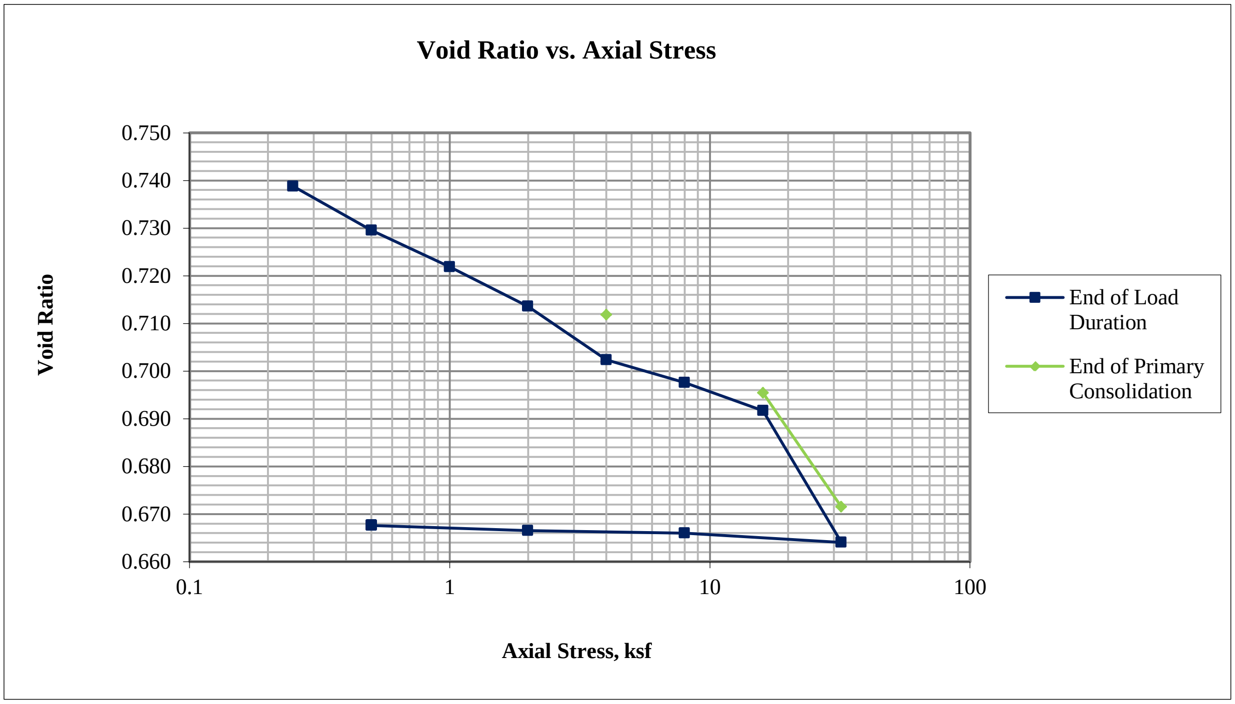
	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1055					0.0000	0.9877	0.00	0.752				
1	0.25	1425					0.0077	0.9800	0.78	0.739				
2	0.50	1425					0.0129	0.9747	1.30	0.730				
3	1.00	1440					0.0173	0.9704	1.74	0.722				
4	2.00	1410					0.0219	0.9657	2.21	0.714				
5	4.00	2785	0.0229	0.9647	2.31	0.712	0.0283	0.9594	2.85	0.702	2 (Root time)	0.712	8.212	0.4
6	8.00	1425					0.0309	0.9567	3.12	0.698				
7	16.00	1430	0.0321	0.9555	3.24	0.695	0.0343	0.9534	3.45	0.692	2 (Root time)	0.696	10.130	0.3
8	32.00	1440	0.0457	0.9420	4.60	0.671	0.0498	0.9378	5.02	0.664	2 (Root time)	0.675	4.980	0.4
9	8.00	105					0.0487	0.9389	4.91	0.666				
10	2.00	90					0.0484	0.9392	4.88	0.667				
11	0.50	180					0.0478	0.9398	4.82	0.668				

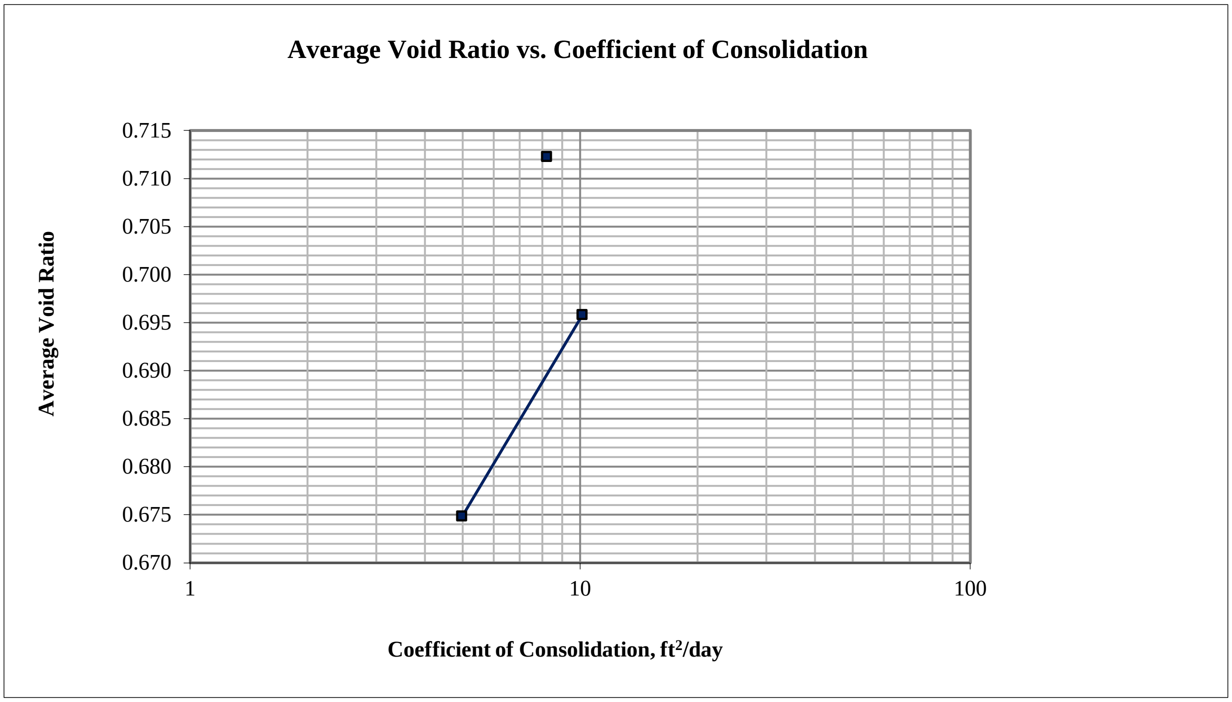
Golder Associates Inc.
Denver, Colorado

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Job Short Title: **Copper Flat Tailings Design Study**

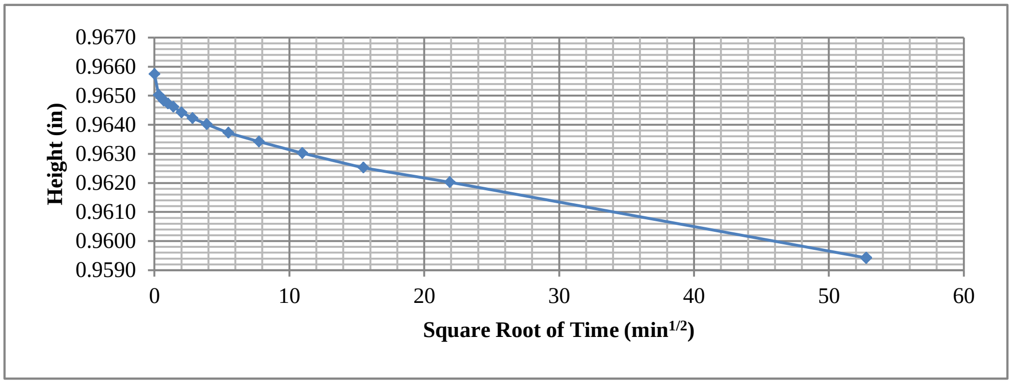
Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-16 @ 29-34 ft	RJM	CCS	3/25/2013	103-92557.006	1



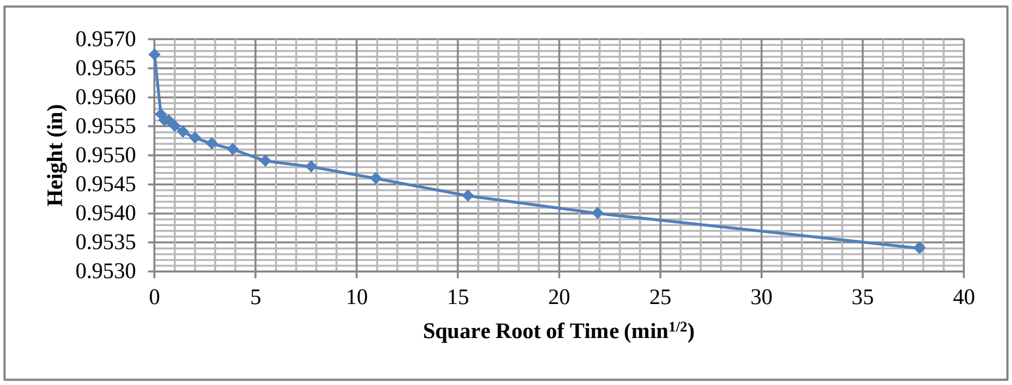


Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-16 @ 29-34 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/25/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**

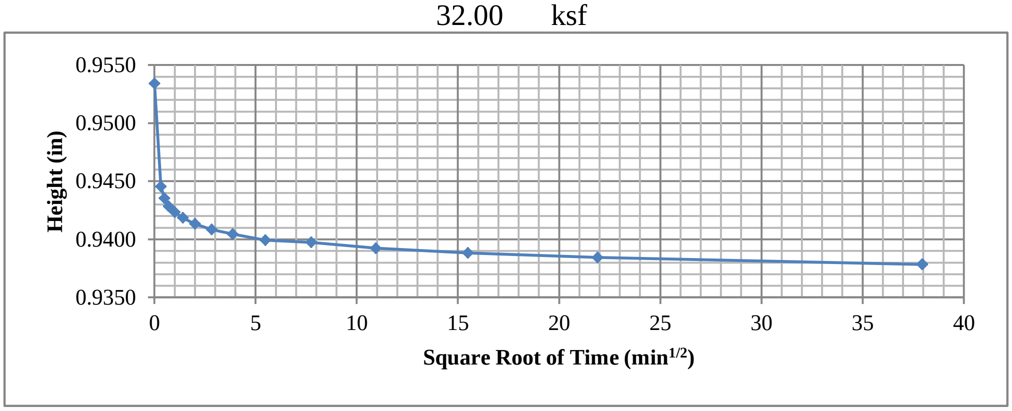
4.00 ksf



16.00 ksf



32.00 ksf



Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-16 @ 29-34 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/25/2013**	**Job Number:** **103-92557.006**	**Figure:** **3**

	Initial		Final	
Height =	0.997	in	0.960	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.886	in^3	4.705	in^3
Water Content =	14.5%		2.7%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5638	in	0.5638	in
Void Ratio =	0.768		0.703	
Degree of Saturation =	51.1%		10.4%	
Wet Mass =	0.308	lb	0.276	lb
Dry Mass =	0.269	lb	0.269	lb
Wet Unit Weight =	109.0	pcf	101.5	pcf
Dry Unit Weight =	95.1	pcf	98.8	pcf

Notes

USCS description (ASTM D2487):	Sandy lean clay, reddish brown, moist					
Atterberg Limits (ASTM D4318):	LL =	25	PL =	14	PI =	11
Percent Finer (ASTM D422):	3/4 in. =	100%	No. 4 =	95%	No. 200 =	52%
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture		
Water Content of Trimmings (ASTM D2216):	14.7%					
Trimming Procedure:	Specimen remolded in ring					
Inundation:	X	Not inundated		Inundated		
Test Method:		A	X	B		
Apparatus:	Frame No.	4	(ELE C-320A)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	0.0045	in				
Estimated Preconsolidation Stress:	14.7	ksf				

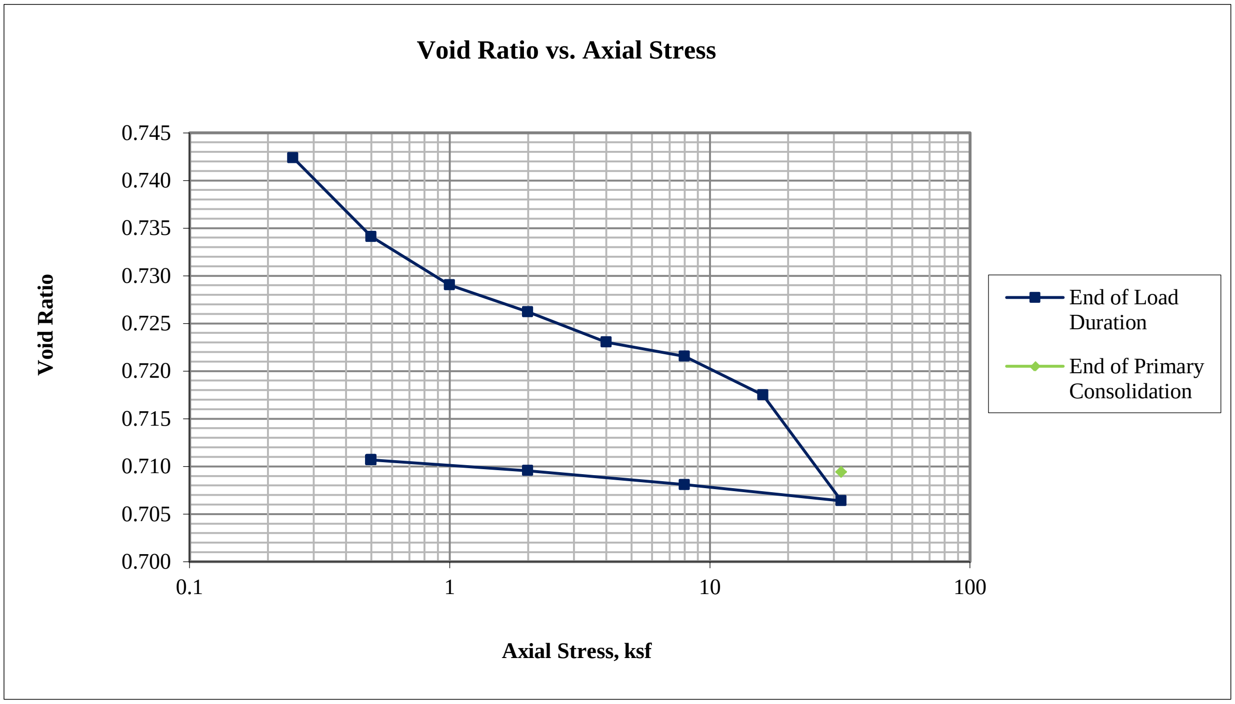
	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1025					0.0000	0.9894	0.00	0.755				
1	0.25	1425					0.0070	0.9824	0.70	0.742				
2	0.50	1425					0.0117	0.9777	1.17	0.734				
3	1.00	1440					0.0145	0.9748	1.46	0.729				
4	2.00	1410					0.0161	0.9732	1.62	0.726				
5	4.00	2780					0.0179	0.9714	1.80	0.723				
6	8.00	1425					0.0187	0.9706	1.88	0.722				
7	16.00	1420					0.0210	0.9683	2.11	0.717				
8	32.00	1440	0.0256	0.9638	2.57	0.709	0.0273	0.9621	2.74	0.706	2 (Root time)	0.710	5.423	0.5
9	8.00	105					0.0263	0.9630	2.64	0.708				
10	2.00	90					0.0255	0.9638	2.56	0.710				
11	0.50	180					0.0249	0.9645	2.49	0.711				

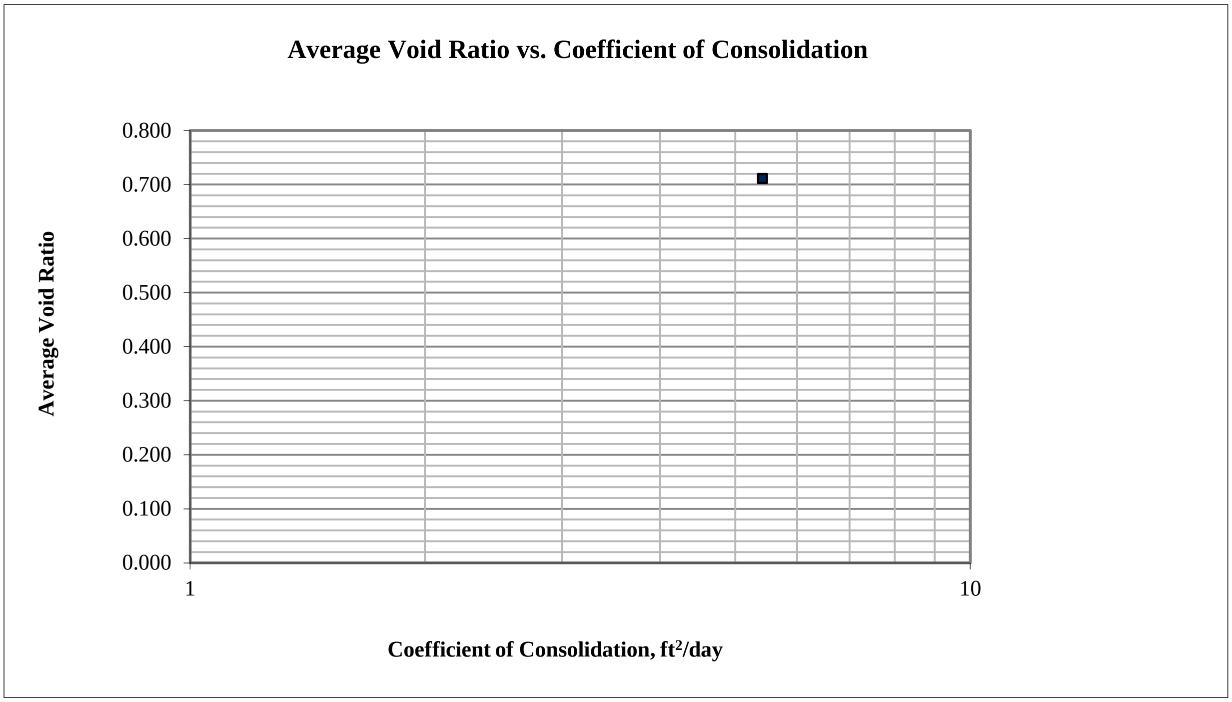
Golder Associates Inc.
Denver, Colorado

Job Short Title: **Copper Flat Tailings Design Study**

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

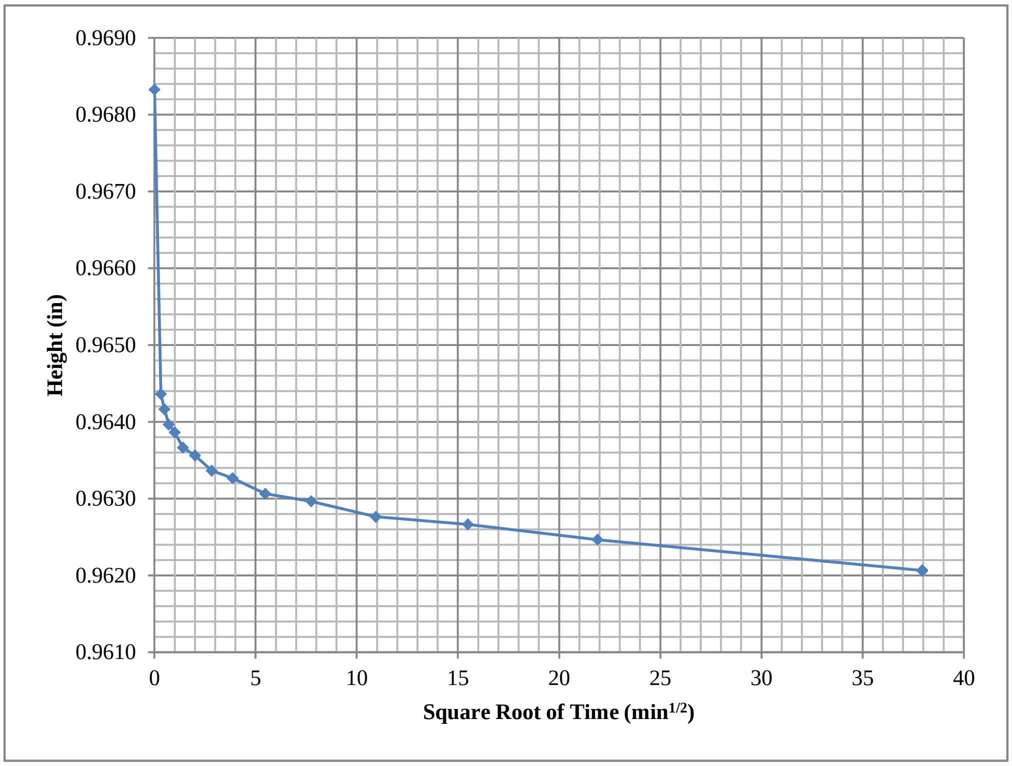
Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-18 @ 23-33.5 ft	RJM	CCS	3/25/2013	103-92557.006	1





Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-18 @ 23-33.5 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/25/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**

32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **TIME-DEFORMATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-18 @ 23-33.5 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/25/2013**	**Job Number:** **103-92557.006**	**Figure:** **3**

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports

	Initial		Final	
Height =	0.994	in	0.924	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.871	in^3	4.528	in^3
Water Content =	28.9%		9.0%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5085	in	0.5085	in
Void Ratio =	0.955		0.817	
Degree of Saturation =	81.7%		29.7%	
Wet Mass =	0.313	lb	0.264	lb
Dry Mass =	0.243	lb	0.243	lb
Wet Unit Weight =	110.9	pcf	100.9	pcf
Dry Unit Weight =	86.1	pcf	92.6	pcf

Notes

USCS description (ASTM D2487):	Fat clay with sand, dark red, wet					
Atterberg Limits (ASTM D4318):	LL =	62	PL =	20	PI =	42
Percent Finer (ASTM D422):	3/4 in. =	100%	No. 4 =	100%	No. 200 =	82%
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	86.0	pcf (dry) at	29.0%	moisture		
Water Content of Trimmings (ASTM D2216):	29.1%					
Trimming Procedure:	Specimen remolded in ring					
Inundation:	X	Not inundated		Inundated		
Test Method:		A	X	B		
Apparatus:	Frame No.	5	(ELE C-320A)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	-0.0246	in				
Estimated Preconsolidation Stress:	--	ksf				

-- indicates test was not performed

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	990					0.0000	0.9933	0.00	0.953				
1	0.25	1425					0.0154	0.9779	1.55	0.923				
2	0.50	1825					0.0307	0.9626	3.09	0.893				
3	1.00	1440					0.0463	0.9470	4.66	0.862				
4	2.00	1410					0.0600	0.9333	6.04	0.835				
5	4.00	2775					0.0778	0.9155	7.82	0.800				
6	8.00	1425					0.0843	0.9090	8.48	0.788				
7	16.00	1425					0.0897	0.9036	9.02	0.777				
8	32.00	1440					0.0960	0.8973	9.65	0.765				
9	8.00	105					0.0950	0.8983	9.55	0.767				
10	2.00	105					0.0948	0.8985	9.54	0.767				
11	0.50	165					0.0939	0.8994	9.45	0.769				

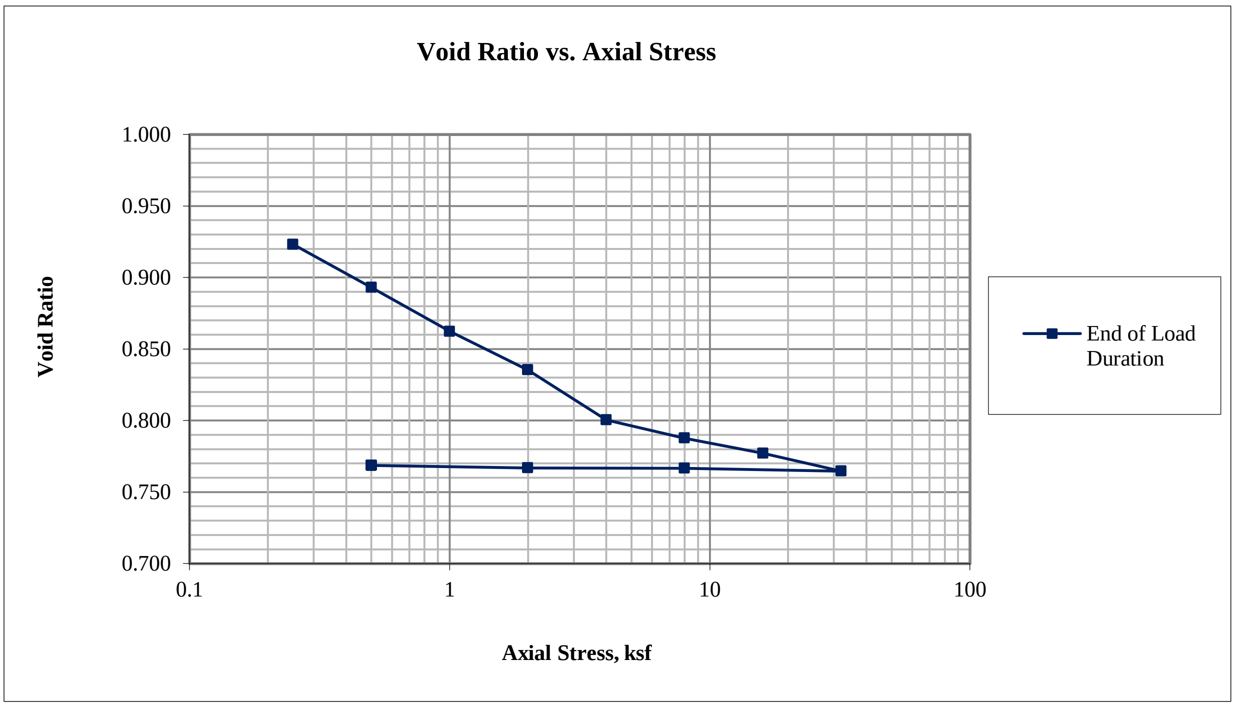
Golder Associates Inc.
Denver, Colorado

Job Short Title: **Copper Flat Tailings Design Study**

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-18 @ 43.5-48.5 ft	RJM	CCS	3/25/2013	103-92557.006	1

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports



Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-18 @ 43.5-48.5 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/25/2013	Job Number: 103-92557.006	Figure: 2

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports

	Initial		Final	
Height =	1.000	in	0.981	in
Diameter =	2.497	in	2.497	in
Area =	4.897	in^2	4.897	in^2
Volume =	4.897	in^3	4.804	in^3
Water Content =	9.7%		1.1%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5363	in	0.5363	in
Void Ratio =	0.865		0.829	
Degree of Saturation =	30.3%		3.6%	
Wet Mass =	0.281	lb	0.259	lb
Dry Mass =	0.256	lb	0.256	lb
Wet Unit Weight =	99.0	pcf	93.0	pcf
Dry Unit Weight =	90.2	pcf	92.0	pcf

Notes

USCS description (ASTM D2487):	Sandy silty clay, brownish yellow, moist					
Atterberg Limits (ASTM D4318):	LL = 25		PL = 21		PI = 4	
Percent Finer (ASTM D422):	3/4 in. = 99%		No. 4 = 99%		No. 200 = 52%	
Specimen Type:	[ ]	Intact	X	Reconstituted		
Remold Targets:	90.0	pcf (dry) at	10.0%	moisture		
Water Content of Trimmings (ASTM D2216):	9.4%					
Trimming Procedure:	Specimen remolded in ring					
Inundation:	X	Not inundated	[ ]	Inundated		
Test Method:	[ ]	A	X	B		
Apparatus:	Frame No.	6	(ELE C-320A)			
Final Water Content Specimen:	X	Entire	[ ]	Partial		
Final Differential Height:	-0.0094	in				
Estimated Preconsolidation Stress:	13.0	ksf				

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	944					0.0000	0.9957	0.00	0.857				
1	0.25	1410					0.0031	0.9926	0.31	0.851				
2	0.50	1410					0.0064	0.9893	0.64	0.845				
3	1.00	1440					0.0086	0.9871	0.86	0.841				
4	2.00	1470					0.0097	0.9860	0.97	0.838				
5	4.00	1410					0.0103	0.9854	1.03	0.837				
6	8.00	1410					0.0119	0.9838	1.19	0.834				
7	16.00	1425	0.0152	0.9805	1.52	0.828	0.0164	0.9794	1.64	0.826	2 (Root time)	0.829	23.310	0.3
8	32.00	1470	0.0275	0.9682	2.75	0.805	0.0300	0.9657	3.00	0.801	2 (Root time)	0.807	3.521	0.4
9	8.00	75					0.0278	0.9679	2.78	0.805				
10	2.00	95					0.0263	0.9694	2.63	0.807				
11	0.50	1315					0.0248	0.9709	2.48	0.810				
12	0.10	195					0.0241	0.9716	2.41	0.812				

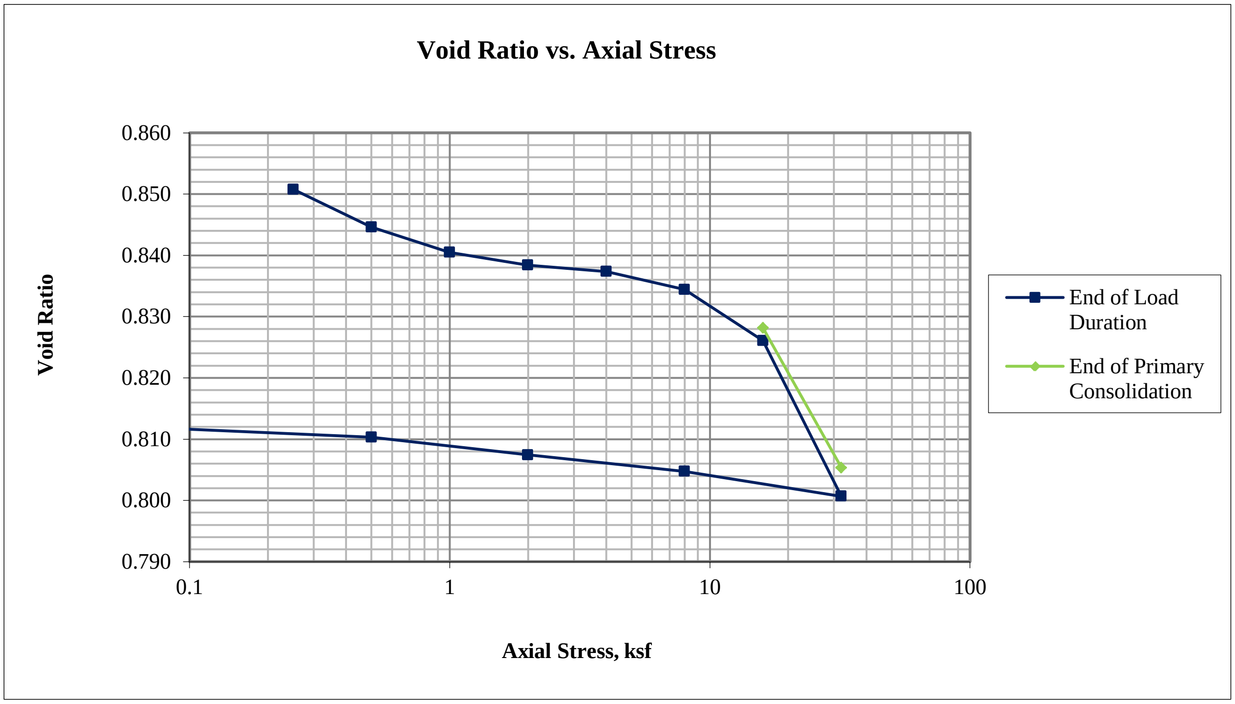
Golder Associates Inc.
Denver, Colorado

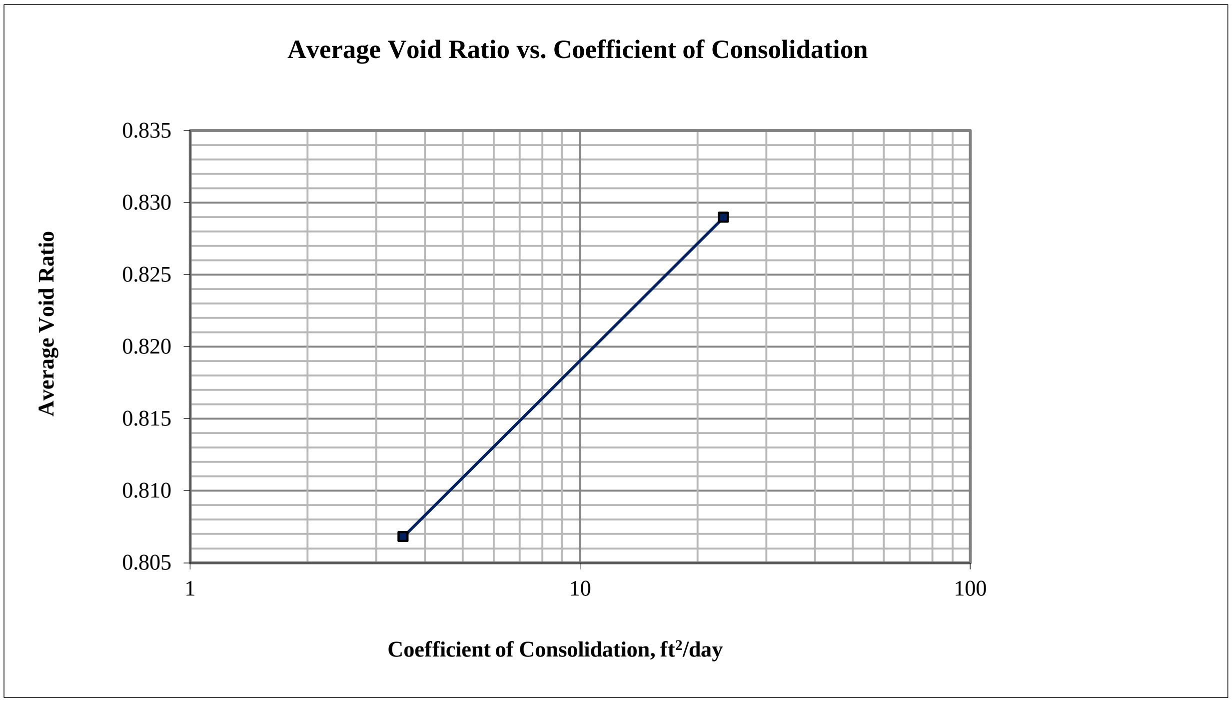
Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Job Short Title: Copper Flat Tailings Design Study

Sample: BH-22 @ 0-8.5 ft

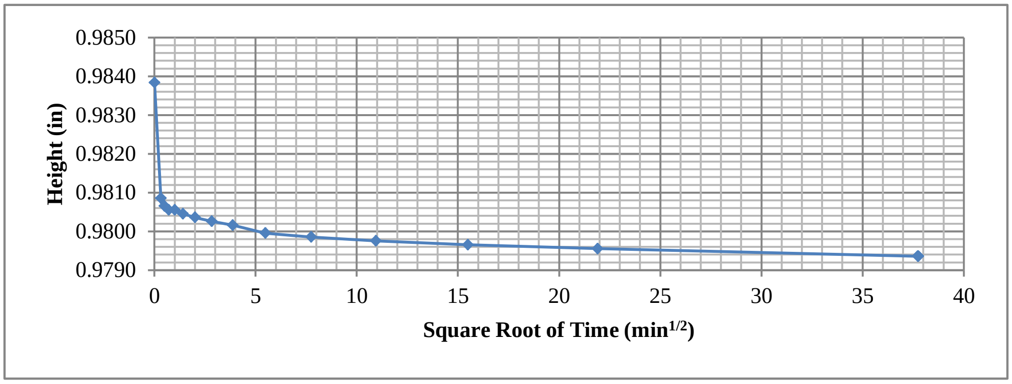
Technician: RJM | **Reviewed:** CCS | **Start Date:** 3/11/2013 | **Job Number:** 103-92557.006 | **Figure:** 1



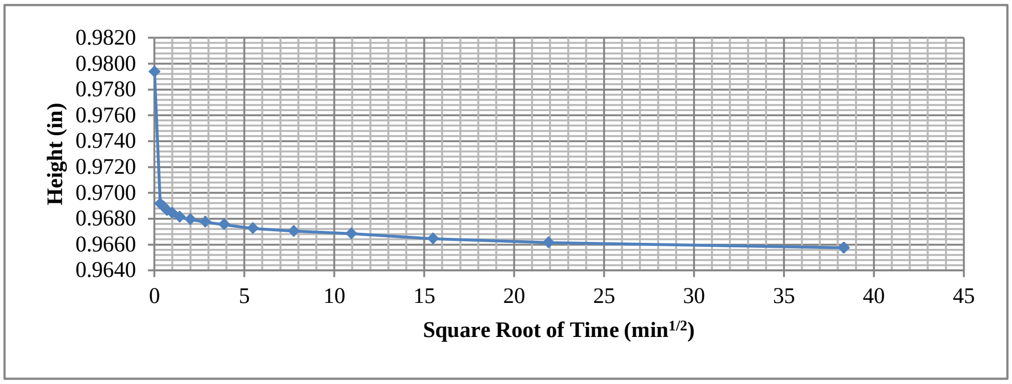


Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-22 @ 0-8.5 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/11/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**

16.00 ksf



32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **TIME-DEFORMATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-22 @ 0-8.5 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/11/2013**	**Job Number:** **103-92557.006**	**Figure:** **3**

	Initial		Final	
Height =	0.997	in	0.924	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.886	in^3	4.528	in^3
Water Content =	14.2%		2.9%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5690	in	0.5690	in
Void Ratio =	0.752		0.624	
Degree of Saturation =	50.8%		12.6%	
Wet Mass =	0.310	lb	0.279	lb
Dry Mass =	0.272	lb	0.272	lb
Wet Unit Weight =	109.6	pcf	106.6	pcf
Dry Unit Weight =	96.0	pcf	103.6	pcf

Notes

Visual description (Golder procedure):	CLAYEY SAND, pale red, moist					
Atterberg Limits (ASTM D4318):	LL = 36		PL = 18		PI = 18	
Percent Finer (ASTM D422):	3/4 in. = 98%		No. 4 = 82%		No. 200 = 37%	
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture		
Water Content of Trimmings (ASTM D2216):	14.5%					
Trimming Procedure:	Specimen remolded in ring					
Inundation:	X	Not inundated		Inundated		
Test Method:		A	X	B		
Apparatus:	Frame No.	5	(ELE C-320A)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	0.0184	in				
Estimated Preconsolidation Stress:	14.5	ksf				

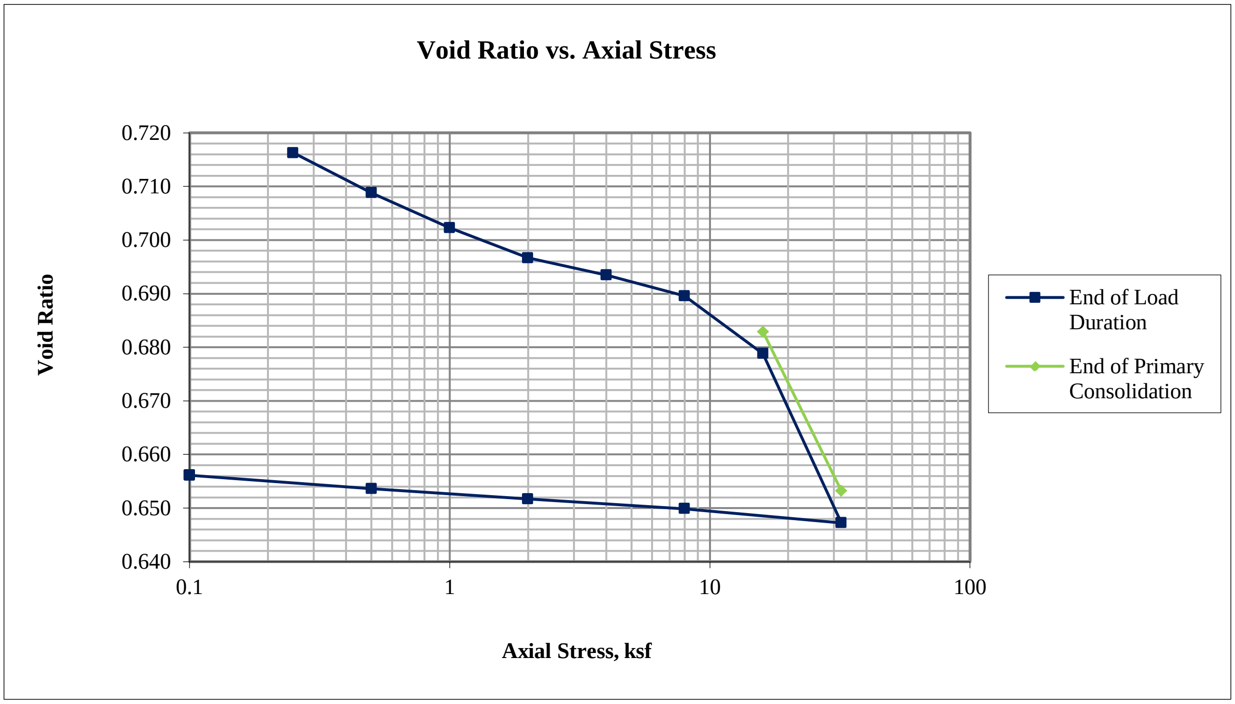
			At End of Primary Consolidation				At End of Load Duration							
	Axial Stress (ksf)	Load Duration (min)	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	980					0.0000	0.9843	0.00	0.730				
1	0.25	1410					0.0077	0.9766	0.77	0.716				
2	0.50	1410					0.0119	0.9724	1.20	0.709				
3	1.00	1440					0.0156	0.9687	1.57	0.702				
4	2.00	1470					0.0188	0.9655	1.89	0.697				
5	4.00	1410					0.0207	0.9636	2.07	0.693				
6	8.00	1415					0.0229	0.9614	2.29	0.690				
7	16.00	1425	0.0267	0.9576	2.67	0.683	0.0290	0.9553	2.91	0.679	2 (Root time)	0.684	31.272	0.3
8	32.00	1440	0.0436	0.9407	4.37	0.653	0.0470	0.9373	4.71	0.647	2 (Root time)	0.655	3.684	0.4
9	8.00	75					0.0455	0.9388	4.56	0.650				
10	2.00	130					0.0444	0.9399	4.46	0.652				
11	0.50	100					0.0433	0.9410	4.34	0.654				
12	0.10	70					0.0419	0.9424	4.20	0.656				

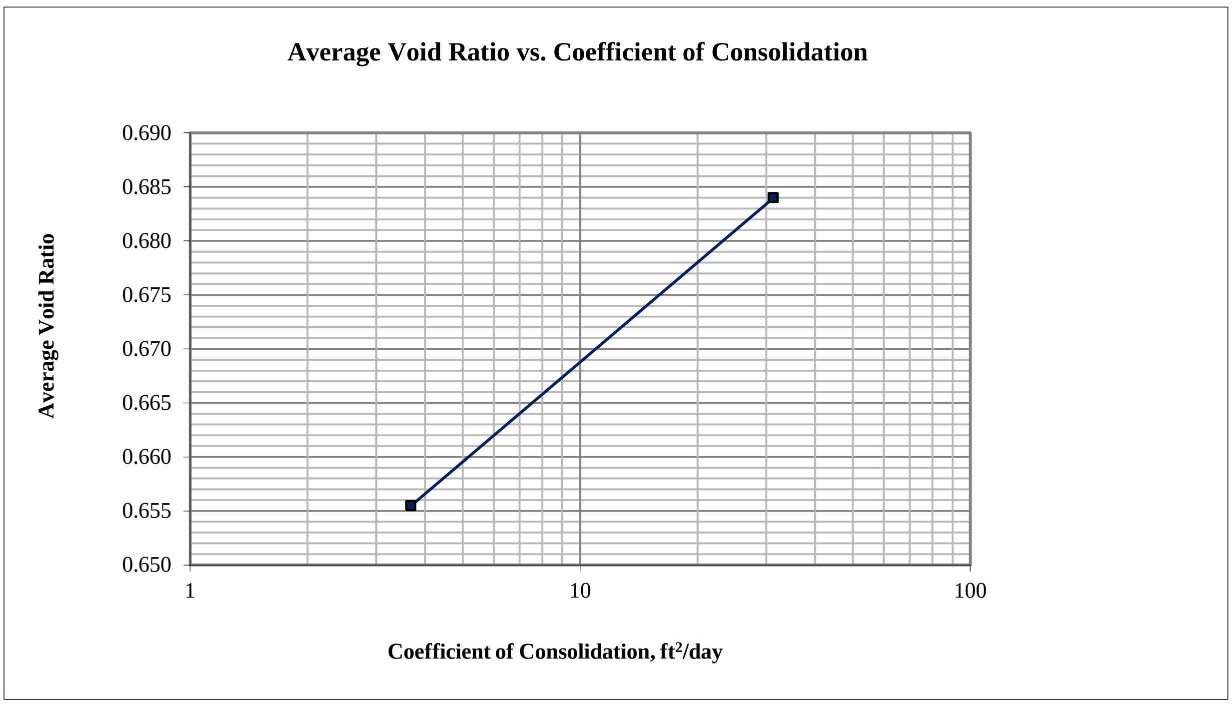
Golder Associates Inc.
Denver, Colorado

Job Short Title:
Copper Flat Tailings Design Study

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

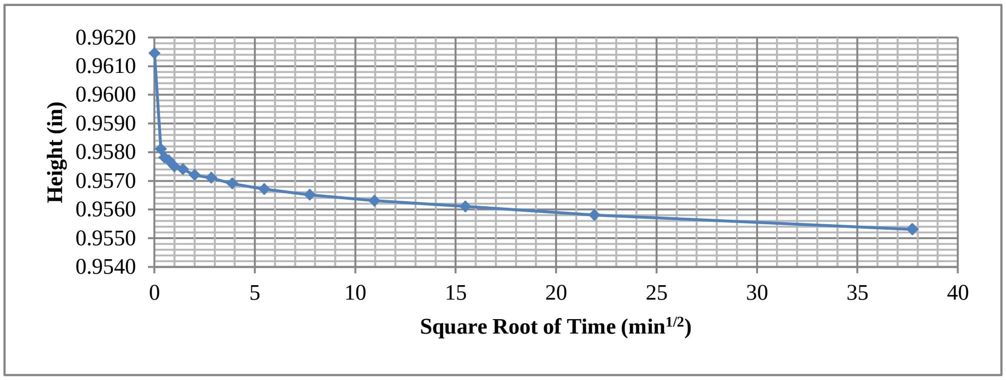
Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-22 @ 28-30 ft	RJM	CCS	3/11/2013	103-92557.006	1



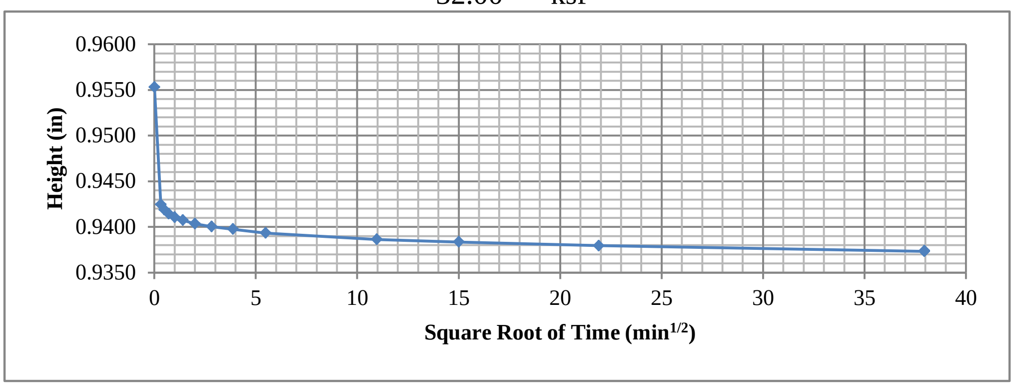


Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-22 @ 28-30 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/11/2013**	**Job Number:** **103-92557.006**	**Figure:** **2**

16.00 ksf



32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **TIME-DEFORMATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-22 @ 28-30 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/11/2013**	**Job Number:** **103-92557.006**	**Figure:** **3**

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports

	Initial		Final	
Height =	1.000	in	0.973	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.901	in^3	4.769	in^3
Water Content =	9.8%		4.2%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5558	in	0.5558	in
Void Ratio =	0.799		0.751	
Degree of Saturation =	33.0%		15.1%	
Wet Mass =	0.291	lb	0.276	lb
Dry Mass =	0.265	lb	0.265	lb
Wet Unit Weight =	102.7	pcf	100.1	pcf
Dry Unit Weight =	93.5	pcf	96.1	pcf

Notes

USCS description (ASTM D2487):	Clayey sand, reddish brown, moist					
Atterberg Limits (ASTM D4318):	LL =	37	PL =	17	PI =	20
Percent Finer (ASTM D422):	3/4 in. =	100%	No. 4 =	95%	No. 200 =	39%
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	93.0	pcf (dry) at	10.0%	moisture		
Water Content of Trimmings (ASTM D2216):	9.9%					
Trimming Procedure:	Specimen remolded in ring					
Inundation:	X	Not inundated		Inundated		
Test Method:		A	X	B		
Apparatus:	Frame No.	6	(ELE C-320A)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	-0.0136	in				
Estimated Preconsolidation Stress:	13.8	ksf				

			At End of Primary Consolidation				At End of Load Duration							
	Axial Stress (ksf)	Load Duration (min)	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	960					0.0000	0.9894	0.00	0.780				
1	0.25	1440					0.0066	0.9828	0.66	0.768				
2	0.50	1425					0.0096	0.9798	0.96	0.763				
3	1.00	1440					0.0116	0.9778	1.16	0.759				
4	2.00	1410					0.0129	0.9765	1.29	0.757				
5	4.00	2770					0.0146	0.9748	1.46	0.754				
6	8.00	1410					0.0159	0.9735	1.59	0.752				
7	16.00	1410	0.0191	0.9703	1.91	0.746	0.0203	0.9692	2.03	0.744	2 (Root time)	0.746	1.313	0.9
8	32.00	1440	0.0304	0.9590	3.04	0.726	0.0330	0.9564	3.30	0.721	2 (Root time)	0.727	3.137	0.5
9	8.00	80					0.0312	0.9582	3.12	0.724				
10	2.00	100					0.0305	0.9589	3.05	0.725				
11	0.50	180					0.0300	0.9594	3.00	0.726				

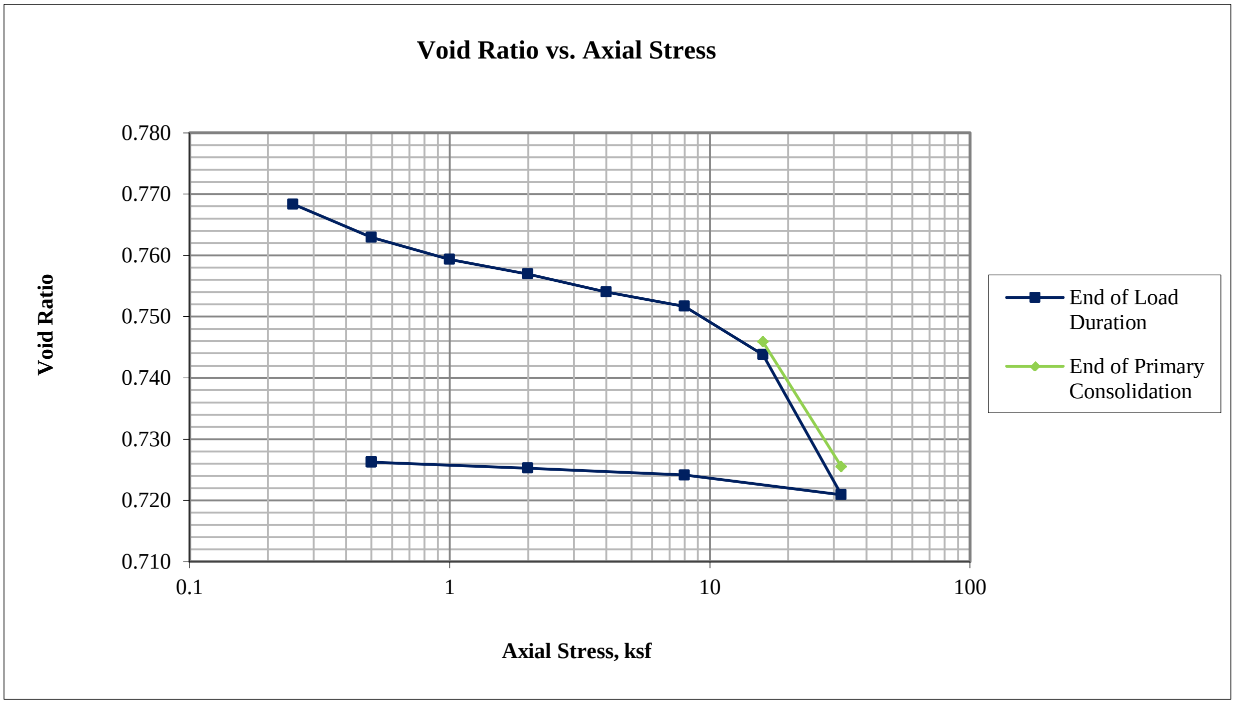
Golder Associates Inc.
Denver, Colorado

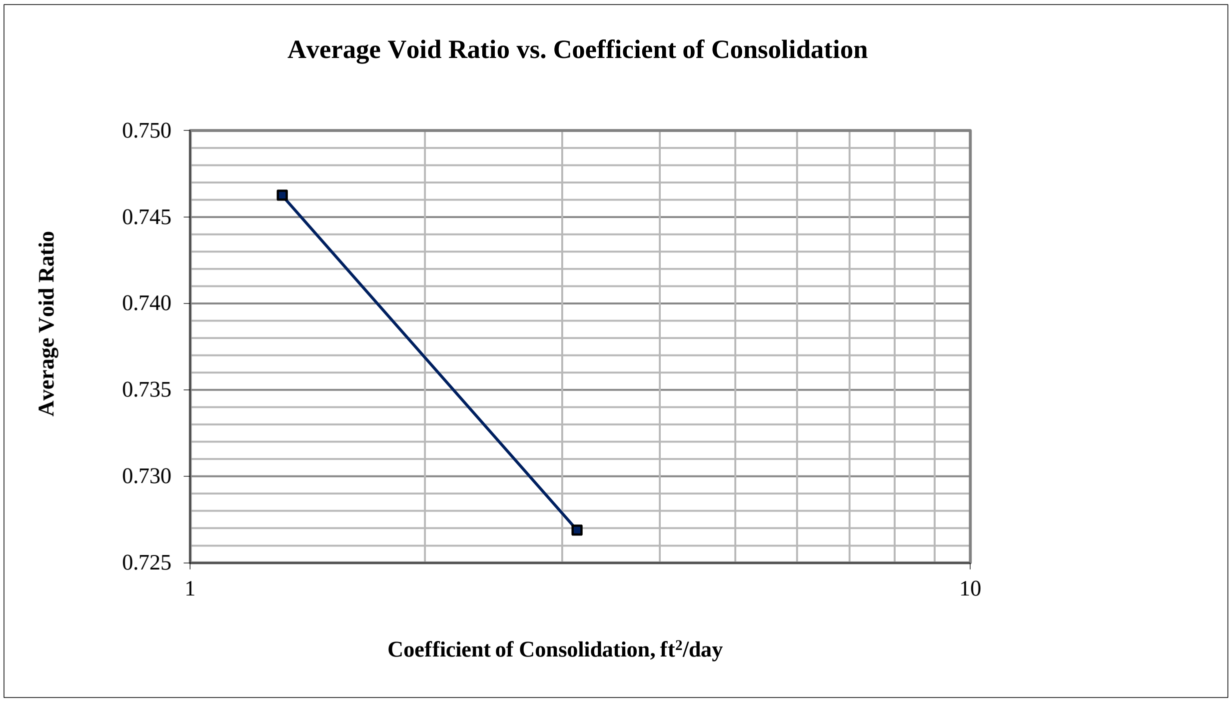
Job Short Title: **Copper Flat Tailings Design Study**

Title:

ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

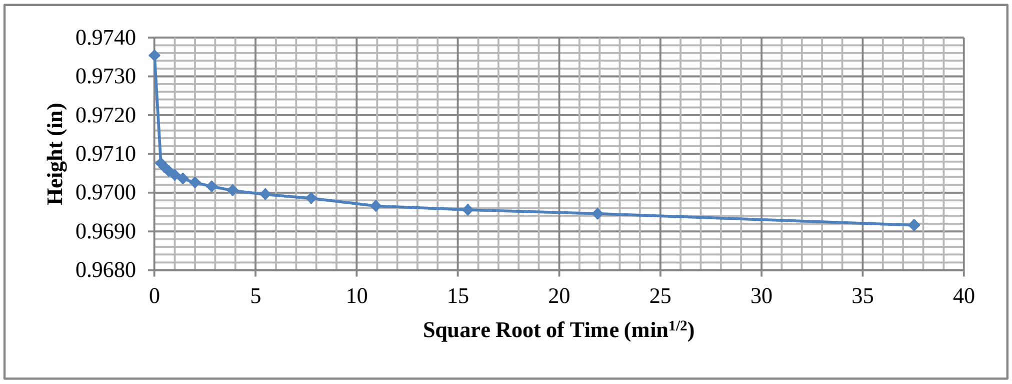
Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-25 @ 22-34 ft	RJM	CCS	3/25/2013	103-92557.006	1



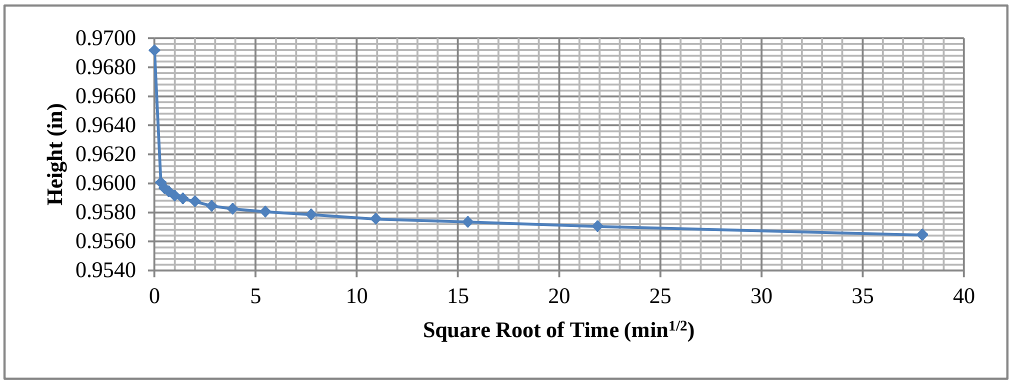


Golder Associates Inc. Denver, Colorado	**Title:** ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-25 @ 22-34 ft	**Technician:** RJM	**Reviewed:** CCS	**Start Date:** 3/25/2013	**Job Number:** 103-92557.006	**Figure:** 2

16.00 ksf



32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **TIME-DEFORMATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **BH-25 @ 22-34 ft**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **3/25/2013**	**Job Number:** **103-92557.006**	**Figure:** **3**

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix A.3 Geotechnical Test Results\4 Consolidation Test Reports

APPENDIX B
TAILINGS TEST RESULTS

APPENDIX B.1
CYCLONE TEST RESULTS,
FULL SCALE CYCLONE PERFORMANCE SIMULATION

KREBS ENGINEERS

SHEET: 6-1

DATE: 15-Nov-13

BY: MPB

Client: Golder Assoc. Copper Flat

Problem: Feed = 29.1% solids; 1222 STPH; 55.5% -200 mesh

U/F = 18.2% -200 mesh; 45.2% recovery

Number, Model Krebs Cyclones: 15 operating gMAX15U-20

	Inlet Area	Vortex Finder	Apex	Pressure Drop
Orifices:	18.00 sq. in.	6.75 in.	TBD	13-14 PSI

Specific Gravity: Solids: 2.650 Liquid: 1.000 Temperature: Amb.°F Viscosity: 1 Cps

	FEED	OVERFLOW	UNDERFLOW
STPH Solids	1222.00	669.86	552.15
STPH Liquids	2977.31	2740.68	236.63
STPH Slurry	4199.31	3410.53	788.78
Wt Solids	29.10	19.64	70.00
S.G. Slurry	1.221	1.139	1.773
Vol% Solids	13.41	8.44	46.82
GPM Slurry	13734.13	11956.71	1777.42
M3/Hr. Slurry	3119.34	2715.64	403.69

Ref: 72.3 4.5 38.9*

Mesh	Micron	FEED			OVERFLOW			UNDERFLOW			ACT.
		Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	REC.
65	208.0	1.80	1.80	22.0	0.00	0.00	0.0	3.98	3.98	22.0	100.0
100	149.0	18.50	16.70	204.1	0.23	0.23	1.6	40.66	36.68	202.5	99.2
150	104.0	30.60	12.10	147.9	2.69	2.46	16.5	64.46	23.79	131.4	88.9
200	74.0	44.50	13.90	169.9	13.74	11.05	74.0	81.81	17.36	95.8	56.4
270	53.0	56.40	11.90	145.4	29.20	15.46	103.5	89.40	7.59	41.9	28.8
325	45.0	61.10	4.70	57.4	35.93	6.73	45.0	91.64	2.24	12.4	21.6
400	37.0	63.70	2.60	31.8	39.89	3.97	26.6	92.58	0.94	5.2	16.4
-400	-37.0	100.00	36.30	443.6	100.00	60.11	402.6	100.00	7.42	40.9	9.2
TOTAL				1222.00			669.86			552.15	45.2

KREBS ENGINEERS
5505 WEST GILLETTE ROAD TUCSON, AZ 85743
TEL: (520) 744-8200 FAX: (520) 744-8300
www.krebs.com

KREBS ENGINEERS

SHEET: 8-1

DATE: 15-Nov-13

BY: MPB

Client: Golder Assoc. Copper Flat

Problem: Feed = 29.1% solids; 1333 STPH; 55.5% -200 mesh

U/F = 18.4% -200 mesh; 45.6% recovery

Number, Model Krebs Cyclones: 16 operating gMAX15U-20

	Inlet Area	Vortex Finder	Apex	Pressure Drop
Orifices:	18.00 sq. in.	6.75 in.	TBD	14 PSI

Specific Gravity: Solids: 2.650 Liquid: 1.000 Temperature: Amb. °F Viscosity: 1 Cps

	FEED	OVERFLOW	UNDERFLOW
STPH Solids	1333.00	724.53	608.47
STPH Liquids	3247.76	2986.98	260.77
STPH Slurry	4580.76	3711.51	869.24
Wt Solids	29.10	19.52	70.00
S.G. Slurry	1.221	1.138	1.773
Vol% Solids	13.41	8.39	46.82
GPM Slurry	14981.66	13022.93	1958.73
M3/Hr. Slurry	3402.68	2957.81	444.87

Ref: 71.4 4.5 38.9*

Mesh	Micron	FEED			OVERFLOW			UNDERFLOW			ACT.
		Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	REC.
65	208.0	1.80	1.80	24.0	0.00	0.00	0.0	3.94	3.94	24.0	100.0
100	149.0	18.50	16.70	222.6	0.21	0.21	1.5	40.28	36.34	221.1	99.3
150	104.0	30.60	12.10	161.3	2.52	2.31	16.7	64.04	23.76	144.6	89.6
200	74.0	44.50	13.90	185.3	13.31	10.79	78.2	81.64	17.60	107.1	57.8
270	53.0	56.40	11.90	158.6	28.73	15.42	111.7	89.35	7.71	46.9	29.6
325	45.0	61.10	4.70	62.7	35.47	6.74	48.8	91.62	2.27	13.8	22.1
400	37.0	63.70	2.60	34.7	39.45	3.98	28.9	92.58	0.95	5.8	16.7
-400	-37.0	100.00	36.30	483.9	100.00	60.55	438.7	100.00	7.42	45.2	9.3
TOTAL				1333.00			724.53			608.47	45.6

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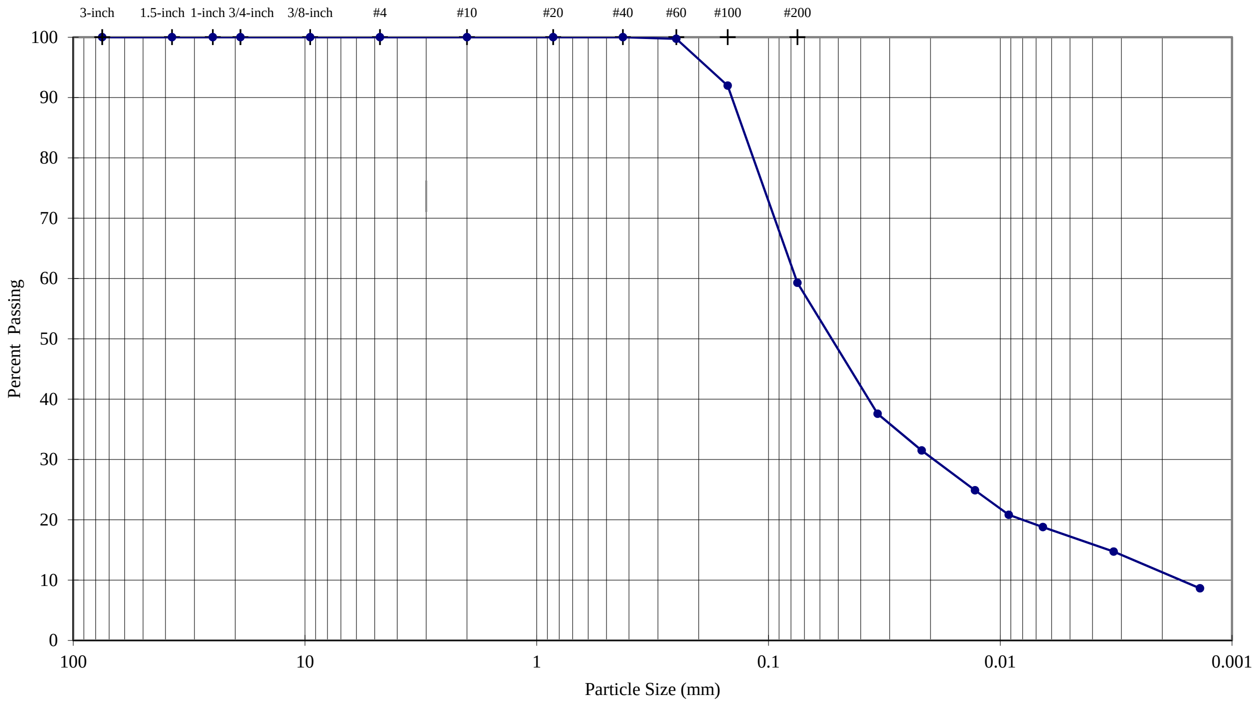
APPENDIX B.2
TAILINGS GRADATIONS

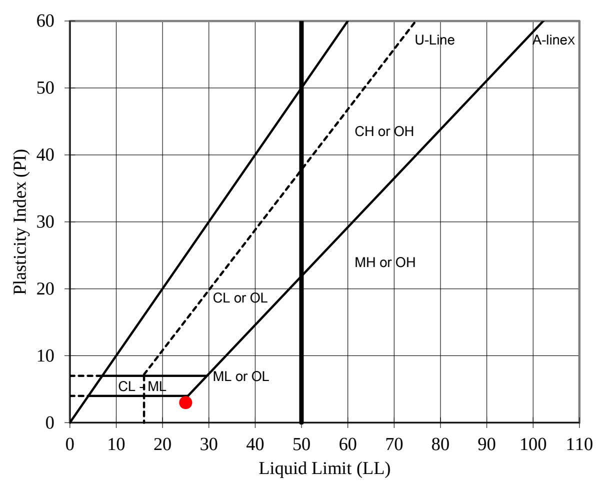
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Whole Tailings Drum** DEPTH (ft): --
TYPE: **Drum**



Sieve Analysis (Initial Separation on No. 4 Sieve); Hydrometer Analysis

Sieve	Particle Size (mm)	% Passing	Description	Percentage
3-inch	75.0	**100.0**		
1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
1-inch	25.0	**100.0**		
3/4-inch	19.0	**100.0**		
3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
#4	4.75	**100.0**		
#10	2.0	**100.0**	Coarse Sand	**0.00**
#20	0.85	**100.0**	Medium Sand	**0.00**
#40	0.425	**100.0**		
#60	0.25	**99.7**	Fine Sand	**40.71**
#100	0.15	**92.0**		
#200	0.075	**59.3**		
	0.034	**37.6**	Silt or Clay Fines	**59.29**
	0.022	**31.5**		
	0.013	**24.9**		
	0.009	**20.8**		
	0.007	**18.8**		
	0.003	**14.7**		
	0.001	**8.6**		



USCS Description (ASTM D 2487):

Dry, yellow sandy silt

LL	PL	PI	SpG
25	**22**	**3**	**2.64**

As-Received Moisture Content (%): --

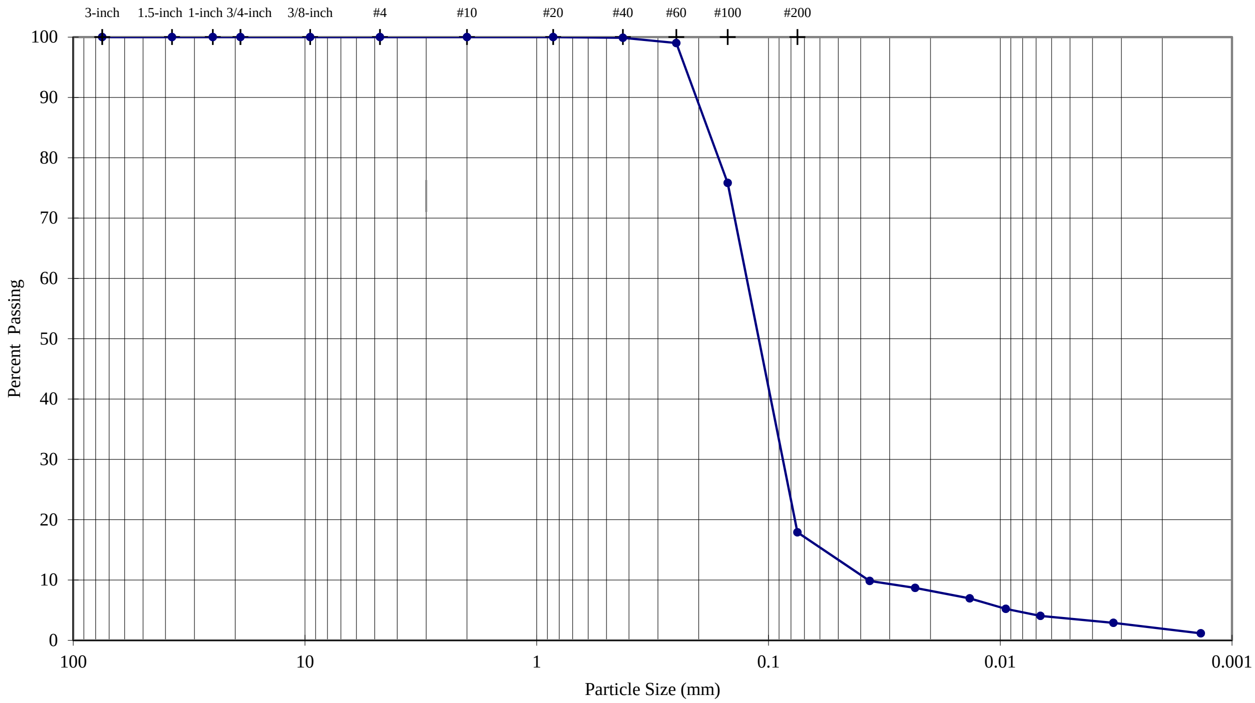
USCS Group Symbol: ML

Notes: 0 g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

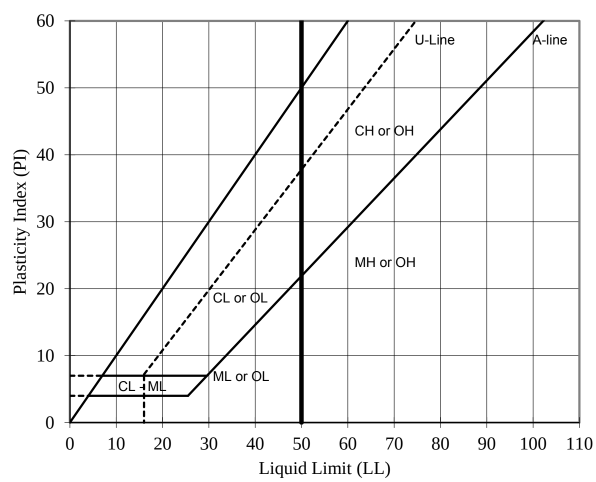
TECH	AM/SRS
DATE	11/13/2012
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Tailings Underflow** DEPTH (ft): --
TYPE: **Pail**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	**100.0**		
	1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
	1-inch	25.0	**100.0**		
	3/4-inch	19.0	**100.0**		
	3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
	#4	4.75	**100.0**		
	#10	2.0	**100.0**	Coarse Sand	**0.00**
	#20	0.85	**100.0**	Medium Sand	**0.12**
	#40	0.425	**99.9**		
	#60	0.25	**99.0**	Fine Sand	**81.98**
	#100	0.15	**75.8**		
	#200	0.075	**17.9**		
Hydrometer Analysis		0.037	**9.8**	Silt or Clay Fines	**17.91**
		0.023	**8.7**		
		0.014	**6.9**		
		0.009	**5.2**		
		0.007	**4.1**		
		0.003	**2.9**		
		0.001	**1.2**		



USCS Description (ASTM D 2487):

Wet, light, yellowish brown silty sand

LL	PL	PI	Spg (assumed)
NP	**NP**	**NP**	**2.7**

As-Received Moisture Content (%): --

USCS Group Symbol: SM

Notes: 0g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

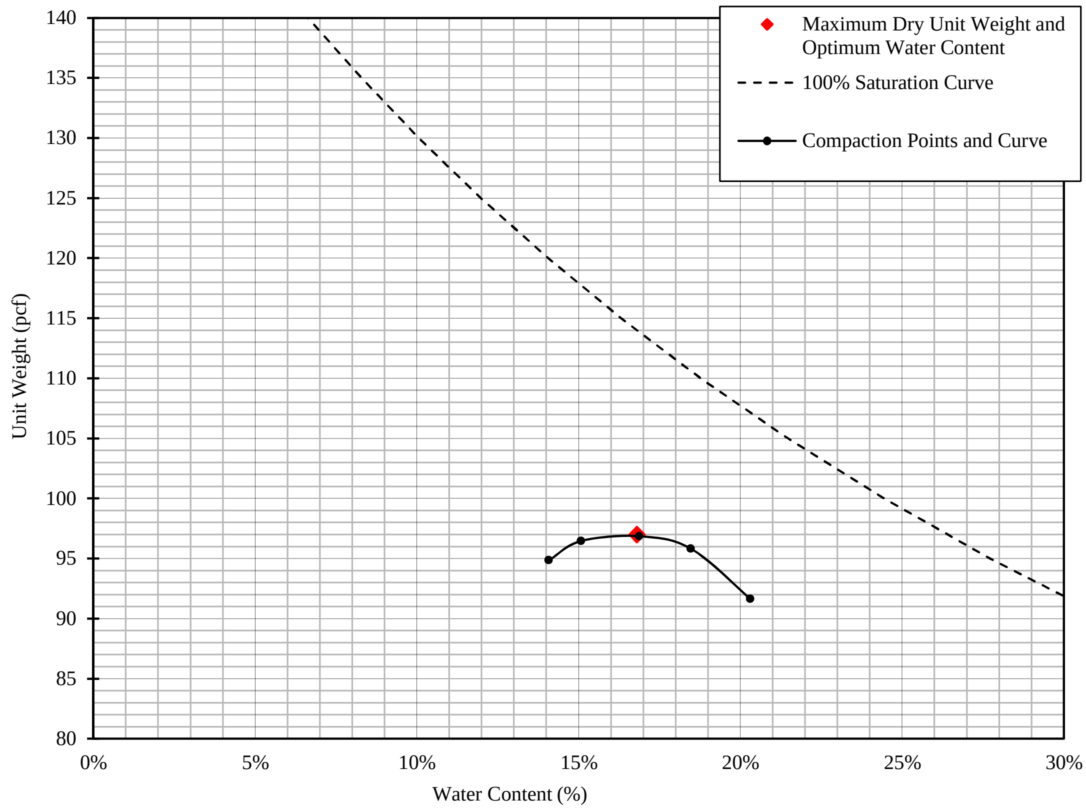
TECH	MC/SRS
DATE	10/24/2012
REVIEW	MB

October-12 | 103-92557-010

LABORATORY COMPACTION CHARACTERISTICS OF SOIL
ASTM D698 - Method A

Manual Rammer	Moist Preparation

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Tailings Underflow** DEPTH (ft): --
TYPE: **Pail**



% Test Fraction Passing #4 Sieve	**100%**
As-Received Moisture Content	**NA**
Specific Gravity (ASTM D854)	**2.64**

Maximum Dry Unit Weight (pcf)	**97.0**
Optimum Water Content (%)	**16.8**

USCS Description (ASTM D 2487): Wet, light, yellowish brown silty sand

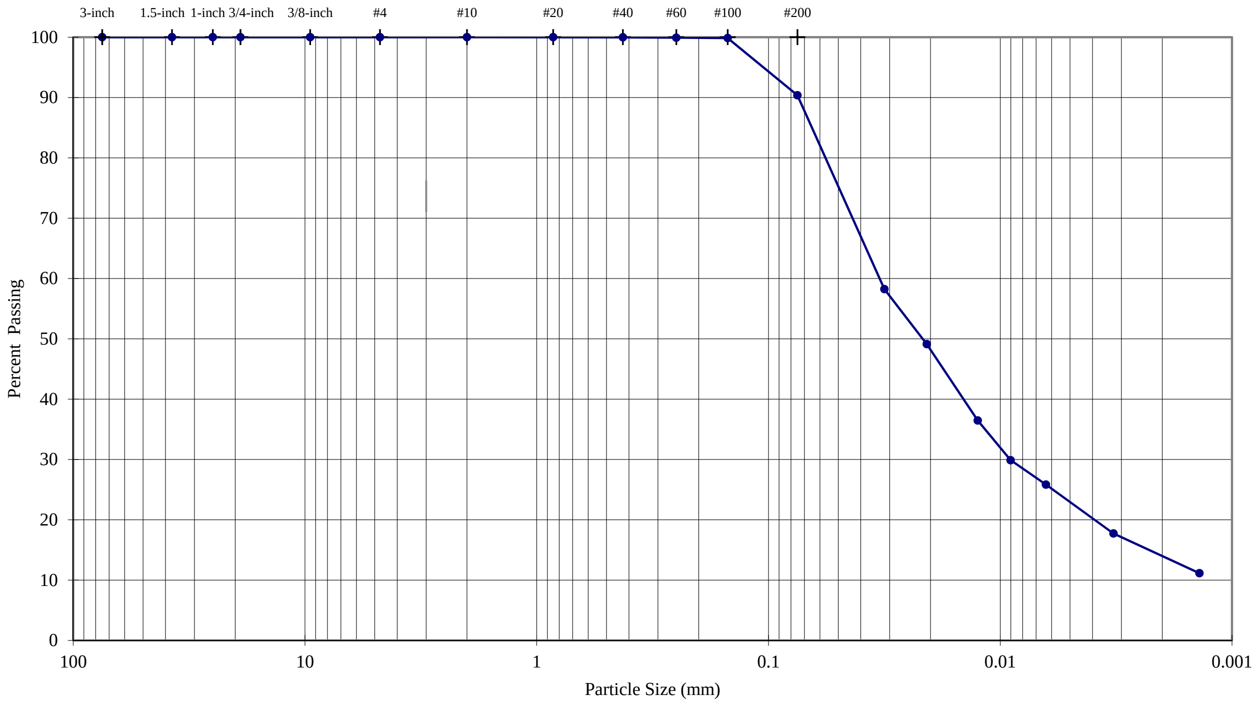
USCS SM

TECH	ACE/MC
DATE	10-25-12
REVIEW	MB

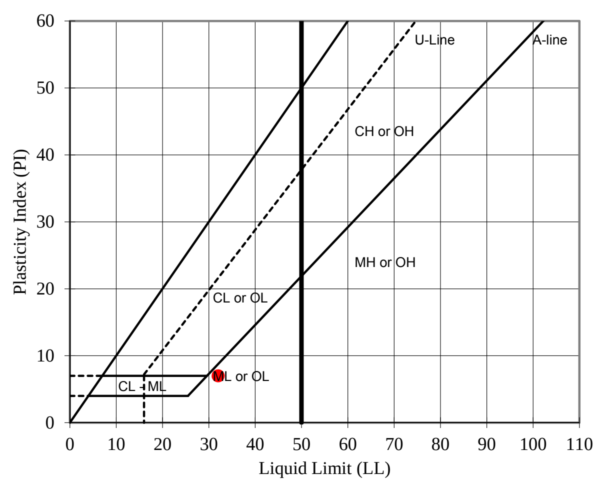
November-12 **103-92557**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Tailings Overflow** DEPTH (ft): --
TYPE: **Drum**



Sieve Analysis (Initial Separation on No. 4 Sieve) / Hydrometer Analysis	Sieve	Particle Size (mm)	% Passing	Description	Percentage
Sieve Analysis	3-inch	75.0	**100.0**		
	1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
	1-inch	25.0	**100.0**		
	3/4-inch	19.0	**100.0**		
	3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
	#4	4.75	**100.0**		
	#10	2.0	**100.0**	Coarse Sand	**0.00**
	#20	0.85	**100.0**	Medium Sand	**0.02**
	#40	0.425	**100.0**		
	#60	0.25	**99.9**	Fine Sand	**9.61**
	#100	0.15	**99.9**		
	#200	0.075	**90.4**		
Hydrometer Analysis		0.032	**58.2**	Silt or Clay Fines	**90.37**
		0.021	**49.1**		
		0.013	**36.5**		
		0.009	**29.9**		
		0.006	**25.8**		
		0.003	**17.7**		
		0.001	**11.1**		



USCS Description (ASTM D 2487):

Dry, olive yellow SILT

LL	PL	PI	SpG (assumed)
32	**25**	**7**	**2.64**

As-Received Moisture Content (%): --

USCS Group Symbol: ML

Notes: 0 g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

TECH	AM/SRS
DATE	1/2/2013
REVIEW	MB

APPENDIX B.3
CYCLONE UNDERFLOW TEST RESULTS

	Point 1		Point 2		Point 3	
Boring or Test Pit:	--		--		--	
Sample:	Tailings Underflow		Tailings Underflow		Tailings Underflow	
Depth:	--	ft	--	ft	--	ft
Point No.:	1		2		3	
Initial						
Length =	5.006	in	5.006	in	5.006	in
Diameter =	2.500	in	2.500	in	2.500	in
Wet Mass =	1.526	lb	1.523	lb	1.517	lb
Area =	4.909	in^2	4.909	in^2	4.909	in^2
Volume =	24.573	in^3	24.573	in^3	24.573	in^3
Specific Gravity =	2.64	(Assumed)	2.64	(Assumed)	2.64	(Assumed)
Dry Mass of Solids =	1.311	lb	1.312	lb	1.306	lb
Moisture Content =	16.4%		16.1%		16.1%	
Wet Unit Weight =	107.3	pcf	107.1	pcf	106.7	pcf
Dry Unit Weight =	92.2	pcf	92.3	pcf	91.9	pcf
Void Ratio =	0.79		0.78		0.79	
Percent Saturation =	55%		54%		54%	
After Consolidation						
Length =	4.989	in	4.977	in	4.971	in
Diameter =	2.470	in	2.469	in	2.429	in
Area =	4.792	in^2 (Method B)	4.787	in^2 (Method B)	4.633	in^2 (Method B)
Volume =	23.906	in^3	23.824	in^3	23.033	in^3
Moisture Content =	27.9%		27.6%		25.7%	
Wet Unit Weight =	121.2	pcf	121.4	pcf	123.2	pcf
Dry Unit Weight =	94.7	pcf	95.2	pcf	98.0	pcf
Void Ratio =	0.74		0.73		0.68	
Percent Saturation =	100%		100%		100%	
B Parameter =	0.98		0.97		0.96	
Shear Rate =	0.083%	/min.	0.083%	/min.	0.082%	/min.
t_{50} =	--	(not computed)	--	(not computed)	--	(not computed)
Strain at Failure =	5.0%		5.0%		5.0%	
Cell Pressure =	120	psi	150	psi	170	psi
Back Pressure =	100	psi	100	psi	80	psi
Confining Pressure =	20	psi	50	psi	90	psi

Notes:

Sample description: Light yellowish brown silty sand

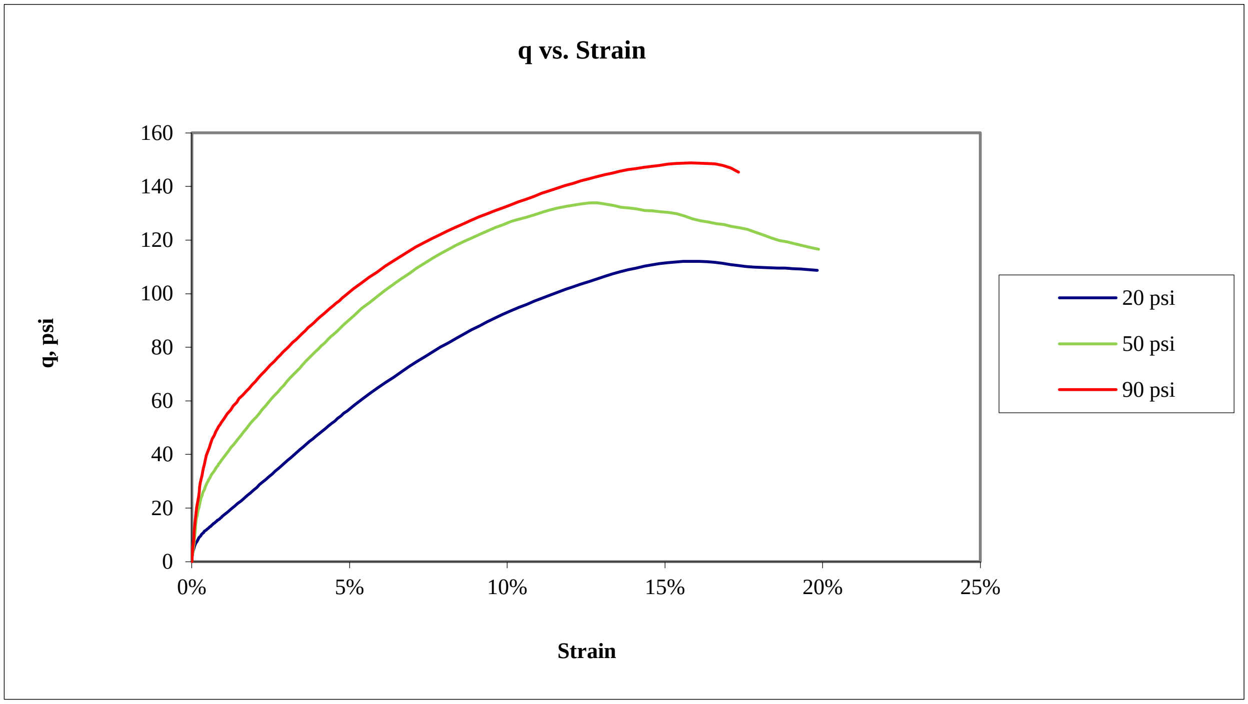
Atterberg limits: LL = NP; PL = NP; PI = NP (ASTM D4318)

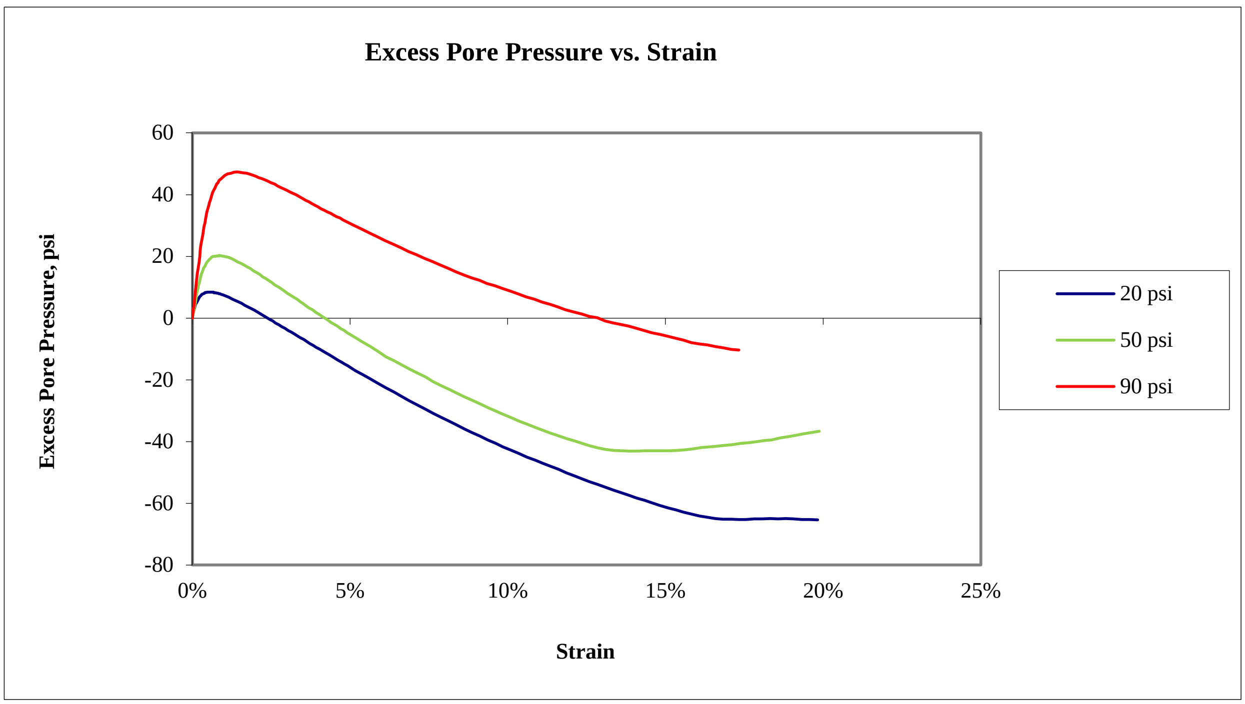
Percent finer: 3/4 in. = 100%; No. 4 = 100%; No. 200 = 18% (ASTM D422, refer to separate report for gradation curve)

Specimen type:		Intact	X	Reconstituted
Moisture from:		Cuttings	X	Entire specimen
Saturation method:	X	Wet		Dry
Failure criterion:		$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$ [5] % strain
Membrane effect:	X	Corrected		Not Corrected

Remold targets: 92.2 pcf (dry) at 16.8% moisture (+/- 2%)

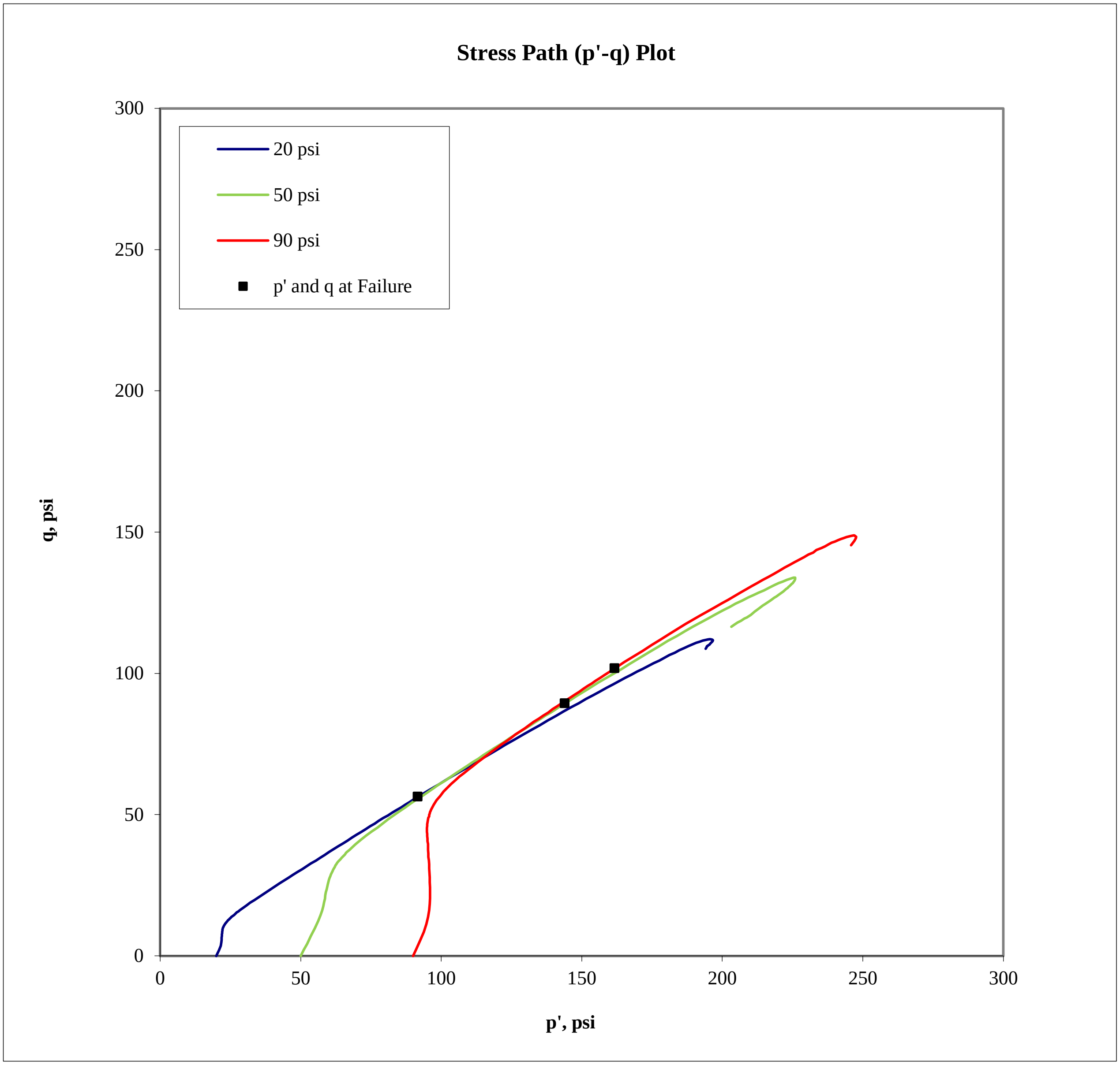
Golder Associates Inc. Denver, Colorado	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **Tailing Underflow**	**Technician:** **RJM/PRH**	**Reviewed:** **CCS**	**Date:** **1/8/2013**	**Job Number:** **103-92557**	**Figure:** **1**





Golder Associates Inc. Denver, Colorado	**Title:** ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT q AND EXCESS PORE PRESSURE PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Tailing Underflow	**Technician:** RJM/PRH	**Reviewed:** CCS	**Date:** 1/8/2013	**Job Number:** 103-92557	**Figure:** 2

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Draft\Appendix B.3 Underflow Test Results

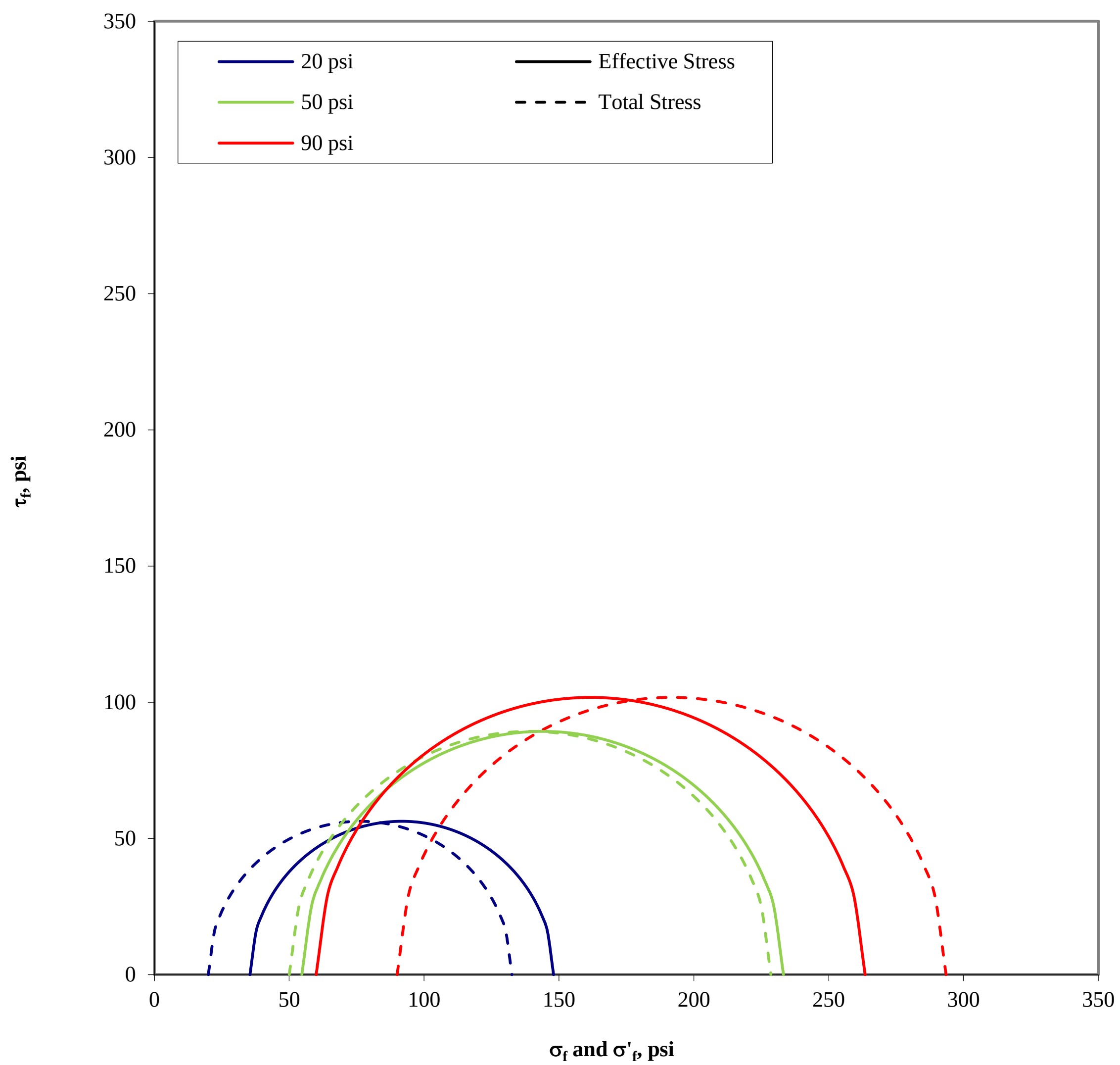


Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
20	76.3	91.7	56.3
50	139.3	143.9	89.3
90	191.8	161.7	101.8

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	**Technician:**	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
Tailing Underflow	**RJM/PRH**	**CCS**	**1/8/2013**	**103-92557**	**3**

Mohr's Circle Diagram



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
20	148.0	35.4	132.6	20.0
50	233.2	54.7	228.6	50.0
90	263.5	60.0	293.5	90.0

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **MOHR'S CIRCLE DIAGRAM**
Job Short Title: **Copper Flat Tailings Design Study**	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
Tailing Underflow	**RJM/PRH**	**CCS**	**1/8/2013**	**103-92557**	**4**

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 20 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Tailing Underflow	Technician: RJM/PRH	Reviewed: CCS	Date: 1/8/2013	Job Number: 103-92557	Figure: 5

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Draft\Appendix B.3 Underflow Test Results

Golder Associates Inc. **Denver, Colorado**	**Title:** ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 50 psi
Job Short Title: Copper Flat Tailings Design Study	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
Tailing Underflow	RJM/PRH	CCS	1/8/2013	103-92557	6

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Draft\Appendix B.3 Underflow Test Results

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 90 psi				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Tailing Underflow	Technician: RJM/PRH	Reviewed: CCS	Date: 1/8/2013	Job Number: 103-92557	Figure: 7

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Draft\Appendix B.3 Underflow Test Results

	Initial		Final	
Height =	0.994	in	0.973	in
Diameter =	2.501	in	2.501	in
Area =	4.913	in^2	4.913	in^2
Volume =	4.883	in^3	4.780	in^3
Water Content =	16.5%		25.0%	
Specific Gravity =	2.64	(Assumed)	2.64	(Assumed)
Height of Solids =	0.5584	in	0.5584	in
Void Ratio =	0.780		0.743	
Degree of Saturation =	55.8%		88.9%	
Wet Mass =	0.304	lb	0.326	lb
Dry Mass =	0.261	lb	0.261	lb
Wet Unit Weight =	107.6	pcf	118.0	pcf
Dry Unit Weight =	92.4	pcf	94.4	pcf

Notes

Visual description (Golder procedure):	Damp, yellowish brown SILTY SAND					
Atterberg Limits (ASTM D4318):	LL = NP		PL = NP		PI = NP	
Percent Finer (ASTM D422):	3/4 in. = 100%		No. 4 = 100%		No. 200 = 18%	
Specimen Type:		Intact	X	Reconstituted		
Remold Targets:	92.2	pcf (dry) at	16.8%	moisture	(+/- 2.0%)	
Water Content of Trimmings (ASTM D2216):	16.6%					
Trimming Procedure:	Specimen trimmed in ring					
Inundation:		Not inundated	X	Inundated at	0.1	ksf
Test Method:		A	X	B		
Apparatus:	Frame No.	2	(Wykeham Farrance 24251)			
Final Water Content Specimen:	X	Entire		Partial		
Final Differential Height:	0.0036	in				
Estimated Preconsolidation Stress:	3.7	ksf				

			At End of Primary Consolidation				At End of Load Duration							
	Axial Stress (ksf)	Load Duration (min)	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	160					0.0000	0.9937	0.00	0.780				
1	0.10	1000					0.0004	0.9933	0.04	0.779				
2	0.25	1500					0.0025	0.9912	0.25	0.775				
3	0.50	1440					0.0045	0.9892	0.45	0.772				
4	1.00	1440					0.0068	0.9869	0.68	0.767				
5	2.00	1440	0.0090	0.9847	0.90	0.764	0.0101	0.9836	1.01	0.762	2 (Root time)	0.764	10.328	0.3
6	4.00	1440	0.0127	0.9810	1.27	0.757	0.0141	0.9796	1.42	0.754	2 (Root time)	0.758	26.471	0.3
7	8.00	1440	0.0176	0.9761	1.77	0.748	0.0192	0.9745	1.93	0.745	2 (Root time)	0.749	22.898	0.3
8	16.00	1440	0.0243	0.9694	2.44	0.736	0.0266	0.9671	2.68	0.732	2 (Root time)	0.737	14.013	0.4
9	4.00	150					0.0234	0.9703	2.35	0.738				
10	1.00	870					0.0201	0.9736	2.02	0.744				
11	0.25	1145					0.0171	0.9766	1.72	0.749				

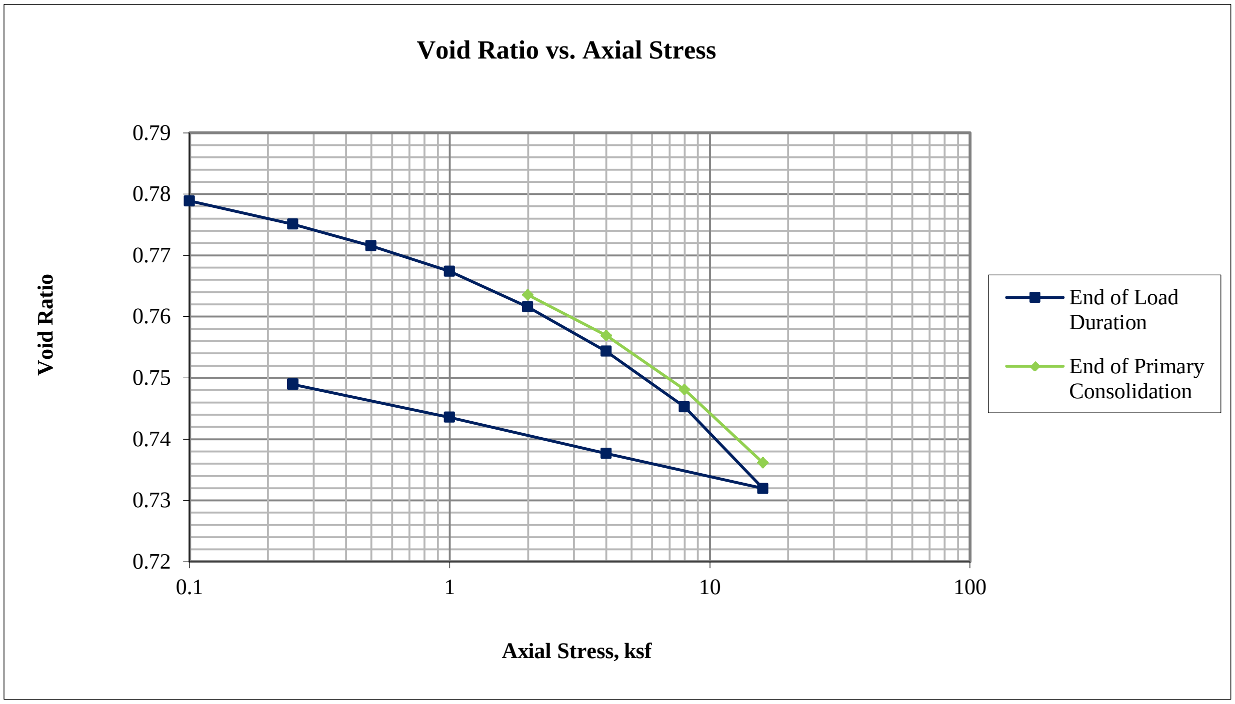
Golder Associates Inc.
Denver, Colorado

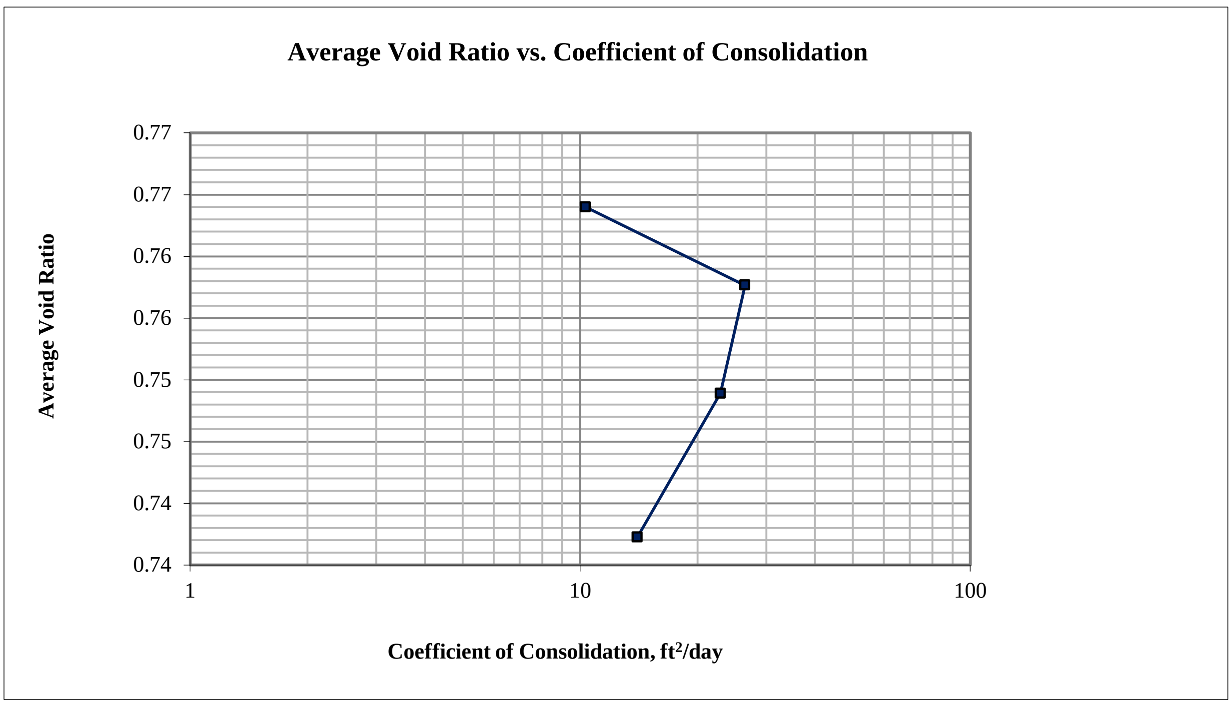
Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Job Short Title: Copper Flat Tailings Design Study

Sample: Tailings Underflow

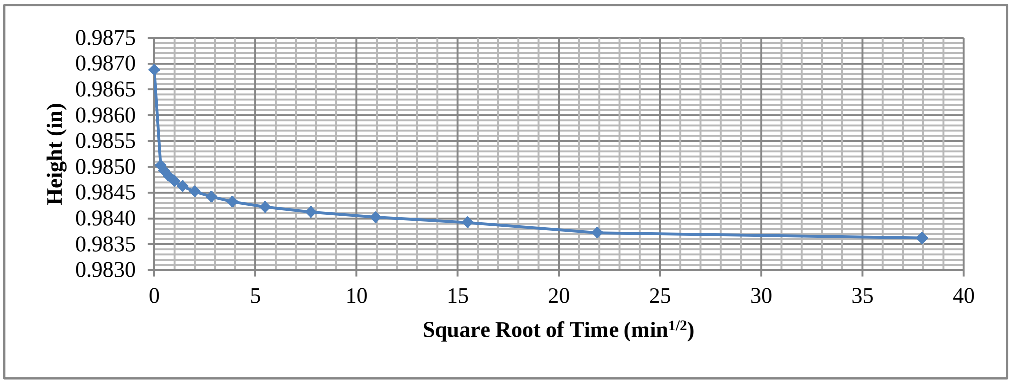
Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	11/12/2012	103-92557	1



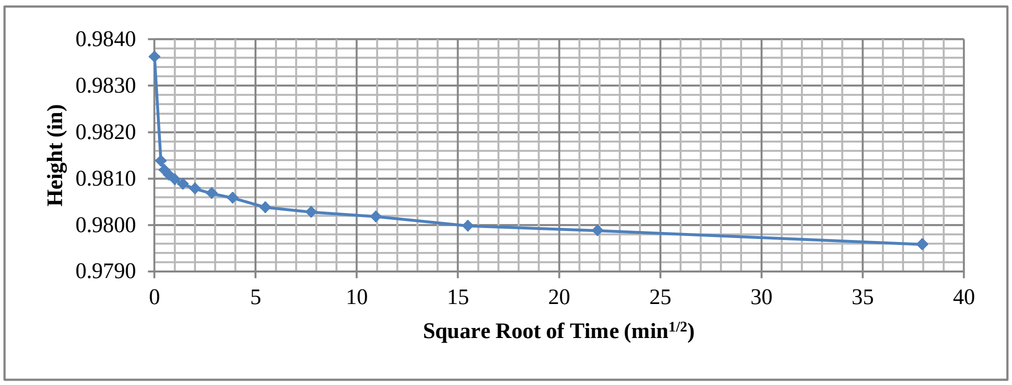


Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **Copper Flat Tailings Design Study**					
Sample: **Tailings Underflow**	**Technician:** **RJM**	**Reviewed:** **CCS**	**Start Date:** **11/12/2012**	**Job Number:** **103-92557**	**Figure:** **2**

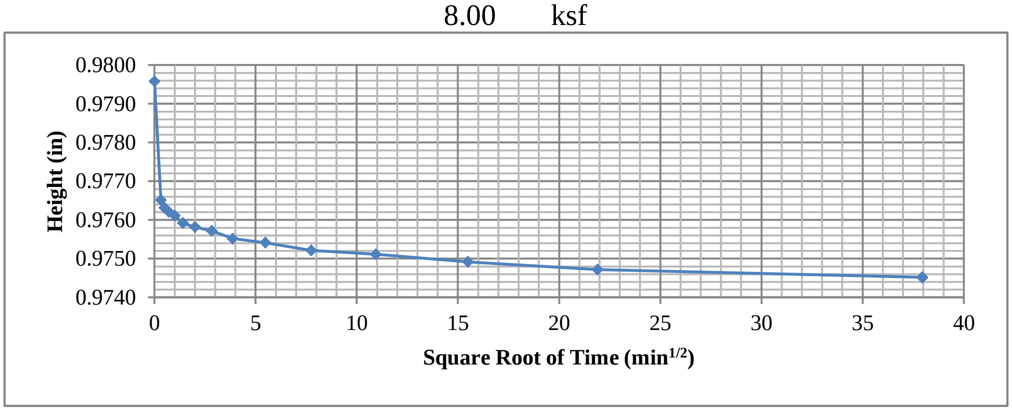
2.00 ksf



4.00 ksf

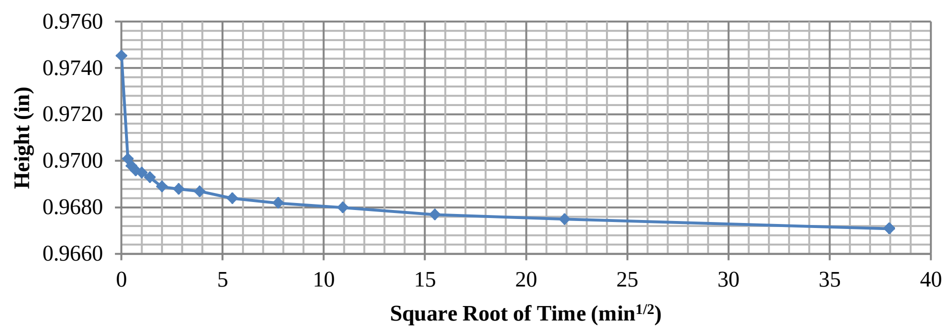


8.00 ksf



Golder Associates Inc. Denver, Colorado	**Title:** ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS (1)				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Tailings Underflow	**Technician:** RJM	**Reviewed:** CCS	**Start Date:** 11/12/2012	**Job Number:** 103-92557	**Figure:** 3

16.00 ksf



Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS (2)				
Job Short Title: Copper Flat Tailings Design Study					
Sample: Tailings Underflow	Technician: RJM	Reviewed: CCS	Start Date: 11/12/2012	Job Number: 103-92557	Figure: 4

APPENDIX B.4
CYCLONE OVERFLOW AND WHOLE TAILINGS
TEST RESULTS

APPENDIX B.4.1
CYCLONE OVERFLOW TEST REPORTS

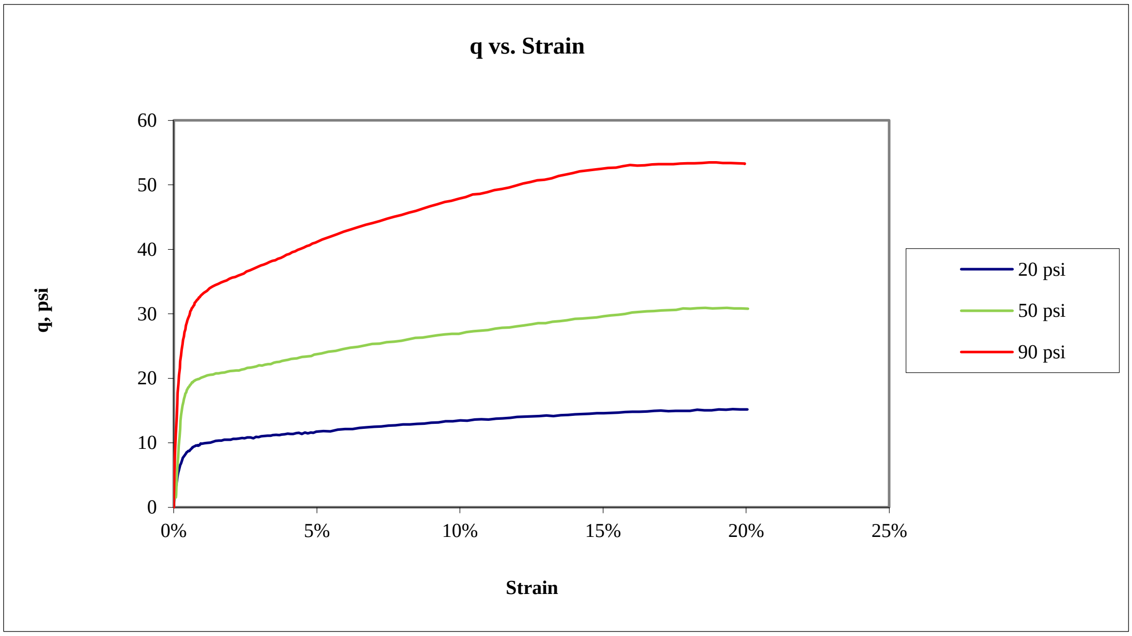
	Point 1		Point 2		Point 3	
Boring or Test Pit:	--		--		--	
Sample:	O/F Flume Beach		O/F Flume Beach		O/F Flume Beach	
Depth:	--	ft	--	ft	--	ft
Point No.:	1		2		3	
Initial						
Length =	4.183	in	4.127	in	4.257	in
Diameter =	1.924	in	1.930	in	1.929	in
Wet Mass =	0.851	lb	0.832	lb	0.868	lb
Area =	2.907	in^2	2.926	in^2	2.922	in^2
Volume =	12.162	in^3	12.074	in^3	12.441	in^3
Specific Gravity =	2.64	(Provided)	2.64	(Provided)	2.64	(Provided)
Dry Mass of Solids =	0.666	lb	0.653	lb	0.682	lb
Moisture Content =	27.7%		27.4%		27.3%	
Wet Unit Weight =	120.9	pcf	119.1	pcf	120.5	pcf
Dry Unit Weight =	94.6	pcf	93.5	pcf	94.7	pcf
Void Ratio =	0.74		0.76		0.74	
Percent Saturation =	99%		95%		98%	
After Consolidation						
Length =	4.091	in	4.080	in	4.224	in
Diameter =	1.894	in	1.866	in	1.849	in
Area =	2.816	in^2 (Method B)	2.734	in^2 (Method B)	2.685	in^2 (Method B)
Volume =	11.522	in^3	11.156	in^3	11.339	in^3
Moisture Content =	24.5%		23.7%		22.1%	
Wet Unit Weight =	124.4	pcf	125.2	pcf	126.9	pcf
Dry Unit Weight =	99.9	pcf	101.2	pcf	103.9	pcf
Void Ratio =	0.65		0.63		0.58	
Percent Saturation =	100%		100%		100%	
B Parameter =	0.95		0.99		0.98	
Shear Rate =	0.051%	/min.	0.084%	/min.	0.083%	/min.
t_{50} =	7.8	min.	3.7	min.	4.4	min.
Strain at Failure =	5.0%		5.0%		5.0%	
Cell Pressure =	60	psi	90	psi	120	psi
Back Pressure =	40	psi	40	psi	30	psi
Confining Pressure =	20	psi	50	psi	90	psi

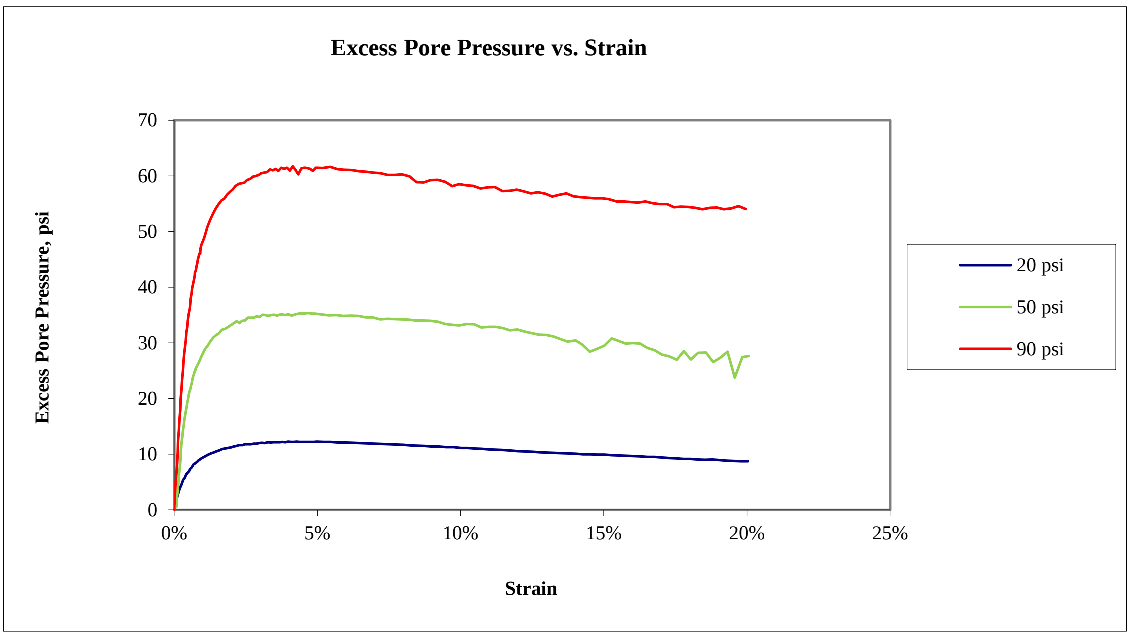
Notes:

Sample description:	Silt, pale yellow, moist					
Atterberg limits:	LL = 28		PL = 25		PI = 3	(ASTM D4318)
Percent finer:	3/4 in. = 100%		No. 4 = 100%		No. 200 = 84%	(ASTM D422, refer to separate report for gradation curve)
Specimen type:		Intact		Reconstituted	X	Slurry consolidated in tube and extruded
Moisture from:	X	Cuttings		Entire specimen		
Saturation method:	X	Wet		Dry		
Failure criterion:		$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$	5	% strain
Membrane effect:	X	Corrected		Not Corrected		

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **Copper Flat Tailngs Design Study**					
Sample: **Overflow Flume Test Beach**	**Technician:** **RJM**	**Reviewed:** **DAR**	**Date:** **3/12/2013**	**Job Number:** **103-92557.010**	**Figure:** **1**

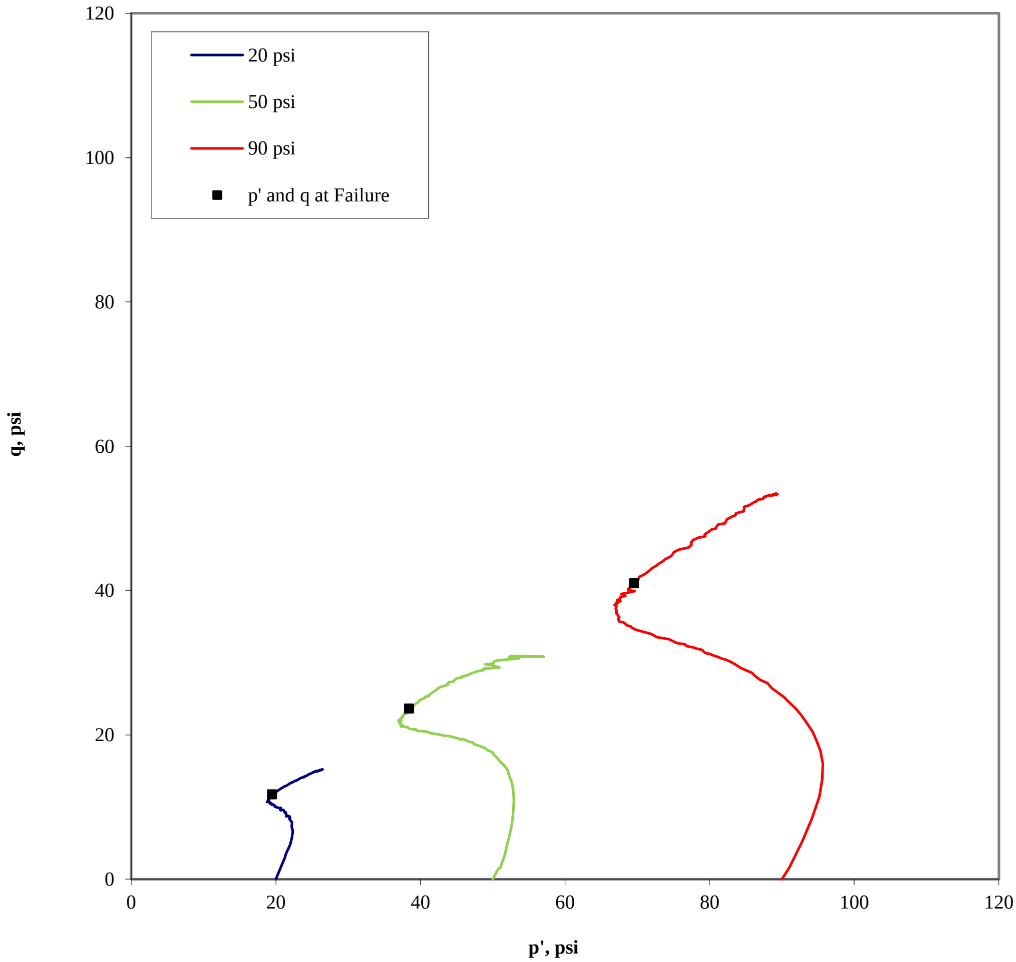
X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix B.4 Flume Sample Test Results\B.4.1





Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **Copper Flat Tailngs Design Study**					
Sample: **Overflow Flume Test Beach**	**Technician:** **RJM**	**Reviewed:** **DAR**	**Date:** **3/12/2013**	**Job Number:** **103-92557.010**	**Figure:** **2**

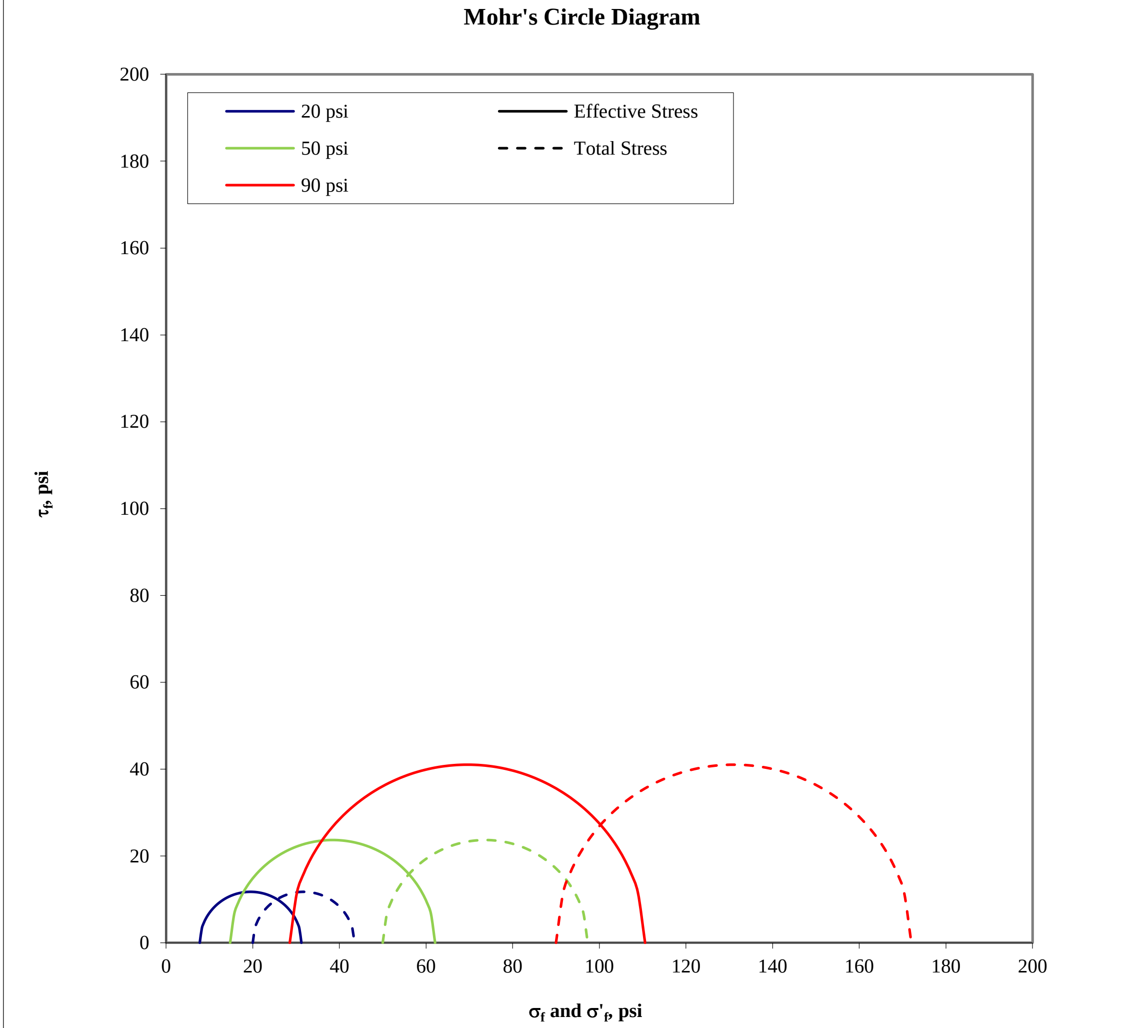
Stress Path (p'-q) Plot



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
20	31.7	19.5	11.7
50	73.7	38.4	23.7
90	131.0	69.6	41.0

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**
Job Short Title: **Copper Flat Tailngs Design Study**	

Sample:	Technician:	Reviewed:	Date:	Job Number:	Figure:
Overflow Flume Test Beach	**RJM**	**DAR**	**3/12/2013**	**103-92557.010**	**3**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
20	31.2	7.8	43.5	20.0
50	62.1	14.8	97.3	50.0
90	110.6	28.5	172.0	90.0

Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT MOHR'S CIRCLE DIAGRAM				
Job Short Title: Copper Flat Tailngs Design Study					
Sample: Overflow Flume Test Beach	Technician: RJM	Reviewed: DAR	Date: 3/12/2013	Job Number: 103-92557.010	Figure: 4

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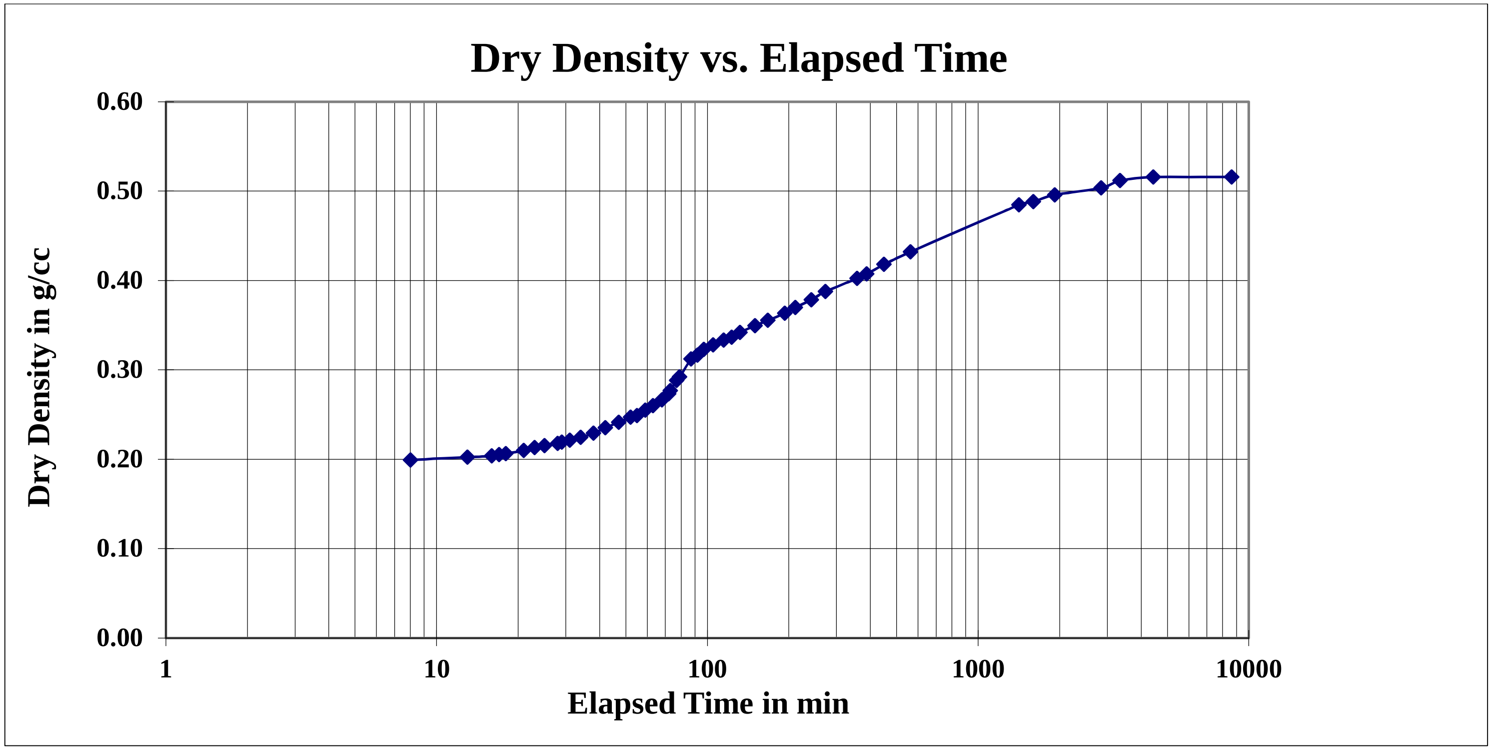
Golder Associates Inc. Denver, Colorado	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 20 psi				
Job Short Title: Copper Flat Tailngs Design Study					
Sample: Overflow Flume Test Beach	Technician: RJM	Reviewed: DAR	Date: 3/12/2013	Job Number: 103-92557.010	Figure: 5

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix B.4 Flume Sample Test Results\B.4.1

Golder Associates Inc. **Denver, Colorado**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SPECIMEN PHOTOGRAPH - 50 psi**				
Job Short Title: **Copper Flat Tailngs Design Study**					
Sample: **Overflow Flume Test Beach**	**Technician:** **RJM**	**Reviewed:** **DAR**	**Date:** **3/12/2013**	**Job Number:** **103-92557.010**	**Figure:** **6**

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix B.4 Flume Sample Test Results\B.4.1

Golder Associates Inc. **Denver, Colorado**	**Title:** ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - 90 psi				
Job Short Title: Copper Flat Tailngs Design Study					
Sample: Overflow Flume Test Beach	**Technician:** RJM	**Reviewed:** DAR	**Date:** 3/12/2013	**Job Number:** 103-92557.010	**Figure:** 7



Golder Associates, Inc. Denver, Colorado			Title: SEDIMENTATION TESTING GRAPHICAL DATA		
Job Short Title: Copper Flat Tailings Design Study					
Sample No. Tailings Overflow Beach	System Single Drain	Reviewed: MB	Date: 08-Nov-12	Job Number: 103-92557	Figure: 2

	Initial	Final	
Length =	7.826	1.25	cm
Diameter =	7.11	7.11	cm
Wet Mass =	358.37	98.17	g
Area =	39.70	39.70	cm^2
Volume =	310.7	49.5	cm^3
Moisture Content =	378.6%	32.5%	
Specific Gravity =	2.64	2.64	
Dry Mass of Solids =	74.88	74.09	g
Unit Weight =	1.15	1.98	g/cm^3
Dry Unit Weight =	0.24	1.50	g/cm^3
Unit Weight =	72.00	123.62	lb/ft^3
Dry Unit Weight =	15.04	93.30	lb/ft^3
Percent Solids =	20.9%	75.5%	

Piston Pressure:	8 psi	562.5 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2
Consolidation pressure:	**3 psi**	210.9 g/cm^2
Before Consolidation		
Initial Sample Height:	7.83	cm
Initial Dry Unit Weight:	0.24	g/cm^3
Initial Void Ratio:	9.96	
After Consolidation		
Final Sample Height:	1.56	cm
Final Dry Unit Weight:	1.20	g/cm^3
Final Void Ratio:	1.20	
Calculations		
Coefficient of Compressibility, a_v	4.15E-02	cm^2/g
Coefficient of Volume Compressibility, m_v	3.79E-03	cm^2/g
Compression Index, C_c	-	

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
6.1	4.70E-06	1.24E-03
13.3	3.51E-06	9.28E-04
17.5	3.27E-06	8.65E-04
22.3	3.10E-06	8.19E-04
27.8	2.98E-06	7.88E-04
34.3	2.89E-06	7.63E-04
42.2	2.81E-06	7.43E-04
52.5	2.72E-06	7.19E-04
66.3	2.66E-06	7.03E-04
88.2	2.58E-06	6.82E-04
Average (of final 3 values)	2.66E-06	7.01E-04

Piston Pressure:	15 psi	1,054.6 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2
Consolidation Pressure:	**10 psi**	703.1 g/cm^2
Before Consolidation		
Initial Sample Height:	1.56	cm
Initial Dry Unit Weight:	1.20	g/cm^3
Initial Void Ratio:	1.20	
After Consolidation		
Final Sample Height:	1.45	cm
Final Dry Unit Weight:	1.28	g/cm^3
Final Void Ratio:	1.06	
Calculations		
Coefficient of Compressibility, a_v	2.99E-04	cm^2/g
Coefficient of Volume Compressibility, m_v	1.36E-04	cm^2/g
Compression Index, C_c	0.28	

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
9.4	2.82E-06	2.1E-02
19.1	2.28E-06	1.7E-02
24.8	2.16E-06	1.6E-02
31.41	2.06E-06	1.5E-02
38.77	2.00E-06	1.5E-02
47.58	1.94E-06	1.4E-02
58.69	1.89E-06	1.4E-02
72.92	1.83E-06	1.4E-02
93.21	1.76E-06	1.3E-02
126.08	1.69E-06	1.2E-02
145.49	1.67E-06	1.2E-02
Average (of final 3 values)	1.71E-06	1.26E-02

Piston Pressure:	30 psi	2,109.2 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2
Consolidation Pressure:	**25 psi**	1,757.7 g/cm^2
Before Consolidation		
Initial Sample Height:	1.45	cm
Initial Dry Unit Weight:	1.28	g/cm^3
Initial Void Ratio:	1.06	
After Consolidation		
Final Sample Height:	1.36	cm
Final Dry Unit Weight:	1.37	g/cm^3
Final Void Ratio:	0.93	
Calculations		
Coefficient of Compressibility, a_v	1.21E-04	cm^2/g
Coefficient of Volume Compressibility, m_v	5.87E-05	cm^2/g
Compression Index, C_c	0.32	

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
13.4	1.86E-06	3.2E-02
26.1	1.56E-06	2.7E-02
33.7	1.49E-06	2.5E-02
42.27	1.44E-06	2.4E-02
51.99	1.40E-06	2.4E-02
63.55	1.37E-06	2.3E-02
77.12	1.35E-06	2.3E-02
94.4	1.33E-06	2.3E-02
117.21	1.32E-06	2.2E-02
152.46	1.31E-06	2.2E-02
175.79	1.30E-06	2.2E-02
Average (of final 3 values)	1.31E-06	2.23E-02

Piston Pressure:	55 psi	3,866.9 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2
Consolidation Pressure:	**50 psi**	3,515.4 g/cm^2
Before Consolidation		
Initial Sample Height:	1.36	cm
Initial Dry Unit Weight:	1.37	g/cm^3
Initial Void Ratio:	0.93	
After Consolidation		
Final Sample Height:	1.30	cm
Final Dry Unit Weight:	1.43	g/cm^3
Final Void Ratio:	0.84	
Calculations		
Coefficient of Compressibility, a_v	4.83E-05	cm^2/g
Coefficient of Volume Compressibility, m_v	2.50E-05	cm^2/g
Compression Index, C_c	0.28	

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
18.5	1.29E-06	5.1E-02
35.8	1.09E-06	4.4E-02
46.0	1.04E-06	4.2E-02
57.41	1.01E-06	4.0E-02
70.07	9.92E-07	4.0E-02
85.49	9.71E-07	3.9E-02
103.67	9.57E-07	3.8E-02
126.62	9.46E-07	3.8E-02
157	9.40E-07	3.8E-02
183.27	9.31E-07	3.7E-02
203.01	9.40E-07	3.8E-02
Average (of final 3 values)	9.37E-07	3.74E-02

Piston Pressure:	105 psi	7,382.3 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2
Consolidation Pressure:	**100 psi**	7,030.8 g/cm^2
Before Consolidation		
Initial Sample Height:	1.30	cm
Initial Dry Unit Weight:	1.43	g/cm3
Initial Void Ratio:	0.84	
After Consolidation		
Final Sample Height:	1.25	cm
Final Dry Unit Weight:	1.50	g/cm^3
Final Void Ratio:	0.76	
Calculations		
Coefficient of Compressibility, a_v	2.33E-05	cm^2/g
Coefficient of Volume Compressibility, m_v	1.27E-05	cm^2/g
Compression Index, C_c	0.27	

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
25.8	8.81E-07	7.0E-02
49.9	7.48E-07	5.9E-02
64.4	7.11E-07	5.6E-02
80.74	6.86E-07	5.4E-02
99.34	6.69E-07	5.3E-02
121.11	6.55E-07	5.2E-02
147.26	6.44E-07	5.1E-02
179.88	6.36E-07	5.0E-02
205.76	6.28E-07	5.0E-02
224.62	6.28E-07	5.0E-02
248.31	6.24E-07	4.9E-02
Average (of final 3 values)	6.26E-07	4.95E-02

Golder Associates Inc.
Denver, Colorado

Job Short Title: Copper Flat Tailings Design Study

Title: SLURRY CONSOLIDATION TEST SAMPLE DATA AND CALCULATIONS

Sample No.	Reviewed:	Date:	Job Number:	Figure:
Tailings Overflow Flume Test Beach	CCS	12/3/2012	103-92557	1

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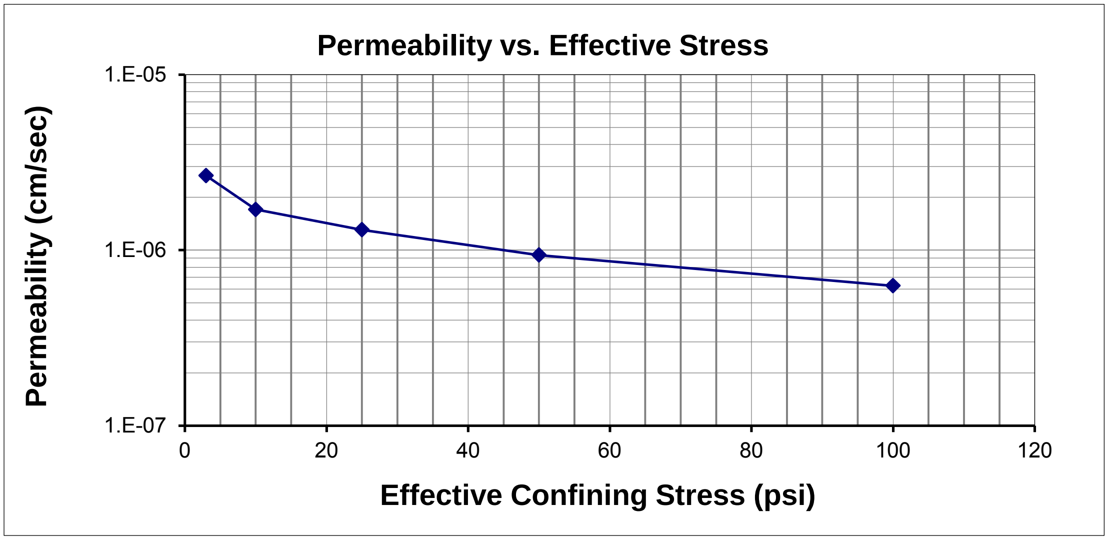
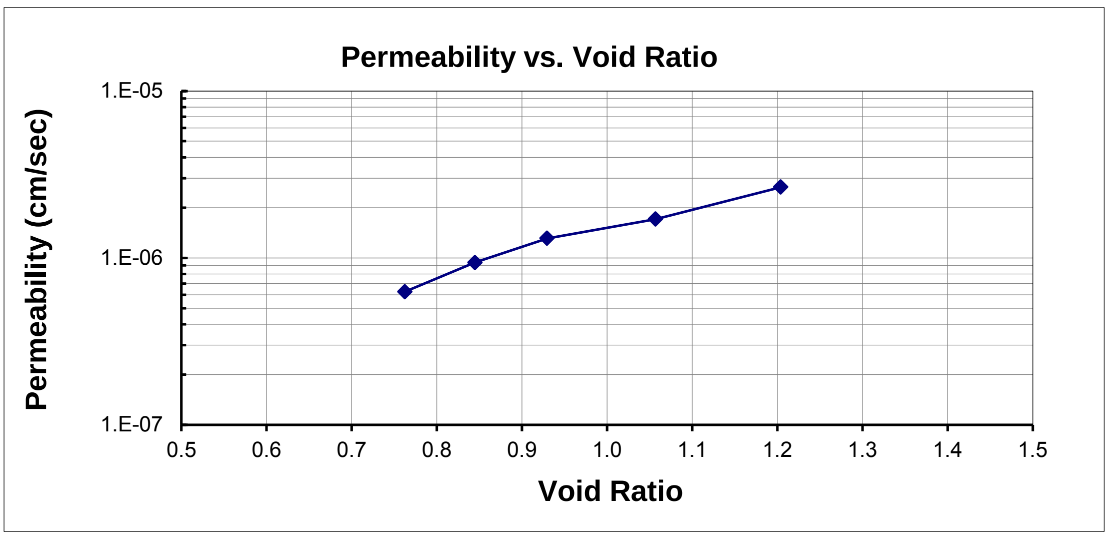
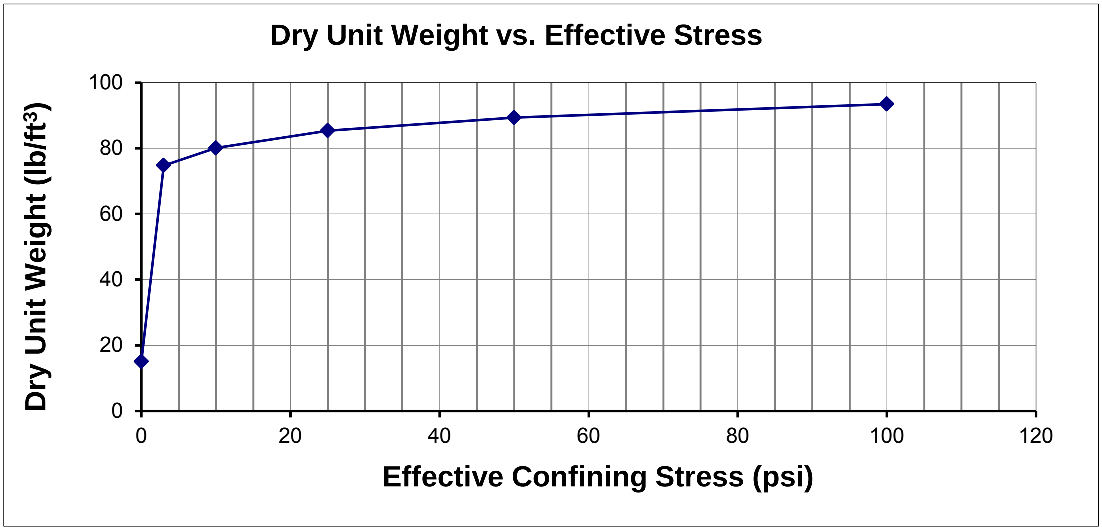
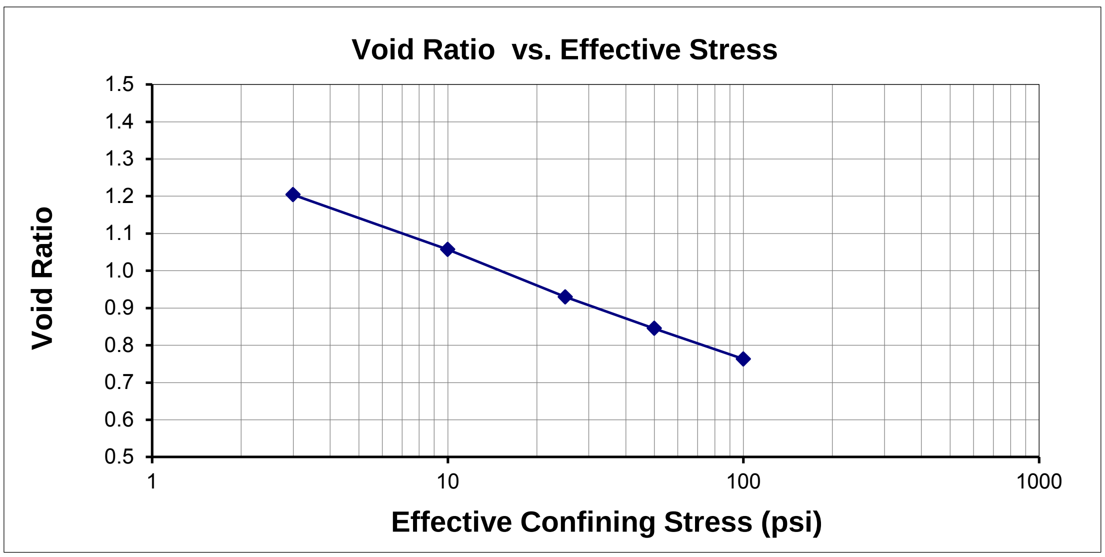




Golder Associates Inc. **Denver, Colorado**		**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **PERMEABILITY DATA**		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Tailings Overflow Flume Test Beach	**Reviewed:** CCS	**Date:** 12/3/2012	**Job Number:** 103-92557	**Figure:** 2





Golder Associates Inc. **Denver, Colorado**	**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **DENSITY DATA**
Job Short Title: Copper Flat Tailings Design Study	

Sample No.	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
Tailings Overflow Flume Test Beach	CCS	12/3/2012	103-92557	3

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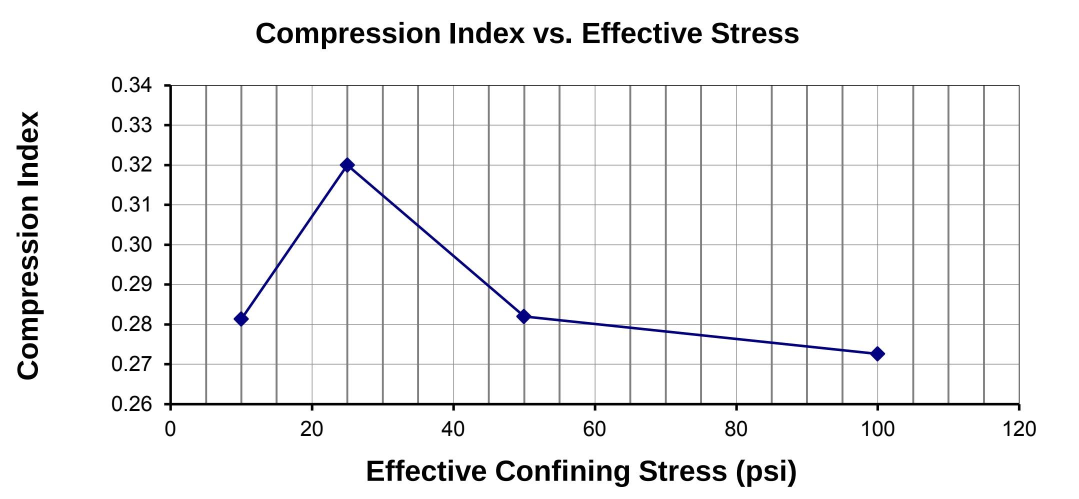

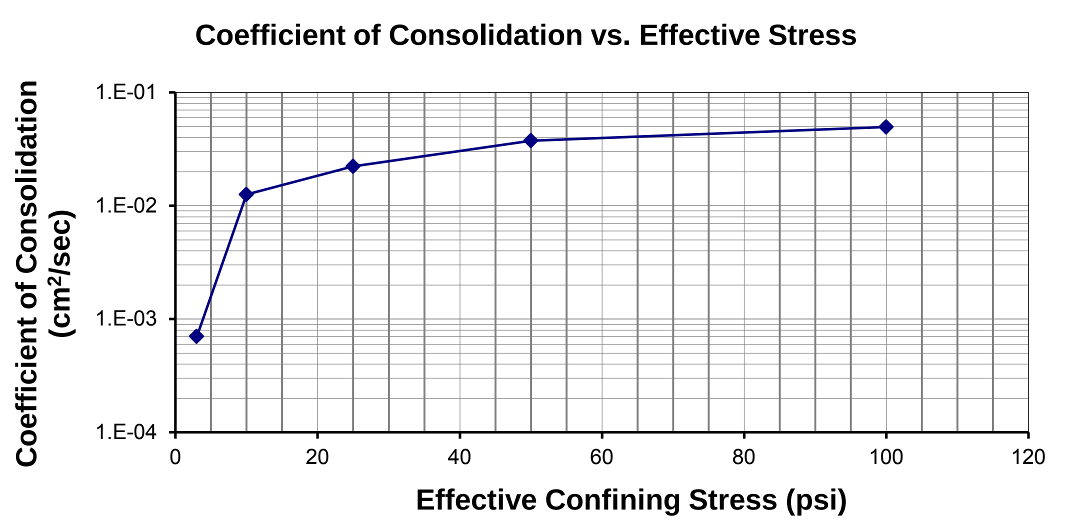

Golder Associates Inc. Denver, Colorado		**Title:** SLURRY CONSOLIDATION TEST RESULTS COMPRESSION DATA		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Tailings Overflow Flume Test Beach	**Reviewed:** CCS	**Date:** 12/3/2012	**Job Number:** 103-92557	**Figure:** 4

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	Initial	Final	
Length =	8.172	0.64	cm
Diameter =	7.104	7.104	cm
Wet Mass =	351.12	53.21	g
Area =	39.64	39.64	cm^2
Volume =	323.9	25.5	cm^3
Moisture Content =	786.2%	37.1%	
Specific Gravity =	2.64	2.64	
Dry Mass of Solids =	39.62	38.81	g
Unit Weight =	1.08	2.08	g/cm^3
Dry Unit Weight =	0.12	1.52	g/cm^3
Unit Weight =	67.67	130.13	lb/ft^3
Dry Unit Weight =	7.64	94.92	lb/ft^3
Percent Solids =	11.3%	72.9%	

	8 psi stage		15 psi stage		30 psi stage		55 psi stage		105 psi stage	
Piston Pressure:	8 psi	562.5 g/cm^2	15 psi	1,054.6 g/cm^2	30 psi	2,109.2 g/cm^2	55 psi	3,866.9 g/cm^2	105 psi	7,382.3 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2	5 psi	351.5 g/cm^2	5 psi	351.5 g/cm^2	5 psi	351.5 g/cm^2	5 psi	351.5 g/cm^2
Consolidation Pressure:	**3 psi**	210.9 g/cm^2	**10 psi**	703.1 g/cm^2	**25 psi**	1,757.7 g/cm^2	**50 psi**	3,515.4 g/cm^2	**100 psi**	7,030.8 g/cm^2
Before Consolidation										
Initial Sample Height:	8.17	cm	1.01	cm	0.86	cm	0.77	cm	0.70	cm
Initial Dry Unit Weight:	0.12	g/cm^3	0.97	g/cm^3	1.14	g/cm^3	1.28	g/cm^3	1.41	g/cm3
Initial Void Ratio:	20.58		1.72		1.32		1.07		0.88	
After Consolidation										
Final Sample Height:	1.01	cm	0.86	cm	0.77	cm	0.70	cm	0.64	cm
Final Dry Unit Weight:	0.97	g/cm^3	1.14	g/cm^3	1.28	g/cm^3	1.41	g/cm^3	1.52	g/cm^3
Final Void Ratio:	1.72		1.32		1.07		0.88		0.74	
Calculations										
Coefficient of Compressibility, a_v	8.94E-02	cm^2/g	8.05E-04	cm^2/g	2.43E-04	cm^2/g	1.07E-04	cm^2/g	3.99E-05	cm^2/g
Coefficient of Volume Compressibility, m_v	4.14E-03	cm^2/g	2.96E-04	cm^2/g	1.05E-04	cm^2/g	5.20E-05	cm^2/g	2.13E-05	cm^2/g
Compression Index, C_c	-		0.76		0.64		0.63		0.47	

Consolidation Pressure 3 psi

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
22.46	8.20E-07	1.98E-04
41.52	7.28E-07	1.76E-04
52.62	7.06E-07	1.70E-04
65.16	6.89E-07	1.66E-04
79.43	6.78E-07	1.64E-04
96.23	6.68E-07	1.61E-04
115.84	6.63E-07	1.60E-04
140.26	6.61E-07	1.60E-04
172.37	6.63E-07	1.60E-04
Average (of final 3 values)	6.62E-07	1.60E-04

Consolidation Pressure 10 psi

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
50.77	3.10E-07	1.0E-03
86.68	2.98E-07	1.0E-03
107.84	2.94E-07	9.9E-04
131.71	2.91E-07	9.8E-04
158.8	2.90E-07	9.8E-04
190.02	2.89E-07	9.7E-04
226.55	2.90E-07	9.8E-04
Average (of final 3 values)	2.89E-07	9.77E-04

Consolidation Pressure 25 psi

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
98.24	1.42E-07	1.4E-03
166.02	1.38E-07	1.3E-03
205.40	1.37E-07	1.3E-03
250.52	1.36E-07	1.3E-03
299.74	1.36E-07	1.3E-03
359.30	1.36E-07	1.3E-03
430.18	1.36E-07	1.3E-03
521.68	1.35E-07	1.3E-03
590.52	1.35E-07	1.3E-03
638.40	1.36E-07	1.3E-03
707.55	1.35E-07	1.3E-03
Average (of final 3 values)	1.35E-07	1.29E-03

Consolidation Pressure 50 psi

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
144.92	8.78E-08	1.7E-03
243.05	8.59E-08	1.7E-03
301.11	8.52E-08	1.6E-03
364.17	8.52E-08	1.6E-03
436.95	8.51E-08	1.6E-03
524.36	8.46E-08	1.6E-03
625.14	8.49E-08	1.6E-03
751.92	8.51E-08	1.6E-03
849.86	8.51E-08	1.6E-03
Average (of final 3 values)	8.50E-08	1.64E-03

Consolidation Pressure 100 psi

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
228.9	5.14E-08	2.4E-03
384.0	5.03E-08	2.4E-03
474.8	5.00E-08	2.4E-03
576.64	4.98E-08	2.3E-03
690.24	4.98E-08	2.3E-03
824.08	4.98E-08	2.3E-03
Average (of final 3 values)	4.98E-08	2.34E-03

Golder Associates Inc.
Denver, Colorado

Title: SLURRY CONSOLIDATION TEST
SAMPLE DATA AND CALCULATIONS

Job Short Title: Copper Flat Tailings Design Study

Sample No.	Reviewed:	Date:	Job Number:	Figure:
Tailings Overflow Flume Test Slime	CCS	12/17/2012	103-92557	1

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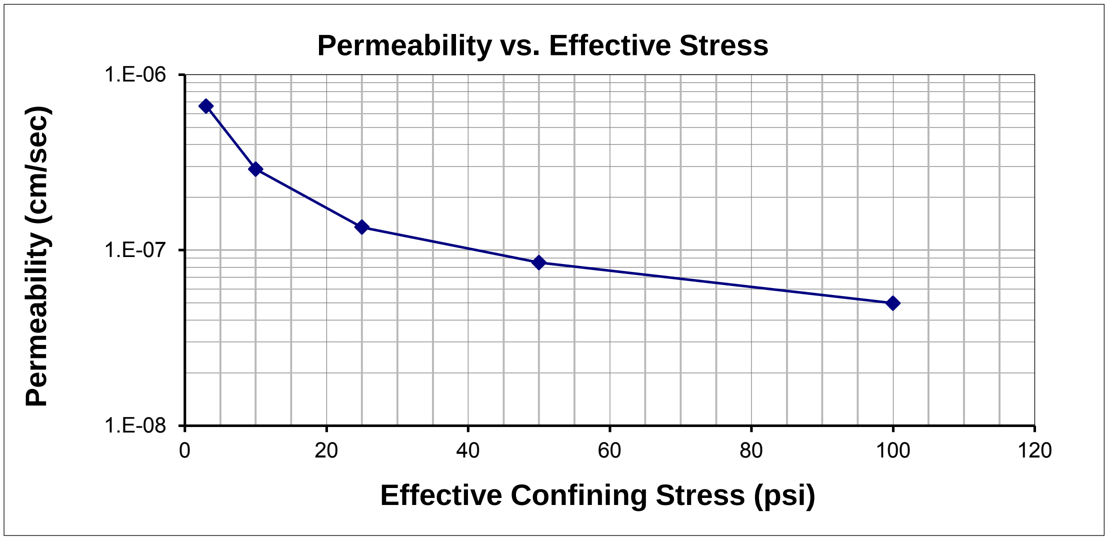

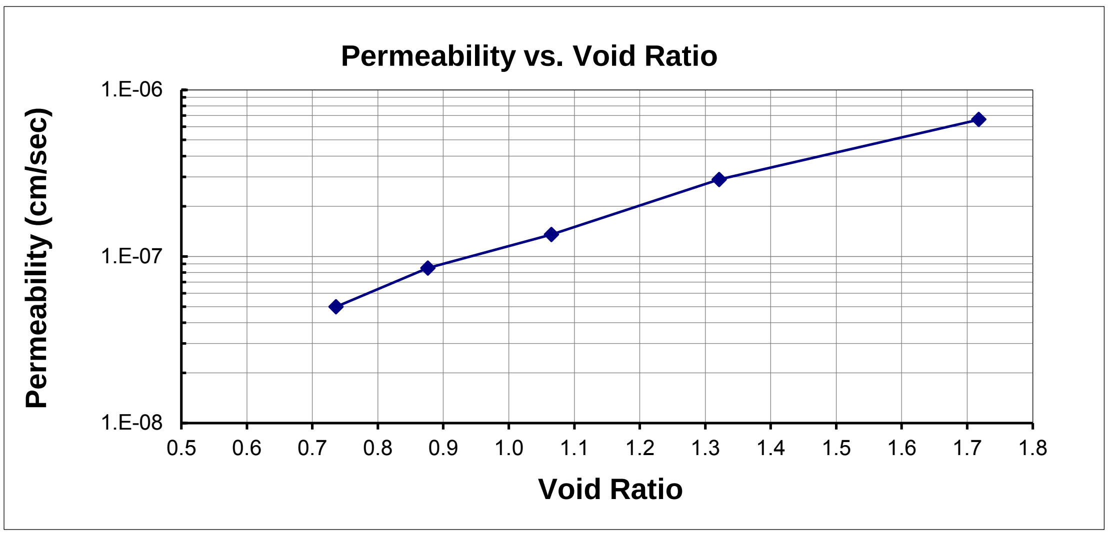

Golder Associates Inc. **Denver, Colorado**		**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **PERMEABILITY DATA**		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Tailings Overflow Flume Test Slime	**Reviewed:** CCS	**Date:** 12/17/2012	**Job Number:** 103-92557	**Figure:** 2

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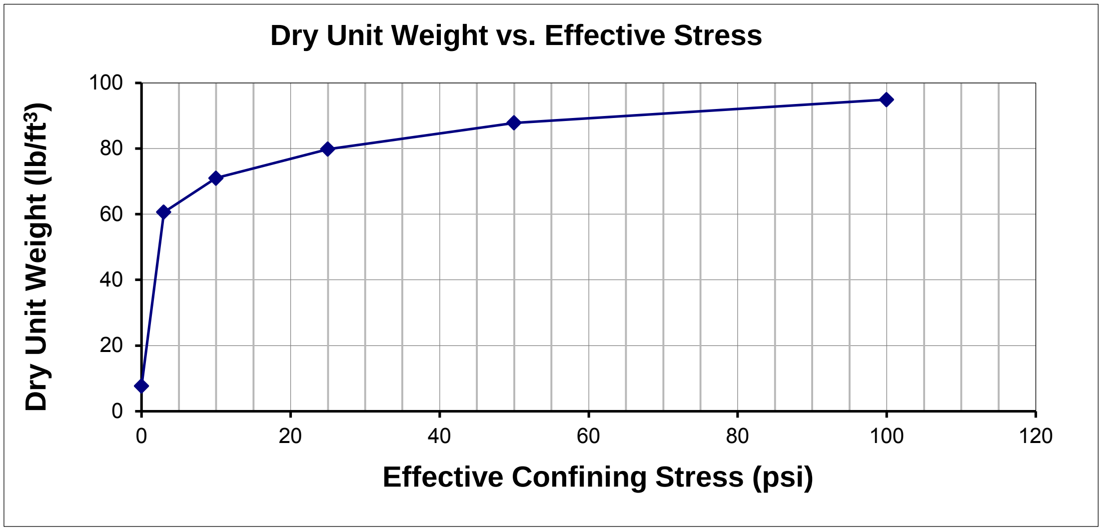
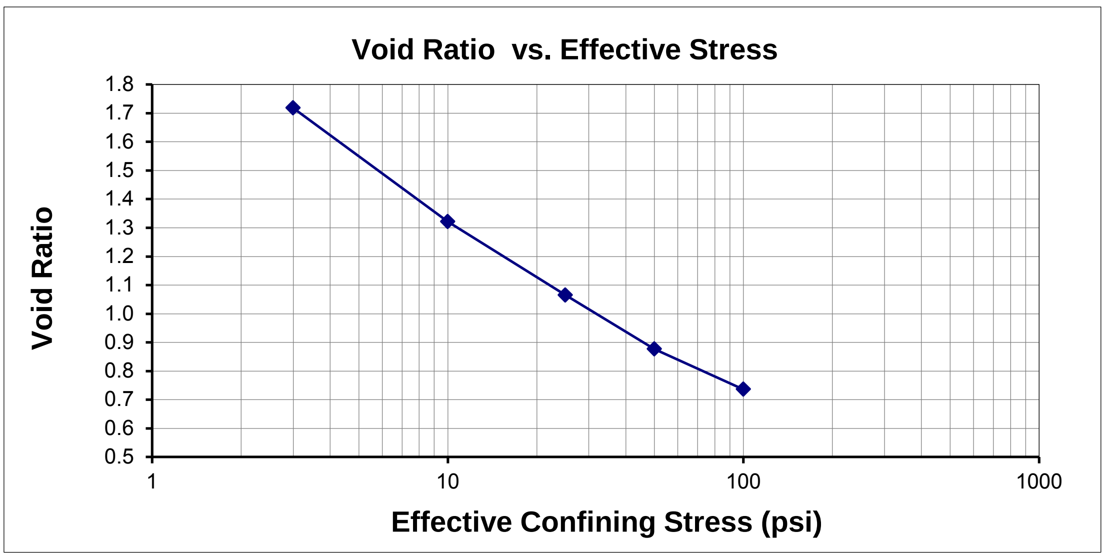
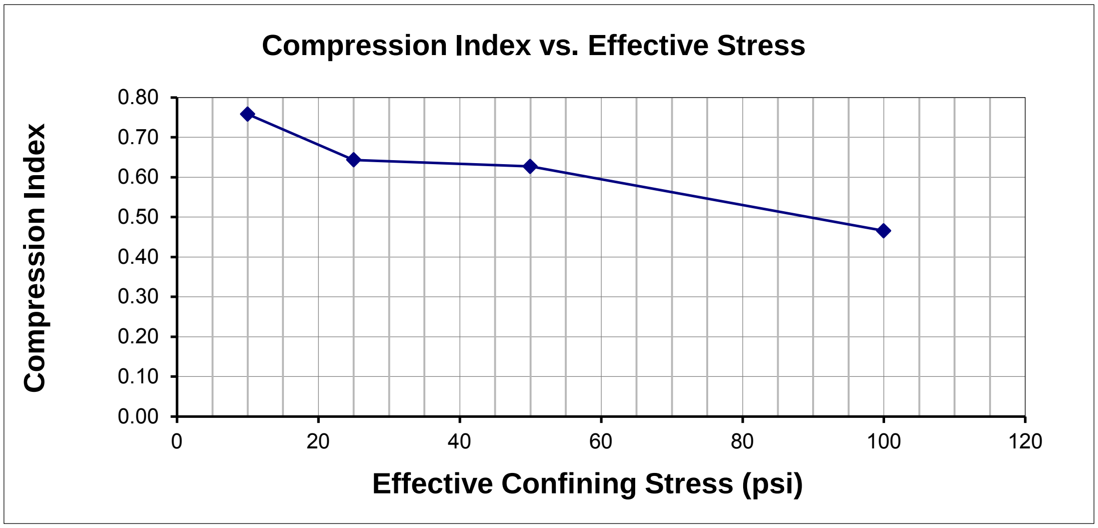
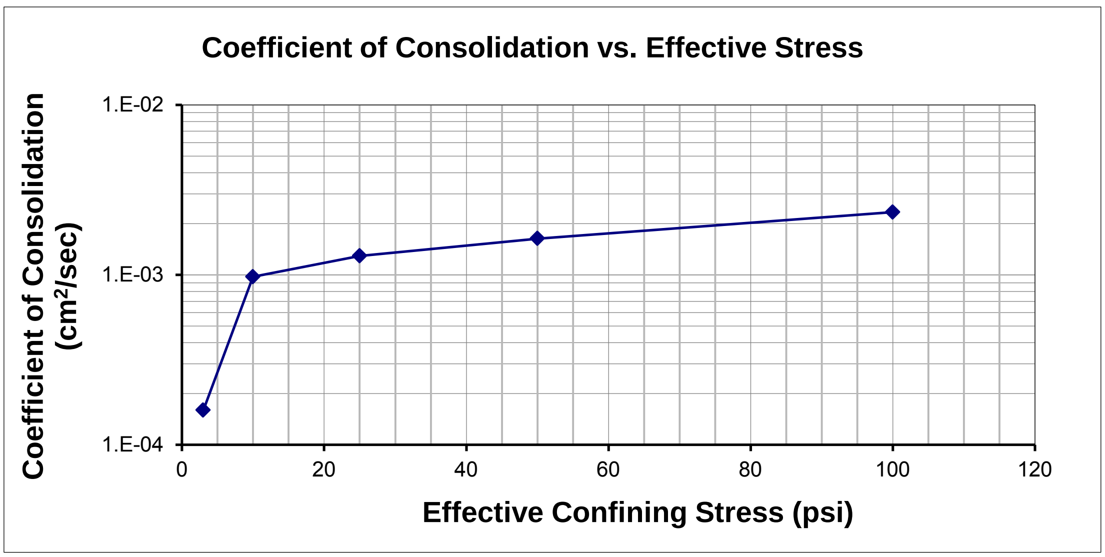




Golder Associates Inc. **Denver, Colorado**		**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **DENSITY DATA**		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Tailings Overflow Flume Test Slime	**Reviewed:** CCS	**Date:** 12/17/2012	**Job Number:** 103-92557	**Figure:** 3





Golder Associates Inc. Denver, Colorado		**Title:** SLURRY CONSOLIDATION TEST RESULTS COMPRESSION DATA		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Tailings Overflow Flume Test Slime	**Reviewed:** CCS	**Date:** 12/17/2012	**Job Number:** 103-92557	**Figure:** 4

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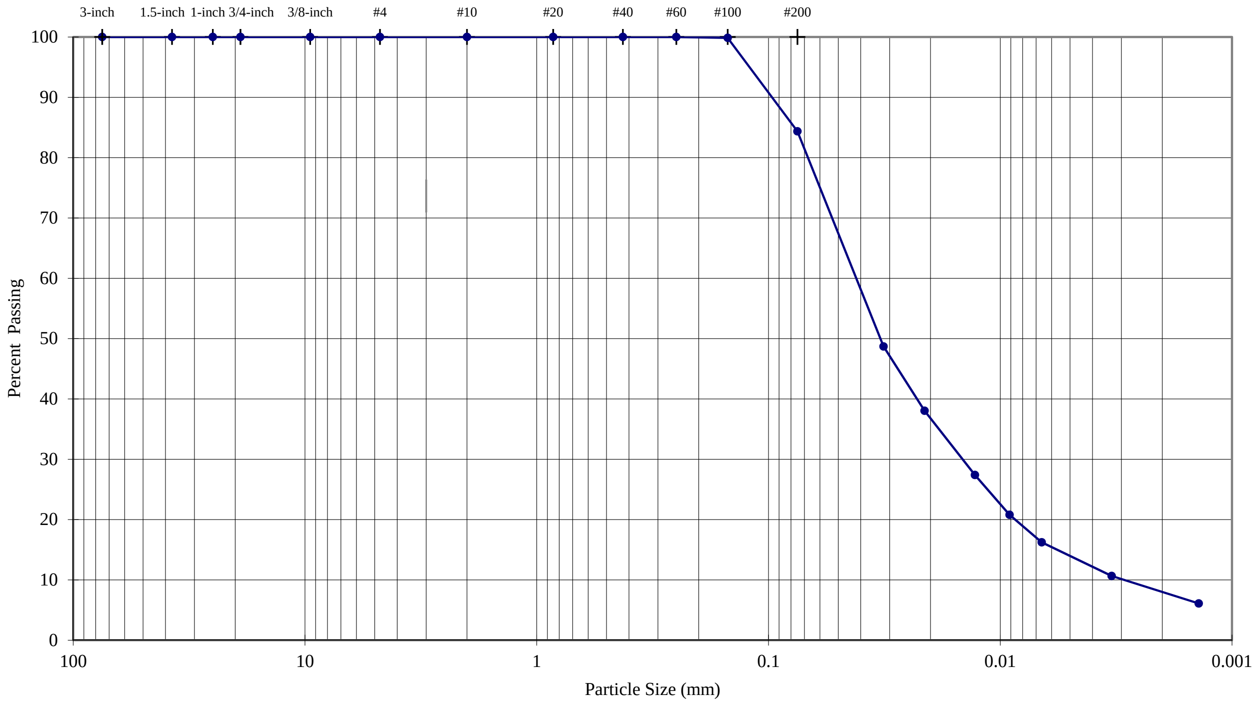
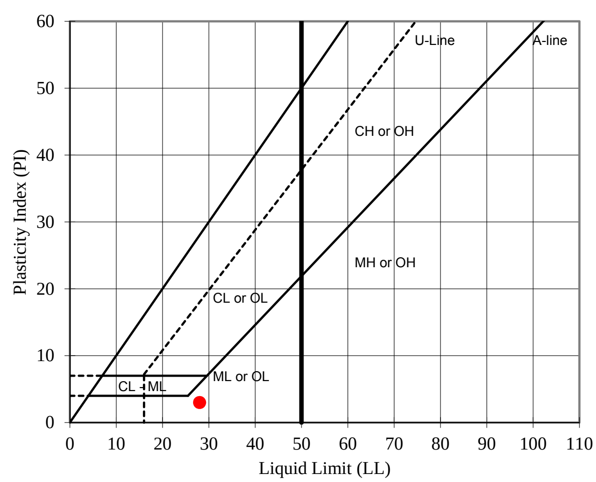
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Tailings Overflow** DEPTH (ft): **Beach**
TYPE: **Flume Test**



	Sieve	Particle Size (mm)	% Passing	Description	Percentage
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	**100.0**		
	1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
	1-inch	25.0	**100.0**		
	3/4-inch	19.0	**100.0**		
	3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
	#4	4.75	**100.0**		
	#10	2.0	**100.0**	Coarse Sand	**0.00**
	#20	0.85	**100.0**	Medium Sand	**0.00**
	#40	0.425	**100.0**		
	#60	0.25	**100.0**	Fine Sand	**15.64**
	#100	0.15	**99.9**		
	#200	0.075	**84.4**		
Hydrometer Analysis		0.032	**48.7**	Silt or Clay Fines	**84.36**
		0.021	**38.0**		
		0.013	**27.4**		
		0.009	**20.8**		
		0.007	**16.2**		
		0.003	**10.7**		
		0.001	**6.1**		



USCS Description (ASTM D 2487):

Dry, pale yellow silt

LL	PL	PI	SpG (assumed)
28	**25**	**3**	**2.64**

As-Received Moisture Content (%): **#DIV/0!**

USCS Group Symbol: ML

Notes: 0g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute
Sample prepared for Atterberg Limits testing by the dry method
Material retained on No. 40 sieve removed from Atterberg Limits sample by sieving
Plastic Limit test performed by hand rolling. Method A Liquid Limit test performed using mechanical device

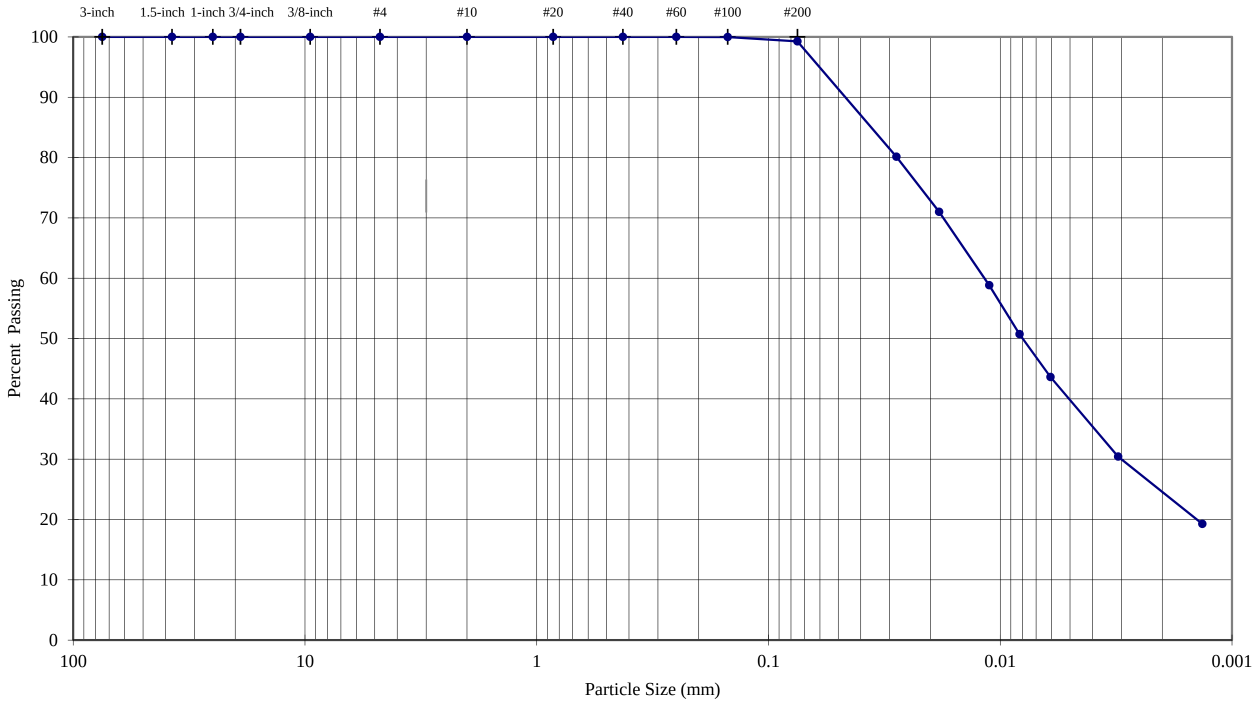
TECH	PRH/SRS
DATE	12/16/2012
REVIEW	MB

Golder Associates

November-12 | 103-92557

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

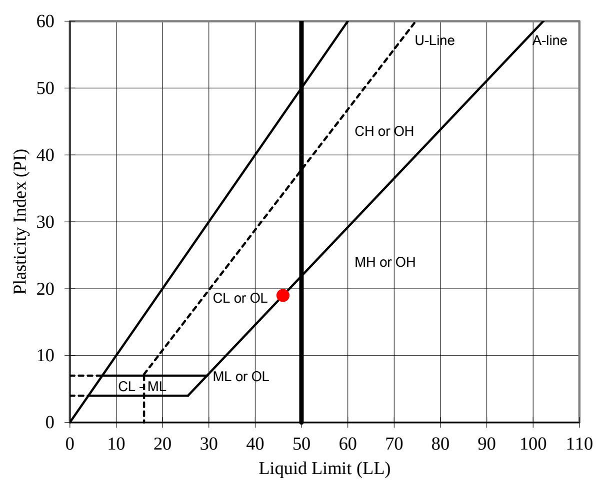
PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Tailings Overflow** DEPTH (ft): **Slime**
TYPE: **Flume Test**



Sieve	Particle Size (mm)	% Passing
3-inch	75.0	**100.0**
1.5-inch	37.5	**100.0**
1-inch	25.0	**100.0**
3/4-inch	19.0	**100.0**
3/8-inch	9.5	**100.0**
#4	4.75	**100.0**
#10	2.0	**100.0**
#20	0.85	**100.0**
#40	0.425	**100.0**
#60	0.25	**100.0**
#100	0.15	**100.0**
#200	0.075	**99.3**
	0.028	**80.1**
	0.018	**71.0**
	0.011	**58.8**
	0.008	**50.7**
	0.006	**43.6**
	0.003	**30.4**
	0.001	**19.3**

Sieve Analysis (Initial Separation on No. 4 Sieve) — 3-inch through #200; Hydrometer Analysis — 0.028 through 0.001

Description	Percentage
Coarse Gravel	**0.00**
Fine Gravel	**0.00**
Coarse Sand	**0.00**
Medium Sand	**0.00**
Fine Sand	**0.74**
Silt or Clay Fines	**99.26**



Visual Description (Golder Procedure):

Dry, pale yellow silty clay

LL	PL	PI	SpG (assumed)
46	**27**	**19**	**2.64**

As-Received Moisture Content (%): --

USCS Group Symbol: CL-ML

Notes: 0g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute

TECH	PRH/SRS
DATE	12/16/2012
REVIEW	MB

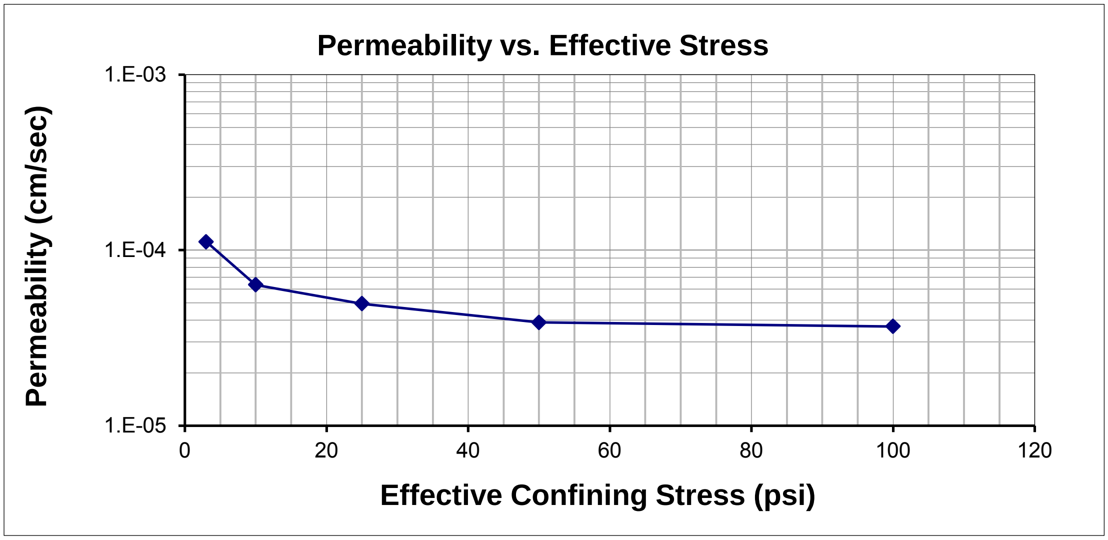
APPENDIX B.4.2
WHOLE TAILINGS TEST REPORTS

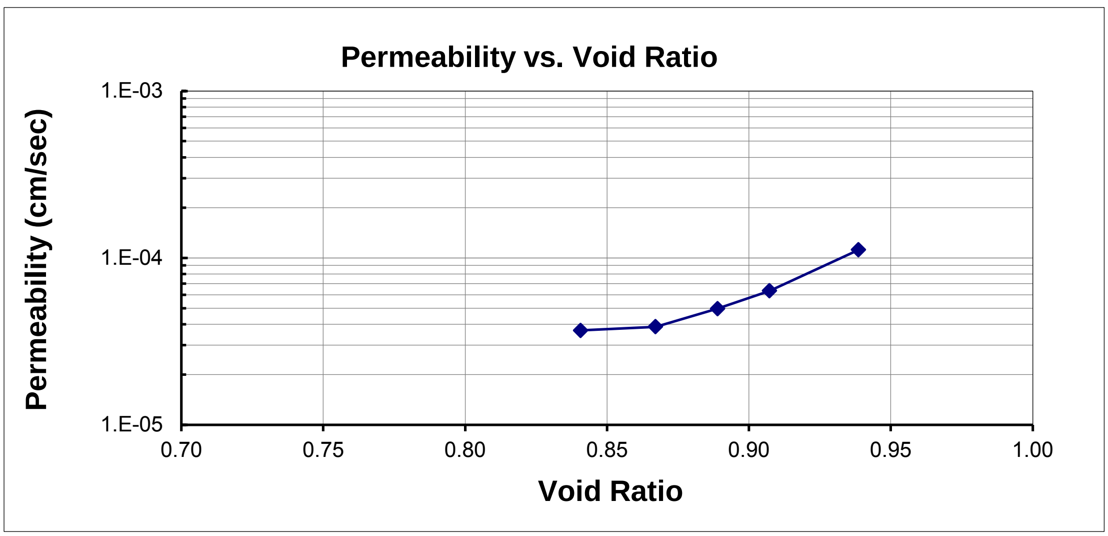
	Initial	Final	
Length =	7.852	5.64	cm
Diameter =	7.104	7.104	cm
Wet Mass =	515.99	424.51	g
Area =	39.64	39.64	cm^2
Volume =	311.2	223.6	cm^3
Moisture Content =	60.1%	32.4%	
Specific Gravity =	2.64	2.64	
Dry Mass of Solids =	322.29	320.63	g
Unit Weight =	1.66	1.90	g/cm^3
Dry Unit Weight =	1.04	1.43	g/cm^3
Unit Weight =	103.50	118.30	lb/ft^3
Dry Unit Weight =	64.65	89.35	lb/ft^3
Percent Solids =	62.5%	75.5%	

	3 psi			10 psi			25 psi			50 psi			100 psi	
Piston Pressure:	8 psi	562.5 g/cm^2	Piston Pressure:	15 psi	1,054.6 g/cm^2	Piston Pressure:	30 psi	2,109.2 g/cm^2	Piston Pressure:	55 psi	3,866.9 g/cm^2	Piston Pressure:	105 psi	7,382.3 g/cm^2
Sample Pressure:	5 psi	351.5 g/cm^2	Sample Pressure:	5 psi	351.5 g/cm^2	Sample Pressure:	5 psi	351.5 g/cm^2	Sample Pressure:	5 psi	351.5 g/cm^2	Sample Pressure:	5 psi	351.5 g/cm^2
Consolidation pressure:	**3 psi**	210.9 g/cm^2	Consolidation Pressure:	**10 psi**	703.1 g/cm^2	Consolidation Pressure:	**25 psi**	1,757.7 g/cm^2	Consolidation Pressure:	**50 psi**	3,515.4 g/cm^2	Consolidation Pressure:	**100 psi**	7,030.8 g/cm^2
Before Consolidation			**Before Consolidation**			**Before Consolidation**			**Before Consolidation**			**Before Consolidation**		
Initial Sample Height:	7.85	cm	Initial Sample Height:	5.94	cm	Initial Sample Height:	5.84	cm	Initial Sample Height:	5.79	cm	Initial Sample Height:	5.72	cm
Initial Dry Unit Weight:	1.04	g/cm^3	Initial Dry Unit Weight:	1.36	g/cm^3	Initial Dry Unit Weight:	1.38	g/cm^3	Initial Dry Unit Weight:	1.40	g/cm^3	Initial Dry Unit Weight:	1.41	g/cm^3
Initial Void Ratio:	1.55		Initial Void Ratio:	0.94		Initial Void Ratio:	0.91		Initial Void Ratio:	0.89		Initial Void Ratio:	0.87	
After Consolidation			**After Consolidation**			**After Consolidation**			**After Consolidation**			**After Consolidation**		
Final Sample Height:	5.94	cm	Final Sample Height:	5.84	cm	Final Sample Height:	5.79	cm	Final Sample Height:	5.72	cm	Final Sample Height:	5.64	cm
Final Dry Unit Weight:	1.36	g/cm^3	Final Dry Unit Weight:	1.38	g/cm^3	Final Dry Unit Weight:	1.40	g/cm^3	Final Dry Unit Weight:	1.41	g/cm^3	Final Dry Unit Weight:	1.43	g/cm^3
Final Void Ratio:	0.94		Final Void Ratio:	0.91		Final Void Ratio:	0.89		Final Void Ratio:	0.87		Final Void Ratio:	0.84	
Calculations			**Calculations**			**Calculations**			**Calculations**			**Calculations**		
Coefficient of Compressibility, a_v	2.90E-03	cm^2/g	Coefficient of Compressibility, a_v	6.37E-05	cm^2/g	Coefficient of Compressibility, a_v	1.73E-05	cm^2/g	Coefficient of Compressibility, a_v	1.24E-05	cm^2/g	Coefficient of Compressibility, a_v	7.52E-06	cm^2/g
Coefficient of Volume Compressibility, m_v	1.14E-03	cm^2/g	Coefficient of Volume Compressibility, m_v	3.28E-05	cm^2/g	Coefficient of Volume Compressibility, m_v	9.09E-06	cm^2/g	Coefficient of Volume Compressibility, m_v	6.59E-06	cm^2/g	Coefficient of Volume Compressibility, m_v	4.03E-06	cm^2/g
Compression Index, C_c	-		Compression Index, C_c	0.06		Compression Index, C_c	0.05		Compression Index, C_c	0.07		Compression Index, C_c	0.09	

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)	Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)	Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)	Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)	Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
3.85	1.12E-04	9.86E-02	6.70	6.33E-05	1.93	10.15	4.96E-05	5.46	10.77	3.86E-05	5.86	8.18	3.68E-05	9.14
4.60	1.12E-04	9.88E-02	8.03	6.33E-05	1.93	12.44	4.92E-05	5.41	12.80	3.89E-05	5.90	9.75	3.69E-05	9.16
5.68	1.11E-04	9.73E-02	9.69	6.38E-05	1.94	15.42	4.99E-05	5.50	15.65	3.86E-05	5.87	11.77	3.65E-05	9.07
Average (of final 3 values)	1.12E-04	9.83E-02	Average (of final 3 values)	6.35E-05	1.93E+00	Average (of final 3 values)	4.96E-05	5.46E+00	Average (of final 3 values)	3.87E-05	5.88E+00	Average (of final 3 values)	3.67E-05	9.12E+00

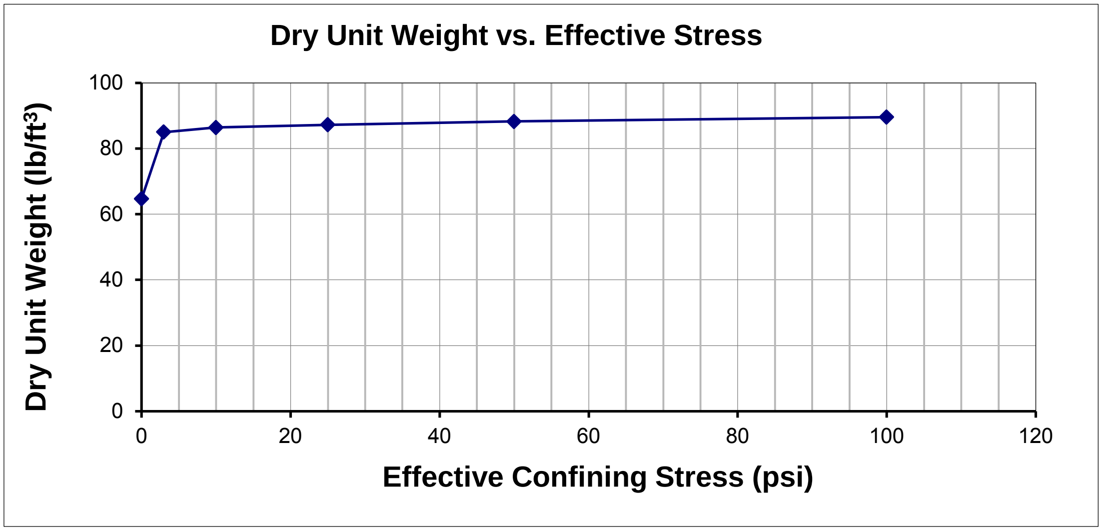
Golder Associates Inc. Denver, Colorado	Title: SLURRY CONSOLIDATION TEST SAMPLE DATA AND CALCULATIONS			
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Whole Tailings Flume Test Beach	**Reviewed:** CCS	**Date:** 11/12/2012	**Job Number:** 103-92557	**Figure:** 1

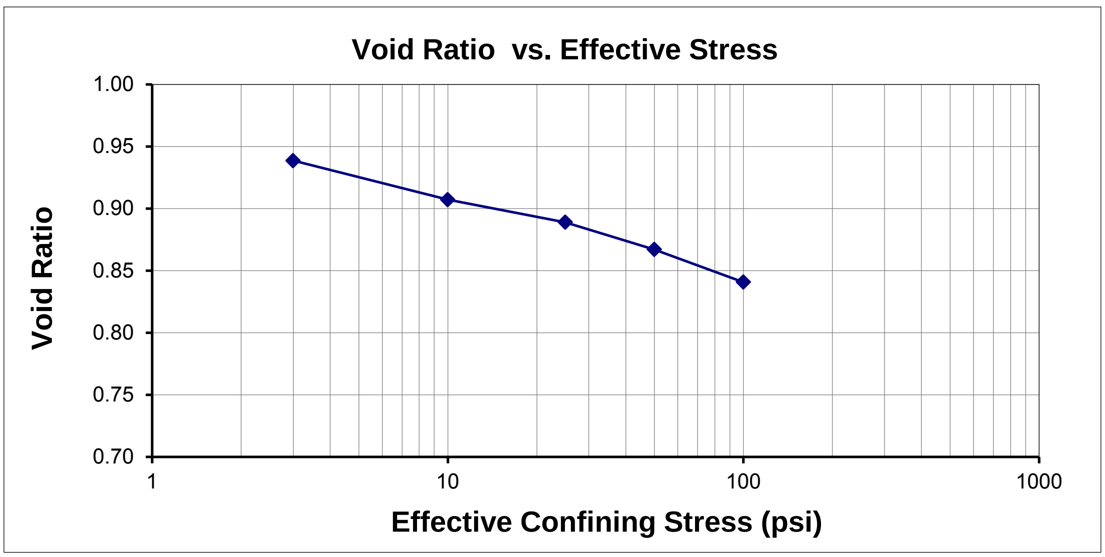




Golder Associates Inc. Denver, Colorado				Title: SLURRY CONSOLIDATION TEST RESULTS PERMEABILITY DATA
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Whole Tailings Flume Test Beach	Reviewed: CCS	Date: 11/12/2012	Job Number: 103-92557	Figure: 2

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix B.4 Flume Sample Test Results\B.4.2

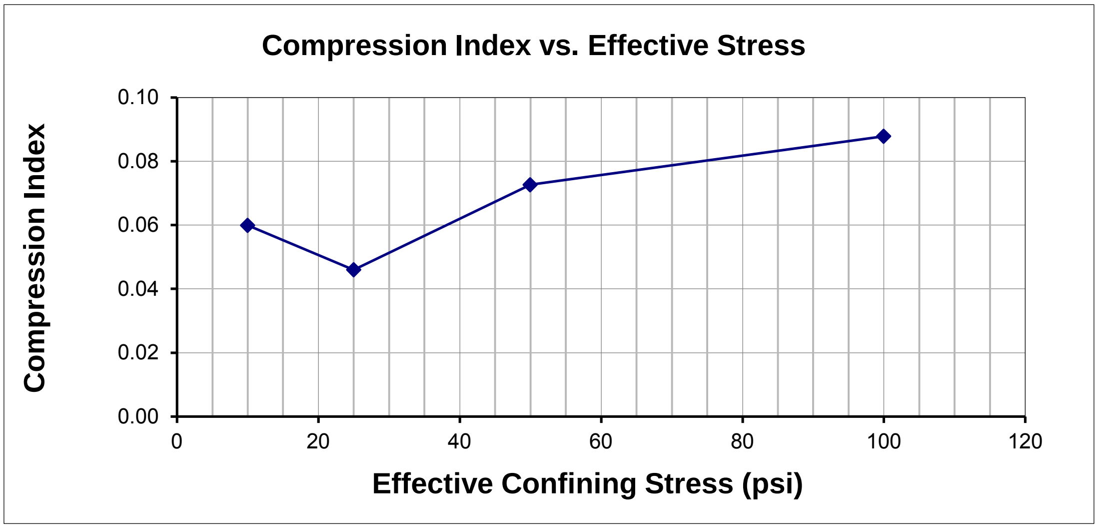


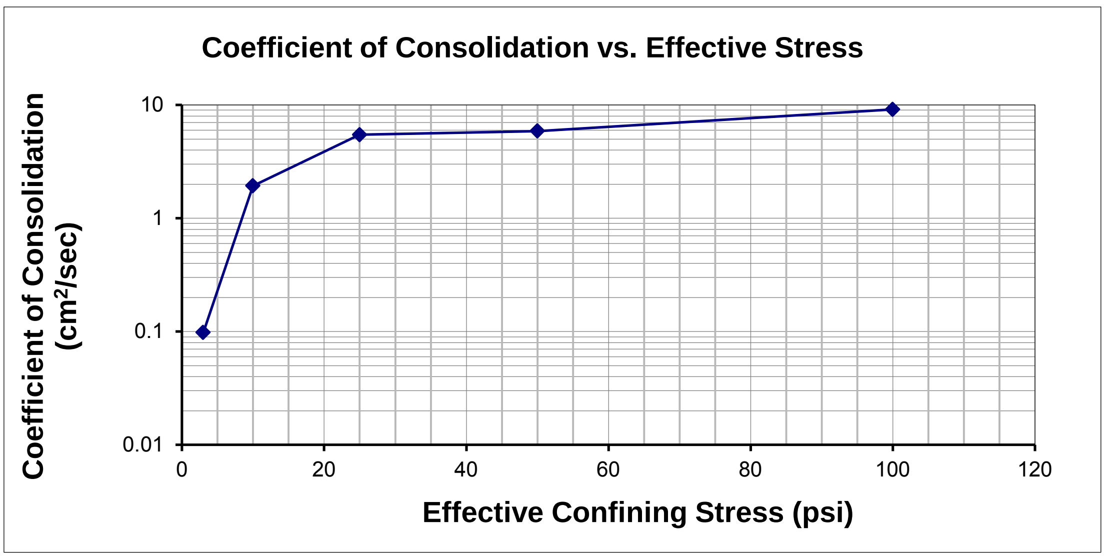


Golder Associates Inc. **Denver, Colorado**	**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **DENSITY DATA**
Job Short Title: Copper Flat Tailings Design Study	

Sample No.	**Reviewed:**	**Date:**	**Job Number:**	**Figure:**
Whole Tailings Flume Test Beach	CCS	11/12/2012	103-92557	3

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix B.4 Flume Sample Test Results\B.4.2





Golder Associates Inc. **Denver, Colorado**		**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **COMPRESSION DATA**		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Whole Tailings Flume Test Beach	**Reviewed:** CCS	**Date:** 11/12/2012	**Job Number:** 103-92557	**Figure:** 4

X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix B.4 Flume Sample Test Results\B.4.2

	Initial	Final	
Length =	7.285	0.740	cm
Diameter =	7.099	7.099	cm
Wet Mass =	338.65	60.46	g
Area =	39.58	39.58	cm^2
Volume =	288.3	29.29	cm^3
Moisture Content =	628.5%	35.5%	
Specific Gravity =	2.64	2.64	
Dry Mass of Solids =	46.49	44.62	g
Unit Weight =	1.174	2.064	g/cm^3
Dry Unit Weight =	0.1612	1.523	g/cm^3
Unit Weight =	73.32	128.6	lb/ft^3
Dry Unit Weight =	10.06	94.90	lb/ft^3
Percent Solids =	13.7%	73.8%	

Piston Pressure:	8 psi	562.5 g/cm^2	
Sample Pressure:	5 psi	351.5 g/cm^2	
Consolidation pressure:	**3 psi**	210.9 g/cm^2	
Before Consolidation			
Initial Sample Height:	7.29	cm	
Initial Dry Unit Weight:	0.16	g/cm^3	
Initial Void Ratio:	15.38		
After Consolidation			
Final Sample Height:	1.11	cm	
Final Dry Unit Weight:	1.02	g/cm^3	
Final Void Ratio:	1.60		
Calculations			
Coefficient of Compressibility, a_v	6.53E-02	cm^2/g	
Coefficient of Volume Compressibility, m_v	3.99E-03	cm^2/g	
Compression Index, C_c	-		

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
204	5.66E-07	1.42E-04
221	5.69E-07	1.43E-04
245	5.65E-07	1.42E-04
Average (of final 3 values)	5.66E-07	1.42E-04

Piston Pressure:	15 psi	1,054.6 g/cm^2	
Sample Pressure:	5 psi	351.5 g/cm^2	
Consolidation Pressure:	**10 psi**	703.1 g/cm^2	
Before Consolidation			
Initial Sample Height:	1.11	cm	
Initial Dry Unit Weight:	1.02	g/cm^3	
Initial Void Ratio:	1.60		
After Consolidation			
Final Sample Height:	0.94	cm	
Final Dry Unit Weight:	1.19	g/cm^3	
Final Void Ratio:	1.21		
Calculations			
Coefficient of Compressibility, a_v	7.85E-04	cm^2/g	
Coefficient of Volume Compressibility, m_v	3.02E-04	cm^2/g	
Compression Index, C_c	0.74		

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
367	2.67E-07	8.8E-04
397	2.69E-07	8.9E-04
440	2.67E-07	8.8E-04
Average (of final 3 values)	2.68E-07	8.86E-04

Piston Pressure:	30 psi	2,109.2 g/cm^2	
Sample Pressure:	5 psi	351.5 g/cm^2	
Consolidation Pressure:	**25 psi**	1,757.7 g/cm^2	
Before Consolidation			
Initial Sample Height:	0.94	cm	
Initial Dry Unit Weight:	1.19	g/cm^3	
Initial Void Ratio:	1.21		
After Consolidation			
Final Sample Height:	0.86	cm	
Final Dry Unit Weight:	1.32	g/cm^3	
Final Void Ratio:	1.00		
Calculations			
Coefficient of Compressibility, a_v	1.98E-04	cm^2/g	
Coefficient of Volume Compressibility, m_v	8.94E-05	cm^2/g	
Compression Index, C_c	0.52		

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
604	1.47E-07	1.6E-03
652	1.49E-07	1.7E-03
718	1.48E-07	1.7E-03
Average (of final 3 values)	1.48E-07	1.66E-03

Piston Pressure:	55 psi	3,866.9 g/cm^2	
Sample Pressure:	5 psi	351.5 g/cm^2	
Consolidation Pressure:	**50 psi**	3,515.4 g/cm^2	
Before Consolidation			
Initial Sample Height:	0.86	cm	
Initial Dry Unit Weight:	1.32	g/cm^3	
Initial Void Ratio:	1.00		
After Consolidation			
Final Sample Height:	0.79	cm	
Final Dry Unit Weight:	1.42	g/cm^3	
Final Void Ratio:	0.86		
Calculations			
Coefficient of Compressibility, a_v	8.26E-05	cm^2/g	
Coefficient of Volume Compressibility, m_v	4.13E-05	cm^2/g	
Compression Index, C_c	0.48		

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
533	9.48E-08	2.3E-03
639	9.46E-08	2.3E-03
770	9.47E-08	2.3E-03
Average (of final 3 values)	9.47E-08	2.30E-03

Piston Pressure:	105 psi	7,382.3 g/cm^2	
Sample Pressure:	5 psi	351.5 g/cm^2	
Consolidation Pressure:	**100 psi**	7,030.8 g/cm^2	
Before Consolidation			
Initial Sample Height:	0.79	cm	
Initial Dry Unit Weight:	1.42	g/cm^3	
Initial Void Ratio:	0.86		
After Consolidation			
Final Sample Height:	0.74	cm	
Final Dry Unit Weight:	1.52	g/cm^3	
Final Void Ratio:	0.73		
Calculations			
Coefficient of Compressibility, a_v	3.53E-05	cm^2/g	
Coefficient of Volume Compressibility, m_v	1.90E-05	cm^2/g	
Compression Index, C_c	0.41		

Δ Time (sec)	Permeability k (cm/sec)	Coefficient of Consolidation, c_v (cm^2/sec)
1024	5.51E-08	2.9E-03
1233	5.52E-08	2.9E-03
1396	5.51E-08	2.9E-03
Average (of final 3 values)	5.51E-08	2.90E-03

Golder Associates Inc.
Denver, Colorado

Title:

SLURRY CONSOLIDATION TEST
SAMPLE DATA AND CALCULATIONS

Job Short Title: Copper Flat Tailings Design Study

Sample No.	Reviewed:	Date:	Job Number:	Figure:
Whole Tailings Flume Test Slime	CCS	10/30/2012	103-92557	1

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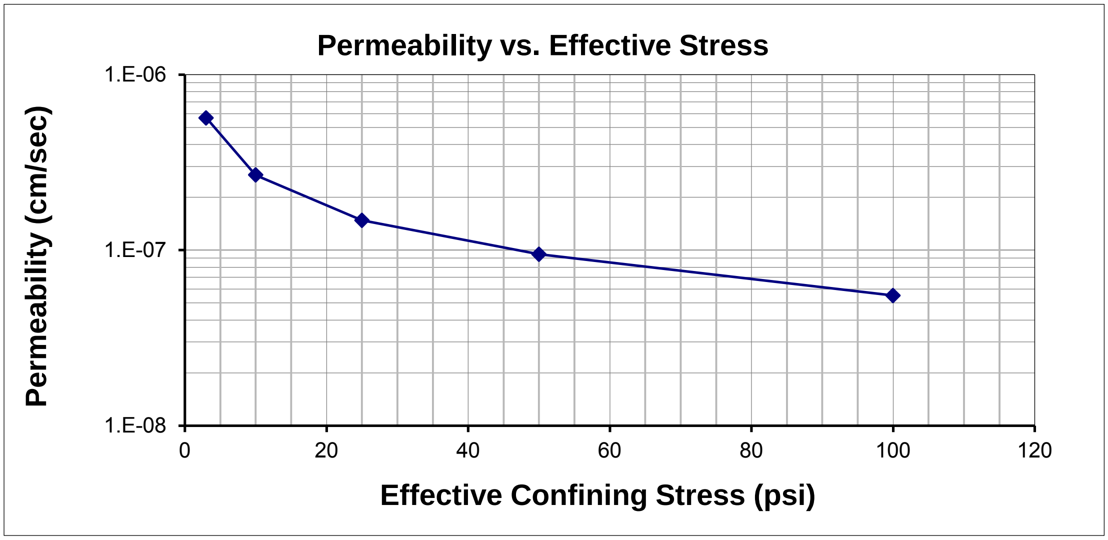

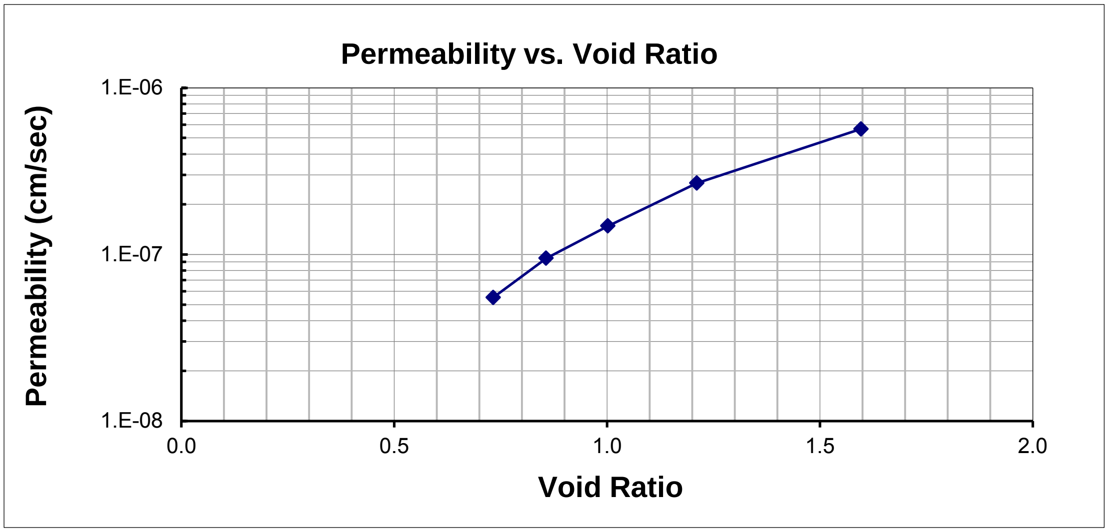

Golder Associates Inc. Denver, Colorado	**Title:** SLURRY CONSOLIDATION TEST RESULTS PERMEABILITY DATA			
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Whole Tailings Flume Test Slime	**Reviewed:** CCS	**Date:** 10/30/2012	**Job Number:** 103-92557	**Figure:** 2

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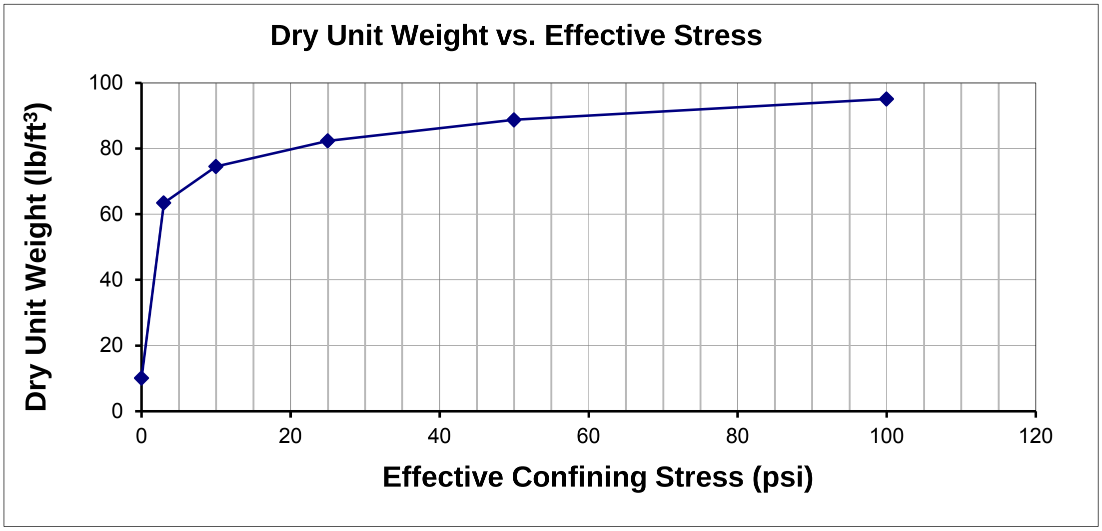
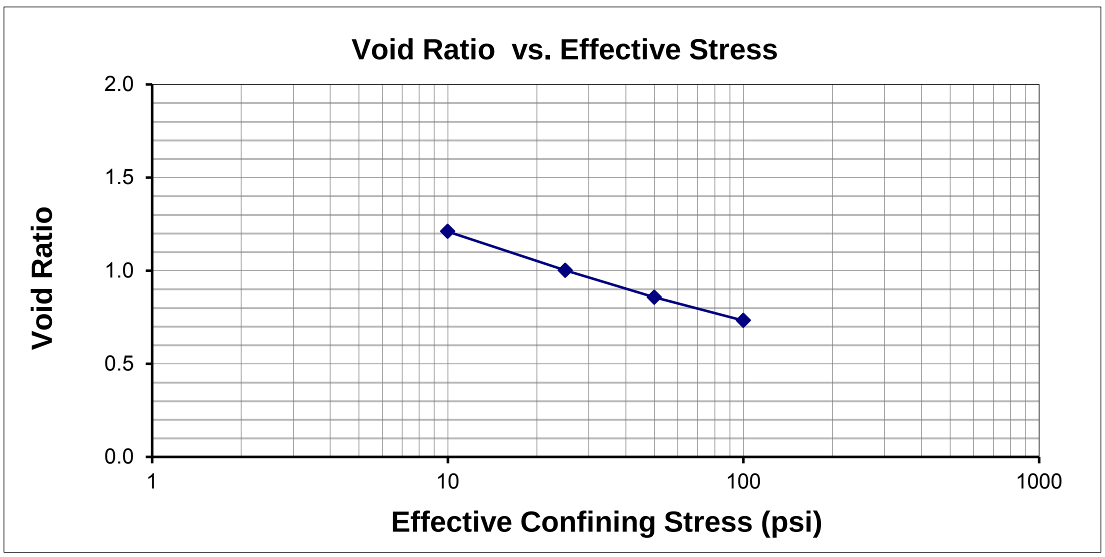
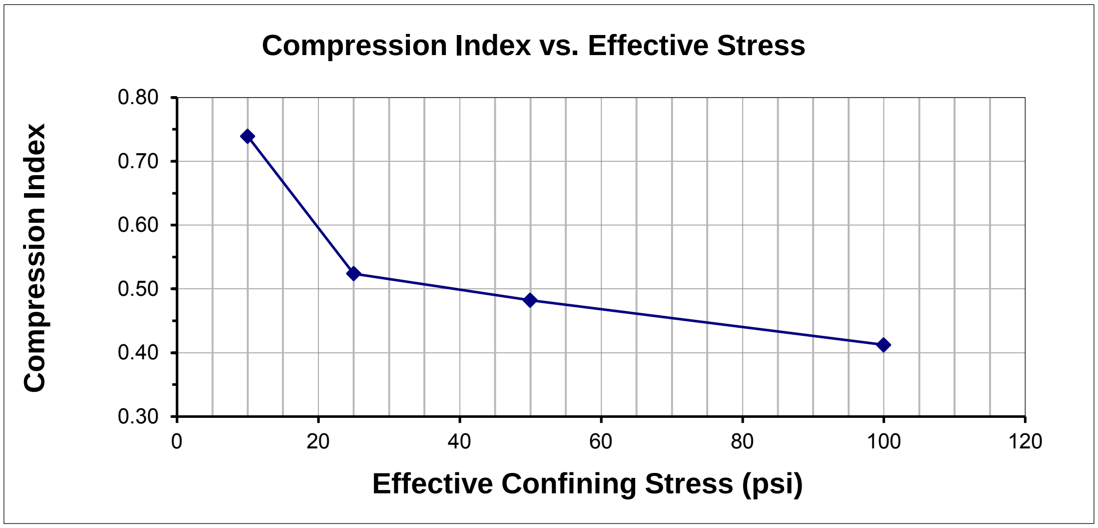
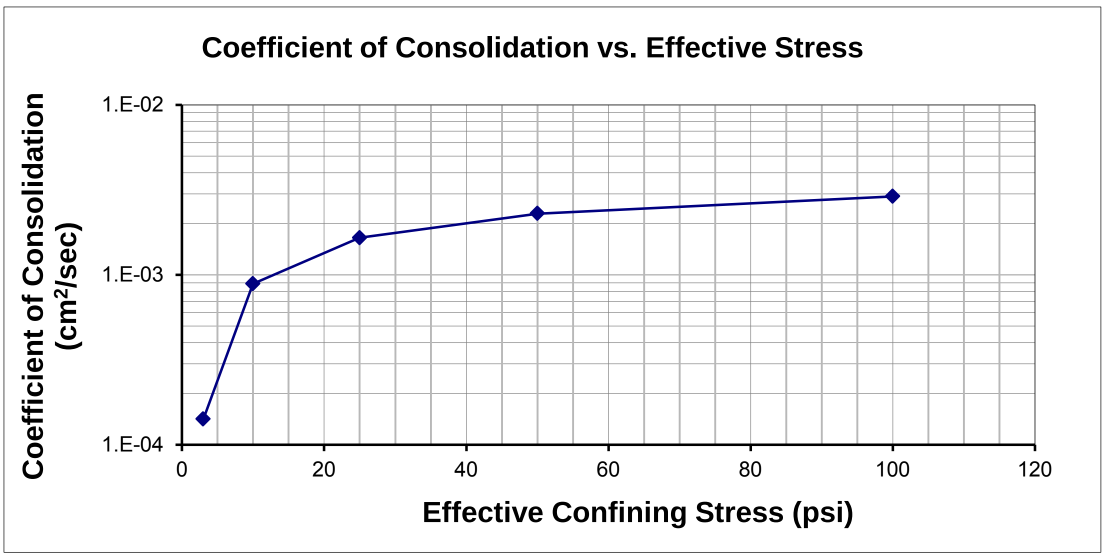




Golder Associates Inc. **Denver, Colorado**		**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **DENSITY DATA**		
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Whole Tailings Flume Test Slime	**Reviewed:** CCS	**Date:** 10/30/2012	**Job Number:** 103-92557	**Figure:** 3



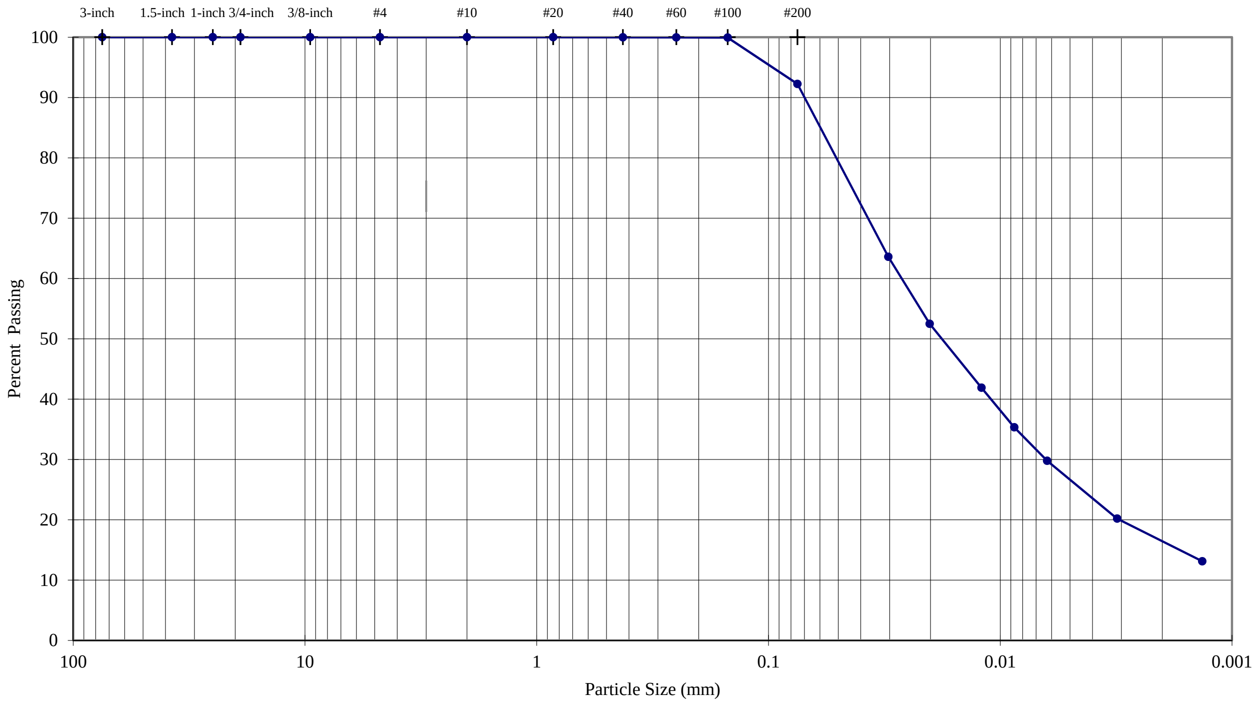


Golder Associates Inc. **Denver, Colorado**	**Title:** **SLURRY CONSOLIDATION TEST RESULTS** **COMPRESSION DATA**			
Job Short Title: Copper Flat Tailings Design Study				
Sample No. Whole Tailings Flume Test Slime	**Reviewed:** CCS	**Date:** 10/30/2012	**Job Number:** 103-92557	**Figure:** 4

November-12 **103-92557**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Whole Tailings Flume** DEPTH (ft): **Beach**
TYPE: **Single Drain**



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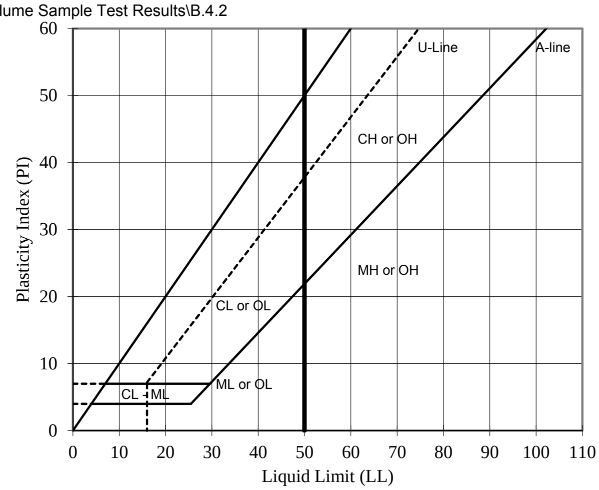
	Sieve	Particle Size (mm)	% Passing	Description	Percentage
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	**100.0**		
	1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
	1-inch	25.0	**100.0**		
	3/4-inch	19.0	**100.0**		
	3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
	#4	4.75	**100.0**		
	#10	2.0	**100.0**	Coarse Sand	**0.00**
	#20	0.85	**100.0**	Medium Sand	**0.02**
	#40	0.425	**100.0**		
	#60	0.25	**100.0**	Fine Sand	**7.72**
	#100	0.15	**99.9**		
	#200	0.075	**92.3**		
Hydrometer Analysis		0.030	**63.6**	Silt or Clay Fines	**92.26**
		0.020	**52.5**		
		0.012	**41.9**		
		0.009	**35.3**		
		0.006	**29.8**		
		0.003	**20.2**		
		0.001	**13.1**		



Visual Description (Golder Procedure):

Wet, light yellowish brown SITLY SAND

LL	PL	PI	Spg (assumed)
--	--	--	**2.64**

As-Received Moisture Content (%)	USCS Group Symbol
--	--

Notes: 0g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute

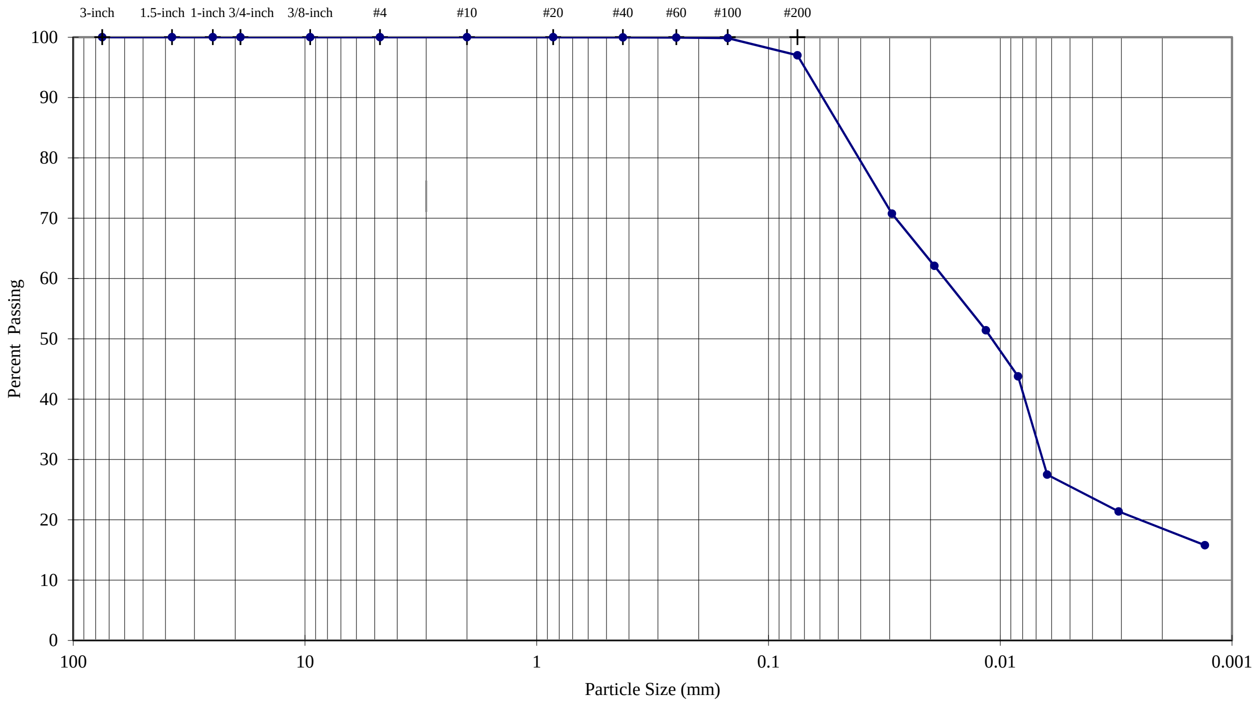
TECH	RJM/SRS
DATE	11/8/2012
REVIEW	MB

Golder Associates

November-12 103-92557

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Whole Tailings** DEPTH (ft): **Slime**
TYPE: **Flume**



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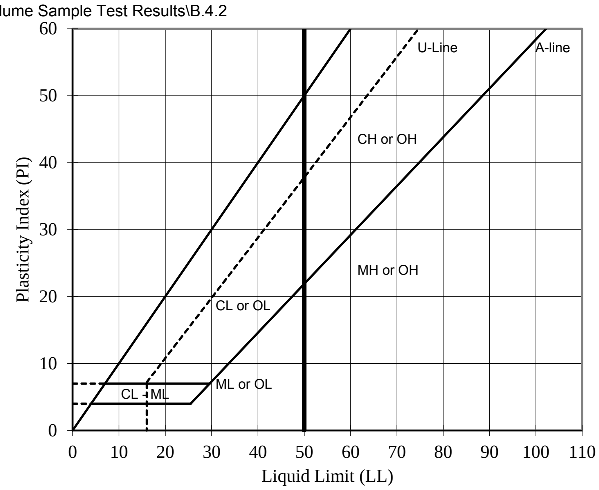
	Sieve	Particle Size (mm)	% Passing	Description	Percentage
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	**100.0**		
	1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
	1-inch	25.0	**100.0**		
	3/4-inch	19.0	**100.0**		
	3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
	#4	4.75	**100.0**		
	#10	2.0	**100.0**	Coarse Sand	**0.00**
	#20	0.85	**100.0**	Medium Sand	**0.04**
	#40	0.425	**100.0**		
	#60	0.25	**99.9**	Fine Sand	**2.96**
	#100	0.15	**99.9**		
	#200	0.075	**97.0**		
Hydrometer Analysis		0.029	**70.8**	Silt or Clay Fines	**97.00**
		0.019	**62.1**		
		0.012	**51.4**		
		0.008	**43.8**		
		0.006	**27.5**		
		0.003	**21.4**		
		0.001	**15.8**		



Visual Description (Golder Procedure):

Wet, light yellowish brown silty sand

LL	PL	PI	SpG (assumed)
--	--	--	**2.64**

As-Received Moisture Content (%)	USCS Group Symbol
--	--

Notes: 0g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute

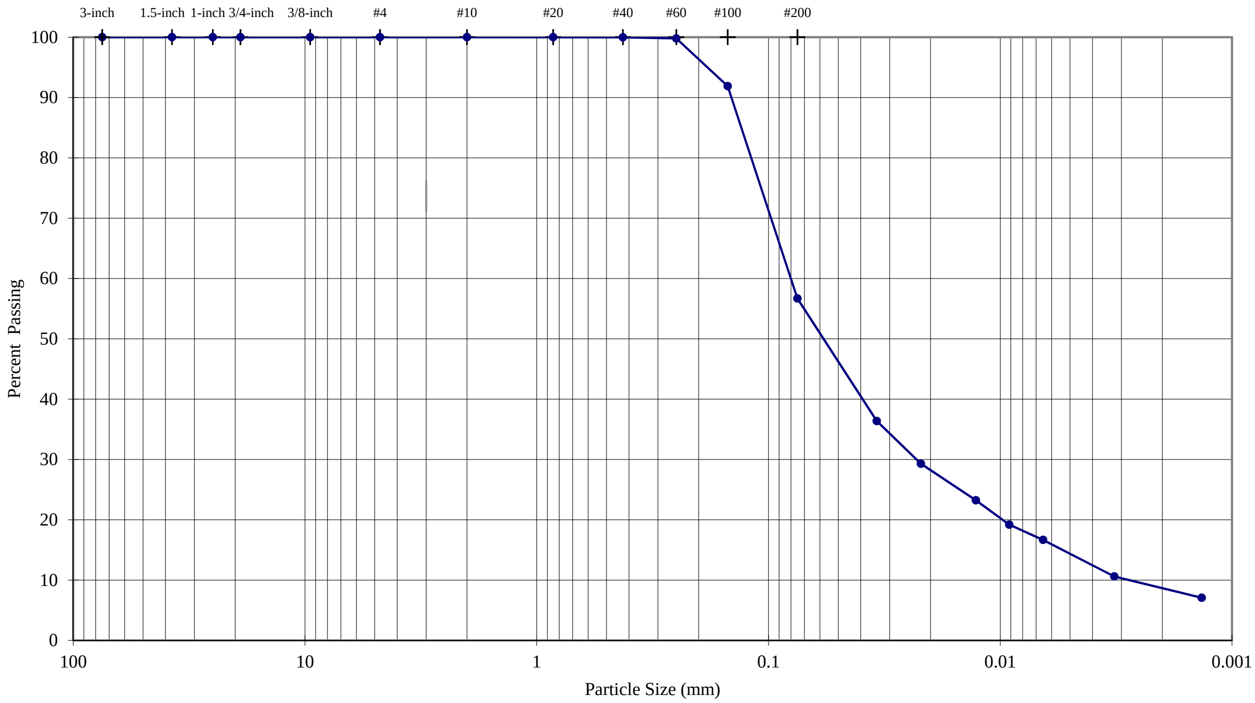
TECH	AM/SRS
DATE	11/8/2012
REVIEW	MB

Golder Associates

November-12 103-92557

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS
ASTM D421, D422, D4318

PROJECT NAME: **Copper Flat Tailings Design Study**
SAMPLE ID: **Whole Tailings Flume** DEPTH (ft): **Slime**
TYPE: **Single Drain**



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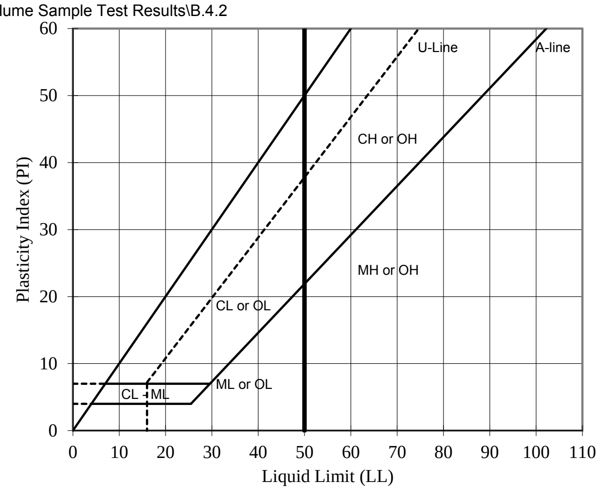
	Sieve	Particle Size (mm)	% Passing	Description	Percentage
Sieve Analysis (Initial Separation on No. 4 Sieve)	3-inch	75.0	**100.0**		
	1.5-inch	37.5	**100.0**	Coarse Gravel	**0.00**
	1-inch	25.0	**100.0**		
	3/4-inch	19.0	**100.0**		
	3/8-inch	9.5	**100.0**	Fine Gravel	**0.00**
	#4	4.75	**100.0**		
	#10	2.0	**100.0**	Coarse Sand	**0.00**
	#20	0.85	**100.0**	Medium Sand	**0.02**
	#40	0.425	**100.0**		
	#60	0.25	**99.8**	Fine Sand	**43.29**
	#100	0.15	**91.9**		
	#200	0.075	**56.7**		
Hydrometer Analysis		0.034	**36.4**	Silt or Clay Fines	**56.69**
		0.022	**29.3**		
		0.013	**23.2**		
		0.009	**19.2**		
		0.007	**16.7**		
		0.003	**10.6**		
		0.001	**7.1**		



Visual Description (Golder Procedure):

Wet, light yellowish brown SITLY SAND

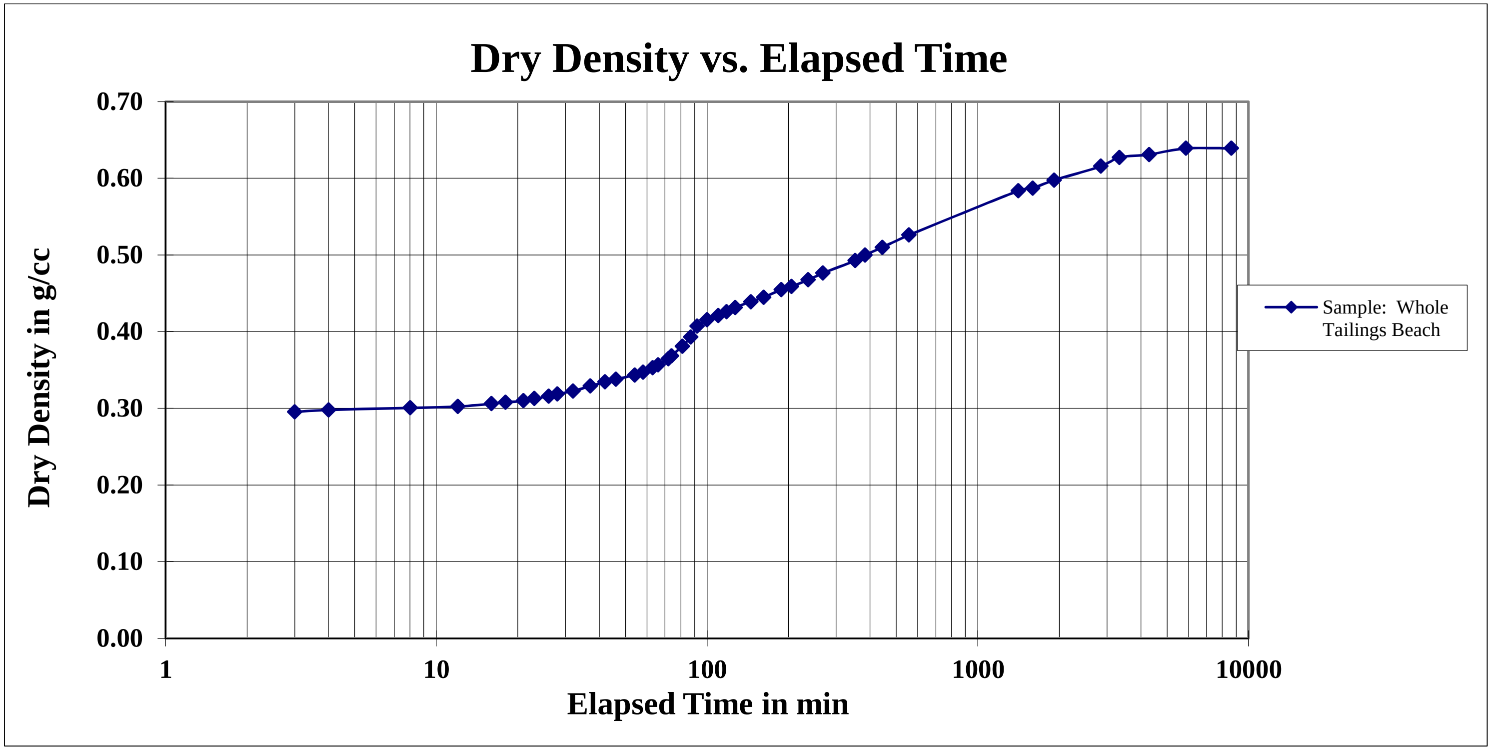
LL	PL	PI	SpG (assumed)
--	--	--	**2.64**

As-Received Moisture Content (%)	USCS Group Symbol
--	--

Notes: 0g of particles up to 4.75mm maximum size were removed from particle size analysis sample prior to testing
Particle size analysis sample mechanically dispersed using Stirring Apparatus A for about 1 minute

TECH	RJM/SRS
DATE	11/8/2012
REVIEW	MB

Golder Associates



Golder Associates, Inc. **Denver, Colorado**			**Title:** SEDIMENTATION TESTING GRAPHICAL DATA		
Job Short Title: Copper Flat Tailings Design Study					
Sample No. Whole Tailings Beach	**System** Single Drain	**Reviewed:** MB	**Date:** 23-Oct-12	**Job Number:** 103-92557	**Figure:** 2

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APPENDIX C
FSCONSOL MODEL OUTPUT

Golder Associates

CALCULATIONS

Date:	November 11, 2013	**Made by:**	CDJ and DMW
Project No.:	133-92505	**Checked by:**	GM
Subject:	Cyclone Overflow Beach and Slimes Tailings Consolidation Analyses	**Reviewed by:**	GG
Project Short Title:	**COPPER FLAT FEASIBILITY DESIGN**		

1.0 OBJECTIVE

Estimate the Tailing Storage Facility (TSF) impoundment capacity by computing the average dry density of tailings at the end-of-filling using a one-dimensional (1D) large strain consolidation model to obtain the void ratio profile with depth. Use calculated 1D percent errors to compute an adjusted average dry density, which is then weighted based on the tailings cyclone overflow split between tailings "beach" versus tailings "slimes" within the TSF impoundment.

2.0 ASSUMPTIONS

- Total tailings production rate (overflow and underflow): 27,618 tons per day
- Total tailings capacity (overflow and underflow): 112 million tons
- Cyclone Availability: 100 percent (i.e. no whole tailings deposited in the TSF impoundment based on the recommendation to produce as much cyclone underflow tailings sand as possible)
- Percentage split of cyclone overflow tailings: 54.75 percent of total
- Tailings production rate (overflow): 15,121 tons per day (calculated based on total tailings production rate and percentage of cyclone overflow)
- Percentage split of slimes: 40 percent by mass of storage in TSF impoundment
- Initial Tailings Overflow Solids Content: 25.9 percent
- Tailings Overflow filling rate
  - Years 0-1:13.3 million kilograms per day
  - Years 1-5:15.4 million kilograms per day
  - Years 5-11:14.2 million kilograms per day
  - Years 11-11.12:13.2 million kilograms per day
- Impermeable Bottom Boundary condition

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3.0 INPUTS

3.1 Geometry

Model geometry was based on the existing ground topography (THEMAC Resources, 2011) and Golder's optimized TSF design. Stage storage curve data used for TSF modeling is displayed in Table 1.

- Bottom Elevation: 5,196 feet above mean sea level (ft-msl)
- Top Dam Crest Elevation: 5,450 ft-msl
- Maximum depth of Impoundment: 254 feet
- Maximum Overflow Impoundment Area: 13.66 million square feet
- Impoundment volume used in the FSConsol analyses: 96.88 million cubic yards (MCY)

Table 1: Elevation–Area-Volume Relationship

Elevation (ft-msl)	Height (ft)	Area (acre)	Cumulative Volume (yd^3)
5,196	0	0.0	0
5,210	14	16.3	367,859
5,225	29	58.6	1,786,931
5,235	39	101.7	3,427,369
5,250	54	141.8	6,859,887
5,265	69	180.3	11,223,775
5,280	84	203.4	16,145,709
5,295	99	240.6	21,968,132
5,310	114	255.1	28,141,570
5,325	129	280.1	34,919,345
5,340	144	288.9	41,911,903
5,355	159	300.0	49,171,933
5,370	174	305.0	56,552,360
5,385	189	308.6	64,019,422
5,400	204	312.6	71,583,431
5,425	229	313.6	84,231,795
5,435	239	313.6	89,291,466
5,450	254	313.6	96,880,975

3.2 Material Properties

Material properties and numerical model inputs are based on laboratory tests performed by Golder Associates Inc. in Denver, CO. Slurry consolidation tests were performed to determine void ratio and permeability versus applied effective stresses. The specific gravity of the tailings material is 2.65 based on laboratory tests.

4.0 METHOD

Calculations were performed using the computer program FSConsol (GWP Software, 1999), which performs a one-dimensional, large-strain consolidation analysis using finite strain consolidation theory as presented in Gibson (1967).

4.1 Numerical Model

4.1.1 Equations

For modeling purposes, it is convenient to express constitutive relationships (permeability and compressibility, respectively) in a closed form. Non-linear relationships are proposed by Abu-Hejleh and Znidarcic (1994 and 1996), defined by Equations 4.1 and 4.2, which are used in consolidation and desiccation numerical models.

$$k = C\,e^{D} \qquad \text{Equation 4.1}$$

$$e = A(\sigma' + Z)^{B} \qquad \text{Equation 4.2}$$

When using FSConsol model, Equation 4.1 remains the same; however, Equation 4.2 is rewritten by the modified power law form to represent compressibility, shown in Equation 4.3.

$$e = A(\sigma')^{B} + M \qquad \text{Equation 4.3}$$

In the above relationships, *e* is the void ratio, σ' is the effective stress, and *k* is hydraulic conductivity functionally dependent on void ratio.

4.1.2 Parameters

The five material parameters, *A, B, C, D,* and *M* (or *Z*)*,* were determined by fitting constitutive relationships to laboratory data, as shown in Figures 1 through 4, which are on the following next two pages (pages 4 and 5). The fitted parameters calculated for those constitutive relationships are shown in Tables 2 and 3 for different systems of units.

Table 2: Permeability Input Parameters for Cyclone Overflow and Whole Tailings

Sample	C (centimeters per second)	D (dimensionless)[1]
Slimes	1.380×10^{-7}	3.353
Beach	1.523×10^{-6}	3.035

Table 3: Compressibility Input Parameters for Cyclone Overflow and Whole Tailings

Sample	A (1/kilopascals)^{B}	B (dimensionless)[1]	M (dimensionless)[1]
Slimes	3.144	-0.1952	-0.1424
Beach	1.787	-0.2983	0.5224

Note:
[1] B, D, and M are dimensionless and valid for English, International, and centimeter-gram-second (cgs) units

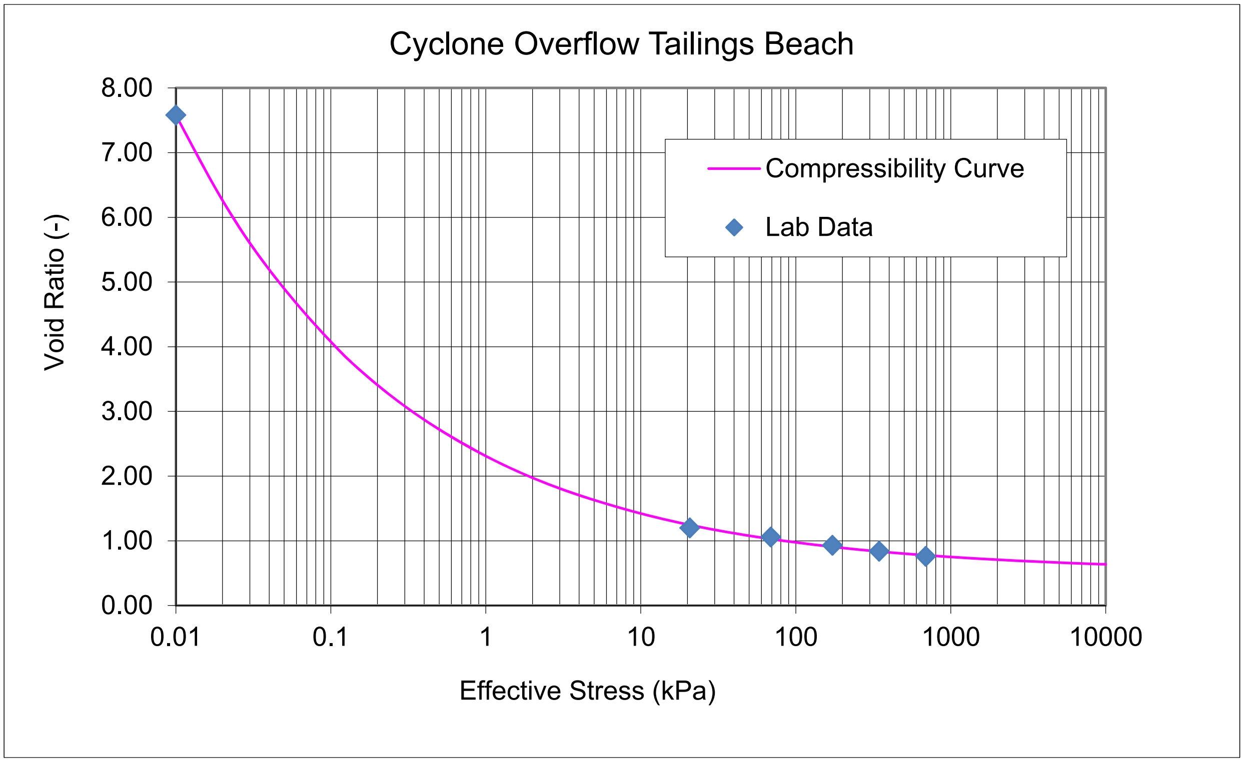


Figure 1: Cyclone Overflow Tailings Beach Compressibility Constitutive Relationship versus Lab Data

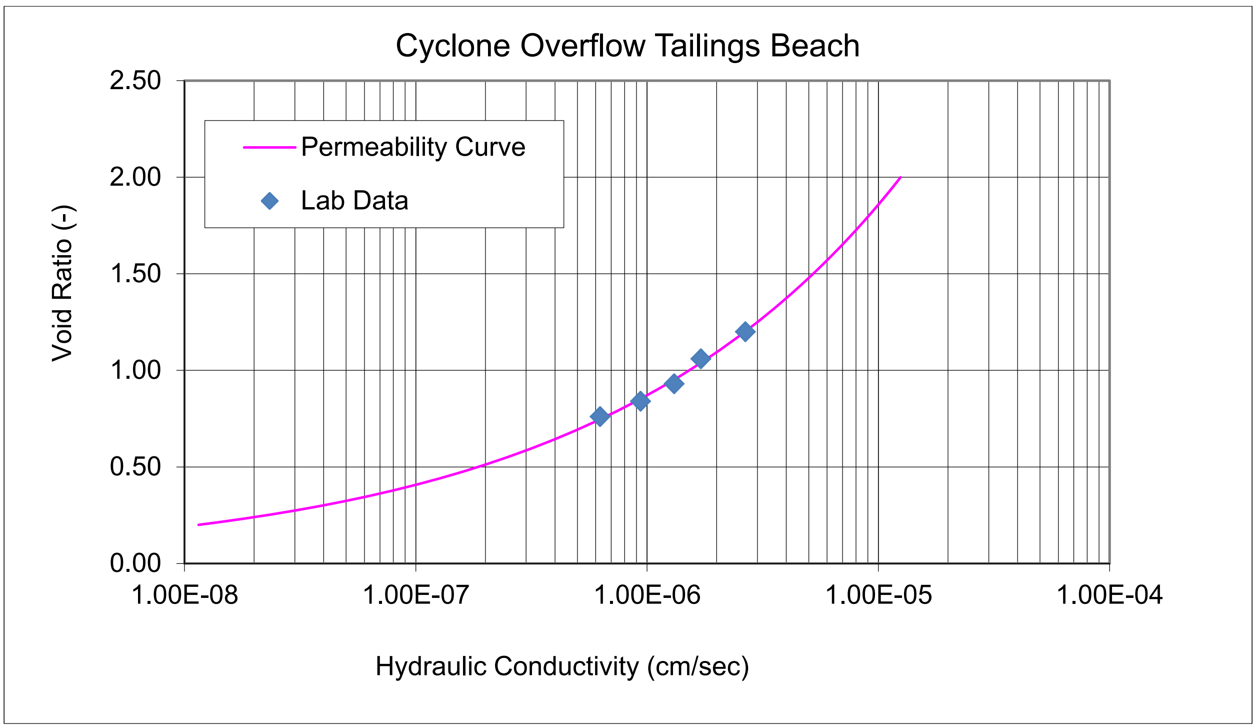


Figure 2: Cyclone Overflow Tailings Beach Permeability Constitutive Relationship versus Lab Data

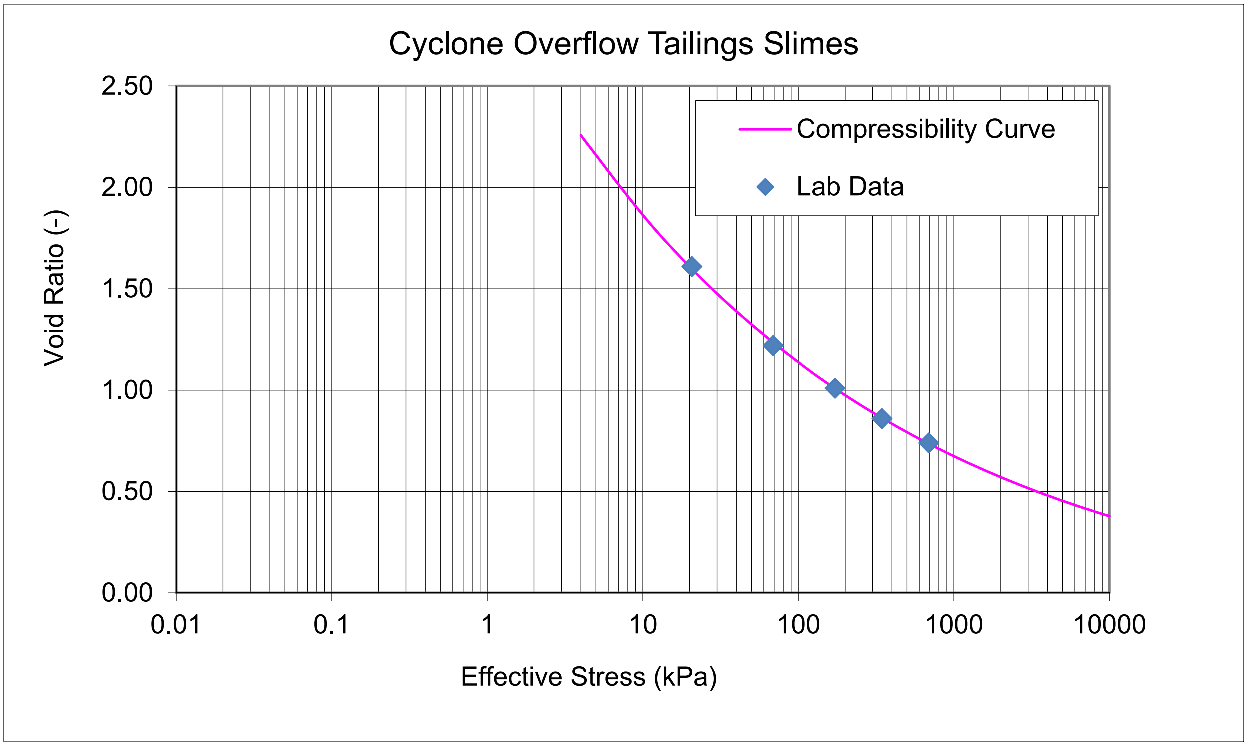


Figure 3: Cyclone Overflow Tailings Slimes Compressibility Constitutive Relationship versus Lab Data

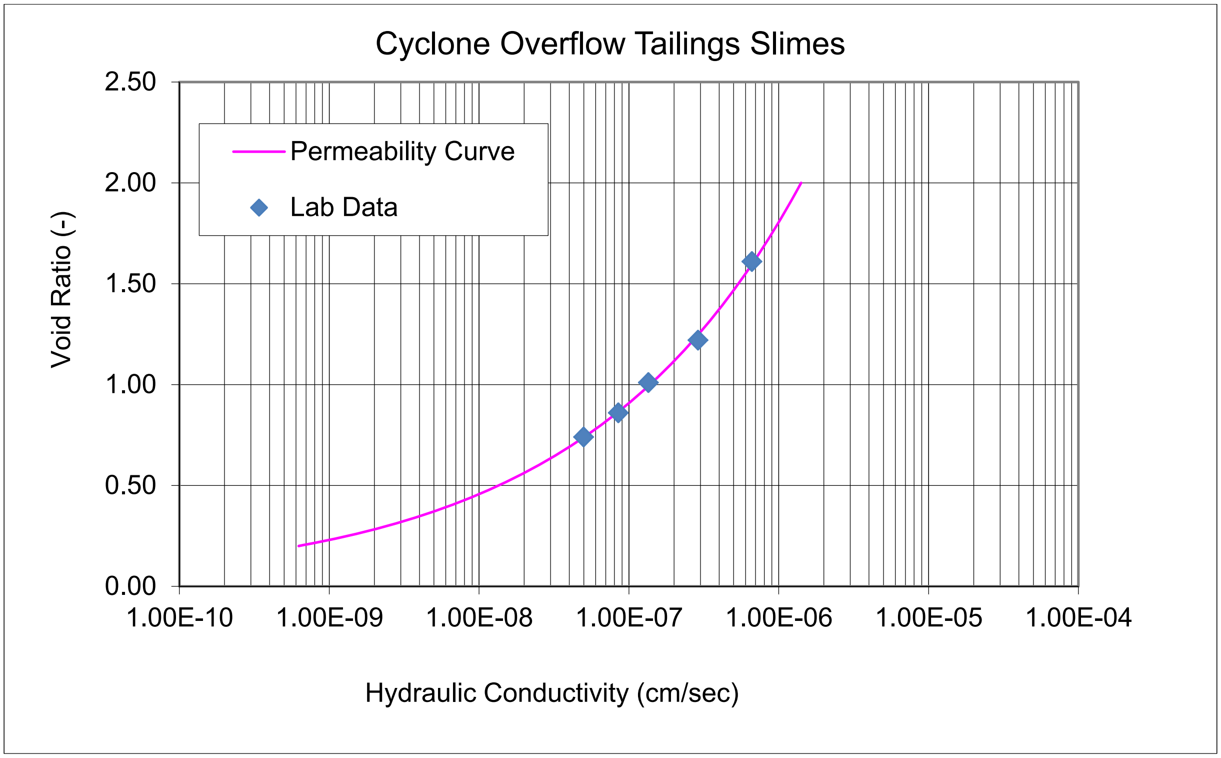


Figure 4: Cyclone Overflow Tailings Slimes Permeability Constitutive Relationship versus Lab Data

4.2 Procedure

The tailings cyclone overflow portion of the TSF was modeled by running a consolidation analysis on a single tailings column located in the deepest part of the impoundment. Using the parameters described above in Section 4.1.2 to define the compressibility and permeability relationships, separate analyses were performed for each material representing either the tailings beach or tailings slimes components of the cyclone overflow.

In each respective model run, the model analyzed each material component assuming it to represent 100 percent of the inflow into the model storage volume (i.e. the impoundment). In the model, the incremental area was calculated based on elevation and volume differences with Golder's TSF design volumes determined using AutoCAD Civil 3D (2013). The storage volume requirement for the TSF impoundment is estimated by applying FSConsol (1999) calculated densities from the final void ratio profile of each tailings component to obtain an overall density that is weighted based on laboratory grain- size distribution results, which is detailed further in Section 4.2.1. Furthermore, the calculated densities based on the FSConsol analyses are adjusted for 1D percent errors as discussed in Section 4.2.2.

4.2.1 Overflow Beach/Slimes Split

Grain-size distribution tests were performed by Golder in the Denver, CO laboratory on tailings beach and slime samples from laboratory flume tests and on total overflow tailings before the flume tests. From the grain-size distributions, the percent by weight of sand versus fines (silt and/or clay) can be used to approximate the weight or mass percentage of the tailings beach and tailings slime that will report to the respective areas within the TSF impoundment. To determine the split, the percentage summation of sand and fines from the tailings beach and tailings slimes samples should equate to the percentage for the original cyclone overflow head sample. Table 4 depicts the results of the laboratory test and the split calculation, which results in an approximate ratio of 60:40 (beach versus slimes).

Table 4: Laboratory and Split Results

Sample	Grain Size Distribution		Split Calculation		
	Sand (%)	Fines (%)	% Solids by Weight	% Sand of Total Overflow	% Fines of Total Overflow
Beach	15.64	84.36	59.7	9.33	50.34
Slimes	0.74	99.26	40.3	0.3	40.03
Cyclone Overflow Head	9.63	90.37	100	9.63	90.37

4.2.2 1D Percent Error

The consolidation model constructed in FSConsol is 1D, and does not accurately take into account the overall geometry of the TSF (i.e. "bowl" shaped), and that mass and volume quantities are larger towards the top than at the bottom of the TSF due to an increase in surface area. The approximated average dry density of each tailings component is corrected based on the calculated average percent error between 1D versus three-dimensional (3D) by checking: height of solids, volume of solids, and mass of solids.

Based on Golder's experience, 1D analysis resulting in less than an average 15 percent error reasonably depicts expected consolidation in the field, and 3D impoundment geometry can be accounted for by reducing the 1D results of estimated average dry density values by the average percent error.

5.0 RESULTS

The average dry density generally increases during filling until the ultimate height of tailings is reached. At closure, the tailings density continues to increase as the consolidation continues. If 100 percent of the inflow into the TSF impoundment is represented by the cyclone overflow tailings slimes samples from the tail section of the flume (i.e., the finest fraction of the tailings), FSConsol predicts that the final average density of the slimes fraction over the modeled profile will be approximately 33.55 pcf. With 100 percent of the inflow representative of cyclone overflow tailings beach materials, FSConsol predicts a final average tailings density of approximately 76.65 pcf. Attachment 1 contains FSConsol outputs for each respective material properties used in the consolidation analysis.

Because a 1D model was used, percent error calculations were performed to account for 3D effects. The error is expected to be greater for cone-shaped impoundments than for flat-based (i.e. bowl shaped) impoundments, and greater with higher rates of rise than lower rates of rise. Based on calculated material properties, the TSF geometry, and the anticipated rate of rise, Golder calculated the 1D modeling error to range between 1.1 to 13.7 percent with an average error ranging between 2.7 to 5.4 percent when considering calculated impoundment capacities. Attachment 2 contains the error calculations for each respective cyclone overflow tailings components.

After accounting for 3D characteristics of the impoundment geometry, the recommended dry density of each tailings component is 31.7 and 74.6 pcf, respectively. In addition, the FSConsol results were submitted to error checking to determine that solids and water inputs calculated by FSConsol were consistent with the delivery rates of the various components.

6.0 CONCLUSIONS

Based on model results and error checking, 31.7 and 74.6 pcf have been assumed, respectively, for the average dry density of the cyclone overflow tailings slimes and cyclone overflow tailings beach materials at the end-of-filling. Capacity has been estimated with 40 percent of the total represented by tailings slime materials, which is based on the calculated beach to slime ratio split discussed previously in Section 4.2.1. Therefore without consideration of 3D and managed deposition effects, the calculated weighted density of tailings slimes and tailings beach based on each component's volume within the TSF impoundment is 48.4 pcf. At this density, the TSF will require approximately 93.8 MCY of storage, which can be achieved by building to an ultimate tailings surface elevation of 5450 ft-msl and an ultimate cyclone underflow tailings sand dam crest elevation of 5460 ft-msl.

A summary for the cyclone overflow tailings beach and slimes components is located in Attachment 3, which contains the percent errors, adjusted densities, corresponding volumes, and the weighted density based on the percentage of the overall volume occupied by that tailings materials.

3D and managed deposition effects could potentially increase the post deposition density to reduce storage volume requirements. On average, a density increase in 5 pcf results in approximately 10 MCY of additional TSF impoundment storage capacity and a decrease in ultimate crest elevation by approximately 20 feet.

Actual flows into the impoundment will be mixed, with cyclone overflow tailings beach inter-fingered with slimes layers as the decant pond migrates upstream away from the embankment and points of cyclone overflow discharge are relocated. The denser and more permeable beach layers will increase the rate of consolidation in the underlying slimes material, resulting in a higher rate of consolidation than that calculated in the model. In addition, the consolidation modeling does not account for managed deposition of tailings. Thin-lift, sub-aerial deposition techniques will result in increases of dry density and a decrease in required storage volume by enhancing evaporation of exposed tailings. Managed deposition will increase consolidation of both the cyclone overflow tailings beach and slimes. However due to the height of the proposed tailings embankment and the design out-slopes, an embankment raise of several feet will also be feasible near the end of the mining operation if additional capacity is needed.

7.0 REFERENCES

Abu-Hejleh, A.N., and D. Znidarcic, 1994. *Estimation of the Consolidation Constitutive Relations*, Computer Methods and Advances in Geomechanics, Siriwardane and Zaman (eds), Balkema, Rotterdam, pp. 499-504.

Abu-Hejleh, A.N., and D. Znidarcic, 1996. *Consolidation Characteristics of Phosphatic Clays*, Journal of Geotechnical Engineering", ASCE, New-York, Vol. 122, No. 4, pp. 295-301.

AutoCAD Civil 3D Package, Version 2013.

Gibson, R.E., England, G. L., and Hussey, M. J. L. (1967). The Theory of One-Dimensional Consolidation of Saturated Clays. Geotechnique, 17: 261-273.

GWP Software, 1999. *FSConsol User's Manual*, GWP Sofware Inc.

THEMAC Resources, 2011. *2-Foot Topography*. Developed. and provided by Cooper Aerial Survey Co., June 18, 2011.

Attachments: Attachment 1- FSConsol Model Output
Attachment 2 - FSConsol Error Checking
Attachment 3 - FSConsol Model Summary

ATTACHMENT 1
FSCONSOL MODEL OUTPUT

FSConsol (c) 1994-2011 - version 3.45 GWP Geo Software Inc.
Date and Time of Analysis (mm/dd/yy) 11/11/2013 at 12:58:34
input filename: P:\2013 Projects\133-92505 Cu Flat TSF\Consolidation\Nov 2013\OF-slimes.fs1

Overflow - slimes (Non-thickened)
Revised flow rates and pond areas 11/11/2013
CDJ

ANALYSIS CONDITIONS
Analysis Type = Pond
Analysis Time = 16.115 years
Maximum Pond Height = 77.42 meters
Number of Filling Rates = 5

Rate kg/day	Period yrs
1.33E+07	1
1.54E+07	4
1.42E+07	6
1.32E+07	0.12
0.00E+00	5

Number of Pond Areas = 17

Pond Height m	Pond Area sq. km
4.27	0.07
4.57	0.24
3.05	0.41
4.57	0.57
4.57	0.73
4.57	0.82
4.57	0.97
4.57	1.03
4.57	1.13
4.57	1.17
4.57	1.21
4.57	1.23
4.57	1.25
4.57	1.26
7.62	1.27
3.05	1.27
4.57	1.27

Number of Surcharge Episodes = 0

INITIAL CONDITIONS
Initial Height = 0.00000 meters

MATERIAL PROPERTIES
Number of Soil Types = 1

Soil Type #1 duration = 16.11 years
Initial Solids Content = 25.90 %
void ratio @ initial S.C. = 7.582; effective stress @ initial S.C. = 10.00 Pascals
Specific Gravity = 2.65
Compressibility Parameters (stress in kPa)
A = 3.144;   B = -0.1952 ;   Mconst = -0.1424
Permeability Parameters (cm/second)
C = 1.38e-07;   D = 3.353

BOUNDARY CONDITIONS
Bottom Boundary: Impermeable
Top Boundary: Constant Water Cap of: 0.000 m thickness

NUMERICAL TWEAKS
Time Step = 0.050 days
Maximum Stress Difference = 1e+06 kPa

OUTPUT PREFERENCES
Time Step Multiplier = 730
Time Step Units from: Time Step (days)

Time Step Output

Elapsed Time days	Height metres	Ave.Sol.Cont. %	Ave. Normalized Ue %	Ave. Dissipation %	Total Solids (kg)	Solids Flux (kg/d/m2)
0	0	25.9	100	0	0	201.363
36.5	8.952323	27.665	99.338	0.662	4.84E+08	32.2474
73	11.974489	28.534	99.338	0.662	9.69E+08	23.1181
109.5	13.962894	29.275	99.29	0.71	1.45E+09	23.1181
146	15.951077	29.826	99.268	0.732	1.94E+09	23.1181
182.5	17.505217	30.356	99.233	0.767	2.42E+09	18.1828
219	18.909844	30.834	99.199	0.801	2.91E+09	18.1828
255.5	20.314418	31.243	99.176	0.824	3.39E+09	18.1828
292	21.599814	31.627	99.153	0.847	3.87E+09	16.1217
328.5	22.7607	31.998	99.128	0.872	4.36E+09	16.1217
365	23.92199	32.331	99.109	0.891	4.84E+09	18.7619
401.5	25.394898	32.553	99.113	0.887	5.41E+09	18.7619
438	26.573655	32.822	99.103	0.897	5.97E+09	15.86
474.5	27.703532	33.079	99.093	0.907	6.53E+09	15.86
511	28.833398	33.316	99.085	0.915	7.10E+09	15.86
547.5	29.963253	33.533	99.08	0.92	7.66E+09	15.86
584	31.006515	33.755	99.073	0.927	8.23E+09	14.9583
620.5	32.029764	33.966	99.066	0.934	8.79E+09	14.9583
657	33.053007	34.164	99.06	0.94	9.35E+09	14.9583
693.5	34.076244	34.349	99.056	0.944	9.92E+09	14.9583
730	35.045301	34.535	99.051	0.949	1.05E+10	13.6253
766.5	35.910971	34.735	99.042	0.958	1.10E+10	13.6253
803	36.776635	34.924	99.035	0.965	1.16E+10	13.6253
839.5	37.642296	35.105	99.028	0.972	1.22E+10	13.6253
876	38.507953	35.276	99.023	0.977	1.27E+10	13.6253
912.5	39.37049	35.441	99.018	0.982	1.33E+10	13.207
949	40.186694	35.608	99.012	0.988	1.39E+10	13.207
985.5	41.002895	35.768	99.007	0.993	1.44E+10	13.207
1022	41.819093	35.922	99.002	0.998	1.50E+10	13.207
1058.5	42.635291	36.069	98.998	1.002	1.56E+10	13.207
1095	43.4515	36.211	98.995	1.005	1.61E+10	13.207
1131.5	44.241255	36.353	98.991	1.009	1.67E+10	12.7196
1168	45.000136	36.496	98.987	1.013	1.72E+10	12.7196
1204.5	45.759528	36.633	98.982	1.018	1.78E+10	12.7196
1241	46.519832	36.766	98.979	1.021	1.84E+10	12.7196
1277.5	47.281436	36.893	98.975	1.025	1.89E+10	12.7196
1314	48.04463	37.015	98.972	1.028	1.95E+10	12.7196
1350.5	48.798638	37.134	98.969	1.031	2.01E+10	12.5125
1387	49.541361	37.25	98.966	1.034	2.06E+10	12.5125
1423.5	50.286082	37.362	98.963	1.037	2.12E+10	12.5125
1460	51.032752	37.47	98.961	1.039	2.18E+10	12.5125
1496.5	51.7813	37.573	98.959	1.041	2.23E+10	12.5125

1533	52.53164	37.672	98.957	1.043	2.29E+10	12.5125
1569.5	53.278167	37.768	98.956	1.044	2.34E+10	12.3672
1606	54.015293	37.863	98.954	1.046	2.40E+10	12.3672
1642.5	54.754054	37.954	98.953	1.047	2.46E+10	12.3672
1679	55.494353	38.041	98.952	1.048	2.51E+10	12.3672
1715.5	56.236103	38.126	98.951	1.049	2.57E+10	12.3672
1752	56.979224	38.207	98.951	1.049	2.63E+10	12.3672
1788.5	57.720815	38.286	98.951	1.049	2.68E+10	12.2088
1825	58.448575	38.365	98.95	1.05	2.74E+10	11.2472
1861.5	59.070262	38.461	98.946	1.054	2.79E+10	11.2472
1898	59.694243	38.553	98.943	1.057	2.84E+10	11.2472
1934.5	60.319981	38.642	98.94	1.06	2.89E+10	11.2472
1971	60.947381	38.728	98.937	1.063	2.95E+10	11.2472
2007.5	61.576356	38.812	98.934	1.066	3.00E+10	11.2472
2044	62.206642	38.893	98.932	1.068	3.05E+10	11.21
2080.5	62.834453	38.972	98.929	1.071	3.10E+10	11.21
2117	63.463654	39.049	98.927	1.073	3.15E+10	11.21
2153.5	64.094161	39.124	98.926	1.074	3.21E+10	11.21
2190	64.725911	39.197	98.924	1.076	3.26E+10	11.21
2226.5	65.358846	39.268	98.923	1.077	3.31E+10	11.21
2263	65.992908	39.337	98.921	1.079	3.36E+10	11.21
2299.5	66.628047	39.404	98.92	1.08	3.41E+10	11.21
2336	67.264213	39.469	98.919	1.081	3.47E+10	11.21
2372.5	67.90136	39.532	98.919	1.081	3.52E+10	11.21
2409	68.539445	39.594	98.918	1.082	3.57E+10	11.21
2445.5	69.178426	39.654	98.918	1.082	3.62E+10	11.21
2482	69.818263	39.713	98.917	1.083	3.67E+10	11.2094
2518.5	70.458862	39.77	98.917	1.083	3.73E+10	11.2094
2555	71.100248	39.826	98.917	1.083	3.78E+10	11.2094
2591.5	71.742389	39.88	98.917	1.083	3.83E+10	11.2094
2628	72.385254	39.933	98.917	1.083	3.88E+10	11.2094
2664.5	73.028814	39.985	98.917	1.083	3.93E+10	11.2094
2701	73.67304	40.036	98.918	1.082	3.99E+10	11.2094
2737.5	74.317906	40.085	98.918	1.082	4.04E+10	11.2094
2774	74.963389	40.134	98.919	1.081	4.09E+10	11.2094
2810.5	75.609464	40.181	98.919	1.081	4.14E+10	11.2094
2847	76.256109	40.227	98.92	1.08	4.19E+10	11.2094
2883.5	76.903302	40.272	98.921	1.079	4.24E+10	11.2094

Observation Point Data

Number of Observation Points: 50
Number of Observation Point Readings: 80
Observation Point Time Step: 36.50 days

E X C E S S   P O R E   P R E S S U R E (kPa)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	16.98446	13.9697	11.04461	8.124095	5.203581	2.283068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	23.19398	19.99803	16.74713	13.82442	10.90391	7.983397	5.062884	2.142371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	27.56299	24.4176	20.65647	17.57597	14.65439	11.73387	8.813361	5.892848	2.972334	0.051821	0	0	0	0	0	0	0	0	0	0	0	0	0
146	31.99563	28.9716	24.83343	21.41572	18.40499	15.48393	12.56342	9.642905	6.722391	3.801878	0.881365	0	0	0	0	0	0	0	0	0	0	0	0
182.5	35.65401	32.76572	28.37042	24.63573	21.39069	18.41559	15.4948	12.57428	9.653769	6.733256	3.812743	0.89223	0	0	0	0	0	0	0	0	0	0	0
219	39.06397	36.30706	31.74427	27.73378	24.24599	21.09897	18.14431	15.22365	12.30314	9.382627	6.462114	3.541601	0.621088	0	0	0	0	0	0	0	0	0	0
255.5	42.50059	39.86499	35.2001	30.95167	27.24053	23.89984	20.81519	17.873	14.95241	12.0319	9.111384	6.190871	3.270358	0.349844	0	0	0	0	0	0	0	0	0
292	45.7345	43.20909	38.48926	34.03705	30.12169	26.59747	23.35327	20.31126	17.37693	14.45638	11.53586	8.61535	5.694836	2.774323	0	0	0	0	0	0	0	0	0
328.5	48.75229	46.3265	41.58553	36.96029	32.85799	29.16233	25.76304	22.5868	19.57533	16.64603	13.7255	10.80498	7.88447	4.963956	2.043443	0	0	0	0	0	0	0	0
365	51.78702	49.45134	44.71334	39.94259	35.66908	31.81312	28.26698	24.95682	21.83091	18.84197	15.9159	12.99538	10.07486	7.15435	4.233837	1.313324	0	0	0	0	0	0	0
401.5	55.42372	53.16975	48.45184	43.56002	39.1298	35.12358	31.43866	28.00023	24.75681	21.66954	18.69754	15.77354	12.85302	9.93251	7.011996	4.091483	1.17097	0	0	0	0	0	0
438	58.51822	56.33862	51.65286	46.66148	42.08809	37.94073	34.12435	30.56376	27.20657	24.01499	20.95819	17.99905	15.07637	12.15585	9.235337	6.314823	3.39431	0.473797	0	0	0	0	0
474.5	61.53186	59.42021	54.77501	49.70286	44.99899	40.71887	36.77769	33.10064	29.63438	26.34067	23.19047	20.15817	17.20885	14.287	11.36648	8.445968	5.525455	2.604942	0	0	0	0	0
511	64.55574	62.50647	57.90753	52.77096	47.94853	43.54343	39.48351	35.69523	32.12446	28.73224	25.48952	22.37309	19.36078	16.41893	13.49761	10.57709	7.656577	4.736064	1.815551	0	0	0	0
547.5	67.58898	65.59711	61.04828	55.8614	50.9316	46.40887	42.23577	38.34102	34.67	31.18299	27.85047	24.64958	21.56118	18.56537	15.6292	12.70819	9.787681	6.867168	3.946654	1.026141	0	0	0
584	70.46748	68.52871	64.03234	58.80731	53.78064	49.14722	44.86611	40.86925	37.10191	33.52364	30.10437	26.82102	23.65508	20.59027	17.60814	14.67626	11.75545	8.83494	5.914426	2.993913	0.0734	0	0
620.5	73.31618	71.42668	66.98411	61.73138	56.61763	51.88012	47.49584	43.40091	39.54083	35.8746	32.37156	29.00824	25.76611	22.62978	19.58505	16.61433	13.68566	10.76497	7.844453	4.92394	2.003426	0	0
657	76.17223	74.32856	69.94041	64.66892	59.47723	54.64194	50.15905	45.96979	42.02029	38.26914	34.68514	31.24439	27.9281	24.72102	21.61008	18.58259	15.62139	12.69508	9.774467	6.853953	3.93344	1.012927	0
693.5	79.03514	77.23425	72.90055	67.61796	62.35679	57.42978	52.85261	48.57251	44.53667	40.70343	37.04109	33.52532	30.13702	26.86081	23.68389	20.59495	17.58236	14.6291	11.70453	8.783955	5.863442	2.942929	0.022415
730	81.80228	80.04144	75.76183	70.47466	65.15186	60.1389	55.47159	51.10395	46.98464	43.07192	39.33368	35.74517	32.28696	28.94346	25.70184	22.55115	19.48142	16.4818	13.53512	10.6118	7.691252	4.770739	1.850226
766.5	84.38044	82.65718	78.43101	73.14483	67.76764	62.67429	57.92079	53.46872	49.26862	45.27887	41.467	37.8079	34.28178	30.87281	27.56803	24.35655	21.22888	18.17606	15.18774	12.24651	9.324076	6.403542	3.483028
803	86.96426	85.27636	81.10277	75.82231	70.3974	65.22897	60.3931	55.85957	51.5812	47.51669	43.63333	39.90562	36.31348	32.84082	29.47449	26.20352	23.01854	19.91121	16.87336	13.89492	10.95816	8.036348	5.115822
839.5	89.55344	87.89887	83.77687	78.50615	73.03965	67.80121	62.86665	58.27447	53.92023	49.7831	45.83023	42.0358	38.37942	34.84474	31.41841	28.08935	24.84816	21.68668	18.59745	15.57291	12.60313	9.669995	6.748615
876	92.14767	90.52461	86.45308	81.19552	75.69306	70.38946	65.39976	60.71166	56.28381	52.07608	48.05556	44.19616	40.47721	36.88211	33.39729	30.01153	26.71535	23.50059	20.36006	17.28703	14.27439	11.31217	8.381963
912.5	94.74083	93.1476	89.12539	83.88386	78.35058	72.98645	67.92506	63.16364	58.66434	54.38792	50.30151	46.3788	42.59886	38.94482	35.40295	31.96183	28.61189	25.34493	22.1538	19.03208	15.97362	12.97163	10.01603
949	97.25118	95.68624	91.71215	86.48908	80.9297	75.50945	70.37968	65.54748	60.97878	56.63549	52.48485	48.50039	44.66093	40.94938	37.3518	33.85662	30.45414	27.13608	23.89526	20.72537	17.62061	14.57531	11.5829
985.5	99.76587	98.22781	94.30063	89.09808	83.51689	78.04471	72.84978	67.94924	63.31314	58.9047	54.6914	50.64666	46.74908	42.98136	39.32936	35.78135	32.32749	28.95942	25.66991	22.45263	19.30193	16.21255	13.17918
1022	102.2847	100.7722	96.89076	91.71043	86.11135	80.59122	75.33427	70.36775	65.66615	61.19421	56.91975	52.81612	48.86175	45.03912	41.33391	37.73424	34.23014	30.81312	27.4759	24.21211	21.01613	17.88285	14.80747
1058.5	104.8075	103.3194	99.48245	94.32577	88.71238	83.14808	77.83213	72.80193	68.03667	63.50281	59.16861	55.00743	50.99751	47.12118	43.36392	39.7137	36.16041	32.69547	29.3115	26.0021	22.76161	19.585	16.46762
1095	107.3342	105.8693	102.0757	96.94379	91.31935	85.71447	80.34242	75.25078	70.42366	65.82939	61.43682	57.21934	53.15507	49.22617	45.41796	41.71824	38.11678	34.6049	31.17513	27.821	24.53681	21.31753	18.1586
1131.5	109.8144	108.3719	104.6203	99.51423	93.88169	88.23961	82.81431	77.66341	72.77615	68.12294	63.67329	59.40071	55.28323	51.30285	47.44472	43.69651	40.04786	36.48998	33.0153	29.6173	26.29022	23.02901	19.82912
1168	112.2395	110.8183	107.1077	102.0282	96.39028	90.71419	85.23839	80.03034	75.08462	70.37388	65.86841	61.54189	57.37228	53.34144	49.43438	45.63864	41.94372	38.3407	34.82202	31.38098	28.01181	24.7094	21.4692
1204.5	114.668	113.2672	109.5965	104.5442	98.90332	93.19625	87.67257	82.40945	77.40691	72.64	68.07992	63.70055	59.47984	55.39953	51.44449	47.60213	43.86182	40.21458	36.65266	33.16938	29.75888	26.41602	23.13619
1241	117.0997	115.7185	112.0866	107.062	101.4204	95.6852	90.1162	84.80003	79.74226	74.92051	70.30697	65.87581	61.60499	57.47615	53.47404	49.58592	45.80108	42.1104	38.50607	34.98132	31.53024	28.14762	24.82884
1277.5	119.5346	118.1721	114.5781	109.5815	103.9412	98.18054	92.56868	87.20142	82.08997	77.21468	72.5488	68.06687	63.74689	59.57042	55.52209	51.58906	47.76048	44.02715	40.38116	36.81568	33.32473	29.90305	26.54598
1314	121.9724	120.628	117.0708	112.1025	106.4653	100.6818	95.02944	89.61302	84.44941	79.52181	74.80468	70.27297	65.90474	61.68151	57.58779	53.61063	49.73908	45.96385	42.27694	38.67144	35.1413	31.68123	28.2865
1350.5	124.3923	123.0653	119.5439	114.6041	108.9717	103.1676	97.47709	92.01337	86.79909	81.82041	77.05308	72.47253	68.05693	63.78775	59.64944	55.62892	51.71515	47.89873	44.17159	40.52675	36.95809	33.46027	30.02851
1387	126.7897	125.4795	121.9929	117.0818	111.4556	105.6333	99.90672	94.39752	89.13403	84.10545	79.28895	74.66046	70.19834	65.88403	61.70188	57.63873	53.68344	49.82653	46.05983	42.37629	38.76975	35.23479	31.76661
1423.5	129.1898	127.8957	124.4431	119.5607	113.9422	108.1036	102.3432	96.79028	91.47899	86.40169	81.537	76.86148	72.35365	67.99496	63.7697	59.66463	55.66851	51.77176	47.96615	44.24455	40.60073	37.02923	33.52521
1460	131.5926	130.3141	126.8946	122.0407	116.4311	110.5784	104.7861	99.1912	93.83351	88.70862	83.79671	79.07501	74.52225	70.11993	65.85227	61.70595	57.66965	53.7337	49.88979	46.13073	42.45023	38.84276	35.30345
1496.5	133.9979	132.7344	129.3472	124.5219	118.9223	113.0572	107.235	101.5998	96.19711	91.02574	86.06756	81.30051	76.7036	72.25835	67.94898	63.76206	59.68621	55.71166	51.83005	48.03411	44.31748	40.67461	37.10055
1533	136.4056	135.1568	131.8009	127.0042	121.4155	115.5398	109.6896	104.0158	98.56937	93.3526	88.34907	83.53749	78.89716	74.40969	70.05925	65.83236	61.71756	57.70501	53.78627	49.954	46.20181	42.52405	38.91577
1569.5	138.8051	137.5703	134.2452	129.4767	123.9	118.0153	112.1388	106.428	100.9392	95.67809	90.63011	85.77479	81.09176	76.56272	72.17185	67.9056	63.75244	59.70246	55.74713	51.87908	48.09183	44.37972	40.73771
1606	141.1853	139.9641	136.6688	131.9285	126.3645	120.4724	114.5714	108.8251	103.2952	97.9908	92.89925	88.00095	83.27592	78.70597	74.27528	69.97026	65.77929	61.69242	57.70105	53.79773	49.97594	46.22995	42.5547
1642.5	143.5676	142.3597	139.0936	134.3813	128.8307	122.9326	117.0088	111.2284	105.6586	100.312	95.17779	90.23727	85.47092	80.86068	76.39076	72.04753	67.81931	63.69608	59.66918	55.73109	51.87524	48.09586	44.38784
1679	145.9522	144.7571	141.5194	136.8349	131.2984	125.3957	119.4506	113.6377	108.0293	102.6415	97.46535	92.48335	87.67633	83.02642	78.51785	74.13695	69.87201	65.71293	61.65099	57.67861	53.78918	49.97688	46.23653
1715.5	148.339	147.1562	143.9463	139.2894	133.7676	127.8615	121.8966	116.0526	110.4068	104.9787	99.76158	94.73881	89.89178	85.20279	80.65612	76.23809	71.93693	67.74249	63.64599	59.6398	55.71725	51.87246	48.10023
1752	150.7278	149.5571	146.3743	141.7446	136.2381	130.3298	124.3466	118.4729	112.7908	107.3235	102.0661	97.00332	92.11689	87.3894	82.80517	78.35053	74.01365	69.78433	65.65374	61.61418	57.65894	53.7821	49.97842
1788.5	153.1132	151.9541	148.7979	144.1952	138.7044	132.7949	126.7948	120.8928	115.1756	109.67	104.3732	99.27101	94.34581	89.58038	84.95912	80.46836	76.09624	71.83251	67.66827	63.59579	59.60829	55.69981	51.86508
1825	155.4704	154.3227	151.1924	146.6165	141.1418	135.2323	129.2165	123.2875	117.5363	111.9933	106.6579	101.517	96.55363	91.7508	87.09303	82.56664	78.15974	73.86204	69.66459	65.55961	61.54027	57.60056	53.73517
1861.5	157.6156	156.6789	153.5739	148.8244	143.3662	137.4576	131.4275	125.4726	119.6887	114.1092	108.7359	103.557	98.55604	93.71636	89.02257	84.46102	80.0198	75.68856	71.45832	67.32125	63.27046	59.29992	55.40426
1898	159.7625	158.6366	155.5563	151.033	145.5916	139.6849	133.6416	127.6622	121.8465	116.2314	110.8211	105.6048	100.5668	95.69082	90.9615	86.36525	81.89014	77.52579	73.26318	69.09441	65.01257	61.01157	57.08601
1934.5	161.9114	160.7959	157.7398	153.3424	147.8181	141.914	135.8588	129.856	124.0095	118.3599	112.9132	107.6601	102.5857	97.67389	92.90951	88.27901	83.77044	79.3734	75.0788	70.87872	66.76621	62.73512	58.78003
1971	164.062	162.9567	159.9243	155.4525	150.0455	144.1449	138.0788	132.0538	126.1776	120.4942	115.0119	109.7228	104.6124	99.66529	94.86632	90.202	85.66039	81.23104	76.90485	72.67385	68.53102	64.4702	60.48592
2007.5	166.2144	165.119	162.1097	157.6632	152.2738	146.3774	140.3015	134.2553	128.3506	122.6342	117.1171	111.7924	106.6467	101.6648	96.83615	92.13393	87.55968	83.09843	78.74102	74.47945	70.30667	66.21647	62.20334
2044	168.3682	167.2824	164.2958	159.8743	154.5026	148.6111	142.5265	136.4602	130.5278	124.7794	119.228	113.8685	108.688	103.6717	98.80486	94.07417	89.46767	84.97489	80.58663	76.29485	72.09246	67.97322	63.93158
2080.5	170.5157	169.4393	166.4749	162.0781	156.7243	150.8384	144.7459	138.6606	132.7015	126.9218	121.337	115.9432	110.7284	105.6782	100.7801	96.01488	91.37652	86.85258	82.43382	78.11217	73.88052	69.73256	65.66273
2117	172.6649	171.5976	168.655	164.2825	158.9468	153.067	146.9676	140.8643	134.8794	129.0694	123.4518	118.0243	112.7758	107.6921	102.7592	97.96375	93.29391	88.73916	84.29025	79.93908	75.67847	71.50212	67.40441
2153.5	174.8156	173.7573	170.836	166.4876	161.1701	155.297	149.1915	143.0712	137.0614	131.2218	125.5721	120.1115	114.8297	109.7131	104.7478	99.92053	95.21957	90.63437	86.15566	81.77528	77.48605	73.28162	69.15634
2190	176.968	175.9184	173.0179	168.6933	163.394	157.5282	151.4174	145.2811	139.2474	133.379	127.6979	122.2047	116.8901	111.741	106.7436	101.885	97.15329	92.53798	88.02978	83.62052	79.30298	75.07077	70.91821
2226.5	179.1218	178.0808	175.2007	170.8997	165.6187	159.7605	153.6454	147.4938	141.4371	135.5406	129.8288	124.3037	118.9568	113.7756	108.7466	103.857	99.09483	94.44974	89.91238	85.47456	81.12901	76.86931	72.68976
2263	181.2772	180.2446	177.3845	173.1066	167.844	161.9941	155.8752	149.7094	143.6305	137.7067	131.9648	126.4083	121.0296	115.8167	110.7565	105.8362	101.044	96.36943	91.80323	87.33714	82.96387	78.67698	74.47073
2299.5	183.4341	182.4096	179.5691	175.3142	170.0699	164.2286	158.1068	151.9276	145.8273	139.877	134.1056	128.5182	123.1083	117.8642	112.7731	107.8224	103.0005	98.29683	93.7021	89.20804	84.80735	80.49354	76.26086
2336	185.5925	184.5759	181.7547	177.5223	172.2965	166.4642	160.3402	154.1483	148.0274	142.0514	136.2512	130.6335	125.1926	119.9177	114.7962	109.8156	104.9642	100.2318	95.60878	91.08704	86.6592	82.31876	78.05991
2372.5	187.7522	186.7434	183.9411	179.7311	174.5236	168.7008	162.5751	156.3714	150.2308	144.2297	138.4013	132.7538	127.2826	121.9773	116.8257	111.8154	106.935	102.174	97.52306	92.97393	88.51922	84.15241	79.86766
2409	189.9134	188.9122	186.1284	181.9408	176.7514	170.9382	164.8116	158.5968	152.4372	146.4118	140.5508	134.8791	129.3779	124.0426	118.8613	113.8217	108.9125	104.1233	99.44476	94.8685	90.3872	85.99427	81.68387
2445.5	192.0759	191.0821	188.3166	184.1503	178.9797	173.1766	167.0496	160.8244	154.6467	148.5975	142.7146	137.0091	131.4785	126.1136	120.9029	115.8344	110.8967	106.0796	101.3737	96.77057	92.26292	87.84414	83.50835
2482	194.2398	193.2533	190.5056	186.3608	181.2085	175.4158	169.2889	163.0542	156.8589	150.7868	144.8775	139.1438	133.5842	128.1901	122.9503	117.8532	112.8874	108.0427	103.3096	98.67993	94.14621	89.70182	85.34088
2518.5	196.4049	195.4255	192.6953	188.5717	183.4378	177.6556	171.5295	165.2859	159.0738	152.9794	147.0443	141.2829	135.6947	130.2718	125.0034	119.8779	114.8843	110.0122	105.2523	100.5963	96.03674	91.56699	87.18113
2555	198.5713	197.5989	194.8859	190.7832	185.6675	179.8963	173.7714	167.5195	161.2914	155.1753	149.215	143.4264	137.81	132.3587	127.062	121.9085	116.8873	111.9881	107.2017	102.5196	97.93446	93.4396	89.02906
2591.5	200.7389	199.7734	197.0772	192.9953	187.8978	182.1377	176.0145	169.755	163.5115	157.3744	151.3894	145.5741	139.9301	134.4507	129.1259	123.9448	118.8963	113.9703	109.1576	104.4497	99.83921	95.31946	90.88447
2628	202.9078	201.949	199.2695	195.2079	190.1286	184.3797	178.2588	171.9922	165.734	159.5766	153.5675	147.726	142.0546	136.5476	131.1952	125.9867	120.9112	115.9587	111.1199	106.3864	101.7508	97.20641	92.74719
2664.5	205.0779	204.1257	201.4625	197.421	192.3598	186.6225	180.5042	174.2312	167.959	161.7817	155.7492	149.8819	144.1836	138.6493	133.2696	128.034	122.9318	117.953	113.0884	108.3296	103.6691	99.10028	94.61706
2701	207.2493	206.3035	203.6563	199.6347	194.5915	188.8659	182.7506	176.4719	170.1861	163.9897	157.9342	152.0417	146.317	140.7557	135.349	130.0866	124.958	119.9532	115.063	110.2791	105.594	101.0009	96.4939
2737.5	209.4218	208.4823	205.8509	201.849	196.8237	191.11	184.9981	178.7141	172.4155	166.2006	160.1226	154.2053	148.4545	142.8666	137.4332	132.1444	126.9896	121.959	117.0435	112.2348	107.5252	102.9082	98.37756
2774	211.5955	210.6622	208.0463	204.0637	199.0563	193.3546	187.2466	180.9578	174.647	168.4141	162.3142	156.3726	150.5962	144.982	139.5223	134.2072	129.0265	123.9705	119.0299	114.1965	109.4627	104.8219	100.2679
2810.5	213.7704	212.8431	210.2424	206.279	201.2893	195.5999	189.4961	183.2031	176.8806	170.6302	164.5089	158.5434	152.7418	147.1018	141.616	136.275	131.0687	125.9873	121.0219	116.1641	111.4063	106.7419	102.1647
2847	215.9464	215.0251	212.4393	208.4949	203.5228	197.8457	191.7464	185.4497	179.1161	172.8489	166.7067	160.7178	154.8913	149.2257	143.7142	138.3476	133.1159	128.0095	123.0195	118.1375	113.3559	108.6681	104.068
2883.5	218.1235	217.2081	214.637	210.7112	205.7568	200.092	193.9976	187.6976	181.3535	175.0699	168.9074	162.8956	157.0446	151.3539	145.8169	140.4249	135.1681	130.037	125.0225	120.1165	115.3114	110.6004	105.9774

days	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	0.562515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	2.195309	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	3.828095	0.907581	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	5.460877	2.54036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	7.088144	4.167258	1.246742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	8.633047	5.707	2.786245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	10.19539	7.250517	4.325896	1.405228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	11.78496	8.808922	5.868344	2.944817	0.024205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	13.40501	10.3924	7.423354	4.486452	1.563753	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	15.05577	12.00488	9.001322	6.038559	3.104778	0.182699	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	16.68639	13.59692	10.55681	7.561533	4.604415	1.673262	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	18.28709	15.15927	12.08212	9.051933	6.064253	3.112194	0.183236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	19.91529	16.74955	13.63549	10.56973	7.548702	4.567991	1.620449	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	21.56976	18.36664	15.21604	12.11471	9.059491	6.046946	3.07263	0.129166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	23.24935	20.0094	16.82272	13.68613	10.59663	7.551201	4.546516	1.578067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	24.95294	21.67674	18.4545	15.28306	12.15949	9.080983	6.044669	3.047279	0.084545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	26.65861	23.34673	20.08945	16.88363	13.72637	10.61493	7.546672	4.518854	1.528239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	28.36095	25.01395	21.72217	18.48246	15.29191	12.14786	9.047741	5.989065	2.969181	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	30.08435	26.70278	23.37702	20.1039	16.88053	13.70423	10.57252	7.482999	4.43329	1.420825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	31.82794	28.41232	25.05309	21.74706	18.49132	15.28321	12.12024	9.000079	5.920488	2.879189	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	33.59092	30.14177	26.74957	23.4111	20.12345	16.88394	13.69009	10.5396	7.430288	4.360022	1.326621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	35.37252	31.89033	28.46564	25.09521	21.7761	18.50561	15.28129	12.10081	8.962045	5.862925	2.801431	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	37.16133	33.64659	30.18987	26.78793	23.4378	20.13677	16.88236	13.67228	10.50437	7.376624	4.287101	1.233872	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	38.94568	35.39884	31.91056	28.47755	25.09683	21.76567	18.48158	15.24225	12.04555	8.889464	5.772105	2.691634	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	40.74662	37.16814	33.64873	30.18509	26.77419	23.41331	20.09993	16.83174	13.60658	10.42248	7.277543	4.169988	1.098067	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	42.56357	38.95388	35.40376	31.90989	28.46924	25.07903	21.73674	18.44005	15.18681	11.97501	8.802785	5.668377	2.570089	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	44.39595	40.75546	37.17506	33.65137	30.18134	26.7622	23.39138	20.06656	16.78557	13.54641	10.34721	7.186211	4.06176	0.972245	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	46.24323	42.57236	38.96206	35.40894	31.90993	28.46221	25.06324	21.71064	18.40225	15.13606	11.91019	8.722897	5.572527	2.457506	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	48.09938	44.39852	40.75872	37.17655	33.64892	30.17301	26.74622	23.3662	20.03075	16.73785	13.48563	10.27233	7.096311	3.956008	0.849934	0	0	0	0	0	0	0	0	0	0	0	0
1825	49.93936	46.20889	42.53995	38.92911	35.37322	31.86946	28.41522	25.00811	21.64593	18.32665	15.04838	11.80938	8.607977	5.442639	2.311889	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	51.57871	47.819	44.12129	40.48212	36.89833	33.36707	29.8857	26.45183	23.06325	19.71791	16.4139	13.14948	9.922985	6.732872	3.577677	0.456044	0	0	0	0	0	0	0	0	0	0	0
1898	53.23109	49.4425	45.71637	42.04922	38.43787	34.87943	31.37127	27.91097	24.4963	21.12519	17.79575	14.50621	11.2549	8.040271	4.860874	1.715319	0	0	0	0	0	0	0	0	0	0	0
1934.5	54.89608	51.07896	47.32476	43.62996	39.99138	36.40609	32.87146	29.38503	25.94458	22.54802	19.19343	15.87905	12.6032	9.36433	6.160981	2.991774	0	0	0	0	0	0	0	0	0	0	0
1971	56.57331	52.72799	48.94604	45.22393	41.55843	37.94661	34.38581	30.87357	27.40763	23.9859	20.60647	17.26752	13.96741	10.70456	7.477511	4.284886	1.125379	0	0	0	0	0	0	0	0	0	0
2007.5	58.26239	54.3892	50.57983	46.83071	43.13861	39.50057	35.91391	32.37614	28.88501	25.43841	22.0344	18.67117	15.34706	12.06049	8.809992	5.59419	2.411778	0	0	0	0	0	0	0	0	0	0
2044	59.9626	56.06187	52.22539	48.44958	44.73117	41.06721	37.45497	33.89198	30.37594	26.90473	23.47642	20.08918	16.74134	13.4313	10.15761	6.918867	3.713776	0.541151	0	0	0	0	0	0	0	0	0
2080.5	61.66605	57.73807	53.87479	50.07259	46.32818	42.63858	39.00105	35.41311	31.87243	28.3769	24.92456	21.51357	18.14224	14.809	11.51235	8.250906	5.023366	1.828491	0	0	0	0	0	0	0	0	0
2117	63.38034	59.42543	55.53564	51.70733	47.9372	44.22224	40.55971	36.94708	33.38204	29.86245	26.38633	22.95185	19.5573	16.20109	12.88173	9.597821	6.348058	3.131202	0	0	0	0	0	0	0	0	0
2153.5	65.10517	61.12361	57.2076	53.35347	49.5579	45.81786	42.13059	38.49355	34.90441	31.36101	27.86138	24.40365	20.98612	17.60718	14.26534	10.9592	7.687443	4.448822	1.242168	0	0	0	0	0	0	0	0
2190	66.84024	62.83232	58.89036	55.01069	51.18995	47.4251	43.71336	40.05216	36.43917	32.87223	29.34932	25.86859	22.42832	19.0269	15.66281	12.33466	9.041128	5.780957	2.552978	0	0	0	0	0	0	0	0
2226.5	68.58527	64.55126	60.58364	56.6787	52.83305	49.04365	45.30768	41.62259	37.986	34.39575	30.84981	27.34632	23.88354	20.45986	17.07376	13.72383	10.40873	7.127225	3.878126	0.660366	0	0	0	0	0	0	0
2263	70.33999	66.28017	62.28715	58.35719	54.4869	50.6732	46.91326	43.20451	39.54457	35.93124	32.36251	28.83649	25.35144	21.90573	18.49783	15.12633	11.78989	8.487257	5.217243	1.978733	0	0	0	0	0	0	0
2299.5	72.10414	68.01878	64.00062	60.0459	56.15121	52.31345	48.52979	44.79763	41.11457	37.47841	33.88711	30.33879	26.83168	23.36416	19.93468	16.54183	13.18426	9.8607	6.569972	3.310952	0.089208	0	0	0	0	0	0
2336	73.87748	69.76683	65.72378	61.74455	57.82571	53.96414	50.15699	46.40165	42.6957	39.03693	35.4233	31.85289	28.32395	24.83483	21.38399	17.96999	14.59149	11.24721	7.935968	4.656632	1.408137	0	0	0	0	0	0
2372.5	75.65977	71.52408	67.45639	63.45289	59.51014	55.625	51.79459	48.01629	44.28768	40.60653	36.97077	33.3785	29.82794	26.31743	22.84543	19.4105	16.01126	12.64647	9.3149	6.015438	2.747009	0	0	0	0	0	0
2409	77.45078	73.2903	69.19821	65.17068	61.20425	57.29576	53.44232	49.64129	45.89023	42.18692	38.52925	34.91533	31.34336	27.81167	24.31871	20.86303	17.44327	14.05814	10.70645	7.387047	4.098869	0.840923	0	0	0	0	0
2445.5	79.2503	75.06526	70.949	66.89768	62.90779	58.97618	55.09993	51.27639	47.50311	43.77783	40.09847	36.4631	32.86992	29.31725	25.80353	22.32731	18.88721	15.48194	12.1103	8.771149	5.463401	2.186039	0	0	0	0	0
2482	81.0581	76.84875	72.70855	68.63365	64.62054	60.66602	56.76718	52.92133	49.12603	45.37901	41.67816	38.02154	34.40734	30.83389	27.29961	23.80304	20.34279	16.91757	13.52617	10.16744	6.8403	3.543723	0.278782	0	0	0	0
2518.5	82.87387	78.64043	74.47652	70.37827	66.34214	62.36493	58.4437	54.57577	50.75865	46.99008	43.26793	39.59026	35.95525	32.36121	28.80656	25.28981	21.8096	18.36461	14.95363	11.57551	8.22915	4.91353	1.627674	0	0	0	0
2555	84.69753	80.44022	76.25282	72.13143	68.07251	64.07281	60.12941	56.23959	52.40086	48.61093	44.86769	41.16916	37.51353	33.89908	30.32424	26.78751	23.28751	19.82293	16.39255	12.9952	9.629796	6.295301	2.990739	0	0	0	0
2591.5	86.5289	82.24795	78.03727	73.89295	69.81143	65.78947	61.82408	57.91257	54.05242	50.24134	46.47719	42.75799	39.08192	35.44725	31.8524	28.29587	24.77626	21.29227	17.84265	14.42625	11.04197	7.688762	4.365655	1.071729	0	0	0
2628	88.3678	84.06342	79.82967	75.66264	71.55872	67.51468	63.52752	59.5945	55.71313	51.88108	48.09621	44.35653	40.66019	37.00548	33.3908	29.81464	26.2756	22.77236	19.30368	15.8684	12.4654	9.093647	5.752156	2.439989	0	0	0
2664.5	90.21406	85.88645	81.62984	77.44029	73.31418	69.24825	65.2395	61.28519	57.38277	53.52994	49.72453	45.96454	42.24812	38.57355	34.93921	31.3436	27.78529	24.26298	20.7754	17.32139	13.89984	10.5097	7.14998	3.819743	0.518729	0	0
2701	92.0675	87.71687	83.4376	79.22573	75.07763	70.99001	66.95986	62.98442	59.06115	55.18771	51.36194	47.58182	43.8455	40.15123	36.49741	32.8825	29.3051	25.76387	22.25756	18.78499	15.34504	11.93667	8.558876	5.210721	1.891307	0	0
2737.5	93.92797	89.55452	85.25279	81.01878	76.84888	72.73975	68.68839	64.69201	60.74806	56.8542	53.00824	49.20816	45.45211	41.73832	38.06517	34.43114	30.8348	27.27482	23.74993	20.25895	16.80077	13.37432	9.978605	6.61268	3.275645	0	0
2774	95.79531	91.39923	87.07523	82.81929	78.62776	74.49731	70.42492	66.40778	62.44333	58.52921	54.66323	50.84337	47.06774	43.3346	39.64229	35.9893	32.37418	28.7956	25.2523	21.74307	18.26679	14.82242	11.40893	8.025384	4.670873	1.34455	0
2810.5	97.66936	93.25086	88.90478	84.62708	80.41411	76.26253	72.16927	68.13154	64.14676	60.21256	56.32674	52.48725	48.69222	44.93987	41.22857	37.55677	33.92304	30.32602	26.76444	23.23711	19.7429	16.28074	12.84963	9.448602	6.076759	2.733236	0
2847	99.54999	95.10925	90.74127	86.442	82.20777	78.03522	73.92128	69.86313	65.85819	61.90408	57.99857	54.13962	50.32534	46.55396	42.82381	39.13336	35.48116	31.86585	28.28615	24.74087	21.22887	17.74908	14.30048	10.88212	7.493078	4.132502	0.799766
2883.5	101.4371	96.97426	92.58456	88.2639	84.00858	79.81524	75.68078	71.60239	67.57745	63.60358	59.67855	55.8003	51.96693	48.17666	44.42782	40.71887	37.04836	33.41491	29.81724	26.25415	22.7245	19.22721	15.76127	12.32571	8.919614	5.542119	2.192397

N O R M A L I Z E D   E X C E S S   P O R E   P R E S S U R E (%)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	92.90502	99.91771	99.90954	99.87706	99.80819	99.56389	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	91.37177	99.73175	99.93711	99.92771	99.90837	99.87489	99.80287	99.53538	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	90.2578	99.36906	99.89207	99.94177	99.93181	99.91485	99.88666	99.83058	99.66468	83.82378	0	0	0	0	0	0	0	0	0	0	0	0	0
146	89.64368	98.91912	99.81661	99.92504	99.94506	99.93546	99.92046	99.8964	99.85146	99.73765	98.87808	0	0	0	0	0	0	0	0	0	0	0	0
182.5	89.07373	98.41125	99.71374	99.89032	99.9366	99.94541	99.9355	99.92053	99.89652	99.8517	99.7384	98.89159	0	0	0	0	0	0	0	0	0	0	0
219	88.61819	97.89495	99.58671	99.84733	99.91613	99.94187	99.94475	99.93435	99.91878	99.89353	99.84549	99.71843	98.41538	0	0	0	0	0	0	0	0	0	0
255.5	88.29472	97.40497	99.44108	99.798	99.89232	99.92887	99.94479	99.94399	99.93316	99.91695	99.89036	99.83873	99.69514	97.22092	0	0	0	0	0	0	0	0	0
292	88.01206	96.93664	99.2769	99.74102	99.86512	99.91293	99.93563	99.94585	99.94243	99.93087	99.91339	99.88406	99.8247	99.64083	0	0	0	0	0	0	0	0	0

days	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

328.5	87.75008	96.48967	99.09645	99.67597	99.83436	99.89489	99.92382	99.93914	99.94549	99.93993	99.92719	99.90753	99.87332	99.79895	99.513	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	87.54737	96.07999	98.9077	99.60484	99.80108	99.87567	99.91118	99.93043	99.94114	99.94455	99.93719	99.92311	99.90084	99.86041	99.76436	99.2443	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	87.50748	95.75165	98.72977	99.53454	99.76887	99.85775	99.89983	99.92277	99.93619	99.94373	99.94494	99.93663	99.92225	99.89942	99.85759	99.75618	99.15321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	87.38755	95.41465	98.53705	99.45401	99.73129	99.83664	99.88624	99.91323	99.92923	99.93897	99.94418	99.94337	99.93371	99.9178	99.89183	99.84189	99.70624	97.93294	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	87.27935	95.10089	98.34246	99.36817	99.69083	99.81407	99.87182	99.90314	99.92177	99.9334	99.94053	99.94386	99.94118	99.93005	99.9121	99.88174	99.81934	99.61757	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	87.19531	94.8148	98.15027	99.27869	99.64813	99.79041	99.85685	99.89276	99.91414	99.92761	99.93622	99.94137	99.94309	99.93863	99.92596	99.90554	99.86956	99.78929	99.4522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	87.13099	94.55365	97.96188	99.18626	99.60332	99.76569	99.84136	99.8821	99.90634	99.92169	99.93169	99.93811	99.94167	99.94191	99.93572	99.92137	99.89793	99.85459	99.74725	99.03485	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	87.05679	94.30237	97.77278	99.08905	99.5552	99.73906	99.82469	99.87065	99.89794	99.91525	99.92666	99.93419	99.93889	99.94105	99.93981	99.93169	99.915	99.88694	99.8312	99.66709	88.00914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	86.99211	94.06872	97.58752	98.98931	99.50479	99.71112	99.8073	99.85877	99.88926	99.90863	99.92145	99.93008	99.93573	99.93899	99.93987	99.93709	99.92684	99.90719	99.87268	99.79731	99.50332	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	86.94075	93.85369	97.40791	98.88818	99.45255	99.68208	99.78932	99.84657	99.88041	99.9019	99.91619	99.9259	99.93245	99.93659	99.93861	99.93825	99.93383	99.92119	99.89779	99.85431	99.7464	99.02238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	86.90068	93.65562	97.23429	98.7862	99.39866	99.652	99.77076	99.83405	99.87139	99.89508	99.91086	99.92168	99.92911	99.93403	99.9369	99.93778	99.93618	99.92995	99.91457	99.88628	99.82974	99.66134	69.1496	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	86.85601	93.46514	97.06301	98.68198	99.34228	99.62025	99.75116	99.82086	99.86188	99.88788	99.90523	99.91717	99.92548	99.93115	99.93473	99.93645	99.9362	99.93322	99.9248	99.90581	99.87015	99.79082	99.46241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	86.79404	93.27404	96.89039	98.57394	99.28247	99.58621	99.73007	99.80662	99.85159	99.88006	99.89906	99.91218	99.92137	99.92776	99.93199	99.93436	99.93495	99.93344	99.92872	99.91732	99.89283	99.84407	99.7137	98.25326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	86.74147	93.09613	96.7237	98.46595	99.22131	99.5511	99.70832	99.79201	99.84109	99.87211	99.89282	99.90714	99.91724	99.92436	99.92921	99.9322	99.93346	99.93289	99.92999	99.92319	99.90796	99.8757	99.8049	99.54653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	86.69718	92.93032	96.56296	98.35838	99.15898	99.51498	99.68595	99.77702	99.83037	99.86404	99.8865	99.90206	99.91309	99.92094	99.92642	99.92998	99.93184	99.93202	99.93025	99.92574	99.91635	99.89601	99.85202	99.73944	98.91014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	86.66018	92.77566	96.4081	98.25153	99.09566	99.47791	99.66295	99.76166	99.81942	99.85583	99.8801	99.89694	99.90891	99.9175	99.9236	99.92772	99.93015	99.93096	99.93004	99.92692	99.9205	99.90776	99.88029	99.8172	99.60788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	86.6289	92.63081	96.25879	98.14554	99.03146	99.43991	99.63931	99.74591	99.80824	99.84747	99.87361	99.89175	99.90469	99.91403	99.92075	99.92542	99.92838	99.92976	99.92954	99.92744	99.92279	99.91399	99.89674	99.85868	99.76059	99.20426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	86.59295	92.48909	96.11158	98.0388	98.96551	99.4004	99.61462	99.72944	99.79653	99.83873	99.86681	99.88631	99.90024	99.91035	99.91768	99.92289	99.92635	99.92825	99.92861	99.92728	99.92381	99.9172	99.90512	99.88109	99.82471	99.64236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	86.56261	92.35624	95.96983	97.93338	98.899	99.36008	99.58933	99.71258	99.7846	99.82984	99.85993	99.88082	99.89576	99.90665	99.91461	99.92035	99.92429	99.92668	99.92758	99.92691	99.92437	99.91929	99.91022	99.89366	99.85929	99.76904	99.29337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	86.5373	92.2316	95.83339	97.82942	98.83208	99.31903	99.56347	99.69535	99.77243	99.8208	99.85295	99.87526	99.89125	99.90292	99.91152	99.91779	99.92221	99.92506	99.92646	99.92637	99.92461	99.92071	99.91368	99.90139	99.8784	99.82706	99.66125	70.76378	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	86.51649	92.11457	95.70209	97.72706	98.7649	99.27731	99.53706	99.67775	99.76003	99.81162	99.84588	99.86965	99.88669	99.89917	99.90841	99.91521	99.92011	99.92341	99.92527	99.92572	99.92463	99.92167	99.91616	99.90667	99.88999	99.85725	99.77479	99.36418	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	86.49974	92.00461	95.57575	97.6264	98.69759	99.23499	99.51013	99.65979	99.74739	99.80229	99.83872	99.86398	99.8821	99.8954	99.90528	99.91262	99.91799	99.92172	99.92403	99.92496	99.92446	99.9223	99.91798	99.91052	99.89783	99.87489	99.82621	99.67591	94.80857	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	86.48131	91.89778	95.45213	97.52632	98.62953	99.19168	99.48239	99.64125	99.73434	99.79266	99.83132	99.85813	99.87736	99.89149	99.90202	99.9099	99.91573	99.9199	99.92261	99.92399	99.92401	99.92251	99.91913	99.91315	99.90314	99.88592	99.85311	99.77406	99.40176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	86.46028	91.79314	95.33068	97.42663	98.56068	99.14733	99.45378	99.62207	99.72083	99.7827	99.82368	99.85207	99.87244	99.88743	99.89863	99.90705	99.91334	99.91792	99.92103	99.92281	99.92329	99.92235	99.91973	99.91489	99.90679	99.89326	99.86918	99.81915	99.66846	94.80073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	86.44268	91.69437	95.21365	97.32878	98.49195	99.10253	99.4247	99.60254	99.70709	99.77257	99.81592	99.84595	99.86748	99.88334	99.89522	99.90419	99.91094	99.91592	99.91942	99.92159	99.92249	99.92206	99.9201	99.91621	99.90961	99.89877	99.88035	99.84558	99.76275	99.3691	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	86.42822	91.60106	95.1009	97.23281	98.42344	99.05732	99.39517	99.58266	99.69311	99.76229	99.80807	99.83975	99.86248	99.87922	99.89178	99.9013	99.90852	99.91391	99.91779	99.92034	99.92163	99.92166	99.92028	99.9172	99.91181	99.90302	99.88852	99.86292	99.81004	99.65128	92.67793	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	86.4166	91.51288	94.99225	97.13876	98.35525	99.01179	99.36521	99.56245	99.67889	99.75185	99.8001	99.83349	99.85742	99.87507	99.88833	99.8984	99.90609	99.91188	99.91613	99.91904	99.92072	99.92117	99.92032	99.91792	99.91355	99.90636	99.89473	99.87512	99.83831	99.75082	99.32948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	86.40759	91.42949	94.88754	97.04663	98.28744	98.96597	99.33485	99.54191	99.66444	99.74125	99.79204	99.82715	99.85232	99.87088	99.88485	99.89549	99.90363	99.90984	99.91445	99.91771	99.91975	99.9206	99.92022	99.91843	99.9149	99.90901	99.89956	99.88413	99.85703	99.80121	99.6332	89.04065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	86.39898	91.34925	94.78575	96.9559	98.21974	98.91972	99.30399	99.52094	99.64967	99.73043	99.7838	99.82069	99.84713	99.86662	99.8813	99.89251	99.90113	99.90773	99.91271	99.91631	99.91869	99.91991	99.91995	99.9187	99.91588	99.91104	99.90327	99.89085	99.87002	99.83102	99.7381	99.27945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	86.39027	91.27165	94.68656	96.86645	98.15214	98.87302	99.27259	99.49954	99.63458	99.71936	99.77539	99.81409	99.84182	99.86227	99.87768	99.88947	99.89856	99.90556	99.9109	99.91483	99.91754	99.9191	99.91953	99.91874	99.91654	99.91256	99.90611	99.89593	99.87943	99.85048	99.79064	99.60732	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	86.3837	91.19808	94.59087	96.77891	98.08509	98.82619	99.24087	99.47783	99.61926	99.70814	99.76687	99.80742	99.83647	99.85788	99.87403	99.8864	99.89597	99.90338	99.90907	99.91333	99.91636	99.91825	99.91904	99.91868	99.91702	99.91377	99.90842	99.9	99.88667	99.86439	99.82254	99.72172	99.19316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	86.3791	91.12828	94.49853	96.69327	98.01863	98.77926	99.20885	99.45584	99.60371	99.69676	99.75824	99.80068	99.83106	99.85346	99.87036	99.88332	99.89337	99.90118	99.90722	99.91181	99.91514	99.91735	99.91848	99.91851	99.91734	99.91474	99.9103	99.9033	99.89238	99.87476	99.84387	99.77963	99.57832	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	86.37631	91.06205	94.40943	96.60952	97.95282	98.73229	99.17657	99.43357	99.58796	99.68522	99.7495	99.79385	99.8256	99.849	99.86666	99.88022	99.89075	99.89897	99.90536	99.91027	99.9139	99.91641	99.91787	99.91826	99.91752	99.91548	99.91183	99.90599	99.89695	99.88275	99.85905	99.81445	99.70578	99.10159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	86.37519	90.99918	94.32342	96.52764	97.88768	98.68532	99.14404	99.41104	99.57199	99.67353	99.74065	99.78696	99.82008	99.8445	99.86293	99.87709	99.88811	99.89674	99.90348	99.9087	99.91264	99.91544	99.9172	99.91793	99.91759	99.91605	99.91307	99.9082	99.90068	99.88905	99.87036	99.83759	99.76907	99.54973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	86.3747	90.93883	94.23994	96.44731	97.82307	98.63827	99.11121	99.38821	99.55576	99.66164	99.73166	99.77995	99.81449	99.83994	99.85915	99.87392	99.88543	99.89447	99.90157	99.9071	99.91133	99.91441	99.91646	99.91751	99.91753	99.91644	99.91404	99.90999	99.90368	99.89404	99.87897	99.85387	99.80647	99.68965	98.9979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	86.37384	90.88019	94.15845	96.36822	97.75883	98.59103	99.07801	99.365	99.53925	99.64953	99.7225	99.77282	99.80879	99.83529	99.8553	99.8707	99.8827	99.89215	99.8996	99.90544	99.90995	99.91331	99.91564	99.91698	99.91734	99.91665	99.91475	99.91139	99.90608	99.89799	99.8856	99.86574	99.83084	99.75721	99.51429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	86.37438	90.82442	94.07972	96.2909	97.69533	98.54389	99.04464	99.34157	99.52253	99.63727	99.71322	99.7656	99.80303	99.83061	99.85142	99.86744	99.87995	99.88981	99.89762	99.90377	99.90856	99.91219	99.91478	99.9164	99.91707	99.91674	99.9153	99.91254	99.90807	99.90126	99.89096	99.87492	99.84818	99.79738	99.6699	98.83507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	86.3762	90.77136	94.00362	96.21534	97.63261	98.49689	99.01112	99.31793	99.50562	99.62486	99.70384	99.75831	99.79722	99.82588	99.84751	99.86417	99.87719	99.88746	99.89562	99.90208	99.90715	99.91104	99.91389	99.91578	99.91674	99.91675	99.91572	99.91348	99.90974	99.90399	99.89535	99.88218	99.86109	99.82393	99.7447	99.47403	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	86.37922	90.72086	93.93006	96.14149	97.57068	98.45005	98.97747	99.29408	99.48852	99.6123	99.69435	99.75093	99.79135	99.82111	99.84357	99.86087	99.8744	99.8851	99.8936	99.90037	99.90572	99.90987	99.91297	99.91512	99.91635	99.91667	99.91601	99.91425	99.91113	99.90627	99.89898	99.88803	99.87104	99.8427	99.78853	99.65017	98.64225	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	86.38334	90.67279	93.85894	96.06933	97.50956	98.40339	98.94372	99.27005	99.47124	99.5996	99.68476	99.74348	99.78543	99.8163	99.8396	99.85755	99.87159	99.88271	99.89158	99.89865	99.90427	99.90868	99.91202	99.91442	99.91591	99.91652	99.91621	99.91486	99.91229	99.90819	99.90202	99.89284	99.87891	99.85663	99.81724	99.73242	99.43247	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	86.38806	90.6267	93.78994	95.99867	97.44915	98.35689	98.90984	99.2458	99.45377	99.58673	99.67503	99.73594	99.77943	99.81143	99.83559	99.85419	99.86876	99.8803	99.88952	99.89691	99.9028	99.90745	99.91104	99.91367	99.91542	99.9163	99.91629	99.91533	99.91324	99.90979	99.90455	99.89679	99.88521	99.86729	99.83734	99.77975	99.63	98.40137	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	86.39146	90.58114	93.72203	95.92883	97.38902	98.31025	98.87563	99.2212	99.43598	99.57362	99.66511	99.72824	99.77331	99.80646	99.83148	99.85076	99.86585	99.87783	99.88741	99.8951	99.90126	99.90616	99.90998	99.91284	99.91482	99.91596	99.91624	99.91561	99.91395	99.91105	99.90658	99.89997	99.89021	99.87545	99.85184	99.80987	99.71827	99.37889	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	86.37986	90.52598	93.648	95.85486	97.32584	98.26121	98.83951	99.19509	99.417	99.55954	99.65441	99.71988	99.76662	99.801	99.82693	99.84691	99.86256	99.87499	99.88493	99.89293	99.89937	99.90451	99.90855	99.91162	99.91381	99.91516	99.91567	99.91531	99.91397	99.91149	99.90757	99.90175	99.89322	99.88053	99.86079	99.82745	99.76172	99.57948	96.97979	0	0	0	0	0	0	0	0	0	0	0	0
1898	86.36959	90.47305	93.57615	95.78242	97.26345	98.21239	98.80332	99.1688	99.39783	99.54531	99.64359	99.71143	99.75987	99.79549	99.82235	99.84304	99.85925	99.87213	99.88245	99.89076	99.89747	99.90285	99.90711	99.91039	99.91278	99.91434	99.91508	99.91497	99.91393	99.91182	99.9084	99.90328	99.8958	99.8848	99.86809	99.84098	99.79141	99.67628	99.1413	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	86.36058	90.42225	93.50641	95.7115	97.20184	98.16382	98.76707	99.14234	99.37848	99.53093	99.63265	99.7029	99.75305	99.78993	99.81773	99.83914	99.85593	99.86926	99.87995	99.88859	99.89557	99.90119	99.90567	99.90915	99.91174	99.9135	99.91446	99.91458	99.91383	99.91207	99.9091	99.9046	99.89802	99.88843	99.87413	99.85167	99.81294	99.73317	99.48425	0	0	0	0	0	0	0	0	0	0	0	0
1971	86.35276	90.3735	93.43869	95.64207	97.14104	98.11551	98.73078	99.11573	99.35897	99.51641	99.62159	99.69428	99.74617	99.78432	99.81307	99.83522	99.85258	99.86637	99.87745	99.8864	99.89365	99.89952	99.90421	99.9079	99.91069	99.91265	99.91381	99.91417	99.91368	99.91224	99.90968	99.90572	99.89993	99.89153	99.87919	99.86032	99.82922	99.77053	99.6238	98.66297	0	0	0	0	0	0	0	0	0	0	0
2007.5	86.34606	90.32669	93.37294	95.57408	97.08104	98.06749	98.69448	99.08898	99.3393	99.50174	99.61042	99.68557	99.73923	99.77866	99.80838	99.83127	99.84921	99.86347	99.87493	99.8842	99.89173	99.89784	99.90275	99.90664	99.90963	99.91178	99.91314	99.91372	99.91348	99.91233	99.91015	99.90669	99.90158	99.8942	99.88347	99.86742	99.84192	99.79688	99.69937	99.34517	0	0	0	0	0	0	0	0	0	0	0
2044	86.34038	90.28173	93.30906	95.50751	97.02185	98.01976	98.65818	99.06211	99.31947	99.48693	99.59914	99.67678	99.73222	99.77296	99.80366	99.8273	99.84582	99.86056	99.8724	99.882	99.88981	99.89615	99.90129	99.90538	99.90855	99.91089	99.91245	99.91324	99.91323	99.91237	99.91052	99.90751	99.90301	99.8965	99.88713	99.87334	99.85208	99.81641	99.74664	99.55607	97.19677	0	0	0	0	0	0	0	0	0	0
2080.5	86.33516	90.23813	93.24672	95.44213	96.96331	97.97225	98.62183	99.03506	99.29945	99.47196	99.58773	99.66788	99.72513	99.76719	99.79888	99.82328	99.8424	99.85761	99.86985	99.87977	99.88786	99.89445	99.89985	99.90409	99.90745	99.90998	99.91173	99.91272	99.91293	99.91232	99.9108	99.90818	99.90422	99.89847	99.89023	99.87828	99.86029	99.83132	99.77874	99.65799	99.11805	0	0	0	0	0	0	0	0	0	0
2117	86.33088	90.19625	93.18614	95.37811	96.90558	97.92507	98.58551	99.00792	99.27929	99.45685	99.5762	99.65891	99.71797	99.76137	99.79407	99.81924	99.83896	99.85466	99.86729	99.87754	99.8859	99.89274	99.8983	99.90279	99.90634	99.90905	99.91099	99.91217	99.91259	99.91223	99.911	99.90875	99.90526	99.90018	99.89292	99.8825	99.8671	99.84312	99.80205	99.71827	99.46238	0	0	0	0	0	0	0	0	0	0
2153.5	86.32751	90.156	93.12727	95.31543	96.84866	97.87823	98.54923	98.98068	99.259	99.44162	99.56457	99.64983	99.71075	99.7555	99.78922	99.81516	99.8355	99.85168	99.86471	99.87529	99.88394	99.89102	99.8968	99.90149	99.90522	99.90811	99.91023	99.91159	99.91223	99.91209	99.91113	99.90922	99.90616	99.90167	99.89526	99.88612	99.87283	99.85268	99.81971	99.75802	99.60604	98.67895	0	0	0	0	0	0	0	0	0
2190	86.32499	90.11733	93.07006	95.25405	96.79253	97.83175	98.51303	98.95337	99.23859	99.42626	99.55283	99.64068	99.70346	99.74959	99.78433	99.81107	99.83202	99.84869	99.86212	99.87304	99.88196	99.88929	99.89529	99.90017	99.90409	99.90716	99.90945	99.911	99.91183	99.91191	99.9112	99.9096	99.90694	99.90297	99.8973	99.88925	99.87769	99.86055	99.83352	99.78615	99.68475	99.32782	0	0	0	0	0	0	0	0	0
2226.5	86.32328	90.08015	93.01444	95.19395	96.73721	97.78564	98.4769	98.92599	99.21806	99.41079	99.54099	99.63144	99.69611	99.74363	99.77941	99.80694	99.82852	99.84568	99.85952	99.87077	99.87998	99.88755	99.89377	99.89885	99.90295	99.9062	99.90866	99.91038	99.9114	99.91169	99.91122	99.9099	99.90761	99.90411	99.89908	99.89197	99.88186	99.86713	99.84459	99.80706	99.73435	99.53957	97.49664	0	0	0	0	0	0	0	0
2263	86.32232	90.04441	92.96037	95.13511	96.68268	97.7399	98.44086	98.89855	99.19742	99.3952	99.52905	99.62213	99.6887	99.73762	99.77445	99.80279	99.82499	99.84266	99.8569	99.86849	99.87799	99.88581	99.89224	99.89752	99.90181	99.90522	99.90785	99.90975	99.91094	99.91143	99.91119	99.91014	99.90817	99.9051	99.90065	99.89435	99.88546	99.8727	99.85365	99.82319	99.76841	99.64446	99.11762	0	0	0	0	0	0	0	0
2299.5	86.32209	90.01006	92.90779	95.07748	96.62895	97.69455	98.40493	98.87106	99.17667	99.37949	99.51701	99.61274	99.68123	99.73156	99.76946	99.7986	99.82144	99.83962	99.85427	99.86621	99.87599	99.88406	99.89071	99.89618	99.90065	99.90423	99.90703	99.90909	99.91046	99.91114	99.91111	99.91031	99.90865	99.90596	99.90202	99.89643	99.88859	99.87746	99.86117	99.83598	99.7932	99.70699	99.45126	86.11629	0	0	0	0	0	0	0
2336	86.32254	89.97703	92.85666	95.02106	96.57599	97.64959	98.36911	98.84354	99.15583	99.36368	99.50488	99.60327	99.6737	99.72546	99.76442	99.79439	99.81788	99.83656	99.85163	99.86391	99.87398	99.8823	99.88917	99.89484	99.89948	99.90323	99.90619	99.90842	99.90996	99.91082	99.91099	99.91042	99.90904	99.90671	99.90323	99.89827	99.89132	99.88155	99.8675	99.84634	99.81201	99.74845	99.595	98.74189	0	0	0	0	0	0	0
2372.5	86.32363	89.94526	92.80693	94.96579	96.52381	97.60502	98.33342	98.816	99.1349	99.34777	99.49265	99.59372	99.6661	99.7193	99.75935	99.79016	99.81429	99.83349	99.84898	99.8616	99.87196	99.88053	99.88762	99.89348	99.8983	99.90222	99.90534	99.90773	99.90944	99.91047	99.91083	99.91049	99.90937	99.90736	99.90429	99.89988	99.89372	99.88511	99.87288	99.85489	99.82675	99.7779	99.67494	99.32794	0	0	0	0	0	0	0
2409	86.32534	89.91472	92.75854	94.91167	96.47241	97.56087	98.29787	98.78844	99.11388	99.33176	99.48034	99.58409	99.65844	99.7131	99.75425	99.78589	99.81067	99.8304	99.84631	99.85928	99.86994	99.87875	99.88606	99.89212	99.89712	99.9012	99.90448	99.90703	99.90889	99.91009	99.91064	99.9105	99.90963	99.90792	99.90522	99.90131	99.89583	99.88821	99.87751	99.86205	99.83859	99.79986	99.72577	99.53268	97.87652	0	0	0	0	0	0
2445.5	86.32762	89.88535	92.71147	94.85867	96.42176	97.51712	98.26246	98.76087	99.09279	99.31566	99.46793	99.57439	99.65073	99.70685	99.74911	99.78159	99.80704	99.82729	99.84362	99.85694	99.8679	99.87696	99.88449	99.89075	99.89592	99.90017	99.90361	99.90631	99.90833	99.90969	99.91041	99.91047	99.90982	99.90839	99.90604	99.90258	99.8977	99.89094	99.88152	99.86812	99.84828	99.81684	99.76089	99.63678	99.14316	0	0	0	0	0	0
2482	86.33045	89.85711	92.66566	94.80675	96.37187	97.47378	98.22721	98.7333	99.07163	99.29946	99.45543	99.56461	99.64295	99.70056	99.74393	99.77727	99.80338	99.82416	99.84093	99.8546	99.86585	99.87517	99.88292	99.88937	99.89472	99.89913	99.90272	99.90557	99.90774	99.90927	99.91016	99.9104	99.90997	99.90879	99.90675	99.90369	99.89936	99.89334	99.88501	99.87332	99.85635	99.83033	99.78656	99.69972	99.45157	94.03317	0	0	0	0	0
2518.5	86.33379	89.82993	92.62107	94.75589	96.32272	97.43086	98.19212	98.70574	99.05041	99.28318	99.44285	99.55476	99.63511	99.69422	99.73871	99.77292	99.7997	99.82102	99.83822	99.85225	99.86379	99.87337	99.88133	99.88798	99.89351	99.89808	99.90183	99.90483	99.90714	99.90882	99.90987	99.91029	99.91006	99.90912	99.90738	99.90468	99.90082	99.89546	99.88808	99.87781	99.86316	99.84129	99.80612	99.74183	99.5905	98.83488	0	0	0	0	0
2555	86.33763	89.8038	92.5785	94.70607	96.2743	97.38836	98.1572	98.6782	99.02913	99.26681	99.43019	99.54489	99.62722	99.68784	99.73345	99.76854	99.796	99.81786	99.83549	99.84988	99.86173	99.87155	99.87974	99.88658	99.89229	99.89702	99.90092	99.90406	99.90653	99.90835	99.90956	99.91015	99.91011	99.90939	99.90792	99.90556	99.90213	99.89735	99.89078	99.88171	99.86896	99.85036	99.82149	99.77193	99.66944	99.34138	0	0	0	0	0
2591.5	86.34193	89.77867	92.53542	94.65726	96.22662	97.34628	98.12246	98.65069	99.00779	99.25037	99.41745	99.53485	99.61926	99.68139	99.72817	99.76413	99.79228	99.81468	99.83275	99.84751	99.85965	99.86973	99.87814	99.88518	99.89106	99.89596	99.9	99.90329	99.90589	99.90786	99.90922	99.90998	99.91012	99.90961	99.90838	99.90633	99.90329	99.89903	99.89317	99.88513	99.87396	99.85796	99.83387	99.79449	99.72029	99.53306	98.21603	0	0	0	0
2628	86.34667	89.7545	92.49429	94.60944	96.17965	97.30462	98.08791	98.6232	98.98642	99.23385	99.40463	99.52479	99.61125	99.67491	99.72284	99.75969	99.78853	99.81148	99.82999	99.84511	99.85756	99.86791	99.87654	99.88376	99.88982	99.89488	99.89907	99.9025	99.90525	99.90736	99.90886	99.90977	99.91009	99.90977	99.90878	99.907	99.90432	99.90052	99.89529	99.88815	99.8783	99.86442	99.84404	99.81201	99.75573	99.63374	99.18279	0	0	0	0
2664.5	86.35183	89.73125	92.45423	94.56291	96.13339	97.26339	98.05355	98.59576	98.965	99.21726	99.39174	99.51467	99.60318	99.66838	99.71748	99.75522	99.78476	99.80826	99.82722	99.8427	99.85546	99.86606	99.87492	99.88234	99.88857	99.89379	99.89813	99.90171	99.90459	99.90683	99.90848	99.90954	99.91002	99.90989	99.90911	99.9076	99.90524	99.90186	99.89718	99.89081	99.8821	99.86997	99.85252	99.82597	99.78181	99.69572	99.45978	96.37947	0	0	0
2701	86.35739	89.70889	92.41523	94.51668	96.08783	97.22258	98.01938	98.56837	98.94355	99.20061	99.37877	99.50447	99.59506	99.66181	99.71208	99.75072	99.78097	99.80503	99.82444	99.84029	99.85336	99.86422	99.87329	99.88092	99.88732	99.8927	99.89718	99.9009	99.90391	99.90629	99.90807	99.90928	99.90992	99.90997	99.90939	99.90812	99.90606	99.90305	99.89887	99.89318	99.88544	99.87477	99.85969	99.83735	99.80178	99.73767	99.59095	98.93443	0	0	0
2737.5	86.36333	89.68739	92.37723	94.4717	96.04296	97.1822	97.98542	98.54103	98.92207	99.18389	99.36574	99.49421	99.58688	99.65519	99.70665	99.7462	99.77715	99.80177	99.82164	99.83786	99.85124	99.86236	99.87166	99.87948	99.88606	99.89159	99.89623	99.90008	99.90322	99.90574	99.90765	99.909	99.90979	99.91	99.90961	99.90857	99.90678	99.90412	99.90038	99.89529	99.88839	99.87896	99.86582	99.84679	99.81754	99.7679	99.66738	99.36286	0	0	0
2774	86.36962	89.66672	92.34022	94.42761	95.99877	97.14224	97.95167	98.51375	98.90057	99.16711	99.35263	99.48389	99.57864	99.64853	99.70118	99.74164	99.77331	99.7985	99.81882	99.83542	99.84911	99.86049	99.87002	99.87804	99.88479	99.89048	99.89526	99.89924	99.90252	99.90516	99.90721	99.90869	99.90963	99.91	99.90979	99.90896	99.90742	99.90507	99.90174	99.89718	99.89101	99.88264	99.87111	99.85473	99.83027	99.7907	99.71736	99.53864	98.48926	0	0
2810.5	86.37625	89.64684	92.30416	94.38441	95.95524	97.1027	97.91813	98.48654	98.87905	99.15028	99.33946	99.47351	99.57036	99.64182	99.69567	99.73706	99.76945	99.79521	99.81599	99.83297	99.84697	99.85862	99.86837	99.87658	99.88351	99.88936	99.89428	99.8984	99.90181	99.90458	99.90675	99.90837	99.90944	99.90996	99.90993	99.90929	99.90799	99.90593	99.90296	99.89887	99.89334	99.88589	99.87571	99.86149	99.84075	99.80849	99.75256	99.63427	99.22846	0	0
2847	86.3832	89.62772	92.26903	94.34206	95.91238	97.06359	97.88481	98.4594	98.85752	99.1334	99.32623	99.46306	99.56202	99.63507	99.69013	99.73245	99.76556	99.7919	99.81315	99.8305	99.84482	99.85673	99.86672	99.87512	99.88223	99.88823	99.8933	99.89755	99.90109	99.90398	99.90628	99.90802	99.90923	99.9099	99.91002	99.90957	99.90849	99.90669	99.90405	99.90039	99.89543	99.88877	99.87975	99.8673	99.84953	99.82273	99.77866	99.69434	99.47314	97.46591	0
2883.5	86.39046	89.60934	92.23479	94.30055	95.87017	97.0249	97.85171	98.43233	98.83598	99.11647	99.31294	99.45256	99.55362	99.62827	99.68455	99.7278	99.76165	99.78857	99.81029	99.82802	99.84266	99.85484	99.86505	99.87366	99.88093	99.88709	99.8923	99.89669	99.90036	99.90337	99.90579	99.90765	99.90899	99.9098	99.91008	99.9098	99.90892	99.90737	99.90503	99.90176	99.89731	99.89134	99.88331	99.87235	99.85697	99.83438	99.79875	99.73552	99.59504	99.02926	

P O R E P R E S S U R E (kPa)

Time   Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0.310038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	104.7969	86.60238	68.48768	50.37756	32.26744	14.15732	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	140.6539	122.2782	103.8377	85.72534	67.61522	49.5051	31.39498	13.28485	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	164.5292	146.204	127.2532	108.9831	90.87195	72.76183	54.65171	36.54158	18.43146	0.321343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	188.4659	170.2621	150.9343	132.327	114.1266	96.01595	77.90583	59.79571	41.68559	23.57547	5.465348	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	207.3704	189.3023	169.7174	150.7931	132.3584	114.1937	96.08333	77.97321	59.86308	41.75296	23.64284	5.532721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	224.5597	206.623	186.8706	167.6705	148.9931	130.6565	112.5122	94.40197	76.29185	58.18173	40.07161	21.96149	3.851368	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	241.7752	223.9598	204.1053	184.6673	165.7665	147.2362	128.962	110.8302	92.71999	74.60987	56.49975	38.38963	20.27951	2.169386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	257.6189	239.9137	220.0042	200.3624	181.2574	162.5436	144.1098	125.8782	107.7542	89.64408	71.53396	53.42384	35.31371	17.20359	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	272.0249	254.4194	234.4888	214.6739	195.382	176.4968	157.9079	139.542	121.3409	103.222	85.11189	67.00177	48.89164	30.78152	12.6714	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	286.4519	268.9365	249.0088	229.0485	209.5854	190.5398	171.8041	153.3043	134.9888	116.8102	98.69455	80.58441	62.47429	44.36417	26.25405	8.143927	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	304.5379	287.1041	267.1966	247.1151	227.4953	208.2995	189.425	170.7969	152.3639	134.087	115.9254	97.8118	79.70168	61.59155	43.48143	25.37131	7.261191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	319.196	301.8366	281.9612	261.7802	242.0172	222.6802	203.6743	184.9241	166.3773	147.9961	129.7497	111.6009	93.48863	75.3785	57.26838	39.15826	21.04814	2.938016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	333.2937	316.0023	296.1674	275.9057	256.0122	236.5425	217.4117	198.545	179.8892	161.4059	143.066	124.8441	106.7052	88.59375	70.48362	52.3735	34.26338	16.15326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	347.4016	330.1725	310.3839	290.0578	270.0457	250.451	231.2015	212.2236	193.4632	174.8814	156.4491	138.143	119.9411	101.8097	83.69873	65.58861	47.47848	29.36836	11.25824	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	361.5187	344.347	324.6086	304.2321	284.1127	264.4003	245.0376	225.9533	207.0927	188.416	169.8939	151.5034	133.2254	115.04	96.91421	78.80359	60.69347	42.58335	24.47323	6.363107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	374.6316	357.513	337.827	317.4124	297.1961	277.3731	257.9024	238.7159	219.759	200.9911	182.3822	163.9092	145.5537	127.2993	109.1275	91.00605	72.89564	54.78551	36.67539	18.56527	0.455151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	387.5184	370.4491	350.8169	330.3745	310.0712	290.1441	270.5702	251.2856	232.236	213.3801	194.6875	176.1345	157.7028	139.3769	121.1425	102.9822	84.86392	66.75362	48.6435	30.53338	12.42326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	400.4124	383.389	363.8112	343.3501	322.9688	302.9439	283.2714	263.8925	244.7534	225.8127	207.0391	188.4087	169.9028	151.5061	133.2056	114.9885	96.83767	78.72175	60.61153	42.50141	24.39129	6.281165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	413.3133	396.3326	376.8093	356.3371	335.8863	315.7697	296.0029	276.5332	257.3078	238.2849	219.433	200.7276	182.1497	163.6839	145.3173	127.0388	108.8366	90.69372	72.57954	54.46936	36.35924	18.24912	0.138998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	425.5869	408.6462	389.177	368.7002	348.1878	327.9853	308.1283	288.5711	269.2622	250.1599	231.232	212.4539	193.8061	175.273	156.8417	138.5014	120.2421	102.0529	83.91659	65.80366	47.6935	29.58338	11.47326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	436.6573	419.7542	400.3384	379.8626	359.2958	339.0129	319.0698	299.4281	280.0384	260.859	241.8575	223.0088	204.2931	185.6945	167.2001	148.7991	130.4818	112.2394	94.06142	75.93058	57.81854	39.7084	21.59828	3.488158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	447.7332	430.8655	411.5024	391.0323	370.4178	350.0597	330.0342	310.3111	290.8431	271.589	252.516	233.5987	214.817	196.1547	177.5988	159.1382	140.7636	122.4667	104.2392	86.07117	67.9448	49.83338	31.72324	13.61312	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	458.8145	441.9802	422.6686	402.2082	381.5521	361.1241	341.0199	321.2181	301.6743	282.3476	263.2051	244.221	225.3751	206.6508	188.0348	169.5162	151.0854	132.7343	114.4554	96.24129	78.0819	59.95915	41.84817	23.73804	5.627917	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	469.9009	453.098	433.8369	413.3897	392.6976	372.2044	352.0251	332.1474	312.53	293.1326	273.9225	254.8735	235.9649	217.1802	198.5058	179.9304	161.4446	143.0403	124.7101	106.4475	88.24525	70.09342	51.97361	33.86291	15.75279	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	480.9555	464.1825	444.9707	424.5395	403.8167	383.2629	363.0119	343.0609	323.372	303.906	284.6299	265.5176	246.5481	227.7044	208.9729	190.3422	171.8027	153.3461	134.9654	116.654	98.40597	80.21438	62.06916	43.95167	25.84118	7.731054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	491.4728	474.7281	455.5644	435.1517	414.4027	393.7929	373.4735	353.4517	333.6934	314.1605	294.8202	275.6462	256.6171	237.7159	218.9288	200.244	181.6519	163.1442	144.7138	126.3543	108.0599	89.82501	71.643	53.50353	35.38788	17.27752	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	501.9945	485.2766	466.1598	445.7677	424.9969	404.3351	383.9505	363.8604	344.0347	324.4366	305.0337	285.7994	266.7122	247.7549	228.9132	210.1756	191.5322	172.9745	154.4954	136.0885	117.7482	99.46918	81.24621	63.07281	44.93833	26.8241	8.713821	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	512.5202	495.8279	476.7568	456.3869	435.5982	414.8885	394.4419	374.2858	354.3946	334.733	315.269	295.9757	276.8318	257.8195	238.9247	220.1354	201.4417	182.8351	164.3083	145.8549	127.4693	109.1464	90.8814	72.66928	54.50364	36.37345	18.26032	0.150096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1058.5	523.0499	506.382	487.3554	467.0091	446.2062	425.4522	404.9467	384.7269	364.772	345.0485	325.5247	306.1739	286.9744	267.9085	248.9616	230.1218	211.3789	192.7243	174.1508	155.6518	137.2217	118.8554	100.5484	82.29624	64.09402	45.93536	27.80885	9.696546	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	533.5836	516.939	497.9557	477.6342	456.8201	436.0256	415.464	395.1827	375.166	355.3821	335.8	316.3929	297.139	278.0205	259.0227	240.1333	221.3423	202.6408	184.0214	165.4777	147.0039	128.595	110.2464	91.954	73.71351	55.52034	37.36797	19.24458	1.132894	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	543.8113	527.189	508.2478	487.9521	467.13	446.2983	425.6834	405.3429	385.266	365.4232	345.7839	326.3217	307.0147	287.8447	268.7969	249.8591	231.0208	212.2734	193.6091	175.0215	156.5048	138.054	119.6645	101.3321	83.05305	64.82333	46.63844	28.49172	10.37096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	553.681	537.08	518.1798	497.9107	477.0832	456.2175	435.5521	415.1544	395.0191	375.1187	355.4237	335.9075	316.5483	297.3279	278.2312	259.2459	240.3613	221.5687	202.8604	184.2298	165.671	147.179	128.7492	110.3774	92.06002	73.79327	55.57347	37.39618	19.25451	1.135946	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	563.5592	546.9785	528.1183	507.8764	487.0459	466.1492	445.4359	424.9832	404.791	384.8345	365.0848	345.5158	326.1055	306.8356	287.691	268.659	249.7291	230.8922	212.1407	193.4678	174.8677	156.3352	137.8658	119.4553	101.0999	82.79627	64.5409	46.33026	28.15995	10.0228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	573.4495	556.8884	538.067	517.8527	497.0215	476.0967	455.3381	434.8323	414.5849	394.5736	374.7704	355.1497	335.6892	316.3708	297.1791	278.1014	259.1269	240.2466	221.4527	202.7383	184.0976	165.5254	147.017	128.5683	110.1756	91.83539	73.54446	55.29963	37.09748	18.93355	0.80048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	583.3556	566.8134	548.0297	527.8436	507.0136	486.0634	465.2619	444.7051	424.404	404.3391	384.4836	364.8121	345.3025	325.9364	306.6985	287.5758	268.5576	249.6347	230.7991	212.044	193.3635	174.7522	156.2055	137.7193	119.2897	100.9134	82.58722	64.3081	46.07307	27.87878	9.720718	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	593.2804	576.7562	558.0094	537.8515	517.0247	496.0516	475.2096	454.6036	434.2504	414.1332	394.2264	374.5051	354.9473	335.5344	316.2511	297.0843	278.0232	259.0583	240.1818	221.3867	202.667	184.0173	165.433	146.9098	128.444	110.0321	91.67108	73.3579	55.08979	36.86387	18.67687	0.524526	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	603.0971	586.5903	567.8793	547.75	526.9279	505.9342	485.0541	464.4007	443.9969	423.8286	403.8716	384.1015	364.4963	345.0375	325.7096	306.4994	287.3961	268.39	249.4733	230.6388	211.8806	193.1931	174.5718	156.0123	137.5108	119.0639	100.6685	82.32159	64.02054	45.76268	27.54525	9.365032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	612.7806	596.2906	577.6144	557.5137	536.698	515.686	494.7698	474.071	453.6179	433.3997	413.3936	393.5755	373.9238	354.4199	335.0481	315.7954	296.6505	277.6039	258.6476	239.7745	220.9784	202.2538	183.596	165.0007	146.4641	127.9827	109.5534	91.17325	72.83959	54.54987	36.30158	18.09209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	622.4865	606.0126	587.3704	567.2983	546.4902	525.462	504.512	483.7695	463.2686	443.0017	422.9474	403.0823	383.3848	363.8365	344.4217	325.127	305.9412	286.8549	267.8597	248.9485	230.115	211.3539	192.6603	174.0298	155.4587	136.9433	118.4806	100.0676	81.70168	63.38035	45.10123	26.86191	8.659836	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	632.214	615.7558	597.1467	577.1032	556.304	535.2616	514.2797	493.4952	472.9479	452.6334	432.5319	412.6206	392.8783	373.2863	353.8291	334.4931	315.2672	296.1417	277.1081	258.1595	239.2894	220.4923	201.7634	183.0983	164.493	145.9442	127.4486	109.0032	90.60549	72.25291	53.94314	35.67394	17.44304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	641.9626	625.5194	606.9425	586.9277	566.1384	545.0837	524.0719	503.2471	482.6548	462.2938	442.146	422.1894	402.4029	382.768	363.269	343.8925	324.627	305.4629	286.3917	267.4061	248.4999	229.6674	210.9037	192.2045	173.5657	154.9839	136.4559	117.9786	99.54947	81.16602	62.82592	44.527	26.26713	8.044118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	651.7312	635.3025	616.7571	596.7707	575.9925	554.9272	533.8873	513.0239	492.3879	471.9815	451.7884	431.7872	411.9573	392.2802	372.7401	353.3236	334.0192	314.8171	295.7087	276.6868	257.745	238.8777	220.0798	201.3469	182.6751	164.0608	145.5008	126.9921	108.532	90.11805	71.74797	53.41959	35.13086	16.87976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	661.4541	645.0395	626.5248	606.5667	585.8004	564.7261	543.66	522.7596	502.0811	481.6304	461.3929	441.3479	421.4753	401.7566	382.1762	362.7203	343.3775	324.1379	304.993	285.9353	266.9585	248.0568	229.2252	210.4592	191.7548	173.1085	154.5169	135.9772	117.4866	99.04255	80.64286	62.28534	43.96799	25.68886	7.446024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	671.0655	654.6645	636.1796	616.2497	595.4961	574.4144	553.3238	532.3879	511.6683	491.1743	470.8932	450.8053	430.8907	411.1311	391.5108	372.0162	352.6356	333.3591	314.1781	295.0852	276.0738	257.1382	238.2734	219.4747	200.7383	182.0604	163.4378	144.8674	126.3467	107.873	89.44404	71.05773	52.71204	34.40507	16.13499	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	680.6951	664.3073	645.8516	625.9497	605.2096	584.1218	563.0084	542.0384	521.279	500.7428	480.419	460.2889	440.3329	420.533	400.8735	381.3407	361.9229	342.61	323.3935	304.2658	285.2204	266.2514	247.3537	228.5229	209.7548	191.0458	172.3925	153.792	135.2416	116.7386	98.28077	79.86601	61.49229	43.15775	24.86059	6.59906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	690.342	673.967	655.5398	635.6657	614.9396	593.8472	572.7125	551.7101	530.912	510.3346	489.9689	469.7973	449.8006	429.9611	410.2629	390.6924	371.2379	351.8892	332.6376	313.4757	294.3966	275.3947	256.4648	237.6022	218.8029	200.0632	181.3797	162.7494	144.1696	125.6377	107.1514	88.70856	70.30716	51.94533	33.62131	15.33342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	700.0054	683.6428	665.2433	645.3967	624.6854	603.5896	582.4351	561.4016	540.5661	519.9484	499.5417	479.3293	459.2927	439.4141	419.6778	400.0701	380.5794	361.1953	341.9092	322.7134	303.6013	284.5669	265.605	246.7111	227.8811	209.111	190.3977	171.7381	153.1294	134.5689	116.0545	97.5839	79.15513	60.76632	42.41572	24.10166	5.822538	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	709.6842	693.3337	674.9613	655.142	634.4459	613.3479	592.1751	571.1119	550.2402	529.5832	509.1363	488.8838	468.8078	448.8907	429.1168	409.4726	389.9461	370.5272	351.207	331.9778	312.833	293.7665	274.7732	255.8484	236.988	218.1881	199.4453	180.7567	162.1194	143.5308	124.9886	106.4906	88.03479	69.61932	51.24242	32.90244	14.59781	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	719.3446	703.0057	684.6599	664.8676	644.1872	623.0881	601.8984	580.8068	559.9	539.2047	518.7183	498.4265	478.3117	458.3567	438.5458	418.8654	399.3037	379.8504	360.4965	341.2344	322.0573	302.9592	283.9349	264.9796	246.0891	227.2597	208.4879	189.7707	171.1052	152.4888	133.9192	115.3941	96.9116	78.46977	60.06687	41.70124	23.37132	5.075643	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	728.8412	712.5136	694.1937	674.4282	653.7639	632.6647	611.4594	590.3407	569.4	548.6673	528.1423	507.8118	487.6589	467.6664	447.819	428.103	408.5065	389.0192	369.6322	350.3376	331.1286	311.9993	292.9443	273.9589	255.0388	236.1803	217.3798	198.6343	179.941	161.2971	142.7004	124.1486	105.6397	87.17185	68.74323	50.35223	31.99728	13.67692	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	737.085	720.7685	702.4739	682.7348	662.087	640.9888	619.7691	598.6246	577.6511	556.882	536.3191	515.9506	495.76	475.7307	455.8473	436.0962	416.4653	396.9445	377.5247	358.198	338.9576	319.7974	300.7122	281.697	262.7477	243.8604	225.0316	206.2582	187.5373	168.8663	150.2429	131.6647	113.1297	94.63612	76.18209	57.76598	39.38626	21.04146	2.730219	0	0	0	0	0	0	0	0	0	0	0	0
1898	745.3533	729.0475	710.7776	691.0647	670.4337	649.3373	628.1045	606.9355	585.9301	565.1255	544.5256	524.1196	503.8921	483.8264	463.9075	444.1217	424.4569	404.903	385.4508	366.0924	346.8209	327.6303	308.5152	289.4706	270.4924	251.5767	232.7199	213.919	195.1709	176.4732	157.8233	139.219	120.6583	102.1392	83.66006	65.21915	46.81491	28.44591	10.11075	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	753.6406	737.3453	719.0996	699.4126	678.7987	657.705	636.4602	615.2677	594.2317	573.3924	552.7561	532.3135	512.0494	491.948	471.994	452.1739	432.4757	412.8891	393.4049	374.0152	354.7131	335.4924	316.3477	297.2741	278.2674	259.3236	240.4392	221.611	202.8361	184.1118	165.4358	146.8057	128.2196	109.6754	91.1714	72.70594	54.27746	35.8845	17.52569	0	0	0	0	0	0	0	0	0	0	0	0
1971	761.946	745.6609	727.4389	707.7775	687.1809	666.0906	644.835	623.6203	602.5546	581.6815	561.0096	540.5309	520.231	500.0942	480.1056	460.2517	440.5205	420.9015	401.3857	381.9651	362.6327	343.3822	324.2084	305.1061	286.0712	267.0997	248.1879	229.3328	210.5314	191.781	173.0791	154.4236	135.8123	117.2432	98.71466	80.22494	61.77248	43.35583	24.97359	6.624479	0	0	0	0	0	0	0	0	0	0	0
2007.5	770.2687	753.9934	735.7946	716.1585	695.5795	674.4934	653.228	631.9921	610.8978	589.9918	569.285	548.7708	528.4355	508.2639	488.2412	468.3539	448.59	428.9392	409.3921	389.941	370.5786	351.2988	332.096	312.9655	293.9027	274.9037	255.965	237.0833	218.2556	199.4793	180.752	162.0712	143.435	124.8414	106.2886	87.77484	69.29866	50.85856	32.45315	14.08113	0	0	0	0	0	0	0	0	0	0	0
2044	778.6055	762.3399	744.1638	724.5526	703.9914	682.9102	661.636	640.3801	619.2581	598.32	577.5791	557.03	536.6599	516.4539	496.3975	476.4772	456.6811	436.9987	417.4208	397.9395	378.5475	359.2386	340.0074	320.8488	301.7584	282.7323	263.7669	244.8589	226.0053	207.2035	188.4509	169.7452	151.0844	132.4665	113.8897	95.35222	76.85258	58.38927	39.96092	21.56623	3.203993	0	0	0	0	0	0	0	0	0	0
2080.5	786.9119	770.6557	752.5017	732.9153	712.3719	691.2963	670.0142	648.7393	627.5906	606.6213	585.8469	565.2635	544.8591	524.6193	504.5296	484.5768	464.7488	445.0352	425.4269	405.9156	386.4943	367.1568	347.8973	328.7111	309.5935	290.5406	271.5488	252.6148	233.7355	214.9084	196.1309	177.4006	158.7154	140.0735	121.4729	102.912	84.3891	65.90285	47.4518	29.03465	10.65017	0	0	0	0	0	0	0	0	0	0
2117	795.2335	778.9865	760.8542	741.2922	720.7668	699.6974	678.4084	657.1155	635.941	614.9414	594.1342	573.5171	553.0789	532.8057	512.6831	492.6981	472.8386	453.0943	433.4558	413.915	394.4648	375.0988	355.8115	336.5978	317.4533	298.3739	279.356	260.3962	241.4917	222.6395	203.8373	185.0826	166.3735	147.7077	129.0836	110.4995	91.95366	73.44469	54.97117	36.5318	18.12534	0	0	0	0	0	0	0	0	0	0
2153.5	803.5695	787.3314	769.2205	749.6825	729.1754	708.1127	686.8175	665.5076	644.3083	623.2791	602.4398	581.7896	561.3181	541.0119	520.857	500.8401	480.9496	461.1748	441.5064	421.9365	402.4576	383.0636	363.7487	344.5079	325.3367	306.2311	287.1874	268.2022	249.2726	230.3957	211.569	192.7903	174.0573	155.368	136.7207	118.1136	99.54502	81.01358	62.51783	44.05646	25.62823	7.23197	0	0	0	0	0	0	0	0	0
2190	811.9193	795.69	777.5999	758.0857	737.5968	716.5413	695.241	673.915	652.6917	631.6337	610.763	590.0802	569.576	549.2373	529.0503	509.0021	489.0808	469.2758	449.578	429.9792	410.472	391.0502	371.708	352.4404	333.2429	314.1114	295.0421	276.0317	257.0773	238.1759	219.3251	200.5225	181.766	163.0535	144.3831	125.7532	107.1622	88.60852	70.09076	51.60761	33.15784	14.74025	0	0	0	0	0	0	0	0	0
2226.5	820.2823	804.0615	785.9918	766.5011	746.0305	724.9828	703.678	682.3369	661.0905	640.0044	619.103	598.3883	577.8518	557.481	537.2624	517.1831	497.2314	477.3967	457.6697	438.0423	418.5071	399.0578	379.6887	360.3946	341.171	322.0137	302.9192	283.8839	264.9049	245.9793	227.1046	208.2784	189.4986	170.763	152.0699	133.4175	114.8043	96.22855	77.68901	59.1843	40.71319	22.27448	3.867113	0	0	0	0	0	0	0	0
2263	828.6579	812.4454	794.3957	774.9282	754.476	733.4364	712.128	690.7726	669.504	648.3907	627.4591	606.713	586.1447	565.7423	545.4924	525.3825	505.4007	485.5365	465.7807	446.125	426.5621	407.0856	387.6898	368.3694	349.12	329.9374	310.8178	291.7579	272.7546	253.8051	234.9067	216.0572	197.2542	178.4959	159.7803	141.1056	122.4703	103.8728	85.31166	66.78562	48.29337	29.83375	11.40563	0	0	0	0	0	0	0	0
2299.5	837.0455	820.8411	802.8111	783.3665	762.9326	741.9017	720.5903	699.2214	677.9315	656.7917	635.8307	615.0537	594.4541	574.0204	553.7397	533.5995	513.5879	493.6946	473.9103	454.2266	434.6363	415.1329	395.7106	376.3643	357.0893	337.8816	318.7372	299.6529	280.6256	261.6523	242.7305	223.8579	205.0321	186.2512	167.5133	148.8166	130.1594	111.5403	92.95787	74.41069	55.89753	37.41719	18.96856	0.557212	0	0	0	0	0	0	0
2336	845.4446	829.2482	811.2374	791.8154	771.4	750.3781	729.0644	707.6829	686.3725	665.2068	644.217	623.4097	602.7793	582.3148	562.0036	541.8334	521.7924	501.8703	482.0578	462.3464	442.729	423.1989	403.7505	384.3784	365.0782	345.8455	326.6767	307.5682	288.5171	269.5203	250.5753	231.6798	212.8314	194.0282	175.2682	156.5496	137.8709	119.2304	100.6268	82.05871	63.52483	45.02398	26.55503	8.116929	0	0	0	0	0	0	0
2372.5	853.8548	837.6661	819.6742	800.2746	779.8775	758.8651	737.5498	716.1565	694.8263	673.6355	652.6175	631.7804	611.1196	590.6247	570.2835	550.0836	530.0136	510.063	490.2225	470.4837	450.8394	431.283	411.8086	392.4111	373.0858	353.8285	334.6354	315.5031	296.4283	277.4083	258.4404	239.5222	220.6514	201.8261	183.0442	164.304	145.6039	126.9423	108.3177	89.7289	71.17449	52.65332	34.16425	15.70621	0	0	0	0	0	0	0
2409	862.2755	846.0945	828.1211	808.7435	788.3649	767.3621	746.0459	724.6415	703.2923	682.0773	661.0317	640.1653	619.4746	598.9497	578.5787	558.3495	538.2508	518.2719	498.4038	478.6379	458.967	439.3845	419.8845	400.4618	381.1117	361.83	342.6128	323.4568	304.3587	285.3156	266.325	247.3843	228.4914	209.6441	190.8406	172.079	153.3577	134.6752	116.0299	97.42052	78.84578	60.30448	41.79547	23.31768	4.870132	0	0	0	0	0	0
2445.5	870.7065	854.5329	836.5777	817.2219	796.8616	775.8689	754.5523	733.1375	711.7702	690.5314	669.4589	648.5638	627.8436	607.2891	586.8887	566.6306	546.5034	526.4966	506.6011	486.8084	467.1111	447.5027	427.9773	408.5297	389.155	369.8492	350.6082	331.4287	312.3075	293.2417	274.2285	255.2656	236.3507	217.4818	198.6568	179.874	161.1317	142.4284	123.7626	105.1329	86.53799	67.97674	49.44798	30.95062	12.48365	0	0	0	0	0	0
2482	879.1472	862.9809	845.0435	825.7092	805.3672	784.3849	763.0684	741.6441	720.2592	698.9975	677.8986	656.9753	636.2261	615.6424	595.213	574.9262	554.7709	534.7365	514.8138	494.9945	475.2712	455.6372	436.0867	416.6143	397.2153	377.8855	358.621	339.4183	320.2742	301.1857	282.1503	263.1654	244.2287	225.3383	206.492	187.6882	168.9252	150.2013	131.5151	112.8652	94.25042	75.66941	57.12108	38.60433	20.11814	1.663594	0	0	0	0	0
2518.5	887.5965	871.4373	853.5175	834.2044	813.8808	792.909	771.5933	750.16	728.7584	707.4744	686.3497	665.3987	644.6208	624.0083	603.5503	583.2352	563.052	542.9903	523.0408	503.1952	483.446	463.7867	444.2112	424.7143	405.2913	385.9378	366.6499	347.4242	328.2573	309.1465	290.089	271.0822	252.1241	233.2123	214.345	195.5204	176.7368	157.9925	139.2862	120.6163	101.9817	83.38115	64.81342	46.27745	27.77222	9.296759	0	0	0	0	0
2555	896.0549	879.9027	862.0001	842.7078	822.4025	801.4417	780.1272	758.6857	737.268	715.9623	694.8123	673.8341	653.0282	632.3872	611.9009	591.5578	571.347	551.2582	531.2822	511.4105	491.6357	471.9513	452.3511	432.83	413.3831	394.0061	374.6951	355.4465	336.2572	317.1242	298.0448	279.0165	260.0369	241.1041	222.2159	203.3707	184.5666	165.8022	147.0758	128.3862	109.7321	91.11207	72.52511	53.9701	35.44599	16.95182	0	0	0	0	0
2591.5	904.5219	888.3766	870.4909	851.2193	830.9322	809.9825	788.6697	767.2205	745.7875	724.4608	703.2862	682.2813	661.4476	640.7786	620.2643	599.8935	579.6554	559.5399	539.5375	519.64	499.8399	480.1305	460.5059	440.9608	421.4902	402.0899	382.756	363.4849	344.2733	325.1183	306.0172	286.9674	267.9667	249.013	230.1042	211.2385	192.4142	173.6297	154.8836	136.1744	117.5008	98.86157	80.25556	61.68167	43.13886	24.62614	6.14261	0	0	0	0
2628	912.9973	896.8587	878.9896	859.7384	839.4695	818.5311	797.2205	775.7643	754.3165	732.9694	711.7708	690.7397	669.8787	649.182	628.64	608.2419	587.9768	567.8347	547.8063	527.8832	508.058	488.324	468.6752	449.1062	429.6122	410.1888	390.8322	371.5387	352.305	333.1282	314.0056	294.9346	275.913	256.9385	238.0092	219.1233	200.2789	181.4747	162.7089	143.9802	125.2874	106.6291	88.00421	69.41161	50.85025	32.31915	13.81738	0	0	0	0
2664.5	921.4808	905.3487	887.4959	868.2649	848.014	827.0871	805.7792	784.3166	762.8548	741.4879	720.2657	699.2089	678.321	657.597	637.0277	616.6025	596.3107	576.1423	556.0881	536.1397	516.2896	496.5312	476.8583	457.2657	437.7485	418.3023	398.9231	379.6074	360.3519	341.1535	322.0096	302.9176	283.8752	264.8801	245.9305	227.0245	208.1603	189.3364	170.5512	151.8033	133.0913	114.4141	95.77053	77.15937	58.57962	40.03029	21.51045	3.019826	0	0	0
2701	929.972	913.8464	896.0096	876.7984	856.5656	835.6504	814.3455	792.8771	771.4018	750.0158	728.7707	707.6885	686.7742	666.0233	645.427	624.975	604.6568	584.4624	564.3826	544.4091	524.5343	504.7517	485.055	465.439	445.8988	426.4299	407.0284	387.6907	368.4135	349.1937	330.0287	310.9158	291.8528	272.8374	253.8677	234.9417	216.0579	197.2144	178.4099	159.6429	140.9121	122.2162	103.554	84.92442	66.32644	47.75904	29.22128	10.71226	0	0	0
2737.5	938.4707	922.3514	904.5303	885.3388	865.1239	844.2206	822.9192	801.4455	779.9573	758.5528	737.2852	716.1783	695.2379	674.4604	653.8374	633.3589	613.0145	592.7944	572.6893	552.6909	532.7917	512.9851	493.2648	473.6257	454.0626	434.5713	415.1476	395.7881	376.4894	357.2484	338.0624	318.9289	299.8454	280.8098	261.8202	242.8745	223.9711	205.1083	186.2847	167.4988	148.7492	130.0347	111.3541	92.70629	74.09023	55.50491	36.94938	18.42274	0	0	0
2774	946.9766	930.8634	913.0579	893.8857	873.6887	852.7974	831.4998	810.0214	788.521	767.0985	745.809	724.6777	703.7117	682.908	662.2586	641.7539	621.3836	601.138	581.0078	560.9848	541.0614	521.231	501.4874	481.8252	462.2395	442.7259	423.2803	403.8992	384.5791	365.3171	346.1104	326.9563	307.8526	288.797	269.7876	250.8223	231.8996	213.0176	194.175	175.3703	156.6021	137.8692	119.1704	100.5045	81.87052	63.26742	44.69427	26.15015	7.634219	0	0
2810.5	955.4894	939.3824	921.592	902.439	882.2598	861.3807	840.0873	818.6046	797.0925	775.6526	754.3417	733.1866	712.1953	691.3657	670.6903	650.1597	629.7638	609.4929	589.3378	569.2904	549.343	529.489	509.7222	490.0372	470.4291	450.8934	431.4261	412.0235	392.6823	373.3995	354.1721	334.9978	315.874	296.7985	277.7694	258.7848	239.8428	220.9419	202.0805	183.2572	164.4705	145.7194	127.0024	108.3186	89.66684	71.04612	52.45548	33.89403	15.3609	0	0
2847	964.009	947.9079	930.1326	910.9985	890.8368	869.9701	848.6812	827.1948	805.6716	784.2148	762.8831	741.7045	720.6884	699.8333	679.1322	658.5759	638.1546	617.8586	597.679	577.6073	557.6362	537.7588	517.969	498.2614	478.6311	459.0735	439.5846	420.1608	400.7986	381.4951	362.2473	343.0528	323.9091	304.8139	285.7654	266.7615	247.8005	228.8807	210.0007	191.1589	172.354	153.5847	134.8498	116.1482	97.47876	78.84055	60.23258	41.65394	23.10375	4.581409	0
2883.5	972.5351	956.4398	938.6792	919.5638	899.4197	878.5654	857.2814	835.7918	814.258	792.7849	771.4328	750.2313	729.1907	708.3103	687.5838	667.0022	646.5558	626.235	606.031	585.9353	565.9406	546.04	526.2275	506.4975	486.8451	467.2658	447.7555	428.3106	408.9276	389.6035	370.3355	351.121	331.9575	312.8429	293.775	274.7521	255.7722	236.8337	217.9352	199.075	180.252	161.4647	142.712	123.9928	105.3059	86.65031	68.02514	49.42944	30.86234	12.32301

SOLIDS CONTENT (%)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	48.21507	26.43877	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	50.90568	32.83791	26.10093	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	52.48414	37.68738	29.08397	25.99081	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	53.60347	41.12871	32.11613	27.75116	25.94424	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	54.47039	43.672	34.69903	29.8817	27.08271	25.9224	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	55.17742	45.63104	36.92066	31.79776	28.70602	26.68906	25.9116	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	55.77405	47.19437	38.8492	33.51623	30.22621	27.98068	26.4366	25.9061	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	56.28987	48.47848	40.53487	35.07161	31.61802	29.23983	27.48928	26.26695	25.90324	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	56.74399	49.55811	42.01728	36.49016	32.89823	30.41202	28.56117	27.13571	26.15023	25.90173	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	57.14945	50.48322	43.32872	37.79116	34.08365	31.50199	29.57474	28.06505	26.87066	26.06924	25.90093	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	57.51558	51.28836	44.49587	38.98921	35.18772	32.52001	30.52603	28.95771	27.6866	26.66621	26.01316	25.90005	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	57.84924	51.99824	45.54072	40.09592	36.22087	33.47543	31.42057	29.80273	28.48334	27.38869	26.50335	25.97466	25.90027	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	58.15565	52.63101	46.48146	41.12086	37.19129	34.37606	32.26476	30.60213	29.2438	28.107	27.14853	26.37713	25.94858	25.90015	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	58.43889	53.20034	47.3331	42.07217	38.1055	35.22822	33.06434	31.36009	29.9672	28.79822	27.80111	26.95132	26.27416	25.93117	25.90008	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	58.70215	53.71666	48.10809	42.95697	38.9688	36.03707	33.82421	32.08081	30.65602	29.45921	28.43435	27.54766	26.78703	26.19124	25.91973	25.90004	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	58.94805	54.1882	48.81674	43.7815	39.7856	36.80687	34.54849	32.76805	31.31327	30.09108	29.04297	28.13146	27.33437	26.64863	26.12456	25.91234	25.90002	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	59.17868	54.62145	49.46767	44.55133	40.55965	37.54113	35.24063	33.42509	31.94185	30.69591	29.62691	28.69535	27.87535	27.1526	26.53106	26.07124	25.90763	25.90001	25.9	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	59.39582	55.02165	50.06809	45.27145	41.2942	38.24283	35.90356	34.05475	32.54434	31.2759	30.18753	29.23829	28.40051	27.65599	26.99604	26.43058	26.02894	25.90467	25.90001	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	59.60093	55.39308	50.62409	45.94631	41.99209	38.91447	36.53976	34.65944	33.12305	31.83311	30.72645	29.76098	28.90787	28.14719	27.46605	26.86003	26.34438	25.99578	25.90284	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	59.79525	55.73927	51.14081	46.57993	42.65587	39.55821	37.15138	35.24126	33.67999	32.36942	31.24531	30.26461	29.3976	28.62333	27.92717	27.30006	26.74102	26.27028	25.97013	25.90171	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	59.97984	56.06317	51.62264	47.17587	43.28783	40.17594	37.74024	35.80204	34.21691	32.8865	31.74565	30.75047	29.87049	29.08408	28.37564	27.73428	27.15385	26.63628	26.20661	25.9506	25.90102	25.9	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	60.15562	56.36724	52.07333	47.73739	43.89007	40.7693	38.30793	36.34334	34.73536	33.38582	32.22886	31.21979	30.32755	29.5299	28.81067	28.15802	27.56382	27.0242	26.54367	26.15201	25.95597	25.90061	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	60.32337	56.6536	52.49611	48.26737	44.46449	41.33977	38.85586	36.86655	35.2367	33.86871	32.69617	31.67375	30.76978	29.96155	29.23243	28.57003	27.96528	27.41212	26.90855	26.46149	26.10538	25.9252	25.90036	25.9	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	60.48379	56.92404	52.89376	48.76842	45.01287	41.88866	39.38524	37.3729	35.72213	34.33633	33.14873	32.1134	31.19815	30.37985	29.64146	28.97023	28.35655	27.79338	27.2763	26.80488	26.3884	26.06579	25.9174	25.90021	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	60.63747	57.1801	53.26872	49.2429	45.53681	42.41717	39.89716	37.86345	36.19272	34.78973	33.58754	32.5397	31.61357	30.78559	30.03842	29.35897	28.7373	28.16584	27.63912	27.15403	26.71155	26.3233	26.03245	25.91185	25.90012	25.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	60.78496	57.42312	53.62309	49.69291	46.03784	42.92638	40.39261	38.33917	36.64942	35.22985	34.0135	32.95354	32.01686	31.17955	30.42396	29.73675	29.10771	28.52893	27.99442	27.49993	27.04344	26.62723	26.26529	26.00462	25.90797	25.90007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	60.92672	57.65426	53.95873	50.12038	46.51733	43.41728	40.87244	38.80091	37.09308	35.65751	34.42743	33.35569	32.40877	31.56244	30.79874	30.10412	29.46814	28.88268	28.3414	27.83951	27.37373	26.943	26.55082	26.21365	25.98165	25.9053	25.90004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	61.06317	57.87456	54.27727	50.52701	46.97661	43.89082	41.33745	39.24944	37.52447	36.07347	34.83008	33.74687	32.79001	31.93491	31.16338	30.46163	29.81905	29.22733	28.67993	28.17171	27.69882	27.25881	26.85144	26.48143	26.16775	25.96294	25.90348	25.90001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	61.19469	58.08492	54.58016	50.91437	47.41686	44.34783	41.78836	39.68544	37.94426	36.47842	35.2221	34.12774	33.16119	32.29758	31.51845	30.80982	30.16091	29.56325	29.01015	28.49626	28.0174	27.57049	27.15375	26.76771	26.41831	26.12709	25.94789	25.90227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	61.32162	58.28611	54.86868	51.28388	47.83921	44.78913	42.22582	40.10954	38.35308	36.87297	35.60411	34.49889	33.5229	32.65099	31.86448	31.14918	30.49417	29.89083	29.33235	28.81322	28.32908	27.87648	27.45297	27.05737	26.69092	26.36081	26.09121	25.93596	25.90139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	61.44425	58.47887	55.14396	51.63681	48.24471	45.21545	42.65044	40.52231	38.75149	37.25768	35.97665	34.86086	33.87566	32.99566	32.20196	31.48019	30.81926	30.21046	29.64684	29.1228	28.63381	28.17624	27.74727	27.34496	26.96868	26.62032	26.30841	26.05971	25.92665	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	61.56288	58.66381	55.40702	51.97433	48.63433	45.62752	43.06278	40.92427	39.14001	37.63305	36.34024	35.21414	34.21996	33.33206	32.53134	31.80327	31.13661	30.52253	29.95397	29.42525	28.93173	28.46964	28.03596	27.62837	27.24538	26.88682	26.55529	26.26068	26.03226	25.91869	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	61.67774	58.8415	55.65877	52.29749	49.00897	46.02597	43.46336	41.31589	39.51909	37.99955	36.69532	35.55919	34.55623	33.66062	32.85306	32.11884	31.4466	30.82739	30.25407	29.72086	29.22304	28.75676	28.31884	27.90675	27.5186	27.15328	26.81109	26.49529	26.21722	26.00851	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	61.78906	59.01245	55.90004	52.60727	49.36948	46.41145	43.85267	41.69761	39.88917	38.35761	37.04233	35.89642	34.88489	33.98175	33.16749	32.42727	31.74959	31.12539	30.54745	30.00992	29.508	29.03775	28.59592	28.17982	27.78735	27.41695	27.06789	26.74086	26.43985	26.17771	25.97731	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	61.89705	59.17712	56.13156	52.90455	49.71665	46.78454	44.23116	42.06983	40.25064	38.70762	37.38165	36.22622	35.20632	34.2958	33.47499	32.72891	32.04592	31.41687	30.83444	30.29272	29.78684	29.31281	28.8673	28.44753	28.05125	27.67667	27.32257	26.98852	26.67561	26.38858	26.14188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	62.0019	59.33593	56.354	53.19012	50.0512	47.1458	44.59926	42.43293	40.60386	39.04993	37.71363	36.54894	35.52085	34.60311	33.7759	33.02408	32.3359	31.70211	31.11532	30.56953	30.05983	29.58217	29.13315	28.70994	28.3102	27.93198	27.57381	27.23471	26.91457	26.61487	26.34115	26.05202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	62.10378	59.48924	56.56797	53.46474	50.37383	47.49575	44.95737	42.78726	40.94916	39.38487	38.03861	36.8649	35.82882	34.90401	34.07053	33.31309	32.61983	31.98142	31.39036	30.84061	30.32721	29.84603	29.39366	28.96719	28.56422	28.18271	27.82104	27.47796	27.15274	26.84554	26.55826	26.29725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	62.20286	59.6374	56.77401	53.72907	50.68518	47.83489	45.30587	43.13314	41.28686	39.71276	38.35689	37.1744	36.13051	35.19879	34.35916	33.59621	32.89799	32.25504	31.65982	31.10622	30.58921	30.10463	29.64901	29.21943	28.81341	28.42886	28.06405	27.71758	27.38843	27.07609	26.78098	26.50542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	62.29927	59.78073	56.97264	53.98374	50.98583	48.1637	45.64513	43.47088	41.61723	40.03387	38.66874	37.47773	36.42621	35.48772	34.64206	33.87371	33.17062	32.52324	31.92395	31.36658	30.84605	30.35817	29.89942	29.46683	29.0579	28.67048	28.30279	27.95332	27.62088	27.30463	27.00429	26.7205	26.45606	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	62.39317	59.9195	57.1643	54.22933	51.27635	48.48263	45.97549	43.80076	41.94055	40.34847	38.97444	37.77514	36.71617	35.77104	34.91947	34.14584	33.43796	32.78624	32.18297	31.62191	31.09795	30.60685	30.14506	29.70956	29.29783	28.90769	28.5373	28.18508	27.84975	27.53028	27.22603	26.93689	26.66376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	62.48466	60.05399	57.34942	54.46635	51.55726	48.7921	46.29727	44.12306	42.25707	40.6568	39.27423	38.06688	37.00063	36.049	35.19164	34.41281	33.70025	33.04426	32.43709	31.87242	31.34511	30.85087	30.38611	29.9478	29.53337	29.14062	28.76766	28.41288	28.07492	27.75266	27.44525	27.15218	26.87353	26.61046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	62.57388	60.18442	57.52838	54.69531	51.82906	49.09251	46.61079	44.43802	42.56701	40.95909	39.56833	38.35317	37.27982	36.32182	35.45877	34.67484	33.95768	33.29752	32.68651	32.11832	31.58772	31.09041	30.62276	30.18171	29.76466	29.36939	28.99397	28.63677	28.29637	27.97159	27.66146	27.36527	27.08266	26.81387	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	62.66093	60.31103	57.70154	54.91664	52.09218	49.38425	46.91634	44.74591	42.87061	41.25555	39.85694	38.63423	37.55394	36.58971	35.72107	34.93214	34.21046	33.54619	32.93142	32.35977	31.82596	31.32565	30.85517	30.41145	29.99185	29.59414	29.21636	28.85684	28.51415	28.18705	27.87449	27.57564	27.28993	27.01711	26.75761	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	62.7459	60.43401	57.86921	55.13076	52.34707	49.66768	47.2142	45.04693	43.16806	41.54639	40.14028	38.91024	37.82318	36.85285	35.97874	35.18488	34.45877	33.79046	33.17201	32.59695	32.05999	31.55674	31.0835	30.63717	30.2151	29.81501	29.43494	29.0732	28.72833	28.39904	28.08425	27.78306	27.49474	27.21883	26.95522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	62.8289	60.55356	58.03171	55.33807	52.59413	49.94316	47.50465	45.34132	43.45957	41.83178	40.41853	39.18139	38.08774	37.11142	36.23194	35.43325	34.70277	34.0305	33.40843	32.83003	32.28998	31.78384	31.3079	30.85902	30.43453	30.03213	29.64984	29.28596	28.93899	28.60762	28.29076	27.98742	27.69681	27.41834	27.15163	26.8967	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	62.91001	60.66984	58.18931	55.53892	52.83372	50.211	47.78795	45.62928	43.7453	42.1119	40.69185	39.44786	38.34778	37.36561	36.48085	35.67741	34.94264	34.26647	33.64084	33.05917	32.51608	32.00711	31.52852	31.07714	30.65028	30.24563	29.86118	29.49522	29.14622	28.81288	28.49403	28.1887	27.89603	27.61533	27.34608	27.08802	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	62.98931	60.78303	58.34226	55.73365	53.06622	50.47152	48.06435	45.91101	44.02545	42.38692	40.96041	39.7098	38.60346	37.61556	36.72562	35.91752	35.17853	34.49853	33.86939	33.28449	32.73843	32.22668	31.74549	31.29166	30.86249	30.45563	30.06908	29.70109	29.35013	29.01488	28.69415	28.38694	28.09236	27.80965	27.53822	27.27765	27.0277	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	63.06689	60.89327	58.49081	55.92255	53.29193	50.72501	48.33407	46.1867	44.30018	42.657	41.22437	39.96738	38.85493	37.86142	36.9664	36.15371	35.41057	34.7268	34.09422	33.50616	32.95716	32.44268	31.95894	31.50271	31.07127	30.66226	30.27365	29.90369	29.55083	29.21372	28.89118	28.58218	28.28579	28.00125	27.72787	27.46515	27.21274	0	0	0	0	0	0	0	0	0	0	0	0	0

1788.5	63.1428	61.00071	58.63517	56.10594	53.51119	50.97176	48.59736	46.45654	44.56964	42.92228	41.48387	40.22072	39.10234	38.10335	37.20334	36.38614	35.63892	34.95144	34.31546	33.72428	33.1724	32.65525	32.169	31.71041	31.27674	30.86562	30.475	30.10311	29.7484	29.40949	29.0852	28.77448	28.47638	28.19011	27.91495	27.65034	27.39581	27.15083	0	0	0	0	0	0	0	0	0	0	0	0
1825	63.21713	61.10546	58.77555	56.28406	53.72427	51.21204	48.85443	46.72069	44.83398	43.1829	41.73903	40.46997	39.34583	38.34146	37.43656	36.61493	35.86369	35.17256	34.53324	33.93899	33.38427	32.86448	32.37577	31.91487	31.47902	31.06583	30.67324	30.29947	29.94294	29.60229	29.2763	28.96391	28.66418	28.37627	28.09945	27.83311	27.57673	27.32992	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	63.28993	61.20766	58.91215	56.45718	53.93147	51.4461	49.10548	46.97934	45.09335	43.43899	41.99	40.71525	39.5855	38.5759	37.66619	36.8402	36.08501	35.39028	34.74767	34.1504	33.59289	33.07051	32.57938	32.11621	31.67821	31.26299	30.86847	30.49285	30.13455	29.79219	29.46455	29.15055	28.84924	28.55976	28.28138	28.01343	27.75537	27.50675	27.26186	0	0	0	0	0	0	0	0	0	0	0
1898	63.36127	61.30742	59.04514	56.62553	54.13303	51.67418	49.35073	47.23263	45.34788	43.69068	42.2369	40.95669	39.8215	38.80677	37.89235	37.06208	36.30299	35.60472	34.95887	34.35863	33.79837	33.27344	32.77992	32.31451	31.87441	31.45719	31.06078	30.68335	30.32332	29.97929	29.65004	29.33448	29.03163	28.74065	28.46077	28.19131	27.9317	27.68144	27.44014	0	0	0	0	0	0	0	0	0	0	0
1934.5	63.4312	61.40485	59.17469	56.78934	54.3292	51.89652	49.59036	47.48073	45.59771	43.93809	42.47983	41.19439	40.05393	39.03419	38.11515	37.28066	36.51775	35.81598	35.16695	34.56377	34.00081	33.47336	32.97749	32.50989	32.06771	31.64854	31.25026	30.87106	30.50933	30.16367	29.83285	29.51576	29.21143	28.91899	28.63767	28.36678	28.10571	27.85395	27.61105	0	0	0	0	0	0	0	0	0	0	0
1971	63.49977	61.50005	59.30096	56.9488	54.52022	52.11334	49.82456	47.72379	45.84296	44.18134	42.71891	41.42847	40.28289	39.25826	38.3347	37.49607	36.72938	36.02418	35.372	34.76593	34.2003	33.67037	33.1722	32.70243	32.25822	31.83712	31.43701	31.05607	30.69267	30.34542	30.01306	29.69448	29.3887	29.09485	28.81213	28.53987	28.27742	28.02425	27.77989	27.54393	0	0	0	0	0	0	0	0	0	0
2007.5	63.56704	61.5931	59.42409	57.10412	54.7063	52.32483	50.05351	47.96194	46.08375	44.42052	42.95425	41.65903	40.50849	39.47909	38.55109	37.70839	36.93798	36.22939	35.57412	34.9652	34.39694	33.86458	33.36413	32.89223	32.44601	32.02301	31.62111	31.23846	30.87343	30.5246	30.19073	29.8707	29.56351	29.26828	28.98422	28.71062	28.44685	28.19235	27.94663	27.70926	0	0	0	0	0	0	0	0	0	0
2044	63.63305	61.6841	59.54422	57.25547	54.88764	52.53122	50.27738	48.19534	46.3202	44.65576	43.18593	41.88617	40.73083	39.69678	38.76442	37.91772	37.14366	36.43173	35.7734	35.16168	34.59082	34.05605	33.55336	33.07936	32.63117	32.20631	31.80264	31.4183	31.05167	30.70131	30.36596	30.0445	29.73592	29.43935	29.15398	28.8791	28.61406	28.35829	28.11128	27.87259	27.63591	0	0	0	0	0	0	0	0	0
2080.5	63.69785	61.77314	59.66147	57.40303	55.06445	52.73267	50.49633	48.42411	46.55242	44.88713	43.41406	42.10996	40.95	39.91141	38.97479	38.12415	37.34649	36.63127	35.96993	35.35544	34.78203	34.24489	33.73999	33.26392	32.81378	32.38708	31.98168	31.59568	31.22747	30.8756	30.5388	30.21594	29.90602	29.60813	29.32148	29.04535	28.77908	28.52208	28.27385	28.03392	27.80188	0	0	0	0	0	0	0	0	0
2117	63.76147	61.86029	59.77598	57.54695	55.2369	52.92938	50.71052	48.64838	46.78052	45.11475	43.63873	42.33052	41.16608	40.12307	39.18227	38.32777	37.54657	36.82811	36.16379	35.54657	34.97064	34.43116	33.92408	33.44597	32.99392	32.56541	32.15829	31.77067	31.4009	31.04755	30.70932	30.38509	30.07384	29.77468	29.48678	29.20943	28.94196	28.68378	28.43438	28.19326	27.96002	0	0	0	0	0	0	0	0	0
2153.5	63.82397	61.94562	59.88785	57.68739	55.40518	53.12152	50.9201	48.86829	47.0046	45.3387	43.86001	42.54791	41.37916	40.33184	39.38695	38.52865	37.74397	37.02231	36.35506	35.73515	35.15672	34.61494	34.10571	33.62559	33.17165	32.74136	32.33255	31.94333	31.57204	31.21722	30.8776	30.55202	30.23947	29.93905	29.64993	29.37138	29.10275	28.84343	28.59289	28.35064	28.11626	27.88933	0	0	0	0	0	0	0	0
2190	63.88538	62.0292	59.9972	57.8245	55.56944	53.30926	51.12523	49.08394	47.22477	45.55907	44.078	42.76222	41.58931	40.5378	39.58891	38.72689	37.93876	37.21396	36.54382	35.92124	35.34037	34.7963	34.28495	33.80285	33.34705	32.91501	32.50454	32.11374	31.74094	31.38469	31.04368	30.71678	30.40296	30.1013	29.81098	29.53128	29.26151	29.00107	28.74943	28.5061	28.27062	28.0426	0	0	0	0	0	0	0	0
2226.5	63.94574	62.11111	60.10411	57.9584	55.72984	53.49274	51.32604	49.29546	47.44112	45.77595	44.29277	42.97353	41.79661	40.74103	39.78823	38.92254	38.13103	37.40312	36.73013	36.10493	35.52163	34.97532	34.46188	33.97783	33.52018	33.08641	32.6743	32.28195	31.90767	31.55	31.20764	30.87944	30.56436	30.26149	29.97	29.68915	29.41827	29.15676	28.90405	28.65965	28.42312	28.19406	27.9673	0	0	0	0	0	0	0
2263	64.00507	62.1914	60.2087	58.08923	55.88653	53.67212	51.52266	49.50296	47.65374	45.98941	44.50439	43.1819	42.00114	40.9416	39.98496	39.11568	38.32085	37.58988	36.91407	36.28628	35.70059	35.15206	34.63656	34.15057	33.69112	33.25563	32.84191	32.44802	32.07229	31.71322	31.36953	31.04005	30.72374	30.41968	30.12704	29.84507	29.5731	29.31052	29.05677	28.81135	28.57381	28.34373	28.12074	0	0	0	0	0	0	0
2299.5	64.06342	62.27013	60.31104	58.21711	56.03965	53.84755	51.71522	49.70655	47.86272	46.19954	44.71295	43.38741	42.20296	41.13957	40.17919	39.30638	38.50827	37.77428	37.0957	36.46536	35.8773	35.32658	34.80904	34.32115	33.8599	33.42274	33.00742	32.61202	32.23485	31.87441	31.52941	31.19866	30.88114	30.57591	30.28214	29.99908	29.72604	29.46242	29.20765	28.96124	28.7227	28.49164	28.26767	27.31154	0	0	0	0	0	0
2336	64.12082	62.34735	60.41123	58.34214	56.18934	54.01916	51.90386	49.90634	48.06816	46.40641	44.9185	43.59012	42.40213	41.33502	40.37098	39.4947	38.69337	37.95641	37.27509	36.64222	36.05183	35.49895	34.97939	34.48962	34.02661	33.58778	33.17089	32.774	32.39541	32.03362	31.68732	31.35533	31.03662	30.73024	30.43536	30.15122	29.87714	29.6125	29.35673	29.10934	28.86985	28.63784	28.41292	28.19473	0	0	0	0	0	0
2372.5	64.17728	62.42313	60.50934	58.46445	56.33572	54.18708	52.08869	50.10242	48.27014	46.6101	45.12112	43.7901	42.59873	41.52799	40.56038	39.6807	38.8762	38.13631	37.45229	36.81692	36.22423	35.66922	35.14767	34.65604	34.19129	33.75081	33.33238	32.93402	32.55403	32.19091	31.84333	31.51012	31.19023	30.88271	30.58674	30.30154	30.02643	29.76079	29.50405	29.25571	29.01528	28.78234	28.55651	28.33743	0	0	0	0	0	0
2409	64.23286	62.49751	60.60546	58.58412	56.47891	54.35144	52.26982	50.2949	48.46873	46.81067	45.32087	43.9874	42.7928	41.71856	40.74746	39.86444	39.05683	38.31404	37.62736	36.98953	36.39457	35.83744	35.31393	34.82046	34.35399	33.9119	33.49193	33.09212	32.71075	32.34631	31.99748	31.66306	31.34201	31.03338	30.73633	30.45009	30.17397	29.90735	29.64966	29.40037	29.15903	28.9252	28.69848	28.47851	28.26225	0	0	0	0	0
2445.5	64.28756	62.57054	60.69965	58.70126	56.61903	54.51235	52.44737	50.48387	48.66403	47.00819	45.51781	44.18209	42.98441	41.90678	40.93227	40.04599	39.2353	38.48967	37.80035	37.1601	36.56289	36.00367	35.47822	34.98294	34.51477	34.07107	33.64959	33.24835	32.86562	32.49989	32.14981	31.81421	31.49202	31.18229	30.88418	30.59691	30.3198	30.05221	29.79358	29.54338	29.30114	29.06643	28.83884	28.61802	28.40363	0	0	0	0	0
2482	64.34143	62.64226	60.79198	58.81596	56.75618	54.66993	52.62144	50.66942	48.85611	47.20274	45.71201	44.37423	43.17362	42.0927	41.11487	40.22538	39.41168	38.66324	37.97133	37.32868	36.72924	36.16797	35.6406	35.14353	34.67367	34.2284	33.80543	33.40277	33.01869	32.65168	32.30038	31.96361	31.64029	31.32948	31.03032	30.74205	30.46396	30.19542	29.93587	29.68477	29.44165	29.20608	28.97764	28.75598	28.54077	28.13776	0	0	0	0
2518.5	64.39447	62.71272	60.88252	58.92831	56.89047	54.8243	52.79215	50.85165	49.04504	47.39437	45.90351	44.56386	43.36046	42.27638	41.29531	40.40268	39.58601	38.83481	38.14034	37.49531	36.89369	36.33038	35.80111	35.30226	34.83075	34.38392	33.95947	33.55541	33.17001	32.80174	32.44923	32.1113	31.78687	31.475	31.17481	30.88554	30.60649	30.33702	30.07656	29.82458	29.58059	29.34417	29.11491	28.89244	28.67641	28.46651	0	0	0	0
2555	64.44672	62.78195	60.97133	59.03839	57.022	54.97555	52.95958	51.03064	49.2309	47.58315	46.09237	44.75105	43.545	42.45787	41.47364	40.57794	39.75835	39.00442	38.30742	37.66006	37.05626	36.49094	35.9598	35.4592	34.98605	34.53767	34.11176	33.70633	33.31962	32.9501	32.5964	32.25733	31.93181	31.61888	31.31767	31.02743	30.74743	30.47704	30.21568	29.96283	29.718	29.48075	29.25068	29.02741	28.8106	28.59994	0	0	0	0
2591.5	64.4982	62.85001	61.05847	59.14628	57.15087	55.12378	53.12383	51.20648	49.41375	47.76914	46.27866	44.93583	43.72729	42.63721	41.64991	40.75119	39.92874	39.17213	38.47263	37.82296	37.21702	36.64971	36.11671	35.61439	35.13961	34.68971	34.26236	33.85556	33.46756	33.0968	32.74193	32.40173	32.07513	31.76116	31.45896	31.16774	30.88681	30.61552	30.35328	30.09958	29.85392	29.61585	29.38498	29.16093	28.94335	28.73193	28.52508	0	0	0
2628	64.54893	62.91692	61.144	59.25205	57.27715	55.2691	53.285	51.37925	49.59367	47.95239	46.46242	45.11826	43.90737	42.81445	41.82416	40.92249	40.09722	39.33797	38.63601	37.98406	37.376	36.80672	36.27189	35.76786	35.29148	34.84006	34.41129	34.00315	33.61387	33.24189	32.88586	32.54455	32.21688	31.90189	31.5987	31.30653	31.02468	30.75249	30.48939	30.23484	29.98836	29.7495	29.51785	29.29303	29.07469	28.86253	28.65624	0	0	0
2664.5	64.59894	62.98272	61.22796	59.35578	57.40095	55.41159	53.44318	51.54902	49.77073	48.13297	46.6437	45.29839	44.08529	42.98963	41.99644	41.09189	40.26385	39.50199	38.79761	38.1434	37.53325	36.96202	36.42539	35.91965	35.44169	34.98878	34.55861	34.14913	33.75859	33.38541	33.02823	32.68582	32.3571	32.04109	31.73693	31.44382	31.16106	30.888	30.62404	30.36867	30.12138	29.88173	29.64931	29.42373	29.20466	28.99177	28.78476	28.52918	0	0
2701	64.64823	63.04745	61.31042	59.45753	57.52234	55.55134	53.59844	51.71587	49.94499	48.31093	46.82255	45.47626	44.26108	43.1628	42.16679	41.25941	40.42866	39.66424	38.95746	38.30102	37.6888	37.11565	36.57722	36.06982	35.59028	35.13591	34.70434	34.29355	33.90175	33.52739	33.16907	32.82558	32.49582	32.17881	31.87369	31.57965	31.296	31.02206	30.75727	30.50108	30.25299	30.01257	29.77939	29.55308	29.33328	29.11968	28.91197	28.70986	0	0
2737.5	64.69684	63.11113	61.39141	59.55738	57.6414	55.68844	53.75088	51.87988	50.11651	48.48632	46.99902	45.65192	44.4348	43.33401	42.33525	41.42511	40.59169	39.82474	39.1156	38.45696	37.8427	37.26765	36.72745	36.21839	35.7373	35.28147	34.84852	34.43643	34.0434	33.66786	33.30842	32.96386	32.63307	32.31508	32.00901	31.71406	31.42951	31.15473	30.8891	30.63211	30.38324	30.14205	29.90813	29.68109	29.46058	29.24628	29.03788	28.83511	0	0
2774	64.74477	63.17381	61.47099	59.65538	57.7582	55.82297	53.90057	52.04112	50.28535	48.65921	47.17315	45.8254	44.60648	43.50328	42.50186	41.58903	40.75299	39.98355	39.27208	38.61127	37.99499	37.41806	36.8761	36.36541	35.88278	35.4255	34.9912	34.57782	34.18357	33.80686	33.44632	33.1007	32.7689	32.44993	32.14292	31.84707	31.56165	31.28602	31.01958	30.76179	30.51215	30.27021	30.03556	29.8078	29.58659	29.3716	29.16253	28.95909	28.76048	0
2810.5	64.79206	63.2355	61.5492	59.75159	57.87282	55.955	54.04759	52.19965	50.45158	48.82962	47.34499	45.99675	44.77616	43.67066	42.66666	41.75119	40.91258	40.1407	39.42692	38.76397	38.14569	37.5669	37.02321	36.5109	36.02676	35.56805	35.1324	34.71774	34.32228	33.94443	33.58279	33.23612	32.90332	32.58339	32.27546	31.97871	31.69243	31.41597	31.14872	30.89014	30.63975	30.39707	30.16169	29.93323	29.71133	29.49567	29.28593	29.08184	28.88315	0
2847	64.83871	63.29624	61.62609	59.84607	57.98533	56.08461	54.19201	52.35555	50.61526	48.99763	47.51459	46.16602	44.94388	43.83618	42.82969	41.91165	41.07051	40.29622	39.58018	38.91511	38.29485	37.71422	37.16882	36.6549	36.16926	35.70913	35.27215	34.85624	34.45959	34.0806	33.71788	33.37017	33.03638	32.7155	32.40665	32.10902	31.82189	31.5446	31.27656	31.01721	30.76606	30.52265	30.28656	30.05741	29.83483	29.6185	29.40811	29.20339	29.00406	28.79393
2883.5	64.88474	63.35606	61.70168	59.93887	58.09578	56.21188	54.3339	52.50889	50.77643	49.16327	47.68199	46.33323	45.10968	43.99988	42.99097	42.07042	41.22681	40.45015	39.73187	39.06471	38.4425	37.86006	37.31296	36.79745	36.31032	35.8488	35.4105	34.99334	34.5955	34.21539	33.8516	33.50287	33.1681	32.84628	32.53652	32.23802	31.95006	31.67195	31.40312	31.14301	30.89112	30.64699	30.4102	30.18036	29.95712	29.74013	29.5291	29.32375	29.1238	28.92901

VOID RATIO e

Time	Height from Bottom (metres)																																																	
days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
36.5	2.846207	7.373159	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
73	2.555706	5.419942	7.502894	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
109.5	2.399144	4.381531	6.461548	7.545913	7.58166	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
146	2.29371	3.793187	5.601304	6.899149	7.564212	7.58166	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
182.5	2.215029	3.417961	4.987102	6.218304	7.134839	7.572819	7.58166	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
219	2.15269	3.157451	4.527553	5.683921	6.581514	7.279163	7.577079	7.58166	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
255.5	2.101314	2.965077	4.171247	5.256617	6.117227	6.82082	7.373982	7.579252	7.58166	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
292	2.057774	2.816344	3.88758	4.905968	5.731296	6.41298	6.990121	7.438722	7.580382	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
328.5	2.020098	2.697258	3.656929	4.612231	5.405144	6.063661	6.628332	7.11573	7.483754	7.580976	7.58166	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
365	1.986965	2.599269	3.466035	4.362223	5.124988	5.762166	6.310349	6.792348	7.212058	7.515235	7.581292	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
401.5	1.957447	2.516864	3.30561	4.146752	4.881037	5.49883	6.031117	6.501276	6.921419	7.287671	7.537151	7.581461	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
438	1.930873	2.446326	3.168968	3.959152	4.666223	5.266253	5.783966	6.241804	6.653683	7.025526	7.347982	7.55225	7.581552	7.58166	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
474.5	1.906737	2.385054	3.051198	3.794419	4.475324	5.058853	5.563296	6.009529	6.41175	6.778255	7.111116	7.396582	7.562507	7.581601	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
511	1.884652	2.331171	2.948619	3.6487	4.304377	4.872379	5.364676	5.800232	6.193001	6.551956	6.881994	7.182542	7.435956	7.569363	7.581628	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
547.5	1.864315	2.283292	2.858429	3.518965	4.150313	4.703539	5.184624	5.610391	5.994305	6.345488	6.669713	6.969693	7.242847	7.467887	7.573871	7.581643	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
584	1.845484	2.240364	2.778466	3.402786	4.010702	4.549743	5.020379	5.437146	5.812864	6.156596	6.474412	6.77006	7.044753	7.294224	7.49371	7.576787	7.581651	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
620.5	1.827964	2.201574	2.707034	3.298195	3.883587	4.408924	4.86973	5.278176	5.646326	5.983072	6.29457	6.584946	6.856607	7.109656	7.338291	7.514459	7.578646	7.581655	7.58166	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
657	1.811593	2.166286	2.642792	3.203579	3.767367	4.279404	4.730884	5.131588	5.492736	5.822979	6.12846	6.413457	6.680819	6.932011	7.166254	7.376264	7.530975	7.579814	7.581657	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
693.5	1.79624	2.133991	2.584662	3.117601	3.660713	4.159807	4.602373	4.995825	5.35047	5.674666	5.974492	6.254276	6.517052	6.764794	6.998275	7.215961	7.409073	7.543962	7.58054	7.581659	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
730	1.78179	2.104278	2.531771	3.039146	3.56251	4.048989	4.482979	4.869594	5.218173	5.536739	5.831272	6.106101	6.364341	6.608181	6.838968	7.056938	7.259869	7.437444	7.55403	7.580985	7.581659	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
766.5	1.768151	2.076811	2.483406	2.967278	3.471813	3.945988	4.371683	4.751814	5.094709	5.408018	5.6976	5.967756	6.221631	6.461514	6.688997	6.904963	7.109204	7.298838	7.461952	7.56171	7.581257	7.58166	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
803	1.755241	2.051312	2.438977	2.901204	3.387812	3.849989	4.267627	4.64157	4.979114	5.287501	5.572445	5.838205	6.08793	6.323954	6.547983	6.761174	6.964053	7.156026	7.33355	7.483064	7.567471	7.58142	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
839.5	1.74299	2.027549	2.397993	2.840252	3.309811	3.760292	4.170078	4.538087	4.870569	5.174331	5.454924	5.716549	5.962347	6.194668	6.415275	6.625455	6.826037	7.017256	7.198172	7.364553	7.501163	7.571717	7.581518	7.58166	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
876	1.731339	2.005327	2.360043	2.783844	3.237206	3.676294	4.078409	4.4407	4.768371	5.067773	5.344273	5.602007	5.844093	6.072887	6.29018	6.497321	6.695284	6.884645	7.065395	7.236261	7.392291	7.516581	7.574791	7.581577	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
912.5	1.720235	1.98448	2.324777	2.731487	3.169468	3.59747	3.992076	4.348834	4.671914	4.96719	5.239832	5.493897	5.732477	5.957923	6.172037	6.376202	6.571465	6.75856	6.93786	7.109141	7.270803	7.417127	7.529604	7.576979	7.581611	7.58166	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
949	1.709631	1.964866	2.291901	2.682752	3.106135	3.523361	3.910606	4.261991	4.580673	4.872031	5.141025	5.391626	5.62689	5.84916	6.060241	6.261532	6.454118	6.638815	6.816171	6.986387	7.149048	7.302219	7.43936	7.540498	7.578511	7.581632	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
985.5	1.699487	1.946364	2.261161	2.637271	3.046801	3.45356	3.833587	4.179737	4.494189	4.781815	5.04735	5.294672	5.526799	5.746056	5.954247	6.152782	6.342763	6.525049	6.700278	6.868846	7.030813	7.185578	7.330858	7.459237	7.549505	7.579567	7.581644	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1022	1.689768	1.928868	2.232338	2.59472	2.991105	3.387709	3.760652	4.101689	4.412059	4.696118	4.958367	5.20258	5.431731	5.648128	5.85357	6.049468	6.236935	6.416855	6.589912	6.7566	6.917195	7.071627	7.219116	7.357011	7.476968	7.556858	7.580285	7.581657	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1058.5	1.680441	1.912286	2.205244	2.554817	2.938729	3.325489	3.69148	4.027512	4.333928	4.614568	4.873686	5.114944	5.341269	5.55495	5.757775	5.951153	6.136207	6.31383	6.484734	6.649466	6.808407	6.961727	7.10924	7.249988	7.380924	7.49273	7.562778	7.580766	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1095	1.671478	1.896537	2.179714	2.517316	2.889389	3.266614	3.625781	3.956907	4.259484	4.536836	4.792961	5.031406	5.255044	5.46614	5.666472	5.857446	6.040187	6.215594	6.384395	6.547166	6.704346	6.856221	7.002872	7.144003	7.278471	7.402803	7.506679	7.567473	7.58111	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1131.5	1.662852	1.881551	2.155604	2.481998	2.84283	3.210828	3.563301	3.889607	4.188446	4.462628	4.715888	4.951648	5.172726	5.381359	5.579314	5.767993	5.948519	6.121796	6.288558	6.449401	6.604794	6.755087	6.90049	7.040999	7.176214	7.304801	7.422823	7.518952	7.571141	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1168	1.654542	1.867265	2.132788	2.448671	2.798826	3.157899	3.503806	3.825375	4.120566	4.391683	4.642192	4.875386	5.094019	5.300303	5.49599	5.682476	5.860882	6.032112	6.196908	6.355872	6.509494	6.65816	6.802145	6.941591	7.076421	7.20613	7.329179	7.441134	7.529678	7.574283	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1204.5	1.646526	1.853624	2.111154	2.417164	2.757173	3.107618	3.447089	3.763997	4.05562	4.323767	4.571628	4.802363	5.01866	5.2227	5.41622	5.60061	5.776985	5.946252	6.109153	6.266298	6.418186	6.565224	6.707727	6.845909	6.979851	7.109409	7.233971	7.351779	7.457862	7.538975	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1241	1.638785	1.840578	2.090605	2.387326	2.717688	3.059797	3.392961	3.705281	3.993407	4.258668	4.503977	4.732351	4.946412	5.148304	5.339752	5.522135	5.696565	5.863949	6.025027	6.180414	6.330616	6.476051	6.617058	6.753891	6.886714	7.015553	7.140197	7.259928	7.372751	7.473117	7.551211	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1277.5	1.631303	1.828082	2.071052	2.359021	2.680206	3.014264	3.341251	3.649051	3.933746	4.196198	4.43904	4.665143	4.877058	5.076895	5.266357	5.446818	5.619384	5.784959	5.944286	6.097977	6.246545	6.390415	6.529938	6.665396	6.796994	6.92485	7.048941	7.168991	7.284169	7.392223	7.486993	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1314	1.624063	1.816097	2.052417	2.332128	2.644578	2.970861	3.291803	3.59515	3.876473	4.136184	4.376637	4.600553	4.810407	5.008271	5.19583	5.374448	5.545225	5.709064	5.866705	6.018763	6.165751	6.3081	6.446168	6.580252	6.710585	6.837333	6.96057	7.080229	7.195969	7.306838	7.410307	7.521958	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1350.5	1.617051	1.804587	2.03463	2.306538	2.610668	2.929447	3.244473	3.543433	3.821439	4.078471	4.316606	4.538411	4.746281	4.94225	5.127983	5.304831	5.473892	5.636062	5.792082	5.942566	6.088028	6.228902	6.365551	6.498281	6.627342	6.752927	6.875165	6.994094	7.109604	7.221287	7.328062	7.427099	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1387	1.610255	1.79352	2.017628	2.282153	2.578353	2.889889	3.199131	3.493768	3.768508	4.022918	4.258799	4.478562	4.684521	4.878668	5.062645	5.237794	5.405204	5.56577	5.72023	5.869197	6.013186	6.152632	6.287903	6.419308	6.547108	6.671514	6.792685	6.910719	7.025618	7.137231	7.245083	7.347953	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1423.5	1.603661	1.782867	2.001355	2.258885	2.547523	2.852069	3.155657	3.446036	3.717555	3.969394	4.20308	4.420866	4.624981	4.817373	4.999662	5.173175	5.338998	5.49802	5.650978	5.798483	5.941051	6.079116	6.213049	6.343163	6.469724	6.592955	6.713034	6.830091	6.944193	7.055313	7.163257	7.267479	7.366609	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1460	1.59726	1.7726	1.98576	2.236655	2.518074	2.815875	3.113941	3.400124	3.668468	3.917783	4.149327	4.365195	4.567528	4.758227	4.938889	5.110829	5.275124	5.432659	5.584169	5.730265	5.871461	6.008192	6.140828	6.269687	6.395037	6.517109	6.636093	6.752137	6.865347	6.975764	7.083331	7.18781	7.288582	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1496.5	1.591041	1.762696	1.970796	2.215389	2.489916	2.781208	3.07388	3.35593	3.621141	3.867974	4.097427	4.311432	4.51204	4.701105	4.880198	5.050621	5.213443	5.369546	5.519661	5.664397	5.804268	5.939709	6.07109	6.19873	6.322901	6.443836	6.561734	6.676757	6.78903	6.898635	7.005589	7.109806	7.211005	7.308488	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1533	1.584994	1.753133	1.956422	2.195023	2.462962	2.747972	3.035379	3.313362	3.575478	3.81987	4.047276	4.259467	4.458404	4.645889	4.823468	4.992428	5.15383	5.308552	5.45732	5.600744	5.739335	5.873528	6.003694	6.130152	6.253175	6.373001	6.489831	6.603837	6.715158	6.823897	6.930115	7.033807	7.134859	7.232946	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1569.5	1.579111	1.74389	1.942599	2.175496	2.437136	2.716083	2.998352	3.27233	3.531391	3.773378	3.998779	4.209203	4.406517	4.592474	4.76859	4.936137	5.096169	5.249556	5.397025	5.539181	5.676536	5.809522	5.938512	6.063824	6.185733	6.304477	6.420261	6.533263	6.64363	6.751481	6.856901	6.95993	7.060543	7.158598	7.253723	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1606	1.573384	1.734948	1.929292	2.156754	2.412365	2.685461	2.962718	3.232754	3.488798	3.728413	3.951847	4.160547	4.356285	4.540761	4.715462	4.881644	5.040351	5.19245	5.338663	5.479594	5.615753	5.747573	5.875423	5.999624	6.12045	6.238142	6.352906	6.464922	6.574345	6.681301	6.785893	6.888187	6.988208	7.085909	7.181119	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1642.5	1.567804	1.726291	1.916469	2.138746	2.388585	2.656032	2.928401	3.194559	3.447622	3.684897	3.906399	4.113414	4.307619	4.490658	4.663989	4.828851	4.986278	5.137132	5.282131	5.421877	5.556879	5.687569	5.814317	5.93744	6.057216	6.173884	6.287653	6.398705	6.507197	6.613265	6.717018	6.818541	6.917887	7.015064	7.110004	7.202511	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1679	1.562366	1.717903	1.904101	2.121429	2.365736	2.627728	2.895331	3.157675	3.407793	3.642758	3.86236	4.067728	4.26044	4.442083	4.614086	4.777669	4.933857	5.083506	5.227331	5.365931	5.499814	5.62941	5.755088	5.877168	5.995924	6.111597	6.224397	6.334507	6.442088	6.547277	6.650192	6.750929	6.849559	6.946119	7.040602	7.132921	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1715.5	1.557063	1.709769	1.892162	2.104758	2.343761	2.600486	2.863442	3.122036	3.369245	3.601928	3.819661	4.023415	4.21467	4.394957	4.565672	4.728016	4.883004	5.031487	5.174175	5.311665	5.444464	5.573	5.697642	5.818709	5.936476	6.051182	6.163039	6.272231	6.378919	6.483245	6.585331	6.685279	6.783171	6.879066	6.972988	7.064914	7.154755	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1752	1.551888	1.701876	1.880626	2.088696	2.32261	2.574247	2.832675	3.087582	3.331917	3.562345	3.778236	3.980408	4.170241	4.349209	4.518672	4.679814	4.83364	4.980993	5.122579	5.258995	5.390742	5.518251	5.641889	5.761974	5.878779	5.992547	6.103486	6.211783	6.3176	6.42108	6.522349	6.621512	6.718661	6.813865	6.90717	6.99859	7.088087	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1788.5	1.546836	1.694212	1.869472	2.073208	2.302235	2.548957	2.802971	3.054257	3.295752	3.52395	3.738026	3.938644	4.127087	4.304769	4.473016	4.632993	4.785691	4.931948	5.072467	5.20784	5.338569	5.465082	5.587746	5.706876	5.822749	5.935604	6.045651	6.153077	6.258044	6.360696	6.461162	6.55955	6.655957	6.750461	6.843119	6.933969	7.023012	7.110291	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1825	1.541902	1.686765	1.858677	2.05826	2.282593	2.524564	2.774278	3.022005	3.260696	3.486689	3.698973	3.898065	4.085149	4.261577	4.428641	4.587485	4.739089	4.884283	5.023767	5.158129	5.28787	5.413416	5.535133	5.653338	5.768305	5.880273	5.989452	6.096029	6.200167	6.302011	6.40169	6.499317	6.594989	6.688791	6.780789	6.871035	6.959553	7.046333	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1861.5	1.53708	1.679523	1.848223	2.043823	2.263643	2.501022	2.746546	2.990778	3.226698	3.45051	3.661026	3.858617	4.04437	4.219574	4.385486	4.543229	4.69377	4.837932	4.97641	5.109791	5.238573	5.363181	5.48398	5.601286	5.715372	5.826477	5.934812	6.040563	6.143893	6.244949	6.343858	6.440737	6.535684	6.628789	6.720124	6.809748	6.897701	6.984	7.070538	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1898	1.532366	1.672478	1.838091	2.029868	2.245348	2.478286	2.719728	2.960528	3.193713	3.415367	3.624135	3.82025	4.004697	4.178706	4.343495	4.500166	4.649674	4.792834	4.930336	5.062764	5.190615	5.314311	5.434218	5.55065	5.66388	5.774147	5.881661	5.986607	6.08915	6.189435	6.287593	6.383739	6.477974	6.57039	6.661063	6.750059	6.837427	6.9232	7.007386	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1934.5	1.527755	1.66562	1.828266	2.016369	2.227672	2.456315	2.693781	2.931211	3.161696	3.381213	3.588254	3.782914	3.96608	4.138921	4.302615	4.458243	4.606746	4.748932	4.885485	5.016987	5.143933	5.266744	5.385784	5.501366	5.613763	5.723214	5.829929	5.934092	6.035868	6.135402	6.232826	6.328254	6.421791	6.513529	6.603547	6.691914	6.778688	6.863911	6.947607	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1971	1.523243	1.65894	1.81873	2.003302	2.210582	2.435071	2.668662	2.902786	3.130604	3.348008	3.553341	3.746567	3.928475	4.100172	4.262797	4.417408	4.564933	4.706171	4.841802	4.972405	5.09847	5.22042	5.338617	5.453373	5.564961	5.673618	5.779554	5.882954	5.983982	6.082784	6.179491	6.274219	6.367071	6.458142	6.547514	6.635258	6.721435	6.806096	6.889275	6.970995	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2007.5	1.518827	1.65243	1.809471	1.990646	2.194049	2.414517	2.644334	2.875214	3.1004	3.315711	3.519355	3.711166	3.891838	4.062414	4.223995	4.377614	4.524187	4.664503	4.799236	4.928963	5.054173	5.175286	5.292662	5.406614	5.517414	5.625299	5.730477	5.833134	5.933433	6.031521	6.127528	6.22157	6.313753	6.404171	6.492906	6.580033	6.665617	6.749711	6.832359	6.91359	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2044	1.514503	1.646083	1.800474	1.978379	2.178045	2.39462	2.62076	2.848457	3.071046	3.284285	3.486258	3.676671	3.856128	4.025605	4.186165	4.338817	4.484461	4.623879	4.757739	4.886614	5.010992	5.131289	5.247867	5.361037	5.471069	5.578201	5.682641	5.784574	5.884163	5.981554	6.076878	6.170251	6.261779	6.351556	6.439667	6.526187	6.611182	6.694711	6.776821	6.857549	6.938974	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2080.5	1.510266	1.63989	1.791727	1.966481	2.162543	2.375347	2.597907	2.82248	3.042507	3.253696	3.454013	3.643047	3.821307	3.989706	4.149267	4.300975	4.445713	4.584255	4.717265	4.845311	4.968877	5.088382	5.204182	5.31659	5.425875	5.532274	5.635995	5.737222	5.836118	5.93283	6.027487	6.120206	6.211094	6.300244	6.387742	6.473664	6.558079	6.641046	6.722618	6.802835	6.881731	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2117	1.506115	1.633847	1.783219	1.954936	2.147517	2.356671	2.57574	2.797252	3.014751	3.22391	3.422588	3.610259	3.787339	3.95468	4.113263	4.264047	4.407902	4.545591	4.677772	4.805009	4.927786	5.046518	5.161561	5.273227	5.381784	5.487468	5.590488	5.691027	5.789247	5.885296	5.979302	6.071383	6.161644	6.250181	6.337078	6.422414	6.506257	6.588669	6.669705	6.749409	6.82782	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2153.5	1.502045	1.627946	1.774937	1.943725	2.132947	2.338562	2.554231	2.77274	2.987746	3.194896	3.39195	3.578273	3.754191	3.920492	4.078116	4.227998	4.37099	4.507846	4.639219	4.765669	4.887676	5.005654	5.11996	5.230902	5.338749	5.443737	5.546074	5.645941	5.743503	5.838904	5.932275	6.023732	6.113381	6.201318	6.287627	6.372387	6.455669	6.537533	6.618038	6.69723	6.775152	6.851842	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2190	1.498054	1.622181	1.766873	1.932833	2.118809	2.320994	2.533351	2.748914	2.961462	3.166624	3.36207	3.547059	3.72183	3.887108	4.043793	4.192791	4.33494	4.470984	4.601569	4.72725	4.848507	4.965751	5.079338	5.189575	5.29673	5.401039	5.502708	5.601921	5.698839	5.793608	5.886359	5.977207	6.066258	6.153607	6.239341	6.323537	6.406266	6.487593	6.567573	6.646257	6.72369	6.799907	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2226.5	1.494139	1.616548	1.759016	1.922245	2.105083	2.303943	2.513072	2.725748	2.935872	3.139066	3.332918	3.516587	3.690227	3.854499	4.010262	4.158395	4.29972	4.43497	4.564785	4.689717	4.810243	4.926771	5.039655	5.149204	5.255684	5.359331	5.460349	5.558923	5.655213	5.749366	5.84151	5.931763	6.020229	6.107004	6.192175	6.275818	6.358006	6.438803	6.518266	6.596448	6.673394	6.749144	6.825353	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2263	1.490297	1.61104	1.751357	1.911947	2.091751	2.287386	2.493368	2.703215	2.910949	3.112196	3.304468	3.486831	3.659352	3.822634	3.977491	4.124777	4.265296	4.399771	4.528834	4.653035	4.772846	4.888676	5.000876	5.109754	5.215575	5.318575	5.418958	5.516908	5.612585	5.706136	5.797688	5.887359	5.975253	6.061467	6.146086	6.229188	6.310845	6.391122	6.470077	6.547763	6.624228	6.699512	6.773651	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2299.5	1.486526	1.605652	1.743889	1.901927	2.078794	2.271301	2.474217	2.681289	2.886668	3.085988	3.276695	3.457763	3.629181	3.791486	3.945454	4.091909	4.231639	4.365355	4.493685	4.617171	4.736285	4.851433	4.962965	5.071187	5.176366	5.278734	5.378498	5.475838	5.570917	5.663878	5.754852	5.843954	5.93129	6.016954	6.101033	6.183605	6.264742	6.344509	6.422964	6.500162	6.576151	6.650973	6.724666	7.052857	99.999	99.999	99.999	99.999	99.999	99.999
2336	1.482823	1.600381	1.736602	1.892171	2.066197	2.255667	2.455593	2.659947	2.863005	3.060418	3.249573	3.429359	3.599685	3.761029	3.914122	4.059762	4.198719	4.331694	4.459306	4.582095	4.700528	4.81501	4.925889	5.033472	5.138023	5.239774	5.338932	5.435677	5.530171	5.622558	5.712966	5.801512	5.888301	5.973428	6.056979	6.139032	6.219659	6.298925	6.37689	6.453607	6.529127	6.603492	6.676742	6.748919	99.999	99.999	99.999	99.999	99.999	99.999
2372.5	1.479187	1.595221	1.729489	1.882669	2.053943	2.240465	2.437477	2.639166	2.839937	3.035463	3.223081	3.401597	3.570843	3.731238	3.88347	4.02831	4.16651	4.298759	4.42567	4.547777	4.665545	4.779375	4.889618	4.996576	5.100513	5.201662	5.300228	5.396392	5.490314	5.582139	5.671994	5.759997	5.846251	5.930852	6.013886	6.09543	6.175558	6.254333	6.331816	6.408062	6.483119	6.557033	6.629844	6.701588	99.999	99.999	99.999	99.999	99.999	99.999
2409	1.475614	1.590169	1.722543	1.87341	2.042017	2.225676	2.419847	2.618924	2.817442	3.011103	3.197196	3.374452	3.54263	3.702088	3.853473	3.997528	4.134986	4.266524	4.392748	4.514189	4.631306	4.744501	4.854121	4.960468	5.063806	5.164367	5.262355	5.35795	5.451313	5.542588	5.631903	5.719374	5.805105	5.889191	5.971719	6.052766	6.132404	6.210698	6.287709	6.363491	6.438093	6.511563	6.58394	6.655261	6.726464	99.999	99.999	99.999	99.999	99.999
2445.5	1.472104	1.58522	1.715758	1.864383	2.030406	2.211284	2.402684	2.599202	2.7955	2.987315	3.171897	3.347905	3.515025	3.673559	3.82411	3.967392	4.104122	4.234964	4.360516	4.481305	4.597786	4.71036	4.819371	4.925121	5.027873	5.127859	5.225281	5.32032	5.413137	5.503875	5.592661	5.679611	5.764831	5.848414	5.930445	6.011005	6.090163	6.167986	6.244533	6.319859	6.394015	6.467047	6.538996	6.6099	6.679793	99.999	99.999	99.999	99.999	99.999
2482	1.468653	1.580371	1.709128	1.85558	2.019095	2.197271	2.38597	2.579979	2.774092	2.964081	3.147164	3.321935	3.488008	3.645628	3.795357	3.93788	4.073895	4.204055	4.32895	4.4491	4.564959	4.676925	4.785341	4.890507	4.992686	5.092109	5.188979	5.283474	5.375757	5.465968	5.554237	5.640679	5.725397	5.808487	5.890033	5.970115	6.048804	6.126164	6.202257	6.277136	6.350853	6.423454	6.494981	6.565473	6.634964	6.767948	99.999	99.999	99.999	99.999

2518.5	1.46526	1.575618	1.702645	1.84699	2.008074	2.183623	2.369686	2.561237	2.753197	2.941381	3.122979	3.296522	3.461558	3.618275	3.767194	3.908971	4.044284	4.173775	4.298025	4.41755	4.532801	4.644172	4.752005	4.856601	4.95822	5.057092	5.15342	5.247384	5.339144	5.428841	5.516604	5.602547	5.686775	5.769382	5.850453	5.930067	6.008295	6.085202	6.160849	6.23529	6.308576	6.380753	6.451865	6.52195	6.591044	6.659185	99.999	99.999	99.999	99.999
2555	1.461924	1.570958	1.696305	1.838605	1.997329	2.170325	2.353816	2.542958	2.732799	2.919198	3.099324	3.271649	3.435658	3.591482	3.739601	3.880643	4.015267	4.144101	4.26772	4.386633	4.501288	4.612077	4.71934	4.823377	4.924448	5.022782	5.118581	5.212024	5.303272	5.392465	5.479732	5.565188	5.648936	5.73107	5.811676	5.890831	5.968608	6.045071	6.12028	6.194291	6.267153	6.338915	6.409618	6.479303	6.548004	6.615755	99.999	99.999	99.999	99.999
2591.5	1.458642	1.566388	1.690102	1.830417	1.98685	2.157362	2.338345	2.525126	2.71288	2.897515	3.076181	3.247298	3.410288	3.565229	3.712559	3.852878	3.986824	4.115014	4.238013	4.356327	4.470398	4.580617	4.687323	4.790813	4.891347	4.989154	5.084435	5.177369	5.268116	5.356816	5.443598	5.528576	5.611853	5.693524	5.773674	5.85238	5.929714	6.005742	6.080522	6.15411	6.226558	6.29791	6.368212	6.437502	6.505817	6.57319	6.640069	99.999	99.999	99.999
2628	1.455413	1.561904	1.684031	1.822419	1.976626	2.144723	2.323257	2.507725	2.693423	2.876315	3.053535	3.223453	3.385433	3.5395	3.686051	3.825656	3.958936	4.086494	4.208886	4.326611	4.440111	4.549772	4.655932	4.758887	4.858895	4.956186	5.05096	5.143395	5.233651	5.321869	5.408175	5.492685	5.575502	5.656719	5.736421	5.814688	5.891588	5.967188	6.041548	6.114722	6.186761	6.257713	6.327619	6.396521	6.464455	6.531455	6.59755	99.999	99.999	99.999
2664.5	1.452235	1.557503	1.678088	1.814603	1.966648	2.132393	2.308538	2.490738	2.674414	2.855582	3.031368	3.200097	3.361076	3.514277	3.660059	3.798962	3.931586	4.058522	4.180318	4.297468	4.410407	4.519521	4.625146	4.727576	4.827071	4.923856	5.018133	5.11008	5.199855	5.287599	5.37344	5.457492	5.539857	5.620629	5.699894	5.777728	5.854204	5.929385	6.003332	6.076099	6.147738	6.218295	6.287814	6.356335	6.423893	6.490525	6.55626	6.638737	99.999	99.999
2701	1.449107	1.553184	1.672267	1.806962	1.956906	2.120362	2.294174	2.474153	2.655838	2.835301	3.009667	3.177216	3.337201	3.489545	3.634567	3.772777	3.904756	4.031082	4.152292	4.268876	4.381267	4.489845	4.594946	4.696862	4.795852	4.892142	4.985933	5.077401	5.166705	5.253986	5.339371	5.422973	5.504896	5.585232	5.664067	5.741479	5.817537	5.892307	5.965849	6.038218	6.109464	6.179634	6.248771	6.316916	6.384106	6.450375	6.515754	6.580277	99.999	99.999
2737.5	1.446027	1.548942	1.666565	1.799491	1.94739	2.108618	2.280152	2.457953	2.637679	2.815459	2.988416	3.154794	3.313794	3.46529	3.609559	3.747086	3.87843	4.004155	4.124791	4.24082	4.352672	4.460724	4.565311	4.666725	4.765221	4.861026	4.954339	5.045339	5.134181	5.221008	5.305946	5.389107	5.470596	5.550505	5.628919	5.705916	5.781565	5.855932	5.929077	6.001054	6.071914	6.141703	6.210466	6.278243	6.34507	6.410981	6.47601	6.540184	99.999	99.999
2774	1.442994	1.544777	1.660976	1.792181	1.938093	2.09715	2.26646	2.442128	2.619924	2.79604	2.967602	3.132819	3.290841	3.441495	3.585021	3.721873	3.852591	3.977725	4.097797	4.213282	4.324605	4.432142	4.536226	4.637145	4.735157	4.830487	4.923333	5.013873	5.102263	5.188645	5.273144	5.355874	5.436937	5.516427	5.594428	5.671018	5.746266	5.820237	5.892992	5.964584	6.035065	6.104482	6.172877	6.24029	6.30676	6.372321	6.437004	6.500839	6.564034	99.999
2810.5	1.440008	1.540684	1.655498	1.785029	1.929006	2.085949	2.253087	2.426662	2.602561	2.777033	2.947213	3.111276	3.268328	3.418148	3.560938	3.697124	3.827225	3.951779	4.071295	4.186245	4.29705	4.404082	4.507671	4.608107	4.705644	4.800508	4.892896	4.982984	5.070931	5.156876	5.240946	5.323252	5.403898	5.482977	5.560573	5.636763	5.711617	5.785201	5.857573	5.928788	5.998897	6.067946	6.13598	6.203037	6.269156	6.334371	6.398714	6.462214	6.5249	99.999
2847	1.437065	1.536663	1.650127	1.778027	1.920122	2.075004	2.24002	2.411545	2.585576	2.758425	2.927234	3.090153	3.246242	3.395235	3.537297	3.672825	3.802318	3.926299	4.04527	4.159695	4.26999	4.376527	4.479631	4.579593	4.676664	4.771071	4.863009	4.952656	5.040168	5.125685	5.209332	5.291223	5.371461	5.450136	5.527334	5.603133	5.677601	5.750803	5.822799	5.893644	5.963387	6.032077	6.099755	6.166462	6.232236	6.297111	6.361118	6.42429	6.486652	6.553329
2883.5	1.434165	1.53271	1.644858	1.771171	1.911433	2.064306	2.22725	2.396765	2.568957	2.740203	2.907654	3.069438	3.22457	3.372744	3.514085	3.648963	3.777856	3.901274	4.019708	4.133616	4.243412	4.349461	4.452091	4.551586	4.648201	4.742159	4.833657	4.92287	5.009955	5.095052	5.178286	5.25977	5.339605	5.417885	5.494693	5.570107	5.644195	5.717024	5.788651	5.859132	5.928517	5.996852	6.064181	6.130544	6.195979	6.260519	6.324197	6.387044	6.449087	6.510354

E F F E C T I V E S T R E S S (kPa)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	1.297072	0.011506	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	2.190207	0.053789	0.01054	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	2.975078	0.155038	0.022318	0.010241	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	3.69638	0.31657	0.045625	0.016065	0.010117	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	4.373517	0.528971	0.081445	0.027049	0.013571	0.010059	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	5.01724	0.780716	0.131742	0.042406	0.020351	0.012272	0.010031	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	5.634325	1.062068	0.197846	0.062649	0.029363	0.017012	0.011499	0.010016	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	6.229403	1.365481	0.280344	0.088378	0.040682	0.023178	0.015042	0.011005	0.010009	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	6.805826	1.685374	0.379174	0.120153	0.054516	0.030685	0.01964	0.013755	0.010676	0.010005	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	7.366122	2.017586	0.493798	0.158464	0.071095	0.039604	0.02513	0.017373	0.012857	0.010453	0.010003	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	7.912257	2.359061	0.623369	0.203704	0.090648	0.050034	0.031523	0.021642	0.015807	0.0122	0.010301	0.010002	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	8.445805	2.707467	0.766872	0.256165	0.113399	0.062079	0.038863	0.026543	0.019268	0.014665	0.011705	0.010198	0.010001	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	8.968049	3.061026	0.92322	0.316035	0.139556	0.07585	0.047204	0.032094	0.0232	0.017555	0.0138	0.011324	0.010128	0.010001	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	9.480052	3.418331	1.091322	0.38341	0.169313	0.091453	0.0566	0.038321	0.027607	0.020816	0.016267	0.013124	0.011025	0.010082	0.010001	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	9.982709	3.778432	1.270124	0.458296	0.20284	0.108995	0.06711	0.045257	0.032504	0.02444	0.019036	0.015265	0.012584	0.01079	0.010052	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	10.47678	4.140418	1.458631	0.540628	0.240284	0.12858	0.078791	0.052933	0.037907	0.028435	0.022096	0.017662	0.014465	0.012145	0.010605	0.010033	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	10.96293	4.503643	1.655925	0.630282	0.281772	0.150307	0.091701	0.061383	0.043836	0.03281	0.025447	0.020298	0.016571	0.013814	0.011783	0.010458	0.01002	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	11.44173	4.86764	1.86116	0.727085	0.3274	0.17427	0.105898	0.07064	0.050311	0.037578	0.029094	0.023169	0.018878	0.015686	0.013275	0.011481	0.010343	0.010013	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	11.91367	5.231971	2.073567	0.830829	0.377245	0.200556	0.121438	0.080739	0.057354	0.042753	0.033047	0.026279	0.021381	0.017731	0.014954	0.012822	0.011228	0.010254	0.010008	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	12.37921	5.596307	2.292447	0.941279	0.431357	0.229248	0.138377	0.091714	0.064986	0.048346	0.037312	0.029632	0.024079	0.019942	0.016787	0.01434	0.012437	0.011014	0.010186	0.010005	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	12.83872	5.960377	2.517171	1.058181	0.489766	0.260418	0.15677	0.103598	0.073226	0.054372	0.041899	0.033234	0.026977	0.022318	0.018763	0.015997	0.013819	0.012107	0.010834	0.010134	0.010003	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	13.29258	6.32397	2.747172	1.181273	0.55248	0.294134	0.176667	0.116425	0.082098	0.060845	0.046818	0.037091	0.030077	0.02486	0.020879	0.017779	0.015327	0.01337	0.011821	0.010681	0.010095	0.010002	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	13.74108	6.686911	2.981938	1.310285	0.619491	0.330453	0.198121	0.130229	0.091622	0.067778	0.052077	0.041209	0.033385	0.02757	0.023136	0.019683	0.016947	0.014752	0.012982	0.011573	0.010552	0.010067	0.010001	0.01	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	14.18453	7.049058	3.221005	1.444946	0.69077	0.369424	0.221177	0.145043	0.10182	0.075187	0.057687	0.045596	0.036904	0.030452	0.025536	0.021708	0.018675	0.016235	0.014254	0.012642	0.011357	0.010443	0.010046	0.010001	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	14.62317	7.410299	3.46396	1.58499	0.766279	0.411091	0.245883	0.160899	0.112714	0.083085	0.063657	0.050258	0.04064	0.033509	0.02808	0.023856	0.020508	0.017814	0.01562	0.013819	0.012343	0.011167	0.010353	0.010031	0.010001	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	15.05725	7.770543	3.710427	1.730152	0.845964	0.455487	0.272278	0.177829	0.124324	0.091485	0.069996	0.055202	0.044598	0.036745	0.030772	0.026127	0.022447	0.019485	0.017071	0.015083	0.013436	0.012078	0.011	0.010278	0.010021	0.010001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	15.48697	8.129712	3.960069	1.880178	0.92976	0.502638	0.300404	0.195863	0.136671	0.100404	0.076715	0.060435	0.048782	0.040162	0.033613	0.028523	0.024493	0.02125	0.018605	0.016424	0.01461	0.013096	0.011843	0.010853	0.010216	0.010014	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	15.91254	8.487753	4.21258	2.03482	1.017594	0.552563	0.330296	0.215031	0.149778	0.109854	0.083823	0.065963	0.053197	0.043766	0.036606	0.031047	0.026647	0.023108	0.020221	0.01784	0.015855	0.014191	0.012794	0.011633	0.010725	0.010167	0.010009	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	16.33415	8.844614	4.467683	2.193838	1.109387	0.605274	0.361988	0.235362	0.163663	0.119851	0.091331	0.071794	0.057849	0.047559	0.039755	0.0337	0.028911	0.02506	0.02192	0.019329	0.017169	0.015353	0.013818	0.012522	0.011445	0.010612	0.010127	0.010006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	16.75195	9.200264	4.72513	2.357004	1.205052	0.660776	0.395509	0.256884	0.178348	0.130408	0.099248	0.077934	0.062743	0.051546	0.043062	0.036485	0.031286	0.027108	0.023703	0.020892	0.018548	0.016576	0.014905	0.013484	0.012278	0.011276	0.010513	0.010095	0.010004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	17.16611	9.554672	4.984693	2.524099	1.304497	0.719067	0.430886	0.279623	0.193853	0.141539	0.107583	0.084391	0.067883	0.05573	0.046531	0.039404	0.033775	0.029253	0.025569	0.022529	0.019994	0.01786	0.016049	0.014504	0.013182	0.012057	0.011124	0.010427	0.01007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	17.57676	9.907817	5.246167	2.694915	1.407629	0.780142	0.468142	0.303603	0.210197	0.153258	0.116348	0.091173	0.073276	0.060115	0.050163	0.04246	0.036378	0.031497	0.02752	0.02424	0.021505	0.019203	0.017248	0.015578	0.014143	0.01291	0.011857	0.010987	0.010352	0.010049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	17.98406	10.25969	5.509365	2.869252	1.514349	0.843987	0.507298	0.32885	0.227399	0.16558	0.125551	0.098285	0.078925	0.064705	0.053962	0.045653	0.039099	0.033839	0.029558	0.026027	0.023084	0.020605	0.018501	0.016702	0.015154	0.013817	0.012662	0.011675	0.010863	0.010288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	18.38811	10.61027	5.774117	3.046924	1.624561	0.910586	0.54837	0.355384	0.245477	0.178518	0.135203	0.105734	0.084837	0.069504	0.057931	0.048988	0.041937	0.036283	0.031682	0.02789	0.024729	0.022068	0.019809	0.017875	0.016211	0.01477	0.01352	0.012436	0.011509	0.010752	0.010205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	18.78904	10.95956	6.040268	3.227749	1.738163	0.979917	0.591372	0.383228	0.264451	0.192085	0.145313	0.11353	0.091017	0.074516	0.062073	0.052465	0.044896	0.03883	0.033896	0.02983	0.026442	0.023591	0.02117	0.019098	0.017314	0.015768	0.014422	0.013249	0.01223	0.011357	0.010653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	19.18696	11.30755	6.307679	3.41156	1.855056	1.051955	0.636316	0.4124	0.284336	0.206295	0.155891	0.121677	0.097469	0.079745	0.066391	0.056089	0.047977	0.04148	0.036198	0.031848	0.028224	0.025174	0.022586	0.020371	0.018462	0.016807	0.015366	0.014105	0.013002	0.01204	0.011219	0.010406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	19.58197	11.65425	6.576218	3.598194	1.975141	1.126671	0.68321	0.442919	0.305151	0.221161	0.166947	0.130183	0.1042	0.085194	0.070888	0.059859	0.051182	0.044236	0.038592	0.033945	0.030075	0.026819	0.024056	0.021692	0.019655	0.017888	0.016348	0.014999	0.013815	0.012774	0.011866	0.011092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	19.97417	11.99965	6.845768	3.787501	2.098318	1.204033	0.732057	0.474801	0.326911	0.236695	0.178491	0.139056	0.111214	0.090868	0.075567	0.06378	0.054513	0.047099	0.041077	0.036121	0.031996	0.028526	0.025582	0.023063	0.020893	0.019011	0.017369	0.01593	0.014664	0.013548	0.012565	0.011705	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	20.36365	12.34378	7.116223	3.979336	2.224491	1.284006	0.782862	0.508061	0.349632	0.252912	0.190531	0.148302	0.118516	0.09677	0.080431	0.067854	0.057972	0.05007	0.043656	0.038379	0.033988	0.030296	0.027164	0.024485	0.022176	0.020174	0.018428	0.016897	0.015548	0.014357	0.013303	0.012371	0.011557	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	20.7505	12.68662	7.387482	4.173564	2.353562	1.366553	0.835625	0.542713	0.373328	0.269821	0.203078	0.157929	0.126112	0.102905	0.085483	0.072082	0.06156	0.053152	0.046329	0.040719	0.036052	0.032129	0.028802	0.025957	0.023506	0.02138	0.019525	0.017899	0.016466	0.015198	0.014074	0.013076	0.012192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	21.13479	13.02819	7.659456	4.370055	2.485438	1.451635	0.890342	0.578768	0.398014	0.287437	0.216141	0.167943	0.134007	0.109276	0.090726	0.076468	0.06528	0.056345	0.049098	0.043141	0.038188	0.034026	0.030497	0.02748	0.024881	0.022627	0.020661	0.018936	0.017416	0.016071	0.014876	0.013813	0.012866	0.012026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	21.5166	13.36849	7.932061	4.568689	2.620025	1.539211	0.947009	0.616237	0.423703	0.305771	0.229729	0.178352	0.142206	0.115888	0.096163	0.081013	0.069133	0.05965	0.051963	0.045648	0.040398	0.035988	0.03225	0.029054	0.026302	0.023916	0.021834	0.020008	0.018399	0.016974	0.015708	0.014579	0.013571	0.012671	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	21.89602	13.70755	8.205222	4.76935	2.757234	1.62924	1.005621	0.655129	0.450408	0.324833	0.24385	0.189162	0.150715	0.122744	0.101797	0.08572	0.073122	0.063071	0.054927	0.048239	0.042682	0.038016	0.034061	0.030681	0.02777	0.025247	0.023046	0.021116	0.019414	0.017908	0.016568	0.015373	0.014304	0.013346	0.01249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	22.27309	14.04536	8.478867	4.971931	2.896976	1.721677	1.066167	0.695452	0.478141	0.344636	0.258515	0.20038	0.159538	0.129849	0.107632	0.090592	0.077248	0.066607	0.05799	0.050917	0.045041	0.040109	0.03593	0.03236	0.029286	0.026621	0.024297	0.022259	0.020463	0.018871	0.017456	0.016194	0.015063	0.014048	0.013137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	22.6479	14.38195	8.752932	5.176327	3.039165	1.816479	1.128638	0.737211	0.506912	0.365189	0.273731	0.212013	0.168682	0.137206	0.113669	0.095631	0.081512	0.070261	0.061154	0.053682	0.047477	0.04227	0.037859	0.034092	0.030849	0.028038	0.025587	0.023438	0.021544	0.019866	0.018373	0.017041	0.015848	0.014776	0.013811	0.012942	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	23.0205	14.71731	9.027358	5.382442	3.183718	1.9136	1.193022	0.780413	0.536732	0.386504	0.289508	0.224068	0.17815	0.144819	0.119913	0.100838	0.085918	0.074034	0.06442	0.056534	0.049989	0.044498	0.039848	0.035877	0.03246	0.029499	0.026917	0.024653	0.022658	0.02089	0.019318	0.017915	0.016657	0.015527	0.014508	0.013589	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	23.39096	15.05148	9.302089	5.590185	3.330553	2.012995	1.259305	0.825061	0.567611	0.408589	0.305853	0.236551	0.187949	0.152693	0.126367	0.106218	0.090467	0.077928	0.067789	0.059476	0.052579	0.046795	0.041898	0.037717	0.034119	0.031003	0.028286	0.025904	0.023805	0.021946	0.020292	0.018815	0.017492	0.016302	0.015229	0.014259	0.013382	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	23.75932	15.38445	9.577075	5.799468	3.479592	2.114618	1.327473	0.871157	0.599558	0.431455	0.322776	0.249469	0.198083	0.16083	0.133033	0.111771	0.09516	0.081944	0.071262	0.062508	0.055247	0.04916	0.044008	0.039611	0.035828	0.032551	0.029695	0.027192	0.024985	0.023032	0.021294	0.019742	0.018351	0.0171	0.015971	0.014951	0.014027	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	24.12565	15.71624	9.852269	6.010208	3.630758	2.218423	1.397507	0.918702	0.63258	0.455111	0.340284	0.262829	0.208557	0.169236	0.139914	0.117501	0.1	0.086084	0.074841	0.065631	0.057995	0.051596	0.046181	0.04156	0.037586	0.034144	0.031145	0.028516	0.0262	0.024148	0.022324	0.020695	0.019235	0.017921	0.016736	0.015664	0.014692	0.013808	0	0	0	0	0	0	0	0	0	0	0	0
1825	24.48999	16.04687	10.12763	6.222329	3.783978	2.324364	1.469392	0.967697	0.666685	0.479566	0.358384	0.276636	0.219377	0.177914	0.147014	0.123409	0.104989	0.090349	0.078527	0.068847	0.060824	0.054102	0.048416	0.043565	0.039394	0.035782	0.032636	0.029878	0.027448	0.025297	0.023383	0.021675	0.020143	0.018766	0.017522	0.016397	0.015377	0.014449	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	24.8524	16.37634	10.40311	6.435757	3.939179	2.432395	1.543109	1.018139	0.70188	0.504827	0.377086	0.290898	0.230547	0.186868	0.154336	0.129499	0.110128	0.09474	0.082321	0.072155	0.063733	0.056679	0.050714	0.045626	0.041252	0.037466	0.034167	0.031277	0.02873	0.026476	0.024471	0.022681	0.021077	0.019633	0.018331	0.017152	0.016082	0.015108	0.014202	0	0	0	0	0	0	0	0	0	0	0
1898	25.21291	16.70468	10.67868	6.650421	4.096292	2.54247	1.618637	1.070028	0.738169	0.530904	0.396396	0.305621	0.242072	0.196102	0.161883	0.135772	0.11542	0.099261	0.086224	0.075558	0.066725	0.059328	0.053076	0.047744	0.043161	0.039195	0.03574	0.032713	0.030047	0.027687	0.025589	0.023715	0.022035	0.020524	0.019161	0.017926	0.016806	0.015787	0.014857	0	0	0	0	0	0	0	0	0	0	0
1934.5	25.57159	17.03189	10.95431	6.866256	4.255251	2.654544	1.695957	1.123361	0.775559	0.557802	0.416321	0.32081	0.253959	0.20562	0.169657	0.142232	0.120866	0.103911	0.090238	0.079057	0.069799	0.062051	0.055502	0.049919	0.045121	0.04097	0.037355	0.034188	0.031399	0.02893	0.026735	0.024775	0.023019	0.021439	0.020013	0.018722	0.01755	0.016483	0.01551	0	0	0	0	0	0	0	0	0	0	0
1971	25.92846	17.35799	11.22996	7.083199	4.415991	2.768571	1.775048	1.178132	0.814054	0.58553	0.436868	0.336472	0.26621	0.215426	0.177662	0.14888	0.126468	0.108692	0.094364	0.082651	0.072958	0.064846	0.057993	0.052151	0.047133	0.042792	0.039012	0.035701	0.032785	0.030205	0.027911	0.025863	0.024028	0.022377	0.020887	0.019538	0.018313	0.017198	0.016181	0.015251	0	0	0	0	0	0	0	0	0	0
2007.5	26.28356	17.68299	11.5056	7.30119	4.578449	2.884508	1.855888	1.234337	0.853657	0.614095	0.458045	0.352612	0.278831	0.225522	0.185901	0.155718	0.132229	0.113607	0.098604	0.086344	0.076201	0.067716	0.060549	0.054442	0.049198	0.044661	0.040711	0.037252	0.034207	0.031512	0.029117	0.026978	0.025062	0.023338	0.021782	0.020374	0.019095	0.017931	0.016869	0.015897	0	0	0	0	0	0	0	0	0	0
2044	26.63695	18.00691	11.7812	7.520174	4.742565	3.002309	1.938454	1.29197	0.894371	0.643501	0.479858	0.369237	0.291827	0.235915	0.194377	0.16275	0.13815	0.118656	0.102957	0.090134	0.079529	0.070661	0.063172	0.056792	0.051314	0.046577	0.042453	0.038843	0.035664	0.032852	0.030352	0.028121	0.026121	0.024323	0.0227	0.021231	0.019897	0.018683	0.017574	0.01656	0.015607	0	0	0	0	0	0	0	0	0
2080.5	26.98866	18.32976	12.05675	7.740096	4.90828	3.121932	2.022723	1.351025	0.936199	0.673755	0.502313	0.386352	0.305203	0.246606	0.203093	0.169978	0.144233	0.123842	0.107427	0.094025	0.082944	0.073681	0.065862	0.059202	0.053484	0.048541	0.044239	0.040472	0.037157	0.034224	0.031618	0.029291	0.027207	0.025332	0.02364	0.022109	0.020718	0.019452	0.018297	0.017239	0.01627	0	0	0	0	0	0	0	0	0
2117	27.33872	18.65155	12.33222	7.960905	5.07554	3.243333	2.108674	1.411495	0.979143	0.704863	0.525416	0.403963	0.318963	0.2576	0.212051	0.177404	0.15048	0.129165	0.112014	0.098015	0.086446	0.076778	0.068619	0.061671	0.055708	0.050553	0.046068	0.042142	0.038686	0.03563	0.032914	0.03049	0.028318	0.026365	0.024603	0.023008	0.021559	0.02024	0.019037	0.017935	0.016925	0	0	0	0	0	0	0	0	0
2153.5	27.68717	18.9723	12.60757	8.182555	5.244288	3.36647	2.19628	1.47337	1.023203	0.73683	0.549174	0.422075	0.333112	0.268901	0.221256	0.18503	0.156893	0.134627	0.116719	0.102108	0.090037	0.079952	0.071444	0.064201	0.057986	0.052614	0.047941	0.043851	0.040252	0.037069	0.03424	0.031717	0.029456	0.027422	0.025588	0.023927	0.02242	0.021047	0.019794	0.018647	0.017596	0.016629	0	0	0	0	0	0	0	0
2190	28.03404	19.29201	12.88281	8.404999	5.414474	3.491302	2.28552	1.536643	1.06838	0.769659	0.573591	0.440693	0.347655	0.280512	0.23071	0.19286	0.163474	0.14023	0.121543	0.106303	0.093716	0.083204	0.074338	0.066791	0.060318	0.054724	0.049858	0.0456	0.041854	0.038541	0.035598	0.032972	0.030619	0.028504	0.026595	0.024868	0.0233	0.021872	0.020569	0.019376	0.018282	0.017277	0	0	0	0	0	0	0	0
2226.5	28.37937	19.6107	13.1579	8.628193	5.586046	3.617789	2.376369	1.601304	1.114673	0.803356	0.598674	0.459823	0.362595	0.292437	0.240415	0.200894	0.170224	0.145976	0.126489	0.110602	0.097486	0.086535	0.077301	0.069444	0.062705	0.056883	0.051819	0.04739	0.043493	0.040047	0.036986	0.034255	0.031809	0.02961	0.027626	0.02583	0.0242	0.022716	0.021361	0.020121	0.018984	0.017939	0.016956	0	0	0	0	0	0	0
2263	28.72318	19.92839	13.43283	8.852095	5.758956	3.745889	2.468802	1.667343	1.162083	0.837923	0.624427	0.47947	0.377937	0.30468	0.250375	0.209136	0.177147	0.151865	0.131556	0.115006	0.101346	0.089945	0.080334	0.072158	0.065147	0.059092	0.053826	0.04922	0.045169	0.041587	0.038405	0.035567	0.033026	0.03074	0.028679	0.026813	0.02512	0.023578	0.02217	0.020883	0.019701	0.018615	0.017615	0	0	0	0	0	0	0
2299.5	29.06551	20.24508	13.70758	9.076668	5.933157	3.875563	2.562795	1.73475	1.210607	0.873364	0.650855	0.499638	0.393686	0.317244	0.260593	0.217588	0.184243	0.1579	0.136748	0.119516	0.105298	0.093435	0.083437	0.074935	0.067646	0.061351	0.055878	0.051092	0.046882	0.043161	0.039856	0.036909	0.034269	0.031896	0.029755	0.027818	0.02606	0.024459	0.022998	0.021661	0.020434	0.019307	0.018269	0.014382	0	0	0	0	0	0
2336	29.40639	20.56079	13.98215	9.301874	6.108603	4.006774	2.658324	1.803514	1.260245	0.909683	0.677962	0.520333	0.409846	0.330133	0.271071	0.226253	0.191514	0.164082	0.142063	0.124132	0.109343	0.097007	0.086612	0.077775	0.0702	0.06366	0.057976	0.053005	0.048633	0.04477	0.041339	0.038279	0.035539	0.033076	0.030855	0.028844	0.02702	0.025359	0.023843	0.022455	0.021183	0.020014	0.018936	0.017942	0	0	0	0	0	0
2372.5	29.74584	20.87553	14.2565	9.527676	6.285252	4.139483	2.755365	1.873624	1.310993	0.946881	0.705754	0.541558	0.42642	0.34335	0.281814	0.235132	0.198963	0.170413	0.147505	0.128857	0.113481	0.100659	0.089859	0.080679	0.072812	0.066021	0.060119	0.054959	0.050422	0.046413	0.042853	0.039679	0.036836	0.034281	0.031977	0.029892	0.028	0.026278	0.024706	0.023267	0.021948	0.020735	0.019618	0.018587	0	0	0	0	0	0
2409	30.08389	21.18932	14.53064	9.754041	6.46306	4.273654	2.853892	1.945067	1.36285	0.984961	0.734234	0.563319	0.443414	0.356899	0.292822	0.244228	0.206591	0.176894	0.153074	0.13369	0.117713	0.104394	0.093178	0.083647	0.075481	0.068433	0.062309	0.056956	0.05225	0.048091	0.0444	0.041108	0.038161	0.035512	0.033123	0.030962	0.029001	0.027216	0.025586	0.024095	0.022728	0.021471	0.020313	0.019245	0.018244	0	0	0	0	0
2445.5	30.42057	21.50215	14.80455	9.980937	6.641988	4.409249	2.953881	2.017832	1.415811	1.023924	0.763406	0.585619	0.46083	0.370783	0.3041	0.253543	0.214401	0.183527	0.158772	0.138634	0.122041	0.108213	0.09657	0.08668	0.078208	0.070897	0.064546	0.058995	0.054116	0.049805	0.045978	0.042567	0.039513	0.036768	0.034293	0.032054	0.030022	0.028173	0.026485	0.024941	0.023524	0.022223	0.021023	0.019916	0.018893	0	0	0	0	0
2482	30.7559	21.81405	15.07822	10.20833	6.821996	4.546235	3.055309	2.091907	1.469874	1.063773	0.793274	0.608463	0.478674	0.385006	0.31565	0.263081	0.222393	0.190312	0.164599	0.143689	0.126465	0.112115	0.100036	0.089778	0.080992	0.073413	0.066892	0.061256	0.056357	0.052079	0.048324	0.045012	0.042076	0.039462	0.037124	0.035024	0.033131	0.031417	0.029862	0.028445	0.027152	0.025967	0.02488	0.023877	0.022951	0.01769	0	0	0	0
2518.5	31.08991	22.12503	15.35163	10.4362	7.003046	4.684576	3.15815	2.167278	1.525034	1.104507	0.823841	0.631854	0.496948	0.39957	0.327474	0.272842	0.230571	0.197253	0.170558	0.148856	0.130986	0.116101	0.103577	0.092942	0.083836	0.075982	0.069161	0.063211	0.057995	0.053403	0.049343	0.045737	0.042523	0.039647	0.037059	0.034724	0.032627	0.030728	0.029006	0.027446	0.026038	0.024798	0.023563	0.022486	0.0213	0.020204	0.019188	0	0	0
2555	31.42262	22.4351	15.62479	10.66451	7.185102	4.824239	3.262382	2.243932	1.581287	1.146128	0.85511	0.655798	0.515657	0.41448	0.339577	0.28283	0.238936	0.20435	0.176648	0.154136	0.135604	0.120173	0.107192	0.096172	0.086739	0.078603	0.07154	0.065369	0.059947	0.055159	0.050911	0.047124	0.043735	0.04069	0.037945	0.035463	0.03321	0.03116	0.02929	0.027579	0.026009	0.024567	0.023239	0.022013	0.020879	0.019828	0	0	0	0
2591.5	31.75406	22.74426	15.89767	10.89324	7.368129	4.96519	3.367979	2.321857	1.638628	1.188637	0.887084	0.680297	0.534803	0.429739	0.35196	0.293046	0.247489	0.211605	0.182873	0.159531	0.140322	0.124331	0.110883	0.099469	0.089701	0.081278	0.073964	0.067571	0.061961	0.057004	0.052609	0.048693	0.045189	0.042055	0.039232	0.036683	0.034376	0.032282	0.030375	0.028634	0.027042	0.025579	0.024239	0.023013	0.021875	0.020481	0.019467	0	0	0
2628	32.08424	23.05253	16.17028	11.12235	7.552093	5.107397	3.474919	2.401038	1.697052	1.232033	0.919766	0.705354	0.554392	0.445349	0.364626	0.303493	0.256233	0.219019	0.189232	0.165041	0.145139	0.128576	0.114651	0.102834	0.092723	0.084007	0.076442	0.069836	0.064033	0.058909	0.054364	0.050314	0.04669	0.043435	0.040501	0.037847	0.03544	0.03325	0.031251	0.029423	0.027747	0.026207	0.024788	0.023478	0.022267	0.021145	0.020104	0	0	0
2664.5	32.41319	23.35993	16.4426	11.35184	7.73696	5.250829	3.583177	2.481462	1.756554	1.276315	0.953158	0.730974	0.574425	0.461314	0.377578	0.314173	0.26517	0.226595	0.195728	0.170667	0.150056	0.132909	0.118495	0.106267	0.095806	0.086791	0.078969	0.072135	0.066135	0.060841	0.056141	0.051951	0.048231	0.044847	0.041815	0.039073	0.036587	0.034324	0.032261	0.030372	0.028642	0.027049	0.025584	0.024232	0.022981	0.021822	0.020747	0.019486	0	0
2701	32.74093	23.66645	16.71463	11.58166	7.9227	5.395456	3.692731	2.563116	1.817127	1.321485	0.987262	0.757159	0.594908	0.477637	0.390818	0.325089	0.274301	0.234333	0.202361	0.176411	0.155075	0.137329	0.122416	0.109768	0.09895	0.089628	0.08154	0.074479	0.068279	0.062806	0.057952	0.053627	0.049759	0.046285	0.043154	0.040323	0.037755	0.035418	0.033287	0.031338	0.029555	0.027908	0.026395	0.024999	0.023708	0.022512	0.021402	0.02037	0	0
2737.5	33.06747	23.97211	16.98637	11.81181	8.109283	5.541246	3.803557	2.645986	1.878765	1.367539	1.022081	0.783913	0.615841	0.49432	0.404349	0.336242	0.283628	0.242235	0.209133	0.182274	0.160197	0.141839	0.126416	0.113338	0.102156	0.092521	0.084163	0.076868	0.070463	0.064811	0.059797	0.055331	0.051337	0.047755	0.044517	0.041595	0.038944	0.036533	0.034333	0.032321	0.030477	0.028782	0.027218	0.02578	0.024448	0.023214	0.022069	0.021004	0	0
2774	33.39285	24.27693	17.25779	12.04226	8.296678	5.688171	3.915633	2.730056	1.941463	1.414478	1.057616	0.811238	0.63723	0.511368	0.418175	0.347635	0.293154	0.250302	0.216044	0.188256	0.165421	0.146439	0.130495	0.116978	0.105423	0.09547	0.086836	0.079302	0.072688	0.066851	0.061676	0.057066	0.052943	0.049242	0.045906	0.04289	0.040155	0.037667	0.035398	0.033322	0.03142	0.029671	0.028061	0.026575	0.025201	0.023929	0.022747	0.021649	0.020624	0
2810.5	33.71708	24.5809	17.52891	12.273	8.484857	5.836203	4.028936	2.815314	2.005213	1.462301	1.093868	0.839137	0.659077	0.528782	0.432296	0.35927	0.302879	0.258537	0.223097	0.194359	0.17075	0.151129	0.134653	0.120689	0.108753	0.098474	0.08956	0.081781	0.074954	0.068929	0.063589	0.058833	0.054579	0.050759	0.047319	0.044209	0.041388	0.038822	0.036481	0.034341	0.032379	0.030576	0.028916	0.027384	0.025968	0.024656	0.023438	0.022306	0.021252	0
2847	34.04017	24.88405	17.79971	12.50399	8.673792	5.985313	4.143444	2.901745	2.070009	1.511004	1.130838	0.867613	0.681384	0.546566	0.446716	0.371149	0.312806	0.26694	0.230293	0.200583	0.176183	0.155911	0.138891	0.12447	0.112146	0.101534	0.092334	0.084306	0.077262	0.071047	0.065538	0.060632	0.056244	0.052306	0.048758	0.045551	0.042642	0.039997	0.037584	0.035378	0.033356	0.031498	0.029786	0.028208	0.026748	0.025395	0.024142	0.022974	0.021888	0.020794
2883.5	34.36214	25.18637	18.07019	12.73522	8.863459	6.135475	4.259135	2.989334	2.135844	1.560587	1.168529	0.896669	0.704156	0.564723	0.461438	0.383274	0.322936	0.275514	0.237632	0.20693	0.181723	0.160784	0.14321	0.128322	0.115602	0.104651	0.095158	0.086877	0.079611	0.073202	0.067521	0.062462	0.057939	0.053879	0.050222	0.046916	0.043919	0.041192	0.038706	0.036433	0.034349	0.032435	0.030672	0.029045	0.027541	0.026148	0.024855	0.023653	0.022535	0.021491

P E R M E A B I L I T Y (cm/second)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	4.6E-06	0.000112	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

73	3.21E-06	3.99E-05	0.000119	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	2.59E-06	1.95E-05	7.19E-05	0.000121	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	2.23E-06	1.21E-05	4.45E-05	8.95E-05	0.000122	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	1.99E-06	8.5E-06	3.02E-05	6.32E-05	0.0001	0.000122	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	1.8E-06	6.52E-06	2.18E-05	4.68E-05	7.65E-05	0.000107	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	1.66E-06	5.28E-06	1.66E-05	3.6E-05	5.98E-05	8.62E-05	0.000112	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	1.55E-06	4.44E-06	1.31E-05	2.86E-05	4.81E-05	7.01E-05	9.36E-05	0.000115	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	1.46E-06	3.84E-06	1.07E-05	2.32E-05	3.95E-05	5.81E-05	7.83E-05	9.93E-05	0.000118	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	1.38E-06	3.39E-06	8.91E-06	1.93E-05	3.31E-05	4.9E-05	6.64E-05	8.5E-05	0.000104	0.000119	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	1.31E-06	3.05E-06	7.6E-06	1.62E-05	2.81E-05	4.19E-05	5.71E-05	7.34E-05	9.05E-05	0.000108	0.00012	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	1.25E-06	2.77E-06	6.6E-06	1.39E-05	2.41E-05	3.62E-05	4.96E-05	6.4E-05	7.93E-05	9.52E-05	0.000111	0.000121	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	1.2E-06	2.54E-06	5.81E-06	1.21E-05	2.1E-05	3.16E-05	4.35E-05	5.64E-05	7E-05	8.44E-05	9.91E-05	0.000113	0.000122	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	1.16E-06	2.36E-06	5.18E-06	1.06E-05	1.84E-05	2.79E-05	3.85E-05	5.01E-05	6.23E-05	7.53E-05	8.88E-05	0.000102	0.000115	0.000122	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	1.11E-06	2.2E-06	4.67E-06	9.37E-06	1.63E-05	2.48E-05	3.44E-05	4.48E-05	5.59E-05	6.76E-05	7.99E-05	9.27E-05	0.000105	0.000117	0.000122	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	1.08E-06	2.06E-06	4.24E-06	8.37E-06	1.45E-05	2.22E-05	3.08E-05	4.03E-05	5.04E-05	6.11E-05	7.24E-05	8.41E-05	9.6E-05	0.000108	0.000118	0.000123	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	1.04E-06	1.95E-06	3.89E-06	7.54E-06	1.3E-05	2E-05	2.79E-05	3.65E-05	4.57E-05	5.55E-05	6.58E-05	7.66E-05	8.77E-05	9.9E-05	0.00011	0.000119	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	1.01E-06	1.84E-06	3.59E-06	6.84E-06	1.18E-05	1.81E-05	2.53E-05	3.32E-05	4.17E-05	5.07E-05	6.02E-05	7.01E-05	8.04E-05	9.1E-05	0.000102	0.000112	0.00012	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	9.83E-07	1.75E-06	3.33E-06	6.24E-06	1.07E-05	1.64E-05	2.3E-05	3.03E-05	3.82E-05	4.65E-05	5.53E-05	6.44E-05	7.4E-05	8.38E-05	9.39E-05	0.000104	0.000114	0.000121	0.000123	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	9.57E-07	1.67E-06	3.11E-06	5.73E-06	9.77E-06	1.5E-05	2.11E-05	2.78E-05	3.51E-05	4.28E-05	5.1E-05	5.95E-05	6.83E-05	7.75E-05	8.7E-05	9.66E-05	0.000106	0.000115	0.000121	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	9.33E-07	1.6E-06	2.91E-06	5.29E-06	8.96E-06	1.38E-05	1.94E-05	2.57E-05	3.24E-05	3.96E-05	4.71E-05	5.51E-05	6.33E-05	7.19E-05	8.07E-05	8.98E-05	9.9E-05	0.000108	0.000116	0.000122	0.000123	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	9.1E-07	1.53E-06	2.74E-06	4.91E-06	8.25E-06	1.27E-05	1.79E-05	2.37E-05	3E-05	3.67E-05	4.38E-05	5.12E-05	5.89E-05	6.69E-05	7.52E-05	8.37E-05	9.24E-05	0.000101	0.00011	0.000118	0.000122	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	8.89E-07	1.48E-06	2.59E-06	4.57E-06	7.63E-06	1.17E-05	1.66E-05	2.2E-05	2.79E-05	3.41E-05	4.07E-05	4.77E-05	5.49E-05	6.24E-05	7.02E-05	7.82E-05	8.64E-05	9.48E-05	0.000103	0.000111	0.000119	0.000122	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	8.69E-07	1.42E-06	2.46E-06	4.27E-06	7.08E-06	1.09E-05	1.54E-05	2.04E-05	2.6E-05	3.18E-05	3.8E-05	4.45E-05	5.13E-05	5.84E-05	6.57E-05	7.32E-05	8.1E-05	8.89E-05	9.7E-05	0.000105	0.000113	0.000119	0.000122	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	8.51E-07	1.37E-06	2.33E-06	4.01E-06	6.6E-06	1.01E-05	1.43E-05	1.91E-05	2.42E-05	2.98E-05	3.56E-05	4.17E-05	4.81E-05	5.48E-05	6.16E-05	6.88E-05	7.61E-05	8.36E-05	9.12E-05	9.9E-05	0.000107	0.000114	0.00012	0.000123	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	8.33E-07	1.33E-06	2.23E-06	3.77E-06	6.17E-06	9.41E-06	1.33E-05	1.78E-05	2.27E-05	2.79E-05	3.34E-05	3.92E-05	4.52E-05	5.15E-05	5.8E-05	6.47E-05	7.16E-05	7.87E-05	8.6E-05	9.34E-05	0.000101	0.000108	0.000115	0.000121	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	8.17E-07	1.29E-06	2.13E-06	3.56E-06	5.78E-06	8.8E-06	1.25E-05	1.67E-05	2.13E-05	2.62E-05	3.14E-05	3.69E-05	4.26E-05	4.85E-05	5.46E-05	6.1E-05	6.75E-05	7.43E-05	8.12E-05	8.82E-05	9.54E-05	0.000103	0.00011	0.000116	0.000121	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	8.01E-07	1.25E-06	2.04E-06	3.37E-06	5.43E-06	8.25E-06	1.17E-05	1.57E-05	2E-05	2.47E-05	2.96E-05	3.48E-05	4.02E-05	4.58E-05	5.16E-05	5.76E-05	6.38E-05	7.02E-05	7.68E-05	8.35E-05	9.03E-05	9.73E-05	0.000104	0.000111	0.000117	0.000122	0.000123	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	7.86E-07	1.21E-06	1.96E-06	3.2E-06	5.12E-06	7.75E-06	1.1E-05	1.47E-05	1.88E-05	2.33E-05	2.79E-05	3.28E-05	3.8E-05	4.33E-05	4.88E-05	5.46E-05	6.05E-05	6.65E-05	7.28E-05	7.91E-05	8.57E-05	9.23E-05	9.9E-05	0.000106	0.000112	0.000118	0.000122	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	7.72E-07	1.18E-06	1.88E-06	3.05E-06	4.84E-06	7.3E-06	1.04E-05	1.39E-05	1.78E-05	2.2E-05	2.64E-05	3.11E-05	3.6E-05	4.1E-05	4.63E-05	5.17E-05	5.73E-05	6.31E-05	6.9E-05	7.51E-05	8.13E-05	8.77E-05	9.41E-05	0.000101	0.000107	0.000113	0.000119	0.000122	0.000123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	7.59E-07	1.15E-06	1.81E-06	2.91E-06	4.58E-06	6.89E-06	9.77E-06	1.31E-05	1.68E-05	2.08E-05	2.5E-05	2.95E-05	3.41E-05	3.89E-05	4.39E-05	4.91E-05	5.45E-05	6E-05	6.56E-05	7.14E-05	7.74E-05	8.34E-05	8.96E-05	9.59E-05	0.000102	0.000108	0.000114	0.000119	0.000122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	7.46E-07	1.12E-06	1.75E-06	2.78E-06	4.35E-06	6.52E-06	9.24E-06	1.24E-05	1.59E-05	1.97E-05	2.37E-05	2.8E-05	3.24E-05	3.7E-05	4.18E-05	4.67E-05	5.18E-05	5.71E-05	6.25E-05	6.8E-05	7.37E-05	7.95E-05	8.54E-05	9.14E-05	9.75E-05	0.000104	0.00011	0.000115	0.00012	0.000122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	7.34E-07	1.09E-06	1.69E-06	2.66E-06	4.14E-06	6.18E-06	8.74E-06	1.17E-05	1.51E-05	1.87E-05	2.25E-05	2.66E-05	3.08E-05	3.52E-05	3.98E-05	4.45E-05	4.94E-05	5.44E-05	5.96E-05	6.49E-05	7.03E-05	7.58E-05	8.15E-05	8.73E-05	9.31E-05	9.9E-05	0.000105	0.000111	0.000116	0.000121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	7.23E-07	1.07E-06	1.64E-06	2.55E-06	3.94E-06	5.86E-06	8.29E-06	1.11E-05	1.43E-05	1.78E-05	2.14E-05	2.53E-05	2.93E-05	3.36E-05	3.79E-05	4.25E-05	4.71E-05	5.19E-05	5.69E-05	6.19E-05	6.71E-05	7.24E-05	7.79E-05	8.34E-05	8.9E-05	9.47E-05	0.0001	0.000106	0.000112	0.000117	0.000121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	7.12E-07	1.04E-06	1.58E-06	2.45E-06	3.76E-06	5.58E-06	7.88E-06	1.06E-05	1.36E-05	1.69E-05	2.04E-05	2.41E-05	2.8E-05	3.2E-05	3.62E-05	4.05E-05	4.5E-05	4.96E-05	5.43E-05	5.92E-05	6.42E-05	6.93E-05	7.45E-05	7.98E-05	8.52E-05	9.07E-05	9.62E-05	0.000102	0.000107	0.000113	0.000118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	7.01E-07	1.02E-06	1.54E-06	2.36E-06	3.6E-06	5.31E-06	7.49E-06	1.01E-05	1.3E-05	1.61E-05	1.95E-05	2.3E-05	2.67E-05	3.06E-05	3.46E-05	3.88E-05	4.3E-05	4.75E-05	5.2E-05	5.67E-05	6.14E-05	6.63E-05	7.13E-05	7.64E-05	8.16E-05	8.69E-05	9.22E-05	9.77E-05	0.000103	0.000109	0.000114	0.00012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	6.91E-07	9.99E-07	1.49E-06	2.27E-06	3.44E-06	5.07E-06	7.14E-06	9.59E-06	1.24E-05	1.54E-05	1.86E-05	2.2E-05	2.56E-05	2.93E-05	3.31E-05	3.71E-05	4.12E-05	4.55E-05	4.98E-05	5.43E-05	5.89E-05	6.36E-05	6.84E-05	7.33E-05	7.83E-05	8.33E-05	8.85E-05	9.37E-05	9.9E-05	0.000104	0.00011	0.000115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	6.82E-07	9.78E-07	1.45E-06	2.19E-06	3.3E-06	4.84E-06	6.81E-06	9.15E-06	1.18E-05	1.47E-05	1.78E-05	2.1E-05	2.45E-05	2.8E-05	3.17E-05	3.56E-05	3.95E-05	4.36E-05	4.78E-05	5.21E-05	5.65E-05	6.1E-05	6.56E-05	7.03E-05	7.51E-05	8E-05	8.5E-05	9.01E-05	9.52E-05	0.0001	0.000106	0.000111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	6.72E-07	9.59E-07	1.41E-06	2.12E-06	3.17E-06	4.63E-06	6.5E-06	8.74E-06	1.13E-05	1.4E-05	1.7E-05	2.01E-05	2.34E-05	2.69E-05	3.04E-05	3.41E-05	3.79E-05	4.18E-05	4.59E-05	5E-05	5.42E-05	5.86E-05	6.3E-05	6.76E-05	7.22E-05	7.69E-05	8.17E-05	8.66E-05	9.15E-05	9.65E-05	0.000102	0.000107	0.000112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	6.63E-07	9.41E-07	1.38E-06	2.05E-06	3.05E-06	4.44E-06	6.22E-06	8.35E-06	1.08E-05	1.34E-05	1.63E-05	1.93E-05	2.25E-05	2.58E-05	2.92E-05	3.27E-05	3.64E-05	4.02E-05	4.41E-05	4.81E-05	5.21E-05	5.63E-05	6.06E-05	6.5E-05	6.94E-05	7.4E-05	7.86E-05	8.33E-05	8.81E-05	9.29E-05	9.78E-05	0.000103	0.000108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	6.55E-07	9.23E-07	1.34E-06	1.99E-06	2.94E-06	4.26E-06	5.96E-06	7.99E-06	1.03E-05	1.29E-05	1.56E-05	1.85E-05	2.16E-05	2.47E-05	2.81E-05	3.15E-05	3.5E-05	3.86E-05	4.24E-05	4.62E-05	5.02E-05	5.42E-05	5.83E-05	6.25E-05	6.68E-05	7.12E-05	7.57E-05	8.02E-05	8.48E-05	8.95E-05	9.43E-05	9.9E-05	0.000104	0.000109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	6.46E-07	9.06E-07	1.31E-06	1.93E-06	2.83E-06	4.09E-06	5.71E-06	7.66E-06	9.89E-06	1.23E-05	1.5E-05	1.78E-05	2.07E-05	2.38E-05	2.7E-05	3.03E-05	3.37E-05	3.72E-05	4.08E-05	4.45E-05	4.83E-05	5.22E-05	5.62E-05	6.03E-05	6.44E-05	6.86E-05	7.29E-05	7.73E-05	8.18E-05	8.63E-05	9.09E-05	9.55E-05	0.0001	0.000105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	6.38E-07	8.9E-07	1.28E-06	1.87E-06	2.73E-06	3.93E-06	5.48E-06	7.35E-06	9.48E-06	1.18E-05	1.44E-05	1.71E-05	1.99E-05	2.29E-05	2.6E-05	2.91E-05	3.24E-05	3.58E-05	3.93E-05	4.29E-05	4.66E-05	5.03E-05	5.42E-05	5.81E-05	6.21E-05	6.62E-05	7.04E-05	7.46E-05	7.89E-05	8.33E-05	8.77E-05	9.22E-05	9.68E-05	0.000101	0.000106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	6.31E-07	8.75E-07	1.25E-06	1.82E-06	2.64E-06	3.79E-06	5.26E-06	7.05E-06	9.1E-06	1.14E-05	1.38E-05	1.64E-05	1.92E-05	2.2E-05	2.5E-05	2.81E-05	3.13E-05	3.45E-05	3.79E-05	4.14E-05	4.49E-05	4.85E-05	5.23E-05	5.61E-05	5.99E-05	6.39E-05	6.79E-05	7.2E-05	7.62E-05	8.04E-05	8.47E-05	8.91E-05	9.35E-05	9.79E-05	0.000102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	6.23E-07	8.61E-07	1.22E-06	1.77E-06	2.56E-06	3.65E-06	5.06E-06	6.78E-06	8.75E-06	1.09E-05	1.33E-05	1.58E-05	1.85E-05	2.12E-05	2.41E-05	2.71E-05	3.01E-05	3.33E-05	3.66E-05	3.99E-05	4.34E-05	4.69E-05	5.05E-05	5.41E-05	5.79E-05	6.17E-05	6.56E-05	6.96E-05	7.36E-05	7.77E-05	8.19E-05	8.61E-05	9.04E-05	9.47E-05	9.91E-05	0.000103	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	6.16E-07	8.47E-07	1.2E-06	1.72E-06	2.48E-06	3.52E-06	4.87E-06	6.52E-06	8.42E-06	1.05E-05	1.28E-05	1.52E-05	1.78E-05	2.05E-05	2.32E-05	2.61E-05	2.91E-05	3.22E-05	3.53E-05	3.86E-05	4.19E-05	4.53E-05	4.88E-05	5.23E-05	5.59E-05	5.96E-05	6.34E-05	6.73E-05	7.12E-05	7.51E-05	7.92E-05	8.33E-05	8.74E-05	9.16E-05	9.59E-05	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	6.09E-07	8.33E-07	1.17E-06	1.67E-06	2.4E-06	3.4E-06	4.7E-06	6.27E-06	8.1E-06	1.01E-05	1.23E-05	1.47E-05	1.72E-05	1.97E-05	2.24E-05	2.52E-05	2.81E-05	3.11E-05	3.41E-05	3.73E-05	4.05E-05	4.38E-05	4.71E-05	5.06E-05	5.41E-05	5.77E-05	6.13E-05	6.51E-05	6.88E-05	7.27E-05	7.66E-05	8.06E-05	8.46E-05	8.87E-05	9.28E-05	9.7E-05	0.000101	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	6.02E-07	8.21E-07	1.15E-06	1.63E-06	2.33E-06	3.29E-06	4.53E-06	6.04E-06	7.8E-06	9.76E-06	1.19E-05	1.42E-05	1.66E-05	1.91E-05	2.17E-05	2.44E-05	2.72E-05	3E-05	3.3E-05	3.6E-05	3.92E-05	4.24E-05	4.56E-05	4.9E-05	5.24E-05	5.58E-05	5.94E-05	6.3E-05	6.67E-05	7.04E-05	7.42E-05	7.8E-05	8.19E-05	8.59E-05	8.99E-05	9.39E-05	9.8E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	5.96E-07	8.08E-07	1.12E-06	1.59E-06	2.26E-06	3.18E-06	4.37E-06	5.83E-06	7.52E-06	9.42E-06	1.15E-05	1.37E-05	1.6E-05	1.84E-05	2.09E-05	2.36E-05	2.63E-05	2.91E-05	3.19E-05	3.49E-05	3.79E-05	4.1E-05	4.42E-05	4.74E-05	5.07E-05	5.41E-05	5.75E-05	6.1E-05	6.46E-05	6.82E-05	7.19E-05	7.56E-05	7.94E-05	8.32E-05	8.71E-05	9.11E-05	9.51E-05	9.91E-05	0	0	0	0	0	0	0	0	0	0	0	0
1825	5.89E-07	7.96E-07	1.1E-06	1.55E-06	2.2E-06	3.08E-06	4.22E-06	5.63E-06	7.26E-06	9.09E-06	1.11E-05	1.32E-05	1.55E-05	1.78E-05	2.03E-05	2.28E-05	2.54E-05	2.81E-05	3.09E-05	3.38E-05	3.67E-05	3.97E-05	4.28E-05	4.59E-05	4.91E-05	5.24E-05	5.57E-05	5.91E-05	6.26E-05	6.61E-05	6.97E-05	7.33E-05	7.7E-05	8.07E-05	8.45E-05	8.83E-05	9.22E-05	9.61E-05	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	5.83E-07	7.85E-07	1.08E-06	1.52E-06	2.14E-06	2.98E-06	4.08E-06	5.43E-06	7.01E-06	8.77E-06	1.07E-05	1.28E-05	1.49E-05	1.72E-05	1.96E-05	2.21E-05	2.46E-05	2.72E-05	2.99E-05	3.27E-05	3.56E-05	3.85E-05	4.15E-05	4.45E-05	4.76E-05	5.08E-05	5.41E-05	5.74E-05	6.07E-05	6.41E-05	6.76E-05	7.11E-05	7.47E-05	7.83E-05	8.2E-05	8.57E-05	8.95E-05	9.33E-05	9.72E-05	0	0	0	0	0	0	0	0	0	0	0
1898	5.77E-07	7.74E-07	1.06E-06	1.48E-06	2.08E-06	2.89E-06	3.95E-06	5.25E-06	6.77E-06	8.48E-06	1.03E-05	1.23E-05	1.45E-05	1.67E-05	1.9E-05	2.14E-05	2.39E-05	2.64E-05	2.9E-05	3.17E-05	3.45E-05	3.73E-05	4.02E-05	4.32E-05	4.62E-05	4.93E-05	5.24E-05	5.57E-05	5.89E-05	6.22E-05	6.56E-05	6.9E-05	7.25E-05	7.6E-05	7.96E-05	8.32E-05	8.69E-05	9.06E-05	9.43E-05	0	0	0	0	0	0	0	0	0	0	0
1934.5	5.71E-07	7.63E-07	1.04E-06	1.45E-06	2.02E-06	2.81E-06	3.83E-06	5.08E-06	6.55E-06	8.2E-06	1E-05	1.19E-05	1.4E-05	1.61E-05	1.84E-05	2.07E-05	2.31E-05	2.56E-05	2.82E-05	3.08E-05	3.35E-05	3.62E-05	3.9E-05	4.19E-05	4.49E-05	4.79E-05	5.09E-05	5.4E-05	5.72E-05	6.04E-05	6.37E-05	6.7E-05	7.04E-05	7.38E-05	7.73E-05	8.08E-05	8.44E-05	8.8E-05	9.17E-05	0	0	0	0	0	0	0	0	0	0	0
1971	5.66E-07	7.53E-07	1.03E-06	1.42E-06	1.97E-06	2.73E-06	3.71E-06	4.92E-06	6.33E-06	7.93E-06	9.68E-06	1.16E-05	1.36E-05	1.56E-05	1.78E-05	2.01E-05	2.24E-05	2.48E-05	2.73E-05	2.99E-05	3.25E-05	3.52E-05	3.79E-05	4.07E-05	4.36E-05	4.65E-05	4.95E-05	5.25E-05	5.56E-05	5.87E-05	6.19E-05	6.51E-05	6.84E-05	7.18E-05	7.51E-05	7.86E-05	8.2E-05	8.56E-05	8.91E-05	9.27E-05	0	0	0	0	0	0	0	0	0	0
2007.5	5.6E-07	7.43E-07	1.01E-06	1.39E-06	1.92E-06	2.65E-06	3.6E-06	4.76E-06	6.13E-06	7.68E-06	9.37E-06	1.12E-05	1.31E-05	1.52E-05	1.73E-05	1.95E-05	2.18E-05	2.41E-05	2.65E-05	2.9E-05	3.15E-05	3.42E-05	3.68E-05	3.95E-05	4.23E-05	4.52E-05	4.81E-05	5.1E-05	5.4E-05	5.71E-05	6.02E-05	6.33E-05	6.65E-05	6.98E-05	7.31E-05	7.64E-05	7.98E-05	8.32E-05	8.67E-05	9.02E-05	0	0	0	0	0	0	0	0	0	0
2044	5.55E-07	7.34E-07	9.91E-07	1.36E-06	1.88E-06	2.58E-06	3.49E-06	4.61E-06	5.94E-06	7.44E-06	9.08E-06	1.09E-05	1.27E-05	1.47E-05	1.68E-05	1.89E-05	2.11E-05	2.34E-05	2.58E-05	2.82E-05	3.07E-05	3.32E-05	3.58E-05	3.84E-05	4.11E-05	4.39E-05	4.67E-05	4.96E-05	5.25E-05	5.55E-05	5.85E-05	6.16E-05	6.47E-05	6.79E-05	7.11E-05	7.43E-05	7.76E-05	8.1E-05	8.43E-05	8.77E-05	9.13E-05	0	0	0	0	0	0	0	0	0
2080.5	5.5E-07	7.25E-07	9.75E-07	1.33E-06	1.83E-06	2.51E-06	3.39E-06	4.47E-06	5.75E-06	7.21E-06	8.8E-06	1.05E-05	1.24E-05	1.43E-05	1.63E-05	1.84E-05	2.05E-05	2.27E-05	2.5E-05	2.74E-05	2.98E-05	3.23E-05	3.48E-05	3.74E-05	4E-05	4.27E-05	4.55E-05	4.83E-05	5.11E-05	5.4E-05	5.69E-05	5.99E-05	6.3E-05	6.6E-05	6.92E-05	7.23E-05	7.55E-05	7.88E-05	8.21E-05	8.54E-05	8.88E-05	0	0	0	0	0	0	0	0	0
2117	5.45E-07	7.16E-07	9.6E-07	1.31E-06	1.79E-06	2.44E-06	3.29E-06	4.34E-06	5.58E-06	6.99E-06	8.54E-06	1.02E-05	1.2E-05	1.39E-05	1.58E-05	1.78E-05	1.99E-05	2.21E-05	2.43E-05	2.66E-05	2.9E-05	3.14E-05	3.39E-05	3.64E-05	3.89E-05	4.16E-05	4.42E-05	4.7E-05	4.97E-05	5.26E-05	5.54E-05	5.83E-05	6.13E-05	6.43E-05	6.73E-05	7.04E-05	7.36E-05	7.67E-05	7.99E-05	8.32E-05	8.65E-05	0	0	0	0	0	0	0	0	0
2153.5	5.4E-07	7.07E-07	9.45E-07	1.28E-06	1.75E-06	2.38E-06	3.2E-06	4.21E-06	5.41E-06	6.78E-06	8.28E-06	9.91E-06	1.16E-05	1.35E-05	1.54E-05	1.73E-05	1.94E-05	2.15E-05	2.37E-05	2.59E-05	2.82E-05	3.05E-05	3.29E-05	3.54E-05	3.79E-05	4.05E-05	4.31E-05	4.57E-05	4.84E-05	5.12E-05	5.4E-05	5.68E-05	5.97E-05	6.26E-05	6.56E-05	6.86E-05	7.17E-05	7.48E-05	7.79E-05	8.11E-05	8.43E-05	8.75E-05	0	0	0	0	0	0	0	0
2190	5.35E-07	6.99E-07	9.3E-07	1.26E-06	1.71E-06	2.32E-06	3.11E-06	4.09E-06	5.26E-06	6.58E-06	8.04E-06	9.62E-06	1.13E-05	1.31E-05	1.49E-05	1.69E-05	1.89E-05	2.09E-05	2.3E-05	2.52E-05	2.74E-05	2.97E-05	3.21E-05	3.45E-05	3.69E-05	3.94E-05	4.2E-05	4.45E-05	4.72E-05	4.99E-05	5.26E-05	5.54E-05	5.82E-05	6.1E-05	6.39E-05	6.69E-05	6.98E-05	7.29E-05	7.59E-05	7.9E-05	8.21E-05	8.53E-05	0	0	0	0	0	0	0	0
2226.5	5.3E-07	6.91E-07	9.17E-07	1.23E-06	1.67E-06	2.27E-06	3.03E-06	3.98E-06	5.11E-06	6.39E-06	7.81E-06	9.35E-06	1.1E-05	1.27E-05	1.45E-05	1.64E-05	1.83E-05	2.04E-05	2.24E-05	2.45E-05	2.67E-05	2.9E-05	3.12E-05	3.36E-05	3.6E-05	3.84E-05	4.09E-05	4.34E-05	4.6E-05	4.86E-05	5.13E-05	5.4E-05	5.67E-05	5.95E-05	6.23E-05	6.52E-05	6.81E-05	7.1E-05	7.4E-05	7.7E-05	8.01E-05	8.32E-05	8.64E-05	0	0	0	0	0	0	0
2263	5.26E-07	6.83E-07	9.03E-07	1.21E-06	1.64E-06	2.21E-06	2.95E-06	3.87E-06	4.96E-06	6.21E-06	7.59E-06	9.09E-06	1.07E-05	1.24E-05	1.41E-05	1.6E-05	1.79E-05	1.98E-05	2.18E-05	2.39E-05	2.6E-05	2.82E-05	3.04E-05	3.27E-05	3.51E-05	3.74E-05	3.98E-05	4.23E-05	4.48E-05	4.74E-05	5E-05	5.26E-05	5.53E-05	5.8E-05	6.08E-05	6.36E-05	6.64E-05	6.93E-05	7.22E-05	7.52E-05	7.81E-05	8.12E-05	8.42E-05	0	0	0	0	0	0	0
2299.5	5.21E-07	6.75E-07	8.9E-07	1.19E-06	1.6E-06	2.16E-06	2.88E-06	3.77E-06	4.82E-06	6.03E-06	7.38E-06	8.84E-06	1.04E-05	1.2E-05	1.38E-05	1.55E-05	1.74E-05	1.93E-05	2.13E-05	2.33E-05	2.54E-05	2.75E-05	2.97E-05	3.19E-05	3.42E-05	3.65E-05	3.89E-05	4.13E-05	4.37E-05	4.62E-05	4.88E-05	5.13E-05	5.39E-05	5.66E-05	5.93E-05	6.2E-05	6.48E-05	6.76E-05	7.05E-05	7.33E-05	7.62E-05	7.92E-05	8.22E-05	9.64E-05	0	0	0	0	0	0
2336	5.17E-07	6.68E-07	8.78E-07	1.17E-06	1.57E-06	2.11E-06	2.8E-06	3.67E-06	4.69E-06	5.87E-06	7.18E-06	8.6E-06	1.01E-05	1.17E-05	1.34E-05	1.51E-05	1.69E-05	1.88E-05	2.07E-05	2.27E-05	2.47E-05	2.68E-05	2.89E-05	3.11E-05	3.33E-05	3.56E-05	3.79E-05	4.03E-05	4.27E-05	4.51E-05	4.76E-05	5.01E-05	5.26E-05	5.52E-05	5.79E-05	6.05E-05	6.33E-05	6.6E-05	6.88E-05	7.16E-05	7.44E-05	7.73E-05	8.02E-05	8.32E-05	0	0	0	0	0	0
2372.5	5.13E-07	6.6E-07	8.66E-07	1.15E-06	1.54E-06	2.06E-06	2.74E-06	3.57E-06	4.57E-06	5.71E-06	6.98E-06	8.36E-06	9.84E-06	1.14E-05	1.3E-05	1.47E-05	1.65E-05	1.83E-05	2.02E-05	2.21E-05	2.41E-05	2.62E-05	2.82E-05	3.04E-05	3.25E-05	3.47E-05	3.7E-05	3.93E-05	4.16E-05	4.4E-05	4.64E-05	4.89E-05	5.14E-05	5.39E-05	5.65E-05	5.91E-05	6.18E-05	6.44E-05	6.72E-05	6.99E-05	7.27E-05	7.55E-05	7.84E-05	8.12E-05	0	0	0	0	0	0
2409	5.09E-07	6.53E-07	8.54E-07	1.13E-06	1.51E-06	2.02E-06	2.67E-06	3.48E-06	4.45E-06	5.56E-06	6.79E-06	8.14E-06	9.58E-06	1.11E-05	1.27E-05	1.44E-05	1.61E-05	1.79E-05	1.97E-05	2.16E-05	2.35E-05	2.55E-05	2.76E-05	2.96E-05	3.17E-05	3.39E-05	3.61E-05	3.84E-05	4.07E-05	4.3E-05	4.53E-05	4.78E-05	5.02E-05	5.27E-05	5.52E-05	5.77E-05	6.03E-05	6.29E-05	6.56E-05	6.83E-05	7.1E-05	7.38E-05	7.66E-05	7.94E-05	8.23E-05	0	0	0	0	0
2445.5	5.05E-07	6.47E-07	8.43E-07	1.11E-06	1.48E-06	1.97E-06	2.61E-06	3.39E-06	4.33E-06	5.41E-06	6.62E-06	7.93E-06	9.34E-06	1.08E-05	1.24E-05	1.4E-05	1.57E-05	1.74E-05	1.92E-05	2.11E-05	2.3E-05	2.49E-05	2.69E-05	2.89E-05	3.1E-05	3.31E-05	3.53E-05	3.75E-05	3.97E-05	4.2E-05	4.43E-05	4.66E-05	4.9E-05	5.15E-05	5.39E-05	5.64E-05	5.89E-05	6.15E-05	6.41E-05	6.67E-05	6.94E-05	7.21E-05	7.48E-05	7.76E-05	8.04E-05	0	0	0	0	0
2482	5.01E-07	6.4E-07	8.32E-07	1.1E-06	1.46E-06	1.93E-06	2.55E-06	3.31E-06	4.22E-06	5.27E-06	6.44E-06	7.73E-06	9.1E-06	1.06E-05	1.21E-05	1.37E-05	1.53E-05	1.7E-05	1.88E-05	2.06E-05	2.24E-05	2.43E-05	2.63E-05	2.83E-05	3.03E-05	3.23E-05	3.45E-05	3.66E-05	3.88E-05	4.1E-05	4.33E-05	4.56E-05	4.79E-05	5.03E-05	5.27E-05	5.51E-05	5.76E-05	6.01E-05	6.27E-05	6.52E-05	6.78E-05	7.05E-05	7.31E-05	7.58E-05	7.86E-05	8.4E-05	0	0	0	0
2518.5	4.97E-07	6.34E-07	8.22E-07	1.08E-06	1.43E-06	1.89E-06	2.49E-06	3.23E-06	4.12E-06	5.14E-06	6.28E-06	7.53E-06	8.87E-06	1.03E-05	1.18E-05	1.33E-05	1.49E-05	1.66E-05	1.83E-05	2.01E-05	2.19E-05	2.38E-05	2.57E-05	2.76E-05	2.96E-05	3.16E-05	3.37E-05	3.58E-05	3.79E-05	4.01E-05	4.23E-05	4.46E-05	4.68E-05	4.92E-05	5.15E-05	5.39E-05	5.63E-05	5.88E-05	6.13E-05	6.38E-05	6.63E-05	6.89E-05	7.15E-05	7.42E-05	7.68E-05	7.95E-05	0	0	0	0
2555	4.93E-07	6.27E-07	8.12E-07	1.06E-06	1.4E-06	1.85E-06	2.43E-06	3.15E-06	4.01E-06	5.01E-06	6.12E-06	7.34E-06	8.65E-06	1E-05	1.15E-05	1.3E-05	1.46E-05	1.62E-05	1.79E-05	1.96E-05	2.14E-05	2.32E-05	2.51E-05	2.7E-05	2.89E-05	3.09E-05	3.29E-05	3.5E-05	3.71E-05	3.92E-05	4.14E-05	4.36E-05	4.58E-05	4.81E-05	5.04E-05	5.27E-05	5.51E-05	5.75E-05	5.99E-05	6.24E-05	6.49E-05	6.74E-05	7E-05	7.25E-05	7.52E-05	7.78E-05	0	0	0	0
2591.5	4.89E-07	6.21E-07	8.02E-07	1.05E-06	1.38E-06	1.82E-06	2.38E-06	3.08E-06	3.92E-06	4.89E-06	5.97E-06	7.16E-06	8.44E-06	9.79E-06	1.12E-05	1.27E-05	1.42E-05	1.58E-05	1.75E-05	1.92E-05	2.09E-05	2.27E-05	2.45E-05	2.64E-05	2.83E-05	3.02E-05	3.22E-05	3.42E-05	3.63E-05	3.83E-05	4.05E-05	4.26E-05	4.48E-05	4.7E-05	4.93E-05	5.16E-05	5.39E-05	5.63E-05	5.86E-05	6.1E-05	6.35E-05	6.6E-05	6.85E-05	7.1E-05	7.35E-05	7.61E-05	7.88E-05	0	0	0
2628	4.86E-07	6.15E-07	7.92E-07	1.03E-06	1.36E-06	1.78E-06	2.33E-06	3.01E-06	3.82E-06	4.77E-06	5.82E-06	6.98E-06	8.23E-06	9.56E-06	1.09E-05	1.24E-05	1.39E-05	1.55E-05	1.71E-05	1.87E-05	2.04E-05	2.22E-05	2.4E-05	2.58E-05	2.76E-05	2.95E-05	3.15E-05	3.35E-05	3.55E-05	3.75E-05	3.96E-05	4.17E-05	4.38E-05	4.6E-05	4.82E-05	5.05E-05	5.27E-05	5.5E-05	5.74E-05	5.97E-05	6.21E-05	6.46E-05	6.7E-05	6.95E-05	7.2E-05	7.45E-05	7.71E-05	0	0	0
2664.5	4.82E-07	6.1E-07	7.83E-07	1.02E-06	1.33E-06	1.75E-06	2.28E-06	2.94E-06	3.73E-06	4.65E-06	5.68E-06	6.82E-06	8.03E-06	9.33E-06	1.07E-05	1.21E-05	1.36E-05	1.51E-05	1.67E-05	1.83E-05	2E-05	2.17E-05	2.34E-05	2.52E-05	2.7E-05	2.89E-05	3.08E-05	3.27E-05	3.47E-05	3.67E-05	3.87E-05	4.08E-05	4.29E-05	4.5E-05	4.72E-05	4.94E-05	5.16E-05	5.39E-05	5.62E-05	5.85E-05	6.08E-05	6.32E-05	6.56E-05	6.8E-05	7.05E-05	7.3E-05	7.55E-05	7.87E-05	0	0
2701	4.79E-07	6.04E-07	7.74E-07	1E-06	1.31E-06	1.71E-06	2.23E-06	2.88E-06	3.65E-06	4.54E-06	5.55E-06	6.65E-06	7.84E-06	9.11E-06	1.04E-05	1.18E-05	1.33E-05	1.48E-05	1.63E-05	1.79E-05	1.95E-05	2.12E-05	2.29E-05	2.47E-05	2.65E-05	2.83E-05	3.01E-05	3.2E-05	3.4E-05	3.59E-05	3.79E-05	3.99E-05	4.2E-05	4.41E-05	4.62E-05	4.84E-05	5.06E-05	5.28E-05	5.5E-05	5.73E-05	5.96E-05	6.19E-05	6.43E-05	6.66E-05	6.9E-05	7.15E-05	7.39E-05	7.64E-05	0	0
2737.5	4.75E-07	5.98E-07	7.65E-07	9.89E-07	1.29E-06	1.68E-06	2.19E-06	2.81E-06	3.57E-06	4.44E-06	5.42E-06	6.5E-06	7.66E-06	8.9E-06	1.02E-05	1.16E-05	1.3E-05	1.45E-05	1.6E-05	1.75E-05	1.91E-05	2.08E-05	2.24E-05	2.41E-05	2.59E-05	2.77E-05	2.95E-05	3.14E-05	3.33E-05	3.52E-05	3.71E-05	3.91E-05	4.11E-05	4.32E-05	4.53E-05	4.74E-05	4.95E-05	5.17E-05	5.39E-05	5.61E-05	5.84E-05	6.06E-05	6.29E-05	6.53E-05	6.76E-05	7E-05	7.24E-05	7.49E-05	0	0
2774	4.72E-07	5.93E-07	7.56E-07	9.76E-07	1.27E-06	1.65E-06	2.14E-06	2.75E-06	3.49E-06	4.33E-06	5.29E-06	6.35E-06	7.49E-06	8.7E-06	9.97E-06	1.13E-05	1.27E-05	1.41E-05	1.56E-05	1.71E-05	1.87E-05	2.03E-05	2.2E-05	2.36E-05	2.54E-05	2.71E-05	2.89E-05	3.07E-05	3.26E-05	3.45E-05	3.64E-05	3.83E-05	4.03E-05	4.23E-05	4.43E-05	4.64E-05	4.85E-05	5.06E-05	5.28E-05	5.5E-05	5.72E-05	5.94E-05	6.17E-05	6.4E-05	6.63E-05	6.86E-05	7.1E-05	7.34E-05	7.58E-05	0
2810.5	4.69E-07	5.88E-07	7.48E-07	9.63E-07	1.25E-06	1.62E-06	2.1E-06	2.7E-06	3.41E-06	4.24E-06	5.17E-06	6.2E-06	7.32E-06	8.5E-06	9.75E-06	1.11E-05	1.24E-05	1.38E-05	1.53E-05	1.68E-05	1.83E-05	1.99E-05	2.15E-05	2.31E-05	2.48E-05	2.65E-05	2.83E-05	3.01E-05	3.19E-05	3.37E-05	3.56E-05	3.75E-05	3.95E-05	4.15E-05	4.34E-05	4.55E-05	4.75E-05	4.96E-05	5.17E-05	5.39E-05	5.6E-05	5.82E-05	6.04E-05	6.27E-05	6.5E-05	6.73E-05	6.96E-05	7.19E-05	7.43E-05	0
2847	4.65E-07	5.83E-07	7.4E-07	9.5E-07	1.23E-06	1.59E-06	2.06E-06	2.64E-06	3.33E-06	4.14E-06	5.06E-06	6.06E-06	7.15E-06	8.31E-06	9.54E-06	1.08E-05	1.21E-05	1.35E-05	1.5E-05	1.64E-05	1.79E-05	1.95E-05	2.11E-05	2.27E-05	2.43E-05	2.6E-05	2.77E-05	2.95E-05	3.13E-05	3.31E-05	3.49E-05	3.68E-05	3.87E-05	4.06E-05	4.26E-05	4.46E-05	4.66E-05	4.86E-05	5.07E-05	5.28E-05	5.49E-05	5.71E-05	5.93E-05	6.15E-05	6.37E-05	6.59E-05	6.82E-05	7.05E-05	7.28E-05	7.54E-05
2883.5	4.62E-07	5.78E-07	7.32E-07	9.38E-07	1.21E-06	1.57E-06	2.02E-06	2.59E-06	3.26E-06	4.05E-06	4.94E-06	5.93E-06	6.99E-06	8.13E-06	9.33E-06	1.06E-05	1.19E-05	1.32E-05	1.46E-05	1.61E-05	1.76E-05	1.91E-05	2.06E-05	2.22E-05	2.38E-05	2.55E-05	2.72E-05	2.89E-05	3.06E-05	3.24E-05	3.42E-05	3.61E-05	3.79E-05	3.98E-05	4.17E-05	4.37E-05	4.57E-05	4.77E-05	4.97E-05	5.18E-05	5.39E-05	5.6E-05	5.81E-05	6.03E-05	6.24E-05	6.47E-05	6.69E-05	6.91E-05	7.14E-05	7.37E-05

FSConsol (c) 1994-2011 - version 3.45 GWP Geo Software Inc.
Date and Time of Analysis (mm/dd/yy) 11/11/2013 at 14:40:56
input filename: P:\2013 Projects\133-92505 Cu Flat TSF\Consolidation\Nov 2013\OF-beach.fs1

Overflow - beach (Non-thickened)
Revised flow rates and pond areas 11/11/2013
CDJ

ANALYSIS CONDITIONS
Analysis Type = Pond
Analysis Time = 16.115 years
Maximum Pond Height = 77.42 meters
Number of Filling Rates = 5

Rate kg/day	Period yrs
1.33E+07	1
1.54E+07	4
1.42E+07	6
1.32E+07	0.12
0.00E+00	5

Number of Pond Areas = 17

Pond Height m	Pond Area sq. km
4.27	0.07
4.57	0.24
3.05	0.41
4.57	0.57
4.57	0.73
4.57	0.82
4.57	0.97
4.57	1.03
4.57	1.13
4.57	1.17
4.57	1.21
4.57	1.23
4.57	1.25
4.57	1.26
7.62	1.27
3.05	1.27
4.57	1.27

Number of Surcharge Episodes = 0

INITIAL CONDITIONS
Initial Height = 0.00000 meters

MATERIAL PROPERTIES
Number of Soil Types = 1

Soil Type #1 duration = 16.11 years
Initial Solids Content = 25.90 %
void ratio @ initial S.C. = 7.582; effective stress @ initial S.C. = 10.00 Pascals
Specific Gravity = 2.65
Compressibility Parameters (stress in kPa)
A = 1.787; B = -0.2983 ; Mconst = 0.5224
Permeability Parameters (cm/second)
C = 1.523e-06; D = 3.035

BOUNDARY CONDITIONS
Bottom Boundary: Impermeable
Top Boundary: Constant Water Cap of: 0.000 m thickness

NUMERICAL TWEAKS
Time Step = 0.050 days
Maximum Stress Difference = 1e+06 kPa

OUTPUT PREFERENCES
Time Step Multiplier = 730
Time Step Units from: Time Step (days)

Time Step Output

Elapsed Time days	Height metres	Ave.Sol.Cont. %	Ave. Normalized Ue %	Ave. Dissipation %	Total Solids (kg)	Solids Flux (kg/d/m2)
0	0	25.9	100	0	0	201.363
36.5	6.098115	39.528	96.536	3.464	4.84E+08	55.9199
73	8.737703	43.656	95.973	4.027	9.69E+08	55.9199
109.5	9.507187	47.682	94.382	5.618	1.45E+09	32.2474
146	10.476951	50.081	93.328	6.672	1.94E+09	32.2474
182.5	11.558634	51.655	92.671	7.329	2.42E+09	32.2474
219	12.236617	53.232	91.655	8.345	2.91E+09	23.1181
255.5	12.810342	54.565	90.672	9.328	3.39E+09	23.1181
292	13.436283	55.614	89.868	10.132	3.87E+09	23.1181
328.5	14.096505	56.462	89.212	10.788	4.36E+09	23.1181
365	14.780841	57.164	88.681	11.319	4.84E+09	26.904
401.5	15.714982	57.566	88.64	11.36	5.41E+09	26.904
438	16.566093	58.003	88.43	11.57	5.97E+09	21.1605
474.5	17.159336	58.556	87.926	12.074	6.53E+09	21.1605
511	17.773119	59.023	87.525	12.475	7.10E+09	21.1605
547.5	18.397756	59.433	87.186	12.814	7.66E+09	21.1605
584	19.030285	59.798	86.897	13.103	8.23E+09	21.1605
620.5	19.668975	60.125	86.649	13.351	8.79E+09	21.1605
657	20.312613	60.421	86.438	13.562	9.35E+09	21.1605
693.5	20.960293	60.689	86.258	13.742	9.92E+09	21.1605
730	21.488683	61.011	85.902	14.098	1.05E+10	18.7619
766.5	22.017166	61.298	85.604	14.396	1.10E+10	18.7619
803	22.551957	61.559	85.34	14.66	1.16E+10	18.7619
839.5	23.091308	61.8	85.105	14.895	1.22E+10	18.7619
876	23.634322	62.023	84.893	15.107	1.27E+10	18.7619
912.5	24.180393	62.229	84.703	15.297	1.33E+10	18.7619
949	24.729068	62.422	84.532	15.468	1.39E+10	18.7619
985.5	25.279985	62.603	84.378	15.622	1.44E+10	18.7619
1022	25.762592	62.813	84.108	15.892	1.50E+10	15.86
1058.5	26.168928	63.039	83.774	16.226	1.56E+10	15.86
1095	26.583726	63.244	83.478	16.522	1.61E+10	15.86
1131.5	27.003419	63.436	83.204	16.796	1.67E+10	15.86
1168	27.426795	63.616	82.95	17.05	1.72E+10	15.86
1204.5	27.853193	63.785	82.711	17.289	1.78E+10	15.86
1241	28.282173	63.946	82.487	17.513	1.84E+10	15.86
1277.5	28.713408	64.098	82.277	17.723	1.89E+10	15.86
1314	29.146638	64.242	82.08	17.92	1.95E+10	15.86
1350.5	29.581652	64.38	81.894	18.106	2.01E+10	15.86
1387	30.018268	64.511	81.72	18.28	2.06E+10	15.86
1423.5	30.42497	64.651	81.498	18.502	2.12E+10	14.9583
1460	30.82099	64.787	81.28	18.72	2.18E+10	14.9583
1496.5	31.21996	64.915	81.079	18.921	2.23E+10	14.9583

1533	31.620997	65.037	80.889	19.111	2.29E+10	14.9583
1569.5	32.023724	65.154	80.709	19.291	2.34E+10	14.9583
1606	32.42791	65.266	80.539	19.461	2.40E+10	14.9583
1642.5	32.833389	65.373	80.378	19.622	2.46E+10	14.9583
1679	33.24003	65.477	80.225	19.775	2.51E+10	14.9583
1715.5	33.647726	65.576	80.079	19.921	2.57E+10	14.9583
1752	34.056384	65.671	79.941	20.059	2.63E+10	14.9583
1788.5	34.465926	65.764	79.81	20.19	2.68E+10	14.9583
1825	34.852455	65.864	79.636	20.364	2.74E+10	12.5521
1861.5	35.144936	65.994	79.325	20.675	2.79E+10	12.5521
1898	35.447468	66.11	79.059	20.941	2.84E+10	12.5521
1934.5	35.754018	66.22	78.81	21.19	2.89E+10	12.5521
1971	36.063325	66.325	78.572	21.428	2.95E+10	12.5521
2007.5	36.374798	66.426	78.345	21.655	3.00E+10	12.5521
2044	36.688086	66.523	78.126	21.874	3.05E+10	12.5521
2080.5	37.002952	66.616	77.914	22.086	3.10E+10	12.5521
2117	37.319222	66.706	77.71	22.29	3.15E+10	12.5521
2153.5	37.636758	66.793	77.513	22.487	3.21E+10	12.5521
2190	37.955451	66.877	77.322	22.678	3.26E+10	12.5521
2226.5	38.275209	66.958	77.137	22.863	3.31E+10	12.5521
2263	38.59595	67.038	76.958	23.042	3.36E+10	12.5521
2299.5	38.917606	67.114	76.785	23.215	3.41E+10	12.5521
2336	39.240116	67.189	76.617	23.383	3.47E+10	12.5521
2372.5	39.548675	67.267	76.425	23.575	3.52E+10	12.1668
2409	39.855497	67.342	76.241	23.759	3.57E+10	12.1668
2445.5	40.163729	67.415	76.064	23.936	3.62E+10	12.1668
2482	40.473023	67.485	75.893	24.107	3.67E+10	12.1668
2518.5	40.783223	67.553	75.728	24.272	3.73E+10	12.1668
2555	41.094232	67.62	75.567	24.433	3.78E+10	12.1668
2591.5	41.405978	67.685	75.411	24.589	3.83E+10	12.1668
2628	41.718406	67.748	75.26	24.74	3.88E+10	12.1668
2664.5	42.031468	67.809	75.113	24.887	3.93E+10	12.1668
2701	42.345125	67.869	74.971	25.029	3.99E+10	12.1668
2737.5	42.65934	67.927	74.832	25.168	4.04E+10	12.1668
2774	42.974082	67.984	74.698	25.302	4.09E+10	12.1668
2810.5	43.28932	68.04	74.567	25.433	4.14E+10	12.1668
2847	43.605029	68.094	74.44	25.56	4.19E+10	12.1668
2883.5	43.918571	68.149	74.309	25.691	4.24E+10	11.7178
2920	44.213906	68.207	74.151	25.849	4.30E+10	11.7178
2956.5	44.511467	68.263	74.005	25.995	4.35E+10	11.7178
2993	44.810075	68.317	73.864	26.136	4.40E+10	11.7178
3029.5	45.109458	68.369	73.728	26.272	4.45E+10	11.7178
3066	45.409486	68.42	73.596	26.404	4.50E+10	11.7178
3102.5	45.710079	68.47	73.468	26.532	4.56E+10	11.7178
3139	46.01118	68.519	73.344	26.656	4.61E+10	11.7178
3175.5	46.312747	68.567	73.222	26.778	4.66E+10	11.7178
3212	46.614745	68.614	73.105	26.895	4.71E+10	11.7178

3248.5	46.917146	68.659	72.99	27.01	4.76E+10	11.7178
3285	47.219924	68.704	72.878	27.122	4.82E+10	11.7178
3321.5	47.523058	68.748	72.769	27.231	4.87E+10	11.7178
3358	47.826528	68.791	72.663	27.337	4.92E+10	11.7178
3394.5	48.130317	68.833	72.559	27.441	4.97E+10	11.7178
3431	48.434408	68.875	72.458	27.542	5.02E+10	11.7178
3467.5	48.730334	68.918	72.344	27.656	5.08E+10	11.527
3504	49.026746	68.96	72.236	27.764	5.13E+10	11.527
3540.5	49.323742	69.001	72.131	27.869	5.18E+10	11.527
3577	49.621177	69.04	72.029	27.971	5.23E+10	11.527
3613.5	49.918983	69.08	71.93	28.07	5.28E+10	11.527
3650	50.21712	69.118	71.834	28.166	5.34E+10	11.527
3686.5	50.515559	69.156	71.74	28.26	5.39E+10	11.527
3723	50.814276	69.193	71.649	28.351	5.44E+10	11.527
3759.5	51.113254	69.229	71.56	28.44	5.49E+10	11.527
3796	51.412476	69.264	71.473	28.527	5.54E+10	11.527
3832.5	51.71193	69.3	71.388	28.612	5.60E+10	11.527
3869	52.011603	69.334	71.305	28.695	5.65E+10	11.527
3905.5	52.311483	69.368	71.224	28.776	5.70E+10	11.527
3942	52.611561	69.401	71.146	28.854	5.75E+10	11.527
3978.5	52.911828	69.434	71.069	28.931	5.80E+10	11.527
4015	53.20818	69.467	70.986	29.014	5.85E+10	10.5821
4051.5	53.463995	69.511	70.833	29.167	5.90E+10	10.5821
4088	53.301506	69.666	69.884	30.116	5.91E+10	0
4124.5	53.129642	69.794	69.049	30.951	5.91E+10	0
4161	52.978348	69.906	68.274	31.726	5.91E+10	0
4197.5	52.839417	70.01	67.527	32.473	5.91E+10	0
4234	52.709426	70.107	66.798	33.202	5.91E+10	0
4270.5	52.586503	70.199	66.079	33.921	5.91E+10	0
4307	52.469474	70.287	65.368	34.632	5.91E+10	0
4343.5	52.357536	70.372	64.661	35.339	5.91E+10	0
4380	52.250103	70.453	63.958	36.042	5.91E+10	0
4416.5	52.14673	70.531	63.257	36.743	5.91E+10	0
4453	52.047066	70.607	62.558	37.442	5.91E+10	0
4489.5	51.950825	70.68	61.86	38.14	5.91E+10	0
4526	51.857772	70.751	61.164	38.836	5.91E+10	0
4562.5	51.767705	70.82	60.468	39.532	5.91E+10	0
4599	51.680452	70.887	59.773	40.227	5.91E+10	0
4635.5	51.59586	70.952	59.079	40.921	5.91E+10	0
4672	51.513796	71.015	58.385	41.615	5.91E+10	0
4708.5	51.43414	71.076	57.693	42.307	5.91E+10	0
4745	51.356784	71.136	57.001	42.999	5.91E+10	0
4781.5	51.281628	71.194	56.31	43.69	5.91E+10	0
4818	51.208581	71.25	55.62	44.38	5.91E+10	0
4854.5	51.137561	71.305	54.932	45.068	5.91E+10	0
4891	51.068488	71.359	54.244	45.756	5.91E+10	0
4927.5	51.001291	71.411	53.559	46.441	5.91E+10	0

4964	50.9359	71.462	52.875	47.125	5.91E+10	0
5000.5	50.872254	71.512	52.193	47.807	5.91E+10	0
5037	50.810289	71.56	51.513	48.487	5.91E+10	0
5073.5	50.749951	71.607	50.836	49.164	5.91E+10	0
5110	50.691184	71.653	50.16	49.84	5.91E+10	0
5146.5	50.633936	71.698	49.488	50.512	5.91E+10	0
5183	50.578159	71.742	48.818	51.182	5.91E+10	0
5219.5	50.523806	71.784	48.151	51.849	5.91E+10	0
5256	50.470832	71.826	47.488	52.512	5.91E+10	0
5292.5	50.419194	71.867	46.827	53.173	5.91E+10	0
5329	50.368851	71.906	46.17	53.83	5.91E+10	0
5365.5	50.319763	71.945	45.517	54.483	5.91E+10	0
5402	50.271894	71.983	44.867	55.133	5.91E+10	0
5438.5	50.225206	72.02	44.221	55.779	5.91E+10	0
5475	50.179665	72.056	43.58	56.42	5.91E+10	0
5511.5	50.135237	72.091	42.942	57.058	5.91E+10	0
5548	50.09189	72.125	42.309	57.691	5.91E+10	0
5584.5	50.049592	72.159	41.68	58.32	5.91E+10	0
5621	50.008314	72.192	41.056	58.944	5.91E+10	0
5657.5	49.968027	72.224	40.437	59.563	5.91E+10	0
5694	49.928703	72.255	39.822	60.178	5.91E+10	0
5730.5	49.890315	72.286	39.213	60.787	5.91E+10	0
5767	49.852837	72.315	38.608	61.392	5.91E+10	0
5803.5	49.816243	72.345	38.008	61.992	5.91E+10	0
5840	49.780511	72.373	37.414	62.586	5.91E+10	0
5876.5	49.745615	72.401	36.825	63.175	5.91E+10	0

Observation Point Data

Number of Observation Points: 50
Number of Observation Point Readings: 162
Observation Point Time Step: 36.50 days

EXCESS PORE PRESSURE (kPa)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	15.19856	11.46588	6.711455	2.978659	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	24.45406	21.45867	15.7133	10.55992	6.162782	2.277317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	28.92925	26.48922	20.78805	14.79739	9.493884	4.784822	0.514361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	33.38402	31.3242	25.99595	19.62737	13.65155	8.274096	3.384326	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	37.95893	36.17112	31.27491	24.84844	18.41266	12.48729	7.067915	2.061288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	41.18531	39.60138	35.11125	28.81582	22.11204	15.75009	9.873194	4.427845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	43.88642	42.46116	38.33037	32.26243	25.44949	18.75946	12.49103	6.655035	1.20439	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	46.64616	45.34814	41.52964	35.72981	28.92746	22.01274	15.41742	9.233917	3.432744	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	49.45535	48.26183	44.71399	39.192	32.48365	25.43763	18.57988	12.09047	5.979004	0.361527	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	52.30825	51.20223	47.88976	42.63938	36.07897	28.98136	21.92443	15.17067	8.778386	2.744043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	56.04124	55.00967	51.90305	46.91043	40.53013	33.44543	26.24941	19.27318	12.62852	6.32403	0.568567	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	59.55284	58.58546	55.66005	50.90822	44.72496	37.70296	30.42284	23.26597	16.39748	9.854383	3.656081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	62.06778	61.15638	58.39152	53.86282	47.88326	40.96076	33.64506	26.34851	19.2851	12.52562	6.080061	0.258376	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	64.60934	63.74724	61.12554	56.80276	51.02694	44.22994	36.91999	29.52287	22.29374	15.33886	8.682789	2.384887	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	67.17514	66.35681	63.86351	59.73053	54.15427	47.50021	40.23015	32.76883	25.40308	18.2738	11.42678	4.884113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	69.76312	68.98395	66.60646	62.6484	57.26506	50.76477	43.56196	36.06942	28.59559	21.31315	14.29171	7.553069	1.294056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	72.37153	71.62763	69.3551	65.55842	60.35994	54.0193	46.90509	39.41049	31.85605	24.44183	17.26199	10.34897	3.768084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	74.99884	74.28689	72.10995	68.46238	63.44004	57.26128	50.25181	42.78038	35.17126	27.64658	20.32436	13.25205	6.464204	0.410187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	77.64374	76.96087	74.87134	71.36181	66.50669	60.48941	53.59645	46.16957	38.52978	30.91561	23.4672	16.24885	9.291266	2.736004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	79.82888	79.17262	77.16336	73.78186	69.08512	63.22709	56.45886	49.09423	41.44562	33.76231	26.20398	18.85236	11.74395	4.943268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	81.97079	81.33897	79.40366	76.14117	71.59427	65.89195	59.25378	51.96583	44.32792	36.59492	28.9429	21.47072	14.22478	7.246411	0.896822	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	84.12712	83.51784	81.65092	78.49926	74.09402	68.54306	62.03801	54.83821	47.22818	39.46381	31.73414	24.15413	16.78201	9.654028	2.925736	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	86.29706	85.70862	83.90514	80.85693	76.5856	71.18111	64.81044	57.7077	50.14044	42.36172	34.57006	26.895	19.40735	12.14591	5.19468	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	88.47983	87.91076	86.16628	83.21481	79.0701	73.80689	67.57051	60.57154	53.05975	45.28227	37.44376	29.68641	22.09362	14.71045	7.592494	1.12793	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	90.67477	90.12373	88.43427	85.57347	81.54854	76.42129	70.31803	63.4277	55.98205	48.21992	40.349	32.52201	24.83443	17.33944	10.08208	3.246097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	92.88126	92.34704	90.70903	87.93334	84.02181	79.02518	73.0531	66.27474	58.90406	51.16989	43.28019	35.39599	27.62395	20.02625	12.64586	5.58744	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	95.09872	94.58025	92.99046	90.29483	86.49071	81.61943	75.77603	69.11168	61.82316	54.12807	46.23233	38.30302	30.45681	22.76517	15.27339	8.050936	1.47352	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	97.0581	96.55442	95.00992	92.3897	88.68745	83.93637	78.21872	71.66937	64.46873	56.82246	48.93244	40.96968	33.05954	25.28259	17.68882	10.33182	3.405063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	98.64905	98.15926	96.65737	94.10834	90.50276	85.8669	80.27178	73.8376	66.72928	59.14021	51.26668	43.28164	35.31765	27.46397	19.77652	12.30265	5.163027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	100.2495	99.77283	98.31114	95.82939	92.31564	87.7902	82.31422	75.99468	68.98204	61.45732	53.61003	45.61329	37.60533	29.68342	21.91008	14.33161	7.033581	0.610823	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	101.8591	101.3948	99.97107	97.55302	94.1266	89.70698	84.34663	78.14069	71.22611	63.77177	55.95948	47.96096	39.91866	31.93698	24.08523	16.41167	8.983385	2.125771	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	103.4775	103.0249	101.6371	99.27939	95.93609	91.61789	86.36963	80.2758	73.46088	66.08191	58.3124	50.32136	42.254	34.22093	26.29811	18.53744	10.9964	3.878829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	105.1043	104.6627	103.309	101.0086	97.74452	93.52354	88.38383	82.4003	75.68595	68.38642	60.66656	52.69155	44.60804	36.5318	28.54517	20.70453	13.06299	5.760153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	106.7392	106.3081	104.9866	102.7408	99.55222	95.42448	90.38981	84.51453	77.90109	70.68425	63.02003	55.0689	46.9777	38.86635	30.82308	22.90919	15.17658	7.728424	1.101646	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	108.3818	107.9607	106.67	104.476	101.3595	97.32123	92.38814	86.61889	80.10622	72.97461	65.37121	57.45108	49.36021	41.2216	33.12876	25.14807	17.33221	9.763027	2.759386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	110.032	109.6203	108.3588	106.2143	103.1667	99.21426	94.37938	88.71378	82.30136	75.25687	67.71872	59.83605	51.75301	43.59472	35.4593	27.41812	19.52586	11.85193	4.606722	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	111.6893	111.2868	110.0531	107.9558	104.974	101.104	96.36405	90.79965	84.48662	77.53062	70.06144	62.222	54.15381	45.98314	37.812	29.7165	21.75415	13.98729	6.565456	0.31565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	113.3537	112.9597	111.7527	109.7004	106.7817	102.9909	98.34264	92.87694	86.66219	79.79553	72.39846	64.60739	56.56053	48.38445	40.18429	32.04058	24.01407	16.16349	8.602068	1.781632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	114.8959	114.5102	113.3285	111.3193	108.461	104.7463	100.1867	94.81721	88.69942	81.92256	74.60014	66.86197	58.84242	50.66755	42.44492	34.25901	26.17403	18.24736	10.56982	3.43076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	116.3724	115.9946	114.8372	112.8692	110.0688	106.4274	101.9535	96.67762	90.65529	83.96834	76.72262	69.04133	61.05455	52.88715	44.64837	36.42618	28.28826	20.29214	12.51471	5.160521	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	117.8553	117.485	116.3509	114.4224	111.6776	108.1066	103.7155	98.53076	92.60227	86.00504	78.83762	71.21665	63.26761	55.11355	46.86472	38.61206	30.42663	22.36703	14.50176	6.984451	0.562852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	119.3443	118.9812	117.8693	115.9787	113.2873	109.7841	105.4731	100.377	94.54068	88.03271	80.94479	73.38709	65.48028	57.34506	49.09204	40.81459	32.58696	24.46945	16.52567	8.876693	1.973498	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	120.8392	120.483	119.3925	117.5383	114.8982	111.4603	107.2267	102.2169	96.47084	90.05148	83.04389	75.55199	67.69142	59.58015	51.32853	43.03182	34.76721	26.59709	18.5824	10.82277	3.62249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	122.3398	121.9904	120.9204	119.1011	116.5103	113.1354	108.9767	104.0506	98.39309	92.06149	85.13478	77.71076	69.90005	61.81743	53.57252	45.26194	36.96548	28.74779	20.66869	12.81345	5.401599	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	123.846	123.503	122.4527	120.667	118.1237	114.8095	110.7233	105.8787	100.3078	94.06293	87.21736	79.86297	72.10528	64.05566	55.82248	47.50324	39.17995	30.91958	22.78185	14.84238	7.267744	0.761028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	125.3577	125.0208	123.9895	122.2361	119.7385	116.483	112.4668	107.7014	102.2152	96.05603	89.29162	82.00825	74.30637	66.29373	58.07701	49.7541	41.4089	33.11062	24.91952	16.90485	9.198494	2.238728	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	126.8746	126.5436	125.5306	123.8083	121.3548	118.1558	114.2075	109.5191	104.1157	98.04101	91.35758	84.14632	76.5027	68.53064	60.33481	52.01305	43.65072	35.31916	27.07962	18.99722	11.18044	3.931308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	128.3967	128.0714	127.0759	125.3836	122.9726	119.8283	115.9457	111.3321	106.0097	100.0181	93.41531	86.27699	78.69372	70.76551	62.59472	54.27867	45.90389	37.54358	29.26027	21.11655	13.20478	5.746394	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	129.9237	129.6039	128.6254	126.962	124.592	121.5006	117.6816	113.1407	107.8974	101.9876	95.46492	88.40012	80.87899	72.99757	64.85565	56.54969	48.16696	39.78233	31.45973	23.26034	15.26535	7.644809	1.035843	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	131.3621	131.0476	130.0864	128.4499	126.1195	123.0791	119.3219	114.8516	109.6856	103.8562	97.41298	90.42206	82.96459	75.1326	67.02309	58.73135	50.34502	41.94041	33.58284	25.3329	17.26402	9.511941	2.487844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	132.3623	132.0529	131.1065	129.4979	127.2058	124.2149	120.5174	116.1159	111.0252	105.2748	98.91032	91.99345	84.60089	76.82067	68.74684	60.47323	52.08749	43.66709	35.27875	26.98301	18.84791	10.98577	3.701687	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1898	133.3671	133.0627	132.1315	130.5489	128.2939	125.3508	121.7113	117.3766	112.3595	106.6866	100.4	93.55717	86.23054	78.50415	70.46899	62.21717	53.83605	45.40396	36.98893	28.65182	20.45707	12.50148	5.029131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	134.3764	134.0768	133.1604	131.6029	129.3837	126.4869	122.9036	118.6339	113.6886	108.0919	101.8822	95.11327	87.85336	80.1826	72.18886	63.96226	55.58958	47.14978	38.71203	30.33779	22.08921	14.05291	6.429942	0.236482	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	135.3901	135.0951	134.193	132.6599	130.4753	127.6233	124.0947	119.8881	115.013	109.4908	103.3571	96.66179	89.46922	81.85567	73.90581	65.70763	57.34707	48.90339	40.44679	32.03947	23.74234	15.63499	7.886487	1.165259	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007.5	136.4081	136.1176	135.2292	133.7197	131.5687	128.7602	125.2845	121.1395	116.3328	110.8837	104.8249	98.20285	91.07804	83.52304	75.61929	67.45252	59.10754	50.66369	42.19201	33.75554	25.41464	17.24389	9.388127	2.329593	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	137.4303	137.1441	136.2691	134.7824	132.6639	129.8976	126.4733	122.3881	117.6482	112.2708	106.2858	99.73653	92.67975	85.18445	77.32883	69.19621	60.87009	52.42965	43.94657	35.48475	27.10448	18.87668	10.92763	3.623616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080.5	138.4566	138.1746	137.3126	135.8479	133.7609	131.0356	127.6613	123.6343	118.9595	113.6524	107.7401	101.263	94.27436	86.8397	79.03401	70.93807	62.63392	54.2003	45.70939	37.2259	28.81036	20.53098	12.49973	5.00509	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2117	139.4869	139.209	138.3595	136.9163	134.8598	132.1742	128.8485	124.8782	120.267	115.0286	109.1879	102.7823	95.86186	88.48863	80.73445	72.67753	64.39826	55.97475	47.47947	38.97788	30.53091	22.20481	14.10041	6.451504	0.27355	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2153.5	140.5211	140.2471	139.4098	137.9874	135.9606	133.3135	130.035	126.1199	121.5708	116.3998	110.6295	104.2947	97.4423	90.13112	82.42984	74.41408	66.16241	57.75214	49.25584	40.73961	32.26487	23.89645	15.72649	7.949059	1.238421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2190	141.5592	141.289	140.4635	139.0613	137.0633	134.4537	131.221	127.3596	122.8712	117.7661	112.0651	105.8003	99.01574	91.76707	84.11992	76.14726	67.92574	59.5317	51.03759	42.51008	34.01107	25.6044	17.37538	9.488535	2.433681	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2226.5	142.601	142.3345	141.5204	140.1378	138.1678	135.5946	132.4066	128.5976	124.1683	119.1278	113.4948	107.2992	100.5822	93.39644	85.80447	77.87666	69.68767	61.31268	52.82388	44.28834	35.76842	27.32729	19.04491	11.06338	3.756964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2263	143.6464	143.3836	142.5807	141.217	139.2742	136.7364	133.5918	129.8338	125.4623	120.485	114.919	108.7917	102.1419	95.01918	87.48329	79.60192	71.44766	63.0944	54.6139	46.07346	37.53589	29.0639	20.73321	12.6687	5.166686	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2299.5	144.6955	144.4362	143.644	142.2989	140.3825	137.8791	134.7768	131.0685	126.7534	121.838	116.3377	110.2779	103.6948	96.6353	89.15625	81.32275	73.20525	64.87624	56.40689	47.86459	39.31252	30.81307	22.43866	14.30073	6.640493	0.398194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2336	145.7481	145.4922	144.7106	143.3834	141.4926	139.0227	135.9616	132.3018	128.0418	123.187	117.7512	111.758	105.2411	98.24481	90.82322	83.03885	74.95999	66.65762	58.20215	49.66091	41.09739	32.57375	24.15981	15.95646	8.164612	1.422087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2372.5	146.7393	146.4867	145.7153	144.4056	142.5398	140.1025	137.0815	133.469	129.2628	124.4672	119.0949	113.1673	106.7161	99.78289	92.41928	84.68516	76.64666	68.37315	59.93416	51.39681	42.82478	34.2801	25.83051	17.56855	9.66497	2.592264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2409	147.7128	147.4634	146.702	145.4093	143.5679	141.1622	138.1803	134.6139	130.4602	125.7228	120.4127	114.5498	108.1636	101.2934	93.98813	86.30526	78.30869	70.06612	61.64607	53.11534	44.53766	35.97498	27.49337	19.17874	11.17911	3.864752	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2445.5	148.6896	148.4434	147.6916	146.4155	144.5977	142.223	139.2792	135.7578	131.6554	126.9748	121.7258	115.9267	109.6049	102.7974	95.55081	87.92005	79.96684	71.75715	63.35839	54.83687	46.25631	37.67856	29.16836	20.80637	12.72332	5.21843	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2482	149.6697	149.4266	148.6842	147.4243	145.6295	143.2849	140.3782	136.9007	132.8485	128.2235	123.0345	117.2982	111.04	104.2951	97.1073	89.52939	81.62083	73.44583	65.07057	56.56078	47.98001	39.39002	30.8545	22.44992	14.29354	6.632809	0.410421	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2518.5	150.653	150.4128	149.6797	148.4354	146.6631	144.3479	141.4773	138.0427	134.0395	129.4691	124.3389	118.6644	112.4693	105.7864	98.65761	91.13317	83.27044	75.13179	66.78213	58.28644	49.70805	41.10857	32.55086	24.10803	15.88658	8.095219	1.386496	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2555	151.6395	151.4022	150.678	149.449	147.6986	145.412	142.5767	139.1839	135.2287	130.7116	125.6392	120.0255	113.8927	107.2716	100.2017	92.73131	84.91544	76.81469	68.49258	60.01329	51.43978	42.83348	34.25657	25.77945	17.49992	9.597044	2.55778	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2591.5	152.629	152.3945	151.6791	150.465	148.736	146.4772	143.6764	140.3245	136.4161	131.9512	126.9356	121.3818	115.3105	108.7506	101.7397	94.32373	86.55567	78.49423	70.20152	61.74079	53.17457	44.56404	35.9708	27.46304	19.13147	11.13207	3.844821	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2628	153.6215	153.3899	152.6829	151.4834	149.7752	147.5436	144.7765	141.4644	137.6019	133.1882	128.2281	122.7333	116.7228	110.2237	103.2717	95.9104	88.19096	80.17014	71.90856	63.46846	54.91184	46.29958	37.69277	29.15776	20.77946	12.69561	5.212293	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2664.5	154.6171	154.3881	153.6895	152.5041	150.8162	148.6112	145.8769	142.6038	138.7861	134.4225	129.5171	124.0803	118.1297	111.6909	104.7975	97.49129	89.82119	81.84216	73.61333	65.19583	56.65102	48.03947	39.42174	30.86268	22.44237	14.28402	6.64034	0.434806	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2701	155.6155	155.3892	154.6987	153.5272	151.8591	149.68	146.9777	143.7428	139.9689	135.6544	130.8025	125.4228	119.5314	113.1523	106.3174	99.06639	91.44624	83.5101	75.31551	66.92246	58.39161	49.78308	41.15702	32.57691	24.11888	15.89438	8.116354	1.425794	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2737.5	156.6169	156.3931	155.7105	154.5525	152.9038	150.75	148.0791	144.8813	141.1504	136.884	132.0847	126.761	120.928	114.6081	107.8314	100.6357	93.06604	85.17376	77.0148	68.64796	60.1331	51.52986	42.89792	34.29964	25.80779	17.52428	9.631688	2.609511	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2774	157.6211	157.3998	156.7249	155.5802	153.9503	151.8212	149.1809	146.0196	142.3346	138.1113	133.3636	128.0951	122.3198	116.0584	109.3396	102.1992	94.68052	86.83296	78.71093	70.37196	61.87503	53.27926	44.64382	36.0301	27.50804	19.17172	11.18008	3.908173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2810.5	158.6281	158.4093	157.7419	156.61	154.9986	152.8937	150.2833	147.1575	143.5097	139.3365	134.6395	129.4253	123.7067	117.5033	110.842	103.757	96.28962	88.48758	80.40366	72.09411	63.61698	55.03076	46.39413	37.76757	29.21866	20.83498	12.7568	5.286907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2847	159.6378	159.4214	158.7614	157.6421	156.0487	153.9674	151.3862	148.2953	144.6877	140.5598	135.9125	130.7516	125.089	118.943	112.3388	105.3091	97.8933	90.13748	82.09277	73.81411	65.35852	56.78387	48.14827	39.51138	30.93876	22.51258	14.35815	6.726016	0.501375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2883.5	160.6408	160.4267	159.7739	158.6669	157.0911	155.0329	152.4803	149.4235	145.8552	141.7717	137.1732	132.0648	126.4574	120.3681	113.8206	106.846	99.4821	91.7731	83.76861	75.52218	67.08983	58.52866	49.89624	41.25144	32.65805	24.19375	15.97173	8.203486	1.50788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2920	161.5557	161.344	160.6982	159.6033	158.0447	156.0091	153.4845	150.461	146.9312	142.8912	138.3405	133.2838	127.7308	121.6975	115.2063	108.2867	100.9748	93.31319	85.34983	77.13692	68.72939	60.18354	51.55635	42.90596	34.29461	25.79617	17.51393	9.629658	2.616528	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2956.5	162.4734	162.2638	161.6249	160.5418	159.0001	156.9865	154.4892	151.4984	148.0064	144.009	139.5054	134.4994	129	123.022	116.5867	109.7219	102.4621	94.8483	86.9269	78.74869	70.36748	61.83873	53.21876	44.565	35.93835	27.40943	19.07341	11.08963	3.836447	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2993	163.3936	163.1862	162.5541	161.4824	159.9572	157.9652	155.4947	152.5358	149.0809	145.1252	140.6677	135.7117	130.2651	124.3418	117.9618	111.1515	103.944	96.37838	88.49968	80.35728	72.0038	63.49383	54.883	46.22803	37.5886	29.0326	20.64859	12.57841	5.132523	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3029.5	164.3163	164.1111	163.4856	162.4252	160.916	158.9452	156.5009	153.5733	150.1546	146.2399	141.8278	136.9207	131.5262	125.657	119.3318	112.5758	105.4204	97.90338	90.06807	81.96249	73.63808	65.14849	56.54863	47.89452	39.24474	30.66486	22.23798	14.09186	6.486457	0.377248	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3066	165.2416	165.0385	164.4194	163.37	161.8766	159.9264	157.5078	154.6109	151.2277	147.3532	142.9856	138.1268	132.7835	126.9677	120.6968	113.9947	106.8915	99.42328	91.63196	83.56414	75.27004	66.80237	58.21525	49.564	40.9062	32.30543	23.84025	15.62681	7.886547	1.290409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3102.5	166.1693	165.9682	165.3555	164.3169	162.839	160.909	158.5155	155.6486	152.3003	148.4652	144.1412	139.3299	134.0371	128.274	122.0569	115.4084	108.3572	100.9381	93.19127	85.16206	76.89946	68.45514	59.88246	51.236	42.57243	33.95358	25.45421	17.18074	9.324666	2.392523	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3139	167.0995	166.9004	166.2938	165.2658	163.803	161.8929	159.524	156.6865	153.3723	149.576	145.2949	140.5302	135.2872	129.576	123.4121	116.8169	109.8177	102.4477	94.74591	86.75611	78.5261	70.10652	61.54989	52.91008	44.24289	35.60864	27.07877	18.7516	10.79486	3.607755	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3175.5	168.0321	167.835	167.2344	166.2168	164.7688	162.8781	160.5333	157.7246	154.4439	150.6855	146.4466	141.7278	136.5337	130.8739	124.7627	118.2204	111.2729	103.9522	96.29583	88.34616	80.14976	71.75623	63.21721	54.58584	45.91711	37.26996	28.71298	20.33764	12.29258	4.902102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3212	168.967	168.7719	168.1773	167.1697	165.7363	163.8646	161.5435	158.763	155.5151	151.794	147.5964	142.9227	137.7769	132.1677	126.1087	119.6188	112.7229	105.4516	97.84099	89.93209	81.77026	73.40401	64.88409	56.26289	47.59459	38.93693	30.35598	21.93739	13.81426	6.256291	0.270703	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3248.5	169.9044	169.7111	169.1223	168.1247	166.7054	164.8524	162.5544	159.8017	156.586	152.9014	148.7445	144.1152	139.0169	133.4577	127.4501	121.0123	114.1679	106.9459	99.38134	91.51381	83.38743	75.04962	66.55022	57.94085	49.2749	40.60898	32.00699	23.54954	15.35703	7.657982	1.147543	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3285	170.844	170.6526	170.0695	169.0816	167.6763	165.8415	163.5662	160.8407	157.6566	154.0079	149.8909	145.3052	140.2538	134.7438	128.7873	122.4011	115.6077	108.4352	100.9169	93.09124	85.00113	76.69285	68.21532	59.61936	50.9576	42.28559	33.66527	25.15728	16.91851	9.098648	2.233901	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3321.5	171.7859	171.5963	171.0188	170.0405	168.6488	166.832	164.5789	161.88	158.7269	155.1134	151.0357	146.4929	141.4876	136.0263	130.1201	123.7851	117.0426	109.9194	102.4475	94.66429	86.6112	78.3335	69.87913	61.2981	52.64228	43.96624	35.33016	26.80667	18.49671	10.57207	3.440854	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3358	172.7301	172.5423	171.9703	171.0013	169.623	167.8237	165.5925	162.9197	159.7971	156.2182	152.179	147.6784	142.7185	137.3052	131.4488	125.1645	118.4725	111.3985	103.9734	96.2329	88.21754	79.97137	71.54138	62.97675	54.32856	45.65046	37.00105	28.44972	20.08995	12.07353	4.730793	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3394.5	173.6765	173.4905	172.9238	171.964	170.5988	168.8168	166.607	163.9599	160.867	157.3221	153.3209	148.8618	143.9466	138.5806	132.7734	126.5394	119.8977	112.8727	105.4943	97.79703	89.82003	81.6063	73.20184	64.655	56.01608	47.3378	38.67736	30.10129	21.69675	13.59931	6.082916	0.196938	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3431	174.6252	174.4408	173.8794	172.9286	171.5763	169.8112	167.6224	165.0004	161.9369	158.4254	154.4614	150.0431	145.1719	139.8526	134.0941	127.9098	121.318	114.342	107.0104	99.35664	91.41857	83.23812	74.86031	66.33259	57.70448	49.02784	40.35854	31.76064	23.31586	15.14646	7.484097	1.041784	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3467.5	175.5375	175.3548	174.7986	173.8566	172.517	170.7684	168.6002	166.0029	162.9682	159.4894	155.562	151.184	146.3561	141.0829	135.3724	129.2374	122.6951	115.768	108.4832	100.8732	92.97456	84.82818	76.47804	67.9707	59.35491	50.68165	42.00558	33.38854	24.90761	16.674	8.886868	2.080055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3504	176.4479	176.2669	175.7157	174.7824	173.4552	171.7229	169.575	167.0019	163.9954	160.5488	156.6575	152.3189	147.5338	142.3059	136.6429	130.5567	124.0636	117.185	109.9472	102.3811	94.52243	86.41085	78.08935	69.60361	61.00156	52.33335	43.6525	35.01886	26.5055	18.21443	10.31965	3.241715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3540.5	177.3605	177.1811	176.6349	175.7101	174.395	172.6787	170.5506	168.0014	165.0227	161.6077	157.7517	153.4521	148.709	143.5259	137.9098	131.8718	125.4276	118.5974	111.4063	103.8844	96.06613	87.99003	79.69808	71.2351	62.64815	53.9866	45.30286	36.65504	28.11267	19.77011	11.78147	4.488249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3577	178.2752	178.0974	177.5561	176.6396	175.3365	173.6358	171.5273	169.0014	166.0499	162.6661	158.8448	154.5835	149.8819	144.7429	139.1731	133.1829	126.7871	120.005	112.8607	105.3831	97.60561	89.5656	81.30409	72.86494	64.29442	55.64105	46.95626	38.29651	29.72832	21.33957	13.26822	5.798029	0.085832	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3613.5	179.1919	179.0157	178.4792	177.5709	176.2796	174.5943	172.5049	170.002	167.0773	163.724	159.937	155.7133	151.0524	145.957	140.433	134.4901	128.1423	121.408	114.3104	106.8773	99.14083	91.13749	82.90721	74.49293	65.94009	57.29639	48.61228	39.94277	31.35173	22.92149	14.77669	7.157579	0.833487	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3650	180.1108	179.9361	179.4043	178.5041	177.2242	175.5541	173.4835	171.0031	168.1047	164.7815	161.0281	156.8414	152.2208	147.1684	141.6895	135.7933	129.4931	122.8064	115.7554	108.3668	100.6717	92.7056	84.5073	76.11889	67.58493	58.9523	50.27055	41.59335	32.9822	24.5147	16.30433	8.55772	1.84269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3686.5	181.0317	180.8585	180.3314	179.439	178.1705	176.5152	174.463	172.0048	169.1323	165.8386	162.1183	157.9681	153.3871	148.377	142.9427	137.0928	130.8398	124.2004	117.1958	109.8517	102.1983	94.26985	86.10425	77.74262	69.22868	60.60851	51.93073	43.24779	34.61911	26.11816	17.84902	9.991817	2.988023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3723	181.9546	181.7829	181.2603	180.3757	179.1183	177.4776	175.4436	173.0072	170.1601	166.8953	163.2076	159.0933	154.5513	149.583	144.1927	138.3886	132.1823	125.5899	118.6316	111.3321	103.7206	95.83019	87.69794	79.36397	70.87114	62.26472	53.59246	44.90566	36.26186	27.73093	19.40897	11.45487	4.223892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3759.5	182.8795	182.7093	182.1912	181.3142	180.0678	178.4413	176.4252	174.0101	171.188	167.9518	164.2961	160.2172	155.7136	150.7864	145.4397	139.6808	133.5208	126.9751	120.0628	112.8079	105.2384	97.38655	89.28826	80.98277	72.5121	63.92068	55.25543	46.56657	37.90992	29.35219	20.98267	12.94298	5.526411	0.011368	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3796	183.8065	183.6376	183.1239	182.2545	181.0187	179.4064	177.4078	175.0137	172.2162	169.0081	165.3838	161.3397	156.874	151.9874	146.6836	140.9694	134.8554	128.3559	121.4896	114.2792	106.7519	98.93889	90.87512	82.5989	74.15137	65.57616	56.91934	48.23011	39.56277	30.98118	22.5688	14.45302	6.880937	0.66749	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3832.5	184.7353	184.5679	184.0585	183.1965	181.9713	180.3728	178.3914	176.018	173.2446	170.0641	166.4709	162.461	158.0325	153.186	147.9246	142.2546	136.1861	129.7326	122.9119	115.746	108.261	100.4872	92.45844	84.21221	75.78877	67.2309	58.58389	49.89594	41.21993	32.61722	24.1662	15.98245	8.277622	1.644715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3869	185.6662	185.5002	184.995	184.1402	182.9253	181.3405	179.376	177.0229	174.2733	171.1199	167.5572	163.5811	159.1894	154.3823	149.1627	143.5365	137.513	131.1051	124.3299	117.2084	109.7658	102.0313	94.03813	85.82259	77.42412	68.88471	60.24881	51.56371	42.88095	34.25967	25.77384	17.52914	9.709417	2.771851	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3905.5	186.5989	186.4343	185.9333	185.0856	183.881	182.3095	180.3616	178.0286	175.3023	172.1756	168.6429	164.7	160.3445	155.5764	150.3981	144.8151	138.8361	132.4736	125.7435	118.6663	111.2661	103.5714	95.61414	87.42992	79.05727	70.53736	61.91384	53.23308	44.54542	35.90795	27.39082	19.09129	11.17105	3.995838	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3942	187.5336	187.3703	186.8734	186.0327	184.8381	183.2798	181.3483	179.0349	176.3316	173.2312	169.7281	165.8178	161.498	156.7683	151.6308	146.0905	140.1557	133.838	127.1529	120.1198	112.7621	105.1073	97.1864	89.03411	80.68808	72.18867	63.57873	54.90376	46.21294	37.56154	29.01631	20.66736	12.65842	5.290089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3978.5	188.4702	188.3082	187.8154	186.9816	185.7968	184.2514	182.336	180.0419	177.3612	174.2867	170.8127	166.9346	162.65	157.9581	152.8608	147.3628	141.4717	135.1985	128.5581	121.569	114.2538	106.639	98.75486	90.63506	82.31641	73.83845	65.24324	56.57544	47.88313	39.21992	30.64956	22.25602	14.16829	6.638674	0.527985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4015	189.3908	189.2301	188.7413	187.9142	186.7392	185.2065	183.3069	181.0319	178.3734	175.3244	171.8789	168.0326	163.7826	159.1281	154.0706	148.6143	142.7664	136.5374	129.9413	122.996	115.7233	108.1488	100.3017	92.21486	83.92429	75.4687	66.88933	58.23002	49.53782	40.86481	32.27207	23.83828	15.68017	8.013218	1.456837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4051.5	190.1205	189.9611	189.4761	188.6557	187.4902	185.97	184.0861	181.8298	179.1931	176.1692	172.7519	168.9368	164.721	160.1033	155.085	149.6699	143.8648	137.6796	131.1276	124.226	116.9957	109.4615	101.6518	93.59843	85.33663	76.90426	68.34179	59.69224	51.00167	42.32076	33.70821	25.23808	17.01687	9.231836	2.375759	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4088	188.845	188.6869	188.2058	187.3919	186.2358	184.7279	182.8593	180.6214	178.0063	175.007	171.6175	167.8332	163.651	159.0696	154.0901	148.7158	142.953	136.8111	130.3029	123.4448	116.2569	108.7631	100.991	92.97156	84.73915	76.33083	67.78628	59.14769	50.46022	41.77323	33.14327	24.64039	16.36263	8.478201	1.556724	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4124.5	187.2191	187.0622	186.5849	185.7775	184.6306	183.1349	181.2813	179.0615	176.4676	173.4926	170.1304	166.3765	162.2274	157.6819	152.7406	147.4065	141.6856	135.5868	129.122	122.3072	115.1616	107.7082	99.97395	91.98889	83.78647	75.40297	66.87729	58.25085	49.56788	40.87653	32.23142	23.69919	15.37267	7.440007	0.872517	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4161	185.5951	185.4393	184.9657	184.1647	183.0269	181.5431	179.7044	177.5024	174.9294	171.9782	168.643	164.9189	160.8026	156.2924	151.3888	146.0946	140.4151	134.3588	127.9373	121.1655	114.062	106.6492	98.95299	91.00264	82.83076	74.47282	65.96694	57.35376	48.67663	39.98257	31.32456	22.76728	14.40879	6.508366	0.434185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4197.5	183.9728	183.8182	183.3483	182.5536	181.4247	179.9526	178.1285	175.9441	173.3916	170.464	167.1553	163.4606	159.3765	154.9012	150.0348	144.7799	139.1415	133.1274	126.7487	120.0197	112.9583	105.5861	97.92805	90.01276	81.87193	73.54025	65.05506	56.4562	47.78621	39.09113	30.42293	21.84779	13.48231	5.678525	0.15992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4234	182.3523	182.1989	181.7326	180.944	179.8239	178.3634	176.5537	174.3865	171.8543	168.9498	165.6673	162.0016	157.9492	153.5083	148.6787	143.4627	137.8648	131.8925	125.5563	118.8699	111.8505	104.5188	96.89914	89.0192	80.90991	72.60515	64.14148	55.55799	46.89646	38.20225	29.52771	20.94496	12.59882	4.937605	0.021012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4270.5	180.7335	180.5813	180.1186	179.336	178.2246	176.7755	174.9799	172.8298	170.3174	167.4358	164.179	160.5419	156.5209	152.1139	147.3206	142.143	136.5852	130.6543	124.3602	117.7161	110.7385	103.4474	95.86623	88.02194	79.94463	71.66741	63.22607	54.659	46.00737	37.31645	28.64073	20.06238	11.75988	4.274292	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4307	179.1166	178.9655	178.5062	177.7297	176.6268	175.1888	173.4072	171.2739	168.7811	165.922	162.6905	159.0816	155.0914	150.7179	145.9605	140.8208	135.3027	129.4128	123.1606	116.5585	109.6225	102.3719	94.82933	87.02093	78.97604	70.72695	62.30876	53.75921	45.11915	36.43459	27.76396	19.20263	10.96513	3.679611	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4343.5	177.5013	177.3514	176.8956	176.1249	175.0304	173.6035	171.8356	169.7187	167.2453	164.4083	161.2018	157.6206	153.661	149.3205	144.5984	139.4962	134.0173	128.1681	121.9573	115.3971	108.5025	101.2923	93.78844	86.01617	78.00408	69.78372	61.3895	52.85871	44.23226	35.55775	26.89923	18.36742	10.21336	3.146442	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4380	175.8878	175.739	175.2866	174.5217	173.4355	172.0194	170.2651	168.1644	165.71	162.8949	159.713	156.1592	152.2295	147.9216	143.2345	138.1693	132.7292	126.9202	120.7506	114.2318	107.3786	100.2087	92.74358	85.00764	77.02873	68.8377	60.46838	51.95777	43.34733	34.68711	26.04814	17.55784	9.503022	2.669022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4416.5	174.276	174.1283	173.6792	172.92	171.842	170.4366	168.6956	166.6109	164.1753	161.3816	158.224	154.6972	150.7972	146.5213	141.8687	136.8401	131.4385	125.6692	119.5404	113.0629	106.2507	99.12116	91.69476	83.99536	76.05002	67.88897	59.54555	51.05677	42.4651	33.82385	25.21206	16.77451	8.832466	2.242569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4453	172.6659	172.5193	172.0735	171.3199	170.2499	168.8551	167.1272	165.0583	162.6411	159.8686	156.7349	153.2347	149.3639	145.1198	140.5012	135.5087	130.145	124.4152	118.3268	111.8902	105.119	98.0296	90.64202	82.97935	75.06802	66.93674	58.62129	50.15623	41.58641	32.9691	24.39213	16.01774	8.200014	1.863017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4489.5	171.0575	170.9119	170.4694	169.7213	168.6592	167.2748	165.5598	163.5065	161.1075	158.3559	155.2457	151.7717	147.9297	143.7169	139.1319	134.1752	128.8491	123.1582	117.1099	110.714	103.9834	96.93415	89.58542	81.95971	74.08283	65.98394	57.69597	49.25675	40.71214	32.12396	23.58925	15.2876	7.604026	1.526844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4526	169.4508	169.3062	168.8669	168.1243	167.07	165.6958	163.9935	161.9555	159.5744	156.8434	153.7565	150.3083	146.4948	142.3128	137.761	132.8396	127.5506	121.8984	115.8898	109.5343	102.8441	95.83487	88.52505	80.93655	73.09464	65.02813	56.77002	48.35898	39.84317	31.28939	22.80419	14.584	7.042905	1.230944	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4562.5	167.8457	167.7022	167.266	166.5288	165.4822	164.118	162.4283	160.4054	158.042	155.3313	152.2672	148.8446	145.059	140.9076	136.3885	131.5019	126.2496	120.6357	114.6665	108.351	101.7012	94.73187	87.46103	79.91003	72.10369	64.0706	55.84399	47.46364	38.9804	30.46632	22.03754	13.90671	6.515103	0.972547	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4599	166.2422	166.0997	165.6667	164.9347	163.8957	162.5415	160.8642	158.8561	156.5101	153.8194	150.7779	147.3804	143.6225	139.5012	135.0145	130.1623	124.9464	119.3703	113.4401	107.1645	100.5547	93.62525	86.39352	78.88038	71.11028	63.11175	54.91843	46.57148	38.12467	29.65556	21.28977	13.25541	6.019124	0.749163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4635.5	164.6405	164.4989	164.0689	163.3422	162.3107	160.9663	159.3011	157.3077	154.9789	152.3079	149.2887	145.9159	142.1854	138.0937	133.6389	128.8208	123.6408	118.1022	112.2107	105.9746	99.40484	92.51519	85.32271	77.84785	70.11478	62.15207	53.994	45.68327	37.27683	28.85784	20.5612	12.62968	5.553514	0.558542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4672	163.0403	162.8998	162.4728	161.7512	160.727	159.3923	157.7391	155.7602	153.4483	150.7967	147.7994	144.4512	140.7475	136.6851	132.2619	127.4775	122.333	116.8315	110.9785	104.7817	98.25167	91.40186	84.24887	76.81277	69.11759	61.1921	53.07133	44.79977	36.43765	28.0738	19.85209	12.02904	5.116867	0.398656	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4708.5	161.4417	161.3022	160.8782	160.1617	159.1448	157.8195	156.1782	154.2135	151.9183	149.2859	146.3103	142.9861	139.309	135.2756	130.8836	126.1324	121.023	115.5583	109.7434	103.5857	97.09541	90.28551	83.17226	75.7755	68.1192	60.23241	52.15113	43.92174	35.60789	27.304	19.16258	11.45298	4.707815	0.267693	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4745	159.8448	159.7062	159.2851	158.5756	157.5638	156.248	154.6184	152.6677	150.3889	147.7754	144.8212	141.5208	137.87	133.8651	129.5039	124.7856	119.711	114.2828	108.5057	102.387	95.93627	89.16638	82.09322	74.73646	67.12009	59.27362	51.23409	43.04992	34.78824	26.54894	18.49273	10.90092	4.325034	0.164058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4781.5	158.2494	158.1117	157.6936	156.987	155.9845	154.6777	153.0596	151.1228	148.8662	146.2654	143.3522	140.0354	136.4304	132.4537	128.1229	123.4372	118.3971	113.005	107.2656	101.1856	94.7745	88.04478	81.01213	73.6961	66.12083	58.31637	50.32092	42.18504	33.97933	25.80901	17.84254	10.37225	3.967237	0.08641	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4818	156.6556	156.5189	156.1036	155.4019	154.4061	153.1086	151.5019	149.5788	147.3322	144.7557	141.8433	138.5897	134.9903	131.0415	126.7408	122.0873	117.0813	111.7252	106.0231	99.98179	93.61037	86.92106	79.9294	72.65492	65.12199	57.3613	49.41232	41.3278	33.18176	25.08456	17.21192	9.866346	3.633177	0.033713	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4854.5	155.0633	154.9276	154.5151	153.8182	152.8293	151.5408	149.9453	148.0356	145.8049	143.2465	140.3547	137.1239	133.5498	129.6285	125.3577	120.736	115.7639	110.4434	104.7786	98.77587	92.4442	85.79558	78.84547	71.61343	64.12417	56.40908	48.50899	40.47884	32.39605	24.37586	16.60076	9.382547	3.321644	0.005366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4891	153.4727	153.3378	152.9281	152.236	151.2538	149.9742	148.3898	146.4934	144.2782	141.7378	138.8662	135.6581	132.1089	128.2149	123.9735	119.3835	114.445	109.16	103.5323	97.56811	91.27632	84.66876	77.76081	70.5722	63.12798	55.46038	47.6116	39.63879	31.62267	23.6831	16.00885	8.920181	3.031468	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4927.5	151.8836	151.7496	151.3426	150.6552	149.6797	148.4089	146.8353	144.9521	142.7523	140.2296	137.378	134.1923	130.6677	126.8007	122.5886	118.0299	113.1248	107.875	102.2843	96.35881	90.10712	83.54103	76.67595	69.53179	62.13407	54.51586	46.72081	38.80825	30.86205	23.00645	15.43596	8.478565	2.761519	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4964	150.296	150.1629	149.7586	149.0758	148.1069	146.8448	145.282	143.4117	141.2271	138.7219	135.8901	132.7265	129.2264	125.3861	121.2029	116.6753	111.8034	106.5888	101.0351	95.14832	88.93699	82.41285	75.59141	68.49279	61.14306	53.57619	45.83725	37.98773	30.11455	22.34598	14.88183	8.057006	2.510705	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000.5	148.71	148.5777	148.1762	147.4979	146.5356	145.2819	143.7298	141.8723	139.7028	137.2148	134.4026	131.2609	127.7849	123.9711	119.8166	115.32	110.4811	105.3016	99.78493	93.93701	87.76637	81.28473	74.50774	67.45582	60.1556	52.64199	44.96152	37.17775	29.38047	21.70175	14.34615	7.654811	2.277974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5037	147.1255	146.9941	146.5952	145.9214	144.9655	143.7203	142.1788	140.3339	138.1792	135.7084	132.9156	129.7955	126.3435	122.5559	118.43	113.9641	109.1582	104.0137	98.53412	92.72528	86.5957	80.15717	73.4255	66.42147	59.17231	51.7139	44.09418	36.37875	28.66009	21.07374	13.82858	7.271284	2.062314	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5073.5	145.5425	145.412	145.0157	144.3464	143.3969	142.1601	140.6289	138.7966	136.6566	134.2027	131.429	128.3304	124.9022	121.1407	117.0432	112.6079	107.8348	102.7254	97.28304	91.51355	85.42546	79.0307	72.34527	65.39036	58.19382	50.79251	43.23578	35.59114	27.95361	20.4619	13.32874	6.905734	1.862752	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5110	143.9612	143.8315	143.4378	142.7729	141.8297	140.6011	139.0803	137.2604	135.1349	132.6978	129.9431	126.8658	123.4612	119.7257	115.6563	111.2517	106.5114	101.4371	96.03209	90.30224	84.25615	77.90586	71.26764	64.36308	57.22073	49.8784	42.3868	34.81528	27.26119	19.86614	12.84627	6.557475	1.678354	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5146.5	142.3814	142.2526	141.8615	141.2009	140.2639	139.0436	137.5329	135.7253	133.6143	131.1938	128.458	125.4018	122.0207	118.311	114.2698	109.8956	105.1882	100.1491	94.78168	89.09184	83.08827	76.7832	70.19317	63.34025	56.25364	48.97211	41.54771	34.05148	26.58296	19.28633	12.38074	6.225829	1.508227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5183	140.8033	140.6753	140.2867	139.6304	138.6997	137.4874	135.9869	134.1914	132.0948	129.6907	126.9737	123.9386	120.5808	116.8968	112.8837	108.54	103.8655	98.86177	93.53222	87.88279	81.92234	75.66327	69.12246	62.32245	55.29311	48.07417	40.71892	33.30003	25.919	18.72233	11.93175	5.910129	1.351516	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5219.5	139.2267	139.0996	138.7135	138.0616	137.1369	135.9327	134.4422	132.6589	130.5764	128.1888	125.4905	122.4763	119.1418	115.4834	111.4984	107.1852	102.5438	97.57555	92.28416	86.6756	80.75887	74.54663	68.05608	61.31024	54.33969	47.18505	39.90081	32.56115	25.26935	18.17393	11.49887	5.609721	1.207405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5256	137.6519	137.5256	137.142	136.4943	135.5758	134.3796	132.8991	131.1278	129.0595	126.6882	124.0084	121.0151	117.7038	114.0711	110.1141	105.8316	101.2232	96.29083	91.03794	85.47075	79.59841	73.43383	66.99459	60.3042	53.3939	46.30521	39.09374	31.83504	24.63401	17.64093	11.08165	5.323963	1.075117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5292.5	136.0789	135.9533	135.5722	134.9288	134.0163	132.8281	131.3575	129.5982	127.544	125.1889	122.5277	119.5552	116.2671	112.66	108.7312	104.4794	99.90439	95.00803	89.79405	84.26874	78.44147	72.32542	65.93854	59.30484	52.45622	45.43505	38.298	31.12186	24.01296	17.12309	10.67965	5.05223	0.95391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5329	134.5076	134.3829	134.0043	133.3651	132.4586	131.2783	129.8176	128.0703	126.0301	123.6913	121.0485	118.0968	114.832	111.2505	107.35	103.129	98.58756	93.72758	88.55294	83.07007	77.28858	71.22194	64.88846	58.31268	51.52713	44.57497	37.51386	30.42172	23.40613	16.62016	10.29242	4.79391	0.843081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5365.5	132.9383	132.8144	132.4382	131.8032	130.9028	129.7304	128.2796	126.5441	124.5179	122.1954	119.571	116.6402	113.3986	109.843	105.9707	101.7808	97.27318	92.44994	87.31508	81.87525	76.14027	70.12391	63.84489	57.32822	50.60705	43.72531	36.74155	29.73471	22.81343	16.13186	9.919516	4.548413	0.741961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5402	131.3709	131.2478	130.8742	130.2434	129.349	128.1844	126.7435	125.0199	123.0078	120.7014	118.0956	115.1856	111.9674	108.4376	104.5939	100.4351	95.96167	91.17554	86.08096	80.68477	74.99704	69.03185	62.80831	56.3519	49.69638	42.88639	35.98126	29.06087	22.23477	15.65792	9.560487	4.315162	0.649915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5438.5	129.8057	129.6834	129.3122	128.6856	127.7972	126.6406	125.2095	123.4978	121.4997	119.2096	116.6223	113.7333	110.5385	107.0347	103.2197	99.09246	94.65344	89.90484	84.85105	79.49913	73.8594	67.94626	61.77919	55.38417	48.7955	42.05847	35.23317	28.40024	21.67	15.19803	9.214888	4.0936	0.566345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5475	128.2427	128.1212	127.7525	127.1301	126.2477	125.099	123.6778	121.9781	119.994	117.7202	115.1516	112.2836	109.1123	105.6347	101.8486	97.75314	93.34892	88.63829	83.62583	78.31881	72.72783	66.86761	60.758	54.42544	47.90474	41.24182	34.4974	27.75281	21.11896	14.75189	8.882277	3.883189	0.490683	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5511.5	126.6821	126.5614	126.1952	125.577	124.7007	123.5599	122.1486	120.4608	118.4909	116.2334	113.6835	110.8367	107.6891	104.2379	100.4809	96.41759	92.04854	87.37634	82.40575	77.14429	71.60282	65.79636	59.74516	53.47607	47.02442	40.43664	33.77405	27.11854	20.58149	14.31918	8.562216	3.68341	0.422392	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5548	125.124	125.0041	124.6404	124.0265	123.1562	122.0234	120.622	118.9463	116.9905	114.7496	112.2185	109.3929	106.2692	102.8446	99.11712	95.08621	90.75273	86.11943	81.19129	75.97604	70.48482	64.73296	58.74108	52.53643	46.1548	39.64311	33.0632	26.49738	20.05739	13.89958	8.254275	3.493762	0.360967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5584.5	123.5686	123.4496	123.0883	122.4787	121.6145	120.4897	119.0984	117.4347	115.4933	113.2689	110.7567	107.9526	104.8531	101.4553	97.75753	93.7594	89.46192	84.86802	79.98289	74.8145	69.37426	63.67782	57.74613	51.60683	45.29613	38.8614	32.36488	25.88926	19.54646	13.49277	7.958031	3.313762	0.305931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5621	122.0162	121.898	121.5392	120.9339	120.0758	118.9591	117.5778	115.9264	113.9993	111.7916	109.2986	106.5162	103.4409	100.0702	96.40255	92.43758	88.17653	83.62254	78.78099	73.66011	68.27157	62.63133	56.76066	50.68756	44.44863	38.09162	31.67912	25.29407	19.04848	13.09842	7.67307	3.142948	0.256837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5657.5	120.4668	120.3495	119.9933	119.3922	118.5404	117.4318	116.0607	114.4215	112.509	110.3181	107.8444	105.0838	102.0332	98.68987	95.05258	91.12115	86.89699	82.3834	77.58602	72.51329	67.17715	61.59386	55.78499	49.7789	43.6125	37.33388	31.00591	24.7117	18.56323	12.71621	7.398983	2.980874	0.213263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5694	118.9208	118.8043	118.4507	117.854	117.0084	115.908	114.5471	112.9204	111.0225	108.8487	106.3944	103.656	100.6301	97.31454	93.708	89.81052	85.6237	81.15104	76.39839	71.37444	66.09139	60.56575	54.81943	48.88107	42.78789	36.58824	30.34522	24.14202	18.09047	12.3458	7.135376	2.827114	0.174813	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5730.5	117.3784	117.2627	116.9117	116.3194	115.4801	114.388	113.0375	111.4233	109.5402	107.3836	104.9491	102.2329	99.23219	95.94464	92.36921	88.50609	84.35707	79.92585	75.2185	70.24394	65.01463	59.54734	53.86425	47.99429	41.97493	35.85477	29.69702	23.58488	17.62996	11.98687	6.881859	2.681259	0.141118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5767	115.8398	115.725	115.3766	114.7888	113.9558	112.8721	111.5321	109.9305	108.0625	105.9232	103.5086	100.8151	97.83972	94.58053	91.03659	87.20825	83.09749	78.70823	74.04673	69.12216	63.94721	58.53891	52.9197	47.11874	41.17375	35.13348	29.06123	23.04013	17.18145	11.6391	6.638057	2.542918	0.11183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5803.5	114.3053	114.1913	113.8456	113.2623	112.4358	111.3606	110.0312	108.4424	106.5895	104.4678	102.0734	99.40272	96.45308	93.2226	89.71052	85.91738	81.84536	77.49855	72.88345	68.00944	62.88945	57.54074	51.98599	46.25458	40.38442	34.42437	28.43778	22.50759	16.74468	11.30215	6.403603	2.411718	0.086626	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5840	112.7752	112.6621	112.319	111.7403	110.9204	109.8537	108.535	106.9593	105.1217	103.0178	100.6438	97.99626	95.07263	91.8712	88.39137	84.63387	80.60104	76.29718	71.72901	66.90611	61.84164	56.55309	51.06333	45.40195	39.60701	33.72745	27.82656	21.98709	16.31941	10.97572	6.178141	2.287299	0.065204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5876.5	111.2497	111.1375	110.7972	110.2231	109.4098	108.3518	107.044	105.4814	103.6593	101.5735	99.22014	96.59603	93.69874	90.52672	87.07953	83.35807	79.36489	75.10447	70.58373	65.81247	60.80405	55.57617	50.15189	44.56097	38.84156	33.04267	27.22747	21.47844	15.90538	10.65949	5.961325	2.169321	0.047284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NORMALIZED EXCESS PORE PRESSURE (%)

Time	Height from Bottom (metres)																																																	
days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	77.8068	97.51546	99.29939	99.36643	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	76.41793	93.65601	98.37343	99.18003	99.29231	98.83386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	73.45281	89.33196	96.48186	98.40755	98.84564	98.67042	92.41206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	71.67941	85.97399	94.28178	97.42869	98.36836	98.50638	97.68023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	70.6037	83.47434	92.13676	96.29068	97.8255	98.28781	98.12488	95.70726	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	69.20271	81.05413	89.8439	94.82996	97.02283	97.82543	97.90685	96.89835	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	67.86418	78.87937	87.61184	93.19984	96.03859	97.23406	97.55034	96.99477	89.60634	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	66.80721	77.07928	85.61212	91.57009	94.96919	96.58432	97.17117	96.96289	94.44979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	65.9615	75.57713	83.84136	89.99731	93.84886	95.87778	96.75592	96.84052	95.65418	75.57119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	65.27819	74.31364	82.28064	88.51357	92.71011	95.12258	96.29969	96.64967	96.09143	91.68067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	65.06636	73.54368	81.1572	87.33502	91.73993	94.46543	95.93171	96.55453	96.47867	95.07059	80.55921	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	64.82075	72.81924	80.11053	86.20235	90.75262	93.74556	95.48014	96.3383	96.54923	95.96512	92.63142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	64.25854	71.87225	78.90576	84.9304	89.61042	92.85311	94.84916	95.92374	96.32653	96.04946	94.18029	68.70935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	63.77497	71.03968	77.82401	83.75422	88.51191	91.95693	94.19223	95.48019	96.06953	96.03493	94.94735	88.42449	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	63.35728	70.30435	76.85047	82.66893	87.46367	91.0678	93.51643	95.00994	95.78096	95.95151	95.33368	92.25575	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	62.99521	69.65216	75.97211	81.66841	86.46897	90.19424	92.82883	94.51628	95.46348	95.81635	95.51853	93.80356	82.5861	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	62.68042	69.07148	75.17753	80.74608	85.52876	89.34263	92.13606	94.0031	95.11983	95.63997	95.58281	94.57363	89.99816	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	62.40608	68.55265	74.45688	79.89543	84.64244	88.51749	91.444	93.47458	94.75287	95.42935	95.56725	94.98857	92.5475	71.45301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	62.16653	68.08757	73.80159	79.11019	83.80835	87.72183	90.75768	92.93492	94.36557	95.18954	95.49443	95.21083	93.77083	87.2964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	61.81681	67.53813	73.08341	78.27534	82.92722	86.87209	90.00592	92.32001	93.89581	94.8566	95.29788	95.20262	94.22979	90.41953	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	61.48392	67.0201	72.40641	77.48379	82.08221	86.04327	89.25675	91.69244	93.4045	94.49756	95.06799	95.1322	94.48465	92.03363	76.27977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	61.18178	66.54491	71.78029	76.74471	81.28327	85.24678	88.52254	91.06423	92.90241	94.12266	94.81744	95.02481	94.62663	92.97927	85.97215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	60.90708	66.10815	71.20023	76.05399	80.52815	84.48293	87.80576	90.43863	92.39225	93.73363	94.54807	94.88662	94.68891	93.56206	89.52188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	60.65693	65.70593	70.66197	75.40782	79.81451	83.7515	87.10819	89.81845	91.87662	93.33234	94.2616	94.72217	94.69226	93.92891	91.34053	77.42624	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	60.42884	65.33488	70.16168	74.80269	79.13998	83.0519	86.43107	89.20607	91.358	92.92073	93.95975	94.53492	94.65019	94.15684	92.40816	85.80389	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	60.2206	64.99201	69.69599	74.2354	78.50222	82.38328	85.77519	88.60342	90.83864	92.50072	93.64417	94.32765	94.57186	94.28959	93.08053	89.15744	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	60.03029	64.67469	69.26187	73.70299	77.89899	81.74461	85.14095	88.01207	90.32058	92.07419	93.31652	94.10264	94.46373	94.35363	93.51891	90.9556	79.13471	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	59.7898	64.31688	68.79604	73.14582	77.27507	81.08579	84.4836	87.3921	89.76751	91.60677	92.94257	93.82416	94.28709	94.30941	93.71875	91.85772	85.1113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	59.47438	63.89375	68.27392	72.53992	76.60767	80.38577	83.78416	86.72666	89.1644	91.08473	92.50961	93.48082	94.03385	94.15983	93.73117	92.2593	87.445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	59.17777	63.49459	67.7798	71.96428	75.97033	79.7127	83.1058	86.07447	88.56621	90.56052	92.06965	93.12776	93.76881	93.99344	93.70868	92.55168	89.02375	67.81613	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	58.89856	63.11765	67.31176	71.417	75.36152	79.06577	82.44858	85.43643	87.97447	90.03578	91.62405	92.76589	93.49263	93.81153	93.65621	92.75681	90.09918	79.33413	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	58.63551	62.76135	66.86802	70.89636	74.77978	78.44405	81.81235	84.81322	87.39044	89.51202	91.17412	92.39618	93.20604	93.61526	93.5778	92.89269	90.85198	84.04185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	58.38746	62.42426	66.44697	70.40071	74.2237	77.84662	81.19685	84.2053	86.81518	88.99056	90.72115	92.01962	92.90982	93.40571	93.47672	92.97319	91.38885	86.66348	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1241	58.15337	62.10505	66.04712	69.92855	73.69194	77.27252	80.60171	83.61297	86.24957	88.47263	90.26636	91.63721	92.60476	93.18391	93.35563	93.00881	91.77468	88.32015	72.45495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	57.93229	61.80253	65.66709	69.47846	73.18321	76.72079	80.02647	83.03636	85.6943	87.95926	89.81089	91.24998	92.29171	92.95079	93.21672	93.00746	92.05072	89.44196	80.42999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	57.72334	61.51559	65.30564	69.04913	72.6963	76.19049	79.47061	82.4755	85.14991	87.45138	89.35579	90.85889	91.9715	92.7073	93.06185	92.97516	92.24424	90.2339	84.26325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	57.52572	61.24323	64.96158	68.63934	72.23006	75.68069	78.9336	81.93031	84.61681	86.94977	88.90203	90.4649	91.64499	92.45432	92.89259	92.91656	92.37396	90.80716	86.54885	60.04843	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	57.3387	60.98451	64.63385	68.24795	71.78341	75.19049	78.41484	81.40063	84.09529	86.4551	88.4505	90.06892	91.31301	92.19269	92.71033	92.83532	92.4531	91.22752	88.05578	76.08727	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	57.13415	60.71174	64.29538	67.84867	71.33104	74.69579	77.8916	80.86524	83.56562	85.94894	87.98373	89.65396	90.95839	91.90437	92.49527	92.70901	92.45705	91.48175	88.99028	81.16197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	56.9244	60.43674	63.95739	67.45218	70.88308	74.20623	77.37317	80.33311	83.03658	85.43997	87.51032	89.22863	90.59004	91.59908	92.25915	92.55414	92.41464	91.63859	89.63194	83.99747	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	56.72442	60.17396	63.63379	67.07182	70.45235	73.73414	76.87141	79.81578	82.51942	84.93921	87.04112	88.80369	90.2188	91.28819	92.01476	92.38684	92.35007	91.74517	90.12151	85.88754	64.03083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	56.53366	59.9227	63.32381	66.70675	70.03801	73.27878	76.38579	79.31296	82.01418	84.447	86.57673	88.37986	89.84538	90.97237	91.76279	92.20818	92.26601	91.8103	90.49528	87.21643	75.52998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	56.35159	59.68232	63.02669	66.35617	69.63937	72.83944	75.9156	78.82435	81.52085	83.96364	86.11767	87.95779	89.47048	90.65225	91.50389	92.01912	92.1647	91.84072	90.77917	88.18716	80.49937	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	56.17774	59.45223	62.74175	66.01936	69.25541	72.41545	75.46077	78.34963	81.03937	83.48933	85.66437	87.53809	89.09474	90.32847	91.2387	91.82055	92.04801	91.8417	90.99203	88.91473	83.4007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	56.01165	59.23188	62.46835	65.6956	68.8857	72.00615	75.0203	77.88844	80.56961	83.02422	85.21723	87.12129	88.71877	90.00165	90.96785	91.61328	91.91752	91.8174	91.1478	89.46916	85.31543	66.36097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	55.85292	59.02075	62.20589	65.38425	68.52949	71.61092	74.59383	77.44044	80.11145	82.5684	84.77656	86.70787	88.34315	89.67237	90.69195	91.39806	91.7746	91.77118	91.25693	89.8956	86.66723	75.98691	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	55.70115	58.81836	61.95381	65.0847	68.18615	71.22916	74.18084	77.00525	79.66471	82.12193	84.34261	86.29826	87.9684	89.34121	90.41158	91.17562	91.62042	91.70576	91.32736	90.22453	87.66254	80.48952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	55.55598	58.62424	61.71159	64.79637	67.85508	70.8603	73.78085	76.58251	79.22919	81.6848	83.9156	85.89285	87.59502	89.00871	90.12732	90.94662	91.45605	91.62341	91.36526	90.47725	88.41582	83.2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	55.41707	58.43799	61.47872	64.51871	67.53573	70.50379	73.39336	76.17184	78.80469	81.25699	83.49568	85.49196	87.22345	88.67536	89.8397	90.71169	91.28242	91.52601	91.37546	90.66915	88.99637	85.03446	68.82224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	55.26649	58.24185	61.2377	64.2345	67.21121	70.14322	73.00247	75.75794	78.37652	80.82449	83.0695	85.08276	86.84123	88.32884	89.53621	90.45769	91.08532	91.39766	91.33984	90.78077	89.39768	86.23109	76.07585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	55.03929	57.9716	60.92521	63.88152	66.82061	69.71911	72.55036	75.28474	77.8905	80.335	82.58649	84.61622	86.4004	87.9216	89.16871	90.13463	90.81086	91.17771	91.18626	90.72064	89.49824	86.69749	78.44122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1898	54.81921	57.70972	60.62222	63.53904	66.44124	69.30667	72.10996	74.82284	77.41485	79.85444	82.11055	84.15456	85.96214	87.51471	88.79964	89.8084	90.53193	90.95189	91.02454	90.64753	89.57448	87.11617	80.5038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	54.60596	57.45586	60.32836	63.20663	66.0727	68.90552	71.68093	74.37198	76.94943	79.38282	81.64184	83.69807	85.52685	87.10864	88.42944	89.47941	90.24885	90.72048	90.85501	90.56205	89.62748	87.47915	82.09302	51.33162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	54.39928	57.2097	60.04327	62.88392	65.71459	68.51526	71.26296	73.93191	76.4941	78.92013	81.18046	83.24701	85.09489	86.70379	88.05853	89.14804	89.96195	90.48377	90.67806	90.46487	89.65867	87.78514	83.32616	66.29981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007.5	54.1989	56.97093	59.76659	62.57053	65.36653	68.13555	70.85569	73.50236	76.04869	78.46632	80.72651	82.80159	84.66658	86.30056	87.68732	88.81468	89.67157	90.24208	90.49405	90.35673	89.66947	88.03795	84.29788	72.59848	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	54.00457	56.73928	59.49802	62.26612	65.02817	67.76603	70.45883	73.08308	75.61303	78.02133	80.28004	82.36199	84.24221	85.89931	87.31621	88.4797	89.37805	89.99574	90.30339	90.2383	89.66132	88.2431	85.07384	76.34381	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080.5	53.81606	56.51445	59.23722	61.97035	64.69915	67.40635	70.07205	72.67381	75.18693	77.58507	79.8411	81.92837	83.82204	85.50037	86.94555	88.14347	89.08173	89.74506	90.10647	90.11024	89.63567	88.40623	85.69964	78.87575	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2117	53.63314	56.2962	58.98392	61.6829	64.37914	67.05618	69.69505	72.27429	74.77021	77.15744	79.40969	81.50085	83.40629	85.10404	86.5757	87.80635	88.78295	89.49038	89.90367	89.97314	89.59389	88.53245	86.20768	80.70997	52.04767	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2153.5	53.45561	56.08426	58.73782	61.40346	64.06782	66.71522	69.32754	71.88426	74.36268	76.73835	78.9858	81.07953	82.99515	84.7106	86.20698	87.46867	88.48203	89.23203	89.69536	89.82759	89.53727	88.62628	86.62155	82.09729	65.96361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2190	53.28326	55.87841	58.49867	61.13174	63.76489	66.38316	68.96923	71.50329	73.96413	76.32766	78.5694	80.66447	82.58879	84.32148	85.83964	87.13075	88.17932	88.97033	89.48191	89.67414	89.46702	88.69158	86.95882	83.17745	72.01024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2226.5	53.1159	55.67841	58.2662	60.86746	63.47006	66.05969	68.61983	71.13168	73.57438	75.92526	78.16046	80.25572	82.18736	83.93334	85.4741	86.79292	87.87512	88.7056	89.26368	89.51331	89.38424	88.73166	87.23285	84.03565	75.65956	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2263	52.95335	55.48406	58.04017	60.61037	63.18304	65.74455	68.27907	70.76864	73.19322	75.531	77.75892	79.85333	81.79098	83.54994	85.11048	86.45545	87.56974	88.43817	89.04103	89.34559	89.28992	88.74935	87.45399	84.72729	78.15344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2299.5	52.79543	55.29514	57.82035	60.36019	62.90358	65.43745	67.9467	70.41411	72.82046	75.14476	77.3647	79.4573	81.39974	83.17027	84.74907	86.11864	87.26348	88.16833	88.81429	89.17145	89.18499	88.74706	87.63036	85.29022	79.97632	55.05896	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2336	52.64198	55.11146	57.60652	60.1167	62.6314	65.13814	67.62246	70.06786	72.4559	74.76637	76.97773	79.06763	81.01373	82.7945	84.39008	85.78274	86.95663	87.89639	88.5838	88.99134	89.07027	88.72686	87.76846	85.75126	81.36606	66.62748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2372.5	52.48181	54.92187	57.38758	59.86886	62.35559	64.83581	67.29568	69.7194	72.08925	74.38578	76.58817	78.67471	80.62351	82.41334	84.02431	85.43848	86.63968	87.61236	88.33873	88.79315	88.93163	88.67159	87.84679	86.08598	82.35933	71.66439	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2409	52.32239	54.73376	57.17082	59.62388	62.08323	64.53744	66.97325	69.3755	71.72717	74.00956	76.20252	78.28497	80.23553	82.03323	83.65827	85.09252	86.31953	87.32359	88.08722	88.58627	88.78082	88.59752	87.89179	86.34932	83.14418	74.91077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2445.5	52.16716	54.55054	56.95961	59.38506	61.81759	64.24625	66.65833	69.03928	71.37278	73.64078	75.82385	77.90153	79.85291	81.65736	83.29519	84.74817	85.99964	87.03371	87.83317	88.37519	88.6233	88.51214	87.91541	86.56567	83.79506	77.22261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2482	52.016	54.37204	56.75377	59.15221	61.55846	63.96201	66.35069	68.71055	71.02588	73.27932	75.45209	77.52434	79.47568	81.28582	82.93523	84.40565	85.68023	86.74297	87.57687	88.16022	88.45954	88.41635	87.91992	86.74166	84.33644	78.95444	54.37798	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2518.5	51.86876	54.1981	56.5531	58.92512	61.30561	63.68451	66.05014	68.3891	70.68629	72.92502	75.08712	77.15336	79.10386	80.9187	82.57854	84.06513	85.36153	86.45161	87.31858	87.94166	88.28997	88.31098	87.90725	86.88256	84.78772	80.29854	65.35872	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2555	51.72532	54.02857	56.35745	58.70361	61.05886	63.41355	65.75646	68.07473	70.35386	72.57774	74.72885	76.78854	78.73745	80.55605	82.22522	83.7268	85.04374	86.15987	87.05853	87.7198	88.11501	88.19678	87.87909	86.99274	85.16426	81.36803	70.71436	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2591.5	51.58555	53.86331	56.16665	58.48751	60.81802	63.14892	65.46945	67.76726	70.02839	72.23734	74.37718	76.42983	78.37646	80.19793	81.87541	83.3908	84.72707	85.86796	86.79699	87.49492	87.93504	88.07443	87.83687	87.07582	85.47819	82.23445	74.08992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2628	51.44934	53.70219	55.98055	58.27663	60.5829	62.89044	65.18893	67.4665	69.70973	71.90367	74.03198	76.07716	78.02087	79.8444	81.52919	83.05729	84.41169	85.57611	86.53419	87.26731	87.75046	87.94457	87.78187	87.13488	85.73918	82.94559	76.46067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2664.5	51.31657	53.54507	55.79899	58.07083	60.35332	62.63792	64.91471	67.17227	69.3977	71.57659	73.69316	75.73046	77.67066	79.49547	81.18664	82.7264	84.09778	85.28451	86.27036	87.03723	87.5616	87.80775	87.71519	87.17255	85.95496	83.53484	78.23013	54.57308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2701	51.18714	53.39182	55.62184	57.86992	60.12911	62.39119	64.64661	66.8844	69.09215	71.25596	73.36061	75.38966	77.3258	79.15118	80.84785	82.39825	83.78549	84.99335	86.00571	86.80494	87.3688	87.6645	87.63784	87.19109	86.13183	84.02629	79.60317	65.15691	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2737.5	51.06093	53.24232	55.44894	57.67378	59.91012	62.15007	64.38445	66.60272	68.79291	70.94164	73.0342	75.05469	76.98627	78.81153	80.51287	82.07294	83.47498	84.70282	85.74045	86.57069	87.17239	87.51531	87.5507	87.19243	86.2749	84.43786	80.69741	70.37623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2774	50.93785	53.09645	55.28019	57.48224	59.69618	61.9144	64.12808	66.32706	68.49983	70.63349	72.71383	74.72545	76.65202	78.47653	80.18175	81.75058	83.16638	84.41308	85.4748	86.33472	86.97266	87.36063	87.45456	87.17826	86.38843	84.7832	81.58627	73.68478	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2810.5	50.8178	52.95411	55.11543	57.29518	59.48714	61.68402	63.87731	66.05726	68.21275	70.33137	72.39938	74.40188	76.323	78.14618	79.85454	81.43124	82.85981	84.12429	85.20893	86.09724	86.76991	87.20087	87.35015	87.15005	86.47596	85.0729	82.31843	76.01925	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2847	50.7007	52.81519	54.95456	57.11245	59.28286	61.45877	63.63201	65.79316	67.93154	70.03515	72.09074	74.08387	75.99916	77.82047	79.53127	81.115	82.5554	83.83661	84.94304	85.85849	86.5644	87.03643	87.23811	87.10909	86.54045	85.31531	82.92773	77.7691	55.59735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2883.5	50.58497	52.67811	54.79599	56.93246	59.08174	61.23707	63.39057	65.53319	67.65462	69.74329	71.78639	73.76997	75.67908	77.498	79.21058	80.80056	82.25185	83.54876	84.67582	85.61712	86.35475	86.86582	87.11692	87.05392	86.58108	85.51229	83.43032	79.11354	65.22422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2920	50.45801	52.53025	54.62712	56.74263	58.87123	61.00641	63.14057	65.26499	67.36973	69.44362	71.47429	73.44822	75.3509	77.16702	78.88079	80.4762	81.93739	83.24877	84.39496	85.36024	86.12716	86.67393	86.96947	86.96444	86.57305	85.63176	83.78429	80.04481	69.66315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2956.5	50.33391	52.38569	54.46196	56.55692	58.66523	60.7806	62.89572	65.00217	67.09038	69.14955	71.16774	73.13185	75.02779	76.84066	78.55502	80.15517	81.62543	82.95037	84.11471	85.10291	85.89795	86.479	86.81706	86.86698	86.55168	85.72688	84.08691	80.8331	72.72909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2993	50.2126	52.24433	54.30041	56.37522	58.4636	60.5595	62.65587	64.7446	66.81643	68.86096	70.86663	72.82076	74.70968	76.51889	78.2333	79.8375	81.31606	82.65367	83.83521	84.8453	85.66731	86.28128	86.66002	86.76212	86.51807	85.8002	84.34541	81.5025	74.95566	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3029.5	50.094	52.10607	54.14236	56.19741	58.26623	60.343	62.42091	64.49213	66.54776	68.57772	70.57085	72.51487	74.39652	76.20168	77.91562	79.52324	81.00934	82.35879	83.5566	84.58757	85.43544	86.081	86.4987	86.65041	86.47325	85.85396	84.56537	82.07174	76.65415	52.12179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3066	49.97804	51.97085	53.98773	56.02338	58.073	60.13096	62.1907	64.24466	66.28424	68.29973	70.28031	72.21411	74.08825	75.889	77.60199	79.21243	80.70534	82.06581	83.279	84.32988	85.20251	85.87839	86.33341	86.53233	86.41814	85.89009	84.75132	82.5569	77.99454	62.93325	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3102.5	49.86463	51.83856	53.83641	55.85303	57.8838	59.92327	61.96512	64.00205	66.02576	68.02686	69.9949	71.91838	73.7848	75.58082	77.2924	78.90507	80.40413	81.77484	83.00253	84.07237	84.9687	85.67366	86.16444	86.40835	86.35357	85.91024	84.90707	82.97124	79.07818	68.24964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3139	49.75372	51.70913	53.68832	55.68627	57.69852	59.71981	61.74404	63.76418	65.77219	67.75901	69.71453	71.6276	73.48612	75.27709	76.98684	78.60121	80.10575	81.48595	82.72731	83.81517	84.73418	85.46704	85.99208	86.27891	86.28029	85.91584	85.03589	83.32551	79.96986	71.63079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3175.5	49.64523	51.58248	53.54336	55.52299	57.51705	59.52047	61.52737	63.53094	65.52342	67.49606	69.43909	71.34169	73.19212	74.97777	76.6853	78.30085	79.81025	81.19922	82.45343	83.55842	84.49911	85.2587	85.81659	86.14441	86.19895	85.90814	85.14064	83.6284	80.71335	74.02779	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3212	49.5391	51.45855	53.40146	55.3631	57.33929	59.32515	61.31498	63.30221	65.27934	67.23792	69.16848	71.06056	72.90276	74.68282	76.38775	78.004	79.51768	80.91472	82.181	83.30224	84.26363	85.04886	85.63822	86.0052	86.11017	85.88827	85.22378	83.88701	81.33946	75.83428	49.04917	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3248.5	49.43527	51.33724	53.26253	55.2065	57.16515	59.13374	61.10676	63.07788	65.03984	66.98447	68.9026	70.78412	72.61795	74.39219	76.09417	77.71066	79.22805	80.6325	81.91009	83.04675	84.0279	84.83768	85.45723	85.86165	86.01449	85.85722	85.28746	84.10717	81.87063	77.25023	61.58948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3285	49.33368	51.2185	53.12649	55.05313	56.99454	58.94614	60.90262	62.85784	64.80481	66.73561	68.64137	70.51229	72.33764	74.10583	75.80454	77.42084	78.9414	80.35263	81.64081	82.79205	83.79206	84.62535	85.27383	85.71406	85.91242	85.81589	85.33356	84.29369	82.32367	78.39058	67.30556	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3321.5	49.23426	51.10226	52.99326	54.90288	56.82735	58.76225	60.70244	62.642	64.57415	66.49124	68.38469	70.245	72.06175	73.82369	75.51882	77.13453	78.65776	80.07515	81.37321	82.53826	83.55623	84.41203	85.08824	85.56275	85.80441	85.7651	85.36373	84.45061	82.71146	79.32718	70.85931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3358	49.13696	50.98846	52.86278	54.75568	56.6635	58.58198	60.50614	62.43025	64.34776	66.25127	68.13247	69.98214	71.79021	73.54572	75.237	76.85173	78.37713	79.80012	81.10739	82.28548	83.32055	84.19788	84.90067	85.40799	85.69091	85.70556	85.37942	84.58131	83.04409	80.10774	73.35245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3394.5	49.04173	50.87702	52.73498	54.61145	56.50291	58.40524	60.31361	62.22249	64.12554	66.01559	67.8846	69.72366	71.52295	73.27186	74.95902	76.57241	78.09954	79.52755	80.84339	82.03378	83.08514	83.98305	84.71132	85.25004	85.57229	85.63796	85.3819	84.68866	83.32955	80.76547	75.22117	46.23582	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3431	48.94852	50.76789	52.60977	54.47011	56.3455	58.23193	60.12476	62.01862	63.90739	65.78411	67.64102	69.46945	71.25991	73.00207	74.68486	76.29658	77.82499	79.2575	80.58128	81.78326	82.8501	83.76769	84.52035	85.08916	85.44894	85.56289	85.3723	84.77513	83.57432	81.32433	76.68174	60.52622	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3467.5	48.85178	50.65552	52.48161	54.3261	56.18568	58.05649	59.93402	61.81308	63.68775	65.55129	67.39618	69.21402	70.99559	72.73086	74.40906	76.01877	77.54802	78.98447	80.3155	81.52826	82.60959	83.54568	84.32131	84.91833	85.31306	85.47147	85.34018	84.828	83.76266	81.76777	77.78228	66.27462	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3504	48.75645	50.54484	52.35541	54.18431	56.02836	57.8838	59.74626	61.61074	63.47147	65.32197	67.15491	68.96218	70.73481	72.46307	74.13647	75.74386	77.27356	78.71346	80.05117	81.27404	82.36912	83.32286	84.12045	84.74448	85.17259	85.37319	85.29758	84.86392	83.92079	82.14757	78.69437	69.89816	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3540.5	48.66305	50.43635	52.23168	54.04527	55.87404	57.71435	59.56198	61.41206	63.25904	65.09662	66.91771	68.71442	70.47808	72.19921	73.86761	75.47241	77.00218	78.44508	79.78893	81.02128	82.1294	83.1	83.91864	84.56859	85.02866	85.26947	85.24644	84.88588	84.05416	82.47665	79.46502	72.44343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3577	48.57153	50.33001	52.11036	53.9089	55.72264	57.54807	59.38108	61.21698	63.05038	64.87516	66.68448	68.47068	70.22533	71.93923	73.60244	75.20438	76.73388	78.17934	79.52881	80.77004	81.89053	82.87721	83.71602	84.39082	84.88152	85.16068	85.18738	84.89508	84.16541	82.76194	80.12072	74.35256	39.07302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3613.5	48.48185	50.22577	51.99139	53.77514	55.5741	57.38488	59.2035	61.02541	62.84539	64.65752	66.45515	68.23087	69.97648	71.68306	73.34092	74.93976	76.46866	77.91626	79.27085	80.52039	81.65257	82.65459	83.51272	84.21136	84.73141	85.04718	85.121	84.89259	84.25678	83.00899	80.68209	75.84628	58.08122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3650	48.39397	50.12358	51.87473	53.64392	55.42835	57.22471	59.02916	60.83727	62.644	64.44361	66.22964	67.99492	69.73148	71.43065	73.08301	74.67851	76.2065	77.65585	79.01508	80.27238	81.41562	82.43225	83.30886	84.03037	84.57855	84.9293	85.04782	84.87938	84.33022	83.22241	81.1652	77.0495	64.88125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3686.5	48.30784	50.02338	51.7603	53.51519	55.28532	57.06749	58.85797	60.65248	62.44613	64.23334	66.00788	67.76276	69.49026	71.18195	72.82867	74.42061	75.94739	77.39812	78.76154	80.02605	81.17974	82.21028	83.10457	83.848	84.42315	84.80733	84.96833	84.85631	84.38738	83.40608	81.5826	78.03931	68.88335	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3723	48.22342	49.92513	51.64806	53.38889	55.14495	56.91314	58.68987	60.47097	62.25169	64.02665	65.78978	67.53431	69.25276	70.9369	72.57784	74.16603	75.69132	77.14307	78.51024	79.78145	80.94499	81.98877	82.89996	83.66441	84.26541	84.68157	84.88298	84.82412	84.42973	83.56329	81.94424	78.86646	71.62366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3759.5	48.14067	49.82878	51.53796	53.26495	55.00717	56.76161	58.52478	60.29266	62.06062	63.82346	65.57528	67.30952	69.0189	70.69544	72.33049	73.91473	75.43827	76.8907	78.26121	79.53862	80.71144	81.7678	82.69515	83.47974	84.10553	84.55229	84.79218	84.78352	84.45856	83.69688	82.25808	79.56603	73.6516	23.67287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3796	48.05955	49.7343	51.42995	53.14332	54.87192	56.61283	58.36265	60.11748	61.87285	63.62369	65.3643	67.0883	68.78863	70.45753	72.08658	73.66669	75.18823	76.64102	78.01446	79.2976	80.47915	81.54745	82.49023	83.29411	83.94368	84.41974	84.69632	84.73513	84.475	83.80928	82.53059	80.16316	75.22558	56.00049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3832.5	47.98002	49.64162	51.32397	53.02396	54.73915	56.46673	58.20339	59.94536	61.68829	63.42728	65.15678	66.8706	68.56189	70.2231	71.84604	73.42188	74.94118	76.39402	77.77001	79.05842	80.24817	81.3278	82.28531	83.10767	83.78004	84.28416	84.59574	84.67951	84.48007	83.90257	82.76708	80.67648	76.48708	63.71047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3869	47.90205	49.55073	51.21999	52.9068	54.6088	56.32325	58.04695	59.77623	61.50688	63.23414	64.95263	66.65634	68.3386	69.9921	71.60885	73.18024	74.69709	76.14969	77.52787	78.82112	80.01854	81.10892	82.08047	82.92053	83.61476	84.14577	84.49076	84.61719	84.47468	83.97859	82.97192	81.12013	77.52164	68.03866	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3905.5	47.82561	49.46156	51.11795	52.79179	54.48081	56.18233	57.89326	59.61003	61.32856	63.04422	64.7518	66.44546	68.11873	69.76448	71.37495	72.94176	74.45595	75.90803	77.28806	78.58571	79.79033	80.89087	81.87582	82.73282	83.448	84.00477	84.3817	84.54863	84.45966	84.03894	83.14881	81.50508	78.38468	70.94346	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3942	47.75065	49.37409	51.01781	52.6789	54.35513	56.04392	57.74226	59.44669	61.15325	62.85745	64.55422	66.2379	67.90219	69.54018	71.1443	72.7064	74.21773	75.66903	77.05057	78.35223	79.56356	80.67372	81.67144	82.54463	83.2799	83.86138	84.26883	84.47427	84.43573	84.08503	83.30085	81.83999	79.11405	73.06997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3978.5	47.67715	49.28828	50.91953	52.56806	54.23171	55.90796	57.5939	59.28616	60.9809	62.67376	64.35982	66.03359	67.68894	69.31914	70.91685	72.47412	73.98241	75.43267	76.81541	78.1207	79.33828	80.45753	81.46739	82.35609	83.11061	83.71576	84.15241	84.39451	84.40357	84.11807	83.43067	82.13182	79.73666	74.70983	53.88045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4015	47.60272	49.20173	50.82071	52.45687	54.10812	55.77202	57.44573	59.12598	60.80905	62.49071	64.16616	65.83008	67.47652	69.09893	70.69017	72.24247	73.74754	75.19652	76.58012	77.88863	79.11197	80.23974	81.26106	82.16444	82.93725	83.56486	84.02913	84.30567	84.35903	84.13337	83.53296	82.37538	80.2543	75.97843	62.41438	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4051.5	47.50442	49.09142	50.69826	52.32219	53.96118	55.61286	57.27448	58.94286	60.61438	62.28493	63.94987	65.60399	67.24152	68.85609	70.44074	71.98789	73.48944	74.93673	76.32064	77.63164	78.85981	79.99488	81.02614	81.94225	82.73079	83.3775	83.86481	84.16941	84.25771	84.0774	83.53977	82.47801	80.52765	76.65995	65.76081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4088	47.14423	48.71855	50.31263	51.92379	53.55006	55.18913	56.83832	58.49454	60.15426	61.81346	63.4676	65.11159	66.73978	68.3459	69.92308	71.46385	72.96014	74.40332	75.78425	77.09326	78.32023	79.45453	80.4849	81.39923	82.18398	82.82321	83.29689	83.57774	83.62552	83.37556	82.71351	81.41064	78.91505	73.36309	52.28229	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4124.5	46.73834	48.29982	49.88099	51.47923	53.09262	54.71891	56.35549	57.99934	59.64702	61.2946	62.93763	64.57113	66.18953	67.78667	69.35575	70.88936	72.37948	73.81745	75.19405	76.49946	77.72324	78.85434	79.88083	80.78962	81.56576	82.19127	82.64295	82.88851	82.87909	82.53394	81.70506	80.08144	76.86191	69.24537	41.01688	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4161	46.33289	47.88153	49.44977	51.03505	52.63549	54.24891	55.87277	57.5041	59.13956	60.77529	62.40694	64.02962	65.63785	67.22555	68.78602	70.31189	71.79516	73.22717	74.5986	75.89945	77.11903	78.24578	79.26712	80.16897	80.93494	81.54488	81.97233	82.17969	82.10901	81.66234	80.65548	78.68984	74.72712	65.32047	31.35783	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4197.5	45.9279	47.46368	49.01896	50.59124	52.17868	53.77915	55.39016	57.00884	58.63189	60.25555	61.87555	63.48709	65.08478	66.66261	68.21395	69.7315	71.20726	72.63255	73.99797	75.29335	76.50766	77.62893	78.64386	79.53735	80.29151	80.88399	81.28489	81.45104	81.31484	80.76012	79.56474	77.2446	72.56379	61.62083	21.67474	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4234	45.52335	47.04626	48.58857	50.1478	51.72217	53.3096	54.90767	56.51355	58.12402	59.7354	61.34349	62.94358	64.53035	66.09789	67.6396	69.14825	70.61585	72.03369	73.39226	74.68122	75.88925	77.00388	78.01111	78.89479	79.63551	80.20857	80.58051	80.70233	80.49625	79.82718	78.43525	75.75867	70.40305	58.1062	10.29416	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4270.5	45.11924	46.62928	48.15859	49.70473	51.26598	52.84029	54.4253	56.01824	57.61596	59.21485	60.81078	62.39911	63.97461	65.53142	67.06302	68.5622	70.021	71.43065	72.78156	74.06318	75.26389	76.37072	77.36896	78.24137	78.96694	79.5186	79.85912	79.93341	79.6532	78.86433	77.27109	74.24386	68.25988	54.73679	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4307	44.71557	46.21272	47.72901	49.26203	50.8101	52.37121	53.94306	55.52293	57.10773	58.69392	60.27744	61.85372	63.41759	64.96326	66.48427	67.97343	69.42278	70.82352	72.16594	73.43931	74.63166	75.72954	76.71747	77.57713	78.28584	78.81405	79.12065	79.14426	78.78599	77.8731	76.07693	72.70957	66.14128	51.48176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4343.5	44.31233	45.7966	47.29984	48.8197	50.35453	51.90237	53.46095	55.02762	56.59934	58.17263	59.74349	61.30742	62.85932	64.39344	65.90339	67.38198	68.82126	70.21237	71.5455	72.80969	73.99266	75.08042	76.05674	76.90215	77.59227	78.09497	78.36516	78.33508	77.89534	76.85557	74.8574	71.16303	64.0506	48.3179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4380	43.90953	45.38089	46.87107	48.37773	49.89927	51.43376	52.97897	54.53232	56.0908	57.65098	59.20895	60.76025	62.29983	63.82202	65.32043	66.78792	68.2165	69.59729	70.92031	72.17442	73.34697	74.42346	75.38685	76.21649	76.88627	77.36141	77.59279	77.50627	76.98228	75.81405	73.61683	69.60989	61.98959	45.22747	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4416.5	43.50715	44.96561	46.44269	47.93613	49.44432	50.96539	52.49714	54.03703	55.58211	57.12901	58.67385	60.21223	61.73917	63.24902	64.73544	66.19129	67.60858	68.97833	70.29046	71.53359	72.6947	73.75875	74.70789	75.52026	76.16795	76.61354	76.80381	76.65841	76.04808	74.75101	72.35917	68.05471	59.95928	42.19629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4453	43.1052	44.55074	46.01472	47.49489	48.98968	50.49725	52.01545	53.54176	55.07329	56.60671	58.13819	59.66339	61.17736	62.67449	64.14847	65.59217	66.99756	68.35559	69.65604	70.88727	72.03593	73.08639	74.01996	74.81356	75.43746	75.85156	75.99863	75.7923	75.09421	73.66894	71.08804	66.50125	57.96043	39.21245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4489.5	42.70367	44.13629	45.58714	47.054	48.53535	50.02935	51.5339	53.04652	54.56435	56.08411	57.60201	59.11375	60.61443	62.09847	63.55957	64.9906	66.38349	67.72912	69.01711	70.23557	71.37077	72.40648	73.32318	74.09653	74.695	75.07579	75.17778	74.90885	74.12224	72.5703	69.80672	64.95275	55.99372	36.26515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4526	42.30255	43.72224	45.15995	46.61348	48.08133	49.5617	51.05251	52.55132	54.0553	55.56121	57.06531	58.56334	60.05041	61.52098	62.96877	64.38663	65.76645	67.099	68.37376	69.57858	70.6993	71.71915	72.6177	73.36937	73.94081	74.28662	74.3419	74.00913	73.13384	71.45751	68.51824	63.41201	54.05977	33.34388	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4562.5	41.90185	43.30861	44.73315	46.17331	47.62761	49.09429	50.57127	52.05615	53.54614	55.03804	56.52812	58.01217	59.48533	60.94208	62.37613	63.78032	65.14649	66.46531	67.72608	68.91638	70.02166	71.02452	71.90368	72.63229	73.17523	73.48454	73.49175	73.09428	72.13071	70.33289	67.22538	61.88153	52.15923	30.43753	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4599	41.50156	42.89537	44.30673	45.7335	47.17421	48.62712	50.09018	51.56103	53.03689	54.51459	55.99046	57.46027	58.91922	60.36179	61.78168	63.17172	64.52367	65.82811	67.07415	68.24908	69.33795	70.32274	71.18131	71.88556	72.39862	72.6701	72.62814	72.16553	71.11457	69.19871	65.9307	60.36353	50.29271	27.53339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4635.5	41.10168	42.48254	43.8807	45.29404	46.72111	48.16019	49.60926	51.06596	52.52756	53.9909	55.45233	56.90767	58.35211	59.78015	61.18548	62.56088	63.89807	65.18749	66.41806	67.5768	68.64832	69.614	70.45083	71.1295	71.61144	71.84394	71.75199	71.22415	70.08716	68.05712	64.63658	58.86001	48.4608	24.61596	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4672	40.70221	42.07011	43.45506	44.85494	46.26833	47.69351	49.12849	50.57094	52.01814	53.46696	54.91376	56.35438	57.78403	59.19719	60.58756	61.94786	63.26974	64.54352	65.75791	66.89965	67.95292	68.89849	69.7125	70.36445	70.81417	71.00675	70.86427	70.27148	69.05019	66.9102	63.34521	57.37279	46.66405	21.66497	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4708.5	40.30313	41.65808	43.02979	44.41619	45.81585	47.22708	48.6479	50.07599	51.50866	52.94279	54.37477	55.80043	57.215	58.61296	59.98796	61.33271	62.63876	63.89628	65.09381	66.21777	67.25192	68.17644	68.96661	69.59083	70.00737	70.15929	69.96599	69.30884	68.00535	65.75991	62.05862	55.90349	44.90296	18.65215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4745	39.90446	41.24644	42.6049	43.97778	45.36367	46.76089	48.16747	49.5811	50.99912	52.4184	53.83536	55.24584	56.64505	58.02748	59.38675	60.7155	62.00519	63.24588	64.42588	65.53131	66.54552	67.44809	68.21351	68.80908	69.19163	69.30235	69.05822	68.33758	66.95429	64.60813	60.77869	54.45358	43.17794	15.53504	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4781.5	39.50618	40.83519	42.18038	43.53972	44.9118	46.29495	47.68721	49.08629	50.48952	51.89381	53.29556	54.69063	56.07422	57.4408	58.78396	60.09628	61.36913	62.59241	63.75424	64.84044	65.83394	66.71374	67.45357	68.01969	68.36761	68.43677	68.14202	67.35906	65.89861	63.45663	59.50714	53.02438	41.48934	12.24298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4818	39.1083	40.42433	41.75624	43.10201	44.46024	45.82926	47.20713	48.59156	49.97989	51.36902	52.75539	54.13483	55.50254	56.85296	58.17965	59.47512	60.73065	61.93599	63.07904	64.14534	65.1174	65.97368	66.68717	67.22318	67.53596	67.56342	67.21849	66.37461	64.83985	62.30707	58.24554	51.61704	39.83743	8.638239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4854.5	38.71081	40.01385	41.33247	42.66465	44.00899	45.36383	46.72723	48.09691	49.47021	50.84406	52.21486	53.57846	54.93003	56.264	57.57388	58.85211	60.08986	61.27674	62.40044	63.44622	64.39617	65.22826	65.91477	66.42011	66.69742	66.6832	66.28873	65.38553	63.77952	61.16101	56.99534	50.2326	38.22237	4.33868	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4891	38.3137	39.60376	40.90907	42.22763	43.55804	44.89864	46.24751	47.60235	48.96052	50.31893	51.674	53.02155	54.35675	55.67398	56.96671	58.22731	59.44685	60.61479	61.71861	62.74328	63.67054	64.47783	65.1368	65.61105	65.85269	65.79701	65.35383	64.3931	62.71902	60.01992	55.75786	48.87194	36.64426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4927.5	37.91699	39.19405	40.48604	41.79096	43.1074	44.43372	45.76797	47.10789	48.45082	49.79366	51.13283	52.46413	53.78272	55.08295	56.35822	57.60083	58.80175	59.9503	61.03374	62.03678	62.9408	63.72278	64.35377	64.79663	65.00255	64.90576	64.41489	63.39858	61.65971	58.88516	54.53427	47.53585	35.10308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4964	37.52066	38.78473	40.06338	41.35463	42.65707	43.96905	45.28864	46.61355	47.94112	49.26827	50.59137	51.90625	53.208	54.49096	55.74847	56.97276	58.15468	59.28341	60.34602	61.32697	62.20728	62.96352	63.56618	63.97745	64.14775	64.01037	63.47296	62.40316	60.60288	57.75798	53.32565	46.22496	33.59875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000.5	37.12471	38.37578	39.64109	40.91865	42.20705	43.50465	44.8095	46.11932	47.43145	48.74277	50.04967	51.34793	52.63265	53.89809	55.13756	56.34321	57.50578	58.61431	59.65569	60.61412	61.47033	62.20046	62.77454	63.15417	63.28905	63.11175	62.5291	61.40801	59.54974	56.63953	52.13295	44.93982	32.13108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5037	36.72916	37.96722	39.21917	40.48302	41.75736	43.04053	44.33058	45.62524	46.92181	48.21719	49.50774	50.78922	52.0567	53.3044	54.52558	55.71229	56.8552	57.94318	58.96297	59.89853	60.73029	61.43406	61.97941	62.32742	62.42724	62.21079	61.58432	60.41421	58.5014	55.53089	50.957	43.68087	30.69981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5073.5	36.33399	37.55905	38.79762	40.04774	41.30798	42.57668	43.85189	45.1313	46.41224	47.69157	48.96563	50.23018	51.48023	52.70998	53.91262	55.08014	56.20309	57.27022	58.26811	59.18049	59.98755	60.66476	61.18132	61.49787	61.56308	61.30838	60.6396	59.42283	57.45895	54.43302	49.79856	42.44845	29.30459	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5110	35.93921	37.15126	38.37646	39.61282	40.85894	42.11313	43.37343	44.63754	45.90275	47.16593	48.42339	49.67085	50.90332	52.11492	53.29881	54.44689	55.54962	56.59565	57.57136	58.46033	59.2425	59.89304	60.38085	60.66618	60.69733	60.40538	59.69588	58.43485	56.42335	53.34679	48.65825	41.24279	27.945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5146.5	35.54483	36.74387	37.95568	39.17828	40.41024	41.64989	42.89524	44.14397	45.39338	46.64031	47.88105	49.1113	50.32602	51.51931	52.68425	53.81269	54.89499	55.91967	56.87301	57.73838	58.49552	59.11937	59.57854	59.83299	59.83073	59.50262	58.75408	57.45123	55.39552	52.273	47.53662	40.06408	26.62054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5183	35.15085	36.33687	37.53529	38.74411	39.9619	41.18696	42.41732	43.65062	44.88416	46.11475	47.33867	48.55159	49.74843	50.92325	52.06908	53.17769	54.23937	55.24254	56.17333	57.01498	57.74703	58.34423	58.77495	58.99895	58.96403	58.60091	57.81506	56.47283	54.37629	51.21235	46.43415	38.91238	25.33065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5219.5	34.75728	35.93029	37.1153	38.31033	39.51392	40.72438	41.9397	43.15753	44.37513	45.58931	46.79632	47.9918	49.17064	50.32685	51.45342	52.54207	53.58298	54.56449	55.47262	56.29047	56.99744	57.5681	57.97066	58.16471	58.09793	57.70103	56.87962	55.50048	53.36644	50.16548	45.3512	37.78772	24.0747	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5256	34.36413	35.52414	36.69574	37.87696	39.06634	40.26216	41.46241	42.66472	43.86633	45.06403	46.25405	47.432	48.59274	49.73024	50.83744	51.90599	52.92601	53.88577	54.77117	55.56521	56.24716	56.79147	57.16621	57.33088	57.23312	56.80373	55.94856	54.53495	52.36665	49.13292	44.28809	36.69004	22.85199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5292.5	33.97142	35.11842	36.27661	37.44402	38.61917	39.80034	40.98548	42.17223	43.35781	44.53897	45.71194	46.87228	48.01483	49.13354	50.22127	51.26963	52.2687	53.20664	54.06929	54.83956	55.49662	56.01481	56.36214	56.49807	56.37028	55.9097	55.02259	53.57694	51.37756	48.11517	43.24505	35.61922	21.66177	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5329	33.57917	34.71315	35.85793	37.01152	38.17244	39.33893	40.50895	41.68011	42.84961	44.0142	45.17005	46.31274	47.43704	48.53687	49.60507	50.6332	51.61126	52.52737	53.3673	54.11388	54.74622	55.2386	55.55899	55.66688	55.51003	55.01964	54.10241	52.6271	50.39974	47.11263	42.22225	34.5751	20.50322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5365.5	33.18739	34.30837	35.43974	36.57951	37.72617	38.87798	40.03286	41.18841	42.34181	43.48978	44.62849	45.75346	46.85947	47.94039	48.98902	49.99687	50.95392	51.84823	52.6655	53.38854	53.99638	54.46331	54.75729	54.83787	54.65299	54.13417	53.18863	51.68603	49.43369	46.12566	41.21979	33.55746	19.37548	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5402	32.79611	33.90409	35.02205	36.14799	37.28041	38.41752	39.55725	40.69717	41.83445	42.96578	44.08732	45.19456	46.28225	47.34423	48.37327	49.36086	50.29692	51.16948	51.96422	52.66388	53.24752	53.6894	53.95754	54.0116	53.79976	53.25388	52.28185	50.75427	48.47986	45.15454	40.23775	32.56605	18.27762	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5438.5	32.40536	33.50034	34.60489	35.71702	36.83519	37.95761	39.08218	40.20646	41.32761	42.4423	43.54665	44.63614	45.70551	46.74855	47.75802	48.72537	49.6405	50.49141	51.26376	51.94028	52.50003	52.91731	53.16022	53.18859	52.95086	52.37936	51.38262	49.83231	47.53865	44.1995	39.27611	31.60055	17.20863	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5475	32.01517	33.09716	34.18831	35.28663	36.39055	37.49828	38.6077	39.71635	40.82136	41.9194	43.00657	44.07833	45.12938	46.15351	47.14344	48.09061	48.9849	49.8143	50.56444	51.21809	51.75431	52.14748	52.36582	52.36936	52.10684	51.5111	50.49144	48.9206	46.61038	43.26074	38.33485	30.66064	16.16748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5511.5	31.62557	32.69458	33.77235	34.85685	35.94654	37.03959	38.13386	39.22689	40.31578	41.39719	42.46719	43.52123	44.554	45.55926	46.52972	47.4568	48.33037	49.13841	49.86657	50.49764	51.01074	51.38033	51.57478	51.55436	51.26818	50.64961	49.60876	48.01952	45.69536	42.33838	37.41387	29.74595	15.15303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5548	31.2366	32.29264	33.35703	34.42775	35.50322	36.5816	37.66074	38.73816	39.81096	40.87575	41.92862	42.96499	43.97951	44.96597	45.91704	46.82414	47.67714	48.46402	49.17047	49.7793	50.2697	50.61627	50.78755	50.74406	50.43534	49.79533	48.73499	47.12944	44.79382	41.43252	36.51307	28.85608	14.1641	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5584.5	30.84831	31.8914	32.94243	33.99937	35.06064	36.12437	37.18841	38.25025	39.30697	40.3552	41.39097	42.40971	43.40607	44.3738	45.30559	46.19285	47.02545	47.79141	48.47642	49.06338	49.53156	49.85569	50.00452	49.93889	49.60875	48.94867	47.87051	46.25065	43.90597	40.5432	35.63228	27.99063	13.19939	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5621	30.46075	31.49089	32.52858	33.57177	34.61885	35.66796	36.71693	37.76323	38.80392	39.83562	40.85436	41.85555	42.83383	43.78294	44.69558	45.56315	46.37556	47.12083	47.78474	48.35021	48.79666	49.09896	49.2261	49.13924	48.7888	48.11002	47.01566	45.38342	43.03198	39.67044	34.77132	27.14916	12.25751	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5657.5	30.07396	31.09119	32.11555	33.14501	34.17794	35.21246	36.24639	37.27718	38.30191	39.31714	40.31892	41.30263	42.26293	43.19354	44.08718	44.93526	45.7277	46.45257	47.0957	47.64011	48.06534	48.34644	48.45265	48.34548	47.97586	47.27971	46.17074	44.52797	42.17195	38.81423	33.92998	26.33122	11.33693	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5694	29.68801	30.69233	31.70339	32.71915	33.73796	34.75793	35.77687	36.79222	37.80102	38.79986	39.78475	40.7511	41.69353	42.60579	43.48059	44.30938	45.0821	45.78687	46.40659	46.93338	47.33792	47.59846	47.68452	47.55798	47.17028	46.45805	45.33601	43.68451	41.32598	37.9745	33.10803	25.53633	10.43597	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5730.5	29.30295	30.29439	31.29218	32.29426	33.29899	34.30446	35.30846	36.30841	37.30137	38.28389	39.25201	40.20109	41.12579	42.01986	42.87602	43.68573	44.439	45.12399	45.72667	46.23031	46.61471	46.85535	46.92204	46.77705	46.37236	45.64533	44.51169	42.85318	40.49413	37.15118	32.3052	24.76404	9.552731	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5767	28.91884	29.89743	30.88198	31.87043	32.86112	33.85213	34.84124	35.82588	36.80307	37.76937	38.72081	39.65276	40.55987	41.43592	42.27363	43.06452	43.79862	44.46416	45.04723	45.53117	45.896	46.11741	46.1655	46.00298	45.58238	44.8418	43.698	42.03412	39.67643	36.34417	31.52123	24.01385	8.685048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5803.5	28.53576	29.50152	30.47286	31.44771	32.42441	33.40103	34.37532	35.34471	36.30622	37.2564	38.19128	39.10624	39.99593	40.85414	41.67363	42.44595	43.16118	43.80764	44.37149	44.83625	45.18208	45.38492	45.41521	45.23606	44.80059	44.04767	42.89509	41.22742	38.87287	35.55333	30.75583	23.28528	7.830346	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5840	28.15377	29.10673	30.0649	31.0262	31.98897	32.95124	33.91079	34.86501	35.81094	36.74512	37.66357	38.56168	39.43412	40.2747	41.0762	41.83022	42.52691	43.15465	43.69972	44.14578	44.47319	44.65814	44.67141	44.47654	44.02723	43.26314	42.10311	40.43314	38.08342	34.77852	30.0087	22.57782	6.985531	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5876.5	27.77295	28.71315	29.65818	30.60599	31.55487	32.50287	33.44775	34.3869	35.31735	36.23564	37.1378	38.01923	38.8746	39.69776	40.48153	41.21754	41.896	42.5054	43.03214	43.46002	43.7696	43.93733	43.93434	43.72463	43.26249	42.48838	41.32218	39.65134	37.30804	34.01957	29.27951	21.89099	6.146686	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PORE PRESSURE (kPa)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0.310038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	75.01125	56.09877	36.15474	17.23234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	110.1611	91.98593	71.05095	50.70796	31.12121	12.04614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	122.1849	104.5651	83.67434	62.49407	42.00096	22.10229	2.642222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	136.1531	118.9135	98.39563	76.83744	55.67201	35.10495	15.02557	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	151.3393	134.3717	114.2859	92.66982	71.04443	49.92945	29.32047	9.124233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	161.2167	144.453	124.7733	103.2882	81.39483	59.84327	38.77676	18.14181	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	169.5461	152.941	133.6206	112.3631	90.36051	68.48088	47.02284	25.99724	5.356986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	178.4463	161.9685	142.9604	121.9709	99.97897	77.87463	56.08971	34.71659	13.72581	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	187.7323	171.3589	152.6215	131.9099	110.0119	87.7763	65.72895	44.04993	22.74885	1.94177	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	197.2985	181.0127	162.5106	142.0706	120.3206	98.03337	75.78683	53.84346	32.26157	11.03762	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	210.1954	193.984	175.6878	155.5056	133.9357	111.6614	89.27573	67.1099	45.27563	23.78153	2.83646	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	222.0564	205.9092	187.7942	167.8528	146.4799	124.2683	101.7986	79.45209	57.39399	35.66129	14.27338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	230.3911	214.2999	196.3454	176.6271	155.4579	133.3458	110.8405	88.35434	66.10132	44.15224	22.51707	1.505775	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	238.9538	222.9119	205.1006	185.5882	164.6228	142.6362	120.1366	97.54991	75.13117	52.98668	31.141	9.653495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	247.6473	231.6492	213.9663	194.6437	173.8778	152.0342	129.5745	106.9236	84.3682	62.04931	40.01268	18.28041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	256.4404	240.4814	222.9143	203.7667	183.1937	161.5038	139.1114	116.4293	93.76583	71.29378	49.08274	27.15448	5.705862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	265.3144	249.3907	231.9285	212.9422	192.5542	171.0239	148.7201	126.0359	103.2918	80.688	58.31855	36.21592	14.44543	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	274.2558	258.364	240.9975	222.1603	201.9483	180.58	158.3809	135.7199	112.9211	90.20684	67.69501	45.43309	23.45564	2.212016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	283.2544	267.3917	250.1126	231.4135	211.3687	190.1618	168.0793	145.4628	122.6334	99.82962	77.1916	54.78364	32.63645	10.89158	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	290.6231	274.787	257.5881	239.017	219.1307	198.083	176.1252	153.571	130.7327	107.8598	85.11188	62.57066	40.27264	18.28235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	297.9494	282.1378	265.0128	246.5607	226.8242	205.9323	184.1045	161.627	138.7995	115.8768	93.03522	70.37343	47.93788	25.76991	4.230709	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	305.352	289.5629	272.5064	254.1651	234.5703	213.8297	192.1351	169.7456	146.946	123.992	101.0728	78.30313	55.74141	33.42382	11.50592	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	312.813	297.0447	280.0517	261.8138	242.3529	221.7588	200.1985	177.9062	155.1493	132.181	109.1997	86.33505	63.65779	41.20674	19.0659	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	320.3227	304.5738	287.6398	269.4987	250.1644	229.7115	208.2856	186.097	163.3956	140.4285	117.4004	94.45342	71.67102	49.09825	26.79068	5.136509	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	327.8746	312.1438	295.2647	277.2143	257.9998	237.6829	216.39	194.3101	171.6748	148.7231	125.6626	102.646	79.76879	57.08419	34.63723	12.61163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	335.4636	319.7496	302.922	284.9567	265.8555	245.6693	224.5076	202.5396	179.9794	157.0556	133.9763	110.9025	87.94081	65.1535	42.5835	20.33548	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	343.0856	327.3873	310.6079	292.7227	273.7289	253.6681	232.635	210.7811	188.303	165.4183	142.3329	119.214	96.17817	73.29693	50.61554	28.20348	6.436452	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	349.7793	334.0958	317.3617	299.5519	280.66	260.7194	239.8121	218.0731	195.6829	172.847	149.7674	126.615	103.5153	80.54872	57.76534	35.21873	13.10237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	355.3564	339.6868	322.9953	305.2567	286.4615	266.636	245.8513	224.2275	201.9296	179.1509	156.0878	132.9131	109.7595	86.71625	63.8392	41.17571	18.84649	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	361.0261	345.3696	328.7183	311.0469	292.3436	272.6285	251.9629	230.4538	208.2515	185.5372	162.5003	139.3139	116.1164	93.00487	70.04192	47.27385	24.78621	3.173839	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	366.7529	351.1087	334.4954	316.8877	298.2717	278.6625	258.1125	236.717	214.6128	191.9688	168.9669	145.7788	122.5469	99.37562	76.33426	53.47109	30.8532	8.805975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	372.5246	356.8921	340.3147	322.7674	304.2345	284.7267	264.2888	243.0054	221.0009	198.4323	175.4732	152.2925	129.0356	105.8129	82.70046	59.75018	37.01953	14.71235	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	378.3343	362.7129	346.1696	328.6796	310.2259	290.8153	270.486	249.3129	227.4089	204.9198	182.0103	158.8457	135.5726	112.3067	89.13048	66.10024	43.26909	20.77664	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	384.1775	368.5666	352.0555	334.6201	316.2419	296.9246	276.7003	255.6354	233.8323	211.4259	188.5721	165.4313	142.1505	118.8496	95.61669	72.51319	49.59098	26.95321	5.136823	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	390.0505	374.4496	357.9693	340.5857	322.2796	303.0517	282.929	261.9702	240.2679	217.9467	195.1537	172.0439	148.7634	125.4352	102.1528	78.98249	55.97701	33.21822	11.02498	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	395.9507	380.3593	363.9081	346.574	328.3368	309.1947	289.1703	268.315	246.713	224.4789	201.7512	178.6789	155.4062	132.0583	108.7333	85.50252	62.42066	39.55712	17.1223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	401.8755	386.2932	369.8699	352.5829	334.4116	315.352	295.4224	274.6684	253.1658	231.0202	208.3614	185.3323	162.0745	138.7142	115.3535	92.06839	68.91643	45.95996	23.34852	1.909108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	407.8231	392.2493	375.8527	358.6108	340.5025	321.522	301.6842	281.0289	259.6245	237.5683	214.9816	192.0009	168.7644	145.3988	122.009	98.67568	75.45956	52.41937	29.66834	7.658296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	413.355	397.7895	381.4182	364.2194	346.1715	327.2672	307.518	286.9589	265.6515	243.685	221.173	198.2452	175.0361	151.6716	128.2594	104.8838	81.60926	58.49298	35.62584	13.29717	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	418.7165	403.1589	386.8119	369.6543	351.6643	332.8332	313.1698	292.7043	271.4923	249.6158	227.1805	204.3096	181.1332	157.7762	134.3478	110.936	87.60845	64.42271	41.45567	18.91188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	424.1133	408.5632	392.2394	375.1214	357.187	338.4263	318.8457	298.4713	277.3532	255.5664	233.2093	210.3988	187.2601	163.9165	140.478	117.0357	93.66071	70.4115	47.35662	24.64971	3.038503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	429.5364	413.9936	397.6921	380.6119	362.7309	344.0381	324.5375	304.2518	283.2258	261.5282	239.2507	216.5034	193.407	170.0821	146.6395	123.1725	99.75521	76.4481	53.31472	30.47613	8.383324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	434.9821	419.4462	403.1661	386.1222	368.2925	349.665	330.2418	310.0423	289.1067	267.4977	245.3005	222.619	199.5689	176.268	152.8267	129.3404	105.8862	82.52649	59.32219	36.37295	13.98307	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	440.4478	424.9185	408.659	391.65	373.8696	355.3051	335.9568	315.8412	294.994	273.4728	251.3565	228.7429	205.7425	182.4703	159.0358	135.5356	112.0496	88.64225	65.37355	42.3287	19.72724	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	445.9318	430.4089	414.169	397.1937	379.4608	360.957	341.6812	321.647	300.8865	279.452	257.4168	234.8728	211.9255	188.6863	165.2635	141.7547	118.2418	94.79179	71.46445	48.33537	25.57113	3.874806	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	451.4326	435.9159	419.695	402.7519	385.0647	366.6196	347.4138	327.4588	306.783	285.4343	263.4802	241.0073	218.1158	194.9135	171.5072	147.9947	124.4599	100.972	77.59127	54.38699	31.49103	9.341656	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	456.949	441.4382	425.2356	408.3236	390.6805	372.292	353.1541	333.276	312.6831	291.4187	269.5457	247.1448	224.3116	201.1499	177.7645	154.2531	130.7012	107.18	83.75087	60.47886	37.47247	15.03373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	462.48	446.9749	430.7898	413.9079	396.3073	377.9734	358.9012	339.098	318.586	297.4048	275.6124	253.2844	230.5116	207.3937	184.0333	160.5277	136.9633	113.4134	89.94046	66.60713	43.50575	20.85776	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	468.0246	452.5251	436.3569	419.5039	401.9443	383.6633	364.6547	344.9242	324.4913	303.3919	281.6796	259.4252	236.7144	213.6434	190.3119	166.8163	143.244	119.6697	96.15753	72.76853	49.58393	26.77378	4.975208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	473.2548	457.7606	441.6088	424.7836	407.2637	389.0337	370.0868	350.427	330.0713	309.0523	287.4195	265.239	242.5919	219.5703	196.2712	172.7898	149.2139	125.6197	102.0725	78.63294	55.37445	32.43276	10.21906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	477.1243	461.6351	445.4991	428.7009	411.2192	393.0387	374.1516	354.5605	334.2802	313.3402	291.7861	269.6796	247.0974	224.1276	200.8642	177.4009	153.8256	130.2156	106.6376	83.15229	59.82758	36.77583	14.30214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1898	481.097	465.6127	449.492	432.7198	415.2751	397.1424	378.3133	358.789	338.5823	317.7198	296.2436	274.2112	251.6949	228.7789	205.5541	182.1127	158.542	134.9203	111.3157	87.78894	64.40458	41.25938	18.59742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	485.1135	469.6341	453.5281	436.781	419.3722	401.2858	382.5129	363.0535	342.9187	322.1323	300.733	278.7745	256.325	233.4646	210.2813	186.8651	163.3028	139.6734	116.046	92.48215	69.04397	45.81806	23.00549	1.622418	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	489.1615	473.6867	457.595	440.8723	423.4981	405.4565	386.7382	367.3421	347.2773	326.5656	305.2422	283.3573	260.9751	238.172	215.0325	191.6447	168.0946	144.4613	120.8151	97.21814	73.7314	50.43444	27.49633	5.585496	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007.5	493.2351	477.7648	461.6868	444.9876	427.647	409.649	390.9836	371.649	351.6527	331.014	309.7656	287.9539	265.6395	242.8949	219.8016	196.4452	172.9106	149.2771	125.6158	101.9898	78.45926	55.09889	32.05352	9.80538	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	497.3307	481.8646	465.8	449.1237	431.8156	413.8597	395.2458	375.971	356.0415	335.4745	314.2999	292.561	270.3146	247.6297	224.5844	201.2622	177.7465	154.1164	130.4438	106.7923	83.22245	59.80504	36.66638	14.17276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080.5	501.4458	485.984	469.9323	453.2781	436.0015	418.0865	399.5226	380.306	360.4416	339.9449	318.843	297.1762	274.998	252.3738	229.3785	206.0929	182.5992	158.9759	135.2954	111.6223	88.01716	64.54818	41.32732	18.64307	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2117	505.5787	490.1209	474.0818	457.449	440.203	422.3277	403.8124	384.6525	364.8517	344.4237	323.3934	301.7982	279.6881	257.1253	234.1815	210.935	187.4661	163.853	140.1681	116.4769	92.84031	69.32461	46.0306	23.19209	1.824527	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2153.5	509.7279	494.2741	478.2472	461.6352	444.4188	426.5821	408.1139	389.0092	369.2706	348.9099	327.95	306.4256	284.3836	261.8828	238.9919	215.7866	192.3453	168.7454	145.0595	121.3537	97.68931	74.13128	50.77172	27.80468	5.904433	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2190	513.8924	498.4424	482.4272	465.8354	448.6478	430.8486	412.4263	393.3754	373.6973	353.4026	332.512	311.0576	289.0834	266.6452	243.8084	220.6461	197.235	173.6513	149.9676	126.2505	102.5619	78.96561	55.54699	32.47053	10.22607	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2226.5	518.071	502.6247	486.621	470.0488	452.8891	435.1263	416.7487	397.7501	378.1312	357.9011	337.0785	315.6933	293.7867	271.4113	248.6298	225.5123	202.1337	178.5691	154.8907	131.1656	107.4561	83.82532	60.35333	37.18219	14.68617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2263	522.2629	506.8203	490.8277	474.2745	457.142	439.4146	421.0804	402.1328	382.5717	362.4048	341.6491	320.3323	298.4929	276.1805	253.4551	230.3841	207.0402	183.4973	159.8272	136.0972	112.37	88.7084	65.18811	41.93399	19.24237	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2299.5	526.4674	511.0283	495.0465	478.5118	461.4058	443.7127	425.4208	406.523	387.0183	366.9132	346.2233	324.974	303.2012	280.9521	258.2835	235.2603	211.9532	188.4346	164.7757	141.0438	117.3021	93.61302	70.049	46.72147	23.87162	2.439716	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2336	530.6838	515.2481	499.2769	482.7601	465.6797	448.0202	429.7695	410.9201	391.4705	371.426	350.8007	329.6179	307.9114	285.7254	263.1143	240.1403	216.8718	193.3798	169.7347	146.0039	122.2508	98.53753	74.93397	51.54102	28.55956	6.627429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2372.5	534.702	519.2696	503.3086	486.8093	469.7539	452.127	433.9163	415.1142	395.7184	375.7333	355.1713	334.0541	312.4133	290.2905	267.7373	244.8135	221.5854	198.1223	174.4937	150.7668	127.0051	103.2708	79.63164	56.18007	33.08688	10.82457	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2409	538.6854	523.2562	507.3052	490.8229	473.7918	456.1966	438.0251	419.2691	399.9258	379.9987	359.499	338.4465	316.8707	294.8109	272.316	249.4436	226.2574	202.8252	179.2156	155.4952	131.7279	107.9756	84.30442	60.80019	37.61095	15.10699	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2445.5	542.686	527.26	511.3186	494.8529	477.8455	460.2812	442.1477	423.4367	404.1448	384.2745	363.8359	342.8472	321.3358	299.3387	276.9025	254.0821	230.9393	207.54	183.9516	160.2405	136.4703	112.703	89.00317	65.45157	42.17891	19.48442	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2482	546.7003	531.2773	515.3454	498.8958	481.9114	464.3772	446.2809	427.6138	408.372	388.5574	368.1788	347.2528	325.8051	303.8705	281.4932	258.7256	235.6275	212.2629	188.698	164.9986	141.2282	117.4486	93.72349	70.1293	46.7833	23.93297	2.520975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2518.5	550.7266	535.3066	519.3839	502.95	485.9881	468.4832	450.4231	431.7988	412.6061	392.846	372.5262	351.6621	330.2774	308.4049	286.0865	263.3725	240.3201	216.9919	193.4526	169.7673	145.9993	122.2102	98.46291	74.83047	51.41941	28.43844	6.540111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2555	554.7641	539.347	523.4332	507.0146	490.0746	472.5983	454.5735	435.9911	416.8463	397.1395	376.8775	356.0743	334.7518	312.9411	290.6817	268.0216	245.0161	221.7258	198.2141	174.5452	150.782	126.9861	103.2196	79.55288	56.08375	32.99126	10.76239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2591.5	558.8118	543.3976	527.4925	511.0889	494.1702	476.7218	458.7314	440.1899	421.0919	401.4374	381.2321	360.4888	339.2278	317.4784	295.2779	272.6723	249.7146	226.4635	202.9812	179.3309	155.5751	131.7749	107.9921	84.2947	60.77352	37.58452	15.10766	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2628	562.8693	547.4578	531.5613	515.1722	498.2743	480.8531	462.8964	444.3947	425.3426	405.7393	385.5896	364.9052	343.705	322.0163	299.8747	277.3238	254.4148	231.2044	207.7532	184.1235	160.3772	136.5754	112.779	89.05434	65.48643	42.21298	19.54005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2664.5	566.936	551.5272	535.639	519.264	502.3865	484.9919	467.068	448.6053	429.598	410.0448	389.9497	369.3233	348.1831	326.5547	304.4717	281.9759	259.1162	235.9475	212.5291	188.922	165.1876	141.3864	117.5791	93.8304	70.22049	46.87253	24.03924	2.6441	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2701	571.0114	555.6053	539.7251	523.3641	506.5063	489.1376	471.2458	452.8212	433.8577	414.3536	394.3121	373.7428	352.6618	331.0931	309.0686	286.6279	263.8182	240.6924	217.3082	193.7256	170.0051	146.207	122.3913	98.62161	74.97397	51.55986	28.59223	6.712061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2737.5	575.0952	559.6916	543.8194	527.4719	510.6335	493.2901	475.4296	457.0422	438.1217	418.6656	398.6767	378.1635	357.1409	335.6314	313.665	291.2797	268.5204	245.4386	222.09	198.5335	174.8291	151.0362	127.2147	103.4268	79.74533	56.27221	33.19001	10.97823	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2774	579.187	563.786	547.9214	531.5871	514.7676	497.4489	479.619	461.2681	442.3895	422.9806	403.0433	382.5852	361.6202	340.1693	318.2608	295.9308	273.2225	250.1854	226.8737	203.3452	179.6586	155.8732	132.0482	108.2449	84.5332	61.00727	37.82602	15.3645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2810.5	583.2865	567.8879	552.0309	535.7094	518.9084	501.6139	483.8139	465.4985	446.661	427.2983	407.4117	387.0079	366.0997	344.7067	322.8557	300.5811	277.9241	254.9325	231.659	208.1598	184.4931	160.7172	136.891	113.0748	89.33631	65.76302	42.49523	19.83573	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2847	587.3933	571.9971	556.1475	539.8386	523.0556	505.7847	488.0139	469.7334	450.9361	431.6186	411.7817	391.4313	370.5791	349.2434	327.4497	305.2303	282.6249	259.6795	236.4452	212.9769	189.3317	165.5674	141.7422	117.9157	94.15351	70.53772	47.19369	24.37194	2.957694	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2883.5	591.4721	576.0782	560.2358	543.9393	527.1739	509.9261	492.1839	473.9374	455.1795	435.9064	416.1183	395.8203	375.0233	353.7443	332.0073	309.8431	287.2896	264.391	241.1969	217.7608	194.1389	170.3881	146.566	122.7316	98.94865	75.29474	51.8831	28.92526	7.040041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2920	595.2844	579.8928	564.0574	547.7729	531.0247	513.7994	496.0852	477.8721	459.1528	439.9231	420.1829	399.9365	379.1939	357.971	336.2902	314.181	291.6795	268.8283	245.6753	222.2178	198.6756	174.9402	151.1234	127.2834	103.4824	79.79439	56.32254	33.24866	11.04593	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2956.5	599.121	583.7317	567.9032	551.6305	534.8991	517.6959	500.0091	481.8286	463.1471	443.96	424.2668	404.0712	383.3822	362.2146	340.5897	318.5352	296.0859	273.2825	250.1714	226.8036	203.2328	179.5145	155.7049	131.8615	108.0452	84.32672	60.8011	37.62771	15.18492	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2993	602.9706	587.5834	571.7617	555.5004	538.7856	521.604	503.9439	485.7954	467.1508	448.0056	428.3585	408.2128	387.5766	366.4638	344.8942	322.8943	300.4971	277.7419	254.6736	231.3416	207.7985	184.0989	160.2985	136.4539	112.6248	88.87924	65.30562	42.04583	19.41034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3029.5	606.8303	591.4453	575.6301	559.3801	542.6814	525.5209	507.887	489.7698	471.1615	452.0572	432.4555	412.3588	391.7747	370.7159	349.2011	327.2555	304.9105	282.2038	259.1789	235.8837	212.3697	188.6905	164.901	141.0573	117.2179	93.44844	69.83196	46.49623	23.70122	2.402406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3066	610.6988	595.3159	579.5072	563.2682	546.5853	529.4455	511.8373	493.7507	475.1779	456.1138	436.5566	416.5082	395.9753	374.9698	353.5094	331.6177	309.3248	286.667	263.6861	240.4286	216.9449	193.2877	169.5105	145.6701	121.8227	98.03229	74.37751	50.97446	28.04459	6.258841	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3102.5	614.5754	599.1945	583.3921	567.1639	550.4964	533.3769	515.7938	497.7372	479.1993	460.1746	440.661	420.6601	400.1777	379.2249	357.8182	335.9802	313.7394	291.1306	268.1942	244.9754	221.5232	197.8893	174.127	150.2909	126.4377	102.6293	78.94028	55.47721	32.43152	10.30977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3139	618.4594	603.0805	587.2843	571.0667	554.4143	537.3145	519.7561	501.7289	483.2251	464.2392	444.7685	424.8142	404.3816	383.4808	362.1273	340.3425	318.1536	295.5941	272.7026	249.5232	226.1036	202.4944	178.7482	154.9188	131.062	107.2381	83.51864	60.00186	36.85551	14.4788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3175.5	622.3503	606.9734	591.1833	574.976	558.3384	541.2581	523.7237	505.7254	487.2551	468.3071	448.8785	428.9701	408.5865	387.737	366.4362	344.7043	322.5672	300.0569	277.2109	254.0717	230.6856	207.1025	183.3739	159.5529	135.6946	111.8578	88.11123	64.54628	41.31161	18.73152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3212	626.2479	610.8729	595.0887	578.8916	562.2685	545.2072	527.6965	509.7264	491.2889	472.3781	452.991	433.1277	412.7923	391.9935	370.7448	349.0653	326.9799	304.519	281.7187	258.6202	235.2688	211.7129	188.0034	164.1926	140.3347	116.4874	92.71683	69.10862	45.79589	23.04831	1.873116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3248.5	630.1517	614.7787	599.0003	582.8131	566.2042	549.1616	531.674	513.7316	495.3263	476.4521	457.1056	437.2867	416.9988	396.25	375.0528	353.4254	331.3913	308.9798	286.2256	263.1685	239.8525	216.3251	192.636	168.8371	144.9815	121.126	97.33438	73.68733	50.30521	27.41655	5.716508	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3285	634.0616	618.6904	602.9177	586.7402	570.1453	553.1209	535.6561	517.7409	499.3672	480.5288	461.2223	441.447	421.2059	400.5064	379.3602	357.7844	335.8014	313.4393	290.7314	267.7161	244.4364	220.9385	197.2714	173.4858	149.6345	125.7728	101.9629	78.28102	54.83695	31.82748	9.773121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3321.5	637.9773	622.6079	606.8408	590.6728	574.0916	557.0851	539.6425	521.754	503.4113	484.6082	465.3409	445.6084	425.4135	404.7626	383.6668	362.1422	340.2101	317.8972	295.2358	272.2629	249.0202	225.5529	201.909	178.1383	154.2929	130.4272	106.6016	82.88846	59.38889	36.27464	13.95382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3358	641.8985	626.5309	610.7693	594.6107	578.0428	561.0539	543.6331	525.7707	507.4584	488.6899	469.4612	449.771	429.6214	409.0185	387.9725	366.4986	344.6171	322.3534	299.7387	276.8086	253.6036	230.1678	206.5482	182.794	158.9562	135.0885	111.2495	87.50855	63.95917	40.75314	18.2208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3394.5	645.8251	630.4593	614.703	598.5536	581.9988	565.0272	547.6278	529.791	511.5086	492.7741	473.5832	453.9345	433.8297	413.2741	392.2773	370.8537	349.0223	326.8078	304.2398	281.3529	258.1863	234.7829	211.1889	187.4524	163.6239	139.756	115.906	92.14029	68.54615	45.2591	22.55309	1.477509	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3431	649.7569	634.3928	618.6418	602.5013	585.9595	569.0047	551.6263	533.8147	515.5616	496.8604	477.7068	458.099	438.0382	417.5293	396.5811	375.2072	353.4258	331.2603	308.7391	285.8956	262.768	239.3979	215.8305	192.1132	168.2954	144.4292	120.5703	96.78277	73.14839	49.78938	26.93741	5.305489	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3467.5	653.7252	638.2098	622.4639	606.3323	589.8031	572.8649	555.5072	537.7203	519.4959	500.8275	481.7105	462.1429	442.1254	421.6625	400.7625	379.4378	357.706	335.5892	313.1149	290.3152	267.227	243.891	220.3512	196.6543	172.8489	148.986	125.1204	101.3137	77.64316	54.21995	31.24321	9.24679	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3504	657.3905	642.0297	626.2889	610.166	593.6491	576.7272	559.3897	541.627	523.4309	504.7948	485.7138	466.1856	446.2109	425.7934	404.9408	383.6649	361.9823	339.9141	317.4866	294.7309	271.6827	248.3815	224.8704	201.195	177.4033	153.5455	129.6751	105.8518	82.14886	58.66818	35.5838	13.31625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3540.5	661.2166	645.8574	630.1216	614.0072	597.5025	580.5966	563.2789	545.54	527.3717	508.7672	489.7215	470.2323	450.2996	429.929	409.1212	387.8936	366.2598	344.2399	321.8593	299.1478	276.1399	252.8742	229.3926	205.74	181.9635	158.1123	134.239	110.4015	86.66956	63.13739	39.95914	17.47631	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3577	665.0491	649.6915	633.9606	617.8545	601.3618	584.4715	567.1734	549.4579	531.3168	512.7433	493.7325	474.2815	454.3903	434.0618	413.3024	392.1226	370.5371	348.5654	326.2315	303.5643	280.5972	257.3676	233.9165	210.2877	186.5276	162.6846	138.8102	114.9608	91.20305	67.62469	44.36372	21.70393	0.802125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3613.5	668.8874	653.5313	637.8052	621.7073	605.2264	588.3515	571.0725	553.3799	535.2656	516.7227	497.7461	478.3328	458.4824	438.1974	417.4837	396.3512	374.8138	352.8899	330.6027	307.9799	285.0539	261.8609	238.4411	214.8372	191.0947	167.2614	143.3877	119.5286	95.74793	72.12809	48.79368	25.98496	4.471262	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3650	672.7309	657.3764	641.6551	625.5652	609.0958	592.236	574.9758	557.3058	539.2178	520.7049	501.762	482.3857	462.5755	442.3334	421.6649	400.5792	379.0894	357.2131	334.9724	312.3942	289.5095	266.3538	242.9659	219.3879	195.6643	171.8421	147.9707	124.1039	100.3031	76.64602	53.24605	30.30983	8.405189	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3686.5	676.5795	661.2265	645.5098	629.4278	612.9697	596.1248	578.883	561.2352	543.1731	524.6897	505.7798	486.4401	466.6694	446.4697	425.8458	404.8063	383.3637	361.5347	339.3405	316.8068	293.9638	270.8457	247.4905	223.9393	200.2357	176.4259	152.5586	128.686	104.8677	81.17716	57.71841	34.67161	12.4782	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3723	680.4328	665.0813	649.3691	633.295	616.848	600.0176	582.794	565.168	547.1312	528.6769	509.7996	490.4957	470.7641	450.6061	430.0263	409.0325	387.6367	365.8546	343.7067	321.2176	298.4164	275.3365	252.0146	228.491	204.8086	181.0126	157.1507	133.2743	109.4409	85.72035	62.20879	39.06507	16.64449	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3759.5	684.2907	668.9407	653.233	637.1664	620.7303	603.9143	586.7086	569.1039	551.0922	532.6664	513.8211	494.5525	474.8593	454.7425	434.2062	413.2577	391.9081	370.1728	348.0709	325.6264	302.8673	279.8258	256.5379	233.0428	209.3825	185.6015	161.7466	137.8682	114.0219	90.27458	66.71546	43.48615	20.87998	0.17533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3796	688.153	672.8044	657.1011	641.0421	624.6167	607.8148	590.6265	573.0429	555.0557	536.658	517.8442	498.6104	478.9551	458.8789	438.3855	417.4817	396.1781	374.489	352.433	330.0331	307.3161	284.3135	261.0601	237.5943	213.9572	190.1924	166.3459	142.4671	118.6101	94.83895	71.23696	47.93157	25.16988	3.766825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3832.5	692.0194	676.6724	660.9734	644.9217	628.5008	611.7188	594.5477	576.9848	559.0218	540.6516	521.8688	502.6693	483.0513	463.0151	442.5641	421.7045	400.4464	378.8033	356.793	334.4375	311.7629	288.7994	265.5811	242.1453	218.5322	194.7847	170.9481	147.0706	123.2049	99.41262	75.772	52.39864	29.50421	7.681692	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3869	695.8902	680.5444	664.8496	648.8052	632.4007	615.6262	598.4722	580.9295	562.9902	544.6473	525.895	506.7292	487.1479	467.1512	446.742	425.9262	404.7131	383.1156	361.1508	338.8396	316.2074	293.2834	270.1006	246.6954	223.1074	199.3783	175.5528	151.6781	127.8058	103.9949	80.31943	56.88512	33.87579	11.74862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3905.5	699.7648	684.4203	668.7297	652.6924	636.2982	619.5371	602.3996	584.877	566.962	548.6448	529.9225	510.79	491.2448	471.2871	450.9192	430.1466	408.9781	387.4259	365.5062	343.2394	320.6496	297.7653	274.6184	251.2446	227.6823	203.9728	180.1597	156.2893	132.4121	108.585	84.87824	61.3891	38.27925	15.91443	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3942	703.6432	688.3001	672.6136	656.5833	640.1991	623.4511	606.3301	588.8271	570.9341	552.6442	533.9514	514.8516	495.3421	475.4228	455.0957	434.3658	413.2414	391.7341	369.8594	347.6367	325.0894	302.2449	279.1344	255.7925	232.2569	208.5679	184.7683	160.9038	137.0233	113.1823	89.44749	65.90894	42.71039	20.15245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3978.5	707.5254	692.1836	676.5012	660.4778	644.1034	627.3684	610.2634	592.7797	574.9094	556.6453	537.9816	518.914	499.4397	479.5582	459.2714	438.5837	417.503	396.0402	374.2102	352.0315	329.5267	306.7223	283.6485	260.3391	236.8309	213.1633	189.3785	165.5211	141.6391	117.7863	94.02636	70.44322	47.16587	24.44665	3.146354	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4015	711.3533	696.0128	680.3343	664.3177	647.953	631.2307	614.1415	596.6769	578.8288	560.5901	541.9551	522.9192	503.4795	483.6354	463.3883	442.7424	421.7049	400.2863	378.5006	356.3657	333.9034	311.1392	288.1025	264.8261	241.346	217.7008	193.9318	170.0829	146.201	122.3384	98.55608	74.93268	51.58496	28.72841	6.982417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4051.5	714.5925	699.2533	683.5787	667.5687	651.2136	634.5038	617.4302	599.9843	582.1581	563.9445	545.3376	526.3329	506.9275	487.1202	466.9123	446.3076	425.3129	403.938	382.1965	360.1053	337.6854	314.9615	291.9622	268.7192	245.2678	221.6459	197.8938	174.0546	150.1744	126.3039	102.5018	78.84204	55.43121	32.45657	10.41089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4088	711.723	696.385	680.7143	664.7109	648.3651	631.6677	614.6094	597.1819	579.3772	561.1883	542.6092	523.6353	504.2635	484.4925	464.3233	443.7594	422.807	401.4756	379.7778	357.73	335.3525	312.6691	289.7074	266.4984	243.0763	219.4784	195.7442	171.9161	148.039	124.1624	100.3428	76.65032	53.18295	30.10892	7.997834	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4124.5	708.4111	693.0744	677.4074	661.4105	645.074	628.3886	611.3455	593.936	576.1525	557.9879	539.4361	520.4926	501.1539	481.4188	461.2878	440.7642	419.8537	398.5652	376.9109	354.9046	332.5712	309.9283	287.0044	263.8271	240.4377	216.8646	193.1493	169.3332	145.4606	121.5797	97.74498	74.02314	50.507	27.38474	5.627639	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4161	705.3028	689.9673	674.3041	658.3135	641.9861	625.3126	608.2843	590.8927	573.1301	554.9894	536.4645	517.5508	498.2449	478.5451	458.4519	437.968	417.099	395.8531	374.2419	352.2805	329.9875	307.3851	284.4992	261.3593	237.9978	214.4502	190.7547	166.9519	143.0852	119.2015	95.35393	71.60703	48.05894	24.9689	3.705116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4197.5	702.3176	686.9833	671.3238	655.3394	639.0209	622.3592	605.3455	587.9715	570.2294	552.1122	533.6139	514.7296	495.4559	475.7909	455.735	435.2905	414.4624	393.2587	371.6904	349.7718	327.5208	304.959	282.1114	259.0065	235.676	212.1547	188.4799	164.6915	140.8319	116.9472	93.08937	69.32463	45.76955	22.77615	2.067936	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4234	699.4219	684.0888	668.4328	652.4546	636.145	619.4948	602.4955	585.1388	567.4169	549.3228	530.8506	511.9954	492.7534	473.1229	453.1037	432.698	411.9106	390.7487	369.2228	347.3468	325.1378	302.6165	279.8072	256.7377	233.4388	209.9444	186.2911	162.518	138.6669	114.7831	90.91894	67.14658	43.61084	20.76001	0.653811	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4270.5	696.5973	681.2653	665.6129	649.6408	633.3398	616.701	599.7159	582.3761	564.6741	546.603	528.1565	509.3298	490.1192	470.5226	450.5397	430.1724	409.4251	388.3046	366.8209	344.9872	322.82	300.3392	277.5684	254.5345	231.2676	207.8008	184.1699	160.4132	136.5719	112.6914	88.82609	65.05813	41.56602	18.89083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4307	693.8323	678.5014	662.8526	646.8864	630.5939	613.9663	596.9951	579.6721	561.9898	543.9411	525.52	506.7214	487.5417	467.9785	448.0315	427.7022	406.9945	385.915	364.4732	342.6815	320.5559	298.1157	275.3835	252.3855	229.151	205.7123	182.1045	158.3653	134.5357	110.6615	86.80127	63.05033	39.62322	17.14809	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4343.5	691.1189	675.7892	660.1438	644.1835	627.8994	611.2829	594.3254	577.0189	559.3558	541.3293	522.9332	504.1624	485.0131	465.483	445.5713	425.2795	404.611	383.5722	362.1718	340.4219	318.3378	295.938	273.2445	250.2826	227.0809	203.6709	180.0871	156.3667	132.5507	108.6866	84.83842	61.11701	37.77333	15.51681	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4380	688.4515	673.1229	657.4809	641.5263	625.2506	608.6449	591.7009	574.4107	556.7666	538.7619	520.3904	501.647	482.5278	463.0302	443.1535	422.8986	402.269	381.2704	359.9111	338.2028	316.1599	293.8005	271.1457	248.2202	225.0517	201.671	178.1121	154.4119	130.6118	106.762	82.93342	59.25351	36.00908	13.98547	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4416.5	685.8256	670.4981	654.8594	638.9106	622.643	606.048	589.1173	571.8431	554.2178	536.2346	517.8873	499.1709	480.0813	460.6159	440.7736	420.5554	399.9641	379.0053	357.6868	336.0197	314.018	291.6988	269.0828	246.1938	223.0589	199.7082	176.1752	152.4968	128.7155	104.8846	81.08325	57.45609	34.32444	12.54493	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4453	683.2378	667.9114	652.276	636.3328	620.0732	603.4887	586.5712	569.3128	551.7059	533.7439	515.4205	496.7307	477.6703	458.2366	438.4284	418.2463	397.693	376.7736	355.4956	333.8694	311.9085	289.6296	267.0524	244.2001	221.0991	197.7792	174.2732	150.6185	126.8591	103.0522	79.28561	55.72161	32.71428	11.18767	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4489.5	680.6853	665.3599	649.7277	633.7901	617.5384	600.9643	584.0598	566.8168	549.2282	531.287	512.9872	494.3236	475.292	455.8896	436.115	415.9687	395.4529	374.5725	353.3346	331.7491	309.8289	287.59	265.0516	242.2363	219.1698	195.8813	172.4038	148.7749	125.0407	101.2629	77.53862	54.04736	31.17417	9.907384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4526	678.1657	662.8413	647.2124	631.2802	615.0363	598.4725	581.5806	564.353	546.7823	528.8617	510.5852	491.9474	472.9442	453.5727	433.8313	413.7202	393.2416	372.3998	351.2016	329.6565	307.7767	285.5779	263.0784	240.3003	217.2688	194.0127	170.565	146.9643	123.2589	99.51551	75.8407	52.43091	29.7002	8.698632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4562.5	675.6771	660.3537	644.728	628.8011	612.5649	596.0112	579.1319	561.9193	544.3663	526.466	508.2123	489.6001	470.6249	451.2839	431.5752	411.499	391.0571	370.2536	349.0947	327.5897	305.7503	283.5913	261.1308	238.3902	215.3943	192.1716	168.7554	145.1854	121.5126	97.80889	74.1905	50.87006	28.28884	7.55668	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4599	673.2177	657.8954	642.2727	626.3512	610.1225	593.5787	576.7118	559.5141	541.9785	524.0982	505.8671	487.28	468.3325	449.0215	429.3452	409.3035	388.8979	368.1322	347.0124	325.5472	303.7478	281.6287	259.2074	236.5046	213.5449	190.3568	166.9739	143.4373	119.8009	96.14217	72.58676	49.3628	26.93691	6.477338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4635.5	670.786	655.4647	639.8451	623.9288	607.7076	591.1736	574.3189	557.1359	539.6174	521.7568	503.548	484.9857	466.0654	446.7841	427.1398	407.1321	386.7624	366.0342	344.9532	323.5275	301.7681	279.6888	257.3067	234.6423	211.7196	188.5673	165.2196	141.7193	118.1232	94.5146	71.02836	47.90722	25.64145	5.456873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4672	668.3808	653.0605	637.4439	621.5327	605.3189	588.7946	571.9518	554.7833	537.2817	519.4406	501.2537	482.7158	463.8226	444.5705	424.9578	404.9837	384.6496	363.9585	342.9159	321.5295	299.8099	277.7704	255.4278	232.8021	209.9174	186.8022	163.4919	140.0307	116.479	92.92551	69.5142	46.50154	24.39976	4.491942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4708.5	666.0008	650.6815	635.0679	619.1618	602.9552	586.4404	569.6095	552.4552	534.9703	517.1483	498.9831	480.4694	461.6026	442.3796	422.798	402.8572	382.5582	361.9039	340.8994	319.5521	297.8722	275.8727	253.5698	230.9834	208.1375	185.0611	161.7902	138.3712	114.8678	91.37429	68.04326	45.14406	23.20928	3.579553	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4745	663.645	648.3266	632.7159	616.8148	600.6155	584.11	567.2908	550.1505	532.6821	514.879	496.7351	478.2452	459.4047	440.2102	420.6594	400.7515	380.4873	359.8695	338.9028	317.5945	295.9542	273.9947	251.7319	229.1855	206.3796	183.3435	160.1143	136.7406	113.2893	89.86036	66.61455	43.83313	22.06763	2.71705	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4781.5	661.3123	645.9949	630.3871	614.491	598.2986	581.8024	564.9947	547.8683	530.4161	512.6317	494.5089	476.0424	457.2278	438.0615	418.5412	398.6659	378.4361	357.8545	336.9254	315.6558	294.0551	272.1358	249.9135	227.4079	204.643	181.6489	158.4639	135.1384	111.7431	88.38315	65.22707	42.56718	20.97255	1.90212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4818	659.002	643.6854	628.0805	612.1892	596.0039	579.5168	562.7205	545.6077	528.1715	510.4054	492.3035	473.8602	455.0712	435.9327	416.4425	396.5994	376.4038	355.858	334.9664	313.7354	292.1744	270.2955	248.1142	225.6501	202.9276	179.9773	156.8387	133.5646	110.2289	86.94212	63.87987	41.34469	19.92191	1.132837	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4854.5	656.713	641.3974	625.7953	609.9088	593.7303	577.2522	560.4671	543.3678	525.9475	508.1995	490.1181	471.6977	452.9339	433.8231	414.3626	394.5514	374.3897	353.8796	333.0251	311.8328	290.3115	268.4733	246.3336	223.9119	201.233	178.3284	155.2387	132.0189	108.7465	85.5367	62.57199	40.16417	18.91366	0.407777	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4891	654.4447	639.1301	623.5307	607.649	591.4773	575.008	558.234	541.148	523.7432	506.0132	487.952	469.5543	450.8155	431.7319	412.3009	392.5213	372.3932	351.9185	331.1012	309.9474	288.466	266.6689	244.5713	222.1931	199.5593	176.702	153.6637	130.5012	107.2955	84.16634	61.30248	39.02421	17.94588	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4927.5	652.1964	636.8826	621.2861	605.409	589.2439	572.7835	556.0204	538.9475	521.5581	503.8458	485.8046	467.4292	448.7151	429.6585	410.2567	390.5084	370.4137	349.9743	329.1941	308.0789	286.6376	264.8819	242.8272	220.4935	197.9061	175.0983	152.1137	129.0115	105.8757	82.83048	60.07039	37.92338	17.01673	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4964	649.9674	634.6545	619.0606	603.1882	587.0297	570.5779	553.8256	536.7656	519.3915	501.6966	483.6752	465.322	446.6323	427.6023	408.2295	388.5124	368.4508	348.0466	327.3034	306.227	284.826	263.1123	241.1012	218.813	196.2737	173.5172	150.5886	127.5495	104.4867	81.52854	58.87478	36.86035	16.12444	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000.5	647.757	632.4449	616.8538	600.9859	584.8339	568.3907	551.649	534.6019	517.2427	499.5652	481.5633	463.232	444.5664	425.563	406.2189	386.5327	366.5042	346.135	325.4288	304.3913	283.031	261.3598	239.3932	217.1516	194.6618	171.9586	149.0885	126.1151	103.1283	80.25993	57.71472	35.83378	15.26733	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5037	645.5646	630.2535	614.6649	598.8015	582.656	566.2212	549.4901	532.4556	515.1113	497.4509	479.4684	461.1587	442.5171	423.54	404.2244	384.5689	364.5734	344.2393	323.5701	302.5717	281.2525	259.6243	237.7031	215.5094	193.0707	170.4226	147.6133	124.7083	101.8	79.02405	56.58928	34.84238	14.4438	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5073.5	643.3898	628.0795	612.4935	596.6346	580.4955	564.069	547.3483	530.3264	512.9968	495.3532	477.39	459.1017	440.4839	421.5328	402.2457	382.6208	362.6581	342.3591	321.7271	300.768	279.4903	257.906	236.0309	213.8864	191.5002	168.9093	146.163	123.3287	100.5016	77.82029	55.49753	33.88491	13.65232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5110	641.2319	625.9224	610.3391	594.4846	578.3518	561.9336	545.2231	528.2136	510.8986	493.2718	475.3276	457.0606	438.4665	419.5413	400.2823	380.688	360.7582	340.4943	319.8997	298.9802	277.7445	256.2046	234.3768	212.2826	189.9507	167.4187	144.7375	121.9764	99.23268	76.64802	54.43854	32.96014	12.89141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5146.5	639.0905	623.7819	608.2011	592.351	576.2244	559.8144	543.1142	526.117	508.8163	491.2062	473.2808	455.035	436.4643	417.565	398.3342	378.7704	358.8734	338.6447	318.0876	297.2082	276.015	254.5203	232.7407	210.6982	188.422	165.9508	143.3368	120.651	97.99286	75.50662	53.41142	32.0669	12.15969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5183	636.9652	621.6574	606.0792	590.2334	574.113	557.7111	541.021	524.0359	506.7496	489.156	471.2494	453.0246	434.4773	415.6036	396.4009	376.8676	357.0035	336.8102	316.291	295.452	274.3019	252.8532	231.1228	209.1332	186.9143	164.5057	141.9609	119.3524	96.78173	74.39544	52.41526	31.20403	11.45581	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5219.5	634.8555	619.5485	603.9728	588.1313	572.017	555.6232	538.9431	521.9702	504.6981	487.1209	469.2329	451.0291	432.505	413.657	394.4824	374.9796	355.1486	334.9908	314.5098	293.7116	272.6053	251.2034	229.5232	207.5878	185.4276	163.0834	140.6095	118.0803	95.59887	73.31384	51.44917	30.37042	10.77849	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5256	632.761	617.4548	601.8816	586.0444	569.9362	553.5504	536.8803	519.9194	502.6615	485.1006	467.2312	449.0482	430.5474	411.725	392.5785	373.1063	353.3084	333.1864	312.7439	291.9871	270.9251	249.5709	227.9421	206.0621	183.9622	161.6839	139.2828	116.8345	94.44385	72.26116	50.51227	29.56498	10.12653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5292.5	630.6813	615.376	599.8053	583.9723	567.8702	551.4923	534.8322	517.8832	500.6394	483.0948	465.2439	447.0818	428.6041	409.8074	390.689	371.2475	351.483	331.397	310.9934	290.2785	269.2616	247.9559	226.3795	204.5561	182.5179	160.3071	137.9805	115.6147	93.31623	71.23675	49.6037	28.78668	9.498751	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5329	628.6162	613.3117	597.7435	581.9147	565.8186	549.4487	532.7984	515.8614	498.6316	481.1032	463.2708	445.1295	426.6751	407.9041	388.8139	369.4033	349.6723	329.6227	309.2584	288.5859	267.6149	246.3586	224.8355	203.0701	181.095	158.9532	136.7025	114.4207	92.21553	70.23996	48.72261	28.03449	8.894057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5365.5	626.5653	611.2616	595.6959	579.8713	563.7813	547.4192	530.7788	513.8537	496.638	479.1258	461.3118	443.1914	424.7602	406.0149	386.9531	367.5735	347.8763	327.8635	307.539	286.9096	265.985	244.779	223.3104	201.6041	179.6933	157.622	135.4486	113.2522	91.14129	69.27011	47.86816	27.30745	8.311389	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5402	624.5284	609.2255	593.6622	577.8418	561.7578	545.4037	528.7731	511.8599	494.6582	477.1622	459.3668	441.2672	422.8594	404.1399	385.1066	365.7583	346.0952	326.1195	305.8353	285.2495	264.3722	243.2174	221.8042	200.1582	178.3131	156.3135	134.2187	112.1087	90.09303	68.32657	47.03953	26.6046	7.749745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5438.5	622.5052	607.2031	591.6423	575.8261	559.7481	543.4018	526.7811	509.8798	492.6921	475.2124	457.4355	439.3569	420.9725	402.2791	383.2744	363.9576	344.329	324.3908	304.1474	283.6059	262.7765	241.6738	220.3171	198.7325	176.9542	155.0275	133.0126	110.9901	89.07025	67.40867	46.23593	25.92503	7.208167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5475	620.4954	605.1941	589.6358	573.8238	557.7518	541.4135	524.8027	507.9133	490.7397	473.2762	455.518	437.4604	419.0995	400.4323	381.4566	362.1715	342.5777	322.6775	302.4754	281.9788	261.1982	240.1484	218.8491	197.327	175.6167	153.7641	131.8301	109.8959	88.07246	66.51577	45.45656	25.26786	6.685746	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5511.5	618.4989	603.1985	587.6426	571.8349	555.7689	539.4385	522.8376	505.9602	488.8007	471.3536	453.6141	435.5776	417.2405	398.5996	379.6531	360.4001	340.8415	320.9797	300.8195	280.3684	259.6373	238.6413	217.4005	195.9418	174.3005	152.5231	130.6709	108.8258	87.09914	65.64722	44.70066	24.63224	6.181616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5548	616.5156	601.216	585.6626	569.8591	553.7992	537.4768	520.8858	504.0205	486.8751	469.4445	451.7238	433.7087	415.3954	396.7811	377.8641	358.6435	339.1204	319.2975	299.1798	278.7749	258.0941	237.1526	215.9711	194.5769	173.0056	151.3044	129.5348	107.7794	86.14981	64.80239	43.96748	24.01736	5.694955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5584.5	614.5453	599.2465	583.6956	567.8964	551.8426	535.5282	518.9472	502.094	484.9629	467.5489	449.8472	431.8535	413.5643	394.9769	376.0895	356.9018	337.4147	317.6312	297.5564	277.1985	256.5686	235.6826	214.5613	193.2323	171.732	150.1077	128.4216	106.7563	85.22394	63.98064	43.2563	23.42242	5.22498	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5621	612.5879	597.2899	581.7416	565.9466	549.899	533.5926	517.0217	500.1807	483.064	465.6667	447.9841	430.0121	411.7472	393.1869	374.3296	355.175	335.7244	315.9808	295.9496	275.6391	255.061	234.2311	213.1708	191.9081	170.4796	148.933	127.3309	105.7562	84.32102	63.18136	42.5664	22.84667	4.77095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5657.5	610.6434	595.3462	579.8004	564.0098	547.9683	531.6701	515.1094	498.2806	481.1785	463.798	446.1347	428.1845	409.9442	391.4113	372.5844	353.4634	334.0496	314.3464	294.3594	274.0971	253.5713	232.7984	211.8	190.6043	169.2483	147.78	126.2625	104.7786	83.44055	62.40393	41.8971	22.28938	4.33216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5694	608.7116	593.4153	577.872	562.0857	546.0505	529.7605	513.2101	496.3937	479.3062	461.9428	444.2989	426.3709	408.1554	389.6502	370.8541	351.767	332.3905	312.7283	292.786	272.5725	252.0998	231.3846	210.4486	189.3207	168.0379	146.6486	125.216	103.8232	82.58202	61.64775	41.24772	21.74985	3.90794	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5730.5	606.7926	591.4971	575.9564	560.1746	544.1457	527.8639	511.3239	494.52	477.4474	460.1011	442.477	424.5712	406.3809	387.9037	369.1387	350.086	330.7473	311.1265	291.2295	271.0654	250.6465	229.9896	209.1169	188.0573	166.8483	145.5386	124.1912	102.8895	81.74492	60.91223	40.61761	21.22741	3.497656	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5767	604.8863	589.5917	574.0537	558.2763	542.2537	525.9804	509.4508	492.6596	475.6019	458.2731	440.6689	422.7857	404.6207	386.172	367.4384	348.4205	329.1201	309.5412	289.6901	269.5759	249.2114	228.6135	207.8047	186.8141	165.6795	144.4496	123.1878	101.977	80.92875	60.1968	40.00615	20.7214	3.100707	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5803.5	602.9928	587.6991	572.1637	556.3908	540.3747	524.1099	507.5909	490.8125	473.77	456.4587	438.8747	421.0144	402.8751	384.455	365.7534	346.7706	327.509	307.9726	288.1679	268.1042	247.7946	227.2563	206.512	185.5909	164.5312	143.3815	122.2053	101.0855	80.13301	59.50087	39.41272	20.23122	2.716523	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5840	601.1122	585.8193	570.2866	554.5183	538.5087	522.2525	505.7442	488.9788	471.9516	454.6582	437.0945	419.2574	401.1441	382.7531	364.0837	345.1366	325.9141	306.4207	286.6629	266.6504	246.3963	225.9181	205.2388	184.3878	163.4032	142.3341	121.2436	100.2145	79.3572	58.82391	38.83672	19.75627	2.344565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5876.5	599.2444	583.9524	568.4225	552.6588	536.6558	520.4083	503.9109	487.1586	470.147	452.8715	435.3285	417.5148	399.4279	381.0663	362.4295	343.5184	324.3356	304.8856	285.1753	265.2144	245.0164	224.5989	203.985	183.2045	162.2955	141.307	120.3022	99.36351	78.60084	58.16535	38.27758	19.29597	1.984322	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SOLIDS CONTENT (%)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	61.25319	46.06851	34.81518	29.43704	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	63.84846	55.54437	45.34537	38.56704	34.36086	31.43891	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	65.27406	59.68427	51.8227	44.84031	40.05051	36.69774	34.12437	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	66.24353	62.04566	55.99396	49.56002	44.49385	40.8195	38.05534	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	66.97139	63.6122	58.81152	53.17992	48.13496	44.24481	41.27897	38.92228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	67.55044	64.75041	60.82063	55.97417	51.16995	47.1816	44.05787	41.57914	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	68.02906	65.62814	62.32444	58.1543	53.70975	49.73867	46.50715	43.91249	41.48918	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	68.43555	66.3338	63.49582	59.88225	55.83685	51.97881	48.69493	46.00763	43.77613	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	68.78787	66.91872	64.438	61.27658	57.62201	53.94387	50.66335	47.9103	45.62052	40.37788	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	69.0981	67.415	65.21566	62.42209	59.12693	55.66696	52.43997	49.65084	47.30205	45.08241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	69.37472	67.84388	65.87114	63.37911	60.40392	57.17747	54.04457	51.24985	48.8559	46.77973	41.37703	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	69.62396	68.22003	66.43327	64.19088	61.49595	58.50258	55.49306	52.72184	50.29963	48.2095	46.04169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	69.85045	68.55394	66.92233	64.88882	62.43766	59.66726	56.79959	54.07762	51.64514	49.52722	47.61315	40.4203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	70.05777	68.85339	67.35299	65.49609	63.25661	60.69399	57.97745	55.3259	52.90109	50.7613	48.87077	46.47827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	70.24875	69.12425	67.73618	66.03005	63.97466	61.60253	59.0394	56.47433	54.07407	51.92249	50.02032	48.14543	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	70.42561	69.37106	68.08015	66.50395	64.60915	62.40994	59.99753	57.53006	55.16939	53.0172	51.09993	49.33436	45.64819	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

620.5	70.59019	69.59739	68.39132	66.928	65.17387	63.13079	60.86316	58.49997	56.1916	54.05001	52.1218	50.37783	48.27418	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	70.74398	69.8061	68.67471	67.31023	65.6799	63.7774	61.64669	59.39083	57.14486	55.02451	53.09189	51.34699	49.5894	42.48341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	70.88822	69.99952	68.93434	67.65702	66.13615	64.36014	62.35754	60.20917	58.03318	55.94368	54.01395	52.26355	50.60829	47.96706	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	71.02396	70.17954	69.17345	67.97347	66.54986	64.88773	63.00412	60.96132	58.86046	56.81018	54.89073	53.13626	51.51321	49.62657	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	71.15209	70.34776	69.39472	68.26377	66.92698	65.3675	63.59389	61.65324	59.63058	57.62648	55.72441	53.9696	52.35568	50.70414	45.78284	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	71.27335	70.50549	69.60032	68.53133	67.27238	65.80563	64.13341	62.29052	60.34738	58.39496	56.51685	54.76633	53.15428	51.59301	49.06801	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	71.3884	70.65386	69.79211	68.77899	67.59013	66.20734	64.6284	62.87833	61.01461	59.118	57.26969	55.5284	53.9171	52.39351	50.51886	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	71.4978	70.79383	69.97162	69.00912	67.88364	66.57704	65.08389	63.42142	61.63592	59.79796	57.98451	56.25732	54.64831	53.14121	51.51856	46.79748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	71.60206	70.92621	70.14016	69.22372	68.15576	66.91849	65.50424	63.92409	62.2148	60.4372	58.66281	56.95435	55.35035	53.85116	52.34132	49.77707	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	71.70159	71.05173	70.29887	69.42449	68.40892	67.23492	65.89325	64.39023	62.75459	61.0381	59.3061	57.62062	56.02483	54.53062	53.0757	51.17851	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	71.79678	71.171	70.44871	69.61288	68.6452	67.52908	66.25425	64.82334	63.25838	61.60296	59.91589	58.25718	56.67296	55.18351	53.75717	52.14252	47.81782	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	71.88798	71.28455	70.59051	69.79013	68.86637	67.80333	66.59013	65.22657	63.72911	62.13406	60.4937	58.86504	57.2957	55.81215	54.40195	52.92461	50.39649	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	71.97547	71.39288	70.72501	69.95733	69.07396	68.05973	66.90345	65.60272	64.16948	62.6336	61.04108	59.44519	57.89387	56.41809	55.01825	53.61335	51.69161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	72.05953	71.49639	70.85284	70.11542	69.2693	68.30006	67.19641	65.95431	64.58196	63.1037	61.55954	59.99864	58.46823	57.00238	55.61057	54.24605	52.60849	46.02152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	72.1404	71.59547	70.97457	70.26521	69.45355	68.52589	67.47098	66.28357	64.96886	63.54637	62.05062	60.52641	59.01949	57.56587	56.18158	54.84106	53.35729	49.96047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	72.21829	71.69044	71.09069	70.40744	69.62771	68.73856	67.72888	66.59252	65.33226	63.96352	62.5158	61.02953	59.54834	58.10923	56.73299	55.40807	54.01409	51.65373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	72.29341	71.78161	71.20165	70.54272	69.79269	68.93927	67.97162	66.88295	65.67408	64.35695	62.95656	61.50904	60.05547	58.63304	57.26594	55.95244	54.61389	52.73567	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	72.36593	71.86924	71.30784	70.67164	69.94927	69.12908	68.20055	67.15646	65.99605	64.72834	63.37431	61.96597	60.5416	59.13786	57.78131	56.47734	55.17478	53.55661	48.27489	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	72.436	71.95358	71.40961	70.79469	70.09813	69.30893	68.41686	67.41447	66.29975	65.07926	63.77041	62.40138	61.00742	59.62419	58.27973	56.98472	55.70686	54.24158	51.10767	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	72.50379	72.03483	71.50728	70.91232	70.23991	69.47964	68.62163	67.65829	66.58664	65.41117	64.14619	62.81628	61.45366	60.09254	58.76174	57.47589	56.21609	54.84628	52.56225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	72.56942	72.11321	71.60114	71.02493	70.37516	69.64194	68.81579	67.88906	66.85801	65.72542	64.50288	63.21169	61.88105	60.54342	59.22781	57.95177	56.70618	55.39896	53.5473	44.02628	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	72.63302	72.18889	71.69143	71.13288	70.50436	69.7965	69.0002	68.10782	67.11705	66.02326	64.84167	63.5886	62.29003	60.97733	59.67835	58.41304	57.17952	55.9152	54.31177	50.02699	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	72.6947	72.26203	71.7784	71.23651	70.62797	69.94392	69.17561	68.3155	67.35885	66.30584	65.16368	63.94798	62.68223	61.39479	60.11377	58.86021	57.63772	56.40415	54.95435	52.11124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	72.75456	72.33279	71.86226	71.33609	70.74638	70.08472	69.34272	68.51296	67.5904	66.57424	65.46997	64.29076	63.05748	61.79632	60.53443	59.29372	58.08193	56.87148	55.52176	53.33379	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	72.81271	72.4013	71.9432	71.4319	70.85995	70.21937	69.50213	68.70096	67.81058	66.82944	65.76151	64.61784	63.4168	62.18246	60.94073	59.71394	58.51294	57.32081	56.03887	54.21778	46.55612	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	72.86922	72.4677	72.02139	71.52419	70.96902	70.34833	69.65441	68.88018	68.02022	67.07734	66.03924	64.93007	63.76093	62.55373	61.33305	60.12122	58.93139	57.75453	56.52048	54.92598	50.81787	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	72.92419	72.53208	72.097	71.61317	71.07389	70.47197	69.80005	69.05125	68.22006	67.30377	66.30466	65.22827	64.09054	62.91067	61.71177	60.51586	59.33775	58.17432	56.97556	55.52983	52.67719	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	72.97769	72.59457	72.17019	71.69904	71.17481	70.59065	69.93953	69.21474	68.41077	67.52451	66.55666	65.51323	64.40633	63.25383	62.07727	60.89816	59.73241	58.58138	57.40971	56.06617	53.84605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	73.02978	72.65527	72.24107	71.782	71.27204	70.7047	70.07324	69.37117	68.59299	67.73525	66.79791	65.78569	64.70896	63.58372	62.42996	61.26842	60.11572	58.97659	57.8266	56.55588	54.70502	47.77453	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	73.08054	72.71426	72.30978	71.8622	71.36581	70.81441	70.20157	69.52101	68.76727	67.93666	67.02848	66.04634	64.99907	63.90089	62.77023	61.62694	60.48797	59.36062	58.22871	57.0116	55.39536	51.41677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	73.13003	72.77163	72.37644	71.93982	71.45632	70.92006	70.32488	69.6647	68.93414	68.12932	67.24902	66.29585	65.27727	64.20585	63.09849	61.97402	60.84943	59.73397	58.61777	57.44135	55.98295	53.15412	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	73.17831	72.82745	72.44115	72.01498	71.54376	71.02189	70.44347	69.80263	69.09407	68.3138	67.46014	66.53485	65.54415	64.49912	63.41512	62.30994	61.20037	60.09704	58.99501	57.85046	56.50283	54.27818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	73.22542	72.88181	72.50402	72.08782	71.62831	71.12013	70.55763	69.93516	69.24751	68.49061	67.6624	66.76393	65.8003	64.78119	63.72055	62.63502	61.54103	60.45019	59.36136	58.24252	56.97537	55.11377	48.96425	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	73.27143	72.93478	72.56513	72.15848	71.71013	71.21498	70.66763	70.06262	69.39486	68.66021	67.85632	66.98363	66.04623	65.05255	64.01516	62.94956	61.87165	60.7937	59.71751	58.62008	57.41317	55.78774	52.00804	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	73.31637	72.9864	72.62457	72.22705	71.78937	71.30665	70.77372	70.18532	69.53648	68.82304	68.04241	67.19447	66.28248	65.31368	64.29935	63.25386	62.19248	61.12782	60.06399	58.98496	57.82437	56.36062	53.53035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1898	73.36029	73.03676	72.68242	72.29365	71.86616	71.39531	70.87612	70.30355	69.67273	68.97951	68.22111	67.39696	66.50953	65.56502	64.57352	63.54824	62.50376	61.4528	60.40124	59.33848	58.2144	56.86374	54.55433	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	73.40324	73.08589	72.73876	72.35837	71.94064	71.48112	70.97505	70.41755	69.80391	69.12998	68.39285	67.59153	66.72784	65.80703	64.83804	63.83301	62.80571	61.76886	60.72961	59.68163	58.5869	57.31787	55.34588	44.43253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	73.44525	73.13386	72.79366	72.42131	72.01292	71.56423	71.07068	70.52758	69.93032	69.27481	68.55801	67.77863	66.93786	66.04012	65.0933	64.10846	63.0986	62.07619	61.04938	60.01514	58.94453	57.73694	55.99901	50.36281	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007.5	73.48636	73.18072	72.84717	72.48255	72.08311	71.64479	71.16321	70.63384	70.05223	69.41432	68.71698	67.95865	67.14002	66.2647	65.33965	64.37492	63.38265	62.37502	61.36082	60.3396	59.28934	58.12966	56.56124	52.68874	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	73.5266	73.2265	72.89937	72.54216	72.15132	71.72293	71.2528	70.73656	70.16989	69.54789	68.87009	68.13198	67.33469	66.48117	65.57747	64.63268	63.65811	62.66553	61.66414	60.65547	59.62289	58.50166	57.05999	54.09361	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080.5	73.56601	73.27126	72.9503	72.60024	72.21764	71.79877	71.33959	70.83591	70.28353	69.67852	69.01766	68.29896	67.52226	66.6899	65.8071	64.88204	63.92523	62.94792	61.95955	60.96315	59.94635	58.85677	57.51235	55.09298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2117	73.60462	73.31503	73.00003	72.65683	72.28216	71.87242	71.42374	70.93208	70.39336	69.80375	69.15999	68.45993	67.70309	66.89124	66.02887	65.12331	64.18424	63.22239	62.24724	61.26296	60.26059	59.19768	57.92952	55.87118	45.1571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2153.5	73.64246	73.35786	73.0486	72.71202	72.34496	71.94399	71.50538	71.02523	70.4996	69.92472	69.29735	68.6152	67.8775	67.08553	66.24311	65.35677	64.43539	63.48914	62.52739	61.55519	60.56631	59.52633	58.31917	56.51337	50.81453	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2190	73.67955	73.39978	73.09606	72.76585	72.40613	72.01357	71.58462	71.11551	70.60242	70.04166	69.43001	68.76507	68.04582	67.2731	66.45014	65.5827	64.67892	63.74835	62.80019	61.84009	60.86404	59.8442	58.6867	57.06505	53.11165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2226.5	73.71592	73.44082	73.14246	72.81839	72.46573	72.08127	71.6616	71.20307	70.702	70.15298	69.5582	68.9098	68.20833	67.45426	66.65025	65.80139	64.91506	64.00023	63.06532	62.11786	61.1542	60.15237	59.03601	57.55302	54.51109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2263	73.75161	73.48102	73.18783	72.8697	72.52383	72.14716	71.7364	71.28804	70.7985	70.26427	69.68216	69.04966	68.36533	67.62931	66.84375	66.0131	65.14406	64.24497	63.32442	62.38872	61.43715	60.45171	59.36999	57.99413	55.50886	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2299.5	73.78662	73.52041	73.23223	72.91982	72.5805	72.21133	71.80914	71.37054	70.89207	70.37031	69.8021	69.18488	68.51708	67.79851	67.0309	66.2181	65.36615	64.48277	63.57618	62.65283	61.71317	60.74289	59.6908	58.39954	56.28534	46.72554	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2336	73.82099	73.55902	73.27567	72.96879	72.6358	72.27386	71.87991	71.4507	70.98286	70.47307	69.91821	69.3157	68.66382	67.96215	67.21198	66.41664	65.58155	64.71382	63.82127	62.91037	61.98251	61.02645	60.0001	58.77694	56.92467	51.45683	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2372.5	73.85474	73.59687	73.31821	73.01668	72.68978	72.33481	71.9488	71.52861	71.071	70.57271	70.03068	69.44232	68.80579	68.12046	67.38724	66.60897	65.79048	64.93832	64.05985	63.16149	62.24539	61.30284	60.29918	59.13178	57.47215	53.57298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2409	73.88788	73.63399	73.35987	73.06351	72.74251	72.39425	72.01589	71.60439	71.15661	70.66938	70.13969	69.56495	68.94323	68.27369	67.55693	66.79533	65.99318	65.15646	64.29209	63.40636	62.50199	61.5724	60.58905	59.46804	57.95393	54.89703	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2445.5	73.92043	73.67042	73.40069	73.10933	72.79402	72.45225	72.08125	71.67812	71.2398	70.76321	70.2454	69.68377	69.07633	68.42206	67.72128	66.97595	66.18985	65.36842	64.51814	63.64511	62.75249	61.83545	60.87051	59.78859	58.38704	55.86144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2482	73.95243	73.70616	73.4407	73.15418	72.84438	72.50886	72.14498	71.74991	71.32069	70.85434	70.34797	69.79896	69.20529	68.56579	67.88052	67.15106	66.38071	65.57441	64.73817	63.8779	62.99705	62.09225	61.1442	60.09565	58.78343	56.62093	47.0797	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2518.5	73.98387	73.74125	73.47992	73.19809	72.89361	72.56414	72.20712	71.81982	71.39939	70.9429	70.44753	69.91069	69.33031	68.70509	68.03486	67.32086	66.56596	65.77459	64.95234	64.10486	63.23581	62.34301	61.41064	60.39099	59.15118	57.25017	51.64048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2555	74.01478	73.7757	73.51838	73.24109	72.94177	72.61815	72.26776	71.88795	71.47598	71.02899	70.54422	70.01912	69.45156	68.84015	68.18451	67.48557	66.7458	65.96916	65.16082	64.32613	63.46891	62.58793	61.67027	60.67601	59.49595	57.79052	53.76146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2591.5	74.04518	73.80954	73.55611	73.28323	72.9889	72.67093	72.32694	71.95437	71.55055	71.11273	70.63818	70.12439	69.56921	68.97116	68.32966	67.64539	66.92041	66.1583	65.36375	64.54186	63.69648	62.82718	61.92345	60.9518	59.82181	58.26701	55.11019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2628	74.07508	73.84279	73.59314	73.32453	73.03503	72.72253	72.38473	72.01915	71.62321	71.19421	70.72953	70.22664	69.68342	69.09828	68.4705	67.8005	67.09	66.34217	65.56129	64.75218	63.91865	63.06093	62.17052	61.21925	60.1318	58.6958	56.09081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2664.5	74.1045	73.87545	73.62948	73.36502	73.08021	72.773	72.44118	72.08236	71.69401	71.27355	70.81837	70.32601	69.79433	69.22168	68.60721	67.95108	67.25474	66.52094	65.75361	64.95721	64.13555	63.28933	62.41172	61.47906	60.42823	59.08778	56.8608	47.38491	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2701	74.13344	73.90757	73.66516	73.40472	73.12446	72.82238	72.49635	72.14406	71.76305	71.35081	70.90481	70.42262	69.90209	69.34152	68.73894	68.09733	67.41481	66.6948	65.94084	65.15711	64.34729	63.5125	62.64732	61.73181	60.71289	59.4506	57.49665	51.85692	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2737.5	74.16193	73.93914	73.7002	73.44367	73.16782	72.87071	72.55029	72.2043	71.83039	71.4261	70.98896	70.51659	70.00683	69.45796	68.86888	68.23939	67.57037	66.86389	66.12314	65.35199	64.554	63.73058	62.8775	61.97797	60.98718	59.78982	58.04079	53.96858	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2774	74.18998	73.97018	73.73462	73.48189	73.21031	72.91803	72.60303	72.26315	71.8961	71.49949	71.07092	70.60802	70.10868	69.57112	68.99417	68.37744	67.72158	67.02837	66.30065	65.54198	64.75579	63.9437	63.10245	62.21794	61.25221	60.10952	58.51891	55.31868	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2810.5	74.21759	74.00072	73.76844	73.51941	73.25198	72.96437	72.65463	72.32066	71.96025	71.57107	71.15076	70.69703	70.20776	69.68115	69.11595	68.51163	67.86862	67.18841	66.47352	65.72723	64.95279	64.15197	63.32234	62.45206	61.50889	60.41281	58.94759	56.30246	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2847	74.24479	74.03077	73.80168	73.55624	73.29284	73.00977	72.70513	72.37689	72.02289	71.64089	71.22858	70.78372	70.30418	69.78817	69.23436	68.6421	68.01162	67.34414	66.64189	65.90785	65.1451	64.35551	63.53731	62.68061	61.75796	60.70207	59.3381	57.07527	48.00171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2883.5	74.27158	74.06033	73.83436	73.59241	73.33293	73.05426	72.75456	72.43187	72.08409	71.70904	71.30447	70.86817	70.39806	69.89231	69.34955	68.76901	68.15073	67.49571	66.80589	66.08397	65.33285	64.55442	63.74751	62.90383	62.00001	60.97918	59.69832	57.71302	52.16725	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2920	74.29797	74.08943	73.86649	73.62793	73.37227	73.09787	72.80297	72.48565	72.1439	71.77557	71.37848	70.95048	70.48948	69.99368	69.46163	68.89248	68.2861	67.64327	66.96566	66.25572	65.51613	64.74882	63.95307	63.12195	62.23556	61.24561	60.034	58.25773	54.17709	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2956.5	74.32397	74.11808	73.89809	73.66284	73.41088	73.14063	72.85038	72.53828	72.20236	71.84055	71.45071	71.03073	70.57856	70.09239	69.57073	69.01265	68.41786	67.78695	67.12134	66.42321	65.69507	64.93882	64.15409	63.33516	62.46502	61.50255	60.34933	58.73393	55.48677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2993	74.34961	74.14628	73.92918	73.69715	73.44879	73.18258	72.89685	72.58981	72.25954	71.90403	71.52121	71.109	70.66538	70.18854	69.67697	69.12963	68.54614	67.92687	67.27304	66.58657	65.86977	65.1245	64.35069	63.54362	62.68876	61.75095	60.64742	59.15919	56.45471	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3029.5	74.37487	74.17406	73.95976	73.73087	73.48602	73.22373	72.94239	72.64026	72.31547	71.96608	71.59006	71.18537	70.75003	70.28223	69.78044	69.24355	68.67106	68.06318	67.42089	66.74591	66.04034	65.30598	64.54299	63.7475	62.90708	61.99157	60.9308	59.54559	57.22123	47.1187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3066	74.39978	74.20143	73.98987	73.76402	73.52259	73.26411	72.98704	72.68967	72.37021	72.02675	71.65731	71.25991	70.8326	70.37356	69.88126	69.35453	68.79275	68.19598	67.56502	66.90135	66.20689	65.48335	64.73108	63.94692	63.12024	62.22505	61.20151	59.90134	57.85665	51.83826	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3102.5	74.42434	74.22838	74.01949	73.79663	73.55852	73.30375	73.03082	72.73809	72.42379	72.08608	71.72303	71.33269	70.91316	70.46262	69.97953	69.46266	68.91131	68.3254	67.70553	67.053	66.36951	65.65671	64.91507	64.14202	63.32846	62.45196	61.46117	60.2323	58.40088	54.04372	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3139	74.44857	74.25495	74.04866	73.8287	73.59383	73.34268	73.07378	72.78554	72.47625	72.14412	71.78726	71.40378	70.99178	70.54949	70.07533	69.56806	69.02687	68.45156	67.84256	67.20097	66.52833	65.82616	65.09505	64.33291	63.53196	62.67277	61.71108	60.54277	58.87854	55.44919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3175.5	74.47246	74.28113	74.07739	73.86026	73.62854	73.3809	73.11593	72.83206	72.52764	72.20092	71.85007	71.47323	71.06855	70.63426	70.16878	69.67082	69.13952	68.57455	67.9762	67.34537	66.68343	65.9918	65.27111	64.5197	63.73091	62.88787	61.9523	60.836	59.30579	56.47055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3212	74.49603	74.30693	74.10568	73.89131	73.66266	73.41845	73.15729	72.87767	72.57798	72.25652	71.91151	71.54111	71.14352	70.71699	70.25994	69.77104	69.24937	68.6945	68.10656	67.4863	66.83491	66.1537	65.44334	64.70251	63.92549	63.09761	62.18568	61.11453	59.69374	57.27035	45.83392	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3248.5	74.51929	74.33237	74.13354	73.92187	73.69622	73.45535	73.1979	72.92241	72.62732	72.31097	71.97162	71.60748	71.21677	70.79777	70.3489	69.86881	69.35652	68.8115	68.23375	67.62386	66.98288	66.31198	65.61184	64.88142	64.11583	63.30229	62.41192	61.38033	60.05029	57.92791	51.48466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3285	74.54224	74.35746	74.161	73.95196	73.72924	73.49161	73.23778	72.96631	72.67569	72.3643	72.03044	71.67238	71.28835	70.87667	70.43575	69.96422	69.46106	68.92564	68.35787	67.75817	67.12742	66.46671	65.77668	65.05655	64.30209	63.50217	62.63161	61.635	60.38124	58.48744	53.89919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3321.5	74.56489	74.3822	74.18806	73.98159	73.76171	73.52726	73.27695	73.00939	72.72312	72.41655	72.08803	71.73587	71.35833	70.95375	70.52055	70.05735	69.56308	69.03704	68.47901	67.8893	67.26864	66.61798	65.93796	65.22797	64.48438	63.69747	62.84524	61.8798	60.69095	58.97586	55.3952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3358	74.58725	74.4066	74.21472	74.01076	73.79367	73.56231	73.31542	73.05168	72.76964	72.46776	72.14443	71.79799	71.42676	71.02907	70.60338	70.14828	69.66266	69.14577	68.59728	68.01736	67.40662	66.76588	66.09576	65.39578	64.66282	63.88839	63.05323	62.11579	60.98276	59.41067	56.46653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3394.5	74.60932	74.43067	74.24101	74.0395	73.82512	73.59677	73.35323	73.0932	72.81527	72.51795	72.19967	71.8588	71.49369	71.10271	70.68431	70.23709	69.7599	69.25192	68.71275	68.14244	67.54145	66.9105	66.25016	65.56006	64.83753	64.07512	63.25594	62.34384	61.25929	59.80383	57.29757	44.56369	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3431	74.63111	74.45442	74.26692	74.06781	73.85609	73.63067	73.3904	73.13398	72.86006	72.56717	72.2538	71.91834	71.55918	71.17471	70.7634	70.32385	69.85487	69.35559	68.82553	68.26462	67.67322	67.05192	66.40125	65.72091	65.0086	64.25781	63.45368	62.56467	61.5226	60.1638	57.97608	51.17791	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3467.5	74.65264	74.47786	74.29248	74.0957	73.88657	73.66403	73.42693	73.17403	72.90401	72.61545	72.30684	71.97665	71.62327	71.24514	70.84072	70.40862	69.94764	69.45685	68.93568	68.384	67.80201	67.19023	66.5491	65.87839	65.17614	64.4366	63.64672	62.77887	61.77435	60.49678	58.55016	53.75717	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3504	74.67389	74.50099	74.31768	74.12319	73.91659	73.69685	73.46285	73.21339	72.94717	72.6628	72.35884	72.03377	71.68602	71.31404	70.91633	70.49149	70.03829	69.55577	69.04331	68.50065	67.92791	67.3255	66.69378	66.0326	65.34022	64.61162	63.83528	62.98698	62.01588	60.80738	59.04817	55.31995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3540.5	74.69489	74.52382	74.34254	74.15029	73.94616	73.72915	73.49818	73.25206	72.98954	72.70927	72.40983	72.08974	71.74746	71.38147	70.99028	70.5725	70.12689	69.65245	69.14848	68.61466	68.05101	67.45781	66.83539	66.1836	65.50095	64.783	64.01959	63.18942	62.24831	61.09908	59.48924	56.43041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3577	74.71563	74.54636	74.36706	74.177	73.97529	73.76095	73.53293	73.29008	73.03117	72.75489	72.45984	72.14459	71.80764	71.44748	71.06264	70.65173	70.21351	69.74694	69.25127	68.72611	68.17136	67.58724	66.97399	66.33148	65.6584	64.95084	64.19982	63.38656	62.47252	61.37466	59.88654	57.28738	41.22203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3613.5	74.73612	74.56862	74.39125	74.20334	74.00399	73.79226	73.56712	73.32745	73.07206	72.79966	72.50891	72.19837	71.8666	71.51211	71.13345	70.72923	70.29821	69.83932	69.35177	68.83507	68.28907	67.71387	67.10966	66.47631	65.81265	65.11525	64.37615	63.57875	62.68928	61.63637	60.24918	57.98427	50.4552	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3650	74.75636	74.59059	74.41513	74.22931	74.03227	73.82309	73.60076	73.3642	73.11224	72.84363	72.55705	72.25111	71.92438	71.57541	71.20276	70.80506	70.38105	69.92965	69.45002	68.94162	68.40419	67.83777	67.24247	66.61815	65.96378	65.27632	64.54871	63.76624	62.89925	61.886	60.58373	58.57196	53.4166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3686.5	74.77637	74.61229	74.43869	74.25492	74.06014	73.85346	73.63388	73.40035	73.15174	72.88682	72.6043	72.30283	71.98101	71.63742	71.27062	70.87927	70.4621	70.01801	69.54612	69.04583	68.51681	67.95902	67.37249	66.75708	66.11187	65.43415	64.71764	63.9493	63.10297	62.12501	60.89507	59.08098	55.13178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3723	74.79615	74.63373	74.46195	74.28019	74.08762	73.88337	73.66648	73.43591	73.19056	72.92924	72.65069	72.35358	72.03654	71.69818	71.33709	70.95192	70.54141	70.10445	69.64012	69.14776	68.62699	68.07767	67.49979	66.89317	66.25699	65.58881	64.88306	64.12815	63.30093	62.3546	61.18693	59.53099	56.32101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3759.5	74.81569	74.6549	74.48491	74.30512	74.11471	73.91284	73.69857	73.4709	73.22874	72.97093	72.69624	72.40338	72.091	71.75773	71.40219	71.02305	70.61904	70.18903	69.73209	69.24749	68.73481	68.19382	67.62444	67.02649	66.3992	65.7404	65.0451	64.30298	63.49353	62.57575	61.46221	59.9353	57.22536	33.27187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3796	74.83501	74.67582	74.50758	74.32971	74.14142	73.94188	73.73018	73.50533	73.26628	73.01189	72.74097	72.45225	72.14442	71.81611	71.46599	71.09272	70.69504	70.27182	69.82208	69.34509	68.84032	68.30751	67.74651	67.1571	66.53857	65.88898	65.20385	64.47397	63.68112	62.78928	61.72319	60.30331	57.95344	49.63434	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3832.5	74.85412	74.69648	74.52997	74.35398	74.16777	73.97051	73.76131	73.53922	73.30321	73.05217	72.78492	72.50024	72.19682	71.87336	71.52851	71.16096	70.76946	70.35286	69.91017	69.4406	68.9436	68.41882	67.86606	67.28507	66.67518	66.03463	65.35941	64.64128	63.86403	62.99587	61.97173	60.64185	58.56287	53.05574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3869	74.873	74.71691	74.55208	74.37794	74.19375	73.99872	73.79198	73.57258	73.33954	73.09176	72.8281	72.54735	72.24826	71.92951	71.5898	71.22783	70.84235	70.43221	69.9964	69.5341	69.0447	68.5278	67.98315	67.41045	66.80908	66.17742	65.51188	64.80507	64.04251	63.19612	62.20932	60.95607	59.08761	54.93029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3905.5	74.89168	74.73709	74.57391	74.40158	74.21939	74.02654	73.82219	73.60544	73.37529	73.1307	72.87054	72.59363	72.29874	71.98459	71.64989	71.29336	70.91375	70.50992	70.08084	69.62565	69.1437	68.63454	68.09785	67.53332	66.94034	66.31743	65.66134	64.96544	64.2168	63.39052	62.43719	61.24987	59.54925	56.19897	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3942	74.91015	74.75704	74.59548	74.42493	74.24468	74.05396	73.85196	73.63779	73.41047	73.16899	72.91225	72.63909	72.3483	72.03864	71.70883	71.3576	70.98372	70.58605	70.16353	69.71529	69.24064	68.73907	68.21022	67.65374	67.06902	66.45471	65.80787	65.12254	64.38712	63.5795	62.65636	61.52631	59.96228	57.15036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3978.5	74.92842	74.77676	74.61679	74.44798	74.26963	74.08101	73.88131	73.66965	73.44511	73.20666	72.95326	72.68376	72.39697	72.09168	71.76664	71.42058	71.0523	70.66063	70.24453	69.8031	69.33559	68.84147	68.32031	67.77175	67.19517	66.58933	65.95156	65.27646	64.55366	63.76344	62.86769	61.78782	60.33685	57.90917	48.73669	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4015	74.94649	74.79626	74.63785	74.47074	74.29426	74.10769	73.91023	73.70104	73.4792	73.24373	72.99358	72.72765	72.44477	72.14375	71.82336	71.48235	71.11952	70.73372	70.32389	69.88911	69.4286	68.94178	68.4282	67.88743	67.31887	66.72136	66.09246	65.42732	64.71658	63.94265	63.0719	62.03635	60.68032	58.53994	52.67565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4051.5	74.96437	74.81553	74.65865	74.49322	74.31857	74.13401	73.93875	73.73197	73.51278	73.28021	73.03324	72.7708	72.49173	72.19488	71.87902	71.54293	71.18543	70.80536	70.40166	69.97338	69.51973	69.04007	68.53392	68.00082	67.44016	66.85086	66.23067	65.5752	64.87603	64.11743	63.26961	62.27348	60.99816	59.07913	54.64178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4088	74.98205	74.83459	74.67921	74.51542	74.34257	74.15997	73.96687	73.76245	73.54584	73.31611	73.07226	72.81321	72.53788	72.24508	71.93365	71.60237	71.25007	70.87559	70.47787	70.05596	69.60902	69.13639	68.63754	68.11198	67.55911	66.97787	66.36623	65.72019	65.03216	64.28802	63.46134	62.50049	61.29431	59.54556	55.41784	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4124.5	74.99955	74.85344	74.69953	74.53735	74.36626	74.18559	73.9946	73.79249	73.57842	73.35146	73.11064	72.85492	72.58322	72.2944	71.98729	71.6607	71.31347	70.94446	70.55259	70.13689	69.69653	69.2308	68.73912	68.22097	67.67576	67.10247	66.49923	65.86238	65.18508	64.45465	63.64754	62.71838	61.57004	59.90545	54.72195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4161	75.01687	74.87208	74.71962	74.55902	74.38965	74.21087	74.02194	73.8221	73.6105	73.38626	73.14841	72.89594	72.62779	72.34285	72.03995	71.71795	71.37567	71.012	70.62585	70.21624	69.78231	69.32333	68.83869	68.32785	67.79017	67.22471	66.62971	66.00185	65.33492	64.61751	63.82854	62.92719	61.8186	60.1306	53.1389	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4197.5	75.034	74.89052	74.73948	74.58042	74.41276	74.23582	74.04892	73.85129	73.64212	73.42053	73.18559	72.9363	72.67161	72.39045	72.09168	71.77415	71.43671	71.07825	70.69768	70.29403	69.86641	69.41405	68.93633	68.43265	67.9024	67.34464	66.75774	66.13866	65.48177	64.77673	64.00433	63.12533	62.03385	60.24737	50.21582	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4234	75.05096	74.90875	74.75911	74.60158	74.43557	74.26045	74.07554	73.88008	73.67328	73.45428	73.22218	72.97599	72.7147	72.43724	72.14249	71.82933	71.49662	71.14325	70.76815	70.37032	69.94886	69.503	69.03206	68.53544	68.01249	67.46231	66.88337	66.27289	65.6257	64.93232	64.17443	63.31096	62.21556	60.28012	43.1738	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4270.5	75.06774	74.9268	74.77852	74.62249	74.45811	74.28477	74.1018	73.90846	73.70399	73.48753	73.25821	73.01506	72.75708	72.48323	72.19241	71.88351	71.55542	71.20703	70.83727	70.44514	70.02973	69.59023	69.12595	68.63626	68.12049	67.57778	67.00667	66.40458	65.76674	65.08412	64.33822	63.48308	62.36635	60.24422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4307	75.08436	74.94465	74.79772	74.64315	74.48037	74.30878	74.12771	73.93646	73.73426	73.52029	73.29369	73.0535	72.79876	72.52844	72.24146	71.93674	71.61316	71.26963	70.90509	70.51854	70.10904	69.67578	69.21804	68.73516	68.22646	67.69109	67.12766	66.53375	65.90482	65.2319	64.49515	63.64148	62.48948	60.14862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4343.5	75.1008	74.96231	74.81671	74.66358	74.50237	74.33249	74.15329	73.96408	73.76411	73.55258	73.32863	73.09135	72.83978	72.5729	72.28968	71.98903	71.66986	71.33109	70.97165	70.59055	70.18684	69.7597	69.30838	68.83219	68.33044	67.80229	67.24639	66.66042	66.03986	65.37537	64.64486	63.78647	62.58799	59.99796	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4380	75.11709	74.97979	74.83549	74.68377	74.5241	74.3559	74.17854	73.99132	73.79354	73.58439	73.36304	73.1286	72.88013	72.61663	72.33708	72.04041	71.72555	71.39142	71.03698	70.66121	70.26318	69.84204	69.397	68.92739	68.43247	67.91141	67.36287	66.78453	66.17174	65.51433	64.78715	63.91861	62.66451	59.79379	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4416.5	75.13321	74.99708	74.85406	74.70374	74.54558	74.37903	74.20346	74.01821	73.82256	73.61575	73.39695	73.16529	72.91984	72.65964	72.38368	72.0909	71.78025	71.45067	71.10111	70.73057	70.33809	69.92282	69.48396	69.0208	68.5326	68.01847	67.4771	66.90604	66.30032	65.64857	64.922	64.03861	62.72125	59.53519	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4453	75.14917	75.0142	74.87244	74.72348	74.56681	74.40187	74.22807	74.04474	73.85119	73.64666	73.43035	73.20141	72.95893	72.70196	72.4295	72.14053	71.83401	71.50887	71.16408	70.79865	70.41161	70.0021	69.5693	69.11246	68.63084	68.1235	67.58906	67.0249	66.4255	65.77798	65.0495	64.14722	62.76002	59.2189	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4489.5	75.16498	75.03115	74.89061	74.743	74.58779	74.42444	74.25237	74.07092	73.87943	73.67714	73.46328	73.237	72.99742	72.7436	72.47458	72.18933	71.88683	71.56603	71.22592	70.86549	70.48378	70.0799	69.65304	69.20241	68.72722	68.2265	67.69874	67.14103	66.54717	65.90249	65.16979	64.24516	62.78228	58.83922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4526	75.18064	75.04792	74.9086	74.7623	74.60853	74.44674	74.27636	74.09677	73.90729	73.70719	73.49572	73.27205	73.03531	72.78459	72.51891	72.2373	71.93874	71.6222	71.28666	70.93112	70.55462	70.15627	69.73522	69.29067	68.82178	68.32748	67.8061	67.25439	66.66526	66.02209	65.28309	64.33313	62.78926	58.38743	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4562.5	75.19614	75.06453	74.9264	74.7814	74.62903	74.46878	74.30006	74.12228	73.93478	73.73684	73.52771	73.30659	73.07263	72.82492	72.56253	72.28449	71.98978	71.67739	71.34632	70.99557	70.62418	70.23123	69.81588	69.37727	68.91451	68.42642	67.91112	67.36491	66.77972	66.13679	65.38964	64.41177	62.78195	57.85083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4599	75.2115	75.08097	74.94402	74.80029	74.64931	74.49055	74.32348	74.14747	73.9619	73.76607	73.55924	73.34062	73.10938	72.86464	72.60546	72.33089	72.03996	71.73164	71.40494	71.05887	70.69248	70.30483	69.89504	69.46223	69.00543	68.52333	68.01378	67.47255	66.89051	66.24665	65.48971	64.48171	62.76116	57.21099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4635.5	75.22671	75.09724	74.96145	74.81897	74.66935	74.51208	74.3466	74.17235	73.98868	73.79491	73.59033	73.37417	73.14559	72.90374	72.64771	72.37655	72.0893	71.78496	71.46254	71.12106	70.75955	70.37707	69.97272	69.54556	69.09454	68.61819	68.11404	67.57729	66.99763	66.35174	65.58356	64.54348	62.72756	56.44066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4672	75.24178	75.11336	74.9787	74.83746	74.68917	74.53335	74.36945	74.19691	74.0151	73.82337	73.621	73.40723	73.18126	72.94224	72.68929	72.42147	72.13782	71.83738	71.51915	71.18215	70.82541	70.44799	70.04895	69.62729	69.18185	68.71099	68.21189	67.6791	67.10109	66.45218	65.67147	64.5976	62.68167	55.49798	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4708.5	75.25671	75.12932	74.99578	74.85575	74.70878	74.55438	74.39203	74.22117	74.04119	73.85145	73.65124	73.43982	73.21641	72.98017	72.73022	72.46567	72.18555	71.88892	71.57478	71.24216	70.8901	70.51761	70.12374	69.70741	69.26736	68.80172	68.30731	67.77797	67.20092	66.54808	65.75371	64.64454	62.62392	54.31505	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4745	75.2715	75.14513	75.01269	74.87385	74.72817	74.57517	74.41435	74.24514	74.06695	73.87916	73.68107	73.47195	73.25104	73.01752	72.77053	72.50917	72.23251	71.9396	71.62946	71.30113	70.95362	70.58595	70.1971	69.78595	69.35107	68.89038	68.40029	67.87391	67.29716	66.63956	65.83055	64.68474	62.55464	52.77201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4781.5	75.28616	75.16079	75.02943	74.89176	74.74735	74.59573	74.4364	74.26881	74.09239	73.9065	73.71049	73.50364	73.28518	73.05433	72.81022	72.55199	72.27871	71.98944	71.68322	71.35907	71.01601	70.65302	70.26906	69.8629	69.43298	68.97696	68.49082	67.96693	67.38986	66.72677	65.90225	64.71859	62.47407	50.62911	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4818	75.30068	75.17629	75.046	74.90949	74.76633	74.61606	74.45819	74.2922	74.11751	73.9335	73.73953	73.53489	73.31884	73.09059	72.84931	72.59413	72.32416	72.03845	71.73606	71.41599	71.07727	70.71885	70.33962	69.93827	69.51309	69.06147	68.57892	68.05704	67.4791	66.80984	65.96907	64.74647	62.38236	47.29344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4854.5	75.31507	75.19166	75.06241	74.92703	74.7851	74.63616	74.47974	74.31531	74.14231	73.96015	73.76818	73.56571	73.35201	73.12632	72.88781	72.63563	72.36889	72.08666	71.788	71.47192	71.13742	70.78343	70.40879	70.01207	69.59141	69.14389	68.66458	68.14429	67.56494	66.88892	66.03124	64.7687	62.27963	40.45404	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4891	75.32933	75.20687	75.07866	74.9444	74.80367	74.65605	74.50104	74.33815	74.16682	73.98646	73.79645	73.59611	73.38472	73.16153	72.92573	72.67648	72.4129	72.13408	71.83907	71.52688	71.19648	70.8468	70.47658	70.08431	69.66793	69.22425	68.74783	68.2287	67.64746	66.96416	66.089	64.78562	62.16587	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4927.5	75.34347	75.22195	75.09476	74.96159	74.82205	74.67571	74.5221	74.36072	74.19102	74.01244	73.82435	73.6261	73.41698	73.19624	72.96309	72.71671	72.45622	72.18072	71.88926	71.58086	71.25446	70.90894	70.54299	70.15499	69.74267	69.30255	68.82869	68.31032	67.72676	67.03571	66.14257	64.7975	62.04106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4964	75.35748	75.23689	75.11069	74.97861	74.84024	74.69517	74.54292	74.38302	74.21493	74.03809	73.8519	73.65569	73.44878	73.23044	72.9999	72.75632	72.49885	72.2266	71.93861	71.63389	71.31137	70.96989	70.60805	70.22412	69.81564	69.37879	68.90717	68.38921	67.80292	67.10371	66.19217	64.80463	61.90508	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000.5	75.37136	75.25169	75.12648	74.99546	74.85825	74.71441	74.56351	74.40507	74.23856	74.06343	73.87908	73.68488	73.48015	73.26416	73.03616	72.79532	72.54081	72.27172	71.98711	71.68597	71.36722	71.02963	70.67175	70.2917	69.88683	69.45301	68.98332	68.46542	67.87604	67.16831	66.23801	64.80725	61.75774	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5037	75.38513	75.26635	75.14212	75.01215	74.87606	74.73345	74.58388	74.42686	74.26191	74.08845	73.90592	73.71369	73.51109	73.2974	73.07188	72.83373	72.5821	72.3161	72.03478	71.73713	71.42202	71.08819	70.73411	70.35776	69.95628	69.52522	69.05717	68.53901	67.94621	67.22964	66.28027	64.80561	61.5988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5073.5	75.39877	75.28088	75.15761	75.02867	74.8937	74.75229	74.60402	74.44841	74.28497	74.11317	73.93242	73.74212	73.5416	73.33017	73.10708	72.87155	72.62274	72.35975	72.08163	71.78736	71.47578	71.14558	70.79513	70.42229	70.02398	69.59544	69.12876	68.61005	68.01353	67.28786	66.31914	64.79991	61.42792	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5110	75.4123	75.29529	75.17295	75.04503	74.91115	74.77093	74.62394	74.46971	74.30777	74.13758	73.95858	73.77017	73.5717	73.36248	73.14177	72.9088	72.66273	72.40267	72.12766	71.83667	71.5285	71.20179	70.85482	70.48531	70.08997	69.66371	69.19813	68.67859	68.07809	67.34309	66.35481	64.79038	61.24471	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5146.5	75.42571	75.30956	75.18815	75.06123	74.92843	74.78938	74.64364	74.49077	74.3303	74.1617	73.98442	73.79786	73.60139	73.39432	73.17594	72.94547	72.70208	72.44487	72.1729	71.88508	71.5802	71.25685	70.9132	70.54684	70.15426	69.73005	69.26532	68.74471	68.14	67.39546	66.38743	64.77719	61.04866	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5183	75.43901	75.3237	75.20321	75.07727	74.94554	74.80763	74.66313	74.5116	74.35257	74.18552	74.00992	73.82518	73.63067	73.42572	73.20961	72.98158	72.7408	72.48637	72.21733	71.93258	71.63089	71.31075	70.97027	70.60688	70.21686	69.79449	69.3304	68.80848	68.19935	67.44511	66.41718	64.76053	60.83917	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5219.5	75.45219	75.33772	75.21813	75.09317	74.96248	74.82569	74.68241	74.53219	74.37457	74.20906	74.03511	73.85215	73.65955	73.45667	73.24278	73.01713	72.77889	72.52717	72.26097	71.9792	71.68057	71.36351	71.02605	70.66546	70.27782	69.85707	69.39339	68.86996	68.25623	67.49215	66.44419	64.74058	60.61555	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5256	75.46526	75.35162	75.23291	75.1089	74.97924	74.84357	74.70148	74.55255	74.39632	74.23231	74.05998	73.87876	73.68804	73.48718	73.27546	73.05213	72.81637	72.56727	72.30383	72.02493	71.72925	71.41515	71.08055	70.7226	70.33714	69.91783	69.45436	68.92923	68.31074	67.53672	66.46863	64.71748	60.37695	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5292.5	75.47822	75.36539	75.24756	75.12449	74.99584	74.86126	74.72034	74.57268	74.41782	74.25528	74.08453	73.90502	73.71615	73.51726	73.30766	73.08659	72.85323	72.60668	72.34591	72.06979	71.77694	71.46567	71.13379	70.77831	70.39487	69.9768	69.51337	68.98636	68.36297	67.57891	66.49061	64.6914	60.1224	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5329	75.49107	75.37904	75.26207	75.13993	75.01228	74.87877	74.73901	74.59259	74.43907	74.27797	74.10878	73.93094	73.74386	73.5469	73.33937	73.12051	72.88949	72.6454	72.38723	72.11378	71.82365	71.51508	71.18578	70.83262	70.45102	70.03402	69.57045	69.04142	68.41302	67.61884	66.51029	64.66246	59.85075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5365.5	75.50381	75.39257	75.27645	75.15522	75.02855	74.8961	74.75747	74.61228	74.46007	74.30039	74.13272	73.95652	73.7712	73.57613	73.3706	73.15389	72.92514	72.68346	72.42778	72.15691	71.86939	71.56339	71.23654	70.88554	70.50563	70.08954	69.62567	69.09448	68.46096	67.65663	66.52777	64.63082	59.56065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5402	75.51644	75.40598	75.2907	75.17037	75.04467	74.91324	74.77574	74.63174	74.48083	74.32253	74.15636	73.98176	73.79816	73.60492	73.40137	73.18674	72.9602	72.72084	72.46758	72.19919	71.91417	71.61063	71.28609	70.93711	70.55873	70.1434	69.67908	69.1456	68.50688	67.69236	66.54319	64.59658	59.25051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5438.5	75.52896	75.41927	75.30482	75.18537	75.06062	74.93022	74.79381	74.65099	74.50134	74.34441	74.17969	74.00666	73.82474	73.6333	73.43166	73.21906	72.99467	72.75755	72.50662	72.24062	71.958	71.6568	71.33444	70.98735	70.61036	70.19563	69.73074	69.19486	68.55087	67.72614	66.55664	64.55987	58.91845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5475	75.54138	75.43245	75.3188	75.20023	75.07641	74.94701	74.81168	74.67002	74.52162	74.36602	74.20273	74.03124	73.85095	73.66126	73.46148	73.25086	73.02855	72.7936	72.54493	72.28122	72.00089	71.70191	71.38161	71.03627	70.66053	70.24629	69.78069	69.24232	68.593	67.75806	66.56824	64.5208	58.56223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5511.5	75.55369	75.4455	75.33266	75.21494	75.09204	74.96363	74.82936	74.68884	74.54165	74.38736	74.22547	74.05548	73.8768	73.68882	73.49085	73.28214	73.06185	72.829	72.5825	72.32099	72.04286	71.74599	71.42763	71.08391	70.7093	70.29541	69.829	69.28805	68.63336	67.78821	66.57809	64.47948	58.17919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5548	75.56589	75.45844	75.34639	75.22952	75.10752	74.98008	74.84685	74.70744	74.56145	74.40844	74.24792	74.07939	73.90228	73.71596	73.51975	73.31291	73.09457	72.86376	72.61934	72.35995	72.08391	71.78905	71.47251	71.1303	70.75669	70.34303	69.87571	69.33211	68.67202	67.81668	66.58629	64.43601	57.7661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5584.5	75.57799	75.47127	75.35999	75.24395	75.12284	74.99636	74.86414	74.72583	74.58101	74.42925	74.27008	74.10298	73.92739	73.74269	73.5482	73.34316	73.12672	72.89787	72.65546	72.39811	72.12406	71.83111	71.51627	71.17546	70.80273	70.3892	69.92088	69.37456	68.70905	67.84355	66.59293	64.39049	57.31907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5621	75.58998	75.48397	75.37346	75.25824	75.13801	75.01246	74.88125	74.74401	74.60034	74.44981	74.29195	74.12624	73.95214	73.76902	73.5762	73.37291	73.1583	72.93134	72.69087	72.43546	72.16332	71.87217	71.55895	71.21941	70.84747	70.43397	69.96456	69.41547	68.74452	67.86889	66.59809	64.34299	56.83327	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5657.5	75.60186	75.49656	75.3868	75.27238	75.15302	75.02839	74.89817	74.76198	74.61943	74.4701	74.31353	74.14919	73.97653	73.79495	73.60375	73.40216	73.18932	72.96419	72.72558	72.47203	72.20171	71.91227	71.60055	71.26219	70.89093	70.47737	70.00679	69.45489	68.77849	67.89278	66.60185	64.29362	56.30273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5694	75.61364	75.50903	75.40002	75.28639	75.16787	75.04415	74.91489	74.77974	74.6383	74.49014	74.33482	74.17181	74.00057	73.82048	73.63085	73.43091	73.21978	72.99641	72.7596	72.50783	72.23924	71.95141	71.6411	71.30383	70.93315	70.51944	70.04764	69.49288	68.81104	67.9153	66.60431	64.24244	55.71986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5730.5	75.62531	75.52139	75.4131	75.30026	75.18257	75.05974	74.93143	74.79729	74.65692	74.50992	74.35582	74.19411	74.02425	73.84561	73.65751	73.45917	73.24969	73.02802	72.79292	72.54286	72.27592	71.98962	71.68063	71.34434	70.97416	70.56023	70.08714	69.52949	68.84222	67.9365	66.60552	64.18954	55.07494	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5767	75.63687	75.53362	75.42606	75.31398	75.19712	75.07516	74.94778	74.81463	74.67532	74.52944	74.37654	74.2161	74.04757	73.87035	73.68373	73.48693	73.27905	73.05902	72.82557	72.57715	72.31177	72.02691	71.71915	71.38377	71.01401	70.59977	70.12534	69.56478	68.87209	67.95647	66.60557	64.135	54.35515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5803.5	75.64833	75.54574	75.43889	75.32757	75.2115	75.0904	74.96394	74.83176	74.69349	74.54871	74.39697	74.23777	74.07055	73.8947	73.70952	73.51421	73.30788	73.08942	72.85756	72.61069	72.34681	72.06331	71.75669	71.42213	71.05271	70.63811	70.16229	69.5988	68.90071	67.97524	66.60452	64.07887	53.54324	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5840	75.65967	75.55775	75.45159	75.34101	75.22574	75.10548	74.97991	74.84868	74.71143	74.56772	74.41712	74.25912	74.09318	73.91866	73.73487	73.54101	73.33617	73.11923	72.88888	72.6435	72.38104	72.09882	71.79328	71.45946	71.09031	70.67529	70.19803	69.6316	68.92814	67.9929	66.60243	64.02123	52.61521	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5876.5	75.67091	75.56963	75.46416	75.35431	75.23982	75.12038	74.99569	74.8654	74.72913	74.58648	74.43699	74.28017	74.11545	73.94223	73.75979	73.56734	73.36393	73.14845	72.91956	72.6756	72.41448	72.13348	71.82893	71.49578	71.12683	70.71133	70.23261	69.66323	68.95442	68.00949	66.59936	63.96215	51.53632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

VOID RATIO e

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.129	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
36.5	1.676305	3.102302	4.961623	6.352263	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
73	1.500453	2.120961	3.194036	4.221152	5.062264	5.779045	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
109.5	1.409806	1.790031	2.463589	3.25986	3.966644	4.571153	5.115712	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
146	1.350391	1.621048	2.082654	2.697052	3.305879	3.841996	4.313543	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
182.5	1.306914	1.515867	1.85592	2.333084	2.855354	3.339403	3.769733	4.15844	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
219	1.272994	1.442638	1.707074	2.084326	2.528821	2.966597	3.364817	3.723388	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
255.5	1.245394	1.387902	1.601944	1.906842	2.283927	2.677846	3.048049	3.384729	3.737208	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
292	1.222256	1.344947	1.523503	1.775352	2.09597	2.448232	2.792045	3.109914	3.403527	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
328.5	1.202423	1.310028	1.46248	1.674654	1.948937	2.262514	2.580606	2.88117	3.158789	3.913	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
365	1.185127	1.280876	1.413441	1.595292	1.831883	2.110454	2.403397	2.687272	2.952295	3.228123	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
401.5	1.169835	1.256026	1.373006	1.531188	1.737133	1.984693	2.25336	2.520747	2.774115	3.014846	3.75452	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
438	1.156161	1.23449	1.338965	1.478312	1.659227	1.879715	2.125372	2.37638	2.618429	2.846842	3.105653	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
474.5	1.14382	1.215569	1.309815	1.433908	1.594233	1.791296	2.015527	2.250364	2.48117	2.700593	2.915689	3.906112	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
511	1.132592	1.198757	1.284495	1.396043	1.539285	1.716165	1.920742	2.1398	2.359348	2.570513	2.772464	3.05159	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
547.5	1.122309	1.183676	1.262237	1.363324	1.492265	1.651772	1.838528	2.042397	2.250685	2.453761	2.647847	2.854157	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
584	1.112836	1.170037	1.242471	1.334726	1.451587	1.596118	1.766849	1.956288	2.153388	2.348378	2.535917	2.721509	3.155269	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
620.5	1.104063	1.157614	1.224761	1.309479	1.416047	1.547634	1.70403	1.879917	2.066008	2.252867	2.434245	2.610251	2.839477	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
657	1.095902	1.14623	1.208771	1.286994	1.38472	1.505077	1.64869	1.811969	1.987337	2.166036	2.341346	2.510965	2.693883	3.587729	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
693.5	1.08828	1.13574	1.194238	1.266815	1.356886	1.467455	1.599687	1.751323	1.916353	2.086907	2.25614	2.420455	2.586296	2.874625	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
730	1.081135	1.126029	1.180949	1.24858	1.331977	1.433977	1.556074	1.697019	1.852173	2.014657	2.177773	2.337178	2.494312	2.689881	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
766.5	1.074416	1.117	1.168735	1.232001	1.309539	1.404002	1.517067	1.648233	1.794028	1.948581	2.105546	2.260171	2.411533	2.576398	3.138195	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
803	1.06808	1.108573	1.157454	1.216844	1.28921	1.377011	1.482012	1.604259	1.741243	1.888063	2.038867	2.188739	2.335488	2.486355	2.750668	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
839.5	1.062088	1.10068	1.146991	1.202921	1.270691	1.352578	1.450364	1.564488	1.693222	1.832561	1.977229	2.122333	2.264952	2.407878	2.595565	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
876	1.056408	1.093264	1.13725	1.190072	1.253739	1.330351	1.421668	1.528399	1.649441	1.78159	1.920186	2.060498	2.199189	2.336714	2.493777	3.012699	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
912.5	1.051011	1.086277	1.128149	1.178167	1.238153	1.310041	1.39554	1.495542	1.609436	1.734716	1.867343	2.002849	2.137684	2.270971	2.412922	2.673737	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
949	1.045873	1.079677	1.119619	1.167097	1.223764	1.291404	1.371656	1.465531	1.572799	1.691551	1.818343	1.949048	2.080045	2.209655	2.342869	2.527954	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
985.5	1.040973	1.073427	1.111602	1.156767	1.21043	1.274236	1.349744	1.438034	1.539168	1.651741	1.772867	1.898795	2.025951	2.152159	2.279575	2.432225	2.891867	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1022	1.036291	1.067495	1.104046	1.147098	1.198032	1.258363	1.329568	1.412762	1.508225	1.614972	1.730621	1.851823	1.975129	2.09807	2.221149	2.357123	2.608303	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1058.5	1.03181	1.061855	1.096906	1.138023	1.186468	1.243639	1.310932	1.389467	1.479689	1.580956	1.691339	1.807888	1.927341	2.047075	2.166584	2.292799	2.476557	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1095	1.027515	1.056481	1.090146	1.129482	1.175649	1.229938	1.293663	1.367933	1.453313	1.549437	1.654775	1.766767	1.882376	1.998929	2.115281	2.235148	2.38721	3.108175	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1131.5	1.023393	1.051351	1.083732	1.121425	1.1655	1.217152	1.277614	1.347974	1.428877	1.520183	1.620707	1.728254	1.840042	1.953422	2.066848	2.182146	2.316519	2.654194	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1168	1.01943	1.046448	1.077633	1.113807	1.155956	1.205187	1.262659	1.329426	1.406189	1.492986	1.588928	1.69216	1.800166	1.910377	2.021004	2.132697	2.256127	2.480317	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1204.5	1.015618	1.041753	1.071824	1.106589	1.146959	1.193963	1.248686	1.312146	1.385078	1.467659	1.559252	1.65831	1.762587	1.869636	1.977532	2.086165	2.202246	2.375062	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1241	1.011944	1.037252	1.066281	1.099736	1.13846	1.183408	1.235599	1.296009	1.365392	1.444033	1.531505	1.626541	1.727156	1.831055	1.936258	2.042148	2.152919	2.298035	2.839396	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1277.5	1.008402	1.03293	1.060985	1.093219	1.130414	1.173461	1.223314	1.280907	1.346998	1.421958	1.505532	1.596701	1.693734	1.794505	1.897036	2.00037	2.107044	2.235551	2.535132	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1314	1.004981	1.028776	1.055916	1.087009	1.122784	1.164067	1.211756	1.266741	1.329778	1.401296	1.481189	1.568652	1.662192	1.759865	1.859737	1.960629	2.063953	2.181686	2.391642	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1350.5	1.001676	1.024777	1.051058	1.081084	1.115533	1.155178	1.20086	1.253427	1.313624	1.381926	1.458344	1.542263	1.632409	1.727024	1.82425	1.922768	2.023212	2.133483	2.298896	3.369132	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1387	0.998478	1.020925	1.046397	1.075422	1.108633	1.146752	1.190569	1.24089	1.298444	1.363737	1.436878	1.517413	1.604272	1.695877	1.790471	1.886659	1.984527	2.08932	2.229237	2.647141	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1423.5	0.995383	1.017209	1.041918	1.070003	1.102055	1.13875	1.18083	1.229061	1.284152	1.346631	1.416682	1.493993	1.577674	1.666327	1.758308	1.852193	1.947683	2.048236	2.172184	2.435275	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1460	0.992383	1.013622	1.03761	1.06481	1.095775	1.131138	1.171598	1.217881	1.270675	1.330518	1.397657	1.471898	1.552515	1.638281	1.727674	1.819276	1.912521	2.009629	2.122903	2.318707	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1496.5	0.989475	1.010155	1.033462	1.059827	1.089771	1.123887	1.162833	1.207297	1.257944	1.315318	1.379713	1.451035	1.528703	1.611652	1.698487	1.787825	1.878912	1.973103	2.07886	2.237696	3.042055	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1533	0.986652	1.006802	1.029462	1.05504	1.084023	1.11697	1.154497	1.197261	1.2459	1.300958	1.362766	1.431314	1.50615	1.586358	1.670672	1.757762	1.846755	1.938385	2.038566	2.174675	2.564701	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1569.5	0.983911	1.003556	1.025603	1.050437	1.078514	1.110361	1.146559	1.187729	1.234488	1.287372	1.346741	1.412656	1.484776	1.562322	1.644157	1.729018	1.81596	1.905275	2.001117	2.12221	2.38064	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1606	0.981247	1.000411	1.021876	1.046005	1.073227	1.104038	1.138988	1.178664	1.223659	1.274501	1.33157	1.394985	1.464502	1.53947	1.618873	1.701527	1.786452	1.873622	1.965944	2.076558	2.271438	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1642.5	0.978657	0.997361	1.018274	1.041733	1.068148	1.097983	1.131758	1.170031	1.213369	1.262291	1.31719	1.378232	1.44526	1.517733	1.594757	1.67523	1.758165	1.843308	1.932666	2.035631	2.194163	2.896889	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1679	0.976136	0.994402	1.014788	1.037613	1.063263	1.092176	1.124844	1.161797	1.203577	1.250692	1.303543	1.362334	1.426982	1.497047	1.571746	1.650067	1.731037	1.814239	1.901019	1.998177	2.133794	2.503961	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1715.5	0.973682	0.991529	1.011412	1.033635	1.058559	1.086601	1.118226	1.153935	1.194249	1.239661	1.290578	1.347233	1.409606	1.47735	1.549784	1.625986	1.705012	1.786337	1.870814	1.963401	2.083584	2.335503	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1752	0.971292	0.988738	1.008142	1.02979	1.054027	1.081244	1.111882	1.146419	1.185351	1.229158	1.278246	1.332875	1.393076	1.458583	1.528814	1.602933	1.680039	1.759535	1.841905	1.930776	2.040031	2.232257	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1788.5	0.968962	0.986024	1.00497	1.026072	1.049654	1.07609	1.105795	1.139224	1.176852	1.219144	1.266503	1.319209	1.377338	1.440694	1.508784	1.58086	1.65607	1.733775	1.814183	1.89994	2.001132	2.158235	2.762112	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1825	0.966689	0.983383	1.001892	1.022472	1.045433	1.071127	1.099949	1.132331	1.168727	1.209586	1.25531	1.306191	1.362341	1.42363	1.489644	1.55972	1.63306	1.709005	1.787559	1.870635	1.965666	2.100148	2.445366	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1861.5	0.964472	0.980813	0.998903	1.018986	1.041354	1.066343	1.094328	1.125718	1.160949	1.200455	1.24463	1.293777	1.34804	1.407343	1.471348	1.539467	1.610965	1.685178	1.761961	1.842671	1.932843	2.051864	2.300462	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1898	0.962308	0.97831	0.995998	1.015606	1.03741	1.061729	1.088918	1.119369	1.153497	1.191721	1.234428	1.281928	1.334392	1.391789	1.45385	1.52006	1.589745	1.662252	1.737327	1.815905	1.902138	2.010263	2.207543	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1934.5	0.960195	0.975871	0.993174	1.012327	1.033592	1.057273	1.083707	1.113266	1.146349	1.183358	1.224674	1.27061	1.321356	1.376926	1.437107	1.501457	1.569361	1.640188	1.713605	1.790228	1.873196	1.97334	2.138071	3.314098	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
1971	0.95813	0.973492	0.990427	1.009144	1.029895	1.052967	1.078682	1.107395	1.139487	1.175344	1.215339	1.259787	1.308895	1.362712	1.42108	1.48362	1.549776	1.618947	1.690748	1.765552	1.845752	1.939782	2.082226	2.611819	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2007.5	0.956112	0.971172	0.987753	1.006053	1.026312	1.048803	1.073834	1.101743	1.132892	1.167656	1.206398	1.24943	1.296976	1.349112	1.40573	1.46651	1.530955	1.598496	1.668717	1.741809	1.819606	1.908774	2.035187	2.379538	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2044	0.954138	0.968908	0.985148	1.003048	1.022836	1.044774	1.069152	1.096295	1.126549	1.160275	1.197824	1.23951	1.285564	1.336091	1.391022	1.450093	1.512863	1.5788	1.647474	1.718938	1.794602	1.879786	1.994235	2.248915	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2080.5	0.952207	0.966698	0.98261	1.000126	1.019464	1.040871	1.064627	1.09104	1.120443	1.153181	1.189597	1.230001	1.274631	1.323615	1.376921	1.434335	1.495468	1.559829	1.626984	1.696888	1.77062	1.852456	1.957706	2.16005	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2117	0.950318	0.964538	0.980136	0.997283	1.016188	1.037089	1.060251	1.085968	1.114559	1.146358	1.181695	1.220877	1.264149	1.311655	1.363396	1.419203	1.478739	1.541553	1.607217	1.675615	1.747567	1.826527	1.924525	2.093053	3.218401	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2153.5	0.948468	0.962428	0.977722	0.994515	1.013006	1.033421	1.056015	1.081068	1.108887	1.13979	1.1741	1.212118	1.254092	1.300181	1.350416	1.404668	1.462647	1.523942	1.588142	1.65508	1.72537	1.801811	1.893961	2.039156	2.565044	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2190	0.946656	0.960365	0.975366	0.991818	1.009911	1.029862	1.051912	1.076332	1.103412	1.133462	1.166793	1.203701	1.244435	1.289167	1.337953	1.3907	1.447162	1.50697	1.569732	1.635246	1.703967	1.778165	1.865504	1.993823	2.339489	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2226.5	0.944881	0.958348	0.973067	0.98919	1.006901	1.026406	1.047936	1.071749	1.098126	1.127362	1.159759	1.195607	1.235156	1.278588	1.325979	1.377271	1.432257	1.49061	1.55196	1.616084	1.683308	1.755479	1.838786	1.95445	2.211396	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999

2263	0.943142	0.956373	0.97082	0.986628	1.003971	1.023048	1.04408	1.067314	1.093017	1.121476	1.152982	1.187818	1.226234	1.268419	1.31447	1.364355	1.417907	1.474836	1.534799	1.597563	1.663351	1.733664	1.813535	1.919428	2.124012	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2299.5	0.941437	0.954441	0.968626	0.984129	1.001118	1.019784	1.040338	1.063016	1.088077	1.115793	1.146447	1.180316	1.217649	1.25864	1.303401	1.351927	1.404086	1.459625	1.518227	1.579657	1.644059	1.71265	1.789545	1.887707	2.058153	3.021416	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2336	0.939765	0.95255	0.96648	0.981689	0.998339	1.016609	1.036705	1.058851	1.083295	1.110302	1.140143	1.173088	1.209383	1.249229	1.29275	1.339964	1.390771	1.444952	1.502221	1.562342	1.6254	1.692379	1.766659	1.858571	2.005276	2.499948	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2372.5	0.938125	0.950697	0.964382	0.979308	0.995629	1.01352	1.033175	1.054811	1.078666	1.104993	1.134056	1.166117	1.20142	1.240168	1.282495	1.328443	1.377938	1.430795	1.486756	1.545594	1.607343	1.672802	1.744753	1.831516	1.960929	2.296523	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2409	0.936515	0.948881	0.962329	0.976982	0.992987	1.010512	1.029744	1.05089	1.07418	1.099856	1.128174	1.15939	1.193742	1.231437	1.272618	1.317343	1.365566	1.417133	1.471814	1.529392	1.589865	1.653876	1.723728	1.806175	1.922598	2.17722	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2445.5	0.934936	0.947102	0.96032	0.974708	0.990409	1.007582	1.026407	1.047083	1.069831	1.094884	1.122489	1.152894	1.186336	1.22302	1.263098	1.306644	1.353635	1.403945	1.457372	1.513713	1.57294	1.635568	1.703504	1.782284	1.888679	2.093881	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2482	0.933385	0.945358	0.958354	0.972486	0.987892	1.004726	1.023159	1.043385	1.065612	1.090067	1.116989	1.146618	1.179187	1.214901	1.253918	1.296326	1.342124	1.391211	1.443412	1.49854	1.556546	1.617844	1.684017	1.759637	1.858073	2.030248	2.978753	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2518.5	0.931862	0.943647	0.956428	0.970313	0.985435	1.001942	1.019998	1.039789	1.061517	1.085399	1.111665	1.14055	1.172282	1.207065	1.245062	1.286373	1.331014	1.378911	1.429914	1.483852	1.540664	1.600677	1.665213	1.738072	1.830046	1.978808	2.481633	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2555	0.930366	0.941969	0.954541	0.968187	0.983035	0.999225	1.016919	1.036292	1.057539	1.080871	1.106509	1.134681	1.165609	1.199497	1.236513	1.276765	1.320288	1.367028	1.416861	1.469632	1.525273	1.584043	1.647046	1.717459	1.804085	1.935527	2.279182	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2591.5	0.928896	0.940322	0.952692	0.966107	0.980689	0.996575	1.013918	1.032889	1.053675	1.076478	1.101512	1.128999	1.159156	1.192186	1.228257	1.267488	1.309928	1.355545	1.404235	1.455862	1.510356	1.56792	1.629477	1.697698	1.779823	1.898028	2.158548	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2628	0.927451	0.938705	0.950879	0.96407	0.978396	0.993987	1.010993	1.029577	1.049918	1.072213	1.096667	1.123497	1.152913	1.185117	1.22028	1.258526	1.299918	1.344443	1.392019	1.442527	1.495895	1.552285	1.612471	1.678704	1.756986	1.864804	2.074481	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2664.5	0.926031	0.937118	0.949102	0.962076	0.976153	0.99146	1.00814	1.02635	1.046264	1.06807	1.091967	1.118165	1.14687	1.17828	1.212568	1.249864	1.290243	1.333708	1.380197	1.429609	1.481874	1.53712	1.595997	1.660411	1.735367	1.834853	2.010504	2.942498	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2701	0.924635	0.93556	0.947359	0.960122	0.973958	0.988991	1.005356	1.023206	1.042708	1.064043	1.087405	1.112995	1.141017	1.171664	1.205109	1.241489	1.280887	1.323323	1.368754	1.417093	1.468278	1.522407	1.58003	1.642763	1.714806	1.807482	1.958964	2.460215	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2737.5	0.923262	0.934029	0.945648	0.958207	0.971811	0.986578	1.002639	1.020141	1.039246	1.060128	1.082975	1.107981	1.135345	1.165258	1.197892	1.233388	1.271838	1.313275	1.357674	1.404965	1.45509	1.508129	1.564544	1.625713	1.695176	1.782193	1.915755	2.260264	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2774	0.921911	0.932525	0.94397	0.956331	0.969709	0.984218	0.999985	1.017153	1.035874	1.05632	1.07867	1.103115	1.129846	1.159052	1.190905	1.225547	1.26308	1.30355	1.346944	1.39321	1.442298	1.494271	1.54952	1.609222	1.676374	1.758619	1.878451	2.140425	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2810.5	0.920582	0.931046	0.942322	0.95449	0.96765	0.98191	0.997393	1.014236	1.032589	1.052614	1.074486	1.098389	1.124512	1.153037	1.184137	1.217957	1.254603	1.294133	1.33655	1.381814	1.429886	1.480816	1.534937	1.593255	1.65832	1.736487	1.845518	2.056722	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2847	0.919274	0.929593	0.940704	0.952686	0.965633	0.979651	0.99486	1.01139	1.029386	1.049005	1.070417	1.093799	1.119335	1.147205	1.177579	1.210604	1.246393	1.285012	1.326478	1.370765	1.417842	1.467752	1.520777	1.577783	1.640945	1.715584	1.815934	1.992992	2.870636	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2883.5	0.917987	0.928164	0.939115	0.950915	0.963656	0.977441	0.992383	1.008611	1.026262	1.04549	1.066457	1.089338	1.114308	1.141547	1.171222	1.20348	1.238439	1.276175	1.316716	1.360049	1.406153	1.455063	1.507025	1.56278	1.624193	1.695746	1.788986	1.941685	2.429815	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2920	0.916719	0.926759	0.937554	0.949177	0.961719	0.975277	0.989962	1.005896	1.023214	1.042064	1.062603	1.085	1.109426	1.136056	1.165056	1.196574	1.230731	1.267611	1.307252	1.349655	1.394805	1.442738	1.493664	1.548222	1.608016	1.676841	1.764166	1.898753	2.241366	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2956.5	0.915471	0.925376	0.936019	0.947472	0.959819	0.973157	0.987592	1.003243	1.02024	1.038725	1.05885	1.08078	1.104681	1.130724	1.159073	1.189876	1.223258	1.259307	1.298074	1.339569	1.383788	1.430764	1.48068	1.53409	1.592374	1.658764	1.741101	1.861872	2.125913	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
2993	0.914242	0.924016	0.934512	0.945797	0.957956	0.97108	0.985274	1.00065	1.017336	1.035468	1.055194	1.076673	1.100068	1.125545	1.153266	1.183378	1.216009	1.251254	1.289171	1.329782	1.37309	1.419129	1.46806	1.520363	1.577233	1.641432	1.719518	1.829439	2.044028	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3029.5	0.913031	0.922677	0.933029	0.944153	0.956128	0.969045	0.983004	0.998115	1.014499	1.03229	1.051631	1.072675	1.095581	1.120512	1.147626	1.177071	1.208976	1.243442	1.280533	1.320281	1.362699	1.407821	1.455791	1.507026	1.562562	1.624775	1.699196	1.800371	1.981148	2.974094	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3066	0.911838	0.92136	0.931572	0.942537	0.954335	0.967051	0.980782	0.995635	1.011728	1.029189	1.048157	1.068781	1.091215	1.115619	1.142147	1.170947	1.20215	1.23586	1.272148	1.311056	1.352605	1.39683	1.44386	1.494062	1.548337	1.608735	1.679959	1.773941	1.930286	2.462054	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3102.5	0.910663	0.920063	0.930138	0.94095	0.952574	0.965095	0.978605	0.993208	1.009019	1.026161	1.044769	1.064987	1.086965	1.110859	1.136822	1.164999	1.195522	1.228499	1.264008	1.302098	1.342797	1.386145	1.432257	1.481457	1.534532	1.593261	1.661666	1.749633	1.887603	2.253437	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3139	0.909504	0.918786	0.928728	0.93939	0.950845	0.963176	0.976472	0.990833	1.00637	1.023203	1.041463	1.061288	1.082826	1.106228	1.131644	1.159219	1.189085	1.221351	1.256103	1.293396	1.333266	1.375755	1.42097	1.469198	1.521129	1.578312	1.644204	1.727071	1.850791	2.12915	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3175.5	0.908362	0.917528	0.92734	0.937856	0.949148	0.961294	0.974381	0.988508	1.00378	1.020313	1.038236	1.057682	1.078794	1.101721	1.126609	1.153601	1.182829	1.214407	1.248423	1.28494	1.324001	1.365651	1.409989	1.457272	1.508108	1.563849	1.627484	1.705973	1.818366	2.042712	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3212	0.907237	0.916289	0.925974	0.936349	0.947481	0.959447	0.972332	0.98623	1.001245	1.017489	1.035085	1.054164	1.074865	1.097331	1.121708	1.148137	1.176749	1.20766	1.240961	1.276723	1.314994	1.355823	1.399304	1.445668	1.495451	1.549842	1.611431	1.686121	1.789327	1.977176	3.131744	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3248.5	0.906126	0.915068	0.92463	0.934866	0.945842	0.957634	0.970322	0.983999	0.998764	1.014727	1.032007	1.050731	1.071034	1.093056	1.116939	1.142822	1.170837	1.201101	1.233709	1.268735	1.306235	1.346261	1.388905	1.434374	1.483144	1.536263	1.595984	1.667344	1.762968	1.924651	2.497165	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3285	0.905031	0.913866	0.923307	0.933407	0.944232	0.955854	0.968351	0.981813	0.996336	1.012027	1.029	1.04738	1.067297	1.088889	1.112294	1.13765	1.165087	1.194723	1.226657	1.260968	1.297716	1.336959	1.378783	1.423379	1.471172	1.523086	1.581091	1.649505	1.73878	1.880887	2.266586	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3321.5	0.903952	0.91268	0.922004	0.931972	0.94265	0.954106	0.966417	0.97967	0.993958	1.009384	1.026061	1.044107	1.063652	1.084827	1.10777	1.132615	1.159492	1.188519	1.219799	1.253413	1.289429	1.327905	1.368929	1.412674	1.459522	1.510291	1.566708	1.632496	1.716384	1.843364	2.133808	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3358	0.902886	0.911512	0.92072	0.93056	0.941094	0.952388	0.964519	0.977569	0.991629	1.006799	1.023187	1.040911	1.060094	1.080867	1.103361	1.127712	1.154046	1.182483	1.213127	1.246064	1.281365	1.319093	1.359334	1.402249	1.448182	1.497858	1.552798	1.616226	1.69549	1.810478	2.043046	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3394.5	0.901835	0.91036	0.919456	0.929171	0.939564	0.950701	0.962656	0.975508	0.989346	1.004268	1.020377	1.037788	1.056621	1.077003	1.099064	1.122935	1.148744	1.176609	1.206635	1.238913	1.273517	1.310514	1.34999	1.392095	1.437139	1.485771	1.53933	1.60062	1.675875	1.781154	1.974978	3.296545	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3431	0.900798	0.909224	0.91821	0.927803	0.938059	0.949044	0.960827	0.973487	0.98711	1.001789	1.017627	1.034735	1.053229	1.073232	1.094874	1.118281	1.14358	1.170889	1.200316	1.231952	1.265877	1.302161	1.340889	1.382202	1.426384	1.474012	1.526275	1.585618	1.65736	1.754642	1.92085	2.528015	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3467.5	0.899774	0.908104	0.916983	0.926456	0.936579	0.947414	0.95903	0.971503	0.984917	0.999361	1.014937	1.03175	1.049915	1.069552	1.090786	1.113744	1.138548	1.165319	1.194163	1.225176	1.258439	1.294026	1.332023	1.372563	1.415905	1.46257	1.513608	1.571165	1.639807	1.730398	1.876034	2.279575	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3504	0.898764	0.907	0.915773	0.925129	0.935122	0.945812	0.957265	0.969557	0.982766	0.996983	1.012303	1.02883	1.046676	1.065958	1.086798	1.109319	1.133645	1.159892	1.188171	1.218576	1.251194	1.286102	1.323384	1.363169	1.405695	1.451429	1.501309	1.557219	1.623099	1.708024	1.837861	2.140315	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3540.5	0.897766	0.90591	0.914581	0.923823	0.933688	0.944236	0.955532	0.967646	0.980657	0.994652	1.009724	1.025974	1.043511	1.062448	1.082905	1.105004	1.128864	1.154604	1.182333	1.212148	1.244138	1.278381	1.314965	1.354013	1.395743	1.440579	1.489358	1.54374	1.607144	1.687217	1.804587	2.04605	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3577	0.896782	0.904835	0.913406	0.922536	0.932277	0.942687	0.953828	0.965769	0.978588	0.992367	1.007198	1.023179	1.040415	1.059018	1.079104	1.100793	1.124203	1.14945	1.176644	1.205885	1.237263	1.270858	1.30676	1.345086	1.386041	1.430009	1.477737	1.530697	1.591865	1.667743	1.775035	1.975801	3.778601	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3613.5	0.895809	0.903774	0.912247	0.921268	0.930888	0.941163	0.952153	0.963926	0.976557	0.990127	1.004723	1.020443	1.037388	1.055666	1.075392	1.096683	1.119655	1.144424	1.1711	1.199782	1.230562	1.263526	1.298761	1.336383	1.376581	1.419707	1.466432	1.51806	1.577198	1.64941	1.7484	1.920205	2.602185	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3650	0.894849	0.902727	0.911104	0.920019	0.92952	0.939663	0.950506	0.962116	0.974564	0.98793	1.002299	1.017764	1.034425	1.052389	1.071766	1.09267	1.115218	1.139523	1.165693	1.193832	1.224031	1.256378	1.290962	1.327895	1.367356	1.409665	1.455427	1.505804	1.563087	1.632067	1.724112	1.874349	2.311005	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3686.5	0.8939	0.901694	0.909976	0.918787	0.928173	0.938187	0.948887	0.960337	0.972607	0.985774	0.999922	1.01514	1.031526	1.049184	1.068222	1.088752	1.110887	1.134741	1.160421	1.188031	1.217664	1.249409	1.283356	1.319616	1.358357	1.399873	1.444711	1.493908	1.549485	1.615593	1.701748	1.835369	2.156665	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3723	0.892963	0.900674	0.908864	0.917573	0.926846	0.936734	0.947294	0.958589	0.970685	0.983659	0.997591	1.012569	1.028689	1.046049	1.064758	1.084924	1.106659	1.130074	1.155278	1.182373	1.211454	1.242612	1.275938	1.31154	1.349578	1.390323	1.434271	1.482351	1.536353	1.599887	1.68099	1.801463	2.055172	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3759.5	0.892038	0.899667	0.907767	0.916376	0.925538	0.935304	0.945728	0.95687	0.968798	0.981583	0.995306	1.01005	1.02591	1.042982	1.061371	1.081183	1.102529	1.125519	1.150259	1.176853	1.205397	1.235983	1.268702	1.303661	1.341012	1.381007	1.424096	1.471115	1.523654	1.584867	1.661593	1.771434	1.980814	5.314685	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3796	0.891123	0.898672	0.906685	0.915196	0.92425	0.933896	0.944186	0.955181	0.966944	0.979546	0.993064	1.007581	1.023188	1.03998	1.058058	1.077527	1.098495	1.121071	1.145361	1.171468	1.199488	1.229515	1.261641	1.295971	1.332652	1.371917	1.414177	1.460186	1.511359	1.570466	1.643362	1.744452	1.922636	2.689045	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3832.5	0.890219	0.89769	0.905617	0.914032	0.922981	0.932509	0.942669	0.953519	0.965121	0.977545	0.990864	1.00516	1.020522	1.037041	1.054816	1.073952	1.094553	1.116727	1.140579	1.166211	1.193722	1.223204	1.25475	1.288467	1.324493	1.363046	1.404504	1.449547	1.499441	1.556625	1.626143	1.719919	1.875052	2.344747	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3869	0.889326	0.896721	0.904562	0.912884	0.921729	0.931143	0.941176	0.951885	0.963331	0.97558	0.988705	1.002787	1.017909	1.034163	1.051643	1.070456	1.0907	1.112483	1.135909	1.16108	1.188093	1.217043	1.248025	1.281141	1.316527	1.354387	1.395068	1.439187	1.487877	1.543296	1.609812	1.697393	1.834866	2.174296	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3905.5	0.888444	0.895763	0.903521	0.911752	0.920496	0.929797	0.939707	0.950278	0.96157	0.973649	0.986586	1.000458	1.015347	1.031343	1.04854	1.067036	1.086934	1.108336	1.131347	1.156069	1.182598	1.21103	1.241459	1.273989	1.308749	1.345933	1.38586	1.429092	1.476646	1.530436	1.594265	1.67654	1.800098	2.065389	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3942	0.887571	0.894817	0.902494	0.910635	0.91928	0.928472	0.938259	0.948696	0.959839	0.971753	0.984506	0.998173	1.012836	1.028581	1.0455	1.06369	1.08325	1.104283	1.126891	1.151175	1.177232	1.205158	1.235048	1.267005	1.301154	1.337678	1.376874	1.419252	1.46573	1.51801	1.579419	1.6571	1.769445	1.986891	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
3978.5	0.886709	0.893882	0.901479	0.909533	0.91808	0.927165	0.936834	0.947139	0.958137	0.969889	0.982463	0.995932	1.010374	1.025875	1.042524	1.060415	1.079647	1.10032	1.122536	1.146393	1.171991	1.199424	1.228788	1.260184	1.293736	1.329616	1.368101	1.409656	1.455112	1.505987	1.565202	1.638871	1.742009	1.926132	2.787381	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4015	0.885856	0.892958	0.900478	0.908445	0.916897	0.925877	0.93543	0.945607	0.956463	0.968057	0.980456	0.993731	1.007959	1.023222	1.039608	1.057209	1.076122	1.096445	1.118278	1.141721	1.166871	1.193823	1.222673	1.253521	1.286489	1.321741	1.359534	1.400296	1.444778	1.494339	1.551554	1.621689	1.717149	1.876824	2.380787	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4051.5	0.885013	0.892045	0.899488	0.907371	0.915731	0.924608	0.934048	0.944099	0.954815	0.966256	0.978485	0.991571	1.005589	1.020621	1.036751	1.054069	1.072672	1.092654	1.114116	1.137155	1.161868	1.188351	1.216698	1.247012	1.279409	1.314048	1.351168	1.391162	1.434713	1.483042	1.538425	1.605423	1.694394	1.835509	2.199769	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4088	0.884179	0.891143	0.898511	0.906311	0.91458	0.923356	0.932685	0.942614	0.953195	0.964485	0.976547	0.989449	1.003264	1.01807	1.03395	1.050995	1.069295	1.088946	1.110045	1.132691	1.156978	1.183003	1.210861	1.240652	1.272491	1.306531	1.342994	1.382246	1.424907	1.472074	1.525771	1.589967	1.673403	1.800374	2.131854	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4124.5	0.883354	0.890252	0.897546	0.905265	0.913444	0.922122	0.931343	0.941151	0.9516	0.962743	0.974643	0.987366	1.000982	1.015568	1.031206	1.047982	1.065988	1.085316	1.106063	1.128325	1.152198	1.177776	1.205156	1.234436	1.26573	1.299184	1.335009	1.373541	1.415347	1.461418	1.513554	1.575237	1.654042	1.773638	2.192664	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4161	0.882539	0.88937	0.896592	0.904231	0.912323	0.920905	0.930019	0.939711	0.95003	0.96103	0.972772	0.985319	0.998741	1.013113	1.028514	1.04503	1.062749	1.081764	1.102167	1.124056	1.147524	1.172667	1.199579	1.22836	1.259121	1.292003	1.327205	1.365039	1.406024	1.451056	1.501748	1.561216	1.636735	1.757074	2.336931	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4197.5	0.881732	0.888499	0.89565	0.903211	0.911217	0.919705	0.928715	0.938292	0.948484	0.959345	0.970932	0.983308	0.996541	1.010704	1.025875	1.042137	1.059577	1.078285	1.098355	1.119879	1.142953	1.167671	1.194127	1.22242	1.25266	1.284983	1.319577	1.356734	1.396928	1.440975	1.490345	1.547998	1.621862	1.748532	2.627222	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4234	0.880934	0.887637	0.894718	0.902204	0.910126	0.918521	0.927429	0.936894	0.946962	0.957686	0.969122	0.981331	0.99438	1.008339	1.023286	1.039301	1.056469	1.074879	1.094623	1.115792	1.138482	1.162785	1.188796	1.216613	1.246343	1.278119	1.312121	1.348619	1.388052	1.431172	1.47937	1.535689	1.609385	1.746143	3.487981	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4270.5	0.880145	0.886785	0.893798	0.901208	0.909048	0.917353	0.926162	0.935516	0.945464	0.956054	0.967364	0.979388	0.992257	1.006018	1.020746	1.036521	1.053423	1.071543	1.090969	1.111793	1.134107	1.158006	1.183582	1.210933	1.240166	1.271408	1.30483	1.340689	1.379393	1.421654	1.468858	1.52434	1.599086	1.748762	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4307	0.879364	0.885943	0.892889	0.900225	0.907984	0.9162	0.924911	0.934159	0.943987	0.954447	0.965591	0.977478	0.990172	1.003739	1.018253	1.033792	1.050437	1.068274	1.08739	1.107877	1.129826	1.15333	1.178482	1.205378	1.234123	1.264843	1.297702	1.332941	1.37095	1.41243	1.458836	1.513951	1.590714	1.755754	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4343.5	0.878591	0.88511	0.89199	0.899254	0.906934	0.915063	0.923678	0.93282	0.942533	0.952865	0.963868	0.9756	0.988122	1.001501	1.015807	1.031116	1.04751	1.06507	1.083885	1.104044	1.125636	1.148755	1.173492	1.199943	1.228213	1.258423	1.290732	1.325373	1.362728	1.403514	1.449321	1.504486	1.584039	1.766817	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4380	0.877826	0.884286	0.891101	0.898294	0.905896	0.91394	0.922462	0.931501	0.9411	0.951307	0.962173	0.973753	0.986108	0.999302	1.013405	1.028491	1.044639	1.061931	1.080451	1.100289	1.121534	1.144277	1.168609	1.194626	1.22243	1.252143	1.283918	1.317985	1.354731	1.394917	1.440317	1.495898	1.578869	1.781898	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4416.5	0.877069	0.883471	0.890222	0.897346	0.904872	0.912832	0.921262	0.9302	0.939689	0.949773	0.960504	0.971936	0.984127	0.997141	1.011046	1.025915	1.041826	1.058852	1.077087	1.096612	1.117518	1.139893	1.16383	1.189422	1.216773	1.246	1.277258	1.310778	1.346964	1.386646	1.431821	1.488129	1.575043	1.801149	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4453	0.87632	0.882664	0.889353	0.896409	0.90386	0.911738	0.920078	0.928917	0.938297	0.948262	0.958862	0.970149	0.98218	0.995019	1.00873	1.023386	1.039061	1.055834	1.073789	1.093009	1.113584	1.135601	1.159152	1.18433	1.211238	1.239994	1.270753	1.303755	1.339432	1.378704	1.423821	1.481122	1.572434	1.824922	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4489.5	0.875578	0.881867	0.888494	0.895483	0.90286	0.910658	0.918911	0.927652	0.936926	0.946774	0.957245	0.968389	0.980265	0.992932	1.006455	1.020903	1.03635	1.052874	1.070564	1.089502	1.109773	1.131398	1.154572	1.179346	1.205823	1.234121	1.264401	1.296916	1.332138	1.371092	1.416301	1.474825	1.570936	1.853799	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4526	0.874844	0.881077	0.887644	0.894567	0.901873	0.909592	0.917757	0.926404	0.935573	0.945307	0.955652	0.966659	0.978382	0.990881	1.004219	1.018465	1.03369	1.04997	1.067386	1.086019	1.105955	1.127282	1.150088	1.174469	1.200525	1.228381	1.258203	1.290263	1.325084	1.363808	1.409244	1.469184	1.570467	1.888648	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4562.5	0.874117	0.880296	0.886804	0.893662	0.900897	0.908538	0.916619	0.925173	0.93424	0.943862	0.954083	0.964955	0.976529	0.988864	1.002022	1.01607	1.031078	1.047121	1.064277	1.082627	1.102256	1.12325	1.145698	1.169695	1.195344	1.222773	1.252159	1.283799	1.318271	1.356847	1.40263	1.464155	1.570958	1.930747	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4599	0.873397	0.879523	0.885973	0.892767	0.899933	0.907498	0.915495	0.923959	0.932926	0.942437	0.952538	0.963277	0.974706	0.986881	0.999863	1.013718	1.028514	1.044325	1.061228	1.079302	1.098631	1.119302	1.141399	1.165023	1.190278	1.217296	1.246269	1.277523	1.311698	1.350202	1.396437	1.459693	1.572356	1.981977	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4635.5	0.872685	0.87876	0.88515	0.891882	0.89898	0.90647	0.914386	0.92276	0.931629	0.941033	0.951016	0.961625	0.972912	0.98493	0.997741	1.011407	1.025996	1.041581	1.058236	1.076041	1.095078	1.115431	1.13719	1.160452	1.185325	1.21195	1.240534	1.271436	1.305364	1.343866	1.390647	1.45576	1.574618	2.045197	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4672	0.871979	0.878001	0.884337	0.891007	0.898038	0.905455	0.913291	0.921577	0.93035	0.939649	0.949517	0.959999	0.971146	0.983011	0.995654	1.009136	1.023524	1.038887	1.055301	1.072844	1.091595	1.111644	1.133069	1.155979	1.180484	1.206734	1.234953	1.265537	1.299265	1.33783	1.385238	1.45232	1.577711	2.124948	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4708.5	0.871281	0.877251	0.883532	0.890142	0.897107	0.904452	0.912209	0.92041	0.929089	0.938284	0.948039	0.958397	0.969407	0.981124	0.993602	1.006904	1.021095	1.036243	1.052421	1.069707	1.088181	1.107926	1.129034	1.151604	1.175756	1.201648	1.229526	1.259825	1.293398	1.332083	1.380191	1.449341	1.58161	2.228943	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4745	0.870589	0.876509	0.882736	0.889286	0.896186	0.903461	0.911141	0.919257	0.927844	0.936939	0.946582	0.956819	0.967696	0.979266	0.991584	1.00471	1.018708	1.033646	1.049595	1.066631	1.084834	1.104288	1.125085	1.147326	1.171138	1.196691	1.224253	1.254298	1.287759	1.326617	1.375487	1.446793	1.586297	2.371601	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4781.5	0.869903	0.875775	0.881947	0.88844	0.895276	0.902482	0.910086	0.91812	0.926616	0.935611	0.945146	0.955264	0.966011	0.977438	0.989599	1.002553	1.016363	1.031096	1.046821	1.063614	1.081553	1.100724	1.121219	1.143144	1.16663	1.191862	1.219131	1.248955	1.282342	1.32142	1.371107	1.44465	1.59176	2.584143	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4818	0.869225	0.875047	0.881167	0.887603	0.894376	0.901514	0.909044	0.916996	0.925404	0.934302	0.943731	0.953732	0.964351	0.975638	0.987646	1.000433	1.014059	1.028591	1.044098	1.060653	1.078337	1.097233	1.117436	1.139056	1.162232	1.187161	1.214161	1.243793	1.277142	1.316482	1.367034	1.442887	1.597995	2.953314	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4854.5	0.868552	0.874327	0.880395	0.886774	0.893487	0.900558	0.908015	0.915887	0.924207	0.933011	0.942335	0.952222	0.962716	0.973866	0.985725	0.998347	1.011795	1.026131	1.041425	1.057753	1.075184	1.093814	1.113735	1.135061	1.157941	1.182587	1.20934	1.238807	1.272153	1.311792	1.363252	1.441482	1.605003	3.900644	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4891	0.867886	0.873614	0.879631	0.885955	0.892607	0.899612	0.906997	0.914792	0.923026	0.931736	0.940959	0.950734	0.961106	0.972122	0.983834	0.996296	1.009569	1.023714	1.038801	1.054901	1.072094	1.090466	1.110115	1.13116	1.153759	1.178138	1.204667	1.233996	1.267368	1.307341	1.359744	1.440414	1.612789	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4927.5	0.867226	0.872908	0.878875	0.885144	0.891736	0.898677	0.905992	0.91371	0.921861	0.930479	0.939601	0.949267	0.959519	0.970405	0.981973	0.994279	1.007381	1.02134	1.036225	1.052107	1.069065	1.087181	1.106574	1.127351	1.149682	1.173813	1.200139	1.229355	1.262781	1.303117	1.356497	1.439664	1.621365	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
4964	0.866572	0.872208	0.878126	0.884341	0.890876	0.897753	0.904999	0.912641	0.92071	0.929239	0.938263	0.947821	0.957956	0.968714	0.980142	0.992295	1.00523	1.019008	1.033697	1.049366	1.066097	1.083978	1.103113	1.123632	1.145711	1.169611	1.195754	1.22488	1.258386	1.299111	1.353494	1.439214	1.630747	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5000.5	0.865924	0.871516	0.877385	0.883547	0.890024	0.896839	0.904017	0.911585	0.919574	0.928014	0.936942	0.946396	0.956416	0.967048	0.97834	0.990344	1.003116	1.016718	1.031215	1.046679	1.063189	1.080837	1.09973	1.120004	1.141844	1.165529	1.191508	1.220567	1.254176	1.295313	1.350724	1.439048	1.64096	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5037	0.865282	0.87083	0.876651	0.882761	0.889182	0.895935	0.903047	0.910542	0.918451	0.926806	0.93564	0.94499	0.954898	0.965408	0.976566	0.988424	1.001038	1.014468	1.028778	1.044043	1.06034	1.077764	1.096425	1.116465	1.13808	1.161566	1.1874	1.216411	1.250144	1.291714	1.348173	1.439152	1.652032	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5073.5	0.864646	0.87015	0.875924	0.881983	0.888348	0.895042	0.902088	0.909512	0.917343	0.925613	0.934354	0.943604	0.953403	0.963792	0.97482	0.986536	0.998995	1.012257	1.026387	1.041458	1.0575	1.074757	1.093195	1.113013	1.134418	1.157721	1.183426	1.212408	1.246284	1.288303	1.34583	1.439512	1.663999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5110	0.864016	0.869477	0.875204	0.881213	0.887524	0.894158	0.901139	0.908494	0.916249	0.924435	0.933086	0.942238	0.951929	0.962201	0.973101	0.984678	0.996987	1.010086	1.024041	1.038924	1.054817	1.071817	1.090042	1.109649	1.130855	1.153989	1.179583	1.208553	1.242588	1.285074	1.343682	1.440114	1.676904	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5146.5	0.863391	0.86881	0.874492	0.880451	0.886708	0.893284	0.900202	0.907488	0.915168	0.923273	0.931835	0.94089	0.950476	0.960634	0.971409	0.982851	0.995013	1.007954	1.021739	1.03644	1.052141	1.068941	1.086963	1.10637	1.12739	1.15037	1.175868	1.204842	1.239052	1.282016	1.341719	1.440946	1.6908	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5183	0.862772	0.868149	0.873786	0.879697	0.885901	0.892419	0.899275	0.906493	0.9141	0.922126	0.930601	0.939561	0.949044	0.959093	0.969743	0.981053	0.993073	1.005866	1.019479	1.034005	1.049521	1.06613	1.083958	1.103175	1.124022	1.146861	1.172277	1.20127	1.235668	1.279121	1.339932	1.441999	1.705746	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5219.5	0.862158	0.867494	0.873087	0.87895	0.885102	0.891564	0.898359	0.905511	0.913046	0.920993	0.929383	0.938251	0.947632	0.957569	0.968104	0.979285	0.991166	1.003803	1.017263	1.031619	1.046957	1.063382	1.081025	1.100064	1.120749	1.14346	1.168807	1.197831	1.232429	1.276382	1.338309	1.44326	1.721816	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5256	0.86155	0.866846	0.872394	0.87821	0.884311	0.890718	0.897453	0.90454	0.912004	0.919874	0.928181	0.936958	0.946241	0.956071	0.96649	0.977546	0.989292	1.001784	1.015089	1.029281	1.044488	1.060697	1.078165	1.097034	1.117568	1.140164	1.165455	1.194523	1.229331	1.273792	1.336843	1.444721	1.739092	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5292.5	0.860947	0.866203	0.871709	0.877478	0.883529	0.889882	0.896558	0.90358	0.910975	0.91877	0.926995	0.935683	0.94487	0.954596	0.964902	0.975836	0.98745	0.999802	1.012957	1.026991	1.041994	1.058074	1.075374	1.094085	1.114479	1.136969	1.162217	1.191339	1.226367	1.271342	1.335525	1.446372	1.757675	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5329	0.860349	0.865566	0.87103	0.876753	0.882755	0.889054	0.895672	0.902632	0.909959	0.91768	0.925825	0.934426	0.943519	0.953143	0.963339	0.974154	0.985641	0.997856	1.010867	1.024748	1.039593	1.055512	1.072654	1.091214	1.111478	1.133875	1.159089	1.188276	1.223532	1.269026	1.334346	1.448205	1.77768	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5365.5	0.859757	0.864935	0.870357	0.876036	0.881989	0.888235	0.894796	0.901694	0.908954	0.916603	0.92467	0.933187	0.942188	0.951712	0.961801	0.972501	0.983863	0.995947	1.008817	1.022552	1.037245	1.053011	1.070001	1.088421	1.108565	1.130878	1.156068	1.185328	1.220819	1.266837	1.333299	1.450211	1.799246	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5402	0.85917	0.86431	0.869691	0.875325	0.88123	0.887425	0.89393	0.900768	0.907963	0.915541	0.923531	0.931964	0.940876	0.950303	0.960287	0.970875	0.982117	0.994073	1.006808	1.020401	1.034949	1.050568	1.067415	1.085703	1.105736	1.127975	1.15315	1.182492	1.218225	1.26477	1.332376	1.452385	1.822535	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5438.5	0.858588	0.863691	0.869031	0.874622	0.880482	0.886624	0.893074	0.899853	0.906983	0.914491	0.922406	0.930759	0.939582	0.948915	0.958798	0.969276	0.980402	0.992234	1.004839	1.018296	1.032704	1.048184	1.064896	1.08306	1.102991	1.125164	1.150333	1.179764	1.215742	1.262817	1.331571	1.454717	1.847742	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5475	0.858011	0.863077	0.868378	0.873925	0.879737	0.885831	0.892228	0.898948	0.906015	0.913456	0.921297	0.92957	0.938308	0.947549	0.957333	0.967705	0.978718	0.99043	1.002909	1.016236	1.03051	1.045857	1.062441	1.080489	1.100325	1.122441	1.147612	1.177139	1.213368	1.260974	1.330877	1.457202	1.875101	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5511.5	0.85744	0.862469	0.867731	0.873236	0.879002	0.885047	0.891391	0.898054	0.905059	0.912433	0.920203	0.928398	0.937053	0.946204	0.955891	0.966161	0.977064	0.988666	1.001018	1.014224	1.028366	1.043586	1.060049	1.077988	1.097739	1.119805	1.144985	1.174613	1.211096	1.259234	1.330288	1.459834	1.904893	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5548	0.856873	0.861867	0.86709	0.872554	0.878275	0.884272	0.890563	0.89717	0.904115	0.911424	0.919123	0.927243	0.935817	0.94488	0.954474	0.964643	0.97544	0.986925	0.999166	1.012247	1.026271	1.041371	1.057719	1.075557	1.095229	1.117253	1.142448	1.172183	1.208922	1.257593	1.329798	1.462607	1.937465	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5584.5	0.856311	0.86127	0.866455	0.871878	0.877556	0.883505	0.889745	0.896297	0.903183	0.910428	0.918059	0.926104	0.934598	0.943577	0.953079	0.963152	0.973847	0.985223	0.997351	1.010317	1.024225	1.03921	1.05545	1.073194	1.092793	1.114782	1.139998	1.169844	1.206843	1.256046	1.329402	1.465515	1.973243	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5621	0.855756	0.860679	0.865826	0.871209	0.876844	0.882746	0.888937	0.895435	0.902263	0.909445	0.917008	0.924982	0.933399	0.942294	0.951708	0.961687	0.972282	0.983554	0.995575	1.008429	1.022225	1.037102	1.053241	1.070896	1.09043	1.112389	1.137632	1.167593	1.204853	1.254587	1.329093	1.468553	2.012762	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5657.5	0.855205	0.860094	0.865204	0.870547	0.876139	0.881996	0.888137	0.894583	0.901354	0.908475	0.915973	0.923876	0.932217	0.941032	0.95036	0.960248	0.970747	0.981919	0.993835	1.006583	1.020273	1.035046	1.051089	1.068662	1.088137	1.110072	1.135347	1.165426	1.202949	1.253213	1.328868	1.471716	2.056699	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5694	0.854659	0.859514	0.864588	0.869892	0.875442	0.881255	0.887347	0.893741	0.900456	0.907518	0.914951	0.922786	0.931054	0.93979	0.949035	0.958834	0.969241	0.980315	0.992131	1.004778	1.018366	1.033041	1.048994	1.066491	1.085912	1.107829	1.13314	1.16334	1.201126	1.251919	1.328722	1.474999	2.105935	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5730.5	0.854118	0.85894	0.863978	0.869244	0.874753	0.880521	0.886567	0.892909	0.89957	0.906573	0.913944	0.921712	0.929908	0.938568	0.947732	0.957446	0.967763	0.978744	0.990464	1.003013	1.016504	1.031086	1.046954	1.06438	1.083753	1.105657	1.131008	1.161332	1.199382	1.250701	1.328649	1.478398	2.161626	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5767	0.853582	0.858371	0.863375	0.868603	0.874071	0.879796	0.885795	0.892088	0.898696	0.905642	0.912952	0.920654	0.928778	0.937362	0.946452	0.956083	0.966313	0.977204	0.988832	1.001287	1.014684	1.029182	1.044968	1.062328	1.081658	1.103553	1.128948	1.159399	1.197713	1.249555	1.328646	1.481909	2.225343	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5803.5	0.853052	0.857808	0.862777	0.867968	0.873397	0.87908	0.885033	0.891277	0.897833	0.904723	0.911973	0.919612	0.92767	0.936184	0.945194	0.954745	0.964891	0.975696	0.987234	0.9996	1.012912	1.027322	1.043035	1.060334	1.079626	1.101516	1.126958	1.157537	1.196114	1.248478	1.328709	1.485529	2.299271	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5840	0.852526	0.857251	0.862186	0.867341	0.872731	0.878371	0.88428	0.890476	0.896981	0.903816	0.911008	0.918585	0.926578	0.935022	0.943956	0.953431	0.963497	0.974218	0.985671	0.997952	1.01118	1.025511	1.041153	1.058396	1.077653	1.099543	1.125035	1.155743	1.194584	1.247466	1.328834	1.489252	2.386567	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999
5876.5	0.852006	0.8567	0.861601	0.86672	0.872071	0.877671	0.883536	0.889686	0.89614	0.902923	0.910058	0.917574	0.925503	0.933879	0.942743	0.952142	0.962129	0.97277	0.984142	0.996341	1.009489	1.023745	1.039321	1.056512	1.075739	1.097631	1.123176	1.154016	1.193118	1.246515	1.329017	1.493075	2.492005	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999	99.999

EFFECTIVE STRESS (kPa)

Time Height from Bottom (metres)

days 0.001 1.54838 3.09676 4.64514 6.19352 7.7419 9.29028 10.8387 12.387 13.9354 15.4838 17.0322 18.5806 20.1289 21.6773 23.2257 24.7741 26.3225 27.8708 29.4192 30.9676 32.516 34.0644 35.6127 37.1611 38.7095 40.2579 41.8063 43.3546 44.903 46.4514 47.9998 49.5482 51.0965 52.6449 54.1933 55.7417 57.2901 58.8384 60.3868 61.9352 63.4836 65.032 66.5803 68.1287 69.6771 71.2255 72.7739 74.3222 75.8706

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	4.335156	0.292132	0.047353	0.018992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	7.546361	1.453549	0.259813	0.087304	0.043924	0.02687	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	10.45556	3.163349	0.75802	0.239455	0.110874	0.064475	0.042234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	13.19005	5.110306	1.576664	0.518	0.226439	0.125458	0.080373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	15.80444	7.160905	2.669099	0.957215	0.409284	0.217531	0.135064	0.092455	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	18.32871	9.256563	3.969033	1.57101	0.678513	0.350109	0.211079	0.141732	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	20.7816	11.36934	5.41985	2.353972	1.049742	0.533636	0.313672	0.206196	0.1397	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	23.17589	13.48498	6.979428	3.289275	1.532376	0.778475	0.448829	0.289229	0.20172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	25.52073	15.59588	8.617642	4.355971	2.129076	1.09368	0.622955	0.394459	0.271642	0.116866	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	27.82302	17.69795	10.31319	5.533326	2.836924	1.486022	0.842444	0.525887	0.357066	0.249001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	30.08812	19.78897	12.05068	6.802763	3.649245	1.959512	1.11319	0.687747	0.460923	0.327901	0.137208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	32.32027	21.86782	13.81902	8.148432	4.557319	2.515436	1.440165	0.884311	0.586063	0.41433	0.290831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	34.52293	23.93401	15.61007	9.557136	5.551663	3.152743	1.827116	1.119674	0.73545	0.515182	0.375707	0.117666	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	36.69897	25.98745	17.41775	11.01801	6.62286	3.868601	2.276438	1.397544	0.912099	0.633307	0.462057	0.312202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	38.85078	28.02826	19.23749	12.52216	7.762035	4.658962	2.789189	1.721067	1.118977	0.771028	0.559309	0.409988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	40.98041	30.0567	21.0658	14.06229	8.961082	5.519056	3.365228	2.092706	1.358891	0.9306	0.670529	0.498938	0.272862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	43.08961	32.0731	22.89999	15.63242	10.21274	6.443773	4.003415	2.514183	1.63439	1.114254	0.797733	0.593794	0.418762	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	45.1799	34.07784	24.73798	17.2276	11.51059	7.427944	4.701833	2.986482	1.947679	1.324152	0.942716	0.699154	0.520538	0.163878	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	47.25262	36.07131	26.57816	18.84377	12.84899	8.466529	5.458005	3.509892	2.300557	1.56234	1.107217	0.817329	0.617216	0.39815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	49.30894	38.05392	28.41923	20.47754	14.22302	9.554732	6.269079	4.08409	2.69439	1.83069	1.292937	0.949995	0.719146	0.523768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	51.3499	40.02607	30.2602	22.12605	15.62837	10.68807	7.131991	4.708231	3.130093	2.130861	1.501523	1.09863	0.830343	0.627244	0.278879	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	53.37643	41.98813	32.10026	23.78696	17.0613	11.86239	8.043587	5.381057	3.608153	2.464257	1.734534	1.264633	0.952967	0.728961	0.477385	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	55.38936	43.94049	33.93877	25.45824	18.51853	13.07391	9.000712	6.100985	4.128659	2.832008	1.993417	1.449355	1.088557	0.835751	0.608013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	57.38945	45.88349	35.77524	27.13822	19.99723	14.31916	10.00028	6.866206	4.691339	3.234963	2.279477	1.654099	1.238404	0.95081	0.719801	0.32885	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	59.37737	47.81748	37.60927	28.82545	21.49488	15.59501	11.03932	7.674751	5.295617	3.673688	2.593855	1.880102	1.40369	1.076046	0.828299	0.537061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	61.35376	49.74279	39.44054	30.5187	23.00931	16.89863	12.115	8.524565	5.940658	4.148478	2.937517	2.128523	1.585531	1.212838	0.940075	0.679496	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	63.31917	51.65972	41.26879	32.21693	24.53861	18.22744	13.22465	9.413551	6.625423	4.659379	3.311236	2.400428	1.784994	1.362329	1.058484	0.800565	0.38852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	65.27412	53.56857	43.09384	33.91923	26.08107	19.57914	14.36578	10.33961	7.348709	5.206207	3.715598	2.696769	2.003095	1.525541	1.185545	0.915814	0.595655	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	67.21909	55.46962	44.91553	35.62483	27.63522	20.95164	15.53604	11.30069	8.109199	5.788579	4.150999	3.018382	2.240792	1.703427	1.322673	1.032211	0.741286	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	69.15452	57.36312	46.73374	37.33306	29.19975	22.34306	16.73328	12.29478	8.905493	6.40594	4.617658	3.365971	2.498975	1.89689	1.470978	1.153371	0.867211	0.289882	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	71.08081	59.24933	48.54841	39.04333	30.77348	23.75171	17.95547	13.31993	9.736141	7.057591	5.115622	3.74011	2.778458	2.106788	1.631409	1.281553	0.987167	0.553746	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	72.99835	61.1285	50.35945	40.75516	32.3554	25.17604	19.20078	14.37431	10.59967	7.742714	5.644785	4.141238	3.07997	2.333932	1.804826	1.418318	1.107244	0.736525	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	74.90748	63.00083	52.16684	42.46809	33.94458	26.61467	20.46747	15.45613	11.4946	8.4604	6.204901	4.569665	3.404152	2.579083	1.992025	1.564825	1.230866	0.886422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	76.80853	64.86655	53.97054	44.18174	35.5402	28.06636	21.75398	16.56373	12.41947	9.209669	6.795601	5.025572	3.75155	2.842945	2.193762	1.722014	1.360203	1.022041	0.418811	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	78.7018	66.72586	55.77055	45.8958	37.14155	29.52996	23.05884	17.69552	13.37284	9.98949	7.41641	5.509024	4.122613	3.126165	2.410744	1.890696	1.496768	1.152462	0.671406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	80.58758	68.57895	57.56687	47.60995	38.74795	31.00444	24.38072	18.85002	14.35331	10.7988	8.066765	6.019971	4.517692	3.429321	2.643641	2.071605	1.641705	1.282746	0.860338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	82.46613	70.426	59.3595	49.32396	40.35884	32.48886	25.71837	20.02582	15.35953	11.63652	8.746026	6.558266	4.937048	3.752927	2.893076	2.265419	1.795938	1.415999	1.020382	0.210009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	84.3377	72.2672	61.14846	51.03759	41.97369	33.98239	27.07066	21.22161	16.39018	12.50155	9.453495	7.123666	5.380844	4.097423	3.159628	2.472771	1.960258	1.554288	1.166817	0.559932	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	86.20254	74.10271	62.93378	52.75066	43.59202	35.48423	28.43654	22.43615	17.44402	13.39282	10.18843	7.715851	5.849158	4.463179	3.443826	2.694258	2.135362	1.699088	1.30768	0.796294	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	88.06086	75.93268	64.71547	54.46298	45.21341	36.99369	29.81504	23.66829	18.51984	14.30925	10.95004	8.334428	6.341987	4.850493	3.746149	2.930439	2.321889	1.851522	1.447623	0.983141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	89.91287	77.75728	66.49359	56.17442	46.83748	38.51013	31.20526	24.91696	19.61649	15.24978	11.73753	8.978945	6.85925	5.25959	4.067021	3.181836	2.520428	2.012487	1.589582	1.147638	0.316181	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	91.75876	79.57663	68.26815	57.88484	48.46388	40.03294	32.60638	26.18114	20.7329	16.21339	12.55007	9.648897	7.400794	5.69063	4.406813	3.448935	2.731528	2.182735	1.735691	1.301084	0.639369	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	93.59873	81.39088	70.03919	59.59413	50.09231	41.56161	34.01764	27.45989	21.86801	17.19908	13.38684	10.34374	7.966407	6.143701	4.76584	3.732179	2.955702	2.362929	1.887495	1.44973	0.877533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	95.43295	83.20017	71.80676	61.30218	51.72246	43.09562	35.43833	28.75233	23.02085	18.20588	14.247	11.06289	8.555817	6.618833	5.144362	4.031972	3.193431	2.553667	2.046146	1.597491	1.075084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1642.5	97.26159	85.00462	73.5709	63.00891	53.3541	44.63454	36.86781	30.05763	24.19049	19.23284	15.12973	11.80575	9.168703	7.115992	5.542586	4.348676	3.445165	2.755496	2.212553	1.747001	1.250931	0.385772	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	99.08481	86.80434	75.33165	64.71424	54.98699	46.17794	38.30545	31.37503	25.37605	20.27906	16.03422	12.57169	9.804701	7.635093	5.960662	4.682611	3.71132	2.968921	2.38747	1.90013	1.415084	0.707474	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	100.9028	88.59946	77.08905	66.4181	56.62091	47.72544	39.75072	32.70379	26.57668	21.34368	16.95965	13.36007	10.46341	8.175998	6.39869	5.034051	3.992282	3.194408	2.571539	2.058274	1.573514	0.952941	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	102.7156	90.39009	78.84315	68.12044	58.25567	49.2767	41.20309	34.04326	27.79161	22.42586	17.90525	14.17024	11.1444	8.738523	6.856721	5.40323	4.288403	3.432391	2.765329	2.22252	1.73008	1.159922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	104.5234	92.17633	80.59399	69.8212	59.8911	50.83139	42.66207	35.39279	29.02009	23.52481	18.87024	15.00156	11.84721	9.322443	7.334758	5.790337	4.600001	3.683272	2.969351	2.393745	1.887429	1.345439	0.469256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	106.3264	93.95828	82.34161	71.52035	61.52704	52.38921	44.12722	36.7518	30.26141	24.63975	19.85387	15.85336	12.57136	9.927495	7.832762	6.19552	4.927358	3.947425	3.184072	2.572681	2.047465	1.518815	0.782371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	108.1246	95.73604	84.08606	73.21783	63.16334	53.94988	45.59812	38.11973	31.51491	25.76997	20.85541	16.72501	13.31636	10.55339	8.350649	6.618887	5.270725	4.225194	3.409919	2.759957	2.211621	1.685612	1.017371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1898	109.9182	97.50971	85.82738	74.91363	64.79987	55.51316	47.07439	39.49607	32.77996	26.91475	21.87417	17.61586	14.08169	11.19979	8.8883	7.060503	5.630314	4.516893	3.647289	2.956122	2.380985	1.848876	1.217942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	111.7074	99.27938	87.56562	76.60771	66.4365	57.0788	48.55567	40.88034	34.05597	28.07345	22.90945	18.52528	14.86685	11.86637	9.44556	7.5204	6.006305	4.822808	3.89655	3.161663	2.556367	2.011387	1.402565	0.224213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	113.4921	101.0451	89.30081	78.30006	68.07313	58.6466	50.04162	42.27206	35.34237	29.24541	23.96061	19.45265	15.67132	12.55274	10.02224	7.998569	6.398843	5.143197	4.158037	3.377006	2.738469	2.17553	1.578112	0.592301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007.5	115.2725	102.807	91.03301	79.99064	69.70966	60.21634	51.53192	43.67083	36.63865	30.43005	25.027	20.39735	16.49456	13.25854	10.61814	8.494973	6.808041	5.478286	4.43206	3.602541	2.927941	2.342993	1.748721	0.87928	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	117.0488	104.5652	92.76226	81.67945	71.34599	61.78784	53.02629	45.07624	37.94429	31.62679	26.10801	21.3588	17.33606	13.98335	11.233	9.009537	7.233978	5.828275	4.718899	3.838629	3.125367	2.514997	1.917246	1.122828	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080.5	118.8209	106.3197	94.48858	83.36648	72.98203	63.36093	54.52445	46.48791	39.25883	32.83506	27.20306	22.33642	18.1953	14.72676	11.86657	9.542162	7.676702	6.19333	5.01881	4.085611	3.331264	2.692474	2.08578	1.340447	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2117	120.5891	108.0706	96.21204	85.0517	74.61772	64.93545	56.02615	47.90549	40.58182	34.05437	28.31158	23.32963	19.07175	15.48837	12.51856	10.09272	8.136232	6.573592	5.332025	4.343805	3.546091	2.876173	2.255916	1.541937	0.252026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2153.5	122.3533	109.8179	97.93266	86.73512	76.25297	66.51124	57.53115	49.32865	41.91283	35.28421	29.43302	24.33789	19.96492	16.26775	13.18869	10.66105	8.612555	6.969172	5.658753	4.613503	3.770257	3.066714	2.428912	1.733428	0.63901	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2190	124.1137	111.5618	99.65049	88.41674	77.88772	68.08817	59.03922	50.75707	43.25148	36.5241	30.56688	25.36067	20.8743	17.06447	13.87662	11.24698	9.105633	7.380157	5.99918	4.89498	4.004133	3.26463	2.60578	1.919046	0.94595	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2226.5	125.8704	113.3023	101.3656	90.09654	79.52192	69.66611	60.55015	52.19046	44.59737	37.7736	31.71264	26.39744	21.79939	17.87811	14.58205	11.85032	9.615404	7.806605	6.353467	5.188482	4.248053	3.470386	2.787358	2.101723	1.208653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2263	127.6233	115.0395	103.0779	91.77452	81.1555	71.24493	62.06375	53.62854	45.95016	39.03227	32.86983	27.44771	22.73972	18.70823	15.30463	12.47084	10.14178	8.248551	6.721756	5.494236	4.502325	3.684396	2.974354	2.283625	1.444266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2299.5	129.3727	116.7734	104.7876	93.45069	82.78842	72.82453	63.57984	55.07105	47.3095	40.29973	34.03799	28.51099	23.6948	19.55441	16.04402	13.10831	10.68465	8.706007	7.104162	5.812447	4.76723	3.907034	3.167373	2.466409	1.662581	0.32502	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2336	131.1186	118.5041	106.4946	95.12505	84.42063	74.4048	65.09824	56.51775	48.67508	41.57556	35.21668	29.58682	24.66417	20.41622	16.79988	13.7625	11.24389	9.178961	7.50078	6.143297	5.043024	4.138639	3.366945	2.651382	1.869808	0.712298	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2372.5	132.861	120.2316	108.1991	96.79759	86.05209	75.98565	66.61878	57.96839	50.04659	42.85941	36.40548	30.67474	25.64739	21.29326	17.57184	14.43313	11.81935	9.667381	7.911683	6.486949	5.329942	4.379523	3.573535	2.839593	2.070155	1.024964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2409	134.6	121.956	109.9009	98.46833	87.68275	77.56697	68.14133	59.42277	51.42374	44.15092	37.60399	31.77432	26.644	22.18509	18.35955	15.11994	12.41086	10.17121	8.336923	6.843543	5.628199	4.62997	3.787561	3.031903	2.266341	1.294388	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2445.5	136.3357	123.6775	111.6002	100.1373	89.31259	79.14869	69.66572	60.88068	52.80626	45.44977	38.81181	32.88514	27.65358	23.09131	19.16266	15.82266	13.01825	10.69039	8.776531	7.2132	5.93799	4.890245	4.009395	3.228989	2.460535	1.539216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2482	138.0681	125.3959	113.297	101.8044	90.94158	80.73072	71.19184	62.34191	54.19389	46.75562	40.02858	34.00679	28.67571	24.01152	19.98081	16.54099	13.64132	11.22481	9.23052	7.596023	6.259489	5.160587	4.239368	3.43144	2.654696	1.767997	0.344335	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2518.5	139.7974	127.1114	114.9914	103.4697	92.56967	82.31299	72.71954	63.80628	55.58639	48.06817	41.25395	35.13888	29.70999	24.94532	20.81364	17.27464	14.27988	11.77439	9.698881	7.992092	6.592854	5.441215	4.47778	3.639805	2.850307	1.986184	0.734867	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2555	141.5234	128.824	116.6833	105.1333	94.19684	83.89544	74.24871	65.27362	56.98352	49.38714	42.48756	36.28104	30.75601	25.89232	21.66079	18.02333	14.9337	12.33899	10.18159	8.401472	6.938222	5.732332	4.72491	3.854575	3.048513	2.197568	1.059279	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2591.5	143.2464	130.5337	118.3728	106.7951	95.82308	85.47799	75.77925	66.74377	58.38505	50.71225	43.72911	37.43289	31.8134	26.85215	22.52192	18.78674	15.60256	12.91848	10.67861	8.824209	7.295713	6.034118	4.981023	4.076187	3.250227	2.404921	1.344577	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2628	144.9664	132.2407	120.0599	108.4551	97.44835	87.06058	77.31103	68.21655	59.79079	52.04323	44.97827	38.5941	32.88178	27.82443	23.39667	19.56459	16.28623	13.51271	11.18987	9.260331	7.66543	6.346744	5.24636	4.305028	3.456205	2.610339	1.604667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2664.5	146.6834	133.9449	121.7447	110.1133	99.07263	88.64316	78.84396	69.69183	61.20052	53.37984	46.23475	39.76432	33.9608	28.8088	24.2847	20.35656	16.98448	14.12153	11.71532	9.709848	8.047459	6.670361	5.521147	4.541445	3.667082	2.815457	1.847872	0.361935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2701	148.3975	135.6464	123.4271	111.7698	100.6959	90.22566	80.37795	71.16947	62.61405	54.72182	47.49825	40.94323	35.05011	29.8049	25.18567	21.16236	17.69705	14.74476	12.25485	10.17276	8.441871	7.005107	5.805592	4.78575	3.883405	3.021581	2.079664	0.762453	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2737.5	150.1086	137.3453	125.1073	113.4246	102.3182	91.80805	81.9129	72.64932	64.03121	56.06896	48.76852	42.13052	36.14937	30.81238	26.09924	21.98168	18.42371	15.38223	12.80838	10.64904	8.848722	7.351105	6.099885	5.038224	4.105649	3.229775	2.303872	1.098433	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2774	151.817	139.0415	126.7852	115.0776	103.9394	93.39028	83.44873	74.13126	65.45183	57.42103	50.04527	43.32589	37.25825	31.83092	27.02509	22.81423	19.16419	16.03376	13.37578	11.13866	9.268053	7.708465	6.4042	5.299126	4.334232	3.440919	2.523304	1.395735	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2810.5	153.5225	140.7351	128.4609	116.7289	105.5595	94.97229	84.98355	75.61517	66.87572	58.77782	51.32827	44.52905	38.37643	32.86017	27.96289	23.6597	19.91825	16.69914	13.95694	11.64157	9.69989	8.077279	6.718695	5.568688	4.569529	3.655757	2.740092	1.667789	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2847	155.2253	142.4262	130.1343	118.3785	107.1786	96.55404	86.5227	77.10093	68.30275	60.13913	52.61726	45.73972	39.50362	33.89983	28.91232	24.5178	20.68562	17.37817	14.55173	12.15772	10.14425	8.457629	7.043514	5.847127	4.811873	3.874923	2.955902	1.922684	0.400422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2883.5	156.9254	144.1148	131.8056	120.0263	108.7967	98.1355	88.06069	78.58844	69.73275	61.50477	53.91202	46.95764	40.63952	34.94958	29.87308	25.38824	21.46606	18.07066	15.16	12.68703	10.60112	8.849581	7.378785	6.134637	5.061566	4.098966	3.172065	2.16577	0.803961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2920	158.6229	145.8009	133.4747	121.6725	110.4136	99.71663	89.59926	80.07758	71.16558	62.87455	55.21232	48.18254	41.78383	36.00911	30.84486	26.27072	22.25929	18.77638	15.7816	13.22942	11.07051	9.253188	7.724622	6.4314	5.318882	4.328364	3.389667	2.400676	1.139444	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2956.5	160.3177	147.4846	135.1417	123.317	112.0294	101.2974	91.13835	81.56827	72.60112	64.24831	56.51796	49.41417	42.9363	37.07814	31.82736	27.16496	23.06507	19.49514	16.41638	13.7848	11.55238	9.668491	8.081129	6.737577	5.584069	4.56354	3.609562	2.62954	1.438535	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2993	162.0099	149.1658	136.8066	124.9598	113.6441	102.8777	92.67789	83.06039	74.03922	65.62587	57.82871	50.65231	44.09664	38.15639	32.82029	28.07067	23.88314	20.2267	17.06418	14.35307	12.04669	10.09552	8.448392	7.053318	5.857354	4.804852	3.832399	2.854747	1.714889	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3029.5	163.6996	150.8447	138.4694	126.6009	115.2577	104.4577	94.21782	84.55387	75.47976	67.00707	59.1444	51.89672	45.2646	39.24356	33.82337	28.98759	24.71324	20.97086	17.72482	14.93412	12.55341	10.53429	8.826488	7.378757	6.138938	5.052607	4.058812	3.078312	1.975521	0.346534	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3066	165.3868	152.5212	140.1301	128.2404	116.8702	106.0371	95.75808	86.04862	76.92263	68.39176	60.46483	53.14717	46.43994	40.3394	34.83632	29.91543	25.55512	21.72739	18.39813	15.52783	13.07247	10.9848	9.21548	7.714014	6.429001	5.307092	4.289401	3.301722	2.225118	0.760032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3102.5	167.0715	154.1955	141.7888	129.8782	118.4815	107.6161	97.29863	87.54455	78.3677	69.77978	61.78981	54.40346	47.62241	41.44365	35.85887	30.85393	26.40852	22.49606	19.08394	16.13408	13.60382	11.44706	9.615419	8.059191	6.727707	5.568578	4.524696	3.526122	2.46704	1.113024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3139	168.7538	155.8674	143.4455	131.5144	120.0917	109.1945	98.83941	89.04159	79.81487	71.17101	63.11918	55.66539	48.81178	42.55605	36.89076	31.80283	27.2732	23.27667	19.78206	16.75273	14.14736	11.92103	10.02634	8.414383	7.035208	5.837316	4.765161	3.752433	2.7038	1.428843	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3175.5	170.4336	157.5371	145.1002	133.1489	121.7007	110.7724	100.3804	90.55966	81.26404	72.5653	64.45277	56.93274	50.00783	43.67636	37.93172	32.76186	28.14891	24.06898	20.49231	17.38365	14.70303	12.40671	10.44828	8.779668	7.351646	6.113542	5.011198	3.98142	2.937341	1.719873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3212	172.1111	159.2045	146.7528	134.7818	123.3086	112.3498	101.9215	92.03869	82.71511	73.96252	65.79041	58.20534	51.21034	44.80434	38.98151	33.73078	29.0354	24.87278	21.2145	18.0267	15.27073	12.90404	10.88125	9.155117	7.677152	6.397468	5.263165	4.213725	3.169207	1.99366	0.281198	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3248.5	173.7862	160.8698	148.4036	136.4131	124.9153	113.9265	103.4627	93.53861	84.16797	75.36255	67.13196	59.48299	52.4191	45.93975	40.03989	34.70933	29.93244	25.68784	21.94844	18.68173	15.85036	13.41298	11.32525	9.540791	8.011843	6.689291	5.521375	4.449905	3.40065	2.255234	0.71567	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3285	175.459	162.5328	150.0524	138.0428	126.5208	115.5026	105.0039	95.03936	85.62254	76.76528	68.47726	60.76553	53.63391	47.08239	41.10661	35.69728	30.83979	26.51395	22.69395	19.34859	16.44181	13.93348	11.78029	9.93674	8.355827	6.989187	5.786111	4.69044	3.6327	2.508165	1.085143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3321.5	177.1295	164.1937	151.6992	139.6709	128.1252	117.0781	106.5451	96.54087	87.07873	78.17057	69.82617	62.05278	54.85457	48.23203	42.18145	36.69438	31.75721	27.35088	23.45082	20.02711	17.04498	14.46547	12.24635	10.34301	8.709202	7.297318	6.057626	4.935754	3.866225	2.755103	1.415041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3358	178.7977	165.8525	153.3442	141.2974	129.7284	118.653	108.0864	98.04308	88.53646	79.57833	71.17856	63.34458	56.08089	49.38846	43.26418	37.70042	32.68448	28.19842	24.21886	20.71715	17.65975	15.00889	12.72342	10.75962	9.072052	7.61383	6.336151	5.186223	4.101958	2.998084	1.718607	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3394.5	180.4638	167.5092	154.9872	142.9223	131.3304	120.2271	109.6275	99.54594	89.99564	80.98844	72.53428	64.64078	57.3127	50.55148	44.35459	38.71514	33.62137	29.05636	24.99789	21.41853	18.28598	15.56366	13.21146	11.18661	9.444452	7.938857	6.621891	5.442181	4.340532	3.238716	2.003791	0.229004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3431	182.1276	169.1638	156.6284	144.5457	132.9313	121.8006	111.1686	101.0494	91.4562	82.40082	73.89323	65.94121	58.54982	51.72089	45.45246	39.73835	34.56766	29.92448	25.78771	22.1311	18.92357	16.1297	13.71044	11.62398	9.826468	8.272518	6.915037	5.70393	4.582494	3.478298	2.27585	0.679427	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3467.5	183.7892	170.8163	158.2678	146.1675	134.531	123.3734	112.7095	102.5534	92.91807	83.81535	75.25526	67.24574	59.79208	52.8965	46.55759	40.76982	35.52313	30.80257	26.58812	22.85469	19.57238	16.70691	14.22032	12.07174	10.21816	8.614922	7.215759	5.971742	4.828325	3.717898	2.538444	1.058484	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3504	185.4486	172.4668	159.9053	147.7877	136.1294	124.9454	114.2503	104.0578	94.38117	85.23194	76.62028	68.55421	61.03931	54.07813	47.66977	41.80934	36.48757	31.69043	27.39894	23.58914	20.23227	17.2952	14.74105	12.52989	10.61956	8.966164	7.524215	6.245861	5.078448	3.958385	2.793931	1.396053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3540.5	187.106	174.1153	161.5409	149.4064	137.7267	126.5167	115.7908	105.5628	95.84543	86.65052	77.98815	69.86651	62.29135	55.2656	48.78881	42.85671	37.46077	32.58785	28.21997	24.33426	20.9031	17.89448	15.27257	12.99842	11.03072	9.326331	7.840547	6.526511	5.33323	4.200445	3.044512	1.707273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3577	188.7612	175.7618	163.1748	151.0235	139.3228	128.0873	117.3312	107.0681	97.31079	88.07098	79.35878	71.18248	63.54806	56.45874	49.91452	43.91172	38.44252	33.49462	29.05103	25.08991	21.58475	18.50464	15.81482	13.47732	11.45166	9.695498	8.164884	6.81389	5.592986	4.444712	3.292065	1.999993	0.133839	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3613.5	190.4143	177.4063	164.8069	152.6392	140.9178	129.6571	118.8713	108.5737	98.77719	89.49324	80.73206	72.50201	64.80928	57.65738	51.04672	44.97418	39.43262	34.41056	29.89192	25.8559	22.27706	19.12558	16.36774	13.96655	11.8824	10.07373	8.497341	7.108178	5.85801	4.691774	3.538019	2.279375	0.60155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3650	192.0653	179.0488	166.4372	154.2532	142.5115	131.2261	120.4111	110.0797	100.2446	90.91723	82.10788	73.82498	66.07487	58.86135	52.18523	46.0439	40.43088	35.33546	30.74246	26.63207	22.97989	19.75718	16.93125	14.46608	12.32296	10.46109	8.838022	7.409539	6.128572	4.942151	3.783504	2.549063	0.997406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3686.5	193.7143	180.6895	168.0657	155.8658	144.104	132.7944	121.9506	111.5859	101.7128	92.34287	83.48616	75.15126	67.34469	60.0705	53.32987	47.12069	41.43709	36.26912	31.60246	27.41824	23.6931	20.39933	17.50528	14.97589	12.77333	10.85761	9.187018	7.718122	6.404925	5.196296	4.029444	2.811753	1.349779	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3723	195.3613	182.3281	169.6925	157.4769	145.6954	134.3618	123.4898	113.0924	103.182	93.77008	84.86679	76.48075	68.6186	61.28467	54.48048	48.20437	42.45109	37.21137	32.47174	28.21425	24.41654	21.05191	18.08973	15.49592	13.23352	11.26334	9.544413	8.03407	6.687299	5.454609	4.276613	3.069516	1.67345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3759.5	197.0062	183.9649	171.3175	159.0864	147.2855	135.9284	125.0286	114.599	104.652	95.19879	86.24969	77.81332	69.89649	62.50372	55.63689	49.29477	43.47267	38.16202	33.35012	29.01994	25.15006	21.7148	18.68454	16.02613	13.70352	11.67831	9.910282	8.35751	6.975905	5.717442	4.525669	3.323987	1.977039	0.036653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3796	198.6492	185.5998	172.9408	160.6945	148.8744	137.4942	126.5671	116.1058	106.1227	96.62893	87.63476	79.14888	71.17821	63.72751	56.79894	50.39171	44.50166	39.12088	34.23743	29.83513	25.89352	22.38788	19.28959	16.56645	14.1833	12.10254	10.28469	8.688562	7.270933	5.98511	4.77718	3.576485	2.266134	0.524446	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3832.5	200.2902	187.2328	174.5624	162.3011	150.4622	139.0592	128.1051	117.6128	107.5941	98.06044	89.02193	80.48732	72.46366	64.95589	57.96647	51.49502	45.53788	40.08777	35.13347	30.65966	26.64676	23.07103	19.9048	17.11684	14.67284	12.53605	10.6677	9.027332	7.57256	6.257894	5.031641	3.828095	2.544626	0.936831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3869	201.9293	188.864	176.1823	163.9062	152.0488	140.6233	129.6428	119.1198	109.0662	99.49326	90.41111	81.82855	73.75271	66.18873	59.13935	52.60455	46.58117	41.06251	36.03809	31.49336	27.40964	23.76412	20.53008	17.67721	15.17212	12.97884	11.05935	9.373921	7.880944	6.536047	5.289488	4.079726	2.815365	1.302084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

3905.5	203.5664	190.4933	177.8006	165.5098	153.6341	142.1866	131.18	120.6268	110.5389	100.9273	91.80223	83.17246	75.04525	67.4259	60.31741	53.72013	47.63135	42.04495	36.95111	32.33608	28.18201	24.46702	21.16531	18.24752	15.6811	13.43092	11.4597	9.728416	8.196232	6.819801	5.551107	4.332146	3.080522	1.636589	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3942	205.2016	192.1208	179.4171	167.112	155.2183	143.749	132.7168	122.1339	112.0121	102.3625	93.1952	84.51897	76.34117	68.66727	61.50052	54.84161	48.68825	43.0349	37.87236	33.18764	28.96372	25.1796	21.81041	18.82767	16.19974	13.89228	11.86878	10.0909	8.518556	7.109363	5.816841	4.586016	3.341798	1.949669	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3978.5	206.8349	193.7465	181.032	168.7127	156.8013	145.3106	134.2531	123.641	113.4859	103.7989	94.58996	85.86798	77.64036	69.91272	62.68855	55.96883	49.75173	44.03219	38.80168	34.04789	29.75462	25.90173	22.46525	19.41759	16.72799	14.36292	12.28661	10.46143	8.848037	7.404923	6.087001	4.841907	3.600562	2.247271	0.451935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4015	208.4664	195.3705	182.6453	170.3119	158.3831	146.8713	135.7889	125.148	114.9602	105.2363	95.98644	87.21941	78.94273	71.16214	63.88135	57.10166	50.82162	45.03668	39.7389	34.91667	30.55456	26.63329	23.12973	20.01721	17.26581	14.84282	12.71322	10.84009	9.184785	7.706656	6.361865	5.100318	3.857935	2.533484	0.8773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4051.5	210.0959	196.9926	184.2569	171.9097	159.9637	148.4311	137.3243	126.655	116.4349	106.6748	97.38456	88.57318	80.24816	72.4154	65.07879	58.23994	51.89776	46.0482	40.68386	35.79382	31.36341	27.37413	23.80375	20.62644	17.81315	15.33197	13.14863	11.22692	9.5289	8.01472	6.641685	5.36169	4.11484	2.810744	1.236969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4088	211.7237	198.613	185.8668	173.5061	161.5431	149.99	138.8591	128.1619	117.9101	108.1142	98.78427	89.92919	81.55657	73.67239	66.28076	59.38354	52.98002	47.06658	41.6364	36.67919	32.181	28.12413	24.48718	21.24519	18.36994	15.83033	13.59285	11.62198	9.880472	8.329259	6.92669	5.626401	4.371854	3.078293	1.420812	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4124.5	213.3496	200.2316	187.4752	175.1011	163.1213	151.5481	140.3933	129.6687	119.3856	109.5545	100.1855	91.28739	82.86786	74.93301	67.48713	60.53233	54.06825	48.09169	42.59638	37.57263	33.00719	28.88315	25.17992	21.87338	18.93613	16.33788	14.04587	12.0253	10.23958	8.650406	7.217078	5.894673	4.627703	3.304403	1.254698	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4161	214.9736	201.8485	189.082	176.6946	164.6984	153.1052	141.9271	131.1754	120.8614	110.9957	101.5882	92.64768	84.18194	76.19715	68.69778	61.68617	55.16229	49.12337	43.56363	38.47397	33.84185	29.65107	25.88185	22.5109	19.51164	16.85458	14.50771	12.43691	10.6063	8.978271	7.512928	6.165653	4.873084	3.455381	0.950429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4197.5	216.5959	203.4637	190.6871	178.2867	166.2742	154.6615	143.4602	132.6819	122.3376	112.4377	102.9922	94.01	85.49872	77.46472	69.91259	62.84494	56.26202	50.16148	44.538	39.38309	34.68482	30.42775	26.59286	23.15767	20.09642	17.3804	14.97834	12.85685	10.98069	9.312872	7.81377	6.436115	5.097634	3.536744	0.577896	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4234	218.2164	205.0772	192.2907	179.8774	167.8489	156.2168	144.9928	134.1882	123.814	113.8805	104.3977	95.37428	86.81812	78.7356	71.13145	64.0085	57.3673	51.20587	45.51936	40.29982	35.53597	31.21306	27.31283	23.81359	20.69039	17.91528	15.45776	13.28512	11.36272	9.653942	8.118261	6.701989	5.296457	3.559947	0.1831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4270.5	219.8351	206.6889	193.8927	181.4667	169.4223	157.7713	146.5248	135.6943	125.2906	115.324	105.8044	96.74044	88.14006	80.0097	72.35426	65.17674	58.478	52.2564	46.50755	41.22402	36.39515	32.00686	28.04164	24.47857	21.29347	18.45919	15.94594	13.72167	11.75223	10.00082	8.424532	6.959893	5.46822	3.534518	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4307	221.4521	208.299	195.4932	183.0546	170.9946	159.3248	148.0563	137.2002	126.7675	116.7683	107.2123	98.10842	89.46445	81.28694	73.5809	66.34955	59.59399	53.31294	47.50244	42.15556	37.26223	32.80904	28.77919	25.1525	21.90559	19.01206	16.44281	14.16638	12.14884	10.35254	8.730626	7.207412	5.613214	3.467796	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4343.5	223.0674	209.9075	197.0921	184.6411	172.5658	160.8774	149.5871	138.7059	128.2445	118.2131	108.6214	99.47816	90.79122	82.56721	74.81127	67.52679	60.71514	54.37536	48.50388	43.09429	38.13707	33.61945	29.52533	25.83529	22.52666	19.57379	16.94825	14.61899	12.55196	10.70793	9.03473	7.44292	5.732405	3.365517	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4380	224.6809	211.5143	198.6895	186.2262	174.1357	162.429	151.1173	140.2113	129.7217	119.6586	110.0317	100.8496	92.1203	83.85044	76.04528	68.70837	61.84133	55.44351	49.51174	44.04007	39.01953	34.43797	30.27997	26.52681	23.15656	20.14426	17.46203	15.07909	12.96086	11.06577	9.335264	7.665356	5.827007	3.232308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4416.5	226.2927	213.1194	200.2853	187.81	175.7045	163.9798	152.6468	141.7164	131.199	121.1047	111.443	102.2227	93.45161	85.13654	77.28282	69.89418	62.97245	56.51729	50.52589	44.99277	39.90948	35.26446	31.04296	27.22693	23.79515	20.72327	17.98387	15.54619	13.3747	11.42484	9.630877	7.874057	5.898308	3.072042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4453	227.9028	214.7229	201.8796	189.3924	177.2721	165.5296	154.1758	143.2213	132.6764	122.5513	112.8553	103.5973	94.78508	86.42542	78.5238	71.0841	64.10837	57.59655	51.5462	45.95225	40.80677	36.09879	31.81416	27.93551	24.44225	21.31057	18.51338	16.01967	13.79257	11.78395	9.920434	8.068633	5.947593	2.888069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4489.5	229.5112	216.3248	203.4724	190.9734	178.8385	167.0785	155.7041	144.7258	134.1539	123.9984	114.2687	104.9735	96.12064	87.71701	79.76813	72.27804	65.24898	58.68118	52.57252	46.91837	41.71128	36.94081	32.59342	28.65236	25.09761	21.90583	19.05007	16.49883	14.21353	12.14202	10.20298	8.248895	5.976116	2.68338	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4526	231.1179	217.9251	205.0638	192.5531	180.4038	168.6264	157.2317	146.23	135.6314	125.446	115.683	106.3511	97.45823	89.01122	81.01572	73.47589	66.39418	59.77105	53.60474	47.891	42.62284	37.79035	33.38056	29.37726	25.76097	22.50867	19.5934	16.98293	14.63663	12.49802	10.47774	8.414798	5.985091	2.46072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4562.5	232.723	219.5238	206.6536	194.1314	181.9679	170.1735	158.7587	147.7338	137.109	126.894	117.0982	107.7302	98.79778	90.30799	82.26648	74.67755	67.54384	60.86605	54.64272	48.86999	43.5413	38.64724	34.17535	30.10995	26.43196	23.11862	20.14276	17.47118	15.06094	12.851	10.74404	8.566412	5.975693	2.222677	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4599	234.3264	221.1209	208.2419	195.7084	183.5308	171.7195	160.285	149.2373	138.5866	128.3425	118.5143	109.1106	100.1392	91.60723	83.52032	75.88293	68.69785	61.96604	55.68632	49.85518	44.46648	39.51127	34.97755	30.85011	27.11021	23.73517	20.69749	17.96277	15.48554	13.2001	11.00136	8.703892	5.949059	1.971762	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4635.5	235.9282	222.7164	209.8288	197.2841	185.0926	173.2647	161.8106	150.7404	140.0641	129.7913	119.9312	110.4923	101.4825	92.90887	84.77716	77.09192	69.85611	63.07089	56.73539	50.8464	45.39818	40.3822	35.78688	31.59739	27.79525	24.35776	21.25687	18.45687	15.90956	13.54454	11.24927	8.827466	5.906292	1.710481	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4672	237.5284	224.3104	211.4142	198.8584	186.6532	174.8089	163.3355	152.2431	141.5416	131.2405	121.3488	111.8752	102.8276	94.21285	86.03691	78.30442	71.01849	64.18048	57.78977	51.84347	46.33619	41.25977	36.60302	32.3514	28.48659	24.98576	21.82019	18.95265	16.33215	13.88363	11.48744	8.937417	5.848461	1.44144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4708.5	239.1269	225.9028	212.9981	200.4314	188.2127	176.3521	164.8598	153.7455	143.0191	132.69	122.7672	113.2594	104.1744	95.51907	87.29948	79.52032	72.18486	65.29465	58.84929	52.84618	47.28026	42.14369	37.4256	33.11169	29.1837	25.61854	22.38669	19.44931	16.75253	14.21674	11.71561	9.034077	5.776606	1.167491	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4745	240.7239	227.4937	214.5806	202.0031	189.771	177.8944	166.3833	155.2474	144.4964	134.1397	124.1864	114.6448	105.5228	96.82746	88.56477	80.73952	73.3551	66.41324	59.91376	53.85431	48.23011	43.03362	38.25422	33.87778	29.88599	26.25541	22.95562	19.94604	17.16995	14.54332	11.93361	9.117815	5.691735	0.891996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4781.5	242.3193	229.0831	216.1617	203.5734	191.3282	179.4358	167.9061	156.7489	145.9737	135.5898	125.6061	116.0312	106.8728	98.13795	89.83268	81.96188	74.52905	67.53607	60.98296	54.8676	49.18545	43.92921	39.08846	34.64914	30.59285	26.89567	23.5262	20.44208	17.58372	14.86288	12.14133	9.189036	5.594827	0.619382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4818	243.9131	230.6709	217.7413	205.1425	192.8842	180.9762	169.4282	158.2499	147.4508	137.04	127.0265	117.4187	108.2243	99.45043	91.1031	83.18727	75.70655	68.66296	62.05668	55.88578	50.14594	44.83005	39.92783	35.42523	31.30366	27.53863	24.09769	20.93667	17.99319	15.17502	12.33871	9.248166	5.486832	0.356567	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4854.5	245.5053	232.2573	219.3195	206.7103	194.4391	182.5157	170.9496	159.7505	148.9278	138.4905	128.4475	118.8072	109.5773	100.7648	92.37591	84.41556	76.88744	69.79369	63.13465	56.90855	51.11123	45.73573	40.77184	36.20547	32.01774	28.18356	24.66935	21.42911	18.39776	15.47936	12.52576	9.295656	5.368669	0.118311	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4891	247.0959	233.8421	220.8963	208.2767	195.9928	184.0542	172.4703	161.2506	150.4045	139.9411	129.869	120.1966	110.9316	102.081	93.65099	85.64657	78.07151	70.92803	64.21659	57.93557	52.08091	46.64577	41.61995	36.98924	32.73443	28.82975	25.24044	21.91872	18.79692	15.77563	12.70253	9.33197	5.241228	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4927.5	248.6851	235.4254	222.4717	209.8419	197.5454	185.5917	173.9902	162.7502	151.8811	141.3918	131.2909	121.5868	112.2871	103.3989	94.92819	86.88014	79.25856	72.06573	65.30221	58.96648	53.05458	47.5597	42.47161	37.77594	33.45306	29.47647	25.81026	22.40487	19.19016	16.06358	12.86911	9.357585	5.105366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4964	250.2726	237.0073	224.0457	211.4057	199.0968	187.1282	175.5093	164.2493	153.3574	142.8425	132.7132	122.9778	113.6438	104.7183	96.20734	88.11608	80.44835	73.20651	66.39118	60.00091	54.03178	48.477	43.32625	38.56492	34.17293	30.12305	26.37814	22.88696	19.57706	16.34302	13.02562	9.372985	4.96191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000.5	251.8587	238.5876	225.6182	212.9683	200.6471	188.6638	177.0276	165.7478	154.8334	144.2932	134.1359	124.3694	115.0015	106.0391	97.48828	89.35416	81.64063	74.35007	67.48315	61.03845	55.01206	49.39715	44.18327	39.35553	34.89338	30.76877	26.94343	23.36444	19.95723	16.6138	13.17224	9.378659	4.811655	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5037	253.4431	240.1665	227.1894	214.5295	202.1961	190.1983	178.5451	167.2457	156.3091	145.7439	135.5587	125.7616	116.3601	107.3611	98.7708	90.59417	82.83513	75.4961	68.57775	62.07866	55.99492	50.31959	45.04207	40.14714	35.61373	31.413	27.50551	23.8368	20.33034	16.87584	13.30916	9.375097	4.655363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5073.5	255.0261	241.7438	228.7591	216.0895	203.744	191.7318	180.0617	168.743	157.7843	147.1944	136.9817	127.1542	117.7195	108.6843	100.0547	91.83585	84.03156	76.64425	69.67458	63.1211	56.97985	51.24377	45.90204	40.9391	36.33332	32.05507	28.0638	24.30359	20.6961	17.12907	13.43658	9.362786	4.493767	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5110	256.6074	243.3196	230.3273	217.648	205.2907	193.2641	181.5775	170.2395	159.259	148.6447	138.4047	128.5472	119.0794	110.0083	101.3398	93.07894	85.22961	77.79416	70.77323	64.16531	57.96633	52.16911	46.76257	41.73076	37.05151	32.69438	28.61776	24.76436	21.05425	17.37347	13.55474	9.342211	4.327565	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5146.5	258.1872	244.8939	231.8941	219.2052	206.836	194.7954	183.0922	171.7353	160.7332	150.0946	139.8277	129.9403	120.4398	111.3329	102.6257	94.32314	86.42893	78.94545	71.87326	65.21078	58.95384	53.09504	47.62304	42.5215	37.76767	33.33034	29.16688	25.21876	21.40461	17.60907	13.6639	9.313849	4.157424	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5183	259.7653	246.4666	233.4594	220.761	208.3801	196.3255	184.6059	173.2302	162.2067	151.5441	141.2503	131.3333	121.8004	112.6581	103.9124	95.56815	87.62919	80.09772	72.97423	66.25704	59.94182	54.02096	48.48284	43.31069	38.4812	33.96239	29.71069	25.66643	21.747	17.8359	13.76432	9.27817	3.98398	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5219.5	261.3419	248.0378	235.0232	222.3153	209.9228	197.8544	186.1186	174.7241	163.6795	152.9929	142.6726	132.7262	123.1609	113.9834	105.1993	96.81365	88.83	81.25055	74.07568	67.30357	60.92972	54.94631	49.34138	44.09774	39.19151	34.59001	30.24876	26.10708	22.08129	18.05403	13.85629	9.235634	3.807841	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5256	262.9167	249.6072	236.5853	223.8681	211.4641	199.3819	187.63	176.217	165.1513	154.4411	144.0944	134.1187	124.5213	115.3086	106.4863	98.0593	90.031	82.40353	75.17714	68.34986	61.91701	55.8705	50.19805	44.88205	39.89805	35.2127	30.78069	26.54044	22.4074	18.26357	13.94009	9.186688	3.62958	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5292.5	264.4897	251.175	238.1458	225.4193	213.0039	200.908	189.1402	177.7088	166.6221	155.8884	145.5154	135.5106	125.8812	116.6335	107.7731	99.30473	91.23178	83.5562	76.27812	69.3954	62.90313	56.79297	51.0523	45.66307	40.60031	35.83	31.30613	26.9663	22.72526	18.46462	14.01601	9.131769	3.449748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5329	266.061	252.741	239.7046	226.9689	214.5421	202.4327	190.6489	179.1992	168.0918	157.3346	146.9354	136.9017	127.2404	117.9578	109.0593	100.5496	92.43193	84.70812	77.37814	70.43965	63.88753	57.71315	51.90354	46.44025	41.29777	36.44151	31.82475	27.38447	23.03484	18.65734	14.08435	9.071299	3.268862	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5365.5	267.6303	254.3051	241.2616	228.5167	216.0786	203.9557	192.1561	180.6882	169.5601	158.7795	148.3544	138.2918	128.5986	119.2811	110.3446	101.7935	93.63103	85.85884	78.47671	71.48211	64.86967	58.63049	52.75125	47.21307	41.98998	37.04681	32.33628	27.79478	23.33613	18.84187	14.14542	9.005688	3.087418	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5402	269.1977	255.8672	242.8166	230.0626	217.6133	205.477	193.6617	182.1757	171.0268	160.2231	149.7719	139.6805	129.9555	120.6031	111.6286	103.0361	94.82867	87.0079	79.57334	72.52226	65.84904	59.54447	53.59491	47.98106	42.6765	37.64555	32.84044	28.19711	23.62916	19.01837	14.19951	8.93533	2.905884	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5438.5	270.7629	257.4273	244.3696	231.6065	219.1461	206.9964	195.1654	183.6613	172.4919	161.6649	151.1878	141.0676	131.3109	121.9236	112.9109	104.2769	96.0244	88.15483	80.66754	73.55959	66.8251	60.45457	54.434	48.74374	43.35692	38.23742	33.33704	28.59138	23.91396	19.18704	14.24692	8.860604	2.724709	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5475	272.3259	258.9852	245.9205	233.1484	220.6768	208.5137	196.6671	185.145	173.9551	163.1049	152.6019	142.4529	132.6643	123.2421	114.1912	105.5155	97.21779	89.29916	81.75883	74.5936	67.79735	61.36028	55.26807	49.50068	44.03087	38.82212	33.82587	28.9775	24.1906	19.34805	14.28796	8.781873	2.544316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5511.5	273.8865	260.5407	247.469	234.6879	222.2052	210.0288	198.1667	186.6265	175.416	164.5427	154.0137	143.8359	134.0156	124.5584	115.4691	106.7516	98.40841	90.44045	82.84673	75.62381	68.76531	62.26113	56.09665	50.25147	44.698	39.39939	34.30678	29.35545	24.45917	19.50162	14.32292	8.699487	2.365115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5548	275.4446	262.0938	249.0151	236.225	223.7312	211.5416	199.6638	188.1056	176.8746	165.9781	155.4232	145.2165	135.3643	125.8719	116.7442	107.9847	99.59581	91.57824	83.93077	76.64974	69.72849	63.15667	56.91932	50.99574	45.35801	39.96899	34.77963	29.72519	24.71974	19.64793	14.35208	8.613777	2.187495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5584.5	276.9999	263.6441	250.5585	237.7594	225.2546	213.0517	201.1583	189.5822	178.3306	167.4109	156.83	146.5943	136.7101	127.1825	118.0161	109.2144	100.7796	92.71207	85.01049	77.67092	70.68646	64.04646	57.73568	51.73314	46.01061	40.53074	35.24434	30.08673	24.97244	19.78721	14.37574	8.525063	2.011836	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5621	278.5524	265.1916	252.0991	239.291	226.7751	214.5589	202.65	191.0558	179.7837	168.8407	158.2337	147.969	138.0526	128.4897	119.2845	110.4403	101.9592	93.8415	86.08544	78.68692	71.63877	64.93009	58.54537	52.46333	46.65554	41.08445	35.7008	30.44009	25.21739	19.91967	14.39417	8.433645	1.838507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5657.5	280.1017	266.736	253.6365	240.8196	228.2926	216.0631	204.1386	192.5263	181.2335	170.2672	159.634	149.3402	139.3916	129.793	120.5488	111.662	103.1344	94.9661	87.15518	79.69729	72.58501	65.80717	59.34802	53.18604	47.29258	41.62997	36.14898	30.78532	25.45472	20.04551	14.40764	8.339811	1.66787	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5694	281.6477	268.2771	255.1707	242.3449	229.8068	217.564	205.6238	193.9934	182.6799	171.6902	161.0307	150.7077	140.7266	131.0923	121.8088	112.8791	104.3047	96.08545	88.2193	80.70163	73.52478	66.67734	60.14332	53.90098	47.92153	42.1672	36.58882	31.12246	25.68457	20.16496	14.41643	8.243833	1.500288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5730.5	283.1902	269.8146	256.7014	243.8666	231.3175	219.0613	207.1054	195.4568	184.1225	173.1093	162.4234	152.0709	142.0572	132.387	123.0641	114.0912	105.4696	97.19913	89.27739	81.69955	74.45771	67.54026	60.93096	54.60793	48.54221	42.69602	37.02033	31.45159	25.9071	20.27824	14.42078	8.14597	1.336132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5767	284.7288	271.3483	258.2283	245.3845	232.8243	220.5547	208.5831	196.9162	185.5611	174.5242	163.8118	153.4297	143.3832	133.6768	124.3142	115.2978	106.6288	98.30675	90.32905	82.69066	75.38346	68.39561	61.71069	55.30666	49.15447	43.21636	37.44349	31.77279	26.12247	20.38556	14.42094	8.046464	1.175786	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5803.5	286.2633	272.878	259.7511	246.8984	234.327	222.044	210.0565	198.3713	186.9952	175.9345	165.1955	154.7836	144.7042	134.9614	125.5587	116.4986	107.7819	99.40792	91.37392	83.67462	76.30169	69.2431	62.48226	55.99698	49.75819	43.72817	37.85834	32.08615	26.33082	20.48714	14.41717	7.945547	1.019661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5840	287.7934	274.4033	261.2695	248.4079	235.8253	223.5289	211.5255	199.8218	188.4246	177.34	166.5741	156.1324	146.0197	136.2403	126.7974	117.6932	108.9285	100.5023	92.41164	84.65109	77.21211	70.08247	63.24543	56.67873	50.35325	44.2314	38.2649	32.39179	26.53234	20.58319	14.40969	7.843434	0.868216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5876.5	289.3188	275.9239	262.7833	249.9127	237.3189	225.009	212.9896	201.2674	189.8489	178.7403	167.9474	157.4755	147.3294	137.5131	128.0298	118.8813	110.0682	101.5895	93.44187	85.61975	78.11441	70.91345	64.00002	57.35176	50.93959	44.72605	38.66322	32.68981	26.72719	20.67392	14.39874	7.74033	0.721975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

P E R M E A B I L I T Y (cm/second)

Time Height from Bottom (metres)

days	0.001	1.54838	3.09676	4.64514	6.19352	7.7419	9.29028	10.8387	12.387	13.9354	15.4838	17.0322	18.5806	20.1289	21.6773	23.2257	24.7741	26.3225	27.8708	29.4192	30.9676	32.516	34.0644	35.6127	37.1611	38.7095	40.2579	41.8063	43.3546	44.903	46.4514	47.9998	49.5482	51.0965	52.6449	54.1933	55.7417	57.2901	58.8384	60.3868	61.9352	63.4836	65.032	66.5803	68.1287	69.6771	71.2255	72.7739	74.3222	75.8706
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36.5	7.31E-06	4.73E-05	0.000197	0.000417	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	5.22E-06	1.49E-05	5.17E-05	0.000121	0.000209	0.000313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109.5	4.32E-06	8.92E-06	2.35E-05	5.5E-05	9.98E-05	0.000153	0.000216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	3.79E-06	6.6E-06	1.41E-05	3.09E-05	5.74E-05	9.06E-05	0.000129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
182.5	3.43E-06	5.38E-06	9.95E-06	1.99E-05	3.68E-05	5.92E-05	8.55E-05	0.000115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
219	3.17E-06	4.63E-06	7.72E-06	1.42E-05	2.54E-05	4.13E-05	6.06E-05	8.23E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
255.5	2.96E-06	4.12E-06	6.37E-06	1.08E-05	1.87E-05	3.03E-05	4.49E-05	6.16E-05	8.33E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
292	2.8E-06	3.74E-06	5.47E-06	8.7E-06	1.44E-05	2.31E-05	3.44E-05	4.77E-05	6.27E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
328.5	2.66E-06	3.46E-06	4.83E-06	7.28E-06	1.15E-05	1.82E-05	2.71E-05	3.78E-05	5E-05	9.57E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
365	2.55E-06	3.23E-06	4.35E-06	6.29E-06	9.56E-06	1.47E-05	2.18E-05	3.06E-05	4.07E-05	5.34E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
401.5	2.45E-06	3.04E-06	3.99E-06	5.55E-06	8.14E-06	1.22E-05	1.79E-05	2.52E-05	3.37E-05	4.34E-05	8.44E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
438	2.37E-06	2.89E-06	3.69E-06	4.99E-06	7.08E-06	1.03E-05	1.5E-05	2.11E-05	2.83E-05	3.65E-05	4.75E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
474.5	2.29E-06	2.75E-06	3.46E-06	4.55E-06	6.27E-06	8.94E-06	1.28E-05	1.79E-05	2.4E-05	3.11E-05	3.92E-05	9.52E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
511	2.22E-06	2.64E-06	3.26E-06	4.19E-06	5.64E-06	7.85E-06	1.1E-05	1.53E-05	2.06E-05	2.67E-05	3.36E-05	4.5E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
547.5	2.16E-06	2.54E-06	3.09E-06	3.9E-06	5.13E-06	6.99E-06	9.67E-06	1.33E-05	1.79E-05	2.32E-05	2.93E-05	3.67E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
584	2.11E-06	2.45E-06	2.94E-06	3.66E-06	4.72E-06	6.3E-06	8.57E-06	1.17E-05	1.56E-05	2.03E-05	2.57E-05	3.18E-05	4.98E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620.5	2.06E-06	2.37E-06	2.82E-06	3.45E-06	4.38E-06	5.73E-06	7.68E-06	1.03E-05	1.38E-05	1.79E-05	2.27E-05	2.8E-05	3.62E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
657	2.01E-06	2.3E-06	2.71E-06	3.28E-06	4.09E-06	5.27E-06	6.95E-06	9.25E-06	1.22E-05	1.59E-05	2.01E-05	2.49E-05	3.08E-05	7.36E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
693.5	1.97E-06	2.24E-06	2.61E-06	3.12E-06	3.85E-06	4.88E-06	6.34E-06	8.34E-06	1.1E-05	1.42E-05	1.8E-05	2.23E-05	2.72E-05	3.75E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
730	1.93E-06	2.18E-06	2.52E-06	2.99E-06	3.64E-06	4.55E-06	5.83E-06	7.58E-06	9.89E-06	1.28E-05	1.62E-05	2E-05	2.44E-05	3.07E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
766.5	1.89E-06	2.13E-06	2.44E-06	2.87E-06	3.45E-06	4.27E-06	5.4E-06	6.94E-06	8.98E-06	1.15E-05	1.46E-05	1.81E-05	2.2E-05	2.69E-05	4.9E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
803	1.86E-06	2.08E-06	2.37E-06	2.76E-06	3.29E-06	4.02E-06	5.03E-06	6.39E-06	8.2E-06	1.05E-05	1.32E-05	1.64E-05	2E-05	2.42E-05	3.28E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839.5	1.83E-06	2.04E-06	2.31E-06	2.67E-06	3.15E-06	3.81E-06	4.71E-06	5.92E-06	7.53E-06	9.58E-06	1.21E-05	1.5E-05	1.82E-05	2.19E-05	2.75E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
876	1.8E-06	2E-06	2.25E-06	2.58E-06	3.03E-06	3.62E-06	4.43E-06	5.52E-06	6.96E-06	8.79E-06	1.1E-05	1.37E-05	1.67E-05	2E-05	2.44E-05	4.33E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
912.5	1.77E-06	1.96E-06	2.2E-06	2.51E-06	2.91E-06	3.46E-06	4.19E-06	5.17E-06	6.46E-06	8.11E-06	1.01E-05	1.25E-05	1.53E-05	1.84E-05	2.21E-05	3.01E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
949	1.75E-06	1.92E-06	2.15E-06	2.43E-06	2.81E-06	3.31E-06	3.97E-06	4.86E-06	6.02E-06	7.51E-06	9.35E-06	1.15E-05	1.41E-05	1.69E-05	2.02E-05	2.54E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
985.5	1.72E-06	1.89E-06	2.1E-06	2.37E-06	2.72E-06	3.18E-06	3.78E-06	4.59E-06	5.64E-06	6.99E-06	8.66E-06	1.07E-05	1.3E-05	1.56E-05	1.86E-05	2.26E-05	3.82E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1022	1.7E-06	1.86E-06	2.06E-06	2.31E-06	2.64E-06	3.06E-06	3.62E-06	4.35E-06	5.3E-06	6.52E-06	8.05E-06	9.88E-06	1.2E-05	1.44E-05	1.72E-05	2.06E-05	2.8E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1058.5	1.67E-06	1.83E-06	2.02E-06	2.25E-06	2.56E-06	2.95E-06	3.46E-06	4.13E-06	5E-06	6.12E-06	7.51E-06	9.19E-06	1.12E-05	1.34E-05	1.59E-05	1.89E-05	2.39E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1095	1.65E-06	1.8E-06	1.98E-06	2.2E-06	2.49E-06	2.85E-06	3.33E-06	3.94E-06	4.74E-06	5.75E-06	7.02E-06	8.57E-06	1.04E-05	1.25E-05	1.48E-05	1.75E-05	2.14E-05	4.76E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131.5	1.63E-06	1.77E-06	1.94E-06	2.16E-06	2.42E-06	2.77E-06	3.2E-06	3.77E-06	4.5E-06	5.43E-06	6.59E-06	8.01E-06	9.69E-06	1.16E-05	1.38E-05	1.63E-05	1.95E-05	2.95E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1168	1.61E-06	1.75E-06	1.91E-06	2.11E-06	2.36E-06	2.68E-06	3.09E-06	3.61E-06	4.29E-06	5.14E-06	6.21E-06	7.52E-06	9.07E-06	1.09E-05	1.29E-05	1.52E-05	1.8E-05	2.4E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1204.5	1.6E-06	1.72E-06	1.88E-06	2.07E-06	2.31E-06	2.61E-06	2.99E-06	3.47E-06	4.09E-06	4.88E-06	5.86E-06	7.07E-06	8.51E-06	1.02E-05	1.21E-05	1.42E-05	1.67E-05	2.1E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1241	1.58E-06	1.7E-06	1.85E-06	2.03E-06	2.26E-06	2.54E-06	2.89E-06	3.35E-06	3.92E-06	4.65E-06	5.55E-06	6.67E-06	8E-06	9.55E-06	1.13E-05	1.33E-05	1.56E-05	1.9E-05	3.62E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1277.5	1.56E-06	1.68E-06	1.82E-06	2E-06	2.21E-06	2.47E-06	2.81E-06	3.23E-06	3.76E-06	4.43E-06	5.27E-06	6.3E-06	7.54E-06	8.98E-06	1.06E-05	1.25E-05	1.46E-05	1.75E-05	2.56E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1314	1.55E-06	1.66E-06	1.8E-06	1.96E-06	2.16E-06	2.42E-06	2.73E-06	3.12E-06	3.62E-06	4.24E-06	5.02E-06	5.97E-06	7.12E-06	8.47E-06	1E-05	1.18E-05	1.37E-05	1.63E-05	2.15E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1350.5	1.53E-06	1.64E-06	1.77E-06	1.93E-06	2.12E-06	2.36E-06	2.65E-06	3.02E-06	3.49E-06	4.07E-06	4.79E-06	5.67E-06	6.74E-06	8E-06	9.44E-06	1.11E-05	1.29E-05	1.52E-05	1.91E-05	6.08E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1387	1.52E-06	1.62E-06	1.75E-06	1.9E-06	2.08E-06	2.31E-06	2.59E-06	2.93E-06	3.36E-06	3.91E-06	4.58E-06	5.4E-06	6.39E-06	7.57E-06	8.92E-06	1.05E-05	1.22E-05	1.43E-05	1.74E-05	2.92E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1423.5	1.5E-06	1.6E-06	1.73E-06	1.87E-06	2.05E-06	2.26E-06	2.52E-06	2.85E-06	3.25E-06	3.76E-06	4.38E-06	5.15E-06	6.08E-06	7.17E-06	8.45E-06	9.89E-06	1.15E-05	1.34E-05	1.6E-05	2.27E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1460	1.49E-06	1.59E-06	1.7E-06	1.84E-06	2.01E-06	2.21E-06	2.46E-06	2.77E-06	3.15E-06	3.62E-06	4.21E-06	4.92E-06	5.79E-06	6.81E-06	8.01E-06	9.37E-06	1.09E-05	1.27E-05	1.5E-05	1.96E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1496.5	1.47E-06	1.57E-06	1.68E-06	1.82E-06	1.98E-06	2.17E-06	2.41E-06	2.7E-06	3.06E-06	3.5E-06	4.05E-06	4.71E-06	5.52E-06	6.48E-06	7.6E-06	8.88E-06	1.03E-05	1.2E-05	1.4E-05	1.76E-05	4.46E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1533	1.46E-06	1.55E-06	1.66E-06	1.79E-06	1.95E-06	2.13E-06	2.36E-06	2.63E-06	2.97E-06	3.38E-06	3.9E-06	4.52E-06	5.28E-06	6.18E-06	7.23E-06	8.44E-06	9.8E-06	1.14E-05	1.32E-05	1.61E-05	2.66E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1569.5	1.45E-06	1.54E-06	1.64E-06	1.77E-06	1.92E-06	2.09E-06	2.31E-06	2.57E-06	2.89E-06	3.28E-06	3.76E-06	4.35E-06	5.06E-06	5.9E-06	6.89E-06	8.03E-06	9.31E-06	1.08E-05	1.25E-05	1.49E-05	2.12E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1606	1.44E-06	1.52E-06	1.63E-06	1.75E-06	1.89E-06	2.06E-06	2.26E-06	2.51E-06	2.81E-06	3.18E-06	3.63E-06	4.18E-06	4.85E-06	5.64E-06	6.57E-06	7.64E-06	8.86E-06	1.02E-05	1.19E-05	1.4E-05	1.84E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1642.5	1.43E-06	1.51E-06	1.61E-06	1.72E-06	1.86E-06	2.02E-06	2.22E-06	2.45E-06	2.74E-06	3.09E-06	3.51E-06	4.03E-06	4.66E-06	5.4E-06	6.28E-06	7.29E-06	8.44E-06	9.75E-06	1.13E-05	1.32E-05	1.65E-05	3.84E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1679	1.42E-06	1.5E-06	1.59E-06	1.7E-06	1.83E-06	1.99E-06	2.18E-06	2.4E-06	2.67E-06	3E-06	3.41E-06	3.89E-06	4.48E-06	5.18E-06	6.01E-06	6.96E-06	8.05E-06	9.29E-06	1.07E-05	1.25E-05	1.52E-05	2.47E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715.5	1.4E-06	1.48E-06	1.58E-06	1.68E-06	1.81E-06	1.96E-06	2.14E-06	2.35E-06	2.61E-06	2.92E-06	3.3E-06	3.76E-06	4.32E-06	4.98E-06	5.76E-06	6.66E-06	7.69E-06	8.86E-06	1.02E-05	1.18E-05	1.41E-05	2E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1752	1.39E-06	1.47E-06	1.56E-06	1.66E-06	1.79E-06	1.93E-06	2.1E-06	2.31E-06	2.55E-06	2.85E-06	3.21E-06	3.64E-06	4.17E-06	4.79E-06	5.52E-06	6.38E-06	7.36E-06	8.46E-06	9.72E-06	1.12E-05	1.33E-05	1.74E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1788.5	1.38E-06	1.46E-06	1.55E-06	1.65E-06	1.76E-06	1.9E-06	2.07E-06	2.26E-06	2.5E-06	2.78E-06	3.12E-06	3.53E-06	4.02E-06	4.61E-06	5.31E-06	6.11E-06	7.04E-06	8.09E-06	9.29E-06	1.07E-05	1.25E-05	1.57E-05	3.33E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1825	1.37E-06	1.45E-06	1.53E-06	1.63E-06	1.74E-06	1.88E-06	2.03E-06	2.22E-06	2.44E-06	2.71E-06	3.04E-06	3.43E-06	3.89E-06	4.45E-06	5.11E-06	5.87E-06	6.75E-06	7.75E-06	8.88E-06	1.02E-05	1.18E-05	1.45E-05	2.3E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1861.5	1.36E-06	1.44E-06	1.52E-06	1.61E-06	1.72E-06	1.85E-06	2E-06	2.18E-06	2.4E-06	2.65E-06	2.96E-06	3.33E-06	3.77E-06	4.3E-06	4.92E-06	5.64E-06	6.48E-06	7.42E-06	8.5E-06	9.74E-06	1.13E-05	1.35E-05	1.91E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1898	1.36E-06	1.42E-06	1.5E-06	1.6E-06	1.7E-06	1.83E-06	1.97E-06	2.14E-06	2.35E-06	2.59E-06	2.89E-06	3.24E-06	3.66E-06	4.15E-06	4.74E-06	5.43E-06	6.22E-06	7.12E-06	8.14E-06	9.31E-06	1.07E-05	1.27E-05	1.68E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1934.5	1.35E-06	1.41E-06	1.49E-06	1.58E-06	1.68E-06	1.8E-06	1.94E-06	2.11E-06	2.31E-06	2.54E-06	2.82E-06	3.15E-06	3.55E-06	4.02E-06	4.58E-06	5.23E-06	5.98E-06	6.84E-06	7.81E-06	8.92E-06	1.02E-05	1.2E-05	1.53E-05	5.78E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	1.34E-06	1.4E-06	1.48E-06	1.57E-06	1.67E-06	1.78E-06	1.92E-06	2.08E-06	2.26E-06	2.49E-06	2.75E-06	3.07E-06	3.45E-06	3.9E-06	4.43E-06	5.04E-06	5.76E-06	6.57E-06	7.5E-06	8.55E-06	9.79E-06	1.14E-05	1.41E-05	2.81E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007.5	1.33E-06	1.39E-06	1.47E-06	1.55E-06	1.65E-06	1.76E-06	1.89E-06	2.04E-06	2.22E-06	2.44E-06	2.69E-06	2.99E-06	3.35E-06	3.78E-06	4.28E-06	4.87E-06	5.55E-06	6.32E-06	7.21E-06	8.21E-06	9.37E-06	1.08E-05	1.32E-05	2.12E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	1.32E-06	1.38E-06	1.46E-06	1.54E-06	1.63E-06	1.74E-06	1.87E-06	2.01E-06	2.19E-06	2.39E-06	2.63E-06	2.92E-06	3.26E-06	3.67E-06	4.15E-06	4.71E-06	5.35E-06	6.09E-06	6.93E-06	7.88E-06	8.99E-06	1.03E-05	1.24E-05	1.78E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080.5	1.31E-06	1.37E-06	1.44E-06	1.52E-06	1.61E-06	1.72E-06	1.84E-06	1.98E-06	2.15E-06	2.35E-06	2.58E-06	2.85E-06	3.18E-06	3.57E-06	4.02E-06	4.55E-06	5.17E-06	5.87E-06	6.67E-06	7.58E-06	8.63E-06	9.89E-06	1.17E-05	1.58E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2117	1.3E-06	1.36E-06	1.43E-06	1.51E-06	1.6E-06	1.7E-06	1.82E-06	1.96E-06	2.12E-06	2.31E-06	2.53E-06	2.79E-06	3.1E-06	3.47E-06	3.9E-06	4.41E-06	4.99E-06	5.66E-06	6.43E-06	7.3E-06	8.29E-06	9.48E-06	1.11E-05	1.43E-05	5.29E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2153.5	1.3E-06	1.36E-06	1.42E-06	1.5E-06	1.58E-06	1.68E-06	1.8E-06	1.93E-06	2.08E-06	2.27E-06	2.48E-06	2.73E-06	3.03E-06	3.38E-06	3.79E-06	4.27E-06	4.83E-06	5.47E-06	6.2E-06	7.03E-06	7.97E-06	9.1E-06	1.06E-05	1.32E-05	2.66E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2190	1.29E-06	1.35E-06	1.41E-06	1.49E-06	1.57E-06	1.67E-06	1.78E-06	1.9E-06	2.05E-06	2.23E-06	2.43E-06	2.67E-06	2.96E-06	3.29E-06	3.69E-06	4.14E-06	4.68E-06	5.29E-06	5.99E-06	6.78E-06	7.68E-06	8.74E-06	1.01E-05	1.24E-05	2.01E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2226.5	1.28E-06	1.34E-06	1.4E-06	1.47E-06	1.56E-06	1.65E-06	1.76E-06	1.88E-06	2.02E-06	2.19E-06	2.39E-06	2.62E-06	2.89E-06	3.21E-06	3.59E-06	4.02E-06	4.53E-06	5.12E-06	5.78E-06	6.54E-06	7.4E-06	8.4E-06	9.67E-06	1.16E-05	1.69E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2263	1.28E-06	1.33E-06	1.39E-06	1.46E-06	1.54E-06	1.63E-06	1.74E-06	1.86E-06	1.99E-06	2.16E-06	2.35E-06	2.57E-06	2.83E-06	3.13E-06	3.49E-06	3.91E-06	4.4E-06	4.95E-06	5.59E-06	6.31E-06	7.14E-06	8.09E-06	9.28E-06	1.1E-05	1.5E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2299.5	1.27E-06	1.32E-06	1.38E-06	1.45E-06	1.53E-06	1.62E-06	1.72E-06	1.83E-06	1.97E-06	2.12E-06	2.31E-06	2.52E-06	2.77E-06	3.06E-06	3.4E-06	3.8E-06	4.27E-06	4.8E-06	5.41E-06	6.1E-06	6.89E-06	7.8E-06	8.91E-06	1.05E-05	1.36E-05	4.37E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2336	1.26E-06	1.31E-06	1.37E-06	1.44E-06	1.52E-06	1.6E-06	1.7E-06	1.81E-06	1.94E-06	2.09E-06	2.27E-06	2.47E-06	2.71E-06	2.99E-06	3.32E-06	3.7E-06	4.14E-06	4.65E-06	5.24E-06	5.9E-06	6.65E-06	7.52E-06	8.57E-06	9.99E-06	1.26E-05	2.46E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2372.5	1.25E-06	1.31E-06	1.36E-06	1.43E-06	1.5E-06	1.59E-06	1.68E-06	1.79E-06	1.92E-06	2.06E-06	2.23E-06	2.43E-06	2.66E-06	2.93E-06	3.24E-06	3.61E-06	4.03E-06	4.52E-06	5.08E-06	5.71E-06	6.43E-06	7.26E-06	8.25E-06	9.56E-06	1.18E-05	1.9E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2409	1.25E-06	1.3E-06	1.36E-06	1.42E-06	1.49E-06	1.57E-06	1.66E-06	1.77E-06	1.89E-06	2.03E-06	2.2E-06	2.39E-06	2.61E-06	2.86E-06	3.17E-06	3.52E-06	3.92E-06	4.39E-06	4.92E-06	5.53E-06	6.22E-06	7.01E-06	7.95E-06	9.16E-06	1.11E-05	1.62E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2445.5	1.24E-06	1.29E-06	1.35E-06	1.41E-06	1.48E-06	1.56E-06	1.65E-06	1.75E-06	1.87E-06	2.01E-06	2.16E-06	2.35E-06	2.56E-06	2.81E-06	3.09E-06	3.43E-06	3.82E-06	4.27E-06	4.78E-06	5.36E-06	6.02E-06	6.78E-06	7.67E-06	8.8E-06	1.05E-05	1.44E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2482	1.24E-06	1.28E-06	1.34E-06	1.4E-06	1.47E-06	1.54E-06	1.63E-06	1.73E-06	1.85E-06	1.98E-06	2.13E-06	2.31E-06	2.51E-06	2.75E-06	3.03E-06	3.35E-06	3.72E-06	4.15E-06	4.64E-06	5.2E-06	5.83E-06	6.56E-06	7.41E-06	8.46E-06	9.99E-06	1.31E-05	4.18E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2518.5	1.23E-06	1.28E-06	1.33E-06	1.39E-06	1.46E-06	1.53E-06	1.62E-06	1.71E-06	1.83E-06	1.95E-06	2.1E-06	2.27E-06	2.47E-06	2.7E-06	2.96E-06	3.27E-06	3.63E-06	4.04E-06	4.51E-06	5.05E-06	5.66E-06	6.35E-06	7.16E-06	8.15E-06	9.54E-06	1.21E-05	2.4E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2555	1.22E-06	1.27E-06	1.32E-06	1.38E-06	1.45E-06	1.52E-06	1.6E-06	1.7E-06	1.8E-06	1.93E-06	2.07E-06	2.23E-06	2.42E-06	2.65E-06	2.9E-06	3.2E-06	3.54E-06	3.93E-06	4.39E-06	4.9E-06	5.49E-06	6.15E-06	6.93E-06	7.86E-06	9.13E-06	1.13E-05	1.86E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2591.5	1.22E-06	1.26E-06	1.31E-06	1.37E-06	1.44E-06	1.51E-06	1.59E-06	1.68E-06	1.78E-06	1.9E-06	2.04E-06	2.2E-06	2.38E-06	2.6E-06	2.84E-06	3.13E-06	3.46E-06	3.83E-06	4.27E-06	4.76E-06	5.32E-06	5.96E-06	6.7E-06	7.59E-06	8.76E-06	1.07E-05	1.57E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2628	1.21E-06	1.26E-06	1.31E-06	1.36E-06	1.43E-06	1.5E-06	1.57E-06	1.66E-06	1.77E-06	1.88E-06	2.02E-06	2.17E-06	2.35E-06	2.55E-06	2.79E-06	3.06E-06	3.38E-06	3.74E-06	4.16E-06	4.63E-06	5.17E-06	5.79E-06	6.49E-06	7.34E-06	8.43E-06	1.01E-05	1.4E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2664.5	1.21E-06	1.25E-06	1.3E-06	1.35E-06	1.42E-06	1.48E-06	1.56E-06	1.65E-06	1.75E-06	1.86E-06	1.99E-06	2.14E-06	2.31E-06	2.51E-06	2.73E-06	3E-06	3.3E-06	3.65E-06	4.05E-06	4.51E-06	5.03E-06	5.62E-06	6.29E-06	7.1E-06	8.12E-06	9.61E-06	1.27E-05	4.03E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2701	1.2E-06	1.24E-06	1.29E-06	1.35E-06	1.41E-06	1.47E-06	1.55E-06	1.63E-06	1.73E-06	1.84E-06	1.96E-06	2.11E-06	2.27E-06	2.46E-06	2.68E-06	2.94E-06	3.23E-06	3.56E-06	3.95E-06	4.39E-06	4.89E-06	5.45E-06	6.11E-06	6.87E-06	7.83E-06	9.18E-06	1.17E-05	2.34E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2737.5	1.2E-06	1.24E-06	1.29E-06	1.34E-06	1.4E-06	1.46E-06	1.54E-06	1.62E-06	1.71E-06	1.82E-06	1.94E-06	2.08E-06	2.24E-06	2.42E-06	2.63E-06	2.88E-06	3.16E-06	3.48E-06	3.85E-06	4.27E-06	4.75E-06	5.3E-06	5.93E-06	6.66E-06	7.56E-06	8.8E-06	1.1E-05	1.81E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2774	1.19E-06	1.23E-06	1.28E-06	1.33E-06	1.39E-06	1.45E-06	1.52E-06	1.6E-06	1.69E-06	1.8E-06	1.92E-06	2.05E-06	2.21E-06	2.38E-06	2.59E-06	2.82E-06	3.09E-06	3.41E-06	3.76E-06	4.17E-06	4.63E-06	5.15E-06	5.75E-06	6.45E-06	7.31E-06	8.45E-06	1.03E-05	1.53E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2810.5	1.18E-06	1.23E-06	1.27E-06	1.32E-06	1.38E-06	1.44E-06	1.51E-06	1.59E-06	1.68E-06	1.78E-06	1.89E-06	2.02E-06	2.17E-06	2.35E-06	2.54E-06	2.77E-06	3.03E-06	3.33E-06	3.67E-06	4.06E-06	4.51E-06	5.01E-06	5.59E-06	6.26E-06	7.07E-06	8.13E-06	9.78E-06	1.36E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2847	1.18E-06	1.22E-06	1.27E-06	1.31E-06	1.37E-06	1.43E-06	1.5E-06	1.58E-06	1.66E-06	1.76E-06	1.87E-06	2E-06	2.14E-06	2.31E-06	2.5E-06	2.72E-06	2.97E-06	3.26E-06	3.59E-06	3.97E-06	4.39E-06	4.88E-06	5.44E-06	6.08E-06	6.85E-06	7.84E-06	9.31E-06	1.24E-05	3.74E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2883.5	1.17E-06	1.21E-06	1.26E-06	1.31E-06	1.36E-06	1.42E-06	1.49E-06	1.56E-06	1.65E-06	1.74E-06	1.85E-06	1.97E-06	2.12E-06	2.28E-06	2.46E-06	2.67E-06	2.91E-06	3.19E-06	3.51E-06	3.87E-06	4.29E-06	4.75E-06	5.29E-06	5.91E-06	6.64E-06	7.57E-06	8.9E-06	1.14E-05	2.25E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2920	1.17E-06	1.21E-06	1.25E-06	1.3E-06	1.35E-06	1.41E-06	1.48E-06	1.55E-06	1.63E-06	1.73E-06	1.83E-06	1.95E-06	2.09E-06	2.24E-06	2.42E-06	2.63E-06	2.86E-06	3.13E-06	3.43E-06	3.78E-06	4.18E-06	4.63E-06	5.15E-06	5.74E-06	6.44E-06	7.31E-06	8.53E-06	1.07E-05	1.76E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2956.5	1.16E-06	1.2E-06	1.25E-06	1.29E-06	1.34E-06	1.4E-06	1.47E-06	1.54E-06	1.62E-06	1.71E-06	1.81E-06	1.93E-06	2.06E-06	2.21E-06	2.38E-06	2.58E-06	2.81E-06	3.07E-06	3.36E-06	3.7E-06	4.08E-06	4.52E-06	5.01E-06	5.58E-06	6.25E-06	7.08E-06	8.2E-06	1E-05	1.5E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2993	1.16E-06	1.2E-06	1.24E-06	1.29E-06	1.34E-06	1.39E-06	1.46E-06	1.53E-06	1.6E-06	1.69E-06	1.79E-06	1.91E-06	2.03E-06	2.18E-06	2.35E-06	2.54E-06	2.76E-06	3.01E-06	3.29E-06	3.62E-06	3.99E-06	4.41E-06	4.88E-06	5.43E-06	6.07E-06	6.85E-06	7.89E-06	9.53E-06	1.33E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3029.5	1.16E-06	1.19E-06	1.23E-06	1.28E-06	1.33E-06	1.38E-06	1.45E-06	1.51E-06	1.59E-06	1.68E-06	1.77E-06	1.88E-06	2.01E-06	2.15E-06	2.31E-06	2.5E-06	2.71E-06	2.95E-06	3.23E-06	3.54E-06	3.9E-06	4.3E-06	4.76E-06	5.29E-06	5.9E-06	6.65E-06	7.61E-06	9.07E-06	1.21E-05	4.16E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3066	1.15E-06	1.19E-06	1.23E-06	1.27E-06	1.32E-06	1.38E-06	1.44E-06	1.5E-06	1.58E-06	1.66E-06	1.76E-06	1.86E-06	1.99E-06	2.12E-06	2.28E-06	2.46E-06	2.66E-06	2.9E-06	3.16E-06	3.47E-06	3.81E-06	4.2E-06	4.64E-06	5.15E-06	5.74E-06	6.45E-06	7.35E-06	8.68E-06	1.12E-05	2.35E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3102.5	1.15E-06	1.18E-06	1.22E-06	1.27E-06	1.31E-06	1.37E-06	1.43E-06	1.49E-06	1.57E-06	1.65E-06	1.74E-06	1.84E-06	1.96E-06	2.1E-06	2.25E-06	2.42E-06	2.62E-06	2.84E-06	3.1E-06	3.39E-06	3.73E-06	4.1E-06	4.53E-06	5.02E-06	5.59E-06	6.26E-06	7.11E-06	8.32E-06	1.05E-05	1.79E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3139	1.14E-06	1.18E-06	1.22E-06	1.26E-06	1.31E-06	1.36E-06	1.42E-06	1.48E-06	1.55E-06	1.63E-06	1.72E-06	1.82E-06	1.94E-06	2.07E-06	2.22E-06	2.38E-06	2.58E-06	2.79E-06	3.04E-06	3.33E-06	3.65E-06	4.01E-06	4.42E-06	4.9E-06	5.44E-06	6.08E-06	6.89E-06	8E-06	9.87E-06	1.51E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3175.5	1.14E-06	1.17E-06	1.21E-06	1.25E-06	1.3E-06	1.35E-06	1.41E-06	1.47E-06	1.54E-06	1.62E-06	1.71E-06	1.81E-06	1.92E-06	2.04E-06	2.19E-06	2.35E-06	2.54E-06	2.75E-06	2.99E-06	3.26E-06	3.57E-06	3.92E-06	4.32E-06	4.78E-06	5.3E-06	5.92E-06	6.68E-06	7.71E-06	9.35E-06	1.33E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3212	1.13E-06	1.17E-06	1.21E-06	1.25E-06	1.29E-06	1.34E-06	1.4E-06	1.46E-06	1.53E-06	1.61E-06	1.69E-06	1.79E-06	1.9E-06	2.02E-06	2.16E-06	2.32E-06	2.5E-06	2.7E-06	2.93E-06	3.2E-06	3.5E-06	3.84E-06	4.22E-06	4.66E-06	5.17E-06	5.76E-06	6.48E-06	7.44E-06	8.91E-06	1.21E-05	4.87E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3248.5	1.13E-06	1.16E-06	1.2E-06	1.24E-06	1.29E-06	1.34E-06	1.39E-06	1.45E-06	1.52E-06	1.59E-06	1.68E-06	1.77E-06	1.88E-06	2E-06	2.13E-06	2.28E-06	2.46E-06	2.66E-06	2.88E-06	3.14E-06	3.43E-06	3.76E-06	4.13E-06	4.55E-06	5.04E-06	5.61E-06	6.29E-06	7.19E-06	8.51E-06	1.11E-05	2.45E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3285	1.13E-06	1.16E-06	1.2E-06	1.24E-06	1.28E-06	1.33E-06	1.38E-06	1.44E-06	1.51E-06	1.58E-06	1.66E-06	1.75E-06	1.86E-06	1.97E-06	2.1E-06	2.25E-06	2.42E-06	2.61E-06	2.83E-06	3.08E-06	3.36E-06	3.68E-06	4.04E-06	4.45E-06	4.92E-06	5.46E-06	6.12E-06	6.96E-06	8.16E-06	1.04E-05	1.83E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3321.5	1.12E-06	1.15E-06	1.19E-06	1.23E-06	1.27E-06	1.32E-06	1.37E-06	1.43E-06	1.5E-06	1.57E-06	1.65E-06	1.74E-06	1.84E-06	1.95E-06	2.08E-06	2.22E-06	2.39E-06	2.57E-06	2.78E-06	3.02E-06	3.29E-06	3.6E-06	3.95E-06	4.35E-06	4.8E-06	5.32E-06	5.95E-06	6.74E-06	7.85E-06	9.75E-06	1.52E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3358	1.12E-06	1.15E-06	1.19E-06	1.22E-06	1.27E-06	1.31E-06	1.36E-06	1.42E-06	1.48E-06	1.55E-06	1.63E-06	1.72E-06	1.82E-06	1.93E-06	2.05E-06	2.19E-06	2.35E-06	2.53E-06	2.74E-06	2.97E-06	3.23E-06	3.53E-06	3.87E-06	4.25E-06	4.69E-06	5.19E-06	5.79E-06	6.54E-06	7.56E-06	9.23E-06	1.33E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3394.5	1.11E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.31E-06	1.36E-06	1.41E-06	1.47E-06	1.54E-06	1.62E-06	1.7E-06	1.8E-06	1.91E-06	2.03E-06	2.17E-06	2.32E-06	2.5E-06	2.69E-06	2.92E-06	3.17E-06	3.46E-06	3.79E-06	4.16E-06	4.58E-06	5.07E-06	5.64E-06	6.35E-06	7.3E-06	8.78E-06	1.2E-05	5.69E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3431	1.11E-06	1.14E-06	1.18E-06	1.21E-06	1.25E-06	1.3E-06	1.35E-06	1.4E-06	1.46E-06	1.53E-06	1.61E-06	1.69E-06	1.78E-06	1.89E-06	2.01E-06	2.14E-06	2.29E-06	2.46E-06	2.65E-06	2.87E-06	3.12E-06	3.39E-06	3.71E-06	4.07E-06	4.48E-06	4.94E-06	5.5E-06	6.17E-06	7.06E-06	8.39E-06	1.1E-05	2.54E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3467.5	1.11E-06	1.14E-06	1.17E-06	1.21E-06	1.25E-06	1.29E-06	1.34E-06	1.4E-06	1.45E-06	1.52E-06	1.59E-06	1.67E-06	1.77E-06	1.87E-06	1.98E-06	2.11E-06	2.26E-06	2.42E-06	2.61E-06	2.82E-06	3.06E-06	3.33E-06	3.64E-06	3.98E-06	4.38E-06	4.83E-06	5.36E-06	6E-06	6.83E-06	8.04E-06	1.03E-05	1.86E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3504	1.1E-06	1.13E-06	1.17E-06	1.2E-06	1.24E-06	1.29E-06	1.33E-06	1.39E-06	1.44E-06	1.51E-06	1.58E-06	1.66E-06	1.75E-06	1.85E-06	1.96E-06	2.09E-06	2.23E-06	2.39E-06	2.57E-06	2.78E-06	3.01E-06	3.27E-06	3.56E-06	3.9E-06	4.28E-06	4.72E-06	5.23E-06	5.84E-06	6.62E-06	7.73E-06	9.66E-06	1.53E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3540.5	1.1E-06	1.13E-06	1.16E-06	1.2E-06	1.24E-06	1.28E-06	1.33E-06	1.38E-06	1.44E-06	1.5E-06	1.57E-06	1.65E-06	1.73E-06	1.83E-06	1.94E-06	2.06E-06	2.2E-06	2.36E-06	2.53E-06	2.73E-06	2.96E-06	3.21E-06	3.5E-06	3.82E-06	4.19E-06	4.61E-06	5.1E-06	5.69E-06	6.43E-06	7.45E-06	9.14E-06	1.34E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3577	1.09E-06	1.12E-06	1.16E-06	1.19E-06	1.23E-06	1.27E-06	1.32E-06	1.37E-06	1.43E-06	1.49E-06	1.56E-06	1.63E-06	1.72E-06	1.81E-06	1.92E-06	2.04E-06	2.17E-06	2.32E-06	2.5E-06	2.69E-06	2.91E-06	3.15E-06	3.43E-06	3.75E-06	4.1E-06	4.51E-06	4.98E-06	5.54E-06	6.24E-06	7.19E-06	8.69E-06	1.2E-05	8.61E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3613.5	1.09E-06	1.12E-06	1.15E-06	1.19E-06	1.23E-06	1.27E-06	1.31E-06	1.36E-06	1.42E-06	1.48E-06	1.54E-06	1.62E-06	1.7E-06	1.8E-06	1.9E-06	2.02E-06	2.15E-06	2.29E-06	2.46E-06	2.65E-06	2.86E-06	3.1E-06	3.37E-06	3.67E-06	4.02E-06	4.41E-06	4.87E-06	5.41E-06	6.07E-06	6.96E-06	8.3E-06	1.1E-05	2.78E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3650	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.31E-06	1.35E-06	1.41E-06	1.47E-06	1.53E-06	1.61E-06	1.69E-06	1.78E-06	1.88E-06	1.99E-06	2.12E-06	2.26E-06	2.43E-06	2.61E-06	2.81E-06	3.04E-06	3.31E-06	3.6E-06	3.94E-06	4.32E-06	4.76E-06	5.28E-06	5.91E-06	6.74E-06	7.96E-06	1.03E-05	1.94E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3686.5	1.08E-06	1.11E-06	1.14E-06	1.18E-06	1.21E-06	1.25E-06	1.3E-06	1.35E-06	1.4E-06	1.46E-06	1.52E-06	1.59E-06	1.67E-06	1.76E-06	1.86E-06	1.97E-06	2.1E-06	2.24E-06	2.39E-06	2.57E-06	2.77E-06	2.99E-06	3.25E-06	3.53E-06	3.86E-06	4.23E-06	4.65E-06	5.15E-06	5.75E-06	6.53E-06	7.65E-06	9.62E-06	1.57E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3723	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.21E-06	1.25E-06	1.29E-06	1.34E-06	1.39E-06	1.45E-06	1.51E-06	1.58E-06	1.66E-06	1.75E-06	1.84E-06	1.95E-06	2.07E-06	2.21E-06	2.36E-06	2.53E-06	2.73E-06	2.94E-06	3.19E-06	3.47E-06	3.78E-06	4.14E-06	4.55E-06	5.03E-06	5.61E-06	6.34E-06	7.37E-06	9.09E-06	1.36E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3759.5	1.08E-06	1.1E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.29E-06	1.33E-06	1.38E-06	1.44E-06	1.5E-06	1.57E-06	1.65E-06	1.73E-06	1.82E-06	1.93E-06	2.05E-06	2.18E-06	2.33E-06	2.5E-06	2.69E-06	2.9E-06	3.14E-06	3.41E-06	3.71E-06	4.06E-06	4.45E-06	4.92E-06	5.47E-06	6.16E-06	7.11E-06	8.64E-06	1.21E-05	0.000243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3796	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.2E-06	1.24E-06	1.28E-06	1.33E-06	1.38E-06	1.43E-06	1.49E-06	1.56E-06	1.63E-06	1.72E-06	1.81E-06	1.91E-06	2.03E-06	2.15E-06	2.3E-06	2.46E-06	2.65E-06	2.85E-06	3.08E-06	3.35E-06	3.64E-06	3.98E-06	4.36E-06	4.81E-06	5.33E-06	5.99E-06	6.88E-06	8.24E-06	1.11E-05	3.07E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3832.5	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.23E-06	1.27E-06	1.32E-06	1.37E-06	1.42E-06	1.48E-06	1.55E-06	1.62E-06	1.7E-06	1.79E-06	1.89E-06	2E-06	2.13E-06	2.27E-06	2.43E-06	2.61E-06	2.81E-06	3.03E-06	3.29E-06	3.57E-06	3.9E-06	4.27E-06	4.7E-06	5.21E-06	5.83E-06	6.66E-06	7.9E-06	1.03E-05	2.02E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3869	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.19E-06	1.23E-06	1.27E-06	1.31E-06	1.36E-06	1.41E-06	1.47E-06	1.54E-06	1.61E-06	1.69E-06	1.77E-06	1.87E-06	1.98E-06	2.1E-06	2.24E-06	2.4E-06	2.57E-06	2.76E-06	2.98E-06	3.23E-06	3.51E-06	3.82E-06	4.18E-06	4.6E-06	5.09E-06	5.68E-06	6.46E-06	7.59E-06	9.61E-06	1.61E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3905.5	1.06E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.3E-06	1.35E-06	1.4E-06	1.46E-06	1.53E-06	1.6E-06	1.67E-06	1.76E-06	1.85E-06	1.96E-06	2.08E-06	2.22E-06	2.37E-06	2.53E-06	2.72E-06	2.94E-06	3.18E-06	3.45E-06	3.75E-06	4.1E-06	4.5E-06	4.97E-06	5.54E-06	6.27E-06	7.31E-06	9.07E-06	1.38E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3942	1.06E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.4E-06	1.45E-06	1.51E-06	1.58E-06	1.66E-06	1.74E-06	1.84E-06	1.94E-06	2.06E-06	2.19E-06	2.33E-06	2.5E-06	2.68E-06	2.89E-06	3.12E-06	3.39E-06	3.68E-06	4.02E-06	4.41E-06	4.86E-06	5.41E-06	6.1E-06	7.05E-06	8.61E-06	1.22E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3978.5	1.06E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.21E-06	1.25E-06	1.29E-06	1.34E-06	1.39E-06	1.44E-06	1.5E-06	1.57E-06	1.65E-06	1.73E-06	1.82E-06	1.92E-06	2.04E-06	2.16E-06	2.31E-06	2.47E-06	2.64E-06	2.85E-06	3.07E-06	3.33E-06	3.62E-06	3.94E-06	4.32E-06	4.75E-06	5.28E-06	5.93E-06	6.82E-06	8.21E-06	1.11E-05	3.42E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4015	1.05E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.21E-06	1.24E-06	1.29E-06	1.33E-06	1.38E-06	1.43E-06	1.49E-06	1.56E-06	1.63E-06	1.71E-06	1.8E-06	1.9E-06	2.01E-06	2.14E-06	2.28E-06	2.43E-06	2.61E-06	2.8E-06	3.02E-06	3.27E-06	3.55E-06	3.87E-06	4.23E-06	4.65E-06	5.15E-06	5.78E-06	6.61E-06	7.86E-06	1.03E-05	2.12E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4051.5	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.17E-06	1.2E-06	1.24E-06	1.28E-06	1.32E-06	1.37E-06	1.43E-06	1.48E-06	1.55E-06	1.62E-06	1.7E-06	1.79E-06	1.88E-06	1.99E-06	2.11E-06	2.25E-06	2.4E-06	2.57E-06	2.76E-06	2.98E-06	3.22E-06	3.49E-06	3.8E-06	4.15E-06	4.56E-06	5.04E-06	5.63E-06	6.41E-06	7.55E-06	9.62E-06	1.67E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4088	1.05E-06	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.2E-06	1.23E-06	1.27E-06	1.32E-06	1.36E-06	1.42E-06	1.47E-06	1.54E-06	1.61E-06	1.69E-06	1.77E-06	1.87E-06	1.97E-06	2.09E-06	2.22E-06	2.37E-06	2.54E-06	2.72E-06	2.93E-06	3.16E-06	3.43E-06	3.73E-06	4.07E-06	4.46E-06	4.92E-06	5.49E-06	6.22E-06	7.27E-06	9.07E-06	1.52E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4124.5	1.05E-06	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.23E-06	1.27E-06	1.31E-06	1.36E-06	1.41E-06	1.47E-06	1.53E-06	1.6E-06	1.67E-06	1.76E-06	1.85E-06	1.95E-06	2.07E-06	2.2E-06	2.34E-06	2.5E-06	2.68E-06	2.89E-06	3.11E-06	3.37E-06	3.66E-06	3.99E-06	4.37E-06	4.82E-06	5.36E-06	6.05E-06	7.02E-06	8.67E-06	1.65E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4161	1.04E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.19E-06	1.22E-06	1.26E-06	1.3E-06	1.35E-06	1.4E-06	1.46E-06	1.52E-06	1.58E-06	1.66E-06	1.74E-06	1.83E-06	1.93E-06	2.05E-06	2.17E-06	2.31E-06	2.47E-06	2.65E-06	2.84E-06	3.06E-06	3.31E-06	3.6E-06	3.92E-06	4.28E-06	4.71E-06	5.23E-06	5.89E-06	6.79E-06	8.43E-06	2E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4197.5	1.04E-06	1.06E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.45E-06	1.51E-06	1.57E-06	1.65E-06	1.73E-06	1.82E-06	1.91E-06	2.02E-06	2.15E-06	2.28E-06	2.44E-06	2.61E-06	2.8E-06	3.02E-06	3.26E-06	3.53E-06	3.84E-06	4.2E-06	4.62E-06	5.11E-06	5.74E-06	6.61E-06	8.3E-06	2.86E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4234	1.04E-06	1.06E-06	1.09E-06	1.11E-06	1.14E-06	1.18E-06	1.21E-06	1.25E-06	1.29E-06	1.34E-06	1.38E-06	1.44E-06	1.5E-06	1.56E-06	1.63E-06	1.71E-06	1.8E-06	1.9E-06	2E-06	2.12E-06	2.26E-06	2.41E-06	2.57E-06	2.76E-06	2.97E-06	3.21E-06	3.47E-06	3.78E-06	4.12E-06	4.52E-06	5E-06	5.6E-06	6.46E-06	8.27E-06	6.75E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4270.5	1.03E-06	1.06E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.21E-06	1.24E-06	1.28E-06	1.33E-06	1.38E-06	1.43E-06	1.49E-06	1.55E-06	1.62E-06	1.7E-06	1.78E-06	1.88E-06	1.98E-06	2.1E-06	2.23E-06	2.38E-06	2.54E-06	2.72E-06	2.93E-06	3.16E-06	3.42E-06	3.71E-06	4.04E-06	4.43E-06	4.89E-06	5.48E-06	6.33E-06	8.31E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4307	1.03E-06	1.05E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.28E-06	1.32E-06	1.37E-06	1.42E-06	1.48E-06	1.54E-06	1.61E-06	1.68E-06	1.77E-06	1.86E-06	1.96E-06	2.08E-06	2.21E-06	2.35E-06	2.51E-06	2.68E-06	2.88E-06	3.11E-06	3.36E-06	3.64E-06	3.97E-06	4.34E-06	4.79E-06	5.36E-06	6.23E-06	8.41E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4343.5	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.2E-06	1.23E-06	1.27E-06	1.32E-06	1.36E-06	1.41E-06	1.47E-06	1.53E-06	1.6E-06	1.67E-06	1.75E-06	1.84E-06	1.94E-06	2.06E-06	2.18E-06	2.32E-06	2.48E-06	2.65E-06	2.84E-06	3.06E-06	3.3E-06	3.58E-06	3.9E-06	4.26E-06	4.7E-06	5.26E-06	6.15E-06	8.57E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4380	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.23E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.46E-06	1.52E-06	1.59E-06	1.66E-06	1.74E-06	1.83E-06	1.93E-06	2.04E-06	2.16E-06	2.29E-06	2.44E-06	2.61E-06	2.8E-06	3.01E-06	3.25E-06	3.52E-06	3.83E-06	4.18E-06	4.61E-06	5.17E-06	6.09E-06	8.79E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4416.5	1.02E-06	1.05E-06	1.07E-06	1.1E-06	1.12E-06	1.15E-06	1.19E-06	1.22E-06	1.26E-06	1.3E-06	1.35E-06	1.4E-06	1.45E-06	1.51E-06	1.57E-06	1.65E-06	1.72E-06	1.81E-06	1.91E-06	2.01E-06	2.13E-06	2.27E-06	2.41E-06	2.58E-06	2.76E-06	2.97E-06	3.2E-06	3.46E-06	3.76E-06	4.11E-06	4.53E-06	5.09E-06	6.05E-06	9.09E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4453	1.02E-06	1.04E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.44E-06	1.5E-06	1.56E-06	1.63E-06	1.71E-06	1.8E-06	1.89E-06	1.99E-06	2.11E-06	2.24E-06	2.38E-06	2.55E-06	2.72E-06	2.93E-06	3.15E-06	3.41E-06	3.7E-06	4.04E-06	4.45E-06	5.02E-06	6.02E-06	9.45E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4489.5	1.02E-06	1.04E-06	1.06E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.25E-06	1.29E-06	1.33E-06	1.38E-06	1.43E-06	1.49E-06	1.55E-06	1.62E-06	1.7E-06	1.78E-06	1.87E-06	1.98E-06	2.09E-06	2.22E-06	2.36E-06	2.51E-06	2.69E-06	2.88E-06	3.1E-06	3.35E-06	3.64E-06	3.97E-06	4.38E-06	4.95E-06	6E-06	9.92E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4526	1.01E-06	1.04E-06	1.06E-06	1.09E-06	1.11E-06	1.14E-06	1.17E-06	1.21E-06	1.24E-06	1.28E-06	1.33E-06	1.37E-06	1.43E-06	1.48E-06	1.54E-06	1.61E-06	1.68E-06	1.77E-06	1.86E-06	1.96E-06	2.07E-06	2.19E-06	2.33E-06	2.48E-06	2.65E-06	2.84E-06	3.06E-06	3.3E-06	3.58E-06	3.91E-06	4.31E-06	4.9E-06	5.99E-06	1.05E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4562.5	1.01E-06	1.03E-06	1.06E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.28E-06	1.32E-06	1.37E-06	1.42E-06	1.47E-06	1.53E-06	1.6E-06	1.67E-06	1.75E-06	1.84E-06	1.94E-06	2.05E-06	2.17E-06	2.3E-06	2.45E-06	2.62E-06	2.8E-06	3.01E-06	3.25E-06	3.52E-06	3.85E-06	4.25E-06	4.84E-06	6E-06	1.12E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4599	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.11E-06	1.13E-06	1.16E-06	1.2E-06	1.23E-06	1.27E-06	1.31E-06	1.36E-06	1.41E-06	1.46E-06	1.52E-06	1.59E-06	1.66E-06	1.74E-06	1.82E-06	1.92E-06	2.03E-06	2.14E-06	2.28E-06	2.42E-06	2.58E-06	2.77E-06	2.97E-06	3.2E-06	3.47E-06	3.79E-06	4.2E-06	4.8E-06	6.02E-06	1.21E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4635.5	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.23E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.45E-06	1.51E-06	1.58E-06	1.65E-06	1.72E-06	1.81E-06	1.9E-06	2.01E-06	2.12E-06	2.25E-06	2.39E-06	2.55E-06	2.73E-06	2.93E-06	3.16E-06	3.42E-06	3.73E-06	4.14E-06	4.76E-06	6.04E-06	1.34E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4672	1E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.3E-06	1.35E-06	1.39E-06	1.45E-06	1.5E-06	1.57E-06	1.63E-06	1.71E-06	1.79E-06	1.89E-06	1.99E-06	2.1E-06	2.23E-06	2.36E-06	2.52E-06	2.69E-06	2.89E-06	3.11E-06	3.37E-06	3.68E-06	4.1E-06	4.73E-06	6.08E-06	1.5E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4708.5	1E-06	1.02E-06	1.05E-06	1.07E-06	1.1E-06	1.12E-06	1.15E-06	1.18E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.44E-06	1.49E-06	1.56E-06	1.62E-06	1.7E-06	1.78E-06	1.87E-06	1.97E-06	2.08E-06	2.2E-06	2.34E-06	2.49E-06	2.66E-06	2.85E-06	3.07E-06	3.33E-06	3.64E-06	4.05E-06	4.7E-06	6.12E-06	1.73E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4745	1E-06	1.02E-06	1.04E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.25E-06	1.29E-06	1.33E-06	1.38E-06	1.43E-06	1.48E-06	1.54E-06	1.61E-06	1.68E-06	1.76E-06	1.85E-06	1.95E-06	2.06E-06	2.18E-06	2.31E-06	2.46E-06	2.63E-06	2.81E-06	3.03E-06	3.28E-06	3.59E-06	4.01E-06	4.67E-06	6.18E-06	2.09E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4781.5	9.98E-07	1.02E-06	1.04E-06	1.06E-06	1.09E-06	1.12E-06	1.14E-06	1.18E-06	1.21E-06	1.24E-06	1.28E-06	1.33E-06	1.37E-06	1.42E-06	1.48E-06	1.53E-06	1.6E-06	1.67E-06	1.75E-06	1.84E-06	1.93E-06	2.04E-06	2.16E-06	2.29E-06	2.43E-06	2.59E-06	2.78E-06	2.99E-06	3.24E-06	3.55E-06	3.97E-06	4.65E-06	6.24E-06	2.72E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4818	9.95E-07	1.02E-06	1.04E-06	1.06E-06	1.09E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.28E-06	1.32E-06	1.36E-06	1.41E-06	1.47E-06	1.53E-06	1.59E-06	1.66E-06	1.74E-06	1.82E-06	1.91E-06	2.02E-06	2.13E-06	2.26E-06	2.4E-06	2.56E-06	2.74E-06	2.95E-06	3.2E-06	3.51E-06	3.93E-06	4.63E-06	6.32E-06	4.08E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4854.5	9.93E-07	1.01E-06	1.03E-06	1.06E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.23E-06	1.27E-06	1.31E-06	1.36E-06	1.41E-06	1.46E-06	1.52E-06	1.58E-06	1.65E-06	1.72E-06	1.81E-06	1.9E-06	2E-06	2.11E-06	2.24E-06	2.38E-06	2.53E-06	2.71E-06	2.92E-06	3.16E-06	3.47E-06	3.9E-06	4.62E-06	6.4E-06	9.48E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4891	9.91E-07	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.23E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.45E-06	1.51E-06	1.57E-06	1.64E-06	1.71E-06	1.79E-06	1.88E-06	1.98E-06	2.09E-06	2.21E-06	2.35E-06	2.5E-06	2.68E-06	2.88E-06	3.13E-06	3.44E-06	3.87E-06	4.61E-06	6.5E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4927.5	9.88E-07	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.44E-06	1.5E-06	1.56E-06	1.62E-06	1.7E-06	1.78E-06	1.87E-06	1.96E-06	2.07E-06	2.19E-06	2.33E-06	2.48E-06	2.65E-06	2.85E-06	3.09E-06	3.4E-06	3.84E-06	4.6E-06	6.6E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4964	9.86E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.12E-06	1.15E-06	1.19E-06	1.22E-06	1.26E-06	1.29E-06	1.34E-06	1.38E-06	1.43E-06	1.49E-06	1.55E-06	1.61E-06	1.68E-06	1.76E-06	1.85E-06	1.95E-06	2.05E-06	2.17E-06	2.3E-06	2.45E-06	2.62E-06	2.82E-06	3.06E-06	3.37E-06	3.82E-06	4.6E-06	6.72E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000.5	9.84E-07	1E-06	1.02E-06	1.05E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.25E-06	1.29E-06	1.33E-06	1.38E-06	1.43E-06	1.48E-06	1.54E-06	1.6E-06	1.67E-06	1.75E-06	1.83E-06	1.93E-06	2.03E-06	2.15E-06	2.28E-06	2.42E-06	2.59E-06	2.79E-06	3.03E-06	3.34E-06	3.79E-06	4.6E-06	6.85E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5037	9.82E-07	1E-06	1.02E-06	1.04E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.24E-06	1.28E-06	1.32E-06	1.37E-06	1.42E-06	1.47E-06	1.53E-06	1.59E-06	1.66E-06	1.74E-06	1.82E-06	1.91E-06	2.01E-06	2.13E-06	2.26E-06	2.4E-06	2.57E-06	2.76E-06	3E-06	3.31E-06	3.77E-06	4.6E-06	6.99E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5073.5	9.79E-07	9.99E-07	1.02E-06	1.04E-06	1.06E-06	1.09E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.28E-06	1.32E-06	1.36E-06	1.41E-06	1.46E-06	1.52E-06	1.58E-06	1.65E-06	1.72E-06	1.8E-06	1.9E-06	2E-06	2.11E-06	2.23E-06	2.38E-06	2.54E-06	2.73E-06	2.97E-06	3.29E-06	3.75E-06	4.6E-06	7.14E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5110	9.77E-07	9.96E-07	1.02E-06	1.04E-06	1.06E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.23E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.45E-06	1.51E-06	1.57E-06	1.64E-06	1.71E-06	1.79E-06	1.88E-06	1.98E-06	2.09E-06	2.21E-06	2.35E-06	2.51E-06	2.71E-06	2.94E-06	3.26E-06	3.73E-06	4.61E-06	7.31E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5146.5	9.75E-07	9.94E-07	1.01E-06	1.03E-06	1.06E-06	1.08E-06	1.11E-06	1.13E-06	1.16E-06	1.2E-06	1.23E-06	1.27E-06	1.31E-06	1.35E-06	1.39E-06	1.45E-06	1.5E-06	1.56E-06	1.63E-06	1.7E-06	1.78E-06	1.86E-06	1.96E-06	2.07E-06	2.19E-06	2.33E-06	2.49E-06	2.68E-06	2.92E-06	3.24E-06	3.72E-06	4.62E-06	7.5E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5183	9.73E-07	9.92E-07	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.44E-06	1.49E-06	1.55E-06	1.61E-06	1.69E-06	1.76E-06	1.85E-06	1.95E-06	2.05E-06	2.17E-06	2.31E-06	2.47E-06	2.66E-06	2.89E-06	3.22E-06	3.7E-06	4.63E-06	7.7E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5219.5	9.71E-07	9.89E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.29E-06	1.34E-06	1.38E-06	1.43E-06	1.48E-06	1.54E-06	1.6E-06	1.67E-06	1.75E-06	1.84E-06	1.93E-06	2.03E-06	2.15E-06	2.29E-06	2.45E-06	2.63E-06	2.87E-06	3.19E-06	3.69E-06	4.64E-06	7.92E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5256	9.69E-07	9.87E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.25E-06	1.29E-06	1.33E-06	1.37E-06	1.42E-06	1.47E-06	1.53E-06	1.59E-06	1.66E-06	1.74E-06	1.82E-06	1.91E-06	2.02E-06	2.13E-06	2.27E-06	2.42E-06	2.61E-06	2.85E-06	3.17E-06	3.68E-06	4.65E-06	8.17E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5292.5	9.67E-07	9.85E-07	1E-06	1.02E-06	1.05E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.24E-06	1.28E-06	1.32E-06	1.37E-06	1.41E-06	1.47E-06	1.52E-06	1.58E-06	1.65E-06	1.73E-06	1.81E-06	1.9E-06	2E-06	2.12E-06	2.25E-06	2.4E-06	2.59E-06	2.83E-06	3.16E-06	3.67E-06	4.67E-06	8.44E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5329	9.65E-07	9.83E-07	1E-06	1.02E-06	1.04E-06	1.07E-06	1.09E-06	1.12E-06	1.14E-06	1.17E-06	1.21E-06	1.24E-06	1.28E-06	1.32E-06	1.36E-06	1.41E-06	1.46E-06	1.51E-06	1.57E-06	1.64E-06	1.71E-06	1.79E-06	1.88E-06	1.99E-06	2.1E-06	2.23E-06	2.38E-06	2.57E-06	2.81E-06	3.14E-06	3.66E-06	4.69E-06	8.73E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5365.5	9.63E-07	9.8E-07	9.99E-07	1.02E-06	1.04E-06	1.06E-06	1.09E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.23E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.45E-06	1.5E-06	1.56E-06	1.63E-06	1.7E-06	1.78E-06	1.87E-06	1.97E-06	2.08E-06	2.21E-06	2.37E-06	2.55E-06	2.79E-06	3.12E-06	3.65E-06	4.71E-06	9.06E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5402	9.61E-07	9.78E-07	9.97E-07	1.02E-06	1.04E-06	1.06E-06	1.08E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.23E-06	1.27E-06	1.3E-06	1.35E-06	1.39E-06	1.44E-06	1.5E-06	1.55E-06	1.62E-06	1.69E-06	1.77E-06	1.86E-06	1.95E-06	2.07E-06	2.2E-06	2.35E-06	2.53E-06	2.77E-06	3.11E-06	3.64E-06	4.73E-06	9.42E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5438.5	9.59E-07	9.76E-07	9.95E-07	1.01E-06	1.03E-06	1.06E-06	1.08E-06	1.11E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.43E-06	1.49E-06	1.55E-06	1.61E-06	1.68E-06	1.76E-06	1.84E-06	1.94E-06	2.05E-06	2.18E-06	2.33E-06	2.52E-06	2.76E-06	3.09E-06	3.63E-06	4.75E-06	9.82E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5475	9.57E-07	9.74E-07	9.92E-07	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.29E-06	1.33E-06	1.38E-06	1.43E-06	1.48E-06	1.54E-06	1.6E-06	1.67E-06	1.75E-06	1.83E-06	1.93E-06	2.04E-06	2.16E-06	2.31E-06	2.5E-06	2.74E-06	3.08E-06	3.63E-06	4.78E-06	1.03E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5511.5	9.55E-07	9.72E-07	9.9E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.13E-06	1.15E-06	1.18E-06	1.22E-06	1.25E-06	1.29E-06	1.33E-06	1.37E-06	1.42E-06	1.47E-06	1.53E-06	1.59E-06	1.66E-06	1.73E-06	1.82E-06	1.91E-06	2.02E-06	2.15E-06	2.3E-06	2.48E-06	2.72E-06	3.07E-06	3.62E-06	4.8E-06	1.08E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5548	9.53E-07	9.7E-07	9.88E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.25E-06	1.28E-06	1.32E-06	1.37E-06	1.41E-06	1.46E-06	1.52E-06	1.58E-06	1.65E-06	1.72E-06	1.81E-06	1.9E-06	2.01E-06	2.13E-06	2.28E-06	2.47E-06	2.71E-06	3.05E-06	3.62E-06	4.83E-06	1.13E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5584.5	9.51E-07	9.68E-07	9.86E-07	1E-06	1.02E-06	1.05E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.17E-06	1.21E-06	1.24E-06	1.28E-06	1.32E-06	1.36E-06	1.41E-06	1.46E-06	1.51E-06	1.57E-06	1.64E-06	1.71E-06	1.79E-06	1.89E-06	1.99E-06	2.12E-06	2.27E-06	2.45E-06	2.69E-06	3.04E-06	3.61E-06	4.86E-06	1.2E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5621	9.49E-07	9.66E-07	9.84E-07	1E-06	1.02E-06	1.04E-06	1.07E-06	1.09E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.45E-06	1.5E-06	1.56E-06	1.63E-06	1.7E-06	1.78E-06	1.87E-06	1.98E-06	2.1E-06	2.25E-06	2.44E-06	2.68E-06	3.03E-06	3.61E-06	4.89E-06	1.27E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5657.5	9.47E-07	9.64E-07	9.81E-07	1E-06	1.02E-06	1.04E-06	1.06E-06	1.09E-06	1.11E-06	1.14E-06	1.17E-06	1.2E-06	1.23E-06	1.27E-06	1.3E-06	1.35E-06	1.39E-06	1.44E-06	1.49E-06	1.55E-06	1.62E-06	1.69E-06	1.77E-06	1.86E-06	1.97E-06	2.09E-06	2.24E-06	2.42E-06	2.67E-06	3.02E-06	3.61E-06	4.92E-06	1.36E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5694	9.46E-07	9.62E-07	9.79E-07	9.98E-07	1.02E-06	1.04E-06	1.06E-06	1.08E-06	1.11E-06	1.13E-06	1.16E-06	1.19E-06	1.23E-06	1.26E-06	1.3E-06	1.34E-06	1.39E-06	1.43E-06	1.49E-06	1.55E-06	1.61E-06	1.68E-06	1.76E-06	1.85E-06	1.96E-06	2.08E-06	2.23E-06	2.41E-06	2.66E-06	3.01E-06	3.61E-06	4.95E-06	1.46E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5730.5	9.44E-07	9.6E-07	9.77E-07	9.95E-07	1.01E-06	1.04E-06	1.06E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.26E-06	1.29E-06	1.33E-06	1.38E-06	1.43E-06	1.48E-06	1.54E-06	1.6E-06	1.67E-06	1.75E-06	1.84E-06	1.94E-06	2.07E-06	2.21E-06	2.4E-06	2.64E-06	3E-06	3.61E-06	4.99E-06	1.58E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5767	9.42E-07	9.58E-07	9.75E-07	9.93E-07	1.01E-06	1.03E-06	1.05E-06	1.08E-06	1.1E-06	1.13E-06	1.16E-06	1.19E-06	1.22E-06	1.25E-06	1.29E-06	1.33E-06	1.37E-06	1.42E-06	1.47E-06	1.53E-06	1.59E-06	1.66E-06	1.74E-06	1.83E-06	1.93E-06	2.05E-06	2.2E-06	2.39E-06	2.63E-06	2.99E-06	3.61E-06	5.03E-06	1.73E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5803.5	9.4E-07	9.56E-07	9.73E-07	9.91E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.1E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.25E-06	1.28E-06	1.32E-06	1.37E-06	1.41E-06	1.46E-06	1.52E-06	1.58E-06	1.65E-06	1.73E-06	1.82E-06	1.92E-06	2.04E-06	2.19E-06	2.37E-06	2.62E-06	2.99E-06	3.61E-06	5.06E-06	1.91E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5840	9.38E-07	9.54E-07	9.71E-07	9.89E-07	1.01E-06	1.03E-06	1.05E-06	1.07E-06	1.09E-06	1.12E-06	1.15E-06	1.18E-06	1.21E-06	1.24E-06	1.28E-06	1.32E-06	1.36E-06	1.41E-06	1.46E-06	1.51E-06	1.58E-06	1.64E-06	1.72E-06	1.81E-06	1.91E-06	2.03E-06	2.18E-06	2.36E-06	2.61E-06	2.98E-06	3.61E-06	5.1E-06	2.13E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5876.5	9.37E-07	9.52E-07	9.69E-07	9.87E-07	1.01E-06	1.02E-06	1.05E-06	1.07E-06	1.09E-06	1.12E-06	1.14E-06	1.17E-06	1.2E-06	1.24E-06	1.27E-06	1.31E-06	1.35E-06	1.4E-06	1.45E-06	1.51E-06	1.57E-06	1.64E-06	1.71E-06	1.8E-06	1.9E-06	2.02E-06	2.17E-06	2.35E-06	2.6E-06	2.97E-06	3.61E-06	5.14E-06	2.43E-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ATTACHMENT 2
FSCONSOL ERROR CHECKING

1-DIMENSIONAL VERSUS 3-DIMENSIONAL
PERCENT ERROR CACLUATION SUMMARY

Parameters used for modeling

H0 (ft)	H1 (ft)	dh (ft)	Volume (ft^3)	Cum Vol (ft^3)	Area (ft^2)	q (ft/day)
5,196	5,210	14	9,932,193	9,932,193	709,442	2.2121
5,210	5,225	15	38,314,944	48,247,137	2,554,330	0.6144
5,225	5,235	10	44,291,826	92,538,963	4,429,183	0.3543
5,235	5,250	15	92,677,986	185,216,949	6,178,532	0.2540
5,250	5,265	15	117,824,976	303,041,925	7,854,998	0.1998
5,265	5,280	15	132,892,218	435,934,143	8,859,481	0.1771
5,280	5,295	15	157,205,421	593,139,564	10,480,361	0.1497
5,295	5,310	15	166,682,826	759,822,390	11,112,188	0.1412
5,310	5,325	15	182,999,925	942,822,315	12,199,995	0.1286
5,325	5,340	15	188,799,066	1,131,621,381	12,586,604	0.1247
5,340	5,355	15	196,020,810	1,327,642,191	13,068,054	0.1201
5,355	5,370	15	199,271,529	1,526,913,720	13,284,769	0.1181
5,370	5,385	15	201,610,674	1,728,524,394	13,440,712	0.1168
5,385	5,400	15	204,228,243	1,932,752,637	13,615,216	0.1153
5,400	5,425	25	341,505,828	2,274,258,465	13,660,233	0.1149
5,425	5,435	10	136,611,117	2,410,869,582	13,661,112	0.1149
5,435	5,450	15	204,916,743	2,615,786,325	13,661,116	0.1149

Check 1D calc - Volume

Compare volume based on filling time, production rate, & average density w/ stage-curve volume

Time	2,883.50	days		
Production	15,121.0	ton/day		
Total mass	43,601,404	ton		
Void Ratio	3.9303			Note: from FSConsol Time Step Data
Dry Density	33.540	pcf		
Volume	2,599,975,881	ft^3		Note: volume=Qm*t/rho_dry
Cum Vol	2,615,786,325	ft^3	EL 5,448.31	Note: from Rate of Rise Ht vs. Cap Table
Error	-0.60%			

Material Properties

Gs	2.65	
A	5.6895	(1/psf)^B
B	-0.1952	
M	-0.1424	
e0	7.581	
w	286.1%	
s	25.9%	
C	3.91E-04	ft/day
D	3.35	

Production

15,121	t/day
182,886	ft^3/day of dry solids
1,569,366	ft^3/day of tailing
2,883.50	days
7.90	years

Check 1D Calc - height of solids

Compare height of solids based on model inputs and based on the calculated void ratio profile

Stage	Height (ft)	Filling time (day)	q (ft/day)	Hs_production
1	14	17.40	2.2121	4.49
2	29	36.04	0.6144	1.33
3	39	71.95	0.3543	1.48
4	54	157.93	0.2540	2.55
5	69	275.86	0.1998	2.75
6	84	407.95	0.1771	2.73
7	99	554.92	0.1497	2.56
8	114	718.78	0.1412	2.70
9	129	910.33	0.1286	2.87
10	144	1,115.33	0.1247	2.98
11	159	1,334.27	0.1201	3.06
12	174	1,557.63	0.1181	3.07
13	189	1,782.92	0.1168	3.07
14	204	2,042.42	0.1153	3.49
15	229	2,480.92	0.1149	5.87
16	239	2,654.21	0.1149	2.32
17	254	2,883.50	0.1149	3.07
			Total	50.38
			Hs_FSConsol	51.35
			Error	1.93%

Note: based on e profile

Check 1D calc - Mass

Calculate total mass based on the void ratio profile and TDF stage storage and compare to mass determined from production rate and total filling time

TIME = 2,883.50

Node	Elev (ft)	Void Ratio	dHs(ft)
1	0.003	1.434	
2	5.080	1.533	2.044
3	10.160	1.645	1.962
4	14.000	1.740	1.426
5	15.240	1.771	0.450
6	20.320	1.911	1.788
7	25.400	2.064	1.700
8	29.000	2.180	1.153
9	30.480	2.227	0.462
10	35.560	2.397	1.534
11	39.000	2.513	0.996
12	40.639	2.569	0.463
13	45.719	2.740	1.390
14	50.799	2.908	1.328
15	54.000	3.010	0.809
16	55.879	3.069	0.465
17	60.959	3.225	1.225
18	66.039	3.373	1.182
19	69.000	3.455	0.671
20	71.119	3.514	0.472
21	76.199	3.649	1.109
22	81.279	3.778	1.078
23	84.000	3.844	0.566
24	86.359	3.901	0.484
25	91.439	4.020	1.024
26	96.519	4.134	1.001
27	99.000	4.187	0.481
28	101.599	4.243	0.498
29	106.678	4.349	0.959
30	111.758	4.452	0.941
31	114.000	4.496	0.409
32	116.838	4.552	0.514
33	121.918	4.648	0.907
34	126.998	4.742	0.892
35	129.000	4.778	0.348
36	132.078	4.834	0.530
37	137.158	4.923	0.864
38	142.238	5.010	0.851
39	144.000	5.039	0.292
40	147.318	5.095	0.547
41	152.398	5.178	0.828
42	157.478	5.260	0.817
43	159.000	5.284	0.243
44	162.558	5.340	0.564
45	167.637	5.418	0.796
46	172.717	5.495	0.787
47	174.000	5.514	0.197
48	177.797	5.570	0.580
49	182.877	5.644	0.769
50	187.957	5.717	0.760
51	189.000	5.732	0.155
52	193.037	5.789	0.597
53	198.117	5.859	0.744
54	203.197	5.929	0.737
55	204.000	5.939	0.116
56	208.277	5.997	0.614
57	213.357	6.064	0.723
58	218.437	6.131	0.716
59	223.517	6.196	0.709
60	228.597	6.261	0.703
61	229.000	6.266	0.056
62	233.677	6.324	0.641
63	238.757	6.387	0.691
64	239.000	6.390	0.033
65	243.836	6.449	0.652
66	248.916	6.510	0.679
67	254.000	7.581	0.632

Calculate total mass of the impoundment based on 1D void ratio profile

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Layer 9
Δ_Height (ft)	14	15.0	10.0	15.0	15.0	15.0	15.0	15.0	15.0
Height (ft)	14	29	39	54	69	84	99	114	129
Hs (ft)	5.43	5.09	2.99	3.99	3.54	3.22	2.99	2.81	2.66
e_avg	1.58	1.95	2.34	2.76	3.23	3.65	4.02	4.34	4.64
rho_dry (pcf)	64.17	56.12	49.47	43.99	39.06	35.55	32.96	30.95	29.33
Vol (ft^3)	9,932,193	38,314,944	44,291,826	92,677,986	117,824,976	132,892,218	157,205,421	166,682,826	182,999,925
Mass (ton)	318,662	1,075,213	1,095,477	2,038,244	2,300,832	2,362,077	2,590,583	2,579,371	2,683,614

	Layer 10	Layer 11	Layer 12	Layer 13	Layer 14	Layer 15	Layer 16	Layer 17
Δ_Height (ft)	15.0	15.0	15.0	15.0	15.0	25.0	10.0	15.0
Height (ft)	144.0	159.0	174.0	189.0	204.0	229.0	239.0	254.0
Hs (ft)	2.54	2.43	2.34	2.26	2.19	3.52	1.36	1.96
e_avg	4.91	5.16	5.40	5.62	5.84	6.10	6.33	6.64
rho_dry (pcf)	27.98	26.83	25.84	24.97	24.19	23.28	22.57	21.64
Vol (ft^3)	188,799,066	196,020,810	199,271,529	201,610,674	204,228,243	341,505,828	136,611,117	204,916,743
Mass (ton)	2,641,449	2,630,075	2,574,663	2,516,815	2,470,154	3,975,111	1,541,374	2,217,043

Time	2,883.5	days	
Production	15,121	ton/day	
Total mass	43,601,404	ton	Note: based on the time of filling and production rate
TDF - total mass	37,610,756	ton	Note: based on the integration of the void ratio profile
Error (%)	13.74%		

1-DIMENSIONAL VERSUS 3-DIMENSIONAL PERCENT ERROR CACLUATION SUMMARY

Parameters used for modeling

H0 (ft)	H1 (ft)	dh (ft)	Volume (ft^3)	Cum Vol (ft^3)	Area (ft^2)	q (ft/day)
5,196	5,210	14	9,932,193	9,932,193	709,442	2.2121
5,210	5,225	15	38,314,944	48,247,137	2,554,330	0.6144
5,225	5,235	10	44,291,826	92,538,963	4,429,183	0.3543
5,235	5,250	15	92,677,986	185,216,949	6,178,532	0.2540
5,250	5,265	15	117,824,976	303,041,925	7,854,998	0.1998
5,265	5,280	15	132,892,218	435,934,143	8,859,481	0.1771
5,280	5,295	15	157,205,421	593,139,564	10,480,361	0.1497
5,295	5,310	15	166,682,826	759,822,390	11,112,188	0.1412
5,310	5,325	15	182,999,925	942,822,315	12,199,995	0.1286
5,325	5,340	15	188,799,066	1,131,621,381	12,586,604	0.1247
5,340	5,355	15	196,020,810	1,327,642,191	13,068,054	0.1201
5,355	5,370	15	199,271,529	1,526,913,720	13,284,769	0.1181
5,370	5,385	15	201,610,674	1,728,524,394	13,440,712	0.1168
5,385	5,400	15	204,228,243	1,932,752,637	13,615,216	0.1153
5,400	5,425	25	341,505,828	2,274,258,465	13,660,233	0.1149
5,425	5,435	10	136,611,117	2,410,869,582	13,661,112	0.1149
5,435	5,450	15	204,916,743	2,615,786,325	13,661,116	0.1149

Check 1D calc - Volume

Compare volume based on filling time, production rate, & average density w/ stage-curve volume

Time	4,057.00	days		
Production	15,121.0	ton/day		
Total mass	61,345,897	ton		
Void Ratio	1.1581			Note: from FSConsol Time Step Data
Dry Density	76.623	pcf		
Volume	1,601,244,549	ft^3		Note: volume=Qm*t/rho_dry
Cum Vol	1,547,514,922	ft^3	EL 5,371.53	Note: from Rate of Rise Ht vs. Cap Table
Error	3.47%			

Material Properties

Gs	2.65	
A	4.4241	(1/psf)^B
B	-0.2983	
M	0.5224	
e0	7.581	
w	286.1%	
s	25.9%	
C	4.32E-03	ft/day
D	3.04	

Production

15,121	t/day
182,886	ft^3/day of dry solids
1,569,327	ft^3/day of tailing
4,057.00	days
11.12	years

Check 1D Calc - height of solids

Compare height of solids based on model inputs and based on the calculated void ratio profile

Stage	Height (ft)	Filling time (day)	q (ft/day)	Hs_production
1	14	25.54	2.2121	6.58
2	29	77.82	0.6144	3.74
3	39	200.19	0.3543	5.05
4	54	433.42	0.2540	6.90
5	69	698.40	0.1998	6.17
6	84	1,009.95	0.1771	6.43
7	99	1,401.09	0.1497	6.83
8	114	1,815.07	0.1412	6.81
9	129	2,345.37	0.1286	7.95
10	144	2,880.33	0.1247	7.77
11	159	3,434.57	0.1201	7.76
12	174	3,993.71	0.1181	7.70
13	189	4,057.00	0.1168	0.86
14	204	4,057.00	0.1153	0.00
15	229	4,057.00	0.1149	0.00
16	239	4,057.00	0.1149	0.00
17	254	4,057.00	0.1149	0.00
			Total	80.56
			Hs_FSConsol	81.47
			Error	1.13%

Note: based on e profile

1-DIMENSIONAL VERSUS 3-DIMENSIONAL PERCENT ERROR CACLUATION SUMMARY

Check 1D calc - Mass

Calculate total mass based on the void ratio profile and TDF stage storage and compare to mass determined from production rate and total filling time

TIME = 4,057.00

Node	Elev (ft)	Void Ratio	dHs(ft)
1	0.003	0.885	
2	5.080	0.892	2.688
3	10.160	0.899	2.680
4	14.000	0.905	2.019
5	15.240	0.907	0.650
6	20.320	0.916	2.658
7	25.400	0.924	2.646
8	29.000	0.931	1.868
9	30.480	0.934	0.766
10	35.560	0.944	2.620
11	39.000	0.951	1.767
12	40.639	0.955	0.839
13	45.719	0.966	2.591
14	50.799	0.978	2.576
15	54.000	0.986	1.615
16	55.879	0.991	0.945
17	60.959	1.005	2.542
18	66.039	1.020	2.524
19	69.000	1.030	1.462
20	71.119	1.036	1.042
21	76.199	1.054	2.484
22	81.279	1.072	2.463
23	84.000	1.083	1.310
24	86.359	1.092	1.130
25	91.439	1.114	2.416
26	96.519	1.136	2.391
27	99.000	1.149	1.158
28	101.599	1.161	1.206
29	106.678	1.188	2.336
30	111.758	1.216	2.307
31	114.000	1.229	1.009
32	116.838	1.246	1.268
33	121.918	1.278	2.246
34	126.998	1.313	2.213
35	129.000	1.328	0.863
36	132.078	1.350	1.316
37	137.158	1.390	2.144
38	142.238	1.433	2.106
39	144.000	1.450	0.722
40	147.318	1.481	1.346
41	152.398	1.537	2.025
42	157.478	1.603	1.977
43	159.000	1.630	0.582
44	162.558	1.691	1.337
45	167.637	1.830	1.840
46	172.717	2.190	1.688
47	174.000	2.340	0.393
48	177.797	2.787	1.066
49	175.533	7.581	-0.366

Calculate total mass of the impoundment based on 1D void ratio profile

	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Layer 9
Δ_Height (ft)	14	15.0	10.0	15.0	15.0	15.0	15.0	15.0	15.0
Height (ft)	14	29	39	54	69	84	99	114	129
Hs (ft)	7.39	7.82	5.15	7.62	7.47	7.30	7.09	6.86	6.59
e_avg	0.90	0.92	0.94	0.97	1.01	1.06	1.11	1.19	1.28
rho_dry (pcf)	87.25	86.22	85.20	84.02	82.38	80.46	78.21	75.60	72.64
Vol (ft^3)	9,932,193	38,314,944	44,291,826	92,677,986	117,824,976	132,892,218	157,205,421	166,682,826	182,999,925
Mass (ton)	433,286	1,651,849	1,886,806	3,893,369	4,853,484	5,346,370	6,147,490	6,300,939	6,646,956

	Layer 10	Layer 11	Layer 12	Layer 13	Layer 14	Layer 15	Layer 16	Layer 17
Δ_Height (ft)	15.0	15.0	15.0	1.5				
Height (ft)	144.0	159.0	174.0	175.5				
Hs (ft)	6.29	5.93	5.26	0.70				
e_avg	1.39	1.53	1.85	1.19				
rho_dry (pcf)	69.32	65.36	57.96	75.44				
Vol (ft^3)	188,799,066	196,020,810	199,271,529	201,610,674				
Mass (ton)	6,543,555	6,406,050	5,775,192	7,605,173				

Time	4,057	days	
Production	15,121	ton/day	
Total mass	61,345,897	ton	Note: based on the time of filling and production rate
TDF - total mass	63,490,519	ton	Note: based on the integration of the void ratio profile
Error (%)	-3.50%		

ATTACHMENT 3
FSCONSOL MODEL SUMMARY

SUMMARY

Input Parameters

Total Mine Tailings	1.12E+08	tons	Total Tailings (Underflow + Overflow)
Cyclone Availability	100.00%		Assumed Plant Operations
Sand Recovery	45.25%		Average Recovery from Cyclone Plant
Slimes Percentage	40.00%		Slimes vs. Beach (Overflow + Whole)
Overflow Percentage	54.75%		Tailings (Overflow + Whole)
Whole Percentage	0.00%		Tailings (Whole versus Total)
Production	27,618	t/day	Total Tailings (Underflow + Overflow)
	15,121	t/day	Tailings Overflow + Whole
	0	t/day	Tailings Whole (Beach + Slimes)
	15,121	t/day	Tailings Overflow (Beach + Slimes)

Overflow

Production	6,048	t/day	Tailings Overflow Slimes
Production	9,073	t/day	Tailings Overflow Beach
Production	0	t/day	Tailings Whole Slimes
Production	0	t/day	Tailings Whole Beach
Capacity	6.13E+07	tons	Tailings Overflow (Beach + Slimes)
Time	4,057	days	Tailings Overflow (Beach + Slimes)
	11.115	years	

FSConsol 1D Percent Errors

	Height	Volume	Mass	Average
OF-slimes	1.93%	0.60%	13.74%	5.42%
OF-beach	1.13%	3.47%	3.50%	2.70%
Whole-slimes	0.00%	0.00%	0.00%	0.00%
Whole-beach	0.00%	0.00%	0.00%	0.00%

FSConsol average densities (for deepest column in TSF)

	Unadjusted		Adjusted	
OF-slimes	33.55	pcf	31.73	pcf
OF-beach	76.65	pcf	74.58	pcf
Whole-slimes	0.00	pcf	0.00	pcf
Whole-beach	0.00	pcf	0.00	pcf

Required Capacity

	5.07E+07	tons	Tailings Underflow Cyclone Sand
	2.45E+07	tons	Tailings Overflow Slimes
	3.68E+07	tons	Tailings Overflow Beach
	0.00E+00	tons	Tailings Whole Slimes
	0.00E+00	tons	Tailings Whole Beach
	1.12E+08	tons	Total Tailings (Underflow + Overflow)
Check	0.0000	tons	OK

Required Volume and Weighted Density

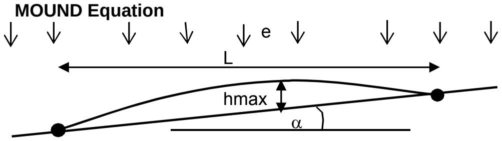
	Unadjusted		Adjusted		Volume	Density	
OF-slimes	1.46E+09	ft^3	1.55E+09	ft^3	61.04%	19.37	pcf
OF-beach	9.60E+08	ft^3	9.87E+08	ft^3	38.96%	29.05	pcf
Whole-slimes	0.00E+00	ft^3	0.00E+00	ft^3	0.00%	0.00	pcf
Whole-beach	0.00E+00	ft^3	0.00E+00	ft^3	0.00%	0.00	pcf
Total	8.97E+07	yd^3	9.38E+07	yd^3	100.00%	48.42	pcf

APPENDIX D
UNDERDRAIN DESIGN CALCULATIONS

APPENDIX D.1
DRAIN PIPE SPACING CALCULATIONS

LCR
4/15/04

MOUND Equation



$$h_{\max} = \frac{L\sqrt{C}}{2}\left[\frac{\tan^2\alpha}{C} + \left(1 - \frac{\tan\alpha}{C}\left(\tan^2\alpha + C\right)^{1/2}\right)\right]$$

Where: L=Drain Spacing
C=Inflow Ratio (e/K)
e=Constant Recharge Rate
k=Drain Media Hydraulic Conductivity
tan α=Slope Between Pipes

h_{max} (ft)	L (ft)	e (cm/sec)	e (ft/day)	k (cm/sec)	k (ft/day)	C	tan α
1.41	45	5.07E-04	1.44E+00	1.00E-01	2.83E+02	5.07E-03	0.01

Assume sand applied over a 600 foot by 100 foot area.
Estimate an equivalent constant recharge rate (e) for the drainage through the sand in the active sand application area
Sand K will be higher but flow will be limited by water in underflow

Estimate Equivalent Constant Recharge Rate (e)

Tons milled	30,000	tpd	
Cyclone recovery	46	percent	
Q sand	13,800	tpd	
Solids content	70	wt percent	
Total underflow	19,714	tpd	
Water in UF	5,914	tpd	
Water in UF	1,042	gpm	
Water retained	42.00%		
Water lost to evap	15.00%		
Seepage	448	gpm	
Application area	600	L (feet)	Estimate
Application area	100	w (feet)	Estimate
Application area	60,000	ft^2	
Application rate	1.66392E-05	feet/sec	
Application rate (e)	**5.07E-04**	**cm/sec**	

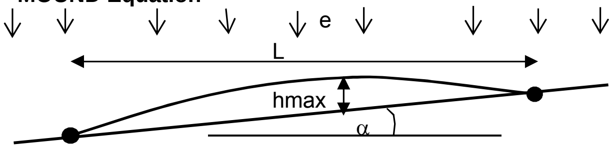
Equivalent flow rate for active sand application area

Masada, T., 1998, "Leachate Flow Mound Equations for Steady-State Flow Over a Landfill Geosynthetic Bottom Liner", Geosynthetics International, Vol. 5, No. 4, pp. 383-397.

Han Ke,[1] Yunmin Chen,[2] and Chuangbing Huang[3]
Estimation of Maximum Liquid Depth in Layered Drainage Blankets over Landfill Barriers
J. Envir. Engrg. Volume 134, Issue 1, pp. 67-76 (January 2008)

LRC
4/15/04

MOUND Equation



$$h_{\max} = \frac{L\sqrt{C}}{2}\left[\frac{\tan^2\alpha}{C} + \left(1 - \frac{\tan\alpha}{C}\left(\tan^2\alpha + C\right)^{1/2}\right)\right]$$

Where: L=Drain Spacing
C=Inflow Ratio (e/K)
e=Constant Recharge Rate
k=Drain Media Hydraulic Conductivity
tan α=Slope Between Pipes

h_{max} (ft)	L (ft)	e (cm/sec)	e (ft/day)	k (cm/sec)	k (ft/day)	C	tan α
1.33	35	2.75E-07	7.80E-04	3.80E-05	1.08E-01	7.24E-03	0.01

K drain test result 3.8e-05 cm/sec, select (native)drain fill
Average of beach and slimes hydraulic conductivity applied (2.75x10^{7}cm/sec).

Masada, T., 1998, "Leachate Flow Mound Equations for Steady-State Flow Over a Landfill Geosynthetic Bottom Liner", Geosynthetics International, Vol. 5, No. 4, pp. 383-397.

Han Ke,[1] Yunmin Chen,[2] and Chuangbing Huang[3]
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APPENDIX D.2
DRAIN PIPE DEFLECTION CALCULATIONS

CALCULATIONS

Date:	April 23, 2013	**Made by:**	CDJ
Project No.:	103-92557	**Checked by:**	GM
Subject:	Underdrain Pipe Deflection Calculations	**Reviewed by:**	MJG
Project Short Title:	**COPPER FLAT FEASIBILITY DESIGN**		

1.0 OBJECTIVE

Determine the amount of deflection that will be experienced by the piping system within the tailings storage facility (TSF) underdrains caused by the surcharge load of the ultimate tailings height.

2.0 ASSUMPTIONS

- Underdrain Fill has a cohesion of 0 pounds per square inch (psi) and a friction angle of 39 degrees based on Golder laboratory tests for tailings underflow cyclone sand material.
- Underdrain Fill has a stress versus strain relationship similar to Silty Sand at a relative density of 80 percent per Standard AASHTO compaction specifications.
- Linear relationship between an applied vertical load of 52.1 to 69.4 psi to extrapolate the appropriate strain for an applied vertical load of 200 psi, which is the total vertical stress component imposed by the ultimate tailings height.
- The maximum burial depth is 240 feet.
- All pipes are perforated corrugated polyethylene (PCPE) N-12 pipes with a flexural modulus of 22,000 psi for a 50-year life span.
- The optimum dry density of the tailings underflow cyclone sand in the TSF is 97 pounds per cubic foot (pcf) per laboratory soil density/moisture content compaction proctor tests. As-delivered moisture content is 30 percent for a wet density of 126 pcf. After initial draindown and evaporation, moisture content of approximately 17 percent (optimum water content) for a wet density of 113.5 pcf. Therefore, use the worse-case scenario of 126 pcf for the loading conditions applied to the underdrain.
- Underdrain pipes will be subject to surface loads associated with saturated tailings overflow. The average dry density of the tailings overflow thickened slimes is estimated to be 73 pcf with a wet density of 108 pcf. The loading condition imposed by the cyclone sand dam fill represents the worst-case scenario for pipe deflection analyses.
- Maximum deflection allowed is 15 percent.

3.0 CALCULATION OF PIPE DEFLECTIONS

Golder analyzed the pipe stresses and deformations based on the work of Burns and Richards (Burns and Richards, 1964) and Hoeg (1968) with modifications to the closed-form, plane strain solutions by Lupo (2001). The closed form equations were modified to allow an incremental stress approach and non-linear material compression. Calculations of deflections were completed using an Excel ™ spreadsheet. Calculations are included in Attachment 1.

Golder Associates Inc.
4730 N. Oracle Road, Suite 210
Tucson, AZ 85705 USA
Tel: (520) 888-8818 Fax: (520) 888-8817 www.golder.com

4.0 RESULTS

A summary of the maximum deflections of the underdrain collection system pipes within the Underdrain Fill for the TSF is shown below in Table 1.

Table 1: Summary of Maximum Pipe Deflections

Pipe Information	No Interface Slippage Vertical Deflection (%)	Full Slippage Vertical Deflection (%)
4-inch PCPE N-12	12.6	13.5
10-inch PCPE N-12	12.9	13.8
12-inch PCPE N-12	10.9	11.5

5.0 CONCLUSIONS

The calculated deflections of the 4-inch, 10-inch and 12-inch diameter PCPE N-12 pipes proposed for use in the impoundment and embankment underdrains at the Copper Flat TSF is estimated to be within the allowable limits under the anticipated worst-case loading and placement conditions. The maximum deflection is estimated to be 11 to 11.5 percent for 12-inch diameter pipe and 12.5 to 14 percent for 4-inch to 10-inch diameter pipes. The maximum allowable deflection of these pipes is 15 percent.

6.0 REFERENCES

Burns, J.Q. and R.M. Richard, 1964. Attenuation of Stresses for Buried Conduits. Proceedings of the Symposium Soil-Structure Interaction, University of Arizona.

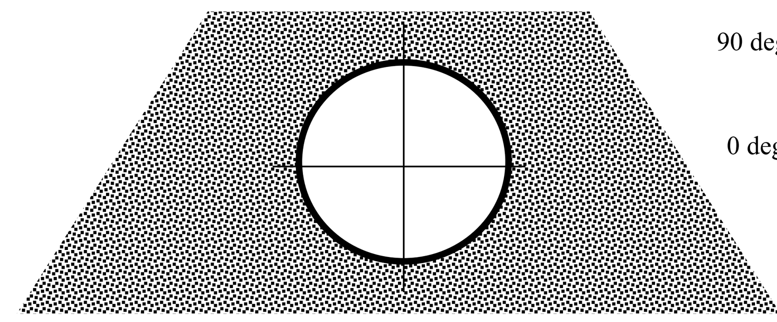
Hoeg, K., 1968. Stresses Against Underground Structural Cylinders. J. Soil Mech. and Foundation Div. ASCE, Vol. 94, No. SM4.

Lupo, J.F., 2001. Stability of HDPE Pipes Under High Heap Loads. SME Annual Meeting, Denver, Colorado. February 26-28, 2001.

ATTACHMENT 1
PIPE DEFLECTION CALCULATION

BURIED PLASTIC PIPE LOADING WORKSHEET V2.0

[With Incremental Stress Analysis (non-linear)]



Model Geometry

90 degrees = Crown

0 degrees = Springline

Project: Copper Flat
4 IN N-12 PIPE

By: CDJ
Date: 04/23/2013
Note: Compression is positive, tension is negative

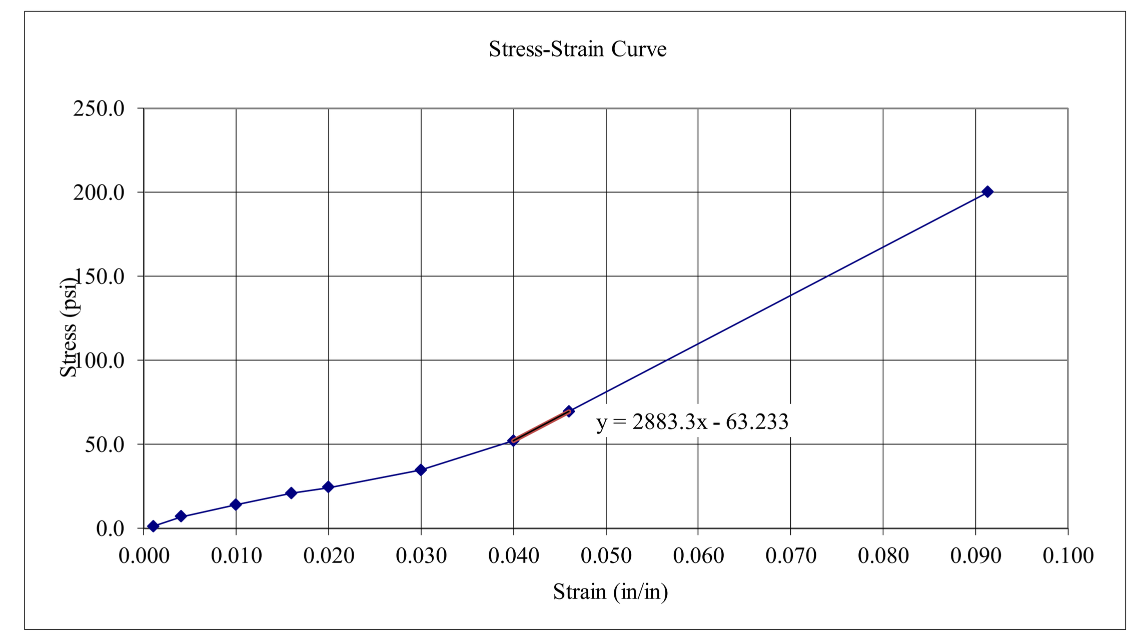
SOIL and PIPE Input Data

Lateral Pressure Parameters

Material	Cohesion	Friction Angle	Contrained Modulus (psi)	Lateral Stress Ratio	B	C
Pipe	n/a	n/a				
Soil	0	39	2191	0.39	0.696	0.30

Pipe Diameter OD (in):	4.78		
Pipe ID (in):	4.10		
Weight of Pipe (lb/ft):	0.41		
Pipe Corrugated (y/n):	y		64.50
Prescribed Constrained Modulus (y/n):	n		0.23
Prescribed Constrained Modulus (psi):	na		
Pipe Wall Thickness (in):	0.02		
Pipe Area (in^2/in):	0.07		
Flexural Modulus (psi), E_f =	22,000		
Ring Compression Modulus (psi), E_{rc} =	22,000		
C value (in)	0.29		
Moment of Inertia (in^4/in) non-corrugated:	11.8		
Moment of Inertia (in^4/in) corrugated (input from manufacturer data):	0.0014	selected I:	0.0014
Stiffness Coefficients			
Flexural Stiffness	13.7		
Ring Compression Stiffness	647.1	Ring Stiffness Factor: 2.3	Pipe Stiffness Less Than Soil

Shell-Medium Parameters		
UF	4.72	Extensional Flexibility ratio = Compressibility ratio = relative flexibility of pipe and soil under uniform loading.
VF	97.0	Bending Flexibility ratio = Flexibility ratio = relative flexibility of pipe and soil under varying radial and
		If both UF and VF are zero then a perfectly rigid embedded pipe.



Soil Compression Data		
Applied Vertical Load (psi)	Vertical Strain (in/in)	Constrained Modulus (psi)
1.0	0.001	1000.00
6.9	0.004	1725.00
13.9	0.010	1390.00
20.8	0.016	1300.00
24.3	0.020	1215.00
34.7	0.030	1156.67
52.1	0.040	1302.50
69.4	0.046	1508.70
200.0	0.091	2190.68

Pipe Mean Radius (in):	2.38	
Depth of Burial (ft):	240.0	
Applied Surface Stress (psf):	0.0	
Soil Density (pcf):	120.0	
Total Vertical Stress Component (psf):	28800.0	Free Field Stress Values
Total Vertical Stress Component (psi):	200.0	

Critical Stress For Buckling Failure (psf): 194.7
Ovality: 0.3
Corrected Stress (psf): 58.4

NO INTERFACE SLIPPAGE

Angle	Soil Stresses (psi) Radial	Soil Stresses (psi) Hoop	Soil Stresses (psi) Shear	Pipe Displacements (in) Radial	Pipe Displacements (in) Hoop	Circumferential Thrust	Moment Thrust	Ring Compression Stress (psi)	Ring Compression Strain (in/in)	Ring Shortening (in)	Inner Bending Stress (psi)	Outer Bending Stress (psi)	Total Inner Stress (psi)	Total Outer Stress (psi)
0	119.6	308.1	0.0	-0.074	0.00E+00	280.7	7.7	4009.8	0.1823	0.0757	1593	1483	5602	5493
10	117.2	301.5	29.6	-0.054	5.92E-02	274.6	7.3	3923.3	0.1783	0.0741	1516	1412	5440	5335
20	110.3	282.5	55.6	0.005	1.11E-01	257.2	6.3	3674.5	0.1670	0.0694	1297	1208	4972	4882
30	99.7	253.4	75.0	0.095	1.50E-01	230.5	4.6	3293.2	0.1497	0.0622	961	895	4254	4188
40	86.8	217.7	85.2	0.205	1.70E-01	197.8	2.7	2825.5	0.1284	0.0533	549	511	3375	3337
50	73.0	179.7	85.2	0.322	1.70E-01	162.9	0.5	2327.8	0.1058	0.0440	110	103	2438	2431
60	60.0	144.0	75.0	0.433	1.50E-01	130.2	-1.5	1860.1	0.0846	0.0351	-302	-281	1558	1579
70	49.5	114.9	55.6	0.522	1.11E-01	103.5	-3.1	1478.9	0.0672	0.0279	-638	-594	841	885
80	42.6	95.9	29.6	0.581	5.92E-02	86.1	-4.1	1230.0	0.0559	0.0232	-857	-798	373	432
90	40.2	89.3	0.0	0.602	2.12E-17	80.1	-4.5	1143.6	0.0520	0.0216	-933	-869	210	275

Vertical Deflection (%):	12.58		149.93
Horizontal Deflection (%):	-3.11		258.17
Radial Soil Pressure at Crown (psi):	40.2	5788	
Circumferential Shortening (in):	1.95		
Arc length of each sector (in) =	0.42		

Max. Compressive Stress (psi): 5602
Max. Tensile Stress (psi): No Tensile Stress

FULL SLIPPAGE

Angle	Soil Stresses (psi)			Pipe Displacements (in)		Circumferential Thrust	Moment Thrust	Ring Compression Stress (psi)	Ring Compression Strain (in/in)	Ring Shortening (in)	Inner Bending Stress (psi)	Outer Bending Stress (psi)	Total Inner Stress (psi)	Total Outer Stress (psi)
	Radial	Hoop	Shear	Radial	Hoop									
0	75.9	81.3	0.0	-0.116	0.00E+00	183.4	8.4	2620.0	0.1191	0.0495	1748	1628	4368	4247
10	76.1	88.4	121.8	-0.093	1.31E-01	183.2	8.0	2617.4	0.1190	0.0494	1663	1548	4280	4165
20	76.8	108.8	229.0	-0.027	2.46E-01	182.7	6.8	2609.8	0.1186	0.0493	1416	1319	4026	3928
30	77.9	140.0	308.5	0.074	3.31E-01	181.9	5.0	2598.3	0.1181	0.0491	1039	967	3637	3566
40	79.2	178.3	350.8	0.198	3.77E-01	180.9	2.8	2584.2	0.1175	0.0488	576	536	3160	3121
50	80.6	219.1	350.8	0.330	3.77E-01	179.8	0.4	2569.2	0.1168	0.0485	83	78	2653	2647
60	81.9	257.4	308.5	0.453	3.31E-01	178.9	-1.8	2555.0	0.1161	0.0482	-379	-353	2176	2202
70	83.0	288.6	229.0	0.554	2.46E-01	178.0	-3.7	2543.5	0.1156	0.0480	-757	-705	1787	1839
80	83.7	309.0	121.8	0.620	1.31E-01	177.5	-4.8	2536.0	0.1153	0.0479	-1003	-934	1533	1602
90	83.9	316.1	0.0	0.643	4.69E-17	177.3	-5.3	2533.4	0.1152	0.0478	-1089	-1013	1445	1520

Vertical Deflection (%):	13.46
Horizontal Deflection (%):	-4.87
Radial Soil Pressure at Crown (psi):	83.9
Circumferential Shortening (in):	1.95
Arc length of each sector (in) =	0.42

12084

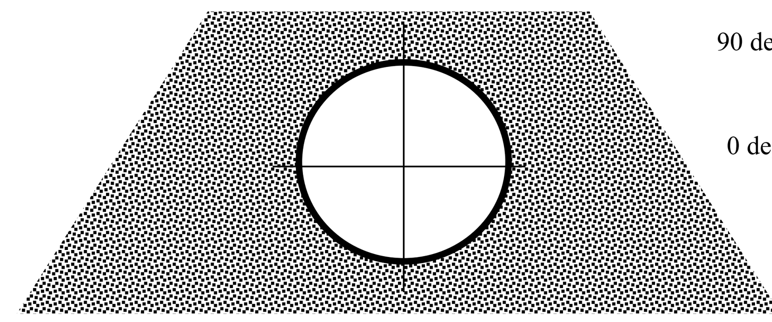
Max. Compressive Stress (psi): 4368
Max. Tensile Stress (psi): No Tensile Stress

Free Field Stress: 200.0 psi
Free Field Stress Times Pipe Radius: 19404 psi

Radius (in)	CROWN				SPRINGLINE			
	Circumferential Thrust (full slip)	Circumferential Thrust (no slip)	Hoop Stress, psi (full slip)	Hoop Stress, psi (no slip)	Circumferential Thrust (full slip)	Circumferential Thrust (no slip)	Hoop Stress, psi (full slip)	Hoop Stress, psi (no slip)
2.38	177.3	80.1	316.1	89.3	183.4	280.7	81.3	308.1
2.88	216.6	97.8	198.1	96.5	224.0	342.9	159.9	261.5
3.38	255.9	115.5	147.9	95.9	264.6	405.1	187.5	239.6
3.88	295.2	133.2	123.0	93.6	305.2	467.2	198.2	227.6
4.38	334.4	150.9	109.2	91.4	345.9	529.4	202.6	220.4
4.88	373.7	168.6	100.9	89.4	386.5	591.6	204.3	215.7
5.38	413.0	186.3	95.5	87.8	427.1	653.8	204.9	212.5
5.88	452.3	204.0	91.8	86.5	467.7	716.0	204.9	210.2
6.38	491.5	221.7	89.3	85.4	508.3	778.2	204.7	208.5
6.88	530.8	239.4	87.4	84.6	548.9	840.3	204.4	207.2
7.38	570.1	257.1	85.9	83.8	589.6	902.5	204.0	206.1
7.88	609.4	274.8	84.8	83.2	630.2	964.7	203.7	205.3
8.38	648.6	292.5	84.0	82.7	670.8	1026.9	203.4	204.7
8.88	687.9	310.2	83.3	82.3	711.4	1089.1	203.1	204.1
9.38	727.2	328.0	82.7	81.9	752.0	1151.3	202.9	203.7
9.88	766.5	345.7	82.2	81.6	792.6	1213.4	202.6	203.3
10.38	805.7	363.4	81.9	81.3	833.3	1275.6	202.4	203.0
10.88	845.0	381.1	81.5	81.1	873.9	1337.8	202.2	202.7
11.38	884.3	398.8	81.2	80.9	914.5	1400.0	202.1	202.4
11.88	923.6	416.5	81.0	80.7	955.1	1462.2	201.9	202.2
12.38	962.8	434.2	80.8	80.5	995.7	1524.4	201.8	202.1
12.88	1002.1	451.9	80.6	80.4	1036.3	1586.5	201.7	201.9
13.38	1041.4	469.6	80.4	80.3	1077.0	1648.7	201.6	201.7
13.88	1080.7	487.3	80.3	80.1	1117.6	1710.9	201.5	201.6
14.38	1119.9	505.0	80.2	80.0	1158.2	1773.1	201.4	201.5
Check Values:	648.6	292.5	155.8	92.0	670.8	1026.9	176.9	240.8
Soil Arching:	Positive Arch	Positive Arch	Negative Arch	Negative Arch	Positive Arch	Positive Arch	Positive Arch	Positive Arch

BURIED PLASTIC PIPE LOADING WORKSHEET V2.0

[With Incremental Stress Analysis (non-linear)]



Model Geometry

Project: Copper Flat
10 IN N-12 PIPE

By: CDJ
Date: 04/23/2013
Note: Compression is positive, tension is negative

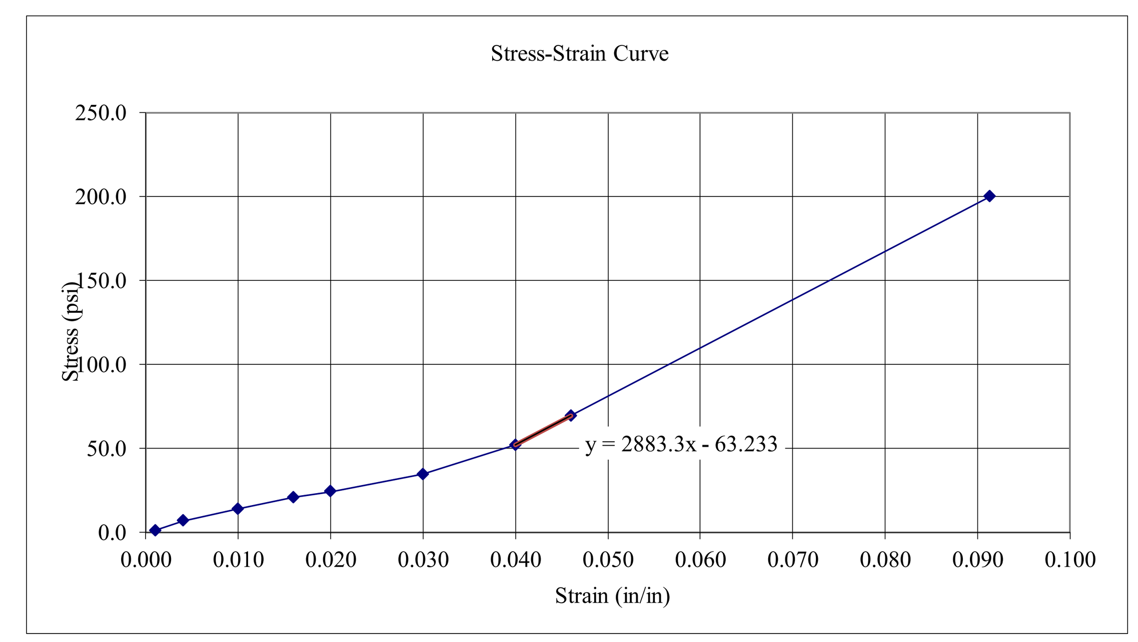
SOIL and PIPE Input Data

Lateral Pressure Parameters

Material	Cohesion	Friction Angle	Contrained Modulus (psi)	Lateral Stress Ratio	B	C
Pipe	n/a	n/a				
Soil	0	39	2191	0.39	0.696	0.30

Pipe Diameter OD (in):	11.36		
Pipe ID (in):	9.90		
Weight of Pipe (lb/ft):	2.26		
Pipe Corrugated (y/n):	y		64.50
Prescribed Constrained Modulus (y/n):	n		0.23
Prescribed Constrained Modulus (psi):	na		
Pipe Wall Thickness (in):	0.03		
Pipe Area (in^2/in):	0.15		
Flexural Modulus (psi), E_f =	22,000		
Ring Compression Modulus (psi), E_{rc} =	22,000		
C value (in)	0.34		
Moment of Inertia (in^4/in) non-corrugated:	346.0		
Moment of Inertia (in^4/in) corrugated (input from manufacturer data):	0.0110	selected I:	0.0110
Stiffness Coefficients			
Flexural Stiffness	8.0		
Ring Compression Stiffness	562.9	Ring Stiffness Factor:	1.3 — Pipe Stiffness Less Than Soil

Shell-Medium Parameters		
UF	5.42	Extensional Flexibility ratio = Compressibility ratio = relative flexibility of pipe and soil under uniform loading.
VF	166.7	Bending Flexibility ratio = Flexibility ratio = relative flexibility of pipe and soil under varying radial and
		If both UF and VF are zero then a perfectly rigid embedded pipe.



Soil Compression Data		
Applied Vertical Load (psi)	Vertical Strain (in/in)	Constrained Modulus (psi)
1.0	0.001	1000.00
6.9	0.004	1725.00
13.9	0.010	1390.00
20.8	0.016	1300.00
24.3	0.020	1215.00
34.7	0.030	1156.67
52.1	0.040	1302.50
69.4	0.046	1508.70
200.0	0.091	2190.68

Pipe Mean Radius (in):	5.67	
Depth of Burial (ft):	240.0	
Applied Surface Stress (psf):	0.0	
Soil Density (pcf):	120.0	
Total Vertical Stress Component (psf):	28800.0	Free Field Stress Values
Total Vertical Stress Component (psi):	200.0	

Critical Stress For Buckling Failure (psf): 642.5
Ovality: 0.3
Corrected Stress (psf): 192.8

NO INTERFACE SLIPPAGE

Angle	Soil Stresses (psi) Radial	Soil Stresses (psi) Hoop	Soil Stresses (psi) Shear	Pipe Displacements (in) Radial	Pipe Displacements (in) Hoop	Circumferential Thrust	Moment Thrust	Ring Compression Stress (psi)	Ring Compression Strain (in/in)	Ring Shortening (in)	Inner Bending Stress (psi)	Outer Bending Stress (psi)	Total Inner Stress (psi)	Total Outer Stress (psi)
0	118.2	313.4	0.0	-0.172	0.00E+00	652.7	25.6	4501.3	0.2046	0.2024	793	734	5294	5236
10	115.8	306.6	29.3	-0.123	1.41E-01	638.5	24.4	4403.7	0.2002	0.1980	755	699	5159	5103
20	108.7	287.1	55.1	0.019	2.65E-01	597.8	20.9	4122.8	0.1874	0.1854	646	598	4769	4721
30	97.9	257.2	74.2	0.237	3.57E-01	535.4	15.5	3692.3	0.1678	0.1660	479	444	4171	4136
40	84.6	220.6	84.3	0.504	4.06E-01	458.8	8.9	3164.3	0.1438	0.1423	274	254	3439	3418
50	70.4	181.6	84.3	0.788	4.06E-01	377.3	1.8	2602.3	0.1183	0.1170	57	52	2659	2655
60	57.1	144.9	74.2	1.055	3.57E-01	300.8	-4.8	2074.3	0.0943	0.0933	-148	-137	1926	1937
70	46.3	115.1	55.1	1.273	2.65E-01	238.4	-10.2	1643.8	0.0747	0.0739	-315	-292	1329	1352
80	39.2	95.6	29.3	1.415	1.41E-01	197.6	-13.7	1362.9	0.0619	0.0613	-424	-393	939	970
90	36.8	88.8	0.0	1.464	5.05E-17	183.5	-14.9	1265.3	0.0575	0.0569	-462	-428	804	837

Vertical Deflection (%):	12.89		149.93
Horizontal Deflection (%):	-3.03		258.17
Radial Soil Pressure at Crown (psi):	36.8	5295	
Circumferential Shortening (in):	5.19		
Arc length of each sector (in) =	0.99		

Max. Compressive Stress (psi): 5294
Max. Tensile Stress (psi): No Tensile Stress

FULL SLIPPAGE

Angle	Soil Stresses (psi) Radial	Soil Stresses (psi) Hoop	Soil Stresses (psi) Shear	Pipe Displacements (in) Radial	Pipe Displacements (in) Hoop	Circumferential Thrust	Moment Thrust	Ring Compression Stress (psi)	Ring Compression Strain (in/in)	Ring Shortening (in)	Inner Bending Stress (psi)	Outer Bending Stress (psi)	Total Inner Stress (psi)	Total Outer Stress (psi)
0	75.2	82.0	0.0	-0.271	0.00E+00	422.3	28.1	2912.3	0.1324	0.1309	869	805	3781	3717
10	75.3	89.2	123.0	-0.216	3.15E-01	422.0	26.7	2910.6	0.1323	0.1309	826	766	3737	3676
20	75.7	109.9	231.1	-0.057	5.93E-01	421.3	22.8	2905.5	0.1321	0.1306	704	652	3610	3558
30	76.3	141.5	311.4	0.187	7.98E-01	420.2	16.7	2897.8	0.1317	0.1303	517	479	3415	3377
40	77.1	180.4	354.1	0.487	9.08E-01	418.8	9.3	2888.3	0.1313	0.1299	288	266	3176	3155
50	77.9	221.8	354.1	0.805	9.08E-01	417.3	1.4	2878.3	0.1308	0.1294	43	40	2922	2918
60	78.7	260.6	311.4	1.105	7.98E-01	416.0	-6.0	2868.8	0.1304	0.1290	-186	-173	2683	2696
70	79.3	292.3	231.1	1.349	5.93E-01	414.9	-12.1	2861.0	0.1300	0.1286	-373	-346	2488	2515
80	79.7	313.0	123.0	1.508	3.15E-01	414.1	-16.0	2856.0	0.1298	0.1284	-495	-459	2361	2397
90	79.8	320.2	0.0	1.564	1.13E-16	413.9	-17.4	2854.3	0.1297	0.1283	-538	-498	2316	2356

Vertical Deflection (%):	13.76
Horizontal Deflection (%):	-4.79
Radial Soil Pressure at Crown (psi):	79.8
Circumferential Shortening (in):	5.19
Arc length of each sector (in) =	0.99

11497

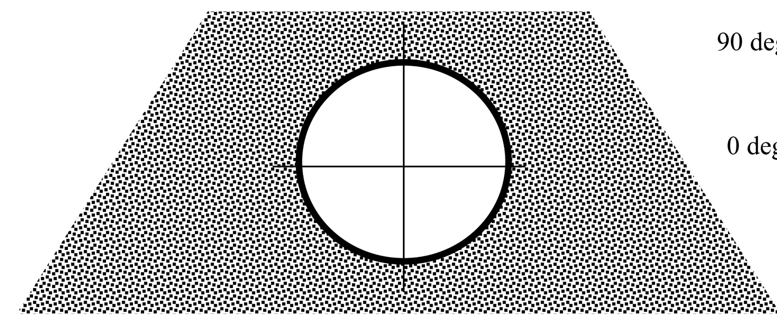
Max. Compressive Stress (psi): 3781
Max. Tensile Stress (psi): No Tensile Stress

Free Field Stress: 200.0 psi
Free Field Stress Times Pipe Radius: 33347 psi

Radius (in)	CROWN Circumferential Thrust (full slip)	CROWN Circumferential Thrust (no slip)	CROWN Hoop Stress, psi (full slip)	CROWN Hoop Stress, psi (no slip)	SPRINGLINE Circumferential Thrust (full slip)	SPRINGLINE Circumferential Thrust (no slip)	SPRINGLINE Hoop Stress, psi (full slip)	SPRINGLINE Hoop Stress, psi (no slip)
5.67	413.9	183.5	320.2	88.8	422.3	652.7	82.0	313.4
6.17	452.2	200.5	256.3	94.2	461.4	713.2	125.7	287.8
6.67	490.6	217.5	213.4	96.5	500.6	773.7	153.0	270.0
7.17	529.0	234.4	183.6	97.1	539.7	834.2	170.5	257.0
7.67	567.3	251.4	162.2	96.9	578.9	894.7	182.0	247.3
8.17	605.7	268.4	146.5	96.2	618.0	955.2	189.7	240.0
8.67	644.0	285.4	134.6	95.3	657.1	1015.8	194.9	234.2
9.17	682.4	302.4	125.5	94.3	696.3	1076.3	198.4	229.6
9.67	720.8	319.4	118.4	93.3	735.4	1136.8	200.8	225.9
10.17	759.1	336.4	112.7	92.4	774.6	1197.3	202.5	222.8
10.67	797.5	353.4	108.2	91.5	813.7	1257.8	203.6	220.3
11.17	835.9	370.4	104.4	90.6	852.9	1318.3	204.3	218.2
11.67	874.2	387.4	101.4	89.8	892.0	1378.8	204.8	216.4
12.17	912.6	404.4	98.8	89.1	931.1	1439.3	205.1	214.8
12.67	950.9	421.4	96.7	88.4	970.3	1499.8	205.2	213.5
13.17	989.3	438.4	94.8	87.8	1009.4	1560.4	205.3	212.3
13.67	1027.7	455.4	93.3	87.2	1048.6	1620.9	205.3	211.3
14.17	1066.0	472.4	91.9	86.7	1087.7	1681.4	205.2	210.4
14.67	1104.4	489.3	90.8	86.2	1126.8	1741.9	205.1	209.6
15.17	1142.7	506.3	89.7	85.8	1166.0	1802.4	205.0	208.9
15.67	1181.1	523.3	88.8	85.4	1205.1	1862.9	204.8	208.3
16.17	1219.5	540.3	88.0	85.0	1244.3	1923.4	204.7	207.8
16.67	1257.8	557.3	87.3	84.6	1283.4	1983.9	204.6	207.3
17.17	1296.2	574.3	86.7	84.3	1322.6	2044.4	204.4	206.8
17.67	1334.6	591.3	86.2	84.0	1361.7	2105.0	204.3	206.4
Check Values:	874.2	387.4	202.4	95.0	892.0	1378.8	156.8	264.2
Soil Arching:	Positive Arch	Positive Arch	Positive Arch	Negative Arch	Positive Arch	Positive Arch	Positive Arch	Positive Arch

BURIED PLASTIC PIPE LOADING WORKSHEET V2.0

[With Incremental Stress Analysis (non-linear)]



Model Geometry

Project: Copper Flat
12 IN N-12 PIPE

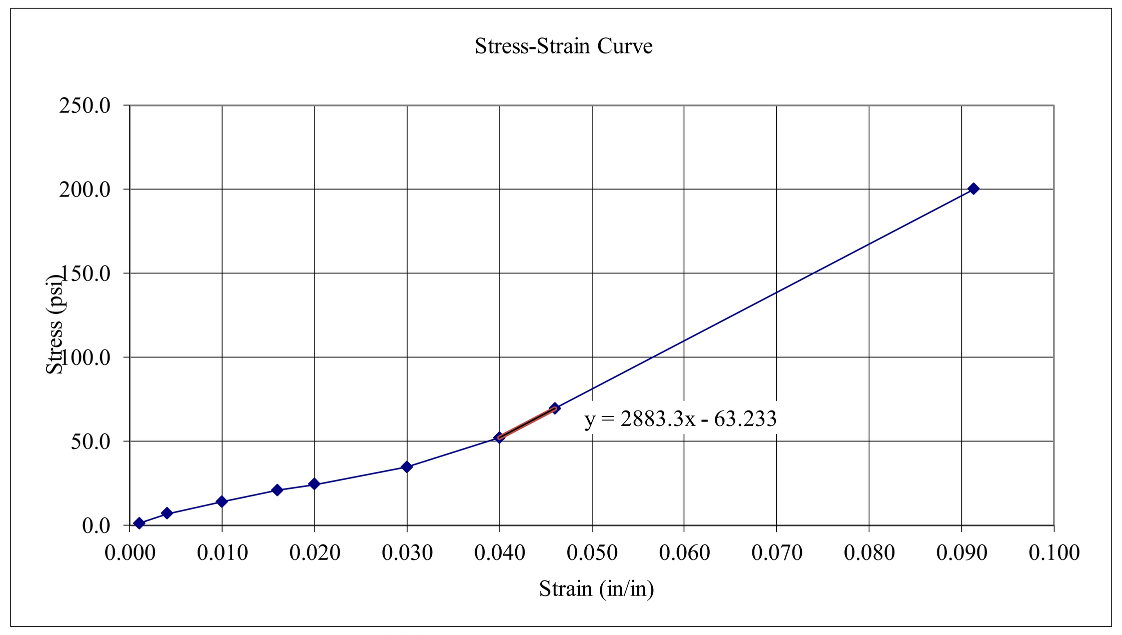
By: CDJ
Date: 04/23/2013
Note: Compression is positive, tension is negative

SOIL and PIPE Input Data

Material	Cohesion	Friction Angle	Contrained Modulus (psi)	Lateral Stress Ratio	B (Lateral Pressure Parameters)	C (Lateral Pressure Parameters)
Pipe	n/a	n/a				
Soil	0	39	2191	0.39	0.696	0.30

Pipe Diameter OD (in):	14.45		
Pipe ID (in):	12.15		
Weight of Pipe (lb/ft):	3.19		
Pipe Corrugated (y/n):	y		64.50
Prescribed Constrained Modulus (y/n):	n		0.23
Prescribed Constrained Modulus (psi):	na		
Pipe Wall Thickness (in):	0.04		
Pipe Area (in^2/in):	0.19		
Flexural Modulus (psi), E_f =	22,000		
Ring Compression Modulus (psi), E_{rc} =	22,000		
C value (in)	0.53		
Moment of Inertia (in^4/in) non-corrugated:	1070.4		
Moment of Inertia (in^4/in) corrugated (input from manufacturer data):	0.0410	selected I:	0.0410
Stiffness Coefficients			
Flexural Stiffness	14.5		
Ring Compression Stiffness	573.8	Ring Stiffness Factor:	2.4 Pipe Stiffness Less Than Soil

Shell-Medium Parameters		
UF	5.32	Extensional Flexibility ratio = Compressibility ratio = relative flexibility of pipe and soil under uniform loading.
VF	92.0	Bending Flexibility ratio = Flexibility ratio = relative flexibility of pipe and soil under varying radial and
		If both UF and VF are zero then a perfectly rigid embedded pipe.



Soil Compression Data		
Applied Vertical Load (psi)	Vertical Strain (in/in)	Constrained Modulus (psi)
1.0	0.001	1000.00
6.9	0.004	1725.00
13.9	0.010	1390.00
20.8	0.016	1300.00
24.3	0.020	1215.00
34.7	0.030	1156.67
52.1	0.040	1302.50
69.4	0.046	1508.70
200.0	0.091	2190.68

Pipe Mean Radius (in):	7.21	
Depth of Burial (ft):	240.0	
Applied Surface Stress (psf):	0.0	
Soil Density (pcf):	120.0	
Total Vertical Stress Component (psf):	28800.0	Free Field Stress Values
Total Vertical Stress Component (psi):	200.0	

Critical Stress For Buckling Failure (psf): 1883.1
Ovality: 0.3
Corrected Stress (psf): 564.9

NO INTERFACE SLIPPAGE

Angle	Soil Stresses (psi) Radial	Soil Stresses (psi) Hoop	Soil Stresses (psi) Shear	Pipe Displacements (in) Radial	Pipe Displacements (in) Hoop	Circumferential Thrust	Moment Thrust	Ring Compression Stress (psi)	Ring Compression Strain (in/in)	Ring Shortening (in)	Inner Bending Stress (psi)	Outer Bending Stress (psi)	Total Inner Stress (psi)	Total Outer Stress (psi)
0	97.9	343.0	0.0	-0.122	0.00E+00	693.6	63.5	3689.5	0.1677	0.2110	820	766	4510	4456
10	95.8	335.2	25.4	-0.071	1.40E-01	678.0	60.5	3606.5	0.1639	0.2062	782	730	4389	4337
20	90.0	312.9	47.7	0.075	2.64E-01	633.1	51.9	3367.6	0.1531	0.1926	671	627	4039	3994
30	80.9	278.8	64.2	0.301	3.56E-01	564.3	38.8	3001.4	0.1364	0.1716	502	468	3503	3470
40	69.9	236.9	73.0	0.577	4.04E-01	479.8	22.7	2552.3	0.1160	0.1459	293	274	2846	2826
50	58.1	192.3	73.0	0.871	4.04E-01	390.0	5.6	2074.3	0.0943	0.1186	72	67	2146	2141
60	47.1	150.4	64.2	1.147	3.56E-01	305.5	-10.5	1625.2	0.0739	0.0929	-136	-127	1489	1498
70	38.1	116.2	47.7	1.372	2.64E-01	236.7	-23.7	1259.0	0.0572	0.0720	-306	-286	953	973
80	32.2	93.9	25.4	1.519	1.40E-01	191.8	-32.2	1020.1	0.0464	0.0583	-417	-389	603	631
90	30.1	86.2	0.0	1.570	5.03E-17	176.2	-35.2	937.1	0.0426	0.0536	-455	-425	482	512

Vertical Deflection (%):	10.86		149.93
Horizontal Deflection (%):	-1.70		258.17
Radial Soil Pressure at Crown (psi):	30.1	4340	
Circumferential Shortening (in):	5.29		
Arc length of each sector (in) =	1.26		

Max. Compressive Stress (psi): 4510
Max. Tensile Stress (psi): No Tensile Stress

FULL SLIPPAGE

	Soil Stresses (psi)			Pipe Displacements (in)										
Angle	Radial	Hoop	Shear	Radial	Hoop	Circumferential Thrust	Moment Thrust	Ring Compression Stress (psi)	Ring Compression Strain (in/in)	Ring Shortening (in)	Inner Bending Stress (psi)	Outer Bending Stress (psi)	Total Inner Stress (psi)	Total Outer Stress (psi)
0	60.5	96.7	0.0	-0.214	0.00E+00	442.9	68.7	2356.0	0.1071	0.1347	889	830	3245	3186
10	60.7	103.8	122.2	-0.157	3.23E-01	442.4	65.4	2353.4	0.1070	0.1346	846	790	3199	3144
20	61.3	124.3	229.6	0.006	6.07E-01	441.1	56.0	2346.0	0.1066	0.1341	723	676	3069	3022
30	62.2	155.6	309.3	0.255	8.18E-01	438.9	41.4	2334.7	0.1061	0.1335	536	500	2870	2835
40	63.4	194.1	351.7	0.561	9.30E-01	436.3	23.6	2320.7	0.1055	0.1327	305	285	2626	2606
50	64.6	235.0	351.7	0.887	9.30E-01	433.5	4.6	2305.9	0.1048	0.1318	60	56	2366	2362
60	65.8	273.5	309.3	1.192	8.18E-01	430.9	-13.2	2291.9	0.1042	0.1311	-170	-159	2122	2133
70	66.7	304.9	229.6	1.442	6.07E-01	428.8	-27.7	2280.6	0.1037	0.1304	-358	-335	1922	1946
80	67.3	325.3	122.2	1.605	3.23E-01	427.4	-37.2	2273.2	0.1033	0.1300	-481	-449	1792	1824
90	67.6	332.4	0.0	1.661	1.16E-16	426.9	-40.5	2270.6	0.1032	0.1298	-523	-489	1747	1782

Vertical Deflection (%):	11.50
Horizontal Deflection (%):	-2.96
Radial Soil Pressure at Crown (psi):	67.6
Circumferential Shortening (in):	5.29
Arc length of each sector (in) =	1.26

9728

Max. Compressive Stress (psi): 3245
Max. Tensile Stress (psi): No Tensile Stress

Free Field Stress: 200.0 psi
Free Field Stress Times Pipe Radius: 18401 psi

	CROWN				SPRINGLINE			
Radius (in)	Circumferential Thrust (full slip)	Circumferential Thrust (no slip)	Hoop Stress, psi (full slip)	Hoop Stress, psi (no slip)	Circumferential Thrust (full slip)	Circumferential Thrust (no slip)	Hoop Stress, psi (full slip)	Hoop Stress, psi (no slip)
7.21	426.9	176.2	332.4	86.2	442.9	693.6	96.7	343.0
7.71	458.3	189.1	278.0	93.0	475.5	744.7	131.0	316.0
8.21	489.7	202.0	238.5	96.8	508.1	795.8	154.3	295.9
8.71	521.1	215.0	209.0	98.7	540.7	846.9	170.3	280.6
9.21	552.5	227.9	186.6	99.4	573.3	897.9	181.4	268.6
9.71	583.9	240.8	169.3	99.5	605.9	949.0	189.3	259.1
10.21	615.3	253.8	155.7	99.1	638.5	1000.1	194.9	251.5
10.71	646.8	266.7	144.8	98.5	671.1	1051.2	198.9	245.2
11.21	678.2	279.6	136.0	97.7	703.7	1102.2	201.8	240.1
11.71	709.6	292.6	128.8	96.9	736.3	1153.3	203.8	235.8
12.21	741.0	305.5	122.9	96.0	768.9	1204.4	205.3	232.1
12.71	772.4	318.4	117.9	95.2	801.5	1255.5	206.3	229.0
13.21	803.8	331.4	113.7	94.3	834.1	1306.5	207.0	226.3
13.71	835.2	344.3	110.1	93.5	866.7	1357.6	207.4	224.0
14.21	866.6	357.2	107.1	92.8	899.3	1408.7	207.7	222.0
14.71	898.1	370.2	104.5	92.0	931.9	1459.7	207.8	220.2
15.21	929.5	383.1	102.2	91.4	964.4	1510.8	207.9	218.7
15.71	960.9	396.0	100.2	90.7	997.0	1561.9	207.8	217.3
16.21	992.3	409.0	98.4	90.1	1029.6	1613.0	207.7	216.1
16.71	1023.7	421.9	96.9	89.5	1062.2	1664.0	207.6	215.0
17.21	1055.1	434.8	95.5	89.0	1094.8	1715.1	207.5	214.0
17.71	1086.5	447.8	94.3	88.5	1127.4	1766.2	207.3	213.1
18.21	1118.0	460.7	93.2	88.0	1160.0	1817.3	207.1	212.3
18.71	1149.4	473.6	92.2	87.6	1192.6	1868.3	206.9	211.5
19.21	1180.8	486.6	91.3	87.2	1225.2	1919.4	206.7	210.9
Check Values:	803.8	331.4	224.2	96.1	834.1	1306.5	159.7	287.8
Soil Arching:	Positive Arch	Positive Arch	Positive Arch	Negative Arch	Positive Arch	Positive Arch	Positive Arch	Positive Arch

APPENDIX E
TSF UNDERDRAIN COLLECTION POND
INFLOW ESTIMATION

Golder Associates	Tailings Storage Facility - Underdrain Collection Pond Inflow Estimate				
Client	**New Mexico Copper Corp**	**By**	**GM/DW**	**Date**	**19-Apr-13**
		Checked	**GM**	**Date**	**15-Jul-13**
Project No.	**103-92557 Phase 011**	**Reviewed**	**MJG**	**Date**	

	Requirements	Criteria		
1	Collect downstream embankment face and toe area runoff	100-yr 24 hour storm	3.73	inches
2	Collect Underflow drainage	Upset period	24	hours
3	Collect impoundment seepage	Upset period	24	hours
4	Provide for contact of free water pond with exposed underdrain	Upset period	24	hours

Hydraulic Conductivity-fully consolidated (from slurry consol tests)

Product	k (cm/sec)	K (ft/sec)
Cyclone overflow beach (cob)	5.00E-07	1.64E-08
Cyclone overflow slimes (cos)	5.00E-08	1.64E-09

The above assume fully consolidated material against drain

1) Downstream Dam Face Runoff

Worst case prior to Final Build-out	Runoff Volume	12.1	acre-feet
	See HEC model Output	3,942,528	Gallons

2) Underflow Drainage

Mining Rate		30000	tpd
Underflow percentage	(Cyclone Simulation)	45.5	percent
Underflow solids content	(Cyclone Simulation)	70	percent by weight
Slurry Volume	(Cyclone Simulation)	568	tons per hour max
Water volume	(Cyclone Simulation)	260	tons per hour max
Delivered water (wt water/wt solids)		1042	gpm
Available for Drainage and Evaporation		58.00%	estimate
Entrainment		42.00%	estimate
Evaporative loss		15.00%	estimate
Draindown		43.00%	
Draindown (gpm)		448	gpm

3) Impoundment Interior Seepage

Assume Areal Split — Beach 60% — Slimes 40%

	Total Area (ft3)	Beach Area	Slimes Area
Final Build-out	14,012,401	8,407,441	5,604,960

Assume unit hydraulic gradient — Hydraulic conductivity based on results of slurry consolidation testing

Beach Seepage	K floor (COB) 1.64E-08 ft/sec		Slimes Seepage	K Floor (COS) 1.64E-09 ft/sec	
ft^3/sec	gpm	Upset (gal)	ft^3/sec	gpm	upset (gal)
0.1379	62	89,132	0.0092	4.13	5,942

4) Seepage Through Exposed Drain

Area exposed	20	Acre	871,200	ft^3	Assumption/estimate
K drain surface layer	3.8000E-05	cm/sec	1.2467E-06	ft/sec	K drain based on permeability test result
Assume max depth 5 feet, average depth 2.5 feet		i=	2.5		

	cfs	gpm	Upset (gal)
Q	2.7154	1,219	1,754,857

Summary Pond Capacity Requirements	Duration	Storage (gallons)	
Dam exterior Runoff	Event	3,942,528	(HEC runoff estimate)
Beach Seepage	Upset	89,132	
Slimes Seepage	Upset	5,942	
Exposed impoundment Underdrain Seepage	Upset	1,754,857	Can be controlled
Dam underdrainage	Upset	645,206	
Total		6,437,666	
		gpm	
Normal flows	Dam drain	448	gpm
	Beach/slimes	66	gpm
	Free Water Pond seepage	1,219	gpm
	Total	**1,733**	**gpm**

APPENDIX F
HYDROLOGIC CALCULATIONS

APPENDIX F.1
IMPOUNDMENT DIVERSION DITCH CALCULATIONS

Copper Flat Diversions, Copper Flat New Mexico
Hydrologic and Hydraulic Calculations / Calculation of Time Concentration (t_c)
AMC II Moisture Conditions

Sub-Basin ID	Undisturbed Area (ac)	CN	Compacted Cover Area (ac)	CN	Stockpile Area (ac)	CN	Wt. CN	S	L (ft)	H1 (ft)	H2 (ft)	Y (%)	Lag (hr)	t_c (hr)	t_c (min)	Lag (min)	Area (mi²)
Northeast- PH1	66.41	85	0.00	92	0.00	50	85.0	1.76	5,318	5,537	5,317	4.13	0.50	0.84	50.5	30	0.10376
Southwest- PH1	47.92	85	0.00	92	0.00	50	85.0	1.76	5,835	5,452	5,307	2.48	0.70	1.17	70.2	42	0.07488
SW-Periphery- PH3	26.09	85	0.00	92	0.00	50	85.0	1.76	4,052	5,452	5,346	2.60	0.51	0.85	51.1	31	0.04076

Curve Number Estimation:

Undisturbed Native Ground
Arid and semiarid rangelands
Cover type = Desert Shrub / Pinyon-Junip
Antecedent condition = II
Hydrologic condition = Poor
Hydrologic soil group = C
Curve number = **85**

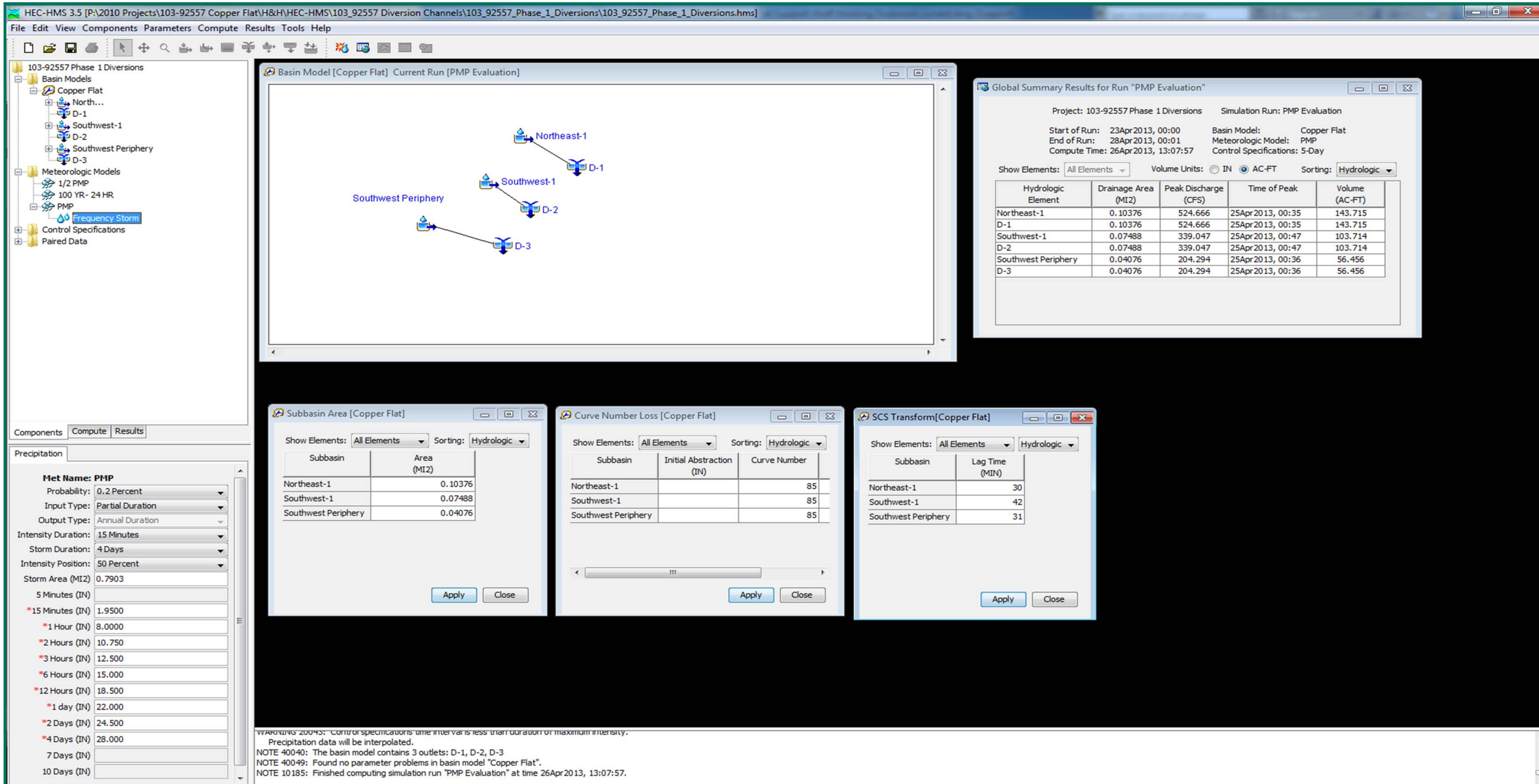
Compacted Cover
Arid and semiarid rangelands
Cover type = Fill
Antecedent condition = II
Hydrologic condition = Poor
Hydrologic soil group = D
Curve number = **92**

TSF
OutSlope
Cover type = Sand
Antecedent condition = II
Hydrologic condition = Poor
Hydrologic soil group = A
Curve number = **50**

Notes:
ac = acres
CN = curve number
Wt. CN = weighted curve number
S = soil and cover parameter
L = length of longest flow path (feet)
H1 = elevation at top of longest flow path (feet)
H2 = elevation at bottom of longest flow path (feet)
Y = H1-H2/L x 100 = slope (%)
Lag = Lag time (hours)
t_c = time of concentraton (hr or min)

Hydrologic Condition:
Poor: <30% ground cover
Fair: 30 to 70% ground cover
Good: >70% ground cover

Copper Flat Diversions - Hydrologic and Hydraulic Results - PMP Storm Evaluation



Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
Northeast-1	0.10376	524.666	25Apr2013, 00:35	143.715
D-1	0.10376	524.666	25Apr2013, 00:35	143.715
Southwest-1	0.07488	339.047	25Apr2013, 00:47	103.714
D-2	0.07488	339.047	25Apr2013, 00:47	103.714
Southwest Periphery	0.04076	204.294	25Apr2013, 00:36	56.456
D-3	0.04076	204.294	25Apr2013, 00:36	56.456

Subbasin	Area (MI2)
Northeast-1	0.10376
Southwest-1	0.07488
Southwest Periphery	0.04076

Subbasin	Initial Abstraction (IN)	Curve Number
Northeast-1		85
Southwest-1		85
Southwest Periphery		85

Subbasin	Lag Time (MIN)
Northeast-1	30
Southwest-1	42
Southwest Periphery	31

103-92557 Copper Flat Stormwater Diversions (PMP) Report

Label	Solve For	Friction Method	Roughness Coefficient	Channel Slope (ft/ft)
D-1 North PMP	Normal Depth	Manning Formula	0.040	0.00500
D-2 West PMP	Normal Depth	Manning Formula	0.045	0.00500
D-3 SW Periphery PMP	Normal Depth	Manning Formula	0.045	0.00500

Normal Depth (ft)	Left Side Slope (ft/ft (H:V))	Right Side Slope (ft/ft (H:V))	Bottom Width (ft)	Discharge (ft^3/s)
4.52	3.50	2.00	10.00	525.00
4.15	2.00	2.00	10.00	340.00
3.20	2.00	2.00	10.00	205.00

Flow Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Top Width (ft)	Critical Depth (ft)
101.29	36.54	2.77	34.85	3.27
75.89	28.55	2.66	26.59	2.73
52.54	24.32	2.16	22.81	2.04

Critical Slope (ft/ft)	Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number
0.01893	5.18	0.42	4.93	0.54
0.02529	4.48	0.31	4.46	0.47
0.02713	3.90	0.24	3.44	0.45

Flow Type	Notes	Messages
Subcritical		
Subcritical		
Subcritical		

APPENDIX F.2
DAM AND TSF UNDERDRAIN COLLECTION POND AREA HYDROLOGIC CALCULATIONS

Copper Flat Dam, Copper Flat, New Mexico
Seepage and Runoff / Calculation of Time Runoff (t_c)
Hydrologic and Hydraulic Calculations
AMC II Moisture Conditions

	Undisturbed		Compacted Cover		Stockpile													Rational method Inputs			
Sub-Basin ID	Area (ac)	CN	Area (ac)	CN	Area (ac)	CN	Wt. CN	S	L (ft)	H1 (ft)	H2 (ft)	Y (%)	Lag (hr)	t_c (hr)	t_c (min)	Lag (min)	Area (mi^2)	Area (acre)	C	Intensity (in/hr)	Q (cfs)
Phase 4	71.09	85	0.00	92	91.82	50	65.3	5.32	8,640	5,385	5,170	2.49	1.71	2.85	171.0	103	0.25454	162.91	0.38	0.907	71.1

Curve Number Estimation:

Undisturbed Native Ground		*Compacted Cover*		*TSF*	
Arid and semiarid rangelands		Arid and semiarid rangelands		OutSlope	
Cover type =	Desert Shrub / Pinyon-Juniper	Cover type =	Fill	Cover type =	Sand
Antecedent condition =	II	Antecedent condition =	II	Antecedent condition =	II
Hydrologic condition =	Poor	Hydrologic condition =	Poor	Hydrologic condition =	Poor
Hydrologic soil group =	C	Hydrologic soil group =	D	Hydrologic soil group =	A
Curve number =	**85**	Curve number =	**92**	Curve number =	**50**
C=	**0.43**	C=	**0.46**	C=	**0.35**

Notes:

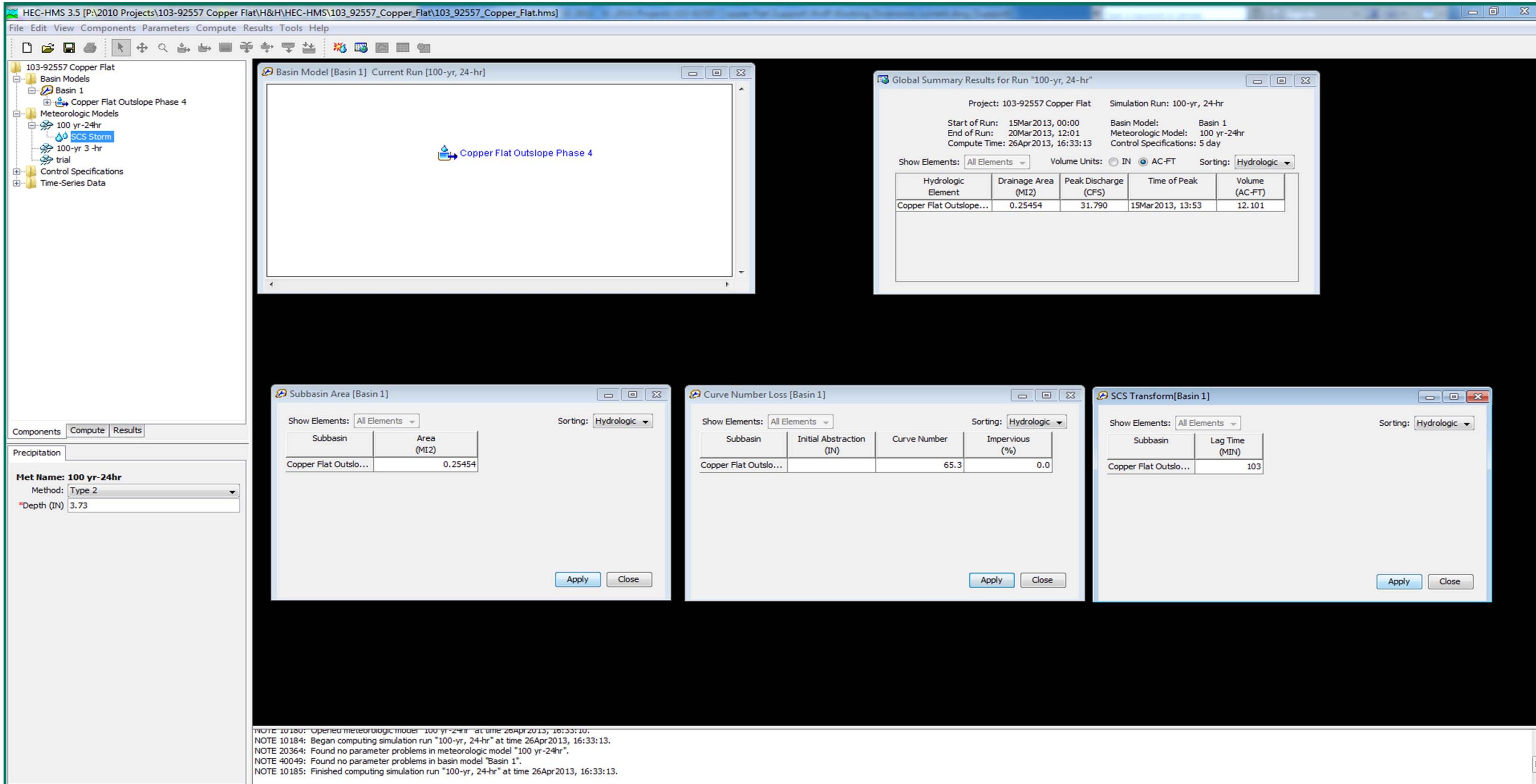
ac = acres
CN = curve number
Wt. CN = weighted curve number
S = soil and cover parameter
L = length of longest flow path (feet)
H1 = elevation at top of longest flow path (feet)
H2 = elevation at bottom of longest flow path (feet)
Y = H1-H2/L x 100 = slope (%)
Lag = Lag time (hours)
t_c = time of concentation (hr or min)
C = Rational Method Coefficient
C_f = Correction factor for 100-year storm event (1.25)
I = rainfall intensity (inches/hour)
A = Area (acres)

Hydrologic Condition:
Poor: <30% ground cover
Fair: 30 to 70% ground cover
Good: >70% ground cover

Rational Method

Q=CiA
$Q=C_fCiA$ Includes correction factor for 100-yr storm duration.
i= 0.907 100-year, 3 hour storm intensity

Copper Flat Dam Toe / Seepage and Runoff
Hydrologic and Hydraulic Results / 100-yr, 24-h Storm Volume



Worksheet for Dam Toe Seepage & Runoff Collection Trench

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.02500	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	71.10	ft³/s

Results

Normal Depth	0.54	ft
Flow Area	5.94	ft²
Wetted Perimeter	12.40	ft
Hydraulic Radius	0.48	ft
Top Width	12.14	ft
Critical Depth	1.08	ft
Critical Slope	0.00226	ft/ft
Velocity	11.98	ft/s
Velocity Head	2.23	ft
Specific Energy	2.77	ft
Froude Number	3.02	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

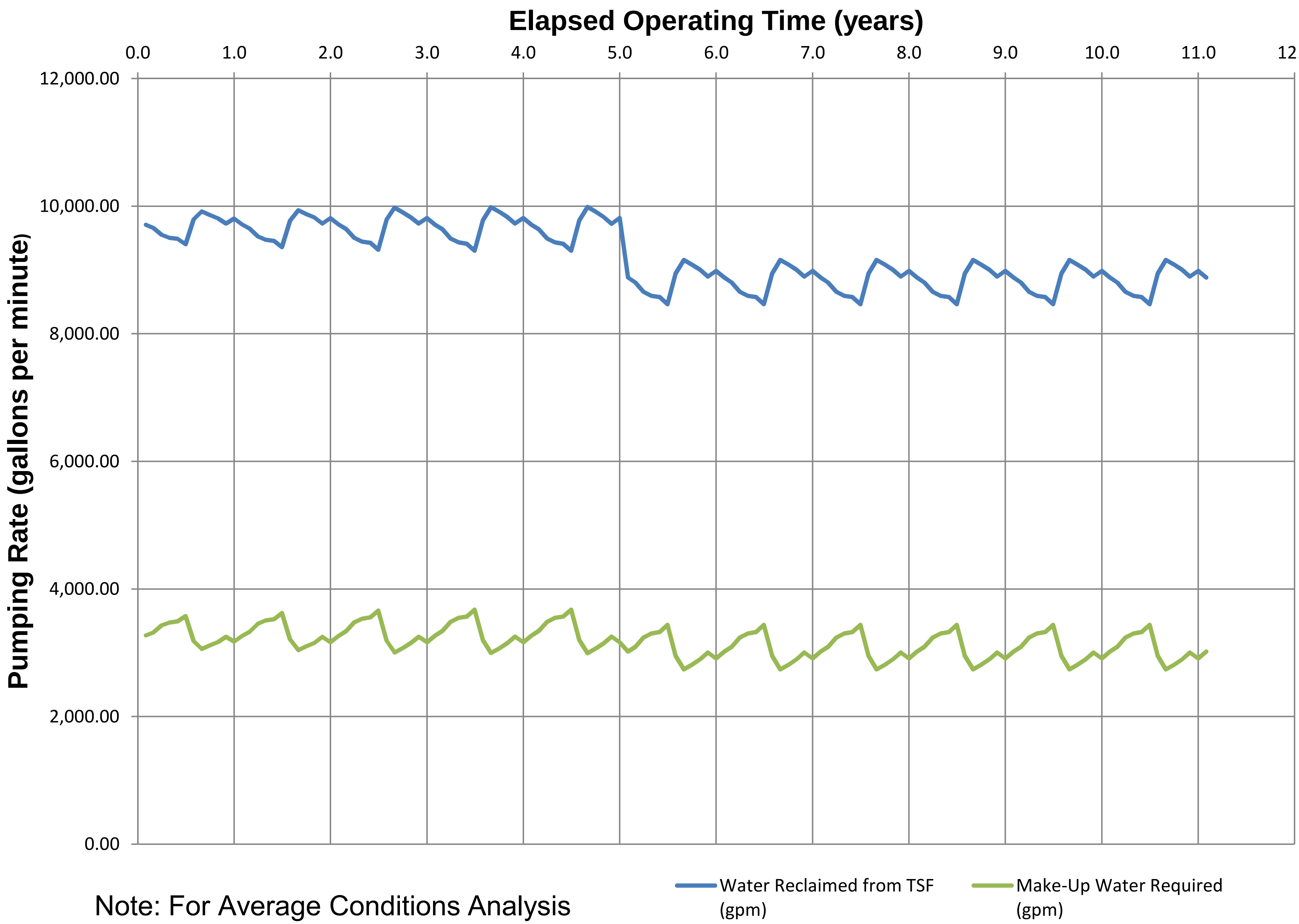
Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.54	ft
Critical Depth	1.08	ft
Channel Slope	0.02500	ft/ft

Worksheet for Dam Toe Seepage & Runoff Collection Trench

GVF Output Data

Critical Slope	0.00226	ft/ft

APPENDIX G
WATER BALANCE CALCULATIONS



Note: For Average Conditions Analysis

Table 1: Water Balance Calculations

Date:	12/16/2013	**Made by:**	4/29/2013 RL/GM
Project No.:	103-92557	**Checked by:**	7/15/2013 GM
Subject:	Copper Flat Climate Summary	**Reviewed**	7/15/2013 MG
Project Short Title:	**Copper Flat Feasibility Study, New Mexico**	**Page:**	1 of 3

Elevation at the site is approximately 5180-5270 feet.

Average Precipitation (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Altitude (ft)	Approx Distance to Site (mi)
Hillsboro (1893 - 2010)	0.58	0.56	0.38	0.33	0.53	0.72	2.33	2.46	2.11	1.18	0.55	0.81	12.54	5,270.00	4.00
Caballo Dam (1936-2010)	0.42	0.38	0.27	0.24	0.37	0.70	1.80	2.03	1.55	0.89	0.44	0.56	9.65	4,190.00	12.30
Copper Flat Site Estimate	0.58	0.56	0.38	0.33	0.53	0.72	2.33	2.46	2.11	1.18	0.55	0.81	12.54	5,200.00	

Average Days with Rain

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Altitude (ft)	Approx Distance to Site (mi)
Hillsboro (1893 - 2010)	3	3	2	2	3	3	9	9	6	4	2	3	49	5,270.00	4.00
Caballo Dam (1936-2010)	3	2	2	1	2	3	8	9	6	4	2	3	45	4,190.00	12.30
Copper Flat Site Estimate	3	3	2	2	3	3	9	9	6	4	2	3	49	5,200.00	

Local Normal Evaporation (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Altitude (ft)	Approx Distance to Site (mi)
														4,190.00	
Copper Flat Site Estimate	4.22	5.57	8.55	9.52	11.15	14.25	10.34	5.94	6.18	3.96	3.68	2.74	86.10	5,385.00	

Table 2: Water Balance Calculations Year 1-5 30,000 tpd mine plan

Date:	12/16/2013	**Made by:**	4/29/2013 RL
Project No.:	103-92557	**Checked by:**	11/15/2013 GM
Subject:	Tailings Properties and Flow rates	**Reviewed**	11/15/2013 BNS
Project Short Title:	**Copper Flat Feasibility Study, New Mexico**	**Page:**	2 of 3

Year 1-5

			Design Disacharge Rate	1,333	tph			
			Cyclone Recovery	608.47	tph	Krebs		
Tailings Discharge			Overflow	725	tph			
			Total	1333	tph	Net (post concentrate recovery)	1316.0	tph
						Factor for average TSF inputs	99%	
Cyclone feed solids	29.10%							

			Cyclone Discharge				
			UF Fraction (wt%)	45.60%	Krebs		=input values
Year 1-5 delivery	31,992 tpd	1,333.0 tph	UF Solids content (wt%)	70.00%	Krebs		
SG	2.64		COF Solids content (wt%)	19.52%	(Krebs)		
			Beach to Slimes Split	60%	Estimate as beach		

Result (entrainment only)		
Average Reclaim	9,749	gpm
Average Make-up	3,229	gpm

Cyclone Feed					**Underflow Tailings**					**Cyclone Overflow (Slimes)**					**Cyclone Overflow (Beach)**				
Total (wt)	109,938	tpd	14,996	gpm	Total (wt)	20,862	tpd	1,963	gpm	Total (wt)	35,633	tpd	5,213	gpm	Total (wt)	53,449	tpd	7,601	gpm
Water (wt)	77,946	tpd	12,978	gpm	Water (wt)	6,258.55	tpd	1,042	gpm	Water (wt)	28,677	tpd	4,775	gpm	Water (wt)	43,016	tpd	7,162	gpm
Solids (wt)	31,992	tpd	2,018	gpm	Solids (wt)	14,603	tpd	921	gpm	Solids (wt)	6,955	tpd	439	gpm	Solids (wt)	10,433	tpd	439	gpm

Post Deposition						**Post Deposition**						**Post Deposition**					
Dry Unit Weight	95.00	pcf				Dry Unit Weight	31.70	pcf	(FSCONSOL)			Dry Unit Weight	74.60	pcf	(FSCONSOL)		
Vsolids	0.58	ft^3	Per unit ft^3														
Vvoids	0.42	ft^3	Per unit ft^3			Vsolids	0.19	ft^3	Per unit ft^3			Vsolids	0.45	ft^3	Per unit ft^3		
Void ratio	0.73					Vvoids	0.81	ft^3	Per unit ft^3			Vvoids	0.55	ft^3	Per unit ft^3		
Saturated Moisture (wt%)	28%					Void ratio	4.20					Void ratio	1.21				
Assumed Moisture (wt%)	18%					Saturated Moisture (wt%)	159%					Saturated Moisture (wt%)	46%				
Vwater	0.27	ft^3	Per unit ft^3			Assumed Moisture (wt%)	159%					Assumed Moisture (wt%)	46%				
Total weight	112.10	lbs	Per unit ft^3			Vwater	0.81	ft^3	Per unit ft^3			Vwater	0.55	ft^3	Per unit ft^3		
Entrained Water	84,250	ft^3/day		437.63	gpm	Total weight	82.09	lbs	Per unit ft^3			Total weight	108.74	lbs	Per unit ft^3		
Drainage and Evaporation				604.42	gpm	Entrained Water	354,388	ft^3/day		1,841	gpm	Entrained Water	153,045	ft^3/day		795	gpm
Evaporation	15.00%			156.31	gpm												
Drainage				448.11	gpm	Free Water				2,934	gpm	Free Water				6,367	gpm

			Design Discharge Rate	1,222	tph			
			Cyclone Recovery	552.15	tph	Krebs		
Tailings Discharge			Overflow	670	tph			
			Total	1222	tph	Net (post concentrate recovery)	1206.0	tph
						Factor for average TSF inputs	99%	
Cyclone feed solids	29.10%							

			Cyclone Discharge				
			UF Fraction (wt%)	45.20%	Krebs		=input values
Year 6-11 delivery	29,328 tpd	1,222.0 tph	UF Solids content (wt%)	70.00%	Krebs		
SG	2.64		COF Solids content (wt%)	19.64%	(Krebs)		
			Beach to Slimes Split	60%	Estimate as beach		

Result (entrainment only)		
Average Reclaim	8,922	gpm
Average Make-up	2,975	gpm

Cyclone Feed					**Underflow Tailings**					**Cyclone Overflow (Slimes)**					**Cyclone Overflow (Beach)**				
Total (wt)	100,784	tpd	13,747	gpm	Total (wt)	18,931	tpd	1,781	gpm	Total (wt)	32,742	tpd	4,786	gpm	Total (wt)	49,113	tpd	6,977	gpm
Water (wt)	71,456	tpd	11,897	gpm	Water (wt)	5,679.26	tpd	946	gpm	Water (wt)	26,312	tpd	4,381	gpm	Water (wt)	39,467	tpd	6,571	gpm
Solids (wt)	29,328	tpd	1,850	gpm	Solids (wt)	13,252	tpd	836	gpm	Solids (wt)	6,431	tpd	406	gpm	Solids (wt)	9,646	tpd	406	gpm
					Water in	182,027	ft^3/day			Water in	843,320	ft^3/day			Water in	1,264,981	ft^3/day		

Post Deposition						**Post Deposition**						**Post Deposition**					
Dry Unit Weight	95.00	pcf				Dry Unit Weight	31.70	pcf	(FSCONSOL)			Dry Unit Weight	74.60	pcf	(FSCONSOL)		
Vsolids	0.58	ft^3	Per unit ft^3														
Vvoids	0.42	ft^3	Per unit ft^3			Vsolids	0.19	ft^3	Per unit ft^3			Vsolids	0.45	ft^3	Per unit ft^3		
Void ratio	0.73					Vvoids	0.81	ft^3	Per unit ft^3			Vvoids	0.55	ft^3	Per unit ft^3		
Saturated Moisture (wt%)	28%					Void ratio	4.20					Void ratio	1.21				
Assumed Moisture (wt%)	18%					Saturated Moisture (wt%)	159%					Saturated Moisture (wt%)	46%				
Vwater	0.27	ft^3	Per unit ft^3			Assumed Moisture (wt%)	159%					Assumed Moisture (wt%)	46%				
Total weight	112.10	lbs	Per unit ft^3			Vwater	0.81	ft^3	Per unit ft^3			Vwater	0.55	ft^3	Per unit ft^3		
Entrained Water	76,452	ft^3/day		397	gpm	Total weight	82.09	lbs	Per unit ft^3			Total weight	108.74	lbs	Per unit ft^3		
Drainage and Evaporation				548	gpm	Entrained Water	327,642	ft^3/day		1,702	gpm	Entrained Water	141,495	ft^3/day		735	gpm
Evaporation	15.00%			142	gpm						gpm						
Drainage				406.63	gpm	Free Water				2,679	gpm	Free Water				5,836	gpm

Table 3: Water Balance Calculations Rev 1.

Date:	12/16/2013	**Made by:**	4/29/2013 RL
Project No.:	103-92557	**Checked:**	11/15/2013 GM
Subject:	Average Year Rainfall Conditions	**Reviewed**	11/15/2013 BNS
Project Short Title:	**Copper Flat Feasibility Study, New Mexico**	**Page:**	3 of 3

Precipitation and Evaporation Data

2	3	4	5	6	7	8	9	10
Month	**Days**	**Precip. (in)**	**Pan evap. (in)**	**Storms/Month**	**Precip/Storm**	**S**	**Runoff/ storm (in)**	**Monthly runoff (in)**
January	31	0.58	4.22	1	0.58	0.87	0.13	0.13
February	28	0.56	5.57	1	0.56	0.87	0.12	0.12
March	31	0.38	8.55	1	0.38	0.87	0.04	0.04
April	30	0.33	9.52	1	0.33	0.87	0.02	0.02
May	31	0.53	11.15	1	0.53	0.87	0.10	0.10
June	30	0.72	14.25	1	0.72	0.87	0.21	0.21
July	31	2.33	10.34	1	2.33	0.87	1.54	1.54
August	31	2.46	5.94	3	0.82	0.87	0.28	0.83
September	30	2.11	6.18	3	0.70	0.87	0.20	0.60
October	31	1.18	3.96	3	0.39	0.87	0.04	0.13
November	30	0.55	3.68	1	0.55	0.87	0.11	0.11
December	31	0.81	2.74	1	0.81	0.87	0.27	0.27

Variables used in Water Balance

Water in Delivered Tailings Year 1-5		12,978	gpm
Water in Delivered Tailings Year 6-11		11,897	gpm
Beach Loss evap factor		50%	of Pan Evap
Surface area subject to wetting		40%	
Net discharge rate factor (post concentrate recovery)		99.0%	
Entrained water (Sand)	Year 1-5	433	gpm
Entrained water (slimes)	Year 1-5	1,822	gpm
Entrained water (beach)	Year 1-5	787	gpm
Entrained water (Sand)	Year 6-11	393	gpm
Entrained water (slimes)	Year 6-11	1,685	gpm
Entrained water (beach)	Year 6-11	728	gpm
TSF Free Water area		40%	of Tailings Area
Maximum Pond Area (Acre)	40	1,742,400	ft2
TSF Free Water Pan Evap. coefficient		75%	
Reclaim Pump capacity		12,978	gpm
Minimum Water Storage		500,000	gal
CN-Native ground areas		92	
Dam Evap (underflow water)	Year 1-5	155	gpm
Dam Evap (underflow water)	Year 6-11	140	gpm

elev	Phase	Time	Total Imp. Area	Lined Area (ft^2)	Undiverted Area (ft^2)
5250	1	0.8		8,482,454	3,369,410
5280	2	1.8		10,415,749	1,317,126
5310	3	3.0	13,385,899	12,231,496	1,154,403
5340	4	4.5	13,385,899	12,964,378	421,521
5380	5	6.7	13,385,899	13,385,899	0
5435	6	9.74	13,385,899	13,385,899	

Results: Average Reclaim 9,215 gpm; Average Make-up 3,169 gpm

(yellow) =input values

Average Make-up (gpm)	
Result	3,169
Entrainment	2924
Precip/runon	2098
Evap	4931
Water in	12438

Notes:

Tailings direct precip. reports 100% to water balance

Impoundment refers to the interior, cyclone overflow and whole tailings storage area

This model does not consider whole tailings discharge which accounts for approximately 7.5% of inflow, except as noted below.

Average post deposition densities reflect periodic whole tailings discharge

Year	Month	Elapsed Years	Total Impoundment Area (ft^2)	Pond Area (ft^2)	Beach Area (ft^2)	Water Inflows: Tailings Water (gal)	Water Inflows: Direct Precip. (gal)	Water Inflows: Runon from undiverted Area (gal)	Water Losses: Total Entrained Water (UF) (gal)	Water Losses: Free Water Pond Evap (gal)	Water Losses: Impoundment Beach Evap. (gal)	Water Losses: Embankment Evap. (gal)	Monthly Balance at TSF (gal)	Water Reclaimed from TSF (gal)	End of Month Water Storage (gal)	Water Reclaimed from TSF (gpm)	Make-Up Water Required (gpm)
1	Jan-15	0.08	8,482,454	1,742,400	6,740,054	579,339,937	3,066,903	271,525	135,827,440	3,437,732	2,659,608	6,907,787	433,845,798	433,345,798	500,000	9,708	3,270
	Feb-15	0.16	8,482,454	1,742,400	6,740,054	523,274,781	2,961,147	249,348	122,682,849	4,537,481	3,510,430	6,239,291	390,015,225	389,515,225	500,000	9,661	3,317
	Mar-15	0.25	8,482,454	1,742,400	6,740,054	579,339,937	2,009,350	82,934	135,827,440	6,965,074	5,388,542	6,907,787	426,843,379	426,343,379	500,000	9,551	3,427
	Apr-15	0.33	8,482,454	1,742,400	6,740,054	560,651,552	1,744,962	49,893	131,445,910	7,755,264	5,999,873	6,684,955	411,060,405	410,560,405	500,000	9,504	3,474
	May-15	0.41	8,482,454	1,742,400	6,740,054	579,339,937	2,802,514	217,295	135,827,440	9,083,108	7,027,162	6,907,787	424,014,249	423,514,249	500,000	9,487	3,491
	Jun-15	0.50	8,482,454	1,742,400	6,740,054	560,651,552	3,807,189	442,457	131,445,910	11,608,456	8,980,903	6,684,955	406,680,975	406,180,975	500,000	9,402	3,576
	Jul-15	0.58	8,482,454	1,742,400	6,740,054	579,339,937	12,320,488	3,227,141	135,827,440	8,423,259	6,516,669	6,907,787	437,712,411	437,212,411	500,000	9,794	3,184
	Aug-15	0.67	8,482,454	1,742,400	6,740,054	579,339,937	13,007,897	1,735,434	135,827,440	4,838,893	3,743,618	6,907,787	443,265,529	442,765,529	500,000	9,919	3,059
	Sep-15	0.75	8,482,454	1,742,400	6,740,054	560,651,552	11,157,180	1,262,448	131,445,910	5,034,404	3,894,876	6,684,955	426,511,035	426,011,035	500,000	9,861	3,117
	Oct-15	0.83	10,415,749	1,742,400	8,673,349	579,339,937	7,661,662	108,901	135,827,440	3,225,929	3,211,617	6,907,787	438,437,727	437,937,727	500,000	9,810	3,168
	Nov-15	0.92	10,415,749	1,742,400	8,673,349	560,651,552	3,571,114	93,230	131,445,910	2,997,833	2,984,533	6,684,955	420,702,665	420,202,665	500,000	9,727	3,251
	Dec-15	1.00	10,415,749	1,742,400	8,673,349	579,339,937	5,259,277	220,641	135,827,440	2,232,082	2,222,179	6,907,787	438,130,366	437,630,366	500,000	9,804	3,174
2	Jan-16	1.08	10,415,749	1,742,400	8,673,349	579,339,937	3,765,902	106,141	135,827,440	3,437,732	3,422,481	6,907,787	434,116,539	433,616,539	500,000	9,714	3,264
	Feb-16	1.16	10,415,749	1,742,400	8,673,349	523,274,781	3,636,043	97,472	122,682,849	4,537,481	4,517,350	6,239,291	389,531,325	389,031,325	500,000	9,649	3,329
	Mar-16	1.25	10,415,749	1,742,400	8,673,349	579,339,937	2,467,315	32,420	135,827,440	6,965,074	6,934,173	6,907,787	425,705,197	425,205,197	500,000	9,525	3,453
	Apr-16	1.33	10,415,749	1,742,400	8,673,349	560,651,552	2,142,668	19,503	131,445,910	7,755,264	7,720,857	6,684,955	409,706,738	409,206,738	500,000	9,472	3,506
	May-16	1.41	10,415,749	1,742,400	8,673,349	579,339,937	3,441,255	84,942	135,827,440	9,083,108	9,042,811	6,907,787	422,504,988	422,004,988	500,000	9,454	3,525
	Jun-16	1.50	10,415,749	1,742,400	8,673,349	560,651,552	4,674,912	172,960	131,445,910	11,608,456	11,556,955	6,684,955	404,703,147	404,203,147	500,000	9,357	3,621
	Jul-16	1.58	10,415,749	1,742,400	8,673,349	579,339,937	15,128,536	1,261,512	135,827,440	8,423,259	8,385,889	6,907,787	436,685,610	436,185,610	500,000	9,771	3,207
	Aug-16	1.67	10,415,749	1,742,400	8,673,349	579,339,937	15,972,618	678,393	135,827,440	4,838,893	4,817,426	6,907,787	444,099,402	443,599,402	500,000	9,937	3,041
	Sep-16	1.75	10,415,749	1,742,400	8,673,349	560,651,552	13,700,091	493,500	131,445,910	5,034,404	5,012,069	6,684,955	427,167,804	426,667,804	500,000	9,877	3,101
	Oct-16	1.83	12,231,496	1,742,400	10,489,096	579,339,937	8,997,297	95,447	135,827,440	3,225,929	3,883,962	6,907,787	439,087,563	438,587,563	500,000	9,825	3,153
	Nov-16	1.92	12,231,496	1,742,400	10,489,096	560,651,552	4,193,656	81,712	131,445,910	2,997,833	3,609,339	6,684,955	420,688,883	420,188,883	500,000	9,727	3,251
	Dec-16	2.00	12,231,496	1,742,400	10,489,096	579,339,937	6,176,111	193,382	135,827,440	2,232,082	2,687,388	6,907,787	438,554,733	438,054,733	500,000	9,813	3,165
3	Jan-17	2.08	12,231,496	1,742,400	10,489,096	579,339,937	4,422,400	93,028	135,827,440	3,437,732	4,138,970	6,907,787	434,043,436	433,543,436	500,000	9,712	3,266
	Feb-17	2.16	12,231,496	1,742,400	10,489,096	523,274,781	4,269,904	85,430	122,682,849	4,537,481	5,463,048	6,239,291	389,207,446	388,707,446	500,000	9,641	3,337
	Mar-17	2.25	12,231,496	1,742,400	10,489,096	579,339,937	2,897,435	28,414	135,827,440	6,965,074	8,385,827	6,907,787	424,679,658	424,179,658	500,000	9,502	3,476
	Apr-17	2.33	12,231,496	1,742,400	10,489,096	560,651,552	2,516,193	17,094	131,445,910	7,755,264	9,337,202	6,684,955	408,461,509	407,961,509	500,000	9,444	3,534
	May-17	2.41	12,231,496	1,742,400	10,489,096	579,339,937	4,041,159	74,448	135,827,440	9,083,108	10,935,904	6,907,787	421,201,305	420,701,305	500,000	9,424	3,554
	Jun-17	2.50	12,231,496	1,742,400	10,489,096	560,651,552	5,489,876	151,592	131,445,910	11,608,456	13,976,379	6,684,955	403,077,319	402,577,319	500,000	9,319	3,659
	Jul-17	2.58	12,231,496	1,742,400	10,489,096	579,339,937	17,765,850	1,105,660	135,827,440	8,423,259	10,141,457	6,907,787	437,411,503	436,911,503	500,000	9,787	3,191
	Aug-17	2.67	12,231,496	1,742,400	10,489,096	579,339,937	18,757,077	594,582	135,827,440	4,838,893	5,825,943	6,907,787	445,791,532	445,291,532	500,000	9,975	3,003
	Sep-17	2.75	12,231,496	1,742,400	10,489,096	560,651,552	16,088,387	432,531	131,445,910	5,034,404	6,061,335	6,684,955	428,445,866	427,945,866	500,000	9,906	3,072
	Oct-17	2.83	12,231,496	1,742,400	10,489,096	579,339,937	8,997,297	95,447	135,827,440	3,225,929	3,883,962	6,907,787	439,087,563	438,587,563	500,000	9,825	3,153
	Nov-17	2.92	12,231,496	1,742,400	10,489,096	560,651,552	4,193,656	81,712	131,445,910	2,997,833	3,609,339	6,684,955	420,688,883	420,188,883	500,000	9,727	3,251
	Dec-17	3.00	12,231,496	1,742,400	10,489,096	579,339,937	6,176,111	193,382	135,827,440	2,232,082	2,687,388	6,907,787	438,554,733	438,054,733	500,000	9,813	3,165
4	Jan-18	3.08	12,964,378	1,742,400	11,221,978	579,339,937	4,687,380	33,968	135,827,440	3,437,732	4,428,163	6,907,787	433,960,163	433,460,163	500,000	9,710	3,268
	Feb-18	3.16	12,964,378	1,742,400	11,221,978	523,274,781	4,525,746	31,194	122,682,849	4,537,481	5,844,756	6,239,291	389,027,345	388,527,345	500,000	9,636	3,342
	Mar-18	3.25	12,964,378	1,742,400	11,221,978	579,339,937	3,071,042	10,375	135,827,440	6,965,074	8,971,752	6,907,787	424,249,301	423,749,301	500,000	9,493	3,485
	Apr-18	3.33	12,964,378	1,742,400	11,221,978	560,651,552	2,666,958	6,242	131,445,910	7,755,264	9,989,600	6,684,955	407,949,022	407,449,022	500,000	9,432	3,546
	May-18	3.41	12,964,378	1,742,400	11,221,978	579,339,937	4,283,296	27,184	135,827,440	9,083,108	11,700,004	6,907,787	420,632,077	420,132,077	500,000	9,412	3,566
	Jun-18	3.50	12,964,378	1,742,400	11,221,978	560,651,552	5,818,817	55,352	131,445,910	11,608,456	14,952,920	6,684,955	402,333,479	401,833,479	500,000	9,302	3,676
	Jul-18	3.58	12,964,378	1,742,400	11,221,978	579,339,937	18,830,337	403,723	135,827,440	8,423,259	10,850,049	6,907,787	437,065,462	436,565,462	500,000	9,780	3,198
	Aug-18	3.67	12,964,378	1,742,400	11,221,978	579,339,937	19,880,957	217,107	135,827,440	4,838,893	6,233,007	6,907,787	446,130,873	445,630,873	500,000	9,983	2,995
	Sep-18	3.75	12,964,378	1,742,400	11,221,978	560,651,552	17,052,365	157,935	131,445,910	5,034,404	6,484,845	6,684,955	428,711,737	428,211,737	500,000	9,912	3,066
	Oct-18	3.83	12,964,378	1,742,400	11,221,978	579,339,937	9,536,394	34,852	135,827,440	3,225,929	4,155,338	6,907,787	439,294,688	438,794,688	500,000	9,830	3,148
	Nov-18	3.92	12,964,378	1,742,400	11,221,978	560,651,552	4,444,929	29,837	131,445,910	2,997,833	3,861,526	6,684,955	420,636,094	420,136,094	500,000	9,725	3,253
	Dec-18	4.00	12,964,378	1,742,400	11,221,978	579,339,937	6,546,169	70,612	135,827,440	2,232,082	2,875,158	6,907,787	438,614,250	438,114,250	500,000	9,814	3,164
5	Jan-19	4.08	12,964,378	1,742,400	11,221,978	579,339,937	4,687,380	33,968	135,827,440	3,437,732	4,428,163	6,907,787	433,960,163	433,460,163	500,000	9,710	3,268
	Feb-19	4.16	12,964,378	1,742,400	11,221,978	523,274,781	4,525,746	31,194	122,682,849	4,537,481	5,844,756	6,239,291	389,027,345	388,527,345	500,000	9,636	3,342
	Mar-19	4.25	12,964,378	1,742,400	11,221,978	579,339,937	3,071,042	10,375	135,827,440	6,965,074	8,971,752	6,907,787	424,249,301	423,749,301	500,000	9,493	3,485
	Apr-19	4.33	12,964,378	1,742,400	11,221,978	560,651,552	2,666,958	6,242	131,445,910	7,755,264	9,989,600	6,684,955	407,949,022	407,449,022	500,000	9,432	3,546
	May-19	4.41	12,964,378	1,742,400	11,221,978	579,339,937	4,283,296	27,184	135,827,440	9,083,108	11,700,004	6,907,787	420,632,077	420,132,077	500,000	9,412	3,566
	Jun-19	4.50	12,964,378	1,742,400	11,221,978	560,651,552	5,818,817	55,352	131,445,910	11,608,456	14,952,920	6,684,955	402,333,479	401,833,479	500,000	9,302	3,676
	Jul-19	4.58	13,385,899	1,742,400	11,643,499	579,339,937	19,442,582	-	135,827,440	8,423,259	11,257,599	6,907,787	436,866,434	436,366,434	500,000	9,775	3,203
	Aug-19	4.67	13,385,899	1,742,400	11,643,499	579,339,937	20,527,362	-	135,827,440	4,838,893	6,467,132	6,907,787	446,326,046	445,826,046	500,000	9,987	2,991
	Sep-19	4.75	13,385,899	1,742,400	11,643,499	560,651,552	17,606,802	-	131,445,910	5,034,404	6,728,430	6,684,955	428,864,655	428,364,655	500,000	9,916	3,062
	Oct-19	4.83	13,385,899	1,742,400	11,643,499	579,339,937	9,846,458	-	135,827,440	3,225,929	4,311,421	6,907,787	439,413,818	438,913,818	500,000	9,832	3,146
	Nov-19	4.92	13,385,899	1,742,400	11,643,499	560,651,552	4,589,451	-	131,445,910	2,997,833	4,006,573	6,684,955	420,605,732	420,105,732	500,000	9,725	3,253
	Dec-19	5.00	13,385,899	1,742,400	11,643,499	579,339,937	6,759,009	-	135,827,440	2,232,082	2,983,155	6,907,787	438,648,482	438,148,482	500,000	9,815	3,163
6	Jan-20	5.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784	-	125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
	Feb-20	5.16	13,385,899	1,742,400	11,643,499	479,701,263	4,672,895	-	113,125,473	4,537,481	6,064,297	5,661,782	355,485,125	354,985,125	500,000	8,804	3,093
	Mar-20	5.25	13,385,899	1,742,400	11,643,499	531,097,826	3,170,893	-	125,246,059	6,965,074	9,308,750	6,268,402	386,980,435	386,480,435	500,000	8,658	3,240
	Apr-20	5.33	13,385,899	1,742,400	11,643,499	513,965,638	2,753,670	-	121,205,864	7,755,264	10,364,830	6,066,195	371,827,156	371,327,156	500,000	8,596	3,302
	May-20	5.41	13,385,899	1,742,400	11,643,499	531,097,826	4,422,562	-	125,246,059	9,083,108	12,139,481	6,268,402	383,283,338	382,783,338	500,000	8,575	3,322
	Jun-20	5.50	13,385,899	1,742,400	11,643,499	513,965,638	6,008,008	-	121,205,864	11,608,456	15,514,583	6,066,195	366,078,548	365,578,548	500,000	8,462	3,435
	Jul-20	5.58	13,385,899	1,742,400	11,643,499	531,097,826	19,442,582	-	125,246,059	8,423,259	11,257,599	6,268,402	399,845,090	399,345,090	500,000	8,946	2,951
	Aug-20	5.67	13,385,899	1,742,400	11,643,499	531,097,826	20,527,362		125,246,059	4,838,893	6,467,132	6,268,402	409,304,702	408,804,702	500,000	9,158	2,740
	Sep-20	5.75	13,385,899	1,742,400	11,643,499	513,965,638	17,606,802		121,205,864	5,034,404	6,728,430	6,066,195	393,037,547	392,537,547	500,000	9,087	2,811
	Oct-20	5.83	13,385,899	1,742,400	11,643,499	531,097,826	9,846,458		125,246,059	3,225,929	4,311,421	6,268,402	402,392,473	401,892,473	500,000	9,003	2,894
	Nov-20	5.92	13,385,899	1,742,400	11,643,499	513,965,638	4,589,451		121,205,864	2,997,833	4,006,573	6,066,195	384,778,624	384,278,624	500,000	8,895	3,002
	Dec-20	6.00	13,385,899	1,742,400	11,643,499	531,097,826	6,759,009		125,246,059	2,232,082	2,983,155	6,268,402	401,627,138	401,127,138	500,000	8,986	2,912
7	Jan-21	6.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784		125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
	Feb-21	6.16	13,385,899	1,742,400	11,643,499	479,701,263	4,672,895		113,125,473	4,537,481	6,064,297	5,661,782	355,485,125	354,985,125	500,000	8,804	3,093
	Mar-21	6.25	13,385,899	1,742,400	11,643,499	531,097,826	3,170,893		125,246,059	6,965,074	9,308,750	6,268,402	386,980,435	386,480,435	500,000	8,658	3,240
	Apr-21	6.33	13,385,899	1,742,400	11,643,499	513,965,638	2,753,670		121,205,864	7,755,264	10,364,830	6,066,195	371,827,156	371,327,156	500,000	8,596	3,302
	May-21	6.41	13,385,899	1,742,400	11,643,499	531,097,826	4,422,562		125,246,059	9,083,108	12,139,481	6,268,402	383,283,338	382,783,338	500,000	8,575	3,322
	Jun-21	6.50	13,385,899	1,742,400	11,643,499	513,965,638	6,008,008		121,205,864	11,608,456	15,514,583	6,066,195	366,078,548	365,578,548	500,000	8,462	3,435
	Jul-21	6.58	13,385,899	1,742,400	11,643,499	531,097,826	19,442,582		125,246,059	8,423,259	11,257,599	6,268,402	399,845,090	399,345,090	500,000	8,946	2,951
	Aug-21	6.67	13,385,899	1,742,400	11,643,499	531,097,826	20,527,362	-	125,246,059	4,838,893	6,467,132	6,268,402	409,304,702	408,804,702	500,000	9,158	2,740
	Sep-21	6.75	13,385,899	1,742,400	11,643,499	513,965,638	17,606,802	-	121,205,864	5,034,404	6,728,430	6,066,195	393,037,547	392,537,547	500,000	9,087	2,811
	Oct-21	6.83	13,385,899	1,742,400	11,643,499	531,097,826	9,846,458	-	125,246,059	3,225,929	4,311,421	6,268,402	402,392,473	401,892,473	500,000	9,003	2,894
	Nov-21	6.92	13,385,899	1,742,400	11,643,499	513,965,638	4,589,451	-	121,205,864	2,997,833	4,006,573	6,066,195	384,778,624	384,278,624	500,000	8,895	3,002
	Dec-21	7.00	13,385,899	1,742,400	11,643,499	531,097,826	6,759,009	-	125,246,059	2,232,082	2,983,155	6,268,402	401,627,138	401,127,138	500,000	8,986	2,912
8	Jan-22	7.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784	-	125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
	Feb-22	7.16	13,385,899	1,742,400	11,643,499	479,701,263	4,672,895	-	113,125,473	4,537,481	6,064,297	5,661,782	355,485,125	354,985,125	500,000	8,804	3,093
	Mar-22	7.25	13,385,899	1,742,400	11,643,499	531,097,826	3,170,893	-	125,246,059	6,965,074	9,308,750	6,268,402	386,980,435	386,480,435	500,000	8,658	3,240
	Apr-22	7.33	13,385,899	1,742,400	11,643,499	513,965,638	2,753,670	-	121,205,864	7,755,264	10,364,830	6,066,195	371,827,156	371,327,156	500,000	8,596	3,302
	May-22	7.41	13,385,899	1,742,400	11,643,499	531,097,826	4,422,562	-	125,246,059	9,083,108	12,139,481	6,268,402	383,283,338	382,783,338	500,000	8,575	3,322
	Jun-22	7.50	13,385,899	1,742,400	11,643,499	513,965,638	6,008,008	-	121,205,864	11,608,456	15,514,583	6,066,195	366,078,548	365,578,548	500,000	8,462	3,435
	Jul-22	7.58	13,385,899	1,742,400	11,643,499	531,097,826	19,442,582	-	125,246,059	8,423,259	11,257,599	6,268,402	399,845,090	399,345,090	500,000	8,946	2,951
	Aug-22	7.67	13,385,899	1,742,400	11,643,499	531,097,826	20,527,362	-	125,246,059	4,838,893	6,467,132	6,268,402	409,304,702	408,804,702	500,000	9,158	2,740
	Sep-22	7.75	13,385,899	1,742,400	11,643,499	513,965,638	17,606,802	-	121,205,864	5,034,404	6,728,430	6,066,195	393,037,547	392,537,547	500,000	9,087	2,811
	Oct-22	7.83	13,385,899	1,742,400	11,643,499	531,097,826	9,846,458	-	125,246,059	3,225,929	4,311,421	6,268,402	402,392,473	401,892,473	500,000	9,003	2,894
	Nov-22	7.92	13,385,899	1,742,400	11,643,499	513,965,638	4,589,451	-	121,205,864	2,997,833	4,006,573	6,066,195	384,778,624	384,278,624	500,000	8,895	3,002
	Dec-22	8.00	13,385,899	1,742,400	11,643,499	531,097,826	6,759,009	-	125,246,059	2,232,082	2,983,155	6,268,402	401,627,138	401,127,138	500,000	8,986	2,912
9	Jan-23	8.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784	-	125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
	Feb-23	8.16	13,385,899	1,742,400	11,643,499	479,701,263	4,672,895	-	113,125,473	4,537,481	6,064,297	5,661,782	355,485,125	354,985,125	500,000	8,804	3,093
	Mar-23	8.25	13,385,899	1,742,400	11,643,499	531,097,826	3,170,893	-	125,246,059	6,965,074	9,308,750	6,268,402	386,980,435	386,480,435	500,000	8,658	3,240
	Apr-23	8.33	13,385,899	1,742,400	11,643,499	513,965,638	2,753,670	-	121,205,864	7,755,264	10,364,830	6,066,195	371,827,156	371,327,156	500,000	8,596	3,302
	May-23	8.41	13,385,899	1,742,400	11,643,499	531,097,826	4,422,562	-	125,246,059	9,083,108	12,139,481	6,268,402	383,283,338	382,783,338	500,000	8,575	3,322
	Jun-23	8.50	13,385,899	1,742,400	11,643,499	513,965,638	6,008,008	-	121,205,864	11,608,456	15,514,583	6,066,195	366,078,548	365,578,548	500,000	8,462	3,435
	Jul-23	8.58	13,385,899	1,742,400	11,643,499	531,097,826	19,442,582	-	125,246,059	8,423,259	11,257,599	6,268,402	399,845,090	399,345,090	500,000	8,946	2,951
	Aug-23	8.67	13,385,899	1,742,400	11,643,499	531,097,826	20,527,362	-	125,246,059	4,838,893	6,467,132	6,268,402	409,304,702	408,804,702	500,000	9,158	2,740
	Sep-23	8.75	13,385,899	1,742,400	11,643,499	513,965,638	17,606,802	-	121,205,864	5,034,404	6,728,430	6,066,195	393,037,547	392,537,547	500,000	9,087	2,811
	Oct-23	8.83	13,385,899	1,742,400	11,643,499	531,097,826	9,846,458	-	125,246,059	3,225,929	4,311,421	6,268,402	402,392,473	401,892,473	500,000	9,003	2,894
	Nov-23	8.92	13,385,899	1,742,400	11,643,499	513,965,638	4,589,451	-	121,205,864	2,997,833	4,006,573	6,066,195	384,778,624	384,278,624	500,000	8,895	3,002
	Dec-23	9.00	13,385,899	1,742,400	11,643,499	531,097,826	6,759,009	-	125,246,059	2,232,082	2,983,155	6,268,402	401,627,138	401,127,138	500,000	8,986	2,912

Table 3: Water Balance Calculations Rev 1.

Date:	12/16/2013	**Made by:**	4/29/2013 RL
Project No.:	103-92557	**Checked:**	11/15/2013 GM
Subject:	Average Year Rainfall Conditions	**Reviewed**	11/15/2013 BNS
Project Short Title:	**Copper Flat Feasibility Study, New Mexico**	**Page:**	3 of 3

Precipitation and Evaporation Data

2	3	4	5	6	7	8	9	10
Month	**Days**	**Precip. (in)**	**Pan evap. (in)**	**Storms/Month**	**Precip/Storm**	**S**	**Runoff/ storm (in)**	**Monthly runoff (in)**
January	31	0.58	4.22	1	0.58	0.87	0.13	0.13
February	28	0.56	5.57	1	0.56	0.87	0.12	0.12
March	31	0.38	8.55	1	0.38	0.87	0.04	0.04
April	30	0.33	9.52	1	0.33	0.87	0.02	0.02
May	31	0.53	11.15	1	0.53	0.87	0.10	0.10
June	30	0.72	14.25	1	0.72	0.87	0.21	0.21
July	31	2.33	10.34	1	2.33	0.87	1.54	1.54
August	31	2.46	5.94	3	0.82	0.87	0.28	0.83
September	30	2.11	6.18	3	0.70	0.87	0.20	0.60
October	31	1.18	3.96	3	0.39	0.87	0.04	0.13
November	30	0.55	3.68	1	0.55	0.87	0.11	0.11
December	31	0.81	2.74	1	0.81	0.87	0.27	0.27

Variables used in Water Balance

Water in Delivered Tailings Year 1-5		12,978	gpm
Water in Delivered Tailings Year 6-11		11,897	gpm
Beach Loss evap factor		50%	of Pan Evap
Surface area subject to wetting		40%	
Net discharge rate factor (post concentrate recovery)		99.0%	
Entrained water (Sand)	Year 1-5	433	gpm
Entrained water (slimes)	Year 1-5	1,822	gpm
Entrained water (beach)	Year 1-5	787	gpm
Entrained water (Sand)	Year 6-11	393	gpm
Entrained water (slimes)	Year 6-11	1,685	gpm
Entrained water (beach)	Year 6-11	728	gpm
TSF Free Water area		40%	of Tailings Area
Maximum Pond Area (Acre)	40	1,742,400	ft2
TSF Free Water Pan Evap. coefficient		75%	
Reclaim Pump capacity		12,978	gpm
Minimum Water Storage		500,000	gal
CN-Native ground areas		92	
Dam Evap (underflow water)	Year 1-5	155	gpm
Dam Evap (underflow water)	Year 6-11	140	gpm

elev	Phase	Time	Total Imp. Area	Lined Area (ft^2)	Undiverted Area (ft^2)
5250	1	0.8		8,482,454	3,369,410
5280	2	1.8		10,415,749	1,317,126
5310	3	3.0	13,385,899	12,231,496	1,154,403
5340	4	4.5	13,385,899	12,964,378	421,521
5380	5	6.7	13,385,899	13,385,899	0
5435	6	9.74	13,385,899	13,385,899	

Results: Average Reclaim 9,215 gpm; Average Make-up 3,169 gpm

(yellow) =input values

Average Make-up (gpm)	
Result	3,169
Entrainment	2924
Precip/runon	2098
Evap	4931
Water in	12438

Notes:

Tailings direct precip. reports 100% to water balance

Impoundment refers to the interior, cyclone overflow and whole tailings storage area

This model does not consider whole tailings discharge which accounts for approximately 7.5% of inflow, except as noted below.

Average post deposition densities reflect periodic whole tailings discharge

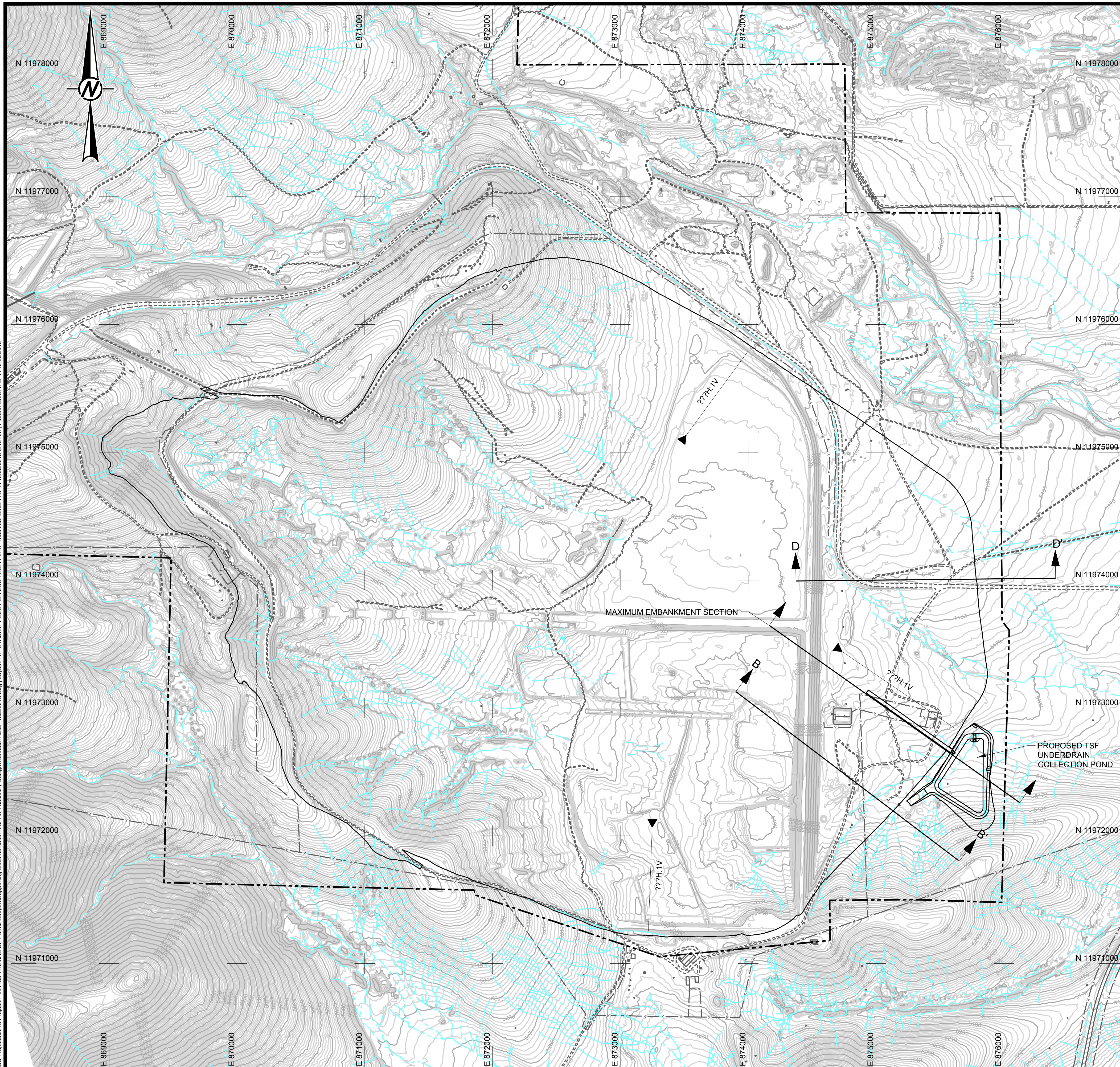
Year	Month	Elapsed Years	Total Impoundment Area (ft^2)	Pond Area (ft^2)	Beach Area (ft^2)	Water Inflows: Tailings Water (gal)	Water Inflows: Direct Precip. (gal)	Water Inflows: Runon from undiverted Area (gal)	Water Losses: Total Entrained Water (UF) (gal)	Water Losses: Free Water Pond Evap (gal)	Water Losses: Impoundment Beach Evap. (gal)	Water Losses: Embankment Evap. (gal)	Monthly Balance at TSF (gal)	Water Reclaimed from TSF (gal)	End of Month Water Storage (gal)	Water Reclaimed from TSF (gpm)	Make-Up Water Required (gpm)
	Jan-24	9.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784	-	125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
	Feb-24	9.16	13,385,899	1,742,400	11,643,499	479,701,263	4,672,895	-	113,125,473	4,537,481	6,064,297	5,661,782	355,485,125	354,985,125	500,000	8,804	3,093
	Mar-24	9.25	13,385,899	1,742,400	11,643,499	531,097,826	3,170,893	-	125,246,059	6,965,074	9,308,750	6,268,402	386,980,435	386,480,435	500,000	8,658	3,240
	Apr-24	9.33	13,385,899	1,742,400	11,643,499	513,965,638	2,753,670	-	121,205,864	7,755,264	10,364,830	6,066,195	371,827,156	371,327,156	500,000	8,596	3,302
	May-24	9.41	13,385,899	1,742,400	11,643,499	531,097,826	4,422,562	-	125,246,059	9,083,108	12,139,481	6,268,402	383,283,338	382,783,338	500,000	8,575	3,322
10	Jun-24	9.50	13,385,899	1,742,400	11,643,499	513,965,638	6,008,008	-	121,205,864	11,608,456	15,514,583	6,066,195	366,078,548	365,578,548	500,000	8,462	3,435
	Jul-24	9.58	13,385,899	1,742,400	11,643,499	531,097,826	19,442,582	-	125,246,059	8,423,259	11,257,599	6,268,402	399,845,090	399,345,090	500,000	8,946	2,951
	Aug-24	9.67	13,385,899	1,742,400	11,643,499	531,097,826	20,527,362	-	125,246,059	4,838,893	6,467,132	6,268,402	409,304,702	408,804,702	500,000	9,158	2,740
	Sep-24	9.75	13,385,899	1,742,400	11,643,499	513,965,638	17,606,802	-	121,205,864	5,034,404	6,728,430	6,066,195	393,037,547	392,537,547	500,000	9,087	2,811
	Oct-24	9.83	13,385,899	1,742,400	11,643,499	531,097,826	9,846,458	-	125,246,059	3,225,929	4,311,421	6,268,402	402,392,473	401,892,473	500,000	9,003	2,894
	Nov-24	9.92	13,385,899	1,742,400	11,643,499	513,965,638	4,589,451	-	121,205,864	2,997,833	4,006,573	6,066,195	384,778,624	384,278,624	500,000	8,895	3,002
	Dec-24	10.00	13,385,899	1,742,400	11,643,499	531,097,826	6,759,009	-	125,246,059	2,232,082	2,983,155	6,268,402	401,627,138	401,127,138	500,000	8,986	2,912
	Jan-25	10.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784	-	125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
	Feb-25	10.16	13,385,899	1,742,400	11,643,499	479,701,263	4,672,895	-	113,125,473	4,537,481	6,064,297	5,661,782	355,485,125	354,985,125	500,000	8,804	3,093
	Mar-25	10.25	13,385,899	1,742,400	11,643,499	531,097,826	3,170,893	-	125,246,059	6,965,074	9,308,750	6,268,402	386,980,435	386,480,435	500,000	8,658	3,240
	Apr-25	10.33	13,385,899	1,742,400	11,643,499	513,965,638	2,753,670	-	121,205,864	7,755,264	10,364,830	6,066,195	371,827,156	371,327,156	500,000	8,596	3,302
	May-25	10.41	13,385,899	1,742,400	11,643,499	531,097,826	4,422,562	-	125,246,059	9,083,108	12,139,481	6,268,402	383,283,338	382,783,338	500,000	8,575	3,322
11	Jun-25	10.50	13,385,899	1,742,400	11,643,499	513,965,638	6,008,008	-	121,205,864	11,608,456	15,514,583	6,066,195	366,078,548	365,578,548	500,000	8,462	3,435
	Jul-25	10.58	13,385,899	1,742,400	11,643,499	531,097,826	19,442,582	-	125,246,059	8,423,259	11,257,599	6,268,402	399,845,090	399,345,090	500,000	8,946	2,951
	Aug-25	10.67	13,385,899	1,742,400	11,643,499	531,097,826	20,527,362	-	125,246,059	4,838,893	6,467,132	6,268,402	409,304,702	408,804,702	500,000	9,158	2,740
	Sep-25	10.75	13,385,899	1,742,400	11,643,499	513,965,638	17,606,802	-	121,205,864	5,034,404	6,728,430	6,066,195	393,037,547	392,537,547	500,000	9,087	2,811
	Oct-25	10.83	13,385,899	1,742,400	11,643,499	531,097,826	9,846,458	-	125,246,059	3,225,929	4,311,421	6,268,402	402,392,473	401,892,473	500,000	9,003	2,894
	Nov-25	10.92	13,385,899	1,742,400	11,643,499	513,965,638	4,589,451	-	121,205,864	2,997,833	4,006,573	6,066,195	384,778,624	384,278,624	500,000	8,895	3,002
	Dec-25	11.00	13,385,899	1,742,400	11,643,499	531,097,826	6,759,009	-	125,246,059	2,232,082	2,983,155	6,268,402	401,627,138	401,127,138	500,000	8,986	2,912
12	Jan-26	11.08	13,385,899	1,742,400	11,643,499	531,097,826	4,839,784	-	125,246,059	3,437,732	4,594,494	6,268,402	396,890,923	396,390,923	500,000	8,880	3,018
						542,619,654	**8,173,890**	127,890	127,590,729	5,826,860	7,227,106	6,434,351	404,240,459	403,740,459	500,000	**9,215**	**3,169**

Average Make-up water **3,169** **gpm**

Maximum Make-up water **3,676** **gpm**

Average (gpm)	12,368	186	3	2,909	133	165	147	9,215

APPENDIX H
STABILITY ANALYSIS SUPPORTING DATA
AND COMPUTER OUTPUT



LEGEND

- 3600 EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 3600 REGRADED CONTOURS (ft -MSL)
- GRADE BREAK
- B B' SLOPE STABILITY SECTION LOCATION

NOTES

1. TAILINGS STORAGE FACILITY SHOWN AT FINAL BUILDOUT.

0 400 800 1200
SCALE FEET

PROJECT

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

Environmentally Responsible. Community-Minded. Local Opportunities.

DRAFT COPPER FLAT PROJECT
30 TPD TAILINGS STORAGE
FACILITY FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

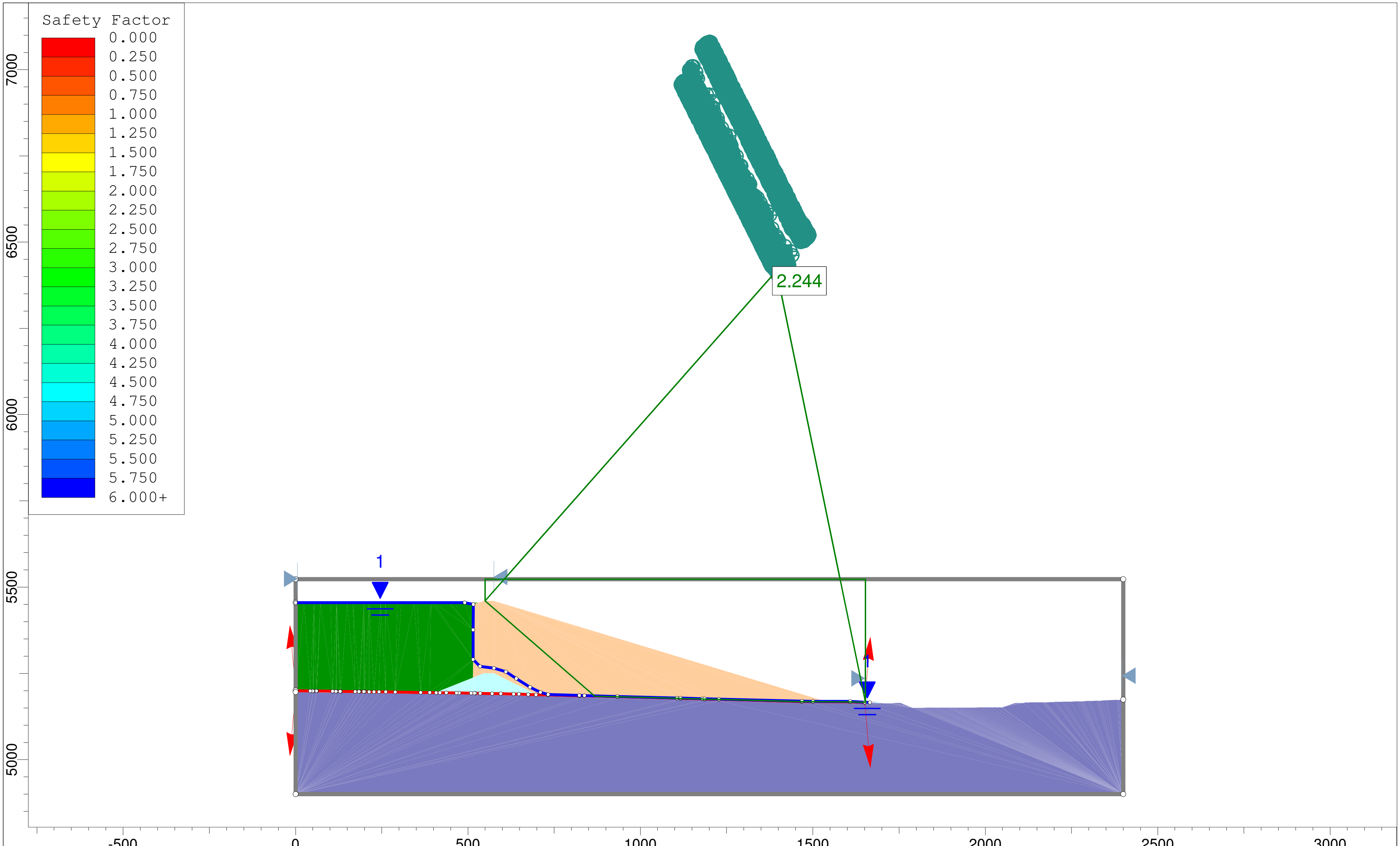
STABILITY SECTION LOCATION PLAN

Golder Associates

PROJECT No.		103-92557	FILE No. 103925557K202_10222015
DESIGN	DMW	2013-04-30	SCALE AS SHOWN
CADD	JHR	2013-04-30	DRAWING
CHECK	GM	2013-05-07	H.1
REVIEW	DAK	2013-05-07	

P:\ABQ Projects\2015 Projects\1531453 THEMAC DP Permit Support\Supporting Documentation\Vol 1K-Feasibility Design\10392557K202_10222015.dwg | Layout: H.1 STABILITY SECTION LOCATION PLAN | Modified: CMONTOYA 10/22/2015 8:45 AM | Plotted: CMONTOYA 10/22/2015

APPENDIX H.1
MAXIMUM EMBANKMENT SECTION



Project	Copper Flat		
Analysis Description	Section A Stability: Downstream, Static, Block Failure, Global		
Drawn By: GS	Scale: 1:4620	Company	Golder Associates Inc.
Date: 11/4/2013, 3:02:21 PM		File Name	1a - SectionA 5460R DS_S_B_G.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 1a - SectionA 5460R DS_S_B_G.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Static, Block Failure, Global
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	26.5	
Tau/Sigma Ratio						0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

Global Minimums

Method: spencer

FS: 2.244240
Axis Location: 1394.865, 6416.541
Left Slip Surface Endpoint: 549.279, 5460.000
Right Slip Surface Endpoint: 1652.746, 5166.147
Left Slope Intercept: 549.279 5522.990
Right Slope Intercept: 1652.746 5522.990
Resisting Moment=8.08765e+009 lb-ft

Driving Moment=3.60374e+009 lb-ft
Resisting Horizontal Force=5.71009e+006 lb
Driving Horizontal Force=2.54433e+006 lb

Global Minimum Coordinates

Method: spencer

X	Y
549.279	5460
868.036	5183.72
933.475	5181.95
1105.87	5177.5
1116.06	5177.23
1179.42	5175.55
1186.08	5175.37
1227.57	5174.27
1468.45	5168.13
1500.4	5168.02
1608.27	5167.61
1623.49	5166.77
1652.75	5166.15
1652.75	5522.99

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 757
Number of Invalid Surfaces: 4064

Error Codes:

Error Code -108 reported for 7 surfaces
Error Code -111 reported for 2282 surfaces
Error Code -112 reported for 19 surfaces
Error Code -116 reported for 1756 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.24424

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	52.9277	124924	Cyclone Underflow	0	39	591.131	1326.64	1638.28	0	1638.28
2	52.9277	315093	Cyclone Underflow	0	39	1658.67	3722.45	4596.85	0	4596.85
3	52.9277	493540	Cyclone Underflow	0	39	2613.17	5864.58	7242.16	0	7242.16
4	52.9277	671986	Cyclone Underflow	0	39	3567.68	8006.72	9887.48	0	9887.48
5	52.9277	850433	Cyclone Underflow	0	39	4522.2	10148.9	12532.8	0	12532.8
6	52.9277	1.02888e+006	Cyclone Underflow	0	39	5476.69	12291	15178.1	0	15178.1
7	1.19075	25204	Liner Interface Zone	0	26.5	4101.89	9205.63	18494.8	31.1774	18463.6
8	65.4393	1.32103e+006	Liner Interface Zone	0	26.5	4296.98	9643.45	19404.1	62.3547	19341.7
9	57.4662	1.0497e+006	Liner Interface Zone	0	26.5	3873.77	8693.66	17499.2	62.3583	17436.9
10	57.4662	946268	Liner Interface Zone	0	26.5	3476.66	7802.45	15711.7	62.3583	15649.3
11	57.4662	842833	Liner Interface Zone	0	26.5	3079.55	6911.24	13924.2	62.3583	13861.8
12	10.1889	138642	Liner Interface Zone	0	26.5	2845.74	6386.52	12871.8	62.3576	12809.4
13	63.358	789325	Liner Interface Zone	0	26.5	2592.07	5817.23	11729.9	62.3559	11667.6
14	6.66227	75711.8	Liner Interface Zone	0	26.5	2350.93	5276.05	10644.5	62.3581	10582.1
15	41.4898	440289	Liner Interface Zone	0	26.5	2184.77	4903.15	9896.55	62.3559	9834.2
16	48.1756	443630	Liner Interface Zone	0	26.5	1875.42	4208.9	8504.11	62.3594	8441.75
17	48.1756	370848	Liner Interface Zone	0	26.5	1542.11	3460.86	7003.76	62.3594	6941.4
18	48.1756	298067	Liner Interface Zone	0	26.5	1208.79	2712.81	5503.4	62.3594	5441.04
19	48.1756	225285	Liner Interface Zone	0	26.5	875.468	1964.76	4003.07	62.3594	3940.71
20	48.1756	152503	Liner Interface Zone	0	26.5	542.148	1216.71	2502.71	62.3594	2440.36
21	31.9454	59717.2	Liner Interface Zone	0	26.5	256.986	576.739	1219.16	62.3993	1156.76

22	53.9361	28069.4	Liner Interface Zone	0	26.5	6.26742	14.0656	90.6102	62.3991	28.2111
23	53.9361	6472.33	Liner Interface Zone	0	26.5	10.742	24.1077	110.752	62.3991	48.3526
24	15.217	1826.04	Liner Interface Zone	0	26.5	0	0	0.432806	62.2097	-61.7769
25	29.2604	1755.63	Liner Interface Zone	0	26.5	2857.95	6413.92	12895.4	31.1049	12864.3

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.24424

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	549.279	5460	1.98387e-022	0	0
2	602.206	5414.12	-113840	11116	-5.57701
3	655.134	5368.25	-69899.2	6825.37	-5.57702
4	708.062	5322.37	28843.8	-2816.47	-5.577
5	760.99	5276.5	182389	-17809.5	-5.57701
6	813.917	5230.62	390735	-38153.7	-5.57702
7	866.845	5184.75	653884	-63849.1	-5.57702
8	868.036	5183.72	664679	-64903.2	-5.57702
9	933.475	5181.95	217883	-21275.3	-5.577
10	990.941	5180.47	-174451	17034.4	-5.57701
11	1048.41	5178.98	-565551	55223.8	-5.57702
12	1105.87	5177.5	-955418	93292.6	-5.57701
13	1116.06	5177.23	-1.02438e+006	100027	-5.57705
14	1179.42	5175.55	-1.45202e+006	141784	-5.57703
15	1186.08	5175.37	-1.49696e+006	146172	-5.57702
16	1227.57	5174.27	-1.77617e+006	173435	-5.57699
17	1275.75	5173.04	-2.10008e+006	205064	-5.57701
18	1323.92	5171.81	-2.42308e+006	236604	-5.57702
19	1372.1	5170.58	-2.74518e+006	268055	-5.57701
20	1420.28	5169.35	-3.06636e+006	299418	-5.57703
21	1468.45	5168.13	-3.38664e+006	330691	-5.57701
22	1500.4	5168.02	-3.59915e+006	351442	-5.57701
23	1554.33	5167.81	-3.83666e+006	374634	-5.57702
24	1608.27	5167.61	-3.84174e+006	375130	-5.57702
25	1623.49	5166.77	-3.86037e+006	376950	-5.57703
26	1652.75	5166.15	6.36684e-021	0	0

List Of Coordinates

Piezoline

X	Y
0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195
732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

Block Search Polyline

X	Y
1650.32	5165.28
1608.27	5167.61
1500.4	5168.02
1468.45	5168.13
1227.57	5174.27
1186.08	5175.37
1179.42	5175.55
1116.06	5177.23
1105.87	5177.5
933.475	5181.95
837.37	5184.54
823.107	5184.92
732.639	5187.36
696.805	5188.32
674.437	5188.92
647.545	5189.63

632.517	5190.03
595.395	5191.04
570.193	5191.45
535.401	5192.01
521.537	5192.24
518.618	5192.28
509.317	5192.41
474.418	5192.97
466.941	5193.08
437.521	5193.55
418.604	5193.82
407.909	5193.99
388.869	5194.29
362.969	5194.7
289.277	5195.79
261.362	5196.12
242.453	5196.34
227.348	5196.51
213.325	5196.67
200.27	5196.81
198.026	5196.84
185.964	5196.98
183.907	5197.01
172.729	5197.13
131.064	5197.72
129.194	5197.75
118.942	5197.86
117.225	5197.89
107.708	5198
61.8783	5198.65
60.3563	5198.67
51.8447	5198.77
50.4444	5198.79
42.5304	5198.88
0	5199.5

External Boundary

X	Y
0	4900
2400	4900
2400	5173.98
2400	5522.99
0	5522.99
0	5455
0	5200.5

0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81
213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79
362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92
837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23

1179.29	5171.55
1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164
1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27
1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5
1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54

1863.56	5150.55
1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85
1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95
1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61
2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6

2079.42	5161.46
2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42
2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03
2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83
2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455
441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455
530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199
117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13

183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01
570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92
696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8
1675.27	5168.86
1680.63	5168.86

Material Boundary

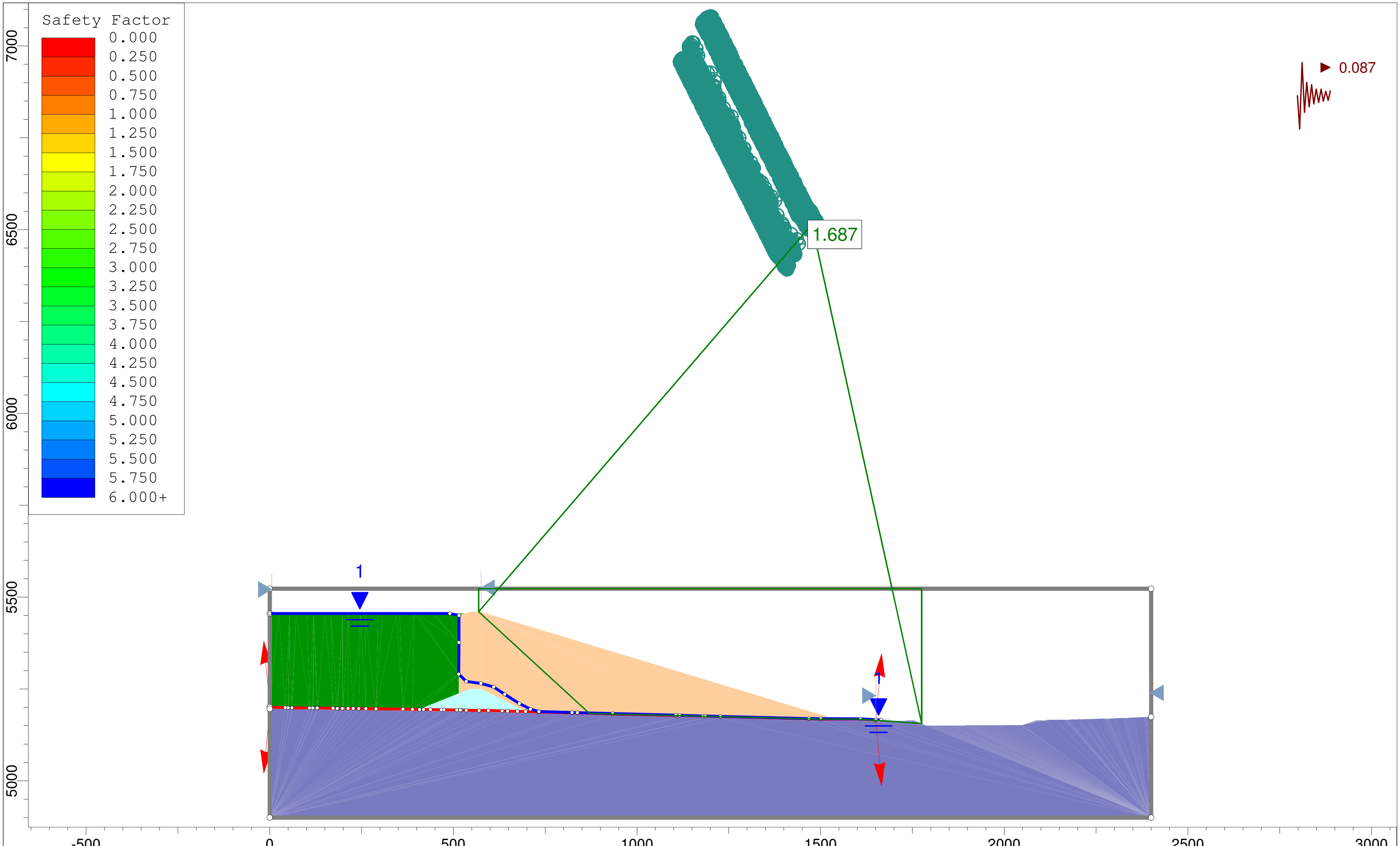
X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63
545.445	5250
575.445	5250
696.805	5189.32



Project	Copper Flat
Analysis Description	Section A Stability: Downstream, Pseudo Static, Block Failure, Global
Drawn By	GS
Scale	1:4338
Company	Golder Associates Inc.
Date	11/4/2013, 3:02:21 PM
File Name	2a - SectionA 5460R DS_PS_B_G.slim

SLIDEINTERPRET 6.008

16465

Slide Analysis Information

Copper Flat

Project Summary

File Name: 2a - SectionA 5460R DS_PS_B_G.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Pseudo Static, Block Failure, Global
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	26.5	
Tau/Sigma Ratio						0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

Global Minimums

Method: spencer

FS: 1.686520

Axis Location: 1476.350, 6514.282
Left Slip Surface Endpoint: 568.826, 5460.000
Right Slip Surface Endpoint: 1775.261, 5155.693
Left Slope Intercept: 568.826 5522.990
Right Slope Intercept: 1775.261 5522.990
Resisting Moment=8.24296e+009 lb-ft
Driving Moment=4.88754e+009 lb-ft
Resisting Horizontal Force=5.38918e+006 lb
Driving Horizontal Force=3.19543e+006 lb

Global Minimum Coordinates

Method: spencer

X	Y
568.826	5460
870.106	5183.66
933.475	5181.95
1105.87	5177.5
1116.06	5177.23
1179.42	5175.55
1186.08	5175.37
1227.57	5174.27
1468.45	5168.13
1500.4	5168.02
1601.92	5167.63
1775.26	5155.69
1775.26	5522.99

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 518
Number of Invalid Surfaces: 4303

Error Codes:

Error Code -108 reported for 22 surfaces
Error Code -111 reported for 2509 surfaces
Error Code -112 reported for 16 surfaces
Error Code -116 reported for 1756 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.68652

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	50.0261	97432.4	Cyclone Underflow	0	39	554.036	934.392	1153.88	0	1153.88
2	50.0261	271871	Cyclone Underflow	0	39	1829.51	3085.51	3810.28	0	3810.28
3	50.0261	445560	Cyclone Underflow	0	39	3022.48	5097.47	6294.86	0	6294.86
4	50.0261	619248	Cyclone Underflow	0	39	4215.44	7109.43	8779.42	0	8779.42
5	50.0261	792937	Cyclone Underflow	0	39	5408.41	9121.4	11264	0	11264
6	50.0261	966626	Cyclone Underflow	0	39	6601.4	11133.4	13748.6	0	13748.6
7	1.12325	23701.6	Liner Interface Zone	0	26.5	5119.91	8634.83	17350	31.1774	17318.8
8	63.369	1.27719e+006	Liner Interface Zone	0	26.5	5707.87	9626.44	19369.9	62.3547	19307.6
9	57.4662	1.0497e+006	Liner Interface Zone	0	26.5	5154.91	8693.86	17499.6	62.3583	17437.2
10	57.4662	946268	Liner Interface Zone	0	26.5	4626.75	7803.1	15713	62.3583	15650.6
11	57.4662	842833	Liner Interface Zone	0	26.5	4098.59	6912.35	13926.4	62.3583	13864
12	10.1889	138642	Liner Interface Zone	0	26.5	3787.56	6387.79	12874.2	62.3576	12811.9
13	63.358	789325	Liner Interface Zone	0	26.5	3450.05	5818.58	11732.6	62.3559	11670.3
14	6.66227	75711.8	Liner Interface Zone	0	26.5	3129.49	5277.95	10648.3	62.3581	10585.9
15	41.4898	440289	Liner Interface Zone	0	26.5	2908.36	4905.01	9900.29	62.3559	9837.93
16	60.2195	543166	Liner Interface Zone	0	26.5	2441.73	4118.02	8321.82	62.3594	8259.46
17	60.2195	429444	Liner Interface Zone	0	26.5	1887.56	3183.41	6447.29	62.3594	6384.93
18	60.2195	315723	Liner Interface Zone	0	26.5	1333.4	2248.8	4572.76	62.3594	4510.4
			Liner Interface							

			Zone							
20	31.9454	59717.2	Liner Interface Zone	0	26.5	345.09	582.001	1229.71	62.3993	1167.31
21	50.7606	27688.4	Liner Interface Zone	0	26.5	9.96282	16.8025	96.0997	62.3991	33.7006
22	50.7606	6091.28	Liner Interface Zone	0	26.5	14.4972	24.4499	111.438	62.3991	49.0388
23	62.898	13110.9	Liner Interface Zone	0	26.5	0	0	102.782	109.089	-6.30725
24	55.2228	27974.9	Foundation Materials	150	29	213.592	360.228	379.262	0	379.262
25	55.2228	30469.2	Foundation Materials	150	29	2490.45	4200.2	7306.76	0	7306.76

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.68652

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	568.826	5460	1.98387e-022	0	0
2	618.852	5414.12	-147187	14297.2	-5.54809
3	668.878	5368.23	-119420	11600	-5.54809
4	718.904	5322.35	-36557.4	3551.05	-5.54809
5	768.93	5276.46	101402	-9849.77	-5.54807
6	818.957	5230.58	294457	-28602.4	-5.54808
7	868.983	5184.69	542608	-52706.9	-5.54809
8	870.106	5183.66	553563	-53771	-5.54809
9	933.475	5181.95	142080	-13801.1	-5.54808
10	990.941	5180.47	-232631	22596.9	-5.54809
11	1048.41	5178.98	-607567	59016.7	-5.54808
12	1105.87	5177.5	-982726	95458.3	-5.54809
13	1116.06	5177.23	-1.04924e+006	101919	-5.54808
14	1179.42	5175.55	-1.46262e+006	142073	-5.54807
15	1186.08	5175.37	-1.50616e+006	146303	-5.5481
16	1227.57	5174.27	-1.77711e+006	172622	-5.5481
17	1287.79	5172.73	-2.17125e+006	210907	-5.54809
18	1348.01	5171.2	-2.56556e+006	249209	-5.54809
19	1408.23	5169.66	-2.96006e+006	287529	-5.54809
20	1468.45	5168.13	-3.35475e+006	325867	-5.54808
21	1500.4	5168.02	-3.56488e+006	346279	-5.54809
22	1551.16	5167.82	-3.79988e+006	369105	-5.54807
23	1601.92	5167.63	-3.80432e+006	369537	-5.54809
24	1664.82	5163.3	-3.87274e+006	376183	-5.54808
25	1720.04	5159.5	-3.93678e+006	382404	-5.54809
26	1775.26	5155.69	6.74534e-021	0	0

List Of Coordinates

Piezoline

X	Y
0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195
732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

Block Search Polyline

X	Y
1650.32	5165.28
1608.27	5167.61
1500.4	5168.02
1468.45	5168.13
1227.57	5174.27
1186.08	5175.37
1179.42	5175.55
1116.06	5177.23
1105.87	5177.5
933.475	5181.95
837.37	5184.54
823.107	5184.92

732.639	5187.36
696.805	5188.32
674.437	5188.92
647.545	5189.63
632.517	5190.03
595.395	5191.04
570.193	5191.45
535.401	5192.01
521.537	5192.24
518.618	5192.28
509.317	5192.41
474.418	5192.97
466.941	5193.08
437.521	5193.55
418.604	5193.82
407.909	5193.99
388.869	5194.29
362.969	5194.7
289.277	5195.79
261.362	5196.12
242.453	5196.34
227.348	5196.51
213.325	5196.67
200.27	5196.81
198.026	5196.84
185.964	5196.98
183.907	5197.01
172.729	5197.13
131.064	5197.72
129.194	5197.75
118.942	5197.86
117.225	5197.89
107.708	5198
61.8783	5198.65
60.3563	5198.67
51.8447	5198.77
50.4444	5198.79
42.5304	5198.88
0	5199.5

External Boundary

X	Y
0	4900
2400	4900
2400	5173.98

2400	5522.99
0	5522.99
0	5455
0	5200.5
0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81
213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79
362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92

837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23
1179.29	5171.55
1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164
1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27
1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5

1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54
1863.56	5150.55
1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85
1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95
1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61

2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6
2079.42	5161.46
2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42
2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03
2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83

2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455
441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455
530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199

117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13
183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01
570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92
696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8

1675.27	5168.86
1680.63	5168.86

Material Boundary

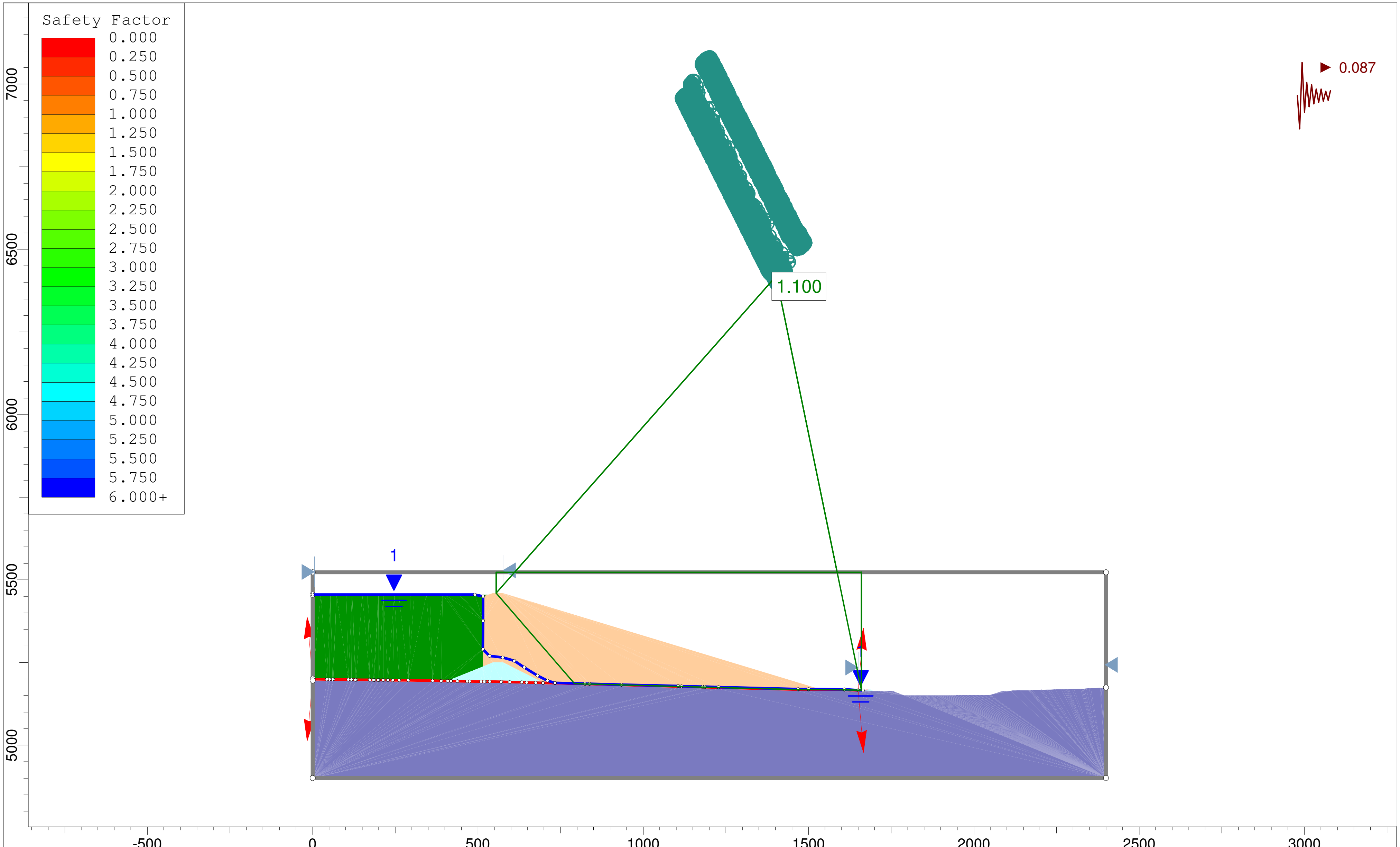
X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63
545.445	5250
575.445	5250
696.805	5189.32



SLIDEINTERPRET 6.008

Project	Copper Flat		
Analysis Description	Section A Stability: Downstream, Pseudo Static, Block Failure, Global		
Drawn By GS	*Scale* 1:4820	*Company*	Golder Associates Inc.
Date 11/4/2013, 3:02:21 PM		*File Name*	3a - SectionA 5460R DS_PS_B_G_min_phi.slim

Slide Analysis Information

Copper Flat

Project Summary

File Name: 3a - SectionA 5460R DS_PS_B_G_min_phi.slim
Last saved with Slide version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Pseudo Static, Block Failure, Global
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

> 103-92557
> Material Property Edits 12/2013
> Liner interface min phi=13.6deg

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

> Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	13.6	
Tau/Sigma Ratio						0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

List Of Coordinates

Piezoline

X	Y

0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195
732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

Block Search Polyline

X	Y
1650.32	5165.28
1608.27	5167.61
1500.4	5168.02
1468.45	5168.13
1227.57	5174.27
1186.08	5175.37
1179.42	5175.55
1116.06	5177.23
1105.87	5177.5
933.475	5181.95
837.37	5184.54
823.107	5184.92
732.639	5187.36
696.805	5188.32
674.437	5188.92
647.545	5189.63
632.517	5190.03

595.395	5191.04
570.193	5191.45
535.401	5192.01
521.537	5192.24
518.618	5192.28
509.317	5192.41
474.418	5192.97
466.941	5193.08
437.521	5193.55
418.604	5193.82
407.909	5193.99
388.869	5194.29
362.969	5194.7
289.277	5195.79
261.362	5196.12
242.453	5196.34
227.348	5196.51
213.325	5196.67
200.27	5196.81
198.026	5196.84
185.964	5196.98
183.907	5197.01
172.729	5197.13
131.064	5197.72
129.194	5197.75
118.942	5197.86
117.225	5197.89
107.708	5198
61.8783	5198.65
60.3563	5198.67
51.8447	5198.77
50.4444	5198.79
42.5304	5198.88
0	5199.5

External Boundary

X	Y
0	4900
2400	4900
2400	5173.98
2400	5522.99
0	5522.99
0	5455
0	5200.5
0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81
213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79
362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92
837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23
1179.29	5171.55

1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164
1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27
1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5
1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54
1863.56	5150.55

1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85
1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95
1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61
2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6
2079.42	5161.46

2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42
2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03
2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83
2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455
441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455
530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199
117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13

183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01
570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92
696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8
1675.27	5168.86
1680.63	5168.86

Material Boundary

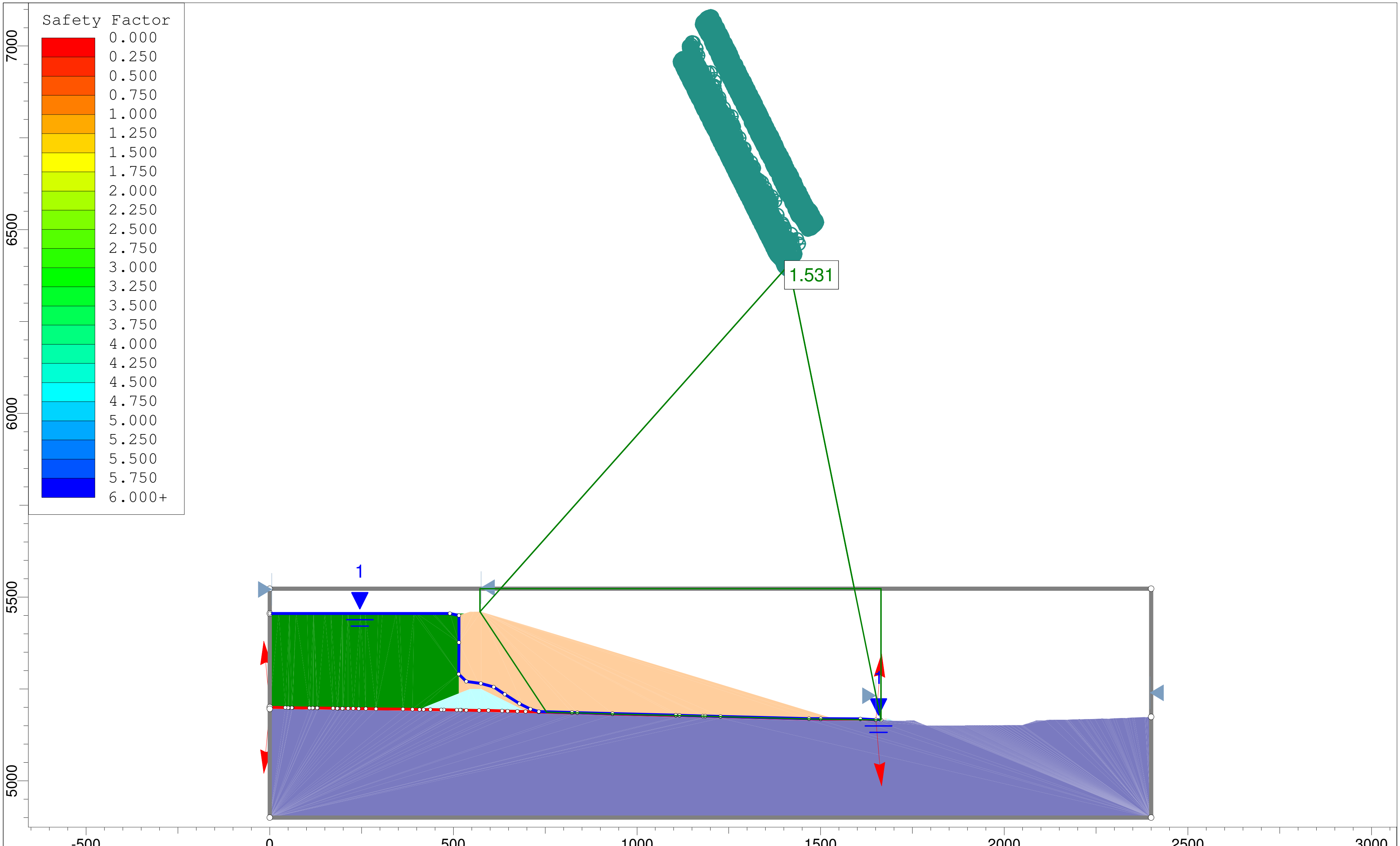
X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63
545.445	5250
575.445	5250
696.805	5189.32



rocscience	Project	Copper Flat	
	Analysis Description	Section A Stability: Downstream, Static, Block Failure, Global	
	Drawn By GS	Scale 1:4338	Company Golder Associates Inc.
SLIDEINTERPRET 6.008	Date 11/4/2013, 3:02:21 PM		File Name 3b - SectionA 5460R DS_S_B_G_min_phi.slim

Slide Analysis Information

Copper Flat

Project Summary

File Name: 3b - SectionA 5460R DS_S_B_G_min_phi.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Static, Block Failure, Global
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

> 103-92557
> Material Property Edits 12/2013
> Liner Interface phi =13.6deg

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

> Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	13.6	
Tau/Sigma Ratio						0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

Global Minimums

Method: spencer

FS: 1.530610
Axis Location: 1412.961, 6404.397
Left Slip Surface Endpoint: 572.648, 5460.000
Right Slip Surface Endpoint: 1664.291, 5165.509
Left Slope Intercept: 572.648 5522.990
Right Slope Intercept: 1664.291 5522.990
Resisting Moment=5.18841e+009 lb-ft

Driving Moment=3.38976e+009 lb-ft
Resisting Horizontal Force=3.37882e+006 lb
Driving Horizontal Force=2.20749e+006 lb

Global Minimum Coordinates

Method: spencer

X	Y
572.648	5460
753.658	5186.79
823.107	5184.92
837.37	5184.54
933.475	5181.95
1105.87	5177.5
1116.06	5177.23
1179.42	5175.55
1186.08	5175.37
1227.57	5174.27
1456.16	5168.44
1664.29	5165.51
1664.29	5522.99

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 1279
Number of Invalid Surfaces: 3542

Error Codes:

Error Code -108 reported for 11 surfaces
Error Code -111 reported for 1763 surfaces
Error Code -112 reported for 12 surfaces
Error Code -116 reported for 1756 surfaces

Error Codes

The following errors were encountered during the computation:

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.
-116 = Not enough slices to analyze the surface Increase the number of slices in the job control in the modeler.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.53061

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	45.0838	142718	Cyclone Underflow	0	39	872.365	1335.25	1648.9	0	1648.9
2	45.0838	419922	Cyclone Underflow	0	39	2833.01	4336.24	5354.81	0	5354.81
3	45.0838	696992	Cyclone Underflow	0	39	4722.56	7228.4	8926.34	0	8926.34
4	45.0838	974063	Cyclone Underflow	0	39	6612.14	10120.6	12497.8	0	12497.8
5	0.674563	16680.5	Liner Interface Zone	0	13.6	3447.02	5276.04	21839.8	31.1774	21808.6
6	69.4483	1.64551e+006	Liner Interface Zone	0	13.6	3646.43	5581.26	23132.6	62.3548	23070.2
7	14.2633	319322	Liner Interface Zone	0	13.6	3440.05	5265.38	21826.8	62.3568	21764.5
8	48.0526	1.02905e+006	Liner Interface Zone	0	13.6	3286.15	5029.81	20853.1	62.3547	20790.8
9	48.0526	957013	Liner Interface Zone	0	13.6	3049.14	4667.05	19353.6	62.3547	19291.3
10	57.4662	1.0497e+006	Liner Interface Zone	0	13.6	2788.59	4268.24	17705.2	62.3583	17642.8
11	57.4662	946268	Liner Interface Zone	0	13.6	2504.03	3832.69	15904.8	62.3583	15842.4
12	57.4662	842833	Liner Interface Zone	0	13.6	2219.46	3397.13	14104.4	62.3583	14042.1
13	10.1889	138642	Liner Interface Zone	0	13.6	2051.94	3140.72	13044.6	62.3576	12982.2
14	63.358	789325	Liner Interface Zone	0	13.6	1870.22	2862.57	11894.8	62.3559	11832.4
15	6.66227	75711.8	Liner Interface Zone	0	13.6	1697.36	2597.99	10801.2	62.3581	10738.8
16	41.4898	440289	Liner Interface Zone	0	13.6	1578.34	2415.83	10048.2	62.3559	9985.82
17	45.7181	422762	Liner Interface Zone	0	13.6	1362.68	2085.73	8683.74	62.3594	8621.38
18	45.7181	357216	Liner Interface Zone	0	13.6	1136.02	1738.8	7249.7	62.3594	7187.34
19	45.7181	291670	Liner Interface Zone	0	13.6	909.35	1391.86	5815.63	62.3594	5753.27
20	45.7181	226124	Liner Interface Zone	0	13.6	682.689	1044.93	4381.59	62.3594	4319.23
21	45.7181	160579	Liner Interface Zone	0	13.6	456.025	697.997	2947.52	62.3594	2885.17
			Liner Interface							

			Zone							
23	52.032	22869.3	Liner Interface Zone	0	13.6	5.72276	8.75932	132.838	96.6312	36.2067
24	52.032	12959.2	Liner Interface Zone	0	13.6	16.2967	24.9439	233.108	130.003	103.105
25	52.032	6697.29	Liner Interface Zone	0	13.6	1011.39	1548.04	6465.57	66.7275	6398.84

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.53061

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	572.648	5460	1.98387e-022	0	0
2	617.732	5391.95	-106388	9073.38	-4.87472
3	662.816	5323.9	59899.5	-5108.59	-4.87473
4	707.9	5255.86	372435	-31763.5	-4.87473
5	752.984	5187.81	831219	-70891.4	-4.87474
6	753.658	5186.79	849640	-72462.5	-4.87474
7	823.107	5184.92	472351	-40285	-4.87474
8	837.37	5184.54	393696	-33576.8	-4.87474
9	885.422	5183.25	126906	-10823.3	-4.87473
10	933.475	5181.95	-143674	12253.4	-4.87474
11	990.941	5180.47	-473336	40368.9	-4.87473
12	1048.41	5178.98	-808251	68932.5	-4.87473
13	1105.87	5177.5	-1.14842e+006	97944.2	-4.87473
14	1116.06	5177.23	-1.20925e+006	103132	-4.87473
15	1179.42	5175.55	-1.59087e+006	135679	-4.87473
16	1186.08	5175.37	-1.63143e+006	139138	-4.87473
17	1227.57	5174.27	-1.88531e+006	160790	-4.87472
18	1273.29	5173.1	-2.16872e+006	184961	-4.87472
19	1319.01	5171.94	-2.45542e+006	209413	-4.87473
20	1364.73	5170.77	-2.74542e+006	234146	-4.87473
21	1410.44	5169.6	-3.03871e+006	259160	-4.87474
22	1456.16	5168.44	-3.3353e+006	284454	-4.87472
23	1508.2	5167.71	-3.67744e+006	313635	-4.87474
24	1560.23	5166.97	-3.86453e+006	329590	-4.87473
25	1612.26	5166.24	-3.87412e+006	330409	-4.87474
26	1664.29	5165.51	6.38965e-021	0	0

List Of Coordinates

Piezoline

X	Y

0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195
732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

Block Search Polyline

X	Y
1650.32	5165.28
1608.27	5167.61
1500.4	5168.02
1468.45	5168.13
1227.57	5174.27
1186.08	5175.37
1179.42	5175.55
1116.06	5177.23
1105.87	5177.5
933.475	5181.95
837.37	5184.54
823.107	5184.92
732.639	5187.36
696.805	5188.32
674.437	5188.92
647.545	5189.63
632.517	5190.03

595.395	5191.04
570.193	5191.45
535.401	5192.01
521.537	5192.24
518.618	5192.28
509.317	5192.41
474.418	5192.97
466.941	5193.08
437.521	5193.55
418.604	5193.82
407.909	5193.99
388.869	5194.29
362.969	5194.7
289.277	5195.79
261.362	5196.12
242.453	5196.34
227.348	5196.51
213.325	5196.67
200.27	5196.81
198.026	5196.84
185.964	5196.98
183.907	5197.01
172.729	5197.13
131.064	5197.72
129.194	5197.75
118.942	5197.86
117.225	5197.89
107.708	5198
61.8783	5198.65
60.3563	5198.67
51.8447	5198.77
50.4444	5198.79
42.5304	5198.88
0	5199.5

External Boundary

X	Y
0	4900
2400	4900
2400	5173.98
2400	5522.99
0	5522.99
0	5455
0	5200.5
0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81
213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79
362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92
837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23
1179.29	5171.55

1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164
1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27
1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5
1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54
1863.56	5150.55

1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85
1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95
1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61
2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6
2079.42	5161.46

2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42
2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03
2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83
2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455
441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455
530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199
117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13

183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01
570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92
696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8
1675.27	5168.86
1680.63	5168.86

Material Boundary

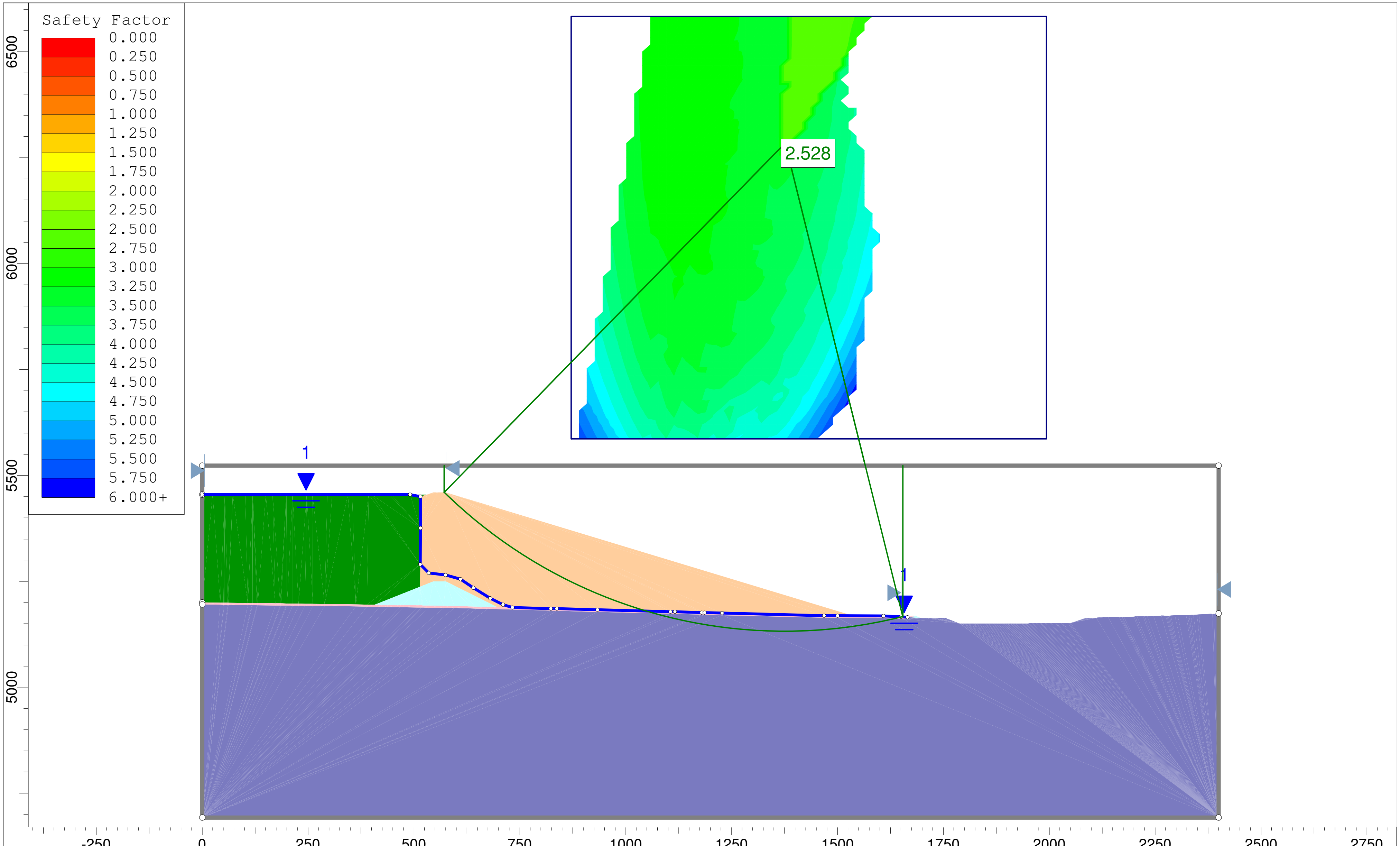
X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63
545.445	5250
575.445	5250
696.805	5189.32



Project	Copper Flat		
Analysis Description	Section A Stability: Downstream, Static, Circular Failure, Global		
Drawn By GS	*Scale* 1:3762	*Company*	Golder Associates Inc.
Date	11/4/2013, 3:02:21 PM	*File Name*	4a - SectionA 5460R DS_S_C_G.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 4a - SectionA 5460R DS_S_C_G.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Static, Circular Failure, Global
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	26.5	
Tau/Sigma Ratio						0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

Global Minimums

Method: spencer

FS: 2.527760
Center: 1376.188, 6284.432
Radius: 1152.416
Left Slip Surface Endpoint: 570.971, 5460.000
Right Slip Surface Endpoint: 1654.244, 5166.064
Left Slope Intercept: 570.971 5522.990
Right Slope Intercept: 1654.244 5522.990
Resisting Moment=8.33108e+009 lb-ft
Driving Moment=3.29583e+009 lb-ft
Resisting Horizontal Force=6.7452e+006 lb

Driving Horizontal Force=2.66845e+006 lb

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 11730
Number of Invalid Surfaces: 29201

Error Codes:

Error Code -101 reported for 408 surfaces
Error Code -103 reported for 2326 surfaces
Error Code -108 reported for 4317 surfaces
Error Code -110 reported for 440 surfaces
Error Code -111 reported for 3813 surfaces
Error Code -1000 reported for 17897 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero) surface / slope intersections.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.52776

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	47.6079	86369.8	Cyclone Underflow	0	39	377.216	953.512	1177.49	0	1177.49
2	47.6079	233141	Cyclone Underflow	0	39	1249.89	3159.43	3901.57	0	3901.57
3	47.6079	356305	Cyclone Underflow	0	39	1954.83	4941.33	6102.03	0	6102.03
4	47.6079	458937	Cyclone Underflow	0	39	2561.02	6473.65	7994.29	0	7994.29
5	47.6079	543134	Cyclone Underflow	0	39	3074.2	7770.84	9596.18	0	9596.18

6	47.6079	610541	Cyclone Underflow	0	39	3499.06	8844.78	10922.4	0	10922.4
7	47.6079	662469	Cyclone Underflow	0	39	3839.45	9705.2	11984.9	0	11984.9
8	47.6079	699974	Cyclone Underflow	0	39	4098.49	10360	12793.5	0	12793.5
9	47.6079	723916	Cyclone Underflow	0	39	4278.69	10815.5	13356	0	13356
10	47.6079	734997	Cyclone Underflow	0	39	4381.94	11076.5	13678.4	0	13678.4
11	19.0295	294789	Liner Interface Zone	0	26.5	2816.41	7119.2	14434.9	155.948	14278.9
12	43.9418	677489	Foundation Materials	150	29	3185.32	8051.73	14255.1	0	14255.1
13	43.9418	666065	Foundation Materials	150	29	3142.02	7942.28	14057.7	0	14057.7
14	43.9418	645159	Foundation Materials	150	29	3052.52	7716.04	13649.5	0	13649.5
15	43.9418	614993	Foundation Materials	150	29	2917.32	7374.28	13032.9	0	13032.9
16	43.9418	575744	Foundation Materials	150	29	2736.7	6917.73	12209.3	0	12209.3
17	43.9418	527526	Foundation Materials	150	29	2510.7	6346.44	11178.7	0	11178.7
18	43.9418	470419	Foundation Materials	150	29	2239.12	5659.95	9940.21	0	9940.21
19	43.9418	404462	Foundation Materials	150	29	1921.59	4857.32	8492.24	0	8492.24
20	43.9418	329659	Foundation Materials	150	29	1557.52	3937.03	6831.97	0	6831.97
21	43.9418	246078	Foundation Materials	150	29	1146.59	2898.3	4958.07	0	4958.07
22	43.9418	156715	Foundation Materials	150	29	744.157	1881.05	3122.9	0	3122.9
23	43.9418	104701	Foundation Materials	150	29	581.701	1470.4	2382.07	0	2382.07
24	43.9418	56711	Foundation Materials	150	29	328.326	829.93	1226.63	0	1226.63
25	16.9217	5084.26	Liner Interface Zone	0	26.5	4370.71	11048.1	22314.9	155.762	22159.1

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.52776

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	570.971	5460	1.98387e-022	0	0
2	618.579	5416.05	-146707	13731.9	-5.34735

3	666.187	5376.71	-127700	11952.8	-5.34734
4	713.795	5341.41	-93307	8733.58	-5.34733
5	761.402	5309.7	-62718.8	5870.51	-5.34733
6	809.01	5281.25	-50008.5	4680.82	-5.34733
7	856.618	5255.79	-65397.2	6121.21	-5.34733
8	904.226	5233.09	-116109	10867.9	-5.34735
9	951.834	5212.99	-206964	19371.9	-5.34732
10	999.442	5195.34	-340792	31898.3	-5.34733
11	1047.05	5180.02	-518731	48553.5	-5.34734
12	1066.08	5174.52	-568159	53179.9	-5.34733
13	1110.02	5163.18	-727759	68118.6	-5.34733
14	1153.96	5153.65	-924346	86519.3	-5.34734
15	1197.9	5145.89	-1.15617e+006	108218	-5.34733
16	1241.85	5139.87	-1.42056e+006	132965	-5.34733
17	1285.79	5135.57	-1.71391e+006	160423	-5.34734
18	1329.73	5132.95	-2.03175e+006	190173	-5.34734
19	1373.67	5132.02	-2.36865e+006	221707	-5.34734
20	1417.61	5132.76	-2.71825e+006	254430	-5.34734
21	1461.56	5135.18	-3.07316e+006	287649	-5.34733
22	1505.5	5139.29	-3.42492e+006	320574	-5.34733
23	1549.44	5145.11	-3.67939e+006	344392	-5.34732
24	1593.38	5152.67	-3.72663e+006	348815	-5.34734
25	1637.32	5161.99	-3.78937e+006	354686	-5.34732
26	1654.24	5166.06	6.3698e-021	0	0

List Of Coordinates

Piezoline

X	Y
0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195
732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5

1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

External Boundary

X	Y
-0.000101814	4692.74
2400	4692.74
2400	5173.98
2400	5522.99
0	5522.99
0	5455
0	5200.5
0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81
213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79

362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92
837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23
1179.29	5171.55
1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164
1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27

1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5
1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54
1863.56	5150.55
1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85
1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95

1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61
2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6
2079.42	5161.46
2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42
2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03

2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83
2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455
441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455

530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199
117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13
183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01
570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92

696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8
1675.27	5168.86
1680.63	5168.86

Material Boundary

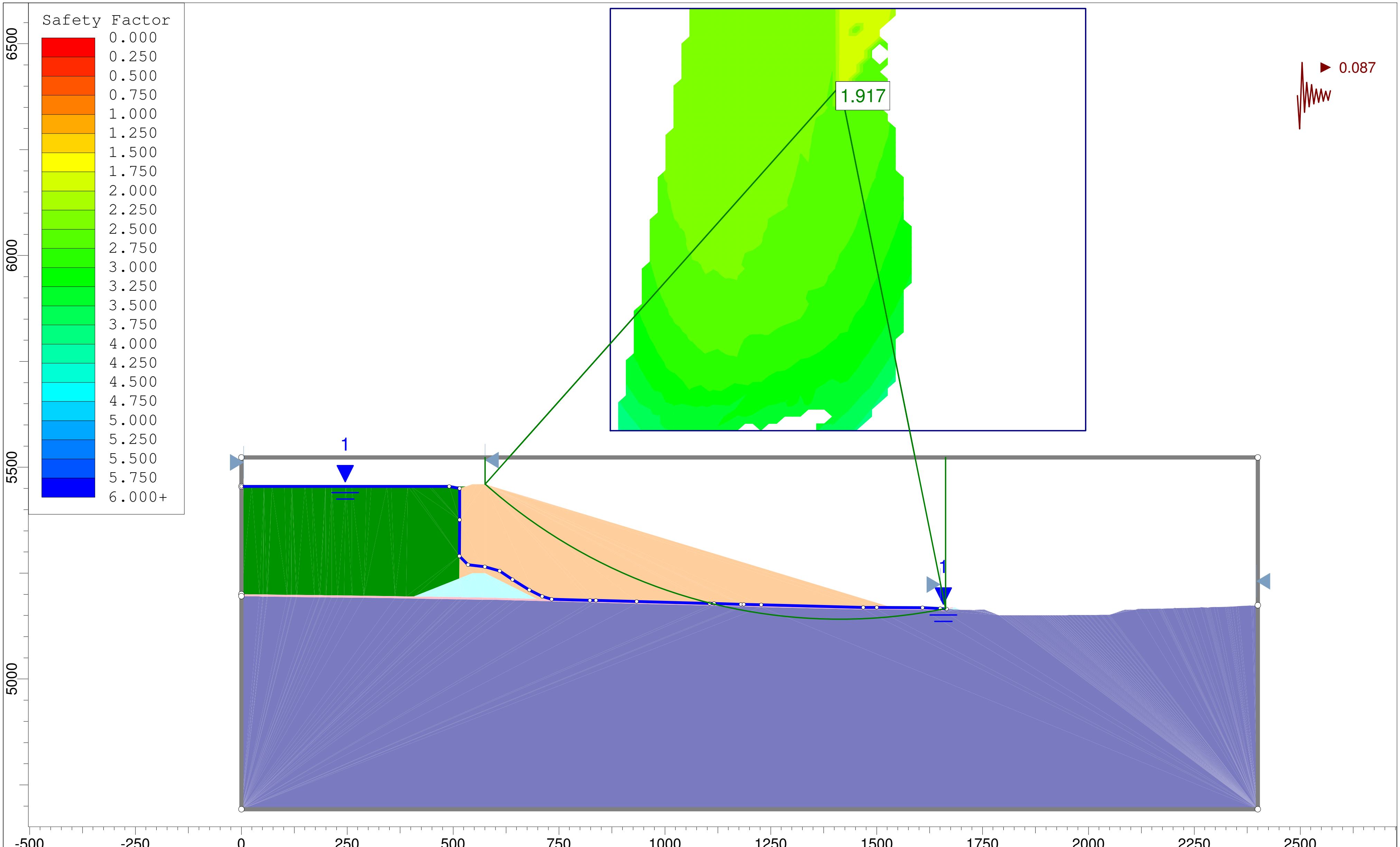
X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63
545.445	5250
575.445	5250
696.805	5189.32



rocscience SLIDEINTERPRET 6.008	*Project* Copper Flat		
	Analysis Description Section A Stability: Downstream, Pseudo Static, Circular Failure, Global		
	Drawn By GS	*Scale* 1:3762	*Company* Golder Associates Inc.
	Date 11/4/2013, 3:02:21 PM		*File Name* 5a - SectionA 5460R DS_PS_C_G.slim

Slide Analysis Information

Copper Flat

Project Summary

File Name: 5a - SectionA 5460R DS_PS_C_G.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Pseudo Static, Circular Failure, Global
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	26.5	
Tau/Sigma Ratio						0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

Global Minimums

Method: spencer

FS: 1.916600
Center: 1413.608, 6400.750
Radius: 1259.972
Left Slip Surface Endpoint: 575.445, 5460.000

Right Slip Surface Endpoint: 1662.506, 5165.607
Left Slope Intercept: 575.445 5522.990
Right Slope Intercept: 1662.506 5522.990
Resisting Moment=7.97722e+009 lb-ft
Driving Moment=4.16218e+009 lb-ft
Resisting Horizontal Force=5.93993e+006 lb
Driving Horizontal Force=3.0992e+006 lb

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 10557
Number of Invalid Surfaces: 30374

Error Codes:

Error Code -101 reported for 408 surfaces
Error Code -103 reported for 2326 surfaces
Error Code -108 reported for 4489 surfaces
Error Code -110 reported for 440 surfaces
Error Code -111 reported for 4814 surfaces
Error Code -1000 reported for 17897 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero) surface / slope intersections.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.9166

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	44.3652	60862.7	Cyclone Underflow	0	39	321.259	615.725	760.358	0	760.358
2	44.3652	174209	Cyclone Underflow	0	39	1244.73	2385.64	2946.02	0	2946.02
			Cyclone							

			Underflow							
4	44.3652	354600	Cyclone Underflow	0	39	2655.19	5088.94	6284.31	0	6284.31
5	44.3652	424335	Cyclone Underflow	0	39	3230.76	6192.08	7646.58	0	7646.58
6	44.3652	481812	Cyclone Underflow	0	39	3723.19	7135.87	8812.07	0	8812.07
7	44.3652	527840	Cyclone Underflow	0	39	4134.48	7924.15	9785.52	0	9785.52
8	44.3652	563095	Cyclone Underflow	0	39	4466.28	8560.07	10570.8	0	10570.8
9	44.3652	588143	Cyclone Underflow	0	39	4719.87	9046.11	11171	0	11171
10	44.3652	603459	Cyclone Underflow	0	39	4896.24	9384.13	11588.4	0	11588.4
11	44.3652	609444	Cyclone Underflow	0	39	4996.03	9575.4	11824.6	0	11824.6
12	44.3652	606436	Cyclone Underflow	0	39	5019.62	9620.6	11880.4	0	11880.4
13	23.4132	316539	Liner Interface Zone	0	26.5	3196.81	6127.01	12445	156.077	12288.9
14	46.4639	615182	Foundation Materials	150	29	3573.33	6848.64	12084.7	0	12084.7
15	46.4639	590270	Foundation Materials	150	29	3445.2	6603.07	11641.7	0	11641.7
16	46.4639	555377	Foundation Materials	150	29	3255.27	6239.06	10985	0	10985
17	46.4639	510675	Foundation Materials	150	29	3003.43	5756.37	10114.2	0	10114.2
18	46.4639	456280	Foundation Materials	150	29	2689.22	5154.15	9027.73	0	9027.73
19	46.4639	392275	Foundation Materials	150	29	2311.95	4431.08	7723.26	0	7723.26
20	46.4639	318701	Foundation Materials	150	29	1870.65	3585.29	6197.43	0	6197.43
21	46.4639	235654	Foundation Materials	150	29	1364.61	2615.41	4447.71	0	4447.71
22	46.4639	146214	Foundation Materials	150	29	861.912	1651.94	2709.57	0	2709.57
23	46.4639	98503.8	Foundation Materials	150	29	693.875	1329.88	2128.55	0	2128.55
24	46.4639	56028.4	Foundation Materials	150	29	408.79	783.486	1142.84	0	1142.84
25	20.1633	6058.23	Liner Interface Zone	0	26.5	4794.2	9188.57	18585.2	155.762	18429.4

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.9166

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	575.445	5460	1.98387e-022	0	0
2	619.81	5422.28	-162525	15041.2	-5.28749
3	664.175	5387.89	-170970	15822.8	-5.2875
4	708.54	5356.52	-168647	15607.8	-5.2875
5	752.906	5327.9	-167853	15534.3	-5.28749
6	797.271	5301.82	-178146	16486.9	-5.2875
7	841.636	5278.09	-206894	19147.4	-5.28749
8	886.001	5256.57	-259659	24030.7	-5.2875
9	930.366	5237.13	-340500	31512.3	-5.2875
10	974.731	5219.68	-452179	41847.8	-5.28749
11	1019.1	5204.13	-596323	55187.9	-5.28749
12	1063.46	5190.41	-773548	71589.6	-5.2875
13	1107.83	5178.45	-983538	91023.5	-5.28749
14	1131.24	5172.83	-1.06166e+006	98253.7	-5.2875
15	1177.7	5163.06	-1.26537e+006	117106	-5.28748
16	1224.17	5155.1	-1.50305e+006	139103	-5.2875
17	1270.63	5148.92	-1.77205e+006	163998	-5.28749
18	1317.1	5144.48	-2.06868e+006	191450	-5.28749
19	1363.56	5141.77	-2.38827e+006	221027	-5.28749
20	1410.02	5140.78	-2.7251e+006	252200	-5.28749
21	1456.49	5141.51	-3.07236e+006	284338	-5.2875
22	1502.95	5143.95	-3.42212e+006	316707	-5.28749
23	1549.42	5148.12	-3.68084e+006	340651	-5.2875
24	1595.88	5154.03	-3.72095e+006	344363	-5.28749
25	1642.34	5161.71	-3.78664e+006	350442	-5.28749
26	1662.51	5165.61	6.38612e-021	0	0

List Of Coordinates

Piezoline

X	Y
0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195

732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

External Boundary

X	Y
-0.000101814	4692.74
2400	4692.74
2400	5173.98
2400	5522.99
0	5522.99
0	5455
0	5200.5
0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81

213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79
362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92
837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23
1179.29	5171.55
1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164

1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27
1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5
1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54
1863.56	5150.55
1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85

1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95
1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61
2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6
2079.42	5161.46
2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42

2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03
2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83
2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455

441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455
530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199
117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13
183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01

570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92
696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8
1675.27	5168.86
1680.63	5168.86

Material Boundary

X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

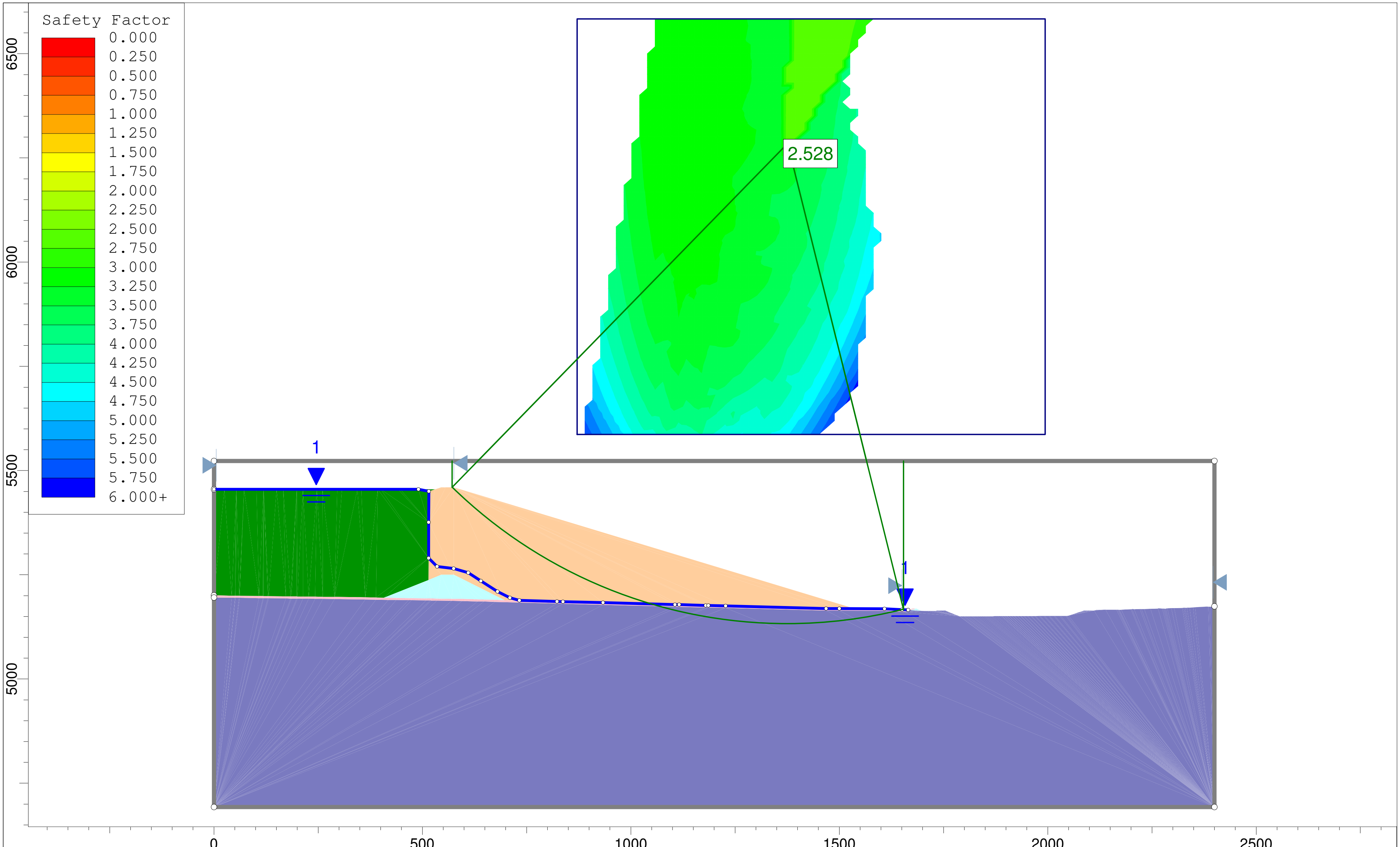
Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63

545.445	5250
575.445	5250
696.805	5189.32



Project	Copper Flat		
Analysis Description	Section A Stability: Downstream, Static, Block Failure, Global, Post Liquefaction Strength		
Drawn By GS	*Scale* 1:3822	*Company*	Golder Associates Inc.
Date 11/4/2013, 3:02:21 PM		*File Name*	6a - SectionA 5460R DS_S_C_G_postliq.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 6a - SectionA 5460R DS_S_C_G_postliq.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section A Stability: Downstream, Static, Block Failure, Global, Post Liquefaction Strength
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 3:02:21 PM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Cyclone Overflow
Color						
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	108
Cohesion [psf]		0	0	150	0	
Friction Angle [deg]		39	29	29	26.5	
Tau/Sigma Ratio						0.05
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated	Automatically Calculated
Ru Value	0		0	0		

Global Minimums

Method: spencer

FS: 2.527620
Center: 1376.188, 6284.432
Radius: 1152.416
Left Slip Surface Endpoint: 570.971, 5460.000
Right Slip Surface Endpoint: 1654.244, 5166.064
Left Slope Intercept: 570.971 5522.990
Right Slope Intercept: 1654.244 5522.990
Resisting Moment=8.3306e+009 lb-ft
Driving Moment=3.29583e+009 lb-ft
Resisting Horizontal Force=6.74519e+006 lb

Driving Horizontal Force=2.6686e+006 lb

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 11802
Number of Invalid Surfaces: 29129

Error Codes:

Error Code -101 reported for 408 surfaces
Error Code -103 reported for 2326 surfaces
Error Code -108 reported for 4262 surfaces
Error Code -110 reported for 440 surfaces
Error Code -111 reported for 3796 surfaces
Error Code -1000 reported for 17897 surfaces

Error Codes

The following errors were encountered during the computation:

-101 = Only one (or zero) surface / slope intersections.
-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.52762

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	47.6079	86369.8	Cyclone Underflow	0	39	377.344	953.782	1177.82	0	1177.82
2	47.6079	233141	Cyclone Underflow	0	39	1249.93	3159.35	3901.47	0	3901.47
3	47.6079	356305	Cyclone Underflow	0	39	1954.88	4941.2	6101.88	0	6101.88
4	47.6079	458937	Cyclone Underflow	0	39	2561.11	6473.51	7994.12	0	7994.12
5	47.6079	543134	Cyclone Underflow	0	39	3074.33	7770.73	9596.06	0	9596.06

6	47.6079	610541	Cyclone Underflow	0	39	3499.23	8844.72	10922.3	0	10922.3
7	47.6079	662469	Cyclone Underflow	0	39	3839.67	9705.22	11984.9	0	11984.9
8	47.6079	699974	Cyclone Underflow	0	39	4098.76	10360.1	12793.7	0	12793.7
9	47.6079	723916	Cyclone Underflow	0	39	4279.01	10815.7	13356.3	0	13356.3
10	47.6079	734997	Cyclone Underflow	0	39	4382.34	11076.9	13678.8	0	13678.8
11	19.0295	294789	Liner Interface Zone	0	26.5	2816.62	7119.35	14435.1	155.948	14279.2
12	43.9418	677489	Foundation Materials	150	29	3185.59	8051.96	14255.5	0	14255.5
13	43.9418	666065	Foundation Materials	150	29	3142.32	7942.59	14058.2	0	14058.2
14	43.9418	645159	Foundation Materials	150	29	3052.84	7716.42	13650.2	0	13650.2
15	43.9418	614993	Foundation Materials	150	29	2917.65	7374.71	13033.7	0	13033.7
16	43.9418	575744	Foundation Materials	150	29	2737.05	6918.22	12210.2	0	12210.2
17	43.9418	527526	Foundation Materials	150	29	2511.05	6346.98	11179.6	0	11179.6
18	43.9418	470419	Foundation Materials	150	29	2239.47	5660.53	9941.26	0	9941.26
19	43.9418	404462	Foundation Materials	150	29	1921.94	4857.93	8493.33	0	8493.33
20	43.9418	329659	Foundation Materials	150	29	1557.85	3937.65	6833.1	0	6833.1
21	43.9418	246078	Foundation Materials	150	29	1146.9	2898.93	4959.21	0	4959.21
22	43.9418	156715	Foundation Materials	150	29	744.38	1881.51	3123.73	0	3123.73
23	43.9418	104701	Foundation Materials	150	29	581.769	1470.49	2382.23	0	2382.23
24	43.9418	56711	Foundation Materials	150	29	328.39	830.044	1226.83	0	1226.83
25	16.9217	5084.26	Liner Interface Zone	0	26.5	4364.66	11032.2	22282.9	155.762	22127.2

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.52762

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	570.971	5460	1.98387e-022	0	0
2	618.579	5416.05	-146699	13710.3	-5.33928

3	666.187	5376.71	-127697	11934.4	-5.33928
4	713.795	5341.41	-93312.8	8720.9	-5.33928
5	761.402	5309.7	-62734.3	5863.08	-5.33929
6	809.01	5281.25	-50034.2	4676.14	-5.33929
7	856.618	5255.79	-65433.1	6115.3	-5.33929
8	904.226	5233.09	-116155	10855.7	-5.33928
9	951.834	5212.99	-207020	19347.9	-5.3393
10	999.442	5195.34	-340860	31856.3	-5.33927
11	1047.05	5180.02	-518810	48487.4	-5.33929
12	1066.08	5174.52	-568241	53107.1	-5.33928
13	1110.02	5163.18	-727848	68023.8	-5.33929
14	1153.96	5153.65	-924444	86397.4	-5.33928
15	1197.9	5145.89	-1.15628e+006	108064	-5.33926
16	1241.85	5139.87	-1.42067e+006	132774	-5.33928
17	1285.79	5135.57	-1.71404e+006	160192	-5.33928
18	1329.73	5132.95	-2.03189e+006	189898	-5.33929
19	1373.67	5132.02	-2.36881e+006	221386	-5.33928
20	1417.61	5132.76	-2.71843e+006	254061	-5.33928
21	1461.56	5135.18	-3.07335e+006	287232	-5.33929
22	1505.5	5139.29	-3.42512e+006	320108	-5.33929
23	1549.44	5145.11	-3.67961e+006	343892	-5.33929
24	1593.38	5152.67	-3.72686e+006	348308	-5.33929
25	1637.32	5161.99	-3.7896e+006	354171	-5.33928
26	1654.24	5166.06	6.3698e-021	0	0

List Of Coordinates

Piezoline

X	Y
0	5455
490.734	5455
515.445	5450
515.2	5376
514.77	5289.93
535	5270
575	5265
610	5255
640	5235
680	5210
710	5195
732.639	5188.36
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5

1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47

External Boundary

X	Y
-0.000101814	4692.74
2400	4692.74
2400	5173.98
2400	5522.99
0	5522.99
0	5455
0	5200.5
0	5195.5

Material Boundary

X	Y
0	5195.5
42.4655	5194.88
50.3797	5194.79
51.7799	5194.77
60.2917	5194.67
61.8068	5194.65
107.644	5194
117.161	5193.89
118.878	5193.87
129.13	5193.75
130.993	5193.72
172.665	5193.13
183.844	5193.01
185.901	5192.98
197.963	5192.84
200.207	5192.81
213.269	5192.67
227.292	5192.51
242.397	5192.34
261.303	5192.12
289.21	5191.79

362.895	5190.7
388.79	5190.29
418.529	5189.82
437.446	5189.55
466.866	5189.08
474.342	5188.97
509.241	5188.41
518.548	5188.28
521.461	5188.24
535.319	5188.01
570.113	5187.45
595.286	5187.04
632.38	5186.03
647.412	5185.63
674.306	5184.92
822.972	5180.92
837.238	5180.55
933.343	5177.96
1105.74	5173.5
1115.93	5173.23
1179.29	5171.55
1185.95	5171.38
1227.44	5170.27
1468.38	5164.13
1500.38	5164.02
1608.12	5163.61
1657.48	5160.88
1670.47	5165.17
1672.7	5165.9
1675.59	5166.86
1680.63	5166.86
1680.63	5168.86
1685.27	5168.86
1688.99	5167
1692.54	5165.23
1695.8	5163.83
1708.19	5163.3
1719.82	5162.97
1727.18	5162.95
1731.2	5162.93
1734.43	5164
1745.27	5164
1754.46	5164
1769.87	5157.85
1778.92	5154.23
1783.82	5152.27

1788.35	5150.47
1789.76	5150.47
1794.29	5150.46
1798.56	5150.46
1800.71	5150.46
1804.88	5150.46
1807.87	5150.46
1811.79	5150.46
1816.58	5150.46
1819.25	5150.47
1822.8	5150.47
1827.21	5150.47
1831.13	5150.48
1835.72	5150.49
1840.51	5150.49
1844.97	5150.5
1848.9	5150.51
1852.34	5150.52
1855.93	5150.53
1859.66	5150.54
1863.56	5150.55
1867.64	5150.56
1871.9	5150.57
1876.36	5150.59
1881.03	5150.6
1885.93	5150.62
1889.81	5150.64
1891.08	5150.64
1895.17	5150.66
1896.49	5150.67
1900.82	5150.68
1902.18	5150.69
1906.77	5150.71
1908.19	5150.72
1913.04	5150.74
1914.52	5150.75
1919.68	5150.77
1921.22	5150.78
1926.7	5150.81
1928.31	5150.82
1934.14	5150.85
1935.83	5150.86
1942.04	5150.89
1943.81	5150.9
1950.44	5150.94
1952.31	5150.95

1959.4	5151
1961.37	5151.01
1968.96	5151.06
1971.06	5151.07
1979.2	5151.12
1981.43	5151.14
1990.18	5151.2
1992.56	5151.22
2001.99	5151.28
2004.53	5151.3
2014.73	5151.37
2017.46	5151.39
2028.5	5151.48
2031.44	5151.5
2043.44	5151.59
2046.62	5151.61
2049.97	5151.64
2058.45	5154.47
2063.14	5156.03
2073.87	5159.6
2079.42	5161.46
2087.05	5164
2097.36	5164
2111.05	5164
2115.66	5165.28
2117.08	5165.67
2123.79	5165.76
2138.52	5166
2164.62	5166.2
2167.74	5166.23
2170.31	5166.24
2171.83	5166.27
2176.22	5166.42
2199.06	5167.14
2202.11	5167.23
2205.69	5167.35
2207.13	5167.37
2221.2	5167.76
2224.83	5167.83
2231.54	5168
2246.4	5168.42
2264.49	5168.76
2267.13	5168.9
2271.07	5168.97
2274.87	5169.01
2277.68	5169.03

2280.46	5169.04
2283.27	5169.13
2286.68	5169.27
2296.4	5169.81
2303.08	5170.12
2323.1	5170.72
2326.63	5170.79
2329.88	5170.83
2333.96	5170.96
2340.37	5171.27
2348.81	5171.75
2353.59	5172
2382.36	5173.52
2385.05	5173.4
2388.88	5173.53
2393.87	5173.83
2396.71	5174
2400	5173.98

Material Boundary

X	Y
0	5455
5.2718	5455
24.9095	5455
53.5041	5455
72.0583	5455
101.782	5455
119.16	5455
150.112	5455
166.208	5455
198.502	5455
213.195	5455
246.959	5455
260.112	5455
295.495	5455
306.947	5455
344.123	5455
353.689	5455
392.858	5455
400.319	5455
441.72	5455
446.819	5455
490.734	5455
517.25	5455
518.848	5455

530.445	5455
545.445	5460
556.072	5460
575.445	5460
1536.14	5168.88

Material Boundary

X	Y
0	5200.5
42.5304	5199.88
50.4444	5199.79
51.8447	5199.77
60.3563	5199.67
61.8783	5199.65
107.708	5199
117.225	5198.89
118.942	5198.86
129.194	5198.75
131.064	5198.72
172.729	5198.13
183.907	5198.01
185.964	5197.98
198.026	5197.84
200.27	5197.81
213.325	5197.67
227.348	5197.51
242.453	5197.34
261.362	5197.12
289.277	5196.79
362.969	5195.7
388.869	5195.29
407.909	5194.99
418.604	5194.82
437.521	5194.55
466.941	5194.08
474.418	5193.97
509.317	5193.41
518.618	5193.28
521.537	5193.24
535.401	5193.01
570.193	5192.45
595.395	5192.04
632.517	5191.03
647.545	5190.63
674.437	5189.92

696.805	5189.32
823.107	5185.92
837.37	5185.54
933.475	5182.95
1105.87	5178.5
1116.06	5178.23
1179.42	5176.55
1186.08	5176.37
1227.57	5175.27
1468.45	5169.13
1500.4	5169.02
1536.14	5168.88
1608.27	5168.61
1650.32	5166.28
1665.01	5165.47
1672.07	5167.8
1675.27	5168.86
1680.63	5168.86

Material Boundary

X	Y
1670.47	5165.17
1685.26	5164.35
1695.8	5163.83

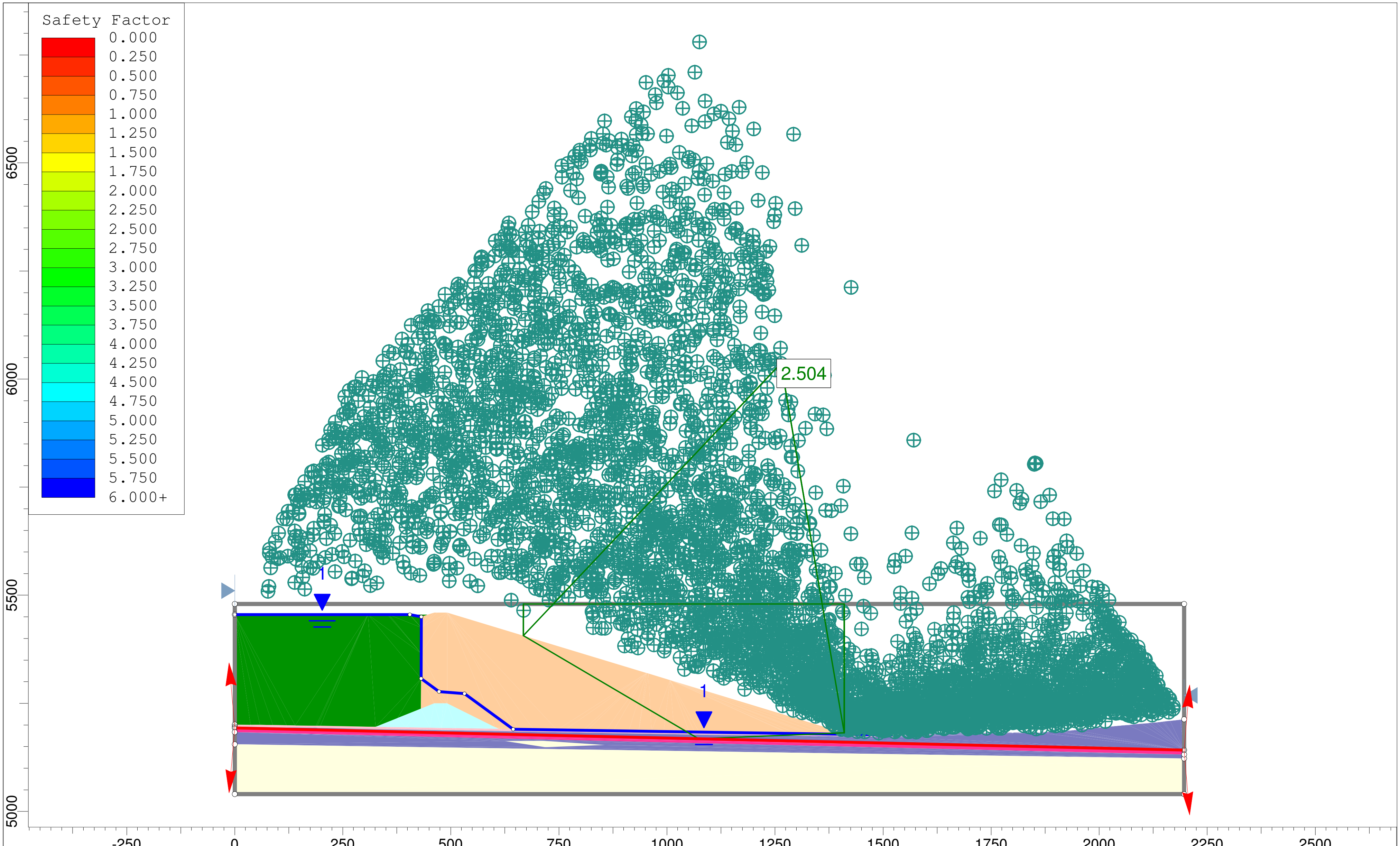
Material Boundary

X	Y
407.909	5194.99
514.508	5237.63
514.77	5289.93
515.2	5376
515.445	5450
519.684	5451.41
530.445	5455

Material Boundary

X	Y
514.508	5237.63
545.445	5250
575.445	5250
696.805	5189.32

APPENDIX H.2
STABILITY SECTION B-B'



Project	Copper Flat		
Analysis Description	Section B-B' Stability: Downstream, Static, Block Failure		
Drawn By GS	*Scale* 1:3686	*Company*	Golder Associates Inc.
Date 11/4/2013, 11:49:04 AM		*File Name*	1 - Section B 5460R - DS_S_B.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 1 - Section B 5460R - DS_S_B.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section B-B' Stability: Downstream, Static, Block Failure
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 11:49:04 AM
Comments:

103-92557
Material Property Edits 12/13

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Soft Clay	Clay	Cyclone Overflow
Color								
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	127	108
Cohesion [psf]		0	0	150	0			
Friction Angle [deg]		39	29	29	26.5			
Tau/Sigma Ratio								0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated			Automatically Calculated
Ru Value	0		0	0		0	0	

Shear Normal Functions

Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765

2506.67	897.9
2924.38	1028.2
3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5

22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7

42606.7	10837.2
43024.4	10930.5
43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6

62656.7	15211.8

Global Minimums

Method: spencer

FS: 2.504180
Axis Location: 1263.734, 6036.472
Left Slip Surface Endpoint: 667.648, 5406.642
Right Slip Surface Endpoint: 1409.947, 5181.705
Left Slope Intercept: 667.648 5480.000
Right Slope Intercept: 1409.947 5480.000
Resisting Moment=2.81387e+009 lb-ft
Driving Moment=1.12367e+009 lb-ft
Resisting Horizontal Force=3.03106e+006 lb
Driving Horizontal Force=1.2104e+006 lb

Global Minimum Coordinates

Method: spencer

X	Y
667.648	5406.64
1073.18	5168.06
1409.95	5181.7
1409.95	5480

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 584
Number of Invalid Surfaces: 4416

Error Codes:

Error Code -106 reported for 2 surfaces
Error Code -107 reported for 1331 surfaces
Error Code -108 reported for 2123 surfaces
Error Code -110 reported for 70 surfaces
Error Code -111 reported for 595 surfaces
Error Code -112 reported for 295 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the

driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 2.50418

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	31.651	16148	Cyclone Underflow	0	39	25.4457	63.7207	78.6884	0	78.6884
2	31.651	48443.9	Cyclone Underflow	0	39	393.5	985.395	1216.86	0	1216.86
3	31.651	80739.8	Cyclone Underflow	0	39	671.529	1681.63	2076.63	0	2076.63
4	31.651	113036	Cyclone Underflow	0	39	949.556	2377.86	2936.4	0	2936.4
5	31.651	145332	Cyclone Underflow	0	39	1227.58	3074.09	3796.18	0	3796.18
6	31.651	177628	Cyclone Underflow	0	39	1505.61	3770.32	4655.95	0	4655.95
7	31.651	209923	Cyclone Underflow	0	39	1783.64	4466.55	5515.73	0	5515.73
8	31.651	242219	Cyclone Underflow	0	39	2061.66	5162.78	6375.5	0	6375.5
9	31.651	274515	Cyclone Underflow	0	39	2339.69	5859.01	7235.27	0	7235.27
10	31.651	306847	Cyclone Underflow	0	39	2618.13	6556.28	8096.33	0	8096.33
11	31.651	339198	Cyclone Underflow	0	39	2896.61	7253.64	8957.49	0	8957.49
12	31.651	371504	Cyclone Underflow	0	39	3174.66	7949.91	9817.32	0	9817.32
13	8.75148	108572	Liner Interface Zone	0	26.5	2185.06	5471.78	11170.6	195.919	10974.6
14	16.9638	218358	Foundation Materials	150	29	2579.64	6459.89	11383.3	0	11383.3
15	30.2226	380408	Foundation Materials	150	29	2774.58	6948.05	12264	0	12264
16	30.2226	344600	Foundation Materials	150	29	2511.83	6290.08	11077	0	11077
17	30.2226	308792	Foundation Materials	150	29	2249.09	5632.12	9890.02	0	9890.02
18	30.2226	272984	Foundation Materials	150	29	1986.34	4974.16	8703	0	8703
19	30.2226	237176	Foundation Materials	150	29	1723.6	4316.2	7516.03	0	7516.03
20	30.2226	201368	Foundation Materials	150	29	1460.85	3658.23	6329.01	0	6329.01
21	31.0757	169713	Liner Interface Zone	0	26.5	967.095	2421.78	5130.02	272.678	4857.34
22	31.0757	131843	Liner Interface Zone	0	26.5	745.37	1866.54	3908.11	164.386	3743.72
23	31.0757	93991.2	Liner Interface Zone	0	26.5	523.772	1311.62	2686.8	56.0937	2630.7
24	31.1043	56349.3	Cyclone Underflow	0	39	474.407	1188	1467.06	0	1467.06
25	31.1043	18783.1	Cyclone Underflow	0	39	1844.88	4619.92	5705.13	0	5705.13

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 2.50418

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	667.648	5406.64	2.69073e-022	0	0
2	699.299	5388.02	-214017	13186.2	-3.5257
3	730.95	5369.4	-256320	15792.6	-3.5257
4	762.601	5350.78	-297148	18308.2	-3.52571
5	794.252	5332.16	-336500	20732.8	-3.52571
6	825.903	5313.53	-374377	23066.5	-3.52571
7	857.554	5294.91	-410779	25309.3	-3.5257
8	889.205	5276.29	-445705	27461.2	-3.52571
9	920.856	5257.67	-479156	29522.2	-3.5257
10	952.507	5239.05	-511131	31492.3	-3.52571
11	984.158	5220.43	-541429	33359	-3.5257
12	1015.81	5201.81	-570296	35137.6	-3.5257
13	1047.46	5183.19	-597825	36833.8	-3.52571
14	1056.21	5178.04	-590828	36402.6	-3.5257
15	1073.18	5168.06	-583080	35925.3	-3.52571
16	1103.4	5169.28	-796681	49085.8	-3.5257
17	1133.62	5170.51	-1.00613e+006	61990.4	-3.52569
18	1163.84	5171.73	-1.21142e+006	74639.1	-3.5257
19	1194.07	5172.96	-1.41256e+006	87031.9	-3.5257
20	1224.29	5174.18	-1.60955e+006	99168.8	-3.52569
21	1254.51	5175.41	-1.80238e+006	111050	-3.52571
22	1285.59	5176.66	-1.98927e+006	122565	-3.52571
23	1316.66	5177.92	-2.17327e+006	133902	-3.52572
24	1347.74	5179.18	-2.35439e+006	145061	-3.52571
25	1378.84	5180.44	-2.53815e+006	156383	-3.52571
26	1409.95	5181.7	4.449e-021	0	0

List Of Coordinates

Piezoline

X	Y
5.68e-014	5455
405.014	5455
431.537	5450
430.947	5307.07
472.744	5276.98
531.255	5272.32
644.321	5190
1526.22	5176.48

Block Search Lines

X	Y

0	5193.11
2196.33	5141.83

External Boundary

X	Y
2196.33	5040
2196.33	5122.6
2196.33	5131.83
2196.33	5141.83
2196.33	5213.03
2196.33	5480
0	5480
5.68434e-014	5454.95
0	5200.91
0	5195.91
0	5193.11
0	5183.11
0	5154.97
0	5040

Material Boundary

X	Y
0	5200.91
36.2762	5200.37
58.5636	5200.04
87.9203	5199.6
119.749	5199.12
139.564	5198.83
187.898	5198.1
191.209	5198.05
198.411	5197.94
325.671	5195.68
352.127	5195.21
395.214	5194.44
451.434	5193.44
477.974	5192.93
511.46	5192.3
610.156	5190.74
613.497	5190.69
617.098	5190.63
644.321	5190
655.674	5189.8
692.306	5189.18
745.298	5188.28
762.917	5188
805.444	5187.28

814.51	5187.13
858.316	5186.39
875.648	5186.09
911.187	5185.49
934.659	5185.09
964.059	5184.6
992.27	5184.12
1016.93	5183.7
1051.65	5183.11
1064.32	5182.9
1074.91	5182.72
1281.77	5180.05
1284.77	5180
1300.41	5179.72
1324.81	5179.5
1334.95	5179.32
1357.91	5179.08
1383.32	5178.96
1399.69	5178.64
1420.91	5178.38
1449.11	5178.05
1457.41	5177.99
1463.99	5177.94
1481.34	5177.51
1528.55	5176.42

Material Boundary

X	Y
0	5195.91
36.2013	5195.37
58.4887	5195.04
87.8455	5194.6
119.674	5194.12
139.49	5193.83
187.823	5193.1
191.134	5193.05
198.329	5192.94
352.038	5190.21
395.126	5189.44
451.342	5188.44
477.88	5187.93
511.373	5187.3
613.418	5185.69
617.004	5185.63
644.218	5185
655.588	5184.8
692.222	5184.18

745.216	5183.28
762.837	5183
805.359	5182.28
814.425	5182.13
858.231	5181.39
875.564	5181.09
911.103	5180.49
934.574	5180.09
963.974	5179.6
992.185	5179.12
1016.85	5178.7
1051.56	5178.12
1064.24	5177.9
1074.84	5177.72
1281.7	5175.05
1284.68	5175
1300.34	5174.72
1324.74	5174.5
1334.87	5174.32
1357.87	5174.08
1383.26	5173.96
1399.61	5173.64
1449.07	5173.05
1457.37	5172.99
1463.91	5172.95
1481.22	5172.51
1529.3	5171.41

Material Boundary

X	Y
1528.55	5176.42
1530.07	5176.92
1540.17	5180.24
1544.4	5180.22
1545.81	5180.22
1550.23	5180.21
1558.65	5175.99

Material Boundary

X	Y
1529.3	5171.41
1531.63	5172.17
1540.96	5175.24
1544.53	5175.72

Material Boundary

X	Y
5.68434e-014	5454.95
308.07	5454.95
353.349	5454.95
356.571	5454.95
403.471	5454.95
405.014	5454.95
446.545	5454.95

Material Boundary

X	Y
1544.53	5175.72
1551.96	5176.06
1555.99	5176
1558.65	5175.99
1560.71	5175.98
1562.45	5175.97
1564.47	5175.96
1567.8	5175.98
1568.92	5175.98
1570.4	5176
1572.7	5176.05
1575.12	5176.1
1577.64	5176.05
1584.69	5177.23
1587.52	5178
1589.43	5178
1595.33	5178.02
1598	5178.02
1599.51	5178.02
1601.92	5178.01
1604.21	5178.01
1606.06	5178.02
1611.05	5178.02
1612.65	5178.02
1615.58	5178.03
1624.1	5178.74
1634.72	5179.56
1676.06	5181.61
1677.91	5181.69
1679.85	5181.31
1689.42	5179.73
1695.55	5179.88
1719.81	5180.46
1722.1	5180.51
1724.26	5180.55
1729.33	5180.77

1736.44	5181.05
1758.17	5181.51
1760.86	5181.57
1763.13	5181.59
1770	5181.77
1776.96	5182
1778.16	5182
1781.4	5182
1786.04	5182
1790.15	5181.96
1792.18	5181.97
1793.61	5181.99
1797.47	5181.99
1801.67	5181.97
1805.2	5181.98
1807.73	5182
1809.68	5182.03
1810.98	5182.03
1812.91	5182
1815.24	5182
1817.46	5182
1820.77	5182
1825.08	5182.06
1827.32	5182.1
1830.04	5182.06
1834	5182.21
1835.24	5182.23
1837.14	5182.32
1847.73	5182.9
1853.36	5183.11
1862.09	5181.97
1863.34	5182
1868.11	5183.18
1878.92	5184
1881.28	5184.04
1882.78	5184.04
1886.78	5184.25
1895.53	5184.46
1902.77	5184.55
1904.49	5184.67
1907.81	5184.94
1915.56	5185.57
1918.57	5185.89
1922.54	5186
1936.83	5187.52
1942.58	5188
1944.05	5188.08
1945.48	5188.13

1980.15	5191.45
1985.49	5192
2003.82	5193.85
2005.48	5194.02
2024.8	5196
2030.13	5196.52
2035.72	5197.07
2041.65	5197.59
2046.56	5198.01
2056.52	5198.85
2066.29	5199.61
2077.93	5200.73
2090.84	5201.99
2097.45	5202.54
2111.64	5204
2118.78	5204.74
2132.35	5206
2146.46	5207.55
2150.18	5208
2163.74	5209.5
2187.21	5212
2196.33	5213.03

Material Boundary

X	Y
430.6	5237.63
430.947	5307.07
431.24	5365.55
431.537	5425
431.537	5449.95
446.545	5454.95
461.554	5460
468.536	5460
491.57	5460
952.795	5320.23
956.93	5318.98
1007.34	5303.73
1420.91	5178.38

Material Boundary

X	Y
325.671	5195.68
377.088	5216.23
430.6	5237.63
461.554	5250
482.872	5250

491.57	5250
601.751	5194.94
610.156	5190.74

Material Boundary

X	Y
0	5193.11
2196.33	5141.83

Material Boundary

X	Y
0	5183.11
2196.33	5131.83

Material Boundary

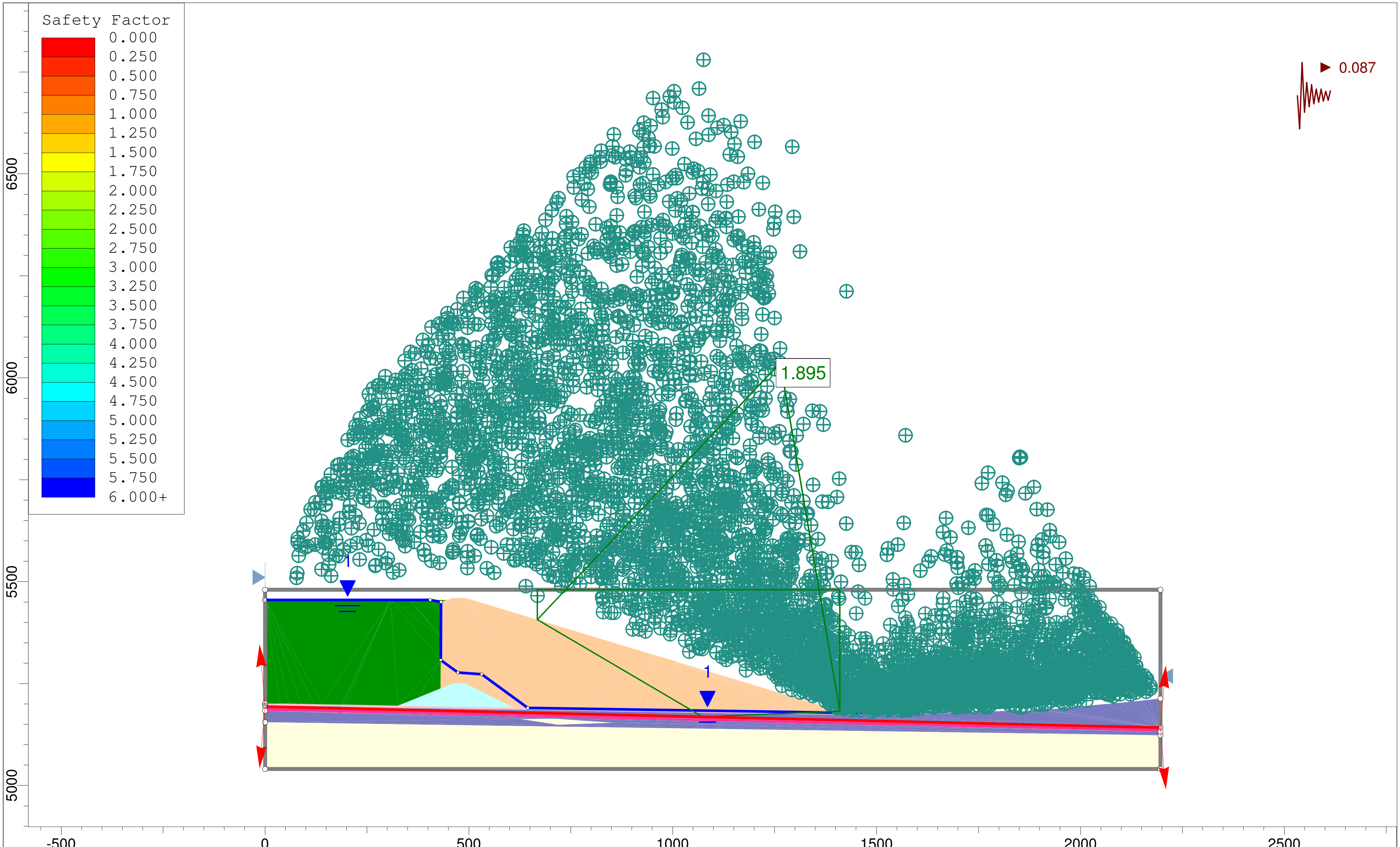
X	Y
0	5154.97
2196.33	5122.6

Material Boundary

X	Y
712.872	5163.35
624.336	5162.59
718.366	5148.52
856.143	5153.54
712.872	5163.35

Material Boundary

X	Y
1544.4	5180.22
1544.53	5175.72



Project	Copper Flat		
Analysis Description	Section B-B' Stability: Downstream, Pseudo Static, Block Failure		
Drawn By GS	*Scale* 1:3908	*Company*	Golder Associates Inc.
Date	11/4/2013, 11:49:04 AM	*File Name*	2 - Section B 5460R - DS_PS_B.slim

rocscience

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 2 - Section B 5460R - DS_PS_B.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section B-B' Stability: Downstream, Pseudo Static, Block Failure
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 11:49:04 AM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Soft Clay	Clay	Cyclone Overflow
Color								
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	127	108
Cohesion [psf]		0	0	150	0			
Friction Angle [deg]		39	29	29	26.5			
Tau/Sigma Ratio								0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated			Automatically Calculated
Ru Value	0		0	0		0	0	

Shear Normal Functions

Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186

835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2
3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2

20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7

40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5
43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765

60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

Global Minimums

Method: spencer

FS: 1.895340
Axis Location: 1263.734, 6036.472
Left Slip Surface Endpoint: 667.648, 5406.642
Right Slip Surface Endpoint: 1409.947, 5181.705
Left Slope Intercept: 667.648 5480.000
Right Slope Intercept: 1409.947 5480.000
Resisting Moment=2.74873e+009 lb-ft
Driving Moment=1.45026e+009 lb-ft
Resisting Horizontal Force=2.96703e+006 lb
Driving Horizontal Force=1.56543e+006 lb

Global Minimum Coordinates

Method: spencer

X	Y
667.648	5406.64
1073.18	5168.06
1409.95	5181.7
1409.95	5480

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 562
Number of Invalid Surfaces: 4438

Error Codes:

Error Code -106 reported for 2 surfaces
Error Code -107 reported for 578 surfaces
Error Code -108 reported for 2726 surfaces
Error Code -110 reported for 101 surfaces
Error Code -111 reported for 671 surfaces
Error Code -112 reported for 360 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge
-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.89534

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	31.651	16148	Cyclone Underflow	0	39	0	0	-57.4289	0	-57.4289
2	31.651	48443.9	Cyclone Underflow	0	39	484.264	917.844	1133.44	0	1133.44
3	31.651	80739.8	Cyclone Underflow	0	39	833.882	1580.49	1951.75	0	1951.75
4	31.651	113036	Cyclone Underflow	0	39	1183.5	2243.14	2770.05	0	2770.05
5	31.651	145332	Cyclone Underflow	0	39	1533.12	2905.79	3588.35	0	3588.35
6	31.651	177628	Cyclone Underflow	0	39	1882.74	3568.44	4406.65	0	4406.65
7	31.651	209923	Cyclone Underflow	0	39	2232.36	4231.08	5224.95	0	5224.95
8	31.651	242219	Cyclone Underflow	0	39	2581.98	4893.73	6043.25	0	6043.25
9	31.651	274515	Cyclone Underflow	0	39	2931.6	5556.38	6861.55	0	6861.55
10	31.651	306847	Cyclone Underflow	0	39	3281.79	6220.1	7681.19	0	7681.19
11	31.651	339198	Cyclone Underflow	0	39	3631.96	6883.8	8500.79	0	8500.79
12	31.651	371504	Cyclone Underflow	0	39	3981.57	7546.43	9319.07	0	9319.07
13	8.75148	108572	Liner Interface Zone	0	26.5	2802.54	5311.77	10849.7	195.919	10653.8
14	16.9638	218358	Foundation Materials	150	29	3293.35	6242.01	10990.3	0	10990.3
15	30.2226	380408	Foundation Materials	150	29	3636.26	6891.94	12162.8	0	12162.8
16	30.2226	344600	Foundation Materials	150	29	3288.53	6232.88	10973.8	0	10973.8
17	30.2226	308792	Foundation Materials	150	29	2940.8	5573.81	9784.82	0	9784.82
18	30.2226	272984	Foundation Materials	150	29	2593.07	4914.75	8595.82	0	8595.82
19	30.2226	237176	Foundation Materials	150	29	2245.34	4255.68	7406.86	0	7406.86
20	30.2226	201368	Foundation Materials	150	29	1897.61	3596.62	6217.86	0	6217.86
21	31.0757	169713	Liner Interface Zone	0	26.5	1250.03	2369.24	5024.65	272.678	4751.98
22	31.0757	131843	Liner Interface Zone	0	26.5	956.103	1812.14	3798.98	164.386	3634.59
23	31.0757	93991.2	Liner Interface Zone	0	26.5	662.33	1255.34	2573.92	56.0937	2517.83
24	31.1043	56349.3	Cyclone Underflow	0	39	574.915	1089.66	1345.62	0	1345.62
25	31.1043	18783.1	Cyclone Underflow	0	39	3181.77	6030.54	7447.09	0	7447.09

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.89534

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	667.648	5406.64	2.69073e-022	0	0
2	699.299	5388.02	-214342	17977.3	-4.79429
3	730.95	5369.4	-256846	21542.3	-4.79432
4	762.601	5350.78	-298096	25002	-4.79431
5	794.252	5332.16	-338091	28356.5	-4.79431
6	825.903	5313.53	-376832	31605.8	-4.79431
7	857.554	5294.91	-414318	34749.8	-4.79431
8	889.205	5276.29	-450549	37788.6	-4.79431
9	920.856	5257.67	-485526	40722.2	-4.79431
10	952.507	5239.05	-519248	43550.5	-4.79431
11	984.158	5220.43	-551514	46256.8	-4.79431
12	1015.81	5201.81	-582571	48861.6	-4.79431
13	1047.46	5183.19	-612510	51372.6	-4.79431
14	1056.21	5178.04	-603106	50583.9	-4.79431
15	1073.18	5168.06	-592352	49682	-4.79432
16	1103.4	5169.28	-798697	66988.6	-4.79431
17	1133.62	5170.51	-1.00144e+006	83993.1	-4.79431
18	1163.84	5171.73	-1.20058e+006	100696	-4.79434
19	1194.07	5172.96	-1.39612e+006	117096	-4.79432
20	1224.29	5174.18	-1.58806e+006	133194	-4.7943
21	1254.51	5175.41	-1.7764e+006	148990	-4.79428
22	1285.59	5176.66	-1.95716e+006	164151	-4.79429
23	1316.66	5177.92	-2.13608e+006	179158	-4.79431
24	1347.74	5179.18	-2.31317e+006	194011	-4.79431
25	1378.84	5180.44	-2.49498e+006	209260	-4.79431
26	1409.95	5181.7	4.449e-021	0	0

List Of Coordinates

Piezoline

X	Y
5.68e-014	5455
405.014	5455
431.537	5450
430.947	5307.07
472.744	5276.98
531.255	5272.32
644.321	5190
1526.22	5176.48

Block Search Lines

X	Y
0	5193.11
2196.33	5141.83

External Boundary

X	Y
2196.33	5040
2196.33	5122.6
2196.33	5131.83
2196.33	5141.83
2196.33	5213.03
2196.33	5480
0	5480
5.68434e-014	5454.95
0	5200.91
0	5195.91
0	5193.11
0	5183.11
0	5154.97
0	5040

Material Boundary

X	Y
0	5200.91
36.2762	5200.37
58.5636	5200.04
87.9203	5199.6
119.749	5199.12
139.564	5198.83
187.898	5198.1
191.209	5198.05
198.411	5197.94
325.671	5195.68
352.127	5195.21
395.214	5194.44
451.434	5193.44
477.974	5192.93
511.46	5192.3
610.156	5190.74
613.497	5190.69
617.098	5190.63
644.321	5190
655.674	5189.8

692.306	5189.18
745.298	5188.28
762.917	5188
805.444	5187.28
814.51	5187.13
858.316	5186.39
875.648	5186.09
911.187	5185.49
934.659	5185.09
964.059	5184.6
992.27	5184.12
1016.93	5183.7
1051.65	5183.11
1064.32	5182.9
1074.91	5182.72
1281.77	5180.05
1284.77	5180
1300.41	5179.72
1324.81	5179.5
1334.95	5179.32
1357.91	5179.08
1383.32	5178.96
1399.69	5178.64
1420.91	5178.38
1449.11	5178.05
1457.41	5177.99
1463.99	5177.94
1481.34	5177.51
1528.55	5176.42

Material Boundary

X	Y
0	5195.91
36.2013	5195.37
58.4887	5195.04
87.8455	5194.6
119.674	5194.12
139.49	5193.83
187.823	5193.1
191.134	5193.05
198.329	5192.94
352.038	5190.21
395.126	5189.44
451.342	5188.44
477.88	5187.93
511.373	5187.3
613.418	5185.69

617.004	5185.63
644.218	5185
655.588	5184.8
692.222	5184.18
745.216	5183.28
762.837	5183
805.359	5182.28
814.425	5182.13
858.231	5181.39
875.564	5181.09
911.103	5180.49
934.574	5180.09
963.974	5179.6
992.185	5179.12
1016.85	5178.7
1051.56	5178.12
1064.24	5177.9
1074.84	5177.72
1281.7	5175.05
1284.68	5175
1300.34	5174.72
1324.74	5174.5
1334.87	5174.32
1357.87	5174.08
1383.26	5173.96
1399.61	5173.64
1449.07	5173.05
1457.37	5172.99
1463.91	5172.95
1481.22	5172.51
1529.3	5171.41

Material Boundary

X	Y
1528.55	5176.42
1530.07	5176.92
1540.17	5180.24
1544.4	5180.22
1545.81	5180.22
1550.23	5180.21
1558.65	5175.99

Material Boundary

X	Y
1529.3	5171.41
1531.63	5172.17

1540.96	5175.24
1544.53	5175.72

Material Boundary

X	Y
5.68434e-014	5454.95
308.07	5454.95
353.349	5454.95
356.571	5454.95
403.471	5454.95
405.014	5454.95
446.545	5454.95

Material Boundary

X	Y
1544.53	5175.72
1551.96	5176.06
1555.99	5176
1558.65	5175.99
1560.71	5175.98
1562.45	5175.97
1564.47	5175.96
1567.8	5175.98
1568.92	5175.98
1570.4	5176
1572.7	5176.05
1575.12	5176.1
1577.64	5176.05
1584.69	5177.23
1587.52	5178
1589.43	5178
1595.33	5178.02
1598	5178.02
1599.51	5178.02
1601.92	5178.01
1604.21	5178.01
1606.06	5178.02
1611.05	5178.02
1612.65	5178.02
1615.58	5178.03
1624.1	5178.74
1634.72	5179.56
1676.06	5181.61
1677.91	5181.69
1679.85	5181.31
1689.42	5179.73

1695.55	5179.88
1719.81	5180.46
1722.1	5180.51
1724.26	5180.55
1729.33	5180.77
1736.44	5181.05
1758.17	5181.51
1760.86	5181.57
1763.13	5181.59
1770	5181.77
1776.96	5182
1778.16	5182
1781.4	5182
1786.04	5182
1790.15	5181.96
1792.18	5181.97
1793.61	5181.99
1797.47	5181.99
1801.67	5181.97
1805.2	5181.98
1807.73	5182
1809.68	5182.03
1810.98	5182.03
1812.91	5182
1815.24	5182
1817.46	5182
1820.77	5182
1825.08	5182.06
1827.32	5182.1
1830.04	5182.06
1834	5182.21
1835.24	5182.23
1837.14	5182.32
1847.73	5182.9
1853.36	5183.11
1862.09	5181.97
1863.34	5182
1868.11	5183.18
1878.92	5184
1881.28	5184.04
1882.78	5184.04
1886.78	5184.25
1895.53	5184.46
1902.77	5184.55
1904.49	5184.67
1907.81	5184.94
1915.56	5185.57
1918.57	5185.89

1922.54	5186
1936.83	5187.52
1942.58	5188
1944.05	5188.08
1945.48	5188.13
1980.15	5191.45
1985.49	5192
2003.82	5193.85
2005.48	5194.02
2024.8	5196
2030.13	5196.52
2035.72	5197.07
2041.65	5197.59
2046.56	5198.01
2056.52	5198.85
2066.29	5199.61
2077.93	5200.73
2090.84	5201.99
2097.45	5202.54
2111.64	5204
2118.78	5204.74
2132.35	5206
2146.46	5207.55
2150.18	5208
2163.74	5209.5
2187.21	5212
2196.33	5213.03

Material Boundary

X	Y
430.6	5237.63
430.947	5307.07
431.24	5365.55
431.537	5425
431.537	5449.95
446.545	5454.95
461.554	5460
468.536	5460
491.57	5460
952.795	5320.23
956.93	5318.98
1007.34	5303.73
1420.91	5178.38

Material Boundary

X	Y

325.671	5195.68
377.088	5216.23
430.6	5237.63
461.554	5250
482.872	5250
491.57	5250
601.751	5194.94
610.156	5190.74

Material Boundary

X	Y
0	5193.11
2196.33	5141.83

Material Boundary

X	Y
0	5183.11
2196.33	5131.83

Material Boundary

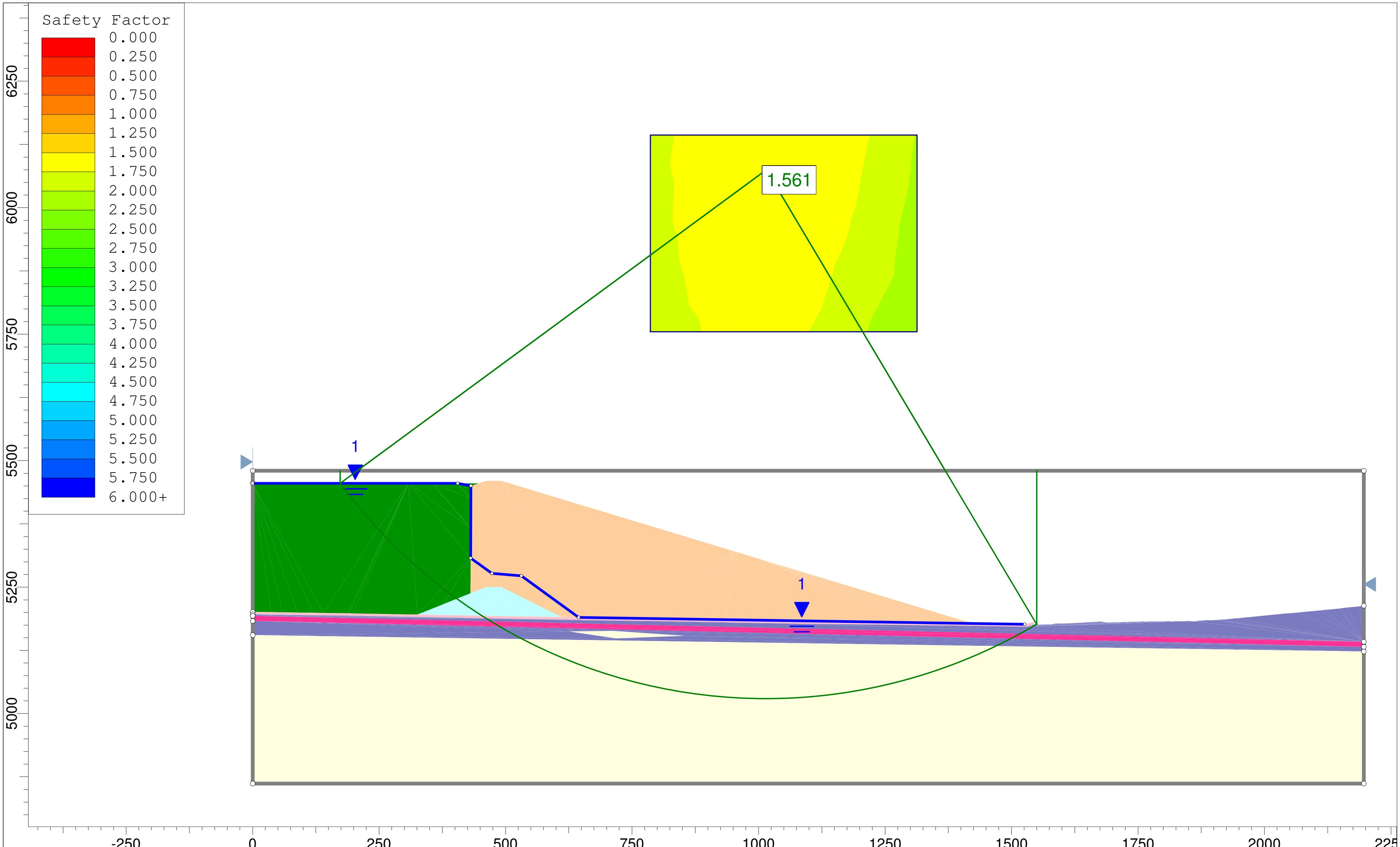
X	Y
0	5154.97
2196.33	5122.6

Material Boundary

X	Y
712.872	5163.35
624.336	5162.59
718.366	5148.52
856.143	5153.54
712.872	5163.35

Material Boundary

X	Y
1544.4	5180.22
1544.53	5175.72



Project	Copper Flat		
Analysis Description	Section B-B' Stability: Downstream, Static, Circular Failure		
Drawn By	GS	Scale	1:3149
Company	Golder Associates Inc.		
Date	11/4/2013, 11:49:04 AM	File Name	3 - Section B 5460R - DS_S_C.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 3 - Section B 5460R - DS_S_C.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section B-B' Stability: Downstream, Static, Circular Failure
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 11:49:04 AM
Comments:

> 103-92557
> Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

> Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Soft Clay	Clay	Cyclone Overflow
Color								
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	127	108
Cohesion [psf]		0	0	150	0			
Friction Angle [deg]		39	29	29	26.5			
Tau/Sigma Ratio								0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated			Automatically Calculated
Ru Value	0		0	0		0	0	

Shear Normal Functions

Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2
3342.09	1156.3

3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8

23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5
43442.1	11023.8

43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

Global Minimums

Method: spencer

FS: 1.560970
Center: 1015.357, 6074.806
Radius: 1045.828
Left Slip Surface Endpoint: 173.020, 5454.947
Right Slip Surface Endpoint: 1550.009, 5175.971
Left Slope Intercept: 173.020 5480.000
Right Slope Intercept: 1550.009 5480.000
Resisting Moment=1.06294e+010 lb-ft
Driving Moment=6.80947e+009 lb-ft
Resisting Horizontal Force=9.56258e+006 lb
Driving Horizontal Force=6.12606e+006 lb

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces: 2506
Number of Invalid Surfaces: 2246

Error Codes:

Error Code -103 reported for 588 surfaces
Error Code -108 reported for 568 surfaces
Error Code -110 reported for 58 surfaces
Error Code -111 reported for 1032 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge

Slice Data

Global Minimum Query (spencer) - Safety Factor: 1.56097

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	76.7812	384179	Cyclone Overflow	421.855	0	270.252	421.855	3388.77	2894.28	494.494
2	76.7812	1.07712e+006	Cyclone Overflow	1183.95	0	758.471	1183.95	10074.5	8108.62	1965.9
3	76.7812	1.63914e+006	Cyclone Overflow	1802.07	0	1154.46	1802.07	16242.9	12337.8	3905.11
4	49.0448	1.33572e+006	Structural Fill Liner Interface	0	29	7124.22	11120.7	20062.4	0	20062.4

			Zone							
6	9.92233	312599	Foundation Materials	150	29	8606.51	13434.5	23965.9	0	23965.9
7	17.4329	567165	Soft Clay	851.163	13.3468	4488.85	7006.95	25946.3	0	25946.3
8	44.5694	1.5136e+006	Foundation Materials	150	29	9663.09	15083.8	26941.3	0	26941.3
9	67.0136	2.36955e+006	Clay	958.267	13.1388	5094.31	7952.07	29962.1	0	29962.1
10	67.0136	2.45379e+006	Clay	1025.15	13.0217	5445.36	8500.05	32321.5	0	32321.5
11	67.0136	2.50548e+006	Clay	1089.15	12.9174	5739.42	8959.07	34313.8	0	34313.8
12	67.0136	2.50972e+006	Clay	1124.79	12.8623	5943.34	9277.38	35704	0	35704
13	67.0136	2.47166e+006	Clay	1148.83	12.8262	6062.3	9463.07	36518	0	36518
14	67.0136	2.39734e+006	Clay	1148.83	12.8262	6103.92	9528.04	36803.3	0	36803.3
15	67.0136	2.28693e+006	Clay	1148.83	12.8262	6063.17	9464.42	36524	0	36524
16	67.0136	2.13981e+006	Clay	1124.79	12.8623	5933.03	9261.28	35633.4	0	35633.4
17	67.0136	1.95593e+006	Clay	1072.75	12.9435	5704.6	8904.71	34077.2	0	34077.2
18	67.0136	1.7351e+006	Clay	1017.45	13.0347	5367	8377.72	31793.1	0	31793.1
19	67.0136	1.47639e+006	Clay	923.265	13.2038	4903.36	7653.99	28688	0	28688
20	67.0136	1.1784e+006	Clay	802.785	13.4506	4288.2	6693.74	24631.1	0	24631.1
21	67.0136	839198	Clay	656.503	13.8133	3481.23	5434.09	19431.3	0	19431.3
22	67.0136	496697	Clay	415.25	14.6733	2204.49	3441.14	11555.9	0	11555.9
23	29.3922	131593	Foundation Materials	150	29	3334.74	5205.43	9120.25	0	9120.25
24	17.8998	52163.6	Soft Clay	192.084	16.2309	1043.45	1628.79	4935.28	0	4935.28
25	32.0382	41314	Foundation Materials	150	29	0	0	-38306.9	0	-38306.9

Interslice Data

Global Minimum Query (spencer) - Safety Factor: 1.56097

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	173.02	5454.95	3.13838e-023	0	0
2	249.802	5362.29	273636	97200.6	19.556
3	326.583	5287.82	965550	342981	19.556
4	403.364	5226.74	1.86896e+006	663889	19.556
5	452.409	5193.42	2.19051e+006	778111	19.556
6	460.564	5188.26	2.26451e+006	804395	19.556
7	470.486	5182.13	2.32639e+006	826376	19.556
8	487.919	5171.72	2.51812e+006	894484	19.556
9	532.488	5147.12	2.72923e+006	969472	19.556
10	599.502	5115.21	3.28961e+006	1.16853e+006	19.556
11	666.515	5088.87	3.69589e+006	1.31285e+006	19.556
12	733.529	5067.67	3.93299e+006	1.39707e+006	19.556
13	800.543	5051.28	3.98821e+006	1.41669e+006	19.556
14	867.556	5039.47	3.85556e+006	1.36957e+006	19.556
15	934.57	5032.1	3.53467e+006	1.25558e+006	19.556
16	1001.58	5029.07	3.03059e+006	1.07652e+006	19.556
17	1068.6	5030.33	2.35334e+006	835950	19.556

18	1135.61	5035.91	1.52056e+006	540130	19.5559
19	1202.62	5045.88	558004	198213	19.5559
20	1269.64	5060.36	-497755	-176812	19.556
21	1336.65	5079.55	-1.59529e+006	-566675	19.5559
22	1403.67	5103.74	-2.6616e+006	-945449	19.556
23	1470.68	5133.3	-3.26006e+006	-1.15803e+006	19.5559
24	1500.07	5148.09	-3.50629e+006	-1.2455e+006	19.556
25	1517.97	5157.67	-3.58004e+006	-1.2717e+006	19.556
26	1550.01	5175.97	4.62169e-021	0	0

List Of Coordinates

Piezoline

X	Y
5.68e-014	5455
405.014	5455
431.537	5450
430.947	5307.07
472.744	5276.98
531.255	5272.32
644.321	5190
1526.22	5176.48

External Boundary

X	Y
2196.33	4861.27
2196.33	5122.6
2196.33	5131.83
2196.33	5141.83
2196.33	5213.03
2196.33	5480
0	5480
5.68434e-014	5454.95
0	5200.91
0	5195.91
0	5193.11
0	5183.11
0	5154.97
0	4861.27

Material Boundary

X	Y
0	5200.91
36.2762	5200.37
58.5636	5200.04

87.9203	5199.6
119.749	5199.12
139.564	5198.83
187.898	5198.1
191.209	5198.05
198.411	5197.94
325.671	5195.68
352.127	5195.21
395.214	5194.44
451.434	5193.44
477.974	5192.93
511.46	5192.3
610.156	5190.74
613.497	5190.69
617.098	5190.63
644.321	5190
655.674	5189.8
692.306	5189.18
745.298	5188.28
762.917	5188
805.444	5187.28
814.51	5187.13
858.316	5186.39
875.648	5186.09
911.187	5185.49
934.659	5185.09
964.059	5184.6
992.27	5184.12
1016.93	5183.7
1051.65	5183.11
1064.32	5182.9
1074.91	5182.72
1281.77	5180.05
1284.77	5180
1300.41	5179.72
1324.81	5179.5
1334.95	5179.32
1357.91	5179.08
1383.32	5178.96
1399.69	5178.64
1420.91	5178.38
1449.11	5178.05
1457.41	5177.99
1463.99	5177.94
1481.34	5177.51
1528.55	5176.42

Material Boundary

X	Y
0	5195.91
36.2013	5195.37
58.4887	5195.04
87.8455	5194.6
119.674	5194.12
139.49	5193.83
187.823	5193.1
191.134	5193.05
198.329	5192.94
352.038	5190.21
395.126	5189.44
451.342	5188.44
477.88	5187.93
511.373	5187.3
613.418	5185.69
617.004	5185.63
644.218	5185
655.588	5184.8
692.222	5184.18
745.216	5183.28
762.837	5183
805.359	5182.28
814.425	5182.13
858.231	5181.39
875.564	5181.09
911.103	5180.49
934.574	5180.09
963.974	5179.6
992.185	5179.12
1016.85	5178.7
1051.56	5178.12
1064.24	5177.9
1074.84	5177.72
1281.7	5175.05
1284.68	5175
1300.34	5174.72
1324.74	5174.5
1334.87	5174.32
1357.87	5174.08
1383.26	5173.96
1399.61	5173.64
1449.07	5173.05
1457.37	5172.99
1463.91	5172.95
1481.22	5172.51
1529.3	5171.41

Material Boundary

X	Y
1528.55	5176.42
1530.07	5176.92
1540.17	5180.24
1544.4	5180.22
1545.81	5180.22
1550.23	5180.21
1558.65	5175.99

Material Boundary

X	Y
1529.3	5171.41
1531.63	5172.17
1540.96	5175.24
1544.53	5175.72

Material Boundary

X	Y
5.68434e-014	5454.95
308.07	5454.95
353.349	5454.95
356.571	5454.95
403.471	5454.95
405.014	5454.95
446.545	5454.95

Material Boundary

X	Y
1544.53	5175.72
1551.96	5176.06
1555.99	5176
1558.65	5175.99
1560.71	5175.98
1562.45	5175.97
1564.47	5175.96
1567.8	5175.98
1568.92	5175.98
1570.4	5176
1572.7	5176.05
1575.12	5176.1
1577.64	5176.05
1584.69	5177.23
1587.52	5178
1589.43	5178

1595.33	5178.02
1598	5178.02
1599.51	5178.02
1601.92	5178.01
1604.21	5178.01
1606.06	5178.02
1611.05	5178.02
1612.65	5178.02
1615.58	5178.03
1624.1	5178.74
1634.72	5179.56
1676.06	5181.61
1677.91	5181.69
1679.85	5181.31
1689.42	5179.73
1695.55	5179.88
1719.81	5180.46
1722.1	5180.51
1724.26	5180.55
1729.33	5180.77
1736.44	5181.05
1758.17	5181.51
1760.86	5181.57
1763.13	5181.59
1770	5181.77
1776.96	5182
1778.16	5182
1781.4	5182
1786.04	5182
1790.15	5181.96
1792.18	5181.97
1793.61	5181.99
1797.47	5181.99
1801.67	5181.97
1805.2	5181.98
1807.73	5182
1809.68	5182.03
1810.98	5182.03
1812.91	5182
1815.24	5182
1817.46	5182
1820.77	5182
1825.08	5182.06
1827.32	5182.1
1830.04	5182.06
1834	5182.21
1835.24	5182.23
1837.14	5182.32

1847.73	5182.9
1853.36	5183.11
1862.09	5181.97
1863.34	5182
1868.11	5183.18
1878.92	5184
1881.28	5184.04
1882.78	5184.04
1886.78	5184.25
1895.53	5184.46
1902.77	5184.55
1904.49	5184.67
1907.81	5184.94
1915.56	5185.57
1918.57	5185.89
1922.54	5186
1936.83	5187.52
1942.58	5188
1944.05	5188.08
1945.48	5188.13
1980.15	5191.45
1985.49	5192
2003.82	5193.85
2005.48	5194.02
2024.8	5196
2030.13	5196.52
2035.72	5197.07
2041.65	5197.59
2046.56	5198.01
2056.52	5198.85
2066.29	5199.61
2077.93	5200.73
2090.84	5201.99
2097.45	5202.54
2111.64	5204
2118.78	5204.74
2132.35	5206
2146.46	5207.55
2150.18	5208
2163.74	5209.5
2187.21	5212
2196.33	5213.03

Material Boundary

X	Y
430.6	5237.63
430.947	5307.07

431.24	5365.55
431.537	5425
431.537	5449.95
446.545	5454.95
461.554	5460
468.536	5460
491.57	5460
952.795	5320.23
956.93	5318.98
1007.34	5303.73
1420.91	5178.38

Material Boundary

X	Y
325.671	5195.68
377.088	5216.23
430.6	5237.63
461.554	5250
482.872	5250
491.57	5250
601.751	5194.94
610.156	5190.74

Material Boundary

X	Y
0	5193.11
2196.33	5141.83

Material Boundary

X	Y
0	5183.11
2196.33	5131.83

Material Boundary

X	Y
0	5154.97
2196.33	5122.6

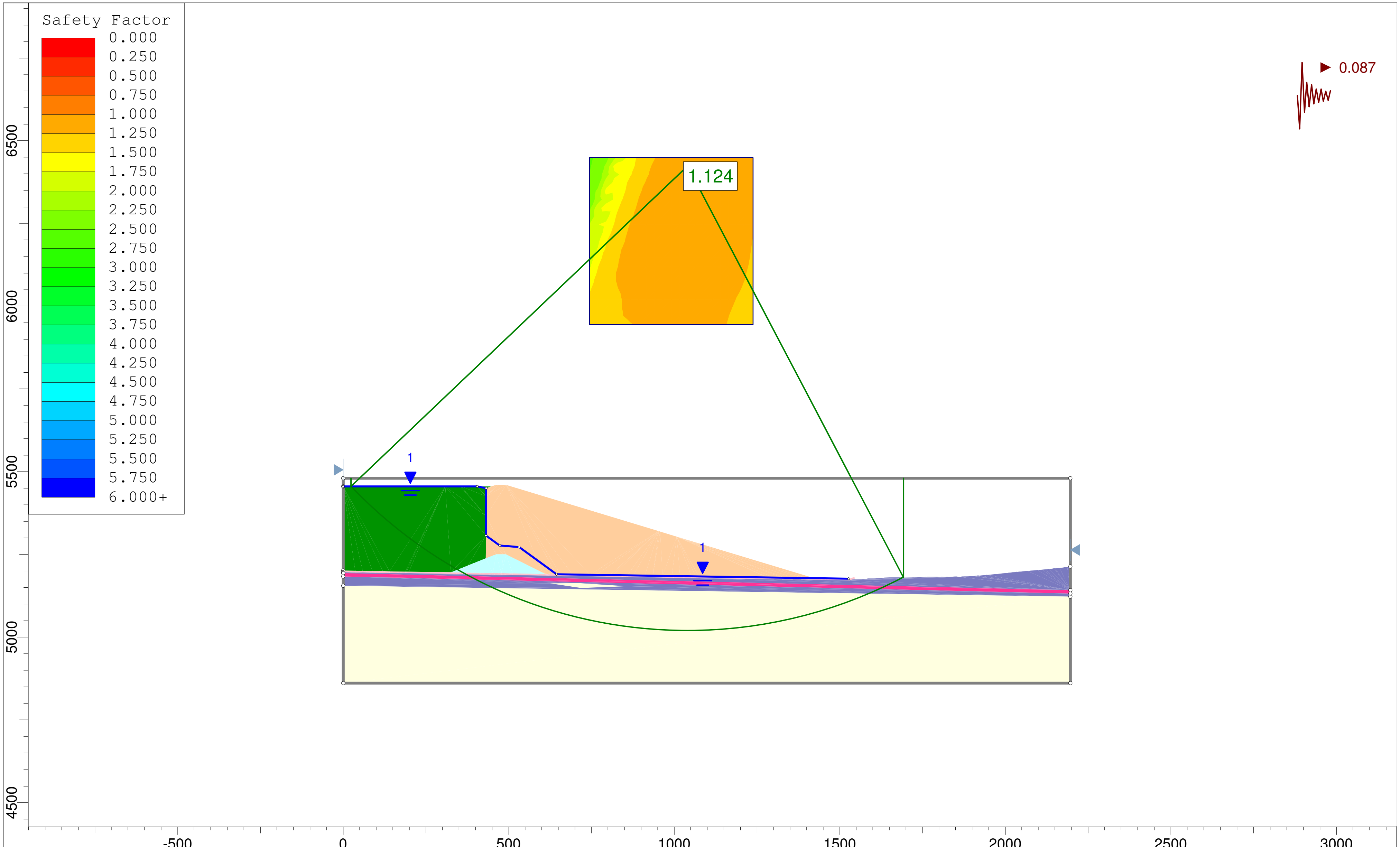
Material Boundary

X	Y
712.872	5163.35
624.336	5162.59
718.366	5148.52
856.143	5153.54

712.872	5163.35

Material Boundary

X	Y
1544.4	5180.22
1544.53	5175.72



Project	Copper Flat		
Analysis Description	Section B-B' Stability: Downstream, Pseudo Static, Circular Failure		
Drawn By GS	*Scale* 1:4812	*Company*	Golder Associates Inc.
Date	11/4/2013, 11:49:04 AM	*File Name*	4 - Section B 5460R - DS_PS_C.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

File Name: 4 - Section B 5460R - DS_PS_C.slim
Slide Modeler Version: 6.008
Project Title: Copper Flat
Analysis: Section B-B' Stability: Downstream, Pseudo Static, Circular Failure
Author: GS
Company: Golder Associates Inc.
Date Created: 11/4/2013, 11:49:04 AM
Comments:

103-92557
Material Property Edits 12/2013

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Soft Clay	Clay	Cyclone Overflow
Color								
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	127	108
Cohesion [psf]		0	0	150	0			
Friction Angle [deg]		39	29	29	26.5			
Tau/Sigma Ratio								0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated			Automatically Calculated
Ru Value	0		0	0		0	0	

Shear Normal Functions

Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2

3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2

24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5
43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4

45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

Global Minimums

Method: spencer

FS: 1.123810
Center: 1040.108, 6423.072
Radius : 1403.939
Left Slip Surface Endpoint : 23.360, 5454.947
Right Slip Surface Endpoint : 1692.275, 5179.801

Left Slope Intercept : 23.360 5480.000
Right Slope Intercept: 1692.275 5480.000
Resisting Moment=1.63529e+010 lb-ft
Driving Moment=1.45513e+010 lb-ft
Resisting Horizontal Force=1.11859e+007 lb
Driving Horizontal Force=9.95361e+006 lb

Valid / Invalid Surfaces

Method: spencer

Number of Valid Surfaces : 2962
Number of Invalid Surfaces : 1889

Error Codes:

Error Code -103 reported for 157 surfaces
Error Code -108 reported for 295 surfaces
Error Code -110 reported for 45 surfaces
Error Code -111 reported for 1392 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).
-110 = The water table or a piezoline does not span the slip region for a given slip surface, when Water Surfaces is specified as the method of pore pressure calculation. If this error occurs, check that the water table or piezoline(s) span the appropriate soil cells.
-111 = safety factor equation did not converge

Slice Data

Global Minimum Query (spencer) - Safety Factor : 1.12381

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	80.3806	338316	Cyclone Overflow	354.754	0	315.671	354.754	2810.07	2435.16	374.913
2	80.3806	966296	Cyclone Overflow	1014.48	0	902.715	1014.48	8202.01	6949.1	1252.91
3	80.3806	1.5053e+006	Cyclone Overflow	1580.74	0	1406.59	1580.74	13358.7	10823.5	2535.17
4	80.3806	1.96936e+006	Cyclone Overflow	2068.26	0	1840.4	2068.26	18204.1	14159.1	4044.96
5	14.7401	408360	Structural Fill	0	29	10033.1	11275.3	20341.2	0	20341.2
6	9.40962	268825	Liner Interface Zone	0	26.5	2406.31	2704.24	21804.5	16380.7	5423.85
7	10.4923	307067	Foundation Materials	150	29	10909.5	12260.2	21847.4	0	21847.4
8	20.0216	607488	Soft Clay	768.583	13.5284	5661.07	6361.96	23247.3	0	23247.3

9	52.3188	1.7336e+006	Foundation Materials	150	29	12811.5	14397.7	25703.6	0	25703.6
10	87.5896	3.31297e+006	Clay	981.666	13.0967	7249.48	8147.04	30799.3	0	30799.3
11	87.5896	3.42764e+006	Clay	1064.65	12.9565	7827.68	8796.82	33608	0	33608
12	87.5896	3.45984e+006	Clay	1124.79	12.8623	8245.76	9266.67	35657	0	35657
13	87.5896	3.42991e+006	Clay	1148.83	12.8262	8547.47	9605.73	37144.6	0	37144.6
14	87.5896	3.32815e+006	Clay	1184.63	12.774	8701.54	9778.88	37907.3	0	37907.3
15	87.5896	3.16781e+006	Clay	1184.63	12.774	8724.24	9804.39	38019.8	0	38019.8
16	87.5896	2.94728e+006	Clay	1166.63	12.8001	8598.76	9663.37	37398.2	0	37398.2
17	87.5896	2.66563e+006	Clay	1131.43	12.8523	8305.25	9333.52	35949.8	0	35949.8
18	87.5896	2.32292e+006	Clay	1064.65	12.9565	7819.93	8788.11	33570.1	0	33570.1
19	87.5896	1.9181e+006	Clay	972.667	13.1128	7106.85	7986.75	30110.9	0	30110.9
20	87.5896	1.44952e+006	Clay	826.586	13.3987	6110.62	6867.18	25358.4	0	25358.4
21	87.5896	1.02444e+006	Clay	594.901	13.9943	4365.68	4906.19	17299	0	17299
22	87.5896	671946	Clay	428.518	14.6125	3167.86	3560.08	12011.5	0	12011.5
23	31.1337	150429	Foundation Materials	150	29	6197.87	6965.23	12295	0	12295
24	20.4885	72741.5	Soft Clay	207.685	16.0664	1567.3	1761.35	5394.65	0	5394.65
25	50.1223	80817.9	Foundation Materials	150	29	0	0	-30536.4	0	-30536.4

Interslice Data

Global Minimum Query (spencer) - Safety Factor : 1.12381

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	23.3603	5454.95	3.13838e-023	0	0
2	103.741	5377	203560	91903.5	24.2983
3	184.122	5310.27	762585	344293	24.2983
4	264.502	5252.82	1.54812e+006	698948	24.2983
5	344.883	5203.36	2.47237e+006	1.11623e+006	24.2983
6	359.623	5195.07	2.52886e+006	1.14174e+006	24.2984
7	369.032	5189.91	2.64233e+006	1.19296e+006	24.2982
8	379.525	5184.25	2.67833e+006	1.20922e+006	24.2984
9	399.546	5173.78	2.8615e+006	1.29191e+006	24.2982
10	451.865	5148.31	3.00094e+006	1.35487e+006	24.2983
11	539.455	5111.44	3.77111e+006	1.70259e+006	24.2983
12	627.044	5081.27	4.31978e+006	1.9503e+006	24.2983
13	714.634	5057.38	4.62901e+006	2.08991e+006	24.2983
14	802.224	5039.43	4.68003e+006	2.11295e+006	24.2983
15	889.813	5027.2	4.46182e+006	2.01443e+006	24.2983
16	977.403	5020.53	3.97363e+006	1.79402e+006	24.2983
17	1064.99	5019.35	3.22395e+006	1.45555e+006	24.2982
18	1152.58	5023.65	2.23282e+006	1.00808e+006	24.2984
19	1240.17	5033.46	1.0351e+006	467329	24.2983
20	1327.76	5048.92	-315412	-142403	24.2983
21	1415.35	5070.21	-1.73811e+006	-784727	24.2984
22	1502.94	5097.62	-2.56212e+006	-1.15675e+006	24.2983
23	1590.53	5131.53	-3.16905e+006	-1.43077e+006	24.2983
24	1621.66	5145.25	-3.50713e+006	-1.5834e+006	24.2982

25	1642.15	5154.77	-3.55818e+006	-1.60645e+006	24.2983
26	1692.27	5179.8	4.50597e-021	0	0

List Of Coordinates

Piezoline

X	Y
5.68e-014	5455
405.014	5455
431.537	5450
430.947	5307.07
472.744	5276.98
531.255	5272.32
644.321	5190
1526.22	5176.48

External Boundary

X	Y
2196.33	4861.27
2196.33	5122.6
2196.33	5131.83
2196.33	5141.83
2196.33	5213.03
2196.33	5480
0	5480
5.68434e-014	5454.95
0	5200.91
0	5195.91
0	5193.11
0	5183.11
0	5154.97
0	4861.27

Material Boundary

X	Y
0	5200.91
36.2762	5200.37
58.5636	5200.04
87.9203	5199.6
119.749	5199.12
139.564	5198.83
187.898	5198.1
191.209	5198.05
198.411	5197.94
325.671	5195.68
352.127	5195.21
395.214	5194.44

451.434	5193.44
477.974	5192.93
511.46	5192.3
610.156	5190.74
613.497	5190.69
617.098	5190.63
644.321	5190
655.674	5189.8
682.306	5189.18
745.298	5188.28
762.917	5188
805.444	5187.28
814.51	5187.13
858.316	5186.39
875.648	5186.09
911.187	5185.49
934.659	5185.09
964.059	5184.6
992.27	5184.12
1016.93	5183.7
1051.65	5183.11
1064.32	5182.9
1074.91	5182.72
1281.77	5180.05
1284.77	5180
1300.41	5179.72
1324.81	5179.5
1334.95	5179.32
1357.91	5179.08
1383.32	5178.96
1399.69	5178.64
1420.91	5178.38
1449.11	5178.05
1457.41	5177.99
1463.99	5177.94
1481.34	5177.51
1528.55	5176.42

Material Boundary

X	Y
0	5195.91
36.2013	5195.37
58.4887	5195.04
87.8455	5194.6
119.674	5194.12
139.49	5193.83
187.823	5193.1
191.134	5193.05
198.329	5192.94
352.038	5190.21

395.126	5189.44
451.342	5188.44
477.88	5187.93
511.373	5187.3
613.418	5185.69
617.004	5185.63
644.218	5185
655.588	5184.8
692.222	5184.18
745.216	5183.28
762.837	5183
805.359	5182.28
814.425	5182.13
858.231	5181.39
875.564	5181.09
911.103	5180.49
934.574	5180.09
963.974	5179.6
992.185	5179.12
1016.85	5178.7
1051.56	5178.12
1064.24	5177.9
1074.84	5177.72
1281.7	5175.05
1284.68	5175
1300.34	5174.72
1324.74	5174.5
1334.87	5174.32
1357.87	5174.08
1383.26	5173.96
1399.61	5173.64
1449.07	5173.05
1457.37	5172.99
1463.91	5172.95
1481.22	5172.51
1529.3	5171.41

Material Boundary

X	Y
1528.55	5176.42
1530.07	5176.92
1540.17	5180.24
1544.4	5180.22
1545.81	5180.22
1550.23	5180.21
1558.65	5175.99

Material Boundary

X	Y

1529.3	5171.41
1531.63	5172.17
1540.96	5175.24
1544.53	5175.72

Material Boundary

X	Y
5.68434e-014	5454.95
308.07	5454.95
353.349	5454.95
356.571	5454.95
403.471	5454.95
405.014	5454.95
446.545	5454.95

Material Boundary

X	Y
1544.53	5175.72
1551.96	5176.06
1555.99	5176
1558.65	5175.99
1560.71	5175.98
1562.45	5175.97
1564.47	5175.96
1567.8	5175.98
1568.92	5175.98
1570.4	5176
1572.7	5176.05
1575.12	5176.1
1577.64	5176.05
1584.69	5177.23
1587.52	5178
1589.43	5178
1595.33	5178.02
1598	5178.02
1599.51	5178.02
1601.92	5178.01
1604.21	5178.01
1606.06	5178.02
1611.05	5178.02
1612.65	5178.02
1615.58	5178.03
1624.1	5178.74
1634.72	5179.56
1676.06	5181.61
1677.91	5181.69
1679.85	5181.31
1689.42	5179.73
1695.55	5179.88

1719.81	5180.46
1722.1	5180.51
1724.26	5180.55
1729.33	5180.77
1736.44	5181.05
1758.17	5181.51
1760.86	5181.57
1763.13	5181.59
1770	5181.77
1776.96	5182
1778.16	5182
1781.4	5182
1786.04	5182
1790.15	5181.96
1792.18	5181.97
1793.61	5181.99
1797.47	5181.99
1801.67	5181.97
1805.2	5181.98
1807.73	5182
1809.68	5182.03
1810.98	5182.03
1812.91	5182
1815.24	5182
1817.46	5182
1820.77	5182
1825.08	5182.06
1827.32	5182.1
1830.04	5182.06
1834	5182.21
1835.24	5182.23
1837.14	5182.32
1847.73	5182.9
1853.36	5183.11
1862.09	5181.97
1863.34	5182
1868.11	5183.18
1878.92	5184
1881.28	5184.04
1882.78	5184.04
1886.78	5184.25
1895.53	5184.46
1902.77	5184.55
1904.49	5184.67
1907.81	5184.94
1915.56	5185.57
1918.57	5185.89
1922.54	5186
1936.83	5187.52
1942.58	5188
1944.05	5188.08

1945.48	5188.13
1980.15	5191.45
1985.49	5192
2003.82	5193.85
2005.48	5194.02
2024.8	5196
2030.13	5196.52
2035.72	5197.07
2041.65	5197.59
2046.56	5198.01
2056.52	5198.85
2066.29	5199.61
2077.93	5200.73
2090.84	5201.99
2097.45	5202.54
2111.64	5204
2118.78	5204.74
2132.35	5206
2146.46	5207.55
2150.18	5208
2163.74	5209.5
2187.21	5212
2196.33	5213.03

Material Boundary

X	Y
430.6	5237.63
430.947	5307.07
431.24	5365.55
431.537	5425
431.537	5449.95
446.545	5454.95
461.554	5460
468.536	5460
491.57	5460
952.795	5320.23
956.93	5318.98
1007.34	5303.73
1420.91	5178.38

Material Boundary

X	Y
325.671	5195.68
377.088	5216.23
430.6	5237.63
461.554	5250
482.872	5250
491.57	5250
601.751	5194.94

610.156	5190.74

Material Boundary

X	Y
0	5193.11
2196.33	5141.83

Material Boundary

X	Y
0	5183.11
2196.33	5131.83

Material Boundary

X	Y
0	5154.97
2196.33	5122.6

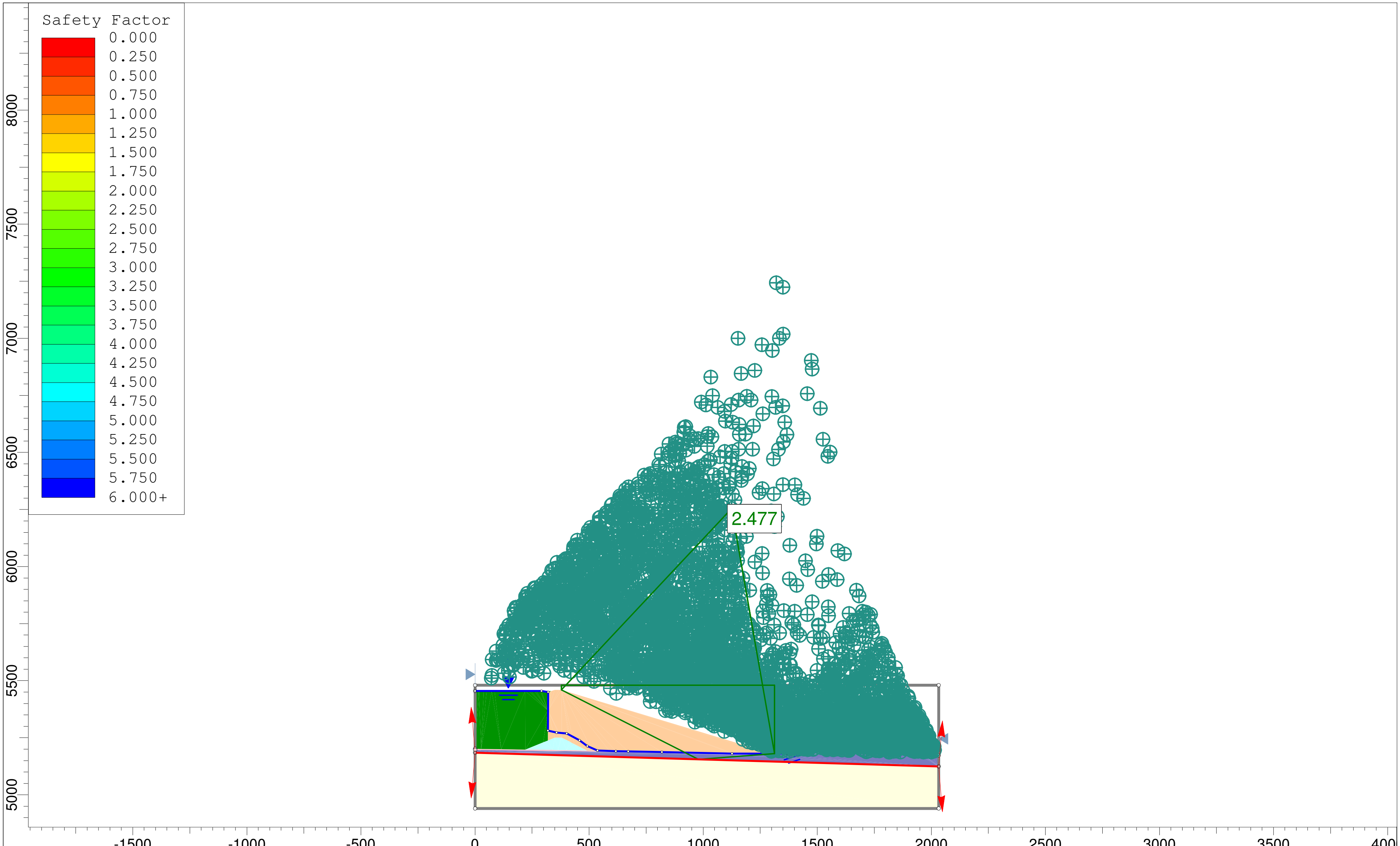
Material Boundary

X	Y
712.872	5163.35
624.336	5162.59
718.366	5148.52
856.143	5153.54
712.872	5163.35

Material Boundary

X	Y
1544.4	5180.22
1544.53	5175.72

APPENDIX H.3
STABILITY SECTION D-D’



Project	Copper Flat		
Analysis Description	Section D-D' Stability: Downstream, Static, Block Failure		
Drawn By GS	*Scale* 1:6984	*Company*	Golder Associates
Date	11/4/2013, 1:11:49 PM	*File Name*	1 - Section D 5460R - DS_S_B.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

- File Name: 1 - Section D 5460R - DS_S_B.slim
- Last saved with Slide version: 6.008
- Project Title: Copper Flat
- Analysis: Section D-D' Stability: Downstream, Static, Block Failure
- Author: GS
- Company: Golder Associates
- Date Created: 11/4/2013, 1:11:49 PM
- Comments:
    - 103-92557
    - Material Property Edits 12/2013

General Settings

- Units of Measurement: Imperial Units
- Time Units: days
- Permeability Units: feet/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Spencer

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 62.4 lbs/ft3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Non-Circular Block Search
- Number of Surfaces: 5000
- Pseudo-Random Surfaces: Enabled
- Convex Surfaces Only: Disabled
- Left Projection Angle (Start Angle): 95
- Left Projection Angle (End Angle): 265
- Right Projection Angle (Start Angle): 85
- Right Projection Angle (End Angle): -85
- Minimum Elevation: Not Defined
- Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Clay	Cyclone Overflow
Color							
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	108
Cohesion [psf]		0	0	150	0		
Friction Angle [deg]		39	29	29	26.5		
Tau/Sigma							0.2

Ratio							
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated		Automatically Calculated
Ru Value	0		0	0		0	

Shear Normal Functions

- Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2
3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7

40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5
43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

List Of Coordinates

Piezoline

X	Y
-8.88178e-016	5455
291.649	5455
319.83	5450
319.649	5281.62
357.393	5272.94
401.861	5268.39
458.094	5238.85
491.717	5213.7
536.883	5193.72
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1279.93	5180.24
1353.21	5180.5
1354	5180.55
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1388.41	5182.87

Block Search Lines

X	Y
0	5184.09
2031.79	5123.76

External Boundary

X	Y
2031.79	4940
2031.79	5123.76
2031.79	5123.76
2031.79	5172.24
2031.79	5172.24
2031.79	5480
0	5480
-8.88178e-016	5455
-3.55271e-015	5201.58
-3.55271e-015	5201.58
-7.10543e-015	5196.58
-7.10543e-015	5196.58
0	5184.09
0	5184.09
0	4940

Material Boundary

X	Y
1406.35	5183.84
1408.84	5183.95
1410.54	5184.06
1414.71	5184.02
1418.24	5184
1421.09	5183.84
1426.9	5183.53
1435.44	5183.45
1446.75	5183.04

1450.41	5182.94
1453.47	5182.87
1477.47	5182.4
1490.36	5182.08
1497.22	5182.06
1503.44	5182.02
1504.84	5182.01
1506.36	5181.99
1507.61	5181.99
1539.7	5181.03
1562.99	5180.38
1590.77	5179.52
1604.77	5179.2
1626.36	5179.14
1657.9	5178.67
1691.72	5178.02
1694.27	5178.02
1699.51	5178
1701.22	5177.98
1702.96	5177.97
1709.66	5177.96
1721.49	5177.64
1740.86	5177.19
1748.22	5177.04
1762.45	5176.63
1778.98	5176.04
1786.55	5175.98
1791.65	5175.94
1792.96	5175.93
1802.43	5175.92
1809.8	5175.69
1828.02	5175.27
1831.2	5175.26
1834.51	5175.24
1842.98	5175.12
1849.95	5175.02
1853.03	5175.01
1856.22	5174.99
1878.02	5174.81
1913.35	5174.36
1921.87	5174.26
1934.29	5174.01
1945.09	5173.97
1947.38	5173.97
1949.12	5173.96
1950.59	5173.96
1961.99	5173.92
1965.58	5173.92
1968.23	5173.92
1981.99	5173.38
1998.24	5173.03
2031.79	5172.24

Material Boundary

X	Y
318.893	5237.63
319.552	5369.37
319.83	5450
325.925	5452.03
334.831	5455
349.832	5460
369.265	5460
379.833	5460
1302.77	5180.32

Material Boundary

X	Y
-3.55271e-015	5201.58
26.3295	5201.18
114.486	5199.85
220.393	5198.23
229.978	5198.08
339.831	5196.4
363.815	5196.12
399.834	5195.69
458.245	5194.82
491.186	5194.33
513.77	5193.99
588.916	5192.09
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1137.58	5179.74
1279.93	5180.24
1302.77	5180.32
1345.35	5180.47
1353.6	5180.52
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1387.79	5182.66
1392.43	5184.19
1403.23	5187.77
1406.35	5187.77
1413.26	5187.76
1416.88	5185.95
1418.29	5185.25
1421.09	5183.84

Material Boundary

X	Y
-7.10543e-015	5196.58
26.2539	5196.18
114.41	5194.85
229.902	5193.08
339.764	5191.4
363.756	5191.12
399.767	5190.69
458.17	5189.82
513.67	5188.99
588.796	5187.09
617.104	5186.46
671.463	5185.23
818.576	5181.92
1126.37	5175
1137.53	5174.74
1279.95	5175.24

1345.37	5175.47
1353.84	5175.53
1368.19	5176.44
1376.37	5176.96
1380.17	5177.05
1385.31	5177.07
1386.81	5177.14
1389.36	5177.91
1394	5179.45
1404.03	5182.77
1406.35	5182.77

Material Boundary

X	Y
220.393	5198.23
299.17	5229.74
318.893	5237.63
349.832	5250
375.024	5250
379.833	5250
413.352	5233.24
421.524	5229.16
434.805	5222.52
491.186	5194.33

Material Boundary

X	Y
-8.88178e-016	5455
3.52609	5455
16.375	5455
38.2237	5455
50.9444	5455
72.93	5455
85.5063	5455
219.596	5455
235.945	5455
243.614	5455
261.097	5455

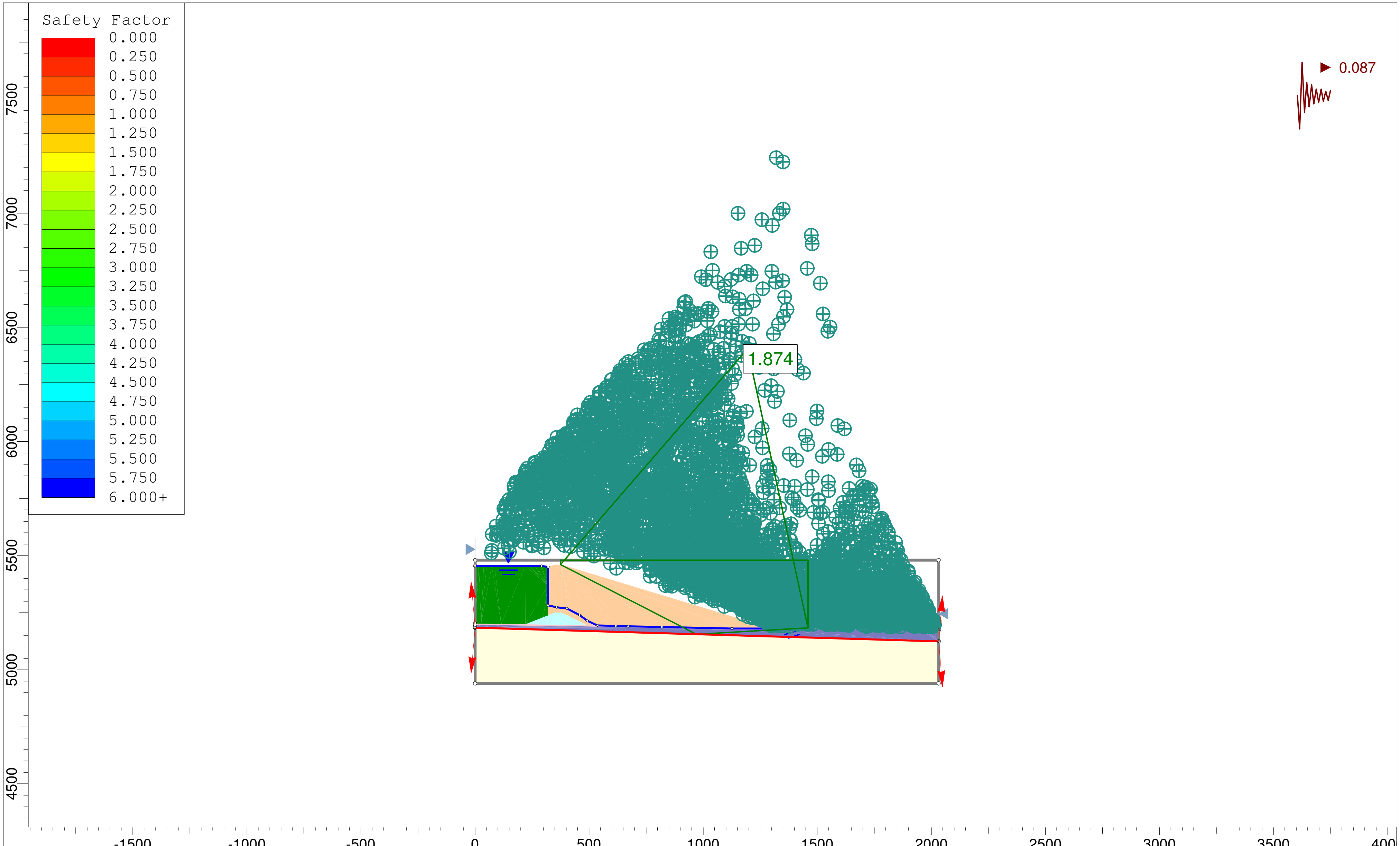
267.631	5455
286.669	5455
291.649	5455
312.952	5455
315.667	5455
334.831	5455

Material Boundary

X	Y
1406.35	5182.77
1406.35	5183.84
1406.35	5187.77

Material Boundary

X	Y
0	5184.09
2031.79	5123.76



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Project	Copper Flat		
Analysis Description	Section D-D' Stability: Downstream, Pseudo Static, Block Failure		
Drawn By GS	*Scale* 1:6984	*Company*	Golder Associates
Date	11/4/2013, 1:11:49 PM	*File Name*	2 - Section D 5460R - DS_PS_B.slim

SLIDEINTERPRET 6.008

Slide Analysis Information

Copper Flat

Project Summary

- File Name: 2 - Section D 5460R - DS_PS_B.slim
- Last saved with Slide version: 6.008
- Project Title: Copper Flat
- Analysis: Section D-D' Stability: Downstream, Pseudo Static, Block Failure
- Author: GS
- Company: Golder Associates
- Date Created: 11/4/2013, 1:11:49 PM
- Comments:

  - 103-92557
  - Material properties edits 12/2013

General Settings

- Units of Measurement: Imperial Units
- Time Units: days
- Permeability Units: feet/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

  - Spencer

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 62.4 lbs/ft3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Non-Circular Block Search
- Number of Surfaces: 5000
- Pseudo-Random Surfaces: Enabled
- Convex Surfaces Only: Disabled
- Left Projection Angle (Start Angle): 95
- Left Projection Angle (End Angle): 265
- Right Projection Angle (Start Angle): 85
- Right Projection Angle (End Angle): -85
- Minimum Elevation: Not Defined
- Minimum Depth: Not Defined

Loading

- Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Clay	Cyclone Overflow
Color							
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Strength=F(overburden)
Unit Weight	1e-025	113	120	120	120	127	108

[lbs/ft3]							
Cohesion [psf]		0	0	150	0		
Friction Angle [deg]		39	29	29	26.5		
Tau/Sigma Ratio							0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated		Automatically Calculated
Ru Value	0		0	0		0	

Shear Normal Functions

- Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2
3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2

32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5
43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

List Of Coordinates

Piezoline

X	Y
-8.88178e-016	5455
291.649	5455
319.83	5450
319.649	5281.62
357.393	5272.94
401.861	5268.39
458.094	5238.85
491.717	5213.7
536.883	5193.72
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1279.93	5180.24
1353.21	5180.5
1354	5180.55
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1388.41	5182.87

Block Search Lines

X	Y
0	5184.09
2031.79	5123.76

External Boundary

X	Y
2031.79	4940
2031.79	5123.76
2031.79	5123.76
2031.79	5172.24
2031.79	5172.24
2031.79	5480
0	5480
-8.88178e-016	5455
-3.55271e-015	5201.58
-3.55271e-015	5201.58
-7.10543e-015	5196.58

-7.10543e-015	5196.58
0	5184.09
0	5184.09
0	4940

Material Boundary

X	Y
1406.35	5183.84
1408.84	5183.95
1410.54	5184.06
1414.71	5184.02
1418.24	5184
1421.09	5183.84
1426.9	5183.53
1435.44	5183.45
1446.75	5183.04
1450.41	5182.94
1453.47	5182.87
1477.47	5182.4
1490.36	5182.08
1497.22	5182.06
1503.44	5182.02
1504.84	5182.01
1506.36	5181.99
1507.61	5181.99
1539.7	5181.03
1562.99	5180.38
1590.77	5179.52
1604.77	5179.2
1626.36	5179.14
1657.9	5178.67
1691.72	5178.02
1694.27	5178.02
1699.51	5178
1701.22	5177.98
1702.96	5177.97
1709.66	5177.96
1721.49	5177.64
1740.86	5177.19
1748.22	5177.04
1762.45	5176.63
1778.98	5176.04
1786.55	5175.98
1791.65	5175.94
1792.96	5175.93
1802.43	5175.92
1809.8	5175.69
1828.02	5175.27
1831.2	5175.26
1834.51	5175.24
1842.98	5175.12
1849.95	5175.02
1853.03	5175.01
1856.22	5174.99
1878.02	5174.81
1913.35	5174.36
1921.87	5174.26
1934.29	5174.01
1945.09	5173.97
1947.38	5173.97
1949.12	5173.96
1950.59	5173.96
1961.99	5173.92
1965.58	5173.92
1968.23	5173.92
1981.99	5173.38
1998.24	5173.03
2031.79	5172.24

Material Boundary

X	Y
318.893	5237.63
319.552	5369.37
319.83	5450
325.925	5452.03
334.831	5455
349.832	5460
369.265	5460
379.833	5460
1302.77	5180.32

Material Boundary

X	Y
-3.55271e-015	5201.58
26.3295	5201.18
114.486	5199.85
220.393	5198.23
229.978	5198.08
339.831	5196.4
363.815	5196.12
399.834	5195.69
458.245	5194.82
491.186	5194.33
513.77	5193.99
588.916	5192.09
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1137.58	5179.74
1279.93	5180.24
1302.77	5180.32
1345.35	5180.47
1353.6	5180.52
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1387.79	5182.66
1392.43	5184.19
1403.23	5187.77
1406.35	5187.77
1413.26	5187.76
1416.88	5185.95
1418.29	5185.25
1421.09	5183.84

Material Boundary

X	Y
-7.10543e-015	5196.58
26.2539	5196.18
114.41	5194.85
229.902	5193.08
339.764	5191.4
363.756	5191.12
399.767	5190.69
458.17	5189.82
513.67	5188.99
588.796	5187.09
617.104	5186.46
671.463	5185.23
818.576	5181.92
1126.37	5175
1137.53	5174.74
1279.95	5175.24
1345.37	5175.47
1353.84	5175.53
1368.19	5176.44
1376.37	5176.96
1380.17	5177.05
1385.31	5177.07
1386.81	5177.14
1389.36	5177.91
1394	5179.45
1404.03	5182.77
1406.35	5182.77

Material Boundary

X	Y
220.393	5198.23
299.17	5229.74
318.893	5237.63
349.832	5250
375.024	5250
379.833	5250
413.352	5233.24
421.524	5229.16
434.805	5222.52

491.186	5194.33

Material Boundary

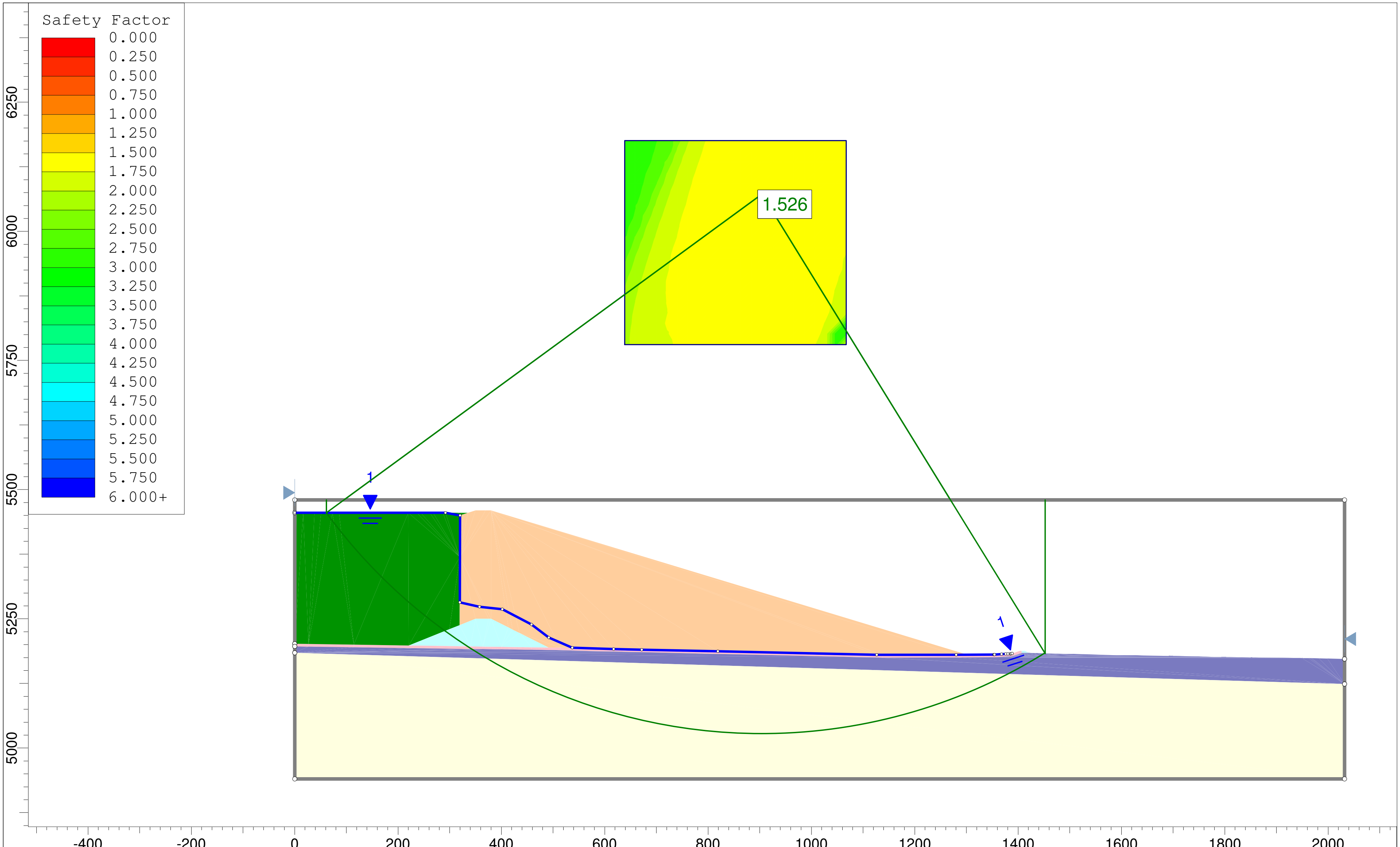
X	Y
-8.88178e-016	5455
3.52609	5455
16.375	5455
38.2237	5455
50.9444	5455
72.93	5455
85.5063	5455
219.596	5455
235.945	5455
243.614	5455
261.097	5455
267.631	5455
286.669	5455
291.649	5455
312.952	5455
315.667	5455
334.831	5455

Material Boundary

X	Y
1406.35	5182.77
1406.35	5183.84
1406.35	5187.77

Material Boundary

X	Y
0	5184.09
2031.79	5123.76



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SLIDEINTERPRET 6.008

Project	Copper Flat
Analysis Description	Section D-D' Stability: Downstream, Static, Circular Failure
Drawn By GS	*Scale* 1:3083
Company	Golder Associates
Date	11/4/2013, 1:11:49 PM
File Name	3 - Section D 5460R - DS_S_C.slim

Slide Analysis Information

Copper Flat

Project Summary

- File Name: 3 - Section D 5460R - DS_S_C.slim
- Last saved with Slide version: 6.008
- Project Title: Copper Flat
- Analysis: Section D-D' Stability: Downstream, Static, Circular Failure
- Author: GS
- Company: Golder Associates
- Date Created: 11/4/2013, 1:11:49 PM
- Comments:
    - 103-92557
    - Material Property Edits 12/2013

General Settings

- Units of Measurement: Imperial Units
- Time Units: days
- Permeability Units: feet/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Spencer

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 62.4 lbs/ft3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Grid Search
- Radius Increment: 10
- Composite Surfaces: Disabled
- Reverse Curvature: Create Tension Crack
- Minimum Elevation: Not Defined
- Minimum Depth: Not Defined

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Clay	Cyclone Overflow
Color							
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	108
Cohesion [psf]		0	0	150	0		
Friction Angle [deg]		39	29	29	26.5		
Tau/Sigma Ratio							0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	Piezometric Line 1

Hu Value	Automatically Calculated		Automatically Calculated		Automatically Calculated
Ru Value	0	0	0	0	

Shear Normal Functions

- Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2
3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8
36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5

43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

List Of Coordinates

Piezoline

X	Y
-8.88178e-016	5455
291.649	5455
319.83	5450
319.649	5281.62
357.393	5272.94
401.861	5268.39
458.094	5238.85
491.717	5213.7
536.883	5193.72
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1279.93	5180.24
1353.21	5180.5
1354	5180.55
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1388.41	5182.87

Block Search Lines

X	Y
0	5184.09
2031.79	5123.76

External Boundary

X	Y
2031.79	4940
2031.79	5123.76
2031.79	5123.76
2031.79	5172.24
2031.79	5172.24
2031.79	5480
0	5480
-8.88178e-016	5455
-3.55271e-015	5201.58
-3.55271e-015	5201.58
-7.10543e-015	5196.58
-7.10543e-015	5196.58
0	5184.09
0	5184.09
0	4940

Material Boundary

X	Y
1406.35	5183.84
1408.84	5183.95
1410.54	5184.06
1414.71	5184.02
1418.24	5184
1421.09	5183.84
1426.9	5183.53
1435.44	5183.45
1446.75	5183.04
1450.41	5182.94
1453.47	5182.87
1477.47	5182.4
1490.36	5182.08
1497.22	5182.06
1503.44	5182.02
1504.84	5182.01

1506.36	5181.99
1507.61	5181.99
1539.7	5181.03
1562.99	5180.38
1590.77	5179.52
1604.77	5179.2
1626.36	5179.14
1657.9	5178.67
1691.72	5178.02
1694.27	5178.02
1699.51	5178
1701.22	5177.98
1702.96	5177.97
1709.66	5177.96
1721.49	5177.64
1740.86	5177.19
1748.22	5177.04
1762.45	5176.63
1778.98	5176.04
1786.55	5175.98
1791.65	5175.94
1792.96	5175.93
1802.43	5175.92
1809.8	5175.69
1828.02	5175.27
1831.2	5175.26
1834.51	5175.24
1842.98	5175.12
1849.95	5175.02
1853.03	5175.01
1856.22	5174.99
1878.02	5174.81
1913.35	5174.36
1921.87	5174.26
1934.29	5174.01
1945.09	5173.97
1947.38	5173.97
1949.12	5173.96
1950.59	5173.96
1961.99	5173.92
1965.58	5173.92
1968.23	5173.92
1981.99	5173.38
1998.24	5173.03
2031.79	5172.24

Material Boundary

X	Y
318.893	5237.63
319.552	5369.37
319.83	5450
325.925	5452.03
334.831	5455
349.832	5460
369.265	5460
379.833	5460
1302.77	5180.32

Material Boundary

X	Y
-3.55271e-015	5201.58
26.3295	5201.18
114.486	5199.85
220.393	5198.23
229.978	5198.08
339.831	5196.4
363.815	5196.12
399.834	5195.69
458.245	5194.82
491.186	5194.33
513.77	5193.99
588.916	5192.09
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1137.58	5179.74
1279.93	5180.24
1302.77	5180.32
1345.35	5180.47
1353.6	5180.52
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1387.79	5182.66
1392.43	5184.19
1403.23	5187.77
1406.35	5187.77
1413.26	5187.76
1416.88	5185.95
1418.29	5185.25
1421.09	5183.84

Material Boundary

X	Y
-7.10543e-015	5196.58
26.2539	5196.18
114.41	5194.85
229.902	5193.08
339.764	5191.4
363.756	5191.12
399.767	5190.69
458.17	5189.82
513.67	5188.99
588.796	5187.09
617.104	5186.46
671.463	5185.23
818.576	5181.92
1126.37	5175
1137.53	5174.74
1279.95	5175.24
1345.37	5175.47
1353.84	5175.53
1368.19	5176.44
1376.37	5176.96
1380.17	5177.05
1385.31	5177.07
1386.81	5177.14

1389.36	5177.91
1394	5179.45
1404.03	5182.77
1406.35	5182.77

Material Boundary

X	Y
1406.35	5182.77
1406.35	5183.84
1406.35	5187.77

Material Boundary

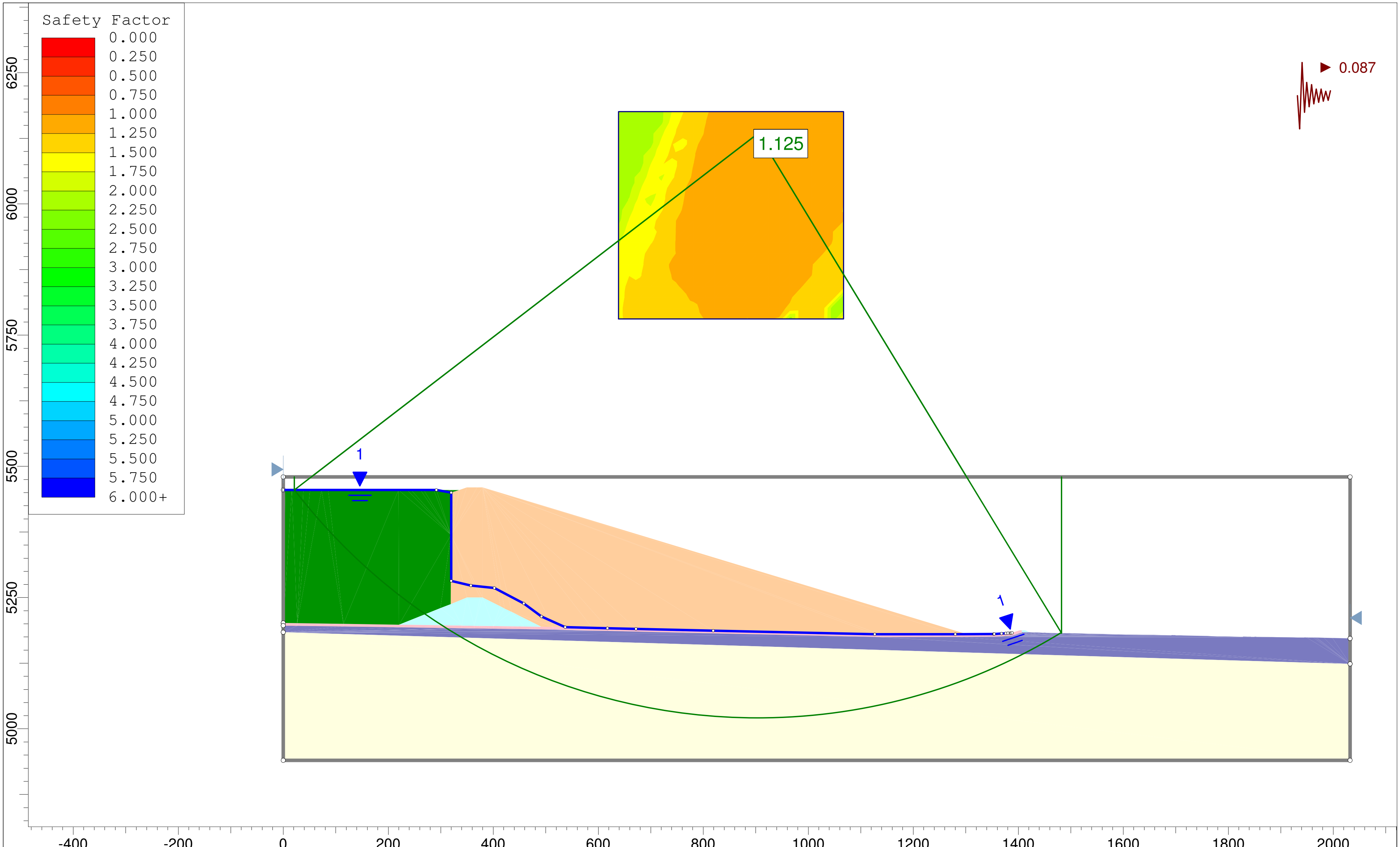
X	Y
220.393	5198.23
299.17	5229.74
318.893	5237.63
349.832	5250
375.024	5250
379.833	5250
413.352	5233.24
421.524	5229.16
434.805	5222.52
491.186	5194.33

Material Boundary

X	Y
0	5184.09
2031.79	5123.76

Material Boundary

X	Y
-8.88178e-016	5455
3.52609	5455
16.375	5455
38.2237	5455
50.9444	5455
72.93	5455
85.5063	5455
219.596	5455
235.945	5455
243.614	5455
261.097	5455
267.631	5455
286.669	5455
291.649	5455
312.952	5455
315.667	5455
334.831	5455



SLIDEINTERPRET 6.008

Project	Copper Flat
Analysis Description	Section D-D' Stability: Downstream, Pseudo Static, Circular Failure
Drawn By	GS
Scale	1:3035
Company	Golder Associates
Date	11/4/2013, 1:11:49 PM
File Name	4 - Section D 5460R - DS_PS_C.slim

Slide Analysis Information

Copper Flat

Project Summary

- File Name: 4 - Section D 5460R - DS_PS_C.slim
- Last saved with Slide version: 6.008
- Project Title: Copper Flat
- Analysis: Section D-D' Stability: Downstream, Pseudo Static, Circular Failure
- Author: GS
- Company: Golder Associates
- Date Created: 11/4/2013, 1:11:49 PM
- Comments:
    - 103-92557
    - Material Property Edits 12/2013

General Settings

- Units of Measurement: Imperial Units
- Time Units: days
- Permeability Units: feet/second
- Failure Direction: Left to Right
- Data Output: Standard
- Maximum Material Properties: 20
- Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

- Spencer

- Number of slices: 50
- Tolerance: 0.005
- Maximum number of iterations: 50
- Check malpha < 0.2: Yes
- Initial trial value of FS: 1
- Steffensen Iteration: Yes

Groundwater Analysis

- Groundwater Method: Water Surfaces
- Pore Fluid Unit Weight: 62.4 lbs/ft3
- Advanced Groundwater Method: None

Random Numbers

- Pseudo-random Seed: 10116
- Random Number Generation Method: Park and Miller v.3

Surface Options

- Surface Type: Circular
- Search Method: Grid Search
- Radius Increment: 10
- Composite Surfaces: Disabled
- Reverse Curvature: Create Tension Crack
- Minimum Elevation: Not Defined
- Minimum Depth: Not Defined

Loading

- Seismic Load Coefficient (Horizontal): 0.087

Material Properties

Property	Air	Cyclone Underflow	Structural Fill	Foundation Materials	Liner Interface Zone	Clay	Cyclone Overflow
Color							
Strength Type	No strength	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Shear Normal function	Strength=F(overburden)
Unit Weight [lbs/ft3]	1e-025	113	120	120	120	127	108
Cohesion [psf]		0	0	150	0		

Friction Angle [deg]		39	29	29	26.5		
Tau/Sigma Ratio							0.2
Water Surface	None	Piezometric Line 1	None	None	Piezometric Line 1	None	Piezometric Line 1
Hu Value		Automatically Calculated			Automatically Calculated		Automatically Calculated
Ru Value	0		0	0		0	

Shear Normal Functions

- Name: User Defined 1

Normal (psf)	Shear (psf)
0.417709	0.4
418.126	186
835.835	342
1253.54	488.3
1671.25	628.8
2088.96	765
2506.67	897.9
2924.38	1028.2
3342.09	1156.3
3759.8	1282.4
4177.5	1406.8
4595.21	1529.8
5012.92	1651.4
5430.63	1771.7
5848.34	1891
6266.05	2009.2
6683.76	2126.5
7101.46	2242.9
7519.17	2358.5
7936.88	2473.3
8354.59	2587.3
8772.3	2700.7
9190.01	2813.5
9607.72	2925.6
10025.4	3037.1
10443.1	3148.1
10860.8	3258.5
11278.5	3368.5
11696.3	3477.9
12114	3586.8
12531.7	3695.4
12949.4	3803.4
13367.1	3911.1
13784.8	4018.3
14202.5	4125.2
14620.2	4231.7
15037.9	4337.8
15455.6	4443.5
15873.3	4548.9
16291.1	4654
16708.8	4758.8
17126.5	4863.2
17544.2	4967.3
17961.9	5071.1
18379.6	5174.7
18797.3	5277.9
19215	5380.9
19632.7	5483.6
20050.4	5586.1
20468.1	5688.2
20885.8	5790.2
21303.6	5891.9
21721.3	5993.3
22139	6094.5
22556.7	6195.5
22974.4	6296.3
23392.1	6396.8
23809.8	6497.1
24227.5	6597.2
24645.2	6697.1
25062.9	6796.8
25480.6	6896.3
25898.4	6995.6
26316.1	7094.7
26733.8	7193.6
27151.5	7292.4
27569.2	7390.9
27986.9	7489.3
28404.6	7587.5
28822.3	7685.5
29240	7783.3
29657.7	7881
30075.4	7978.5
30493.1	8075.8
30910.9	8173
31328.6	8270
31746.3	8366.9
32164	8463.6
32581.7	8560.2
32999.4	8656.6
33417.1	8752.9
33834.8	8849
34252.5	8945
34670.2	9040.8
35087.9	9136.5
35505.6	9232.1
35923.4	9327.5
36341.1	9422.8

36758.8	9517.9
37176.5	9613
37594.2	9707.9
38011.9	9802.6
38429.6	9897.3
38847.3	9991.8
39265	10086.2
39682.7	10180.5
40100.4	10274.7
40518.2	10368.7
40935.9	10462.6
41353.6	10556.4
41771.3	10650.1
42189	10743.7
42606.7	10837.2
43024.4	10930.5
43442.1	11023.8
43859.8	11116.9
44277.5	11210
44695.2	11302.9
45112.9	11395.7
45530.7	11488.4
45948.4	11581
46366.1	11673.6
46783.8	11766
47201.5	11858.3
47619.2	11950.5
48036.9	12042.6
48454.6	12134.7
48872.3	12226.6
49290	12318.4
49707.7	12410.2
50125.4	12501.8
50543.2	12593.4
50960.9	12684.8
51378.6	12776.2
51796.3	12867.5
52214	12958.7
52631.7	13049.8
53049.4	13140.8
53467.1	13231.7
53884.8	13322.6
54302.5	13413.3
54720.2	13504
55138	13594.6
55555.7	13685.1
55973.4	13775.5
56391.1	13865.9
56808.8	13956.1
57226.5	14046.3
57644.2	14136.4
58061.9	14226.5
58479.6	14316.4
58897.3	14406.3
59315	14496.1
59732.7	14585.8
60150.5	14675.5
60568.2	14765
60985.9	14854.5
61403.6	14943.9
61821.3	15033.3
62239	15122.6
62656.7	15211.8

List Of Coordinates

Piezoline

X	Y
-8.88178e-016	5455
291.649	5455
319.83	5450
319.649	5281.62
357.393	5272.94
401.861	5268.39
458.094	5238.85
491.717	5213.7
536.883	5193.72
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1279.93	5180.24
1353.21	5180.5
1354	5180.55
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1388.41	5182.87

Block Search Lines

X	Y
0	5184.09
2031.79	5123.76

External Boundary

X	Y
2031.79	4940
2031.79	5123.76
2031.79	5123.76
2031.79	5172.24
2031.79	5172.24
2031.79	5480
0	5480
-8.88178e-016	5455
-3.55271e-015	5201.58
-3.55271e-015	5201.58
-7.10543e-015	5196.58
-7.10543e-015	5196.58
0	5184.09
0	5184.09
0	4940

Material Boundary

X	Y

1406.35	5183.84
1408.84	5183.95
1410.54	5184.06
1414.71	5184.02
1418.24	5184
1421.09	5183.84
1426.9	5183.53
1435.44	5183.45
1446.75	5183.04
1450.41	5182.94
1453.47	5182.87
1477.47	5182.4
1490.36	5182.08
1497.22	5182.06
1503.44	5182.02
1504.84	5182.01
1506.36	5181.99
1507.61	5181.99
1539.7	5181.03
1562.99	5180.38
1590.77	5179.52
1604.77	5179.2
1626.36	5179.14
1657.9	5178.67
1691.72	5178.02
1694.27	5178.02
1699.51	5178
1701.22	5177.98
1702.96	5177.97
1709.66	5177.96
1721.49	5177.64
1740.86	5177.19
1748.22	5177.04
1762.45	5176.63
1778.98	5176.04
1786.55	5175.98
1791.65	5175.94
1792.96	5175.93
1802.43	5175.92
1809.8	5175.69
1828.02	5175.27
1831.2	5175.26

1834.51	5175.24
1842.98	5175.12
1849.95	5175.02
1853.03	5175.01
1856.22	5174.99
1878.02	5174.81
1913.35	5174.36
1921.87	5174.26
1934.29	5174.01
1945.09	5173.97
1947.38	5173.97
1949.12	5173.96
1950.59	5173.96
1961.99	5173.92
1965.58	5173.92
1968.23	5173.92
1981.99	5173.38
1998.24	5173.03
2031.79	5172.24

Material Boundary

X	Y
318.893	5237.63
319.552	5369.37
319.83	5450
325.925	5452.03
334.831	5455
349.832	5460
369.265	5460
379.833	5460
1302.77	5180.32

Material Boundary

X	Y
-3.55271e-015	5201.58
26.3295	5201.18
114.486	5199.85
220.393	5198.23

229.978	5198.08
339.831	5196.4
363.815	5196.12
399.834	5195.69
458.245	5194.82
491.186	5194.33
513.77	5193.99
588.916	5192.09
617.217	5191.45
671.576	5190.23
818.688	5186.92
1126.48	5180
1137.58	5179.74
1279.93	5180.24
1302.77	5180.32
1345.35	5180.47
1353.6	5180.52
1367.88	5181.43
1376.15	5181.96
1380.11	5182.05
1385.14	5182.07
1386.21	5182.14
1387.79	5182.66
1392.43	5184.19
1403.23	5187.77
1406.35	5187.77
1413.26	5187.76
1416.88	5185.95
1418.29	5185.25
1421.09	5183.84

Material Boundary

X	Y
-7.10543e-015	5196.58
26.2539	5196.18
114.41	5194.85
229.902	5193.08
339.764	5191.4
363.756	5191.12
399.767	5190.69

458.17	5189.82
513.67	5188.99
588.796	5187.09
617.104	5186.46
671.463	5185.23
818.576	5181.92
1126.37	5175
1137.53	5174.74
1279.95	5175.24
1345.37	5175.47
1353.84	5175.53
1368.19	5176.44
1376.37	5176.96
1380.17	5177.05
1385.31	5177.07
1386.81	5177.14
1389.36	5177.91
1394	5179.45
1404.03	5182.77
1406.35	5182.77

Material Boundary

X	Y
220.393	5198.23
299.17	5229.74
318.893	5237.63
349.832	5250
375.024	5250
379.833	5250
413.352	5233.24
421.524	5229.16
434.805	5222.52
491.186	5194.33

Material Boundary

X	Y
-8.88178e-016	5455
3.52609	5455
16.375	5455
38.2237	5455
50.9444	5455
72.93	5455
85.5063	5455
219.596	5455
235.945	5455
243.614	5455
261.097	5455
267.631	5455
286.669	5455
291.649	5455
312.952	5455
315.667	5455
334.831	5455

Material Boundary

X	Y
1406.35	5182.77
1406.35	5183.84
1406.35	5187.77

Material Boundary

X	Y
0	5184.09
2031.79	5123.76

APPENDIX I
FOUNDATION SETTLEMENT POTENTIAL EVALUATION

APPENDIX I.1
SETTLEMENT POTENTIAL, COPPER FLAT TAILINGS EMBANKMENT FOUNDATION

REVISED JUNE 2016

CALCULATIONS

Date:	April 23, 2013	**Made by:**	DP
Project No.:	103-92557	**Checked by:**	GM
Subject:	Settlement Potential, Copper Flat Tailings Embankment Foundation	**Reviewed by:**	MJG
Project Short Title:	**COPPER FLAT FEASIBILITY STUDY TAILINGS DISPOSAL FACILITY DESIGN**		

1.0 OBJECTIVE

Evaluate the consolidation characteristics of the soil strata, and estimate the post-construction subgrade settlement under the containment embankments for the Copper Flat Tailings Impoundment.

2.0 BACKGROUND

Golder is completing the feasibility level designing of the Copper Flat tailings impoundment embankment which will impound slurried tailings to an estimated maximum depth of approximately 230 feet at the impoundment embankment. An earthen starter dam will be constructed to a height of approximately 50 feet and the remainder of the dam will be constructed with sand recovered from the tailings in a cyclone plant. A geotechnical investigation was performed in the vicinity of the proposed embankment, which included standard penetration testing and sample collection from the surface to a depth of 53 feet. Drilling indicated that the tailings embankment area consists primarily of alluvial deposits that include silt, sand and gravel, underlain by clay.

For the settlement analysis, representative samples of the foundation strata were analyzed in Golder's geotechnical laboratory for index properties, gradation, and Atterberg limits. Additionally, select samples were remolded in the laboratory, and the remolded samples were subjected to one-dimensional consolidation testing. The results are summarized in the following sections.

Drill hole logs were input onto a site plan and cross-sections through the embankment were developed. Two cross-sections (B-B' and D-D') were further developed for settlement potential analyses with the addition of information from the site investigation conducted in 1980 for the former Quintana mining operation (*Tailings Dam and Disposal Area, Quintana Minerals Corporation, Copper Flats Project, Golddust, New Mexico*, Sergent Hauskins and Beckwith, 1980). Generalized soil and rock designations were assigned to the strata.

Settlement calculations were developed for the post-construction embankment, which represents the worst-case condition. Staged settlement was not analyzed because the results for the post-construction condition demonstrate that the amount of predicted settlement (approximately 2.1 feet under the heaviest loaded portion of embankment) is tolerable, and, will be adequately mitigated by fill placement during ongoing embankment construction.

Settlement calculations were performed using the computer model SETTLE3D v. 2.0, a computer program developed by Rocscience, Inc. for the analysis of settlement and consolidation under foundations and embankments.

The results of the consolidation tests performed on the samples obtained during geotechnical investigations are included in Attachment 1. Tables summarizing the laboratory consolidation test results and the computer modeling input parameters are included in Attachment 2. The SETTLE3D computer model output files are included in Attachment 3. Figures depicting the two embankment sections

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analyzed for foundation settlement, as well as a graphical representation of the analysis results, are included in Attachment 4.

3.0 LABORATORY ANALYSIS

Laboratory one-dimensional consolidation analyses were performed on representative samples obtained during the geotechnical investigation. The results of the geotechnical laboratory analyses are summarized in the Tables included in Attachment 1. Consolidation tests were generally conducted on the fine grain fraction of the soil- strata, on remolded drill hole samples.

As shown, the soil strata generally have compression index values (Cc) ranging from 0.035 to 0.09, and estimated initial void ratio values ranging from 0.71 to 0.75. The compression index results were obtained from review of the laboratory graphs of void ratio versus stress, and were obtained for loads ranging from 16 to 32 kilopounds per square foot (ksf).

4.0 COMPUTER MODELING

Computer modeling was performed using SETTLE3D v. 2.0. The results of the modeling are included in Attachment 3.

The following parameters were incorporated into the analyses:

- Settlement Index (Cc) values obtained from laboratory testing of soil fraction of field samples.
- Initial void ratio (e_0) values estimated from review of the consolidation test graphs.
- Unit weights estimated from the consolidation test results, and based on previous experience with similar soils.
- An overconsolidation ratio (OCR) of 1.0 assumed.
- A Poisson's Ratio of 0.3 was assumed, based on a published range of values from 0.2 to 0.4 for sandy clays.
- The model was initialized for primary consolidation, with non-linear settlement characteristics.

A conservative value of 4,000 ksf was assigned for the constrained modulus of the coarse sand and gravel, caliche and weathered basalt layers. The constrained modulus was assigned to represent inter-particle consolidation in the gravels and sands. Settlement in these layers was demonstrated to be minimal, even with the conservative modulus value used in the model. (Reference: US Army Corps of Engineers, EM 1110-1-1904, 1990).

Modeling was performed on an individual point basis, at a minimum of 5 analysis points on each embankment cross-section. The model was initialized for 1-dimensional Boussinesq Methodology.

5.0 RESULTS

5.1 Settlement Beneath Embankment

The results of the consolidation analyses are summarized on Figures 5 and 7 in Attachment 4. As shown on the figures, calculated settlement beneath the impoundment embankment ranges from approximately 2.1 to 0.2 feet, with settlement decreasing as the weight of post-construction loading decreases towards the outer toe of the embankment. The results of the consolidation testing indicate the various soils at the site exhibit generally similar consolidation characteristics. Based on the consolidation testing and computer modeling, settlement beneath the embankment is projected to be generally uniform.

The consolidation analyses results are considered conservative, as the laboratory consolidation testing was performed on the fine-grained fraction of soil samples. The effects of inter-particle bearing contact within the gravel-rich strata, which will reduce the estimated settlement, have not been considered in the analyses. Based on the field Standard Penetration Testing (SPT) results, which showed the strata to generally be very dense to hard, actual post-construction consolidation settlement of less than 1 foot is anticipated.

As the embankment will be constructed continuously, it is anticipated that observed settlement will be accommodated by managing dam fill placement during embankment construction.

5.2 Settlement Beneath Outlet Piping

Section F-F' was developed along the proposed outlet pipe alignment, as shown on Figure 9. The pipe will be comprised of 14-inch diameter Schedule 80 carbon steel, encased in a minimum 42-inch by 42-inch concrete-filled trench.

From review of Section F-F', it appears the inlet of the outlet pipe will be founded within clay overlaying a basalt rock layer. Settlement of the outlet pipe foundation may be reduced at the inlet side by the basalt, which appears to transition to soil-gravel strata at some undefined location along the pipe downstream of the inlet. Stresses induced by the limited differential settlement are expected to be negligible, and limited by the concrete backfill and steel pipe strength. The pipe currently is proposed with a vertical drop of approximately 31 feet along the 1290-foot length of pipe. Post consolidation pipe slope (assuming a worst-case settlement of 2.1 feet at the pipe inlet) would average 2.3 percent along the length of the pipe. As described above, field standard penetration tests suggest actual post-construction settlement will be less than that calculated on the basis of consolidation test results.

Attachments

Attachment 1 – Laboratory Test Summary Tables and Consolidation Test Results
Attachment 2 – Consolidation Testing Summary and SETTLE 3D Model Input Tables
Attachment 3 – SETTLE 3D Output Files
Attachment 4 – Embankment Analysis Cross-sections with Graphical Output Results (Sections B-B' and D-D' only)

ATTACHMENT 1
LABORATORY TEST SUMMARY TABLES AND CONSOLIDATION TEST RESULTS

	Initial		Final	
Height =	0.994	in	0.960	in
Diameter =	2.499	in	2.499	in
Area =	4.905	in^2	4.905	in^2
Volume =	4.875	in^3	4.709	in^3
Water Content =	14.4%		4.8%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5641	in	0.5641	in
Void Ratio =	0.762		0.702	
Degree of Saturation =	51.1%		18.5%	
Wet Mass =	0.308	lb	0.282	lb
Dry Mass =	0.269	lb	0.269	lb
Wet Unit Weight =	109.3	pcf	103.6	pcf
Dry Unit Weight =	95.5	pcf	98.9	pcf

Notes

USCS description (ASTM D2487):	Lean clay with sand, yellowish red, moist				
Atterberg Limits (ASTM D4318):	LL = 47		PL = 20		PI = 27
Percent Finer (ASTM D422):	3/4 in. = 100%		No. 4 = 99%		No. 200 = 81%
Specimen Type:	[ ]	Intact	[X]	Reconstituted	
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture	
Water Content of Trimmings (ASTM D2216):	14.6%				
Trimming Procedure:	Specimen remolded in ring				
Inundation:	[X]	Not inundated	[ ]	Inundated	
Test Method:	[ ]	A	[X]	B	
Apparatus:	Frame No.	1	(Wykeham Farrance 24251)		
Final Water Content Specimen:	[X]	Entire	[ ]	Partial	
Final Differential Height:	-0.0158 in				
Estimated Preconsolidation Stress:	Not Computed				

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1058					0.0000	0.9901	0.00	0.755				
1	0.25	1410					0.0083	0.9818	0.84	0.740				
2	0.50	1410					0.0174	0.9726	1.75	0.724				
3	1.00	1440					0.0254	0.9647	2.55	0.710				
4	2.00	1470					0.0315	0.9585	3.17	0.699				
5	4.00	1425					0.0361	0.9540	3.63	0.691				
6	8.00	1425					0.0390	0.9510	3.93	0.686				
7	16.00	1425	0.0410	0.9491	4.12	0.683	0.0431	0.9470	4.33	0.679	2 (Root time)	0.683	3.650	0.5
8	32.00	1440	0.0474	0.9426	4.77	0.671	0.0502	0.9398	5.05	0.666	2 (Root time)	0.672	2.520	0.5
9	8.00	95					0.0485	0.9415	4.88	0.669				
10	2.00	120					0.0473	0.9427	4.76	0.671				
11	0.50	95					0.0464	0.9436	4.67	0.673				
12	0.10	70					0.0459	0.9442	4.62	0.674				

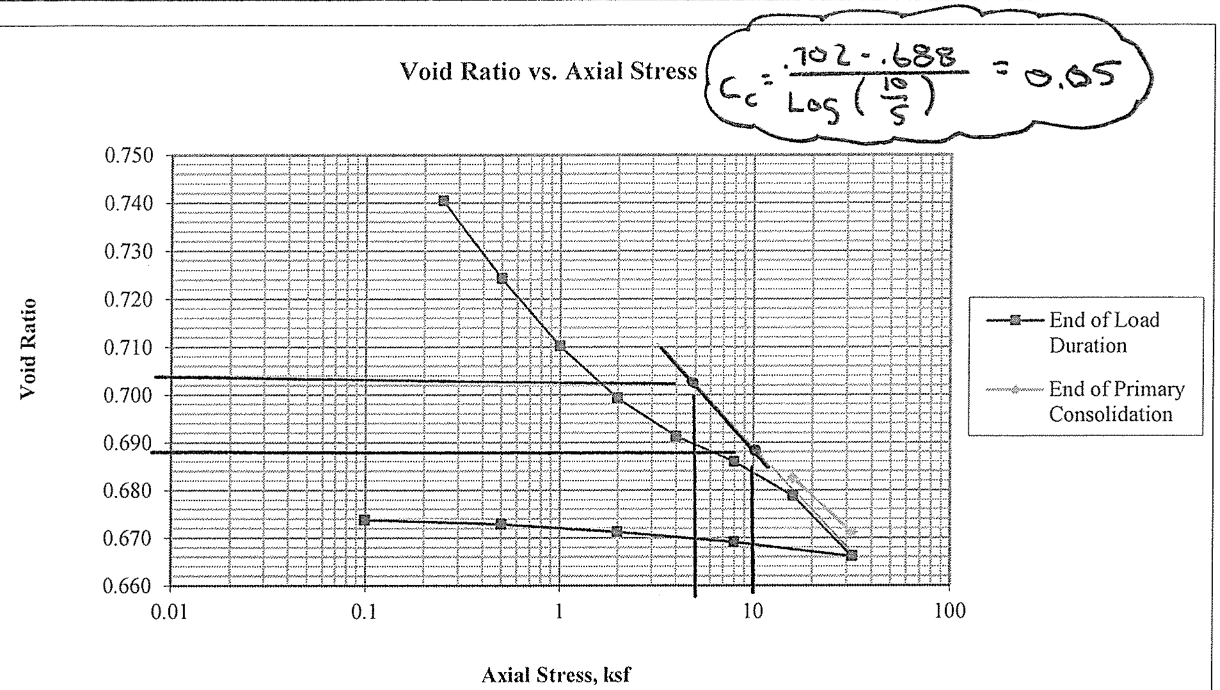
Golder Associates Inc.
Denver, Colorado

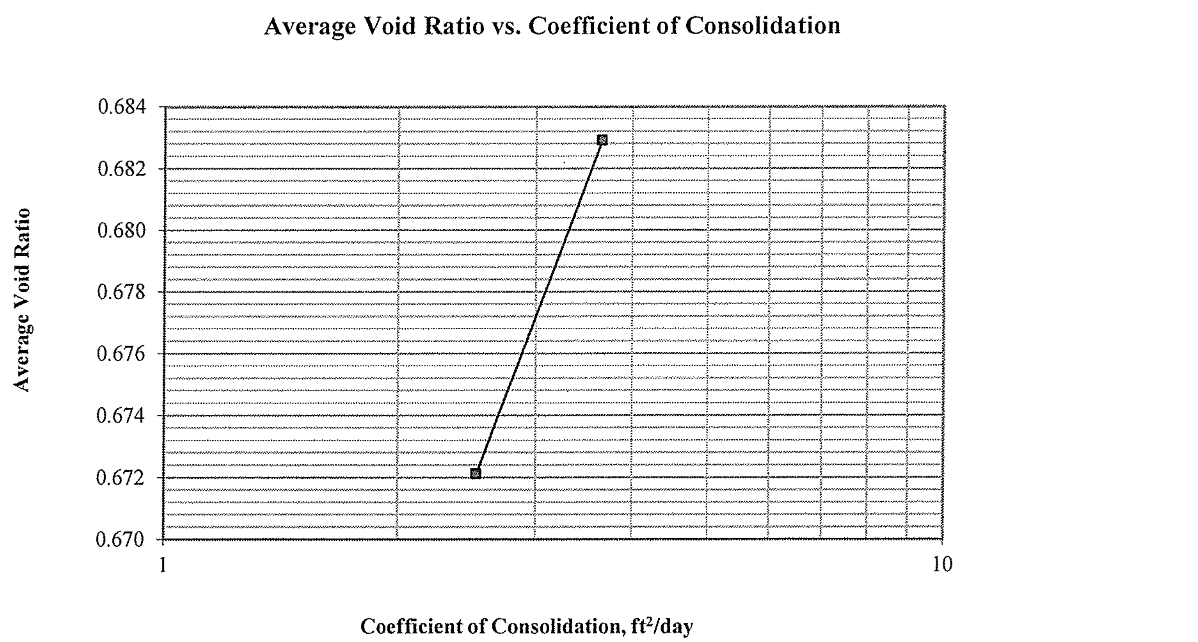
Job Short Title: Copper Flat Tailings Design Study

Sample: BH-10 @ 19-33 ft

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

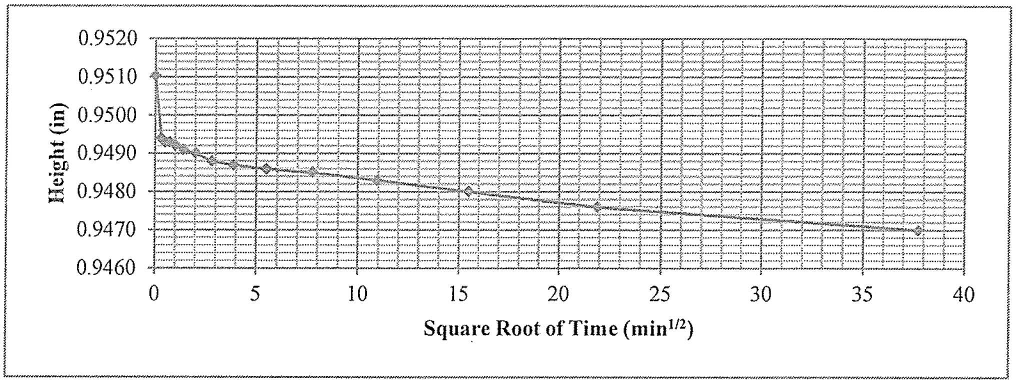
Technician: RJM | **Reviewed:** CCS | **Start Date:** 3/11/2013 | **Job Number:** 103-92557.006 | **Figure:** 1



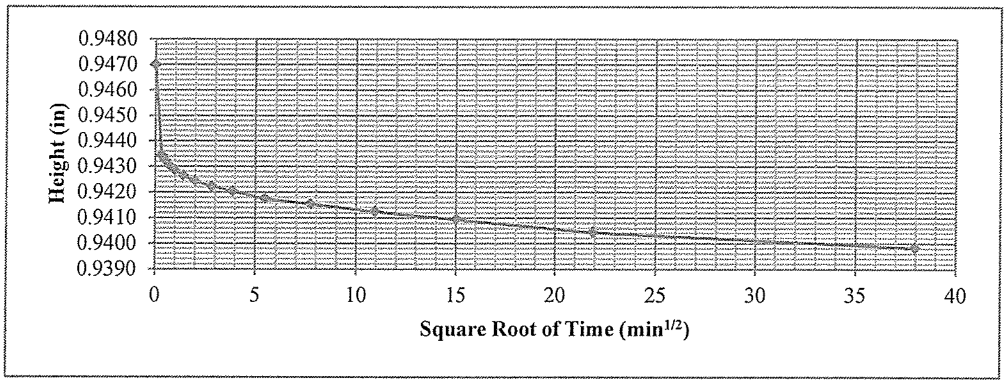


Golder Associates Inc. Denver, Colorado	**Title:** ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-10 @ 19-33 ft	**Technician:** RJM	**Reviewed:** CCS	**Start Date:** 3/11/2013	**Job Number:** 103-92557.006	**Figure:** 2

16.00 ksf



32.00 ksf



Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-10 @ 19-33 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/11/2013	Job Number: 103-92557.006	Figure: 3

	Initial		Final	
Height =	0.997	in	0.905	in
Diameter =	2.496	in	2.496	in
Area =	4.893	in^2	4.893	in^2
Volume =	4.878	in^3	4.428	in^3
Water Content =	25.9%		6.4%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5215	in	0.5215	in
Void Ratio =	0.912		0.735	
Degree of Saturation =	76.7%		23.5%	
Wet Mass =	0.313	lb	0.264	lb
Dry Mass =	0.248	lb	0.248	lb
Wet Unit Weight =	110.8	pcf	103.2	pcf
Dry Unit Weight =	88.0	pcf	97.0	pcf

Notes

USCS description (ASTM D2487):	Fat clay, dark red, moist				
Atterberg Limits (ASTM D4318):	LL = 66		PL = 31		PI = 35
Percent Finer (ASTM D422):	3/4 in. = 100%		No. 4 = 100%		No. 200 = 90%
Specimen Type:		Intact	X	Reconstituted	
Remold Targets:	86.0	pcf (dry) at	29.0%	moisture	
Water Content of Trimmings (ASTM D2216):	28.8%				
Trimming Procedure:	Speciment remolded in ring				
Inundation:	X	Not inundated		Inundated	
Test Method:		A	X	B	
Apparatus:	Frame No.	4	(ELE C-320A)		
Final Water Content Specimen:	X	Entire		Partial	
Final Differential Height:	-0.0304	in			
Estimated Preconsolidation Stress:	Not Computed				

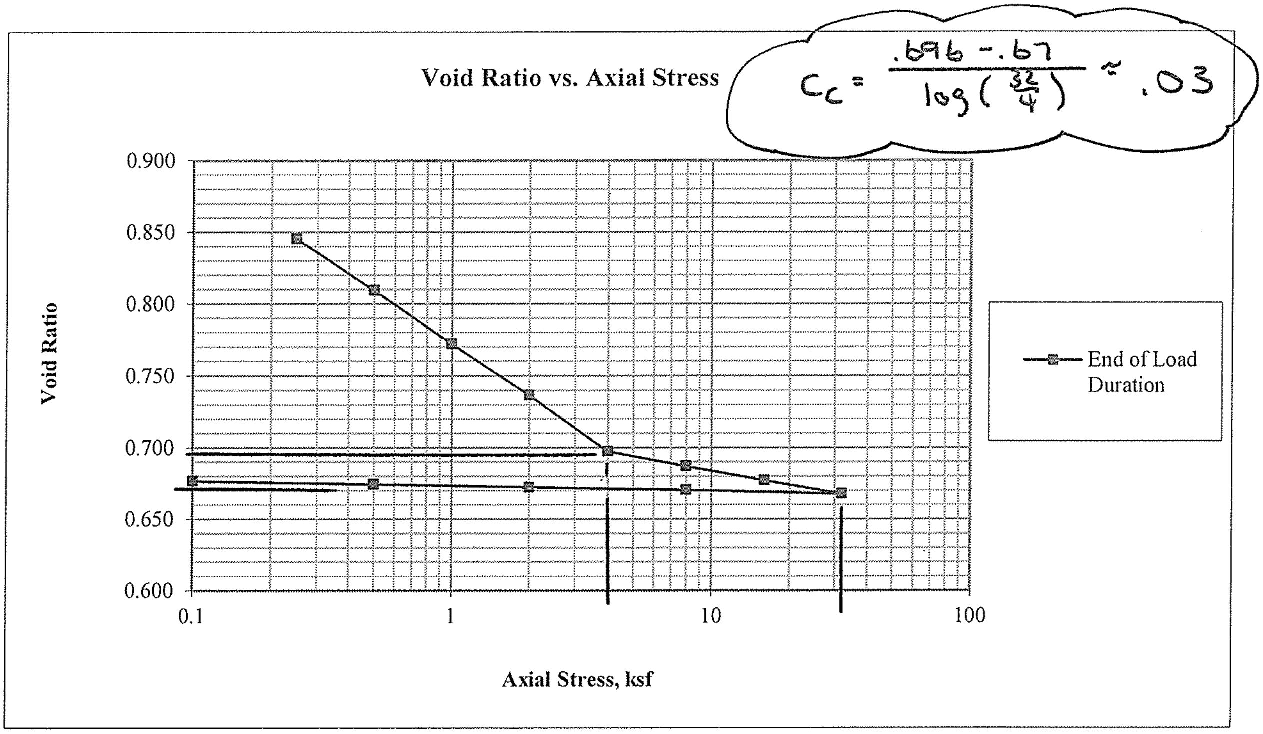
	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1019					0.0000	0.9822	0.00	0.883				
1	0.25	1410					0.0197	0.9625	1.98	0.845				
2	0.50	1410					0.0385	0.9437	3.86	0.809				
3	1.00	1430					0.0579	0.9242	5.81	0.772				
4	2.00	1470					0.0764	0.9057	7.66	0.737				
5	4.00	1415					0.0968	0.8853	9.71	0.698				
6	8.00	1420					0.1023	0.8798	10.26	0.687				
7	16.00	1425					0.1074	0.8747	10.77	0.677				
8	32.00	1440					0.1123	0.8699	11.26	0.668				
9	8.00	90					0.1109	0.8712	11.13	0.670				
10	2.00	115					0.1099	0.8722	11.02	0.672				
11	0.50	100					0.1089	0.8733	10.92	0.674				
12	0.10	70					0.1076	0.8746	10.79	0.677				

Golder Associates Inc.
Denver, Colorado

Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT SPECIMEN AND SUMMARY DATA

Job Short Title: Copper Flat Tailings Design Study

Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-12 @ 33.5-48.5 ft	RJM	CCS	3/11/2013	103-92557.006	1



Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-12 @ 33.5-48.5 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/11/2013	Job Number: 103-92557.006	Figure: 2

	Initial		Final	
Height =	0.993	in	0.887	in
Diameter =	2.500	in	2.500	in
Area =	4.909	in^2	4.909	in^2
Volume =	4.874	in^3	4.354	in^3
Water Content =	14.1%		1.7%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5636	in	0.5636	in
Void Ratio =	0.762		0.574	
Degree of Saturation =	49.8%		8.0%	
Wet Mass =	0.307	lb	0.274	lb
Dry Mass =	0.269	lb	0.269	lb
Wet Unit Weight =	108.9	pcf	108.7	pcf
Dry Unit Weight =	95.5	pcf	106.9	pcf

Notes

USCS description (ASTM D2487):	Clayey sand with gravel, yellowish brown, dry				
Atterberg Limits (ASTM D4318):	LL = 23		PL = 14		PI = 9
Percent Finer (ASTM D422):	3/4 in. = 98%		No. 4 = 83%		No. 200 = 36%
Specimen Type:		Intact	X	Reconstituted	
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture	
Water Content of Trimmings (ASTM D2216):	14.7%				
Trimming Procedure:	Specimen remolded in ring				
Inundation:	X	Not inundated		Inundated	
Test Method:		A	X	B	
Apparatus:	Frame No.	1	(Wykeham Farrance 24251)		
Final Water Content Specimen:	X	Entire		Partial	
Final Differential Height:	0.0528 in				
Estimated Preconsolidation Stress:	16.4 ksf				

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1055					0.0000	0.9877	0.00	0.752				
1	0.25	1425					0.0077	0.9800	0.78	0.739				
2	0.50	1425					0.0129	0.9747	1.30	0.730				
3	1.00	1440					0.0173	0.9704	1.74	0.722				
4	2.00	1410					0.0219	0.9657	2.21	0.714				
5	4.00	2785	0.0229	0.9647	2.31	0.712	0.0283	0.9594	2.85	0.702	2 (Root time)	0.712	8.212	0.4
6	8.00	1425					0.0309	0.9567	3.12	0.698				
7	16.00	1430	0.0321	0.9555	3.24	0.695	0.0343	0.9534	3.45	0.692	2 (Root time)	0.696	10.130	0.3
8	32.00	1440	0.0457	0.9420	4.60	0.671	0.0498	0.9378	5.02	0.664	2 (Root time)	0.675	4.980	0.4
9	8.00	105					0.0487	0.9389	4.91	0.666				
10	2.00	90					0.0484	0.9392	4.88	0.667				
11	0.50	180					0.0478	0.9398	4.82	0.668				

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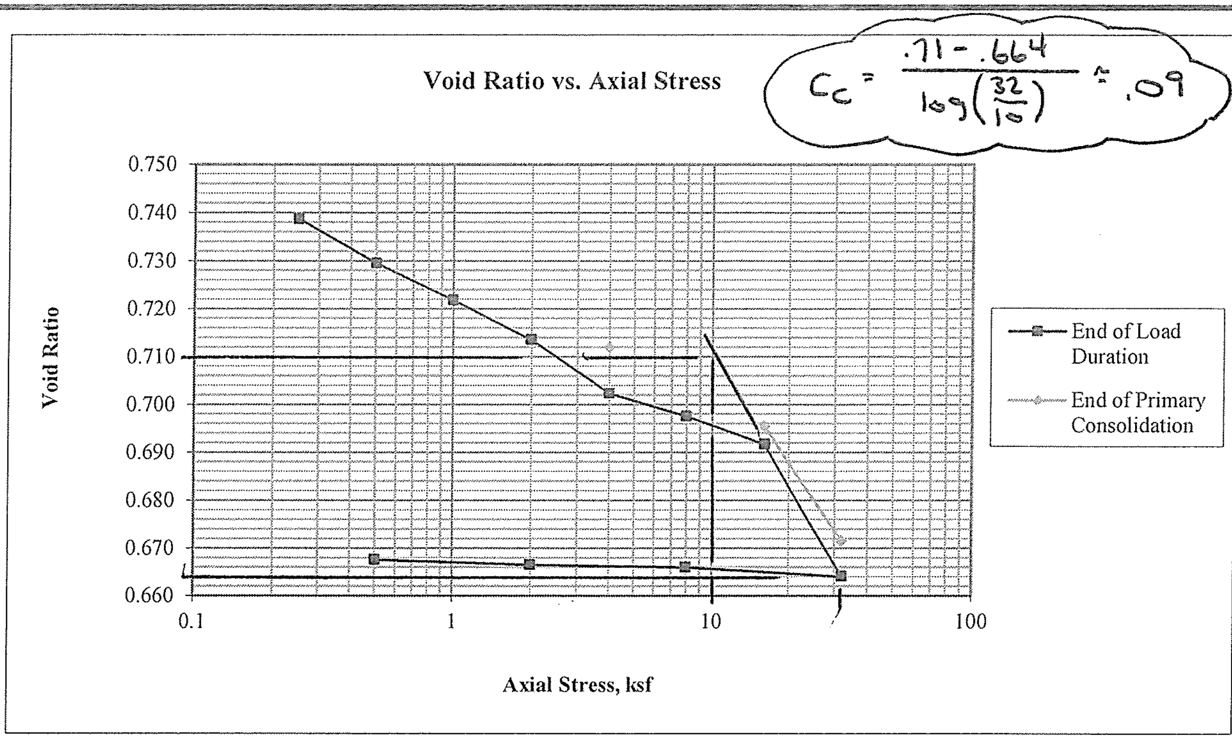
Denver, Colorado

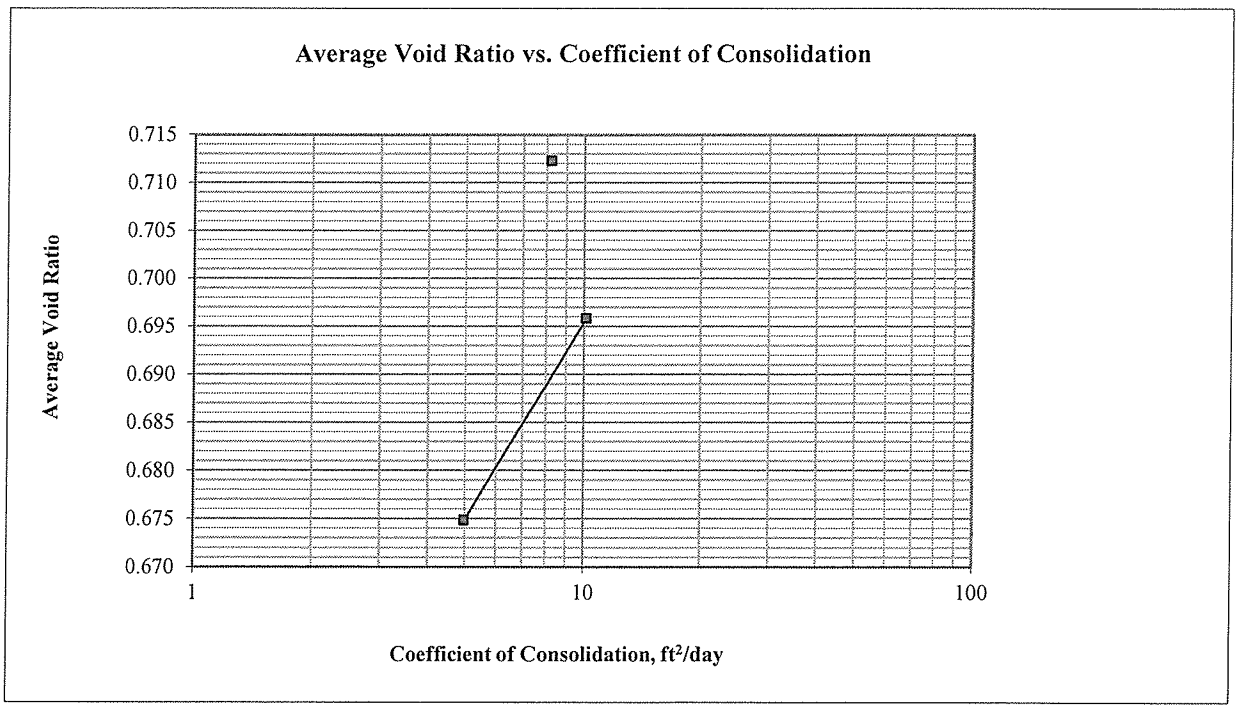
Job Short Title: Copper Flat Tailings Design Study

Sample: BH-16 @ 29-34 ft

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

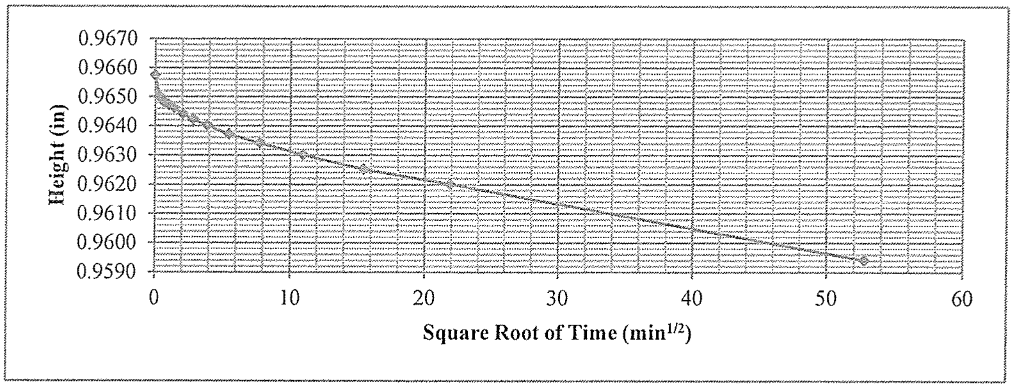
Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	3/25/2013	103-92557.006	1



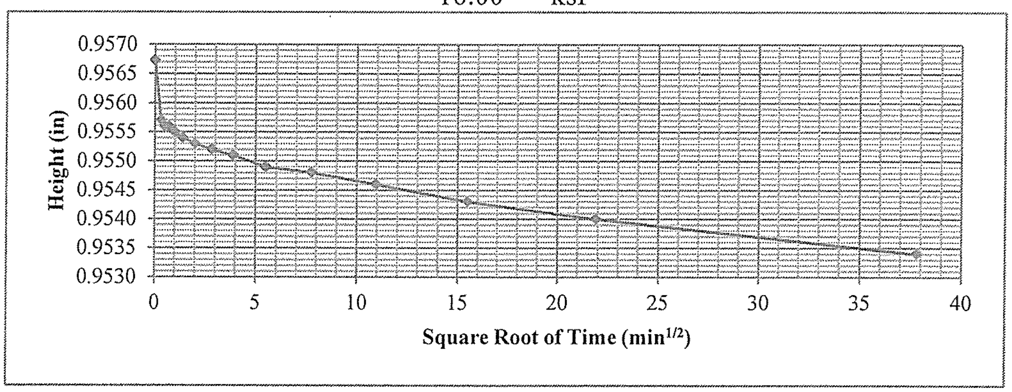


Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-16 @ 29-34 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/25/2013	Job Number: 103-92557.006	Figure: 2

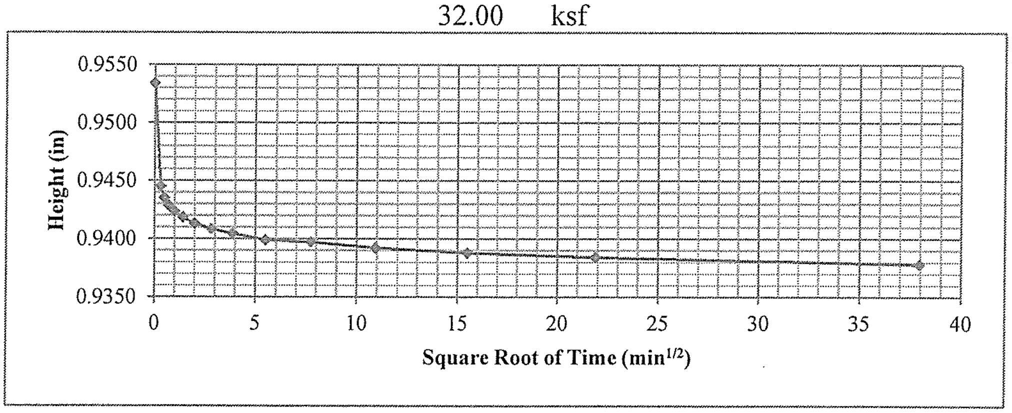
4.00 ksf



16.00 ksf



32.00 ksf



Golder Associates Inc.
Denver, Colorado

Job Short Title: Copper Flat Tailings Design Study

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
TIME-DEFORMATION PLOTS

Sample:	Technician:	Reviewed:	Start Date:	Job Number:	Figure:
BH-16 @ 29-34 ft	RJM	CCS	3/25/2013	103-92557.006	3

	Initial		Final	
Height =	0.997	in	0.960	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.886	in^3	4.705	in^3
Water Content =	14.5%		2.7%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5638	in	0.5638	in
Void Ratio =	0.768		0.703	
Degree of Saturation =	51.1%		10.4%	
Wet Mass =	0.308	lb	0.276	lb
Dry Mass =	0.269	lb	0.269	lb
Wet Unit Weight =	109.0	pcf	101.5	pcf
Dry Unit Weight =	95.1	pcf	98.8	pcf

Notes

USCS description (ASTM D2487):	Sandy lean clay, reddish brown, moist				
Atterberg Limits (ASTM D4318):	LL = 25		PL = 14		PI = 11
Percent Finer (ASTM D422):	3/4 in. = 100%		No. 4 = 95%		No. 200 = 52%
Specimen Type:	[ ]	Intact	X	Reconstituted	
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture	
Water Content of Trimmings (ASTM D2216):	14.7%				
Trimming Procedure:	Specimen remolded in ring				
Inundation:	X	Not inundated	[ ]	Inundated	
Test Method:	[ ]	A	X	B	
Apparatus:	Frame No.	4	(ELE C-320A)		
Final Water Content Specimen:	X	Entire	[ ]	Partial	
Final Differential Height:	0.0045 in				
Estimated Preconsolidation Stress:	14.7 ksf				

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	1025					0.0000	0.9894	0.00	0.755				
1	0.25	1425					0.0070	0.9824	0.70	0.742				
2	0.50	1425					0.0117	0.9777	1.17	0.734				
3	1.00	1440					0.0145	0.9748	1.46	0.729				
4	2.00	1410					0.0161	0.9732	1.62	0.726				
5	4.00	2780					0.0179	0.9714	1.80	0.723				
6	8.00	1425					0.0187	0.9706	1.88	0.722				
7	16.00	1420					0.0210	0.9683	2.11	0.717				
8	32.00	1440	0.0256	0.9638	2.57	0.709	0.0273	0.9621	2.74	0.706	2 (Root time)	0.710	5.423	0.5
9	8.00	105					0.0263	0.9630	2.64	0.708				
10	2.00	90					0.0255	0.9638	2.56	0.710				
11	0.50	180					0.0249	0.9645	2.49	0.711				

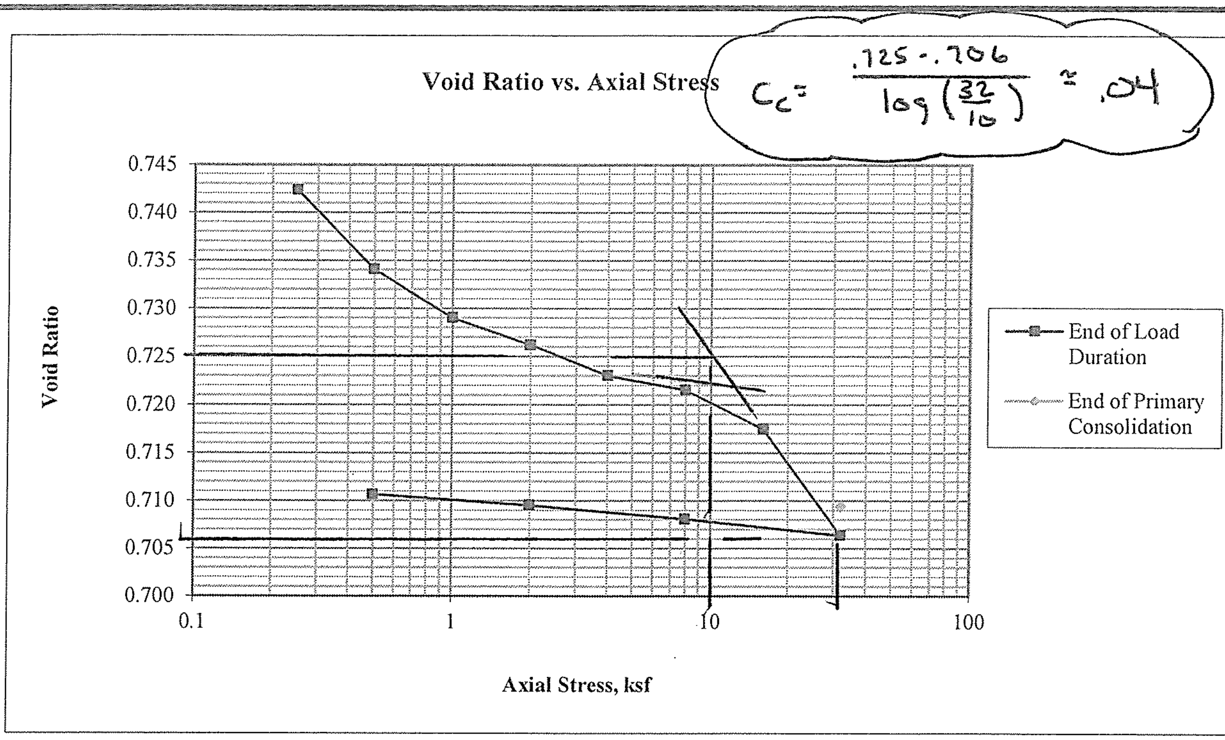
Golder Associates Inc.
Denver, Colorado

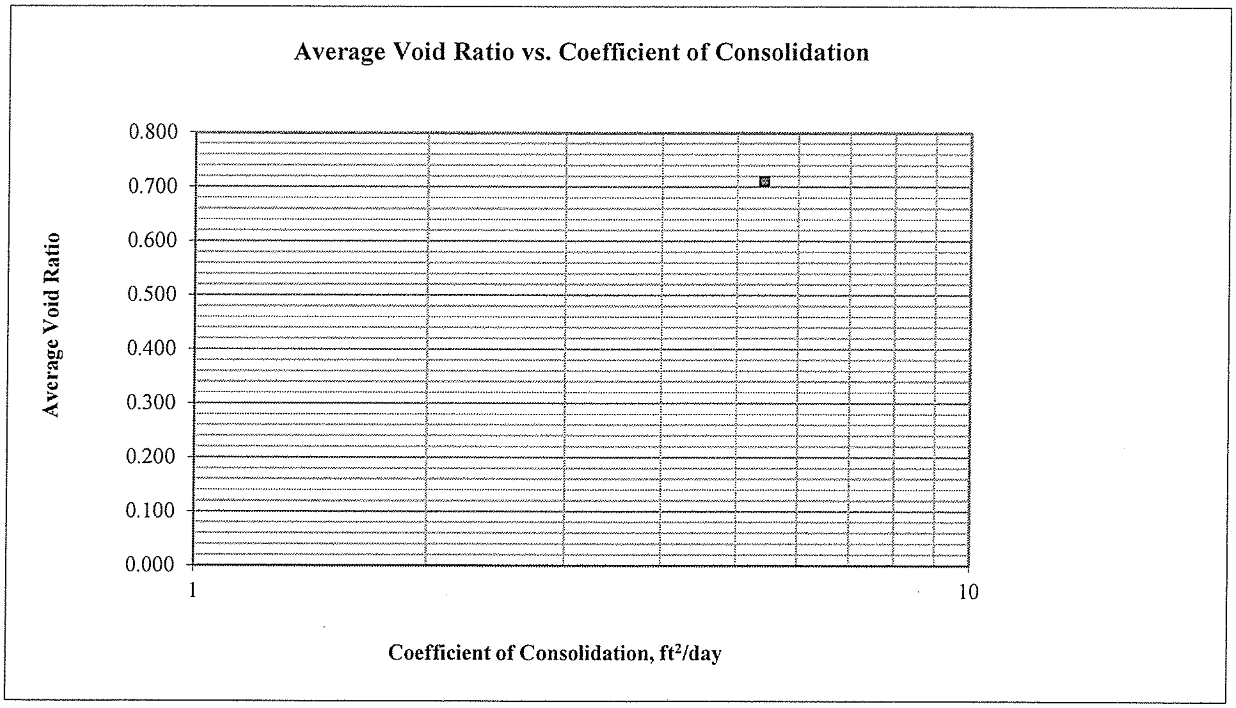
Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Job Short Title: Copper Flat Tailings Design Study

Sample: BH-18 @ 23-33.5 ft

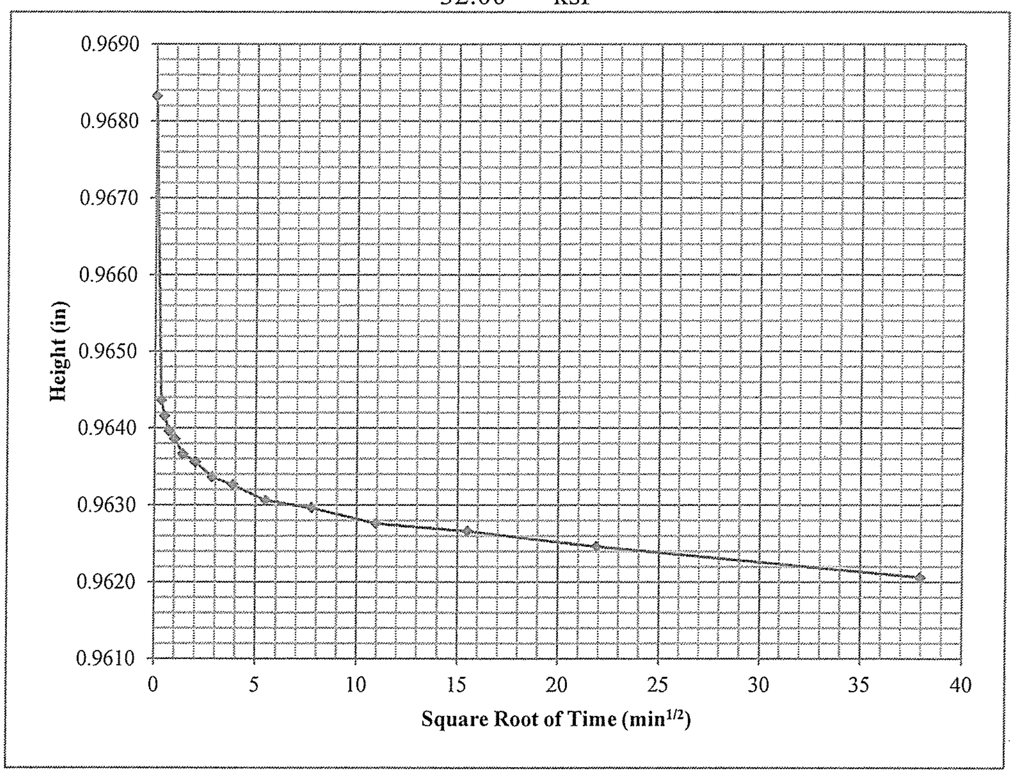
Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	3/25/2013	103-92557.006	1





Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-18 @ 23-33.5 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/25/2013	Job Number: 103-92557.006	Figure: 2

32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-18 @ 23-33.5 ft	**Technician:** RJM	**Reviewed:** CCS	**Start Date:** 3/25/2013	**Job Number:** 103-92557.006	**Figure:** 3

	Initial		Final	
Height =	0.994	in	0.924	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.871	in^3	4.528	in^3
Water Content =	28.9%		9.0%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5085	in	0.5085	in
Void Ratio =	0.955		0.817	
Degree of Saturation =	81.7%		29.7%	
Wet Mass =	0.313	lb	0.264	lb
Dry Mass =	0.243	lb	0.243	lb
Wet Unit Weight =	110.9	pcf	100.9	pcf
Dry Unit Weight =	86.1	pcf	92.6	pcf

Notes

USCS description (ASTM D2487): Fat clay with sand, dark red, wet

Atterberg Limits (ASTM D4318): LL = 62 PL = 20 PI = 42

Percent Finer (ASTM D422): 3/4 in. = 100% No. 4 = 100% No. 200 = 82%

Specimen Type: [ ] Intact [X] Reconstituted

Remold Targets: 86.0 pcf (dry) at 29.0% moisture

Water Content of Trimmings (ASTM D2216): 29.1%

Trimming Procedure: Specimen remolded in ring

Inundation: [X] Not inundated [ ] Inundated

Test Method: [ ] A [X] B

Apparatus: Frame No. 5 (ELE C-320A)

Final Water Content Specimen: [X] Entire [ ] Partial

Final Differential Height: -0.0246 in

Estimated Preconsolidation Stress: -- ksf

-- indicates test was not performed

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	990					0.0000	0.9933	0.00	0.953				
1	0.25	1425					0.0154	0.9779	1.55	0.923				
2	0.50	1825					0.0307	0.9626	3.09	0.893				
3	1.00	1440					0.0463	0.9470	4.66	0.862				
4	2.00	1410					0.0600	0.9333	6.04	0.835				
5	4.00	2775					0.0778	0.9155	7.82	0.800				
6	8.00	1425					0.0843	0.9090	8.48	0.788				
7	16.00	1425					0.0897	0.9036	9.02	0.777				
8	32.00	1440					0.0960	0.8973	9.65	0.765				
9	8.00	105					0.0950	0.8983	9.55	0.767				
10	2.00	105					0.0948	0.8985	9.54	0.767				
11	0.50	165					0.0939	0.8994	9.45	0.769				

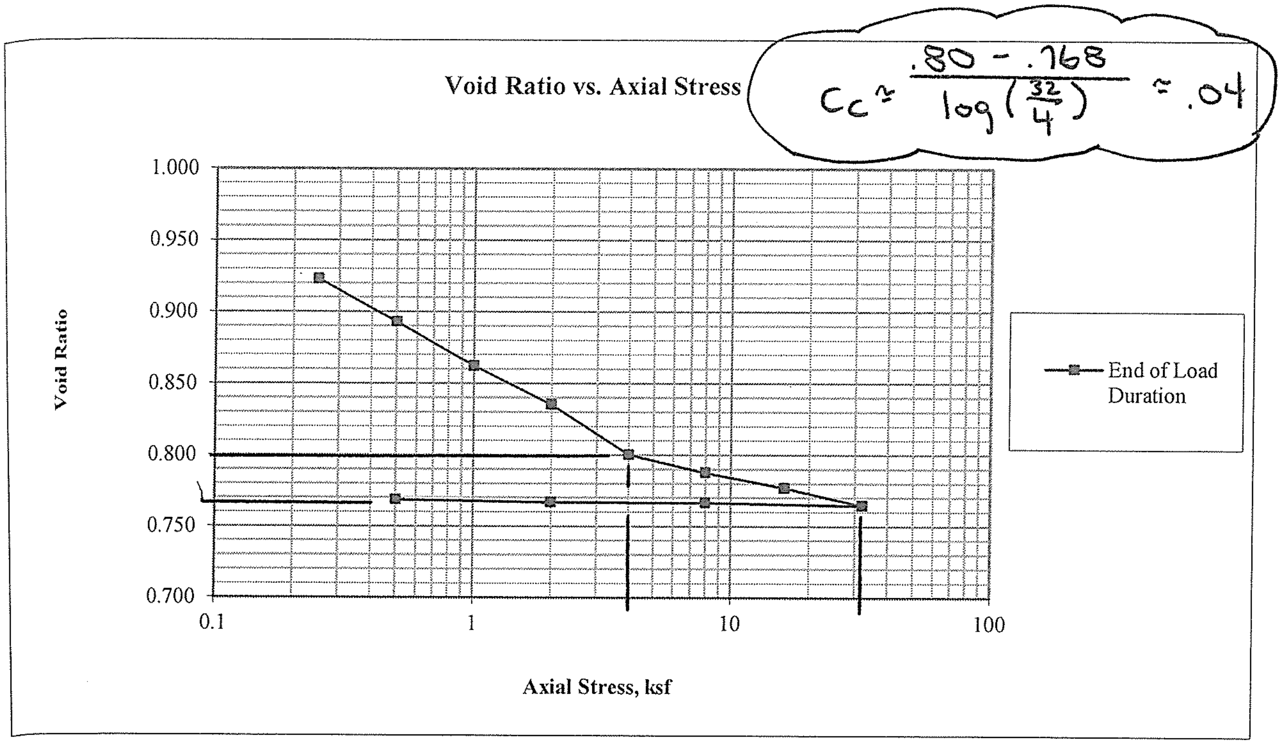
Golder Associates Inc.
Denver, Colorado

Job Short Title: Copper Flat Tailings Design Study

Sample: BH-18 @ 43.5-48.5 ft

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	3/25/2013	103-92557.006	1



Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-18 @ 43.5-48.5 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/25/2013	Job Number: 103-92557.006	Figure: 2

	Initial		Final	
Height =	1.000	in	0.981	in
Diameter =	2.497	in	2.497	in
Area =	4.897	in^2	4.897	in^2
Volume =	4.897	in^3	4.804	in^3
Water Content =	9.7%		1.1%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5363	in	0.5363	in
Void Ratio =	0.865		0.829	
Degree of Saturation =	30.3%		3.6%	
Wet Mass =	0.281	lb	0.259	lb
Dry Mass =	0.256	lb	0.256	lb
Wet Unit Weight =	99.0	pcf	93.0	pcf
Dry Unit Weight =	90.2	pcf	92.0	pcf

Notes

USCS description (ASTM D2487):	Sandy silty clay, brownish yellow, moist				
Atterberg Limits (ASTM D4318):	LL = 25		PL = 21		PI = 4
Percent Finer (ASTM D422):	3/4 in. = 99%		No. 4 = 99%		No. 200 = 52%
Specimen Type:		Intact	X	Reconstituted	
Remold Targets:	90.0	pcf (dry) at	10.0%	moisture	
Water Content of Trimmings (ASTM D2216):	9.4%				
Trimming Procedure:	Specimen remolded in ring				
Inundation:	X	Not inundated		Inundated	
Test Method:		A	X	B	
Apparatus:	Frame No.	6	(ELE C-320A)		
Final Water Content Specimen:	X	Entire		Partial	
Final Differential Height:	-0.0094	in			
Estimated Preconsolidation Stress:	13.0	ksf			

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	944					0.0000	0.9957	0.00	0.857				
1	0.25	1410					0.0031	0.9926	0.31	0.851				
2	0.50	1410					0.0064	0.9893	0.64	0.845				
3	1.00	1440					0.0086	0.9871	0.86	0.841				
4	2.00	1470					0.0097	0.9860	0.97	0.838				
5	4.00	1410					0.0103	0.9854	1.03	0.837				
6	8.00	1410					0.0119	0.9838	1.19	0.834				
7	16.00	1425	0.0152	0.9805	1.52	0.828	0.0164	0.9794	1.64	0.826	2 (Root time)	0.829	23.310	0.3
8	32.00	1470	0.0275	0.9682	2.75	0.805	0.0300	0.9657	3.00	0.801	2 (Root time)	0.807	3.521	0.4
9	8.00	75					0.0278	0.9679	2.78	0.805				
10	2.00	95					0.0263	0.9694	2.63	0.807				
11	0.50	1315					0.0248	0.9709	2.48	0.810				
12	0.10	195					0.0241	0.9716	2.41	0.812				

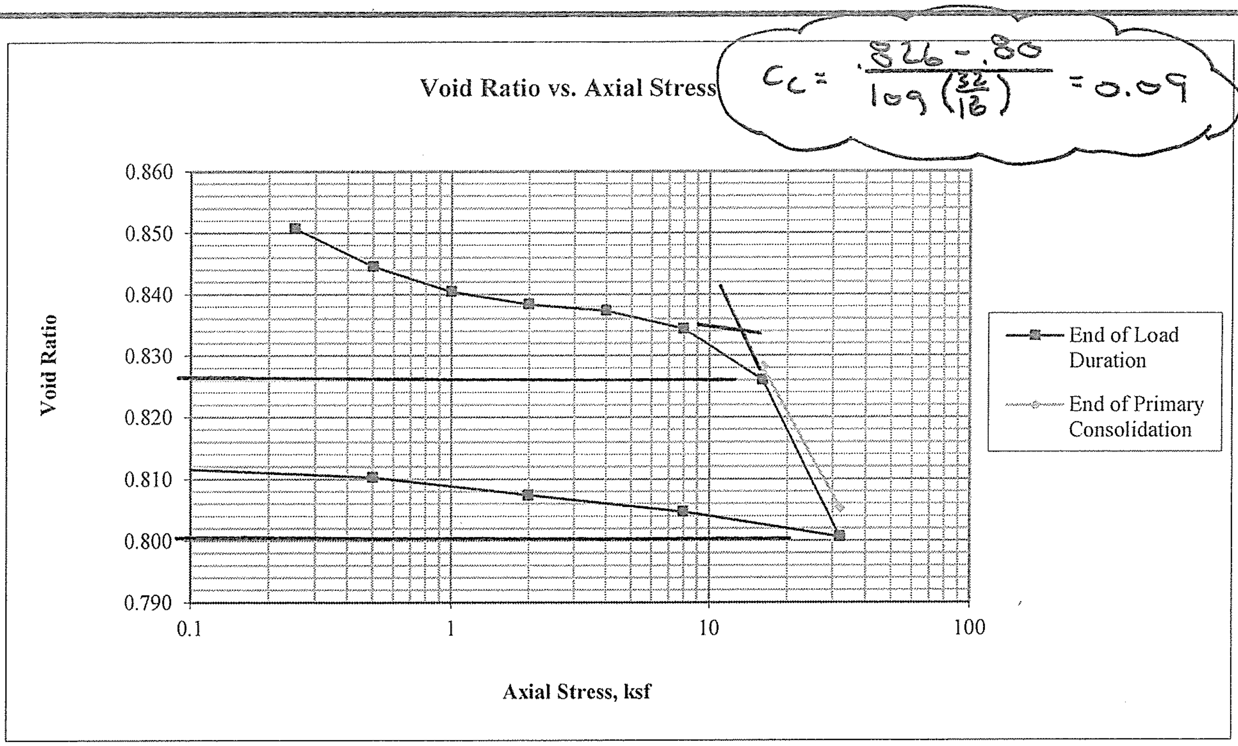
Golder Associates Inc.
Denver, Colorado

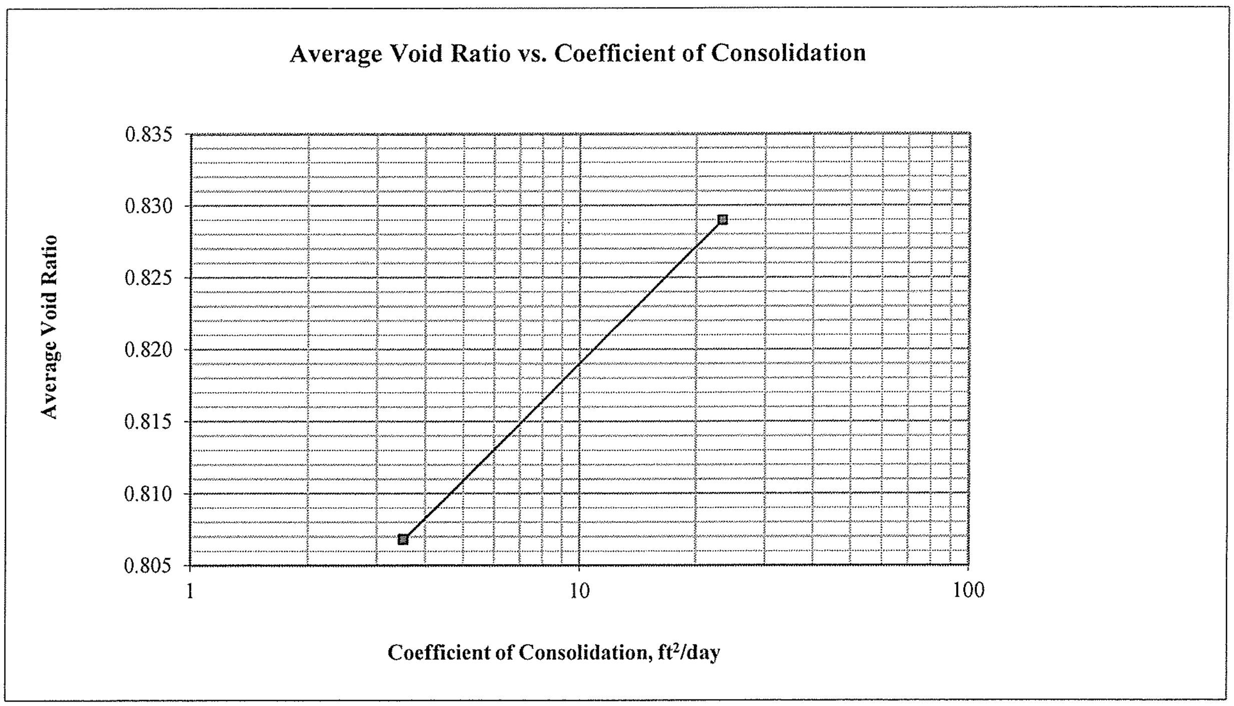
Job Short Title: Copper Flat Tailings Design Study

Sample: BH-22 @ 0-8.5 ft

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

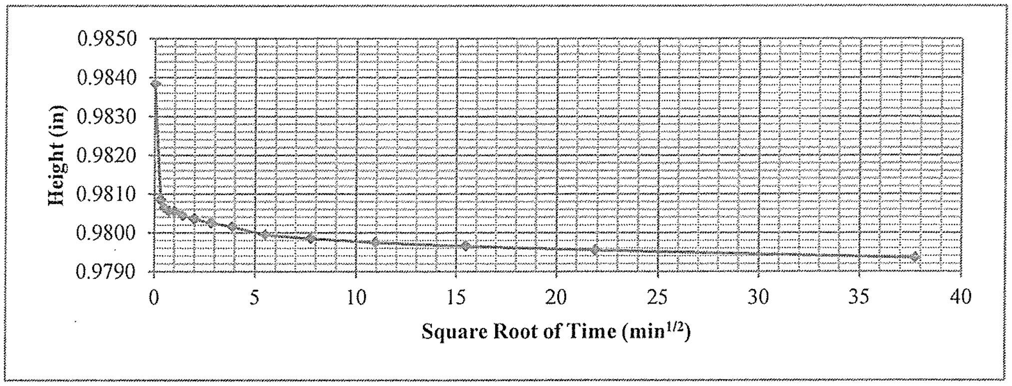
Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	3/11/2013	103-92557.006	1



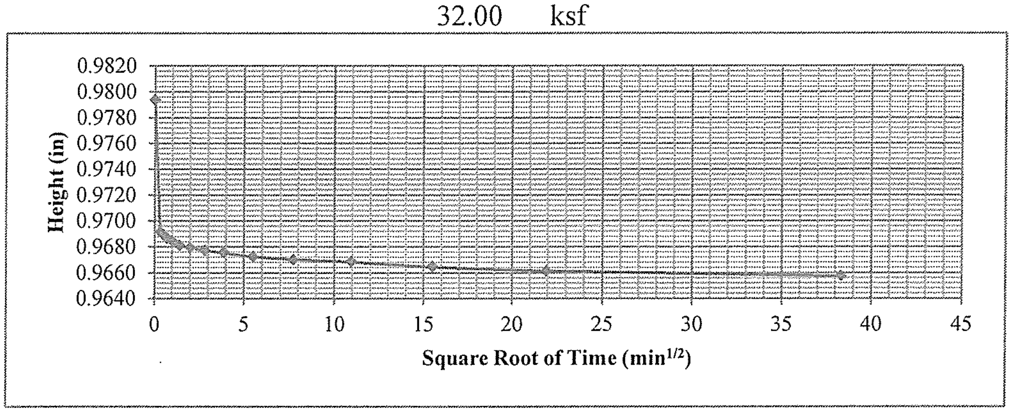


Golder Associates Inc. **Denver, Colorado**	**Title:** ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-22 @ 0-8.5 ft	**Technician:** RJM	**Reviewed:** CCS	**Start Date:** 3/11/2013	**Job Number:** 103-92557.006	**Figure:** 2

16.00 ksf



32.00 ksf



Golder Associates Inc. **Denver, Colorado**	**Title:** ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-22 @ 0-8.5 ft	**Technician:** RJM	**Reviewed:** CCS	**Start Date:** 3/11/2013	**Job Number:** 103-92557.006	**Figure:** 3

	Initial		Final	
Height =	0.997	in	0.924	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.886	in^3	4.528	in^3
Water Content =	14.2%		2.9%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5690	in	0.5690	in
Void Ratio =	0.752		0.624	
Degree of Saturation =	50.8%		12.6%	
Wet Mass =	0.310	lb	0.279	lb
Dry Mass =	0.272	lb	0.272	lb
Wet Unit Weight =	109.6	pcf	106.6	pcf
Dry Unit Weight =	96.0	pcf	103.6	pcf

Notes

Visual description (Golder procedure):	CLAYEY SAND, pale red, moist				
Atterberg Limits (ASTM D4318):	LL = 36		PL = 18		PI = 18
Percent Finer (ASTM D422):	3/4 in. = 98%		No. 4 = 82%		No. 200 = 37%
Specimen Type:		Intact	X	Reconstituted	
Remold Targets:	95.0	pcf (dry) at	15.0%	moisture	
Water Content of Trimmings (ASTM D2216):	14.5%				
Trimming Procedure:	Specimen remolded in ring				
Inundation:	X	Not inundated		Inundated	
Test Method:		A	X	B	
Apparatus:	Frame No.	5	(ELE C-320A)		
Final Water Content Specimen:	X	Entire		Partial	
Final Differential Height:	0.0184 in				
Estimated Preconsolidation Stress:	14.5 ksf				

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	980					0.0000	0.9843	0.00	0.730				
1	0.25	1410					0.0077	0.9766	0.77	0.716				
2	0.50	1410					0.0119	0.9724	1.20	0.709				
3	1.00	1440					0.0156	0.9687	1.57	0.702				
4	2.00	1470					0.0188	0.9655	1.89	0.697				
5	4.00	1410					0.0207	0.9636	2.07	0.693				
6	8.00	1415					0.0229	0.9614	2.29	0.690				
7	16.00	1425	0.0267	0.9576	2.67	0.683	0.0290	0.9553	2.91	0.679	2 (Root time)	0.684	31.272	0.3
8	32.00	1440	0.0436	0.9407	4.37	0.653	0.0470	0.9373	4.71	0.647	2 (Root time)	0.655	3.684	0.4
9	8.00	75					0.0455	0.9388	4.56	0.650				
10	2.00	130					0.0444	0.9399	4.46	0.652				
11	0.50	100					0.0433	0.9410	4.34	0.654				
12	0.10	70					0.0419	0.9424	4.20	0.656				

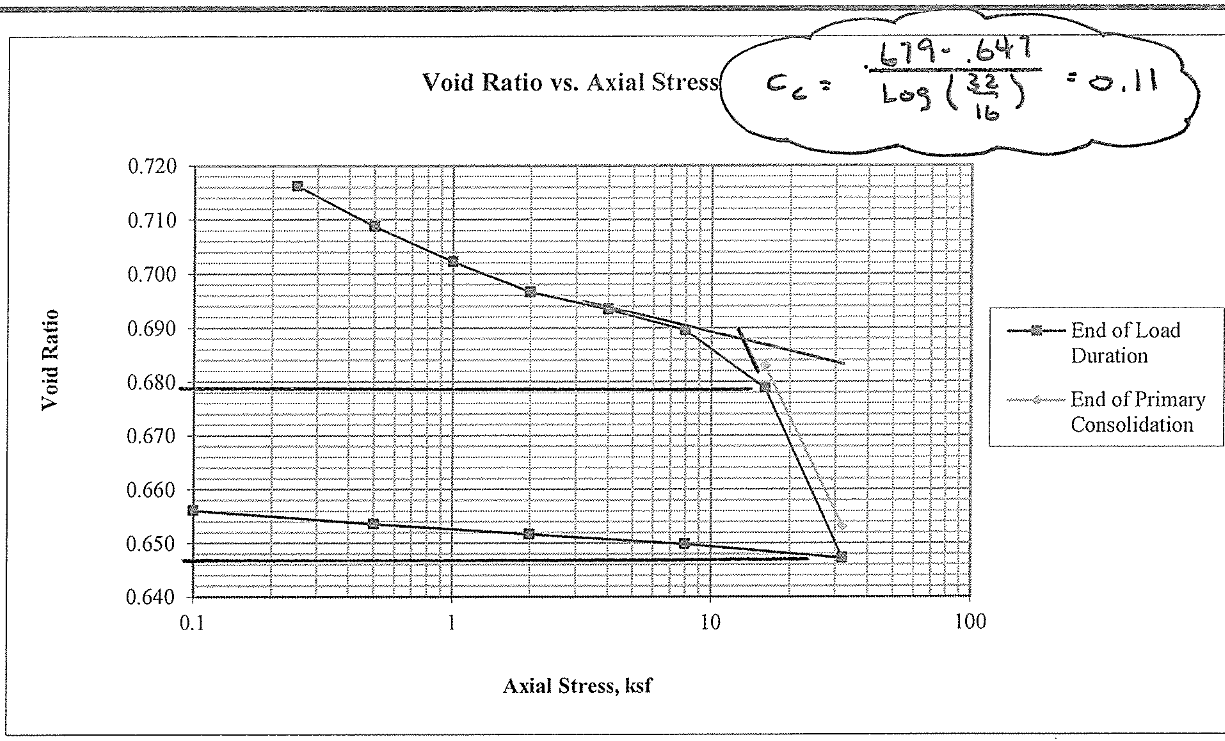
Golder Associates Inc.
Denver, Colorado

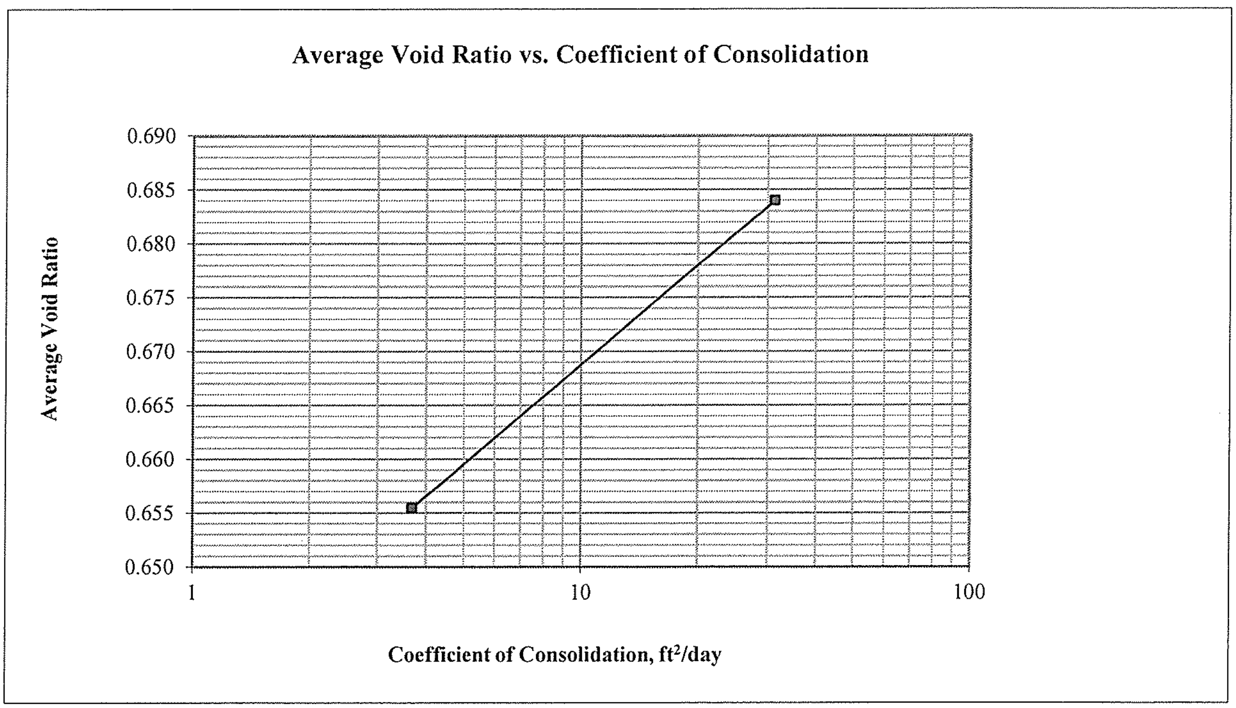
Job Short Title: Copper Flat Tailings Design Study

Sample: BH-22 @ 28-30 ft

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

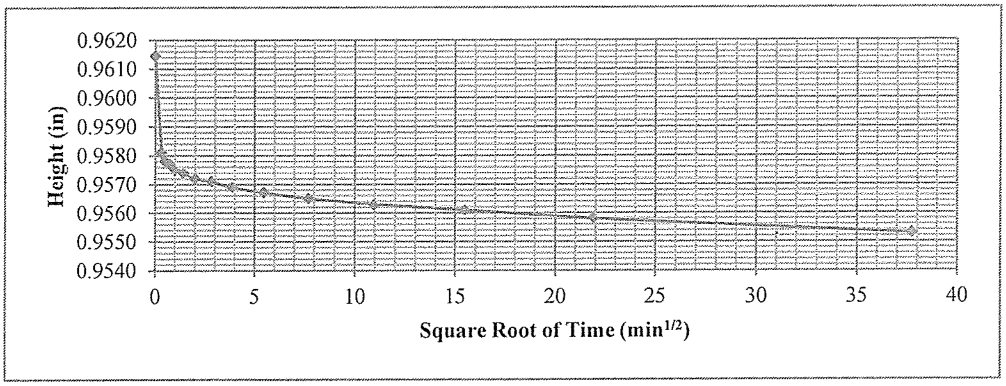
Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	3/11/2013	103-92557.006	1



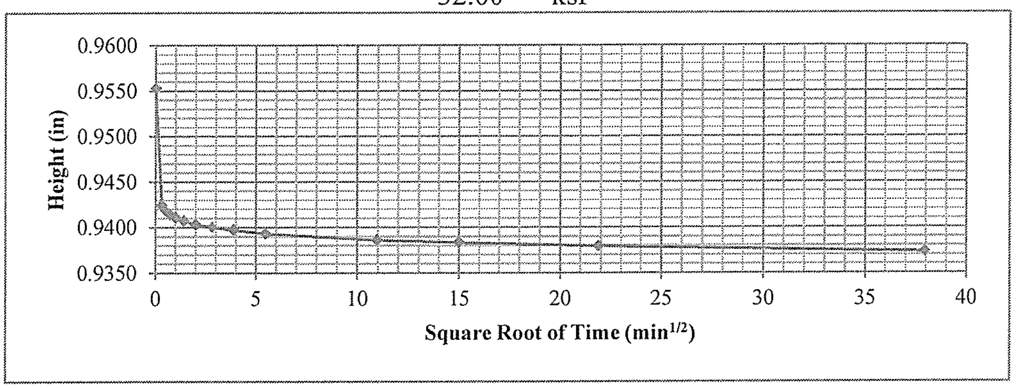


Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-22 @ 28-30 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/11/2013	Job Number: 103-92557.006	Figure: 2

16.00 ksf



32.00 ksf



Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-22 @ 28-30 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/11/2013	Job Number: 103-92557.006	Figure: 3

	Initial		Final	
Height =	1.000	in	0.973	in
Diameter =	2.498	in	2.498	in
Area =	4.901	in^2	4.901	in^2
Volume =	4.901	in^3	4.769	in^3
Water Content =	9.8%		4.2%	
Specific Gravity =	2.70	(Assumed)	2.70	(Assumed)
Height of Solids =	0.5558	in	0.5558	in
Void Ratio =	0.799		0.751	
Degree of Saturation =	33.0%		15.1%	
Wet Mass =	0.291	lb	0.276	lb
Dry Mass =	0.265	lb	0.265	lb
Wet Unit Weight =	102.7	pcf	100.1	pcf
Dry Unit Weight =	93.5	pcf	96.1	pcf

Notes

USCS description (ASTM D2487):	Clayey sand, reddish brown, moist		
Atterberg Limits (ASTM D4318):	LL = 37	PL = 17	PI = 20
Percent Finer (ASTM D422):	3/4 in. = 100%	No. 4 = 95%	No. 200 = 39%
Specimen Type:	[ ] Intact	[X] Reconstituted	
Remold Targets:	93.0 pcf (dry) at	10.0% moisture	
Water Content of Trimmings (ASTM D2216):	9.9%		
Trimming Procedure:	Specimen remolded in ring		
Inundation:	[X] Not inundated	[ ] Inundated	
Test Method:	[ ] A	[X] B	
Apparatus:	Frame No. 6	(ELE C-320A)	
Final Water Content Specimen:	[X] Entire	[ ] Partial	
Final Differential Height:	-0.0136 in		
Estimated Preconsolidation Stress:	13.8 ksf		

	Axial Stress (ksf)	Load Duration (min)	At End of Primary Consolidation: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	At End of Load Duration: Deformation (in)	Specimen Height (in)	Axial Strain (%)	Void Ratio	Time Deformation Method	Average Void Ratio	Coefficient of Consolidation (ft^2/day)	Time to 50% Consolidation (min)
Seating	0.10	960					0.0000	0.9894	0.00	0.780				
1	0.25	1440					0.0066	0.9828	0.66	0.768				
2	0.50	1425					0.0096	0.9798	0.96	0.763				
3	1.00	1440					0.0116	0.9778	1.16	0.759				
4	2.00	1410					0.0129	0.9765	1.29	0.757				
5	4.00	2770					0.0146	0.9748	1.46	0.754				
6	8.00	1410					0.0159	0.9735	1.59	0.752				
7	16.00	1410	0.0191	0.9703	1.91	0.746	0.0203	0.9692	2.03	0.744	2 (Root time)	0.746	1.313	0.9
8	32.00	1440	0.0304	0.9590	3.04	0.726	0.0330	0.9564	3.30	0.721	2 (Root time)	0.727	3.137	0.5
9	8.00	80					0.0312	0.9582	3.12	0.724				
10	2.00	100					0.0305	0.9589	3.05	0.725				
11	0.50	180					0.0300	0.9594	3.00	0.726				

Golder Associates Inc.
Denver, Colorado

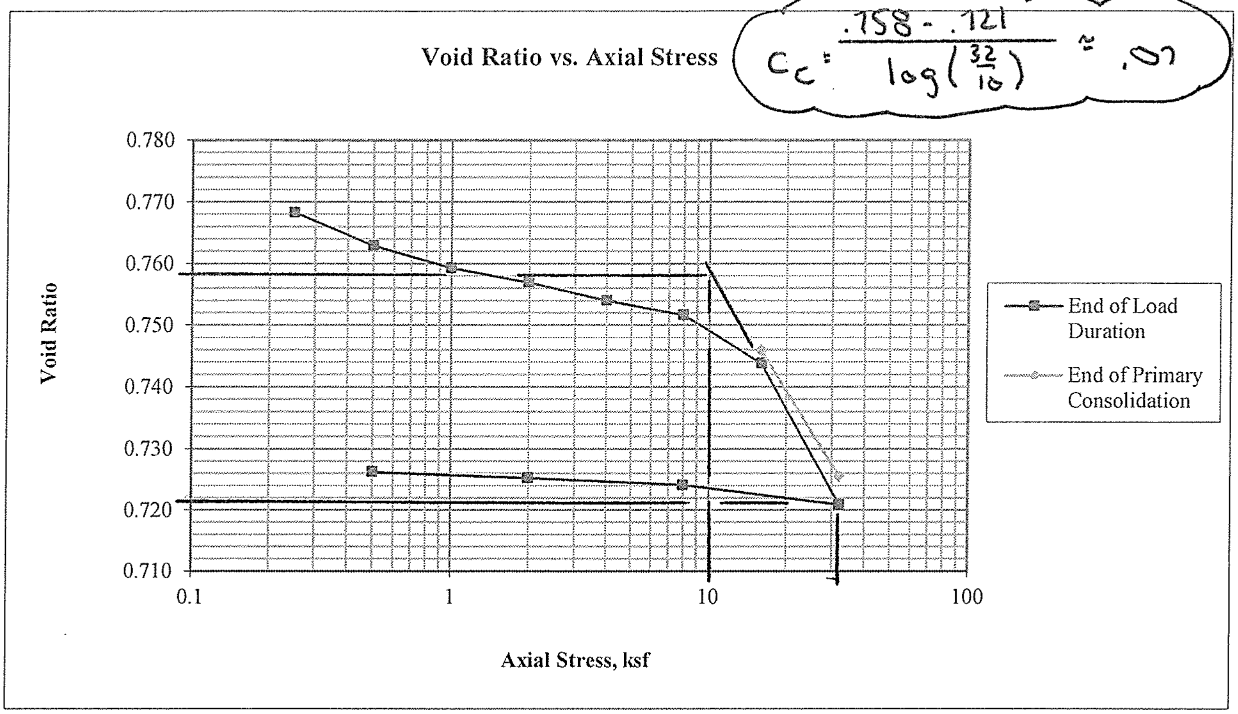
Job Short Title: Copper Flat Tailings Design Study

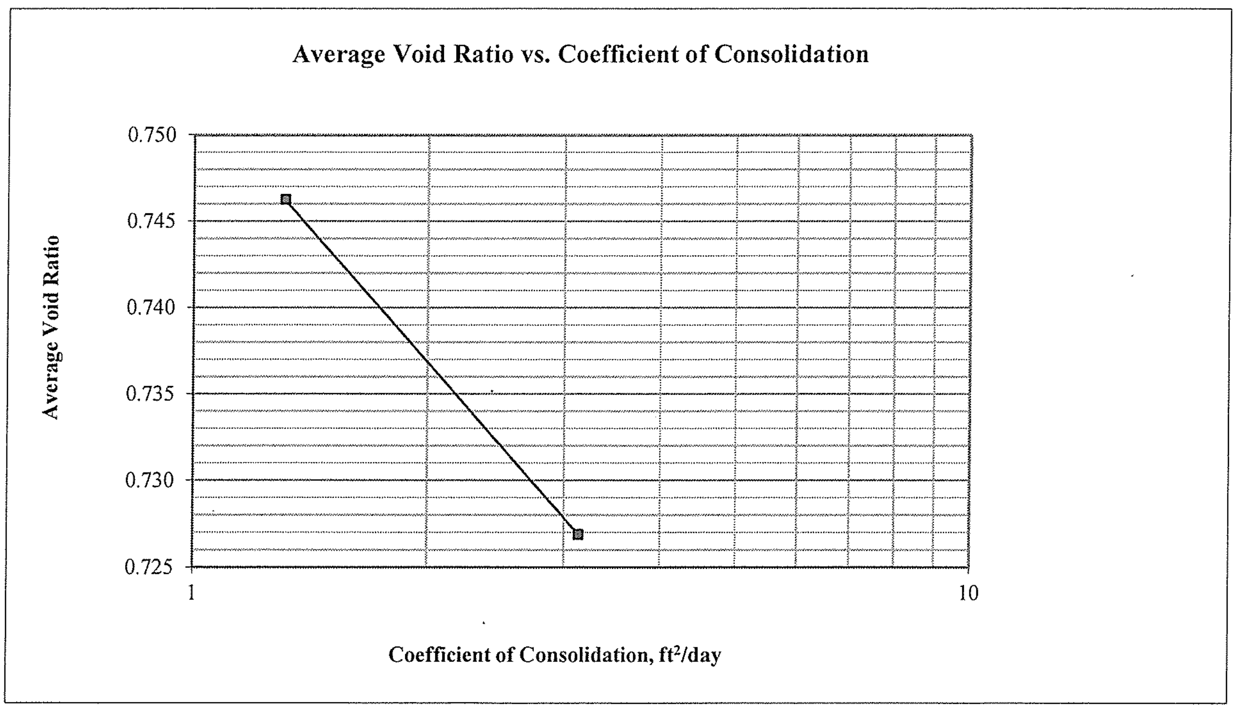
Sample: BH-25 @ 22-34 ft

Title:
ASTM D2435
ONE-DIMENSIONAL CONSOLIDATION TEST REPORT
SPECIMEN AND SUMMARY DATA

Technician:	Reviewed:	Start Date:	Job Number:	Figure:
RJM	CCS	3/25/2013	103-92557.006	1

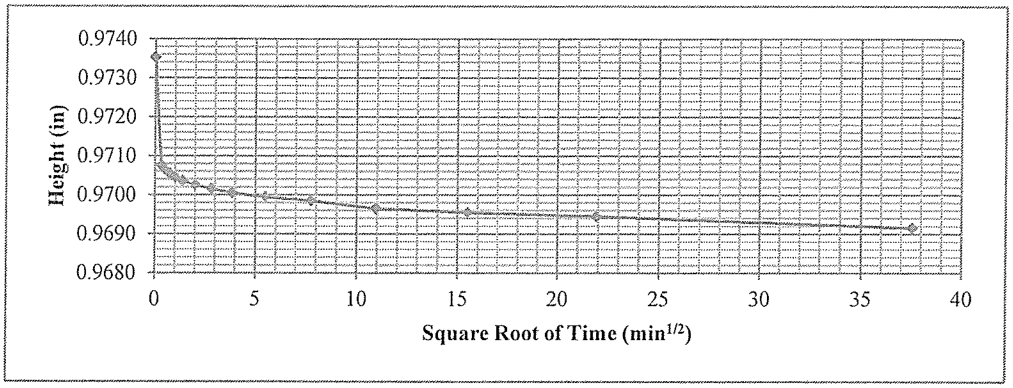
X:\Tucson\Projects\13proj\133-92505 Copper Flat TSF\30,000 TPD Report\Appendix I Foundation Settlement Potential Evaluation



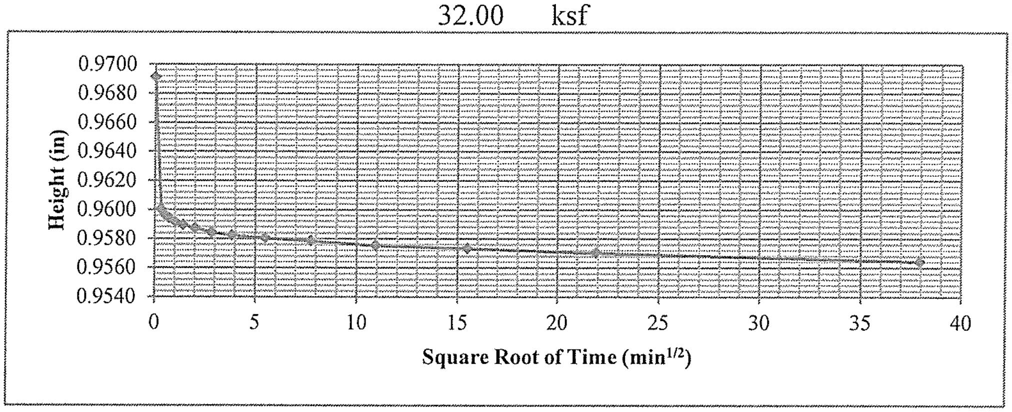


Golder Associates Inc. Denver, Colorado	Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT CONSOLIDATION PLOTS				
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-25 @ 22-34 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/25/2013	Job Number: 103-92557.006	Figure: 2

16.00 ksf



32.00 ksf



Golder Associates Inc. Denver, Colorado		Title: ASTM D2435 ONE-DIMENSIONAL CONSOLIDATION TEST REPORT TIME-DEFORMATION PLOTS			
Job Short Title: Copper Flat Tailings Design Study					
Sample: BH-25 @ 22-34 ft	Technician: RJM	Reviewed: CCS	Start Date: 3/25/2013	Job Number: 103-92557.006	Figure: 3

ATTACHMENT 2
CONSOLIDATION TESTING SUMMARY AND SETTLE 3D MODEL INPUT TABLES

Table 1: Summary Results Of Consolidation Tests -- Copper Flat, Sierra County, New Mexico

Boring No.	Sample Depth	In-situ Overburden Pressure at Midpoint of Tested Stratum (kips, Note 1)	Material Classification	Void Ratio, min	Void Ratio, max	Void Ratio, mean	Estimated Initial Void Ratio (from consolidation curve)	Cc for Analysis (Note 2)	Estimated Moist Density (final) (pcf) (Note 3)
BH-10	19-33	2.86	CL	0.666	0.74	0.703	0.69	0.05	104
BH-12	33.5-48.5	4.51	CH	0.67	0.845	0.7575	0.69	0.3	104
BH-16	29-34	3.465	SC	0.664	0.738	0.701	0.704	0.09	110
BH-18	23-33.5	3.1075	CL	0.706	0.742	0.724	0.724	0.04	103
BH-18	43.5-48.5	5.06	CH	0.767	0.925	0.846	0.79	0.04	102
BH-22	0-8.5	0.4675	ML	0.8	0.85	0.825	0.844	0.09	98
BH-22	28-30	3.19	SC	0.646	0.716	0.681	0.695	0.11	108
BH-25	22-34	3.08	SC	0.727	0.746	0.7365	0.756	0.07	101

Notes

1. Based on an assumed unit weight of 110 pcf.
2. Generally based on portion of curve developed for loading between 16 and 32 kips.
3. Moist Density estimated for water content ranging from 3 to 6 percent.

Table 2: Stratum Parameters For Settlement Analaysis -- Copper Flat, Sierra County, New Mexico

Stratum Designation	Soil Types	Assumed Initial Void Ratio	Assumed Cc Value	Referenced Consolidation Tests	Assumed Unit Weight (pcf)	Young's Modulus (ksf)
1	ML, CL-ML, SM	0.74	0.09	BH-16, BH-22 (2), BH-25	106	NA
2	CL	0.71	0.045	BH-10, BH-18	104	NA
3	CH, MH	0.75	0.035	BH-12, BH-18	103	NA
4 (Note 1)	Gravel, Sand	NA	NA	Ref. 1	110	4000
5 (Note 2)	Basalt, Caliche	NA	NA	Ref. 1	125	4000
6 (Note 3)	Embankment Fill	NA	NA	NA	97	NA
7 (Note 4)	Tailings	NA	NA	NA	97	NA

Notes

1. Settlement within embankment fill not calculated for foundation settlement evaluation.
2. Settlement within tailings not analyzed for foundation settlement evaluation.

References

1. US Army Corps of Engineer, EM-1110-1904, 1990.

Table 3A: SETTLE3D Input Parameters -- Copper Flat, Sierra County, New Mexico

Cross-Section	Analysis Section	Stratum Number	Thickness (ft)	Unit Weight (kcf)	Loading Pressure (rectangular, ksf)	Assumed Poisson Ratio (Note 1)	Cc	Cr (Note 2)	e0	OCR
B-B'	1	6	234.4	0.097	22.7	na	na	na	na	na
" "	" "	2	19.3	0.104		0.3	0.045	0.1	0.71	1
" "	" "	2	39.8	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	27.6	0.103		0.3	0.035	0.1	0.75	1
B-B'	2	6	143	0.097	13.9	na	na	na	na	na
" "	" "	2	66.5	0.104		0.3	0.045	0.1	0.71	1
" "	" "	2	9	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	12	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	14	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	28	0.103		0.3	0.035	0.1	0.75	1
B-B'	3	6	137	0.097	13.3	na	na	na	na	na
" "	" "	2	15.5	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	2.1	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	28.3	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	28.6	0.103		0.3	0.035	0.1	0.75	1
B-B'	4	6	75.2	0.097	7.3	na	na	na	na	na
" "	" "	2	12.5	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	4.9	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	23	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	28	0.103		0.3	0.035	0.1	0.75	1
B-B'	5	6	9.8	0.097	1.0	na	na	na	na	na
" "	" "	1	18.8	0.106		0.3	0.09	0.1	0.74	1
" "	" "	3	5.9	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	19.2	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	25.1	0.103		0.3	0.035	0.1	0.75	1

Notes

1. Poisson Ratio of 0.3 is approximation, based on published values ranging from 0.2 to 0.4 for sandy clays.
2. Cr value of 0.1 loaded into program, although rebound is not projected for the project.

Table 3A: SETTLE3D Input Parameters -- Copper Flat, Sierra County, New Mexico

Cross-Section	Analysis Section	Stratum Number	Thickness (ft)	Unit Weight (kcf)	Loading Pressure (rectangular, ksf)	Assumed Poisson Ratio (Note 1)	Cc	Cr (Note 2)	e0	OCR
B-B'	1	6	234.4	0.097	22.7	na	na	na	na	na
" "	" "	2	19.3	0.104		0.3	0.045	0.1	0.71	1
" "	" "	2	39.8	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	27.6	0.103		0.3	0.035	0.1	0.75	1
B-B'	2	6	143	0.097	13.9	na	na	na	na	na
" "	" "	2	66.5	0.104		0.3	0.045	0.1	0.71	1
" "	" "	2	9	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	12	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	14	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	28	0.103		0.3	0.035	0.1	0.75	1
B-B'	3	6	137	0.097	13.3	na	na	na	na	na
" "	" "	2	15.5	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	2.1	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	28.3	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	28.6	0.103		0.3	0.035	0.1	0.75	1
B-B'	4	6	75.2	0.097	7.3	na	na	na	na	na
" "	" "	2	12.5	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	4.9	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	23	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	28	0.103		0.3	0.035	0.1	0.75	1
B-B'	5	6	9.8	0.097	1.0	na	na	na	na	na
" "	" "	1	18.8	0.106		0.3	0.09	0.1	0.74	1
" "	" "	3	5.9	0.103		0.3	0.035	0.1	0.75	1
" "	" "	2	19.2	0.104		0.3	0.045	0.1	0.71	1
" "	" "	3	25.1	0.103		0.3	0.035	0.1	0.75	1

Notes

1. Poisson Ratio of 0.3 is approximation, based on published values ranging from 0.2 to 0.4 for sandy clays.
2. Cr value of 0.1 loaded into program, although rebound is not projected for the project.

ATTACHMENT 3
SETTLE 3D OUTPUT FILES

Settle3D Analysis Information
Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section B-B', Line 1.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.49066 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.97303
Consolidation Settlement [ft]	0	1.97303
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	22.7
Total Stress [ksf]	0	31.6782
Total Strain	-0	0.10667
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.020072	31.6754
Over-consolidation Ratio	1	1
Void Ratio	0.527594	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 22.7 ksf
Depth: 0 ft

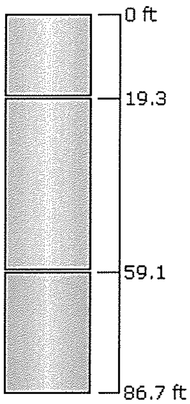
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 2	19.3	0
2	Soil Stratum 2	39.8	19.3
3	Soil Stratum 3	27.6	59.1



Soil Properties

Property	Soil Stratum 3	Soil Stratum 2
Color		
Unit Weight [kips/ft^3]	0.103	0.104
Primary Consolidation	Enabled	Enabled
Material Type	Non-Linear	Non-Linear
Cc	0.035	0.045
Cr	0.1	0.1
e0	0.75	0.71
OCR	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 55

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section B-B', Line 2.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.646645 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.98619
Consolidation Settlement [ft]	0	1.98619
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	13.9
Total Stress [ksf]	0	27.3058
Total Strain	-0	0.0869309
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.006916	27.303
Over-consolidation Ratio	1	1
Void Ratio	0.561348	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 13.9 ksf
Depth: 0 ft

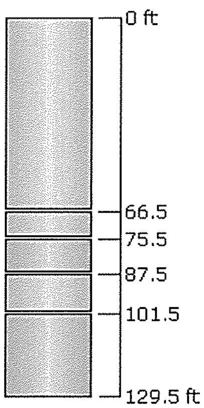
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 2	66.5	0
2	Soil Stratum 2	9	66.5
3	Soil Stratum 3	12	75.5
4	Soil Stratum 2	14	87.5
5	Soil Stratum 3	28	101.5



Soil Properties

Property	Soil Stratum 3	Soil Stratum 2
Color		
Unit Weight [kips/ft^3]	0.103	0.104
Primary Consolidation	Enabled	Enabled
Material Type	Non-Linear	Non-Linear
Cc	0.035	0.045
Cr	0.1	0.1
e0	0.75	0.71
OCR	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 59

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section B-B', Line 3.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.561914 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.4179
Consolidation Settlement [ft]	0	1.4179
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	13.3
Total Stress [ksf]	0	21.0132
Total Strain	-0	0.103067
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.01612	21.0103
Over-consolidation Ratio	1	1
Void Ratio	0.533756	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 13.3 ksf
Depth: 0 ft

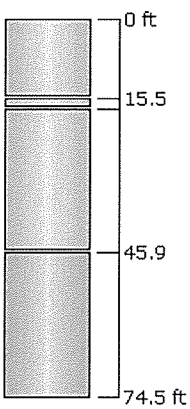
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 2	15.5	0
2	Soil Stratum 3	2.1	15.5
3	Soil Stratum 2	28.3	17.6
4	Soil Stratum 3	28.6	45.9



Soil Properties

Property	Soil Stratum 3	Soil Stratum 2
Color		
Unit Weight [kips/ft^3]	0.103	0.104
Primary Consolidation	Enabled	Enabled
Material Type	Non-Linear	Non-Linear
Cc	0.035	0.045
Cr	0.1	0.1
e0	0.75	0.71
OCR	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 61

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section B-B', Line 4.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.491452 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.00705
Consolidation Settlement [ft]	0	1.00705
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	7.3
Total Stress [ksf]	0	14.379
Total Strain	-0	0.0723724
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.065	14.3761
Over-consolidation Ratio	1	1
Void Ratio	0.586243	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 7.3 ksf
Depth: 0 ft

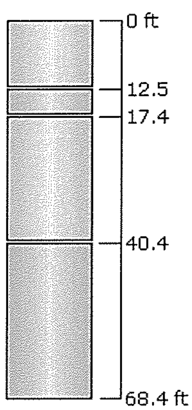
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 2	12.5	0
2	Soil Stratum 3	4.9	12.5
3	Soil Stratum 2	23	17.4
4	Soil Stratum 3	28	40.4



Soil Properties

Property	Soil Stratum 3	Soil Stratum 2
Color		
Unit Weight [kips/ft^3]	0.103	0.104
Primary Consolidation	Enabled	Enabled
Material Type	Non-Linear	Non-Linear
Cc	0.035	0.045
Cr	0.1	0.1
e0	0.75	0.71
OCR	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 53

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information
Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section B-B', Line 5.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.562388 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	0.508677
Consolidation Settlement [ft]	0	0.508677
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	1
Total Stress [ksf]	0	8.18236
Total Strain	-0	0.139728
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.019928	8.17977
Over-consolidation Ratio	1	1
Void Ratio	0.496874	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 1 ksf
Depth: 0 ft

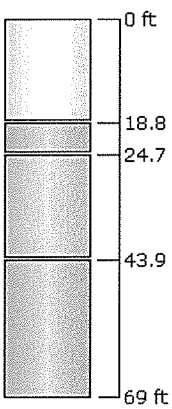
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 1	18.8	0
2	Soil Stratum 3	5.9	18.8
3	Soil Stratum 2	19.2	24.7
4	Soil Stratum 3	25.1	43.9



Soil Properties

Property	Soil Stratum 1	Soil Stratum 3	Soil Stratum 2
Color			
Unit Weight [kips/ft^3]	0.106	0.103	0.104
Primary Consolidation	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear
Cc	0.09	0.035	0.045
Cr	0.1	0.1	0.1
e0	0.74	0.75	0.71
OCR	1	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 61

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section D-D', Line 1.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.499416 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	2.11072
Consolidation Settlement [ft]	0	2.11072
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	23.4
Total Stress [ksf]	0	28.7145
Total Strain	-0	0.211235
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.019292	28.7127
Over-consolidation Ratio	1	1
Void Ratio	0.372451	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 23.4 ksf
Depth: 0 ft

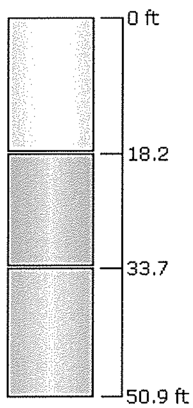
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 1	18.2	0
2	Soil Stratum 3	15.5	18.2
3	Soil Stratum 2	17.2	33.7



Soil Properties

Property	Soil Stratum 1	Soil Stratum 3	Soil Stratum 2
Color			
Unit Weight [kips/ft^3]	0.106	0.103	0.104
Primary Consolidation	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear
Cc	0.09	0.035	0.045
Cr	0.1	0.1	0.1
e0	0.74	0.75	0.71
OCR	1	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 55

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section D-D', Line 2.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.498987 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.98358
Consolidation Settlement [ft]	0	1.98358
Immediate Settlement [ft]	0	0
Loading Stress [ksf]	0	18.5
Total Stress [ksf]	0	24.1716
Total Strain	-0	0.206331
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.018974	24.1698
Over-consolidation Ratio	1	1
Void Ratio	0.380985	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 18.5 ksf
Depth: 0 ft

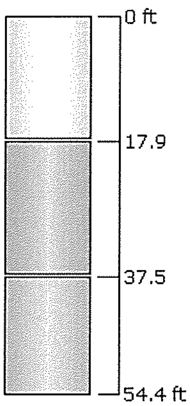
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 1	17.9	0
2	Soil Stratum 3	19.6	17.9
3	Soil Stratum 2	16.9	37.5



Soil Properties

Property	Soil Stratum 1	Soil Stratum 3	Soil Stratum 2
Color			
Unit Weight [kips/ft^3]	0.106	0.103	0.104
Primary Consolidation	Enabled	Enabled	Enabled
Material Type	Non-Linear	Non-Linear	Non-Linear
Cc	0.09	0.035	0.045
Cr	0.1	0.1	0.1
e0	0.74	0.75	0.71
OCR	1	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 55

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section D-D', Line 3.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.576466 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	1.40443
Consolidation Settlement [ft]	0	1.35522
Immediate Settlement [ft]	0	0.0492125
Loading Stress [ksf]	0	12.7
Total Stress [ksf]	0	18.5709
Total Strain	-0	0.203888
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.014522	18.5692
Over-consolidation Ratio	1	1
Void Ratio	0	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 12.7 ksf
Depth: 0 ft

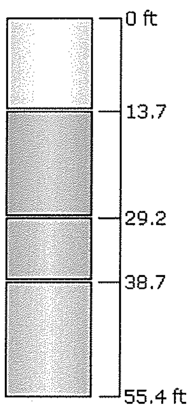
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 1	13.7	0
2	Soil Stratum 4	15.5	13.7
3	Soil Stratum 3	9.5	29.2
4	Soil Stratum 2	16.7	38.7



Soil Properties

Property	Soil Stratum 1	Soil Stratum 3	Soil Stratum 2	Soil Stratum 4
Color				
Unit Weight [kips/ft^3]	0.106	0.103	0.104	0.11
Immediate Settlement	Disabled	Disabled	Disabled	Enabled
Es [ksf]				4000
Esur [ksf]				4000
Primary Consolidation	Enabled	Enabled	Enabled	Disabled
Material Type	Non-Linear	Non-Linear	Non-Linear	
Cc	0.09	0.035	0.045	
Cr	0.1	0.1	0.1	
e0	0.74	0.75	0.71	
OCR	1	1	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions
1	15.349, 19.014	Auto: 65

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section D-D', Line 4.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.636294 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	0.948079
Consolidation Settlement [ft]	0	0.914599
Immediate Settlement [ft]	0	0.03348
Loading Stress [ksf]	0	6.2
Total Stress [ksf]	0	12.7328
Total Strain	-0	0.141231
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.05777	12.7313
Over-consolidation Ratio	1	1
Void Ratio	0	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 6.2 ksf
Depth: 0 ft

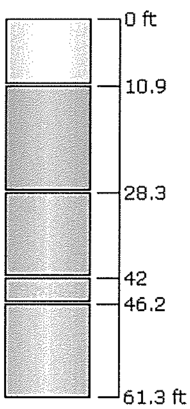
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 1	10.9	0
2	Soil Stratum 4	17.4	10.9
3	Soil Stratum 3	13.7	28.3
4	Soil Stratum 5	4.2	42
5	Soil Stratum 2	15.1	46.2



Soil Properties

Property	Soil Stratum 1	Soil Stratum 3	Soil Stratum 2	Soil Stratum 4	Soil Stratum 5
Color					
Unit Weight [kips/ft^3]	0.106	0.103	0.104	0.11	0.115
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Enabled
Es [ksf]				4000	4000
Esur [ksf]				4000	4000
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Disabled
Material Type	Non-Linear	Non-Linear	Non-Linear		
Cc	0.09	0.035	0.045		
Cr	0.1	0.1	0.1		
e0	0.74	0.75	0.71		
OCR	1	1	1	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions

1	15.349, 19.014	Auto: 71

Field Point Grid

Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

Settle3D Analysis Information

Copper Flat Embankment Post-Construction Settlement

Project Settings

Document Name: Section D-D', Line 5.s3z
Project Title: Copper Flat Embankment Post-Construction Settlement
Analysis: 1-D Boussinesq
Author: David Poe, P.E.
Company: Golder Associates
Date Created: 4/25/2013, 2:08:28 PM
Stress Computation Method: Boussinesq
Use average properties to calculate layered stresses

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.583683 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [ft]	0	0.175852
Consolidation Settlement [ft]	0	0.173272
Immediate Settlement [ft]	0	0.00257999
Loading Stress [ksf]	0	0.4
Total Stress [ksf]	0	7.63261
Total Strain	-0	0.0875971
Degree of Consolidation [%]	0	100
Pre-consolidation Stress [ksf]	0.04134	7.61899
Over-consolidation Ratio	1	1
Void Ratio	0	0.75
Hydroconsolidation Settlement [ft]	0	0

Loads

1. Rectangular Load

Length: 2000 ft
Width: 2000 ft
Rotation angle: 0 degrees
Load Type: Flexible
Area of Load: 4e+006 ft^2
Load: 0.4 ksf
Depth: 0 ft

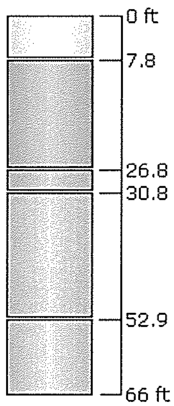
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-984.651	-980.986
1015.35	-980.986
1015.35	1019.01
-984.651	1019.01

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	Soil Stratum 1	7.8	0
2	Soil Stratum 4	19	7.8
3	Soil Stratum 3	4	26.8
4	Soil Stratum 5	22.1	30.8
5	Soil Stratum 2	13.1	52.9



Soil Properties

Property	Soil Stratum 1	Soil Stratum 3	Soil Stratum 2	Soil Stratum 4	Soil Stratum 5
Color					
Unit Weight [kips/ft^3]	0.106	0.103	0.104	0.11	0.115
Immediate Settlement	Disabled	Disabled	Disabled	Enabled	Enabled
Es [ksf]				4000	13000
Esur [ksf]				4000	13000
Primary Consolidation	Enabled	Enabled	Enabled	Disabled	Disabled
Material Type	Non-Linear	Non-Linear	Non-Linear		
Cc	0.09	0.035	0.045		
Cr	0.1	0.1	0.1		
e0	0.74	0.75	0.71		
OCR	1	1	1	1	1

Query Points

Point #	(X,Y) Location	Number of Divisions

1	15.349, 19.014	Auto: 63

Field Point Grid

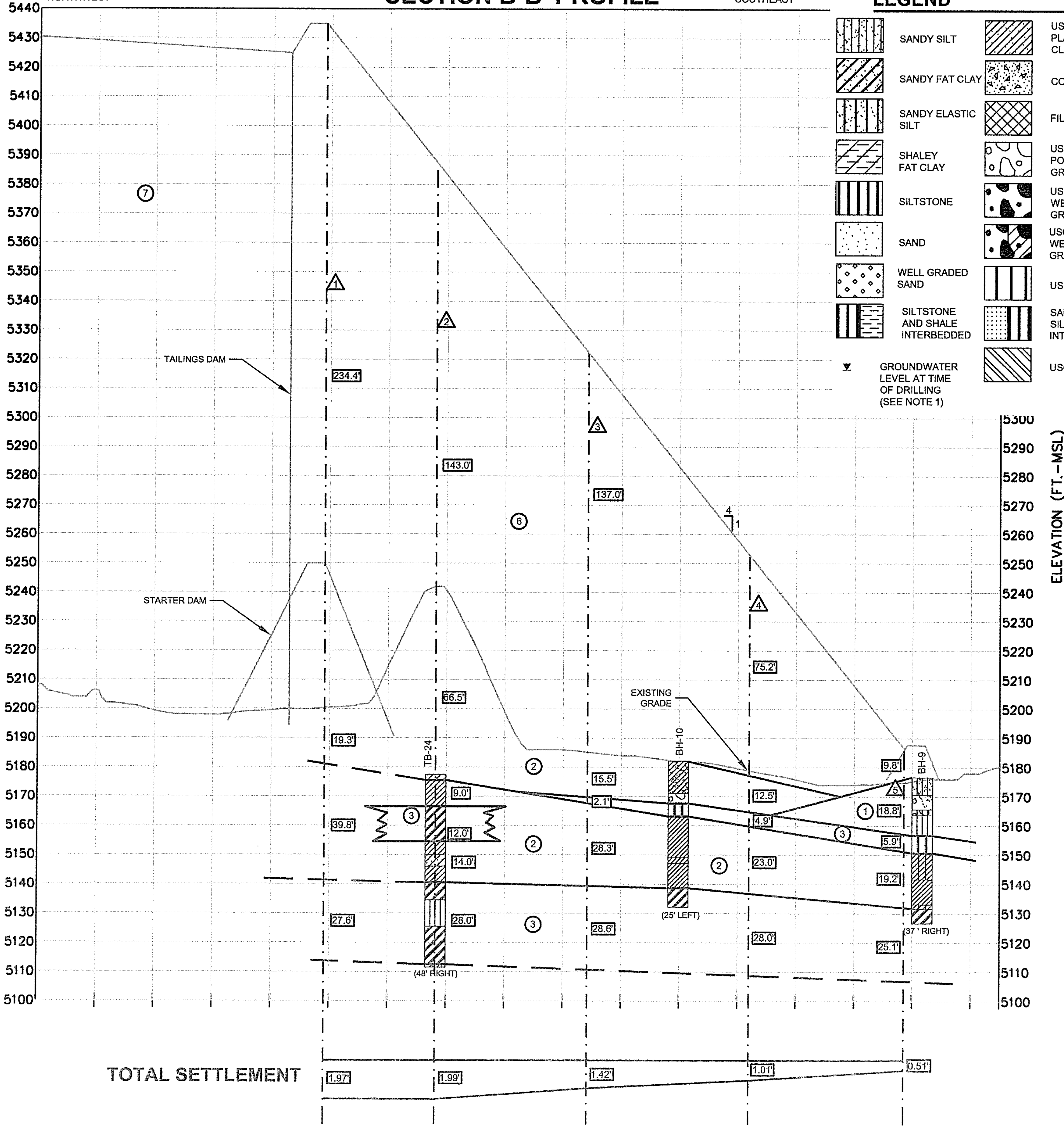
Number of points: 289
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
2015.35	2019.01
2015.35	-1989.31
-1989.58	-1989.31
-1989.58	2019.01

ATTACHMENT 4
EMBANKMENT ANALYSIS CROSS-SECTIONS WITH GRAPHICAL OUTPUT RESULTS
(SECTIONS B-B' AND D-D' ONLY)

SECTION B-B' PROFILE



LEGEND

- SANDY SILT
- SANDY FAT CLAY
- SANDY ELASTIC SILT
- SHALEY FAT CLAY
- SILTSTONE
- SAND
- WELL GRADED SAND
- SILTSTONE AND SHALE INTERBEDDED
- GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
- USCS LOW PLASTICITY SANDY CLAY
- CONCRETE
- FILL (MADE GROUND)
- USCS POORLY-GRADED GRAVEL
- USCS WELL-GRADED GRAVEL
- USCS WELL-GRADED GRAVEL WITH CLAY
- USCS ELASTIC SILT
- SANDSTONE AND SILTSTONE INTERBEDDED
- USCS CL-CH
- CLAYEY SAND
- USCS HIGH PLASTICITY CLAY
- USCS LOW PLASTICITY CLAY
- SANDSTONE
- SANDSTONE AND SHALE
- WELL GRADED SAND WITH CLAY
- SHALE
- SHALEY ELASTIC SILT
- POORLY GRADED SAND WITH SILT

STRATUM DESCRIPTORS

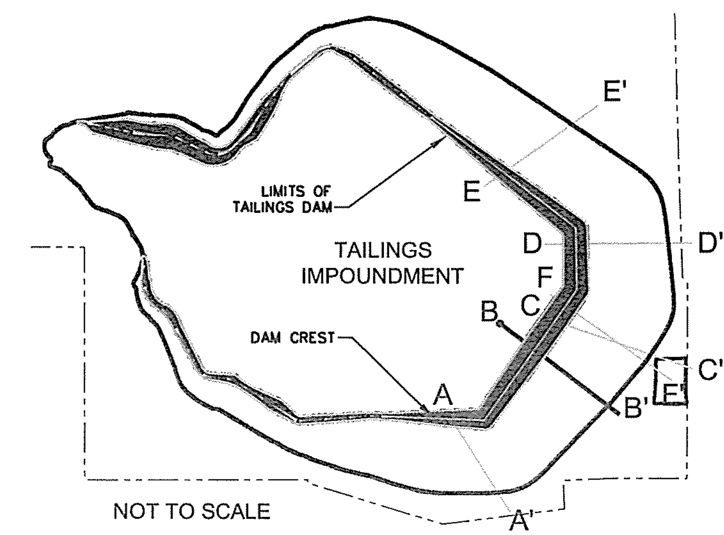
- (1) ML, CL-ML, SM
- (2) CL
- (3) CH, MH
- (4) GRAVEL, SAND
- (5) BASALT, CALICHE
- (6) EMBANKMENT FILL
- (7) TAILINGS (CONSOLIDATED)
- △ ANALYSIS SECTION
- [12.0'] STRATUM/FILL THICKNESS

NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. EXISTING FIVE (5) FOOT TOPOGRAPHY AND PERMIT BOUNDARY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. TOPOGRAPHY IN THE MINE AREA AND TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.

200 0 200
HORIZONTAL SCALE FEET

40 0 40
VERTICAL SCALE FEET



NOT TO SCALE

DRAFT

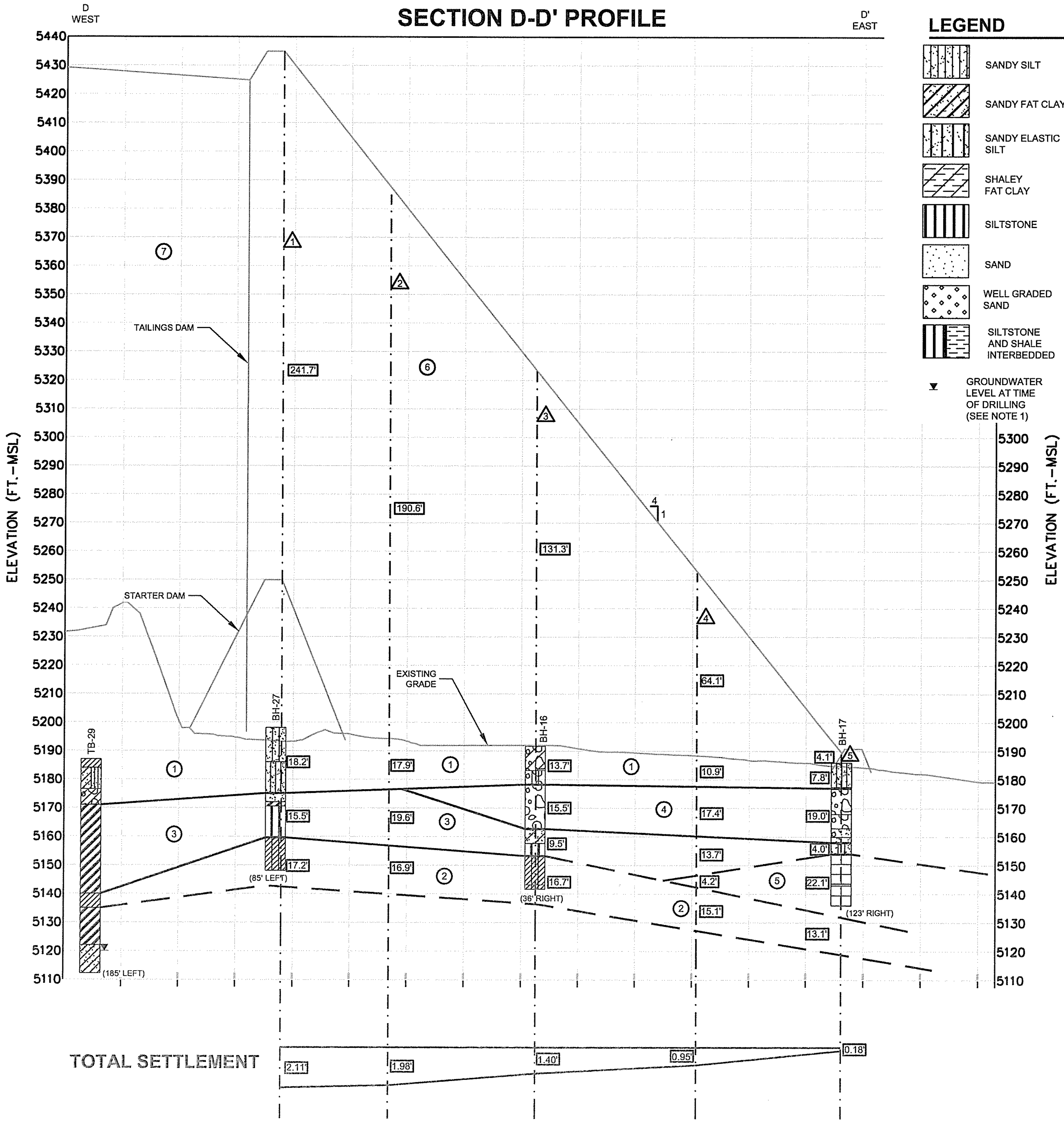
PROJECT
COPPER FLAT PROJECT
TAILINGS STORAGE FACILITY
SIERRA COUNTY, NEW MEXICO

TITLE
GEOLOGIC CROSS SECTION B-B'

Golder Associates

PROJECT No.		10392557	FILE No.	10392557A003
DESIGN	CMT	2/21/13	SCALE	AS SHOWN
CADD	CMT	2/21/13	FIGURE	
CHECK	DEP	2/21/13		5
REVIEW	GM	2/21/13		

SECTION D-D' PROFILE



LEGEND

SANDY SILT	USCS LOW PLASTICITY SANDY CLAY	CLAYEY SAND
SANDY FAT CLAY	CONCRETE	USCS HIGH PLASTICITY CLAY
SANDY ELASTIC SILT	FILL (MADE GROUND)	USCS LOW PLASTICITY CLAY
SHALEY FAT CLAY	USCS POORLY-GRADED GRAVEL	SANDSTONE
SILTSTONE	USCS WELL-GRADED GRAVEL	SANDSTONE AND SHALE
SAND	USCS WELL-GRADED GRAVEL WITH CLAY	WELL GRADED SAND WITH CLAY
WELL GRADED SAND	USCS ELASTIC SILT	SHALE
SILTSTONE AND SHALE INTERBEDDED	SANDSTONE AND SILTSTONE INTERBEDDED	SHALEY ELASTIC SILT
GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)	CALICHE	POORLY GRADED SAND WITH SILT

STRATUM DESCRIPTORS

1. ML, CL-ML, SM
2. CL
3. CH, MH
4. GRAVEL, SAND
5. BASALT, CALICHE
6. EMBANKMENT FILL
7. TAILINGS (CONSOLIDATED)

△ ANALYSIS SECTION

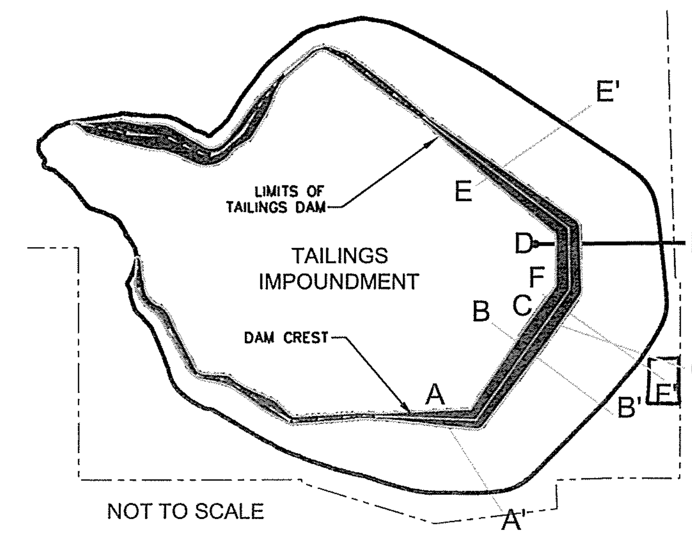
12.0' STRATUM/FILL THICKNESS

NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. EXISTING FIVE (5) FOOT TOPOGRAPHY AND PERMIT BOUNDARY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. TOPOGRAPHY IN THE MINE AREA AND TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.

200 0 200
HORIZONTAL SCALE FEET

40 0 40
VERTICAL SCALE FEET



NOT TO SCALE

DRAFT

PROJECT
COPPER FLAT PROJECT
TAILINGS STORAGE FACILITY
SIERRA COUNTY, NEW MEXICO

TITLE
GEOLOGIC CROSS SECTION D-D'

Golder Associates

PROJECT No.		10392557	FILE No.	10392557A005
DESIGN	CMT	2/21/13	SCALE	AS SHOWN
CADD	CMT	2/21/13	FIGURE	
CHECK	DEP	2/21/13		7
REVIEW	GM	2/21/13		

APPENDIX I.2
SETTLEMENT & GEOMEMBRANE STRAIN ANALYSIS

REVISED JUNE 2016
REVISED NOVEMBER 2016

SETTLEMENT & GEOMEMBRANE STRAIN ANALYSIS

Made By: JL
Checked by: GM
Reviewed by: MP
Revised by: TS

1.0 OBJECTIVE

Estimate the tensile strain caused by differential settlement of the in-situ subsurface materials inferred below the proposed Copper Flat tailing facility.

2.0 METHODOLOGY

The proposed geomembrane liner system may experience tensile strain because of differential settlement caused from the loading (tailings and embankment) of the subsurface soils.

2.1 Settlement Analysis

Settlement was calculated using the finite element software SigmaW from the 2012 GeoStudio package. Cross sections A and B (both shown in plan view on Figure 1 and in profile view in Figure 2) showing the proposed tailing facility and tailings embankment layout/dimensions, inferred subsurface soils and boundaries were imported into the software for analyses. Geotechnical properties for each subsurface material layer were selected from previous reports (Refs. 1 and 2) and from experience with similar soils. The geotechnical properties were incorporated into the software and used for the settlement analyses. Figure 3 provides information on the geologic units and geologic structrures (Refs. 4, 5 and 6) associated with cross sections A and B along with the the proposed tailing facility and tailings embankment layout/dimensions. Table 1 below provides a list of the geotechnical subsurface material layers and properties.

Table 1: Geotechnical Subsurface Material Layers and Properties

Material No.	Material Name	Geotechnical Properties		
		Unit Weight (lb/ft^3)	Poisson's Ratio (-)	Effective Modulus (lb/ft^2)
0	Tailings/Embankment	97	0.49	10,000,000
1	Well-Graded Gravel	110	0.30	4,000,000
2	Well-Graded Sand with Silt and Gravel	110	0.30	4,000,000
3	Conglomerate	130	0.30	5,000,000
4	Basalt	160	0.30	100,000,000
5	Lean Clay, Fat Clay, Silty Clay	104	0.30	790,600
6	Silt	106	0.30	671,400
7	Caliche	125	0.30	100,000,000
8	Bedrock	175	0.30	100,000,000

2.1 Tensile Strain from Differential Settlement

Settlement results from the SigmaW runs were used to calculate the induced strain in the geomembrane liner system along Cross Section A and B shown in Figure 1 and Figure 2.

The tensile strain of a base liner system caused by differential settlement can be estimated by the following equation:

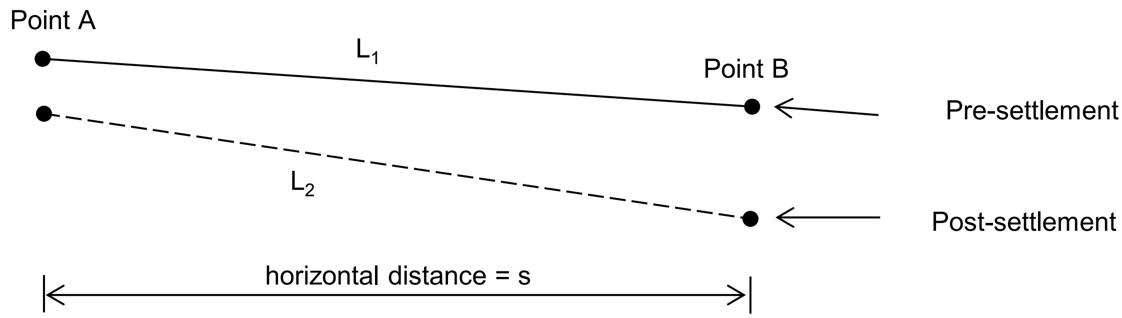


Illustration: Liner Differential Settlement

$$\varepsilon = \frac{L_2 - L_1}{L_1}$$

$$L = \sqrt{(Elev.A - Elev.B)^2 + s^2}$$

Where:
- **e** = Tensile strain in liner system between Points A and B
- L_1 = Distance between Points A and B, pre-settlement
- L_2 = Distance between Points A and B, post-settlement
- s = Horizontal distance between Points A and B

3.0 CALCULATIONS AND RESULTS

3.1 Tensile Strain from Differential Settlement

The settlement results for Cross Section A and Cross Section B are illustrated below. Points for liner strain evaluation were selected at locations where peaks or valleys were observed in the results. The liner strain evaluations due to differential settlement of the subsurface materials are summarized in Table 2 and Table 3.

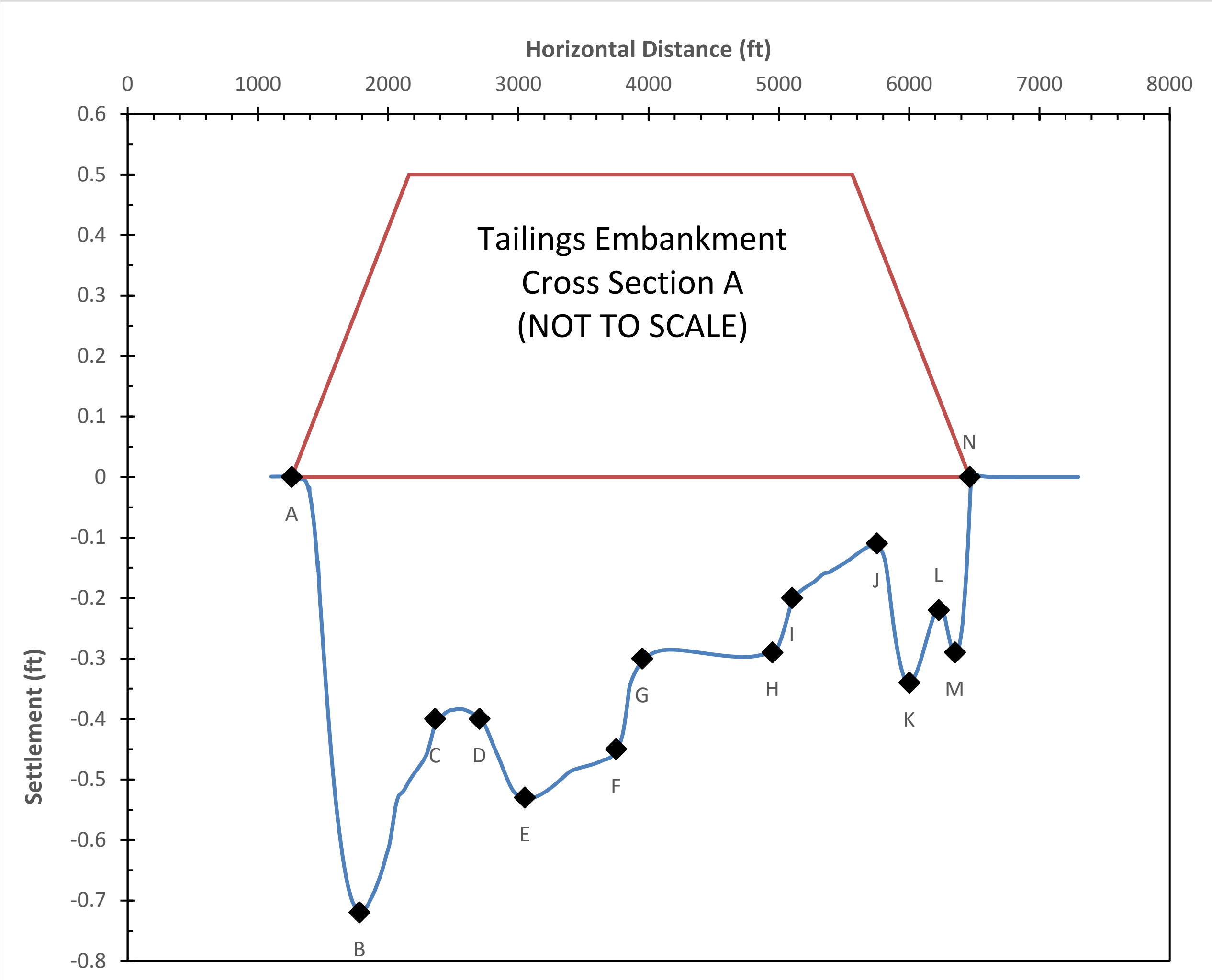


Illustration: Settlement Profile - Cross Section A
(refer to Figure 2 for location along horizontal distance)

Table 2: Liner Integrity Analysis Results - Cross Section A

Points	Elevations: Pre-settlement, feet	Elevations: Post-settlement, feet	Settlement, feet	Horizontal Distance (s), feet	Pre-settlement Dist. (L_1), feet	Post-settlement Dist. (L_2), feet	Tensile Strain
A B	5383.4 5311.7	5383.4 5311.0	0.00 0.72	520.00	524.920	525.019	0.0188%
B C	5311.7 5275.5	5311.0 5275.1	0.72 0.40	580.00	581.129	581.109	Under Compression
D E	5267.5 5251.8	5267.1 5251.3	0.40 0.53	350.00	350.352	350.358	0.0017%
E F	5251.8 5230.0	5251.3 5229.6	0.53 0.45	700.00	700.339	700.337	Under Compression
F G	5230.0 5230.2	5229.6 5229.9	0.45 0.30	200.00	200.000	200.000	0.0001%
H I	5239.6 5197.3	5239.3 5197.1	0.29 0.20	150.00	155.850	155.826	Under Compression
I J	5197.3 5185.2	5197.1 5185.1	0.20 0.11	650.00	650.113	650.111	Under Compression
J K	5185.2 5180.4	5185.1 5180.1	0.11 0.34	250.00	250.046	250.051	0.0018%
K L	5180.4 5176.7	5180.1 5176.5	0.34 0.22	225.00	225.030	225.028	Under Compression
L M	5176.7 5173.3	5176.5 5173.0	0.22 0.29	125.00	125.046	125.048	0.0015%
M N	5173.3 5168.5	5173.0 5168.5	0.29 0.00	113.00	113.102	113.090	Under Compression
Maximum Tensile Strain due to Differential Settlement =							0.0188%

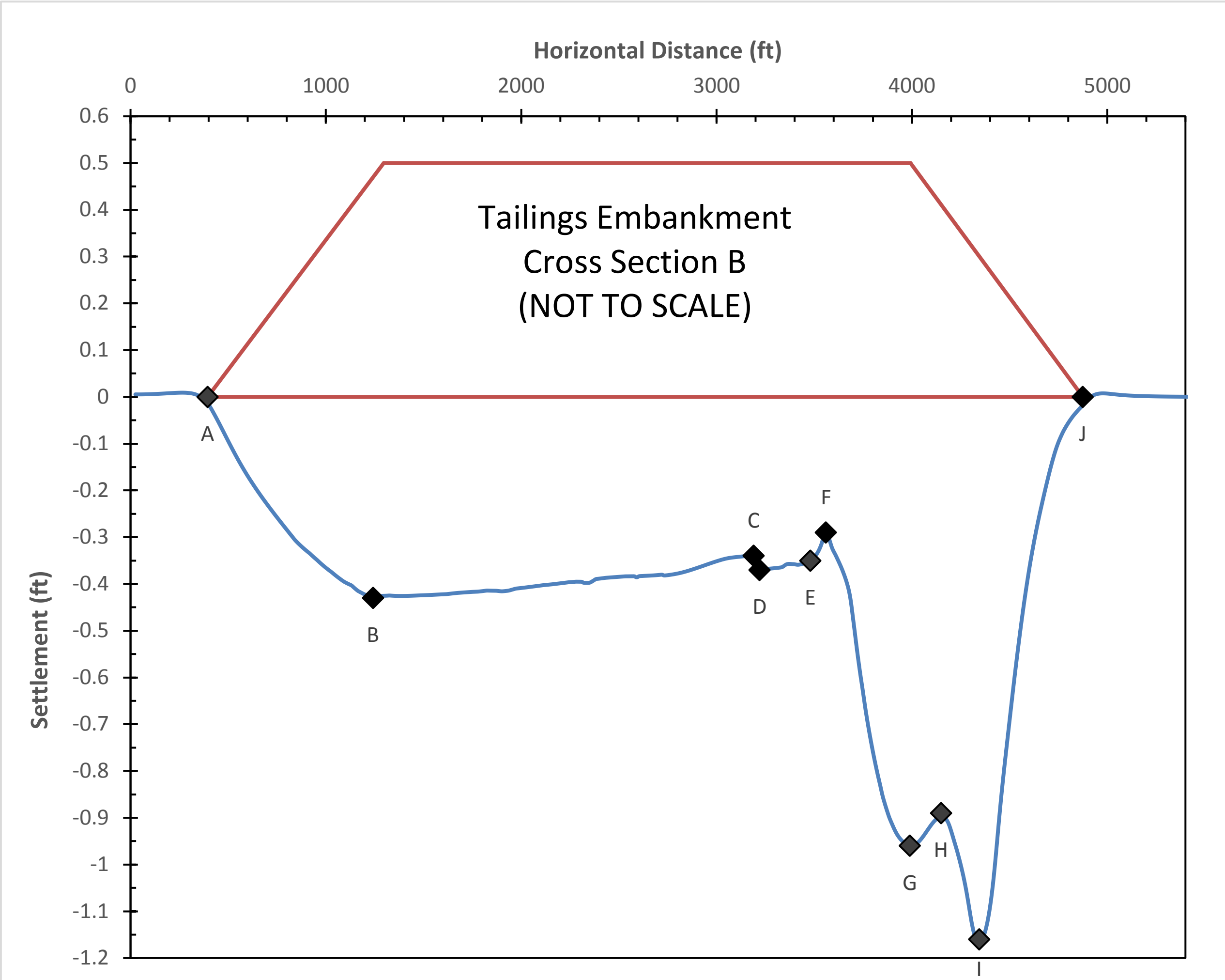


Illustration: Settlement Profile - Cross Section B
(refer to Figure 2 for location along horizontal distance)

Table 3: Liner Integrity Analysis Results - Cross Section B

Points	Elevations		Settlement, feet	Horizontal Distance (s), feet	Pre-settlement Dist. (L_1), feet	Post-settlement Dist. (L_2), feet	Tensile Strain
	Pre-settlement, feet	Post-settlement, feet					
A B	5280.2 5226.4	5280.2 5226.0	0.00 0.43	847.00	848.707	848.734	0.0032%
C D	5213.7 5229.7	5213.4 5229.3	0.34 0.37	30.00	34.000	33.986	Under Compression
E F	5239.3 5211.6	5239.0 5211.3	0.35 0.29	79.00	83.716	83.696	Under Compression
F G	52116.0 5196.2	52115.7 5195.2	0.29 0.96	430.00	46921.770	46922.440	0.0014%
G H	5196.2 5197.3	5195.2 5196.4	0.96 0.89	160.00	160.004	160.004	0.0003%
H I	5197.3 5198.6	5196.4 5197.4	0.89 1.16	195.00	195.004	195.003	Under Compression
I J	5198.6 5199.3	5197.4 5199.3	1.16 0.00	530.00	530.000	530.003	0.0005%
Maximum Tensile Strain due to Differential Settlement =							0.0032%

4.0 DISCUSSION AND CONCLUSIONS

It is understood that the liner system will consist of HDPE 80 mil geomembrane liner between a liner bedding fill layer and tailings. The minimum allowable tensile strain for geomembrane is 10% (Refs. 3). Based on the analysis performed herein and available information at the time of this calculation, the estimated tensile strain along Cross Section A and Cross Section B are less then the allowable tensile strain. The allowable strain is presented in Table 4.

Table 4: Summary of Allowable Liner Strains

Cross Section	Max. Tensile Strain from Differential Settlement	Liner Component	Allowable Tensile Strain	Tensile Strain less than Allowable?
A	0.0188%	Geomembrane	10%	Yes
B	0.0032%			Yes

The potential strain of the geomembrane liner system was analyzed for overall differential settlement along two cross sections (Cross Section A and B) within the proposed Copper Flat tailing facility. Based on the available information, experience with similar subsurface materials and conservative assumptions, the maximum liner strain is estimated to be 0.02%, from differential settlement which is less than the allowable strain for geomembrane liners.

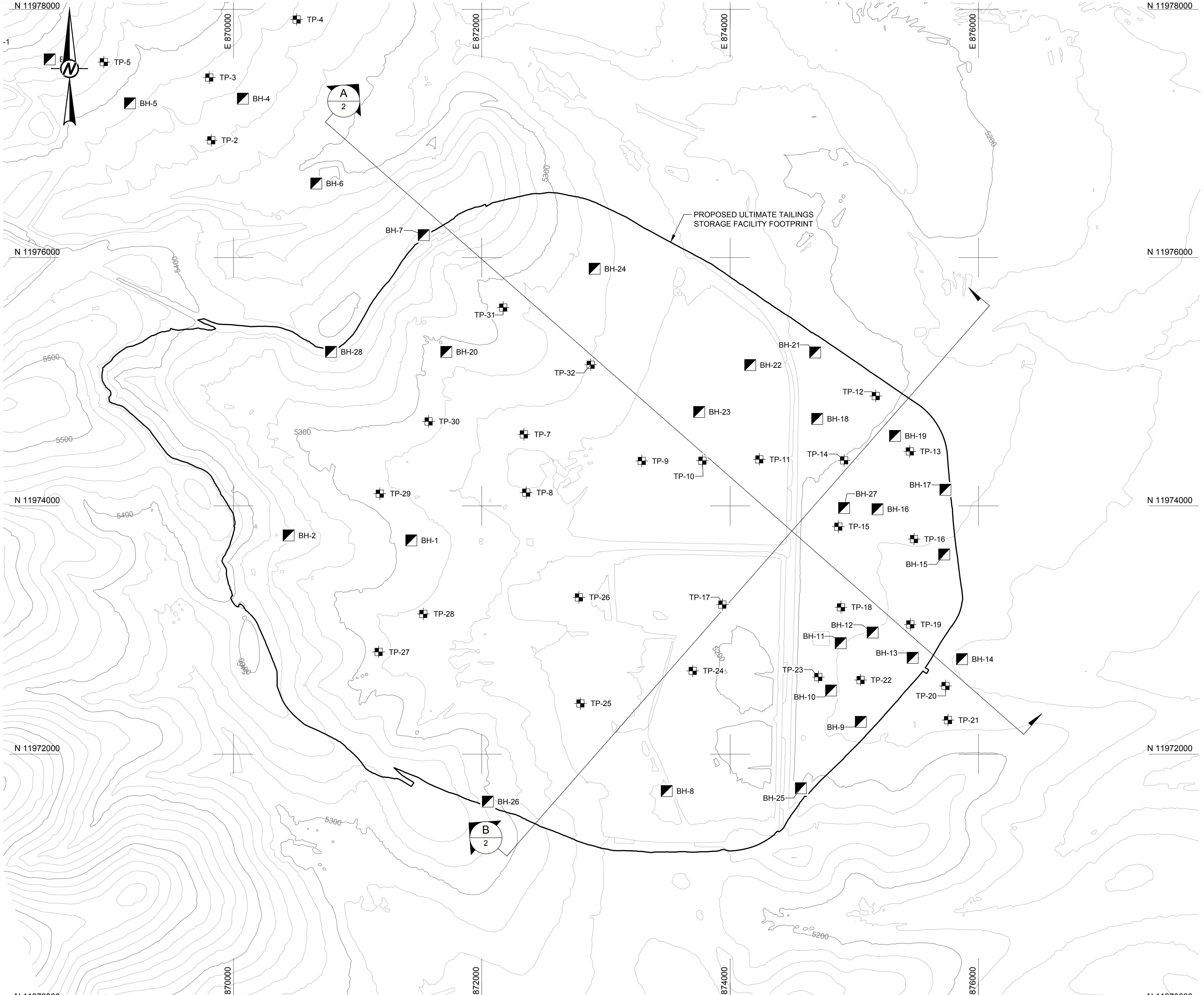
5.0 REFERENCES

1. - Golder 2013, Feasibility Study Copper Flat Project, Sierra County, New Mexico, Volume 1 - Tailings Storage Facility, report dated July 2013, Golder Project No. 103-92557.011
2. - SHB (Sergent, Hauskins and Beckwith), 1980. Tailings Dam and Disposal Area - Quintana Minerals Corporation - Copper Flats Project - Golddust, New Mexico. October 14, 1980
3. - Robert M. Koerner (2005) Designing with Geosynthetics, Fifth Edition, Pearson/Prentice Hall.
4. - A.J Jochems and Others (2014) DRAFT Geologic Map of the Hisslboro 7.5-Minute Quadrangle, Sierra County, New Mexico: New Mexico Bureau of Geoloty and Mineral Resources pen-File Geologic Map 242
5. - D.J. Koening and Others (2015) DRAFT Geologic Map of the Skute Stone Arroyo 7.5-Minute Quadrangle, Sierra County, New Mexico: New Mexico Bureau of Geoloty and Mineral Resources pen-File Geologic Map 252
6. - JSAI (John Shomaker and Associates, Inc.) 2014. Figure 11K-2b of Copper Flat Mine Discharge Permit Application,dated December 2015.

GeoStudio File Names	**Description**
Full Cross Section A.gsz	Cross Section A Settlement Analysis
Full Cross Section B.gsz	Cross Section B Settlement Analysis

Attachments

Figure 1: Cross Section Location Plan
Figure 2: Geologic Cross Sections
Figure 3: Geologic Cross-Sections Near Tailings Storage Facility



LEGEND

3600	EXISTING GROUND CONTOUR (ft -MSL)
BH-11	HOLLOW STEM AUGER (HSA) BOREHOLE
TP-8	TEST PIT
A / 2	CROSS-SECTION CALLOUT SECTION ID DRAWING SHEET LOCATION

0 250 500
1" = 500' FEET

CLIENT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION

Environmentally Responsible. Community-Minded. Local Opportunities.

PROJECT

COPPER FLAT

SIERRA COUNTY, NEW MEXICO

TITLE

CROSS-SECTION LOCATION PLAN

CONSULTANT

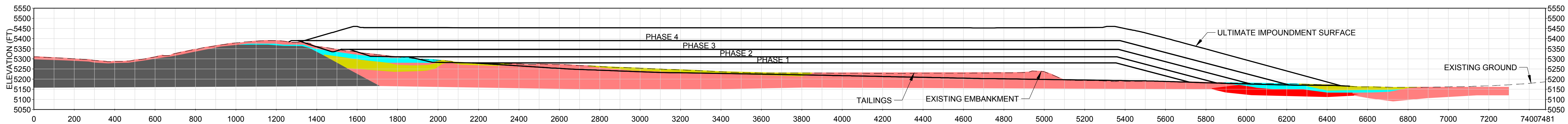
Golder Associates

YYYY-MM-DD	2016-05-11
DESIGNED	JS
PREPARED	JHR
REVIEWED	JL
APPROVED	GM

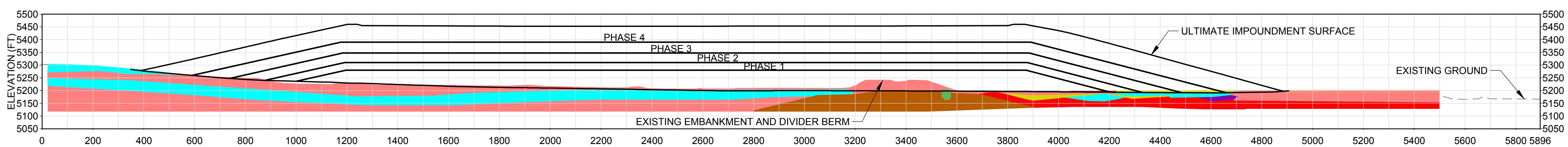
PROJECT NO.	CONTROL	REV.	FIGURE
1531453	0001	A	1

Path: \\tucson\cadd\CHEVRON\QUESTA\99_PROJECTS\1533370_GirDamIngo\0002_EAP\02_PRODUCTION\DWG\ | File Name: 1531453_0001_FIG_001.dwg

1 in — IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



SCALE 1" = 500' A 2 CROSS-SECTION A



SCALE 1" = 500' B 2 CROSS-SECTION B

0 250 500
1" = 500' FEET

LEGEND

- WELL-GRADED GRAVEL
- WELL-GRADED SAND WITH SILT AND GRAVEL
- CONGLOMERATE
- BASALT
- LEAN CLAY, FAT CLAY, SILTY CLAY
- SILT
- CALICHE
- BEDROCK

CLIENT
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PROJECT
COPPER FLAT

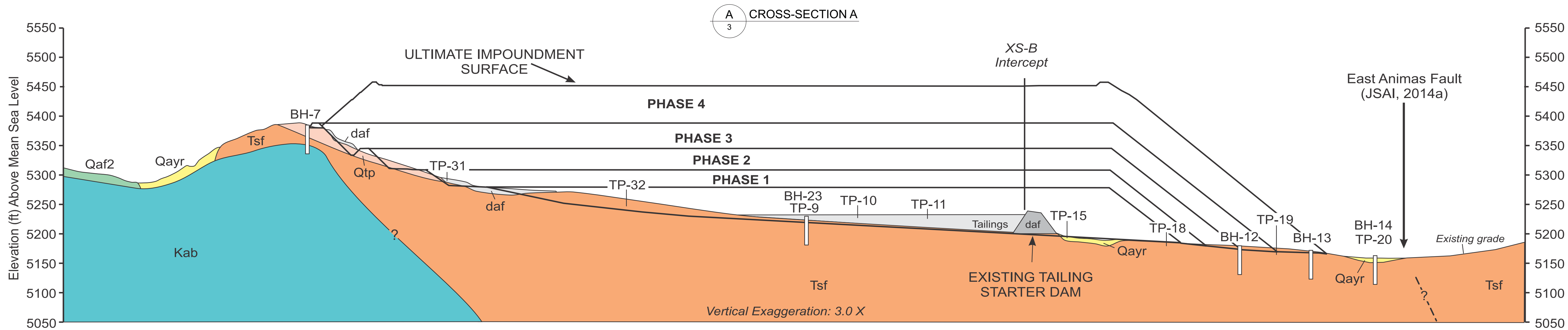
SIERRA COUNTY, NEW MEXICO

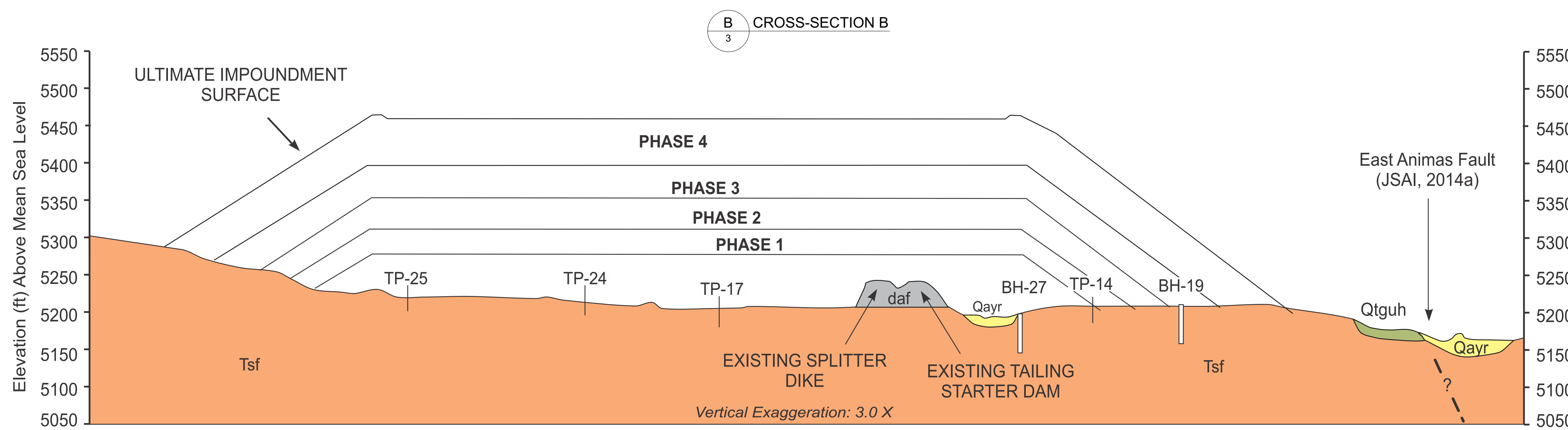
TITLE
GEOLOGIC CROSS-SECTIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-05-11
DESIGNED	JS
PREPARED	JHR
REVIEWED	JL
APPROVED	GM

PROJECT NO.	CONTROL	REV.	FIGURE
1531453	0001	A	2





LEGEND

Description of Geologic Units

Unit	Description
daf	Historic mining-related disturbed materials, including borrow materials, dredge materials, excavations and fill
Qayr	Young and recent (modern and historic) alluvium, undivided (present to middle Holocene)
Qtguh	High level terrace deposit associated with smaller canyons, undivided
Qaf2	Alluvial fans graded to the level of level of Qao2 stream terraces (middle Pleistocene?)
Qtp	Palomas Formation of the Santa Fe Group (lower Pliocene to mid Pleistocene), differentiated from underlying Santa Fe Gp. strata by more cobbles, boulders
Tsf	Santa Fe Group predating the Palomas Fm. (Miocene to Pliocene). Pebbly sandstone and conglomerate
Kab	Laharic flow breccia of Copper Flat
\ ? \	Inferred fault location

Sources of data for surficial geologic units:

(1) New Mexico Bureau of Geology and Mineral Resources
*DRAFT Open-File Geologic Map 242 (A.P. Jochems and Others, 2014)
*DRAFT Open-File Geologic Map 252 (D.J. Koning and Others, 2015)
has not been field verified and may not depict site-specific geology with accuracy

(2) Updated geologic data from existing test pit and borehole logs

(3) Regional surface geology and location of East Animas Fault presented on Figure 11K-2b of discharge permit application package, taken from JSAI, 2014a

Horizontal Scale (feet)
0 250 500

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PROJECT
COPPER FLAT

SIERRA COUNTY, NEW MEXICO

TITLE
GEOLOGIC CROSS-SECTIONS NEAR TAILINGS STORAGE FACILITY

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-2
DESIGNED	LCK
PREPARED	LCK
REVIEWED	TS
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
1531453	0001		3

APPENDIX J
DRAWINGS

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO
NOVEMBER 2015

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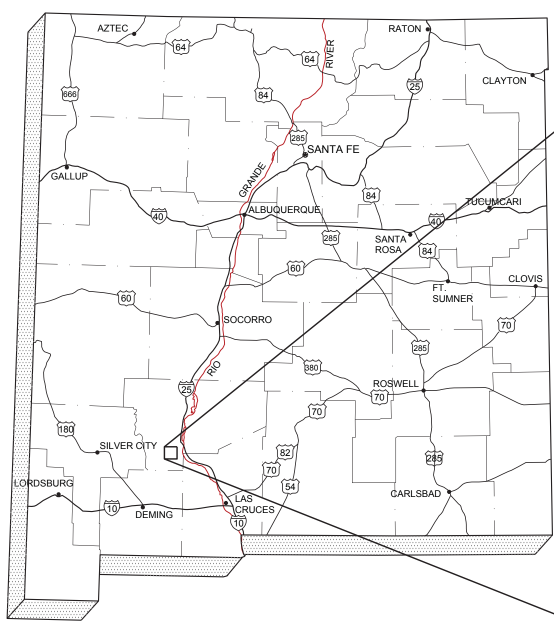
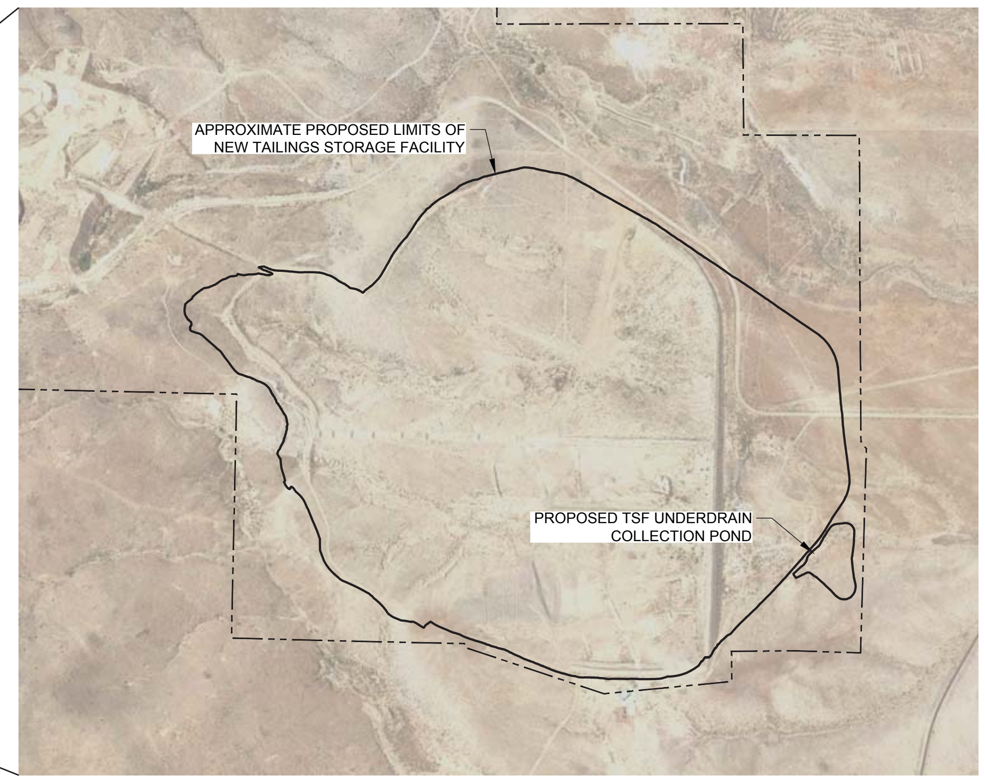


STATE OF NEW MEXICO
NOT TO SCALE



LOCATION MAP
NOT TO SCALE

DRAWING LIST

No.	DRAWING TITLE
1	TITLE SHEET AND LOCATION MAP
2	EXISTING CONDITIONS AND PROPOSED FACILITIES PLAN
3	GEOTECHNICAL TEST AND GEOLOGIC CROSS-SECTION LOCATIONS
4	GEOLOGIC CROSS-SECTION A-A'
5	GEOLOGIC CROSS-SECTION B-B'
6	GEOLOGIC CROSS-SECTION C-C'
7	GEOLOGIC CROSS-SECTION D-D'
8	GEOLOGIC CROSS-SECTION E-E'
9	GEOLOGIC CROSS-SECTION F-F'
10	TAILINGS STORAGE FACILITY GRADING PLAN
11	TAILINGS STORAGE FACILITY PHASE 1 PLAN
12	TAILINGS STORAGE FACILITY AT FINAL BUILDOUT
13	TAILINGS STORAGE FACILITY CROSS-SECTIONS
14	TAILINGS STORAGE FACILITY DETAILS
15	DAM AND IMPOUNDMENT UNDERDRAIN PLAN
16	DAM UNDERDRAIN DETAILS (1 of 2)
17	DAM UNDERDRAIN DETAILS (2 of 2)
18	TSF UNDERDRAIN COLLECTION POND PLAN
19	TSF UNDERDRAIN COLLECTION POND CROSS-SECTION AND DETAILS(1 OF 2)
20	TSF UNDERDRAIN COLLECTION POND CROSS-SECTION AND DETAILS(2 OF 2)
21	CYCLONE STATION, SURGE POND AND PROCESS AREA PLAN
22	SURGE POND PLAN, CROSS-SECTIONS, AND DETAILS
23	GENERAL PROCESS FLOW DIAGRAM
24	TAILINGS DELIVERY AND DISTRIBUTION PIPING PLAN
25	TAILINGS DISTRIBUTION PLAN AND PROFILE (1 OF 2)
26	TAILINGS DISTRIBUTION PLAN AND PROFILE (2 OF 2)
27	WATER RECLAIM SYSTEM PIPING PLAN
28	WATER RECLAIM SYSTEM DETAILS
29	TAILINGS DISTRIBUTION AND SECONDARY CONTAINMENT DETAILS AND SECTIONS

GENERAL REFERENCES

1. 2-FOOT TOPOGRAPHY DEVELOPED BY COOPER AERIAL SURVEY CO. BASED ON JUNE 18, 2011 AERIAL SURVEY AND PROVIDED BY THEMAC RESOURCES.
2. COORDINATE SYSTEM IS IN UTM ZONE 13 NAD83 U.S. FOOT.

NOTES

1. DRAWINGS TO BE READ IN CONJUNCTION WITH FEASIBILITY LEVEL DESIGN, 30,000 TPD TAILINGS STORAGE FACILITY, SIERRA COUNTY, NEW MEXICO.

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

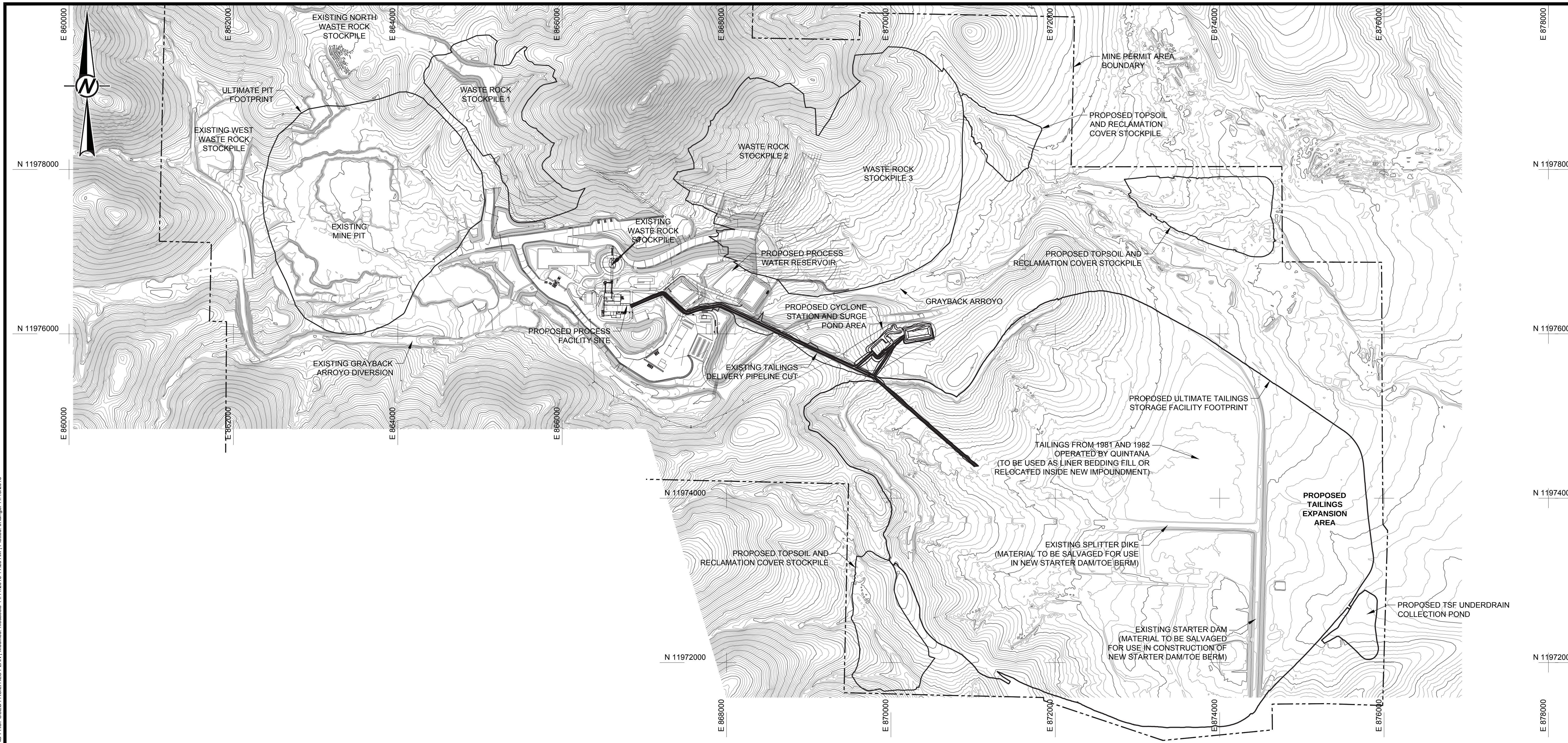
DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE
TITLE SHEET AND LOCATION MAP

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K001
DESIGN	DW	2013-04-08	SCALE	NOT TO SCALE
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		1
REVIEW	DAK	2013-07-17		



NOTES

1. EXISTING FIVE (5) FOOT TOPOGRAPHY AND PERMIT BOUNDARY PROVIDED BY NEW MEXICO COPPER CORPORATION.

2. TOPOGRAPHY IN THE MINE AREA AND TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION
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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

EXISTING CONDITIONS AND PROPOSED FACILITIES PLAN

Golder Associates

PROJECT No.		103-92557	FILE No. 10392557K002
DESIGN	DW	2013-04-08	SCALE AS SHOWN
CADD	JHR	2013-07-10	DRAWING
CHECK	GM	2013-07-16	2
REVIEW	DAK	2013-07-17	

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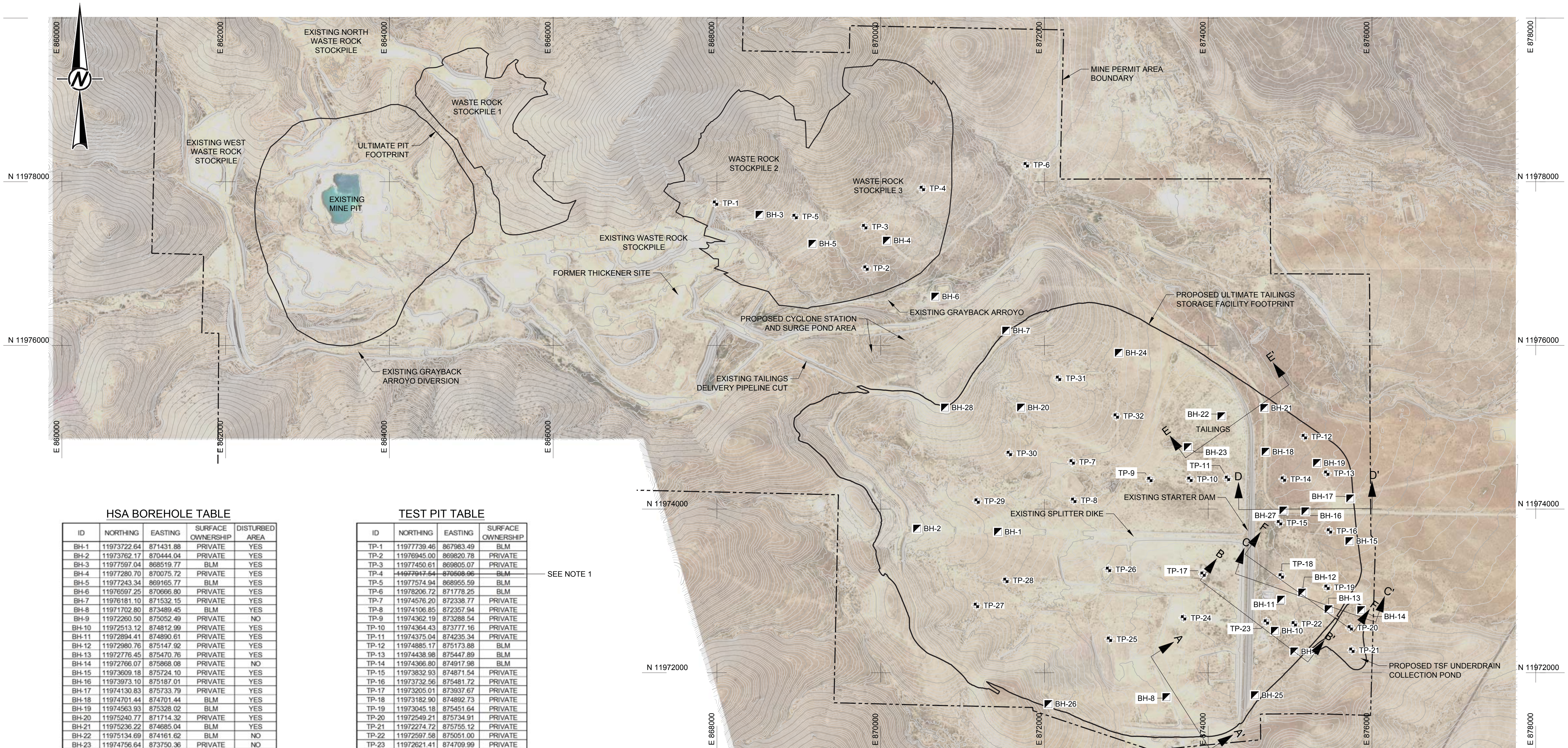

HSA BOREHOLE TABLE

ID	NORTHING	EASTING	SURFACE OWNERSHIP	DISTURBED AREA
BH-1	11973722.64	871431.88	PRIVATE	YES
BH-2	11973762.17	870444.04	PRIVATE	YES
BH-3	11977597.04	868519.77	BLM	YES
BH-4	11977280.70	870075.72	PRIVATE	YES
BH-5	11977243.34	869165.77	BLM	YES
BH-6	11976597.25	870666.80	PRIVATE	YES
BH-7	11976181.10	871532.15	PRIVATE	YES
BH-8	11971702.80	873489.45	BLM	YES
BH-9	11972260.50	875052.49	PRIVATE	NO
BH-10	11972513.12	874812.99	PRIVATE	YES
BH-11	11972894.41	874890.61	PRIVATE	YES
BH-12	11972980.76	875147.92	PRIVATE	YES
BH-13	11972776.45	875470.76	PRIVATE	YES
BH-14	11972766.07	875868.08	PRIVATE	NO
BH-15	11973609.18	875724.10	PRIVATE	YES
BH-16	11973973.10	875187.01	PRIVATE	YES
BH-17	11974130.83	875733.79	PRIVATE	YES
BH-18	11974701.44	874701.44	BLM	YES
BH-19	11974563.93	875328.02	BLM	YES
BH-20	11975240.77	871714.32	PRIVATE	YES
BH-21	11975236.22	874685.04	BLM	YES
BH-22	11975134.69	874161.62	BLM	NO
BH-23	11974756.64	873750.36	PRIVATE	NO
BH-24	11975910.38	872908.33	BLM	YES
BH-25	11971725.72	874570.21	BLM	YES
BH-26	11971618.08	872048.45	BLM	YES
BH-27	11973982.94	874917.98	PRIVATE	YES
BH-28	11975241.04	870785.44	PRIVATE	YES

TEST PIT TABLE

ID	NORTHING	EASTING	SURFACE OWNERSHIP
TP-1	11977739.46	867983.49	BLM
TP-2	11976945.00	869820.78	PRIVATE
TP-3	11977450.61	869805.07	PRIVATE
TP-4	~~11977917.54~~	~~870508.96~~	~~BLM~~ — SEE NOTE 1
TP-5	11977574.94	868955.59	BLM
TP-6	11978206.72	871778.25	BLM
TP-7	11974576.20	872338.77	PRIVATE
TP-8	11974106.85	872357.94	PRIVATE
TP-9	11974362.19	873288.54	PRIVATE
TP-10	11974364.43	873777.16	PRIVATE
TP-11	11974375.04	874235.34	PRIVATE
TP-12	11974885.17	875173.88	BLM
TP-13	11974438.98	875447.89	BLM
TP-14	11974366.80	874917.98	BLM
TP-15	11973832.93	874871.54	PRIVATE
TP-16	11973732.56	875481.72	PRIVATE
TP-17	11973205.01	873937.67	PRIVATE
TP-18	11973182.90	874892.73	PRIVATE
TP-19	11973045.18	875451.64	PRIVATE
TP-20	11972549.21	875734.91	PRIVATE
TP-21	11972274.72	875755.12	PRIVATE
TP-22	11972597.58	875051.00	PRIVATE
TP-23	11972621.41	874709.99	PRIVATE
TP-24	11972670.75	873699.23	PRIVATE
TP-25	11972408.78	872794.31	PRIVATE
TP-26	11973262.64	872782.60	PRIVATE
TP-27	11972823.18	871169.18	PRIVATE
TP-28	11973129.48	871528.89	PRIVATE
TP-29	11974098.42	871178.07	PRIVATE
TP-30	11974680.06	871571.56	PRIVATE
TP-31	11975597.72	872172.62	BLM
TP-32	11975136.61	872876.80	BLM

LEGEND

- — · — · — MINE PERMIT AREA BOUNDARY
- BH-1 — HOLLOW STEM AUGER (HSA) BOREHOLE
- TP-29 — TEST PIT

NOTES

1. TP-4 TEST PIT NOT EXCAVATED DUE TO LACK OF ACCESS.

REFERENCES

1. EXISTING FIVE (5) FOOT TOPOGRAPHY AND PERMIT BOUNDARY PROVIDED BY NEW MEXICO COPPER CORPORATION.
2. TOPOGRAPHY IN THE MINE AREA AND TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION

Environmentally Responsible. Community-Minded. Local Opportunities.

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

GEOTECHNICAL TEST AND GEOLOGIC CROSS-SECTION LOCATIONS

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K003
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
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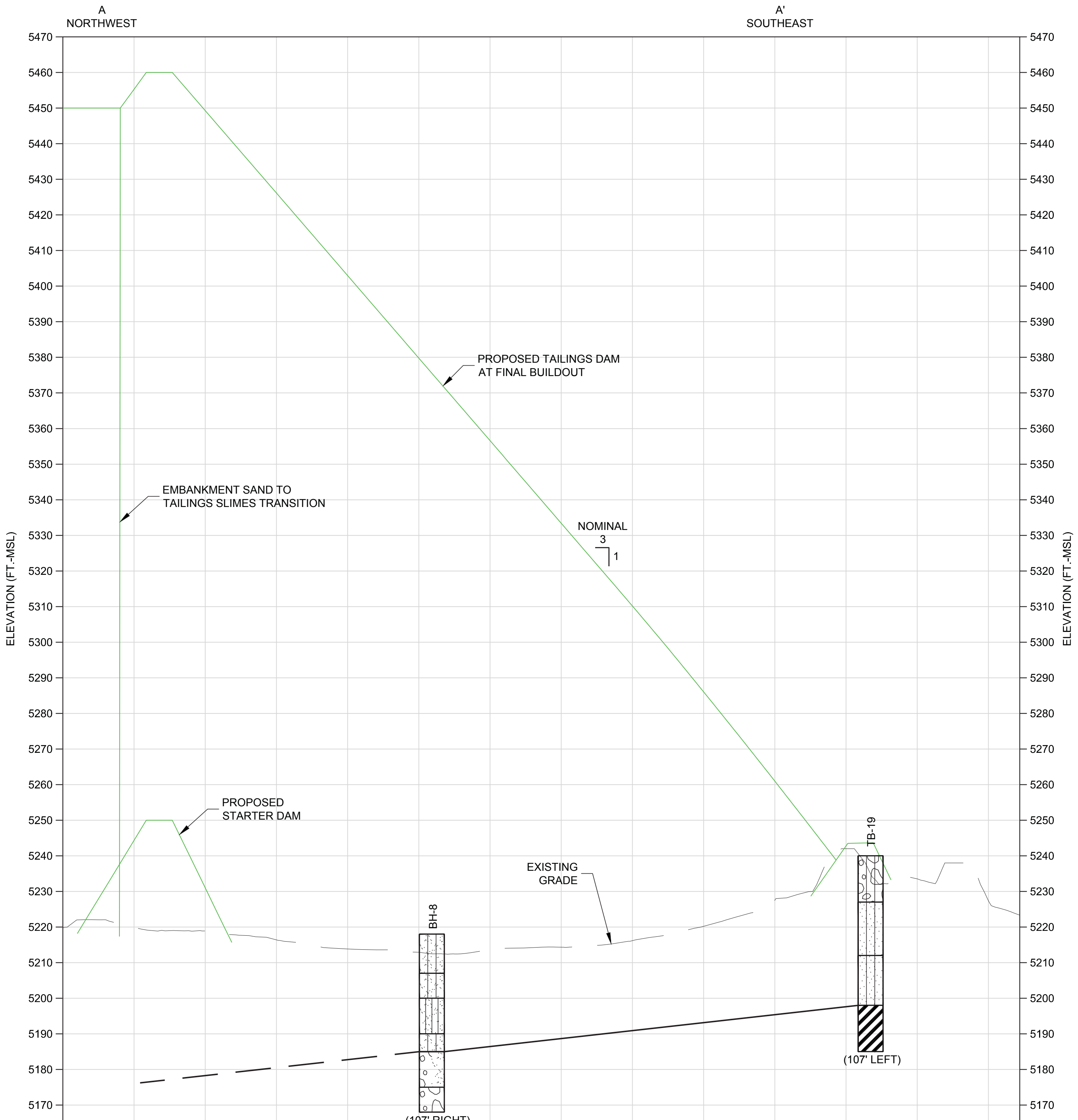
CHECK	GM	2013-07-16		
REVIEW	DAK	2013-07-17		



NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. PROFILE OF EXISTING GROUND BASED ON FIVE (5) FOOT TOPOGRAPHY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. PROFILE IN THE TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.
4. SEE DRAWING 3 FOR LOCATION OF INDIVIDUAL CROSS-SECTION LINES.

LEGEND

- SANDY SILT
- USCS LOW PLASTICITY SANDY CLAY
- CLAYEY SAND
- SANDY FAT CLAY
- CONCRETE
- USCS HIGH PLASTICITY CLAY
- SANDY ELASTIC SILT
- FILL (MADE GROUND)
- USCS LOW PLASTICITY CLAY
- SHALEY FAT CLAY
- USCS POORLY-GRADED GRAVEL
- SANDSTONE
- SILTSTONE
- USCS WELL-GRADED GRAVEL
- SANDSTONE AND SHALE
- SAND
- USCS WELL-GRADED GRAVEL WITH CLAY
- WELL GRADED SAND WITH CLAY
- WELL GRADED SAND
- USCS ELASTIC SILT
- SHALE
- SILTSTONE AND SHALE INTERBEDDED
- SANDSTONE AND SILTSTONE INTERBEDDED
- SHALEY ELASTIC SILT
- ▼ GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
- BASALT
- POORLY GRADED SAND WITH SILT

0 100 200 300
HORIZONTAL SCALE FEET

0 20 40 60
VERTICAL SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

GEOLOGIC CROSS-SECTION A-A'

Golder Associates

PROJECT No.		103-92557	FILE No. 10392557K004
DESIGN	DW	2013-04-08	SCALE AS SHOWN
CADD	JHR	2013-07-10	DRAWING
CHECK	GM	2013-07-16	4
REVIEW	DAK	2013-07-17	

16723

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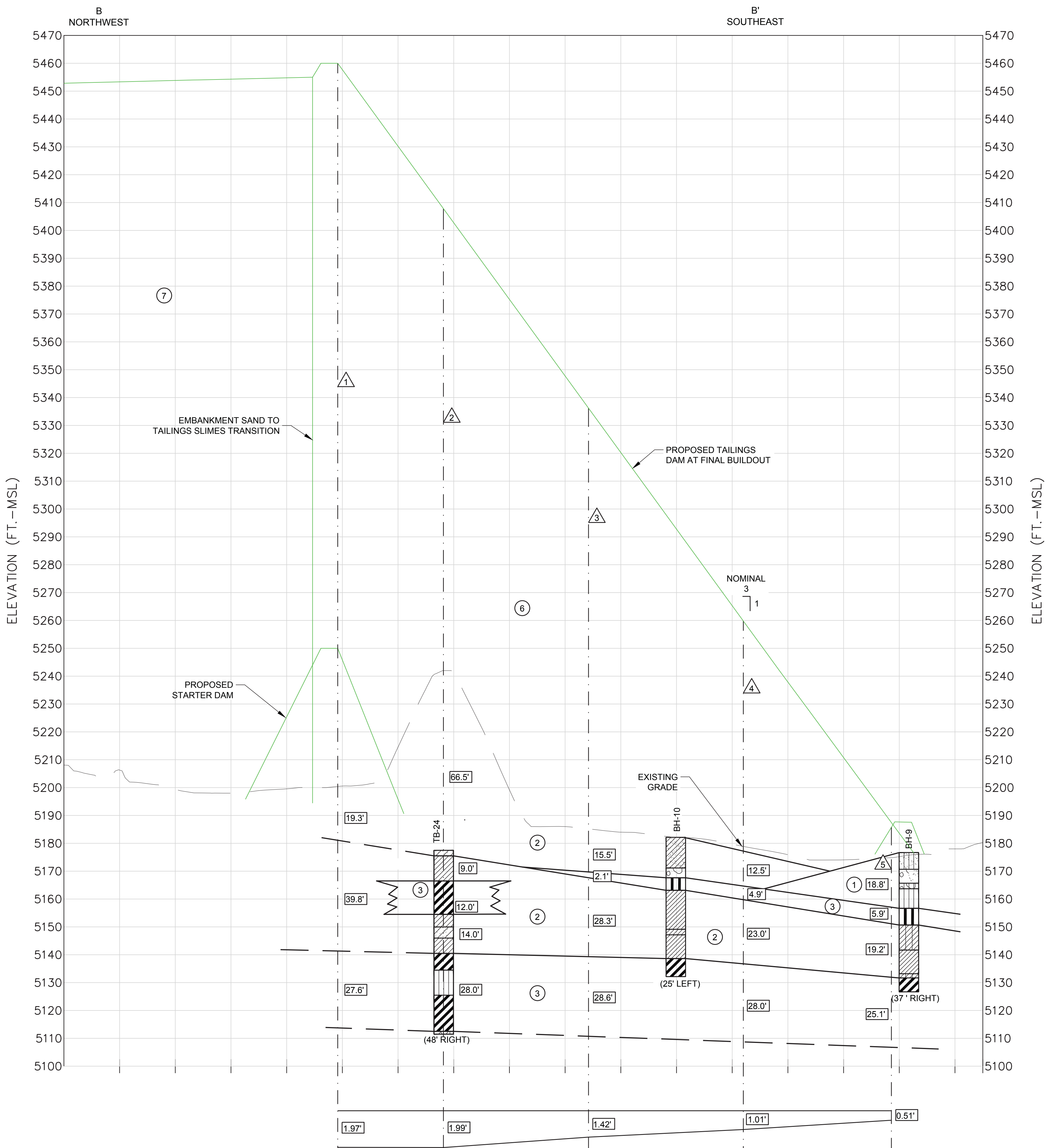


STRATUM DESCRIPTORS

1. ML, CL-ML, SM
2. CL
3. CH, MH
4. GRAVEL, SAND
5. BASALT, CALICHE
6. EMBANKMENT FILL
7. TAILINGS (CONSOLIDATED)

12.0' STRATUM THICKNESS

NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. PROFILE OF EXISTING GROUND BASED ON FIVE (5) FOOT TOPOGRAPHY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. PROFILE IN THE TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.
4. SEE DRAWING 3 FOR LOCATION OF INDIVIDUAL CROSS-SECTION LINES.

LEGEND

SANDY SILT
USCS LOW PLASTICITY SANDY CLAY
CLAYEY SAND
SANDY FAT CLAY
CONCRETE
USCS HIGH PLASTICITY CLAY
SANDY ELASTIC SILT
FILL (MADE GROUND)
USCS LOW PLASTICITY CLAY
SHALEY FAT CLAY
USCS POORLY-GRADED GRAVEL
SANDSTONE
SILTSTONE
USCS WELL-GRADED GRAVEL
SANDSTONE AND SHALE
SAND
USCS WELL-GRADED GRAVEL WITH CLAY
WELL GRADED SAND WITH CLAY
WELL GRADED SAND
USCS ELASTIC SILT
SHALE
SILTSTONE AND SHALE INTERBEDDED
SANDSTONE AND SILTSTONE INTERBEDDED
SHALEY ELASTIC SILT
GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
BASALT
POORLY GRADED SAND WITH SILT
SETTLEMENT SECTION LINE AND IDENTIFIER

HORIZONTAL SCALE 0 100 200 300 FEET

VERTICAL SCALE 0 20 40 60 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DW	NIL	GM	DAK

DRAWING USE

PRELIMINARY
FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

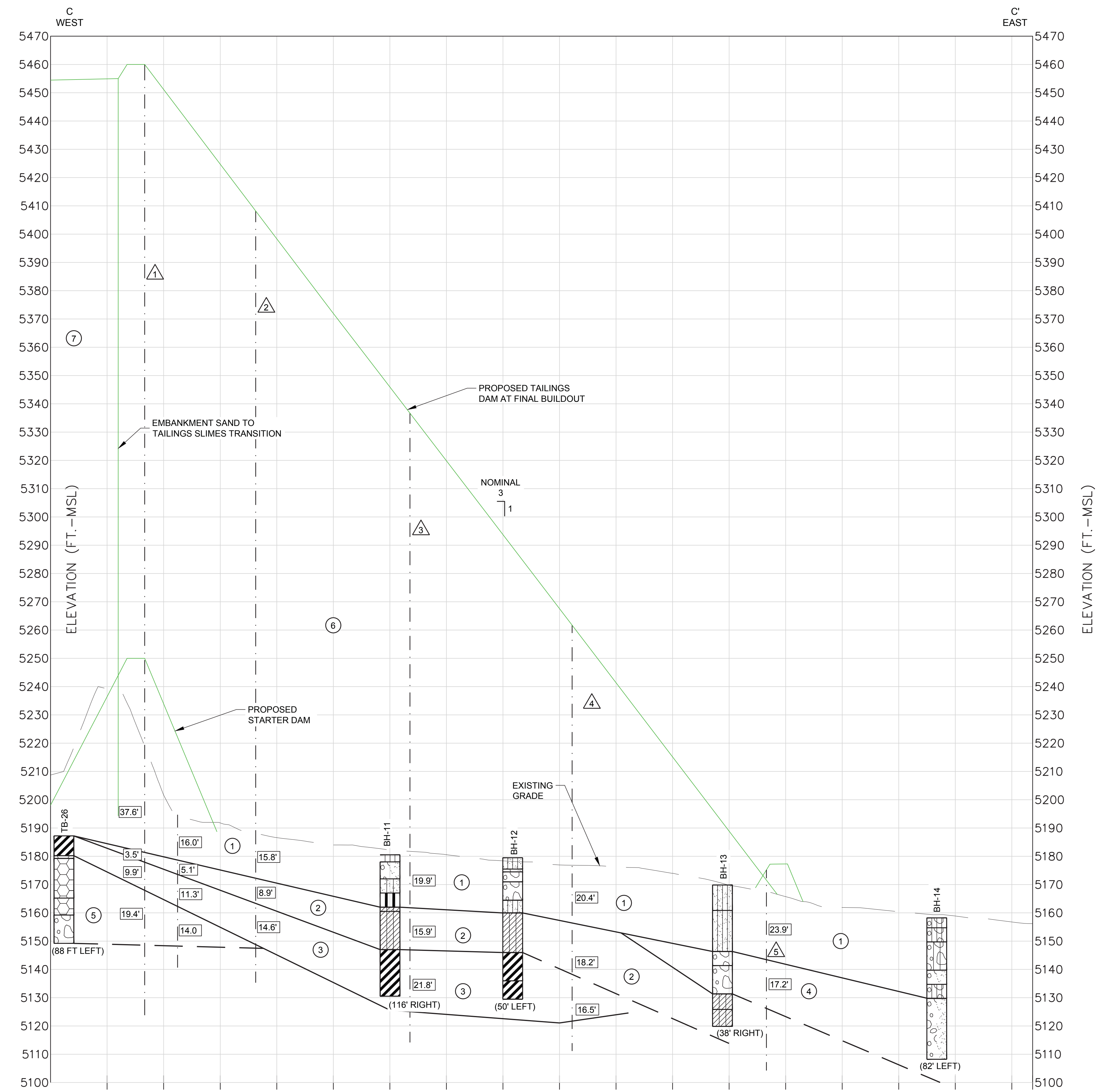
TITLE

GEOLOGIC CROSS-SECTION B-B'

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K004
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		5
REVIEW	DAK	2013-07-17		

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K004.dwg | Layout: 5 GEOLOGIC CROSS-SECTION B-B' | Modified: rlocascio 11/11/2015 1:44 PM | Plotted: JRangel 11/13/2015



HORIZONTAL SCALE 0 100 200 300 FEET

VERTICAL SCALE 0 20 40 60 FEET

STRATUM DESCRIPTORS

1. ML, CL-ML, SM
2. CL
3. CH, MH
4. GRAVEL, SAND
5. BASALT, CALICHE
6. EMBANKMENT FILL
7. TAILINGS (CONSOLIDATED)

12.0' STRATUM THICKNESS

NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. PROFILE OF EXISTING GROUND BASED ON FIVE (5) FOOT TOPOGRAPHY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. PROFILE IN THE TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.
4. SEE DRAWING 3 FOR LOCATION OF INDIVIDUAL CROSS-SECTION LINES.

LEGEND

- SANDY SILT
- USCS LOW PLASTICITY SANDY CLAY
- CLAYEY SAND
- SANDY FAT CLAY
- CONCRETE
- USCS HIGH PLASTICITY CLAY
- SANDY ELASTIC SILT
- FILL (MADE GROUND)
- USCS LOW PLASTICITY CLAY
- SHALEY FAT CLAY
- USCS POORLY-GRADED GRAVEL
- SANDSTONE
- SILTSTONE
- USCS WELL-GRADED GRAVEL
- SANDSTONE AND SHALE
- SAND
- USCS WELL-GRADED GRAVEL WITH CLAY
- WELL GRADED SAND WITH CLAY
- WELL GRADED SAND
- USCS ELASTIC SILT
- SHALE
- SILTSTONE AND SHALE INTERBEDDED
- SANDSTONE AND SILTSTONE INTERBEDDED
- SHALEY ELASTIC SILT
- GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
- BASALT
- POORLY GRADED SAND WITH SILT
- SETTLEMENT SECTION LINE AND IDENTIFIER

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DW	NIL	GM	DAK

DRAWING USE

PRELIMINARY
FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

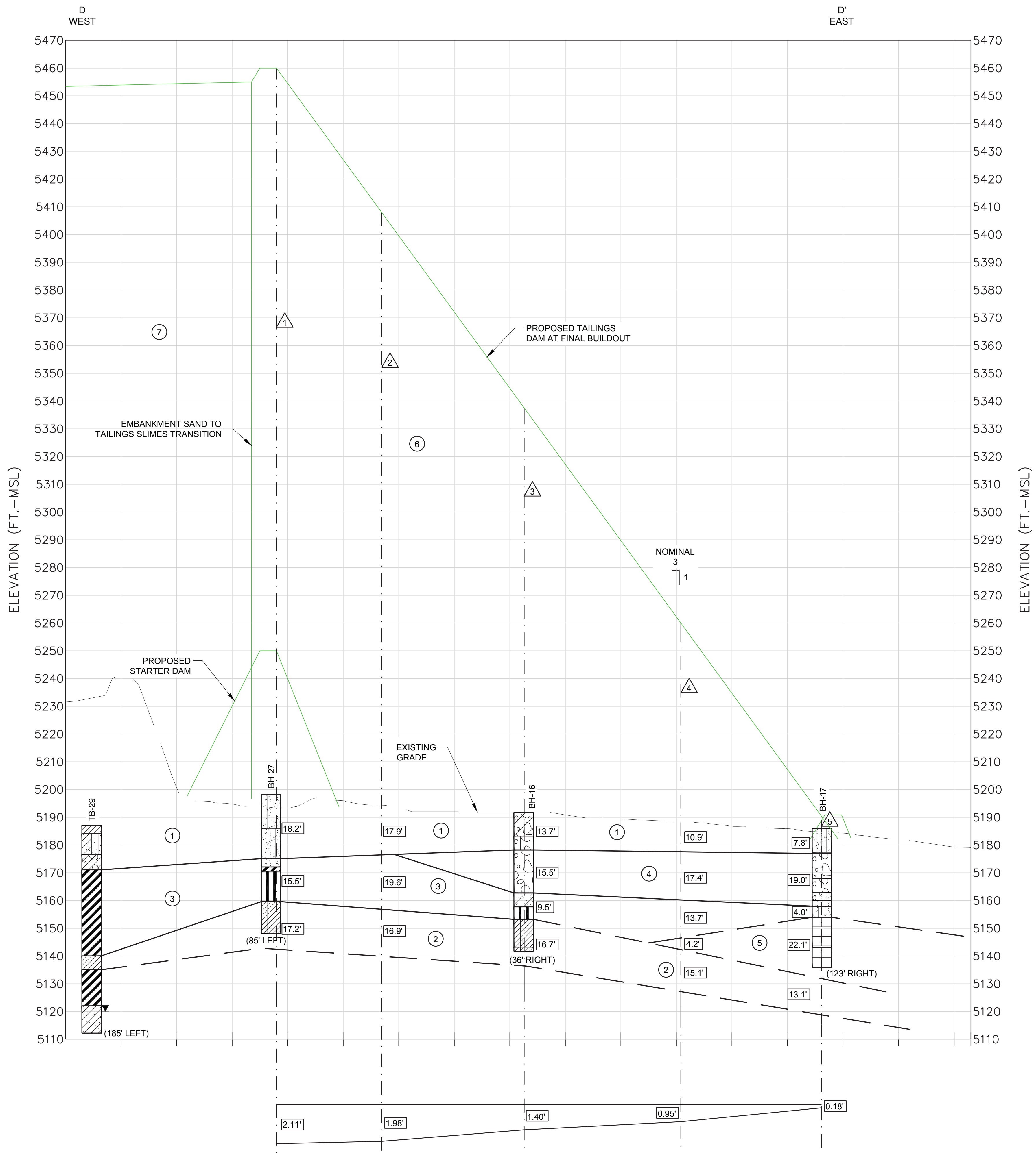
GEOLOGIC CROSS-SECTION C-C'

Golder Associates

PROJECT No.		103-92557
DESIGN	DW	2013-04-08
CADD	JHR	2013-07-10
CHECK	GM	2013-07-16
REVIEW	DAK	2013-07-17

FILE No.	10392557K004
SCALE	AS SHOWN
DRAWING	6

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K004.dwg | Layout: 6 GEOLOGIC CROSS-SECTION C-C' | Modified: nlocascio 11/11/2015 1:44 PM | Plotted: JRangel 11/13/2015



STRATUM DESCRIPTORS

1. ML, CL-ML, SM
2. CL
3. CH, MH
4. GRAVEL, SAND
5. BASALT, CALICHE
6. EMBANKMENT FILL
7. TAILINGS (CONSOLIDATED)

12.0' STRATUM THICKNESS

NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. PROFILE OF EXISTING GROUND BASED ON FIVE (5) FOOT TOPOGRAPHY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. PROFILE IN THE TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.
4. SEE DRAWING 3 FOR LOCATION OF INDIVIDUAL CROSS-SECTION LINES.

LEGEND

SANDY SILT
SANDY FAT CLAY
SANDY ELASTIC SILT
SHALEY FAT CLAY
SILTSTONE
SAND
WELL GRADED SAND
SILTSTONE AND SHALE INTERBEDDED
GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
SETTLEMENT SECTION LINE AND IDENTIFIER
USCS LOW PLASTICITY SANDY CLAY
CONCRETE
FILL (MADE GROUND)
USCS POORLY-GRADED GRAVEL
USCS WELL-GRADED GRAVEL
USCS WELL-GRADED GRAVEL WITH CLAY
USCS ELASTIC SILT
SANDSTONE AND SILTSTONE INTERBEDDED
BASALT
CLAYEY SAND
USCS HIGH PLASTICITY CLAY
USCS LOW PLASTICITY CLAY
SANDSTONE
SANDSTONE AND SHALE
WELL GRADED SAND WITH CLAY
SHALE
SHALEY ELASTIC SILT
POORLY GRADED SAND WITH SILT

HORIZONTAL SCALE 0 100 200 300 FEET
VERTICAL SCALE 0 20 40 60 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

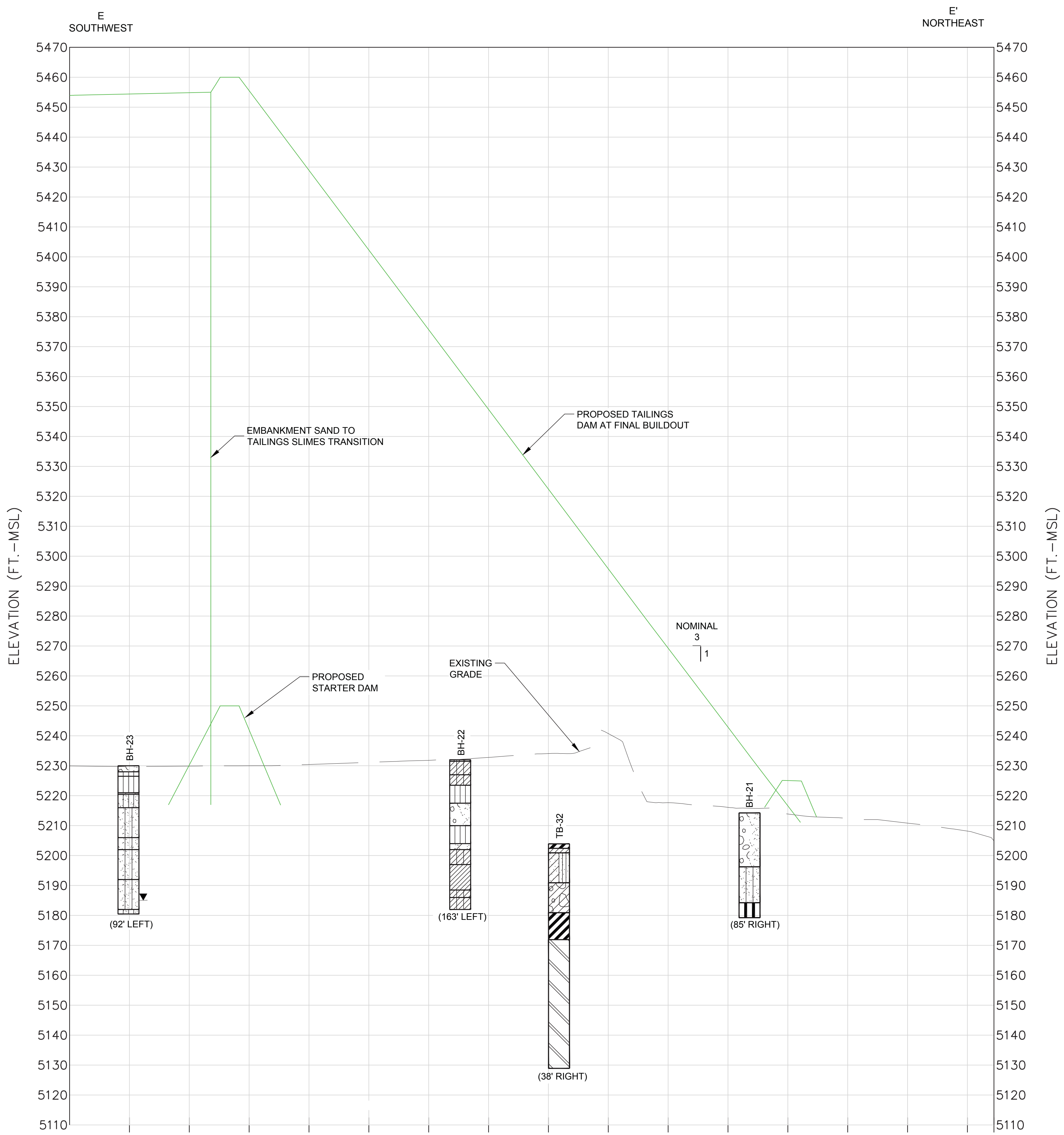
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

GEOLOGIC CROSS-SECTION D-D'

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K004
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	7
CHECK	GM	2013-07-16		
REVIEW	DAK	2013-07-17		



NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. PROFILE OF EXISTING GROUND BASED ON FIVE (5) FOOT TOPOGRAPHY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. PROFILE IN THE TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.
4. SEE DRAWING 3 FOR LOCATION OF INDIVIDUAL CROSS-SECTION LINES.

LEGEND

- SANDY SILT
- USCS LOW PLASTICITY SANDY CLAY
- CLAYEY SAND
- SANDY FAT CLAY
- CONCRETE
- USCS HIGH PLASTICITY CLAY
- SANDY ELASTIC SILT
- FILL (MADE GROUND)
- USCS LOW PLASTICITY CLAY
- SHALEY FAT CLAY
- USCS POORLY-GRADED GRAVEL
- SANDSTONE
- SILTSTONE
- USCS WELL-GRADED GRAVEL
- SANDSTONE AND SHALE
- SAND
- USCS WELL-GRADED GRAVEL WITH CLAY
- WELL GRADED SAND WITH CLAY
- WELL GRADED SAND
- USCS ELASTIC SILT
- SHALE
- SILTSTONE AND SHALE INTERBEDDED
- SANDSTONE AND SILTSTONE INTERBEDDED
- SHALEY ELASTIC SILT
- ▼ GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
- BASALT
- POORLY GRADED SAND WITH SILT

0 100 200 300
HORIZONTAL SCALE FEET

0 20 40 60
VERTICAL SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DW	NIL	GM	DAK

DRAWING USE

PRELIMINARY
FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

GEOLOGIC CROSS-SECTION E-E'

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K004
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		8
REVIEW	DAK	2013-07-17		

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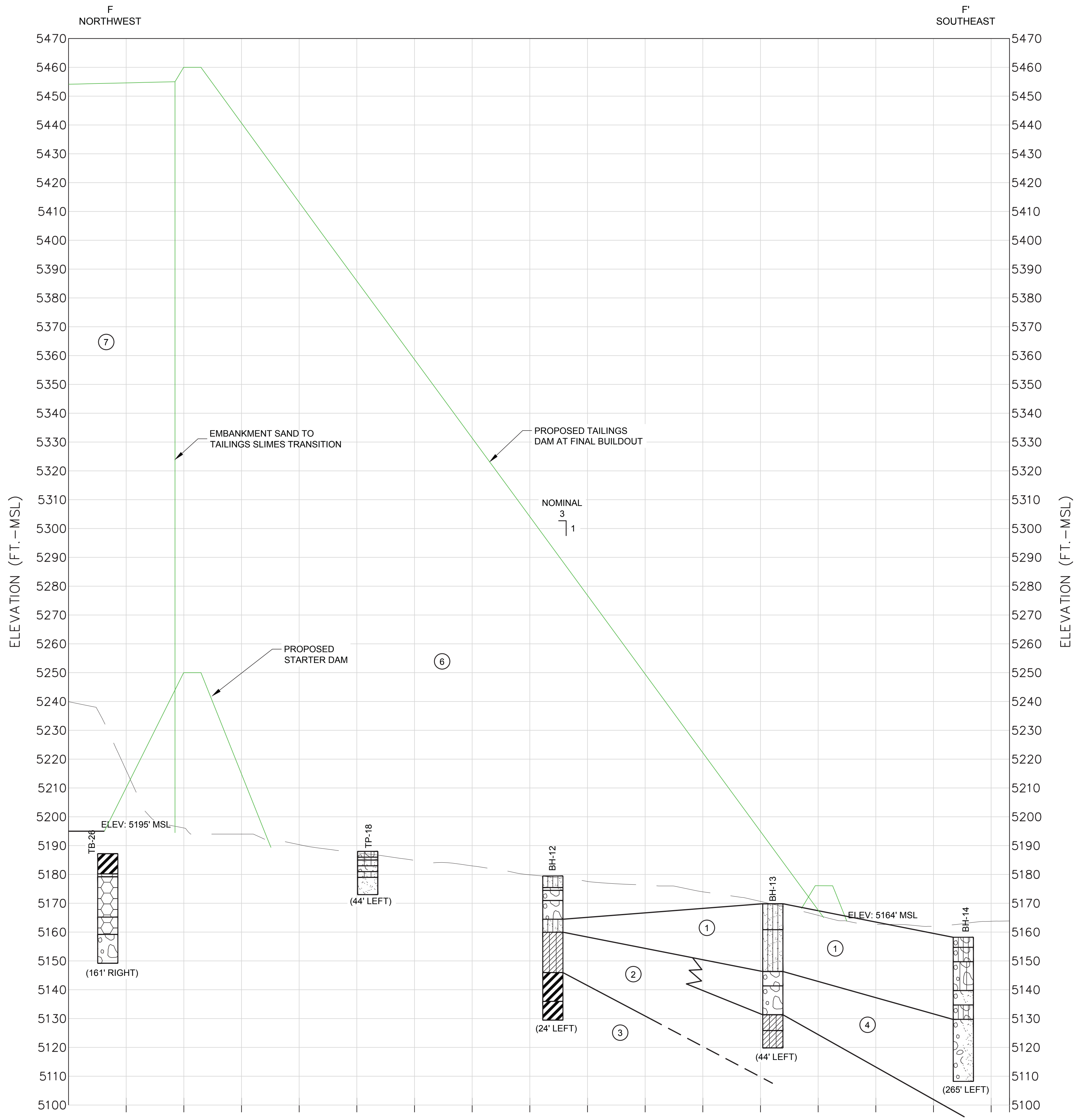


STRATUM DESCRIPTORS

1. ML, CL-ML, SM
2. CL
3. CH, MH
4. GRAVEL, SAND
5. BASALT, CALICHE
6. EMBANKMENT FILL
7. TAILINGS (CONSOLIDATED)

12.0' STRATUM THICKNESS

NOTES

1. FOR BORINGS WITHOUT STATIC AND/OR INITIAL WATER LEVELS, NO WATER LEVEL OBSERVATIONS WERE MADE AT THE TIME OF THE INVESTIGATIONS.
2. PROFILE OF EXISTING GROUND BASED ON FIVE (5) FOOT TOPOGRAPHY PROVIDED BY NEW MEXICO COPPER CORPORATION.
3. PROFILE IN THE TAILINGS STORAGE FACILITY REPRESENTS EXISTING CONDITIONS AND DISTURBANCE ASSOCIATED WITH QUINTANA 1981-82 MINING OPERATIONS.
4. SEE DRAWING 3 FOR LOCATION OF INDIVIDUAL CROSS-SECTION LINES.

LEGEND

- SANDY SILT
- USCS LOW PLASTICITY SANDY CLAY
- CLAYEY SAND
- SANDY FAT CLAY
- CONCRETE
- USCS HIGH PLASTICITY CLAY
- SANDY ELASTIC SILT
- FILL (MADE GROUND)
- USCS LOW PLASTICITY CLAY
- SHALEY FAT CLAY
- USCS POORLY-GRADED GRAVEL
- SANDSTONE
- SILTSTONE
- USCS WELL-GRADED GRAVEL
- SANDSTONE AND SHALE
- SAND
- USCS WELL-GRADED GRAVEL WITH CLAY
- WELL GRADED SAND WITH CLAY
- WELL GRADED SAND
- USCS ELASTIC SILT
- SHALE
- SILTSTONE AND SHALE INTERBEDDED
- SANDSTONE AND SILTSTONE INTERBEDDED
- SHALEY ELASTIC SILT
- ▼ GROUNDWATER LEVEL AT TIME OF DRILLING (SEE NOTE 1)
- BASALT
- POORLY GRADED SAND WITH SILT

0 200 400 600
HORIZONTAL SCALE FEET

0 20 40 60
VERTICAL SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

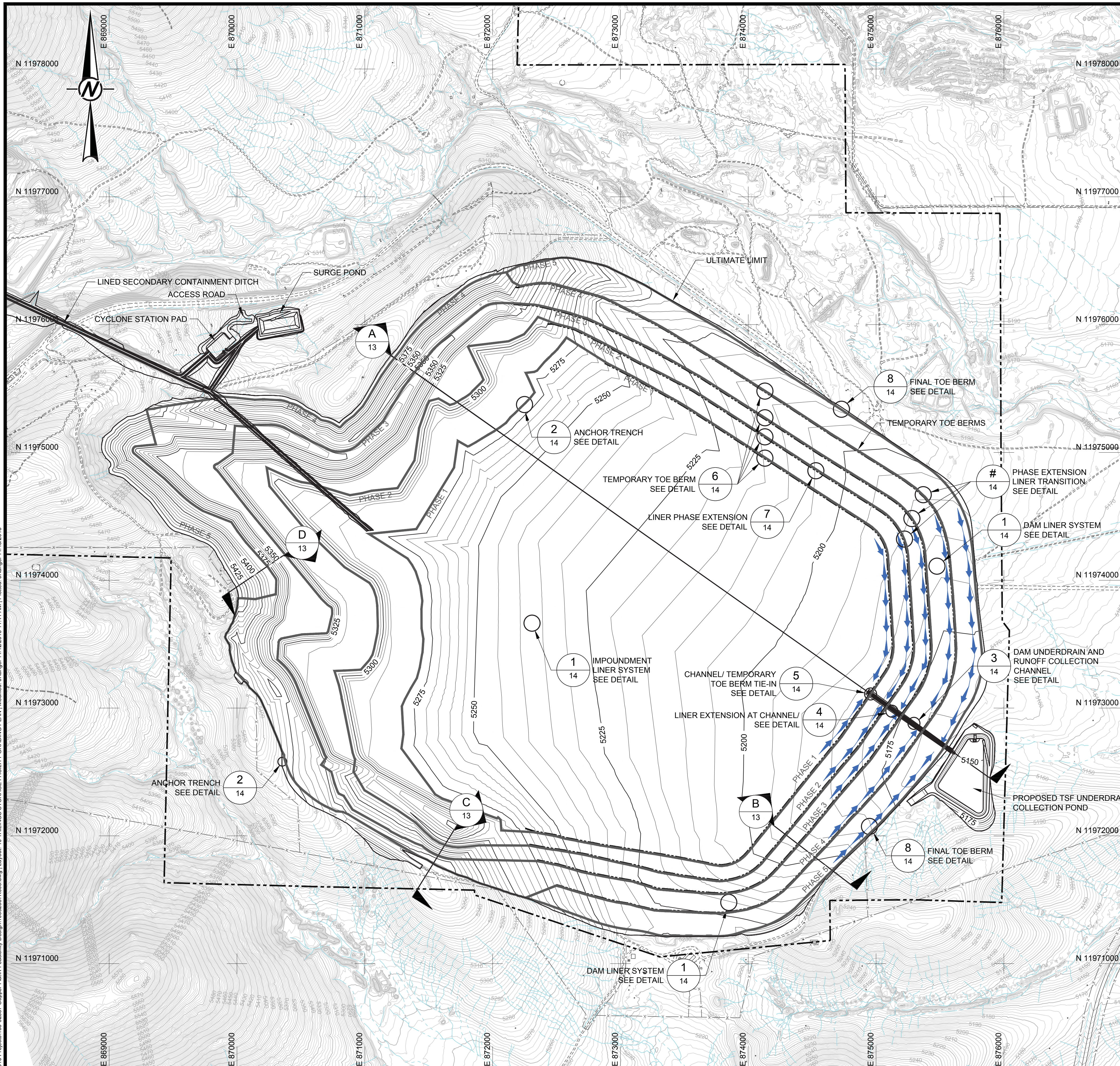
PROJECT
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

TITLE
GEOLOGIC CROSS-SECTION F-F'

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K004
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		9
REVIEW	DAK	2013-07-17		



LEGEND

- 3600 EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 3600 REGRADED CONTOURS (ft -MSL)
- TEMPORARY TOE BERM CENTERLINE
- PHASE 1 PHASE BOUNDARY
- GRADE BREAK
- DRAINAGE
- SLOPE INDICATOR
- 3H:1V or 3H/1V 3 HORIZONTAL TO 1 VERTICAL SLOPE
- 5% GRADE INDICATOR
- DETAIL CALLOUT: 1 / 14 — DETAIL ID, DRAWING SHEET LOCATION
- CROSS-SECTION CALLOUT: A / 13 — SECTION ID, DRAWING SHEET LOCATION

SCALE 0 400 800 1200 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY
FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

TAILINGS STORAGE FACILITY GRADING PLAN

Golder Associates

PROJECT No.		103-92557	FILE No. 10392557K005
DESIGN	DW	2013-04-08	SCALE AS SHOWN
CADD	JHR	2013-07-10	DRAWING
CHECK	GM	2013-07-16	10
REVIEW	DAK	2013-07-17	

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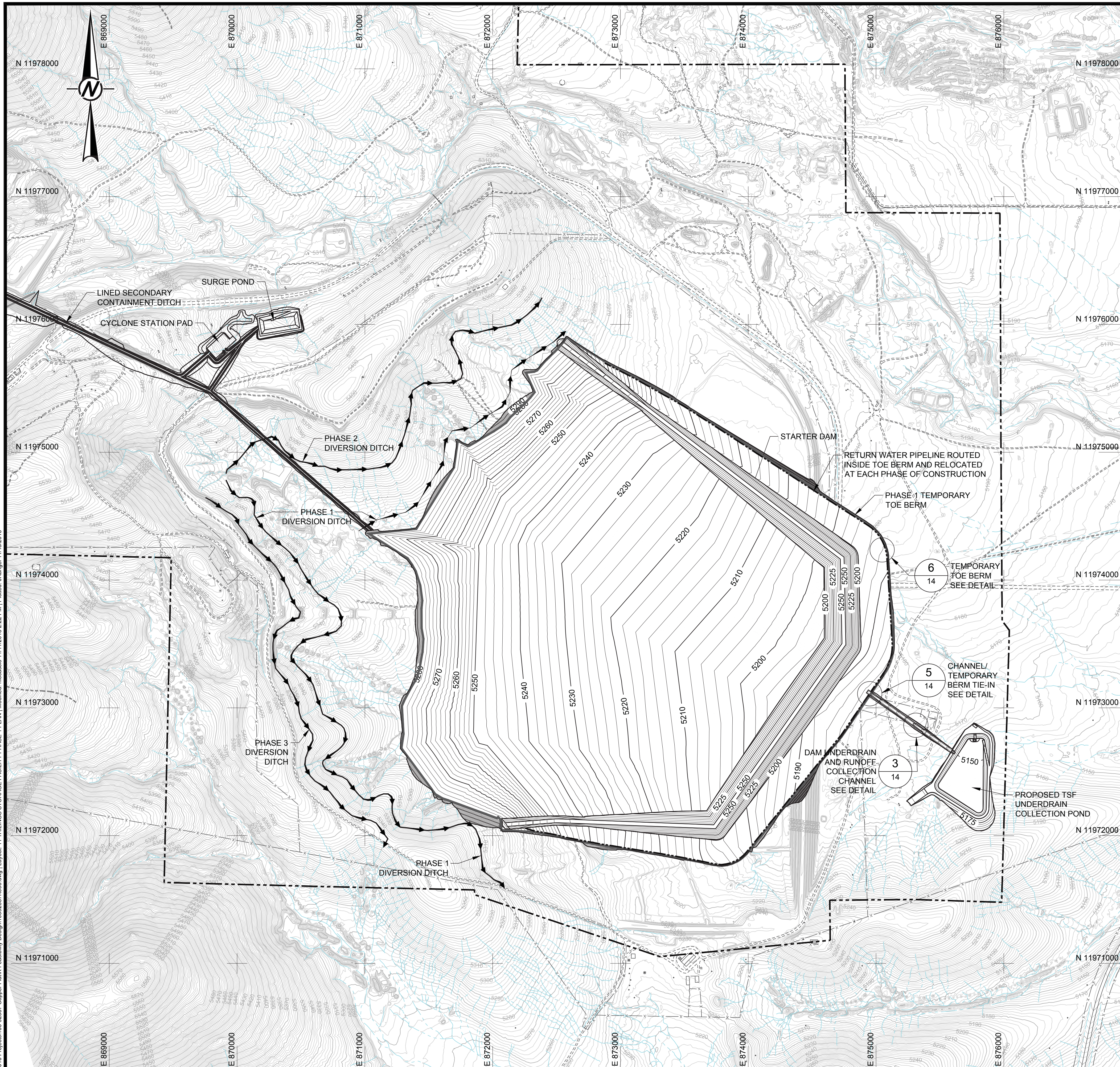

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K006.dwg | Layout: 11 TAILINGS STORAGE FACILITY PHASE 1 PLAN | Modified: nlocascio 11/11/2015 2:22 PM | Plotted: JRangel 11/13/2015

LEGEND

- 3600 EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 3600 REGRADED CONTOURS (ft -MSL)
- TEMPORARY TOE BERM CENTERLINE
- PHASE 1 PHASE BOUNDARY
- GRADE BREAK
- SLOPE INDICATOR
- 3H:1V or 3H/1V 3 HORIZONTAL TO 1 VERTICAL SLOPE
- 5% GRADE INDICATOR
- 1/14 DETAIL CALLOUT: DETAIL ID, DRAWING SHEET LOCATION
- A/13 CROSS-SECTION CALLOUT: SECTION ID, DRAWING SHEET LOCATION

SCALE 0 400 800 1200 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION

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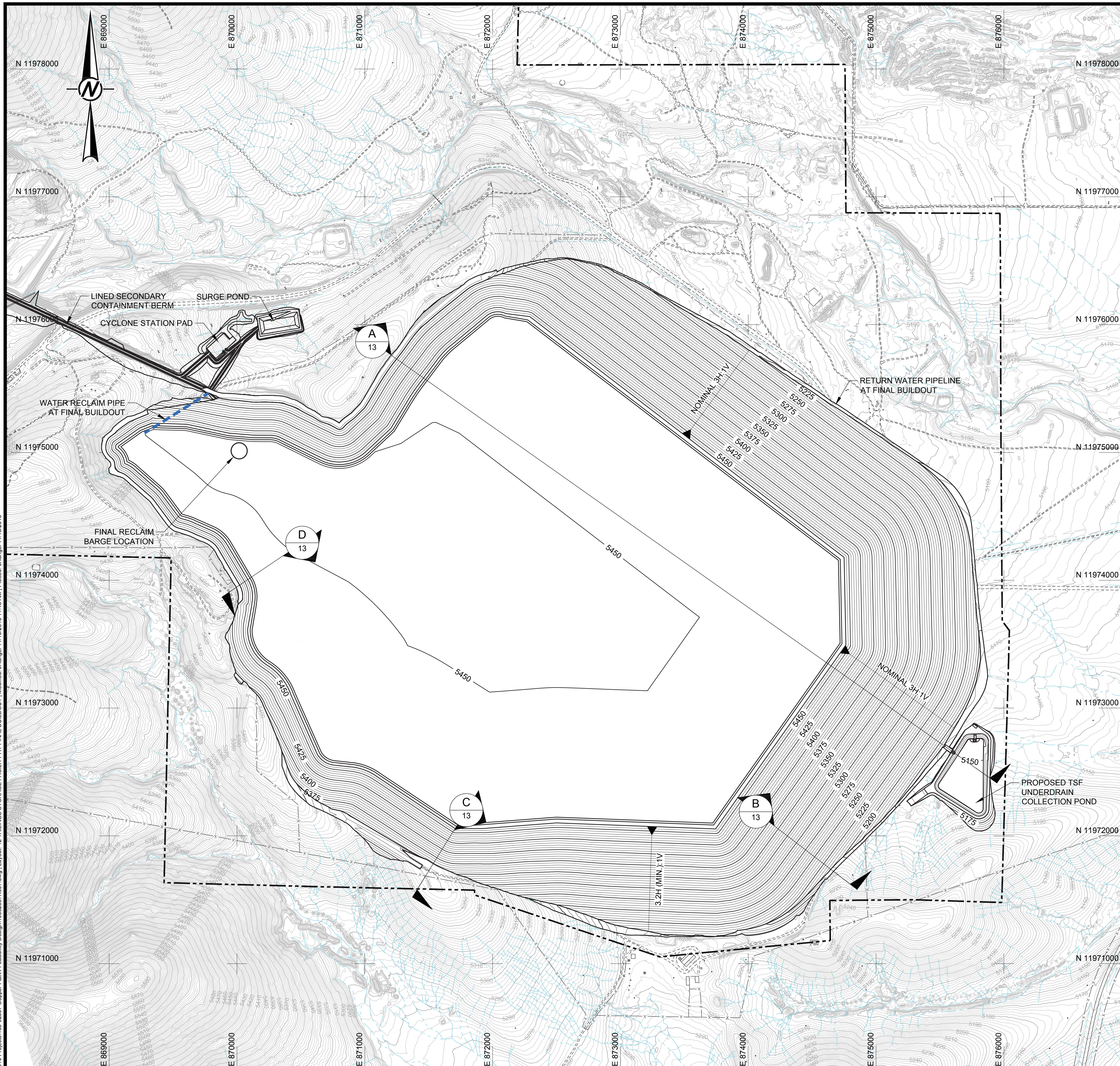
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

TAILINGS STORAGE FACILITY PHASE 1 PLAN

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K006
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		11
REVIEW	DAK	2013-07-17		



LEGEND

3600	EXISTING GROUND CONTOUR (ft -MSL)
	EXISTING ROADS
	EXISTING DRAINAGE
	EXISTING FENCELINE
	MINE PERMIT AREA BOUNDARY
3600	REGRADED CONTOURS (ft -MSL)
	GRADE BREAK
	SLOPE INDICATOR
3H:1V or 3H/1V	3 HORIZONTAL TO 1 VERTICAL SLOPE
5%	GRADE INDICATOR
1 / 14	DETAIL CALLOUT DETAIL ID DRAWING SHEET LOCATION
A / 13	CROSS-SECTION CALLOUT SECTION ID DRAWING SHEET LOCATION

0 400 800 1200
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY
FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

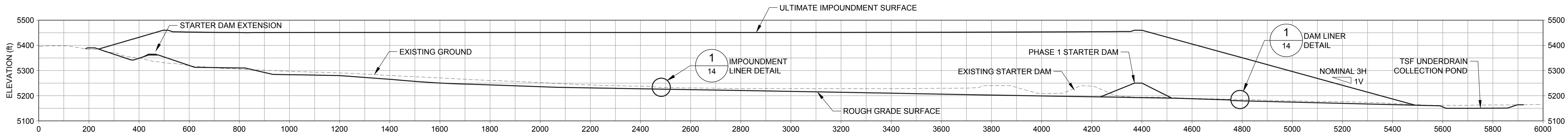
TITLE

TAILINGS STORAGE FACILITY AT FINAL BUILDOUT

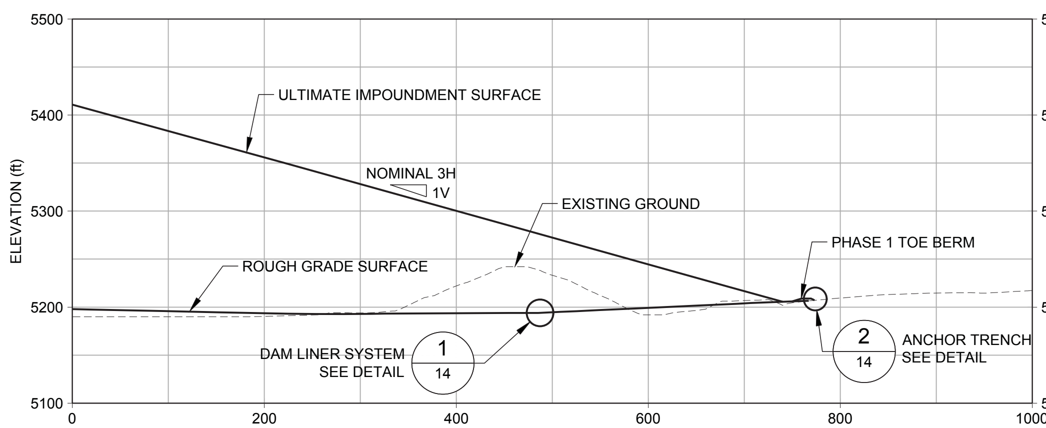
Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K007
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		12
REVIEW	DAK	2013-07-17		

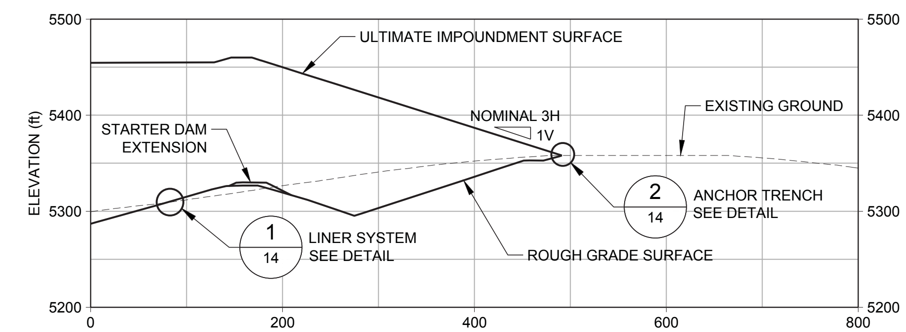
K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K007.dwg | Layout: 12 TAILINGS STORAGE FACILITY AT FINAL BUILDOUT | Modified: JRangel 11/13/2015 11:45 AM | Plotted: JRangel 11/13/2015



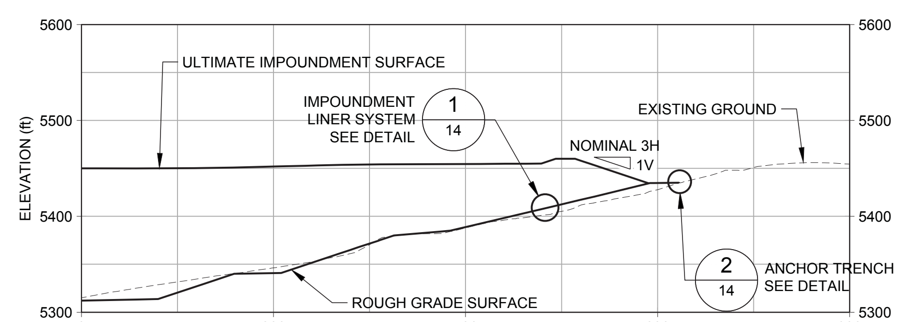
SCALE A (A/13) CROSS-SECTION A



SCALE B (B/13) CROSS-SECTION B



SCALE B (C/13) CROSS-SECTION C



NOTE: STARTER DAM EXTENSION TO BE SHOWN ON DETAILED DESIGN DRAWINGS.

SCALE B (D/13) CROSS-SECTION D

SCALE B: 0 100 200 300 FEET

SCALE A: 0 200 400 600 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION
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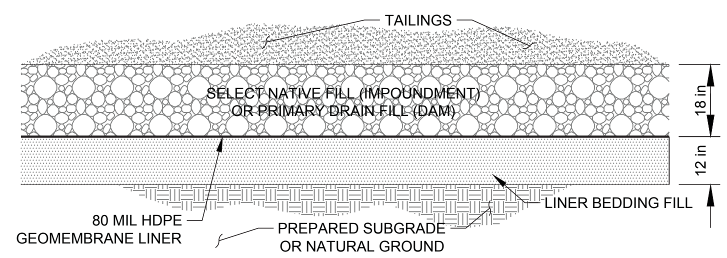
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

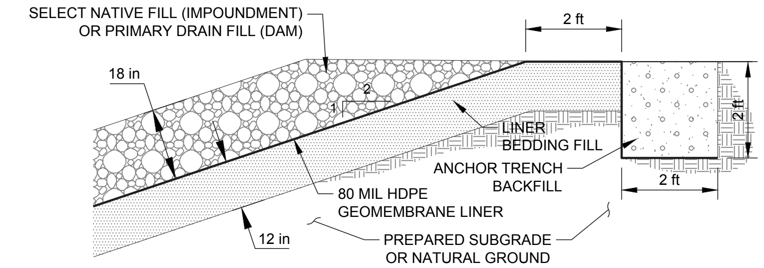
TAILINGS STORAGE FACILITY CROSS-SECTIONS

Golder Associates

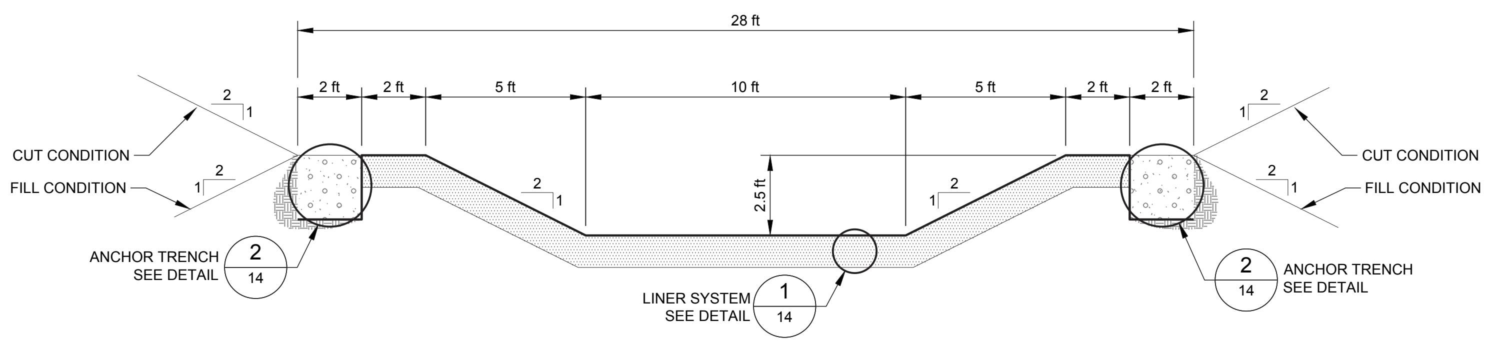
PROJECT No.		103-92557	FILE No.	10392557K008
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		13
REVIEW	DAK	2013-07-17		



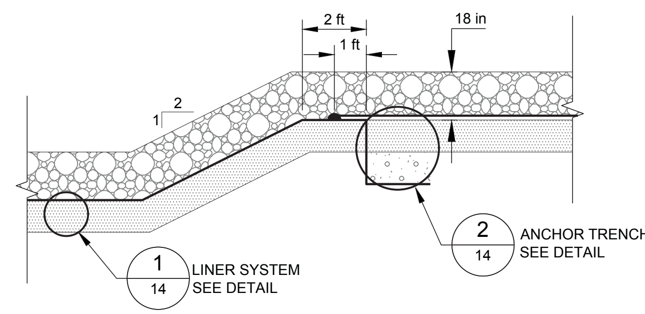
SCALE: N.T.S. 1/14 IMPOUNDMENT LINER SYSTEM DETAIL



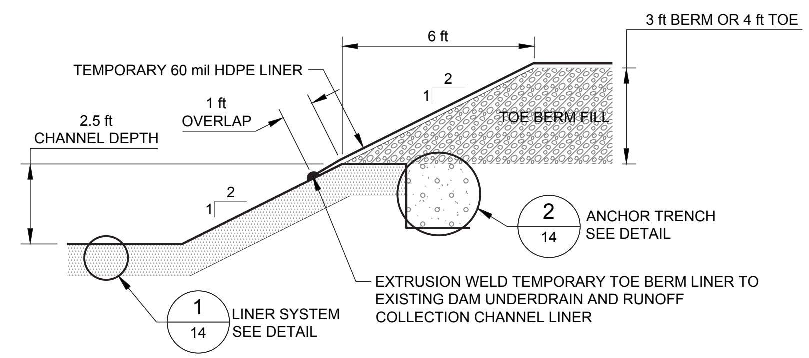
SCALE: N.T.S. 2/14 ANCHOR TRENCH DETAIL



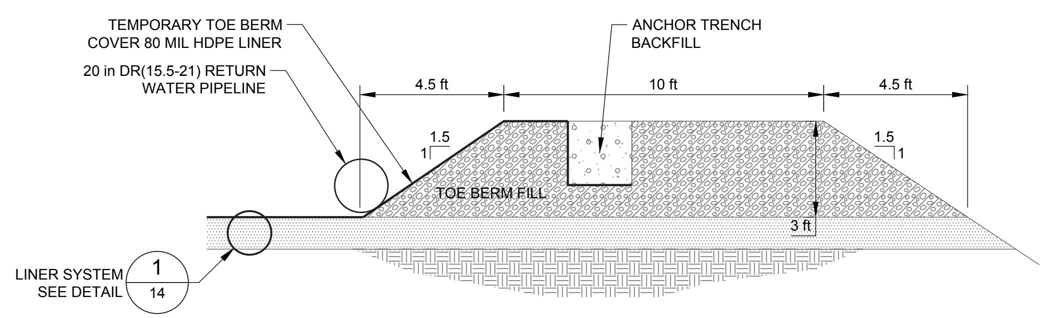
SCALE: N.T.S. 3/14 DAM UNDERDRAIN AND RUNOFF COLLECTION CHANNEL DETAIL



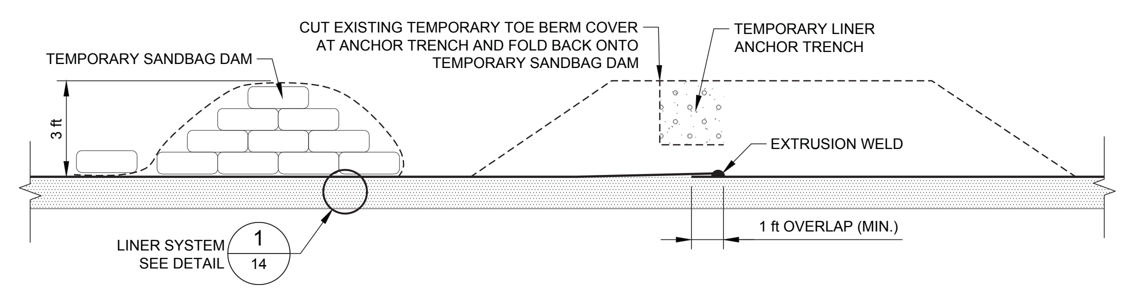
SCALE: N.T.S. 4/14 LINER EXTENSION WITH CHANNEL ANCHOR DETAIL



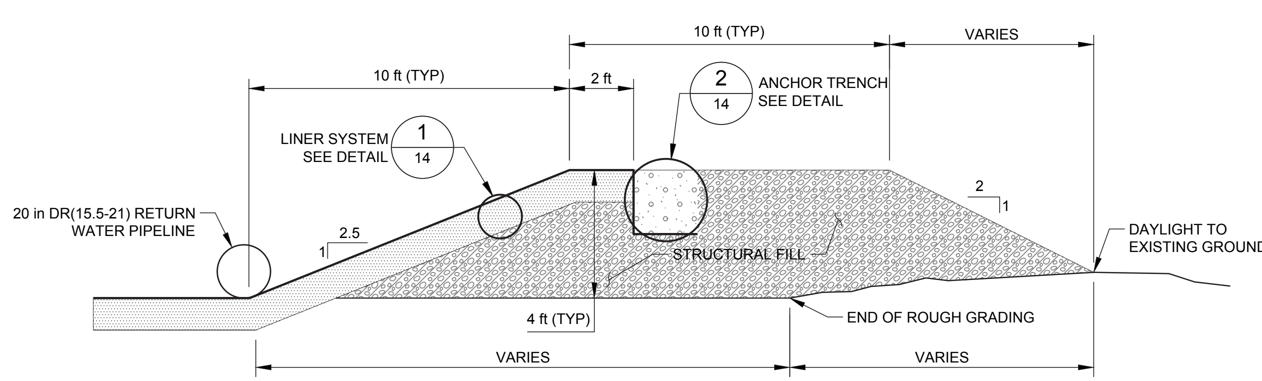
SCALE: N.T.S. 5/14 CHANNEL/TEMPORARY BERM TIE-IN DETAIL



SCALE N.T.S. 6/14 TEMPORARY TOE BERM DETAIL



SCALE N.T.S. 7/14 PHASE EXTENSION LINER TIE-IN AT TOE BERM DETAIL



SCALE: N.T.S. 8/14 FINAL TOE BERM DETAIL

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE
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FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

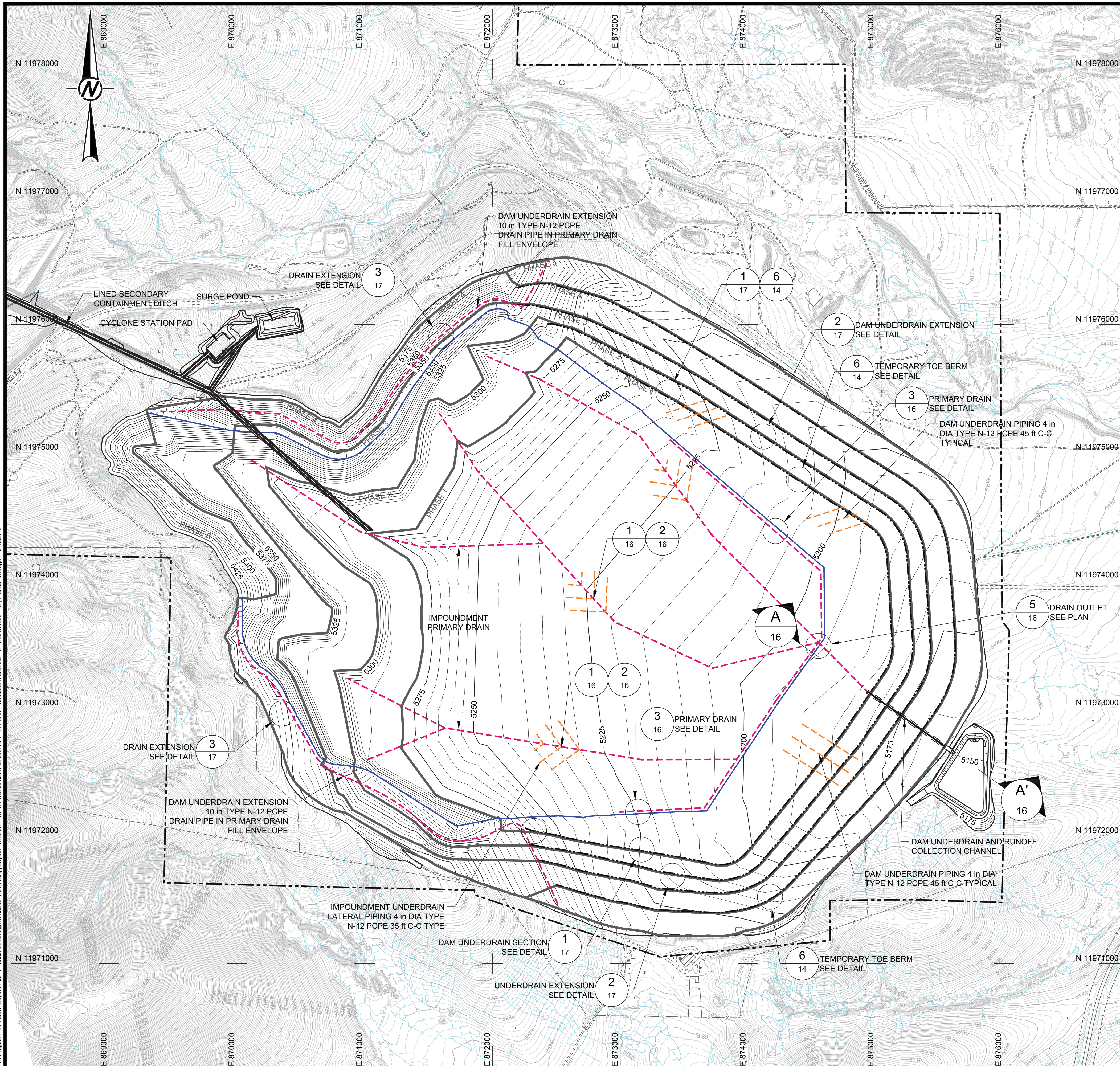
TITLE

TAILINGS STORAGE FACILITY DETAILS

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K009
DESIGN	DW	2013-04-08	SCALE	NOT TO SCALE
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		14
REVIEW	DAK	2013-07-17		

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K009.dwg | Layout: 14 TAILINGS STORAGE FACILITY DETAILS | Modified: JRangel 11/13/2015 12:11 PM | Plotted: JRangel 11/13/2015



K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K010.dwg | Layout: 15 DAM AND IMPOUNDMENT UNDERDRAIN PLAN | Modified: nlocascio 11/11/2015 3:25 PM | Plotted: JRangel 11/13/2015

LEGEND

- 3600 — EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 10 IN. DIA. N-12 PCPE PIPE
- 12 IN. DIA. N-12 PCPE PIPE
- 14 in SCH80 STEEL
- 4 IN. DIA. N-12 PCPE PIPE
- LIMIT IMPOUNDMENT UNDERDRAIN SYSTEMS
- 3600 — REGRADED CONTOURS (ft -MSL)
- TEMPORARY TOE BERM CENTERLINE
- PHASE 1 — PHASE BOUNDARY
- GRADE BREAK
- SLOPE INDICATOR
- 3H:1V or 3H/1V — 3 HORIZONTAL TO 1 VERTICAL SLOPE
- 5% — GRADE INDICATOR
- 1/14 — DETAIL CALLOUT, DETAIL ID, DRAWING SHEET LOCATION
- A/13 — CROSS-SECTION CALLOUT, SECTION ID, DRAWING SHEET LOCATION

NOTES

1.) TYPICAL ORIENTATION FOR 4 in UNDERDRAIN PIPING SHOWN. COVERAGE WILL BE AT 35 ft C-C SPACING OVER IMPOUNDMENT UNDERDRAIN AREA. COVERAGE WILL BE 45 ft C-C OVER DAM UNDERDRAIN AREA.

2.) THE MAIN BODY OF THE EMBANKMENT WILL BE UNDERLAIN WITH A BLANKET DRAIN WITH INTERNAL 4 in PCPE PIPE NETWORK. DAM UNDERDRAIN EXTENSION IN PHASE 2 THROUGH PHASE 5 WILL INCLUDE A 10 in DIAMETER PCPE DRAIN CONSTRUCTED ON THE OUTER TOE OF THE STARTER DAM

SCALE 0 400 800 1200 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

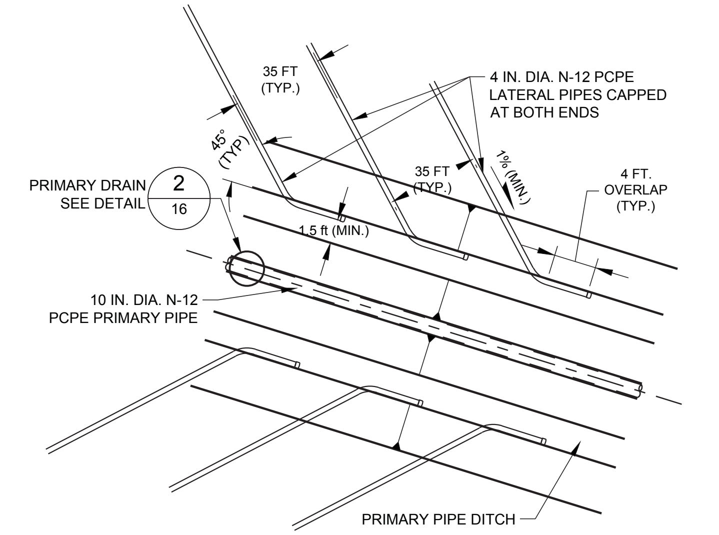
TITLE

DAM AND IMPOUNDMENT UNDERDRAIN PLAN

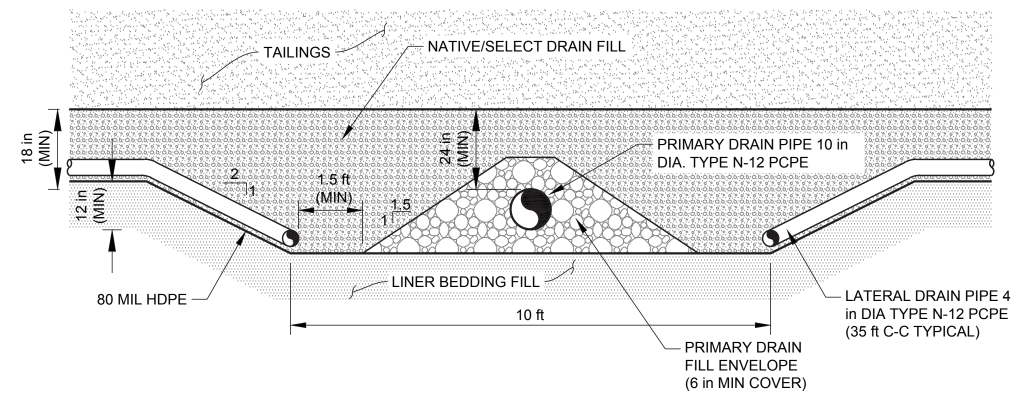
Golder Associates

PROJECT No.		103-92557	FILE No. 10392557K010
DESIGN	DW	2013-04-08	SCALE AS SHOWN
CADD	JHR	2013-07-10	DRAWING
CHECK	GM	2013-07-16	15
REVIEW	DAK	2013-07-17	

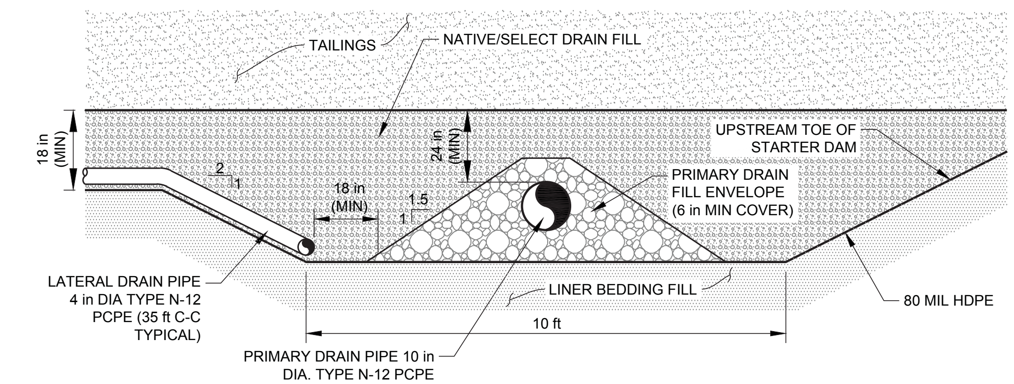
16734



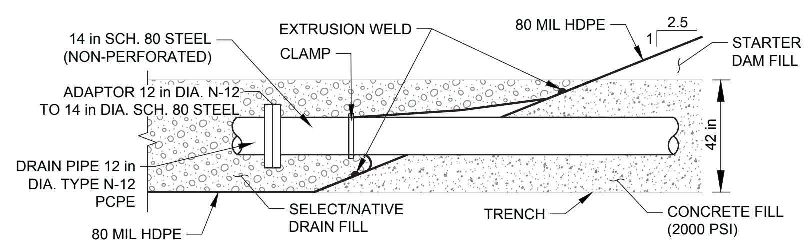
NTS 1/16 IMPOUNDMENT DRAIN PLACEMENT



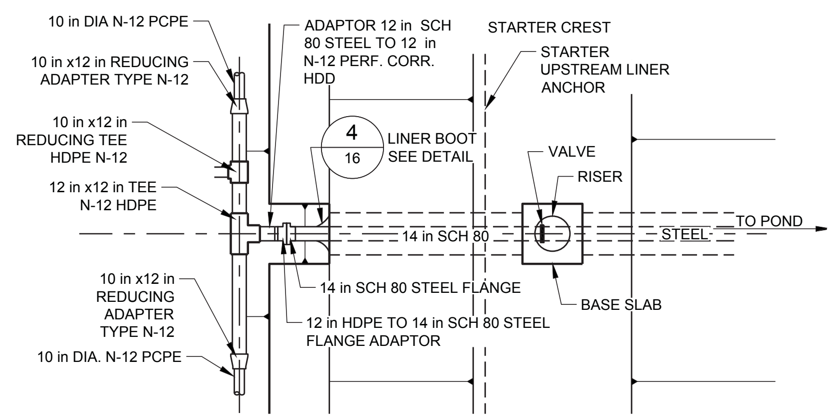
NTS 2/16 PRIMARY DRAIN PLACEMENT



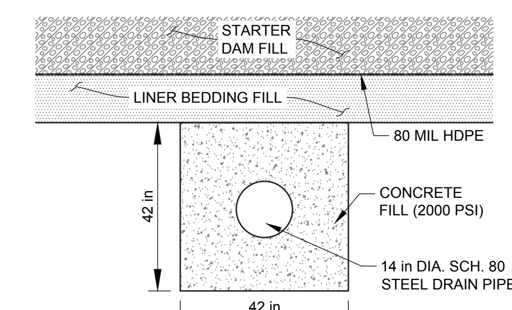
NTS 3/16 PRIMARY DRAIN PLACEMENT AT STARTER DAM TOE



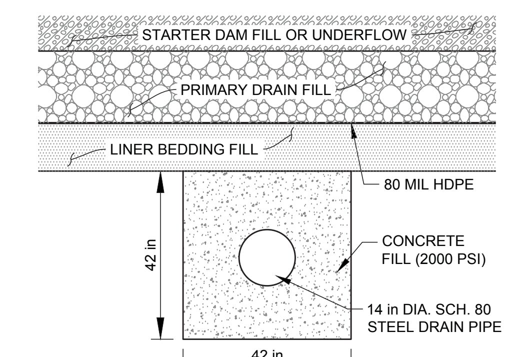
NTS 4/16 DETAIL DRAIN PIPE TO STARTER DAM ENTRY



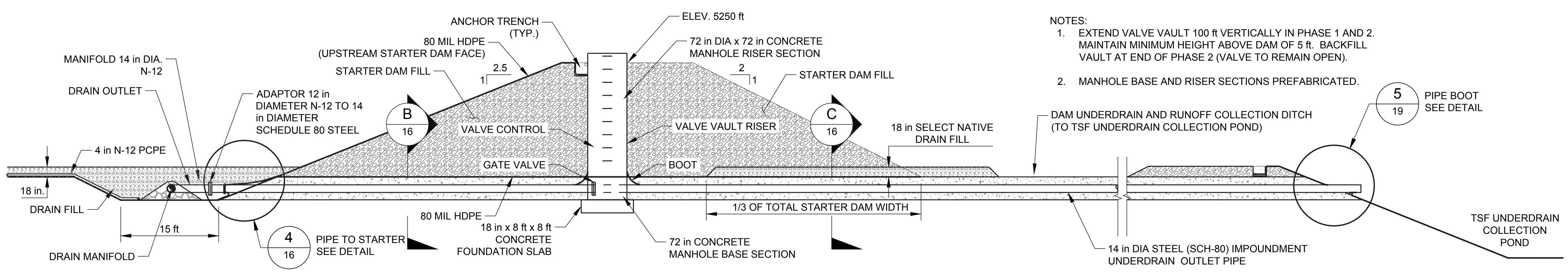
NTS 5/16 DRAIN OUTLET PLAN



NTS B/16 SECTION B-B



NTS C/16 SECTION C-C



NTS A/16 SECTION A-A DRAIN OUTLET

NOTES:

1. EXTEND VALVE VAULT 100 ft VERTICALLY IN PHASE 1 AND 2. MAINTAIN MINIMUM HEIGHT ABOVE DAM OF 5 ft. BACKFILL VAULT AT END OF PHASE 2 (VALVE TO REMAIN OPEN).
2. MANHOLE BASE AND RISER SECTIONS PREFABRICATED.

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

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PROJECT

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30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

DAM UNDERDRAIN DETAILS (1 of 2)

Golder Associates

PROJECT No.		103-92557	FILE No. 10392557K011
DESIGN	DW	2013-04-08	SCALE AS SHOWN
CADD	JHR	2013-07-10	DRAWING
CHECK	GM	2013-07-16	16
REVIEW	DAK	2013-07-17	

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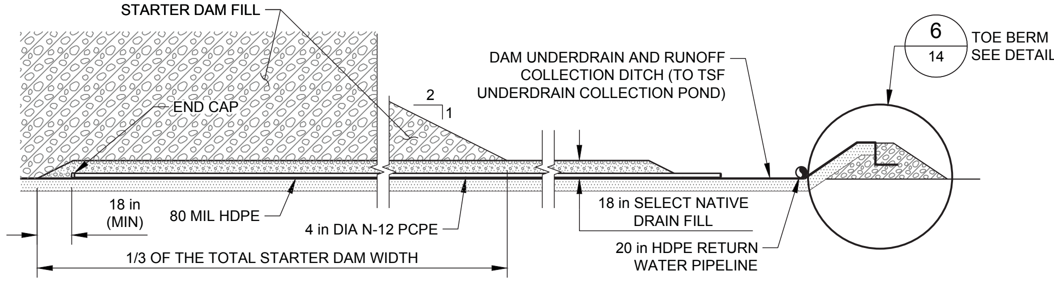
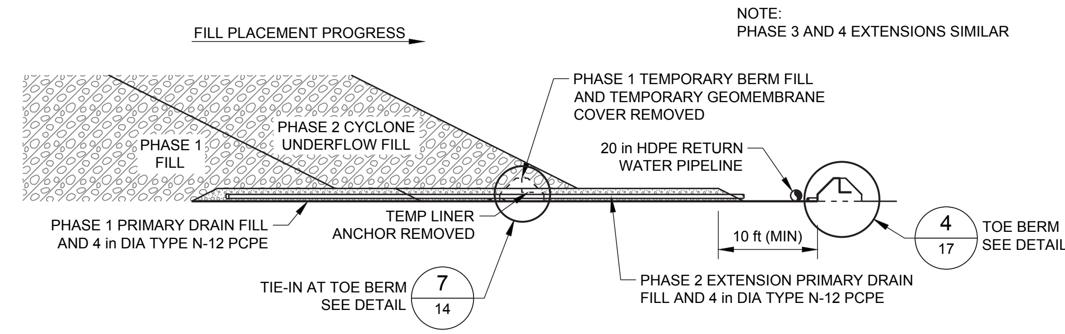
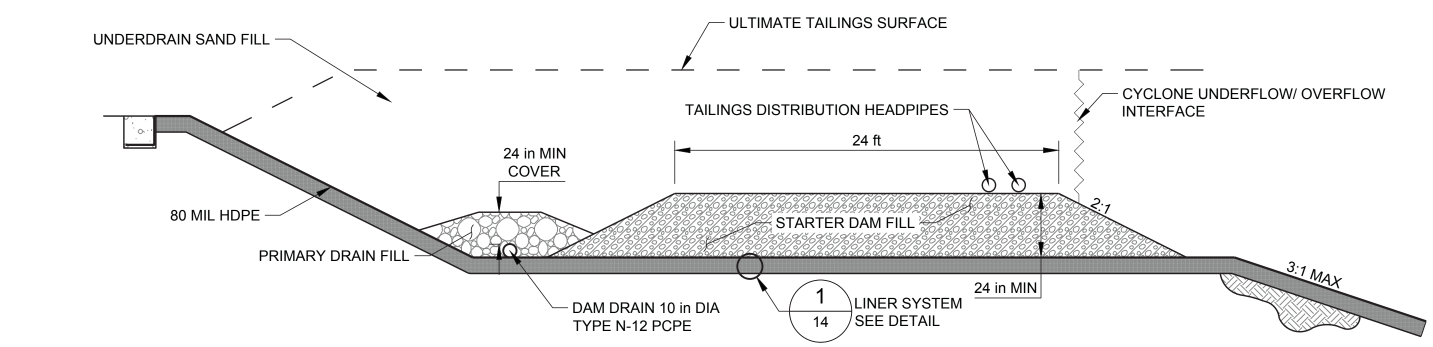


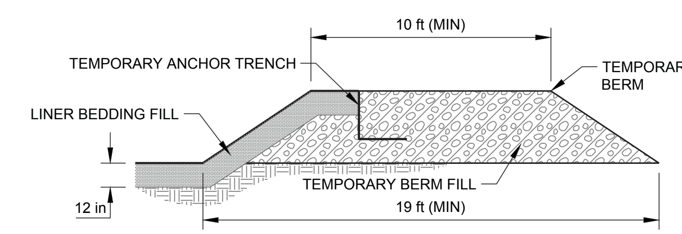
NTS 1/17 DAM UNDERDRAIN SECTION



NTS 2/17 PHASE 1 TO PHASE 2 TSF LINER AND DAM UNDERDRAIN EXTENSION



NTS 3/17 DAM UNDERDRAIN 10 IN PCPE DRAIN EXTENSION



NTS 4/17 TEMPORARY PERIMETER BERM

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

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30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

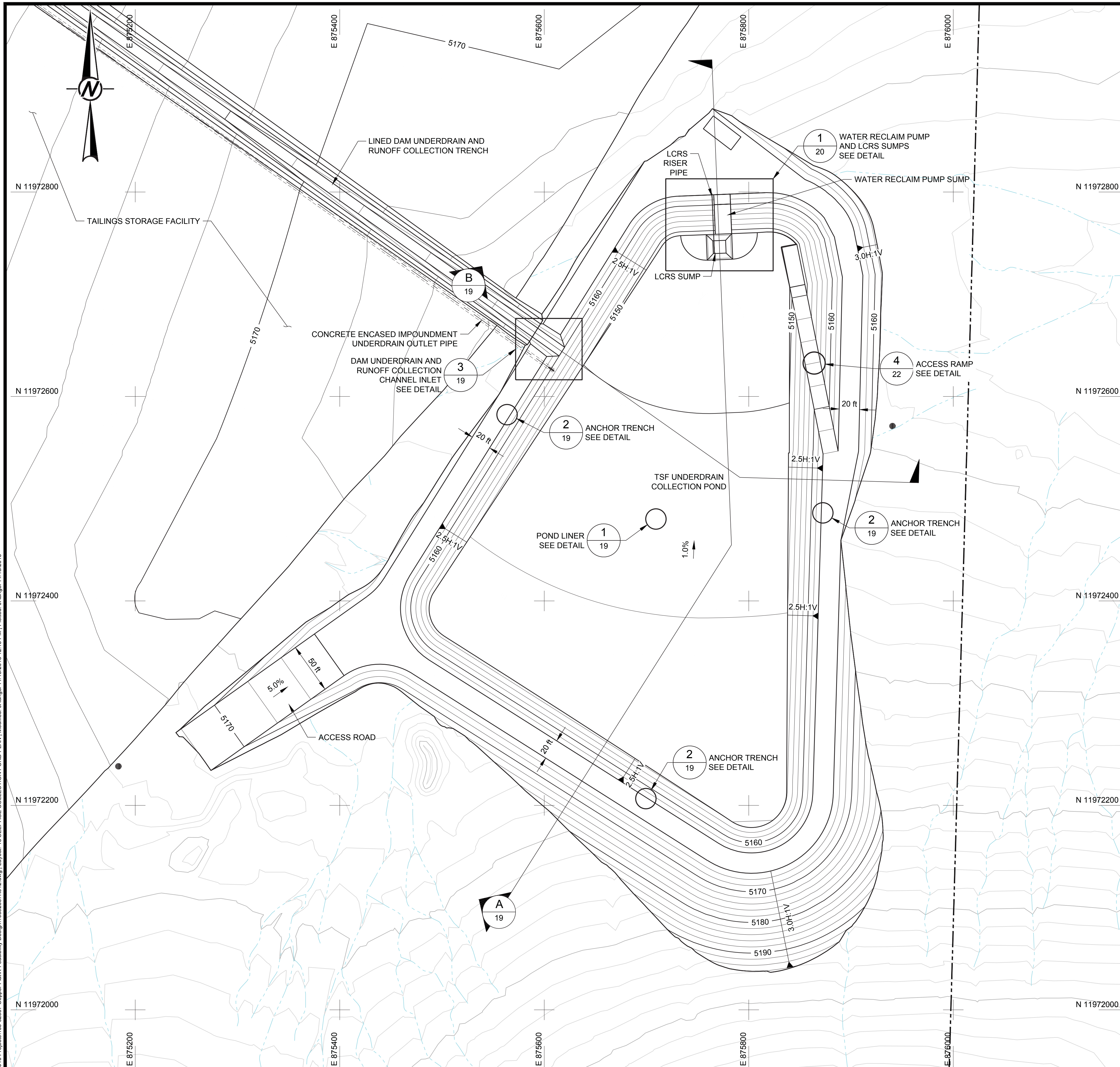
TITLE

DAM UNDERDRAIN DETAILS (2 of 2)

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K011
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		17
REVIEW	DAK	2013-07-17		

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K011.dwg | Layout: 17 DAM UNDERDRAIN DETAILS (2 of 2) | Modified: nlocascio 11/11/2015 4:05 PM | Plotted: JRangel 11/13/2015



LEGEND

- 3600 EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 3600 REGRADED CONTOURS (ft -MSL)
- GRADE BREAK
- SLOPE INDICATOR
- 3H:1V or 3H/1V 3 HORIZONTAL TO 1 VERTICAL SLOPE
- 5% GRADE INDICATOR
- DETAIL CALLOUT: DETAIL ID (1) / DRAWING SHEET LOCATION (14)
- CROSS-SECTION CALLOUT: SECTION ID (A) / DRAWING SHEET LOCATION (13)

0 50 100 150
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

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30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

TSF UNDERDRAIN COLLECTION POND PLAN

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K012
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		18
REVIEW	DAK	2013-07-17		

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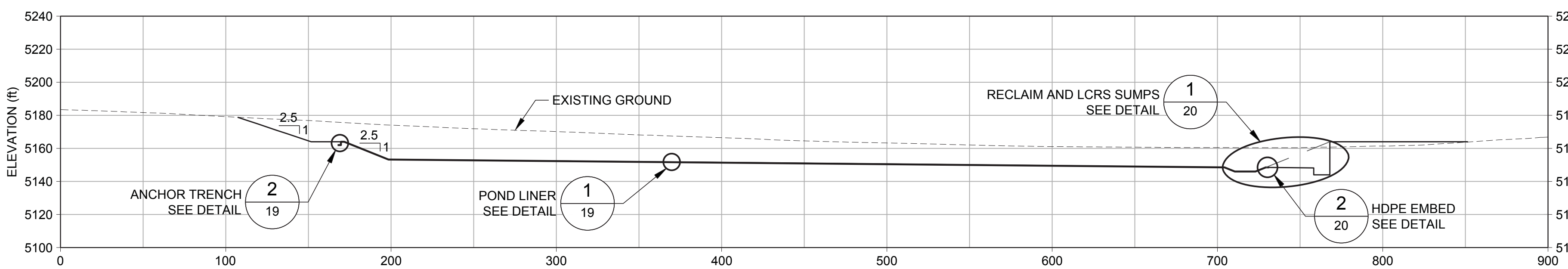
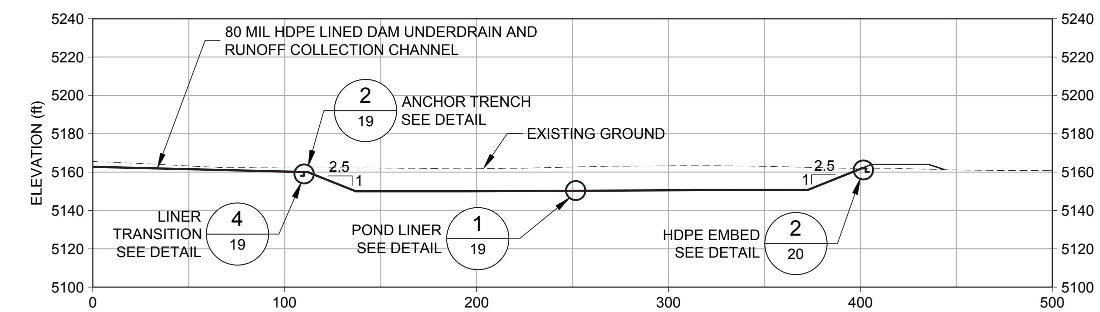
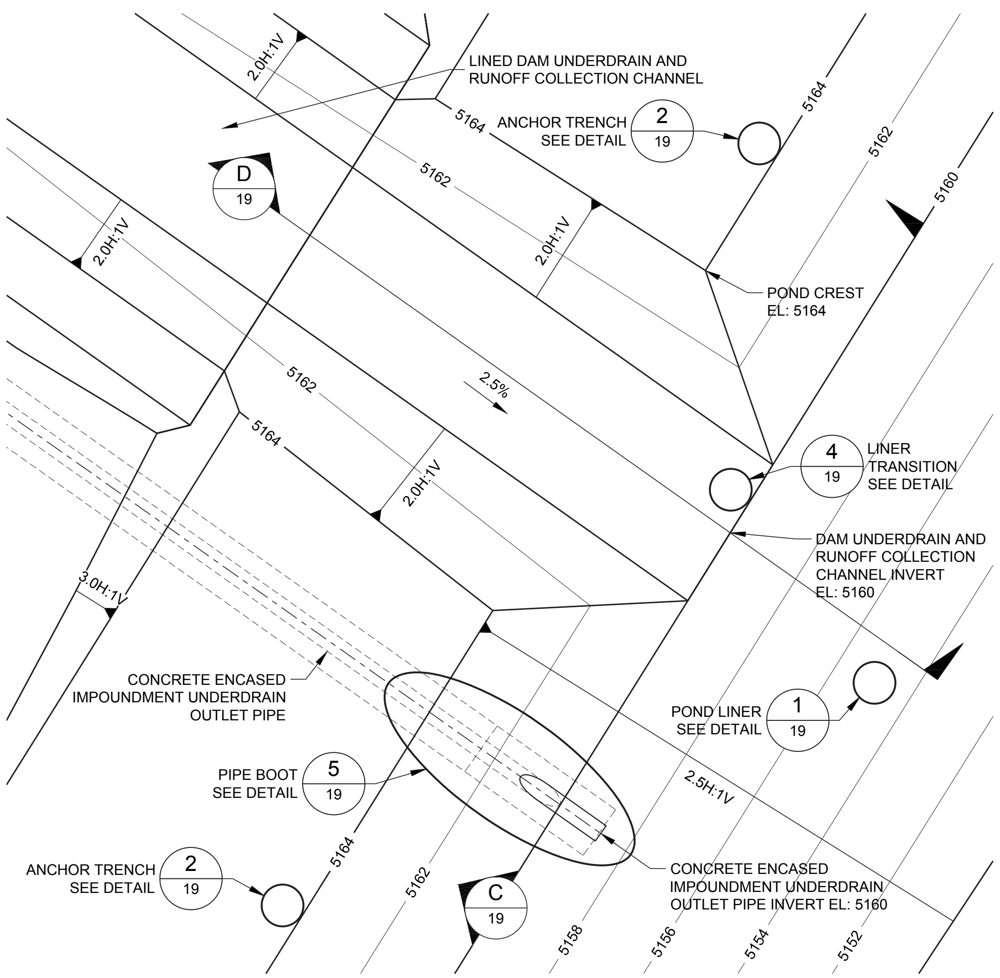


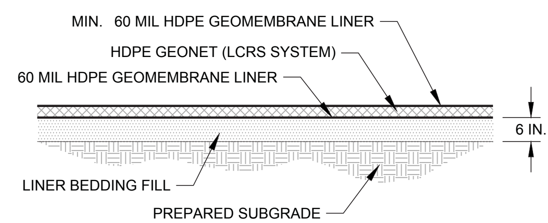
SCALE A (A / 19) CROSS-SECTION A



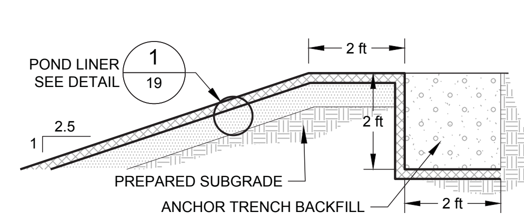
SCALE A (B / 19) CROSS-SECTION B



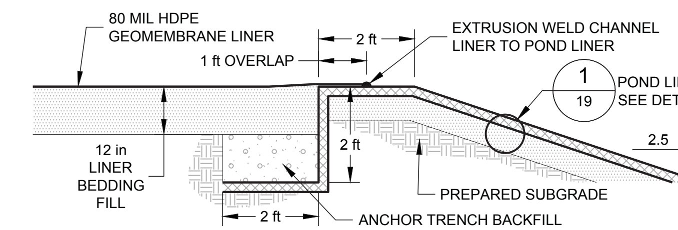
SCALE B (3 / 19) DAM UNDERDRAIN AND RUNOFF COLLECTION CHANNEL INLET TO POND



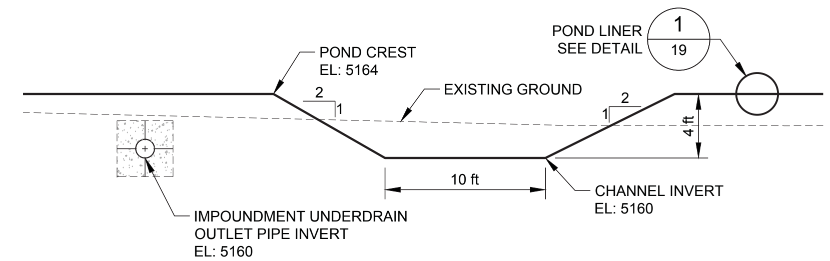
N.T.S. (1 / 19) POND LINER SYSTEM DETAIL



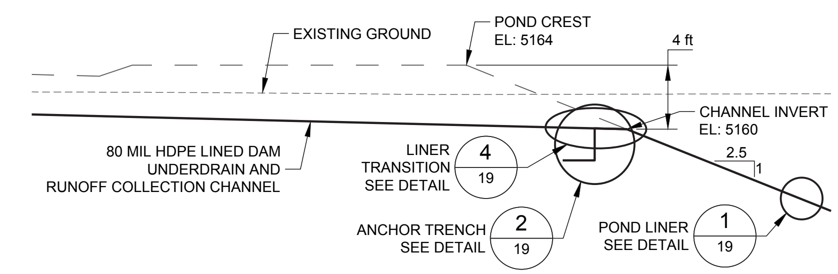
N.T.S. (2 / 19) POND ANCHOR TRENCH DETAIL



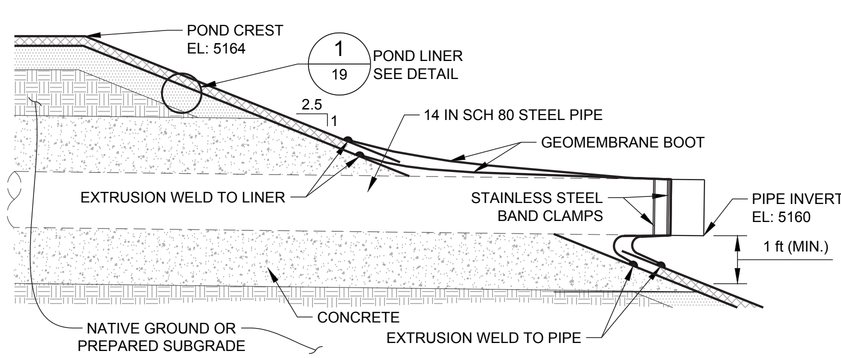
N.T.S. (4 / 19) CHANNEL LINER TO POND LINER TRANSITION DETAIL



N.T.S. (C / 19) DAM UNDERDRAIN AND RUNOFF COLLECTION CHANNEL ELEVATION SECTION



N.T.S. (D / 19) DAM UNDERDRAIN AND RUNOFF COLLECTION CHANNEL INLET SECTION



N.T.S. (5 / 19) IMPOUNDMENT UNDERDRAIN OUTLET PIPE BOOT DETAIL

0 6 12 18
SCALE B FEET

0 50 100 150
SCALE A FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE
TSF UNDERDRAIN COLLECTION POND CROSS-SECTION AND DETAILS(1 OF 2)

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K013
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		19
REVIEW	DAK	2013-07-17		

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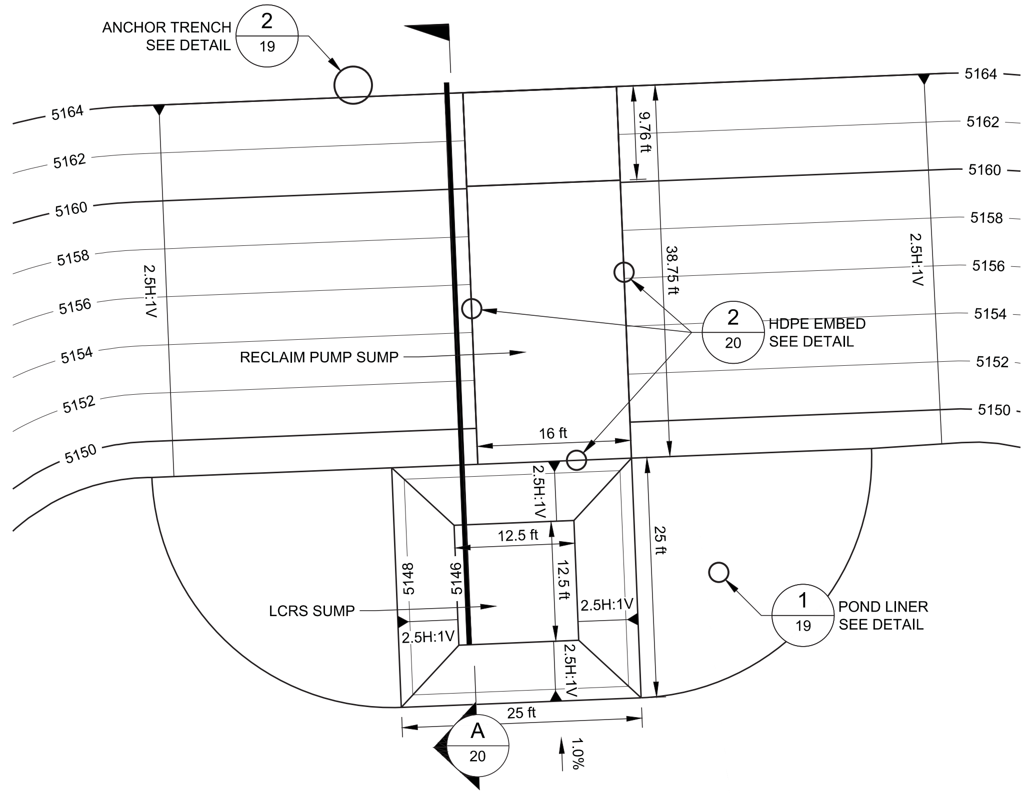
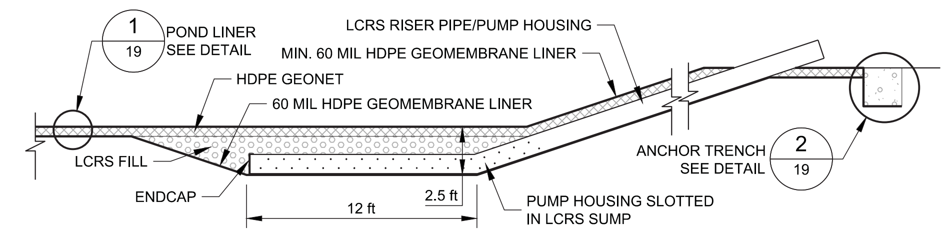
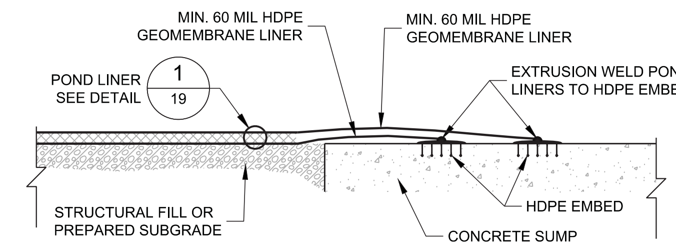


SCALE A (1/20) RECLAIM PUMP SUMP AND LCRS SUMP DETAIL



N.T.S. (A/20) LCRS SUMP SECTION



N.T.S. (2/20) CONCRETE DOUBLE EMBED DETAIL

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SCALE A FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

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FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

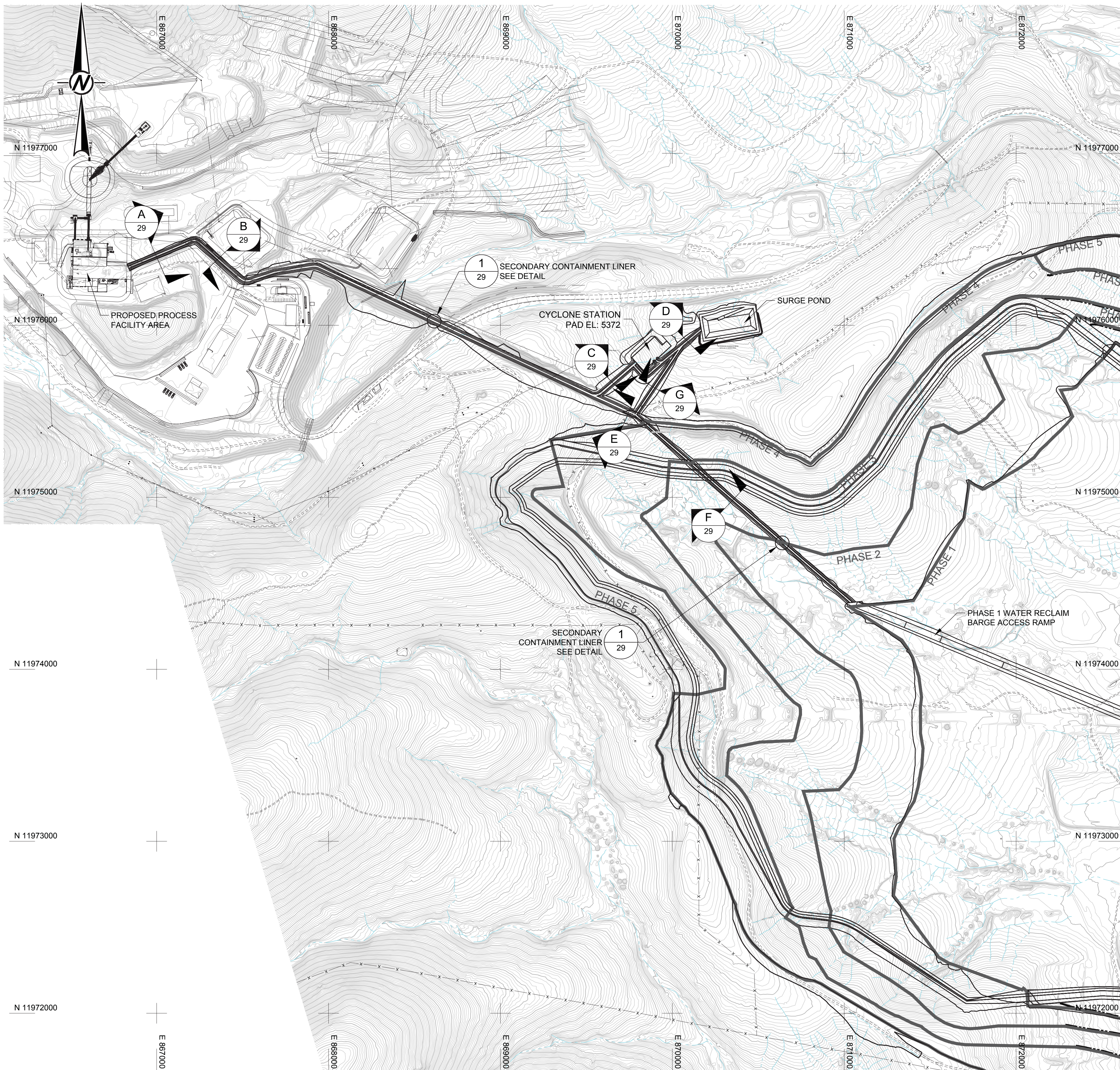
TITLE

TSF UNDERDRAIN COLLECTION POND CROSS-SECTION AND DETAILS(2 OF 2)

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K013
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		20
REVIEW	DAK	2013-07-17		

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K013.dwg | Layout: 20 SEEPAGE COLLECTION POND CROSS-SECTIONS AND DETAILS (2 OF 2) | Modified: nlocascio 11/11/2015 4:21 PM | Plotted: JRangel 11/13/2015



LEGEND

3600	EXISTING GROUND CONTOUR (ft -MSL)
	EXISTING ROADS
	EXISTING DRAINAGE
x x x	EXISTING FENCELINE
3600	REGRADED CONTOURS (ft -MSL)
	GRADE BREAK
	SLOPE INDICATOR
3H:1V or 3H/1V	3 HORIZONTAL TO 1 VERTICAL SLOPE
5%	GRADE INDICATOR
1 / 14	DETAIL CALLOUT DETAIL ID DRAWING SHEET LOCATION
A / 13	CROSS-SECTION CALLOUT SECTION ID DRAWING SHEET LOCATION

0 300 600 900
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES | NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

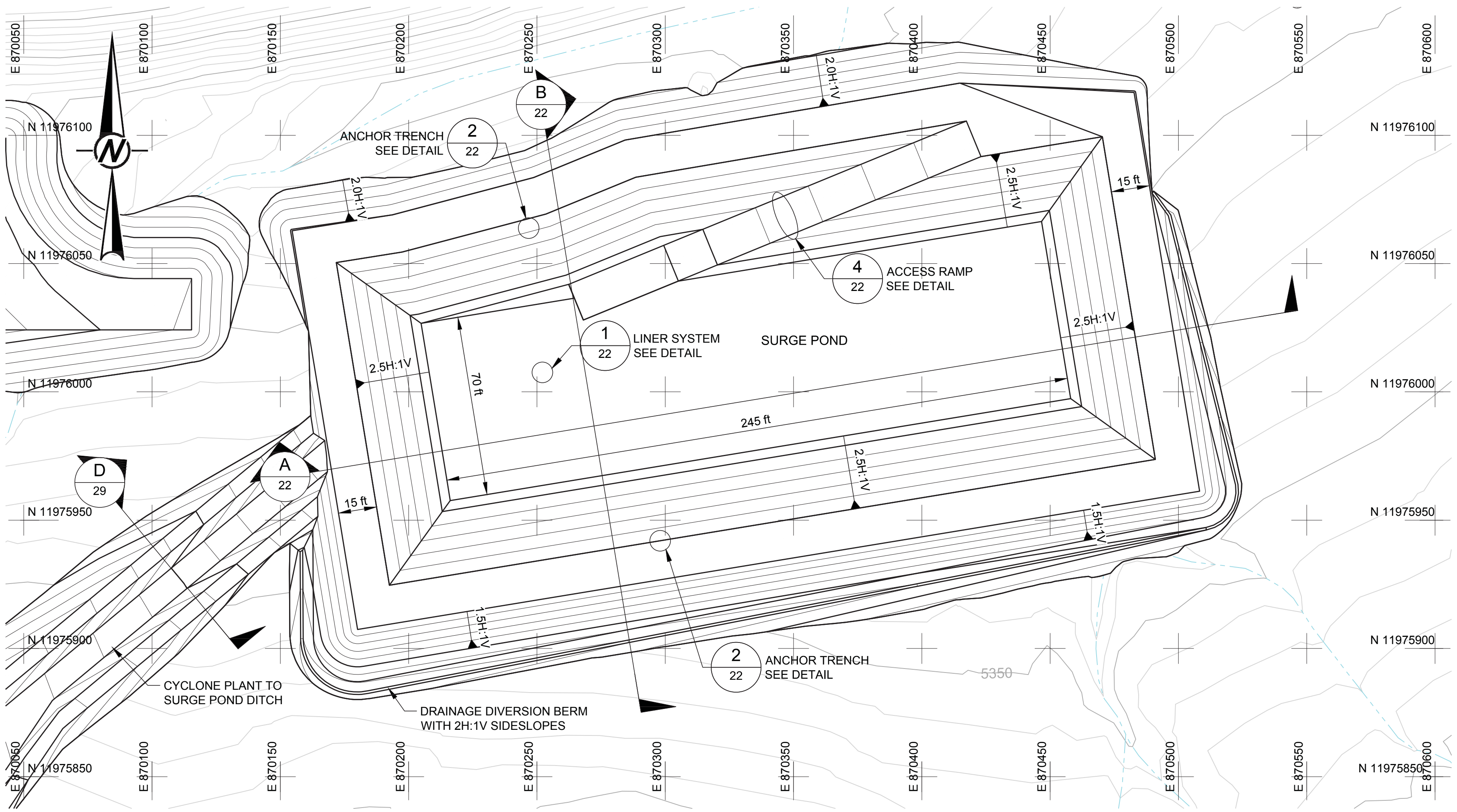
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

CYCLONE STATION, SURGE POND AND PROCESS AREA PLAN

Golder Associates

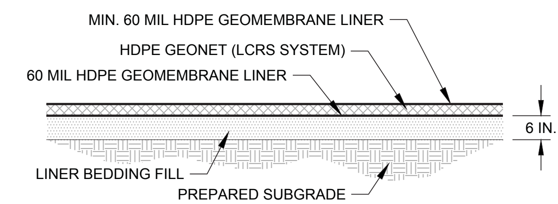
PROJECT No.		103-92557	FILE No.	10392557K014
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		21
REVIEW	DAK	2013-07-17		



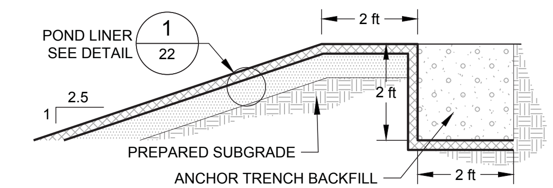
SURGE POND PLAN
SCALE A

LEGEND

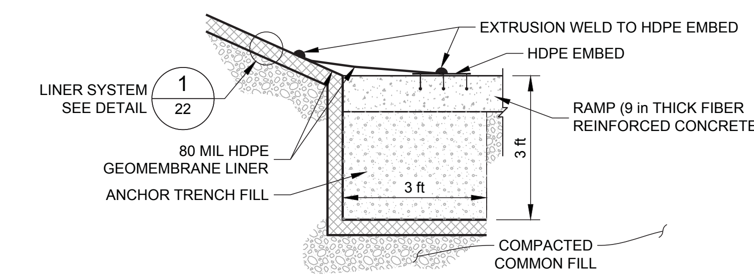
3600	EXISTING GROUND CONTOUR (ft -MSL)
3600	REGRADED CONTOURS (ft -MSL)
	GRADE BREAK
	SLOPE INDICATOR
3H:1V or 3H/1V	3 HORIZONTAL TO 1 VERTICAL SLOPE
5%	GRADE INDICATOR
1 / 2-315	DETAIL CALLOUT DETAIL ID DRAWING SHEET LOCATION
A / 2-313	CROSS-SECTION CALLOUT SECTION ID DRAWING SHEET LOCATION



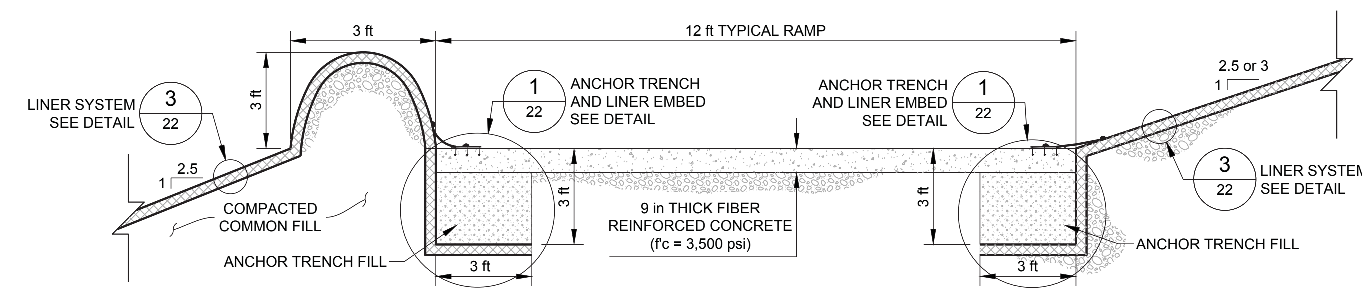
N.T.S. 1 / 22 SURGE POND LINER SYSTEM DETAIL



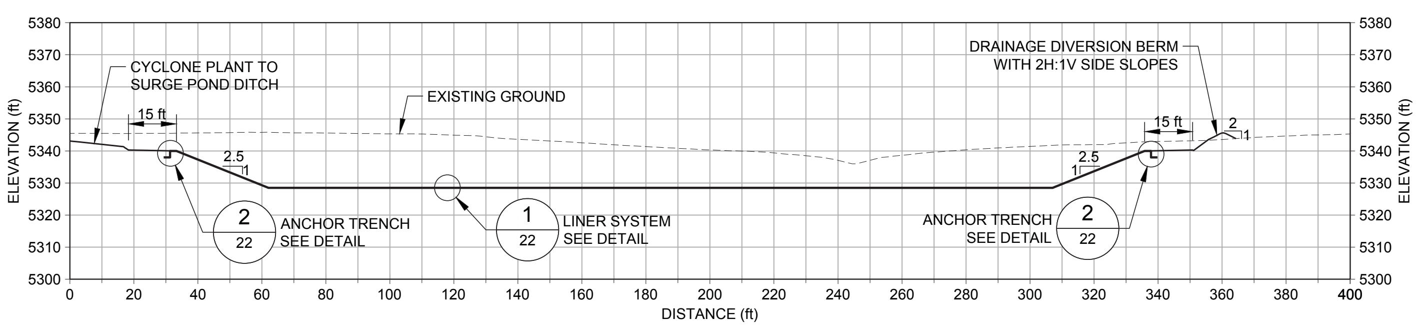
N.T.S. 2 / 22 SURGE POND ANCHOR TRENCH DETAIL



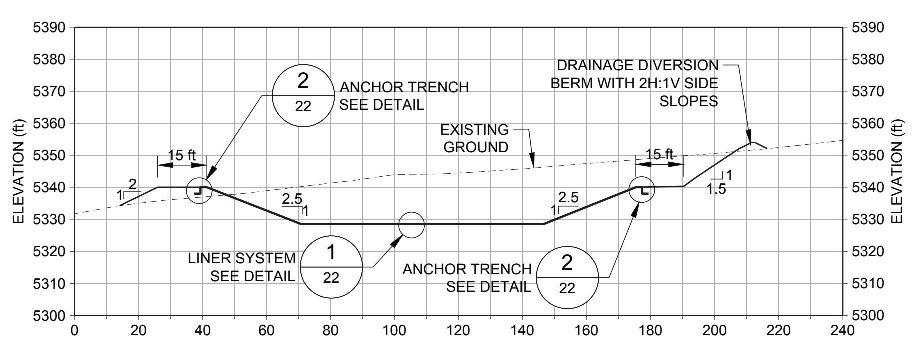
N.T.S. 3 / 22 TYPICAL ANCHOR TRENCH AND LINER EMBED DETAIL



N.T.S. 4 / 22 TYPICAL ACCESS RAMP DETAIL



SCALE A A / 22 CROSS-SECTION A



SCALE A B / 22 CROSS-SECTION B

0 30 60 90
SCALE A FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

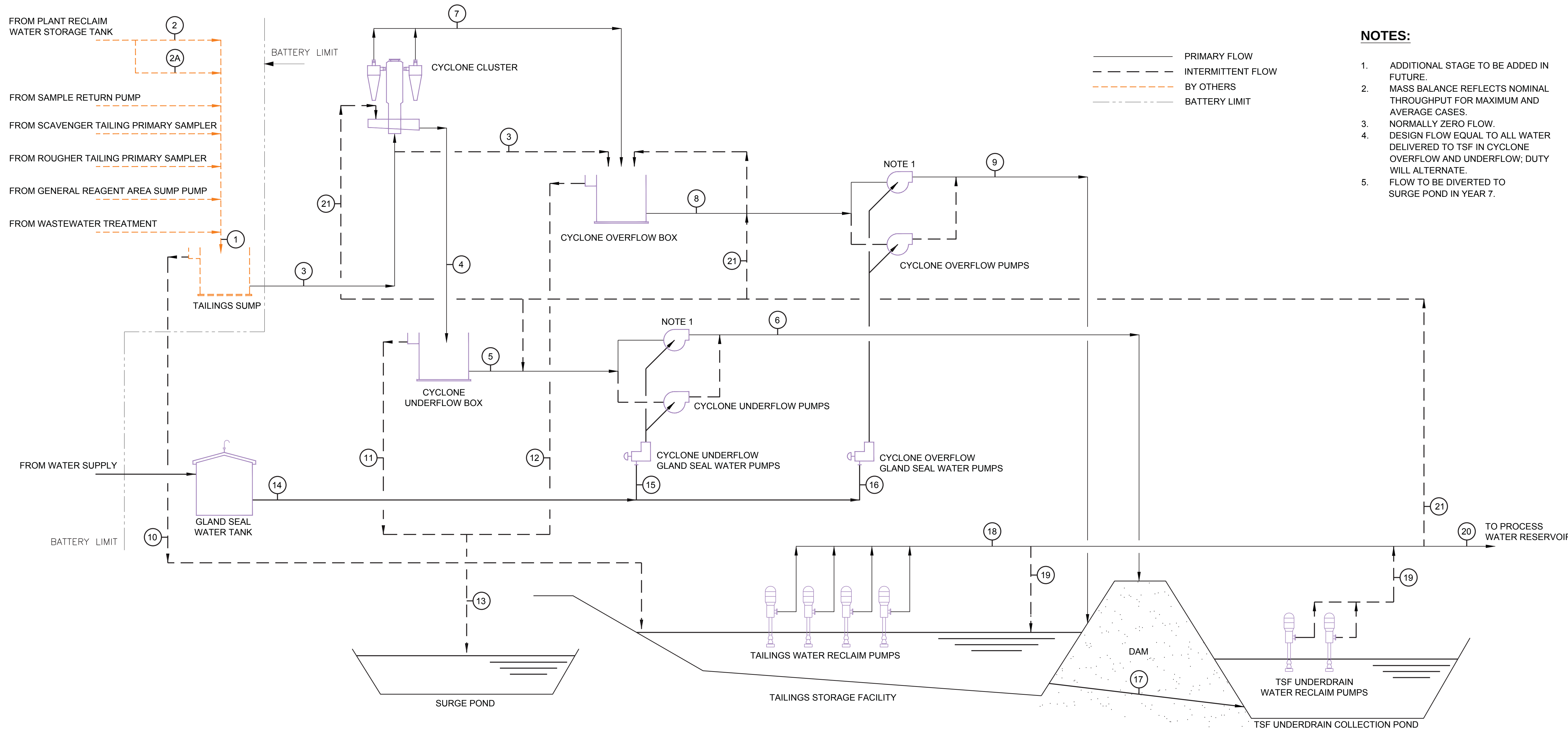
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE
SURGE POND PLAN, CROSS-SECTIONS, AND DETAILS

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K015
DESIGN	DW	2013-05-03	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		22
REVIEW	DAK	2013-07-17		

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K015.dwg | Layout: 22 SURGE POND PLAN CROSS-SECTIONS AND DETAILS | Modified: nlocascio 11/12/2015 7:55 AM | Plotted: JRangel 11/13/2015



NOTES:

1. ADDITIONAL STAGE TO BE ADDED IN FUTURE.
2. MASS BALANCE REFLECTS NOMINAL THROUGHPUT FOR MAXIMUM AND AVERAGE CASES.
3. NORMALLY ZERO FLOW.
4. DESIGN FLOW EQUAL TO ALL WATER DELIVERED TO TSF IN CYCLONE OVERFLOW AND UNDERFLOW; DUTY WILL ALTERNATE.
5. FLOW TO BE DIVERTED TO SURGE POND IN YEAR 7.

Note 2	Tailings Sump Feed	Tailings Sump Flush Water Note 3	Dilution Water Note 3	Tailings Sump Outlet/ Cyclone Inlet	Cyclone Underflow	Cyclone Underflow Box Discharge	Cyclone Underflow Pump Discharge	Cyclone Overflow	Cyclone Overflow Box Discharge	Cyclone Overflow Pump Discharge	Tailings Sump Overflow Note 3, 5	Cyclone Underflow Box Overflow Note 3	Cyclone Overflow Box Overflow Note 3	Cyclone Area Surge Discharge Note 3	Gland Seal Water Supply Header	Cyclone Underflow Pump Gland Seal Water	Cyclone Overflow Pump Gland Seal Water	TSF Under-flow	TSF Reclaim Water Note 4	TSF Underdrain Collection Pond Reclaim Water Note 4	Reclaim Water to Plant	Cyclone Area Flush Water from TSF Note 3
Stream	1	2	2A	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
TPD (solids)	32000			32000	14550	14550	14550	17450	17450	17450	32000	14550	32000	32000								
Solids (t/h)	1333			1333	606	606	606	727	727	727	1333	606	1333	1333								
Solution (t/h)	3249	3755	0	3249	260	260	264	2989	2989	3001	3249	260	3249	3249	17	4	13	3267	3267	1001	3267	490
Slurry (t/h)	4582			4582	866	866	870	3716	3716	3728	4582	866	4582	4582								
Solids (%) Cw	29.1%			29.1%	70.0%	70.0%	69.7%	19.6%	19.6%	19.5%	29.1%	70.0%	29.1%	29.1%								
Solids (gpm)	2018			2018	918	918	918	1101	1101	1101	2018	918	2018	2018								
Solution (gpm)	12981	14999	0	12981	1038	1038	1054	11943	11943	11993	12981	1038	12981	12981	66	16	50	13047	13047	4000	13047	1956
Slurry (gpm)	14999			14999	1956	1956	1972	13044	13044	13094	14999	1956	14999	14999								
Solids (%) Cv	13.5%			13.5%	46.9%	46.9%	46.5%	8.4%	8.4%	8.4%	13.5%	46.9%	13.5%	13.5%								
Solids SG	2.64			2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64								
Solution SG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Slurry SG	1.22			1.22	1.77	1.77	1.76	1.14	1.14	1.14	1.22	1.77	1.77	1.22								

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
C	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
B	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	MJG

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES
NEW MEXICO COPPER CORPORATION
Environmentally Responsible. Community-Minded. Local Opportunities.

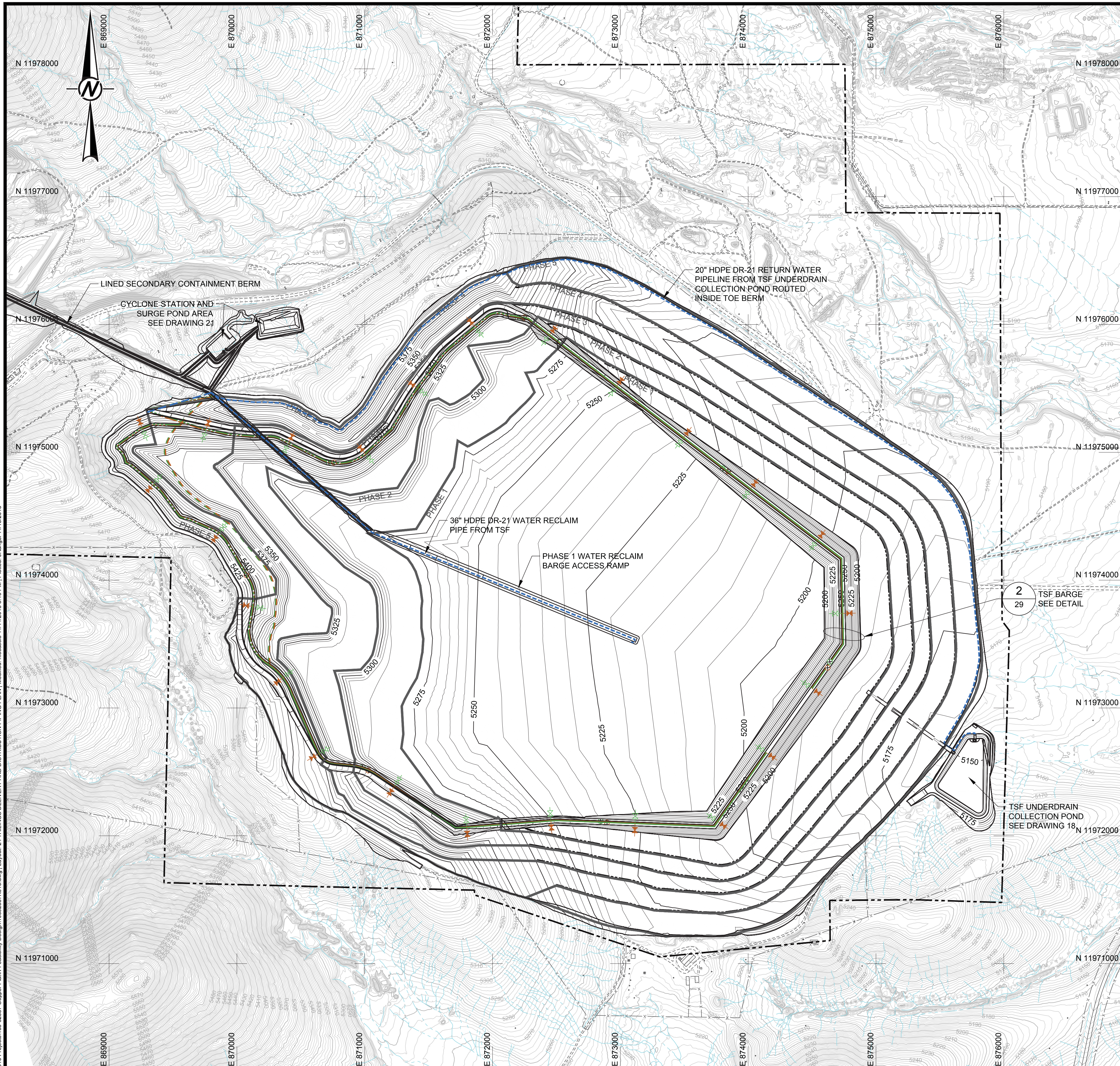
COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

GENERAL PROCESS FLOW DIAGRAM

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K023
DESIGN	DMW	2013-04-08	SCALE	NTS
CADD	JHR	2013-07-10	DRAWING	23
CHECK	GM	2013-07-16		
REVIEW	DAK	2013-07-17		



K:\2010 Projects\103-92557 Copper Flat\K Feasibility Design\10392557K016.dwg | Layout: 24 TAILINGS DELIVERY AND DISTRIBUTION PIPING PLAN | Modified: nlocascio 11/11/2015 5:19 PM | Plotted: JRangel 11/13/2015

LEGEND

- 3600 — EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 3600 — REGRADED CONTOURS (ft -MSL)
- PHASE 1 — PHASE BOUNDARY
- 12 IN. DIA. DR-9 HDPE CYLONE UNDERFLOW PIPELINE - PERMANENT ALIGNMENT
- 12 IN. DIA. DR-9 HDPE CYCLONE UNDERFLOW PIPELINE - TEMPORARY ALIGNMENT
- 12 IN. DIA. DR-9 HDPE CYCLONE UNDERFLOW PIPELINE - FINAL ALIGNMENT
- 30 IN. DIA. DR-17 HDPE CYCLONE OVERFLOW PIPELINE - PERMANENT ALIGNMENT
- 30 IN. DIA. DR-17 HDPE CYCLONE OVERFLOW PIPELINE - TEMPORARY ALIGNMENT
- 30 IN. DIA. DR-17 HDPE CYCLONE OVERFLOW PIPELINE - FINAL ALIGNMENT
- PINCH VALVES
- KNIFE GATES
- GRADE BREAK
- SLOPE INDICATOR
- 3H:1V or 3H/1V — 3 HORIZONTAL TO 1 VERTICAL SLOPE
- 5% — GRADE INDICATOR
- 1 / 14 — DETAIL CALLOUT: DETAIL ID, DRAWING SHEET LOCATION
- A / 13 — CROSS-SECTION CALLOUT: SECTION ID, DRAWING SHEET LOCATION

NOTES

1. PHASE 1 TAILINGS DISTRIBUTION BEGINS AT EL: 5250 AND ENDS AT EL: 5280.
2. KNIFE GATE VALVES ON CYCLONE UNDERFLOW AND CYCLONE OVERFLOW DISTRIBUTION PIPES AT 2000 ft SPACING. (SHOWN SPACED FOR CLARITY)
3. SPIGOTS ON CYCLONE OVERFLOW PIPE AT 660 ft SPACING. (SHOWN SPACED FOR CLARITY)
4. SPIGOTS ON CYCLONE UNDERFLOW PIPE AT 330 ft SPACING. (SHOWN SPACED FOR CLARITY)

0 400 800 1200
SCALE FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

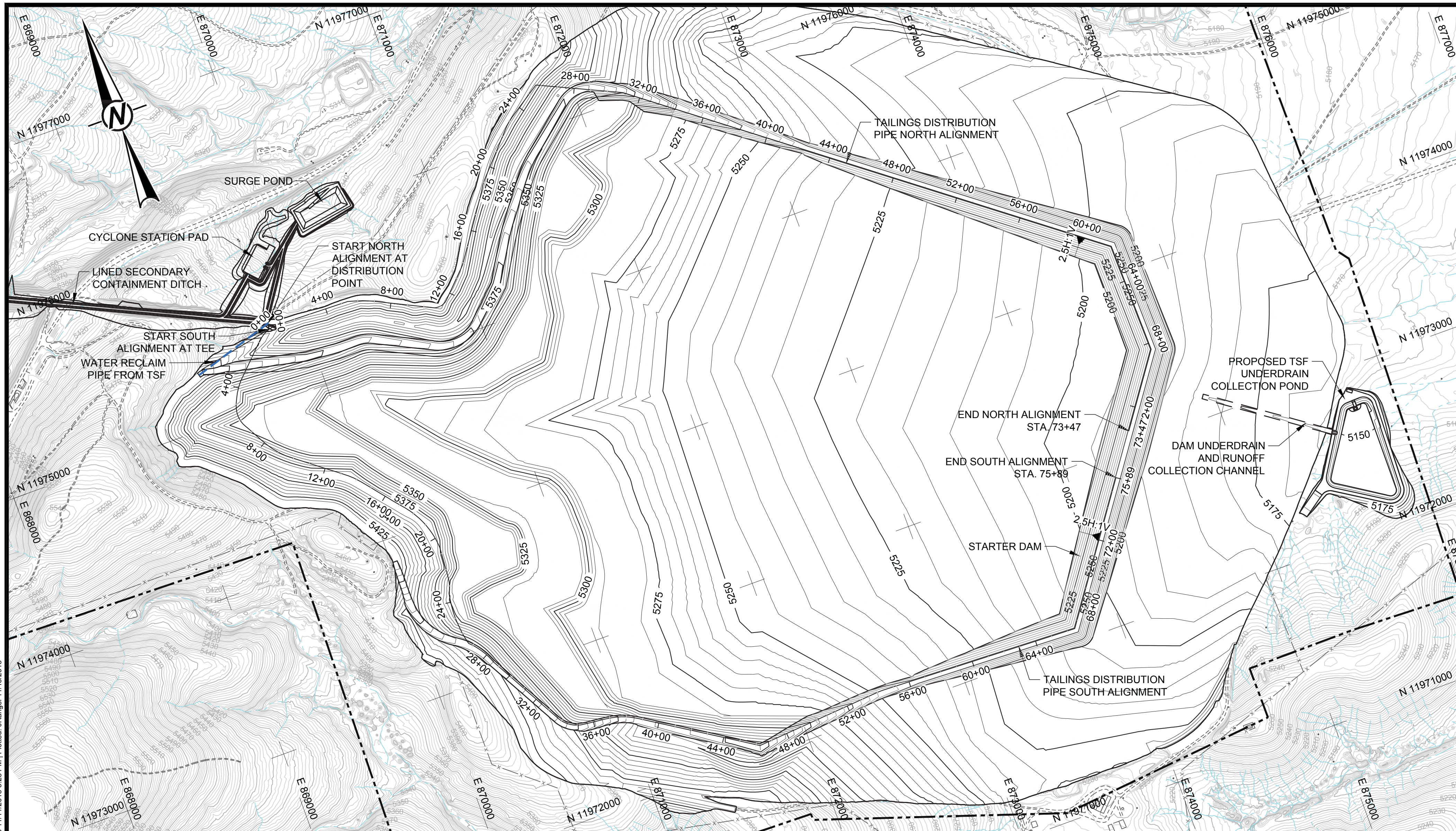
TITLE

TAILINGS DELIVERY AND DISTRIBUTION PIPING PLAN

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K016
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		24
REVIEW	DAK	2013-07-17		

16743

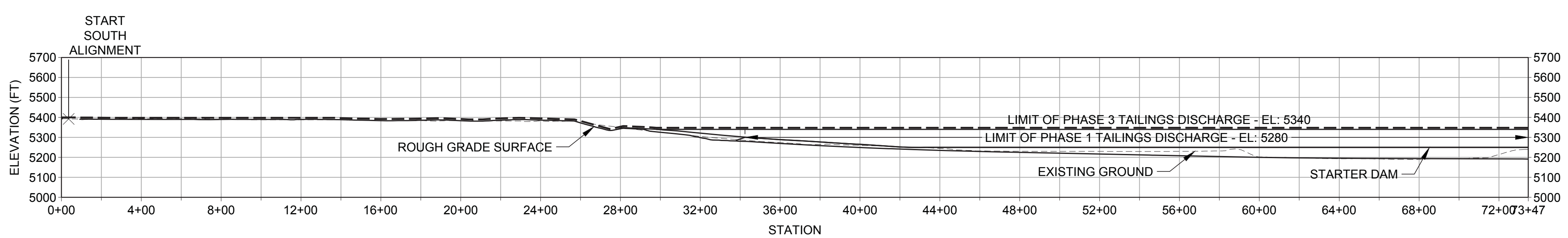


PHASES 1-3 TAILINGS DISTRIBUTION PLAN

SCALE A

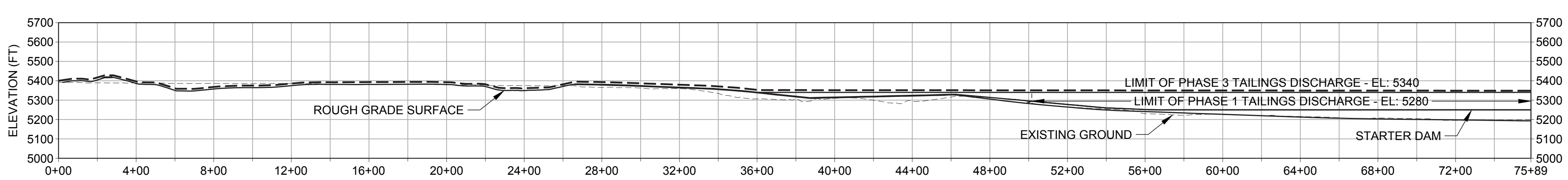
LEGEND

3600	EXISTING GROUND CONTOUR (ft -MSL)
	EXISTING ROADS
	EXISTING DRAINAGE
	EXISTING FENCELINE
	MINE PERMIT AREA BOUNDARY
3600	REGRADED CONTOURS (ft -MSL)
	GRADE BREAK
	SLOPE INDICATOR
3H:1V or 3H/1V	3 HORIZONTAL TO 1 VERTICAL SLOPE
5%	GRADE INDICATOR
	TAILINGS DELIVERY AND DISTRIBUTION PIPE AT PHASE 3 LIMITS
	WATER RECLAIM PIPE



PHASES 1-3 TAILINGS DISTRIBUTION NORTH ALIGNMENT PROFILE

SCALE A



PHASES 1-3 TAILINGS DISTRIBUTION SOUTH ALIGNMENT PROFILE

SCALE A

0 400 800 1200

SCALE A FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

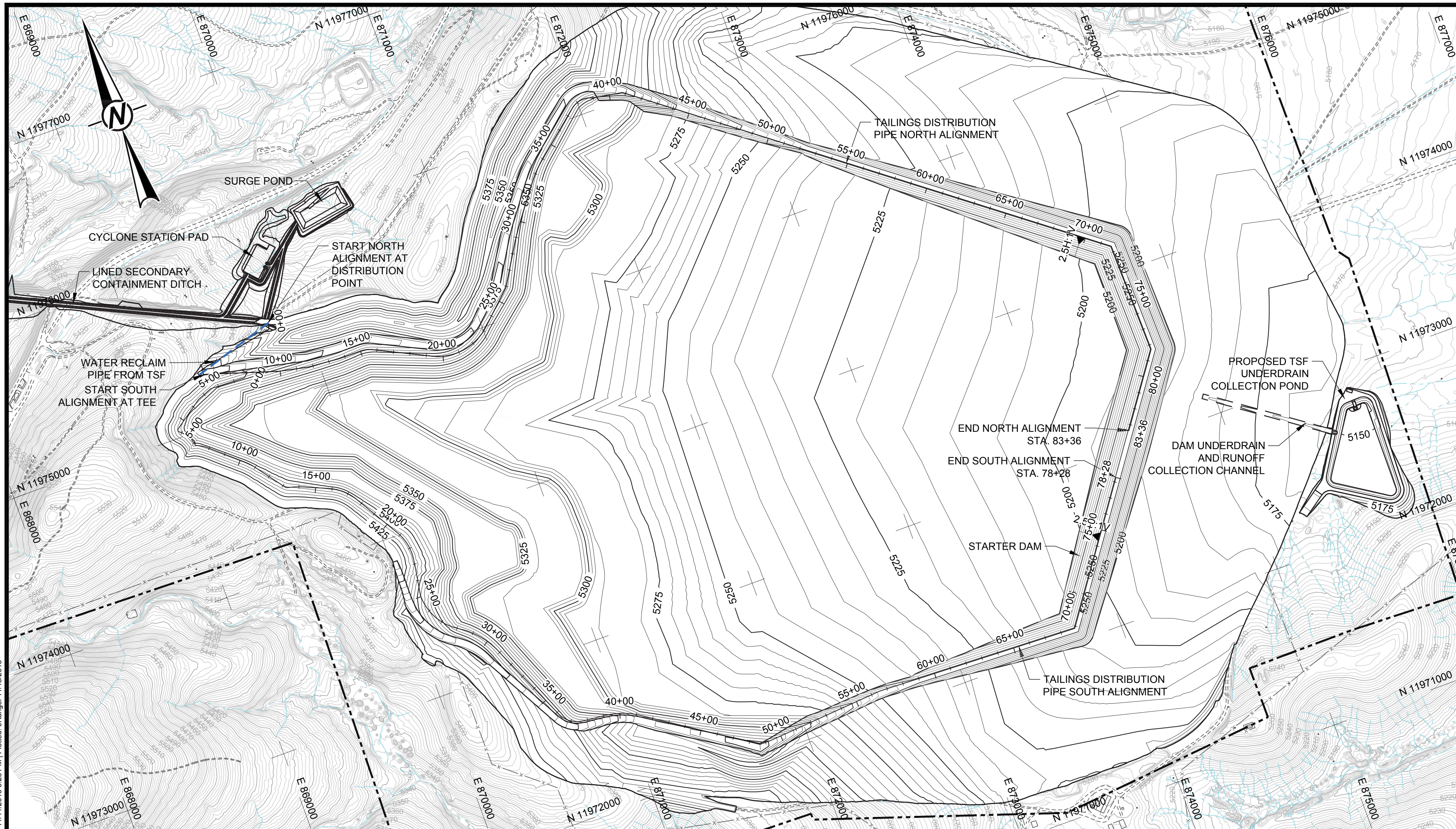
TITLE

TAILINGS DISTRIBUTION PLAN AND PROFILE (1 OF 2)

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K017
DESIGN	DW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		25
REVIEW	DAK	2013-07-17		

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K017.dwg | Layout: 25 TAILINGS DISTRIBUTION PLAN AND PROFILE (1 OF 2) | Modified: nlocascio 11/11/2015 5:25 PM | Plotted: JRangel 11/13/2015

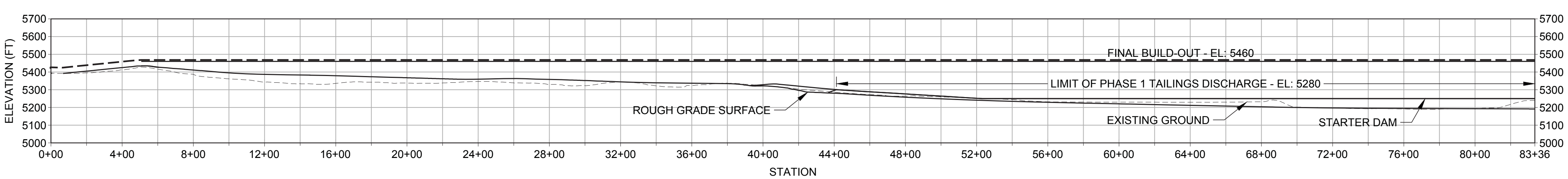


PHASES 4-5 TAILINGS DISTRIBUTION PLAN

SCALE A

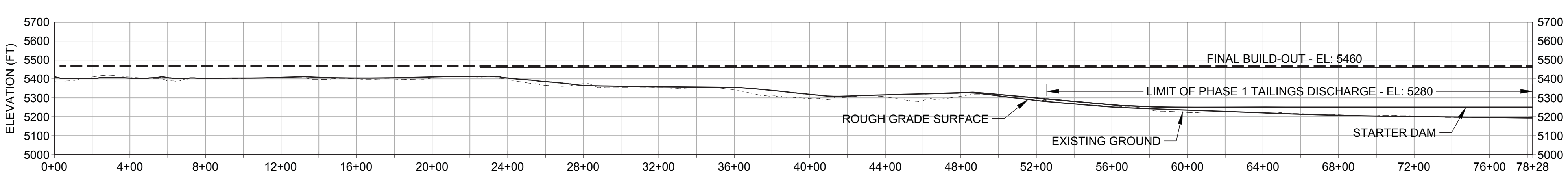
LEGEND

3600	EXISTING GROUND CONTOUR (ft -MSL)
	EXISTING ROADS
	EXISTING DRAINAGE
	EXISTING FENCELINE
	MINE PERMIT AREA BOUNDARY
3600	REGRADED CONTOURS (ft -MSL)
	PHASE BOUNDARY
	GRADE BREAK
	SLOPE INDICATOR
3H:1V or 3H/1V	3 HORIZONTAL TO 1 VERTICAL SLOPE
5%	GRADE INDICATOR
	TAILINGS DELIVERY AND DISTRIBUTION PIPE AT FINAL BUILD-OUT
	WATER RECLAIM PIPE



PHASES 4-5 TAILINGS DISTRIBUTION NORTH ALIGNMENT PROFILE

SCALE A



PHASES 4-5 TAILINGS DISTRIBUTION SOUTH ALIGNMENT PROFILE

SCALE A

0 400 800 1200

SCALE A FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION

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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

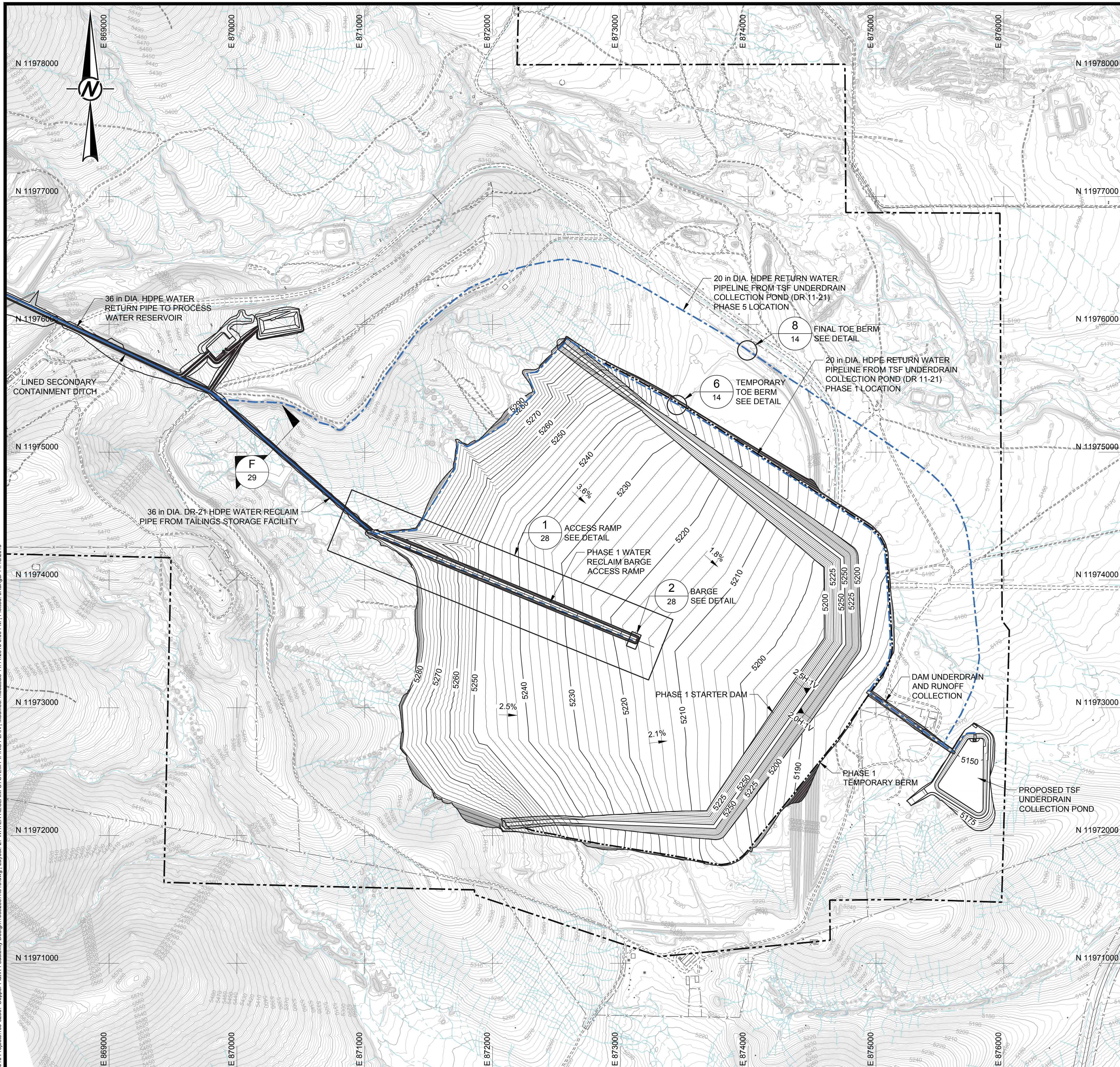
TITLE

TAILINGS DISTRIBUTION PLAN AND PROFILE (2 OF 2)

Golder Associates

PROJECT No.		103-92557	FILE No. 10392557K017
DESIGN	DMW	2013-04-08	SCALE AS SHOWN
CADD	JHR	2013-07-10	DRAWING
CHECK	GM	2013-07-16	26
REVIEW	DAK	2013-07-17	

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K017.dwg | Layout: 26 TAILINGS DISTRIBUTION PLAN AND PROFILE (2 OF 2) | Modified: nlocascio 11/11/2015 5:25 PM | Plotted: JRangel 11/13/2015



LEGEND

- 3600 — EXISTING GROUND CONTOUR (ft -MSL)
- EXISTING ROADS
- EXISTING DRAINAGE
- EXISTING FENCELINE
- MINE PERMIT AREA BOUNDARY
- 3600 — REGRADED CONTOURS (ft -MSL)
- INTERMEDIATE TOE BERM CENTERLINE
- GRADE BREAK
- SLOPE INDICATOR
- 3H:1V or 3H/1V — 3 HORIZONTAL TO 1 VERTICAL SLOPE
- 5% — GRADE INDICATOR
- DETAIL CALLOUT (1 / 14): DETAIL ID, DRAWING SHEET LOCATION

NOTES

1. SEE DRAWING 29 FOR RETURN WATER PIPE DITCH SECTIONS AND DETAILS.
2. RETURN WATER PIPELINE FROM TSF UNDERDRAIN AND RUNOFF COLLECTION POND WILL BE ROUTED INSIDE THE EMBANKMENT TOE BERM AND WILL REQUIRE RELOCATION AT EACH CONSTRUCTION PHASE.
3. RETURN WATER PIPELINE WILL BE RELOCATED TO THE TOE BERM AT EACH PHASE OF BUILDOUT. PHASE 1 AND PHASE 5 LOCATIONS ARE SHOWN ON DRAWING.

SCALE 0 400 800 1200 FEET

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
F	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
E	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	MJG
C	2013-11-15	ISSUED FOR 30,000 TPD M3 USE	DMW	NIL	GM	MJG
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE
PRELIMINARY
FOR AGENCY REVIEW

PROJECT
THEMAC RESOURCES — NEW MEXICO COPPER CORPORATION
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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

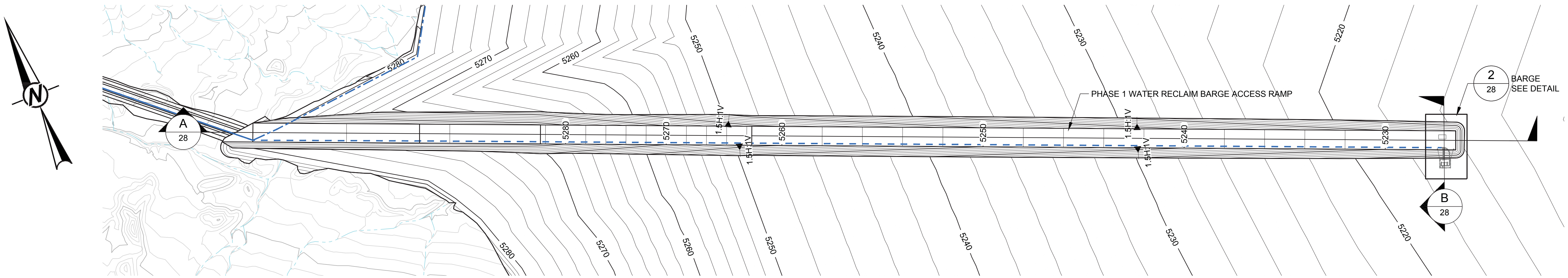
WATER RECLAIM SYSTEM PIPING PLAN

Golder Associates

PROJECT No.		103-92557
DESIGN	DW	2013-04-08
CADD	JHR	2013-07-10
CHECK	GM	2013-07-16
REVIEW	DAK	2013-07-17

FILE No. 10392557K018
SCALE AS SHOWN
DRAWING **27**

K:\2010 Projects\103-92557 Copper Flat\K-Feasibility Design\10392557K018.dwg | Layout: 27 WATER RECLAIM SYSTEM PIPING PLAN | Modified: nlocascio 11/11/2015 6:00 PM | Plotted: JRangel 11/13/2015



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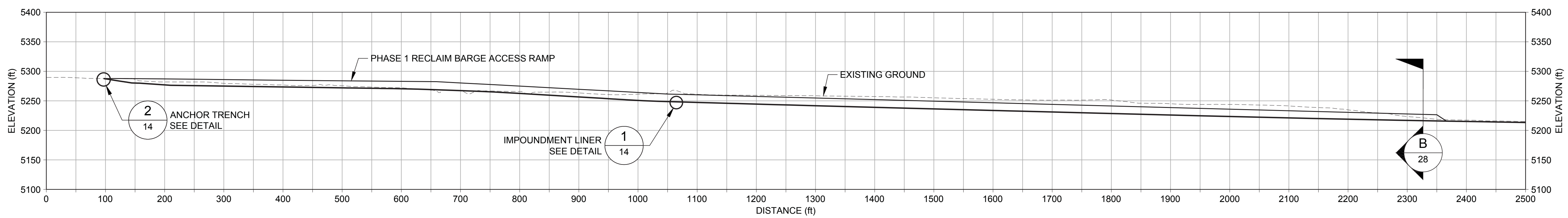

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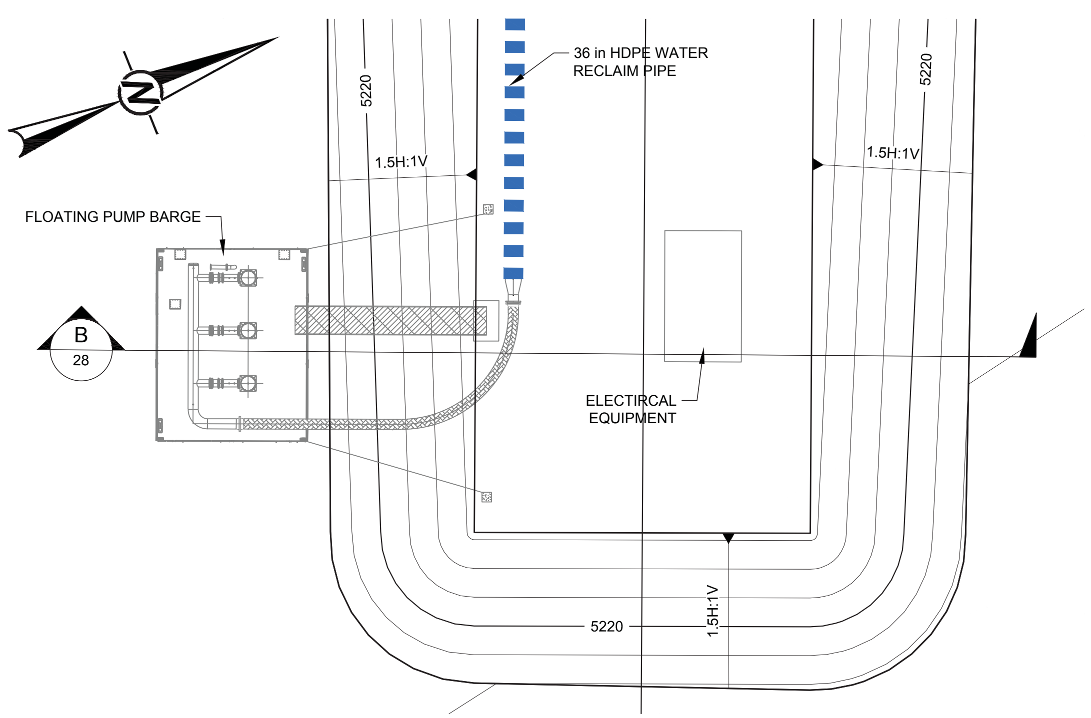

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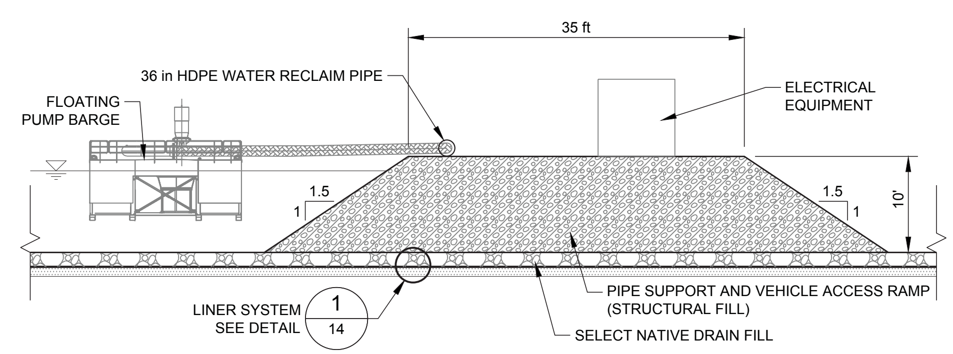

N.T.S. (B/28) RECLAIM BARGE SECTION

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SCALE B FEET

0 100 200 300
SCALE A FEET

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E	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
D	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
C	2014-01-06	ISSUED FOR FEASIBILITY REPORT (30,000 TPD)	DMW	JHR	GM	DAK
B	2013-07-17	ISSUED FOR FEASIBILITY STUDY	DMW	NIL	GM	DAK
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	DAK

DRAWING USE

PRELIMINARY

FOR AGENCY REVIEW

PROJECT

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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

WATER RECLAIM SYSTEM DETAILS

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K018
DESIGN	DW	2013-04-08	SCALE	NOT TO SCALE
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		28
REVIEW	DAK	2013-07-17		

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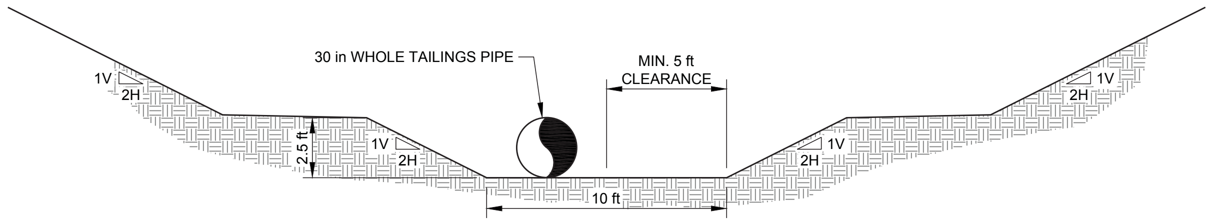

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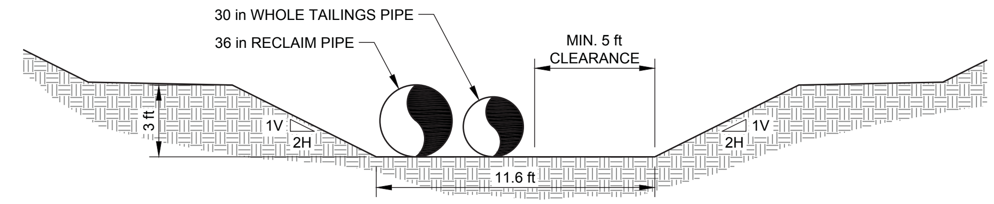

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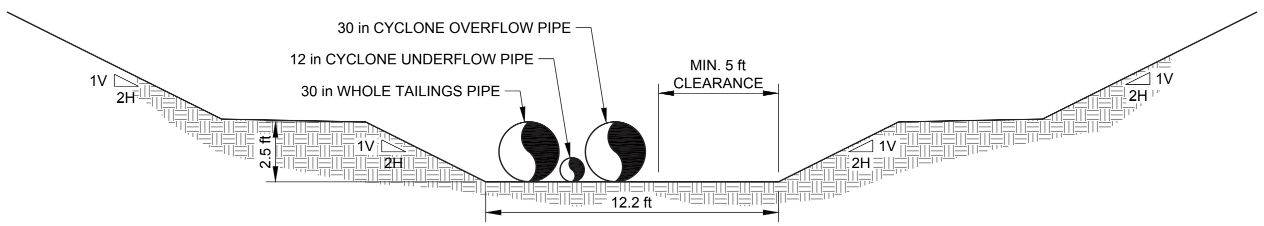

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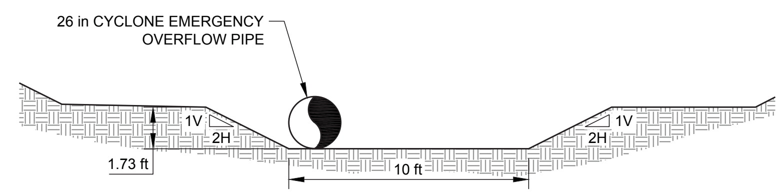
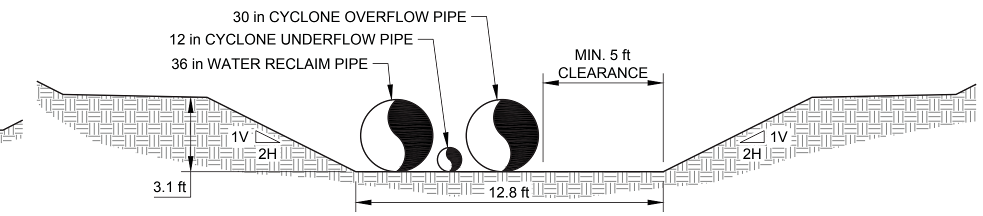


SCALE: N.T.S. D 29 CYCLONE PLANT TO SURGE POND DITCH



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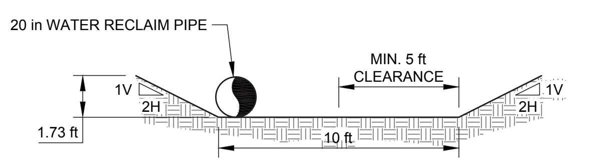

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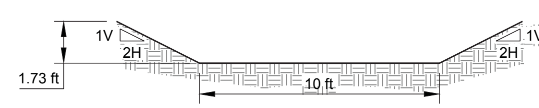

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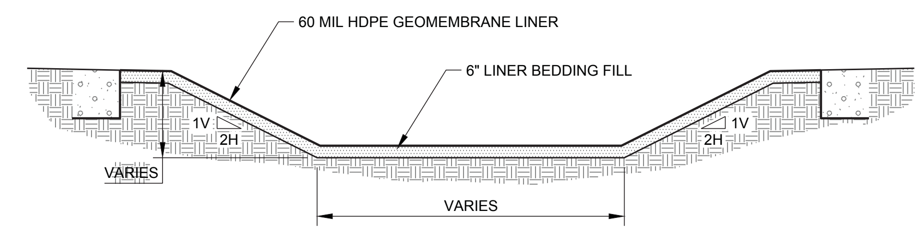

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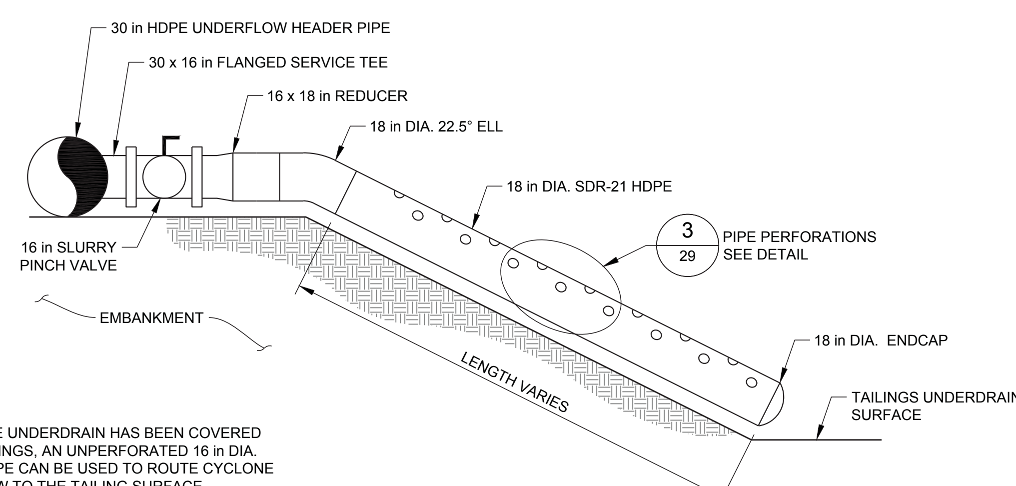
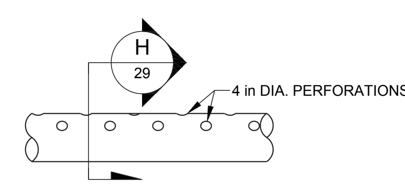
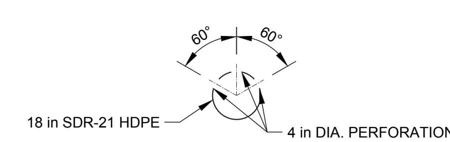


NOTE:
WHEN THE UNDERDRAIN HAS BEEN COVERED WITH TAILINGS, AN UNPERFORATED 16 in DIA. SDR-32 PIPE CAN BE USED TO ROUTE CYCLONE OVERFLOW TO THE TAILING SURFACE

SCALE: N.T.S. 2 29 ENERGY DISSIPATOR/SCOUR PROTECTION CYCLONE OVERFLOW DISTRIBUTION SYSTEM



SCALE: N.T.S. 3 29 PIPE PERFORATION DETAIL



SCALE: N.T.S. H 29 PIPE PERFORATION SECTION

REV	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
C	2015-11-12	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
B	2015-10-27	ISSUED FOR CLIENT AND AGENCY REVIEW	GM	NIL	GM	MJG
A	2013-05-03	ISSUED FOR CLIENT REVIEW	DMW	NIL	GM	MJG

DRAWING USE
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PROJECT
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COPPER FLAT PROJECT
30K TPD TAILINGS STORAGE FACILITY
FEASIBILITY DESIGN
SIERRA COUNTY, NEW MEXICO

TITLE

TAILINGS DISTRIBUTION AND SECONDARY CONTAINMENT DETAILS AND SECTIONS

Golder Associates

PROJECT No.		103-92557	FILE No.	10392557K022
DESIGN	DMW	2013-04-08	SCALE	AS SHOWN
CADD	JHR	2013-07-10	DRAWING	
CHECK	GM	2013-07-16		29
REVIEW	DAK	2013-07-17		

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Engineering Earth's Development, Preserving Earth's Integrity

M3-PN120085
Revision 0

ARCHITECTURE
ENGINEERING
CONSTRUCTION MANAGEMENT

Copper Flat Project

Impoundment Design Report

Prepared For:

THEMAC RESOURCES

16750

Certified Professional Engineer Seal

This report documents work conducted under the oversight of the following Engineer:

HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER

Harry Lewsley, P.E.

Signature

Exp. 12/31/2017

Date 12/7/2015

IMPOUNDMENT DESIGN REPORT
COPPER FLAT PROJECT

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NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp. 12/31/2017

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Harry Lewsley 12/7/2015

HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp.12/31/2017

1 INTRODUCTION

The Copper Flat Project is located in South Central New Mexico, near the town of Hillsboro, approximately 150 miles south of Albuquerque, and approximately 20 miles southwest of Truth or Consequences (straight-line distances) (Figure 1). The Project is owned and operated by New Mexico Copper Corporation (NMCC), a wholly owned subsidiary of THEMAC Resources Group Limited.

The State of New Mexico has promulgated regulations pertaining to groundwater protection at copper mining facilities (New Mexico Administrative Code Title 20, Chapter 6, Part 7 [20.6.7 NMAC], the “Copper Rule”), the stated purpose of which is “to control discharges of water contaminants specific to copper mine facilities and their operations to prevent water pollution.”

This report provides the design criteria, location, purpose, operation, and performance of certain elements of the project identified in Section 2 of this report to comply with 20.6.7 NMAC. This report excludes the design considerations for the Tailings Storage Facility (TSF), i.e., the tailings impoundment, underdrain collection pond, surge pond and the secondary containment trench from the processing facility to the TSF, which have been completed by others and are reported separately.

2 SYSTEM DESCRIPTIONS

Impacted Stormwater Impoundments are designed to receive surface drainage that potentially has come in contact with water contaminants on a copper mine facility. These systems consist of a network of diversion channels designed to convey to the impoundment at minimum the peak from a 100-year-return-interval storm with at least 6 inches of freeboard per 20.6.7.17.D.(2).(f). The Impacted Stormwater Impoundments are designed to store impacted stormwater for less than 30 days and include an engineered liner system, as described in Section 3.2.

The Process Water Reservoir is designed to receive reclaimed process water from a variety of sources including the TSF, impacted stormwater impoundments and freshwater supply system conveyed via pipelines. The reservoir also receives direct precipitation to the pond surface and embankment crest area. The Process Water Reservoir is designed with an engineered liner system, leak collection system, and subgrade bedding, as described in Section 3.3.

3 BASIS OF DESIGN

3.1 GENERAL

All impoundments for the Copper Flat Project will be considered "new" impoundments as defined by NMAC 20.6.7.17 (D).

Outside Slopes	20.6.7.17.D.(1).(a) NMAC	Maximum 2:1 (H:V)
Static factor of safety	20.6.7.17.D.(1).(a) NMAC	Minimum 1.3
Liner Sidewall seams	20.6.7.17.D.(1).(e) NMAC	Vertical only
Capacity	20.6.7.17.D.(2) NMAC	Contain 100-year return interval storm event plus minimum 2 ft of freeboard

3.2 IMPACTED STORMWATER IMPOUNDMENTS

Impacted stormwater impoundments are designed to hold impacted stormwater for less than 30 days in accordance with NMAC 20.6.7.17 (D) (4) and (7).

Liner system	20.6.7.17.D.(4).(a) NMAC	Compacted minimum 6-inch subbase overlain by 60 mil HDPE liner system
Wind protection	20.6.7.17.D.(4).(d) NMAC	Weighting system to limit liner damage in high winds
Spillway design	20.6.7.17.D.(7) NMAC	Safely discharge peak flow from 24-hour storm event with 25-year return

3.3 PROCESS WATER RESERVOIR

Process Water Impoundments/Reservoirs are designed to hold process water at design capacity plus impacted stormwater for more than 30 days in accordance with NMAC 20.6.7.17 (D) (3).

Liner system	20.6.7.17.D.(3).(a)and 20.6.7.17.D.(3). (c) NMAC	Primary 60 mil HDPE liner over a secondary 60 mil HDPE liner with drainage layer over a compacted minimum 6-inch subbase
Leakage collection system	20.6.7.17.D.(3).(d) NMAC	Drainage layer between primary and secondary liners with fluid removal system
Drainage layer	20.6.7.17.D.(3).(d) NMAC	Granular soil material or geosynthetic drainage net
Drainage layer slope	20.6.7.17.D.(3).(d) NMAC	At least 2 percent
Drainage layer permeability	20.6.7.17.D.(3).(d) NMAC	At least 1 x 10^{-2} centimeters per second (cm/s)
Collection sump	20.6.7.17.D.(3).(d) NMAC	At confluence drainage layer with dedicated automatic pump system with totalizing flow meter and automated failure alarm system
Spillway design	20.6.7.17.D.(7) NMAC	No discharge to ground surface, safely discharge peak process flows

4 DESIGN AND CONSTRUCTION OF IMPACTED STORMWATER IMPOUNDMENTS AND PROCESS WATER RESERVOIR

The Copper Flat Project permit boundary (Figure 2) incorporates the mine pit, processing plant area, waste rock stockpiles (WRSPs), and the TSF. The TSF and related facilities including the cyclone plant, surge pond, and underdrain collection pond are described by others. The mine and process plant area includes five developed watershed (WS) areas (Figure 3) that are managed as part of this plan. The facilities described below are designed to manage process and impacted stormwater to prevent releases from the site to surface water and groundwater (Figure 4).

4.1 FACILITIES

WS A includes the process plant, maintenance, and administrative areas of the Copper Flat Project. It also includes WS E, which is the Process Water Reservoir as a separate, internal area of stormwater and process water management (Sec. 4.1.5). During precipitation events, sheet flow of stormwater is directed (Figure 5) to open channel conveyances designed to convey the peak flow from a 100-year return interval storm event with at least 6 inches of freeboard to Impacted Stormwater Impoundment A (Figures 6 and 7). The impoundment is designed with a spillway that is capable of safely discharging the peak flow from a 25-year, 24-hour precipitation event with a 90 percent chance of not being exceeded during the design life of the impoundment. Design criteria for Impacted Stormwater Impoundment A are presented in Table 1.

WS B includes runoff from the western flank of Animas Peak and proposed new waste rock stockpiles (WRSP-1) (Figure 3). During precipitation events, sheet flow of stormwater is directed (Figure 3) to open channel conveyances designed to convey the peak flow from a 100-year return interval storm event with at least 6 inches of freeboard to Impacted Stormwater Impoundment B (Figures 8 and 9). The impoundment is designed with a spillway to the mine pit that is capable of safely discharging the peak flow from a 25-year, 24-hour precipitation event with a 90 percent chance of not being exceeded during the design life of the impoundment. Design criteria for Impacted Stormwater Impoundment B are presented in Table 1.

WS C includes runoff from the eastern flank of Animas Peak and proposed new waste rock stockpiles (WRSP-2 and 3) (Figure 3). During precipitation events, sheet flow of stormwater is directed (Figure 3) to open channel conveyances designed to convey the peak flow from a 100-year return interval storm event with at least 6 inches of freeboard to Impacted Stormwater Impoundment C (Figures 10 and 11). The impoundment is designed with a spillway that is capable of safely discharging the peak flow from a 25-year, 24-hour precipitation event with a 90 percent chance of not being exceeded during the design life of the impoundment. Design criteria for Impacted Stormwater Impoundment C are presented in Table 1.

WS D includes runoff from uphill slopes and existing waste rock stockpiles (EWRSP-1 and -2b) to the mine pit (Figure 3). During precipitation events, sheet flow of stormwater is directed by natural drainage channels and open channel conveyances designed to convey the peak flow from a 100-year return interval storm event with at least 6 inches of freeboard to the mine pit.

WS E consists of direct precipitation onto the lined surfaces of the Process Water Reservoir and unlined perimeter road that is directed to the reservoir (Figure 3). The amount of direct precipitation to the pond is small (9.5 cubic feet per second [cfs]) in comparison to the design throughput of process solutions through the pond (100,000 cfs). The design freeboard of 2 ft is more than adequate to handle the additional flux from a precipitation event. The design capacity of the pond is 726,400 cubic feet (ft^3) with 2 ft of freeboard and the ultimate capacity is 938,000 ft^3 (Figures 12 and 13). Overtopping of the reservoir is controlled by an alarm system and emergency shutoff system. Overtopping flows, in the event of system failure, are directed to the lined tailings conveyance trench to the lined tailings impoundment. Design criteria for the Process Water Reservoir are presented in Table 1.

4.2 SURFACE WATER CONTROL

Surface areas draining to the Impacted Stormwater Impoundments (A, B, and C), mine pit, and Process Water Reservoir will be shielded from run-on surface drainage by site diversions as described in a separate report.

4.3 GEOLOGIC HAZARDS

No geologic hazards are known to exist in the vicinities of the Impacted Stormwater Impoundments or Process Water Reservoir. Impacted Stormwater Impoundment B is located on the eastern wall of the ultimate mine pit (Figure 11J-3). In the event of a pit slope failure, any liquids contained in Impacted Stormwater Impoundment B would be contained in the mine pit.

4.4 SOLUTION CHARACTERIZATION

Liquids routinely expected to enter the Impacted Stormwater Impoundments (A, B, and C) are direct precipitation and stormwater runoff from areas impacted by mining activities including mining, hauling, waste rock stockpiling, mineral processing, and shipping and receiving of goods and products. The Impacted Stormwater Impoundments will be typically empty. Impacted stormwater collected in the impoundments will be pumped out and used as process makeup water.

Liquids routinely expected to enter the Process Water Reservoir include direct precipitation, water reclaimed from the Copper-Moly (Cu-Mo) Thickener, fresh make-up water from the water supply wellfield, and reclaimed water from the Tailings Impoundment and Underdrain Collection Pond. The Process Water Reservoir is typically maintained at a nearly full operational level at all times to ensure continuity of the process during short-term interruptions of return or makeup flows. The physical characteristics of these constituents are expected to be neutral to slightly alkaline and completely compatible with the liner materials. Flows from upset conditions in the concentrator do not flow directly to the Process Water Reservoir, but would eventually contribute to the water reclaimed from the Tailings Impoundment and Underdrain Collection Pond.

4.5 CAPACITY AND STORAGE DESIGN

The capacity and storage design of the subject impoundments and reservoir are provided in Table 1. The impacted water impoundments are designed to contain the runoff from a 100-year, 24-hour storm event with a minimum of 2 ft of freeboard.

The Process Water Reservoir is designed to contain the maximum design process flow plus stormwater runoff from the reservoir catchment area with a minimum of 2 ft of freeboard.

4.6 SPILLWAY DESIGN

Spillways for Impacted Stormwater Impoundments A, B, and C are designed to safely discharge the peak runoff of a 25-year, 24-hour precipitation event. The spillways for Impacted Stormwater Impoundments A and C are designed as open channel spillways with slopes that are suitable for vehicle access on the perimeter road. The spillway for Impacted Stormwater Impoundment B is designed as a culvert beneath the haul road. The culvert(s) will have sufficient capacity to safely pass peak runoff from the prescribed precipitation event.

Overflow protection for the process water reservoir is accomplished via a designed solution conveyance to the lined tailings conveyance trench, which conveys any upset flows that exceed the maximum capacity without compromising the integrity of the structure.

4.7 SITE PREPARATION

The pond areas will be cleared and grubbed of vegetation. Any unsuitable foundation materials within the pond footprint will be excavated and replaced. Bedding soil will be placed, moisture conditioned, and compacted pursuant to 20.6.7.17.D.(3) and (4). The bedding soil must be free of sharp rock, vegetation, and stubble to a depth of at least 6 inches. The bedding surface must be smooth to ensure good contact between the liner and the bedding. The liner must be placed on a layer of sand or fine soil. The floor of the bedding surface will be sloped to collection sump at grades of up to 1 percent to facilitate removal of the contents. Side slopes will be less than 2H:1V to permit proper installation of the liner system. The liner bedding shall have an acceptance certificate prior to installation of the liner.

4.8 LINER SYSTEMS

Pursuant to 20.6.7.17.D.(4), the liner system of the Impacted Stormwater Impoundments consists of a single 60 mil HDPE textured geomembrane liner that is certified as UV resistant in accordance with a Construction Quality Assurance and Construction Quality Control (CQA/CQC) Plan, which will be generated and approved prior to construction. Liner panels shall be oriented such that the seams on the sidewall of the impoundments are vertical. Sufficient slack in the liner will be maintained to accommodate expansion and contraction of the liner material due to changes in temperature. These impoundments are typically empty and the liner will be weighted to prevent wind damage. The liner shall be secured in an anchor trench (Figure 14, Detail 3).

Pursuant to 20.6.7.17.D. (3), the liner system for the Process Water Reservoir consists of a secondary liner, drainage layer, and primary liner. The drainage layer connects directly to the fluid collection sump and fluid removal system to alleviate the need for fluid collection pipes. This reservoir typically contains solution and will not require the liner to be weighted unless there is a prolonged period when the reservoir will be empty and susceptible to wind damage. The liner system shall be secured in an anchor trench (Figure 14, Detail 1).

The lower (secondary) liner consists of a single 60 mil HDPE geomembrane AGRU® drainage liner, or equivalent, that is installed in accordance with an approved CQA/CQC Plan. This type of secondary liner, paired with a primary liner, doubles as a drainage layer with a coefficient of permeability of 1×10^{-2} cm/s on a design slope of 2 percent. Liner panels shall be oriented such that the seams on the sidewall of the impoundments are vertical. Sufficient slack in the liner will be maintained to accommodate expansion and contraction of the liner material due to changes in temperature.

The primary liner for the Process Water Reservoir consists of a single 60 mil HDPE textured geomembrane liner that is certified as UV resistant and installed in accordance with an approved CQA/CQC Plan. Liner panels shall be oriented such that the seams on the sidewall of the impoundments are vertical. Sufficient slack in the liner will be maintained to accommodate expansion and contraction of the liner material due to changes in temperature.

A CQA/CQC plan will be developed by the design engineer and the liner installation contractor and for approval by the appropriate agency as part of the final design prior to construction. The plan includes the following elements.

- Identification of persons and entities responsible for overseeing the program.
- Inspection protocols for subgrade, materials, placement, anchoring, welding, testing, and repairing.
- Identification of field and laboratory testing equipment and testing entities.
- Procedures for observing and testing liner, subgrade, bedding, etc.
- Verification protocol for manufacturer's QC testing.
- Procedures for reviewing results of testing and inspection.
- Corrective actions for material repair, subgrade and bedding deficiencies, weld testing failures, or other construction defects.
- Seaming procedures, qualification, testing, and inspection.
- QA/QC reporting procedures, schedules, and certifications.

- Guidelines, schedules, contents, and certifications for submission of a CQA/CQC report.

4.9 LEAK COLLECTION SYSTEM

Pursuant to 20.6.7.17.D.(3).(d), the liner drainage layer of the process water reservoir discharges directly into a leakage collection sump (Figure 14, Detail 6) which is part of the fluid removal system. The sump contains granular fill materials to convey the drainage fluid to the fluid removal pipe and pump system. The fluid removal pipe consists of a 6" Sch. 80 polyvinyl chloride (PVC) pipe with 3 ft of slotted screen at the bottom for water collection. The fluid removal pipe can be cleaned using conventional pipe cleaning equipment. An automated fluid removal pump is installed at the bottom of the pipe to enable removal of leakage. The pump is activated in the presence of drainage fluid in the sump and is turned off when the fluid has been removed. A totalizing flow meter records the volume of fluid removed from the sump. The pump also has an alarm system to notify the operator of system failure.

4.10 PERFORMANCE INSPECTIONS AND OPERATIONAL MONITORING

Routine inspections of the Process Water Reservoir and Impacted Stormwater Impoundments begin at the time of construction and proceed quarterly. Additional inspections are prescribed in the event of a process upset or a significant stormwater flow event. Inspections include visual assessment of integrity and physical assessment of pond capacity. Water levels in the ponds are noted with respect to the freeboard. Totalizing meter readings are recorded from fluid removal pumps from the leakage collection sump and from the impacted stormwater impoundment pumps.

TABLES

Table 1: Impoundment Design Criteria

Impoundment ID	Stormwater Impoundment A	Stormwater Impoundment B	Stormwater Impoundment C	Process Water Reservoir
Catchment Area (ac)	91.06	98.52	198.66	1.80
Peak Flow, Q100 (cfs)[1]	200.25	176.88	315.76	9.54
Pond Size - Approx, Surface area (ac)	1.98	2.12	6.37	1.80
Freeboard Requirement (ft)	2.0	2.0	2.0	2.0
Capacity at Freeboard (ft^3)	976,800	748,400	1,405,500	726,400
Design Capacity at spillway/crest (ft^3)	1,280,500	913,200	1,802,100	938,000
Primary Liner Specifications[2]	60 mil HDPE or equivalent 6" fine soil subgrade Certified UV resistant	60 mil HDPE or equivalent 6" fine soil subgrade Certified UV resistant	60 mil HDPE or equivalent 6" fine soil subgrade Certified UV resistant	60 mil HDPE or equivalent Certified UV resistant
Secondary Liner Specifications[2]	N/A	N/A	N/A	60 mil HDPE or equivalent 6" fine soil subgrade
Drainage Layer Specifications[3]	N/A	N/A	N/A	Geonet drainage layer Slope min. 2% Perm. min. 1 x 10-2 cm/s
Perforated Fluid Collection System[4]	N/A	N/A	N/A	Geonet drainage layer
Fluid Removal System[2]	N/A	N/A	N/A	Automatic pump Totalizing flow meter Automated failure alarm
Design Flow for Conveyance Structures (cfs)	Q100 = 200.25	Q100 = 176.88	Q100 = 315.76	Q100 = 9.54
Design Storm for Pond & Source	100-yr, 24hr rainfall event, WS A	100-yr, 24hr rainfall event, WS B	100-yr, 24hr rainfall event, WS C	100-yr, 24hr rainfall event, WS E
Design Storm for Spillway & Source	200-yr, 24hr rainfall event, WS A	200-yr, 24hr rainfall event, WS B	200-yr, 24hr rainfall event, WS C	N/A
Peak Flow, Q200 for Spillway (cfs)[5]	6.16	6.37	8.80	N/A
Bank Slopes	2:1 (H:V) Max	2:1 (H:V) Max	2:1 (H:V) Max	2:1 (H:V) Max

[1] Precipitation data is per NOAA Atlas 14, Volume 1, Version 5; Hillsboro, NM, Station ID: 29-4009

[2] Specifications are per 20.6.7.17.D.(3) and (4)(c)

[3] Specifications are per 20.6.7.17.D.(3)(d)

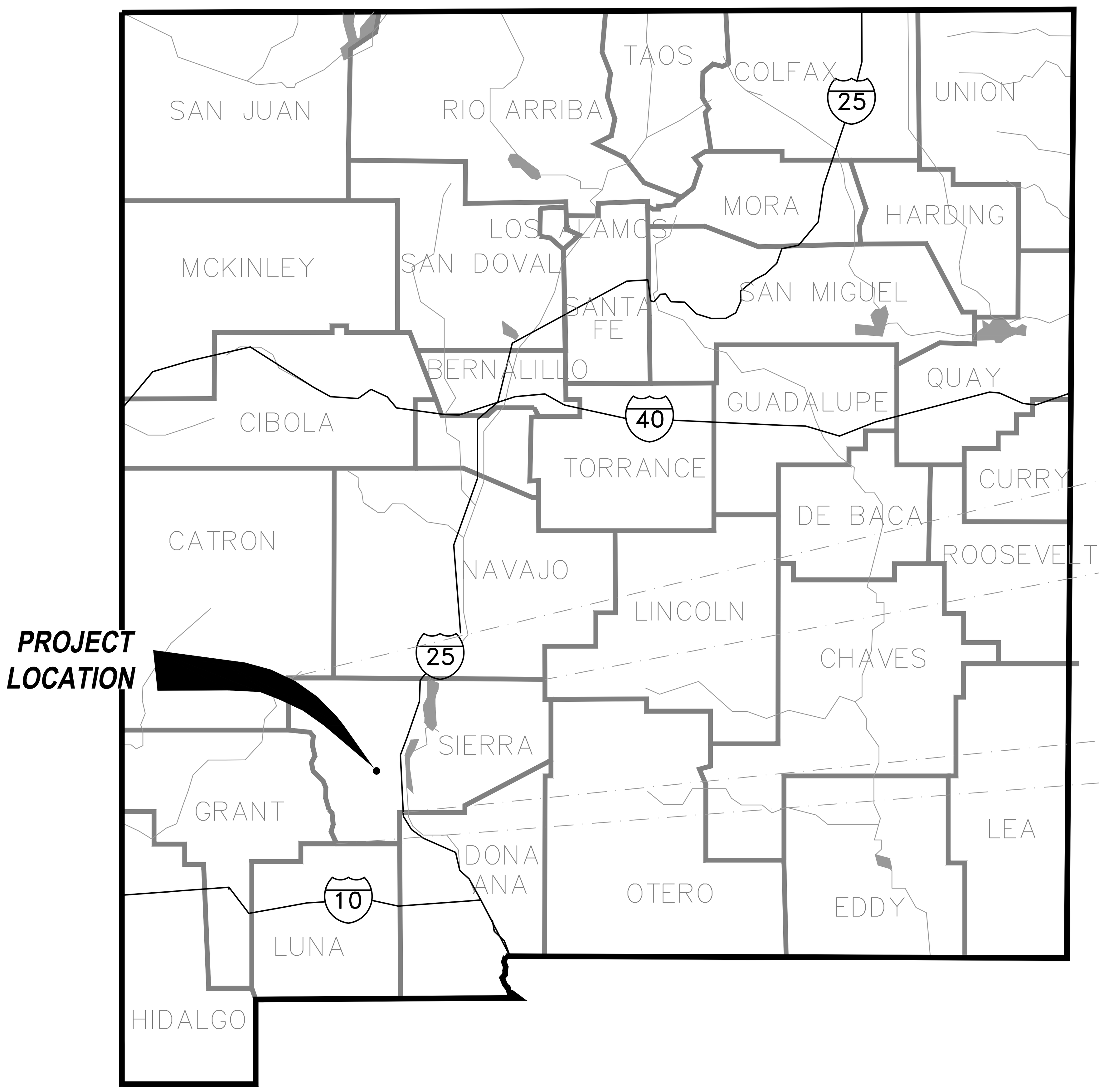
[4] Geonet layer drains directly into collection sump and fluid removal system

[5] Design Flow for spillway is approximate flow from pond to spillway during the 200-yr event assuming the spillway elevation is at the 100-yr WSEL

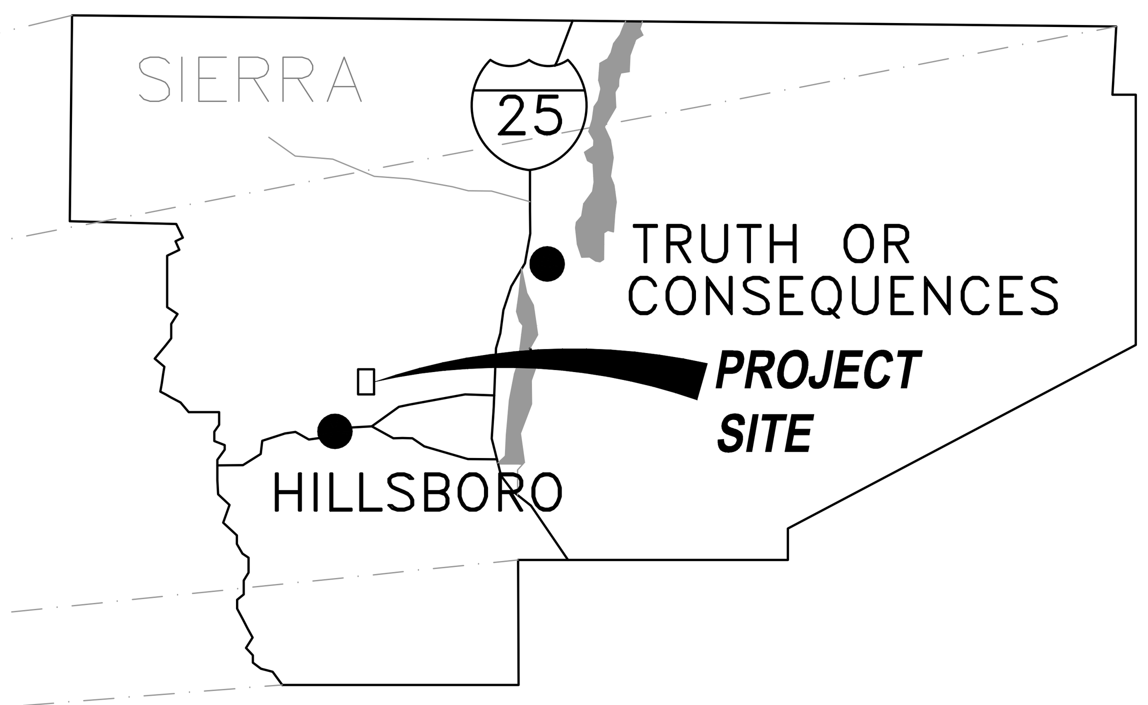
FIGURES

NEW MEXICO COPPER CORPORATION

COPPER FLAT PROJECT
SIERRA COUNTY, NEW MEXICO



STATE OF NEW MEXICO
NOT TO SCALE



PROJECT LOCATION MAP
NOT TO SCALE

FIGURE 1

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

DO NOT SCALE 11x17 DRAWINGS

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE:	NONE	DATE
DESIGNED BY	SAM	DEC12
DRAWN BY	SAM	DEC12
CHECKED BY	TDL	JAN13
PROJECT MGR	RKZ	
CLIENT APPR.		

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COPPER FLAT PROJECT

SITE GENERAL
CIVIL
PROJECT AREA
SITE LOCATION PLAN

JOB NO. M3 PN-120085
DWG NO. 0000-CI-001
REV NO. P4
DATE 05 MAR 13

16764

FIGURE 2

EWRSP = EXISTING WASTE ROCK STOCKPILE
WRSP = WASTE ROCK STOCKPILE

SITE PLAN
SCALE: 1:500

500' 250' 0' 500' 1000'
1" = 500'
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 500'		DATE
DESIGNED BY	SAM	DEC12
DRAWN BY	SAM	DEC12
CHECKED BY	TDL	JAN13
PROJECT MGR	RKZ	
CLIENT APPR.		

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COPPER FLAT PROJECT

SITE GENERAL
CIVIL
PROJECT AREA
PROPOSED SITE PLAN

JOB NO. M3 PN-120085
DWG NO. **FIGURE 11J-1**
REV NO. P18
DATE 16 NOV 15

16765

WATERSHED SUMMARY

WATERSHED ID	AREA (AC)	Q100 (CFS)
WS A	95.71	171.82
WS B	92.12	202.55
WS C	198.66	315.76
WS D	233.81	497.35
WS E	1.80	9.54

LEGEND:

- FLOW ARROW
- WATERSHED BOUNDARY
- RUNOFF CONCENTRATION POINT
- DRAINAGE SWALE

FIGURE 3

PLAN VIEW
SCALE: 1" = 300'

EWRSP = EXISTING WASTE ROCK STOCKPILE
WRSP = WASTE ROCK STOCKPILE

300 150 0 300 600
SCALE IN FEET
CONTOUR INTERVAL = 5FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THE MAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-021	IMPACTED STORMWATER IMPOUNDMENT A PLAN VIEW		
0000-CI-023	IMPACTED STORMWATER IMPOUNDMENT B PLAN VIEW		
0000-CI-025	PROCESS WATER RESERVOIR PLAN VIEW		
0000-CI-027	IMPACTED STORMWATER IMPOUNDMENT D PLAN VIEW		

REVISIONS						REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 300'	DATE
DESIGNED BY SAM	NOV 12
DRAWN BY SAM	NOV 12
CHECKED BY TDL	NOV 12
PROJECT MGR RKZ	NOV 12
CLIENT APPR.	

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COPPER FLAT PROJECT

GENERAL SITE
CIVIL
MINE AREA
DEVELOPED WATERSHED AREAS

JOB NO. M3 PN-120085
DWG NO. **FIGURE 11J-3**
REV NO. P10
DATE 29 OCT 15

SITE PLAN

SCALE: 1:200

NOTES

1. POND SIDE SLOPES ARE 2:1 (H:V).
2. ALL CUT SLOPES ARE 1.5:1 (H:V). ALL FILL SLOPES ARE 2:1 (H:V).

FIGURE 4

200 100 0 200 400 600

SCALE IN FEET
CONTOUR INTERVAL = 5.0FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CV-021	IMPACTED STORMWATER IMPOUNDMENT B, PLAN VIEW		
0000-CV-023	IMPACTED STORMWATER IMPOUNDMENT A, PLAN VIEW		
0000-CV-025	PROCESS WATER RESERVOIR PLAN VIEW		
0000-CV-027	IMPACTED STORMWATER IMPOUNDMENT C, PLAN VIEW		

REVISIONS						REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: AS NOTED		DATE
DESIGNED BY	SAM	JUL 15
DRAWN BY	SAM	JUL 15
CHECKED BY	JPN	JUL 15
PROJECT MGR	RKZ	JUL 15
CLIENT APPR.		

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COPPER FLAT PROJECT

JOB NO. M3 PN-120085

SITE GENERAL
CIVIL
STORMWATER & PROCESS WATER PONDS
OVERALL PLAN

DWG NO. 0000-CI-020

REV NO. P3 DATE 09 OCT 15

FIGURE 5

SITE PLAN
SCALE: 1:100

SCALE IN FEET
PROPOSED CONTOUR INTERVAL = 1.0FT
EXISTING CONTOUR INTERVAL = 5.0FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THE MAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1"= 100'	DATE
DESIGNED BY SAM	FEB 13
DRAWN BY SAM	FEB 13
CHECKED BY TDL	FEB 13
PROJECT MGR RKZ	FEB 13
CLIENT APPR.	

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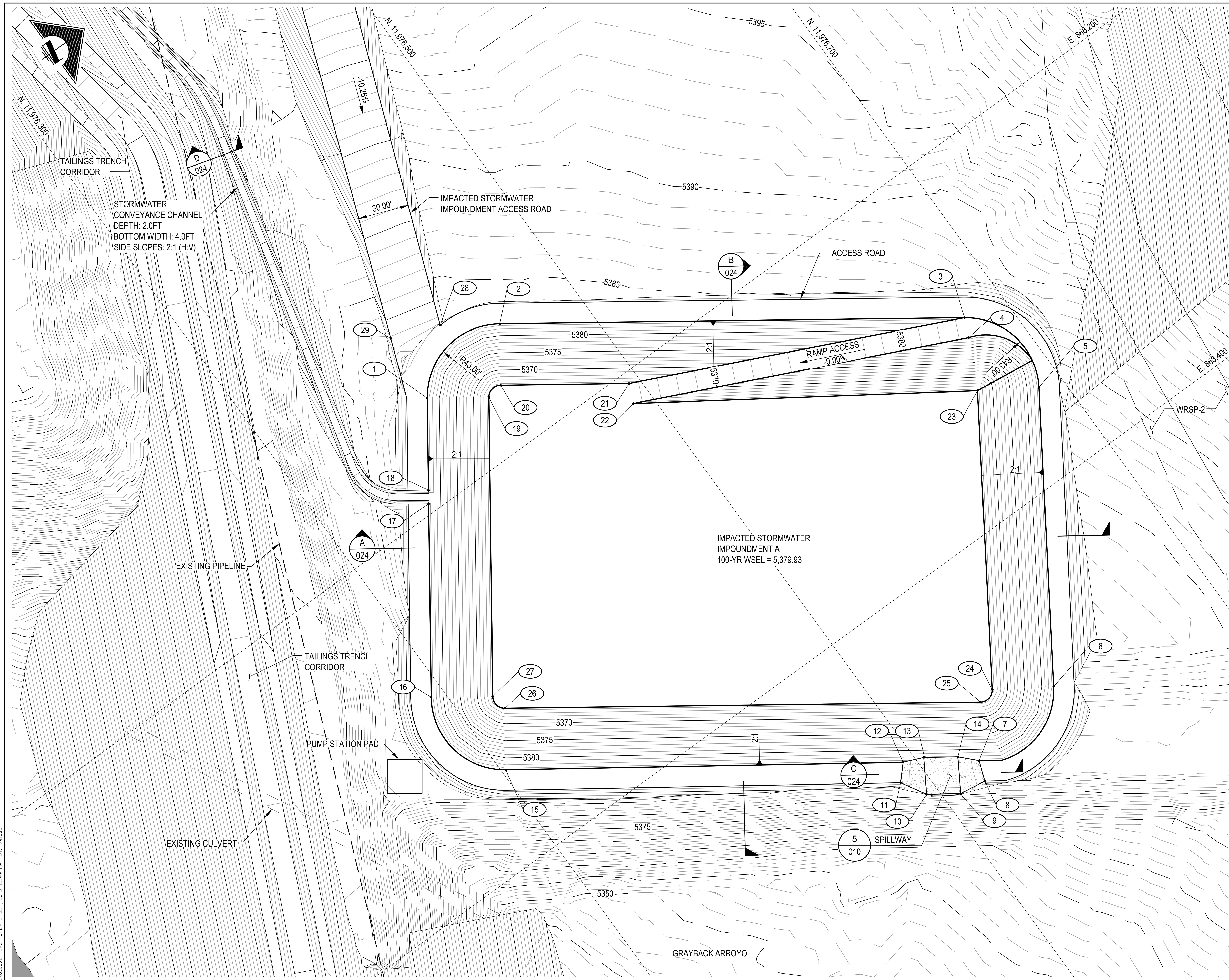
COPPER FLAT PROJECT

SITE GENERAL CIVIL PROJECT AREA PROCESS AREA SITE PLAN

JOB NO. M3 PN-120085
DWG NO. **0000-CI-007**
REV NO. P9
DATE 09 OCT 15

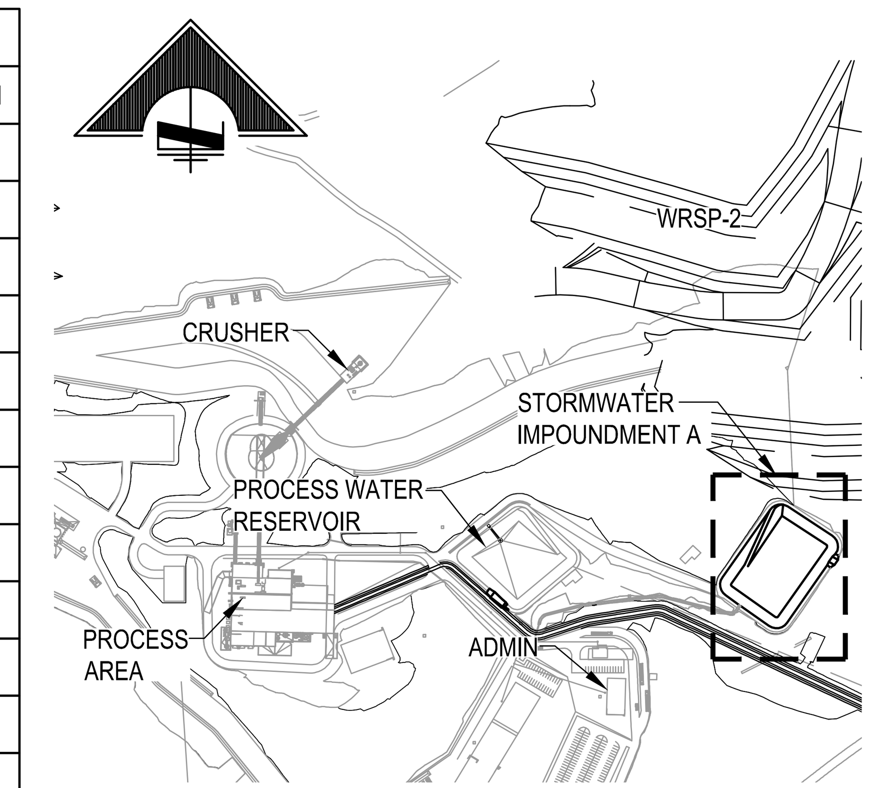
16768



PLAN

SCALE: 1" = 30'

POINT TABLE			
POINT #	NORTHING	EASTING	ELEVATION
1	11976393.13	868144.02	5383.50
2	11976453.06	868133.72	5383.50
3	11976675.02	868290.57	5383.50
4	11976670.08	868301.51	5383.50
5	11976686.19	868349.21	5383.50
6	11976590.39	868495.80	5383.50
7	11976529.56	868505.28	5383.50
8	11976525.25	868516.90	5383.50
9	11976509.58	868514.53	5381.96
10	11976493.13	868503.16	5381.96
11	11976484.86	868488.73	5383.50
12	11976493.10	868479.86	5383.50
13	11976504.45	868484.69	5382.18
14	11976520.85	868496.13	5382.18
15	11976302.43	868346.86	5383.50
16	11976292.13	868286.93	5383.50
17	11976357.47	868194.48	5383.50
18	11976362.08	868187.95	5383.50
19	11976422.53	868164.79	5365.50
20	11976432.28	868163.12	5365.50
21	11976493.65	868206.42	5365.50
22	11976488.60	868217.31	5365.50
23	11976656.01	868329.59	5365.50
24	11976560.26	868476.10	5365.50
25	11976550.36	868477.99	5365.50
26	11976323.21	868317.47	5365.50
27	11976321.53	868307.71	5365.50
28	11976424.35	868113.97	5383.50
29	11976396.34	868103.21	5383.50



KEY MAP

SCALE: 1" = 500'

NOTES:

1. STORMWATER IMPOUNDMENT A IS INTENDED TO CAPTURE STORMWATER RUNOFF FROM THE MINE SITE PROCESS AREA.
2. STORMWATER IMPOUNDMENT IS SIZED TO CONTAIN THE 100-YR, 24-HR RAINFALL EVENT WITH A MINIMUM OF 2.0 FEET OF FREEBOARD.
3. STORMWATER IMPOUNDMENT SHALL BE SINGLE LINED WITH 60MIL HDPE LINER, PER DETAIL 4 ON SHEET 0000-CI-010, OR APPROVED EQUAL.
4. STORMWATER SPILLWAY IS DESIGNED FOR THE 25-YR, 24-HR RAINFALL EVENT AT MINIMUM.
5. SPILLWAY IS DESIGNED TO ALLOW FOR VEHICULAR TRAFFIC.

IMPOUNDMENT SUMMARY		
CAPACITY AT 100-YR WSEL	976,772	CU-FT
ULTIMATE CAPACITY	1,280,516	CU-FT

FIGURE 6

30 15 0 30 60
SCALE IN FEET
CONTOUR INTERVAL = 1.0FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THE MAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-024	IMPACTED STORMWATER IMPOUNDMENT A, SECTIONS		
0000-CI-010	STANDARD DETAILS SHEET 3		

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: AS NOTED		DATE
DESIGNED BY	SAM	JUN 15
DRAWN BY	SAM	JUN 15
CHECKED BY	JPN	AUG 15
PROJECT MGR	RKZ	AUG 15
CLIENT APPR.		

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COPPER FLAT PROJECT

GENERAL SITE
CIVIL
IMPACTED STORMWATER IMPOUNDMENT A
PLAN VIEW

JOB NO. M3 PN-120085
DWG NO. 0000-CI-023
REV NO. P3
DATE 09 OCT 15

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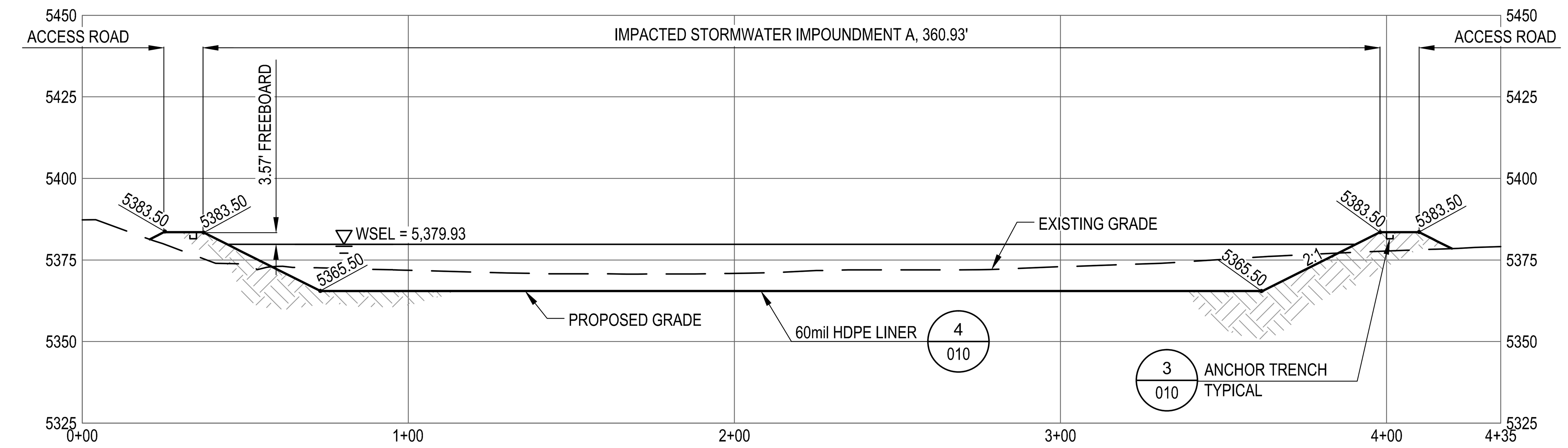
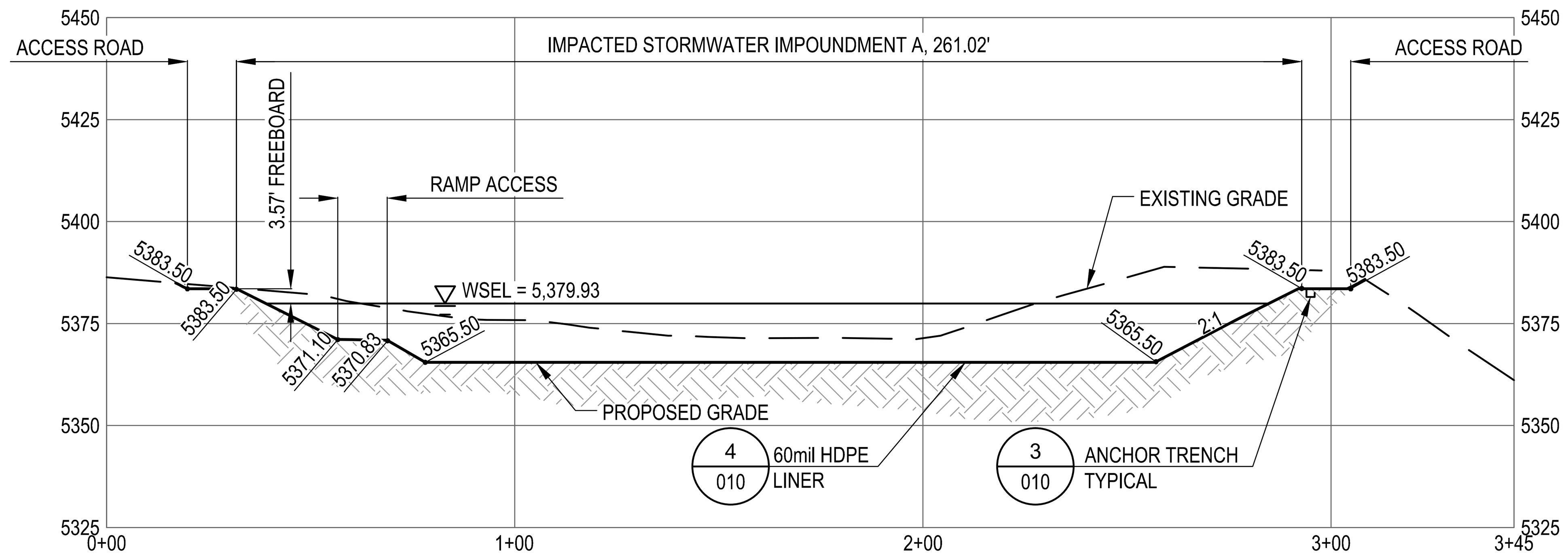


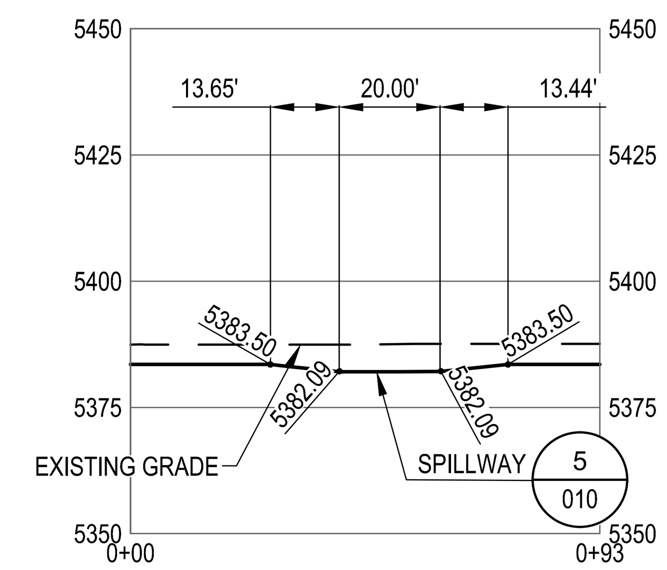
SECTION A / 023

SCALE: 1" = 30'



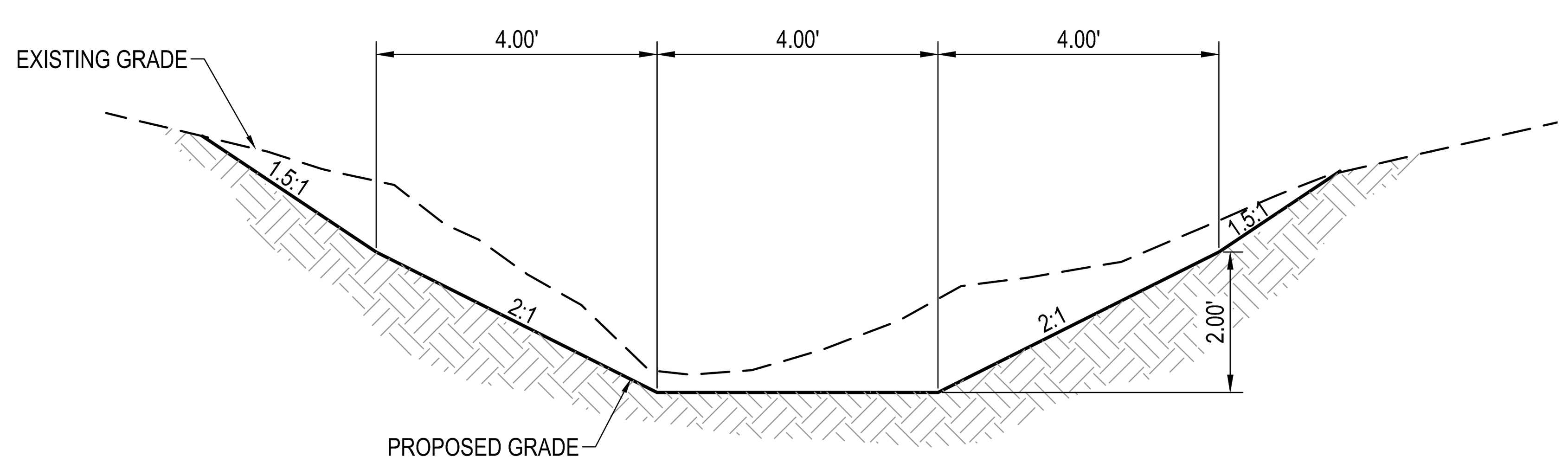
SECTION B / 023

SCALE: 1" = 30'



SECTION C / 023

SCALE: 1" = 30'



SECTION D / 023

SCALE: NTS

NOTES:

1. STORMWATER CONVEYANCE CHANNEL WILL BE DESIGNED TO CONVEY, AT A MINIMUM, THE PEAK FLOW FROM A 100 YEAR RETURN INTERVAL STORM EVENT WHILE PRESERVING NO LESS THAN 6 INCHES OF FREEBOARD.
2. CONVEYANCE STRUCTURE WILL BE DESIGNED TO MINIMIZE PONDING AND INFILTRATION OF STORMWATER.

FIGURE 7

30 15 0 30 60

SCALE IN FEET

DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

DWG. NO.	TITLE
0000-CI-023	IMPACTED STORMWATER IMPOUNDMENT A, PLAN VIEW
0000-CI-010	STANDARD DETAILS SHEET 3

SCALE: AS NOTED		DATE
DESIGNED BY	SAM	JUN 15
DRAWN BY	SAM	JUN 15
CHECKED BY	JPN	AUG 15
PROJECT MGR	RKZ	AUG 15
CLIENT APPR.		

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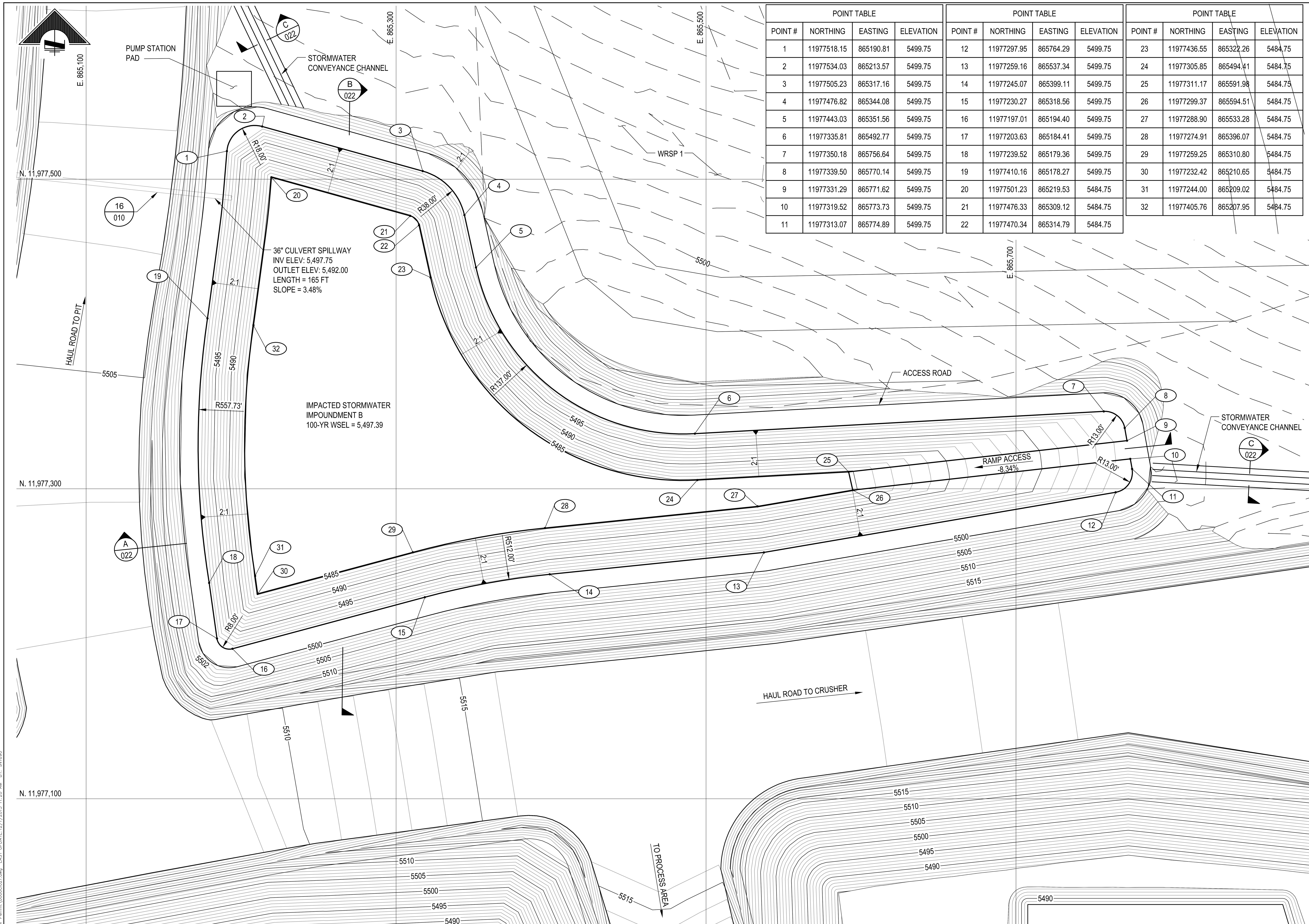
COPPER FLAT PROJECT

GENERAL SITE
CIVIL
IMPACTED STORMWATER IMPOUNDMENT A
SECTIONS

JOB NO. M3 PN-120085

DWG NO. **0000-CI-024**

REV NO. P3 DATE 09 OCT 15



POINT TABLE

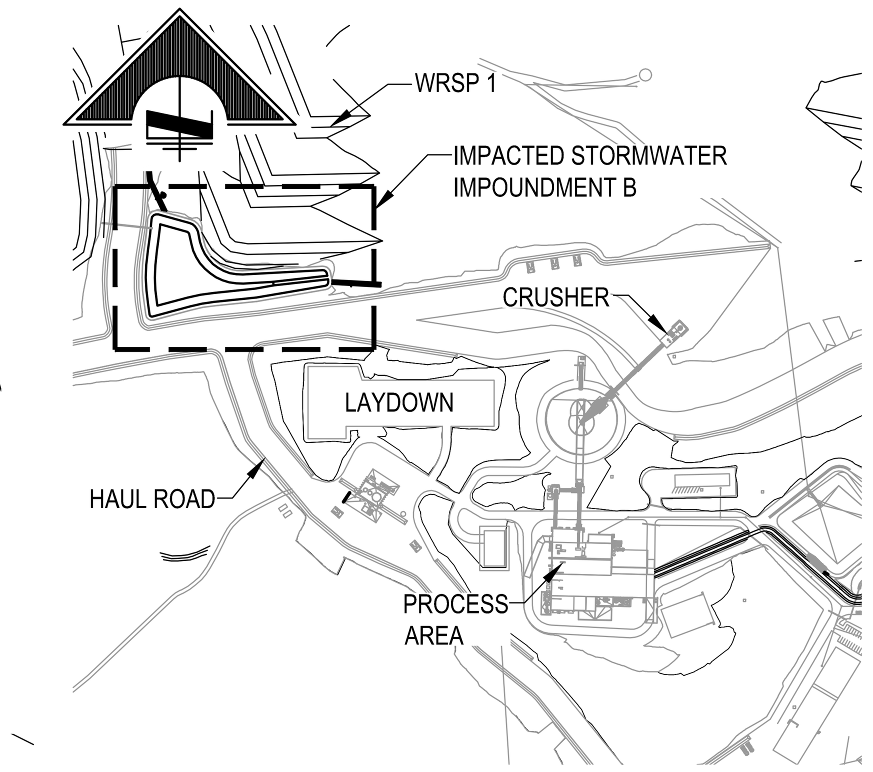
POINT #	NORTHING	EASTING	ELEVATION
1	11977518.15	865190.81	5499.75
2	11977534.03	865213.57	5499.75
3	11977505.23	865317.16	5499.75
4	11977476.82	865344.08	5499.75
5	11977443.03	865351.56	5499.75
6	11977335.81	865492.77	5499.75
7	11977350.18	865756.64	5499.75
8	11977339.50	865770.14	5499.75
9	11977331.29	865771.62	5499.75
10	11977319.52	865773.73	5499.75
11	11977313.07	865774.89	5499.75

POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION
12	11977297.95	865764.29	5499.75
13	11977259.16	865537.34	5499.75
14	11977245.07	865399.11	5499.75
15	11977230.27	865318.56	5499.75
16	11977197.01	865194.40	5499.75
17	11977203.63	865184.41	5499.75
18	11977239.52	865179.36	5499.75
19	11977410.16	865178.27	5499.75
20	11977501.23	865219.53	5484.75
21	11977476.33	865309.12	5484.75
22	11977470.34	865314.79	5484.75

POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION
23	11977436.55	865322.26	5484.75
24	11977305.85	865494.41	5484.75
25	11977311.17	865591.98	5484.75
26	11977299.37	865594.51	5484.75
27	11977288.90	865533.28	5484.75
28	11977274.91	865396.07	5484.75
29	11977259.25	865310.80	5484.75
30	11977232.42	865210.65	5484.75
31	11977244.00	865209.02	5484.75
32	11977405.76	865207.95	5484.75



KEY MAP
SCALE: 1" = 500'

NOTES:

1. STORMWATER IMPOUNDMENT B IS INTENDED TO CAPTURE STORMWATER RUNOFF FROM THE WASTE ROCK STOCK PILE 1 (WRSP-1).
2. STORMWATER IMPOUNDMENT IS SIZED TO CONTAIN THE 100-YR, 24-HR RAINFALL EVENT WITH A MINIMUM OF 2.0 FEET OF FREEBOARD.
3. STORMWATER CULVERT SPILLWAY IS DESIGNED FOR THE 25-YR, 24HR RAINFALL EVENT AT MINIMUM.
4. STORMWATER IMPOUNDMENT SHALL BE SINGLE LINED WITH 60mil HDPE LINER PER DETAIL 4 ON DWG. 0000-CI-010, OR APPROVED EQUIVALENT.

IMPOUNDMENT SUMMARY

CAPACITY AT 100-YR WSEL	748,445	CU-FT
ULTIMATE CAPACITY	913,160	CU-FT

FIGURE 8

PLAN
SCALE: 1" = 30'

30 15 0 30 60
SCALE IN FEET
CONTOUR INTERVAL = 1.0FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-022	IMPACTED STORMWATER IMPOUNDMENT B SECTIONS		
0000-CI-005	STANDARD DETAILS SHEET 2		

REVISIONS

NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

REVISIONS

NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE:	AS NOTED	DATE
DESIGNED BY	SAM	JUN 15
DRAWN BY	SAM	JUN 15
CHECKED BY	JPN	JUN 15
PROJECT MGR	RKZ	JUN 15
CLIENT APPR.		

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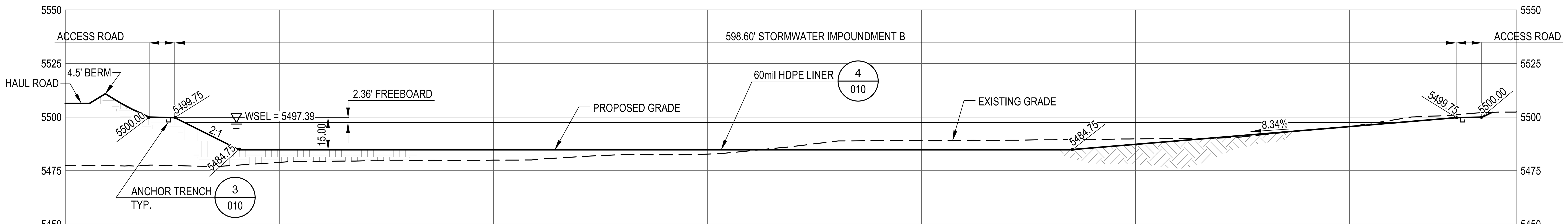
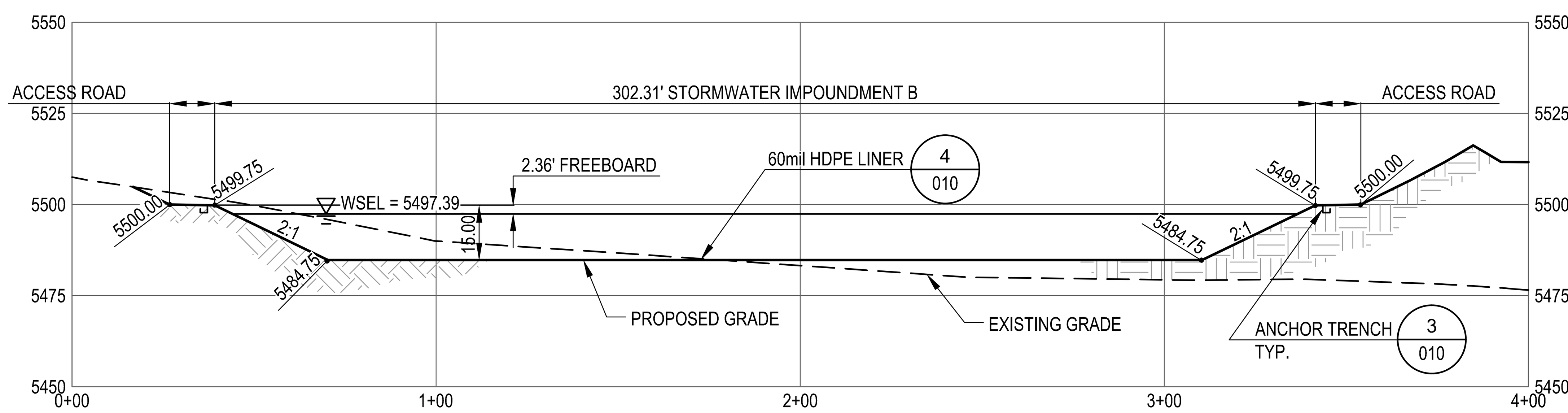
COPPER FLAT PROJECT

GENERAL SITE
CIVIL
IMPACTED STORMWATER IMPOUNDMENT B
PLAN VIEW

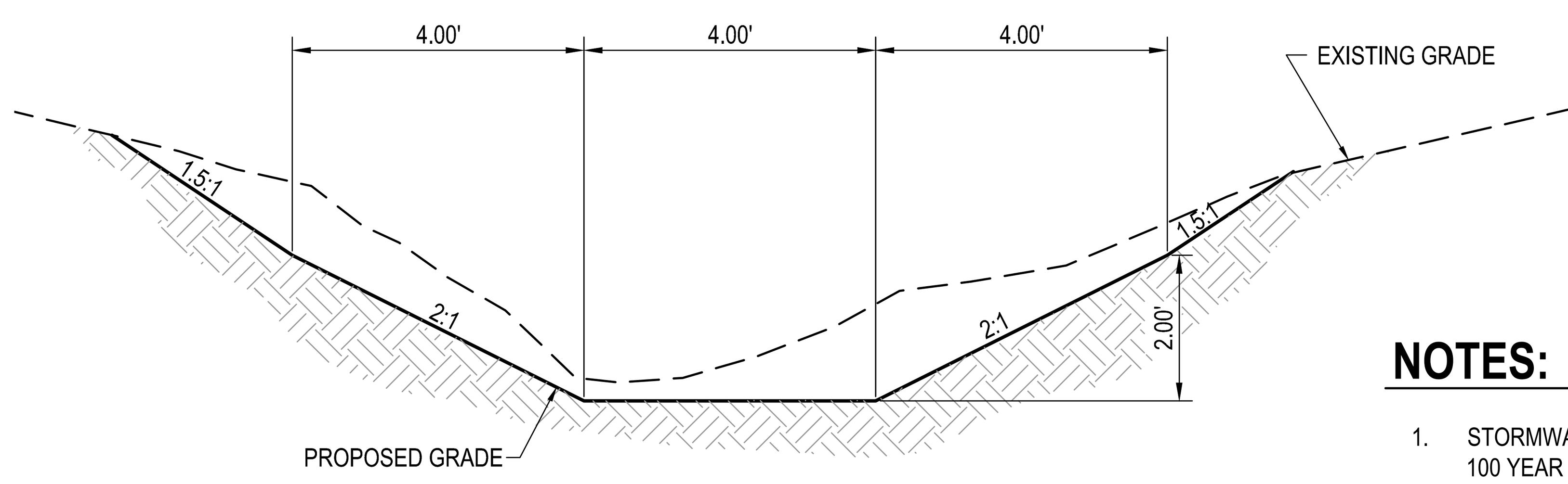
JOB NO. M3 PN-120085
DWG NO. 0000-CI-021
REV NO. P4
DATE 27 OCT 15



SECTION A / 021
SCALE: 1" = 30'



SECTION B / 021
SCALE: 1" = 30'



SECTION C / 021
SCALE: 1" = 30'

NOTES:

1. STORMWATER CONVEYANCE CHANNEL WILL BE DESIGNED TO CONVEY, AT A MINIMUM, THE PEAK FLOW FROM A 100 YEAR RETURN INTERVAL STORM EVENT WHILE PRESERVING NO LESS THAN 6 INCHES OF FREEBOARD.
2. CONVEYANCE STRUCTURE WILL BE DESIGNED TO MINIMIZE PONDING AND INFILTRATION OF STORMWATER.

FIGURE 9

30 15 0 30 60
SCALE IN FEET
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
NOT FOR CONSTRUCTION

THEMAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-021	IMPACTED STORMWATER IMPOUNDMENT B PLAN VIEW		
0000-CI-010	STANDARD DETAILS SHEET 3		

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: AS NOTED		DATE
DESIGNED BY	SAM	JUN 15
DRAWN BY	SAM	JUN 15
CHECKED BY	JPN	AUG 15
PROJECT MGR	RKZ	AUG 15
CLIENT APPR.		

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COPPER FLAT PROJECT
JOB NO. M3 PN-120085
GENERAL SITE
CIVIL
IMPACTED STORMWATER IMPOUNDMENT B
SECTIONS
DWG NO. **0000-CI-022**
REV NO. P3
DATE 09 OCT 15

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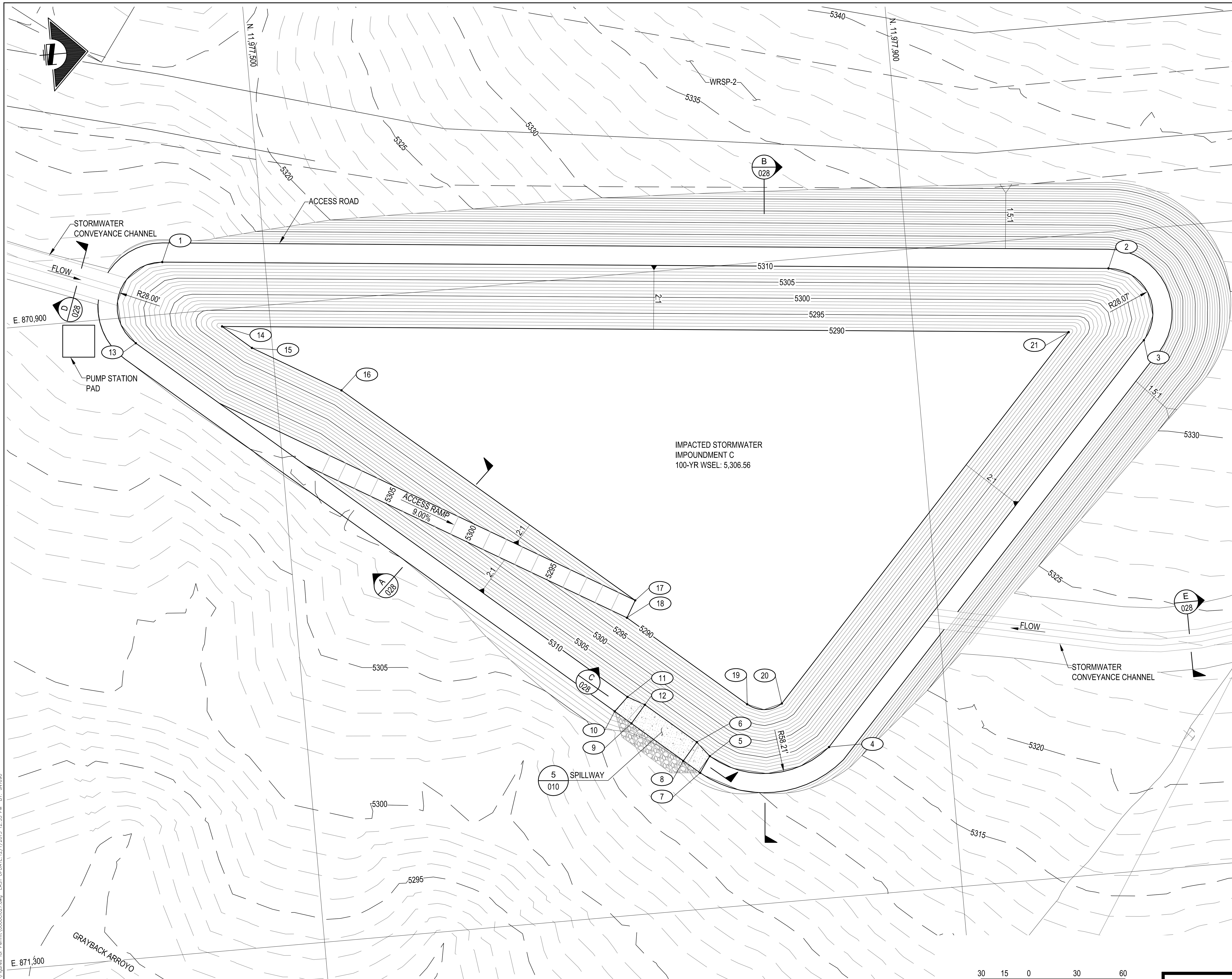
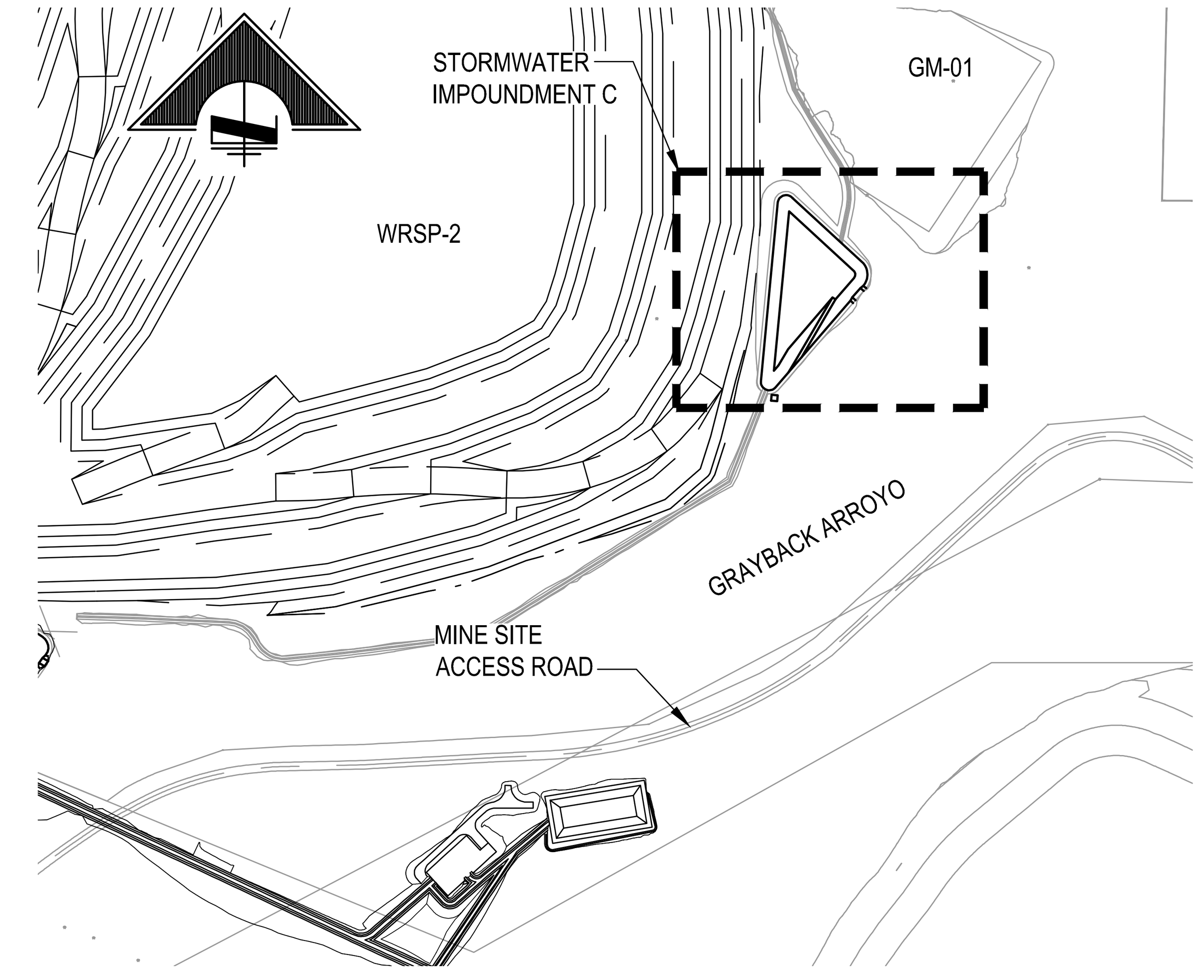


PLAN

SCALE: 1" = 30'



KEY MAP

SCALE: 1" = 500'

NOTES:

1. IMPACTED STORMWATER IMPOUNDMENT C IS INTENDED TO COLLECT AND RETAIN STORMWATER RUNOFF FROM WASTE ROCK STOCKPILE 2 (WRSP-2) AND WASTE ROCK STOCKPILE 3 (WRSP-3).
2. STORMWATER IMPOUNDMENT IS SIZED TO CONTAIN THE 100-YR, 24-HR RAINFALL EVENT WITH A MINIMUM OF 2.0 FEET OF FREEBOARD.
3. STORMWATER IMPOUNDMENT SHALL BE SINGLE LINED WITH 60mil HDPE PER DETAIL 4 ON SHEET 0000-CI-010, OR APPROVED EQUIVALENT.
4. STORMWATER SPILLWAY IS DESIGNED FOR THE 25-YR, 24-HR RAINFALL EVENT AT MINIMUM.
5. SPILLWAY IS DESIGNED TO ALLOW FOR VEHICULAR TRAFFIC.

IMPOUNDMENT SUMMARY

CAPACITY AT 100-YR WSEL	1,405,507	CU-FT
ULTIMATE CAPACITY	1,802,067	CU-FT

POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION
1	11977436.02	870867.41	5310.00
2	11978024.85	870922.90	5310.00
3	11978042.98	870969.57	5310.00
4	11977824.76	871205.86	5310.00
5	11977750.03	871205.03	5310.00
6	11977742.72	871195.59	5308.81
7	11977743.12	871214.89	5310.00
8	11977733.33	871206.49	5308.67
9	11977703.03	871180.38	5308.67
10	11977693.25	871171.96	5310.00
11	11977702.00	871163.65	5310.00

POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION
12	11977712.41	871169.49	5308.81
13	11977415.12	870916.50	5310.00
14	11977469.75	870910.76	5290.00
15	11977487.16	870925.76	5290.00
16	11977540.59	870957.08	5290.00
17	11977712.07	871103.95	5290.00
18	11977706.00	871114.30	5290.00
19	11977776.14	871174.73	5290.00
20	11977797.74	871176.15	5290.00
21	11977996.59	870960.41	5290.00

FIGURE 10

30 15 0 30 60
SCALE IN FEET
CONTOUR INTERVAL = 1.0FT
DO NOT SCALE 11x17 DRAWINGS

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REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-028	IMPACTED STORMWATER IMPOUNDMENT C SECTIONS		
0000-CI-005	STANDARD DETAILS SHEET 2		
0000-CI-010	STANDARD DETAILS SHEET 3		

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PROJECT MGR RKZ	AUG 15
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GENERAL SITE
CIVIL
IMPACTED STORMWATER IMPOUNDMENT C
PLAN VIEW

JOB NO. M3 PN-120085
DWG NO. 0000-CI-027
REV NO. P3
DATE 09 OCT 15

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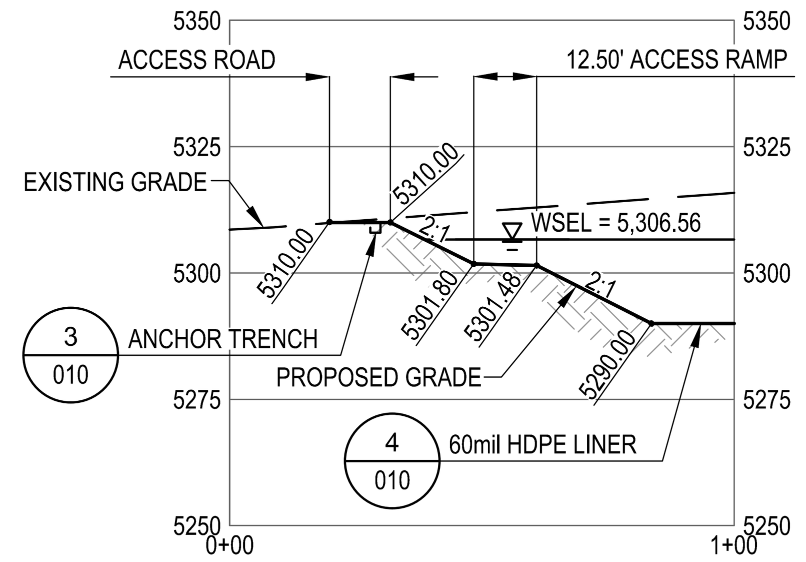

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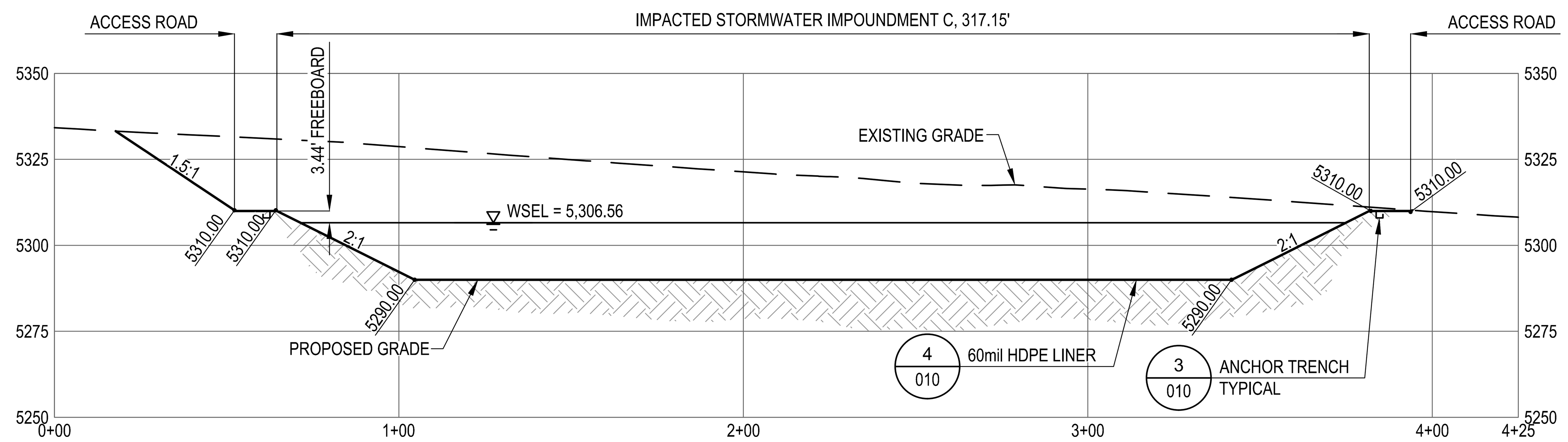

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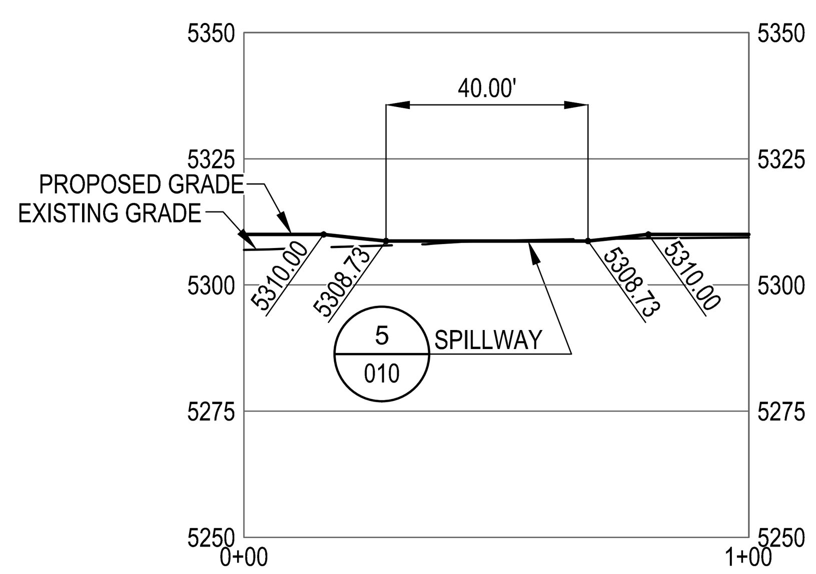

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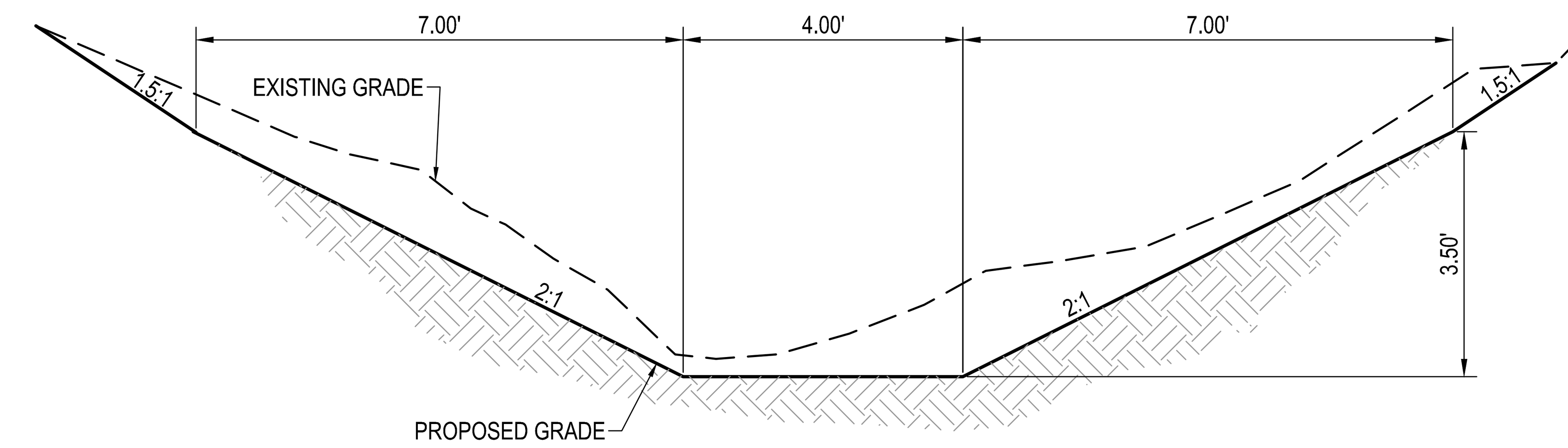
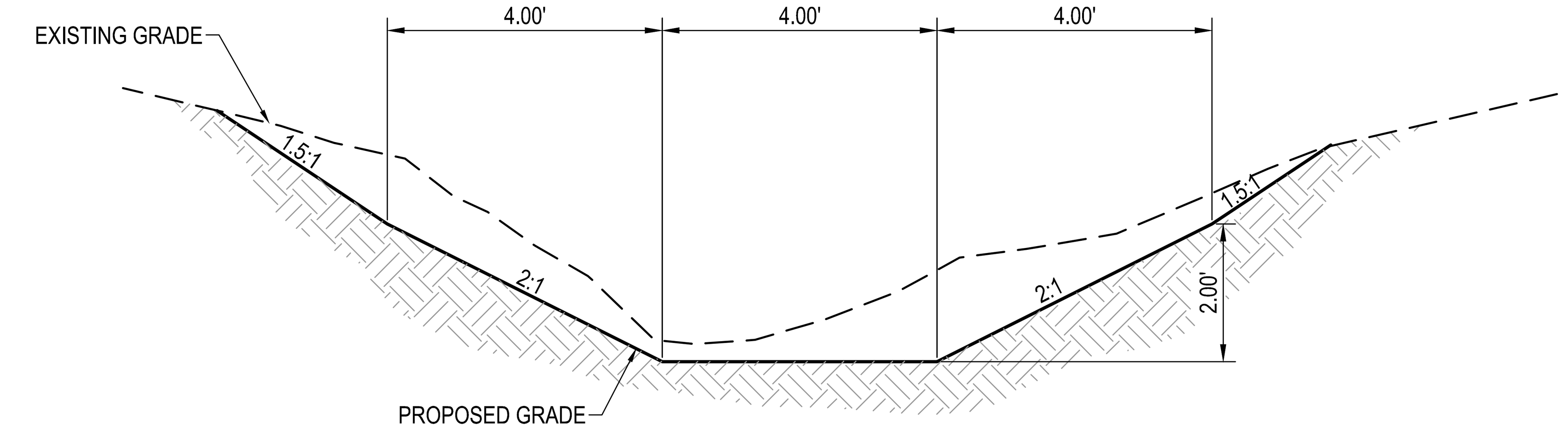


SECTION D 027
SCALE: NTS

NOTES:

1. STORMWATER CONVEYANCE CHANNEL WILL BE DESIGNED TO CONVEY, AT A MINIMUM, THE PEAK FLOW FROM A 100 YEAR RETURN INTERVAL STORM EVENT WHILE PRESERVING NO LESS THAN 6 INCHES OF FREEBOARD.

2. CONVEYANCE STRUCTURE WILL BE DESIGNED TO MINIMIZE PONDING AND INFILTRATION OF STORMWATER.



SECTION E 027
SCALE: NTS

FIGURE 11

30 15 0 30 60
SCALE IN FEET
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
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THE MAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-027	IMPACTED STORMWATER IMPOUNDMENT C, PLAN VIEW		
0000-CI-010	STANDARD DETAILS SHEET 3		

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IMPACTED STORMWATER IMPOUNDMENT C
SECTIONS

JOB NO. M3 PN-120085
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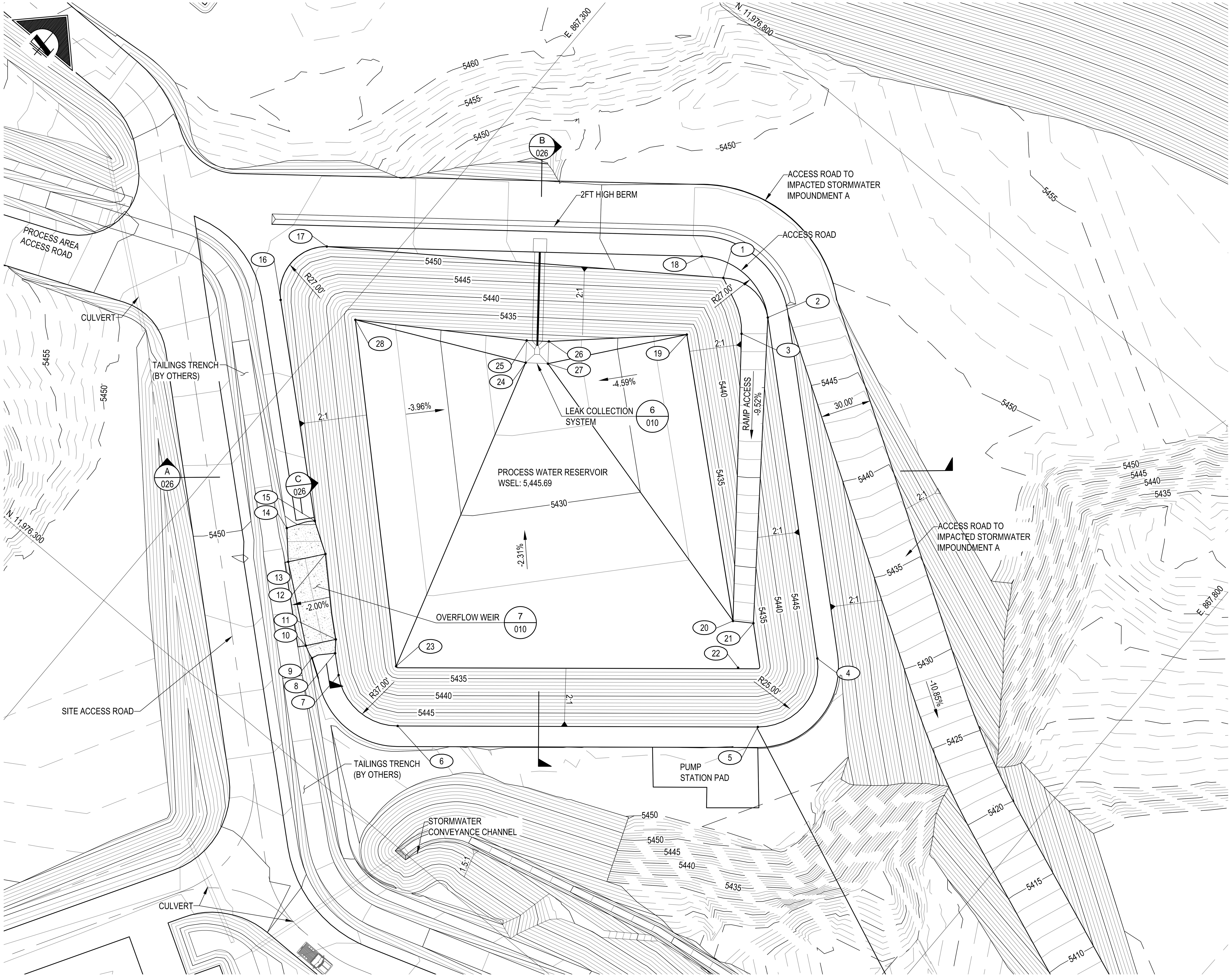
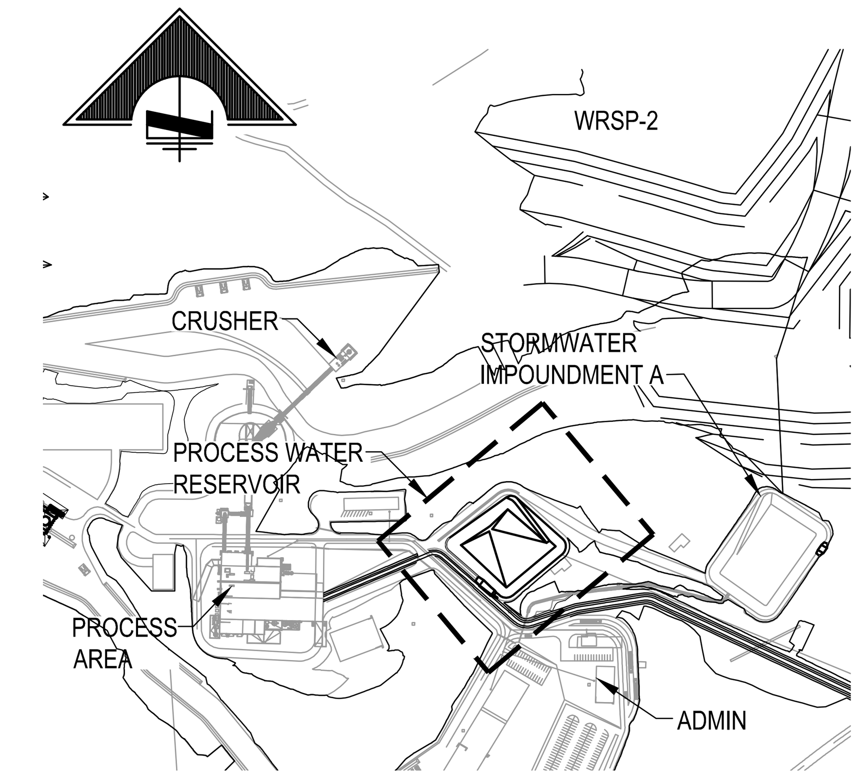


PLAN
SCALE: 1" = 30'

POINT TABLE			
POINT #	NORTHING	EASTING	ELEVATION
1	11976677.01	867456.22	5448.90
2	11976676.01	867490.99	5448.90
3	11976658.90	867485.30	5448.00
4	11976525.20	867641.13	5444.30
5	11976488.75	867638.96	5448.61
6	11976354.25	867478.64	5448.90
7	11976354.80	867433.15	5448.90
8	11976363.32	867423.40	5448.90
9	11976352.45	867414.83	5448.90
10	11976355.69	867407.41	5447.80
11	11976369.69	867418.41	5448.16
12	11976404.09	867381.76	5448.24
13	11976386.62	867368.04	5447.80
14	11976401.16	867354.74	5449.81
15	11976414.90	867364.55	5450.22
16	11976500.94	867266.34	5452.92
17	11976542.17	867266.96	5452.92
18	11976678.55	867438.45	5449.02
19	11976637.98	867461.15	5431.90
20	11976519.41	867579.10	5431.84
21	11976526.05	867589.10	5431.90
22	11976508.16	867609.15	5431.90
23	11976380.38	867455.56	5431.90
24	11976564.87	867399.57	5428.10
25	11976575.19	867391.67	5428.10
26	11976583.10	867401.99	5428.10
27	11976572.78	867409.89	5428.10
28	11976520.09	867307.24	5431.90



KEY MAP
SCALE: 1" = 500'

NOTES:

1. THE PROCESS WATER RESERVOIR IS INTENDED TO RETAIN PROCESS WATER, STORMWATER THAT FALLS DIRECTLY ON THE POND SURFACE, AND STORMWATER TRANSFERED FROM OTHER IMPACTED STORMWATER IMPOUNDMENTS.
2. THE PROCESS WATER RESERVOIR IS SIZED TO RETAIN 12 HRS OF 7,200GPM INFLOW AND THE 100-YR, 24-HR RAINFALL EVENT PLUS 2 FEET OF FREEBOARD.
3. THE PROCESS WATER WATER RESERVOIR SHALL BE DOUBLE LINED WITH 60mil HDPE PER DETAIL 2 SHEET 0000-CI-010.
4. THE PROCESS WATER RESERVOIR OVERFLOW WEIR IS DESIGNED FOR THE 25-YR, 24-HR RAINFALL EVENT AT CAPACITY (SEE NOTE 2) AT MINIMUM. THE WEIR CONVEYS PROCESS WATER INTO THE TAILINGS TRENCH AND TO THE TAILINGS IMPOUNDMENT.
5. OVERFLOW WEIR IS DESIGNED TO ALLOW FOR VEHICULAR TRAFFIC.

IMPOUNDMENT SUMMARY		
CAPACITY AT 100-YR WSEL	726,365	CU-FT
ULTIMATE CAPACITY	937,998	CU-FT

FIGURE 12

30 15 0 30 60
SCALE IN FEET
CONTOUR INTERVAL = 1.0FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THE MAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-026	PROCESS WATER RESERVOIR SECTIONS		
0000-CI-010	STANDARD DETAILS SHEET 3		

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GENERAL SITE
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PROCESS WATER RESERVOIR
PLAN VIEW

DWG NO. 0000-CI-025
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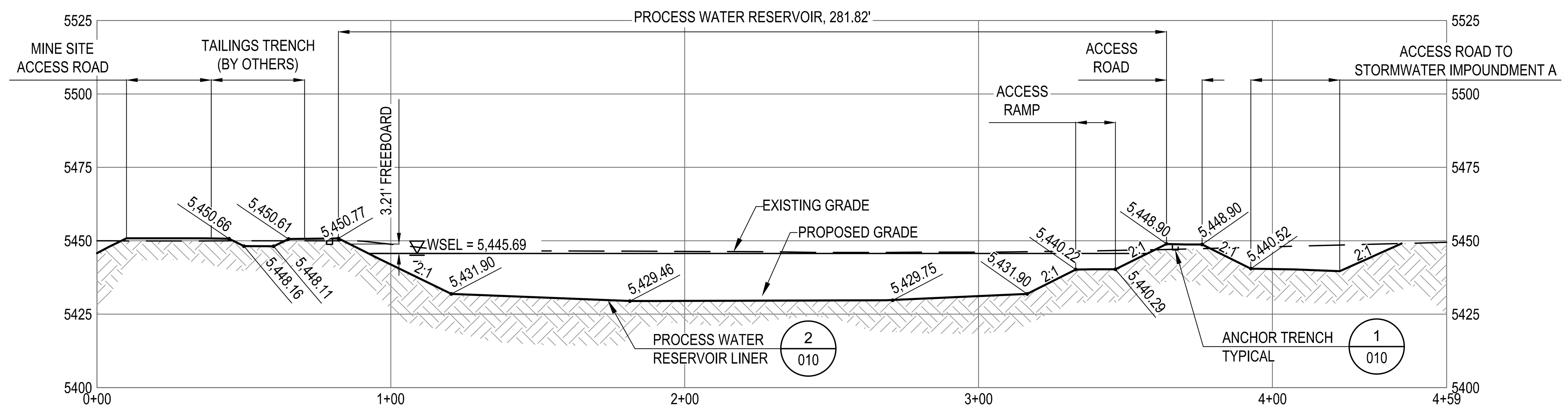

SECTION A
025
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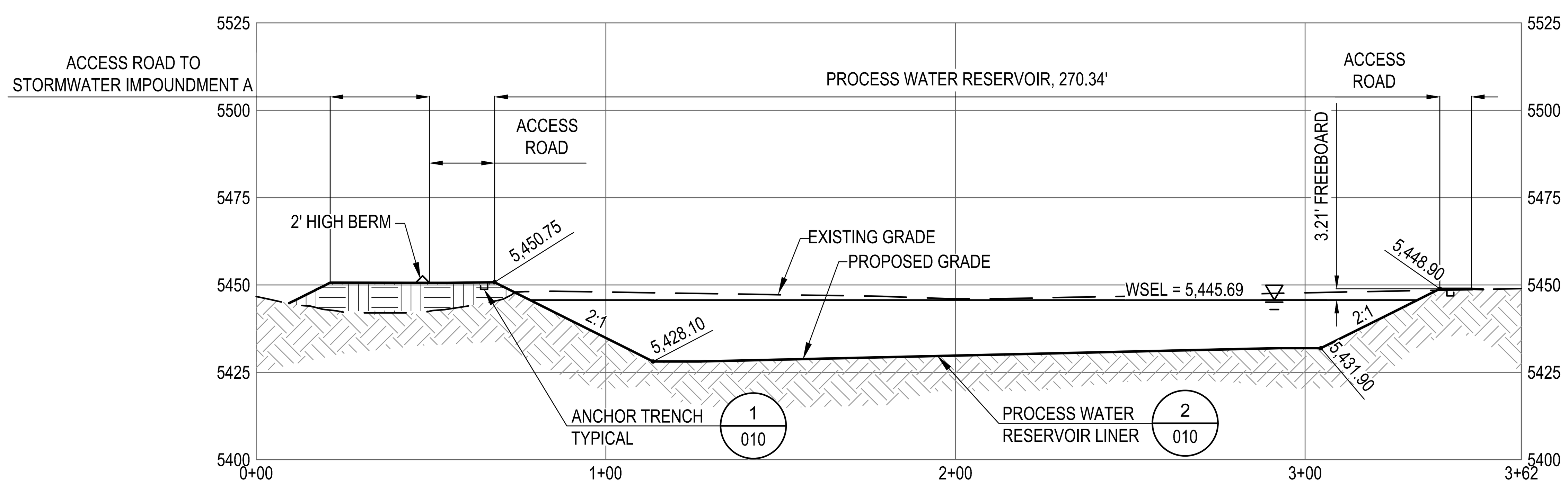

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025
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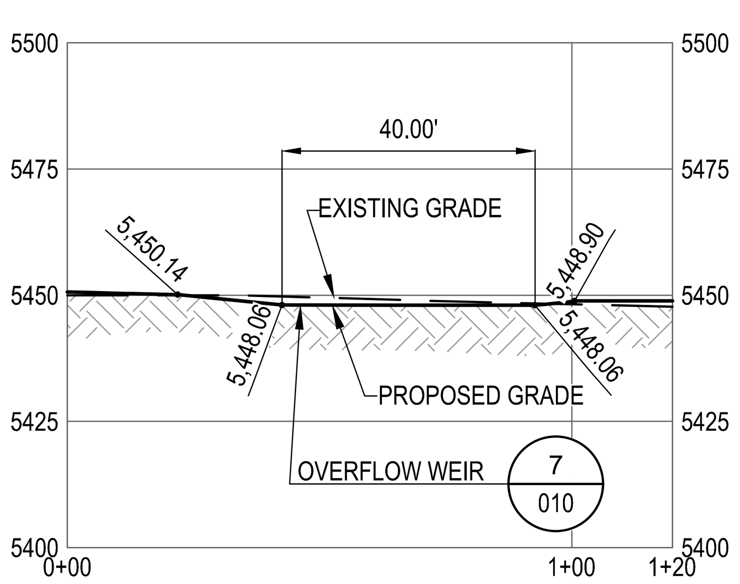

SECTION C
025
SCALE: 1" = 30'

FIGURE 13

30 15 0 30 60
SCALE IN FEET
DO NOT SCALE 11x17 DRAWINGS

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REFERENCES		REFERENCES	
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0000-CI-025	PROCESS WATER RESERVOIR PLAN VIEW		
0000-CI-010	STANDARD DETAILS SHEET 3		

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PROCESS WATER RESERVOIR
SECTIONS

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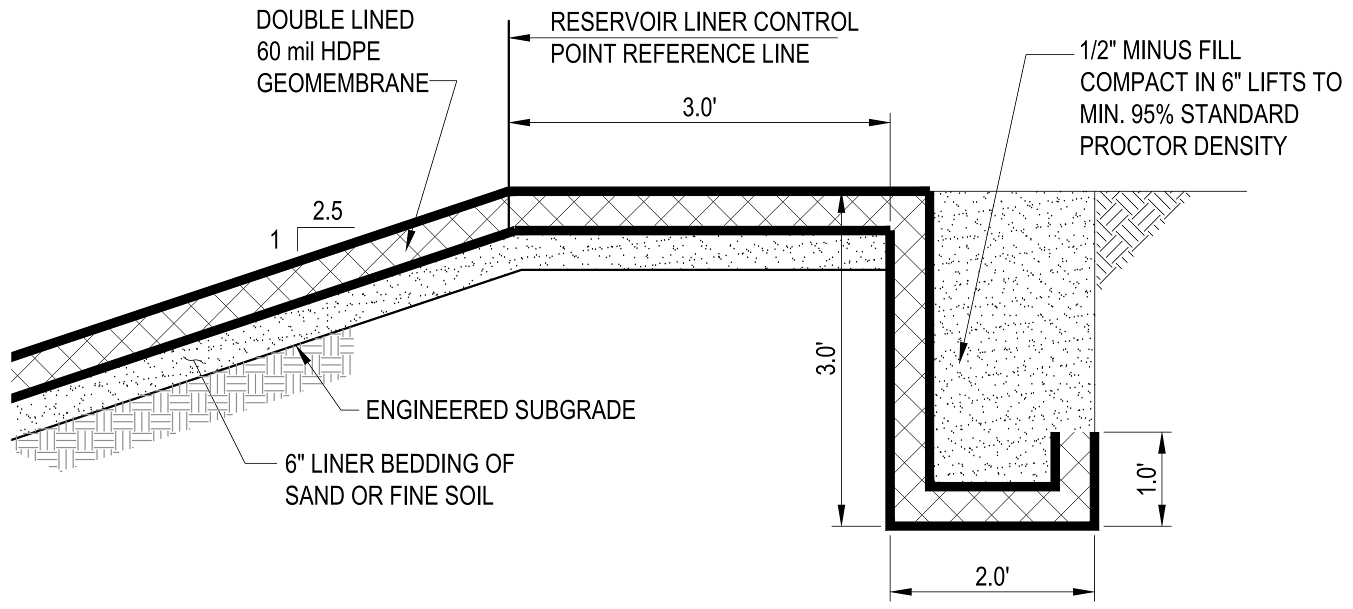
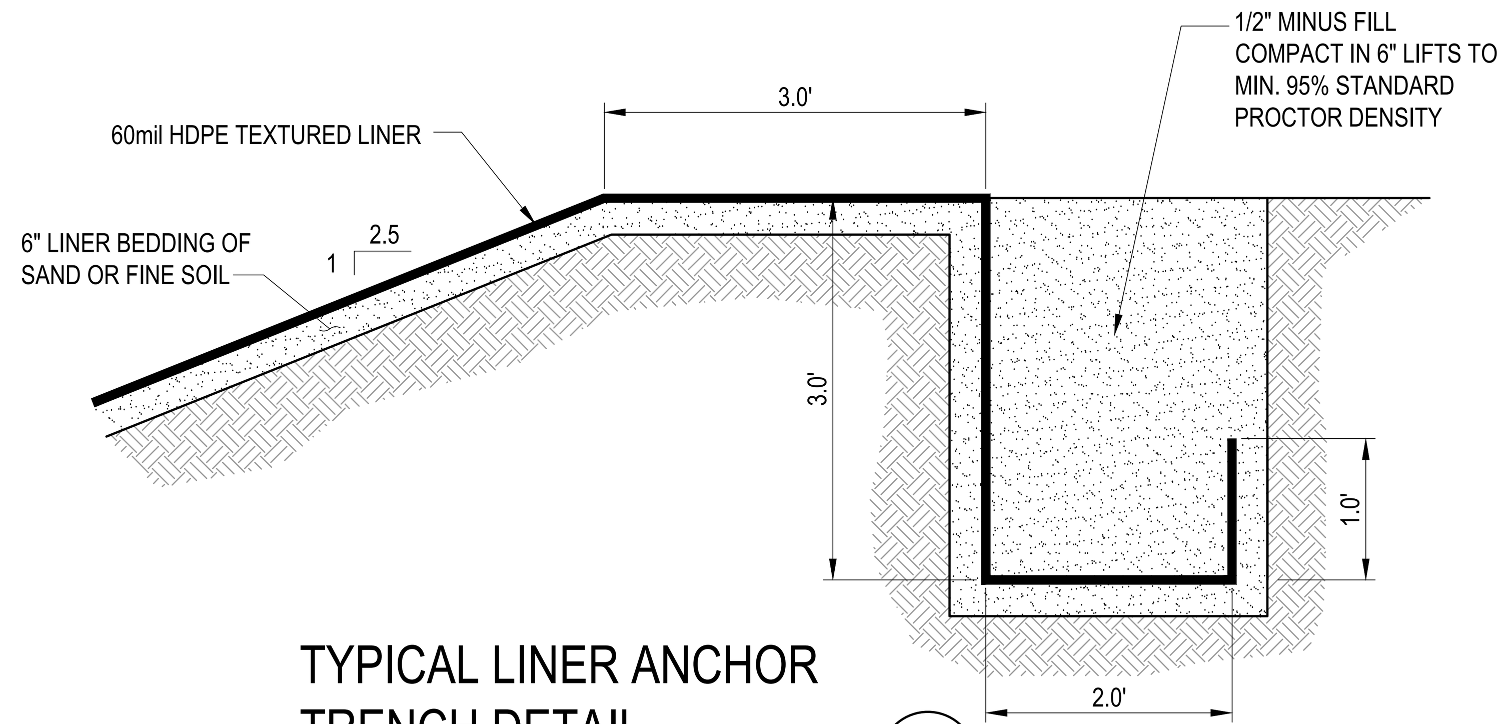
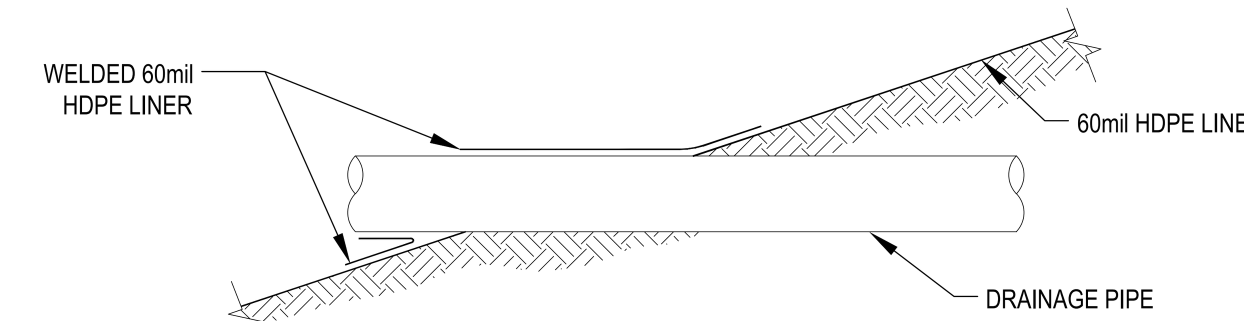


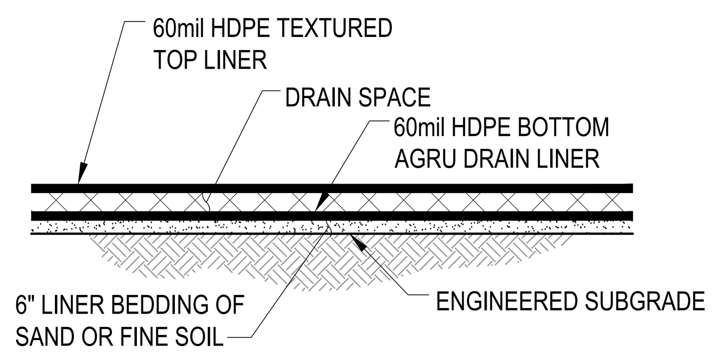
PROCESS WATER RESERVOIR
LINER ANCHOR DETAIL
N.T.S.
1
026



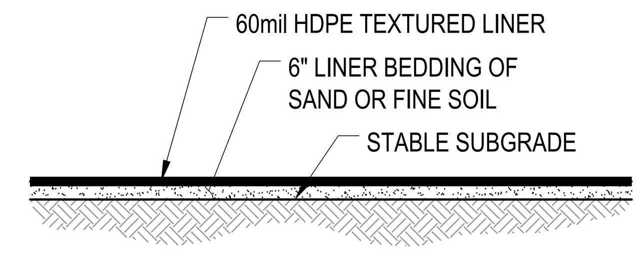
TYPICAL LINER ANCHOR
TRENCH DETAIL
N.T.S.
3
022, 024, 028



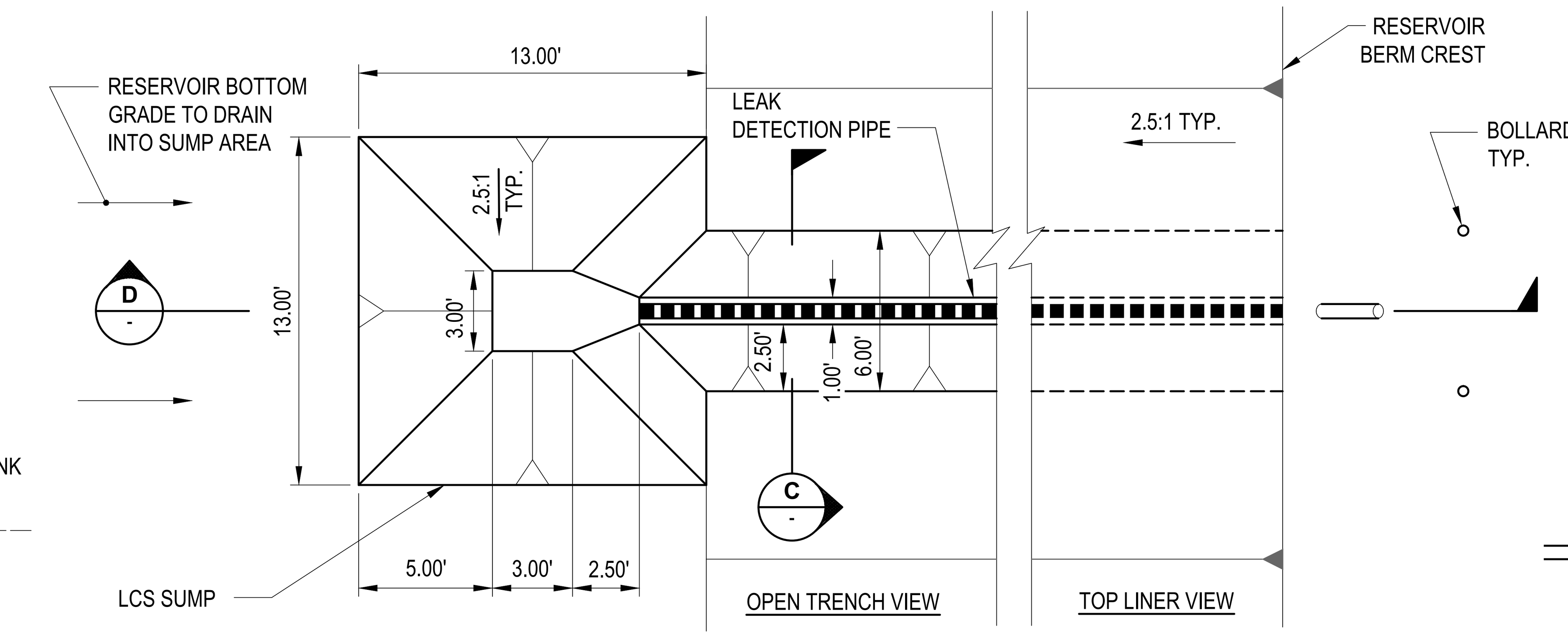
PIPE PENETRATING LINER
N.T.S.
16
-



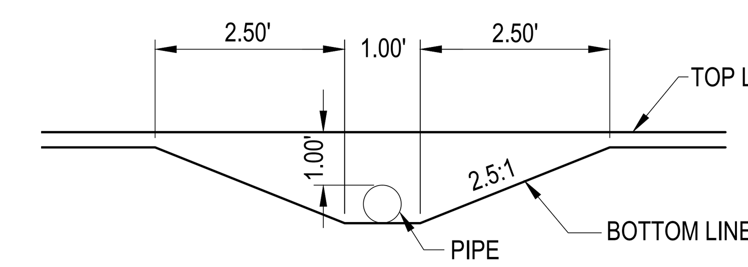
TYPICAL PROCESS WATER
RESERVOIR LINER
N.T.S.
2
026



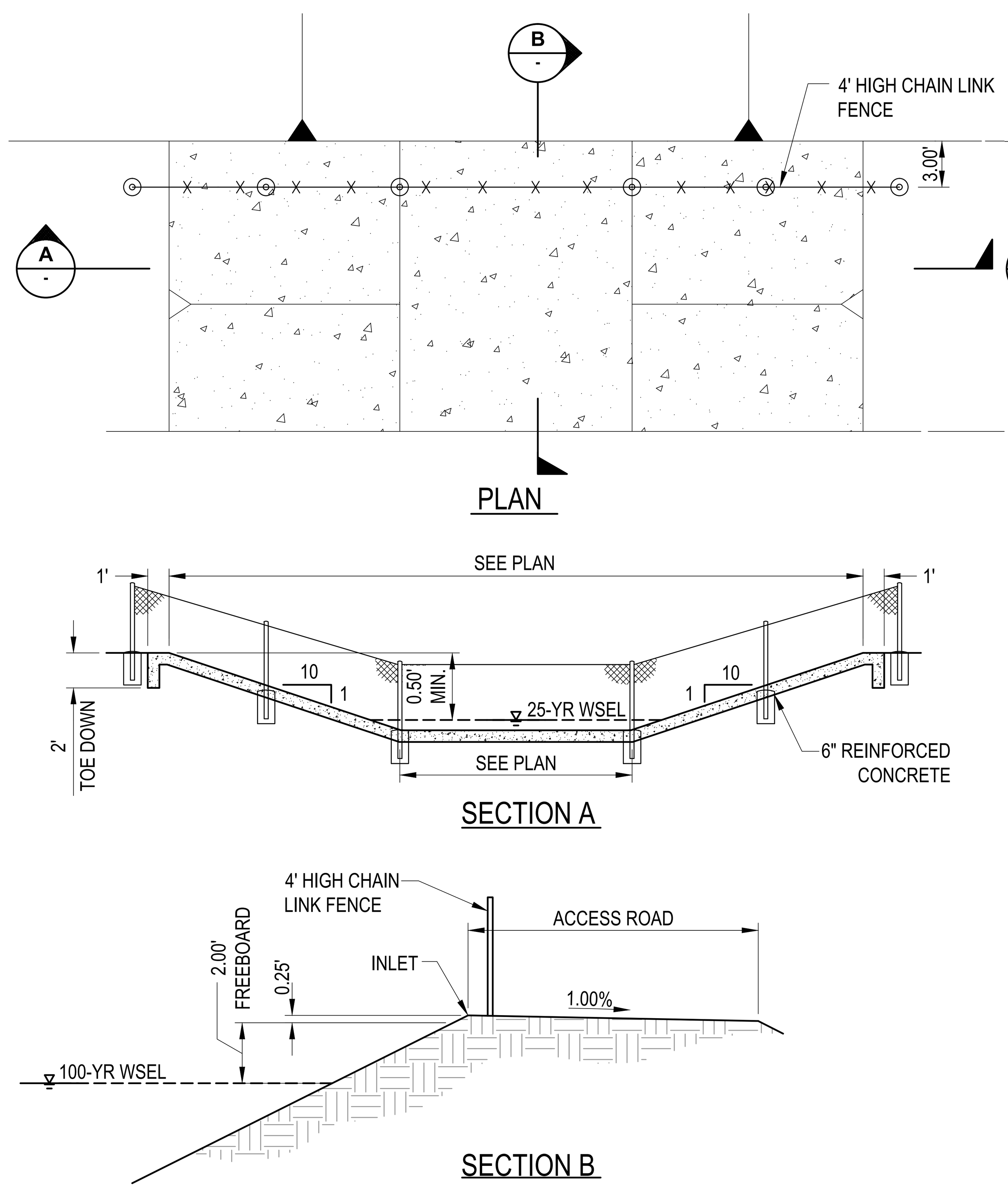
TYPICAL STORMWATER
IMPOUNDMENT LINER
N.T.S.
4
022, 024, 028



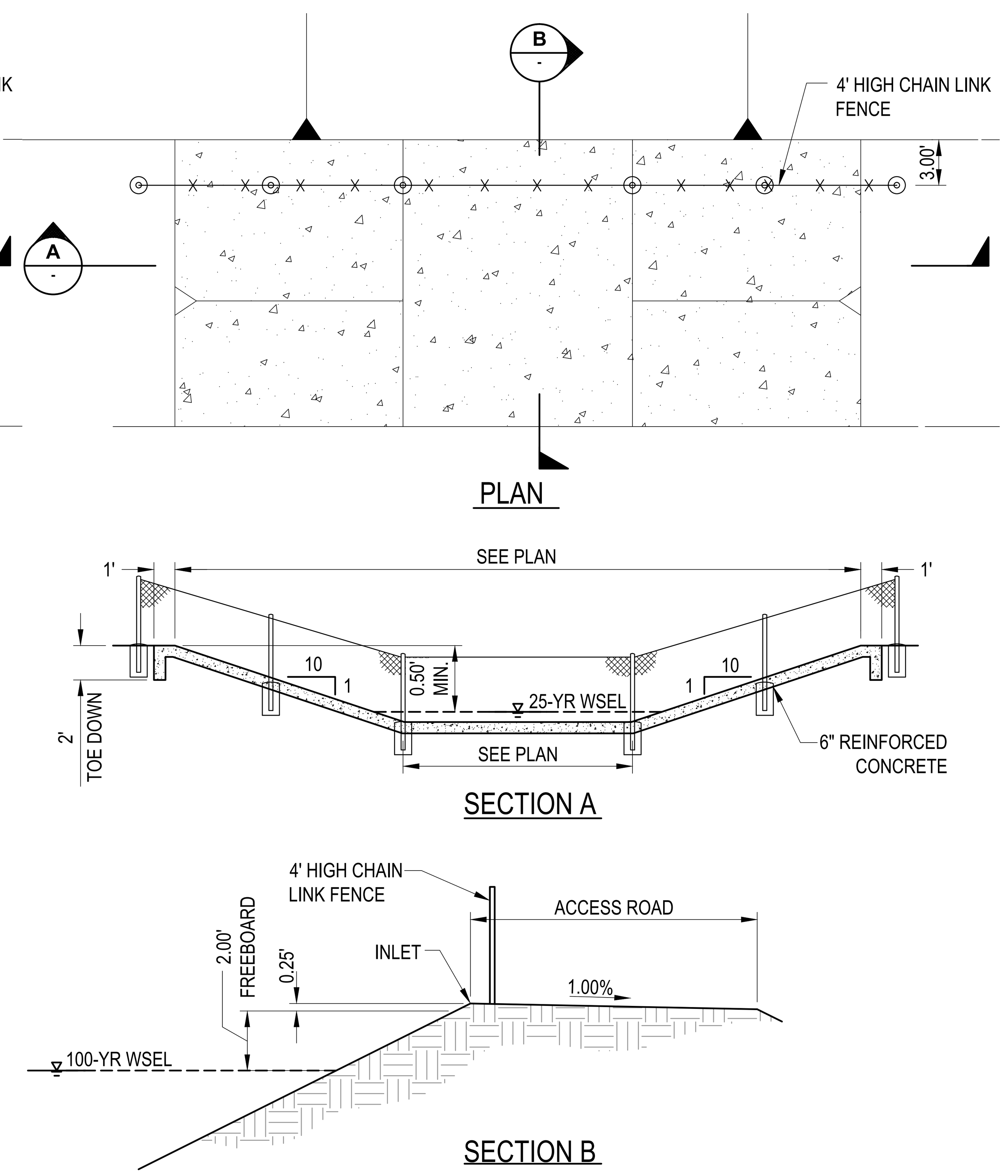
PROCESS WATER RESERVOIR - LCS PLAN
N.T.S.
6
025



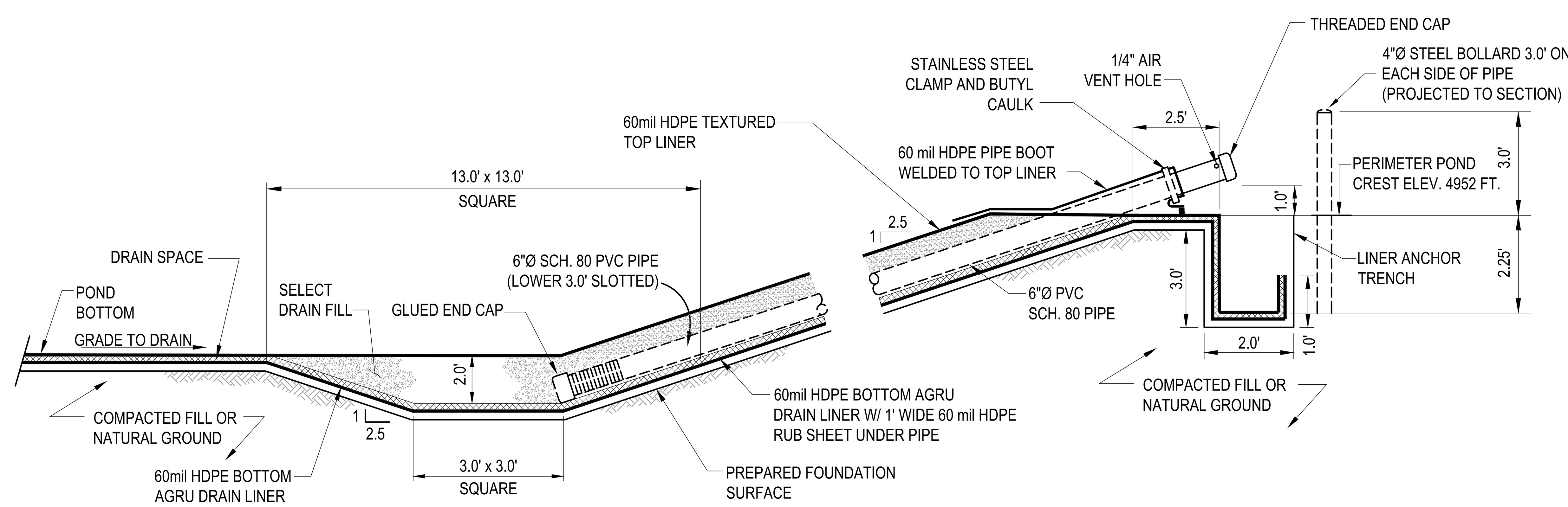
SECTION C



SPILLWAY
N.T.S.
5
021, 023, 027



OVERFLOW WEIR
N.T.S.
7
025



SECTION D

FIGURE 14

PRELIMINARY
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REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE
0000-CI-023	IMPACTED STORMWATER IMPOUNDMENT A, PLAN VIEW		
0000-CI-025	PROCESS WATER RESERVOIR PLAN VIEW		
0000-CI-027	IMPACTED STORMWATER IMPOUNDMENT C, PLAN VIEW		

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GENERAL/STANDARDS
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STANDARD DETAILS
SHEET 3

JOB NO. M3 PN-120085
DWG NO.
0000-CI-010
REV NO. P3
DATE 09 OCT 15

16777

M3-PN120085
Revision 0

ARCHITECTURE
ENGINEERING
CONSTRUCTION MANAGEMENT

Copper Flat Project

Process Facility Containment Report

Prepared For:

THEMAC RESOURCES

16778

Certified Professional Engineer Seal

This report documents work conducted under the oversight of the following Engineer:

HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp. 12/31/2017

Harry Lewsley, P.E.

Harry Lewsley

Signature

Date 12/7/2015

PROCESS FACILITY CONTAINMENT REPORT
COPPER FLAT PROJECT

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Harry Lewsley 12/7/2015

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LIST OF DRAWINGS

Harry Lewsley 12/7/2015

HARRY J. LEWSLEY
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Exp. 12/31/2017

1 INTRODUCTION

The Copper Flat Project is located in South Central New Mexico, near the town of Hillsboro, approximately 150 miles south of Albuquerque, and approximately 20 miles southwest of Truth or Consequences (straight-line distances) as illustrated in Drawing (Dwg.) 000-CI-001. The Project is owned and operated by New Mexico Copper Corporation (NMCC), a wholly owned subsidiary of THEMAC Resources Group Limited.

The State of New Mexico has promulgated regulations pertaining to groundwater protection at copper mining facilities (New Mexico Administrative Code Title 20, Chapter 6, Part 7 [20.6.7 NMAC], the "Copper Rule"), the stated purpose of which is "to control discharges of water contaminants specific to copper mine facilities and their operations to prevent water pollution."

This report provides the design criteria, location, and capacity of containment systems for the process areas identified in Section 2 of this report to comply with 20.6.7 NMAC, Sections 22, 23, and 26. This report excludes design considerations for the Impacted Stormwater Impoundments, Process Water Reservoir, and Tailings Storage Facility (TSF), i.e., the tailings impoundment, underdrain collection pond, surge pond and the secondary containment trench from the processing facility to the TSF, which have been completed by others and are reported separately.

2 PROCESS AREA IDENTIFICATION

Pursuant to 20.6.17.22 and .23, tanks and pipelines for new construction as proposed for the Copper Flat Project are required to be designed with adequate containment to prevent migration of process solutions to groundwater. Specific areas of the project for which the containment designs are described in this report include the following areas with tanks that require secondary containment.

- Concentrator Area
- Truck Shop
- Fuel Station
- Process Water Storage Tank

This report also describes containment for the following areas that contain process equipment and/or liquids that require containment to prevent release to the environment.

- Crusher
- Coarse Ore Stockpile and Ore Reclaim Tunnel
- Truck and Equipment Washing Unit
- Analytical Laboratory
- Domestic Sewage Treatment Facility

Discussion of containment of facilities related to the tailings storage facility (TSF) (tailings pipelines, tailings storage facility), impacted stormwater impoundments, and the process water reservoir is not included in this report.

The following containment areas will be covered by a roof and therefore will not collect appreciable precipitation.

- Grinding
- Copper Flotation
- Molybdenum Flotation
- Copper Filtration
- Diesel Reagents
- Flotation Reagents
- Sodium Hydrosulfide Reagents
- Truck Shop Tank Farm
- Assay Laboratory
- Wastewater Treatment Facility

The following areas will be uncovered and will therefore collect precipitation. Monthly inspections of these facilities are required by 2.6.7.22 and .23 NMAC. However, after occurrence of a significant precipitation event, the collection sumps will be inspected and collected water will be evacuated within 30 days to maintain required containment capacity. Stormwater evacuated from these areas will be added to the process reservoir or process stream for disposal.

- Copper-Moly Thickening
- Copper Thickening
- Lime Reagents
- Wheel Wash
- Fuel Station
- Truck and Equipment Washing Unit
- Process Water Storage Tank

3 BASIS OF DESIGN

Tanks and pipelines for the Copper Flat Project are designed in accordance with NMAC 20.6.7.23 (A). Most process pipelines are located within buildings with concrete floors sloped to drain to containment sumps. Process pipelines located outside of buildings will have secondary containment for management of leaks and spills. Pipelines are designed in accordance with the following specifications.

Construction Materials	20.6.7.23.A.(1).(a) NMAC	Impermeable materials compatible with contents and resistant to corrosion or degradation
Leak Detection	20.6.7.23.A.(1).(b) NMAC	Mechanism for monitoring integrity
Containment	20.6.7.23.A.(1).(c) NMAC	Secondary containment provided by building floors, double-walled piping, or lined trenches.

Tanks containing process solutions, reagents, chemicals, and petroleum products are located within a building area or on concrete containment pads with curbs or stem walls that are designed to be impermeable to the contents of the contained tanks. Joints between containment curbs and floors will be sealed with approved water stops to seal against leaks. Tanks are designed to contain the stored material, prevent overflows, and are resistant to corrosion or degradation. Tanks for this project (Table 1) are above ground and designed in accordance with the following specifications, except where specifically noted.

Construction Materials	20.6.7.23.A.(2).(a) NMAC	Impermeable materials compatible with contents and resistant to corrosion or degradation
Foundation	20.6.7.23.A.(2).(b) NMAC	Constructed concrete foundation
Containment	20.6.7.23.A.(2).(c) and 20.6.7.23.A.(2).(d) NMAC	Concrete containment to prevent run-on. Containment volume sized to contain 110% of volume of largest tank in the enclosed area while accounting for unusable volume with the containment due to the presence of other tanks, equipment, pedestals, etc.

The majority of process solution pipelines will be placed inside secondary containment for tanks and process buildings. When process pipelines cannot be positioned within secondary containment for tanks or process buildings, the pipe will either be double walled and positioned to drain to an established containment area, or secondary containment specific to the pipeline will be constructed.

Containment sumps will be sealed with water stops at joints and coatings applied where necessary to provide a watertight seal in order to prevent leaking solution to the environment. A list of containment sumps and the destination of liquids collecting in the sumps is provided as Table 2.

4 PROCESS FACILITY CONTAINMENT AREAS

Containment of process solutions, reagents, and other potential groundwater contaminants associated with the Copper Flat Project is delineated below by process area. The areas described include the primary mineral processing circuit and other ancillary areas that are essential to the operation of the project, such as vehicle washing and maintenance, fueling operations, assaying, and sanitary wastewater treatment. The portions of the project area addressed in this report are identified in Dwg. 0000-CI-008. Containment of process solutions is discussed below by process area and by location of ancillary facilities. A list of tanks designed for installation at the Copper Flat Project is presented as Table 1. Table 1 provides location, dimensions, material of construction, and capacity of the tanks in gallons. These tank capacities are compared with the capacities of containments in which they are located to demonstrate adequate containment.

Containment is provided around tanks and in areas with process piping to prevent loss of contents, control leaks and spills, and prevent release of solutions to the surface or ground water. Concrete containment walls are used to contain leaks and spills where tanks are present. The net volume of the containment is designed to contain at least 110 percent of the volume of the largest tank or series of connected tanks in the system. Any leakage, spillage, or wash water within a containment area is directed by sloped concrete floors to a watertight drainage sump. A list of the sumps present in each of the containment areas and the disposition of the captured solutions is presented in Table 2. The sumps listed in Table 2 are containment sumps.

4.1 CONCENTRATOR AREA

Drawing 3000-FS-000 summarizes the Copper Flat ore process flowsheet. Processing of the ore begins with the Crusher. Crushed ore is conveyed to the Coarse Ore Stockpile to be used as mill feed. A concrete tunnel beneath the Coarse Ore Stockpile is used to reclaim the crushed ore and convey it to the Grinding Area. Coarse ore is combined with water in the grinding mills to create a slurry that flows by gravity to Copper Flotation. Concentrate containing copper (Cu) and molybdenum (Moly) is pumped to the Copper-Molybdenum Thickening area and then to the Molybdenum Flotation area for separation of Copper and Moly. Moly Concentrates are filtered, dried, and bagged for shipment in this area. The remaining Copper concentrate is pumped to the Copper Thickening area where excess water is removed. Thickened Copper concentrates are pumped to the Copper Filtration area for dewatering prior to loading onto trucks for offsite shipment. The wheels of trucks and trailers loaded with Copper concentrate are washed In the Wheel Wash area to prevent the loss of concentrate and contamination of roadways.

Chemicals used in the process described above are stored in the Reagents area. Several containment areas are present in the Reagent area to isolate chemicals that may be incompatible or require special handling. Containment areas in the Reagents area include Lime Containment, Diesel Containment, General Reagents Containment, and Sodium Hydrosulfide (NaHS) Containment. The sumps are equipped with a dedicated sump pump to remove the contained liquids and transfer them to an appropriate location in the process.

An overall plan of the Concentrator Area is provided in Dwg. 0000-GA-050. Locations of tanks and sumps are shown on the drawing along with flow arrows depicting the slope of the floor surfaces to demonstrate flows to the collection sumps for the identified areas. A table on the drawing provides the volume of the largest tank in a given area and compares it with the capacity of the containment sump in which it resides.

The concentrator perimeter will be enclosed by curbing to prevent migration of process solutions away from the concentrator building. Unless specified below, general containment curbing at the perimeter of the concentrator will be at least 4 inches tall.

4.1.1 Crushing Area

The Crusher Area (Dwg. 0000-CI-008) does not contain any tanks. The crusher takes large blocks of ore recovered from the mine pit and crushes it to sizes that can be efficiently handled in the grinding area. Crushing is a dry process, but the crusher dump pocket is open to precipitation. Water is used in the crusher to suppress dust during the transfer of crushed ore to the conveying system to feed the Coarse Ore Stockpile. Water is used to wash down areas within the crusher that accumulate dust and dirt. Precipitation and the moisture content of the ore also contribute minor amounts of water that will collect at the bottom of the crusher structure.

A collection sump located in the lowest level of the concrete crusher facility collects water within the primary crusher and pump it to the Coarse Ore Reclaim Tunnel sump using a dedicated sump pump. The sump has a capacity of approximately 560 gallons. The sump pump will be configured for automatic start when solution is detected and the capacity of the crusher sump is appropriate for the potential solution flows.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Crushing Area				
No Storage Tanks	na	na	na	na
		Containment Volume (gallons)	560	

4.1.2 Coarse Ore Stockpile and Ore Reclaim Tunnel Area

The Coarse Ore Stockpile and Reclaim Tunnel Area (Dwg. 0000-CI-008) does not contain any tanks. The Coarse Ore Stockpile accumulates crushed ore for delivery to the grinding area of the concentrator for processing. An existing concrete Reclaim Tunnel lies beneath this area and will be used to recover crushed ore at a controllable rate to supply feed to the grinding circuit. Process water and fresh water piping to the Concentrator pass through the Reclaim Tunnel.

Water used for wash down and dust suppression, as well as the water pumped from Crusher sump, drains to a sump in the bottom of the Reclaim Tunnel. Process water or fresh water solution coming from piping in the tunnel and moisture from precipitation or excess water contained in the crushed ore will drain to the Reclaim Tunnel sump.

A dedicated sump pump will be used to transfer collected water from the Reclaim Tunnel sump to the concentrator through the Primary Cyclone Feed system. The Reclaim Tunnel Sump has a capacity of approximately 6,400 gallons. The sump pump will be configured for automatic start when solution is detected and the capacity of the Reclaim Tunnel sump is appropriate for the potential solution flows. The installed pumping capacity will be sufficient to evacuate the sump at a flow rate equal to the rate that may be generated by a broken water line.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Reclaim Tunnel Area				
No Storage Tanks	na	na	na	na
		Containment Volume (gallons)	6,400	

4.1.3 Grinding Area

A conveyor from the Reclaim Tunnel delivers crushed ore to the semi-autogenous grinding (SAG) mill. Water is added to the SAG mill to begin the grinding process. Discharge from the SAG mill is pumped to the Primary Cyclone classifiers in closed circuit with the Ball Mill. The slurry is circulated through the Ball Mill until the particles are fine enough to flow out of the top of the cyclones and on the Rougher Flotation Conditioning Tank. A portion of the circulating slurry will go through a gravity concentration circuit to recover separable gold prior to fine grinding.

The only tank in the Grinding Area (Dwg. 0000-GA-050) is the Gravity Concentrate Tank. This tank accumulates concentrate from gravity gold separation and will typically be filled with 8,000 gallons of wet solids. The Grinding Area containment volume is 200,000 gallons. The large containment volume in this area is not based on required capacity but rather results from requirements for setup and configuration of the grinding equipment. Therefore, the resulting containment capacity is more than adequate to contain the contents of the gravity concentrate tank and any operating upsets or maintenance conditions that may occur in the grinding circuit or elsewhere in the concentrator area.

All leakage or spillage of liquids or water used to wash down equipment and floors in this area reports to the Grinding Area Containment sump. The sump is equipped with a dedicated pump and automatic start/stop controls. Liquids accumulated in this sump are pumped back into the Primary Cyclone Feed system.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Grinding Area Containment				
Gravity Concentrate Tank	12.00	9.50	8,000	Carbon Steel
		Containment Volume (gallons)	200,000	

4.1.4 Copper Flotation Area

Copper Flotation (Dwg. 0000-GA-050) includes the Rougher Conditioning Tank, rougher flotation cells, and other equipment to recover the sulfide minerals in the process slurry. The floor in the Copper Flotation area is sloped to facilitate gravity flow from one flotation cell to the next.

The floor slopes are directed to the Copper Flotation Area sump. Solutions accumulated in the Copper Flotation Area sump are returned to the Rougher Flotation Conditioning Tank. The sump is equipped with a dedicated pump and automatic start/stop control.

The largest tank the Copper Flotation Area is the Rougher Flotation Conditioning Tank with a capacity of 69,300 gallons, which requires a containment capacity of approximately 76,200 gallons at 110% of capacity. The net containment volume in the Copper Flotation Area is 79,000 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Copper Flotation Area Containment				
Rougher Flotation Conditioning Tank	22.00	25.00	69,300	Carbon Steel
		Containment Volume (gallons)	79,000	

4.1.5 Copper-Molybdenum Thickening Area

The Copper-molybdenum (Copper-Moly) Thickening Area (Dwg. 0000-GA-050) recovers water from the rougher flotation concentrate in preparation for separating the moly into a saleable product. The area includes the flocculant mixing and distribution system, Copper-Moly thickener, and Copper-Moly thickener overflow tank.

The floor slopes are directed to the Copper-Moly Thickening Area sump. Solutions accumulated in the Copper-Moly Thickening Area sump are returned to the Copper-Moly Separation Conditioning Tank. The sump is equipped with a dedicated pump and automatic start/stop control.

The largest vessel is the Copper-Moly Concentrate Thickener at a capacity of 17,700 gallons., which requires a containment capacity of approximately 19,500 gallons at 110% of capacity. The designed containment volume is 29,000 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Copper-Moly Thickening Area Containment				
Flocculant Mix Tank	12.00	7.25	6,100	Carbon Steel
Flocculant Distribution Tank	12.00	7.25	6,100	Carbon Steel
Copper-Moly Concentrate Thickener	20.00	7.50	17,700	Carbon Steel
Copper-Moly Concentrate Thickener Overflow Tank	4.00	10.67	1,000	Carbon Steel
		Containment Volume (gallons)	29,000	

4.1.6 Molybdenum Flotation Area

Molybdenum (Moly) Flotation (Dwg. 0000-GA-050) separates the moly from the copper concentrate and refines it through a series of flotation and cleaning steps into a saleable product that is filtered, dried, and bagged for shipment to the buyer. The area includes the copper-moly separation conditioning tank, moly filter feed tank, and moly filter cloth wash tank.

The floor slopes are directed to the Moly Flotation Area sump. Solutions accumulated in the Moly Flotation Area sump are returned to the Copper-Moly Separation Conditioning Tank. The sump is equipped with a dedicated pump and automatic start/stop control.

The largest vessel is the Moly Filter Feed Tank at a capacity of 2,000 gallons., which requires a containment capacity of approximately 2,200 gallons at 110% of capacity. The designed containment volume is 8,300 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Moly Flotation Area Containment				
Copper-Moly Separation Conditioning Tank	4.00	10.67	1,000	Carbon Steel
Moly Filter Cloth Wash Tank	4.00	6.00	560	Carbon Steel
Moly Filter Feed Tank	8.00	6.00	2,000	Carbon Steel

Containment Volume (gallons)	8,300

4.1.7 Copper Thickening Area

The Copper Thickening Area (Dwg. 0000-GA-050) receives the copper concentrate from the moly flotation circuit and dewaters it in preparation for filtration to make a shippable concentrate. The area includes a stock tank for storage of thickened concentrates to act as surge capacity for production. Copper Filtrate tanks receive water recovered from the filters for recycling through the thickener.

The floor slopes are directed to the Copper Thickening Area sump. Solutions accumulated in the Copper Thickening Area sump are returned to the Copper Thickener feed box. The sump is equipped with a dedicated pump and automatic start/stop control.

The largest vessel is the Copper Concentrate Stock Tank at a capacity of 41,760 gallons., which requires a containment capacity of approximately 46,000 gallons at 110% of capacity. The designed containment volume is 50,000 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Copper Thickening Area Containment				
Copper Concentrate Thickener Overflow Tank	4.00	4.00	375	Carbon Steel
Copper Concentrate Stock Tank	17.00	25.00	41,760	Carbon Steel
Copper Filtrate Tank	4.00	4.00	375	Carbon Steel
Copper Filtrate Tank	4.00	4.00	375	Carbon Steel
Copper Concentrate Filter Cloth Wash Tank	4.00	6.00	560	Carbon Steel
Containment Volume (gallons)			50,000	

4.1.8 Copper Filtration Area

The Copper Filtration Area (Dwg. 0000-GA-050) does not contain any tanks. Thickened copper concentrate from the stock tank is pumped to a pair of plate-and-frame filters that produce a filter cake suitable for bulk shipment. The water recovered from the filters returns to the copper thickener via the Copper Filtrate Tanks that are located with the thickener. The filter cake drops to the floor in the Concentrate Loadout area and is loaded into concentrate trailers for shipment offsite.

The floor slopes are directed to the Copper Loadout Area sump. Solutions accumulated in the Copper Loadout Area sump are returned to the Copper Thickener feed box. The sump is equipped with a dedicated pump and automatic start/stop control.

The designed containment in the Copper Filtration Area is approximately 25,000 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Copper Filtration and Concentrate Loadout Area Containment				

No Storage Tanks	na	na	na	na
		Containment Volume (gallons)	25,000	

4.1.9 Wheel Wash Area

The Wheel Wash Area (Dwg. 0000-GA-050) consists of the wheel wash tank and pump area and a concrete containment area in which the wheels of the concentrate trucks are washed to remove adhering copper concentrates before driving off onto the site roads.

The floor slopes are directed to the Wheel Wash Area sump. Solutions accumulated in the Wheel Wash Area sump are returned to the Copper Thickener feed box. The sump is equipped with a dedicated pump and automatic start/stop control.

The largest vessel is the Wheel Wash Surge Tank at a capacity of 560 gallons., which requires a containment capacity of approximately 620 gallons at 110% of capacity. The designed containment volume is 15,000 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Wheel Wash Area Containment				
Wheel Wash Surge Tank	4.00	6.00	560	Carbon Steel
		Containment Volume (gallons)	15,000	

4.1.10 Reagents Area

The Reagents Area (Dwg. 0000-GA-050) includes equipment and storage tanks to contain reagents used in the process. This area is configured into four separate containments to separate and manage Lime Reagent, Diesel Reagent, Flotation Reagent, and Sodium Hydrosulfide (NaHS) Reagent.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Concentrator: Lime Reagent Containment				
Milk of Lime	12.00	23.67	20,000	Carbon Steel
Milk of Lime	12.00	23.67	20,000	Carbon Steel
		Containment Volume (gallons)	30,000	
Concentrator: Diesel Reagent Containment				
No. 2 Diesel Storage Tank	8.00	6.00	2,000	Carbon Steel
		Containment Volume (gallons)	4,800	
Concentrator: Flotation Reagent Containment				

Pax Mix Tank	8.00	10.67	4,000	Carbon Steel
Pax Distribution Tank	8.00	10.67	4,000	Carbon Steel
MIBC Storage Tank	8.00	6.00	2,000	Carbon Steel
AERO 238 Mix Tank	8.00	10.67	4,000	Carbon Steel
AERO 238 Distribution Tank	8.00	10.67	4,000	Carbon Steel
Moly Collector Mix Tank	8.00	6.00	2,300	Carbon Steel
Moly Collector Distribution Tank	8.00	6.00	2,300	Carbon Steel
		Containment Volume (gallons)	10,200	
Concentrator: Sodium Hydrosulfide Reagent Containment				
NaHS Mix Tank	8.00	10.67	4,000	Stainless Steel
NaHS Distribution Tank	8.00	10.67	4,000	Stainless Steel
NaHS Stock Tank	8.00	10.67	4,000	Stainless Steel
		Containment Volume (gallons)	4,900	

4.1.10.1 Lime Reagent Area

The Lime Reagent Area (Dwg. 0000-GA-050) consists of a Lime Silo, Lime Slaker, and Milk of Lime tanks to receive pebble lime from the supplier and convert it to a lime slurry that can be used to raise the pH of process solutions.

The floor slopes are directed to the Lime Reagent Area sump. Solutions accumulated in the Lime Reagent Area sump are returned to the milk of lime distribution box. The containment will be inspected on a regular basis per regulatory requirements and solutions evacuated immediately as observed and the source will be investigated and addressed. Solutions will be evacuated from the containment using a portable pump.

The largest vessels are the Milk of Lime Tanks at a capacity of 20,000 gallons., which requires a containment capacity of approximately 22,000 gallons at 110% of capacity. The designed containment volume is 30,000 gallons.

4.1.10.2 Diesel Containment Area

Diesel fuel is used as a reagent in the flotation process. It is stored in the Diesel Tank in the Diesel Containment (Dwg. 0000-GA-050) and has its own containment area and sump.

The floor slopes are directed to the Diesel Containment Area sump. Leaked or spilled diesel fuel accumulating in the sump is pumped out using a portable pump and deposited in the Used Oil Storage Tank (Sec. 4.2). The containment will be inspected on a regular basis per regulatory requirements and solutions evacuated as soon as observed, and the source will be investigated and addressed.

The Diesel Containment Tank has a capacity of 2,000 gallons., which requires a containment capacity of approximately 2,200 gallons. The designed containment volume is 4,800 gallons.

4.1.10.3 Flotation Reagent Area

The Flotation (General) Reagents Area contains tanks with compatible aqueous reagents that are used in the process.

The floor slopes are directed to the Flotation Reagent Area sump. Solutions accumulating in the sump are pumped to the tailings box to be combined with tailings and report to the TSF. The containment will be inspected on a regular basis per regulatory requirement and solutions evacuated immediately as observed and the source will be investigated and addressed. The sump is equipped with a dedicated pump and manual start/stop control.

The largest vessels are the Aero 238 Tanks at a capacity of 4,000 gallons., which requires a containment capacity of approximately 4,400 gallons. The designed containment volume is 10,200 gallons.

4.2 TRUCK SHOP

The Truck Shop is located south east of the concentrator (Dwg. 0000-CI-008) and provides maintenance services for the mining and mobile equipment fleet. Tanks will be constructed at the truck shop (Dwg. 1010-AR-012) to store required maintenance fluids such as: motor oil, gear oil, hydraulic oil, engine coolant, and used oil and coolant for recycling.

The floor slopes are directed to the Truck Shop Tank Farm Area sump. Leaked or spilled diesel fuel accumulating in the sump is pumped out using a portable pump and deposited in the Used Oil Storage Tank for recycling. The containment will be inspected on a regular basis per regulatory requirement and solutions evacuated immediately as observed and the source will be investigated and addressed. Solutions will be evacuated from the containment using a portable pump.

The Used Oil Storage Tank has a capacity of 2,000 gallons., which requires a containment capacity of approximately 2,200 gallons. The designed containment volume is 5,600 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Truck Shop Tank Farm Containment				
Used Oil Storage Tank	8.00	6.00	2,000	Carbon Steel
Used Anti-Freeze Storage Tank	8.00	6.00	2,000	Carbon Steel
ATF Fluid Storage Tank	6.00	6.00	1,000	Carbon Steel
Hydraulic Fluid Storage Tank	6.00	6.00	1,000	Carbon Steel
Engine Oil Storage Tank	6.00	6.00	1,000	Carbon Steel
Gear Oil Storage Tank	6.00	6.00	1,000	Carbon Steel
Anti-Freeze/Coolant Storage Tank	6.00	6.00	1,000	Carbon Steel
Containment Volume (gallons)			5,600	

4.3 FUEL STATION

A Fuel Station with secondary containment for project vehicles will be constructed on the haulage road west of the concentrator (Dwg. 0000-CI-008). Tanks, pumps, and piping associated with the fuel station will be positioned inside the containment facility (Dwg. 1010-GA-010). During fueling and fuel offloading operations, vehicles and equipment will be parked on concrete pads that are sloped to drain into solution containment sumps. Liquid from the sumps will be evacuated into a portable used oil tank for transfer to the used oil holding facility for recycling.

The floor slopes at the fueling areas and within the tank containment are directed to the Fuel Station Area sumps. Solutions accumulated in the Fuel Station Area sumps are pumped out and transported offsite by a Certified used oil recycler. The containment will be inspected on a regular basis per regulatory requirement and solutions evacuated immediately as observed and the source will be investigated and addressed. Solutions will be evacuated from the containment using a portable pump.

The largest vessel is the Off Road Diesel Fuel Storage Tank at a capacity of 100,000 gallons., which requires a containment capacity of approximately 110,000 gallons at 110% of capacity. The designed containment volume is 119,000 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Fuel Station Containment				
Off Road Diesel Fuel Storage Tank	28.00	24.00	100,000	Carbon Steel
On Road Diesel Storage Tank	12.00	12.00	10,000	Carbon Steel
Gasoline Storage Tank	12.00	12.00	10,000	Carbon Steel
Urea Tank	4.00	6.00	560	Carbon Steel
Urea Tank	4.00	6.00	560	Carbon Steel
		Containment Volume (gallons)	119,000	

4.4 TRUCK AND EQUIPMENT WASHING UNIT

A Truck and Equipment Washing Unit (Truck Wash) will be constructed along the haulage road from the mine to the Truck Shop (Dwg. 0000-CI-008). This facility is designed in accordance with 20.6.7.26 NMAC. The washing unit includes a concrete pad on which equipment will be parked for washing (Dwg. 1010-GA-001). The pad will be sloped to drain into a concrete basin for separating water, solids, oil, and grease. The water from the basin will be recycled and reused for washing equipment. Oil and grease will be skimmed from the settling basin and stored in sealed drums for proper disposal. After draining, sediment will be removed from the basin and either loaded directly into a dump truck for disposal at tailings or stored on a concrete pad adjacent to the facility for re-handling and disposal at the TSF. The settling basin will be designed to provide at least 12 inches of freeboard during operation. During periods of precipitation, excess water will be removed from the settling basin by a water truck and transported to the a process water impoundment for reuse.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Equipment Wash Pad				
Settling Basin	40' W x 50' L x 3' D		50,000	Concrete
		Containment Volume (gallons)	50,000	

4.5 ASSAY LABORATORY

The Assay Laboratory (Dwg. 0000-CI-008) uses a variety of reagents for sample process and analytical testing of mine and process samples. Sinks and drains in areas with potential chemical use are piped to a below-ground holding tank (Dwg. 3010-AR-003) so that they are not commingled with sanitary wastes from the building's restrooms and breakroom area. The chemical holding tank will be installed in a concrete, water tight vault as secondary containment.

The floor slopes in the Assay Lab Chemical Waste tank containment are directed to a collection sump. Solutions accumulated in the Assay Lab Chemical Waste sump are pumped out and taken to the TSF or transferred to a portable tank and removed from site by a certified disposal contractor. The containment will be inspected on a regular basis and solutions evacuated immediately as observed and the source will be investigated and addressed. Solutions will be evacuated from the containment using a portable pump.

The only vessel is the Chemical Waste Tank at a capacity of 1,200 gallons., which requires a containment capacity of approximately 1,300 gallons at 110% of capacity. The designed containment volume is 7,500 gallons.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Assay Laboratory				
Assay Lab Chemical Waste Tank	4.00	14.00	1,200	Polypropylene
		Containment Volume (gallons)	7,700	

4.6 DOMESTIC WASTEWATER TREATMENT FACILITY

A packaged wastewater treatment facility (WWTF) for treatment of domestic sanitary will be installed on an existing concrete slab located near the Guardhouse at the main entrance (Dwg. 0000-CI-008). Concrete, water tight curbing will be installed at the perimeter of the foundation slab to provide a minimum volume of 5,000 gallons of secondary containment for the facility. The containment will be inspected on a regular basis and solutions evacuated immediately as observed and the source will be investigated and addressed. Solutions will be evacuated from the containment using a portable pump.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Sanitary Wastewater Treatment Facility				
Sewage Treatment Equalization Tank	9.60	8.00	4,300	Carbon Steel
Sewage Treatment Treatment Tank	9.60	8.00	4,300	Carbon Steel
Sewage Treatment Solids Holding Tank	9.60	8.00	4,300	Carbon Steel
		Containment Volume (gallons)	5,000	

4.7 PROCESS WATER STORAGE TANK

Process water from the Process Water Reservoir will be pumped to the Process Water Storage Tank (Dwg. 0000-CI-008) on the slopes of Animas Peak to provide consistent line pressure using gravity head to supply water for use in the process. The tank will be installed within a lined earthen basin with a secondary containment capacity of at least 190,000 gallons, plus 2 feet of freeboard. The containment basin will be lined with 60 mil HDPE liner or equivalent. The containment will be inspected on a regular basis and solutions evacuated immediately as observed and the source will be investigated and addressed. Solutions will be evacuated from the containment using a portable pump. Any water collecting in the basin will be pumped out within 30 days and deposited in the Process Water Reservoir.

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gallons)	TANK MATERIAL
Miscellaneous Site				
Process Water Head Tank	30.00	32.00	170,000	Carbon Steel

TABLES

Table 1: List of Tanks and Process Solution Containment Areas

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gal)	TANK MATERIAL
Concentrator: Grinding Area Containment				
Gravity Concentrator Concentrate Tank	12.00	9.50	8,000	Carbon Steel
		Containment Volume (gal)	200,000	
Concentrator: Copper Flotation Area Containment				
Rougher Flotation Conditioning Tank	22.00	25.00	69,300	Carbon Steel
		Containment Volume (gal)	79,000	
Concentrator: Copper Regrind Area Containment				
Copper 1st Cleaner Conditioning Tank	12.00	7.25	6,000	Carbon Steel
		Containment Volume (gal)	8,900	
Concentrator: Moly Flotation Area Containment				
Cu-Mo Separation Conditioning Tank	4.00	10.67	1,000	Carbon Steel
Moly Filter Cloth Wash Tank	4.00	6.00	560	Carbon Steel
Moly Filter Feed Tank	8.00	6.00	2,000	Carbon Steel
		Containment Volume (gal)	8,300	
Concentrator: Copper-Moly Thickening Area Containment				
Flocculant Mix Tank	12.00	7.25	6,100	Carbon Steel
Flocculant Distribution Tank	12.00	7.25	6,100	Carbon Steel
Cu-Mo Concentrate Thickener	20.00	7.50	17,700	Carbon Steel
Cu-Mo Concentrate Thickener Overflow Tank	4.00	10.67	1,000	Carbon Steel
		Containment Volume (gal)	13,000	
Concentrator: Copper Thickening Area Containment				
Cu-Mo Concentrate Thickener	20.00	7.50	17,700	Carbon Steel
Cu Concentrate Thickener Overflow Tank	4.00	4.00	375	Carbon Steel
Cu Concentrate Stock Tank	17.00	25.00	41,760	Carbon Steel
Copper Filtrate Tank	4.00	4.00	375	Carbon Steel
Copper Filtrate Tank	4.00	4.00	375	Carbon Steel
Cu Concentrate Filter Cloth Wash Tank	4.00	6.00	560	Carbon Steel
		Containment Volume (gal)	50,000	
Concentrator: CopperFiltration and Concentrate Loadout Area Containment				
No Storage Tanks				
		Containment Volume (gal)	25,000	

Table 1: List of Tanks and Process Solution Containment Areas

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gal)	TANK MATERIAL
Concentrator: Copper Filtration Wheel Wash Area Containment				
Wheel Wash Surge Tank	4.00	6.00	560	Carbon Steel
		Containment Volume (gal)	15,000	
Concentrator: Lime Reagent Containment				
Milk of Lime	12.00	23.67	20,000	Carbon Steel
Milk of Lime	12.00	23.67	20,000	Carbon Steel
		Containment Volume (gal)	30,000	
Concentrator: Diesel Reagent Containment				
No. 2 Diesel Storage Tank	8.00	6.00	2,000	Carbon Steel
		Containment Volume (gal)	4,800	
Concentrator: General Reagent Containment				
Pax Mix Tank	8.00	10.67	4,000	Carbon Steel
Pax Distribution Tank	8.00	10.67	4,000	Carbon Steel
MIBC Storage Tank	8.00	6.00	2,000	Carbon Steel
AERO 238 Mix Tank	8.00	10.67	4,000	Carbon Steel
AERO 238 Distribution Tank	8.00	10.67	4,000	Carbon Steel
Moly Collector Mix Tank	8.00	6.00	2,300	Carbon Steel
Moly Collector Distribution Tank	8.00	6.00	2,300	Carbon Steel
		Containment Volume (gal)	10,200	
Concentrator: Sodium Hydrosulfide Reagent Containment				
NaHS Mix Tank	8.00	10.67	4,000	Stainless Steel
NaHS Distribution Tank	8.00	10.67	4,000	Stainless Steel
NaHS Stock Tank	8.00	10.67	4,000	Stainless Steel
		Containment Volume (gal)	4,900	

Table 1: List of Tanks and Process Solution Containment Areas

TANK DESCRIPTION	TANK DIAMETER (ft)	TANK HEIGHT (ft)	TANK VOLUME (gal)	TANK MATERIAL
Truck Shop Tank Farm Containment				
Used Oil Storage Tank	8.00	6.00	2,000	Carbon Steel
Used Anti-Freeze Storage Tank	8.00	6.00	2,000	Carbon Steel
ATF Fluid Storage Tank	6.00	6.00	1,000	Carbon Steel
Hydraulic Fluid Storage Tank	6.00	6.00	1,000	Carbon Steel
Engine Oil Storage Tank	6.00	6.00	1,000	Carbon Steel
Gear Oil Storage Tank	6.00	6.00	1,000	Carbon Steel
Anti-Freeze/Coolant Storage Tank	6.00	6.00	1,000	Carbon Steel
		Containment Volume (gal)	5,600	
Fuel Station Containment				
Off Road Diesel Fuel Storage Tank	28.00	24.00	100,000	Carbon Steel
On Road Diesel Storage Tank	12.00	12.00	10,000	Carbon Steel
Gasoline Storage Tank	12.00	12.00	10,000	Carbon Steel
Urea Tank	4.00	6.00	560	Carbon Steel
Urea Tank	4.00	6.00	560	Carbon Steel
		Containment Volume (gal)	119,000	
Equipment Wash Pad				
Settling Basin	40' W x 50' L x 3' D		50,000	Concrete
		Containment Volume (gal)	50,000	
Miscellaneous Site				
Process Water Head Tank	30.00	32.00	170,000	Carbon Steel
Assay Lab Chemical Waste Tank	4.00	14.00	1,200	Polypropylene
Sewage Treatment Equalization Tank	9.60	8.00	4,300	Carbon Steel
Sewage Treatment Treatment Tank	9.60	8.00	4,300	Carbon Steel
Sewage Treatment Solids Holding Tank	9.60	8.00	4,300	Carbon Steel

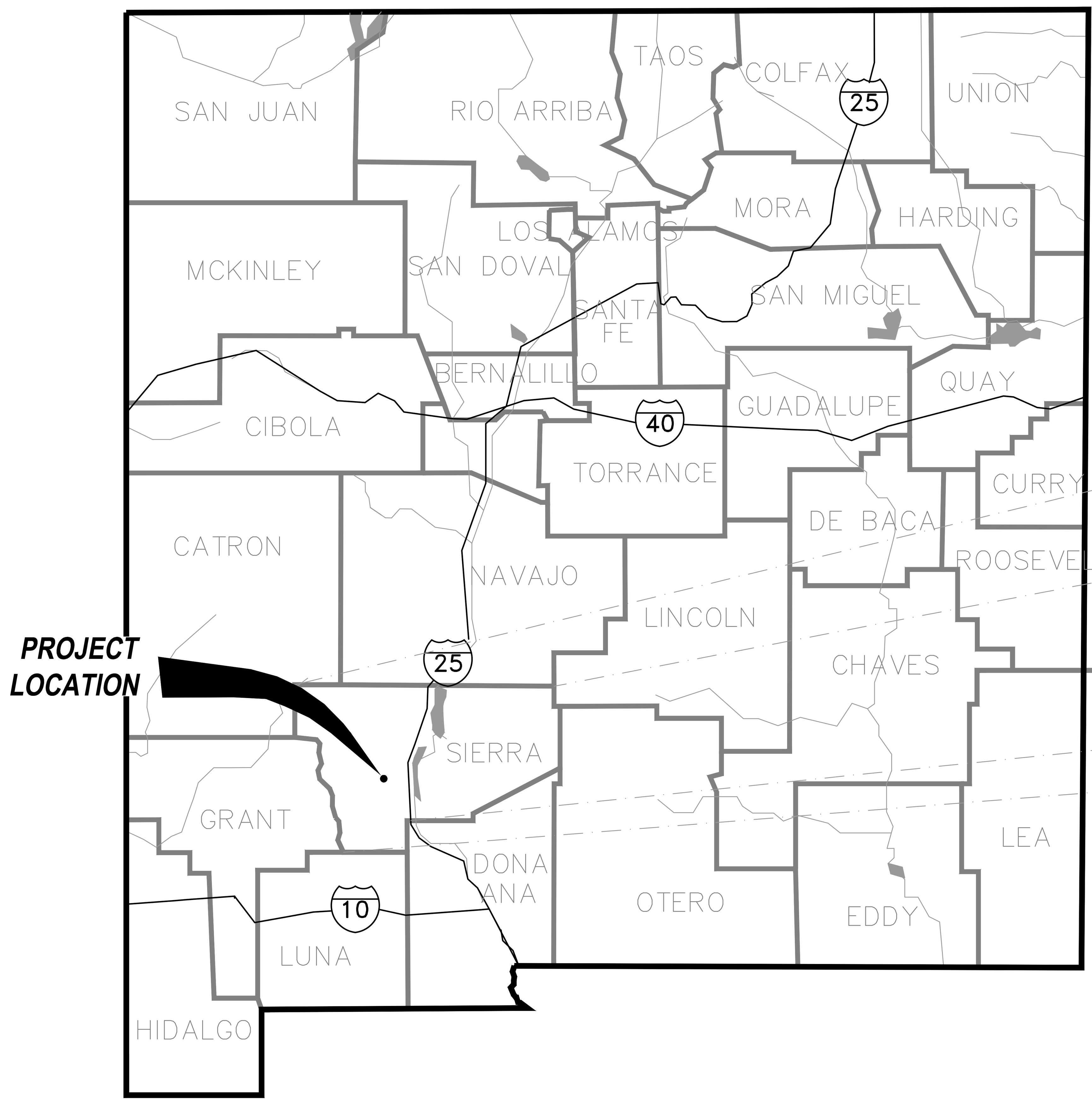
Table 2: Containment and Cleanout Sumps

Location	Reports To
Crusher	Recalim Tunnel Sump
Reclaim Tunnel	Primary Cyclone Feed System
Grinding Area	Primary Cyclone Feed System
Copper Flotation Area	Rougher Flotaiton Conditioning Tank
Copper Regrind Area	Copper Regrind Cyclone Feed Box
Mo Flotation Area	Copper-Molybdenum Separation Conditioning Tank
Copper-Molybdenum Thickening Area	Copper-Molybdenum Thickener
Copper Thickening Area	Copper Concentrate Thickener
Copper Filtration and Concentrate Loadout Area	Copper Concentrate Thickener
Copper Filtration Wheel Wash Area	Copper Concentrate Thickener
Lime Containment Area	Lime Distribution Box
Diesel Reagent Containment Area	Used Oil Tank
General Reagent Containment Area	Tailings Sump
Sodium Hydrosulfide Reagent Containment Area	Copper-Molybdenum Separation Conditioning Tank
Mobile Equipment Shop Containment	Certified Used Oil Recycler
Fuel Station Containment	Certified Used Oil Recycler
Heavy Equipment Fuel Pad	Certified Used Oil Recycler
Light Vehicle Fuel/Fuel Offload Pad	Certified Used Oil Recycler
Equipment Wash Pad Settling Basin	Closed Basin; Zero Discharge
Process Water Head Tank Containment	Process Water Reservoir
Sewage Treatment Plant	Sewage Treatment Plant or Sanitary Waste Disposal Contractor
Chemical Waste Containment	TSF or Certified Contractor Disposal

DRAWINGS

NEW MEXICO COPPER CORPORATION

COPPER FLAT PROJECT
SIERRA COUNTY, NEW MEXICO



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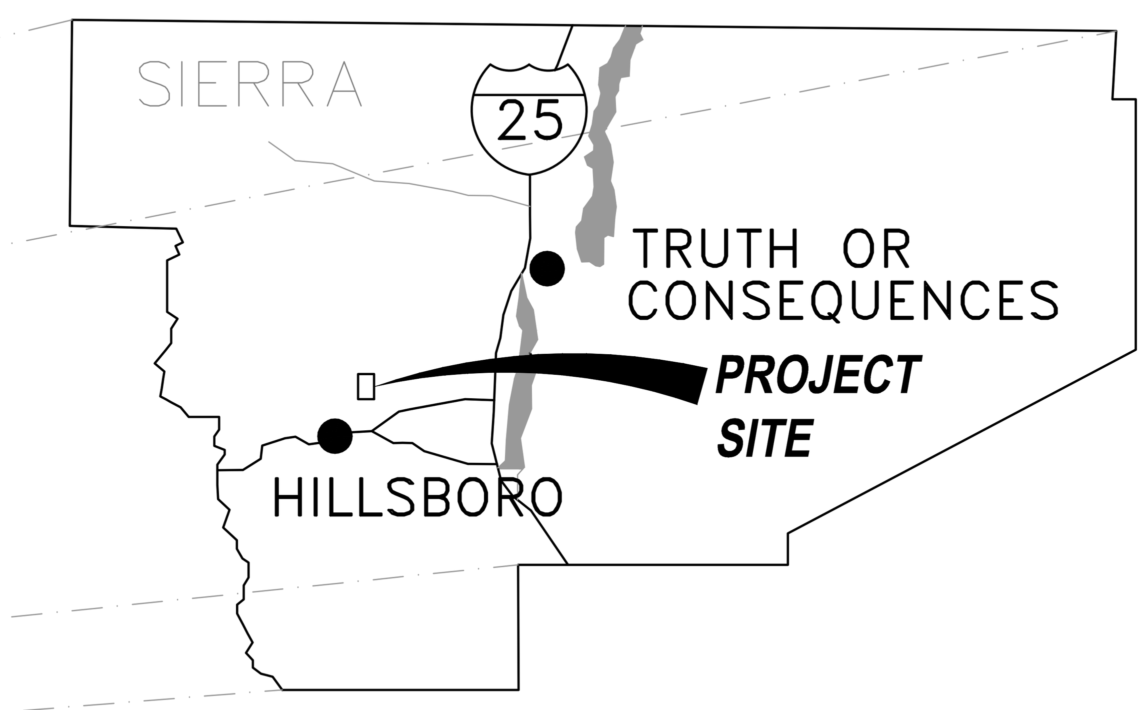

PROJECT LOCATION MAP
NOT TO SCALE

PRELIMINARY
FOR AGENCY REVIEW

DO NOT SCALE 11x17 DRAWINGS

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DRAWN BY	SAM	DEC12
CHECKED BY	TDL	JAN13
PROJECT MGR	RKZ	
CLIENT APPR.		

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THE MAC RESOURCES

COPPER FLAT PROJECT

SITE GENERAL
CIVIL
PROJECT AREA
SITE LOCATION PLAN

JOB NO. M3 PN-120085
DWG NO. **0000-CI-001**
REV NO. P4
DATE 05 MAR 13

16802

SITE PLAN
SCALE: 1:150

150 75 0 150 300
SCALE IN FEET
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FOR AGENCY REVIEW

THEMAC RESOURCES

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DRAWN BY	SAM	FEB 13
CHECKED BY	TDL	FEB 13
PROJECT MGR	RKZ	FEB 13
CLIENT APPR.		

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COPPER FLAT PROJECT

SITE GENERAL
CIVIL
PROJECT AREA
PROCESS FACILITY CONTAINMENT AREAS

JOB NO. M3 PN-120085
DWG NO. **0000-CI-008**
REV NO. p1
DATE 25 NOV 15

16803

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES	
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DRAWN BY	FC	JUL 11
CHECKED BY		
PROJECT MGR		
CLIENT APPR.		

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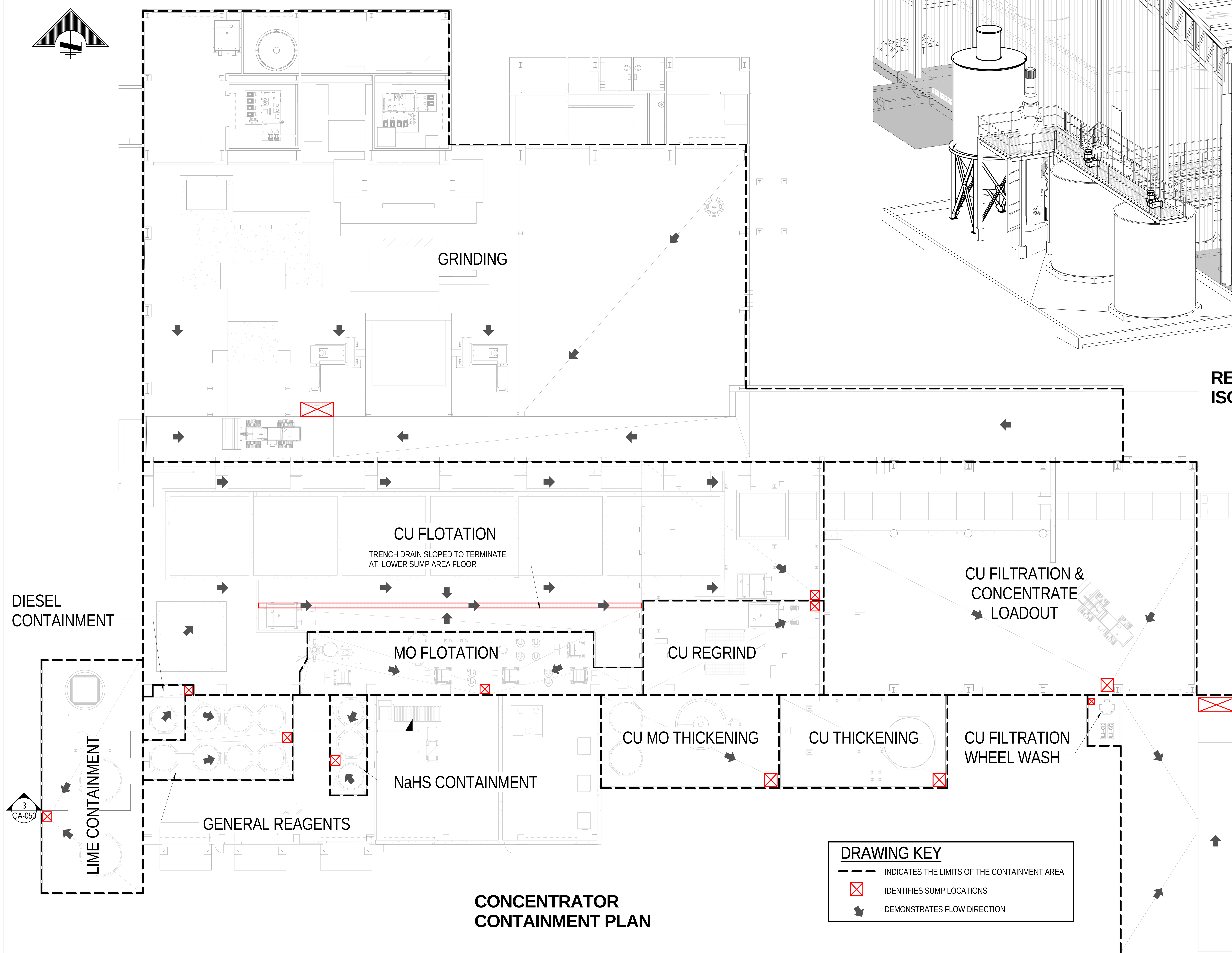
COPPER FLAT PROJECT

PROCESSING PLANT 30,000 TPD CONVENTIONAL TAILINGS OVERALL FLOW SHEET

JOB NO. M3 PN-120085
DWG NO. **3000-FS-000**
REV NO. P6
DATE 18 MAR 13

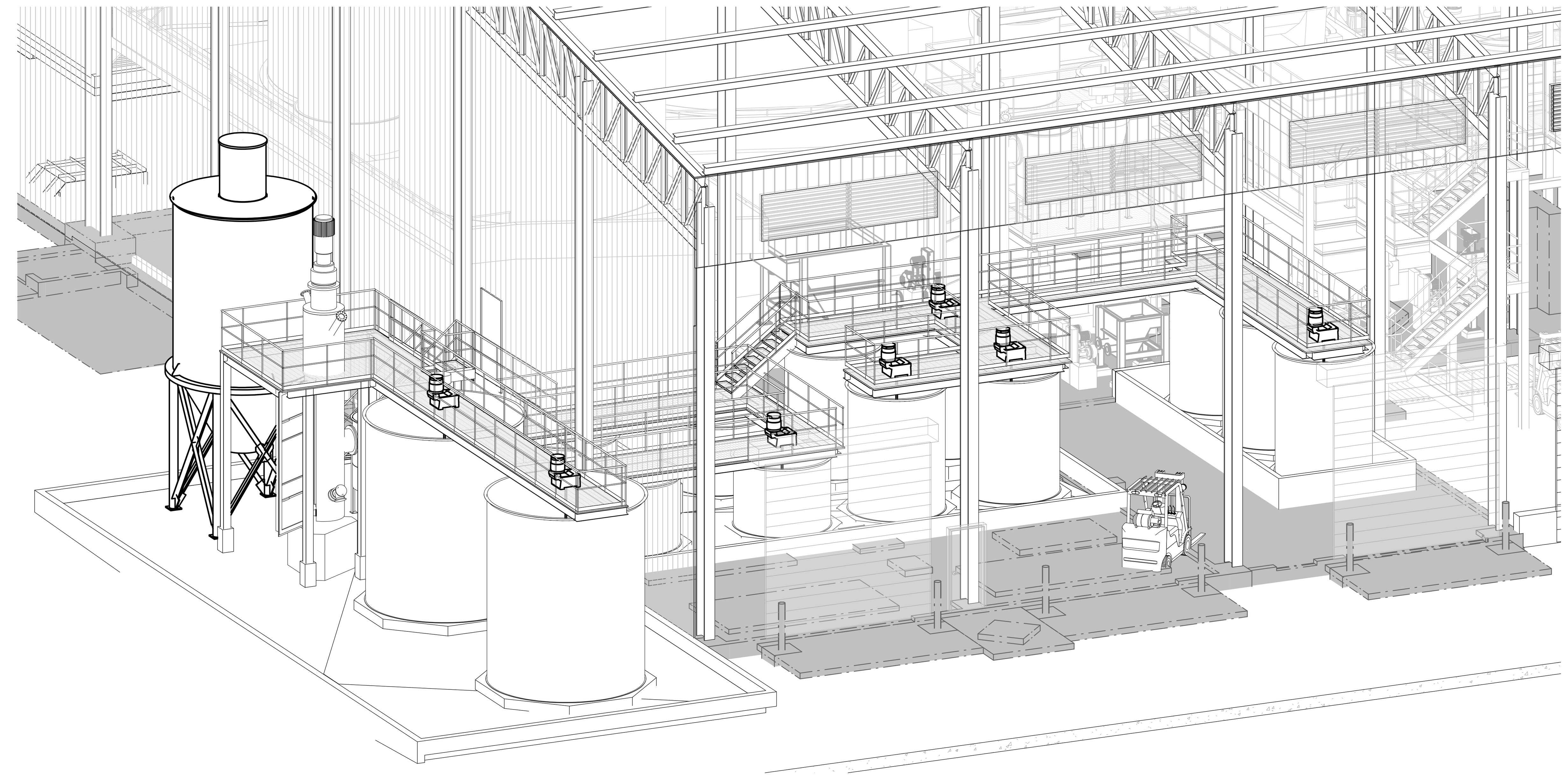
16804



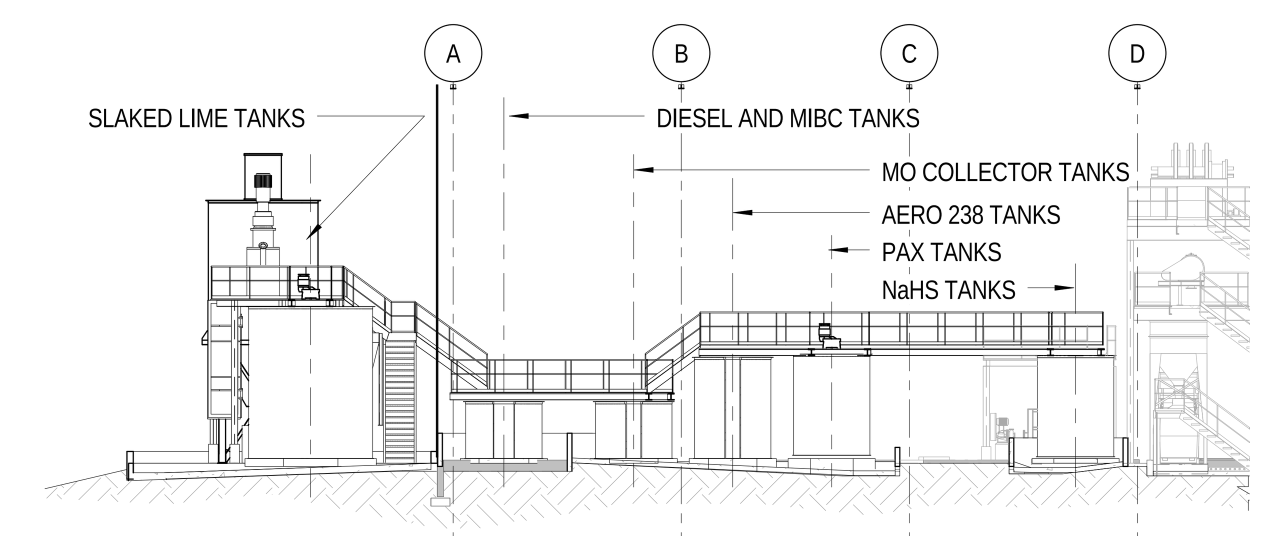
CONCENTRATOR CONTAINMENT PLAN

DRAWING KEY

- INDICATES THE LIMITS OF THE CONTAINMENT AREA
- IDENTIFIES SUMP LOCATIONS
- DEMONSTRATES FLOW DIRECTION



REAGENTS AREA ISOMETRIC



REAGENTS SECTION

3 GA-050

SCALE: 1/16" = 1'-0"

Containment Area	Tank Name	Tank Volume (gal)	Containment Volume Required (gal)	Containment Volume Provided (gal)
General Reagents	PAX Mix Tank*	4,000	4,400	10,200
	PAX DistributionTank	4,000		
	MIBC Storage Tank	2,000		
	Moly Collector Mix Tank	2,300		
	Moly Collector Distribution Tank	2,300		
	AERO 238 Mix Tank	4,000		
	AERO 238 Distribution Tank	4,000		
Diesel Containment	No. 2 Diesel Storage Tank*	2,000	2,200	4,800
Lime Containment	Milk of Lime Storage Tank*	20,000	22,000	30,000
	Milk of Lime Storage Tank	20,000		
NaHS Containment	NaHS Distribution Tank*	4,000	4,400	4,900
	NaHS Mix Tank	4,000		
	NaHS Stock Tank	4,000		
Cu Flotation	Rougher Flotation Tank*	66,000	72,600	79,000
Cu Regrind	Cu 1st Cleaner Conditioning Tank*	1,000	1,100	8,900
Mo Flotation	Filter Feed Tank*	2,000	2,200	8,300
Cu Thickening	Cu Concentrate Stock Tank*	41,800	46,000	50,000
Cu-Mo Thickening	Cu-Mo Concentrate Thickener*	17,700	19,500	29,000
Cu Filtration-Wheel Wash	Wheel Wash Surge Tank*	560	620	750

* - Denotes largest tank in containment area

PRELIMINARY
NOT FOR CONSTRUCTION

THEMAC RESOURCES

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DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

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DESIGNED BY	AF	NOV 15
DRAWN BY	AF	NOV 15
CHECKED BY	AF	NOV 15
PROJECT MGR		
CLIENT APPR		

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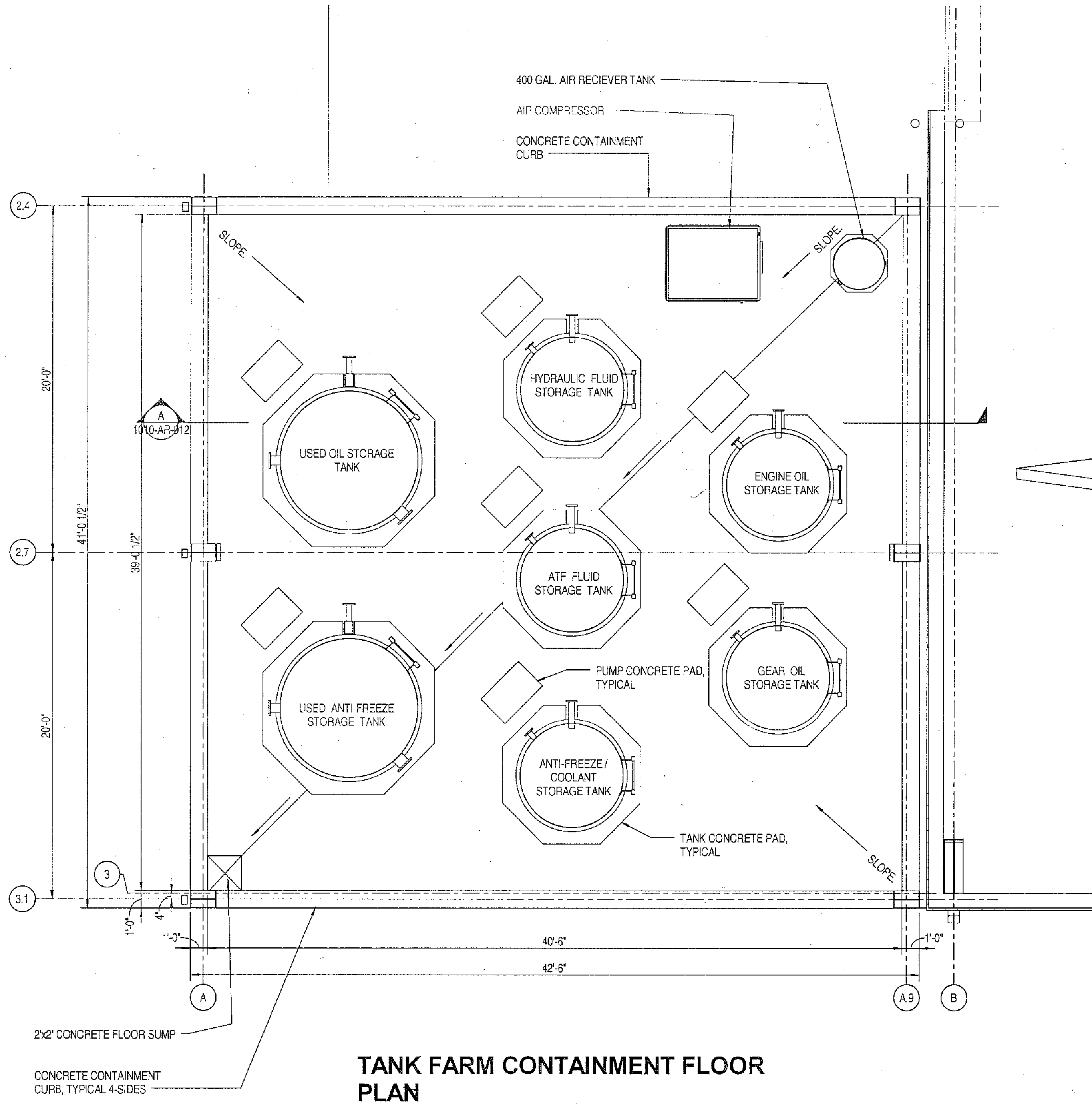
COPPER FLAT PROJECT

PROJECT PERMITTING GENERAL ARRANGEMENT CONCENTRATOR AREA CONTAINMENT PLAN

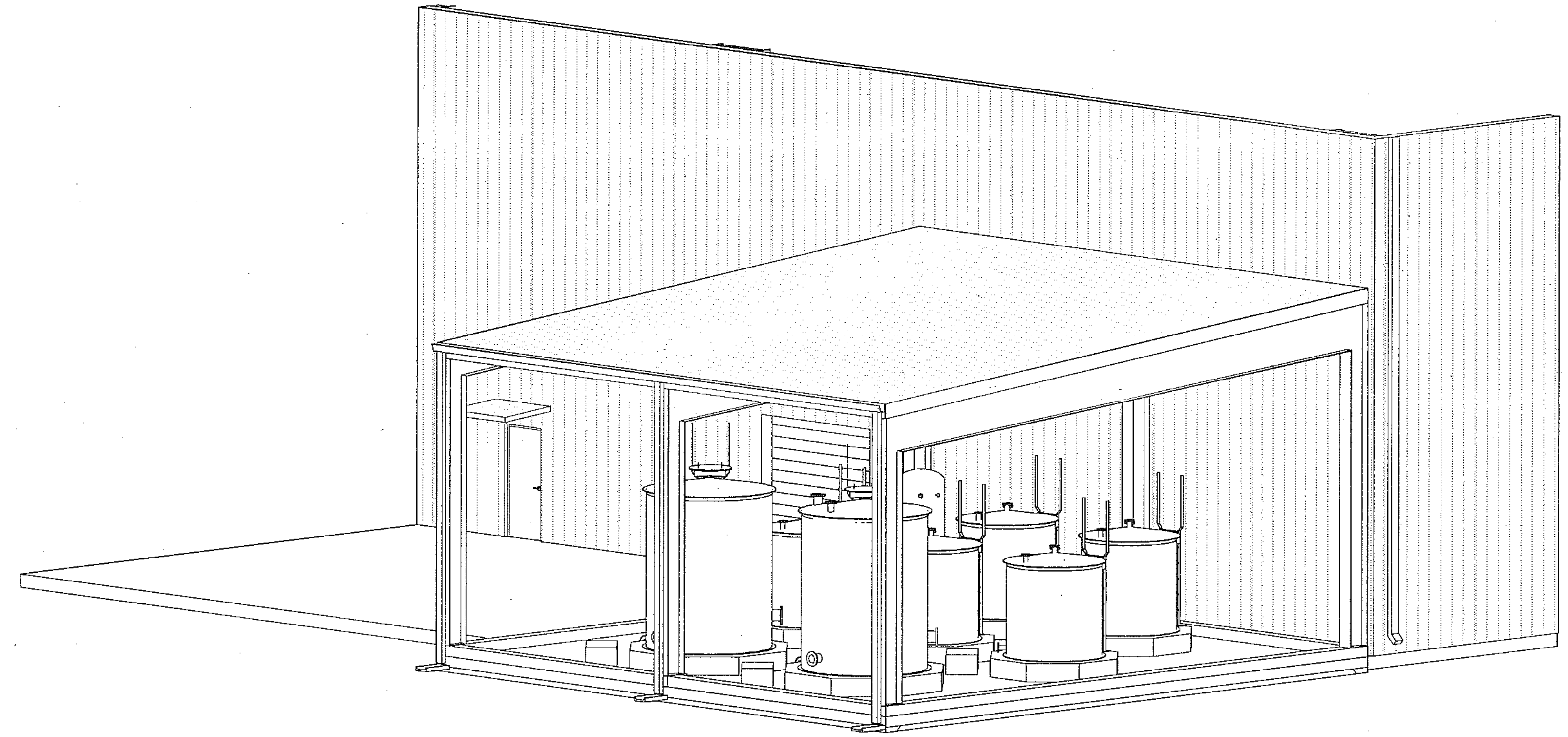
PROJECT NO. M3-PN120085
DWG NO. 0000-GA-050
REV NO. P1
DATE 11/30/15

16805



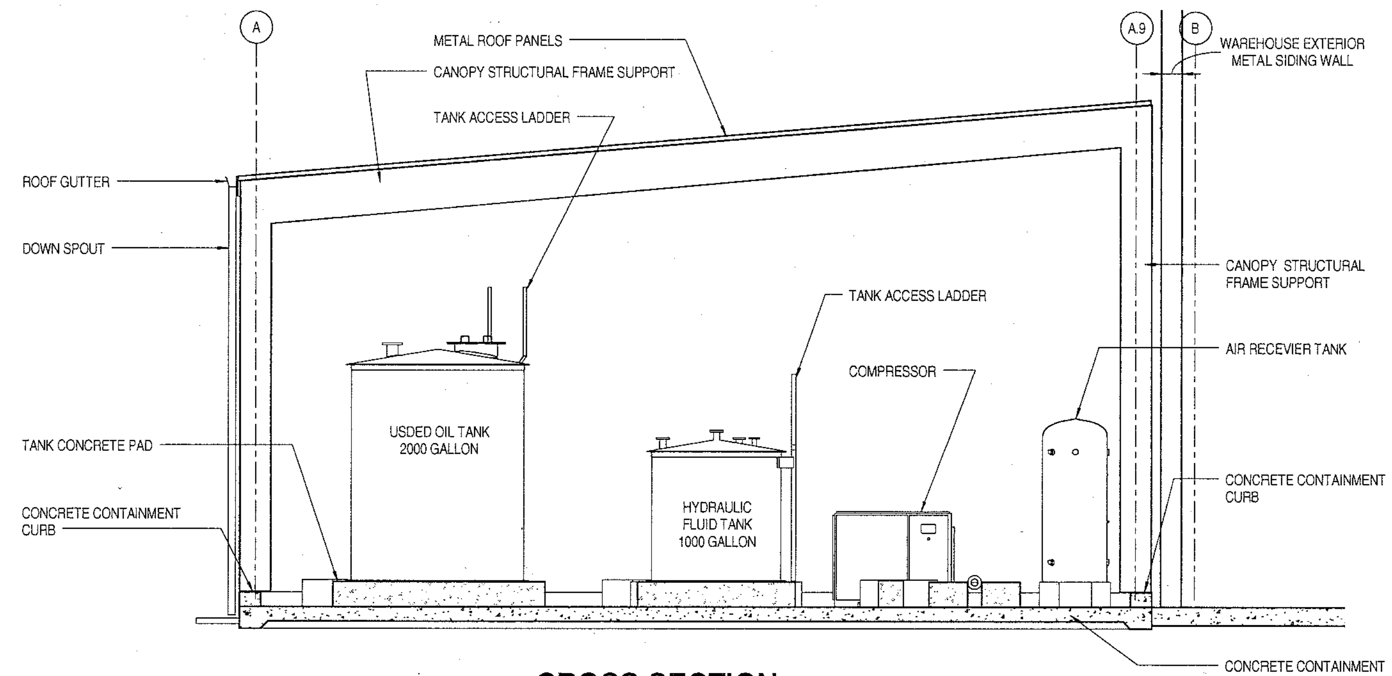
TANK FARM CONTAINMENT FLOOR PLAN

SCALE: 1/4" = 1'-0"



TRUCK SHOP - TANK FARM CONTAINMENT

SCALE:



CROSS SECTION (A)

SCALE: 1/4" = 1'-0"

CONTAINMENT AREA	TANK NAME	TANK VOLUME (GAL.)	CONTAINMENT VOLUME REQUIRED (GAL.)	CONTAINMENT VOLUME PROVIDED (GAL.)
TRUCK SHOP TANK FARM.	USED OIL STORAGE TANK *	2,000	2,200	5,600
	USED ANTI-FREEZE STORAGE TANK	2,000		
	ATF FLUID STORAGE TANK	1,000		
	HYDRAULIC FLUID STORAGE TANK	1,000		
	ENGINE OIL STORAGE TANK	1,000		
	GEAR OIL STORAGE TANK	1,000		
	ANTI-FREEZE / COOLANT STORAGE TANK	1,000		

* DENOTES LARGEST TANK IN CONTAINMENT AREA

PRELIMINARY
NOT FOR CONSTRUCTION

DO NOT SCALE 11x17 DRAWINGS

THEMAC RESOURCES

REFERENCES DWG. NO.	REFERENCES TITLE	REFERENCES DWG. NO.	REFERENCES TITLE	REVISIONS NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	REVISIONS NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

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CHECKED BY	RSS	NOV. 15
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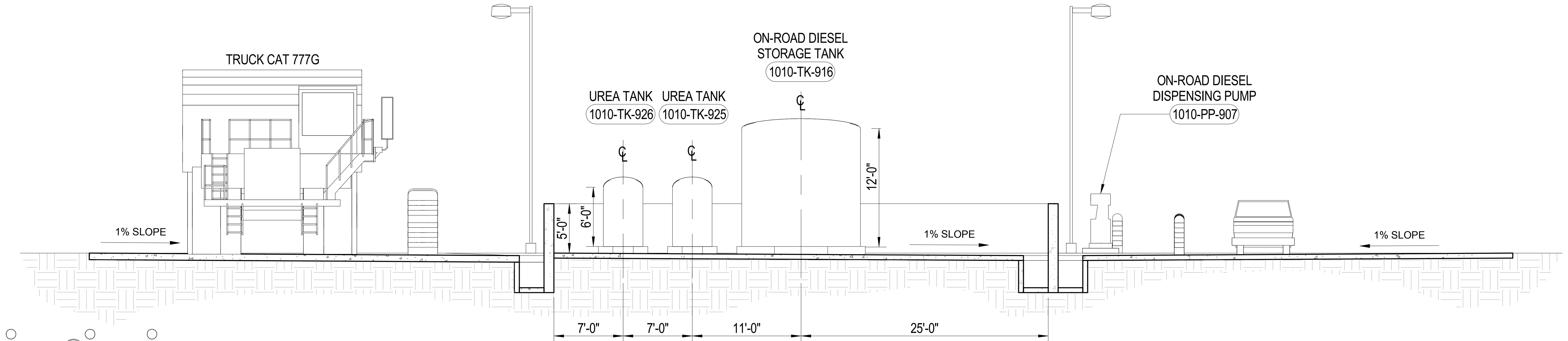
COPPER FLAT PROJECT
ADMINISTRATION AREA
ARCHITECTURAL
TRUCK SHOP
TANK FARM CONTAINMENT

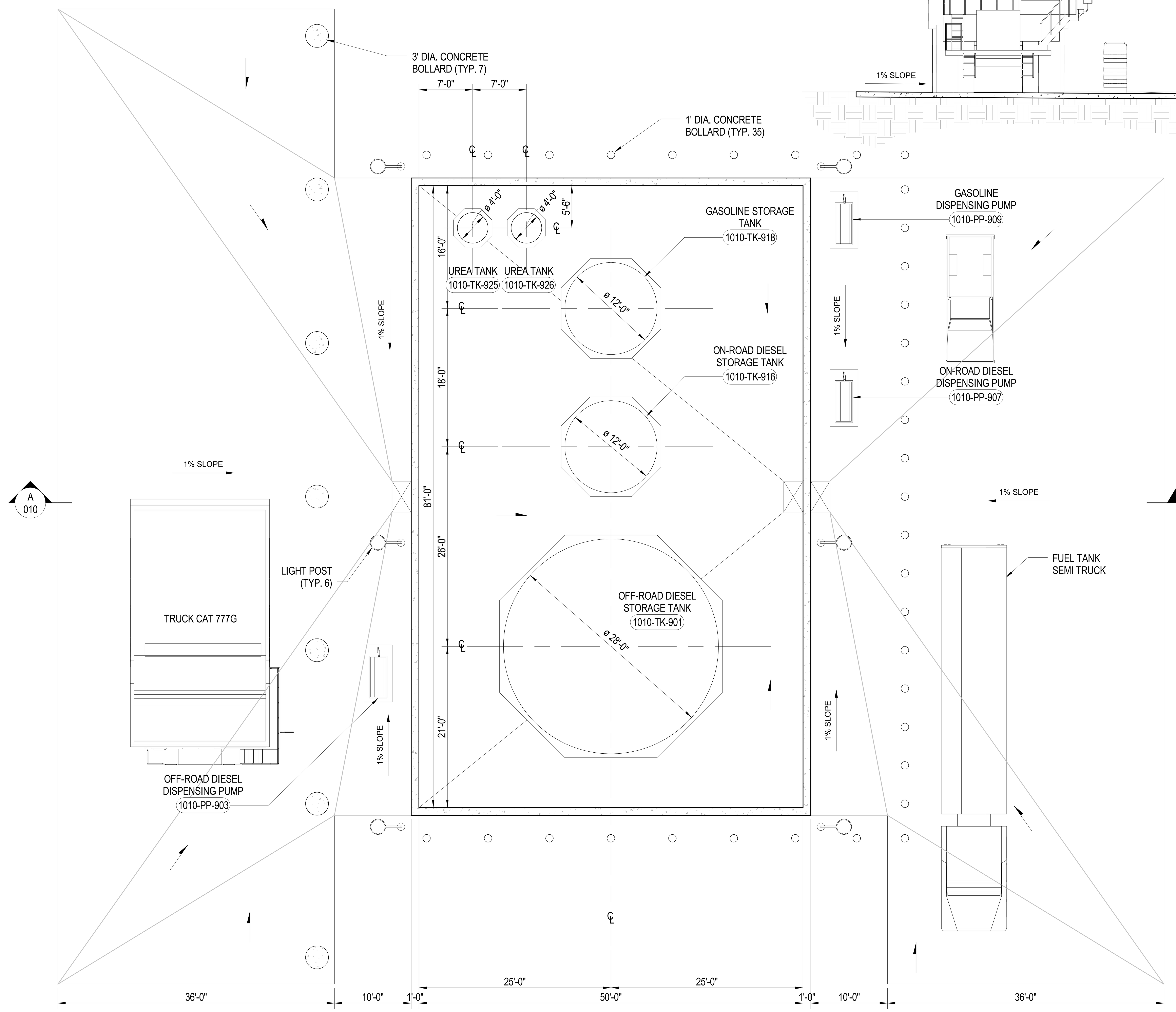
PROJECT NO. M3-PN120085
DWG NO. 1010-AR-012
REV NO. P2
DATE 11/18/15



SECTION

SCALE: 1/8" = 1'-0"

A / 010



FUEL STATION CONTAINMENT PLAN

SCALE: 1/8" = 1'-0"

DRAWING KEY	
☒	CONTAINMENT SUMP
←	DEMONSTRATES FLOW DIRECTION

CONTAINMENT AREA	TANK NAME	TANK VOLUME	CONTAINMENT VOLUME	
		(GAL.)	REQUIRED (GAL.)	PROVIDED (GAL.)
FUEL STATION TANK FARM	OFF-ROAD DIESEL STORAGE TANK *	100,000	110,000	119,000
	ON-ROAD DIESEL STORAGE TANK	10,000		
	GASOLINE STORAGE TANK	10,000		
	UREA TANK	560		
	UREA TANK	560		

* DENOTES LARGEST TANK IN CONTAINMENT AREA

8' 4' 0' 8' 16'
1/8" = 1'-0"
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
NOT FOR CONSTRUCTION

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
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DRAWN BY	JC	NOV 15
CHECKED BY		
PROJECT MGR		
CLIENT APPR		

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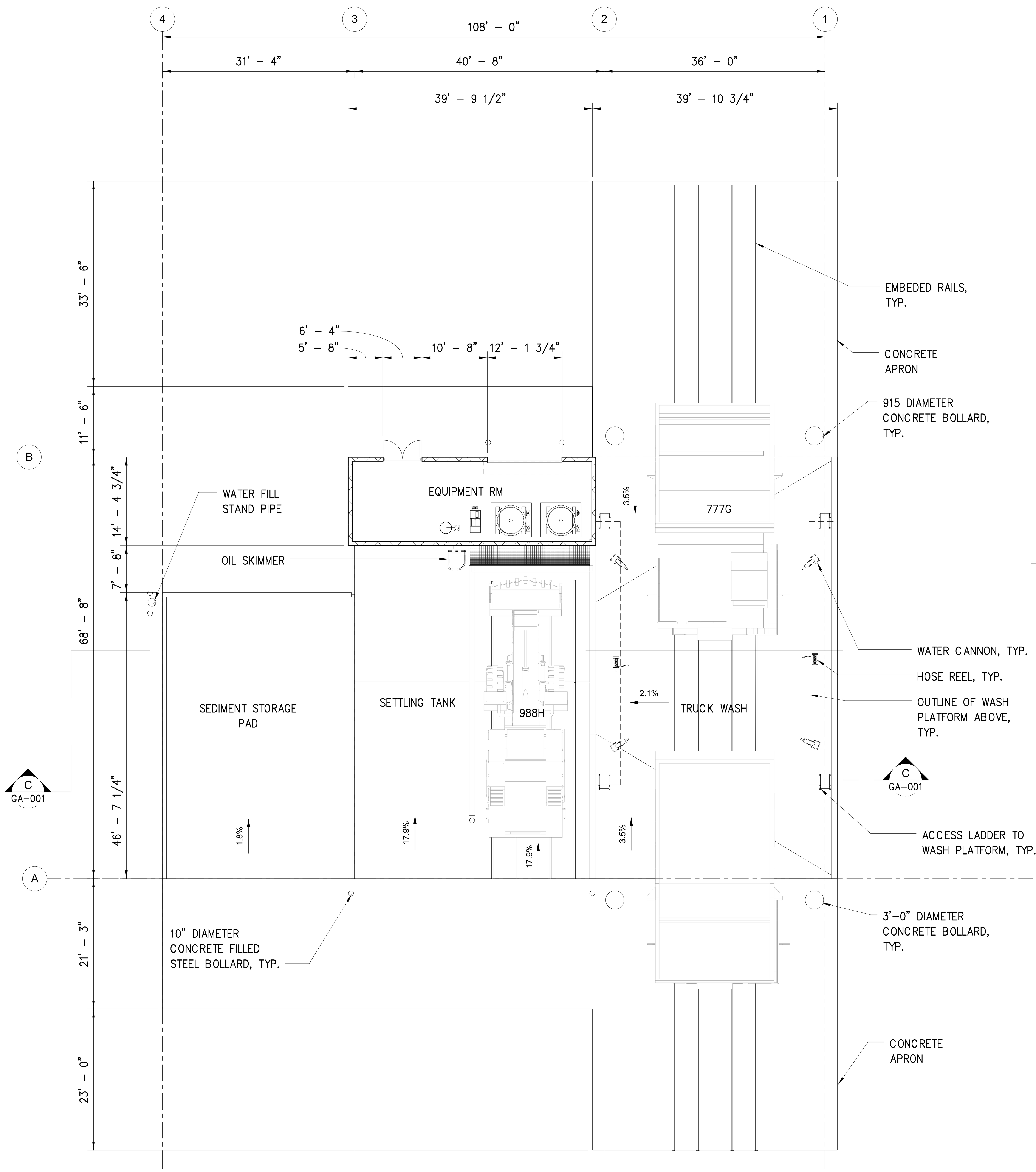
COPPER FLAT PROJECT

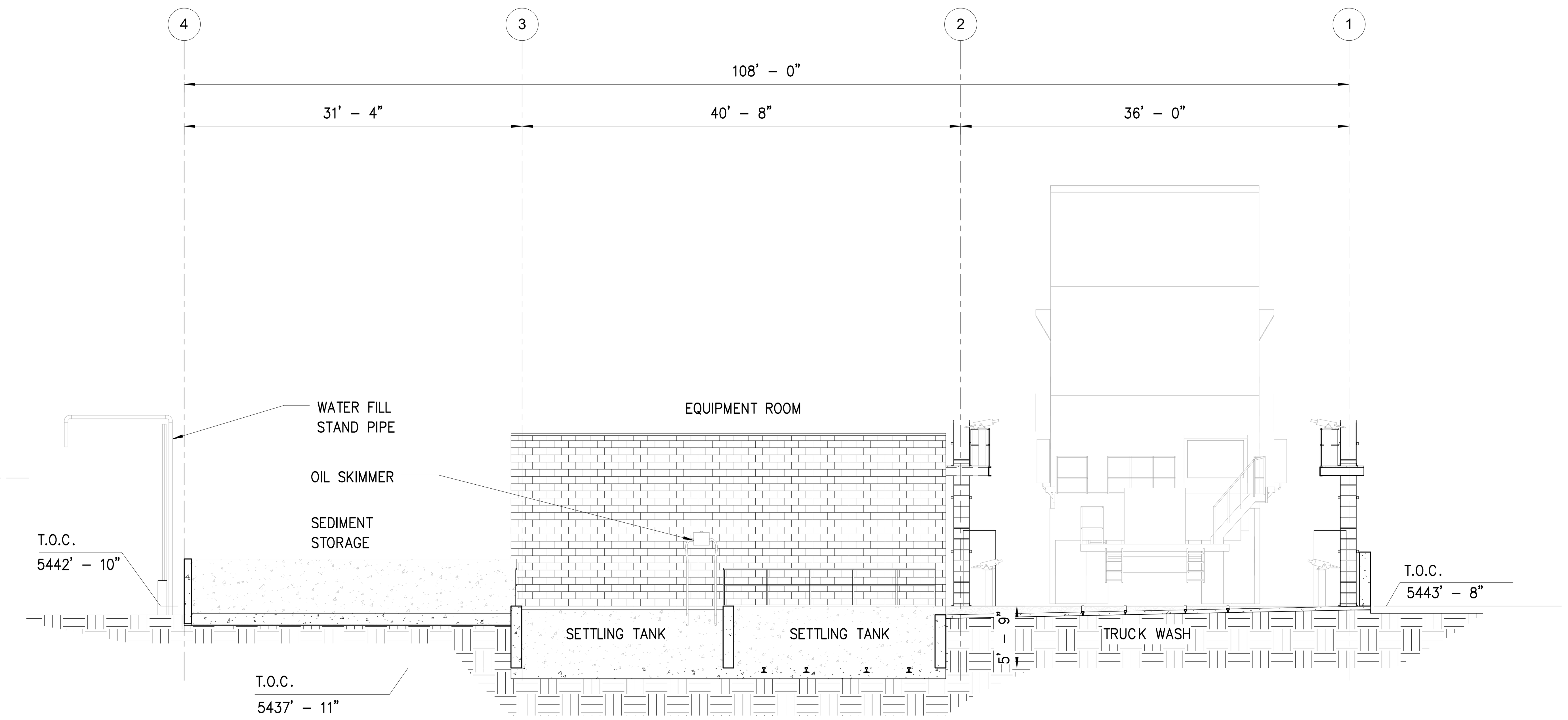
ADMINISTRATION AREA
GENERAL ARRANGEMENT
FUEL STATION
CONTAINMENT PLAN

PROJECT NO. M3-PN120085
DWG NO. 1010-GA-010
REV NO. P1
DATE 19 NOV 15



FLOOR PLAN

SCALE: 3/32" = 1'–0"



SECTION C-C

SCALE: 1/8" = 1'–0"

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DRAWN BY	SDI	NOV 15
CHECKED BY		
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CLIENT APPR		

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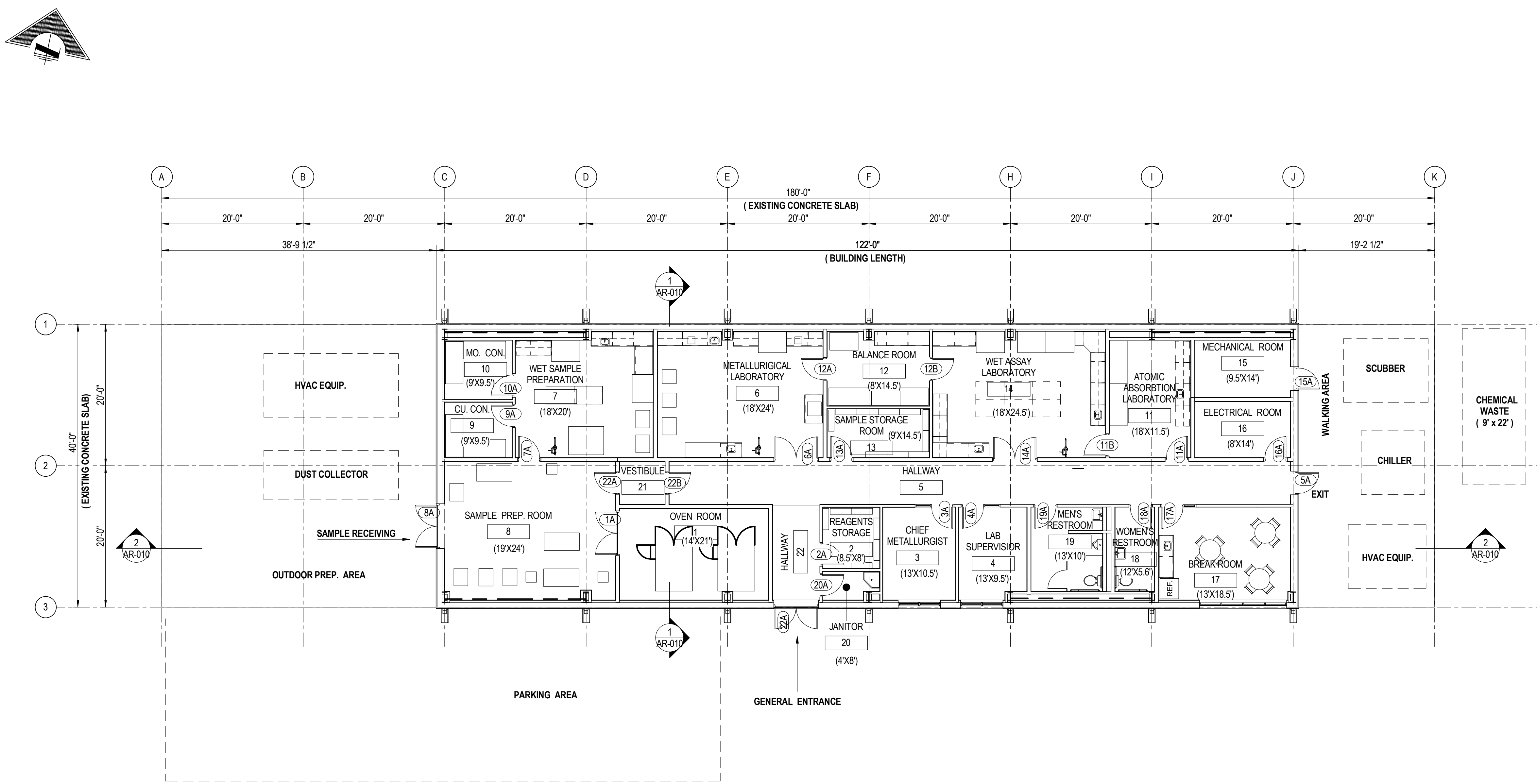
COPPER FLAT PROJECT

ADMINSTRATION AREA
GENERAL ARRANGEMENT
TRUCK WASH
FLOOR PLAN & SECTION

PROJECT NO. M3-PN120085
DWG NO. 1010-GA-001
REV NO. P1
DATE 20 NOV 15



FLOOR PLAN

SCALE: 1/8" = 1'-0"

ANALYSIS:

1. VENDOR ENGINEERED PREFABRICATED METAL BUILDING.
2. NEW BUILDING SIZE: 122'-0" x 40'-0" = 4,880 SQ. FT.
3. EXISTING CONRETE SLAB SQUARE FOOTAGE = 7,200 SQ. FT.
4. COLUMN LINE SPACING SAME AS PRIOR BUILDING, UTILIZING EXISTING FOUNDATIONS.

8' 4' 0' 8' 16'
1/8" = 1'-0"
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
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REFERENCES		REFERENCES		REVISIONS						REVISIONS					
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DESIGNED BY	R. RAMOS	NOV. 12
DRAWN BY	R. RAMOS	NOV. 12
CHECKED BY	R.S.	NOV. 12
PROJECT MGR		
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COPPER FLAT PROJECT

CONCENTRATOR AREA ARCHITECTURAL LABORATORY FLOOR PLAN

PROJECT NO. M3-PN120085
DWG NO. 3010-AR-003
REV NO. P2
DATE 5 DEC. 12

Appendix D

Copper Flat

Site Diversion Analysis

M3 Engineering & Technology Corporation

Revised, June 2016

M3-PN120085
Revision 0

Copper Flat Project

Site Diversion Analysis Report

Prepared For:

THEMAC RESOURCES

16811

Certified Professional Engineer Seal

This report documents work conducted under the oversight of the following Engineer:

Harry Lewsley, P.E.

HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp. 12/31/2017

Signature

Date 12/5/2015

SITE DIVERSION ANALYSIS
COPPER FLAT PROJECT

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Harry Lewsley 12/7/2015

HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp. 12/31/2017

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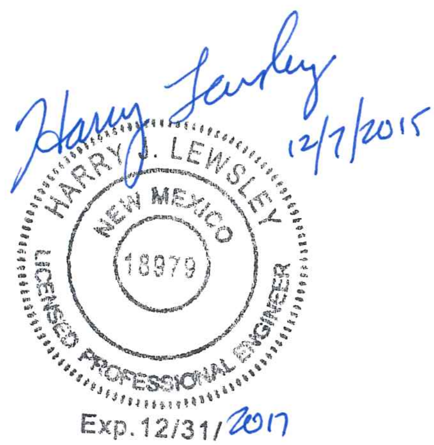

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HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp. 12/31/2017

LIST OF APPENDICES

Harry Lewsley 12/7/2015

HARRY J. LEWSLEY
NEW MEXICO
18979
LICENSED PROFESSIONAL ENGINEER
Exp. 12/31/2017

1 PURPOSE AND SCOPE OF ANALYSIS

The Copper Flat Project proposed for mine development by THEMAC Reources, Inc. through its subsidiary, New Mexico Copper Company (NMCC), lies within the Greenhorn Arroyo sub-basin in Sierra County, New Mexico (Dwg. 0000-CI-100).

Previous development of the mining property was conducted by Quintana Minerals Company (Quintana). The natural drainage pattern in the area (Dwg. 0000-CI-101) was modified by Quintana to divert surface drainages away from the proposed mine pit and protect the operations from flooding (Dwg. 0000-CI-102). In addition to the diversions, Quintana placed large diameter culverts beneath two crossings of Grayback Arroyo near the mine entrance. These structures are still in place and will be used by NMCC to limit stormwater run-on and prevent the site impacted areas from interacting with uncontained surface water flows for the planned mining operation (Dwg. 0000-CI-103).

The analysis completed was to evaluate existing diversions and water conveyance features at the Copper Flat Project with regard to their adequacy in conveying flows from storm events and protecting the site from flooding. In order to evaluate the adequacy of the existing diversions it was necessary to identify and evaluate surface water flow prior to the existence of the diversions (Dwg. 000-CI-104). Analytical methods were used to calculate the peak discharges, runoff volumes, and to determine if the existing site diversions and Grayback Arroyo culverts had the adequate capacity to convey the peak discharges and runoff around and away from the proposed site. Peak flows were analyzed for each sub-basin contributing to surface water flows upstream of the project area using the the HydroCAD program which uses both Soil Conservation Service (SCS) TR-20 methods (SCS, 1982) and TR-55 methods (USDA, 1986). An SCS 24-hour Type II storm was selected for simulation due to the project's location. Upstream watersheds were delineated as depicted on Dwg. 0000-CI-104.

The result of this evaluation demonstrates that existing diversions and culverts are adequate to prevent run-on or flooding of the mine site.

2 TYPE OF ANALYSIS

2.1 HYDROLOGY

Peak discharge and volume analysis was performed for drainage areas contributing to the Grayback Arroyo located within the Copper Flat project area. The return periods used were:

- 100-year, 24-hour storm, (Q100)
- 200-year, 24-hour storm, (Q200)
- 500-year, 24-hour storm, (Q500)

2.2 HYDRAULICS

Culvert and channel capacity analysis was conducted for the Grayback Arroyo to determine water surface elevations during the design storm for the two existing culvert crossings.

3 KEY ASSUMPTIONS

- Minimum of 10 percent impervious area assumed for all watersheds.
- Minimum time of concentration set to 5 minutes for developed watersheds and 10 minutes for natural watersheds.
- Soil Class D assumed because fine to medium sand and clay dominate beneath the top layer of soil, which will likely be excavated, in accordance with THEMAC Conceptual Model of Groundwater Flow.
- Surface description used for natural watersheds is “Desert Shrub Range” with a curve number (CN) of 86.
- Existing culverts were modeled assuming that they are in good condition and free of any debris.

4 PROCEDURES AND METHODS USED:

- Peak Discharges:
  - Calculated by the SCS methods using HydroCAD.
  - Calculated the existing discharges for the 100-, 200-, and 500-year, 24-hour storm events.
  - The peak discharges were found using an antecedent moisture condition (AMC) of II to represent normal conditions.
  - Time of concentration was calculated using the SCS Lag time method.
  - The length of longest watercourse, Lc, and mean watershed slope, Sc, were determined by using a combination of site surveys and USGS topographic maps.
- Culvert Capacity Calculations:
  - Calculated the existing culvert capacity for the 100-, 200-, and 500-year, 24-hour storm events.
  - Culvert capacity calculations completed using the Federal Highway Administration (FHWA) HY-8 program for Crossing #1. HY-8 was chosen for the first existing culvert crossing as the culverts will be subject to the peak discharge of the entire watershed reporting to them.
  - Culvert capacity calculations for Crossing #2 were computed utilizing HydroCAD due to the upstream ponding, which will mitigate the peak discharge and thus make the existing culvert at Crossing #2 act as a orifice outlet instead of a standard culvert.
  - Combined peak discharges at each crossing are less than the cumulative respective discharges due to the “routing” effect of Grayback Arroyo.

5 TECHNICAL DATA

- Precipitation depths are per the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Precipitation Frequency Estimates (NOAA, 2006) near Hillsboro,NM.
- The watershed characteristic summary for the existing watersheds can be found in Appendix A.
- The files for the HydroCAD analysis for Pre-Quintana & Post-Quintana watersheds can be found in Appendices B and C, respectively.
- The HydroCAD analysis for the culvert crossings can be found in Appendix D.
- The HY-8 culvert analysis can be found in Appendix E.

6 RESULTS

Analysis of the pre-mine development topography and drainage pattern identified sixteen watersheds (Dwg. 0000-CI-105) contributing to Grayback Arroyo in the project area. These watersheds were analyzed using HydroCAD and the results are shown in Table 1 in cubic feet per second (cfs) for each watershed. The upstream drainages merged in the central portion of the current Copper Flat Project area and passed through to the eastern boundary via Grayback Arroyo.

Table 1: Pre-Quintana Watershed Characteristics

Watershed ID	Area (ac)	Lc (ft)	Avg. Sc (ft/ft)	Tc (min)	Q100 (cfs)	Q200 (cfs)	Q500 (cfs)
1	352.00	7,396	0.164	30.70	708.72	813.94	952.23
2	117.79	3,175	0.231	13.10	377.27	432.11	504.05
3	100.96	4,242	0.194	18.10	277.70	318.42	371.87
4	85.03	3,389	0.304	12.10	280.90	321.62	375.03
5	107.36	4,088	0.346	13.10	343.86	393.85	459.42
6	377.55	9,338	0.267	29.00	788.24	906.94	1060.97
7	144.47	5,064	0.277	17.40	405.48	464.86	542.79
8	92.01	3,617	0.273	13.40	291.83	334.29	389.99
9	235.91	7,005	0.267	23.00	567.91	651.70	761.76
10	333.62	10,278	0.262	31.50	660.28	758.38	887.32
11	397.83	7,149	0.182	28.30	843.39	968.42	1132.73
12	236.95	6,590	0.292	21.00	600.47	688.82	804.86
13	282.46	7,744	0.258	25.30	641.72	736.61	861.28
14	161.96	5,608	0.160	24.90	371.20	426.07	498.15
15	55.11	2,582	0.184	12.50	179.83	205.93	240.16
16	83.15	3,076	0.078	22.10	204.89	235.08	274.73

Lc = Length of longest waterpath
Sc = Slope
Tc = Time of concentration
Q = Flowrate

Diversion of surface drainages away from the prospective mining area was accomplished by Quintana using a number of diversions shown in Dwg. 0000-CI-105. Diversion 1 is an earthen diversion that re-routed a portion of Watershed 14 (Dwg. 0000 CI 105) to the east into an existing drainage that wraps around the north side of Animas Peak. Diversion 2 consists of earthen diversions routing Watersheds 12 and 13 southward to Diversion 3. Diversion 3 is a composite earthen diversion and bedrock cut that re-routes Watershed 10, 12, and 13 south into Watershed 6, where it joins the ancestral Grayback Arroyo channel south of the mine area (Dwg. 0000-CI-105). Diversion of surface drainages away from the mine area allows for surface water in the mine area to be managed in a manner that prevents impacted stormwater from migrating offsite or impacting groundwater.

Table 2 lists the watersheds that exist after the Quintana diversions, as altered by the NMCC development plan. The Quintana diversions and NMCC development plan alters the drainage pattern in the project area to facilitate control of impacted stormwater. As a result, Watersheds 15 and 16 (Dwg. 0000-CI-104) are completely within the project stormwater control area and are eliminated as tributaries to Grayback Arroyo and portions of Watersheds 1, 2, 3, and 14 are included in the project stormwater control area and isolated from interaction with Grayback Arroyo.

Table 2: Final Watershed Characteristics

Watershed ID	Area (ac)	Lc (ft)	Avg. Sc (ft/ft)	Tc (min)	Q100 (cfs)	Q200 (cfs)	Q500 (cfs)
1	28.21	N/A	0.249	5.00	117.20	133.97	155.94
2	106.56	3,068	0.314	11.00	363.66	415.35	484.31
3	34.99	1,603	0.177	8.70	129.54	148.20	172.66
4	75.02	3,047	0.339	10.50	259.92	297.56	346.92
5	124.19	5,976	0.340	18.00	342.49	392.70	458.61
6	331.22	8,173	0.310	24.20	774.13	888.50	1038.74
7	144.47	5,064	0.296	16.90	411.06	471.20	550.14
8	92.01	3,617	0.274	13.40	291.83	334.29	389.99
9	235.91	7,005	0.268	23.00	567.91	651.70	761.76
10	330.41	10,278	0.276	30.80	663.73	762.30	891.85
11	397.83	7,149	0.182	28.30	843.39	968.42	1132.73
12	227.42	6,590	0.315	20.20	588.30	674.80	789.72
13	275.51	7,744	0.293	23.80	649.87	745.85	871.93
14	79.97	3,545	0.224	14.60	243.90	279.49	326.19

Lc = Length of longest waterpath
Sc = Slope
Tc = Time of concentration
Q = Flowrate

In addition to the Diversions described above, Quintana installed culverts to convey water beneath two earthen crossings over the Grayback Arroyo channel southeast of the process plant area (Dwg. 0000-CI-103). The characteristics of these culverts were evaluated with respect to the calculated flows from the diverted and natural drainages upstream from the proposed mine area. Those characteristics and flows are presented in Tables 3 and 4. The modeled flows through the composite Grayback Arroyo drainage upstream of the culverts were evaluated to ensure that the culverts were adequate to transmit the necessary flows without risk of damage to the structures and flooding of the proposed mine site.

Table 3: Existing Culvert Characteristics and Flows

Crossing No.	Culvert CP Location	Description	End Treatment	Q100 (cfs)	Q200 (cfs)	Q500 (cfs)
1	2	3 – 177” CMPs	Projecting	3,552.39	4,191.95	5,046.09
2	1	1 – 177” CMP	Projecting	3,066.00	3,418.33	3,856.73

Table 4: Existing Culvert Elevations, Lengths, and Slopes

Crossing No.	Inlet Elev. (ft)	Outlet Elev. (ft)	Length (ft)	Slope (ft/ft)	Q100 Headwater Elev. (ft)	Q200 Headwater Elev. (ft)	Q500 Headwater Elev. (ft)	Top of Roadway Elev. (ft)
1	5372.0	5370.0	194.40	0.0103	5391.64	5397.05	5406.01	5419.0
2	5352.0	5344.0	255.4	0.0313	5386.54	5391.04	5396.71	5403.0

7 CONCLUSIONS

The 24-hour storm flows for 100-year, 200-year, and 500-year return periods were evaluated for the watersheds as they exist at present. Analysis of the results of the hydrologic analyses presented in this report demonstrates that the extisting diversions and control structures are adequate to protect the site from flooding during the modeled flow events.

The analyses conducted also determined that both culvert crossings are capable of conveying the Q500 without overtopping the adjacent roadway or pipeline corridor. This conclusion is based on the assumption that the culverts analyzed are in good working condition. Field inspection of the culverts completed by M3 found the body of the existing culverts to be in good condition; repair will be required at the upstream inlets and vegetation removal undertaken at culvert inlets and outlets in order to meet the conditions of this analysis.

8 REFERENCES

Bonin, GM, Martin, D., Lin, B., Parzybok, T., Yekta, M., and Riley, D., 2000. Precipitation Frequency Atlas of the United States, NOAA Atlas 14 Addendum, Volume 1, Version 4.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah) Addendum – Update to Version 3.0. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Silver Spring, Maryland, 2004 revised 2006.

USDA, 1986. Urban Hydrology for Small Watersheds. U.S. Department of Agriculture, National Resources Conservation Service, Conservation Engineering Division. Technical Release (TR) 55. June, SCS, 1986.

SCS, 1982. [Draft] Computer Program Co. Project Formulation – Hydrology. Soil Conservation Service Technical Release 20. Washington, DC.

DRAWINGS

LEGEND

- DRAINAGE BASIN BOUNDARY
- MINE PROPERTY BOUNDARY
- GRAYBACK ARROYO
- FLOWLINE

SITE PLAN

SCALE: 1" = 2500'

2500 1250 0 2500 5000

SCALE IN FEET

CONTOUR INTERVAL = 50'

DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY

FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE:	1" = 2500'	DATE
DESIGNED BY	JPN	OCT 15
DRAWN BY	JPN	OCT 15
CHECKED BY		
PROJECT MGR		
CLIENT APPR.		

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COPPER FLAT PROJECT

GENERAL SITE
CIVIL
GREENHORN ARROYO
PRE-MINING WATERSHED BASIN

JOB NO. M3 PN-120085

DWG NO. **0000-CI-100**

REV NO.	DATE
P2	20 NOV 15

16827

LEGEND

DRAINAGE BASIN BOUNDARY	
MINE PROPERTY BOUNDARY	
GRAYBACK ARROYO	
FLOWLINE	

SITE PLAN

SCALE: 1" = 1000'

1000 500 0 1000 2000
SCALE IN FEET
CONTOUR INTERVAL = 20 FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

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GENERAL SITE
COPPER FLAT SITE
EXISTING HYDROLOGY
PRE-QUINTANA MINING

JOB NO. M3 PN-120085
DWG NO. 0000-CI-101
REV NO. P1
DATE 20 NOV 15

LEGEND

- DRAINAGE BASIN BOUNDARY
- MINE PROPERTY BOUNDARY
- GRAYBACK ARROYO
- FLOWLINE

SITE PLAN

SCALE: 1" = 1000'

1000 500 0 1000 2000

SCALE IN FEET
CONTOUR INTERVAL = 20 FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 1000'	DATE
DESIGNED BY JPN	OCT 15
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CLIENT APPR.	

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COPPER FLAT PROJECT

GENERAL SITE
COPPER FLAT SITE
EXISTING HYDROLOGY
POST QUINTANA MINING

JOB NO. M3 PN-120085
DWG NO. 0000-CI-102
REV NO. P1
DATE 20 NOV 15

SITE PLAN

SCALE: 1:500

500' 250' 0' 500' 1000'

1" = 500'

DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THE MAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 500'		DATE
DESIGNED BY	JPN	OCT 15
DRAWN BY	JPN	OCT 15
CHECKED BY		
PROJECT MGR	RKZ	
CLIENT APPR.		

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COPPER FLAT PROJECT

JOB NO. M3 PN-120085

SITE GENERAL
CIVIL
GRAYBACK ARROYO DIVERSION
THROUGH NMCC PROJECT SITE

DWG NO. 0000-CI-103

REV NO. P2 DATE 20 NOV 15

LEGEND:

- FLOW ARROW
- WATERSHED BOUNDARY
- RUNOFF CONCENTRATION POINT
- WATERCOURSE PATH
- MINE PERMIT BOUNDARY

WATERSHED SUMMARY

WATERSHED ID	AREA (AC)	Q100 (CFS)
1	352.00	708.72
2	117.79	377.27
3	100.96	277.70
4	85.03	280.90
5	107.36	343.86
6	377.55	788.24
7	144.47	405.48
8	92.01	291.83
9	235.91	567.91
10	333.62	660.28
11	397.83	843.39
12	236.95	600.47
13	282.46	641.72
14	161.96	371.20
15	55.11	179.83
16	83.15	204.89

PLAN VIEW
SCALE: 1" = 600'

600 300 0 600 1200
SCALE IN FEET
CONTOUR INTERVAL = 25FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 600'		DATE
DESIGNED BY	AJE	OCT 15
DRAWN BY	AJE	OCT 15
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PROJECT MGR		
CLIENT APPR.		

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COPPER FLAT PROJECT

GENERAL SITE
CIVIL
PRE QUINTANA
EXISTING WATERSHED AREAS

JOB NO. M3 PN-120085
DWG NO. 0000-CI-104
REV NO. P2
DATE 09 JUN 16

WATERSHED SUMMARY

WATERSHED ID	AREA (AC)	Q100 (CFS)
1	28.21	117.20
2	106.56	363.66
3	34.99	129.54
4	75.02	259.92
5	124.19	342.49
6	331.22	774.13
7	144.47	411.06
8	92.01	291.83
9	235.91	567.91
10	330.41	663.73
11	397.83	843.39
12	227.42	588.30
13	275.51	649.87
14	79.97	243.90

LEGEND:

- FLOW ARROW
- WATERSHED BOUNDARY
- RUNOFF CONCENTRATION POINT
- WATERCOURSE PATH
- MINE PROPERTY BOUNDARY

PLAN VIEW
SCALE: 1" = 600'

600 300 0 600 1200
SCALE IN FEET
CONTOUR INTERVAL = 25FT
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES	
DWG. NO.	TITLE	DWG. NO.	TITLE

REVISIONS						
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

REVISIONS					
NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE:	1" = 600'	DATE
DESIGNED BY	AJE	OCT 15
DRAWN BY	AJE	OCT 15
CHECKED BY		
PROJECT MGR		
CLIENT APPR.		

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COPPER FLAT PROJECT

GENERAL SITE
CIVIL
POST QUINTANA
EXISTING WATERSHED AREAS

JOB NO. M3 PN-120085
DWG NO. **0000-CI-105**
REV NO. P2
DATE 09 JUN 16

16832

APPENDIX A

WATERSHED SUMMARY - EXISTING

Adam Edwards
11/24/2015

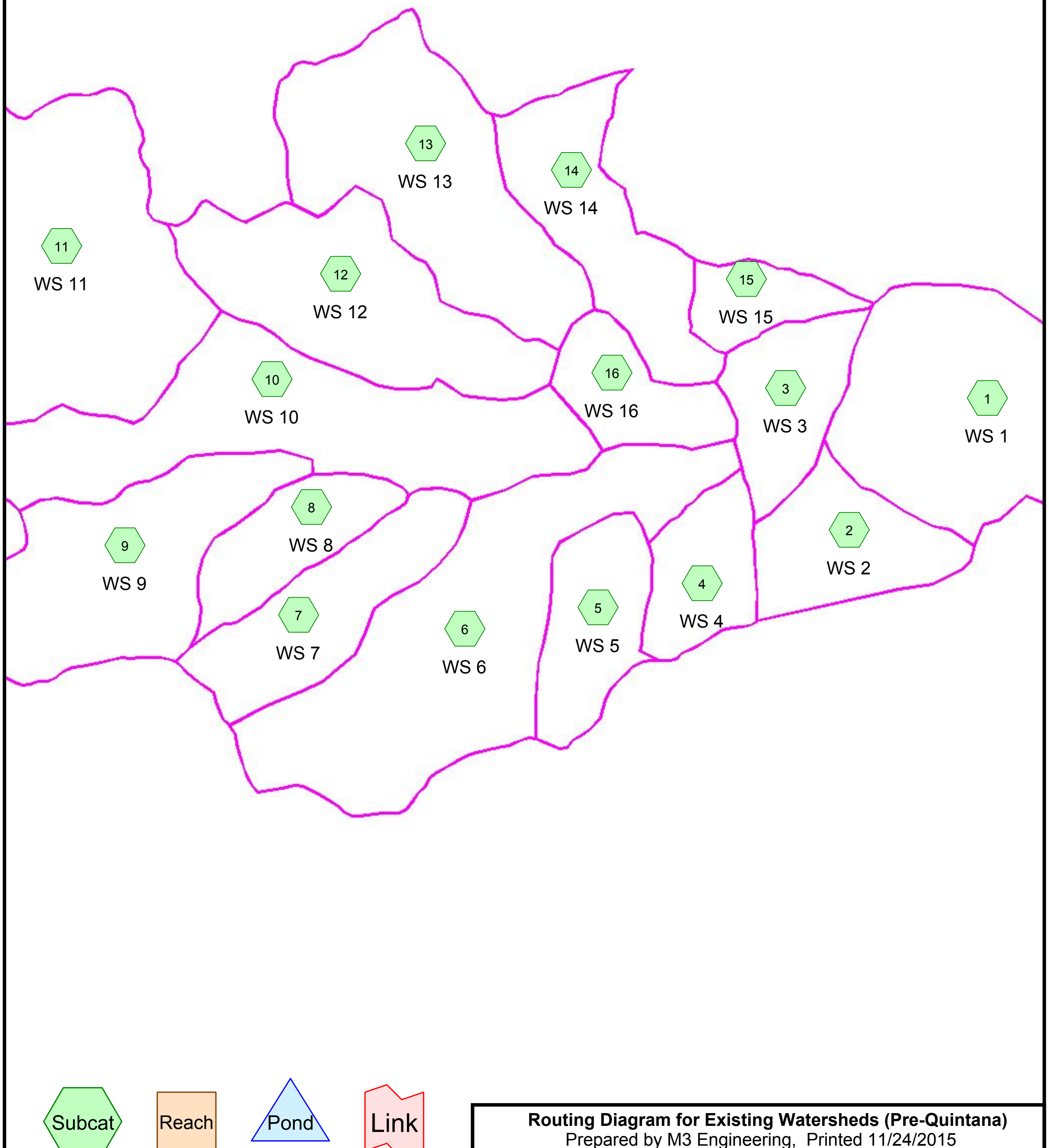
Pre-Quintana Existing

Watershed ID	Area	Total Area	Desert Shrub CN=86	Impervious Area CN=98	Pit Material CN=80	L_c	Avg. S_c	Q_{100} - SCS	Tc Method	Tc	Weighted SCS CN	Soil Type
--	*sq. feet*	*acres*	*acres*	*acres*	*acres*	*ft*	*ft/ft*	*cfs*	--	*min*	--	--
1	15,333,000	352.00	316.80	35.20	0.00	7,396	0.164	708.72	SCS Lag	30.70	87	D
2	5,131,142	117.79	106.01	11.78	0.00	3,175	0.231	377.27	SCS Lag	13.10	87	D
3	4,397,931	100.96	90.87	10.10	0.00	4,242	0.194	277.70	SCS Lag	18.10	87	D
4	3,703,864	85.03	76.53	8.50	0.00	3,389	0.304	280.9	SCS Lag	12.10	87	D
5	4,676,541	107.36	96.62	10.74	0.00	4,088	0.346	343.86	SCS Lag	13.10	87	D
6	16,446,115	377.55	339.79	37.75	0.00	9,338	0.267	788.24	SCS Lag	29.00	87	D
7	6,292,945	144.47	130.02	14.45	0.00	5,064	0.277	405.48	SCS Lag	17.40	87	D
8	4,008,126	92.01	82.81	9.20	0.00	3,617	0.273	291.83	SCS Lag	13.40	87	D
9	10,276,128	235.91	212.32	23.59	0.00	7,005	0.267	567.91	SCS Lag	23.00	87	D
10	14,532,660	333.62	300.26	33.36	0.00	10,278	0.262	660.28	SCS Lag	31.50	87	D
11	17,329,719	397.83	358.05	39.78	0.00	7,149	0.182	843.39	SCS Lag	28.30	87	D
12	10,321,490	236.95	213.25	23.69	0.00	6,590	0.292	600.47	SCS Lag	21.00	87	D
13	12,303,894	282.46	254.21	28.25	0.00	7,744	0.258	641.72	SCS Lag	25.30	87	D
14	7,054,905	161.96	145.76	16.20	0.00	5,608	0.160	371.2	SCS Lag	24.90	87	D
15	2,400,616	55.11	49.60	5.51	0.00	2,582	0.184	179.83	SCS Lag	12.50	87	D
16	3,621,863	83.15	74.83	8.31	0.00	3,076	0.078	204.89	SCS Lag	22.10	87	D

Post-Quintana Existing

Watershed ID	Area	Total Area	Desert Shrub CN=86	Impervious Area CN=98	Pit Material CN=80	L_c	Avg. S_c	Q_{100} - SCS	Tc Method	Tc	Weighted SCS CN	Soil Type
--	*sq. feet*	*acres*	*acres*	*acres*	*acres*	*ft*	*ft/ft*	*cfs*	--	*min*	--	--
1 (pond)	1,228,747	28.21	25.39	2.82	0.00	0	0.249	**117.20**	Minimum	5.00	87	D
2	4,641,978	106.56	95.91	10.66	0.00	3,068	0.314	**363.66**	SCS Lag	11.00	87	D
3	1,523,968	34.99	31.49	3.50	0.00	1,603	0.177	**129.54**	SCS Lag	8.70	87	D
4	3,267,841	75.02	67.52	7.50	0.00	3,047	0.339	**259.92**	SCS Lag	10.50	87	D
5	5,409,568	124.19	111.77	12.42	0.00	5,976	0.340	**342.49**	SCS Lag	18.00	87	D
6	14,427,914	331.22	298.10	33.12	0.00	8,173	0.310	**774.13**	SCS Lag	24.20	87	D
7	6,292,945	144.47	130.02	14.45	0.00	5,064	0.296	**411.06**	SCS Lag	16.90	87	D
8	4,008,126	92.01	82.81	9.20	0.00	3,617	0.274	**291.83**	SCS Lag	13.40	87	D
9	10,276,128	235.91	212.32	23.59	0.00	7,005	0.268	**567.91**	SCS Lag	23.00	87	D
10	14,392,904	330.41	297.37	33.04	0.00	10,278	0.276	**663.73**	SCS Lag	30.80	87	D
11	17,329,719	397.83	358.05	39.78	0.00	7,149	0.182	**843.39**	SCS Lag	28.30	87	D
12	9,906,558	227.42	204.68	22.74	0.00	6,590	0.315	**588.30**	SCS Lag	20.20	87	D
13	12,001,134	275.51	247.96	27.55	0.00	7,744	0.293	**649.87**	SCS Lag	23.80	87	D
14	3,483,496	79.97	71.97	8.00	0.00	3,545	0.224	**243.90**	SCS Lag	14.60	87	D

APPENDIX B



Routing Diagram for Existing Watersheds (Pre-Quintana)
Prepared by M3 Engineering, Printed 11/24/2015
HydroCAD® 10.00-15 s/n 07786 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2,847.730	86	Desert shrub range, Fair, HSG D (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16)
316.410	98	Impervious, HSG D (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16)
3,164.140	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
3,164.140	HSG D	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
0.000	Other	
3,164.140		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	2,847.730	0.000	2,847.730	Desert shrub range, Fair	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
0.000	0.000	0.000	316.410	0.000	316.410	Impervious	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
0.000	**0.000**	**0.000**	**3,164.140**	**0.000**	**3,164.140**	**TOTAL AREA**	

Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=352.000 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,396' Slope=0.1640 '/' Tc=30.7 min CN=87 Runoff=708.72 cfs 69.315 af

Subcatchment2: WS 2 Runoff Area=117.790 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,175' Slope=0.2310 '/' Tc=13.1 min CN=87 Runoff=377.27 cfs 23.195 af

Subcatchment3: WS 3 Runoff Area=100.970 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=4,242' Slope=0.1940 '/' Tc=18.1 min CN=87 Runoff=277.70 cfs 19.883 af

Subcatchment4: WS 4 Runoff Area=85.030 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,389' Slope=0.3050 '/' Tc=12.1 min CN=87 Runoff=280.90 cfs 16.744 af

Subcatchment5: WS 5 Runoff Area=107.360 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=4,088' Slope=0.3460 '/' Tc=13.1 min CN=87 Runoff=343.86 cfs 21.141 af

Subcatchment6: WS 6 Runoff Area=377.540 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=9,338' Slope=0.2670 '/' Tc=29.0 min CN=87 Runoff=788.24 cfs 74.344 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=5,064' Slope=0.2780 '/' Tc=17.4 min CN=87 Runoff=405.48 cfs 28.449 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=291.83 cfs 18.118 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=567.91 cfs 46.455 af

Subcatchment10: WS 10 Runoff Area=333.620 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=10,278' Slope=0.2630 '/' Tc=31.5 min CN=87 Runoff=660.28 cfs 65.695 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=843.39 cfs 78.339 af

Subcatchment12: WS 12 Runoff Area=236.940 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=6,590' Slope=0.2920 '/' Tc=21.0 min CN=87 Runoff=600.47 cfs 46.657 af

Subcatchment13: WS 13 Runoff Area=282.460 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,744' Slope=0.2590 '/' Tc=25.3 min CN=87 Runoff=641.72 cfs 55.621 af

Subcatchment14: WS 14 Runoff Area=161.960 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=5,608' Slope=0.1600 '/' Tc=24.9 min CN=87 Runoff=371.20 cfs 31.893 af

Subcatchment15: WS 15 Runoff Area=55.110 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=2,582' Slope=0.1840 '/' Tc=12.5 min CN=87 Runoff=179.83 cfs 10.852 af

Subcatchment16: WS 16 Runoff Area=83.140 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,076' Slope=0.0780 '/' Tc=22.1 min CN=87 Runoff=204.89 cfs 16.372 af

Total Runoff Area = 3,164.140 ac Runoff Volume = 623.071 af Average Runoff Depth = 2.36"
90.00% Pervious = 2,847.730 ac 10.00% Impervious = 316.410 ac

Summary for Subcatchment 1: WS 1

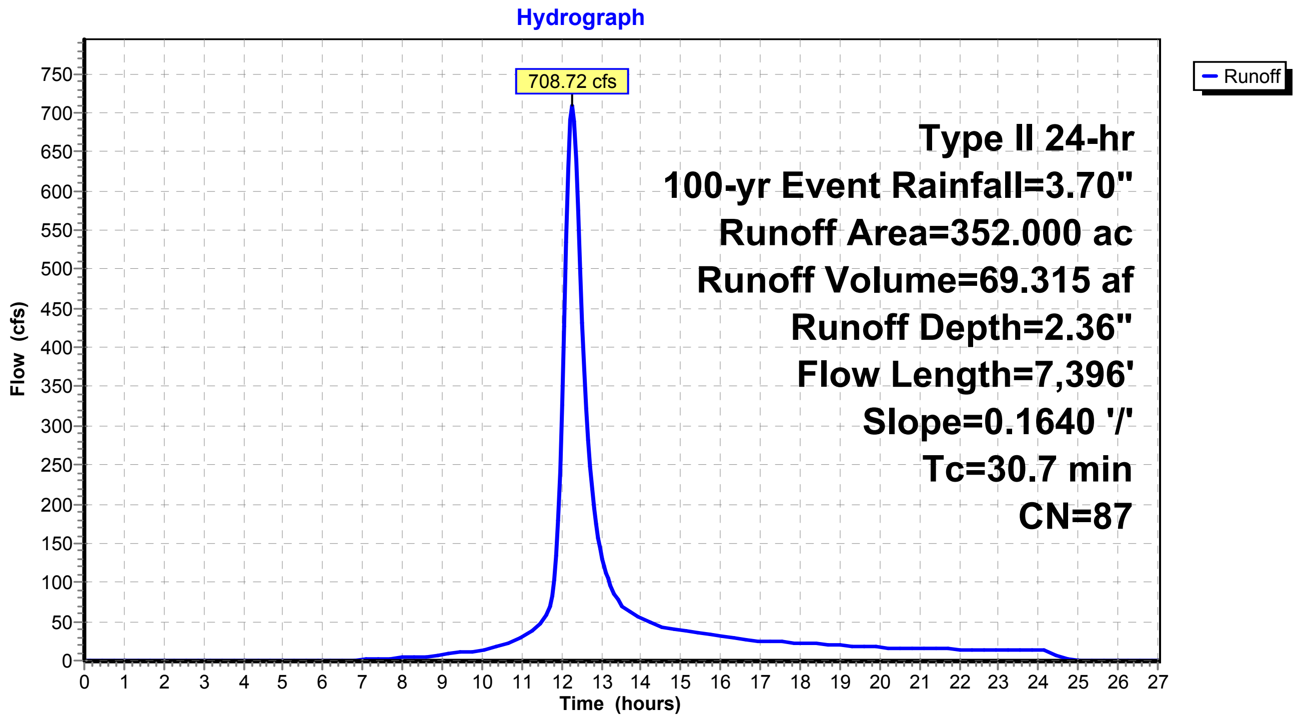
Runoff = 708.72 cfs @ 12.25 hrs, Volume= 69.315 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	316.800	86	Desert shrub range, Fair, HSG D
*	35.200	98	Impervious, HSG D
	352.000	87	Weighted Average
	316.800		90.00% Pervious Area
	35.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.7	7,396	0.1640	4.02		**Lag/CN Method,**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

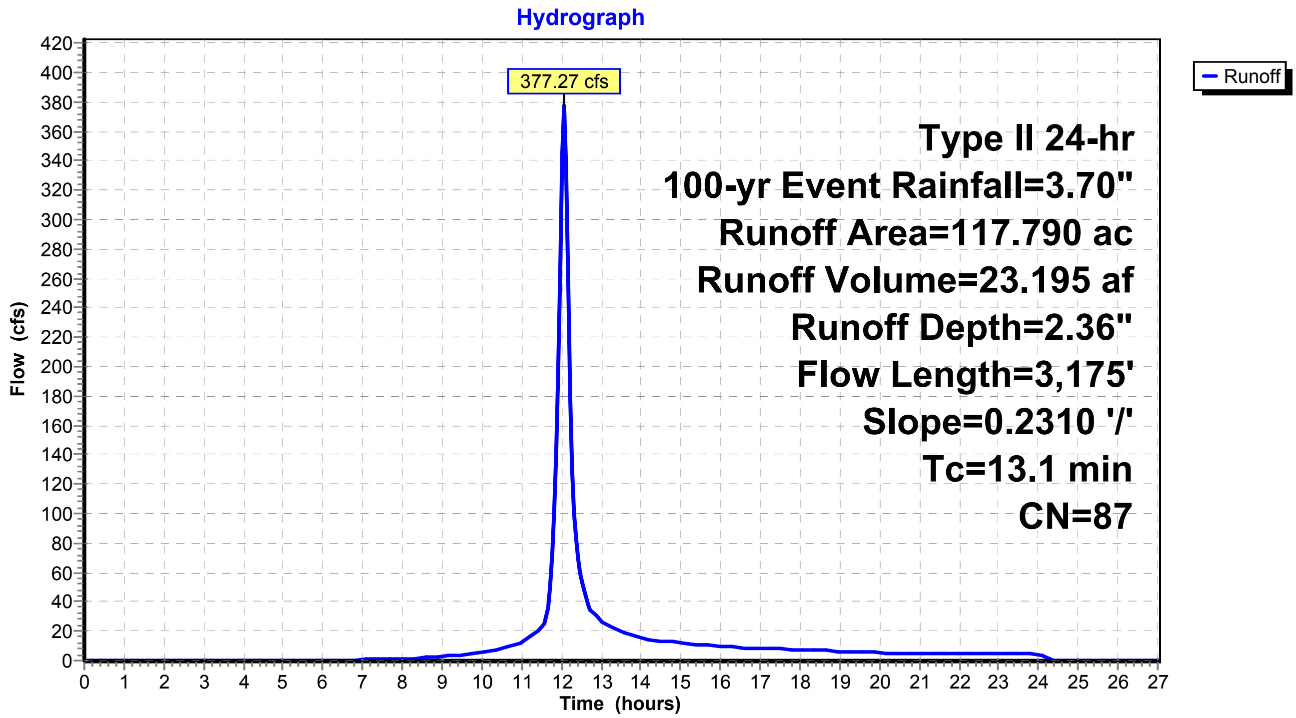
Runoff = 377.27 cfs @ 12.05 hrs, Volume= 23.195 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	106.010	86	Desert shrub range, Fair, HSG D
*	11.780	98	Impervious, HSG D
	117.790	87	Weighted Average
	106.010		90.00% Pervious Area
	11.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	3,175	0.2310	4.03		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

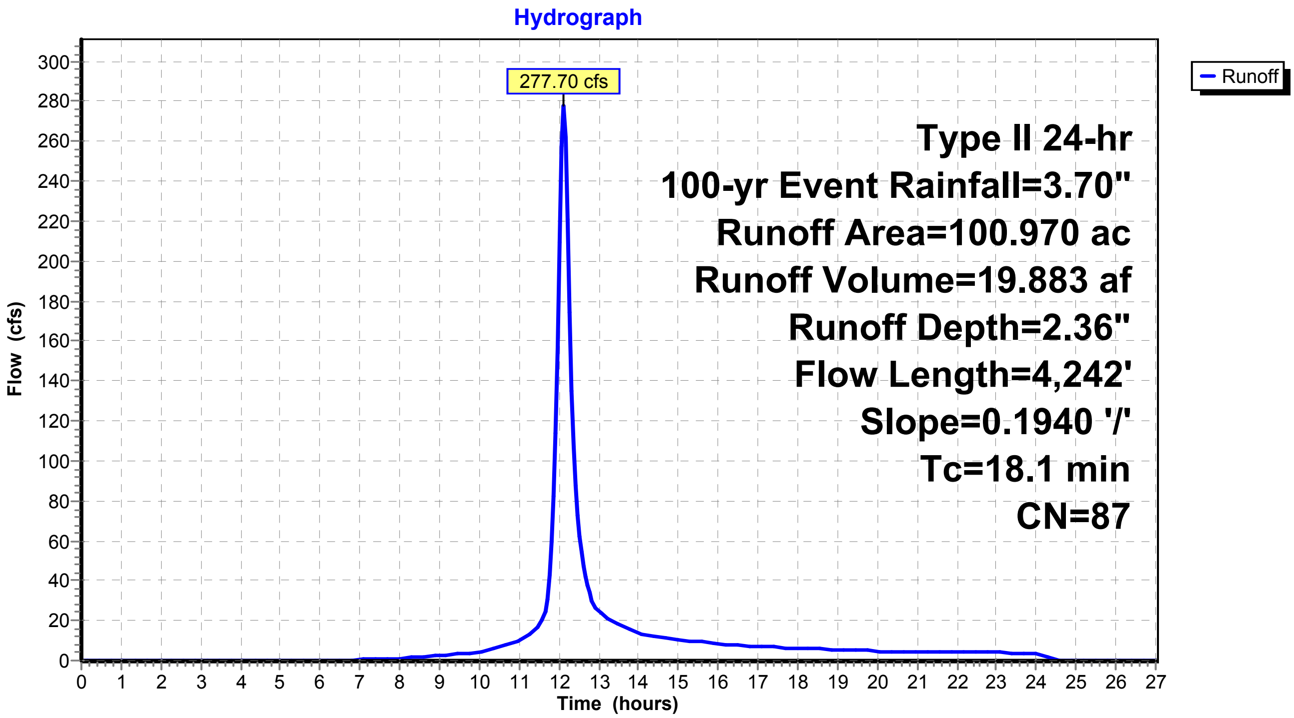
Runoff = 277.70 cfs @ 12.10 hrs, Volume= 19.883 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	90.870	86	Desert shrub range, Fair, HSG D
*	10.100	98	Impervious, HSG D
	100.970	87	Weighted Average
	90.870		90.00% Pervious Area
	10.100		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	4,242	0.1940	3.91		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

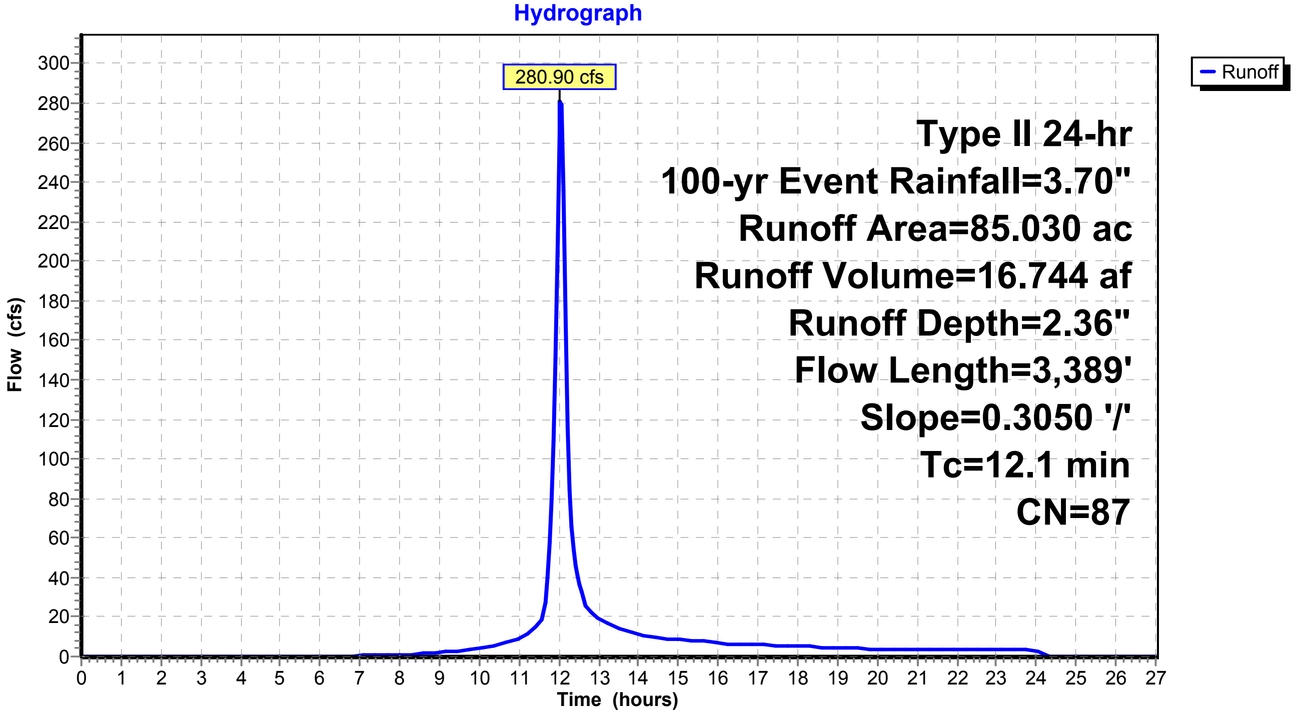
Runoff = 280.90 cfs @ 12.04 hrs, Volume= 16.744 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	76.530	86	Desert shrub range, Fair, HSG D
*	8.500	98	Impervious, HSG D
	85.030	87	Weighted Average
	76.530		90.00% Pervious Area
	8.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	3,389	0.3050	4.69		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

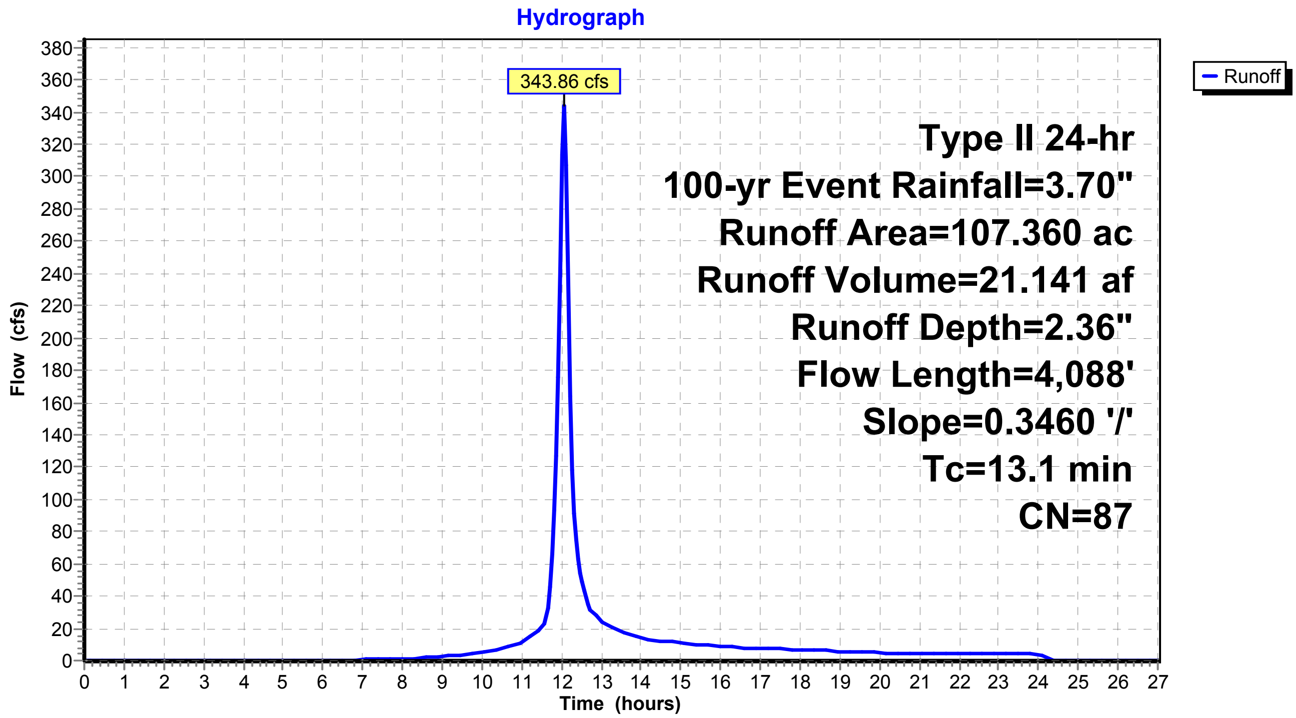
Runoff = 343.86 cfs @ 12.05 hrs, Volume= 21.141 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	96.620	86	Desert shrub range, Fair, HSG D
*	10.740	98	Impervious, HSG D
	107.360	87	Weighted Average
	96.620		90.00% Pervious Area
	10.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	4,088	0.3460	5.18		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

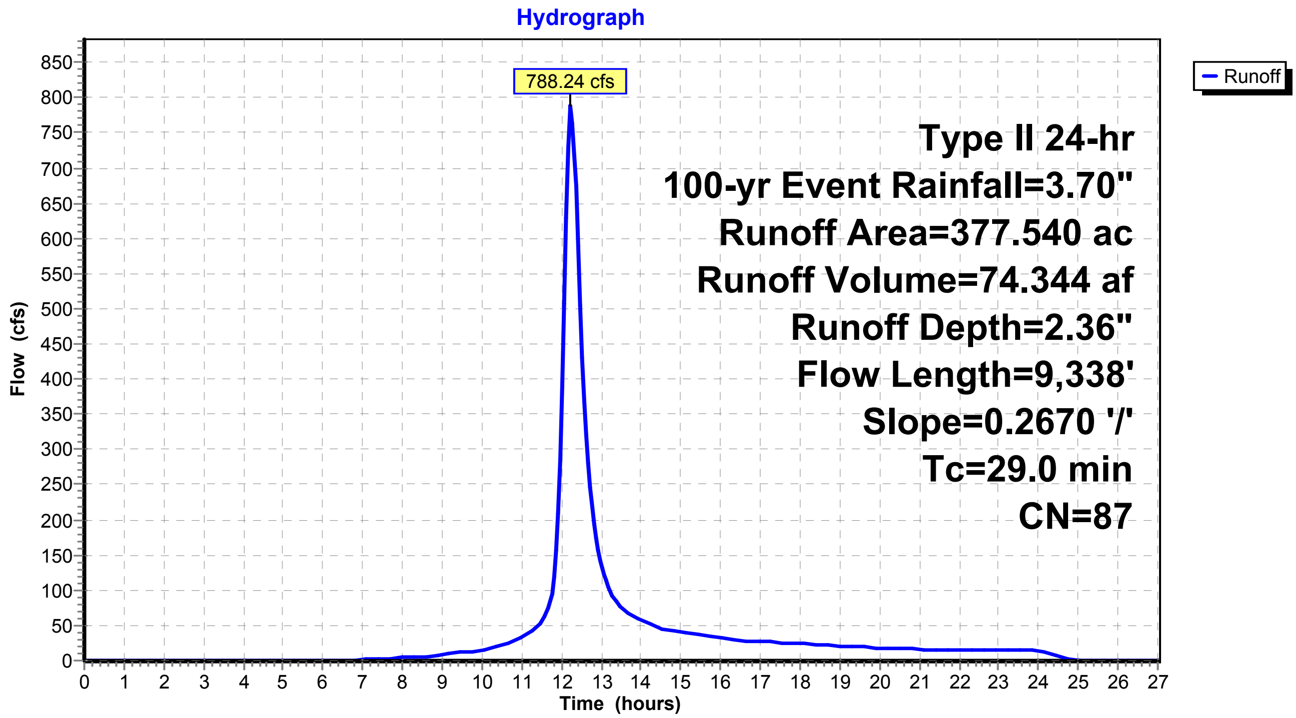
Runoff = 788.24 cfs @ 12.23 hrs, Volume= 74.344 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	339.790	86	Desert shrub range, Fair, HSG D
*	37.750	98	Impervious, HSG D
	377.540	87	Weighted Average
	339.790		90.00% Pervious Area
	37.750		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.0	9,338	0.2670	5.37		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

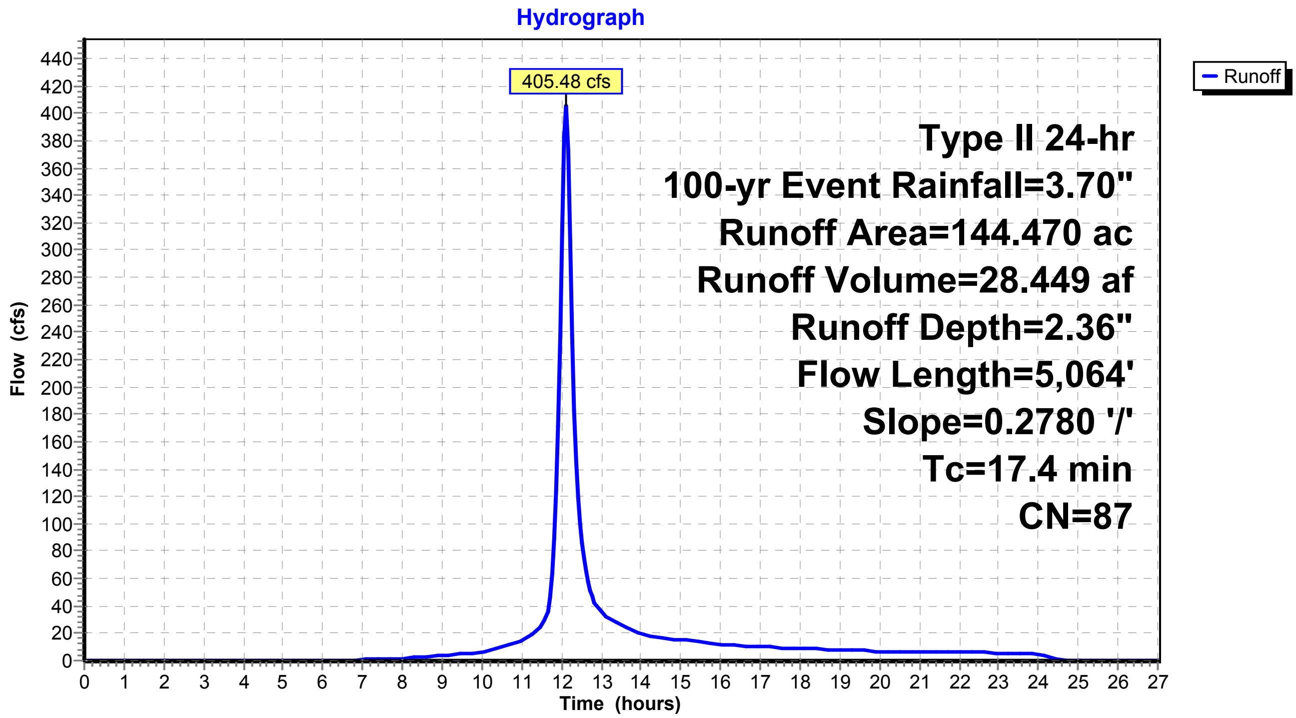
Runoff = 405.48 cfs @ 12.10 hrs, Volume= 28.449 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	5,064	0.2780	4.85		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

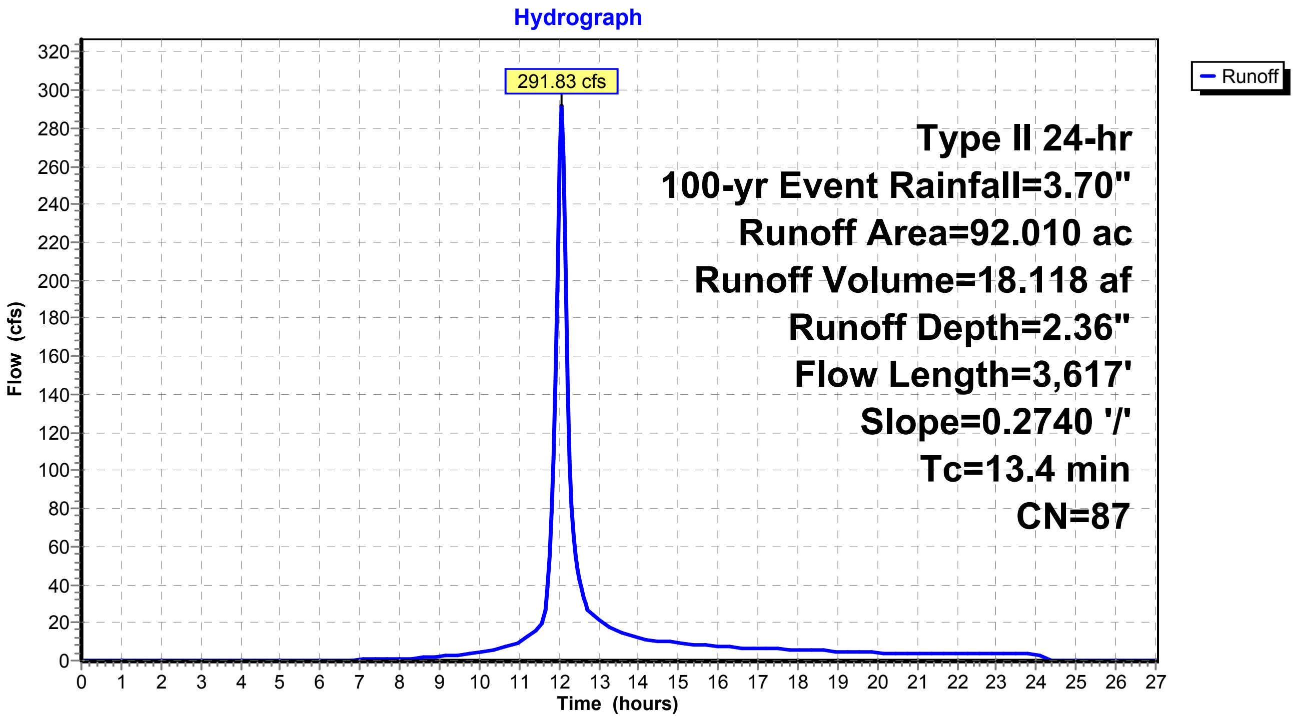
Runoff = 291.83 cfs @ 12.05 hrs, Volume= 18.118 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

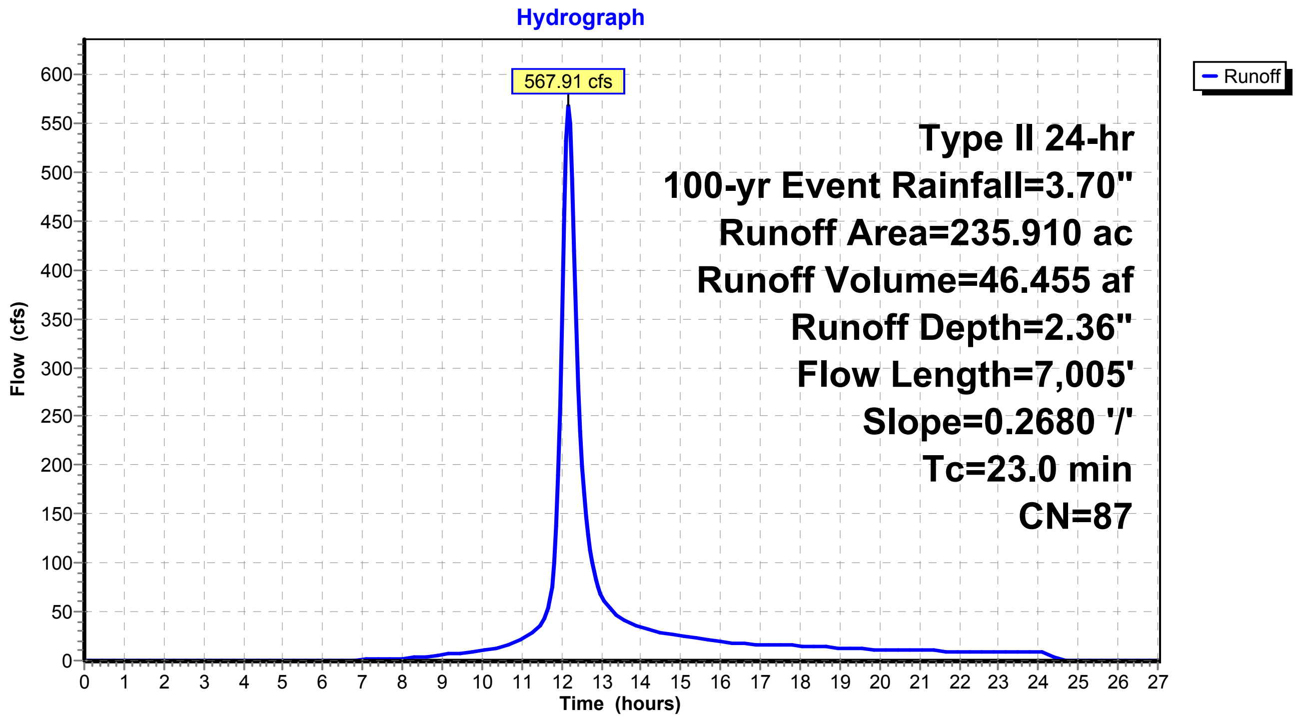
Runoff = 567.91 cfs @ 12.16 hrs, Volume= 46.455 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

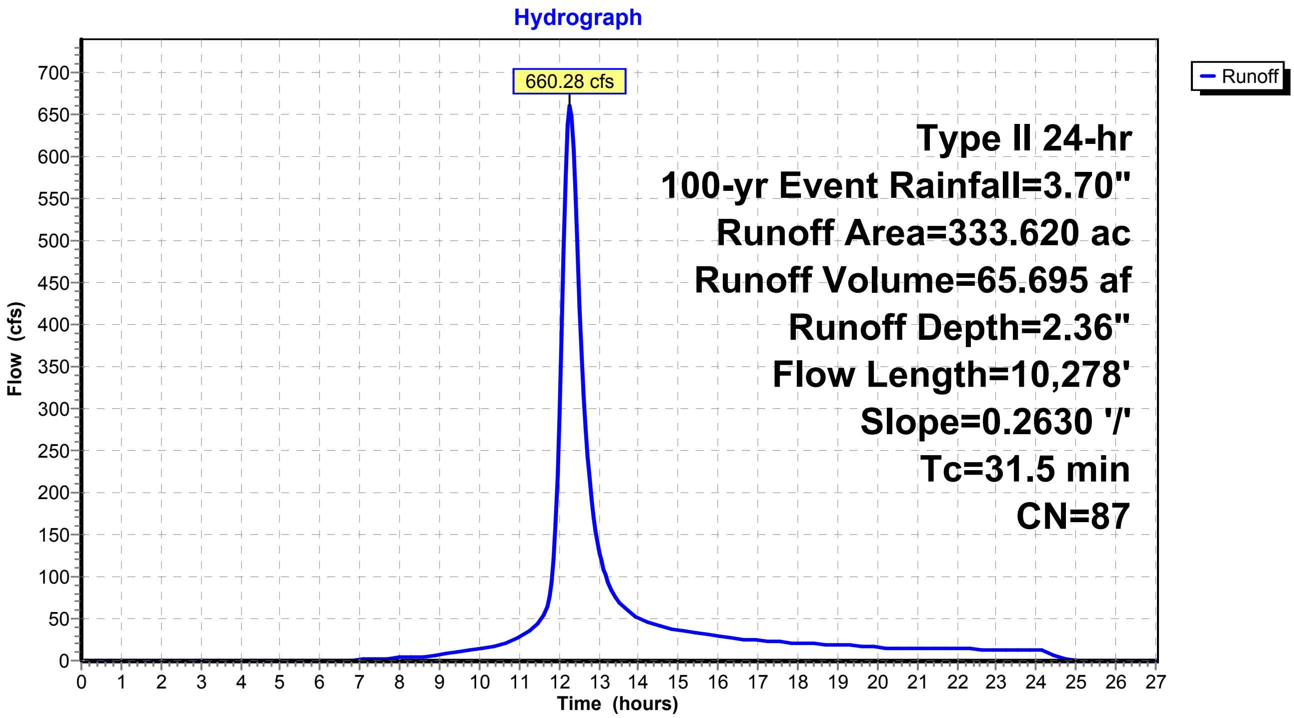
Runoff = 660.28 cfs @ 12.26 hrs, Volume= 65.695 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	300.260	86	Desert shrub range, Fair, HSG D
*	33.360	98	Impervious, HSG D
	333.620	87	Weighted Average
	300.260		90.00% Pervious Area
	33.360		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	10,278	0.2630	5.43		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

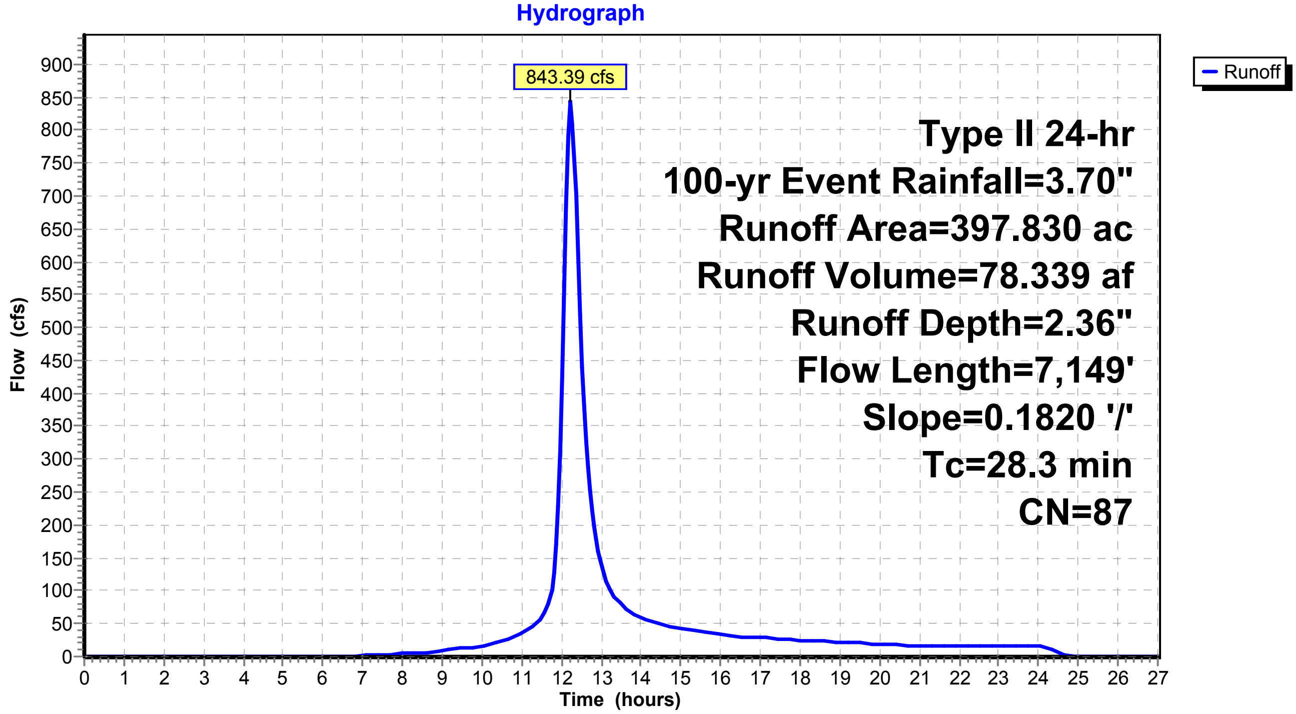
Runoff = 843.39 cfs @ 12.22 hrs, Volume= 78.339 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

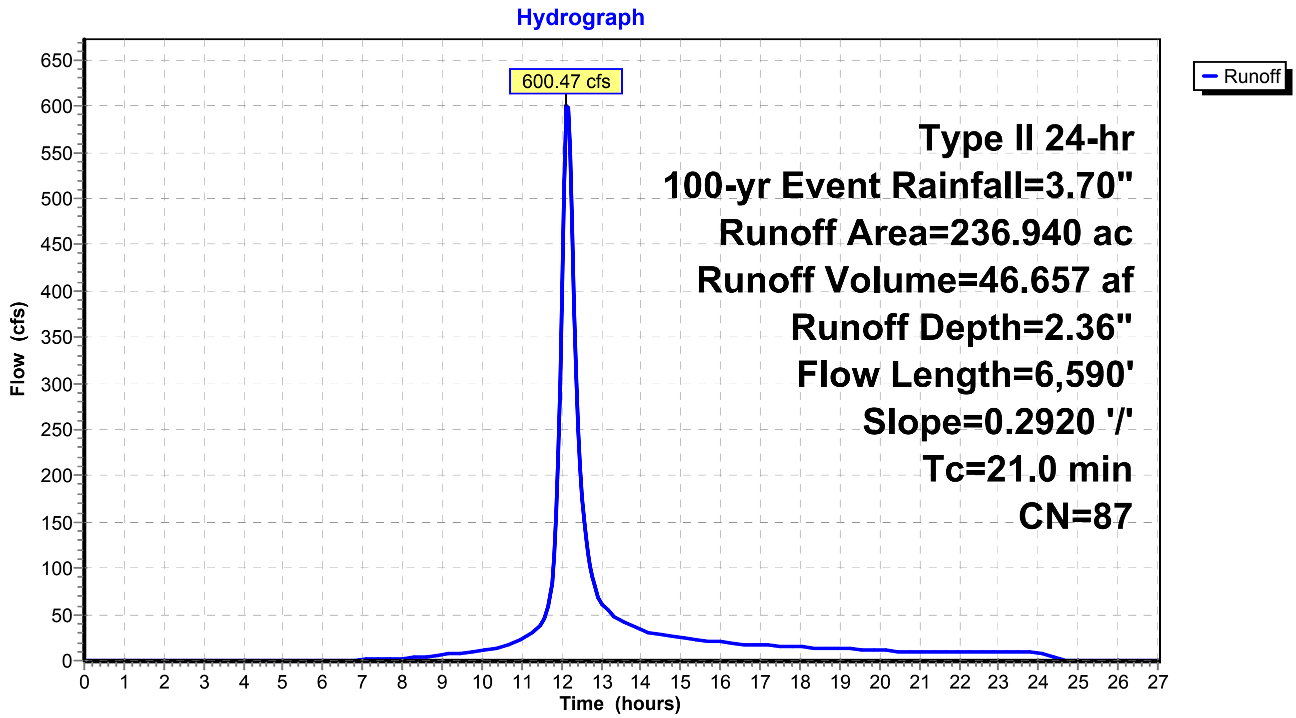
Runoff = 600.47 cfs @ 12.14 hrs, Volume= 46.657 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	213.250	86	Desert shrub range, Fair, HSG D
*	23.690	98	Impervious, HSG D
	236.940	87	Weighted Average
	213.250		90.00% Pervious Area
	23.690		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	6,590	0.2920	5.24		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

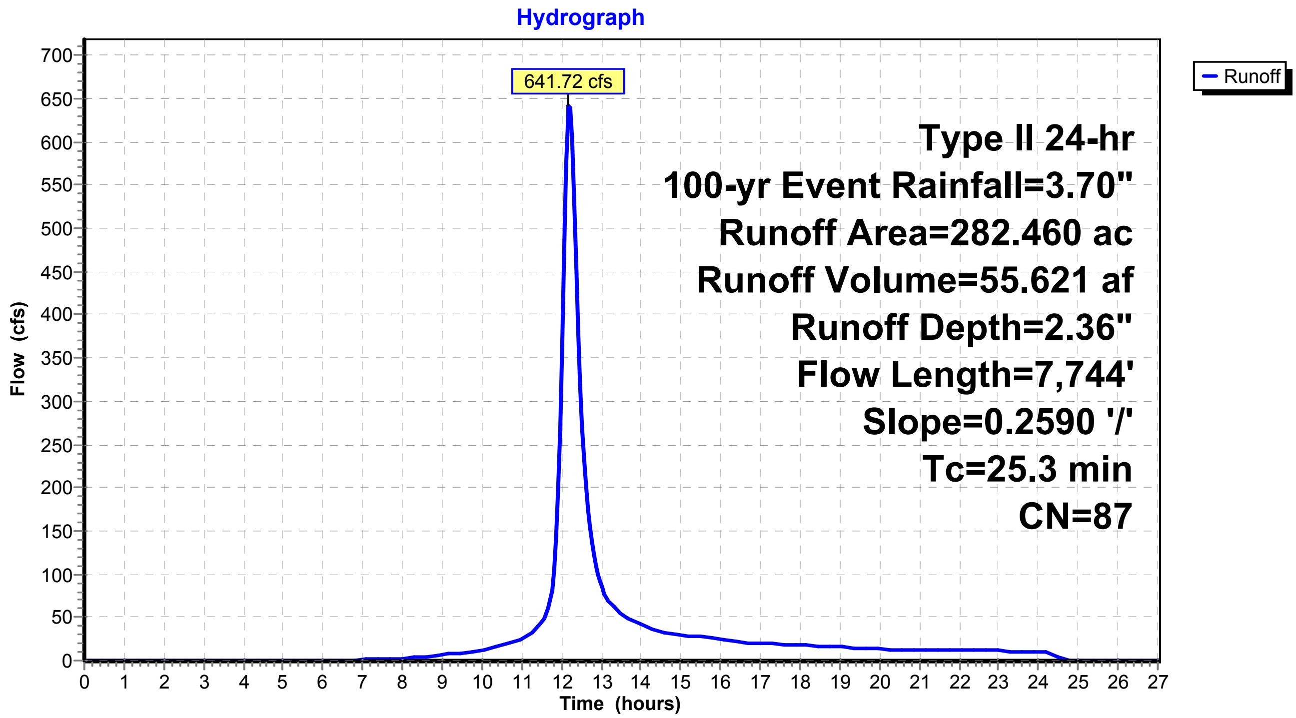
Runoff = 641.72 cfs @ 12.18 hrs, Volume= 55.621 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	254.210	86	Desert shrub range, Fair, HSG D
*	28.250	98	Impervious, HSG D
	282.460	87	Weighted Average
	254.210		90.00% Pervious Area
	28.250		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.3	7,744	0.2590	5.10		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Subcatchment 14: WS 14

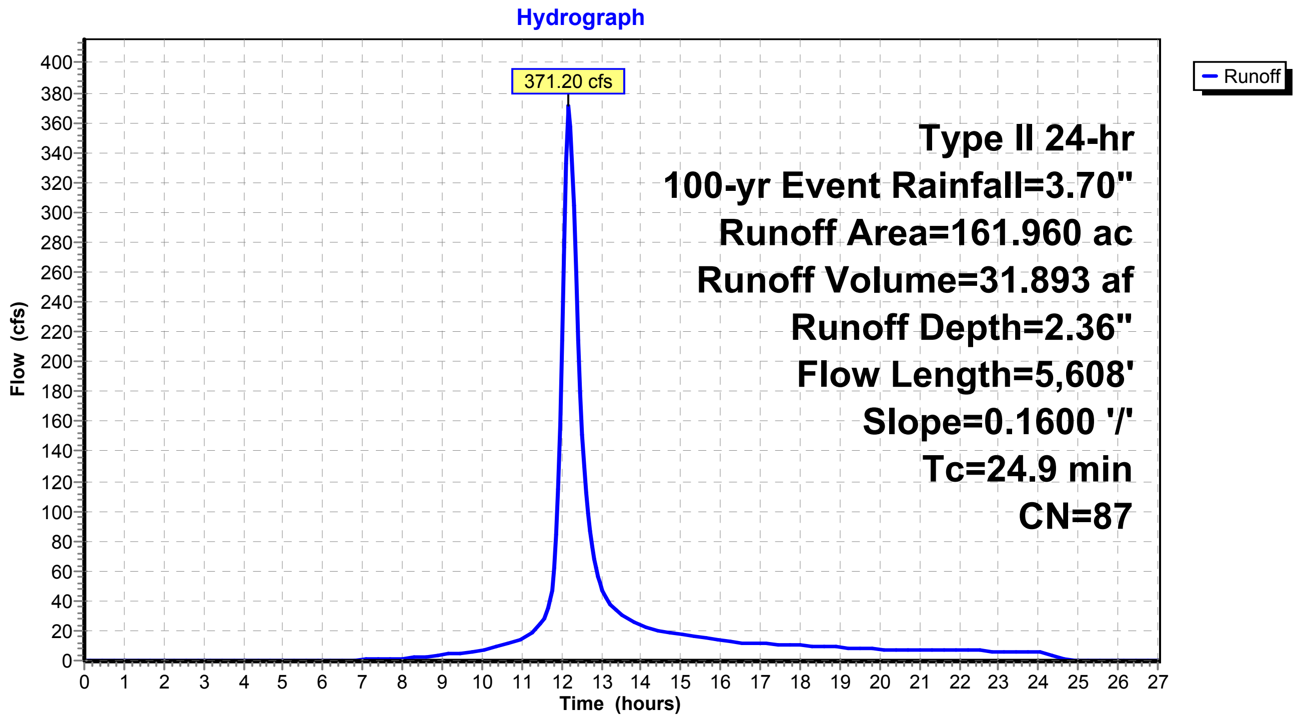
Runoff = 371.20 cfs @ 12.18 hrs, Volume= 31.893 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	145.760	86	Desert shrub range, Fair, HSG D
*	16.200	98	Impervious, HSG D
	161.960	87	Weighted Average
	145.760		90.00% Pervious Area
	16.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.9	5,608	0.1600	3.75		**Lag/CN Method,**

Subcatchment 14: WS 14



Summary for Subcatchment 15: WS 15

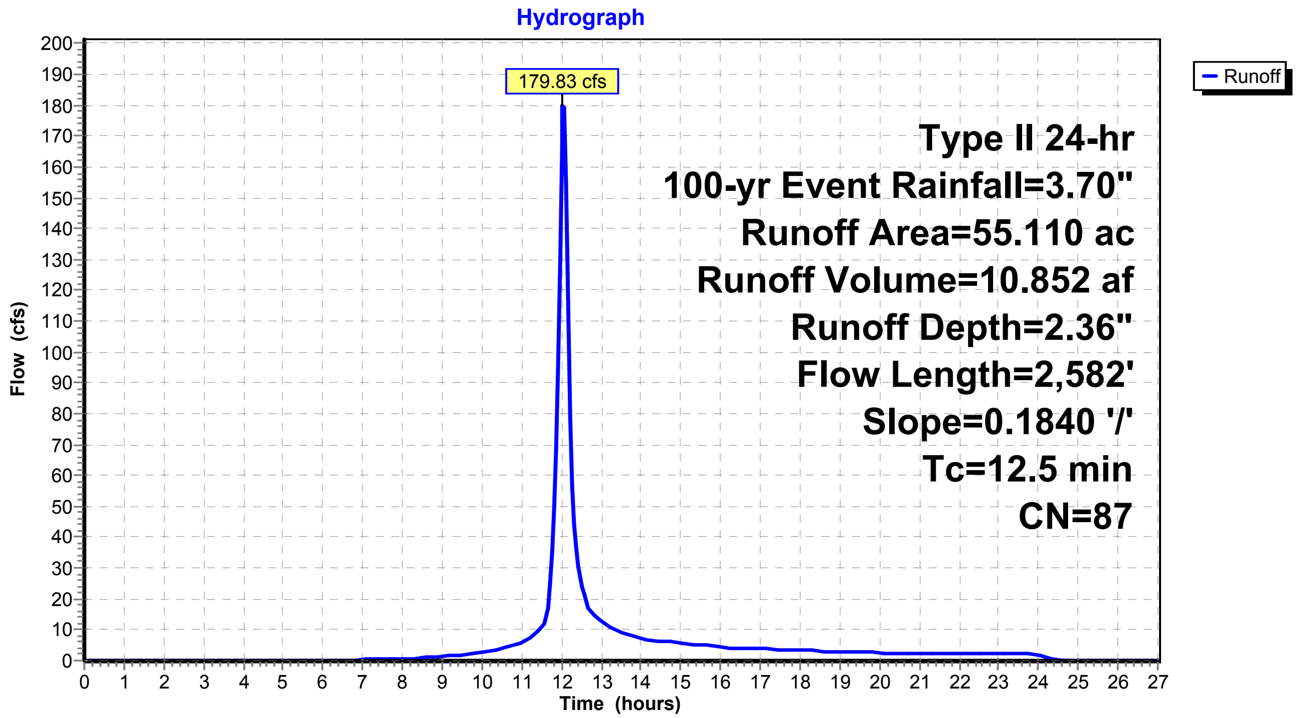
Runoff = 179.83 cfs @ 12.04 hrs, Volume= 10.852 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	49.600	86	Desert shrub range, Fair, HSG D
*	5.510	98	Impervious, HSG D
	55.110	87	Weighted Average
	49.600		90.00% Pervious Area
	5.510		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	2,582	0.1840	3.45		**Lag/CN Method,**

Subcatchment 15: WS 15



Summary for Subcatchment 16: WS 16

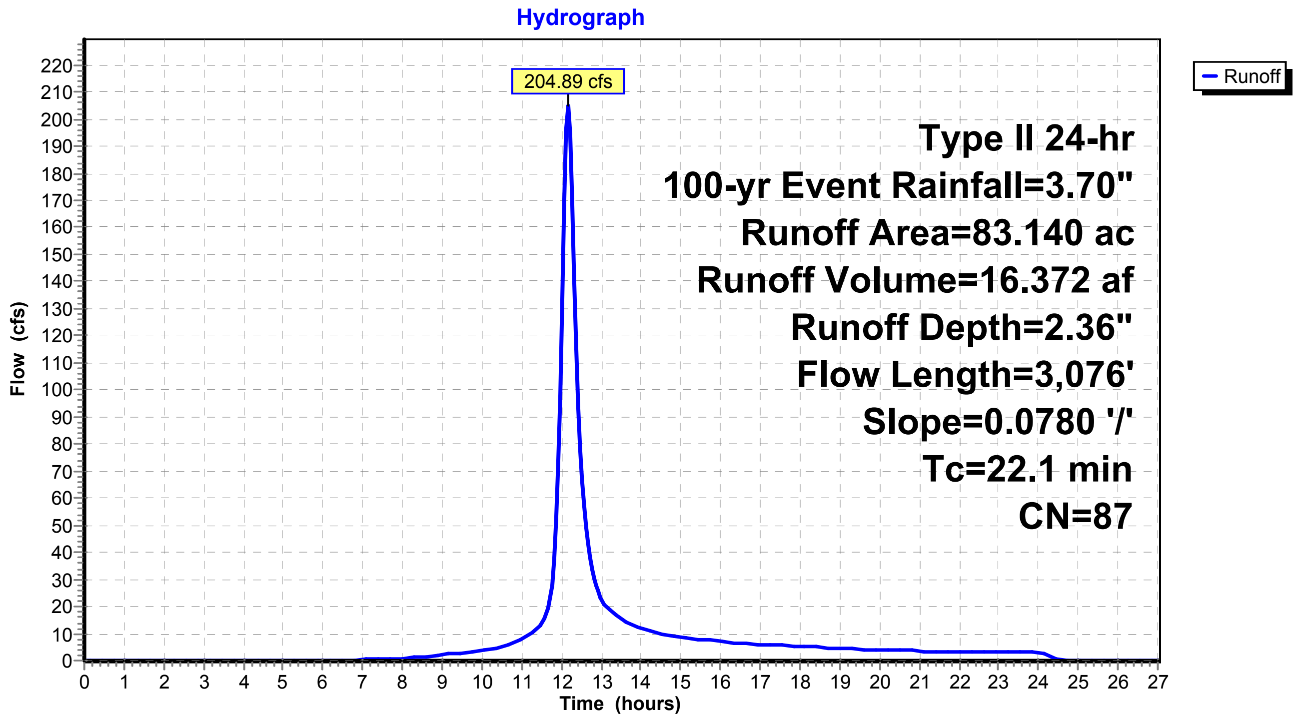
Runoff = 204.89 cfs @ 12.15 hrs, Volume= 16.372 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	74.830	86	Desert shrub range, Fair, HSG D
*	8.310	98	Impervious, HSG D
	83.140	87	Weighted Average
	74.830		90.00% Pervious Area
	8.310		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	3,076	0.0780	2.32		**Lag/CN Method,**

Subcatchment 16: WS 16



Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=352.000 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,396' Slope=0.1640 '/' Tc=30.7 min CN=87 Runoff=813.94 cfs 79.767 af

Subcatchment2: WS 2 Runoff Area=117.790 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,175' Slope=0.2310 '/' Tc=13.1 min CN=87 Runoff=432.11 cfs 26.693 af

Subcatchment3: WS 3 Runoff Area=100.970 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=4,242' Slope=0.1940 '/' Tc=18.1 min CN=87 Runoff=318.42 cfs 22.881 af

Subcatchment4: WS 4 Runoff Area=85.030 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,389' Slope=0.3050 '/' Tc=12.1 min CN=87 Runoff=321.62 cfs 19.269 af

Subcatchment5: WS 5 Runoff Area=107.360 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=4,088' Slope=0.3460 '/' Tc=13.1 min CN=87 Runoff=393.85 cfs 24.329 af

Subcatchment6: WS 6 Runoff Area=377.540 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=9,338' Slope=0.2670 '/' Tc=29.0 min CN=87 Runoff=906.94 cfs 85.555 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=5,064' Slope=0.2780 '/' Tc=17.4 min CN=87 Runoff=464.86 cfs 32.739 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=334.29 cfs 20.851 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=651.70 cfs 53.460 af

Subcatchment10: WS 10 Runoff Area=333.620 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=10,278' Slope=0.2630 '/' Tc=31.5 min CN=87 Runoff=758.38 cfs 75.602 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=968.42 cfs 90.153 af

Subcatchment12: WS 12 Runoff Area=236.940 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=6,590' Slope=0.2920 '/' Tc=21.0 min CN=87 Runoff=688.82 cfs 53.693 af

Subcatchment13: WS 13 Runoff Area=282.460 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,744' Slope=0.2590 '/' Tc=25.3 min CN=87 Runoff=736.61 cfs 64.009 af

Subcatchment14: WS 14 Runoff Area=161.960 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=5,608' Slope=0.1600 '/' Tc=24.9 min CN=87 Runoff=426.07 cfs 36.702 af

Subcatchment15: WS 15 Runoff Area=55.110 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=2,582' Slope=0.1840 '/' Tc=12.5 min CN=87 Runoff=205.93 cfs 12.489 af

Subcatchment16: WS 16 Runoff Area=83.140 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,076' Slope=0.0780 '/' Tc=22.1 min CN=87 Runoff=235.08 cfs 18.841 af

Total Runoff Area = 3,164.140 ac Runoff Volume = 717.031 af Average Runoff Depth = 2.72"
90.00% Pervious = 2,847.730 ac 10.00% Impervious = 316.410 ac

Summary for Subcatchment 1: WS 1

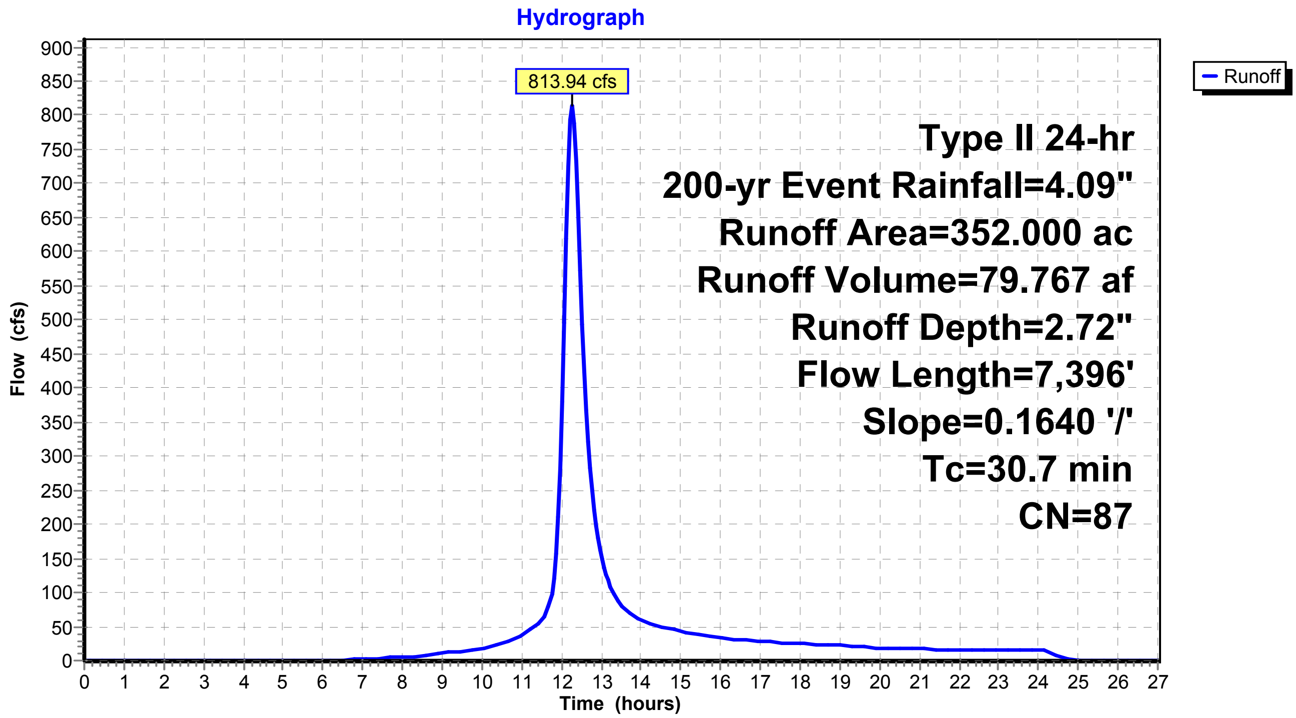
Runoff = 813.94 cfs @ 12.25 hrs, Volume= 79.767 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	316.800	86	Desert shrub range, Fair, HSG D
*	35.200	98	Impervious, HSG D
	352.000	87	Weighted Average
	316.800		90.00% Pervious Area
	35.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.7	7,396	0.1640	4.02		**Lag/CN Method,**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

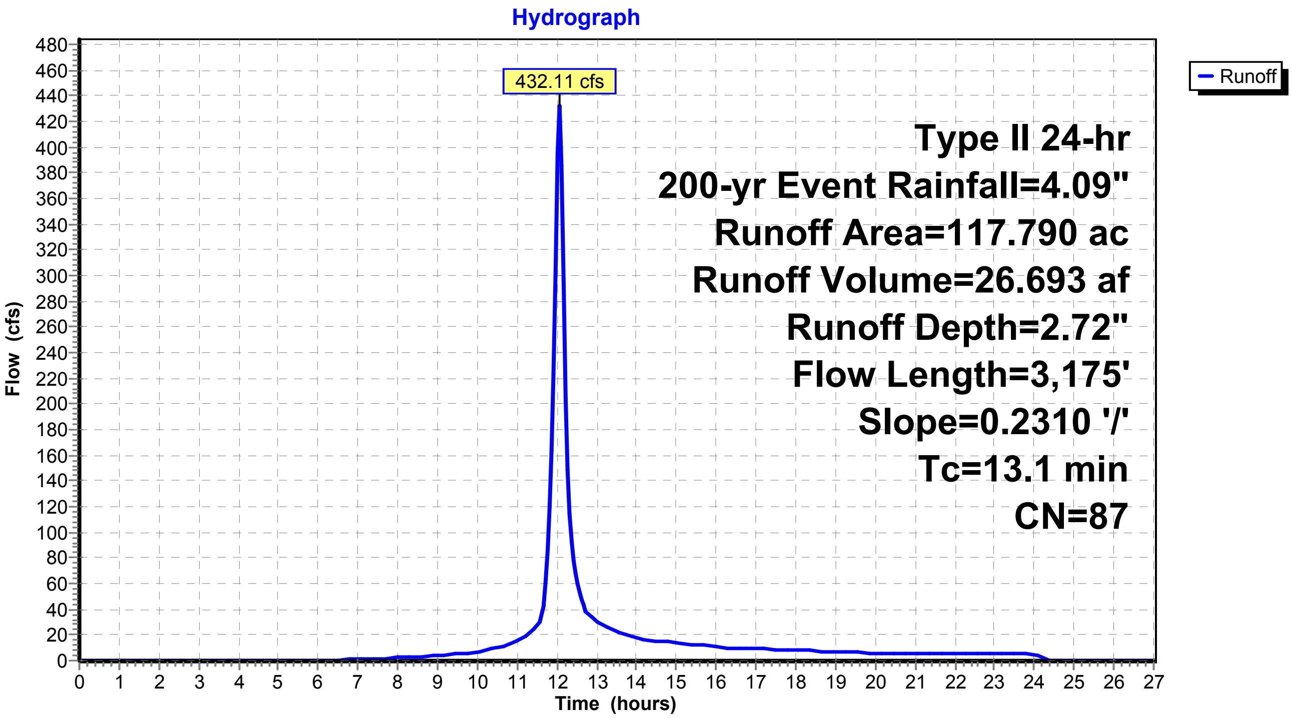
Runoff = 432.11 cfs @ 12.05 hrs, Volume= 26.693 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	106.010	86	Desert shrub range, Fair, HSG D
*	11.780	98	Impervious, HSG D
	117.790	87	Weighted Average
	106.010		90.00% Pervious Area
	11.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	3,175	0.2310	4.03		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

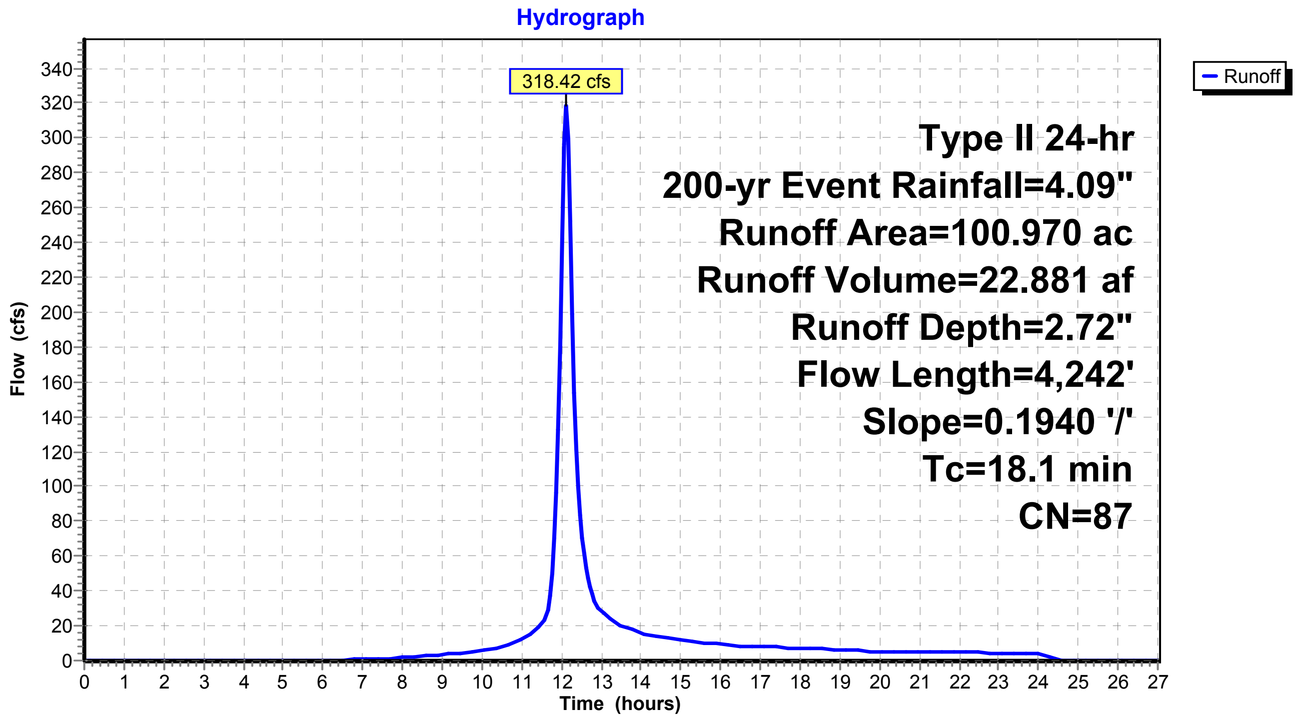
Runoff = 318.42 cfs @ 12.10 hrs, Volume= 22.881 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	90.870	86	Desert shrub range, Fair, HSG D
*	10.100	98	Impervious, HSG D
	100.970	87	Weighted Average
	90.870		90.00% Pervious Area
	10.100		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	4,242	0.1940	3.91		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

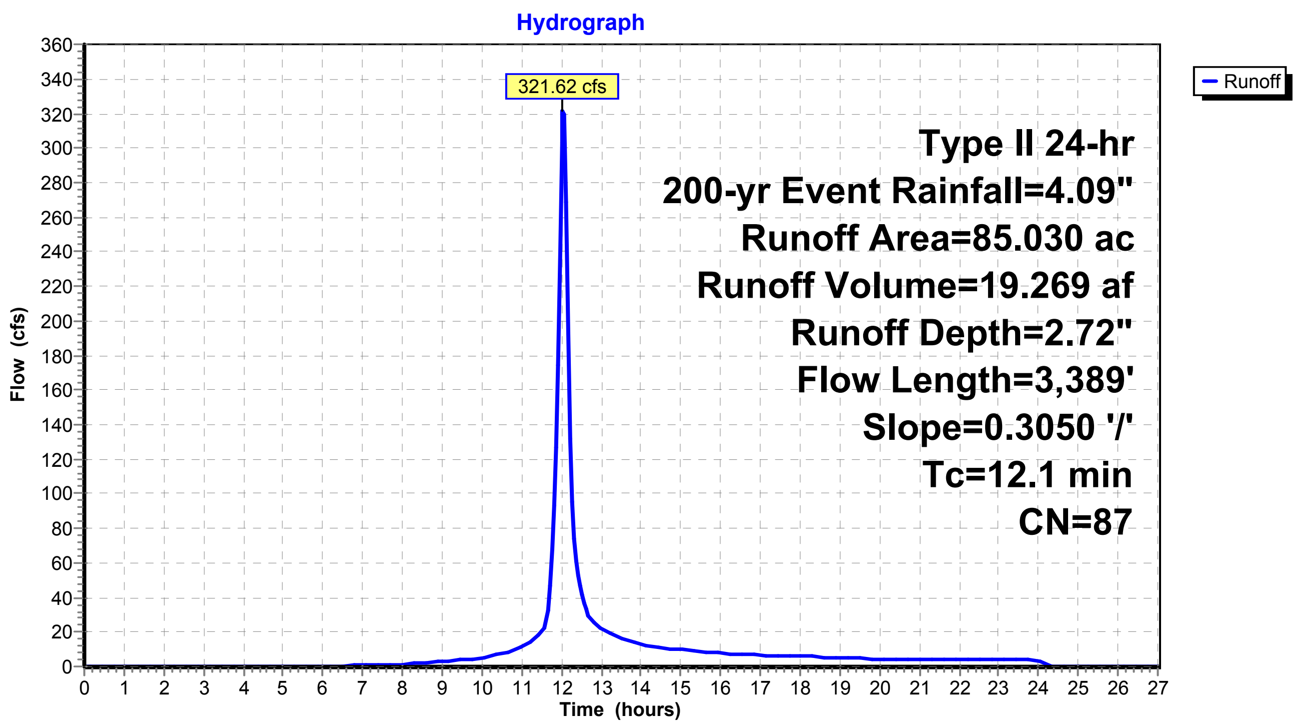
Runoff = 321.62 cfs @ 12.04 hrs, Volume= 19.269 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	76.530	86	Desert shrub range, Fair, HSG D
*	8.500	98	Impervious, HSG D
	85.030	87	Weighted Average
	76.530		90.00% Pervious Area
	8.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	3,389	0.3050	4.69		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

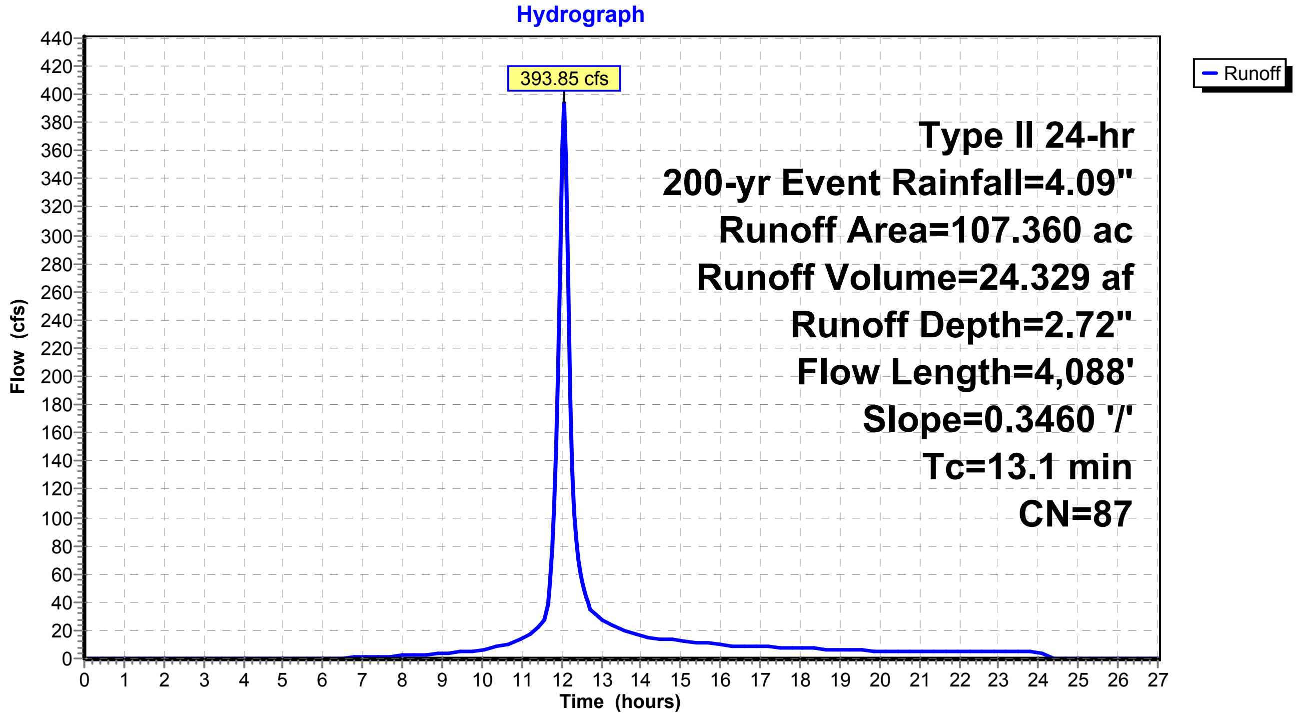
Runoff = 393.85 cfs @ 12.05 hrs, Volume= 24.329 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	96.620	86	Desert shrub range, Fair, HSG D
*	10.740	98	Impervious, HSG D
	107.360	87	Weighted Average
	96.620		90.00% Pervious Area
	10.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	4,088	0.3460	5.18		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

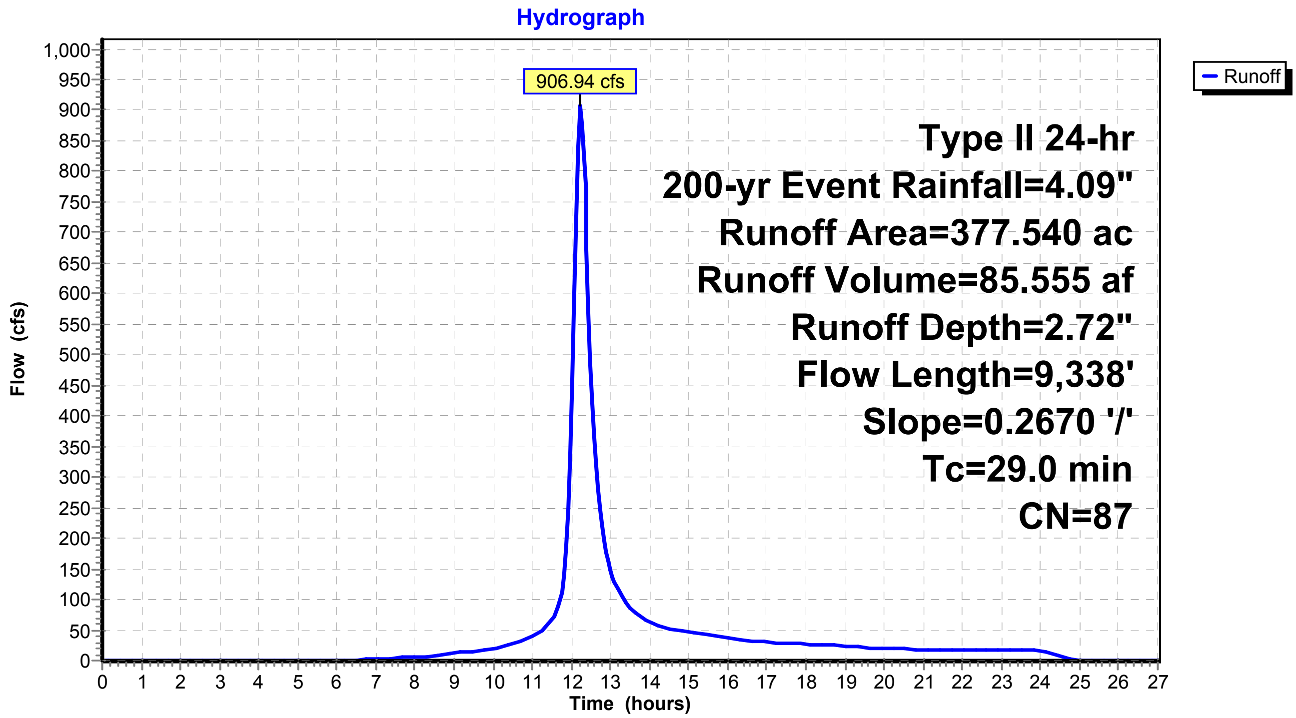
Runoff = 906.94 cfs @ 12.22 hrs, Volume= 85.555 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	339.790	86	Desert shrub range, Fair, HSG D
*	37.750	98	Impervious, HSG D
	377.540	87	Weighted Average
	339.790		90.00% Pervious Area
	37.750		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.0	9,338	0.2670	5.37		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

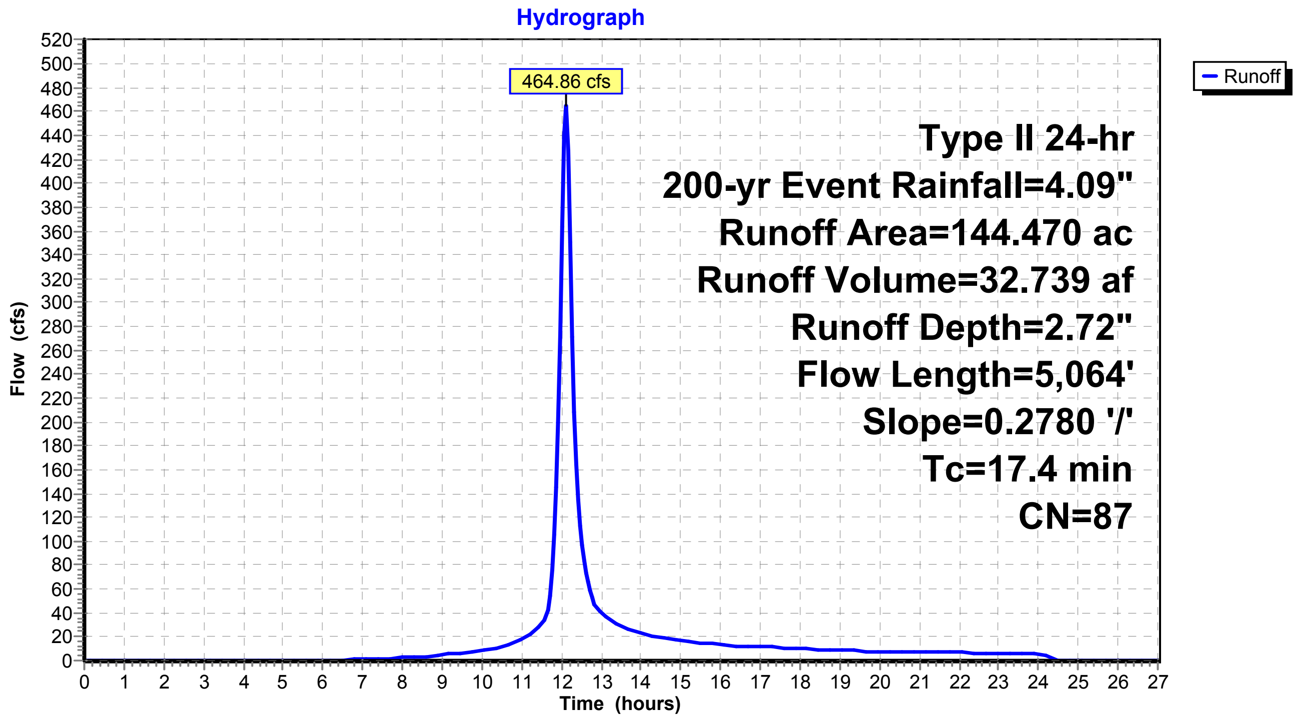
Runoff = 464.86 cfs @ 12.09 hrs, Volume= 32.739 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	5,064	0.2780	4.85		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

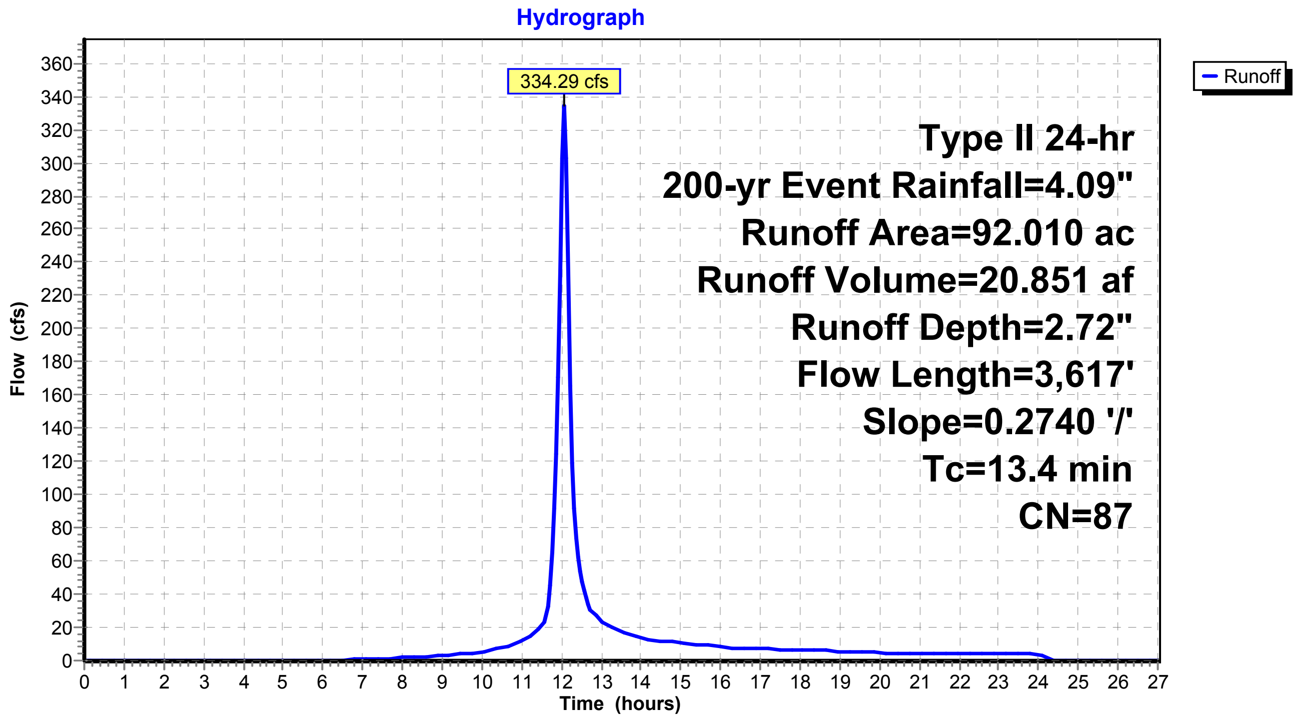
Runoff = 334.29 cfs @ 12.05 hrs, Volume= 20.851 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

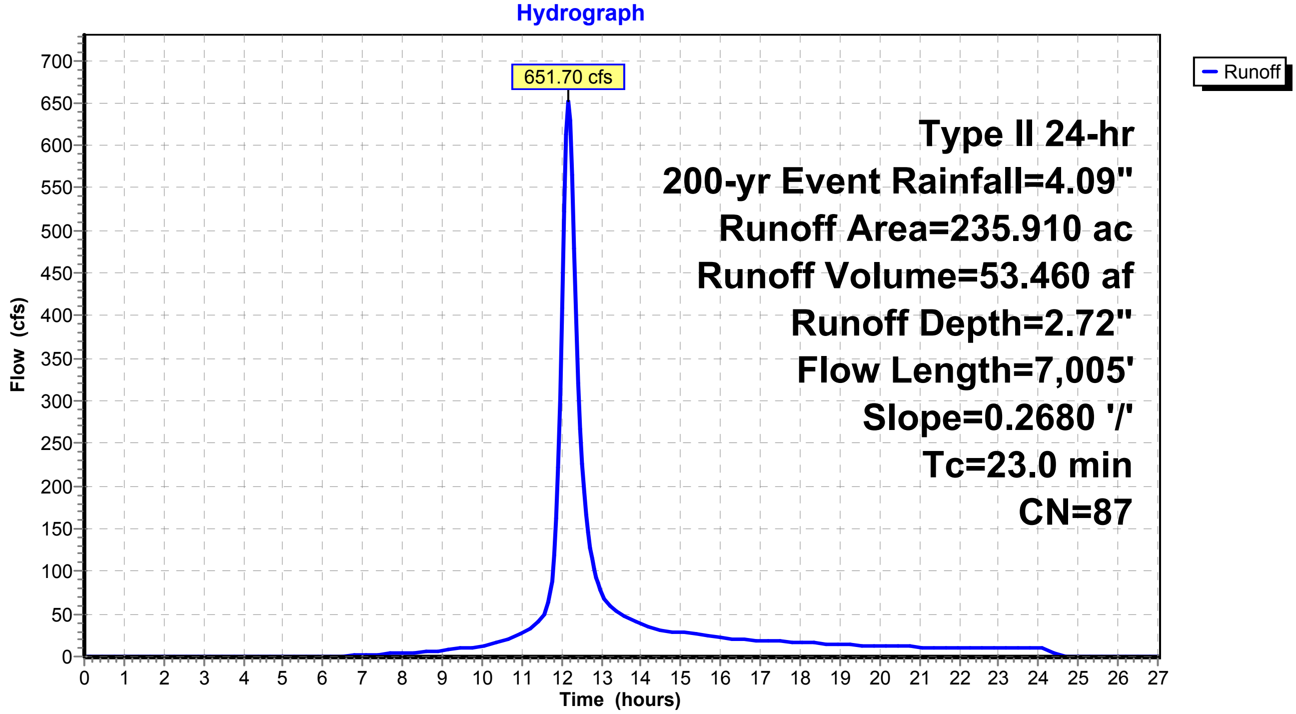
Runoff = 651.70 cfs @ 12.16 hrs, Volume= 53.460 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

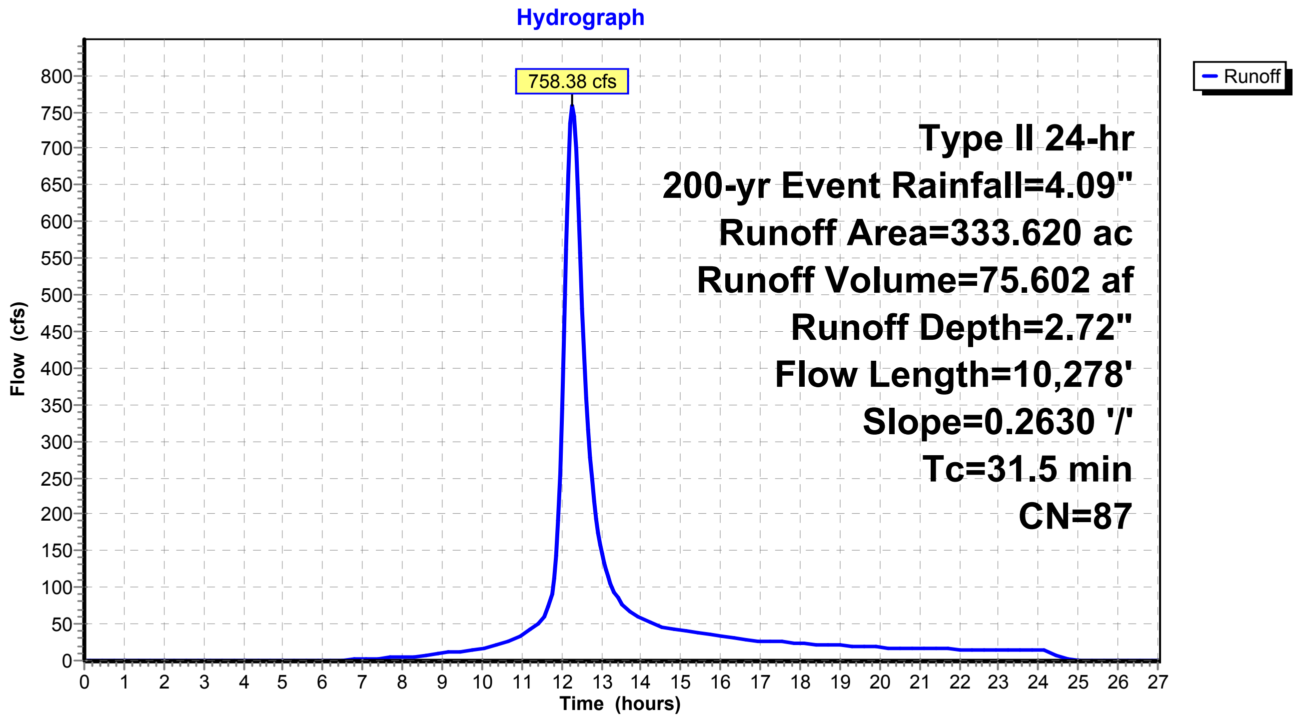
Runoff = 758.38 cfs @ 12.26 hrs, Volume= 75.602 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	300.260	86	Desert shrub range, Fair, HSG D
*	33.360	98	Impervious, HSG D
	333.620	87	Weighted Average
	300.260		90.00% Pervious Area
	33.360		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	10,278	0.2630	5.43		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

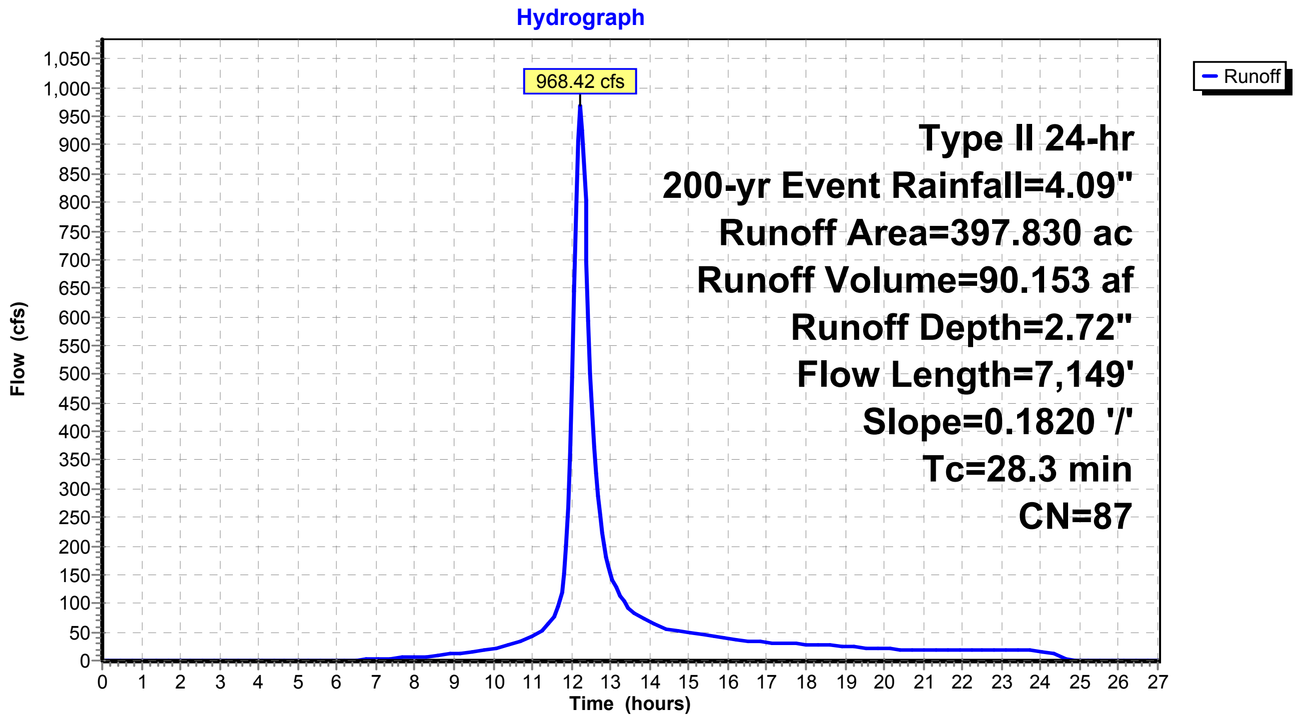
Runoff = 968.42 cfs @ 12.22 hrs, Volume= 90.153 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

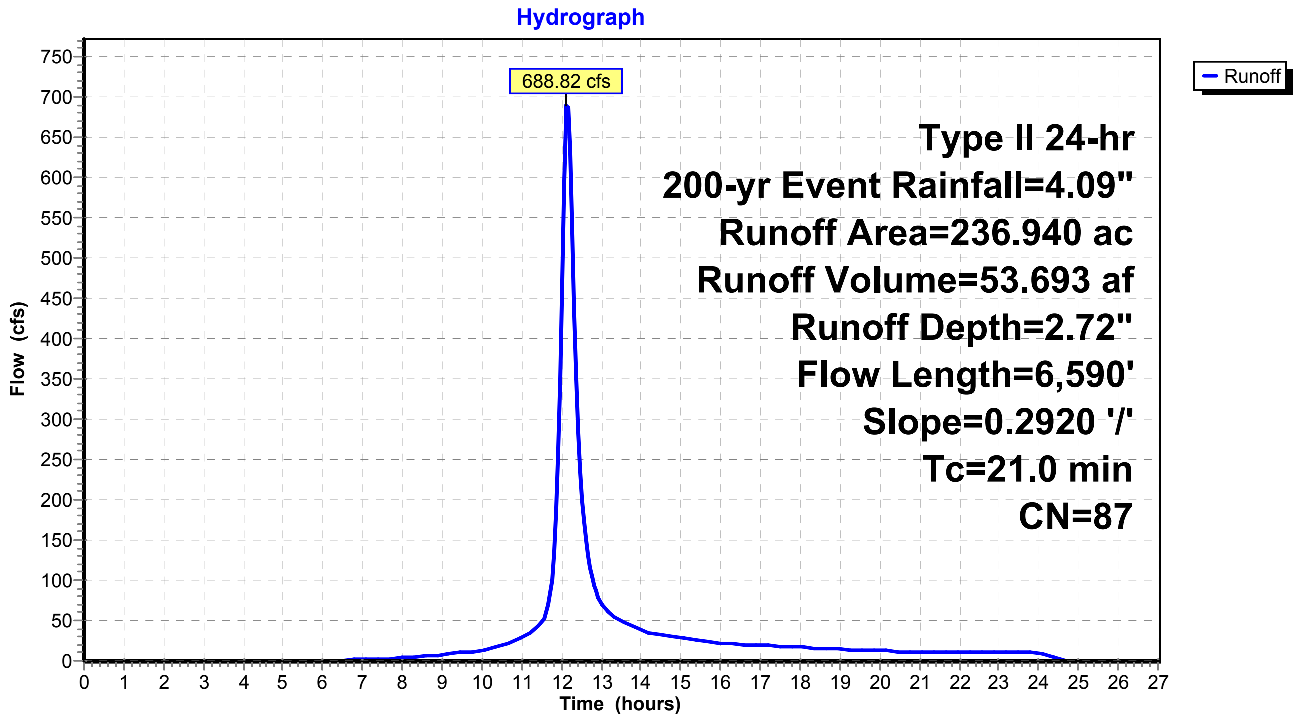
Runoff = 688.82 cfs @ 12.13 hrs, Volume= 53.693 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	213.250	86	Desert shrub range, Fair, HSG D
*	23.690	98	Impervious, HSG D
	236.940	87	Weighted Average
	213.250		90.00% Pervious Area
	23.690		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	6,590	0.2920	5.24		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

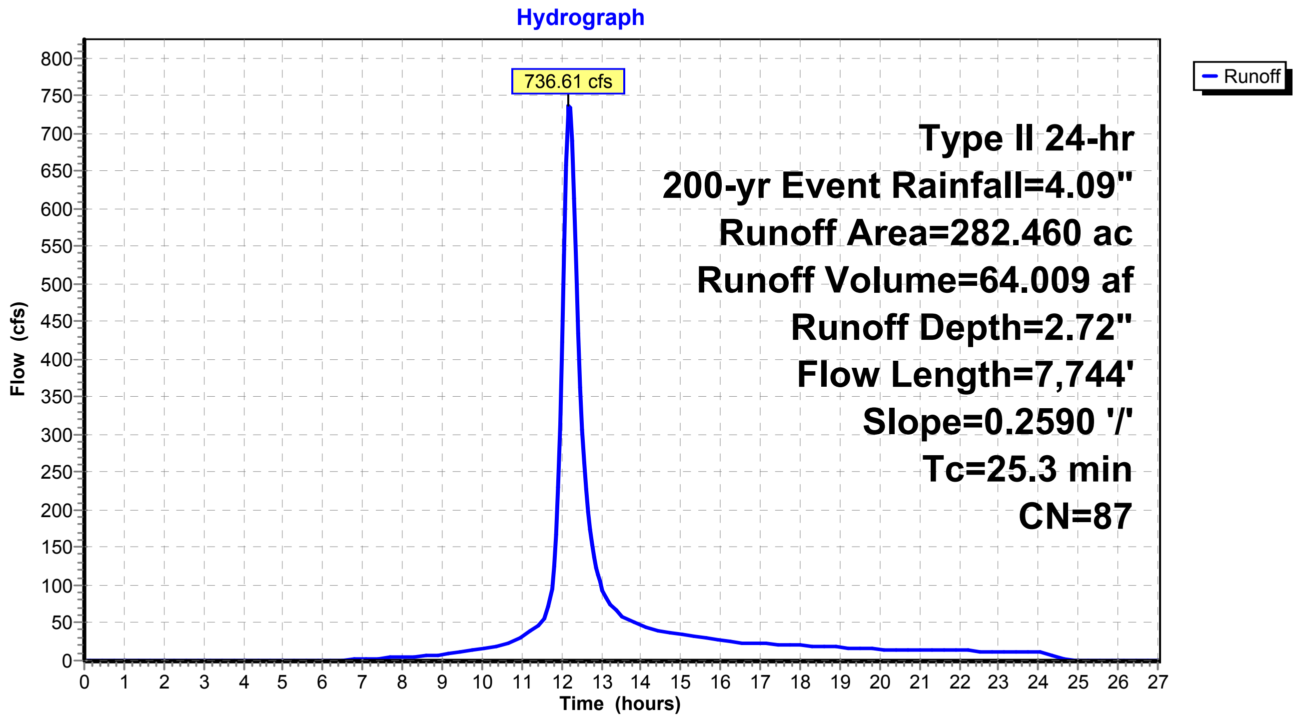
Runoff = 736.61 cfs @ 12.18 hrs, Volume= 64.009 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	254.210	86	Desert shrub range, Fair, HSG D
*	28.250	98	Impervious, HSG D
	282.460	87	Weighted Average
	254.210		90.00% Pervious Area
	28.250		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.3	7,744	0.2590	5.10		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Subcatchment 14: WS 14

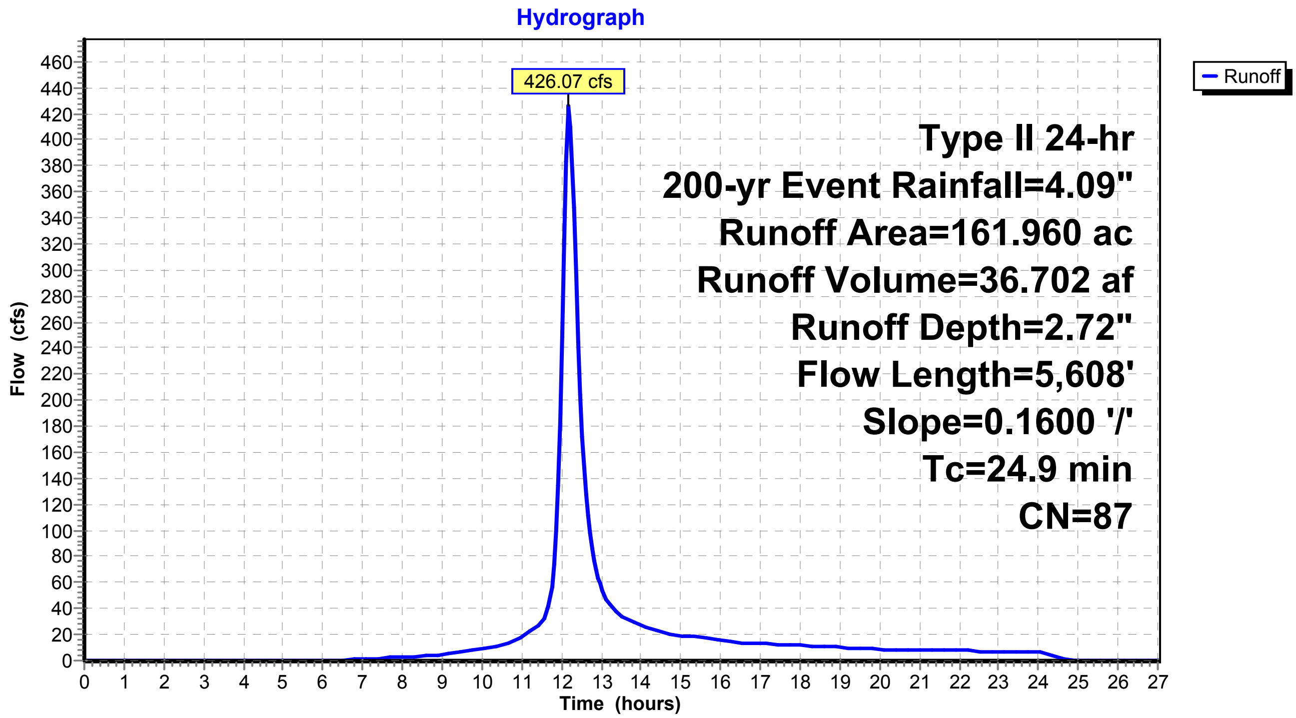
Runoff = 426.07 cfs @ 12.18 hrs, Volume= 36.702 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	145.760	86	Desert shrub range, Fair, HSG D
*	16.200	98	Impervious, HSG D
	161.960	87	Weighted Average
	145.760		90.00% Pervious Area
	16.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.9	5,608	0.1600	3.75		**Lag/CN Method,**

Subcatchment 14: WS 14



Summary for Subcatchment 15: WS 15

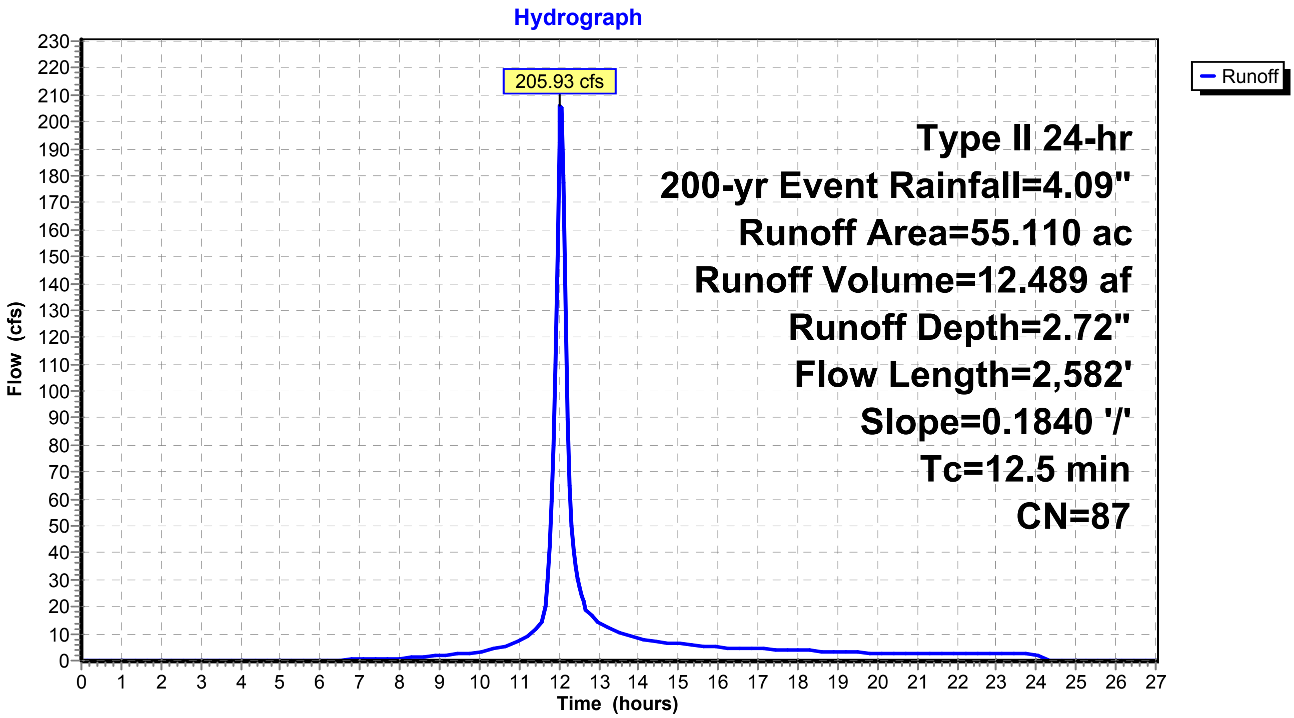
Runoff = 205.93 cfs @ 12.04 hrs, Volume= 12.489 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	49.600	86	Desert shrub range, Fair, HSG D
*	5.510	98	Impervious, HSG D
	55.110	87	Weighted Average
	49.600		90.00% Pervious Area
	5.510		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	2,582	0.1840	3.45		**Lag/CN Method,**

Subcatchment 15: WS 15



Summary for Subcatchment 16: WS 16

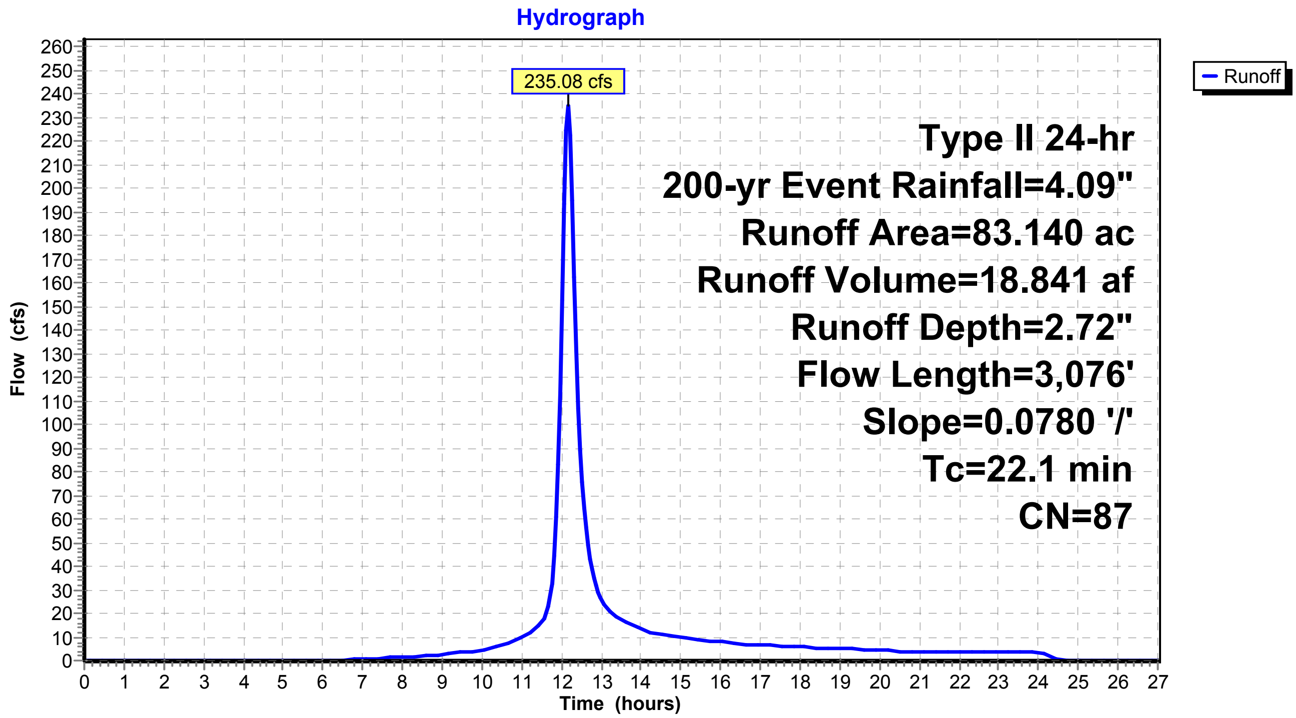
Runoff = 235.08 cfs @ 12.15 hrs, Volume= 18.841 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	74.830	86	Desert shrub range, Fair, HSG D
*	8.310	98	Impervious, HSG D
	83.140	87	Weighted Average
	74.830		90.00% Pervious Area
	8.310		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	3,076	0.0780	2.32		**Lag/CN Method,**

Subcatchment 16: WS 16



Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=352.000 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,396' Slope=0.1640 '/' Tc=30.7 min CN=87 Runoff=952.23 cfs 93.637 af

Subcatchment2: WS 2 Runoff Area=117.790 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,175' Slope=0.2310 '/' Tc=13.1 min CN=87 Runoff=504.05 cfs 31.334 af

Subcatchment3: WS 3 Runoff Area=100.970 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=4,242' Slope=0.1940 '/' Tc=18.1 min CN=87 Runoff=371.87 cfs 26.859 af

Subcatchment4: WS 4 Runoff Area=85.030 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,389' Slope=0.3050 '/' Tc=12.1 min CN=87 Runoff=375.03 cfs 22.619 af

Subcatchment5: WS 5 Runoff Area=107.360 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=4,088' Slope=0.3460 '/' Tc=13.1 min CN=87 Runoff=459.42 cfs 28.559 af

Subcatchment6: WS 6 Runoff Area=377.540 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=9,338' Slope=0.2670 '/' Tc=29.0 min CN=87 Runoff=1,060.97 cfs 100.431 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=5,064' Slope=0.2780 '/' Tc=17.4 min CN=87 Runoff=542.79 cfs 38.431 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=389.99 cfs 24.476 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=761.76 cfs 62.755 af

Subcatchment10: WS 10 Runoff Area=333.620 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=10,278' Slope=0.2630 '/' Tc=31.5 min CN=87 Runoff=887.32 cfs 88.748 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=1,132.73 cfs 105.828 af

Subcatchment12: WS 12 Runoff Area=236.940 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=6,590' Slope=0.2920 '/' Tc=21.0 min CN=87 Runoff=804.86 cfs 63.029 af

Subcatchment13: WS 13 Runoff Area=282.460 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,744' Slope=0.2590 '/' Tc=25.3 min CN=87 Runoff=861.28 cfs 75.138 af

Subcatchment14: WS 14 Runoff Area=161.960 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=5,608' Slope=0.1600 '/' Tc=24.9 min CN=87 Runoff=498.15 cfs 43.084 af

Subcatchment15: WS 15 Runoff Area=55.110 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=2,582' Slope=0.1840 '/' Tc=12.5 min CN=87 Runoff=240.16 cfs 14.660 af

Subcatchment16: WS 16 Runoff Area=83.140 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,076' Slope=0.0780 '/' Tc=22.1 min CN=87 Runoff=274.73 cfs 22.116 af

Total Runoff Area = 3,164.140 ac Runoff Volume = 841.705 af Average Runoff Depth = 3.19"
90.00% Pervious = 2,847.730 ac 10.00% Impervious = 316.410 ac

Summary for Subcatchment 1: WS 1

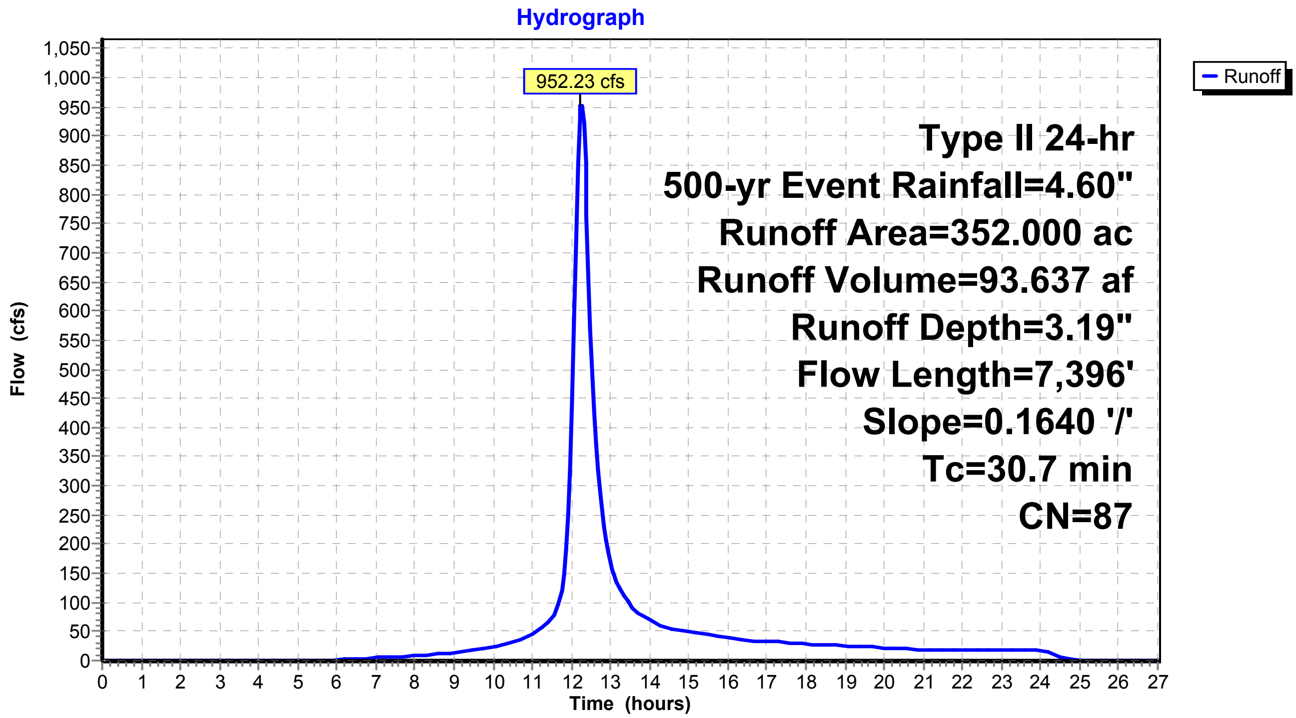
Runoff = 952.23 cfs @ 12.25 hrs, Volume= 93.637 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	316.800	86	Desert shrub range, Fair, HSG D
*	35.200	98	Impervious, HSG D
	352.000	87	Weighted Average
	316.800		90.00% Pervious Area
	35.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.7	7,396	0.1640	4.02		**Lag/CN Method,**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

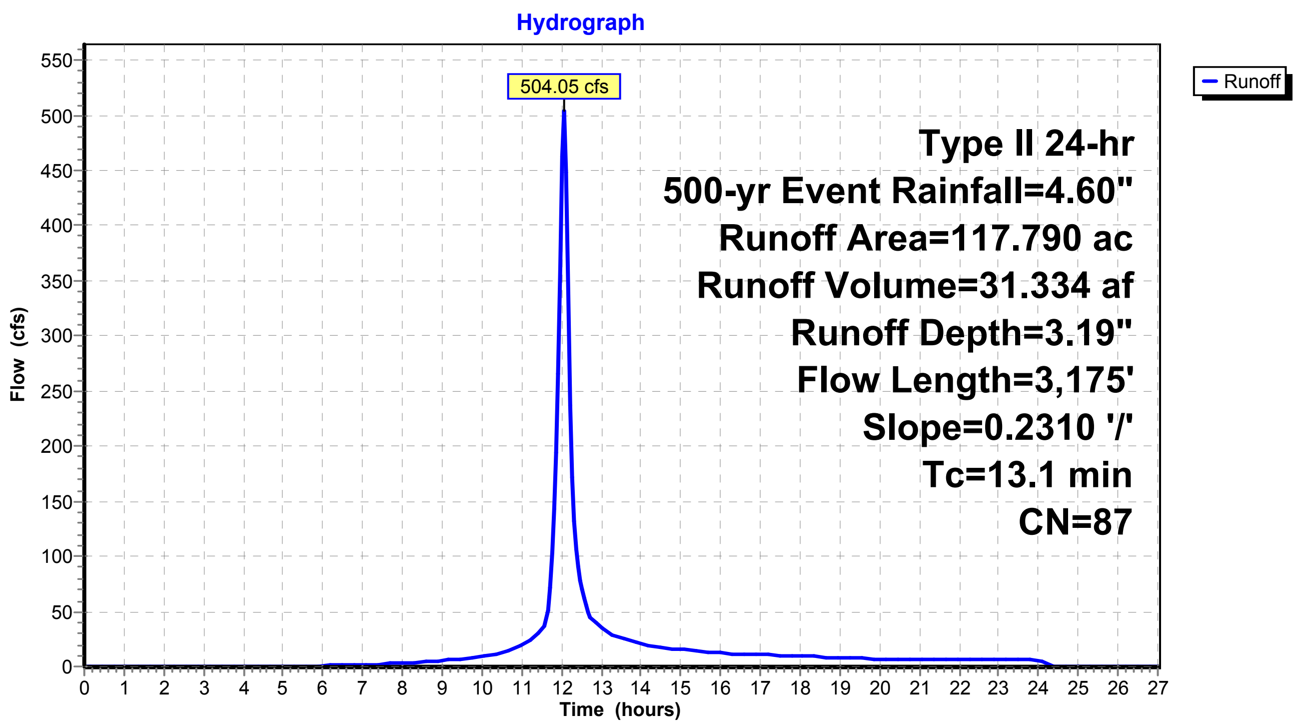
Runoff = 504.05 cfs @ 12.05 hrs, Volume= 31.334 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	106.010	86	Desert shrub range, Fair, HSG D
*	11.780	98	Impervious, HSG D
	117.790	87	Weighted Average
	106.010		90.00% Pervious Area
	11.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	3,175	0.2310	4.03		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

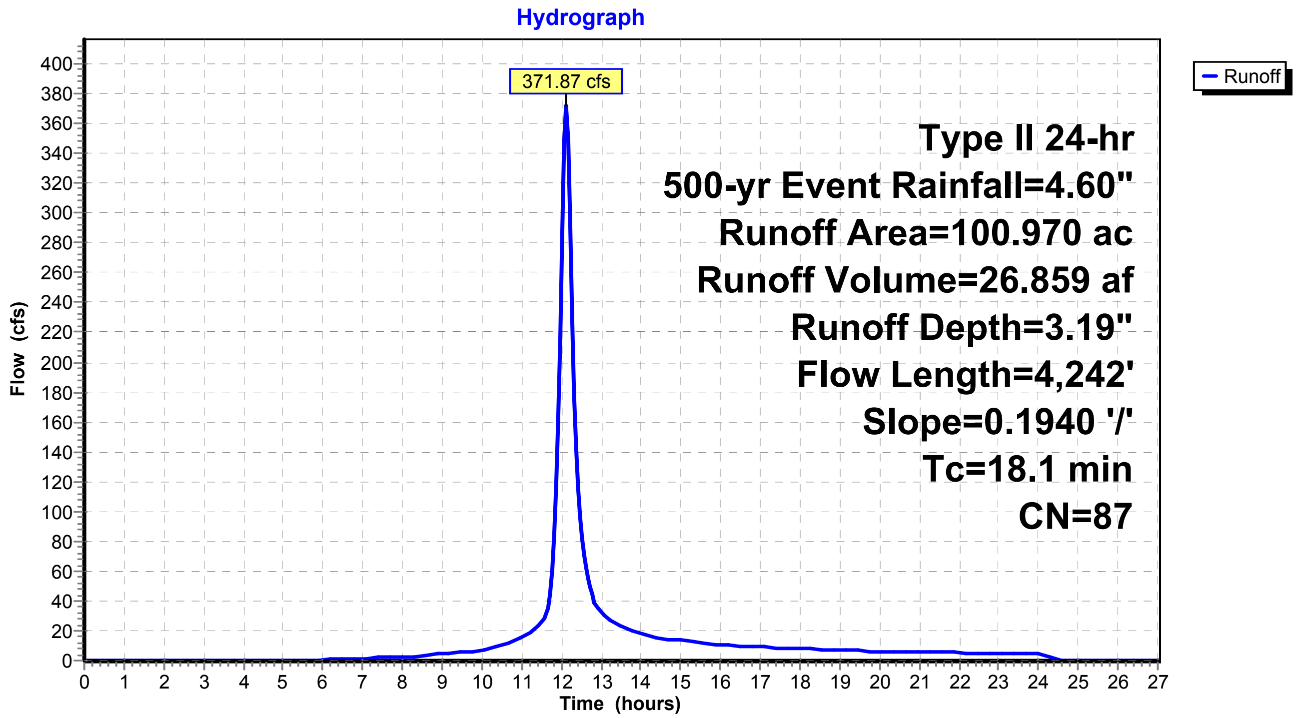
Runoff = 371.87 cfs @ 12.10 hrs, Volume= 26.859 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	90.870	86	Desert shrub range, Fair, HSG D
*	10.100	98	Impervious, HSG D
	100.970	87	Weighted Average
	90.870		90.00% Pervious Area
	10.100		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.1	4,242	0.1940	3.91		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

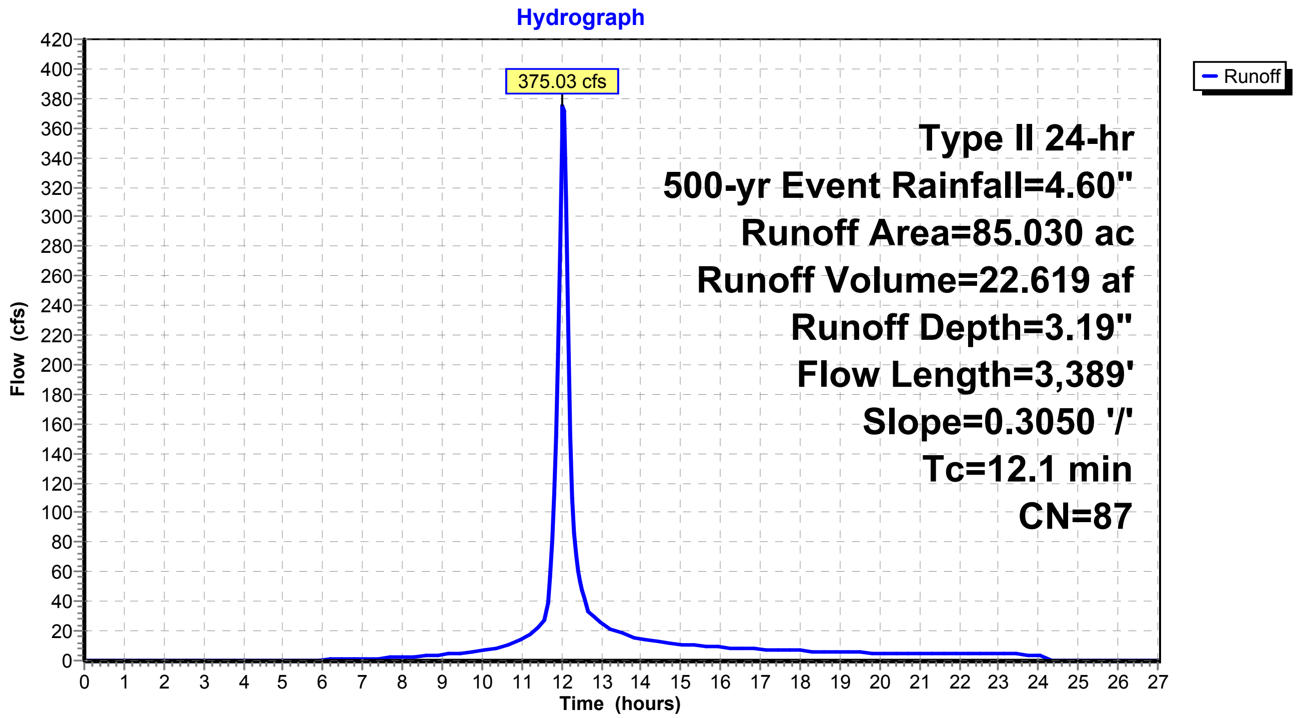
Runoff = 375.03 cfs @ 12.04 hrs, Volume= 22.619 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	76.530	86	Desert shrub range, Fair, HSG D
*	8.500	98	Impervious, HSG D
	85.030	87	Weighted Average
	76.530		90.00% Pervious Area
	8.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	3,389	0.3050	4.69		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

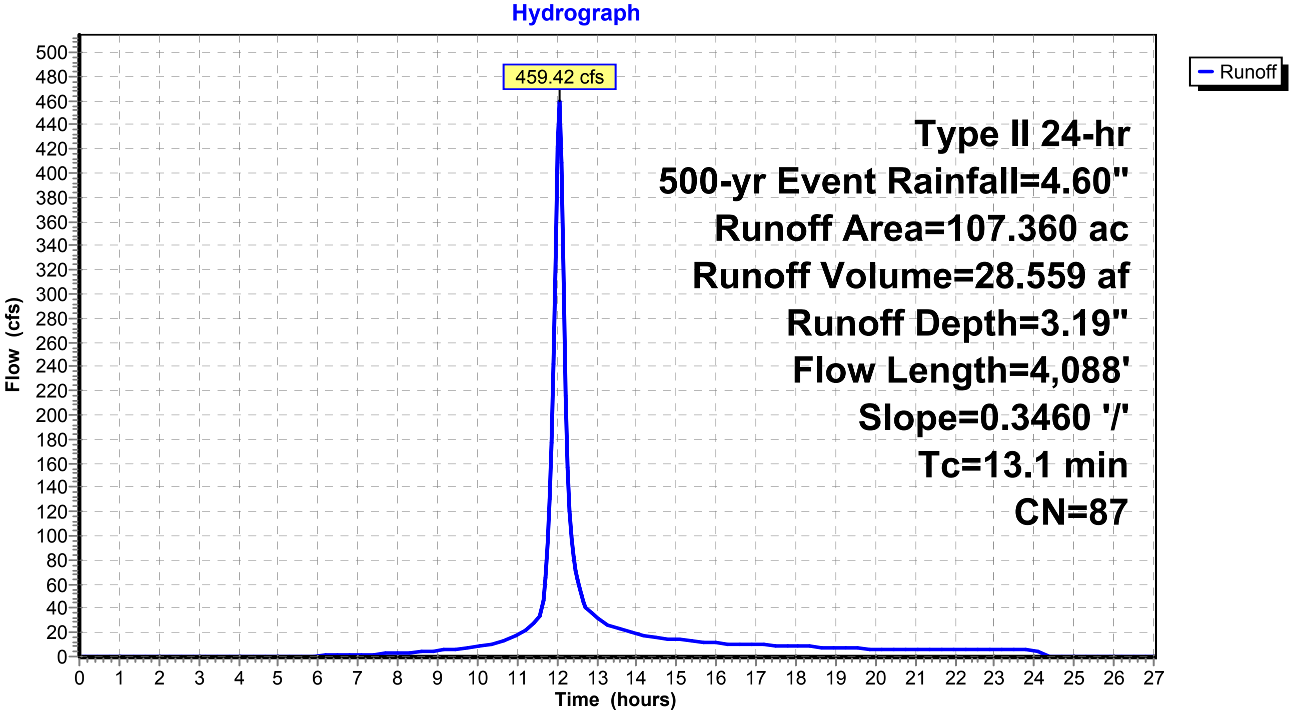
Runoff = 459.42 cfs @ 12.05 hrs, Volume= 28.559 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	96.620	86	Desert shrub range, Fair, HSG D
*	10.740	98	Impervious, HSG D
	107.360	87	Weighted Average
	96.620		90.00% Pervious Area
	10.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.1	4,088	0.3460	5.18		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

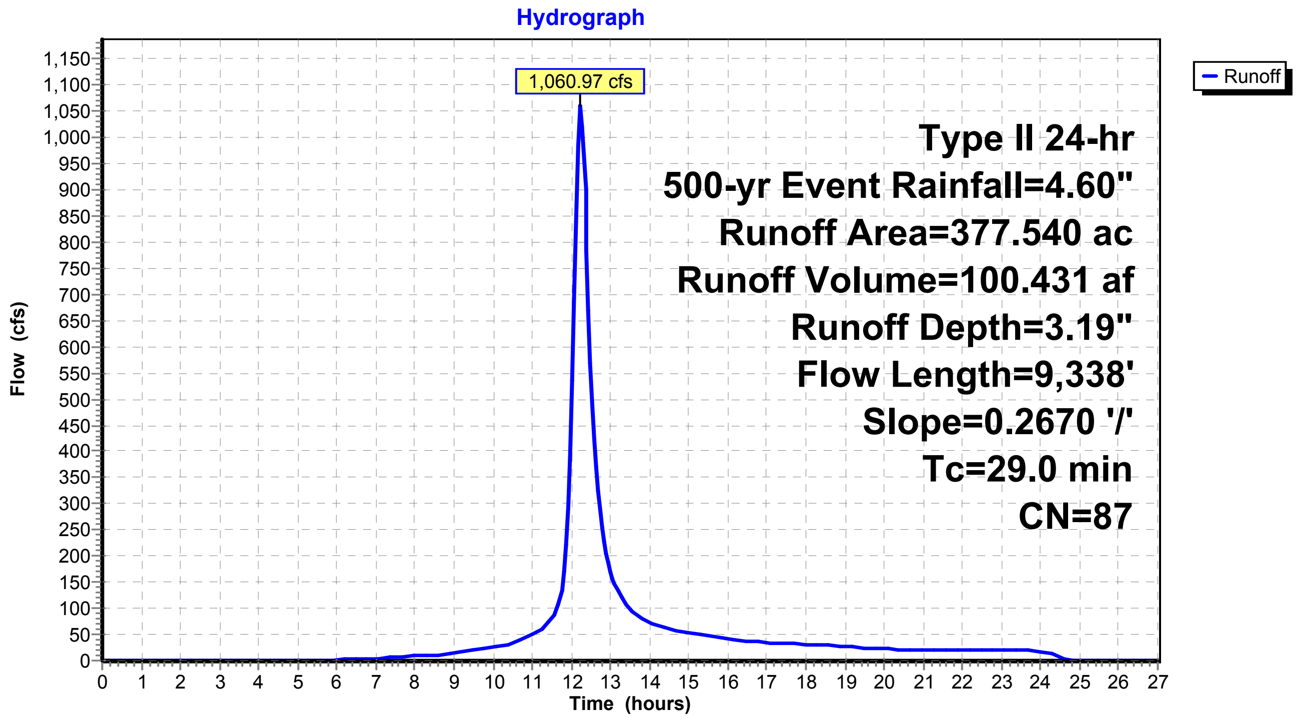
Runoff = 1,060.97 cfs @ 12.22 hrs, Volume= 100.431 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	339.790	86	Desert shrub range, Fair, HSG D
*	37.750	98	Impervious, HSG D
	377.540	87	Weighted Average
	339.790		90.00% Pervious Area
	37.750		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
29.0	9,338	0.2670	5.37		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

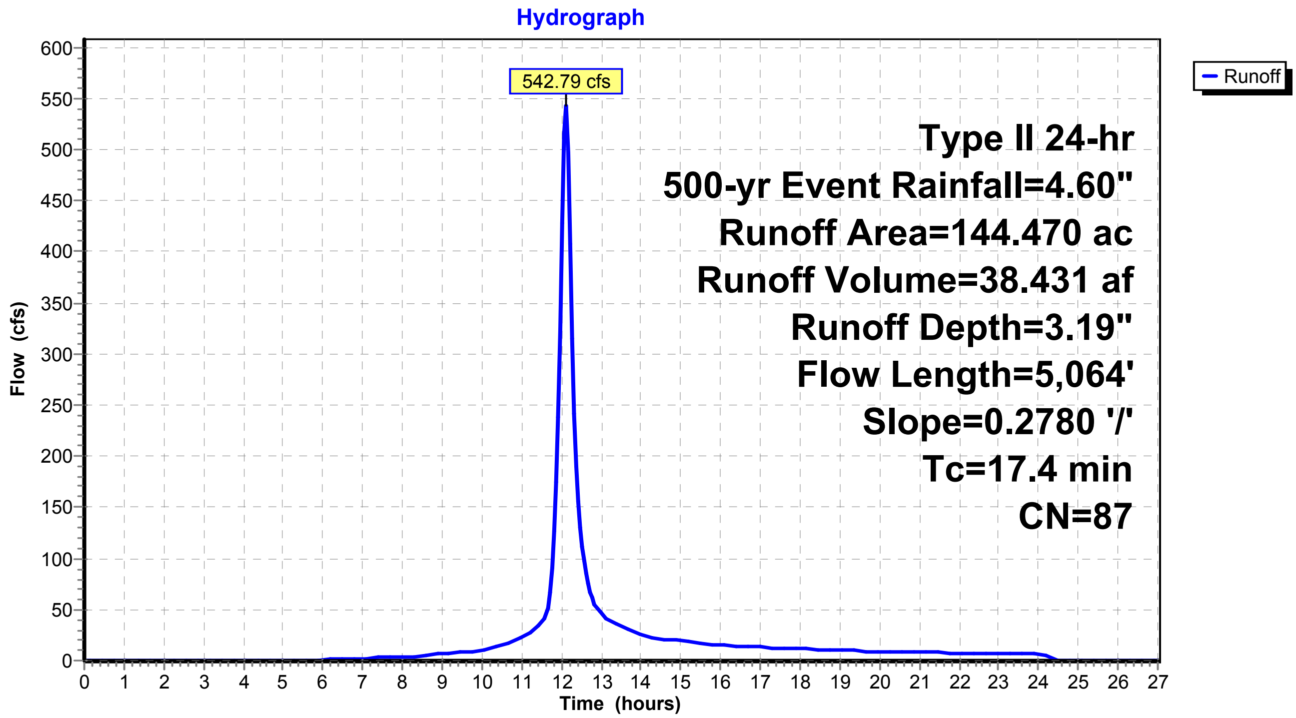
Runoff = 542.79 cfs @ 12.09 hrs, Volume= 38.431 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.4	5,064	0.2780	4.85		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

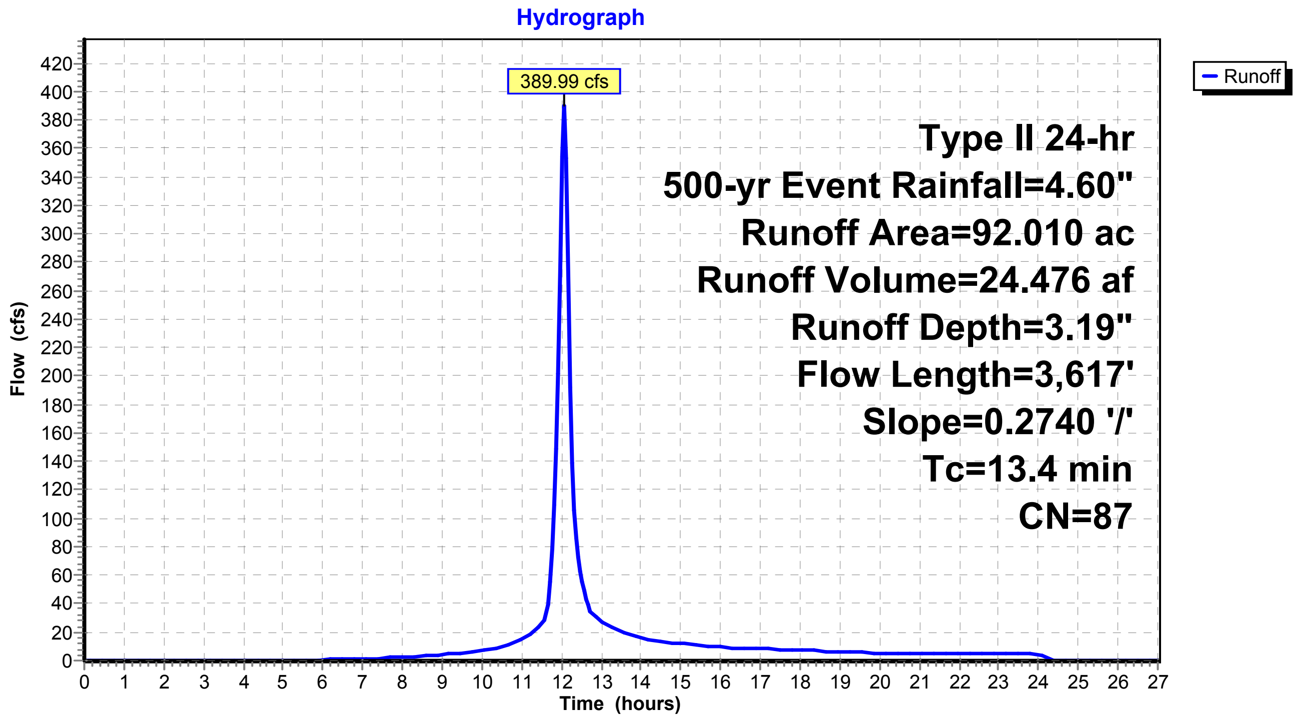
Runoff = 389.99 cfs @ 12.05 hrs, Volume= 24.476 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

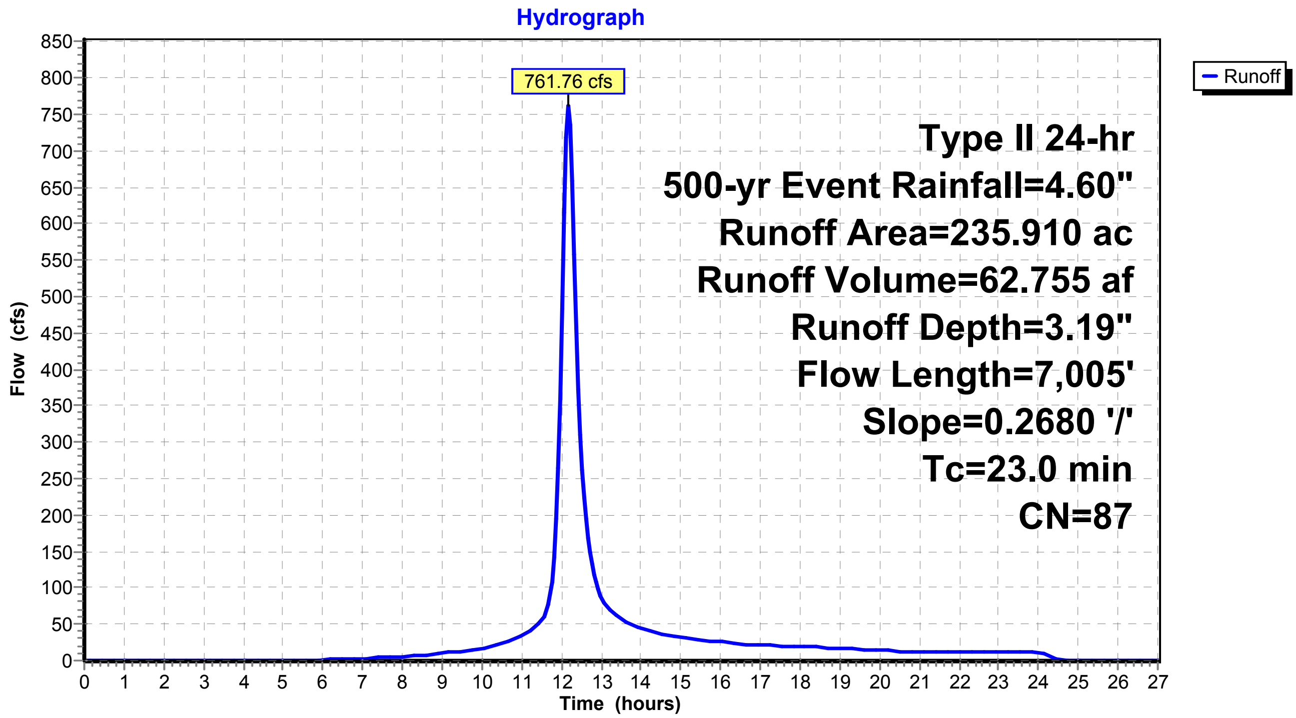
Runoff = 761.76 cfs @ 12.16 hrs, Volume= 62.755 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

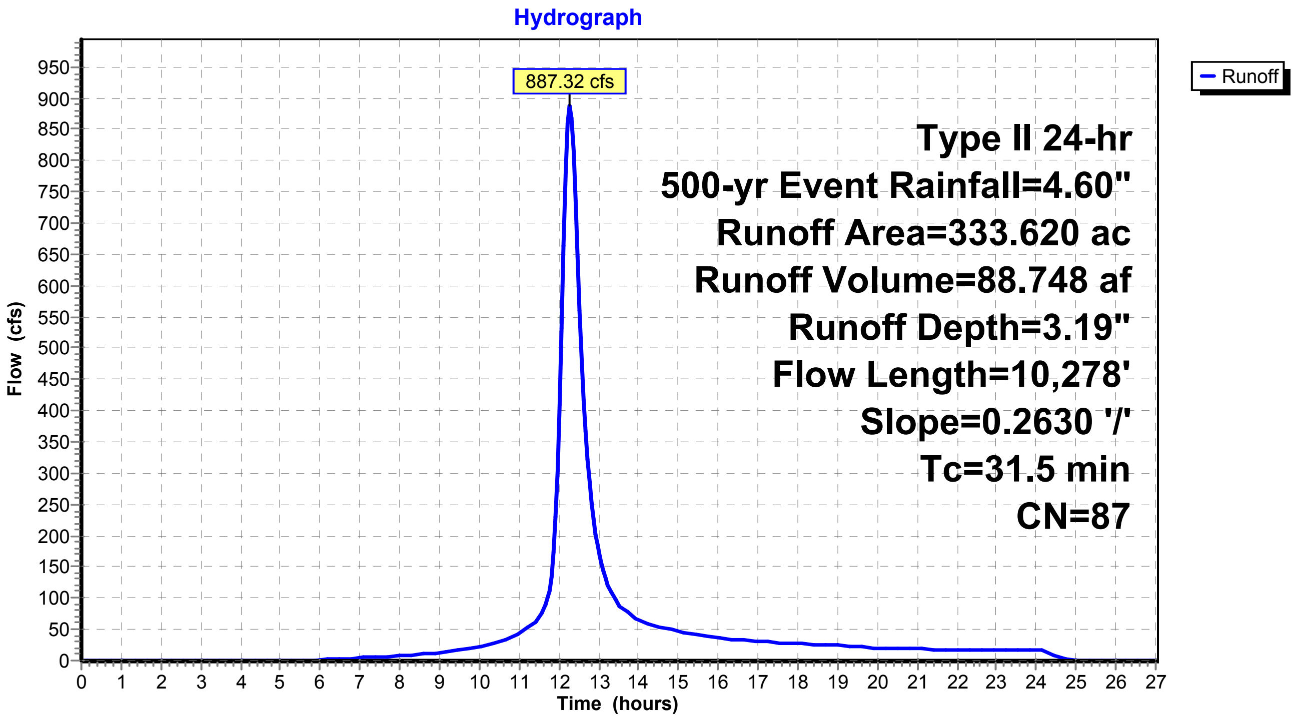
Runoff = 887.32 cfs @ 12.26 hrs, Volume= 88.748 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	300.260	86	Desert shrub range, Fair, HSG D
*	33.360	98	Impervious, HSG D
	333.620	87	Weighted Average
	300.260		90.00% Pervious Area
	33.360		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	10,278	0.2630	5.43		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

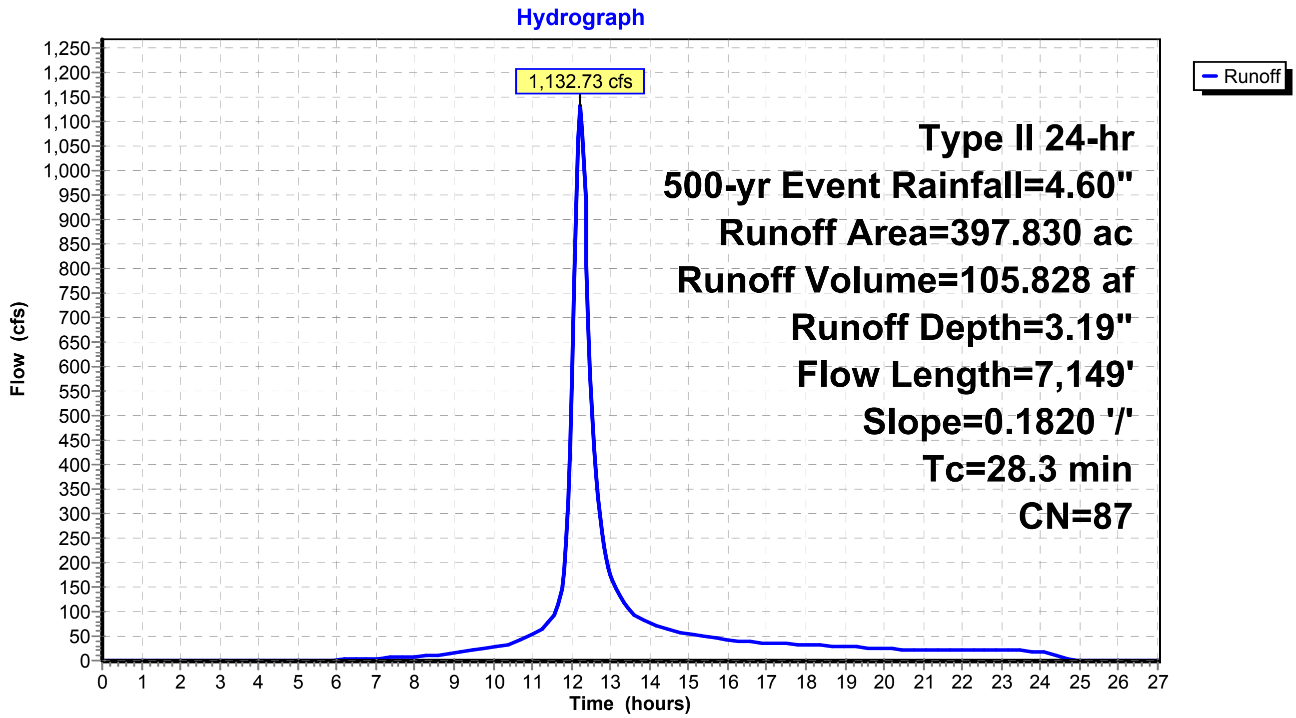
Runoff = 1,132.73 cfs @ 12.22 hrs, Volume= 105.828 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

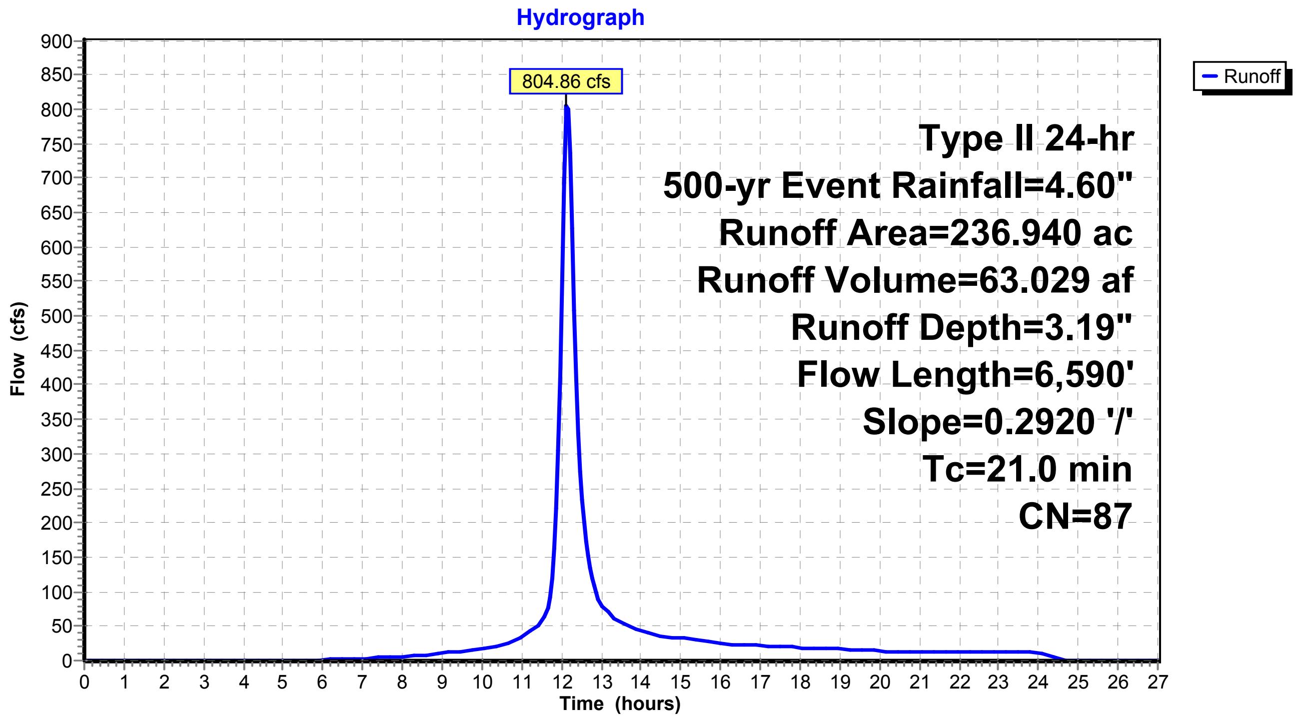
Runoff = 804.86 cfs @ 12.13 hrs, Volume= 63.029 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	213.250	86	Desert shrub range, Fair, HSG D
*	23.690	98	Impervious, HSG D
	236.940	87	Weighted Average
	213.250		90.00% Pervious Area
	23.690		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.0	6,590	0.2920	5.24		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

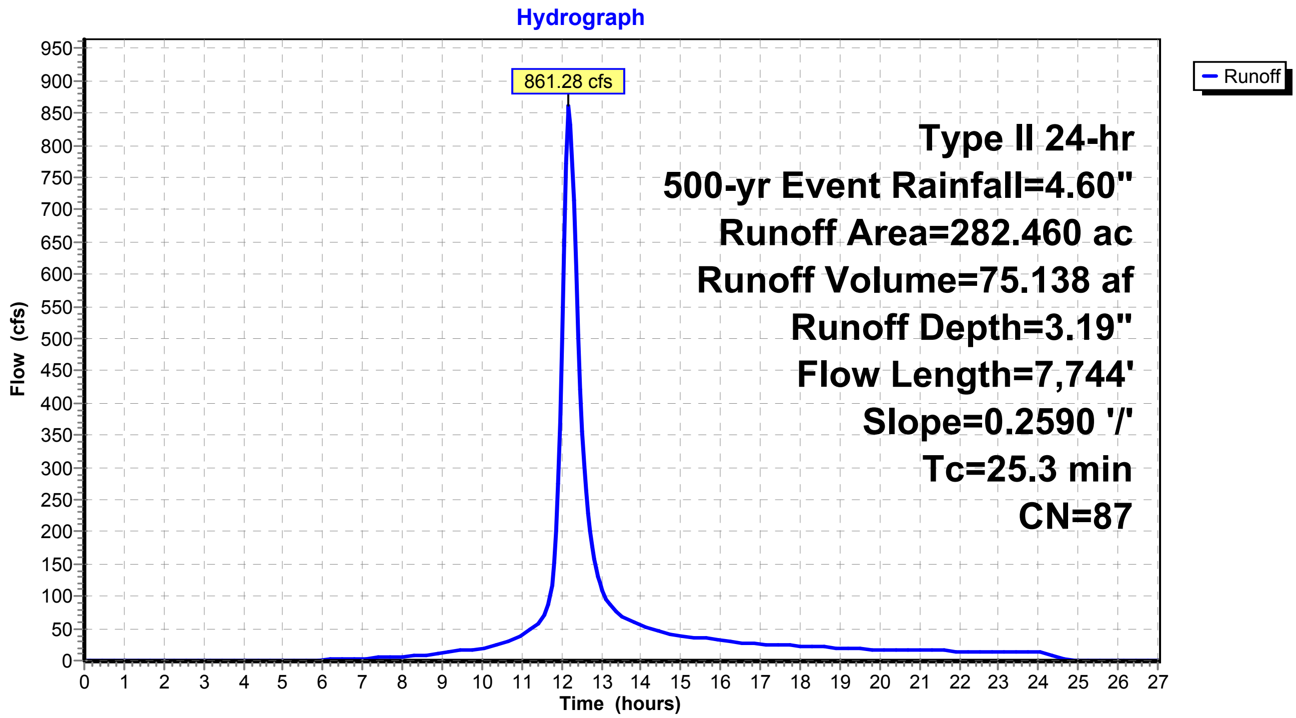
Runoff = 861.28 cfs @ 12.18 hrs, Volume= 75.138 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	254.210	86	Desert shrub range, Fair, HSG D
*	28.250	98	Impervious, HSG D
	282.460	87	Weighted Average
	254.210		90.00% Pervious Area
	28.250		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.3	7,744	0.2590	5.10		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Subcatchment 14: WS 14

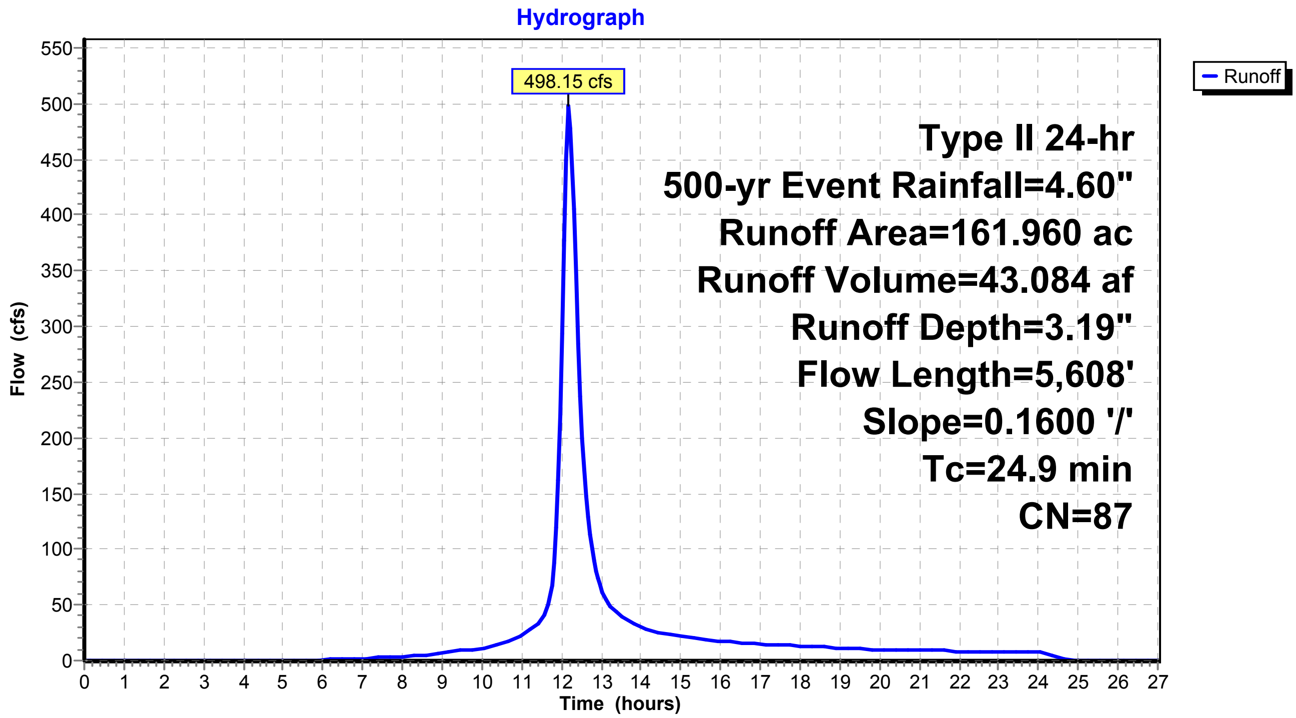
Runoff = 498.15 cfs @ 12.18 hrs, Volume= 43.084 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	145.760	86	Desert shrub range, Fair, HSG D
*	16.200	98	Impervious, HSG D
	161.960	87	Weighted Average
	145.760		90.00% Pervious Area
	16.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.9	5,608	0.1600	3.75		**Lag/CN Method,**

Subcatchment 14: WS 14



Summary for Subcatchment 15: WS 15

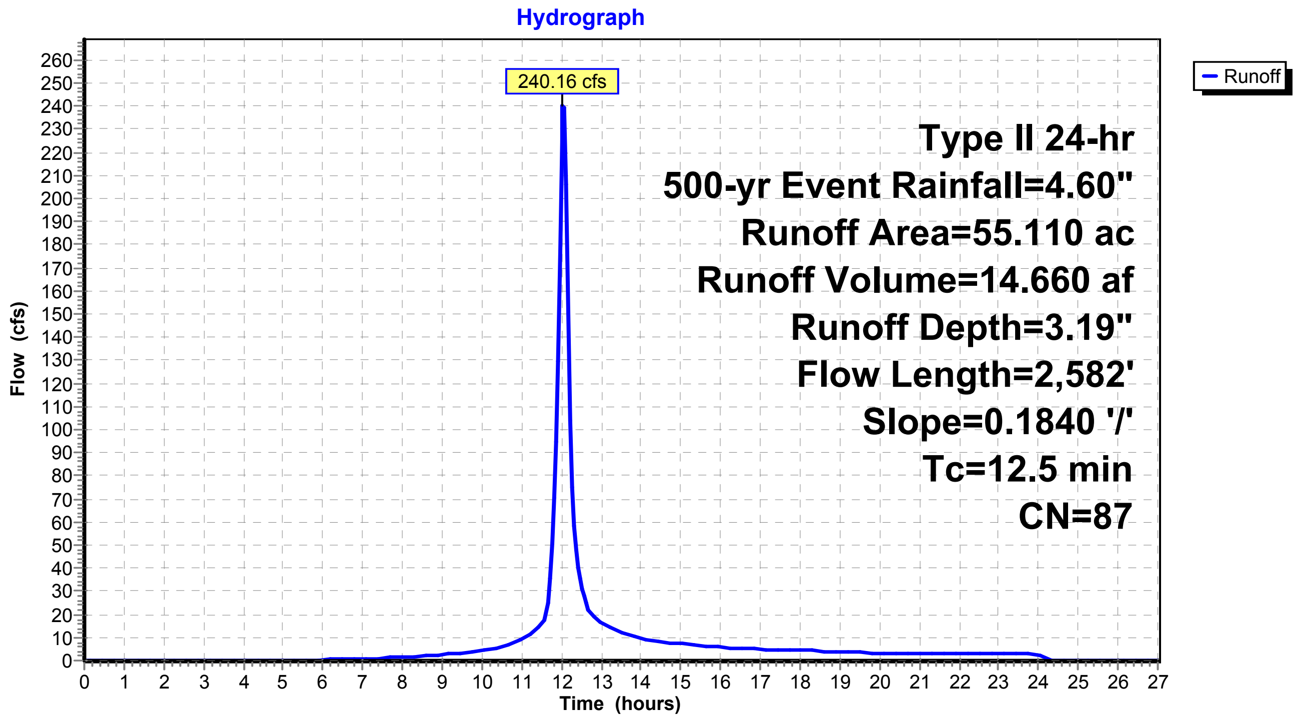
Runoff = 240.16 cfs @ 12.04 hrs, Volume= 14.660 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	49.600	86	Desert shrub range, Fair, HSG D
*	5.510	98	Impervious, HSG D
	55.110	87	Weighted Average
	49.600		90.00% Pervious Area
	5.510		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	2,582	0.1840	3.45		**Lag/CN Method,**

Subcatchment 15: WS 15



Summary for Subcatchment 16: WS 16

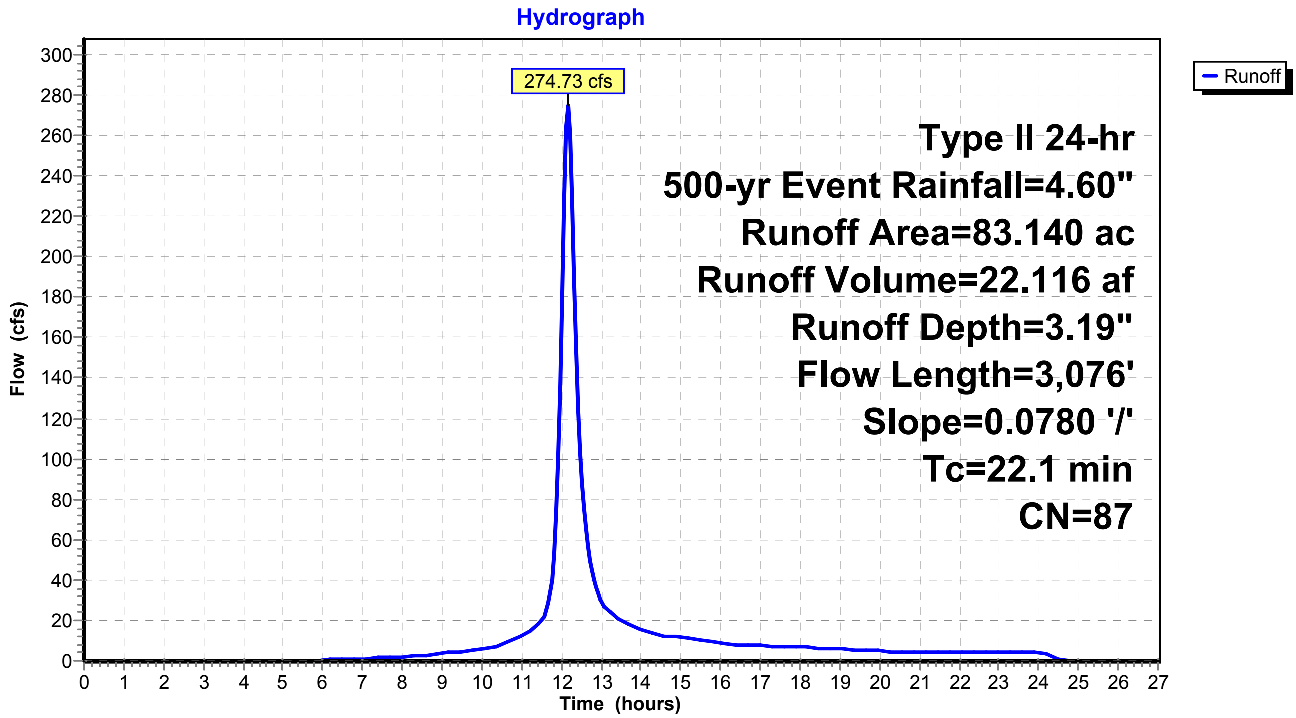
Runoff = 274.73 cfs @ 12.15 hrs, Volume= 22.116 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

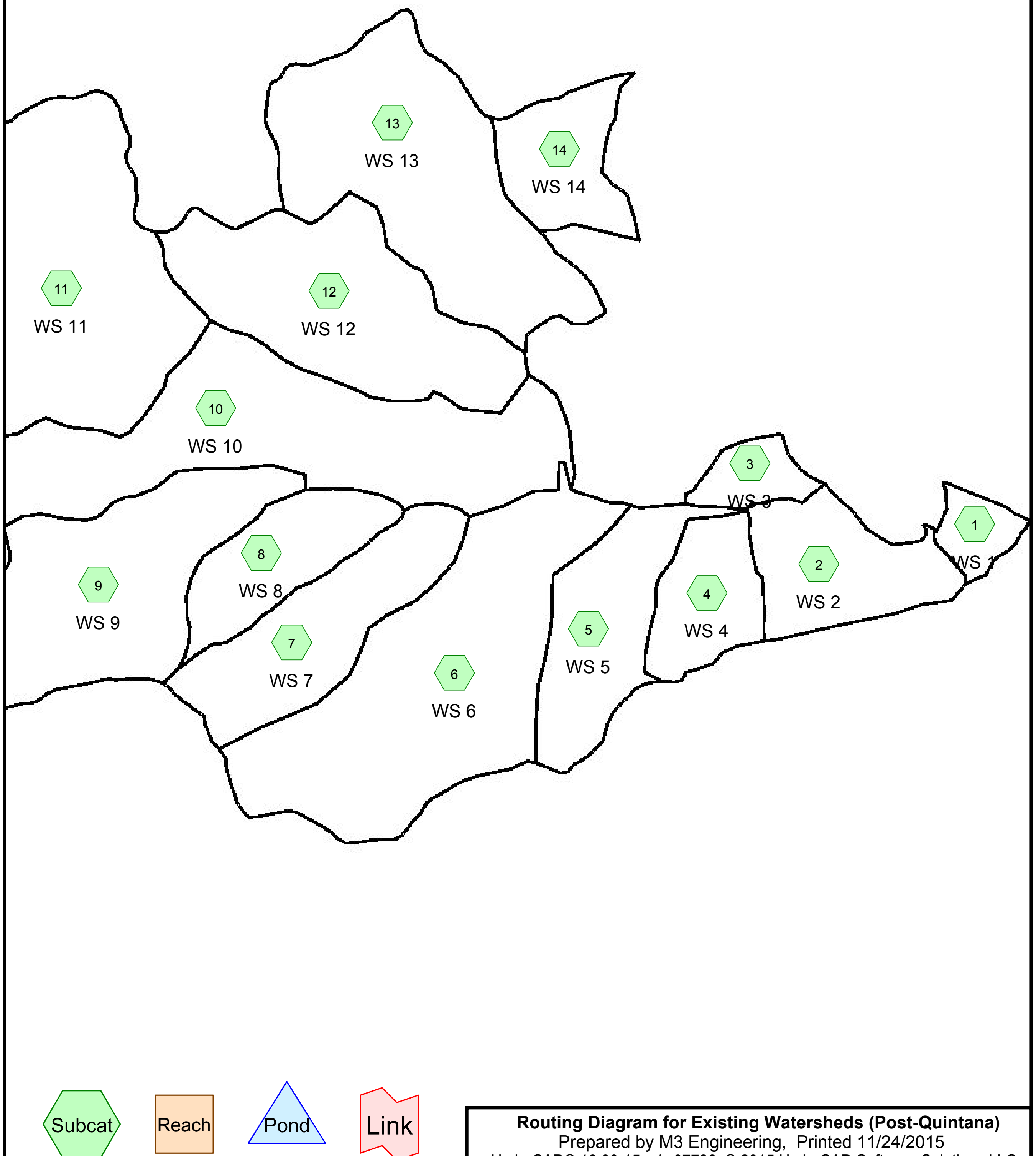
	Area (ac)	CN	Description
	74.830	86	Desert shrub range, Fair, HSG D
*	8.310	98	Impervious, HSG D
	83.140	87	Weighted Average
	74.830		90.00% Pervious Area
	8.310		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	3,076	0.0780	2.32		**Lag/CN Method,**

Subcatchment 16: WS 16



APPENDIX C



Routing Diagram for Existing Watersheds (Post-Quintana)
Prepared by M3 Engineering, Printed 11/24/2015
HydroCAD® 10.00-15 s/n 07786 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2,235.360	86	Desert shrub range, Fair, HSG D (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)
248.370	98	Impervious, HSG D (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)
2,483.730	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
2,483.730	HSG D	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
0.000	Other	
2,483.730		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	2,235.360	0.000	2,235.360	Desert shrub range, Fair	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
0.000	0.000	0.000	248.370	0.000	248.370	Impervious	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
0.000	**0.000**	**0.000**	**2,483.730**	**0.000**	**2,483.730**	**TOTAL AREA**	

Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=28.210 ac 10.00% Impervious Runoff Depth=2.36"
Tc=5.0 min CN=87 Runoff=117.20 cfs 5.555 af

Subcatchment2: WS 2 Runoff Area=106.570 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,068' Slope=0.3140 '/' Tc=11.0 min CN=87 Runoff=363.66 cfs 20.985 af

Subcatchment3: WS 3 Runoff Area=34.990 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=1,603' Slope=0.1770 '/' Tc=8.7 min CN=87 Runoff=129.54 cfs 6.890 af

Subcatchment4: WS 4 Runoff Area=75.020 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,047' Slope=0.3390 '/' Tc=10.5 min CN=87 Runoff=259.92 cfs 14.773 af

Subcatchment5: WS 5 Runoff Area=124.190 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=5,976' Slope=0.3400 '/' Tc=18.0 min CN=87 Runoff=342.49 cfs 24.455 af

Subcatchment6: WS 6 Runoff Area=331.220 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=8,173' Slope=0.3100 '/' Tc=24.2 min CN=87 Runoff=774.13 cfs 65.223 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=5,064' Slope=0.2960 '/' Tc=16.9 min CN=87 Runoff=411.06 cfs 28.449 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=291.83 cfs 18.118 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=567.91 cfs 46.455 af

Subcatchment10: WS 10 Runoff Area=330.410 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=10,278' Slope=0.2760 '/' Tc=30.8 min CN=87 Runoff=663.73 cfs 65.063 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=843.39 cfs 78.339 af

Subcatchment12: WS 12 Runoff Area=227.420 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=6,590' Slope=0.3150 '/' Tc=20.2 min CN=87 Runoff=588.30 cfs 44.783 af

Subcatchment13: WS 13 Runoff Area=275.510 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,744' Slope=0.2930 '/' Tc=23.8 min CN=87 Runoff=649.87 cfs 54.252 af

Subcatchment14: WS 14 Runoff Area=79.970 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,545' Slope=0.2240 '/' Tc=14.6 min CN=87 Runoff=243.90 cfs 15.747 af

Total Runoff Area = 2,483.730 ac Runoff Volume = 489.087 af Average Runoff Depth = 2.36"
90.00% Pervious = 2,235.360 ac 10.00% Impervious = 248.370 ac

Summary for Subcatchment 1: WS 1

[49] Hint: Tc<2dt may require smaller dt

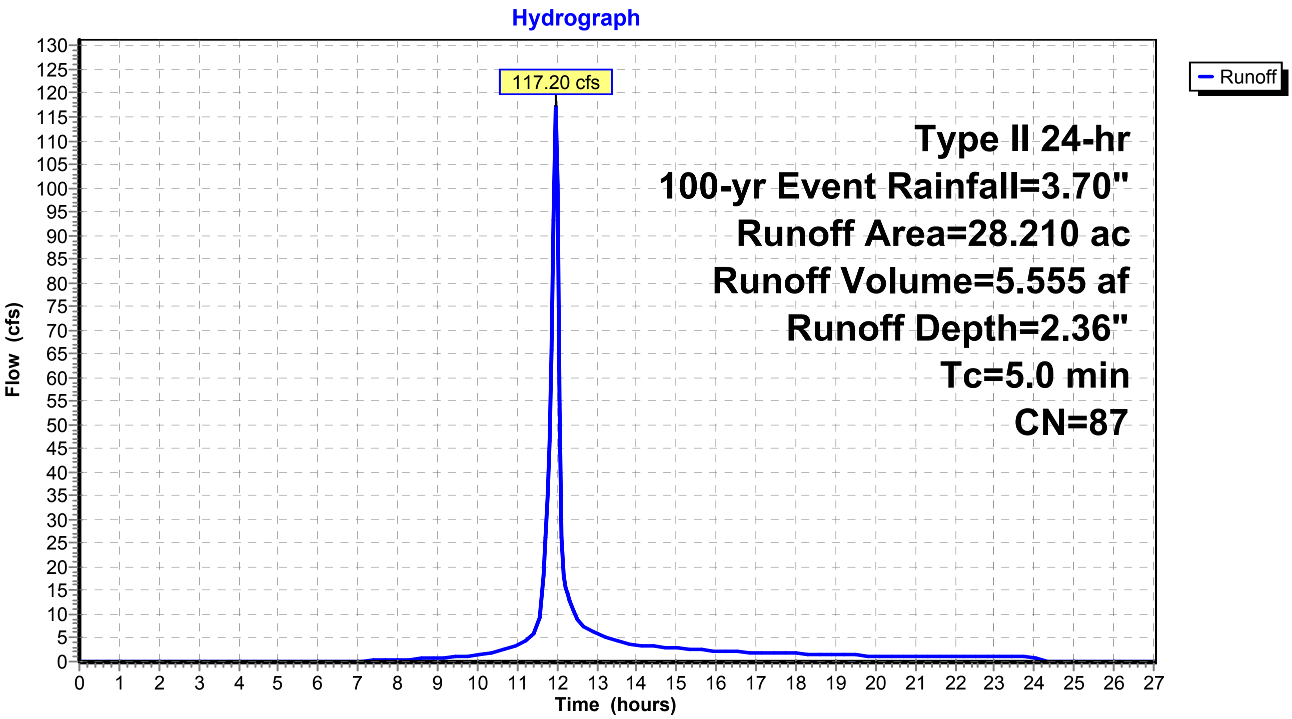
Runoff = 117.20 cfs @ 11.95 hrs, Volume= 5.555 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	25.390	86	Desert shrub range, Fair, HSG D
*	2.820	98	Impervious, HSG D
	28.210	87	Weighted Average
	25.390		90.00% Pervious Area
	2.820		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum Tc**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

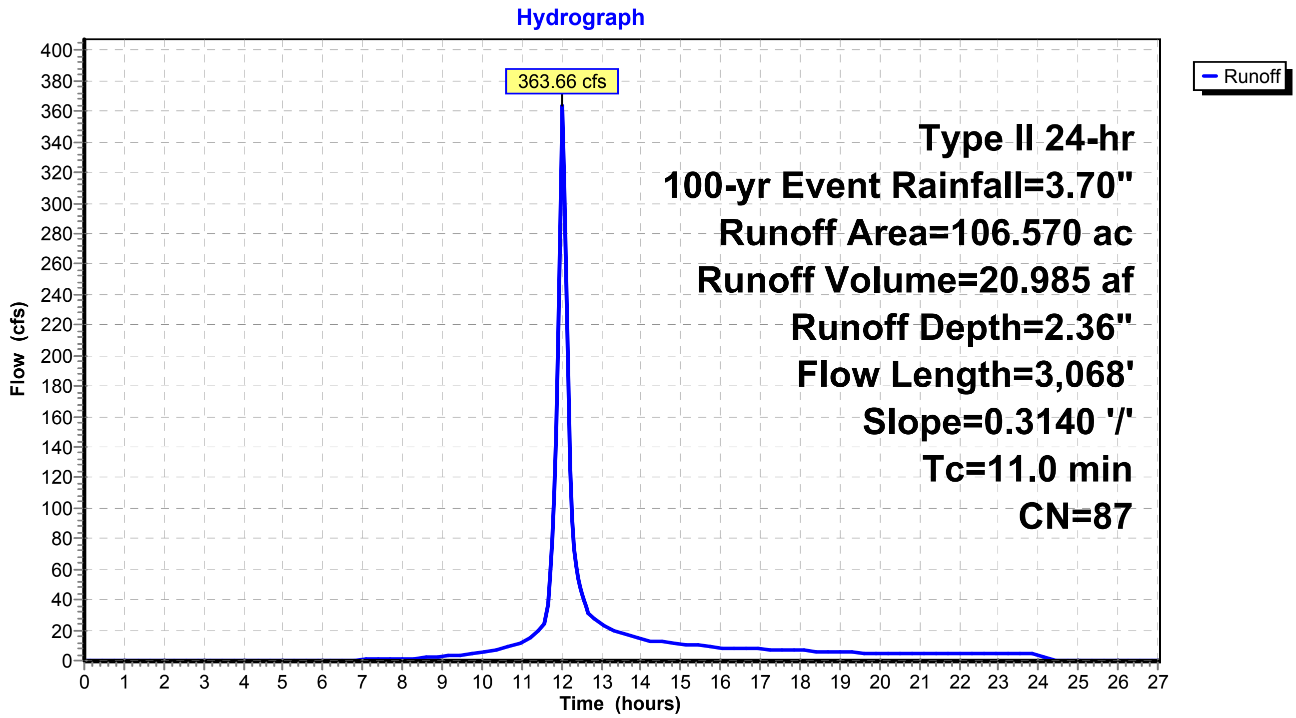
Runoff = 363.66 cfs @ 12.03 hrs, Volume= 20.985 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	95.910	86	Desert shrub range, Fair, HSG D
*	10.660	98	Impervious, HSG D
	106.570	87	Weighted Average
	95.910		90.00% Pervious Area
	10.660		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	3,068	0.3140	4.66		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

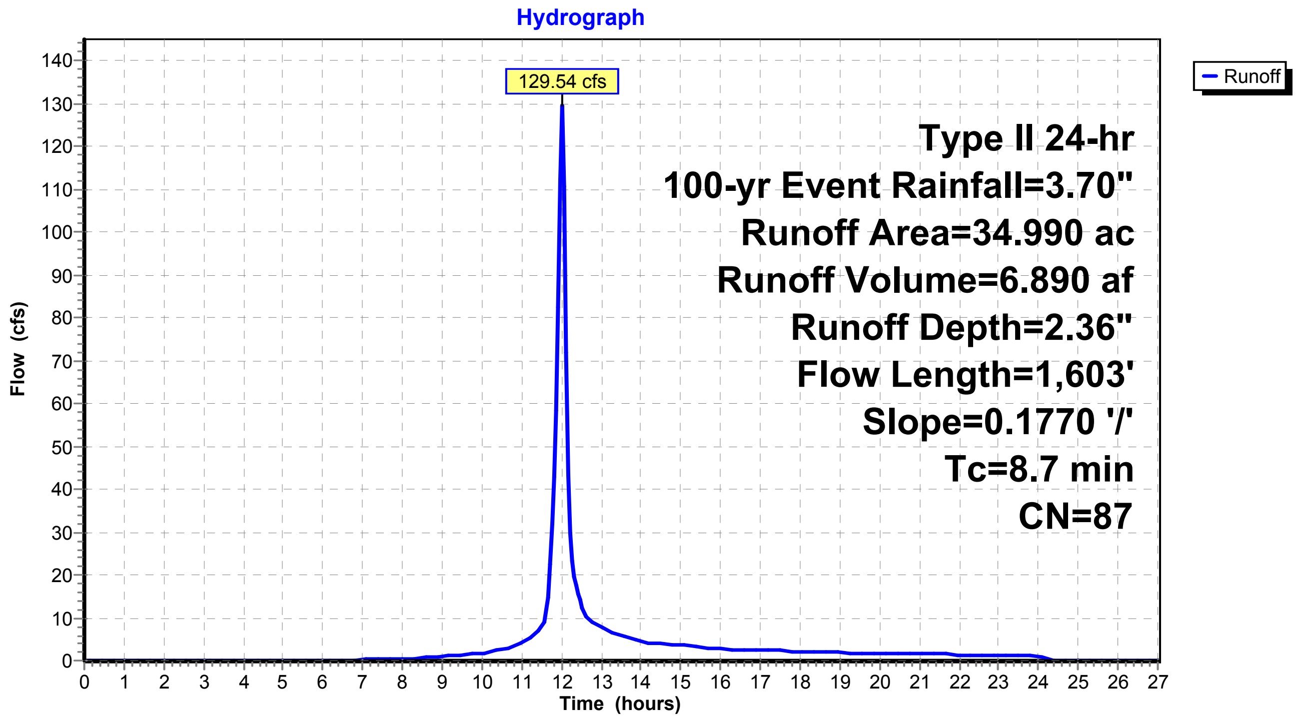
Runoff = 129.54 cfs @ 12.00 hrs, Volume= 6.890 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	31.490	86	Desert shrub range, Fair, HSG D
*	3.500	98	Impervious, HSG D
	34.990	87	Weighted Average
	31.490		90.00% Pervious Area
	3.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	1,603	0.1770	3.07		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

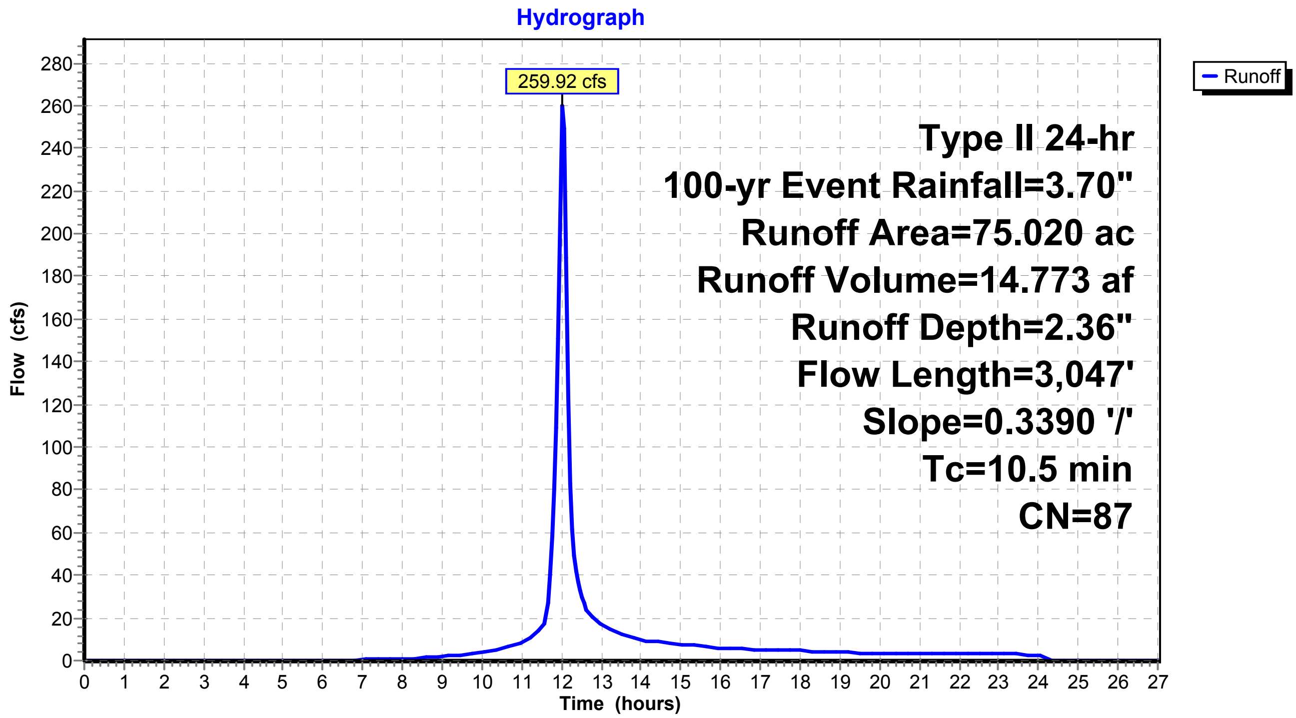
Runoff = 259.92 cfs @ 12.02 hrs, Volume= 14.773 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	67.520	86	Desert shrub range, Fair, HSG D
*	7.500	98	Impervious, HSG D
	75.020	87	Weighted Average
	67.520		90.00% Pervious Area
	7.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	3,047	0.3390	4.84		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

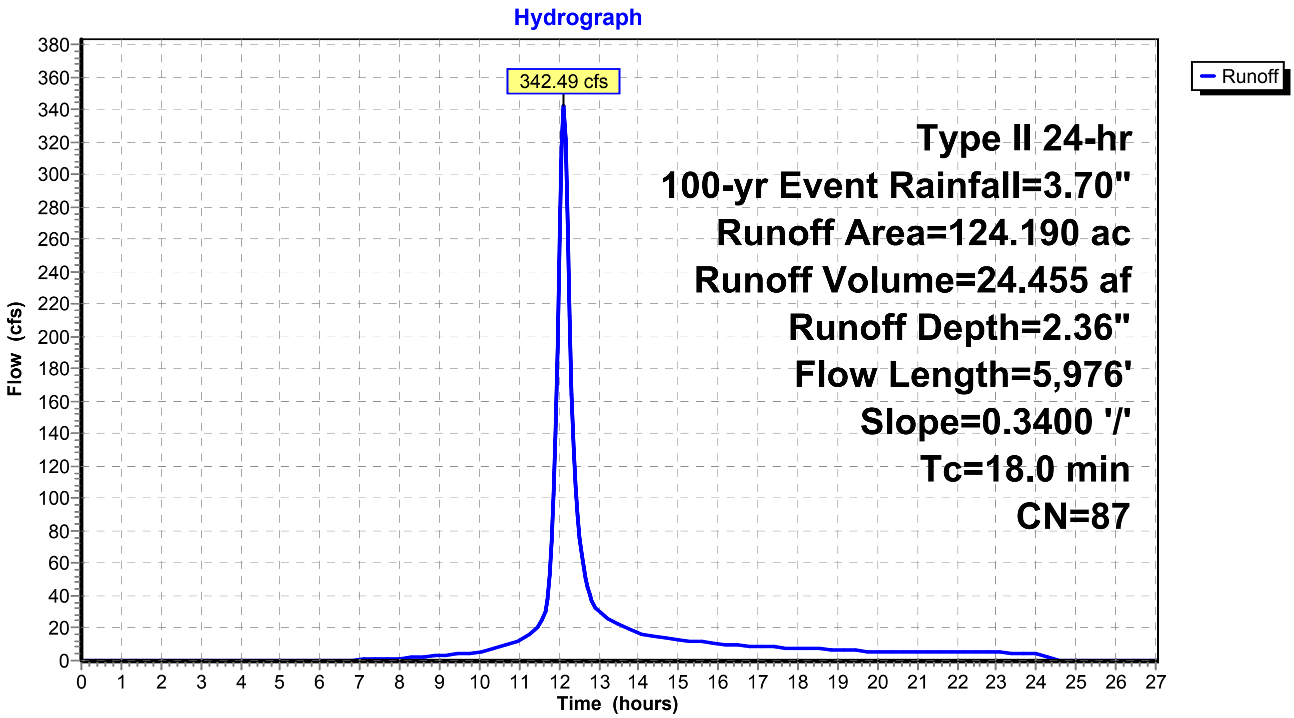
Runoff = 342.49 cfs @ 12.10 hrs, Volume= 24.455 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	111.770	86	Desert shrub range, Fair, HSG D
*	12.420	98	Impervious, HSG D
	124.190	87	Weighted Average
	111.770		90.00% Pervious Area
	12.420		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	5,976	0.3400	5.54		**Lag/CN Method,**

Subcatchment 5: WS 5



Existing Watersheds (Post-Quintana)
Prepared by M3 Engineering
HydroCAD® 10.00-15 s/n 07786 © 2015 HydroCAD Software Solutions LLC

Type II 24-hr 100-yr Event Rainfall=3.70"
Printed 11/24/2015

Summary for Subcatchment 6: WS 6

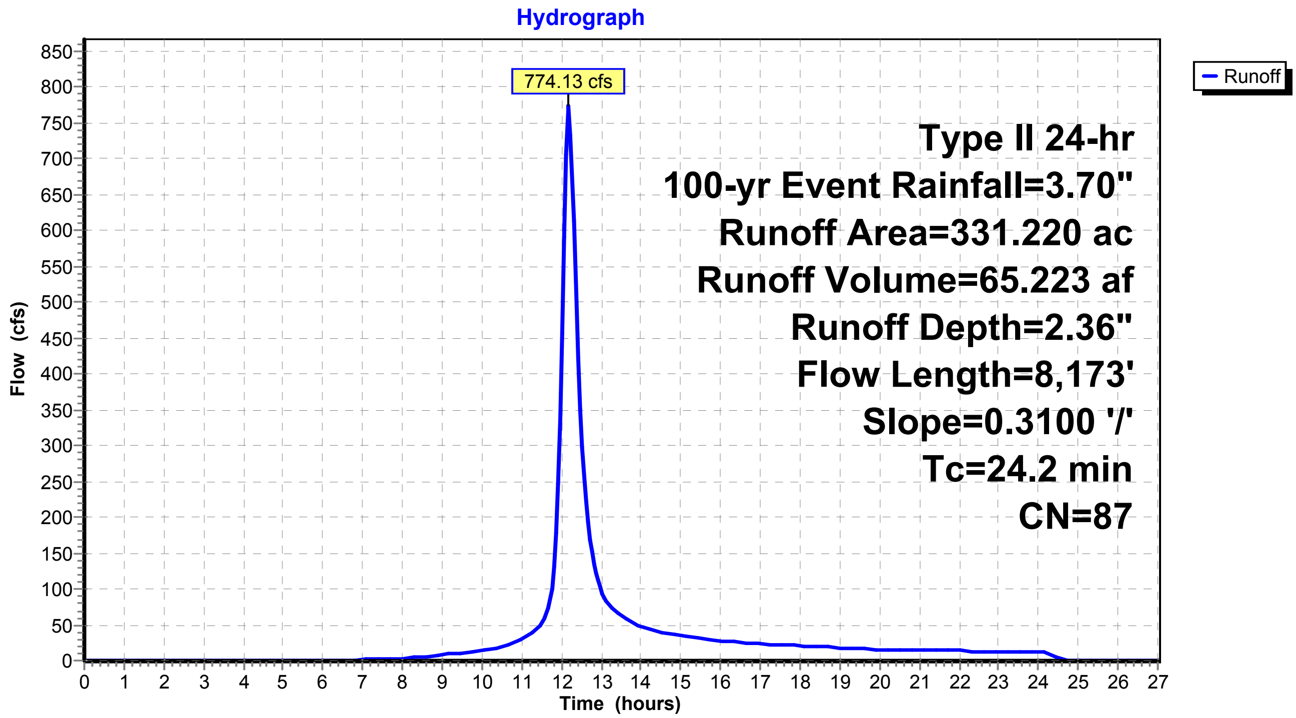
Runoff = 774.13 cfs @ 12.17 hrs, Volume= 65.223 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	298.100	86	Desert shrub range, Fair, HSG D
*	33.120	98	Impervious, HSG D
	331.220	87	Weighted Average
	298.100		90.00% Pervious Area
	33.120		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.2	8,173	0.3100	5.64		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

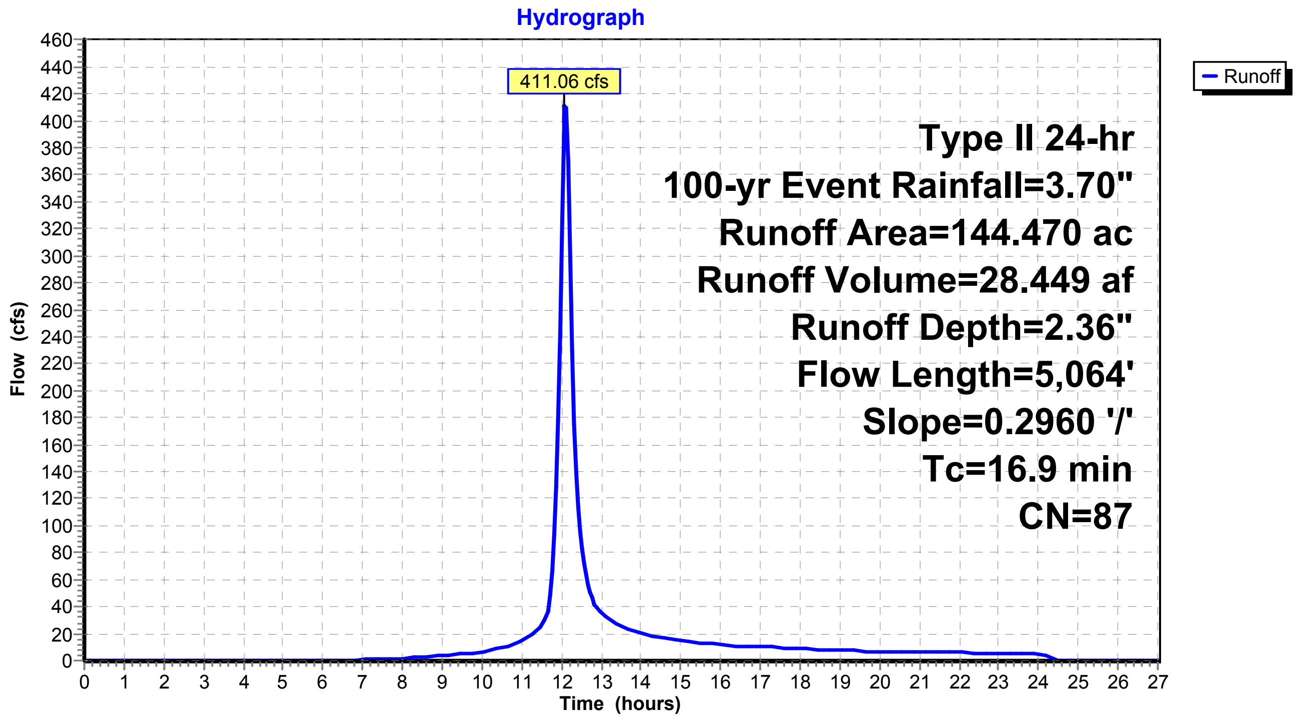
Runoff = 411.06 cfs @ 12.09 hrs, Volume= 28.449 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	5,064	0.2960	5.00		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

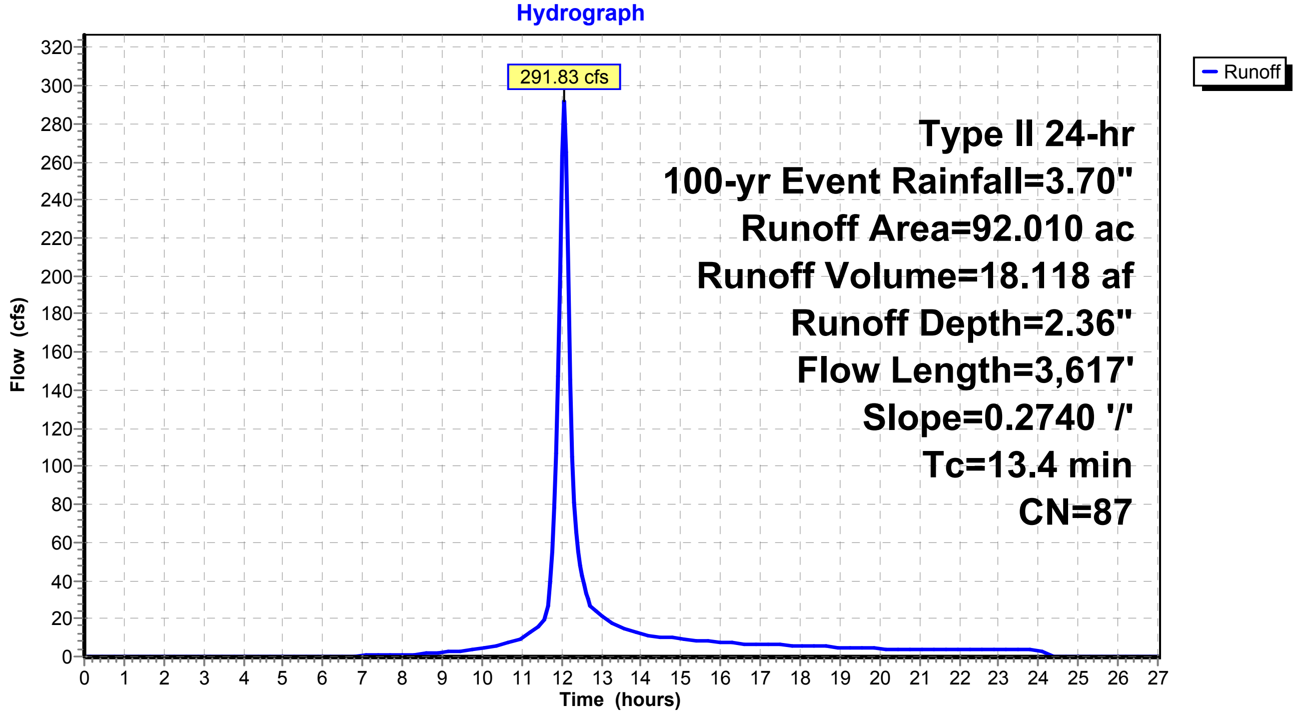
Runoff = 291.83 cfs @ 12.05 hrs, Volume= 18.118 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

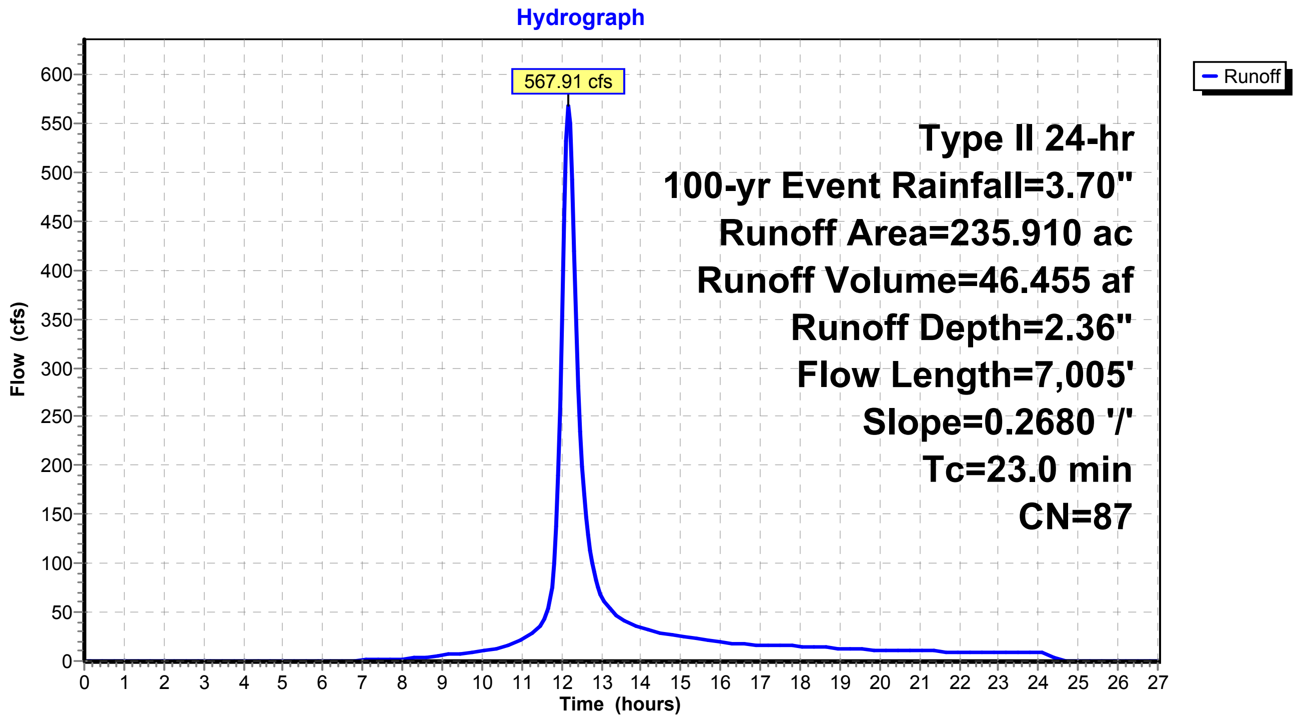
Runoff = 567.91 cfs @ 12.16 hrs, Volume= 46.455 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

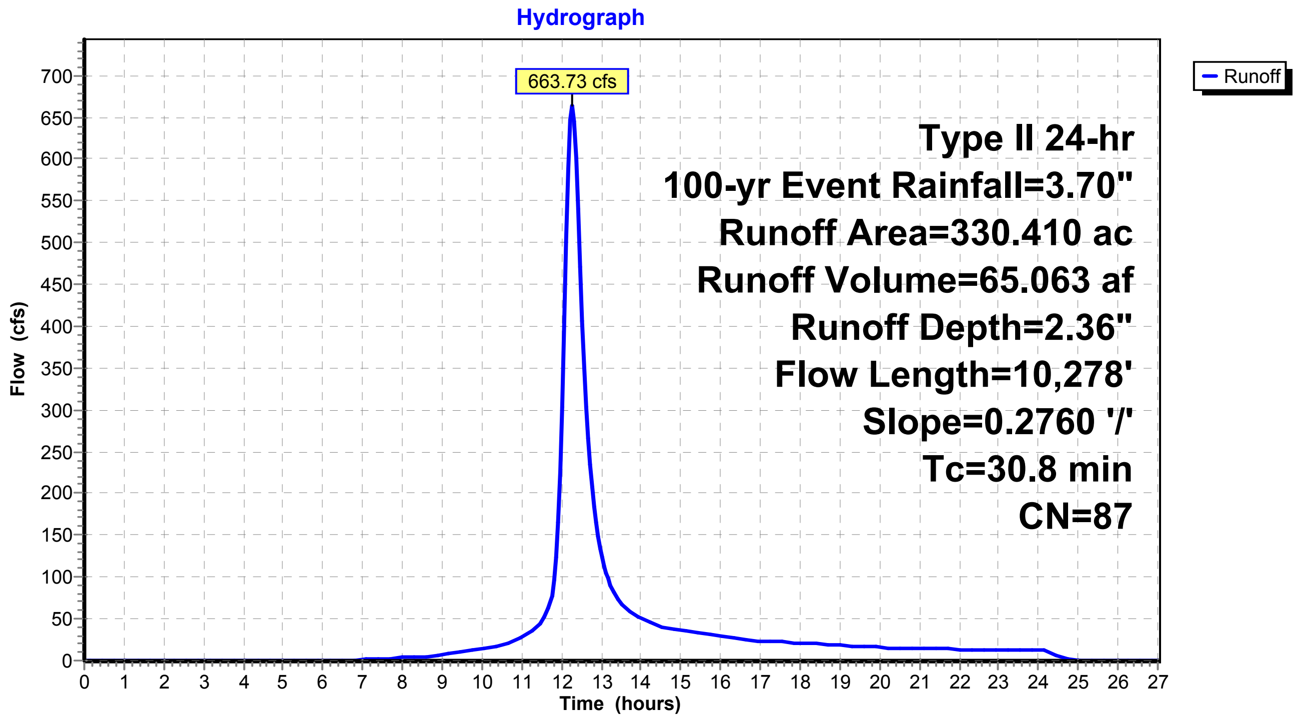
Runoff = 663.73 cfs @ 12.25 hrs, Volume= 65.063 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	297.370	86	Desert shrub range, Fair, HSG D
*	33.040	98	Impervious, HSG D
	330.410	87	Weighted Average
	297.370		90.00% Pervious Area
	33.040		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	10,278	0.2760	5.57		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

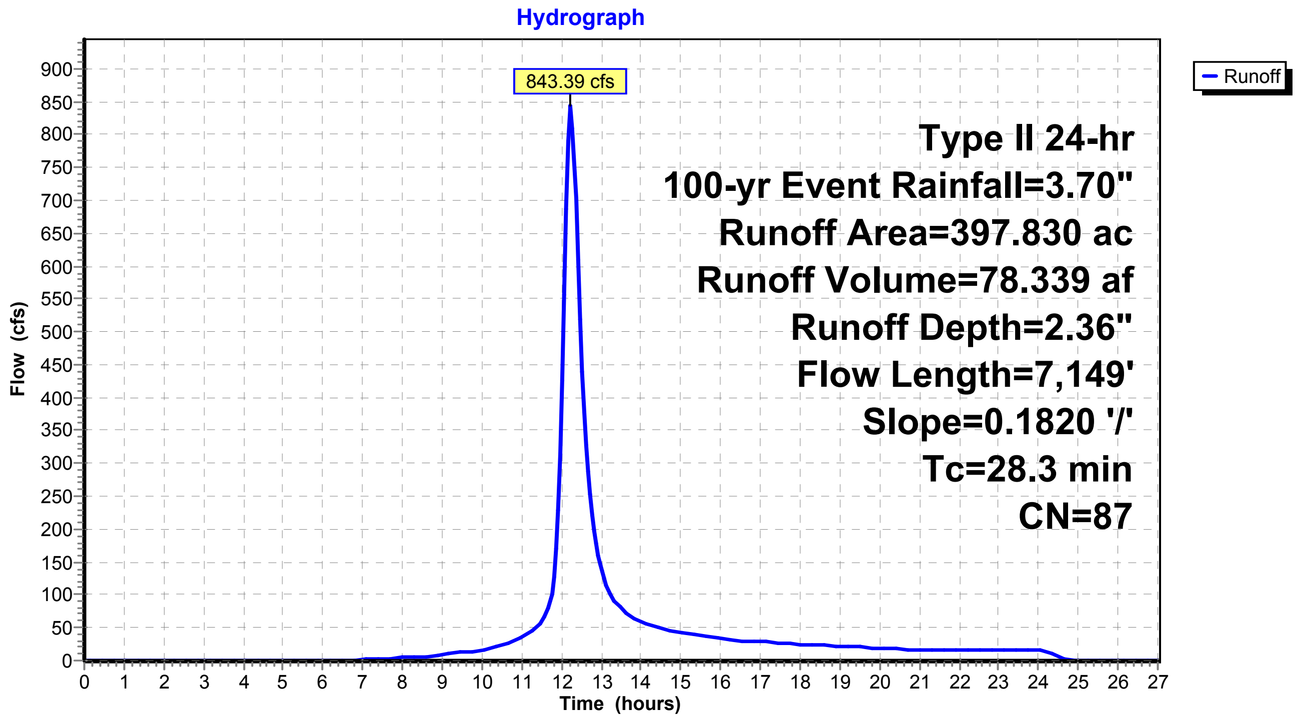
Runoff = 843.39 cfs @ 12.22 hrs, Volume= 78.339 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

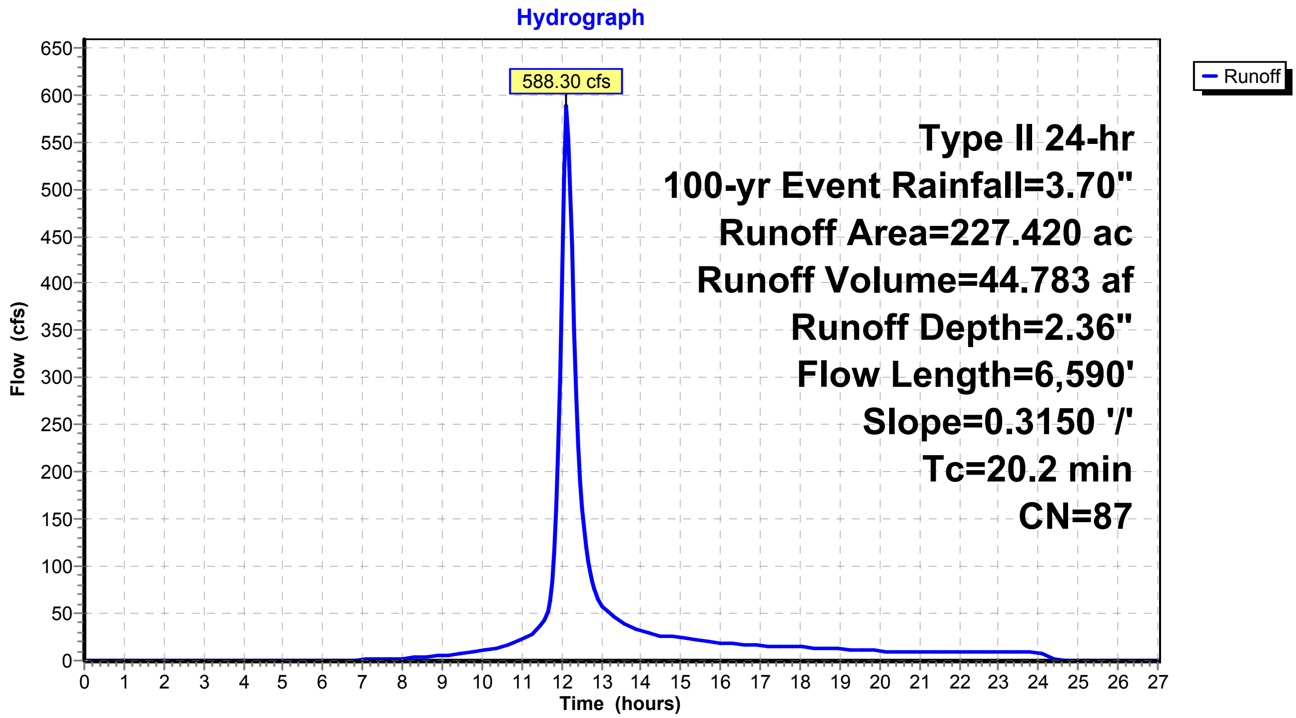
Runoff = 588.30 cfs @ 12.13 hrs, Volume= 44.783 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	204.680	86	Desert shrub range, Fair, HSG D
*	22.740	98	Impervious, HSG D
	227.420	87	Weighted Average
	204.680		90.00% Pervious Area
	22.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	6,590	0.3150	5.44		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

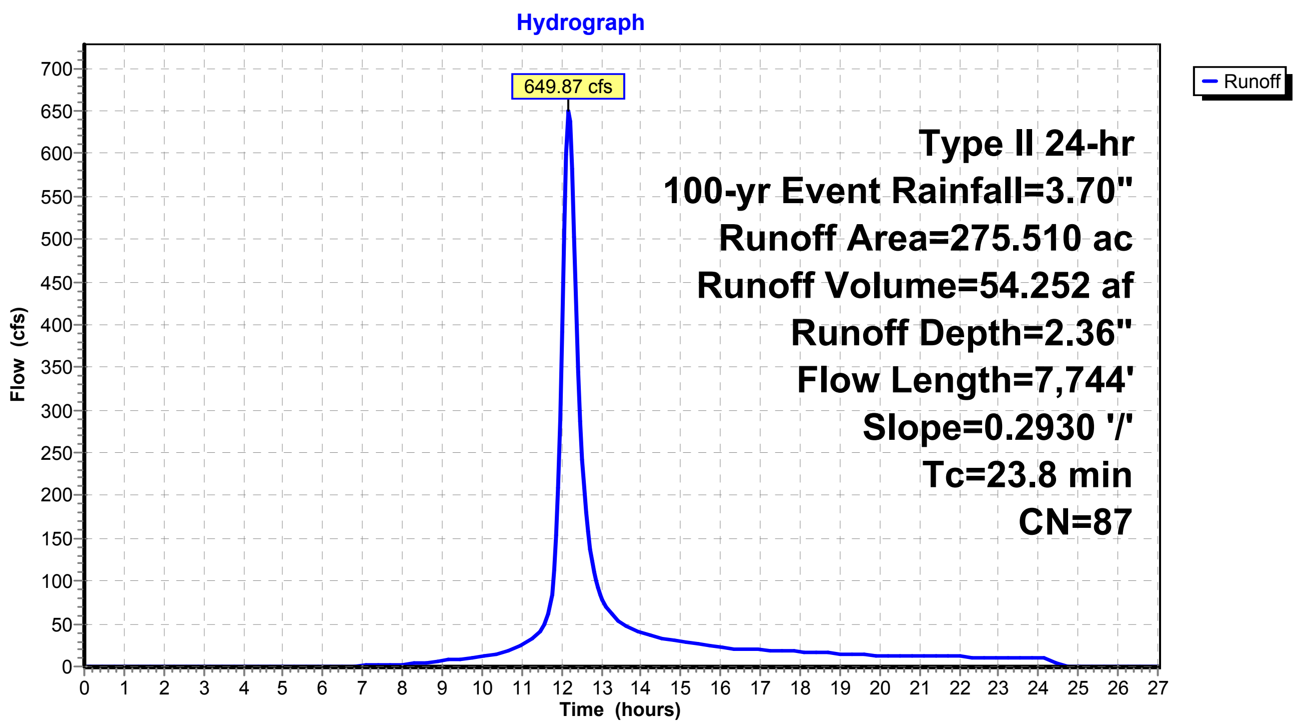
Runoff = 649.87 cfs @ 12.17 hrs, Volume= 54.252 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	247.960	86	Desert shrub range, Fair, HSG D
*	27.550	98	Impervious, HSG D
	275.510	87	Weighted Average
	247.960		90.00% Pervious Area
	27.550		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	7,744	0.2930	5.42		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Subcatchment 14: WS 14

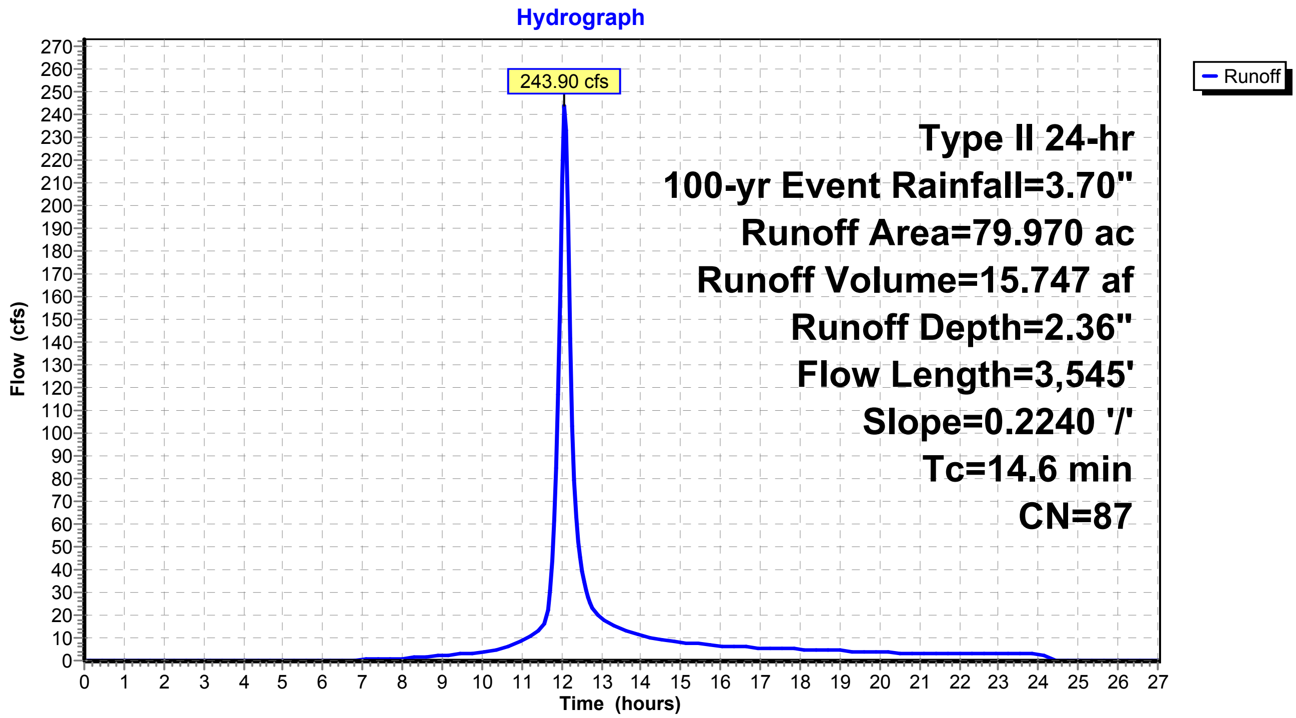
Runoff = 243.90 cfs @ 12.06 hrs, Volume= 15.747 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	71.970	86	Desert shrub range, Fair, HSG D
*	8.000	98	Impervious, HSG D
	79.970	87	Weighted Average
	71.970		90.00% Pervious Area
	8.000		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	3,545	0.2240	4.05		**Lag/CN Method,**

Subcatchment 14: WS 14



Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=28.210 ac 10.00% Impervious Runoff Depth=2.72"
Tc=5.0 min CN=87 Runoff=133.97 cfs 6.393 af

Subcatchment2: WS 2 Runoff Area=106.570 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,068' Slope=0.3140 '/' Tc=11.0 min CN=87 Runoff=415.35 cfs 24.150 af

Subcatchment3: WS 3 Runoff Area=34.990 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=1,603' Slope=0.1770 '/' Tc=8.7 min CN=87 Runoff=148.20 cfs 7.929 af

Subcatchment4: WS 4 Runoff Area=75.020 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,047' Slope=0.3390 '/' Tc=10.5 min CN=87 Runoff=297.56 cfs 17.000 af

Subcatchment5: WS 5 Runoff Area=124.190 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=5,976' Slope=0.3400 '/' Tc=18.0 min CN=87 Runoff=392.70 cfs 28.143 af

Subcatchment6: WS 6 Runoff Area=331.220 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=8,173' Slope=0.3100 '/' Tc=24.2 min CN=87 Runoff=888.50 cfs 75.058 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=5,064' Slope=0.2960 '/' Tc=16.9 min CN=87 Runoff=471.20 cfs 32.739 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=334.29 cfs 20.851 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=651.70 cfs 53.460 af

Subcatchment10: WS 10 Runoff Area=330.410 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=10,278' Slope=0.2760 '/' Tc=30.8 min CN=87 Runoff=762.30 cfs 74.875 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=968.42 cfs 90.153 af

Subcatchment12: WS 12 Runoff Area=227.420 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=6,590' Slope=0.3150 '/' Tc=20.2 min CN=87 Runoff=674.80 cfs 51.536 af

Subcatchment13: WS 13 Runoff Area=275.510 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,744' Slope=0.2930 '/' Tc=23.8 min CN=87 Runoff=745.85 cfs 62.434 af

Subcatchment14: WS 14 Runoff Area=79.970 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,545' Slope=0.2240 '/' Tc=14.6 min CN=87 Runoff=279.49 cfs 18.122 af

Total Runoff Area = 2,483.730 ac Runoff Volume = 562.843 af Average Runoff Depth = 2.72"
90.00% Pervious = 2,235.360 ac 10.00% Impervious = 248.370 ac

Summary for Subcatchment 1: WS 1

[49] Hint: Tc<2dt may require smaller dt

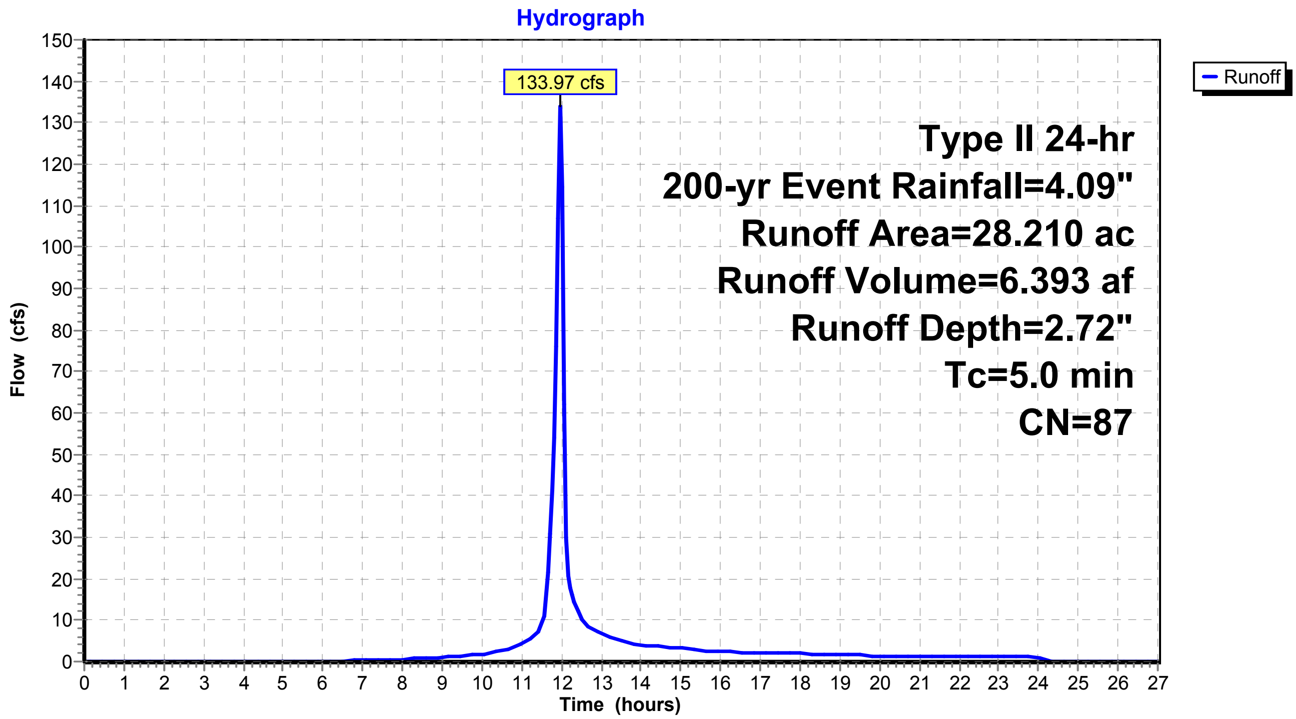
Runoff = 133.97 cfs @ 11.95 hrs, Volume= 6.393 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	25.390	86	Desert shrub range, Fair, HSG D
*	2.820	98	Impervious, HSG D
	28.210	87	Weighted Average
	25.390		90.00% Pervious Area
	2.820		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum Tc**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

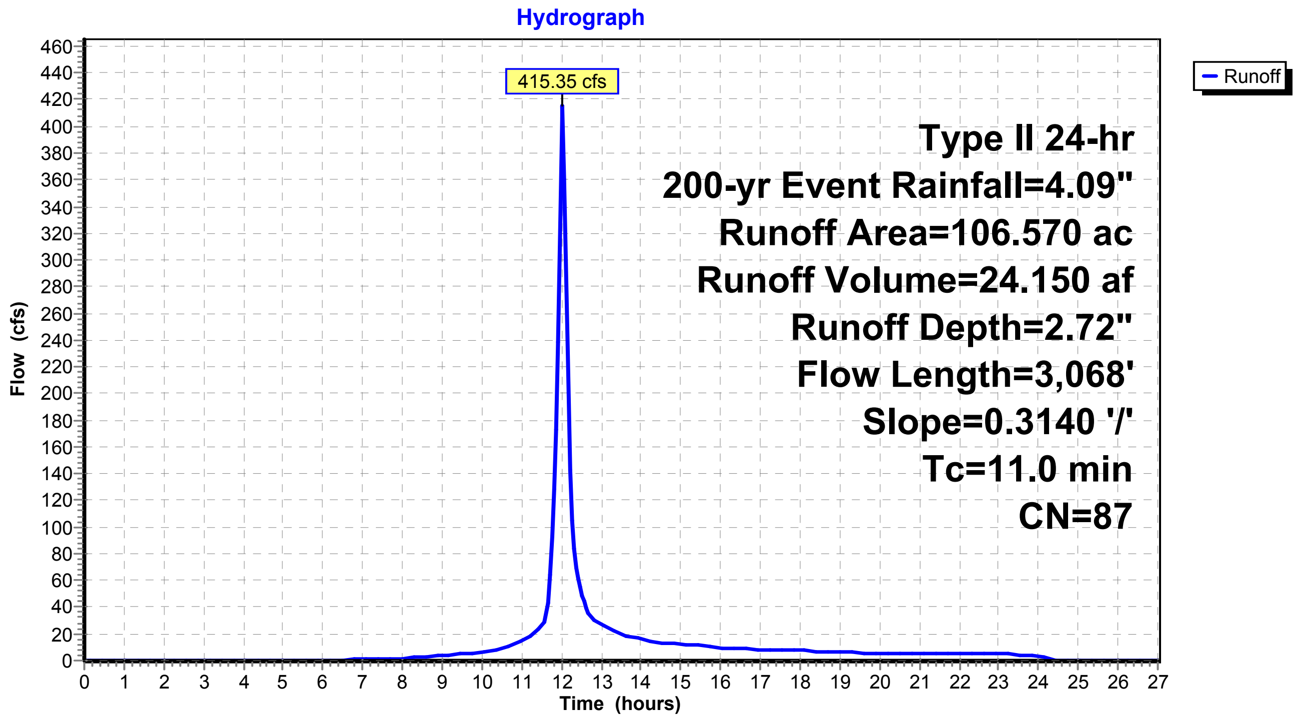
Runoff = 415.35 cfs @ 12.02 hrs, Volume= 24.150 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	95.910	86	Desert shrub range, Fair, HSG D
*	10.660	98	Impervious, HSG D
	106.570	87	Weighted Average
	95.910		90.00% Pervious Area
	10.660		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	3,068	0.3140	4.66		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

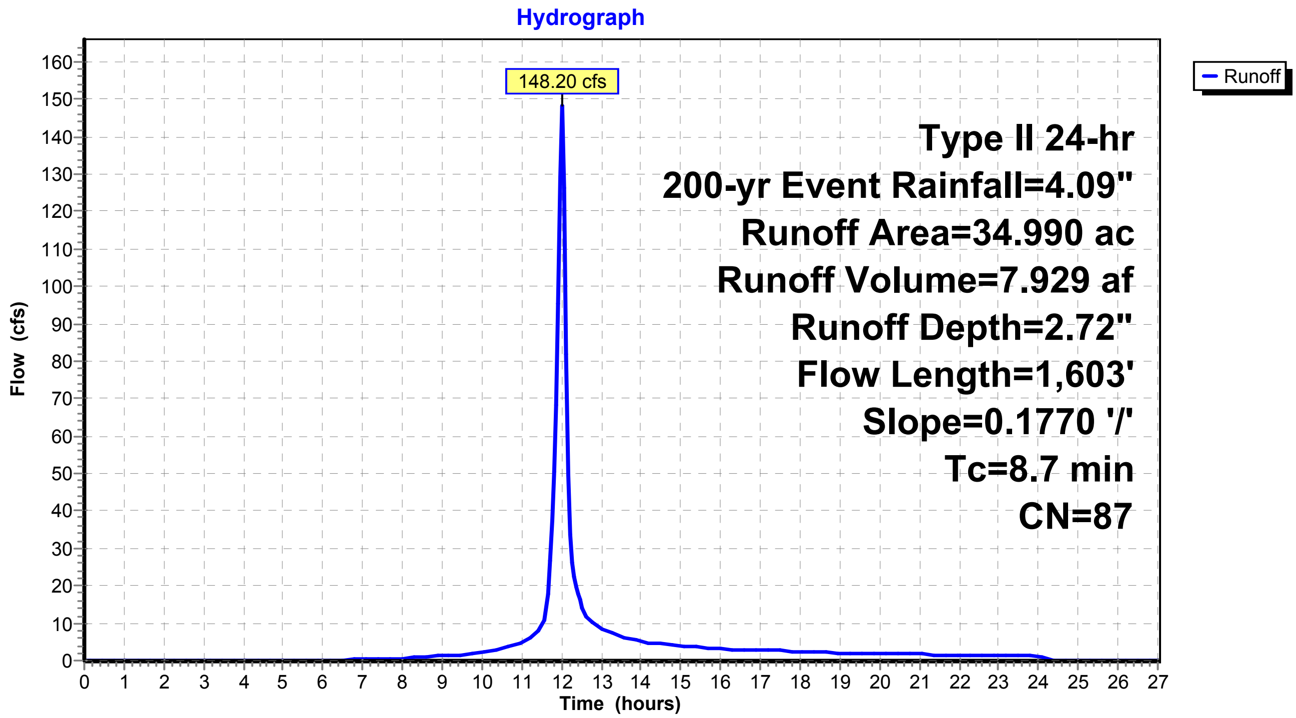
Runoff = 148.20 cfs @ 12.00 hrs, Volume= 7.929 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	31.490	86	Desert shrub range, Fair, HSG D
*	3.500	98	Impervious, HSG D
	34.990	87	Weighted Average
	31.490		90.00% Pervious Area
	3.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	1,603	0.1770	3.07		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

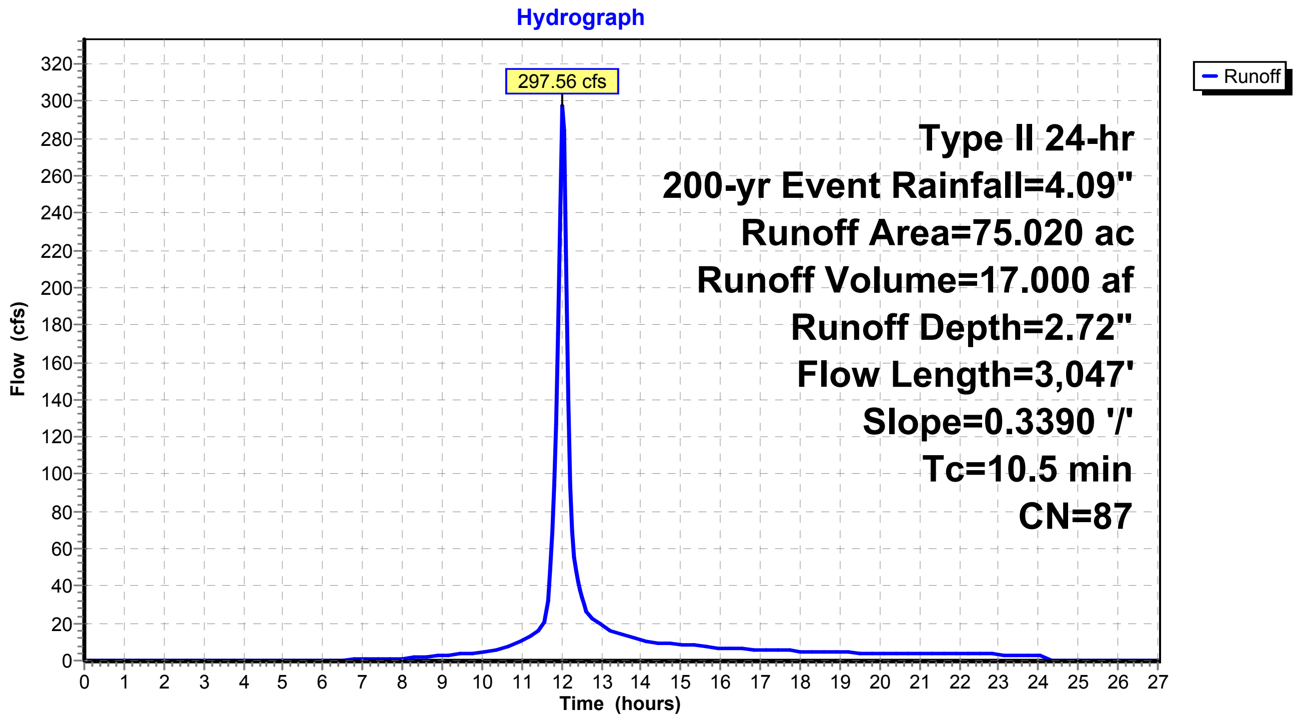
Runoff = 297.56 cfs @ 12.02 hrs, Volume= 17.000 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	67.520	86	Desert shrub range, Fair, HSG D
*	7.500	98	Impervious, HSG D
	75.020	87	Weighted Average
	67.520		90.00% Pervious Area
	7.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	3,047	0.3390	4.84		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

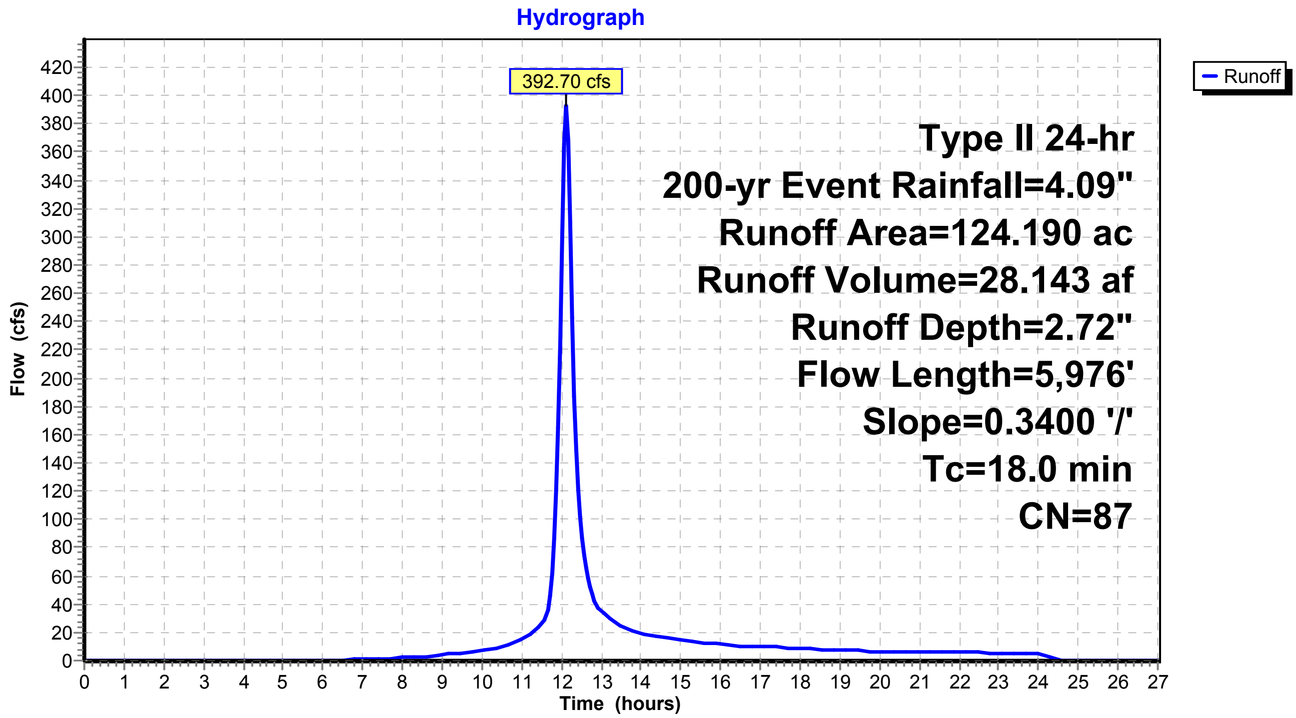
Runoff = 392.70 cfs @ 12.10 hrs, Volume= 28.143 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	111.770	86	Desert shrub range, Fair, HSG D
*	12.420	98	Impervious, HSG D
	124.190	87	Weighted Average
	111.770		90.00% Pervious Area
	12.420		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	5,976	0.3400	5.54		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

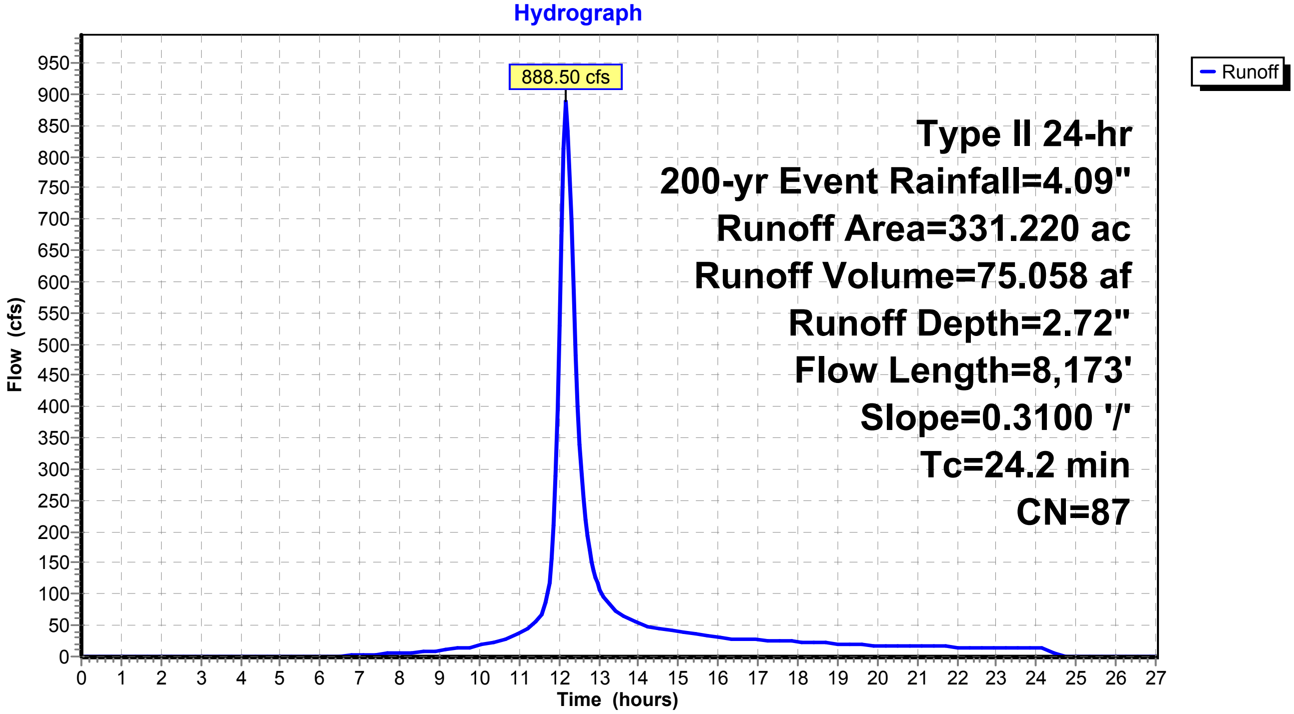
Runoff = 888.50 cfs @ 12.17 hrs, Volume= 75.058 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	298.100	86	Desert shrub range, Fair, HSG D
*	33.120	98	Impervious, HSG D
	331.220	87	Weighted Average
	298.100		90.00% Pervious Area
	33.120		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.2	8,173	0.3100	5.64		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

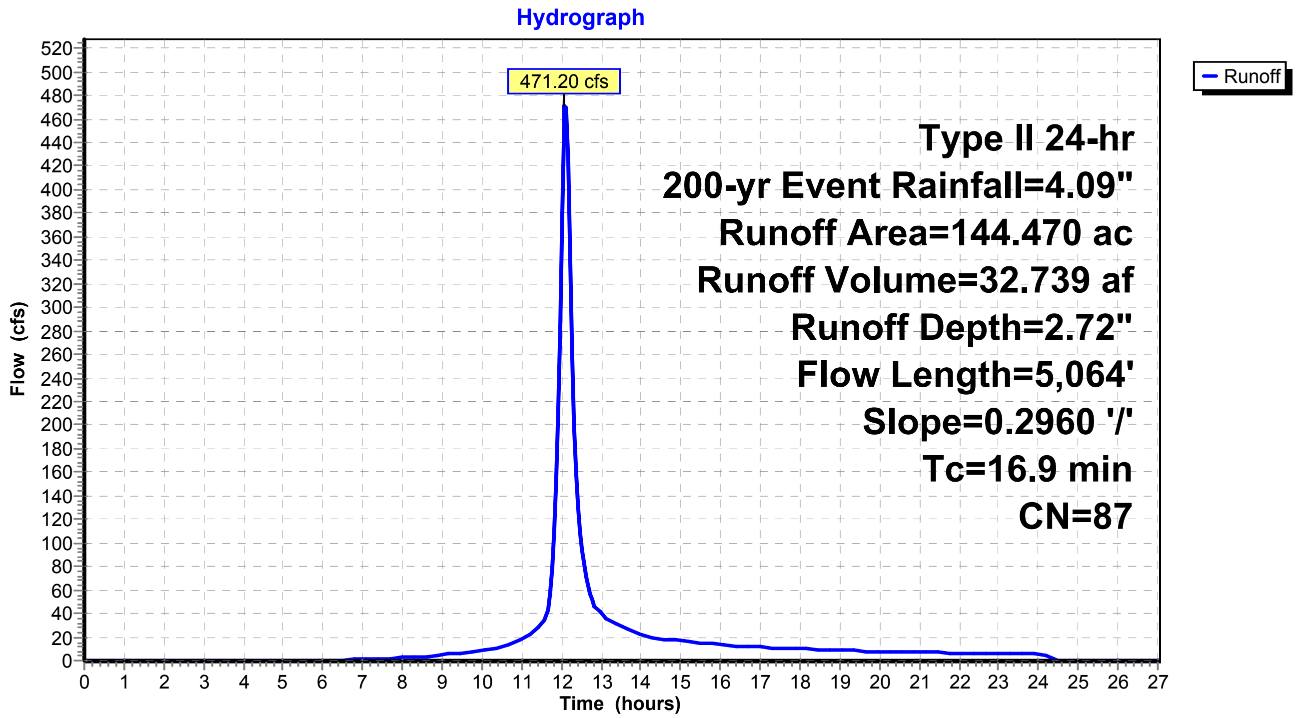
Runoff = 471.20 cfs @ 12.09 hrs, Volume= 32.739 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	5,064	0.2960	5.00		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

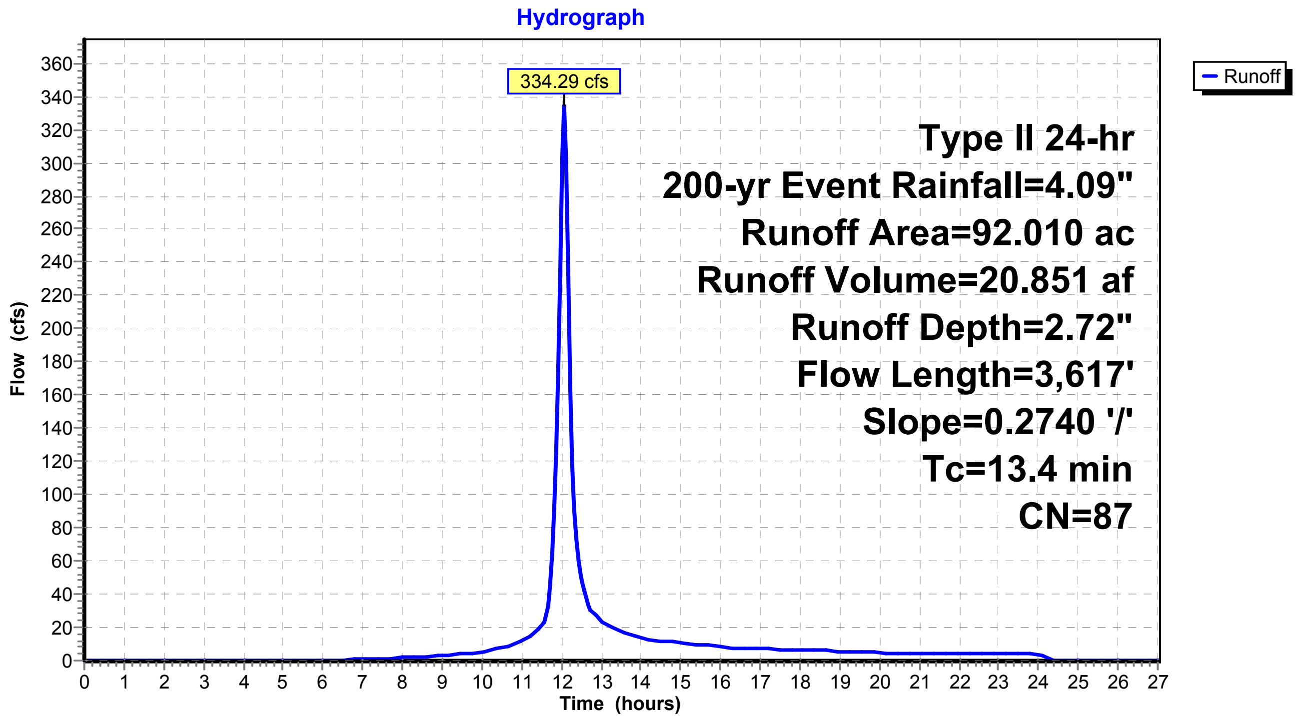
Runoff = 334.29 cfs @ 12.05 hrs, Volume= 20.851 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

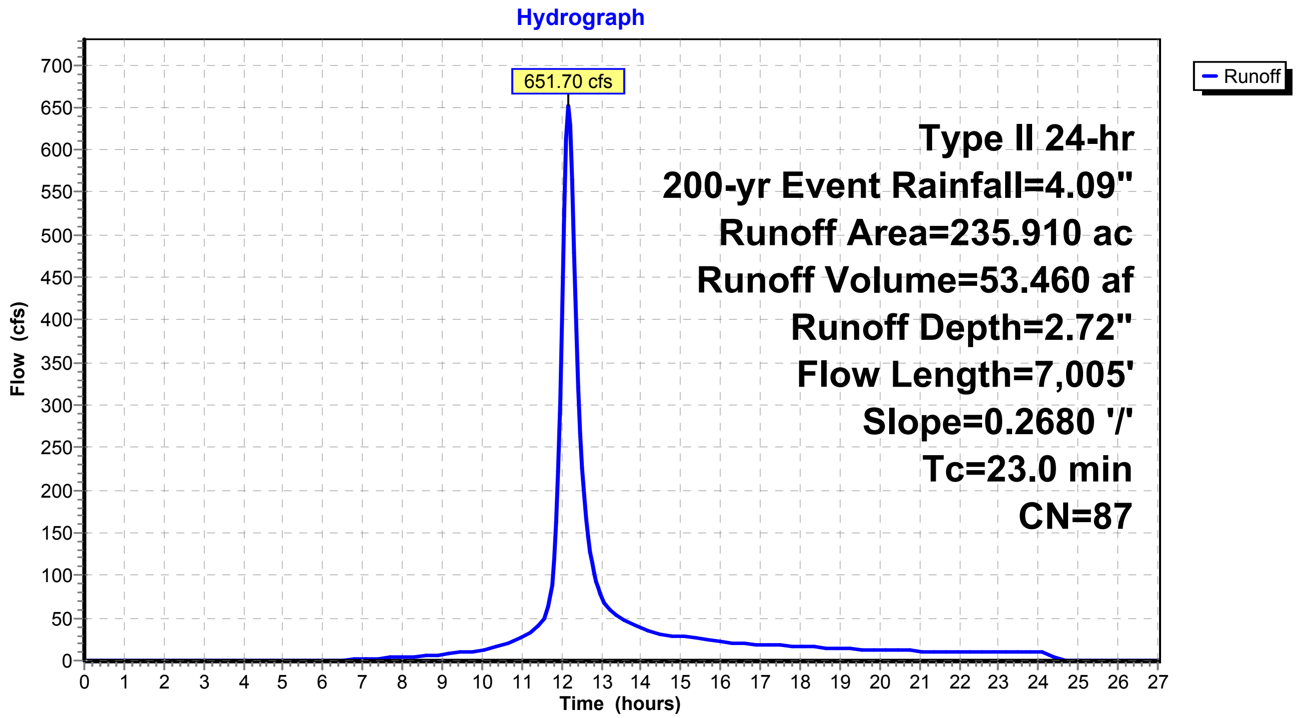
Runoff = 651.70 cfs @ 12.16 hrs, Volume= 53.460 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

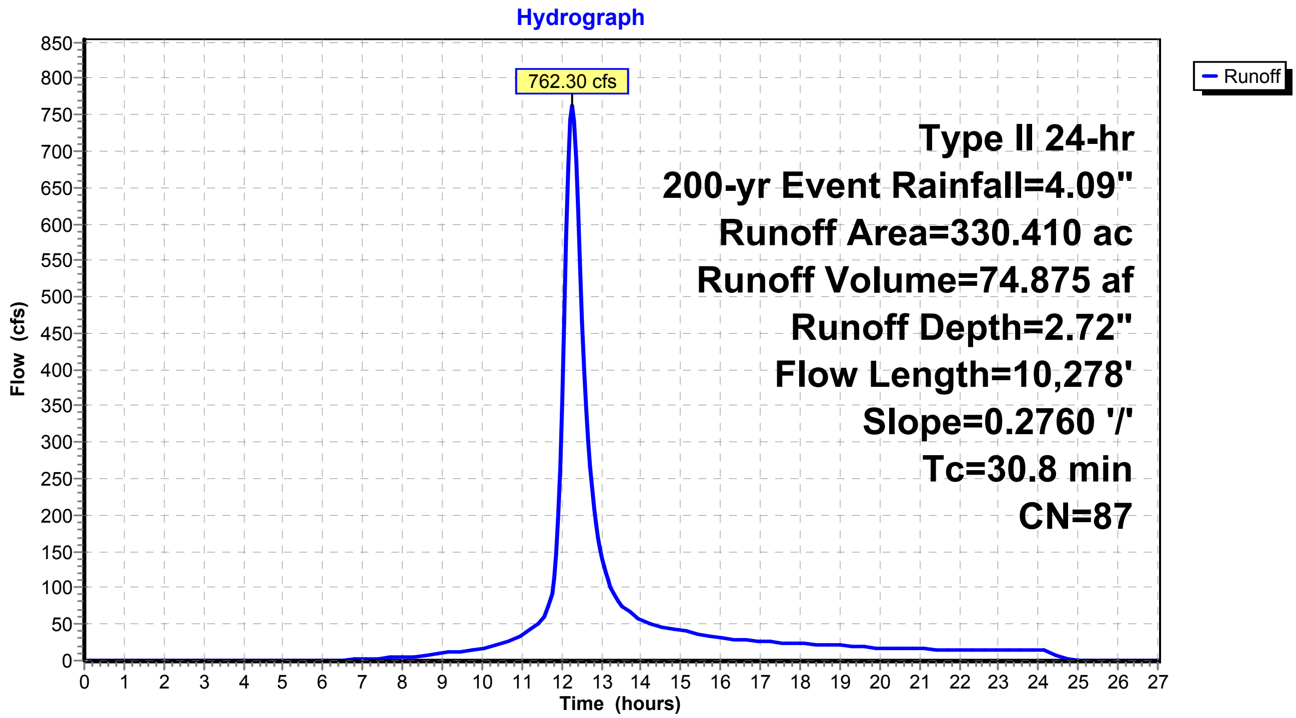
Runoff = 762.30 cfs @ 12.25 hrs, Volume= 74.875 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	297.370	86	Desert shrub range, Fair, HSG D
*	33.040	98	Impervious, HSG D
	330.410	87	Weighted Average
	297.370		90.00% Pervious Area
	33.040		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	10,278	0.2760	5.57		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

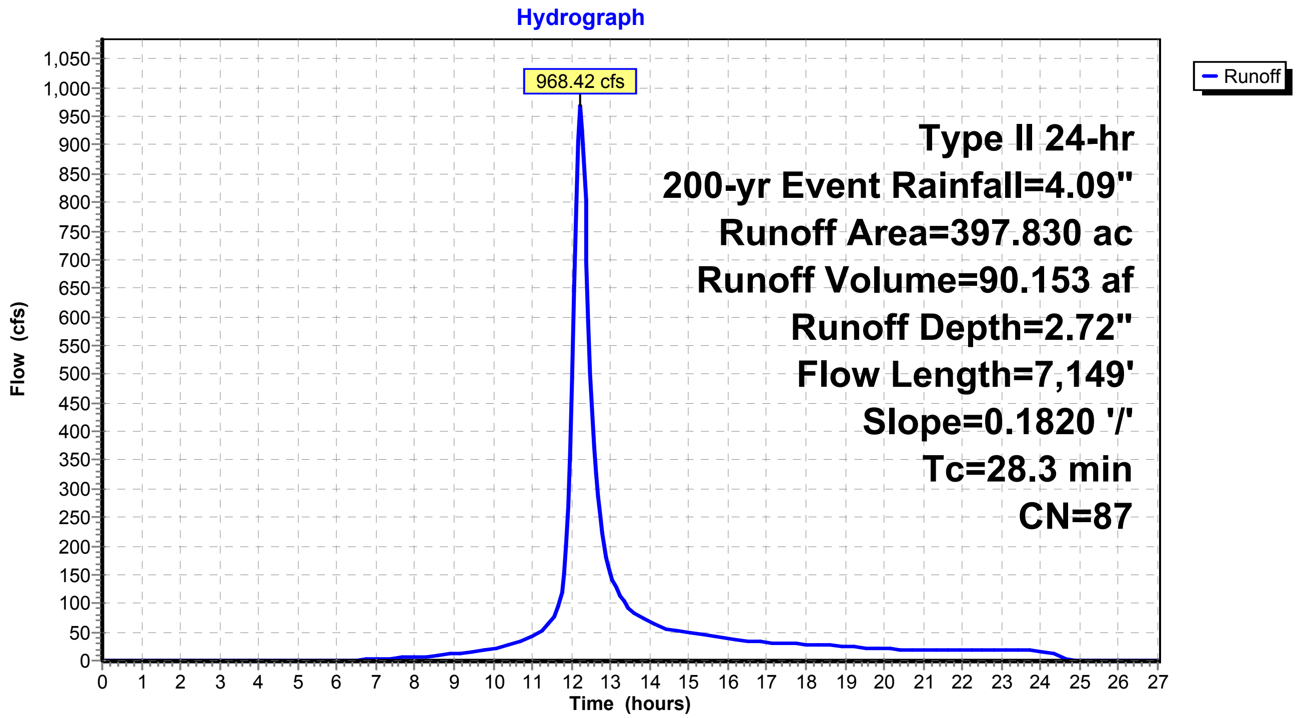
Runoff = 968.42 cfs @ 12.22 hrs, Volume= 90.153 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

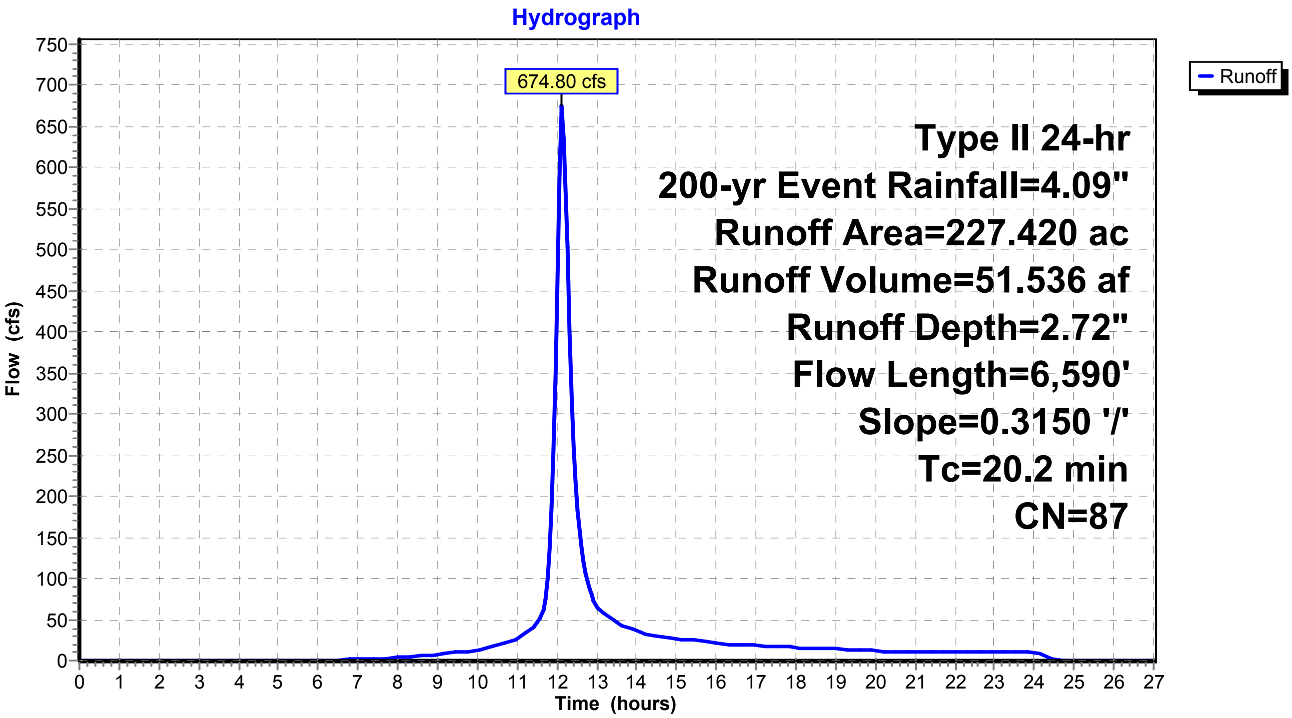
Runoff = 674.80 cfs @ 12.13 hrs, Volume= 51.536 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	204.680	86	Desert shrub range, Fair, HSG D
*	22.740	98	Impervious, HSG D
	227.420	87	Weighted Average
	204.680		90.00% Pervious Area
	22.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	6,590	0.3150	5.44		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

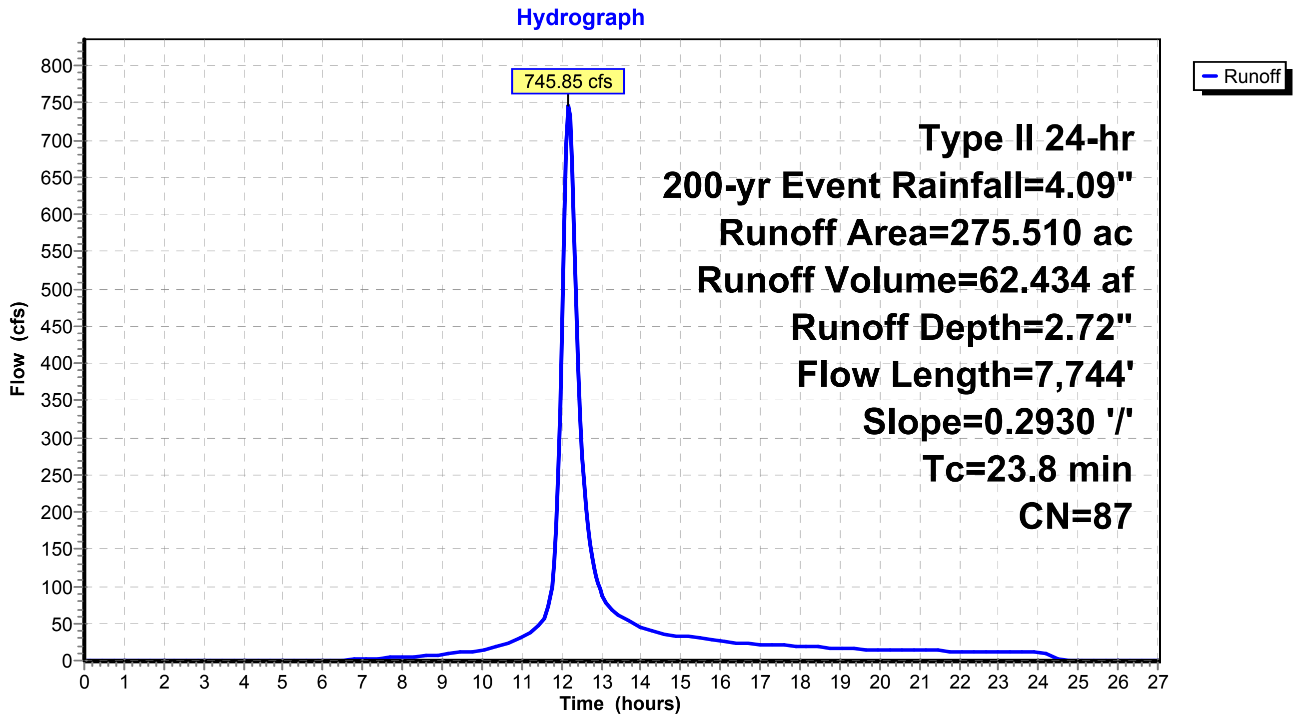
Runoff = 745.85 cfs @ 12.17 hrs, Volume= 62.434 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	247.960	86	Desert shrub range, Fair, HSG D
*	27.550	98	Impervious, HSG D
	275.510	87	Weighted Average
	247.960		90.00% Pervious Area
	27.550		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	7,744	0.2930	5.42		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Subcatchment 14: WS 14

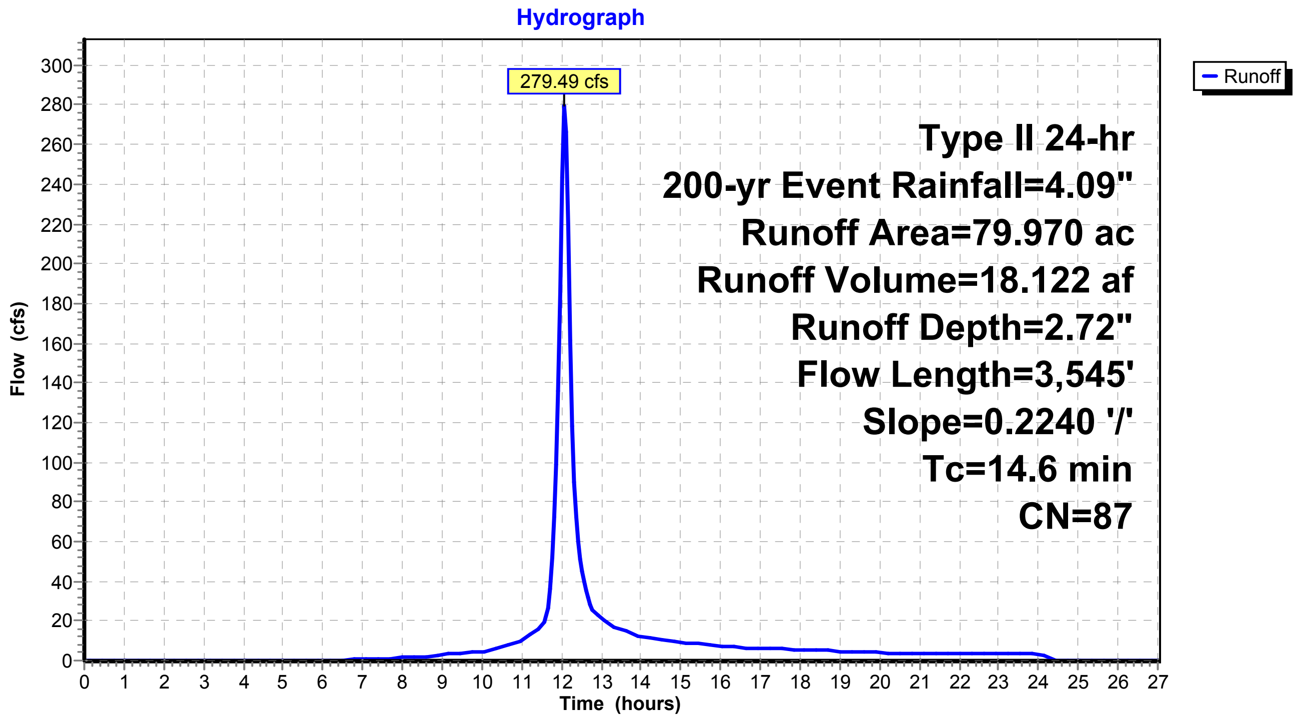
Runoff = 279.49 cfs @ 12.06 hrs, Volume= 18.122 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	71.970	86	Desert shrub range, Fair, HSG D
*	8.000	98	Impervious, HSG D
	79.970	87	Weighted Average
	71.970		90.00% Pervious Area
	8.000		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	3,545	0.2240	4.05		**Lag/CN Method,**

Subcatchment 14: WS 14



Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=28.210 ac 10.00% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=87 Runoff=155.94 cfs 7.504 af

Subcatchment2: WS 2 Runoff Area=106.570 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,068' Slope=0.3140 '/' Tc=11.0 min CN=87 Runoff=484.31 cfs 28.349 af

Subcatchment3: WS 3 Runoff Area=34.990 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=1,603' Slope=0.1770 '/' Tc=8.7 min CN=87 Runoff=172.66 cfs 9.308 af

Subcatchment4: WS 4 Runoff Area=75.020 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,047' Slope=0.3390 '/' Tc=10.5 min CN=87 Runoff=346.92 cfs 19.956 af

Subcatchment5: WS 5 Runoff Area=124.190 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=5,976' Slope=0.3400 '/' Tc=18.0 min CN=87 Runoff=458.61 cfs 33.036 af

Subcatchment6: WS 6 Runoff Area=331.220 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=8,173' Slope=0.3100 '/' Tc=24.2 min CN=87 Runoff=1,038.74 cfs 88.109 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=5,064' Slope=0.2960 '/' Tc=16.9 min CN=87 Runoff=550.14 cfs 38.431 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=389.99 cfs 24.476 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=761.76 cfs 62.755 af

Subcatchment10: WS 10 Runoff Area=330.410 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=10,278' Slope=0.2760 '/' Tc=30.8 min CN=87 Runoff=891.85 cfs 87.894 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=1,132.73 cfs 105.828 af

Subcatchment12: WS 12 Runoff Area=227.420 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=6,590' Slope=0.3150 '/' Tc=20.2 min CN=87 Runoff=789.72 cfs 60.497 af

Subcatchment13: WS 13 Runoff Area=275.510 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,744' Slope=0.2930 '/' Tc=23.8 min CN=87 Runoff=871.93 cfs 73.289 af

Subcatchment14: WS 14 Runoff Area=79.970 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,545' Slope=0.2240 '/' Tc=14.6 min CN=87 Runoff=326.19 cfs 21.273 af

Total Runoff Area = 2,483.730 ac Runoff Volume = 660.707 af Average Runoff Depth = 3.19"
90.00% Pervious = 2,235.360 ac 10.00% Impervious = 248.370 ac

Summary for Subcatchment 1: WS 1

[49] Hint: Tc<2dt may require smaller dt

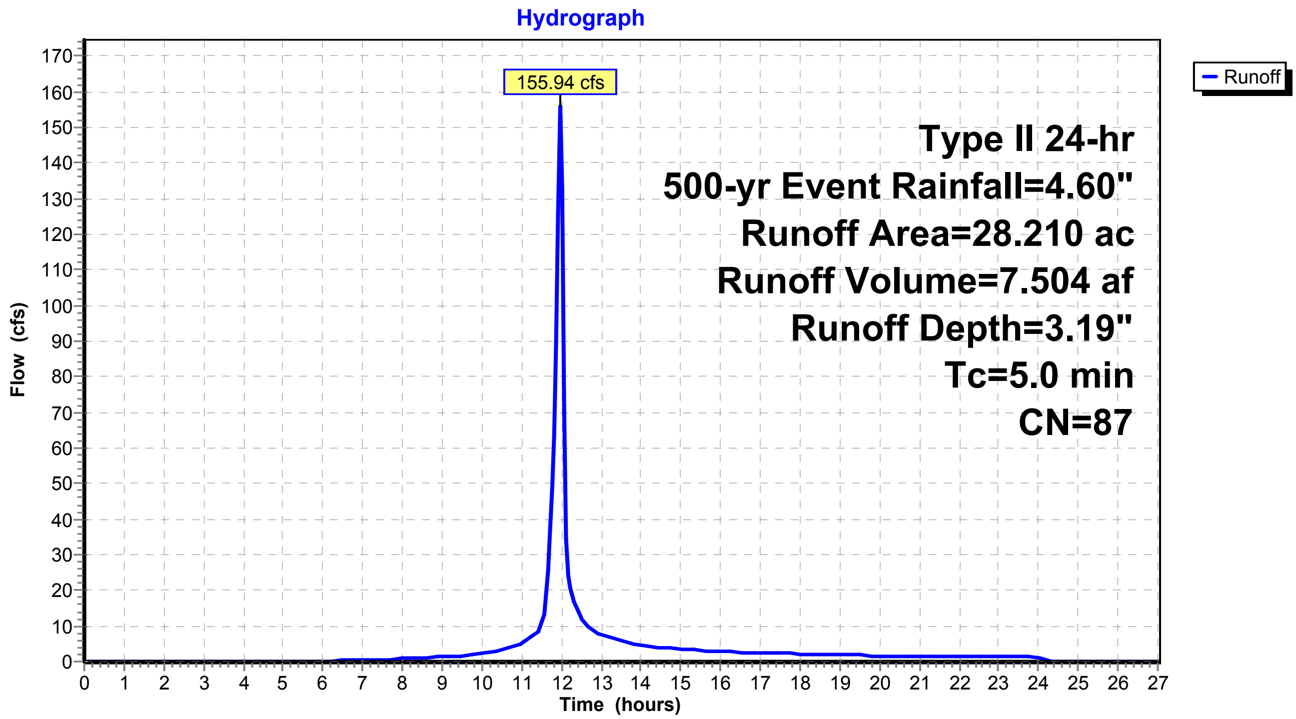
Runoff = 155.94 cfs @ 11.95 hrs, Volume= 7.504 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	25.390	86	Desert shrub range, Fair, HSG D
*	2.820	98	Impervious, HSG D
	28.210	87	Weighted Average
	25.390		90.00% Pervious Area
	2.820		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum Tc**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

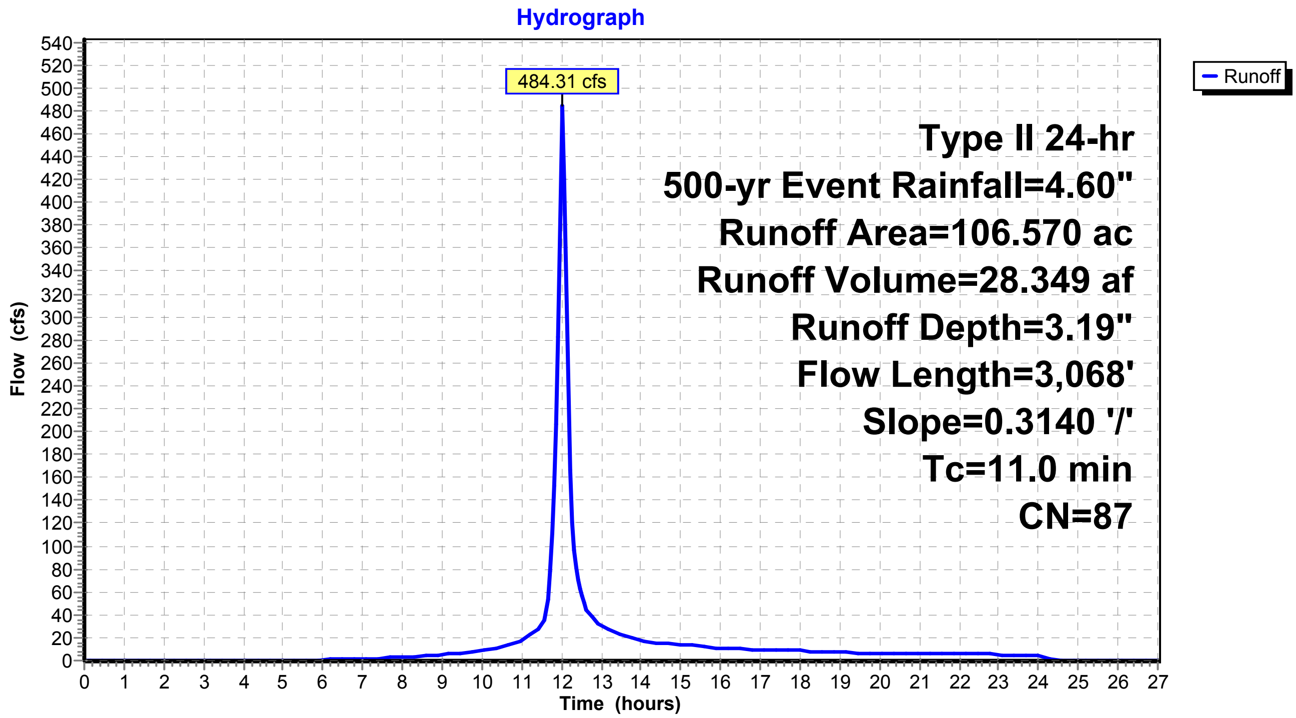
Runoff = 484.31 cfs @ 12.02 hrs, Volume= 28.349 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	95.910	86	Desert shrub range, Fair, HSG D
*	10.660	98	Impervious, HSG D
	106.570	87	Weighted Average
	95.910		90.00% Pervious Area
	10.660		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	3,068	0.3140	4.66		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

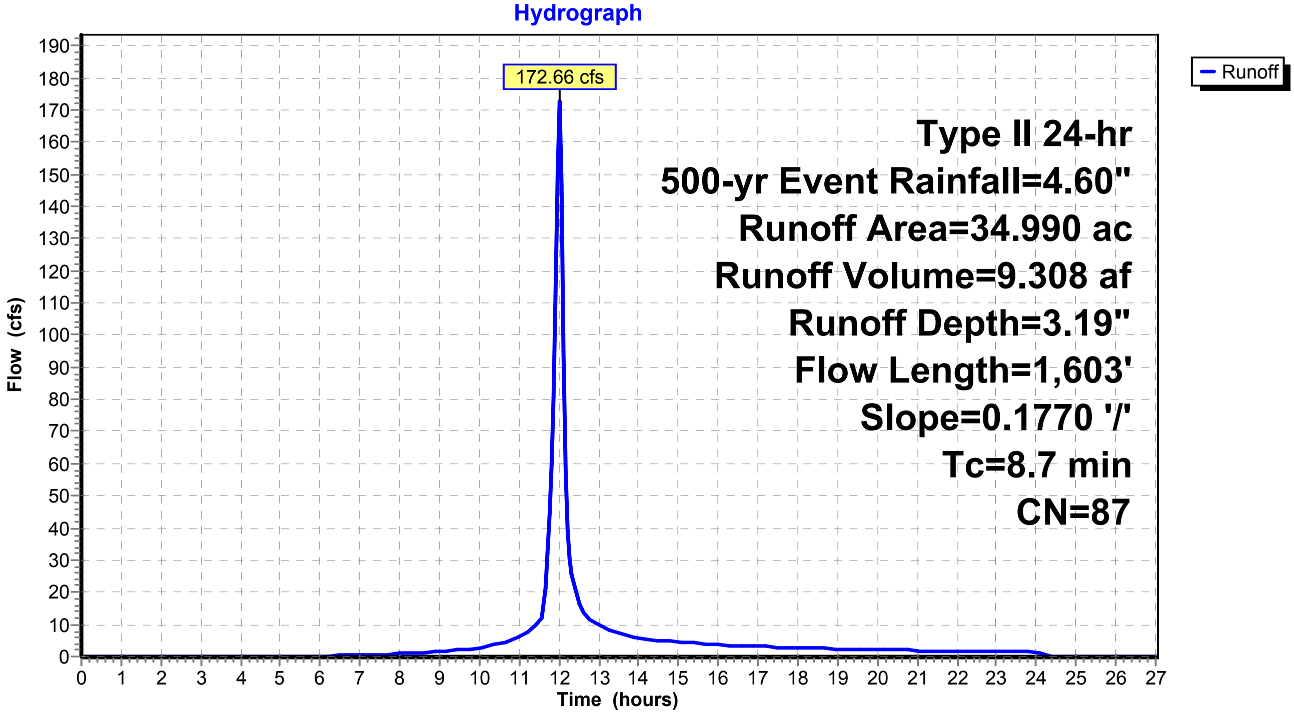
Runoff = 172.66 cfs @ 12.00 hrs, Volume= 9.308 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	31.490	86	Desert shrub range, Fair, HSG D
*	3.500	98	Impervious, HSG D
	34.990	87	Weighted Average
	31.490		90.00% Pervious Area
	3.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	1,603	0.1770	3.07		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

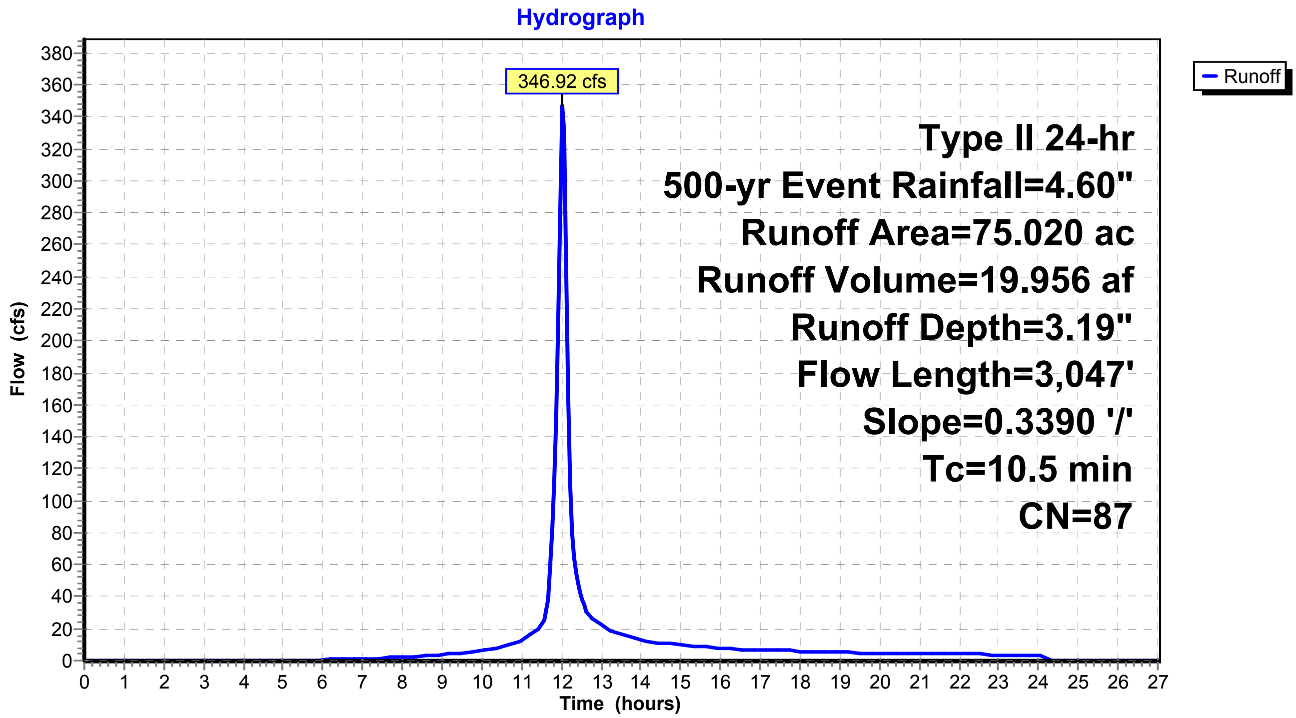
Runoff = 346.92 cfs @ 12.02 hrs, Volume= 19.956 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	67.520	86	Desert shrub range, Fair, HSG D
*	7.500	98	Impervious, HSG D
	75.020	87	Weighted Average
	67.520		90.00% Pervious Area
	7.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	3,047	0.3390	4.84		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

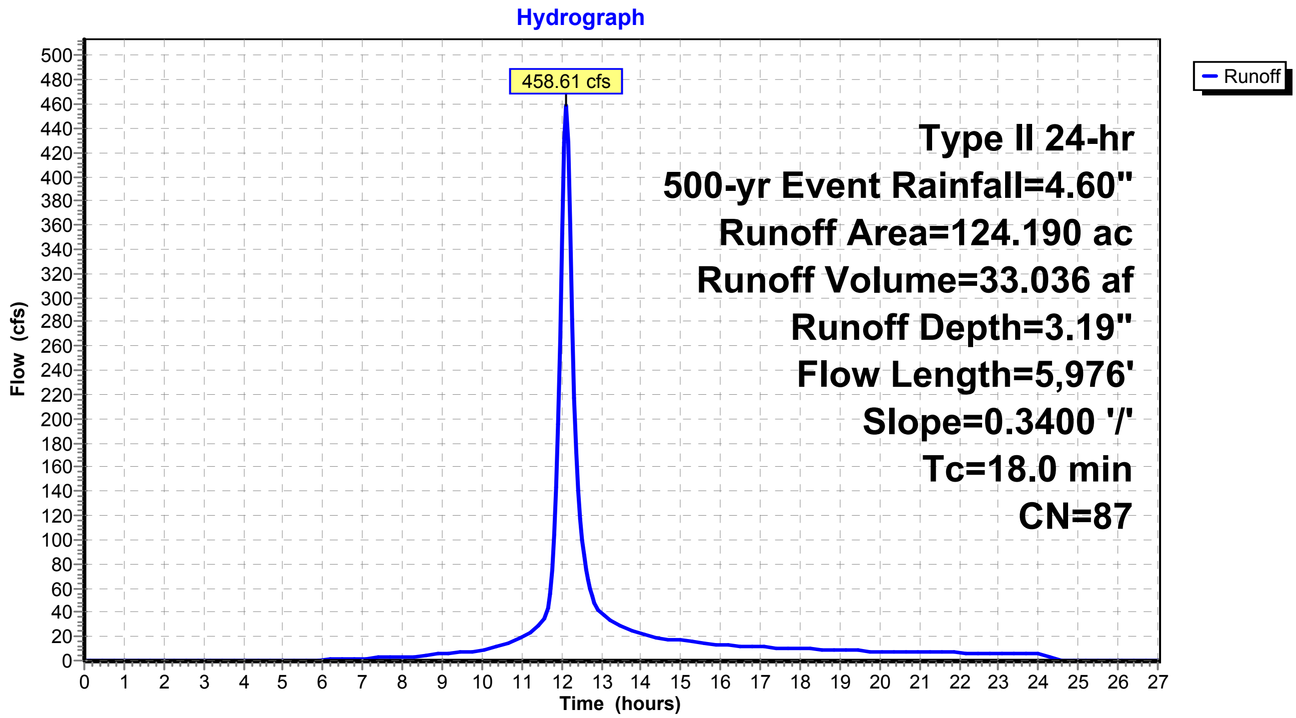
Runoff = 458.61 cfs @ 12.10 hrs, Volume= 33.036 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	111.770	86	Desert shrub range, Fair, HSG D
*	12.420	98	Impervious, HSG D
	124.190	87	Weighted Average
	111.770		90.00% Pervious Area
	12.420		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	5,976	0.3400	5.54		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

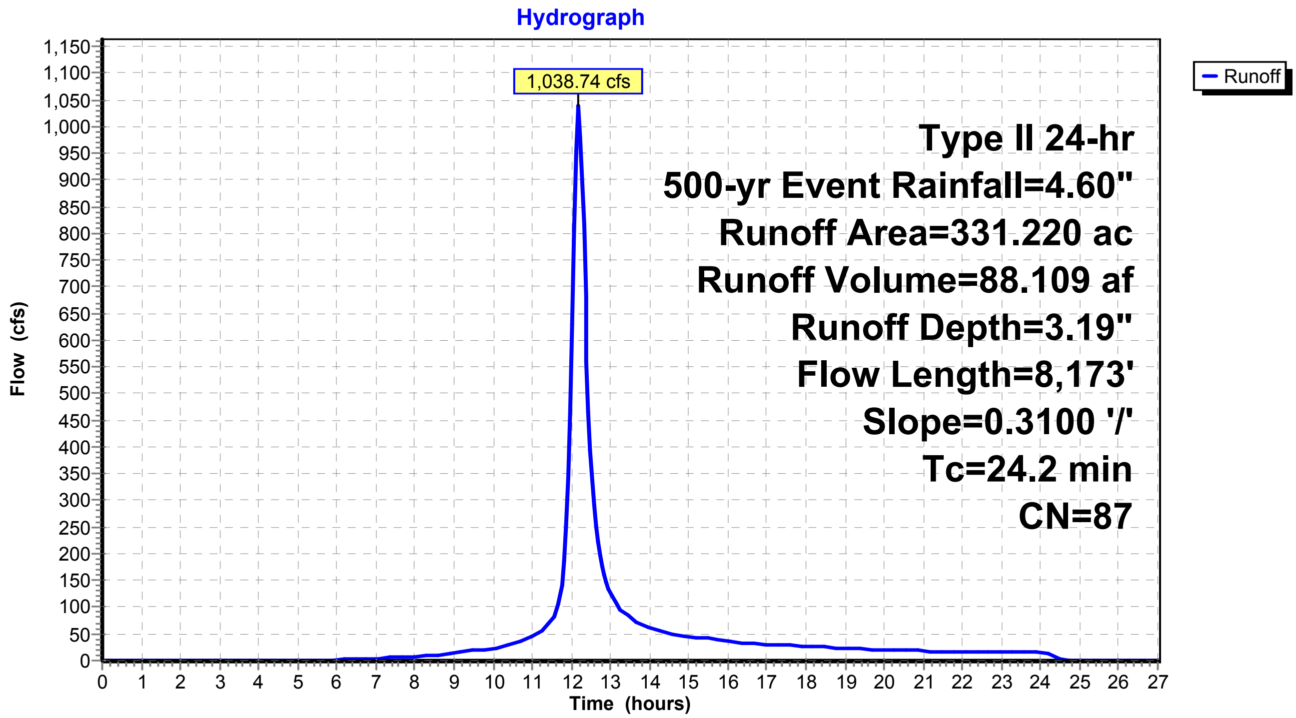
Runoff = 1,038.74 cfs @ 12.17 hrs, Volume= 88.109 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	298.100	86	Desert shrub range, Fair, HSG D
*	33.120	98	Impervious, HSG D
	331.220	87	Weighted Average
	298.100		90.00% Pervious Area
	33.120		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.2	8,173	0.3100	5.64		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

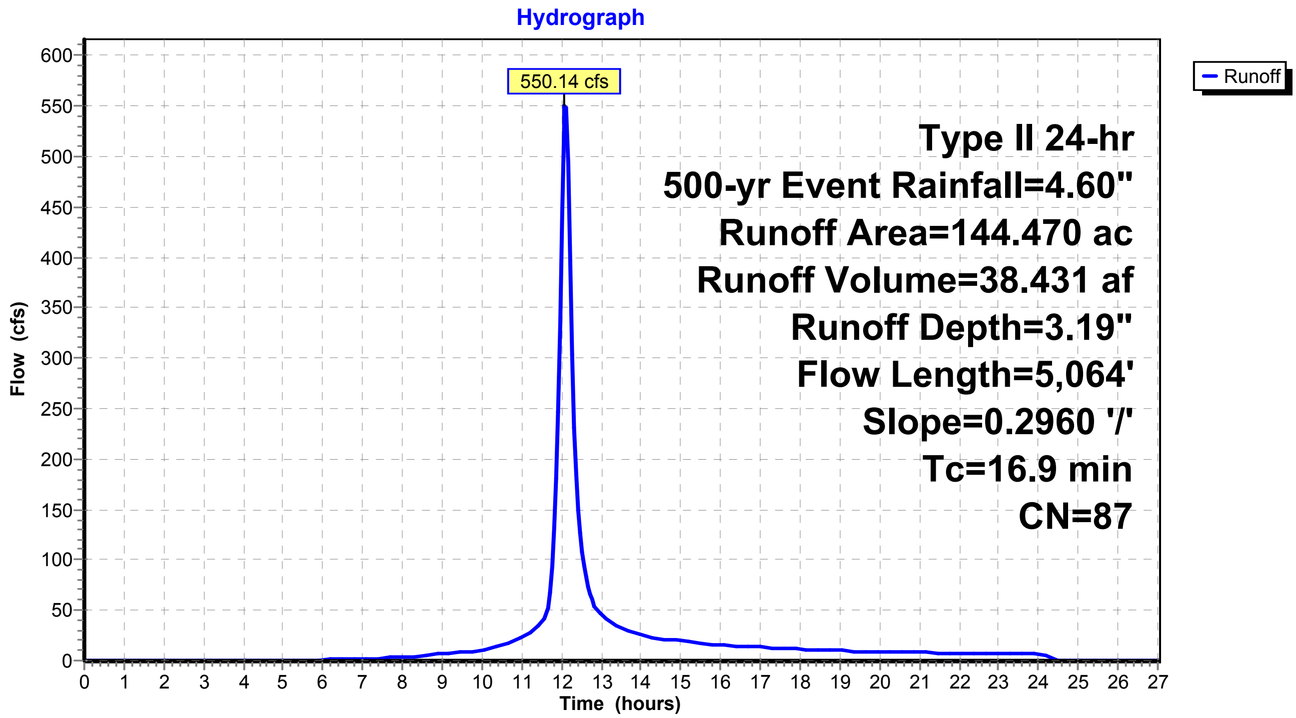
Runoff = 550.14 cfs @ 12.09 hrs, Volume= 38.431 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	5,064	0.2960	5.00		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

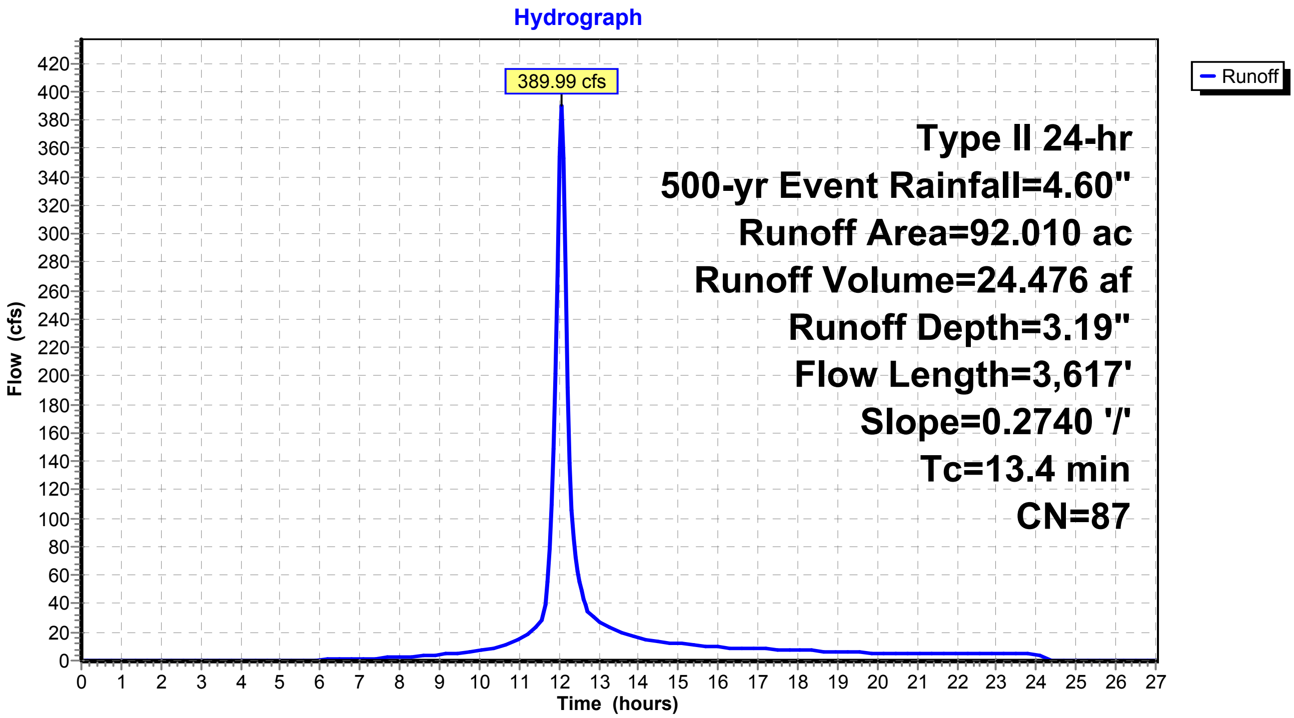
Runoff = 389.99 cfs @ 12.05 hrs, Volume= 24.476 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

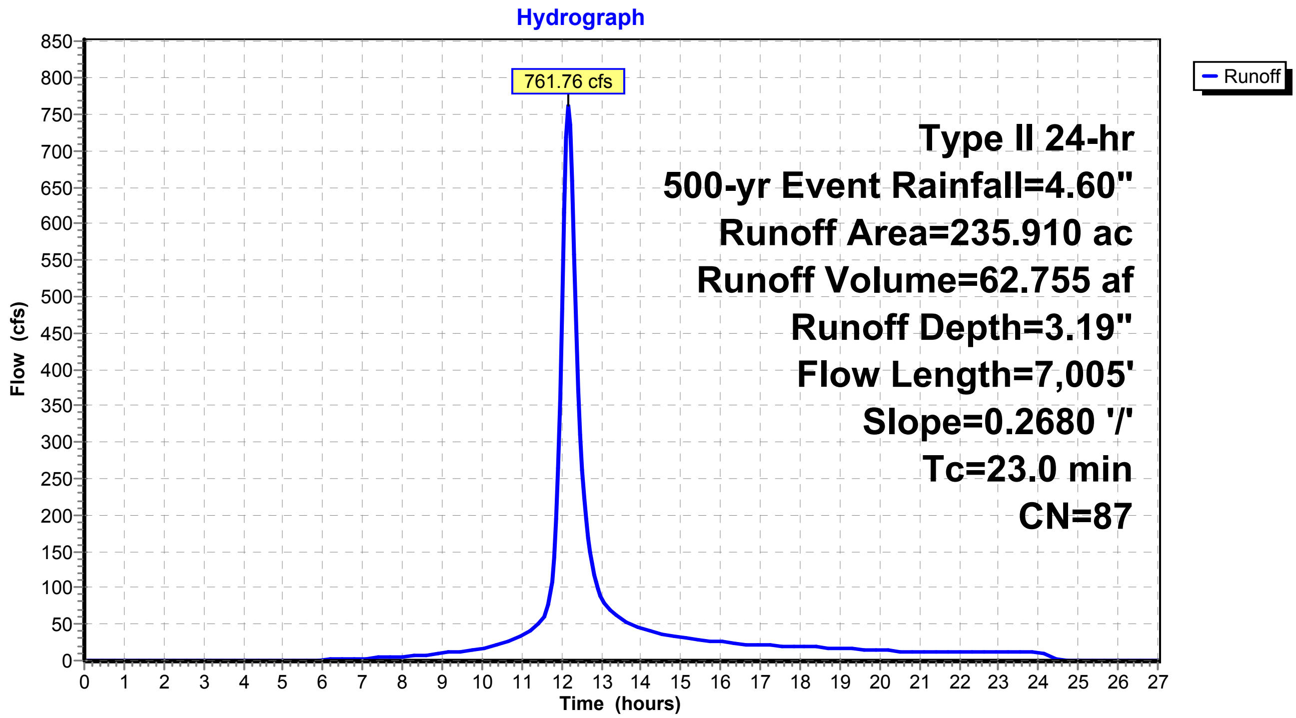
Runoff = 761.76 cfs @ 12.16 hrs, Volume= 62.755 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

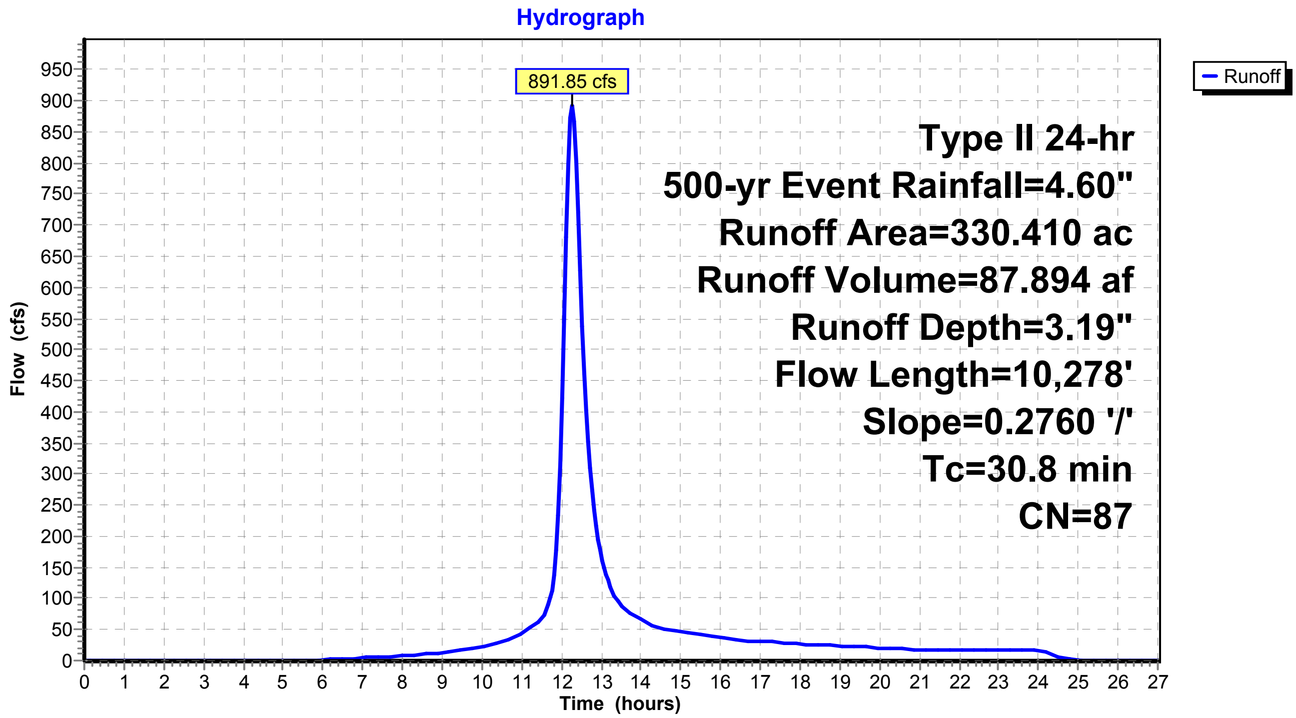
Runoff = 891.85 cfs @ 12.25 hrs, Volume= 87.894 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	297.370	86	Desert shrub range, Fair, HSG D
*	33.040	98	Impervious, HSG D
	330.410	87	Weighted Average
	297.370		90.00% Pervious Area
	33.040		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	10,278	0.2760	5.57		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

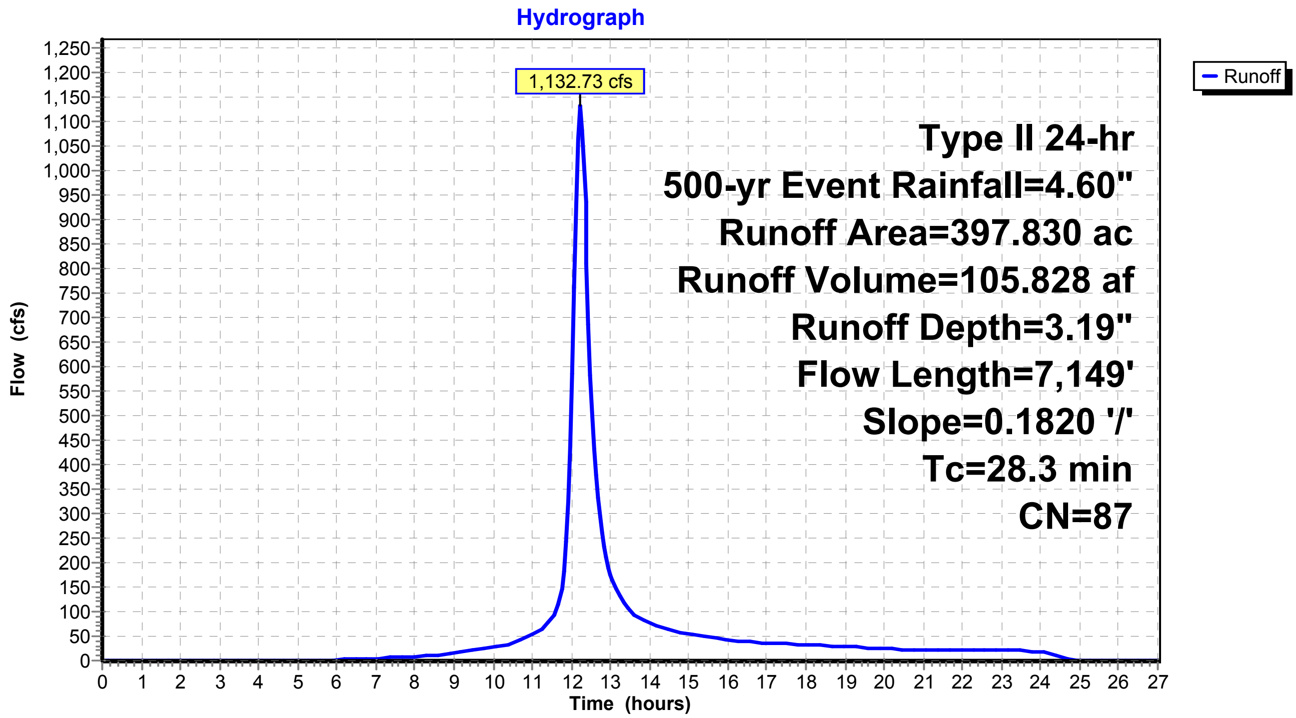
Runoff = 1,132.73 cfs @ 12.22 hrs, Volume= 105.828 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

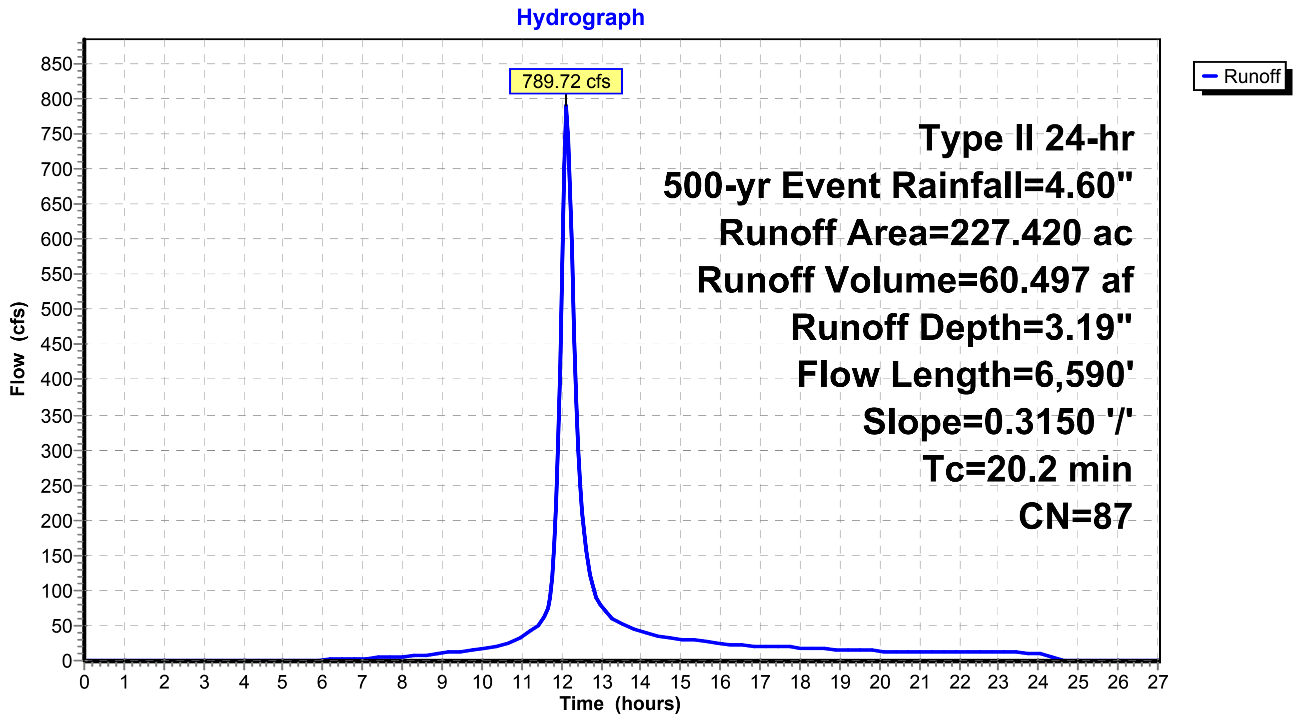
Runoff = 789.72 cfs @ 12.12 hrs, Volume= 60.497 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	204.680	86	Desert shrub range, Fair, HSG D
*	22.740	98	Impervious, HSG D
	227.420	87	Weighted Average
	204.680		90.00% Pervious Area
	22.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	6,590	0.3150	5.44		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

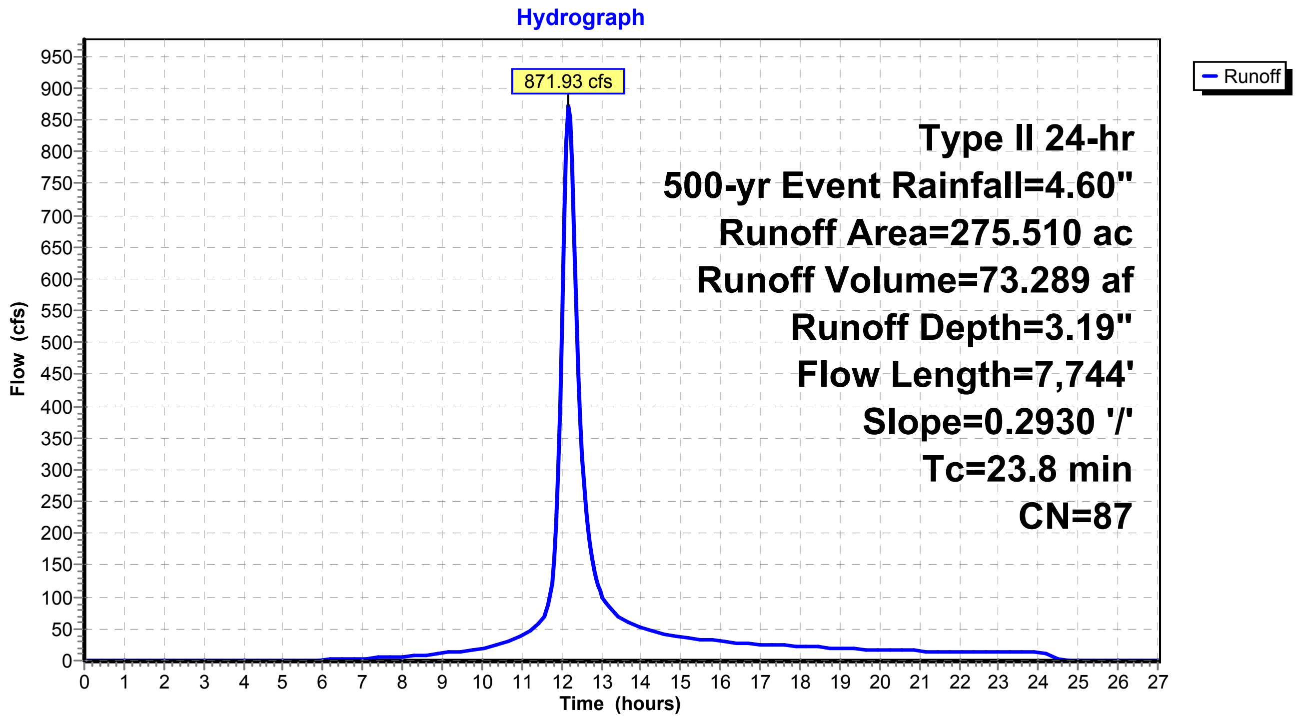
Runoff = 871.93 cfs @ 12.16 hrs, Volume= 73.289 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	247.960	86	Desert shrub range, Fair, HSG D
*	27.550	98	Impervious, HSG D
	275.510	87	Weighted Average
	247.960		90.00% Pervious Area
	27.550		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	7,744	0.2930	5.42		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Subcatchment 14: WS 14

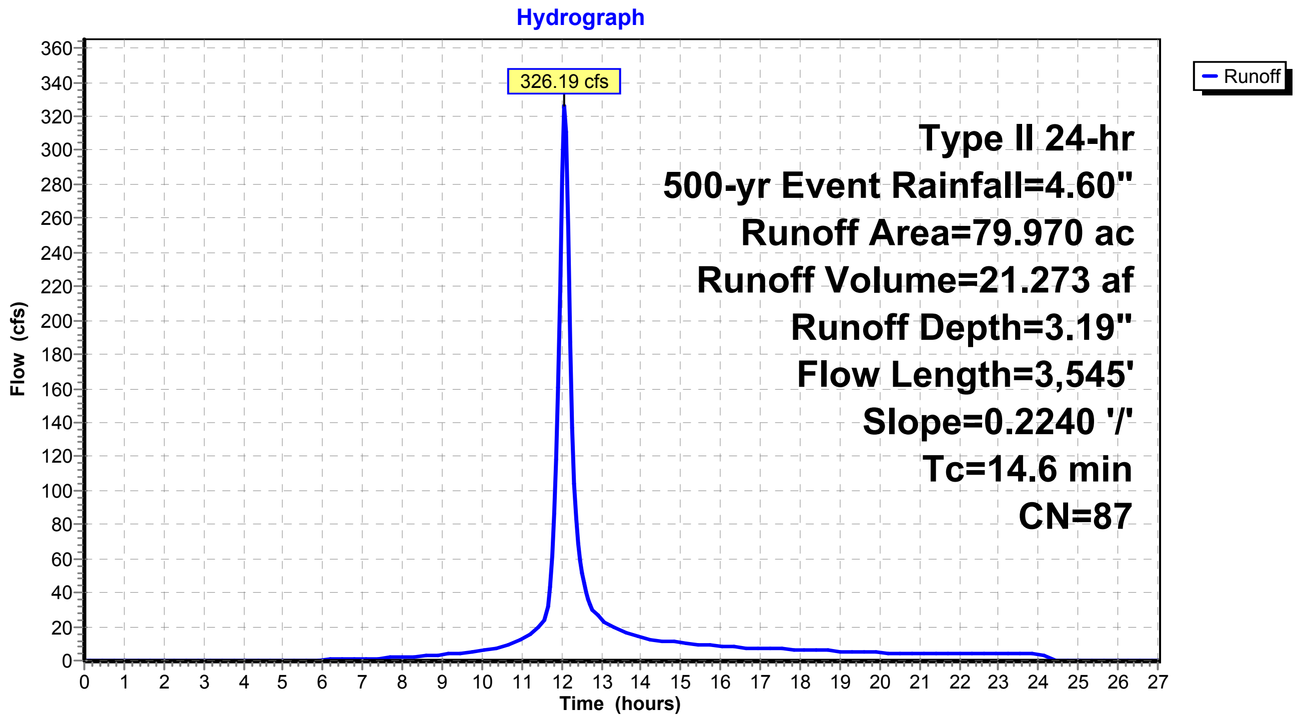
Runoff = 326.19 cfs @ 12.06 hrs, Volume= 21.273 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

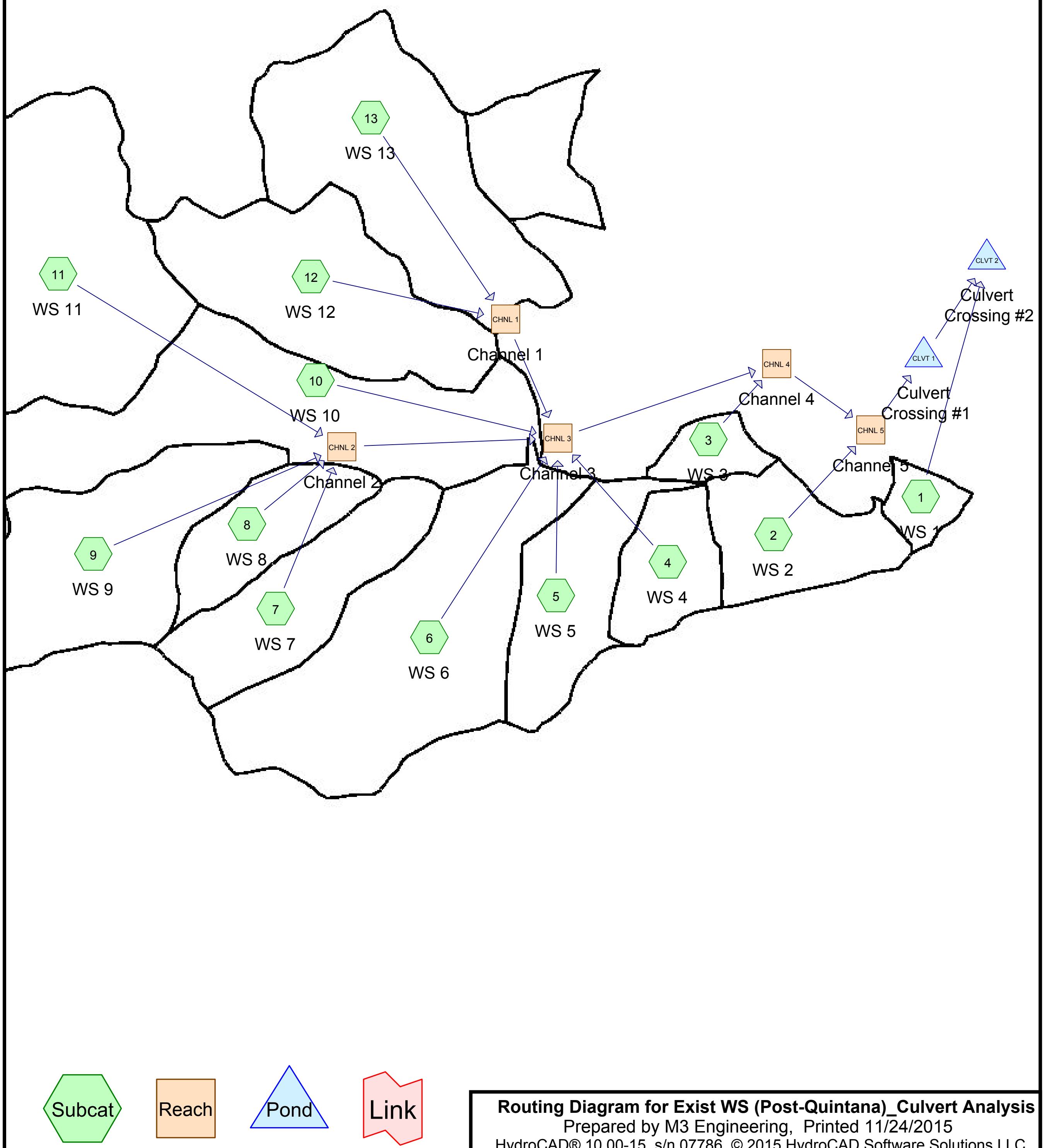
	Area (ac)	CN	Description
	71.970	86	Desert shrub range, Fair, HSG D
*	8.000	98	Impervious, HSG D
	79.970	87	Weighted Average
	71.970		90.00% Pervious Area
	8.000		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	3,545	0.2240	4.05		**Lag/CN Method,**

Subcatchment 14: WS 14



APPENDIX D



Routing Diagram for Exist WS (Post-Quintana)_Culvert Analysis
Prepared by M3 Engineering, Printed 11/24/2015
HydroCAD® 10.00-15 s/n 07786 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2,163.390	86	Desert shrub range, Fair, HSG D (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)
240.370	98	Impervious, HSG D (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)
2,403.760	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
2,403.760	HSG D	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
0.000	Other	
2,403.760		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	2,163.390	0.000	2,163.390	Desert shrub range, Fair	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
0.000	0.000	0.000	240.370	0.000	240.370	Impervious	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
0.000	**0.000**	**0.000**	**2,403.760**	**0.000**	**2,403.760**	**TOTAL AREA**	

Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=28.210 ac 10.00% Impervious Runoff Depth=2.36"
Tc=5.0 min CN=87 Runoff=117.20 cfs 5.555 af

Subcatchment2: WS 2 Runoff Area=106.570 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,068' Slope=0.3140 '/' Tc=11.0 min CN=87 Runoff=363.66 cfs 20.985 af

Subcatchment3: WS 3 Runoff Area=34.990 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=1,603' Slope=0.1770 '/' Tc=8.7 min CN=87 Runoff=129.54 cfs 6.890 af

Subcatchment4: WS 4 Runoff Area=75.020 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,047' Slope=0.3390 '/' Tc=10.5 min CN=87 Runoff=259.92 cfs 14.773 af

Subcatchment5: WS 5 Runoff Area=124.190 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=5,976' Slope=0.3400 '/' Tc=18.0 min CN=87 Runoff=342.49 cfs 24.455 af

Subcatchment6: WS 6 Runoff Area=331.220 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=8,173' Slope=0.3100 '/' Tc=24.2 min CN=87 Runoff=774.13 cfs 65.223 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=5,064' Slope=0.2960 '/' Tc=16.9 min CN=87 Runoff=411.06 cfs 28.449 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=291.83 cfs 18.118 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=567.91 cfs 46.455 af

Subcatchment10: WS 10 Runoff Area=330.410 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=10,278' Slope=0.2760 '/' Tc=30.8 min CN=87 Runoff=663.73 cfs 65.063 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=843.39 cfs 78.339 af

Subcatchment12: WS 12 Runoff Area=227.420 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=6,590' Slope=0.3150 '/' Tc=20.2 min CN=87 Runoff=588.30 cfs 44.783 af

Subcatchment13: WS 13 Runoff Area=275.510 ac 10.00% Impervious Runoff Depth=2.36"
Flow Length=7,744' Slope=0.2930 '/' Tc=23.8 min CN=87 Runoff=649.87 cfs 54.252 af

Reach CHNL 1: Channel 1 Avg. Flow Depth=2.49' Max Vel=8.88 fps Inflow=1,228.49 cfs 99.035 af
n=0.036 L=1,919.0' S=0.0155 '/' Capacity=12,871.33 cfs Outflow=1,184.09 cfs 99.033 af

Reach CHNL 2: Channel 2 Avg. Flow Depth=1.68' Max Vel=9.03 fps Inflow=1,933.74 cfs 171.361 af
n=0.036 L=7,061.5' S=0.0255 '/' Capacity=32,870.94 cfs Outflow=1,565.27 cfs 170.940 af

Reach CHNL 3: Channel 3 Avg. Flow Depth=5.30' Max Vel=13.90 fps Inflow=3,580.90 cfs 439.487 af
n=0.036 L=3,680.5' S=0.0162 '/' Capacity=10,812.70 cfs Outflow=3,520.63 cfs 439.082 af

Reach CHNL 4: Channel 4 Avg. Flow Depth=3.72' Max Vel=20.81 fps Inflow=3,535.74 cfs 445.972 af
n=0.036 L=1,100.0' S=0.0545 '/' Capacity=19,828.03 cfs Outflow=3,523.29 cfs 445.885 af

Reach CHNL 5: Channel 5 Avg. Flow Depth=6.13' Max Vel=16.97 fps Inflow=3,572.05 cfs 466.870 af
n=0.036 L=2,163.7' S=0.0231 '/' Capacity=10,541.66 cfs Outflow=3,552.39 cfs 466.654 af

Pond CLVT 1: Culvert Crossing Peak Elev=5,389.78' Storage=1,214,495 cf Inflow=3,552.39 cfs 466.654 af
117.0" Round Culvert x 3.00 n=0.024 L=194.4' S=0.0103 '/' Outflow=3,058.70 cfs 466.511 af

Pond CLVT 2: Culvert Crossing Peak Elev=5,386.54' Storage=5,175,763 cf Inflow=3,066.00 cfs 472.066 af
117.0" Round Culvert n=0.024 L=255.4' S=0.0313 '/' Outflow=1,545.71 cfs 472.015 af

Total Runoff Area = 2,403.760 ac Runoff Volume = 473.340 af Average Runoff Depth = 2.36"
90.00% Pervious = 2,163.390 ac 10.00% Impervious = 240.370 ac

Summary for Subcatchment 1: WS 1

[49] Hint: Tc<2dt may require smaller dt

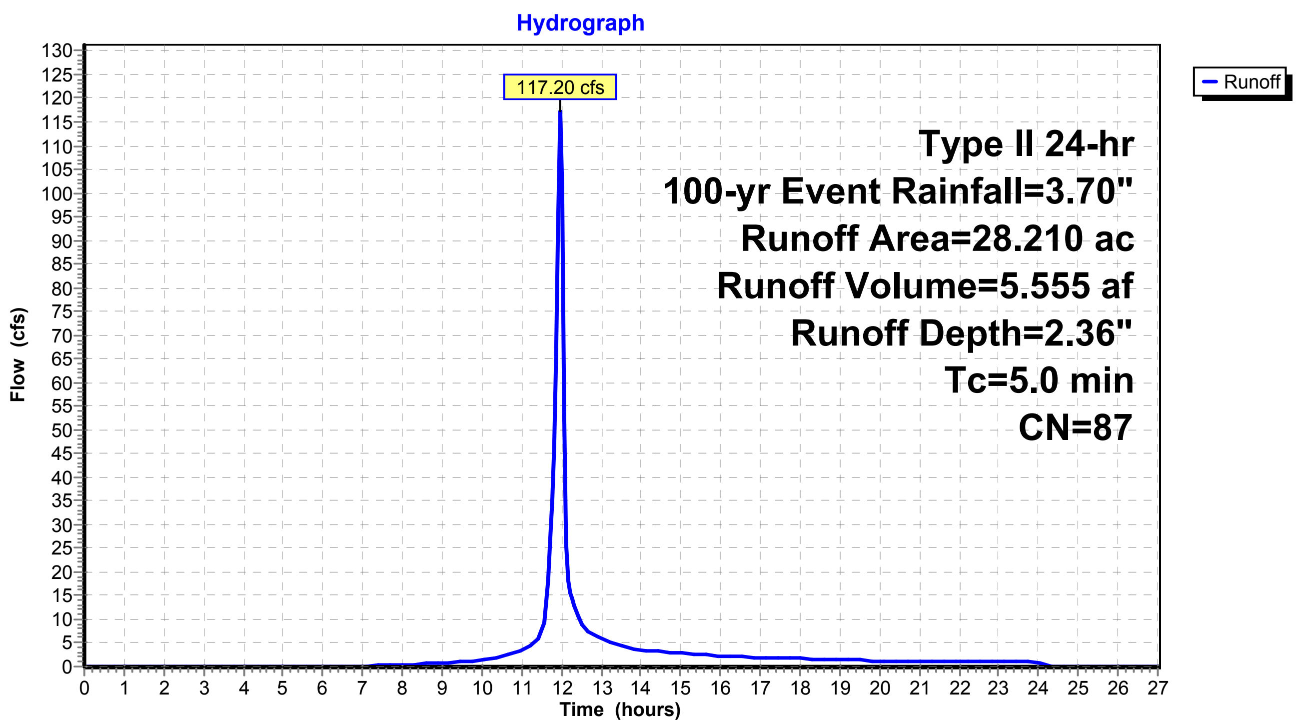
Runoff = 117.20 cfs @ 11.95 hrs, Volume= 5.555 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	25.390	86	Desert shrub range, Fair, HSG D
*	2.820	98	Impervious, HSG D
	28.210	87	Weighted Average
	25.390		90.00% Pervious Area
	2.820		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum Tc**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

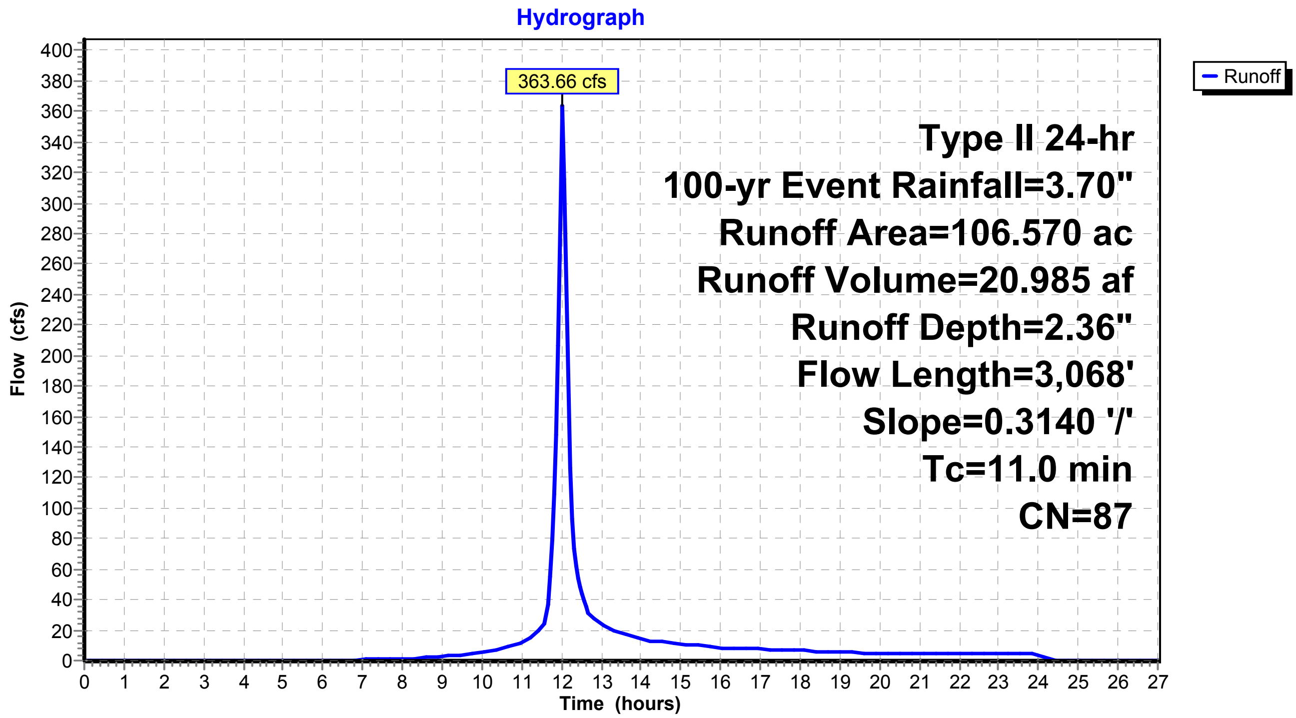
Runoff = 363.66 cfs @ 12.03 hrs, Volume= 20.985 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	95.910	86	Desert shrub range, Fair, HSG D
*	10.660	98	Impervious, HSG D
	106.570	87	Weighted Average
	95.910		90.00% Pervious Area
	10.660		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	3,068	0.3140	4.66		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

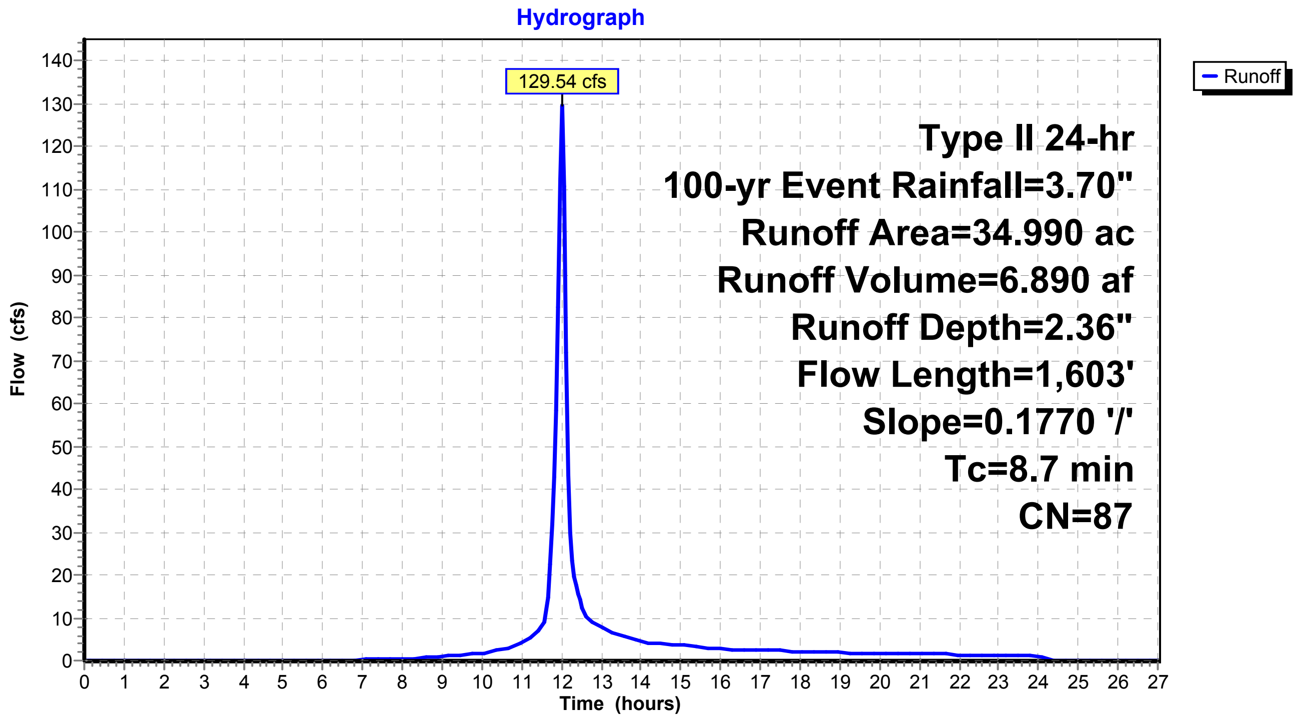
Runoff = 129.54 cfs @ 12.00 hrs, Volume= 6.890 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	31.490	86	Desert shrub range, Fair, HSG D
*	3.500	98	Impervious, HSG D
	34.990	87	Weighted Average
	31.490		90.00% Pervious Area
	3.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	1,603	0.1770	3.07		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

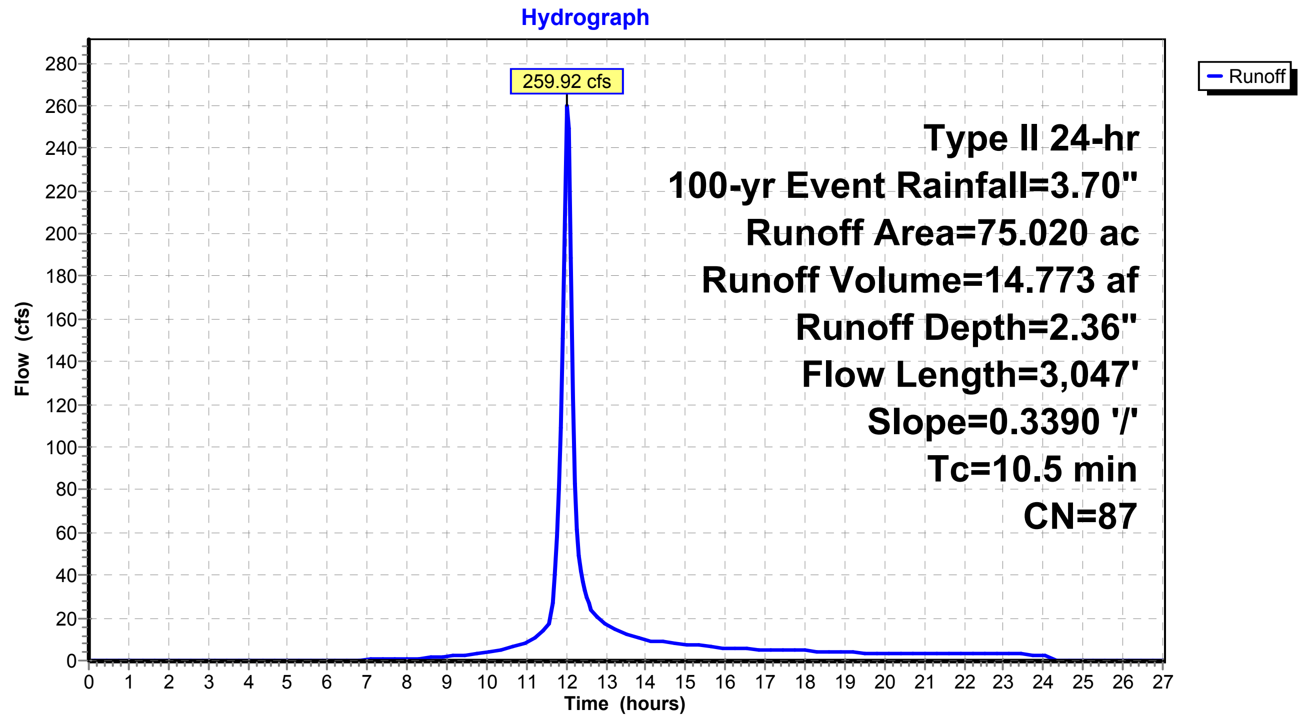
Runoff = 259.92 cfs @ 12.02 hrs, Volume= 14.773 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	67.520	86	Desert shrub range, Fair, HSG D
*	7.500	98	Impervious, HSG D
	75.020	87	Weighted Average
	67.520		90.00% Pervious Area
	7.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	3,047	0.3390	4.84		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

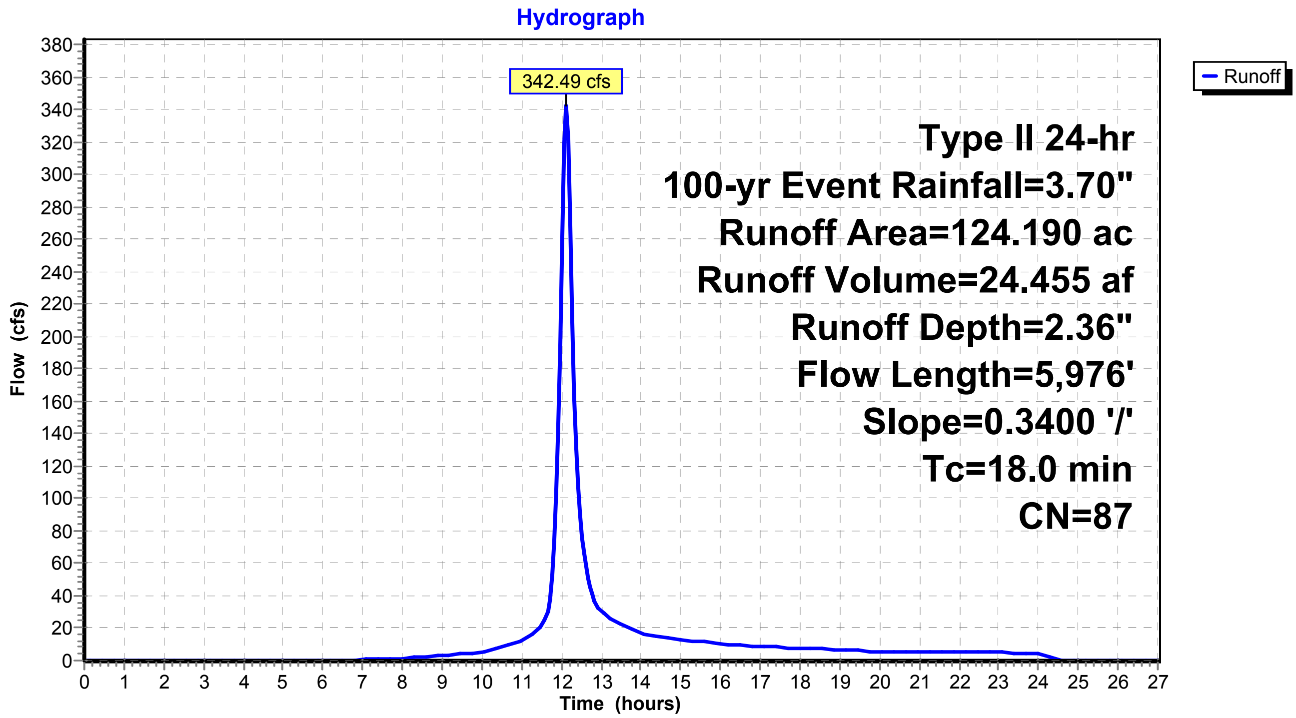
Runoff = 342.49 cfs @ 12.10 hrs, Volume= 24.455 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	111.770	86	Desert shrub range, Fair, HSG D
*	12.420	98	Impervious, HSG D
	124.190	87	Weighted Average
	111.770		90.00% Pervious Area
	12.420		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	5,976	0.3400	5.54		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

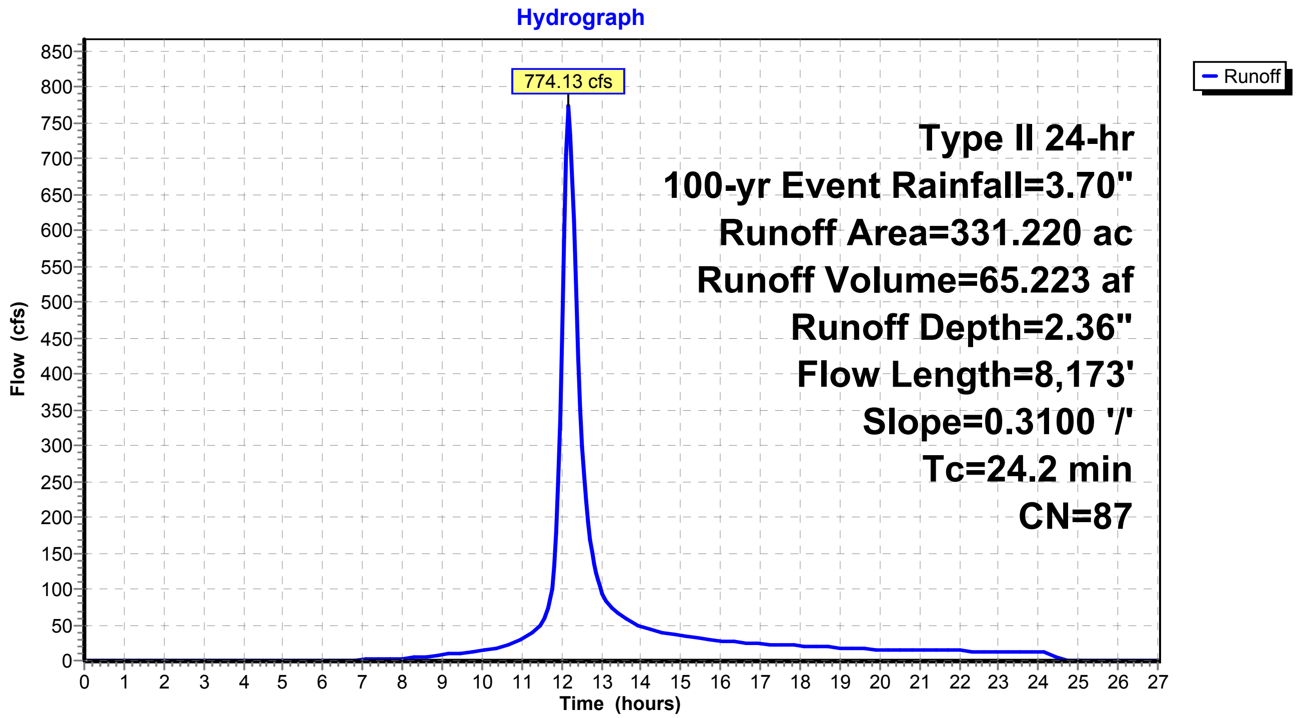
Runoff = 774.13 cfs @ 12.17 hrs, Volume= 65.223 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	298.100	86	Desert shrub range, Fair, HSG D
*	33.120	98	Impervious, HSG D
	331.220	87	Weighted Average
	298.100		90.00% Pervious Area
	33.120		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.2	8,173	0.3100	5.64		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

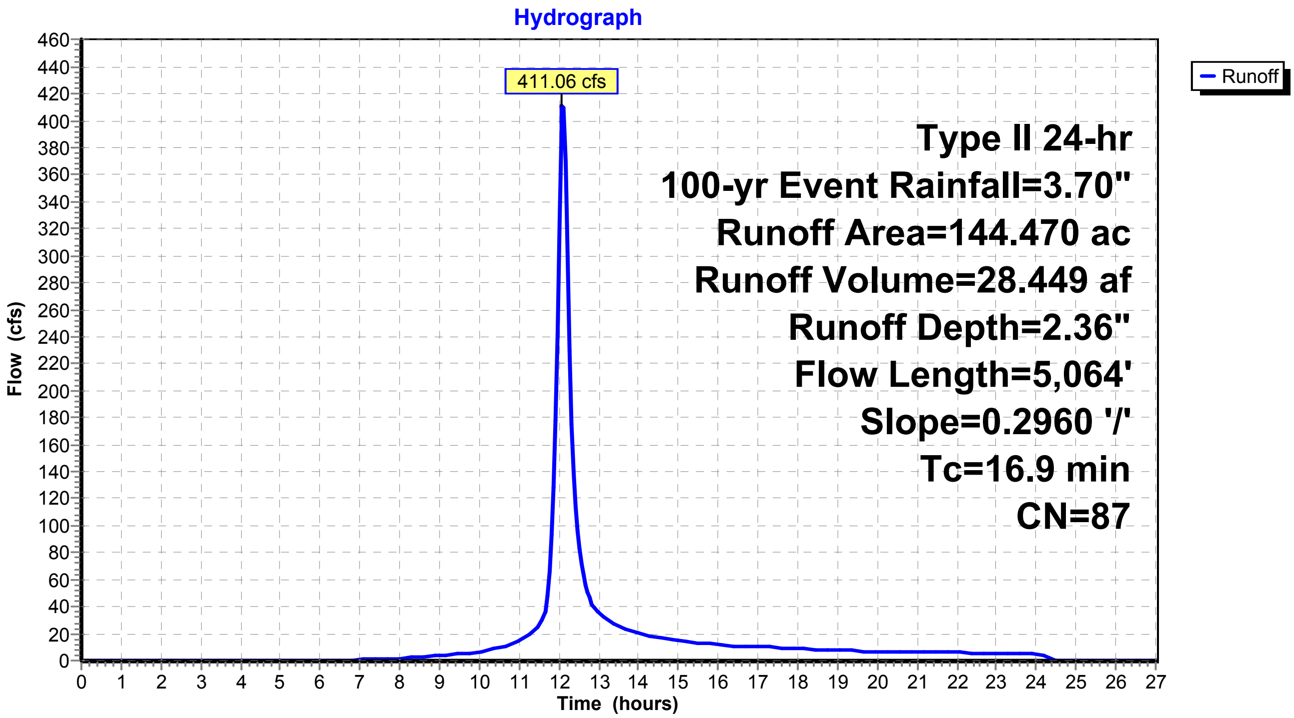
Runoff = 411.06 cfs @ 12.09 hrs, Volume= 28.449 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	5,064	0.2960	5.00		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

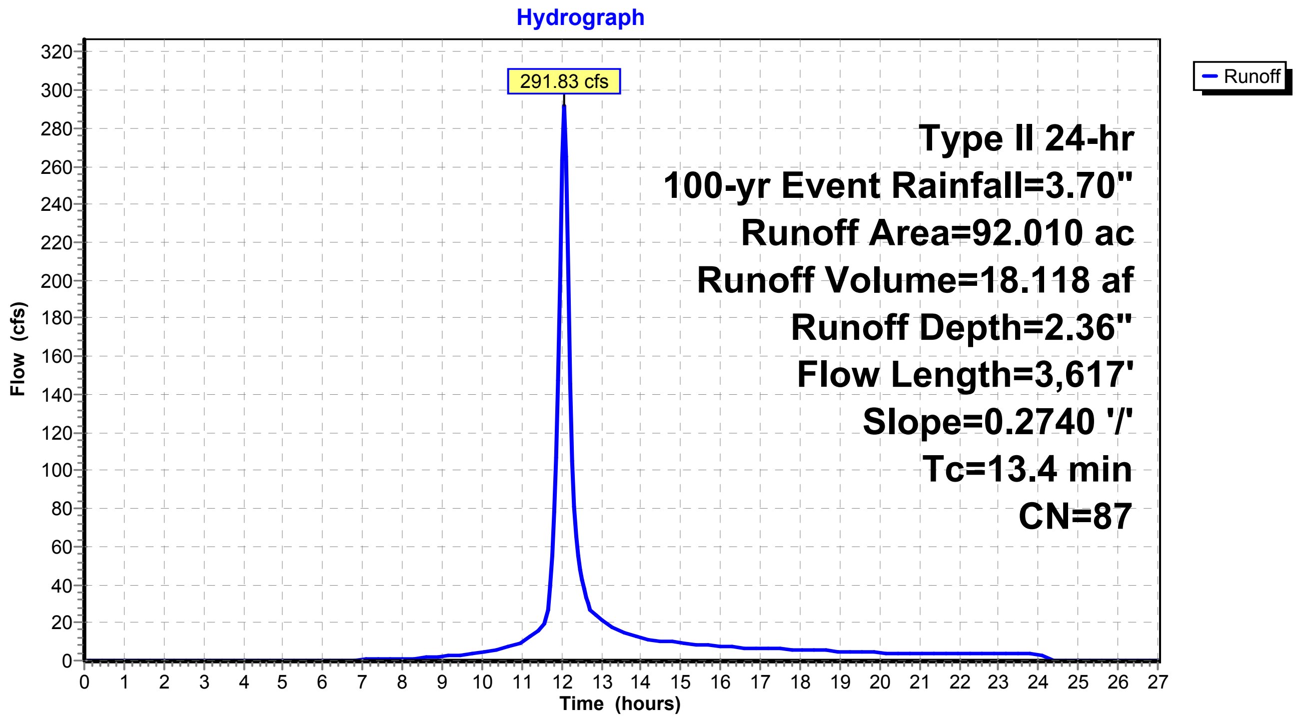
Runoff = 291.83 cfs @ 12.05 hrs, Volume= 18.118 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

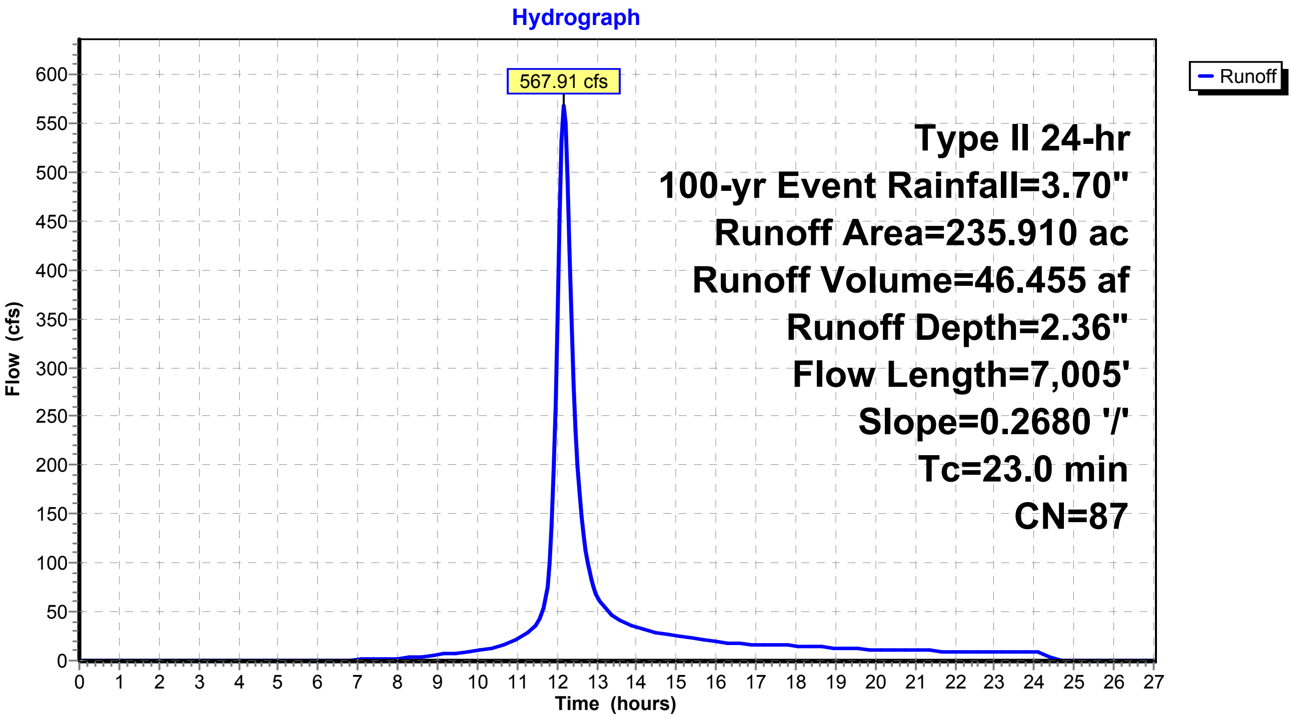
Runoff = 567.91 cfs @ 12.16 hrs, Volume= 46.455 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

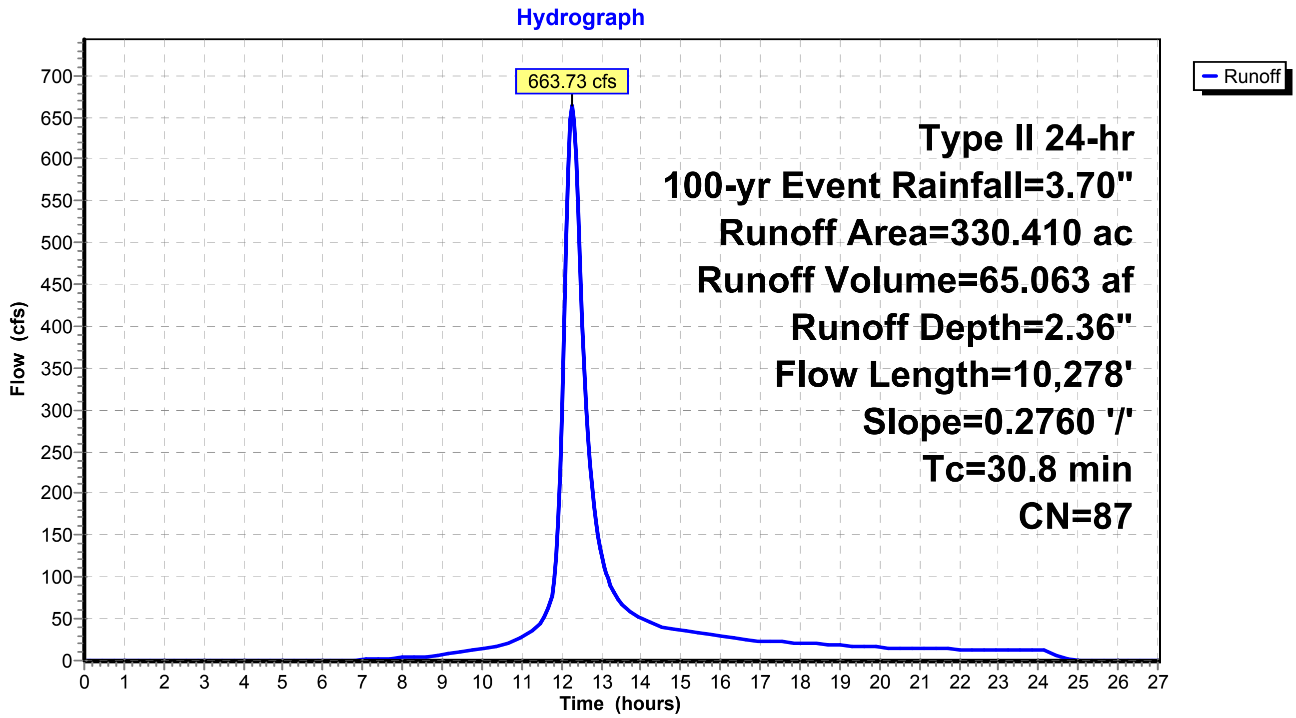
Runoff = 663.73 cfs @ 12.25 hrs, Volume= 65.063 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	297.370	86	Desert shrub range, Fair, HSG D
*	33.040	98	Impervious, HSG D
	330.410	87	Weighted Average
	297.370		90.00% Pervious Area
	33.040		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	10,278	0.2760	5.57		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

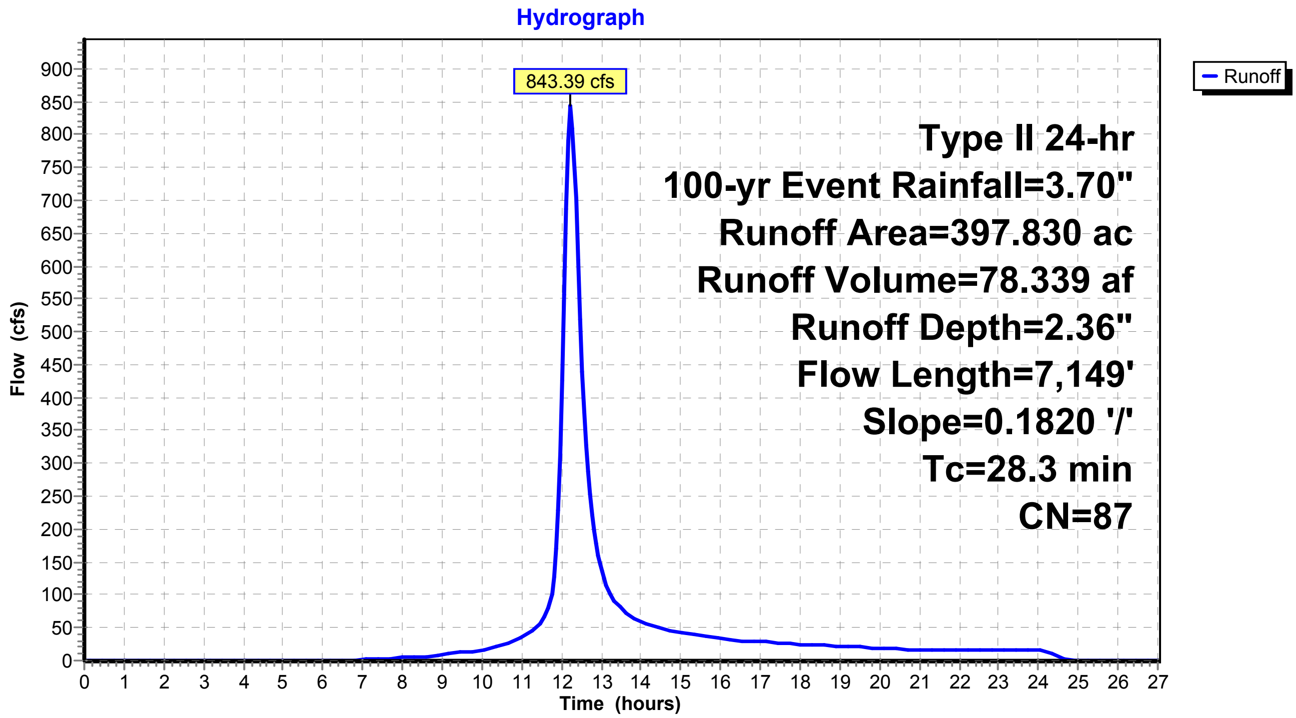
Runoff = 843.39 cfs @ 12.22 hrs, Volume= 78.339 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

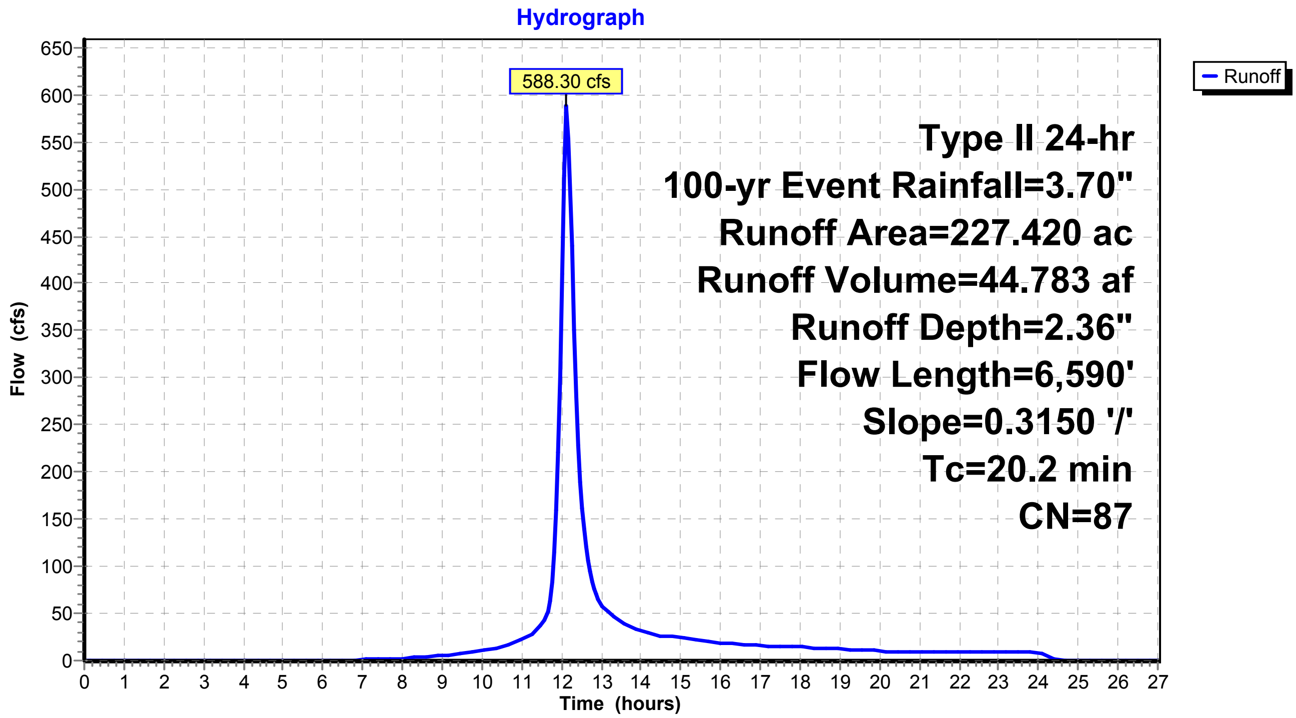
Runoff = 588.30 cfs @ 12.13 hrs, Volume= 44.783 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	204.680	86	Desert shrub range, Fair, HSG D
*	22.740	98	Impervious, HSG D
	227.420	87	Weighted Average
	204.680		90.00% Pervious Area
	22.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	6,590	0.3150	5.44		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

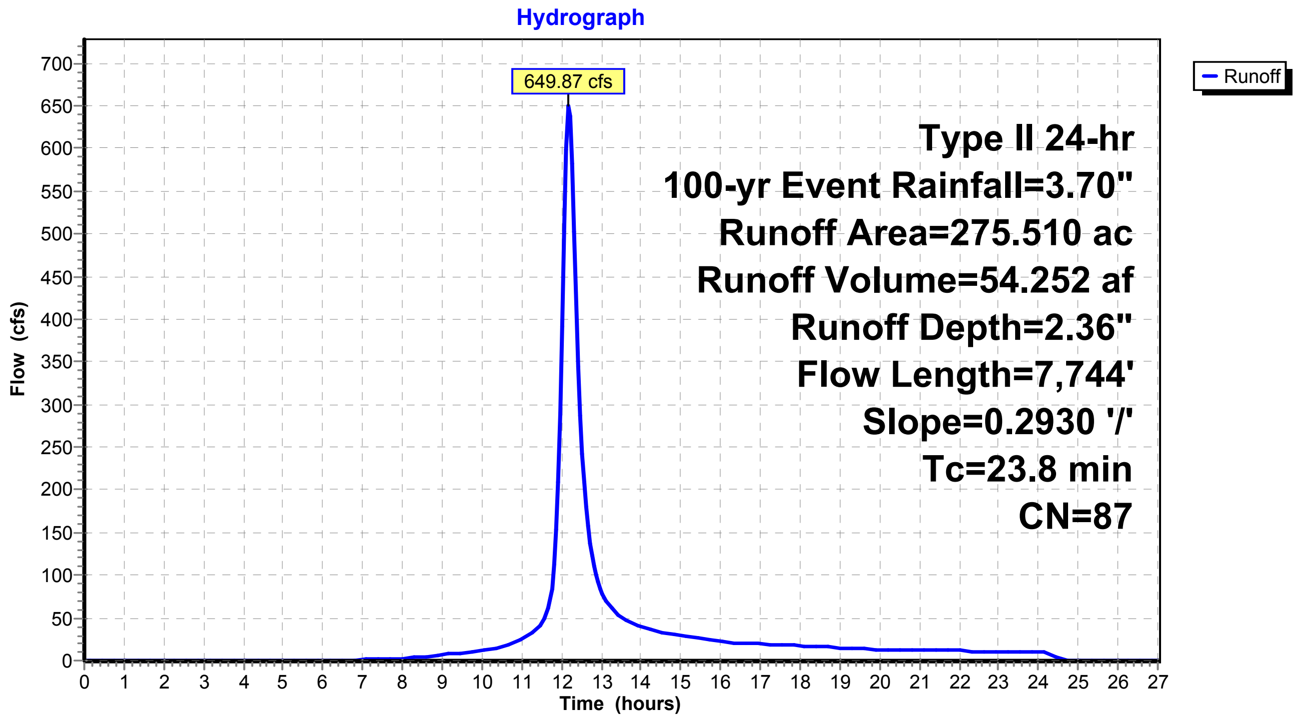
Runoff = 649.87 cfs @ 12.17 hrs, Volume= 54.252 af, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Event Rainfall=3.70"

	Area (ac)	CN	Description
	247.960	86	Desert shrub range, Fair, HSG D
*	27.550	98	Impervious, HSG D
	275.510	87	Weighted Average
	247.960		90.00% Pervious Area
	27.550		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	7,744	0.2930	5.42		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Reach CHNL 1: Channel 1

Inflow Area = 502.930 ac, 10.00% Impervious, Inflow Depth = 2.36" for 100-yr Event event
Inflow = 1,228.49 cfs @ 12.15 hrs, Volume= 99.035 af
Outflow = 1,184.09 cfs @ 12.25 hrs, Volume= 99.033 af, Atten= 4%, Lag= 6.1 min

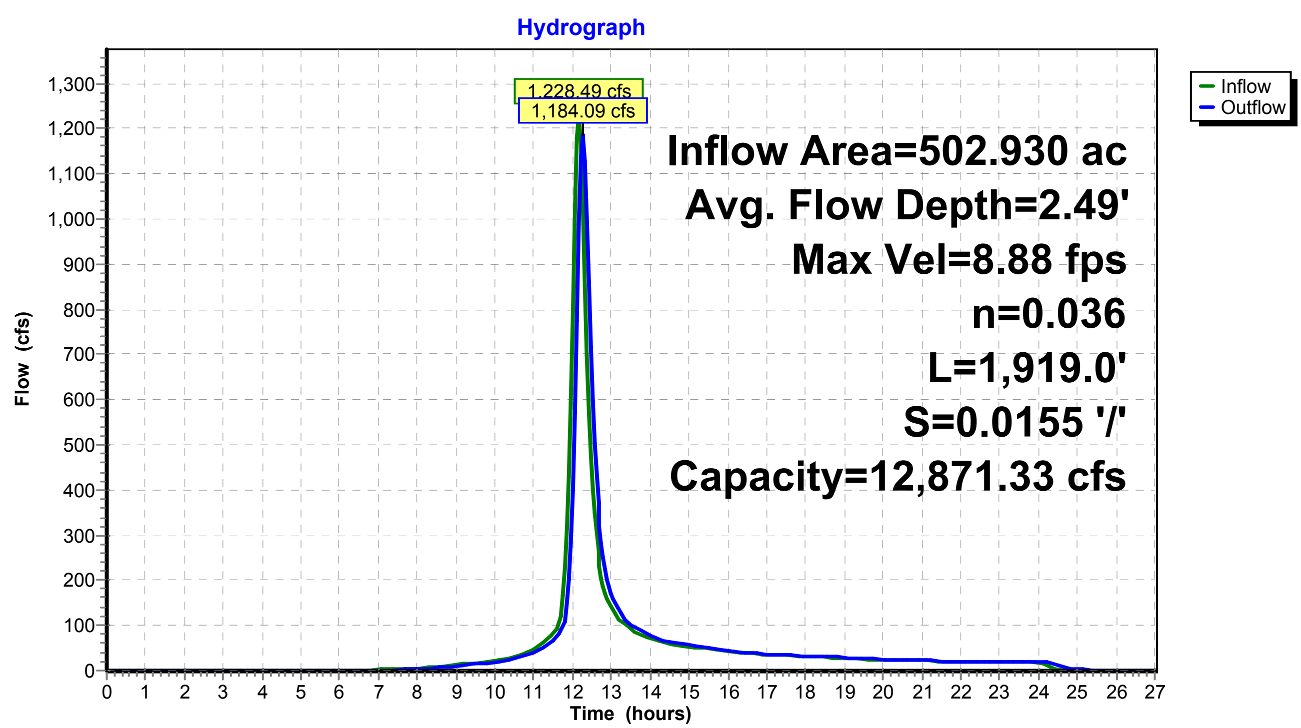
Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.88 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 2.21 fps, Avg. Travel Time= 14.4 min

Peak Storage= 257,291 cf @ 12.19 hrs
Average Depth at Peak Storage= 2.49'
Bank-Full Depth= 10.00' Flow Area= 650.0 sf, Capacity= 12,871.33 cfs

50.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 80.00'
Length= 1,919.0' Slope= 0.0155 '/'
Inlet Invert= 5,569.50', Outlet Invert= 5,539.70'

‡

Reach CHNL 1: Channel 1



Summary for Reach CHNL 2: Channel 2

Inflow Area = 870.220 ac, 10.00% Impervious, Inflow Depth = 2.36" for 100-yr Event event
Inflow = 1,933.74 cfs @ 12.14 hrs, Volume= 171.361 af
Outflow = 1,565.27 cfs @ 12.49 hrs, Volume= 170.940 af, Atten= 19%, Lag= 21.3 min

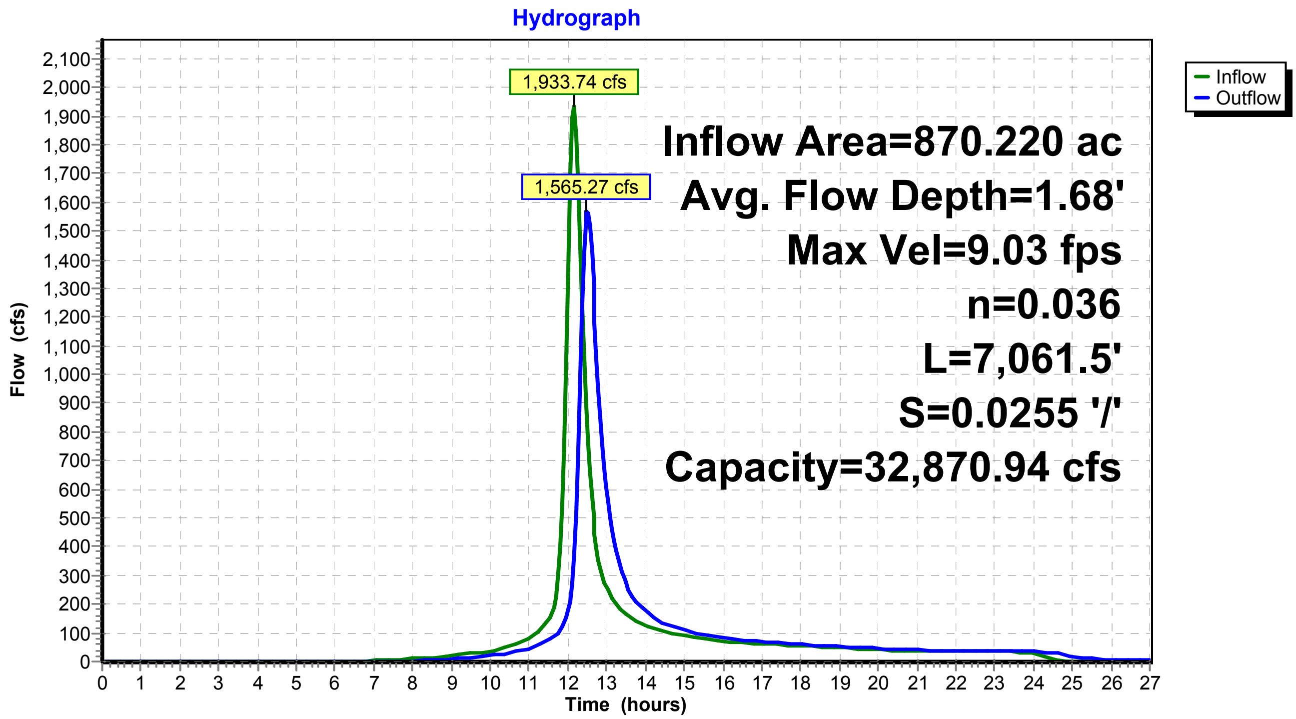
Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.03 fps, Min. Travel Time= 13.0 min
Avg. Velocity = 2.51 fps, Avg. Travel Time= 46.9 min

Peak Storage= 1,228,925 cf @ 12.27 hrs
Average Depth at Peak Storage= 1.68'
Bank-Full Depth= 10.00' Flow Area= 1,225.0 sf, Capacity= 32,870.94 cfs

100.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 2.5 2.0 '/' Top Width= 145.00'
Length= 7,061.5' Slope= 0.0255 '/'
Inlet Invert= 5,720.00', Outlet Invert= 5,539.70'

‡

Reach CHNL 2: Channel 2



Summary for Reach CHNL 3: Channel 3

[62] Hint: Exceeded Reach CHNL 1 OUTLET depth by 3.53' @ 12.45 hrs
[62] Hint: Exceeded Reach CHNL 2 OUTLET depth by 3.70' @ 12.40 hrs

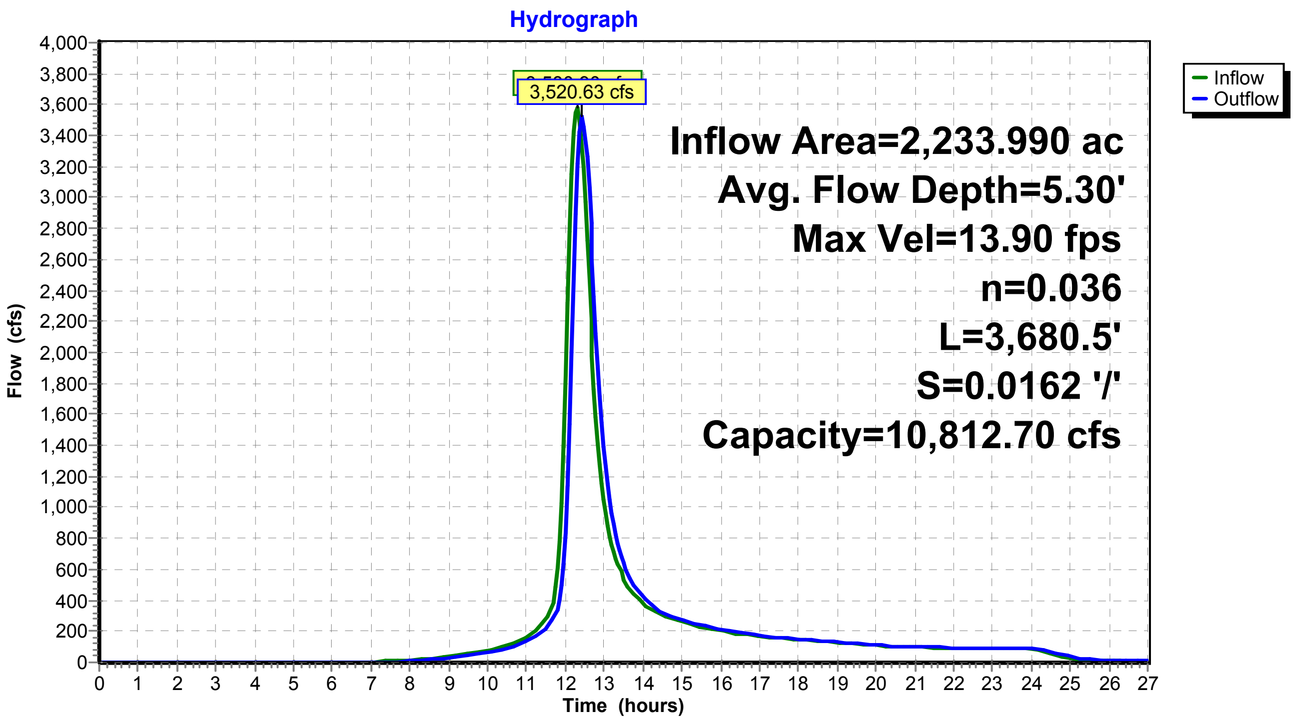
Inflow Area = 2,233.990 ac, 10.00% Impervious, Inflow Depth > 2.36" for 100-yr Event event
Inflow = 3,580.90 cfs @ 12.29 hrs, Volume= 439.487 af
Outflow = 3,520.63 cfs @ 12.42 hrs, Volume= 439.082 af, Atten= 2%, Lag= 7.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.90 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 4.18 fps, Avg. Travel Time= 14.7 min

Peak Storage= 935,003 cf @ 12.35 hrs
Average Depth at Peak Storage= 5.30'
Bank-Full Depth= 10.00' Flow Area= 550.0 sf, Capacity= 10,812.70 cfs

40.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 70.00'
Length= 3,680.5' Slope= 0.0162 '/'
Inlet Invert= 5,539.70', Outlet Invert= 5,480.00'

Reach CHNL 3: Channel 3



Summary for Reach CHNL 4: Channel 4

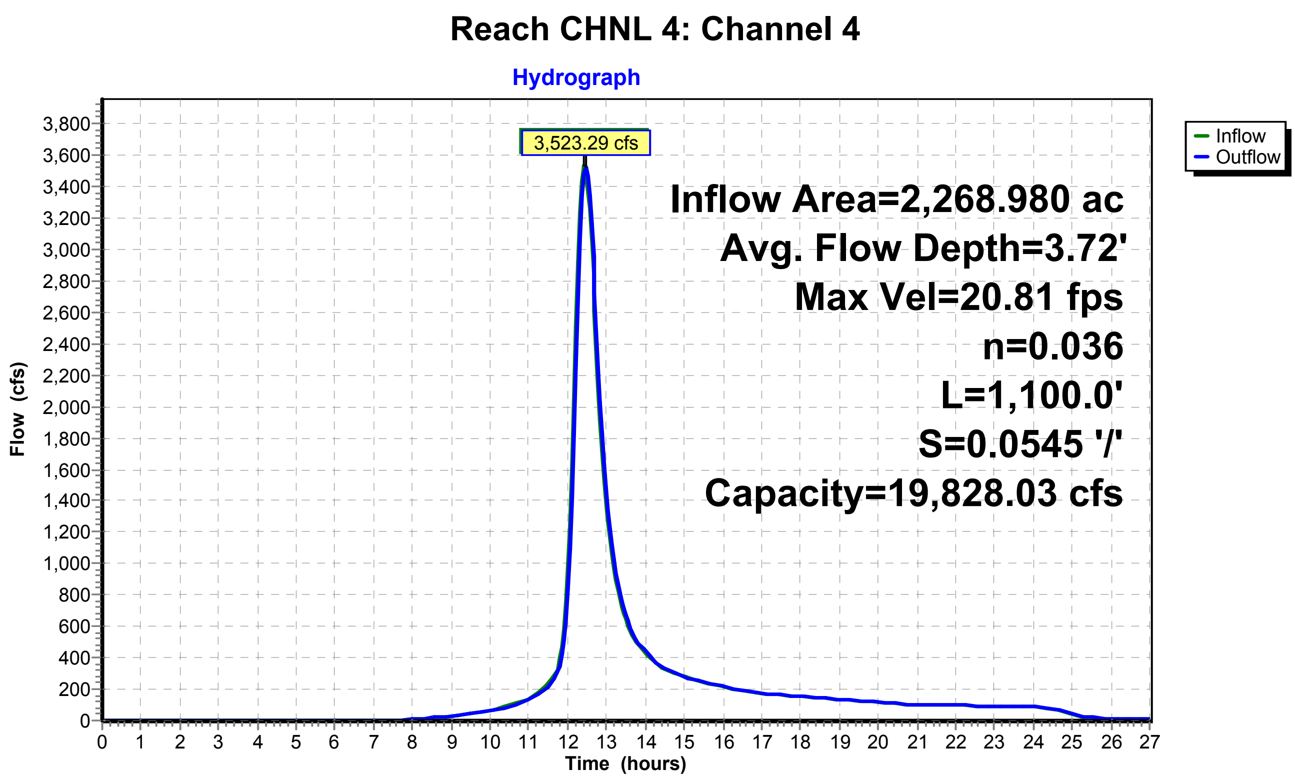
[61] Hint: Exceeded Reach CHNL 3 outlet invert by 3.72' @ 12.45 hrs

Inflow Area = 2,268.980 ac, 10.00% Impervious, Inflow Depth > 2.36" for 100-yr Event event
Inflow = 3,535.74 cfs @ 12.42 hrs, Volume= 445.972 af
Outflow = 3,523.29 cfs @ 12.45 hrs, Volume= 445.885 af, Atten= 0%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 20.81 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 6.18 fps, Avg. Travel Time= 3.0 min

Peak Storage= 186,563 cf @ 12.43 hrs
Average Depth at Peak Storage= 3.72'
Bank-Full Depth= 10.00' Flow Area= 550.0 sf, Capacity= 19,828.03 cfs

40.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 70.00'
Length= 1,100.0' Slope= 0.0545 '/'
Inlet Invert= 5,480.00', Outlet Invert= 5,420.00'



Summary for Reach CHNL 5: Channel 5

[62] Hint: Exceeded Reach CHNL 4 OUTLET depth by 2.45' @ 12.55 hrs

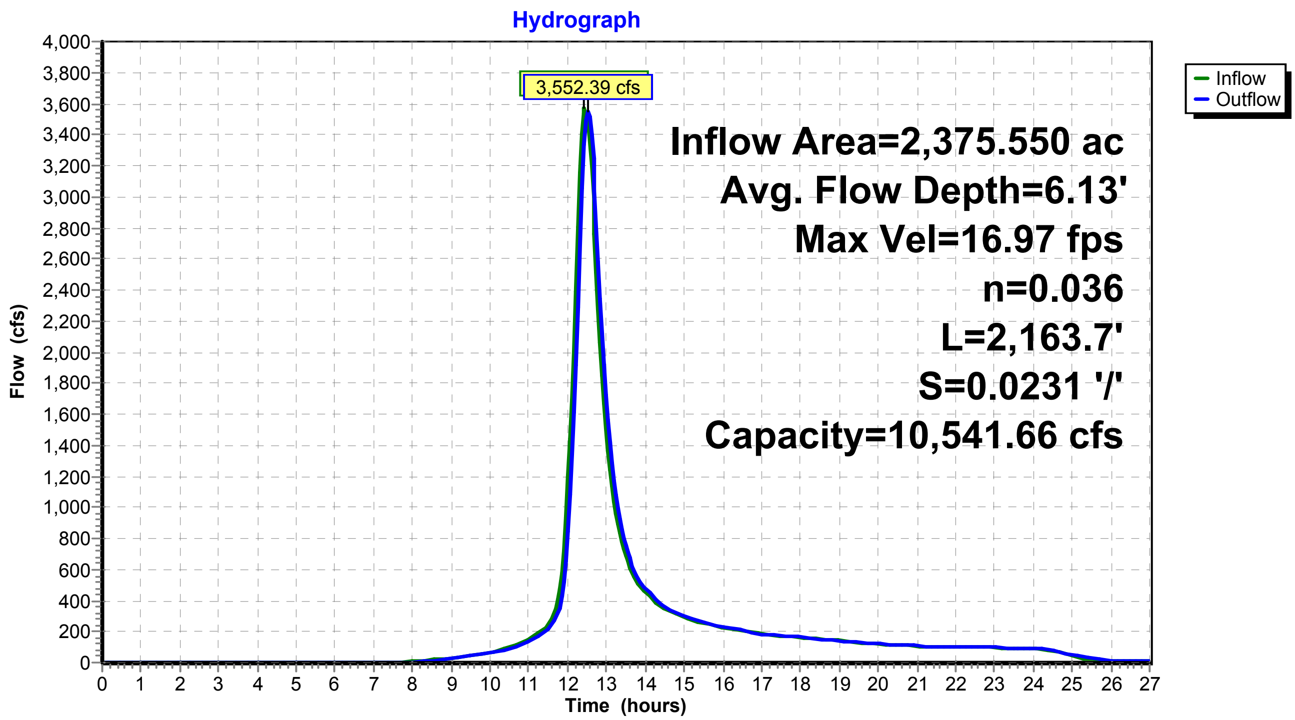
Inflow Area = 2,375.550 ac, 10.00% Impervious, Inflow Depth > 2.36" for 100-yr Event event
Inflow = 3,572.05 cfs @ 12.44 hrs, Volume= 466.870 af
Outflow = 3,552.39 cfs @ 12.51 hrs, Volume= 466.654 af, Atten= 1%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 16.97 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 5.55 fps, Avg. Travel Time= 6.5 min

Peak Storage= 453,859 cf @ 12.47 hrs
Average Depth at Peak Storage= 6.13'
Bank-Full Depth= 11.00' Flow Area= 456.5 sf, Capacity= 10,541.66 cfs

25.00' x 11.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 58.00'
Length= 2,163.7' Slope= 0.0231 '/'
Inlet Invert= 5,420.00', Outlet Invert= 5,370.00'

Reach CHNL 5: Channel 5



Summary for Pond CLVT 1: Culvert Crossing #1

[62] Hint: Exceeded Reach CHNL 5 OUTLET depth by 14.44' @ 12.75 hrs

Inflow Area = 2,375.550 ac, 10.00% Impervious, Inflow Depth > 2.36" for 100-yr Event event
Inflow = 3,552.39 cfs @ 12.51 hrs, Volume= 466.654 af
Outflow = 3,058.70 cfs @ 12.70 hrs, Volume= 466.511 af, Atten= 14%, Lag= 11.4 min
Primary = 3,058.70 cfs @ 12.70 hrs, Volume= 466.511 af

Routing by Stor-Ind method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Peak Elev= 5,389.78' @ 12.70 hrs Surf.Area= 0 sf Storage= 1,214,495 cf
Flood Elev= 5,419.00' Surf.Area= 0 sf Storage= 12,108,960 cf

Plug-Flow detention time= 3.5 min calculated for 465.649 af (100% of inflow)
Center-of-Mass det. time= 3.3 min (865.7 - 862.5)

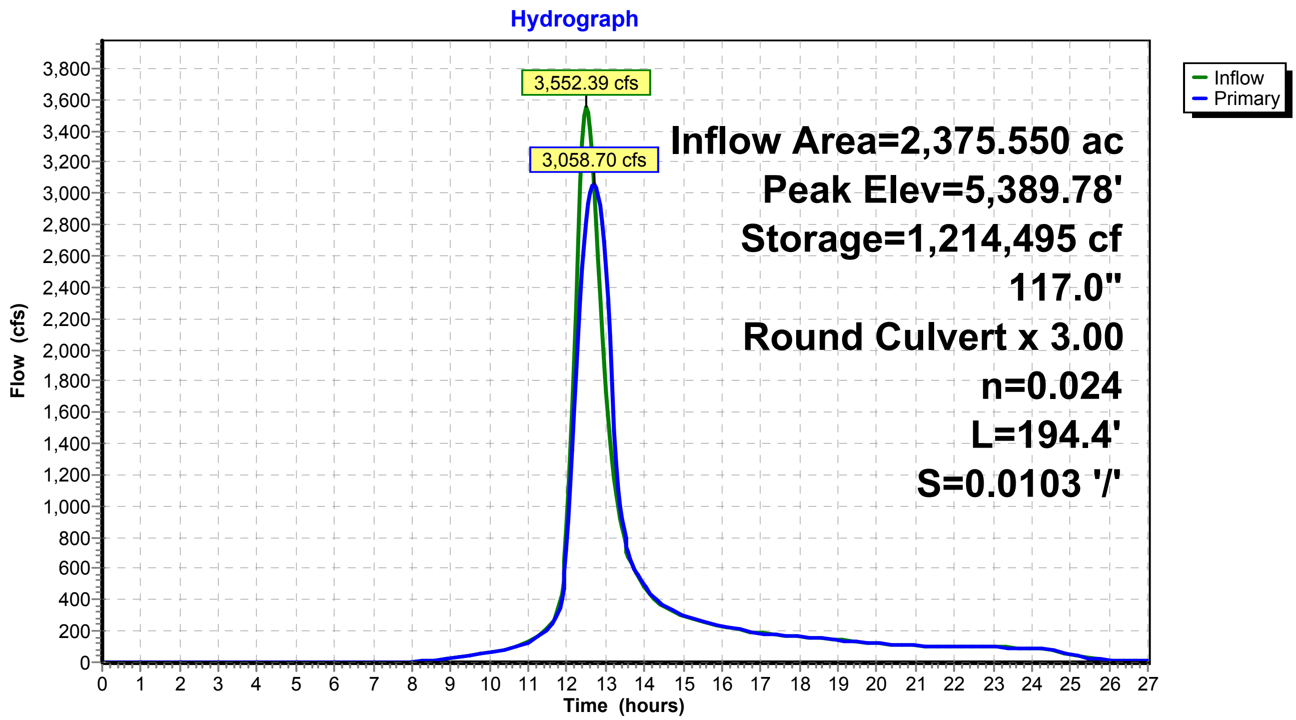
Volume	Invert	Avail.Storage	Storage Description
#1	5,370.00'	12,108,960 cf	**Culvert Crossing #1**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
5,370.00	0
5,371.00	1,264
5,372.00	4,909
5,373.00	7,513
5,374.00	16,645
5,375.00	29,237
5,376.00	46,725
5,377.00	71,156
5,378.00	103,816
5,379.00	144,375
5,380.00	193,809
5,381.00	252,611
5,382.00	321,098
5,383.00	399,998
5,384.00	488,627
5,385.00	587,544
5,386.00	697,578
5,387.00	818,723
5,388.00	950,841
5,389.00	1,094,170
5,390.00	1,248,216
5,391.00	1,412,011
5,392.00	1,587,481
5,393.00	1,774,410
5,394.00	1,971,598
5,395.00	2,046,356
5,396.00	2,266,171
5,397.00	2,498,604
5,398.00	2,742,207
5,399.00	2,998,577
5,400.00	3,272,610
5,401.00	3,564,605
5,402.00	3,875,249
5,403.00	4,205,411
5,404.00	4,554,001
5,405.00	4,921,330
5,406.00	5,306,733
5,407.00	5,710,058
5,408.00	6,132,117
5,409.00	6,572,849
5,410.00	7,032,579
5,411.00	7,512,479
5,412.00	8,012,116
5,413.00	8,533,107
5,414.00	9,078,172
5,415.00	9,647,155
5,416.00	10,235,642
5,417.00	10,841,380
5,418.00	11,465,162
5,419.00	12,108,960

Device	Routing	Invert	Outlet Devices
#1	Primary	5,372.00'	**117.0" Round Culvert X 3.00** L= 194.4' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,372.00' / 5,370.00' S= 0.0103 '/' Cc= 0.900 n= 0.024, Flow Area= 74.66 sf

Primary OutFlow Max=3,057.57 cfs @ 12.70 hrs HW=5,389.77' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 3,057.57 cfs @ 13.65 fps)

Pond CLVT 1: Culvert Crossing #1



Summary for Pond CLVT 2: Culvert Crossing #2

[81] Warning: Exceeded Pond CLVT 1 by 7.40' @ 13.35 hrs

Inflow Area = 2,403.760 ac, 10.00% Impervious, Inflow Depth > 2.36" for 100-yr Event event
Inflow = 3,066.00 cfs @ 12.70 hrs, Volume= 472.066 af
Outflow = 1,545.71 cfs @ 13.19 hrs, Volume= 472.015 af, Atten= 50%, Lag= 29.9 min
Primary = 1,545.71 cfs @ 13.19 hrs, Volume= 472.015 af

Routing by Stor-Ind method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Peak Elev= 5,386.54' @ 13.19 hrs Surf.Area= 0 sf Storage= 5,175,763 cf
Flood Elev= 5,403.00' Surf.Area= 0 sf Storage= 10,142,539 cf

Plug-Flow detention time= 26.2 min calculated for 471.143 af (100% of inflow)
Center-of-Mass det. time= 26.0 min (891.1 - 865.1)

Volume	Invert	Avail.Storage	Storage Description
#1	5,352.00'	10,142,539 cf	**Existing Pond** Listed below

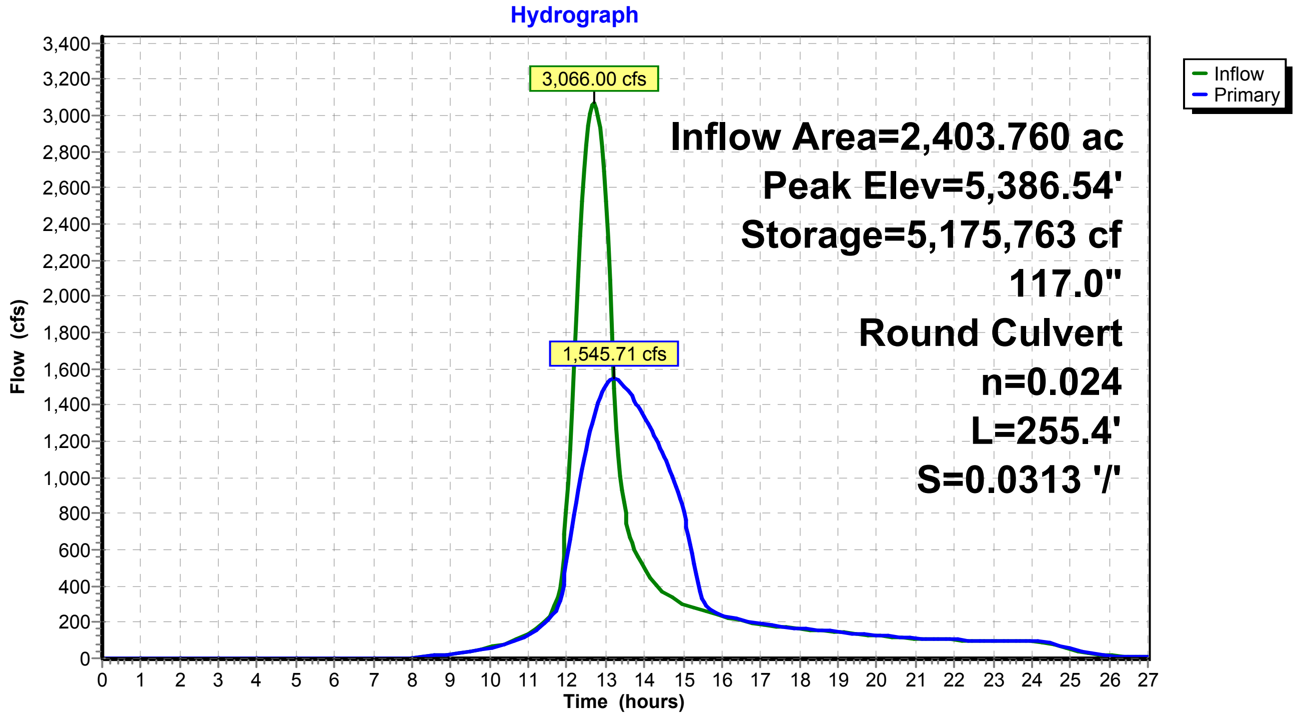
Elevation (feet)	Cum.Store (cubic-feet)
5,352.00	0
5,353.00	2,681
5,354.00	7,382
5,355.00	15,397
5,356.00	28,286
5,357.00	47,224
5,358.00	75,773
5,359.00	117,133
5,360.00	170,345
5,361.00	235,331
5,362.00	312,331
5,363.00	399,765
5,364.00	497,494
5,365.00	605,663
5,366.00	724,610
5,367.00	855,928
5,368.00	1,000,315
5,369.00	1,157,122
5,370.00	1,325,832
5,371.00	1,505,243
5,372.00	1,693,878
5,373.00	1,890,808
5,374.00	2,095,234
5,375.00	2,306,959
5,376.00	2,525,755
5,377.00	2,751,367
5,378.00	2,983,426
5,379.00	3,221,478
5,380.00	3,465,168
5,381.00	3,714,247
5,382.00	3,968,434
5,383.00	4,227,291
5,384.00	4,490,405
5,385.00	4,757,518
5,386.00	5,028,418
5,387.00	5,302,894
5,388.00	5,580,732
5,389.00	5,861,867
5,390.00	6,146,219
5,391.00	6,433,776
5,392.00	6,724,543
5,393.00	7,018,534
5,394.00	7,315,762
5,395.00	7,616,273
5,396.00	7,920,106
5,397.00	8,227,290
5,398.00	8,537,855
5,399.00	8,851,826
5,400.00	9,169,229
5,401.00	9,490,117

5,402.00	9,814,540
5,403.00	10,142,539

Device	Routing	Invert	Outlet Devices
#1	Primary	5,352.00'	**117.0" Round Culvert** L= 255.4' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,352.00' / 5,344.00' S= 0.0313 '/' Cc= 0.900 n= 0.024, Flow Area= 74.66 sf

Primary OutFlow Max=1,545.45 cfs @ 13.19 hrs HW=5,386.53' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1,545.45 cfs @ 20.70 fps)

Pond CLVT 2: Culvert Crossing #2



Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=28.210 ac 10.00% Impervious Runoff Depth=2.72"
Tc=5.0 min CN=87 Runoff=133.97 cfs 6.393 af

Subcatchment2: WS 2 Runoff Area=106.570 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,068' Slope=0.3140 '/' Tc=11.0 min CN=87 Runoff=415.35 cfs 24.150 af

Subcatchment3: WS 3 Runoff Area=34.990 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=1,603' Slope=0.1770 '/' Tc=8.7 min CN=87 Runoff=148.20 cfs 7.929 af

Subcatchment4: WS 4 Runoff Area=75.020 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,047' Slope=0.3390 '/' Tc=10.5 min CN=87 Runoff=297.56 cfs 17.000 af

Subcatchment5: WS 5 Runoff Area=124.190 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=5,976' Slope=0.3400 '/' Tc=18.0 min CN=87 Runoff=392.70 cfs 28.143 af

Subcatchment6: WS 6 Runoff Area=331.220 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=8,173' Slope=0.3100 '/' Tc=24.2 min CN=87 Runoff=888.50 cfs 75.058 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=5,064' Slope=0.2960 '/' Tc=16.9 min CN=87 Runoff=471.20 cfs 32.739 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=334.29 cfs 20.851 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=651.70 cfs 53.460 af

Subcatchment10: WS 10 Runoff Area=330.410 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=10,278' Slope=0.2760 '/' Tc=30.8 min CN=87 Runoff=762.30 cfs 74.875 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=968.42 cfs 90.153 af

Subcatchment12: WS 12 Runoff Area=227.420 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=6,590' Slope=0.3150 '/' Tc=20.2 min CN=87 Runoff=674.80 cfs 51.536 af

Subcatchment13: WS 13 Runoff Area=275.510 ac 10.00% Impervious Runoff Depth=2.72"
Flow Length=7,744' Slope=0.2930 '/' Tc=23.8 min CN=87 Runoff=745.85 cfs 62.434 af

Reach CHNL 1: Channel 1 Avg. Flow Depth=2.71' Max Vel=9.34 fps Inflow=1,409.59 cfs 113.970 af
n=0.036 L=1,919.0' S=0.0155 '/' Capacity=12,871.33 cfs Outflow=1,364.28 cfs 113.968 af

Reach CHNL 2: Channel 2 Avg. Flow Depth=1.84' Max Vel=9.59 fps Inflow=2,220.40 cfs 197.202 af
n=0.036 L=7,061.5' S=0.0255 '/' Capacity=32,870.94 cfs Outflow=1,835.68 cfs 196.763 af

Reach CHNL 3: Channel 3 Avg. Flow Depth=5.83' Max Vel=14.67 fps Inflow=4,230.35 cfs 505.807 af
n=0.036 L=3,680.5' S=0.0162 '/' Capacity=10,812.70 cfs Outflow=4,159.08 cfs 505.394 af

Reach CHNL 4: Channel 4 Avg. Flow Depth=4.10' Max Vel=22.02 fps Inflow=4,176.49 cfs 513.323 af
n=0.036 L=1,100.0' S=0.0545 '/' Capacity=19,828.03 cfs Outflow=4,160.94 cfs 513.234 af

Reach CHNL 5: Channel 5 Avg. Flow Depth=6.72' Max Vel=17.83 fps Inflow=4,217.67 cfs 537.384 af
n=0.036 L=2,163.7' S=0.0231 '/' Capacity=10,541.66 cfs Outflow=4,191.95 cfs 537.163 af

Pond CLVT 1: Culvert Crossing Peak Elev=5,392.92' Storage=1,758,861 cf Inflow=4,191.95 cfs 537.163 af
117.0" Round Culvert x 3.00 n=0.024 L=194.4' S=0.0103 '/' Outflow=3,410.14 cfs 537.020 af

Pond CLVT 2: Culvert Crossing Peak Elev=5,391.04' Storage=6,444,314 cf Inflow=3,418.33 cfs 543.413 af
117.0" Round Culvert n=0.024 L=255.4' S=0.0313 '/' Outflow=1,658.81 cfs 543.361 af

Total Runoff Area = 2,403.760 ac Runoff Volume = 544.720 af Average Runoff Depth = 2.72"
90.00% Pervious = 2,163.390 ac 10.00% Impervious = 240.370 ac

Summary for Subcatchment 1: WS 1

[49] Hint: Tc<2dt may require smaller dt

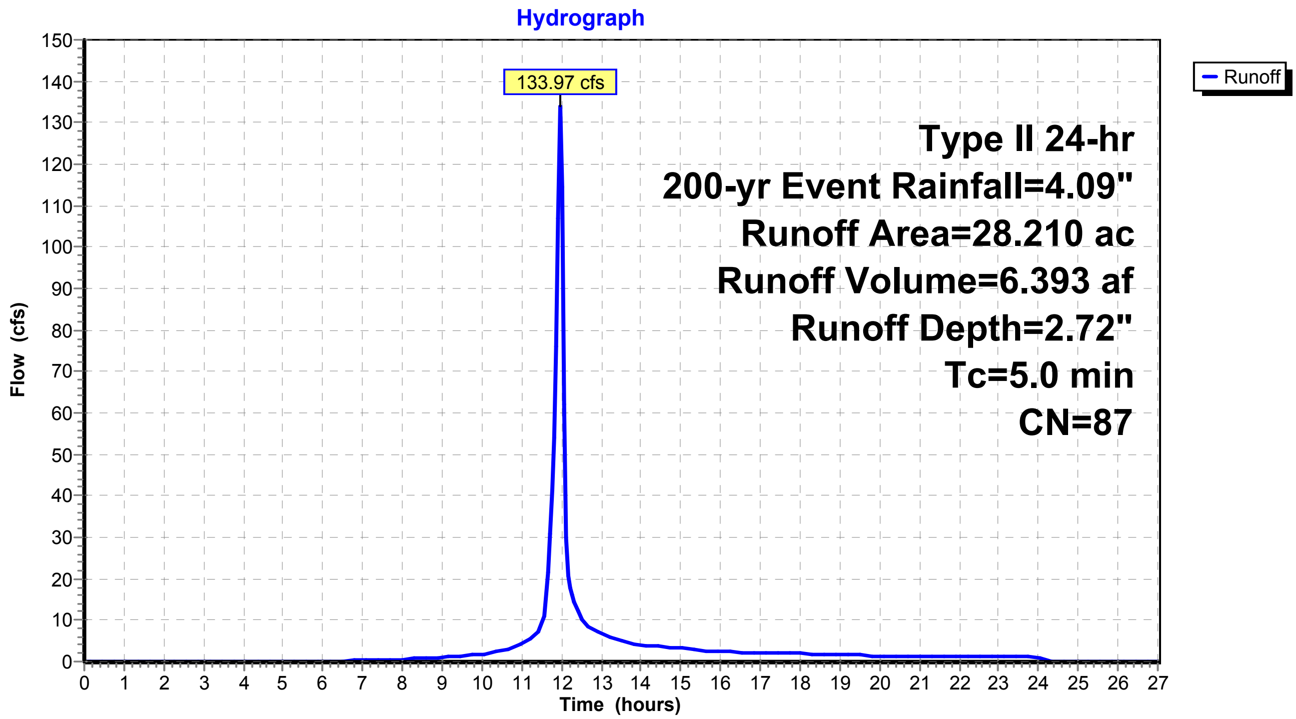
Runoff = 133.97 cfs @ 11.95 hrs, Volume= 6.393 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	25.390	86	Desert shrub range, Fair, HSG D
*	2.820	98	Impervious, HSG D
	28.210	87	Weighted Average
	25.390		90.00% Pervious Area
	2.820		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum Tc**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

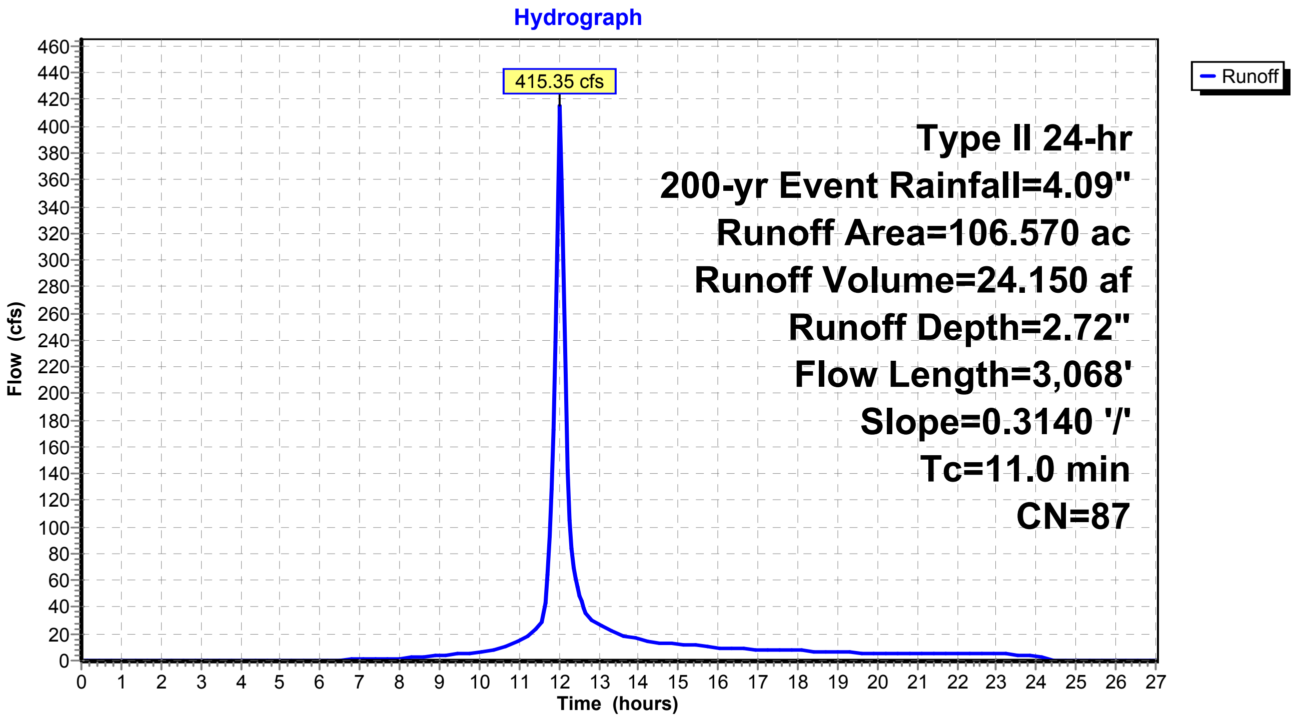
Runoff = 415.35 cfs @ 12.02 hrs, Volume= 24.150 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	95.910	86	Desert shrub range, Fair, HSG D
*	10.660	98	Impervious, HSG D
	106.570	87	Weighted Average
	95.910		90.00% Pervious Area
	10.660		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	3,068	0.3140	4.66		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

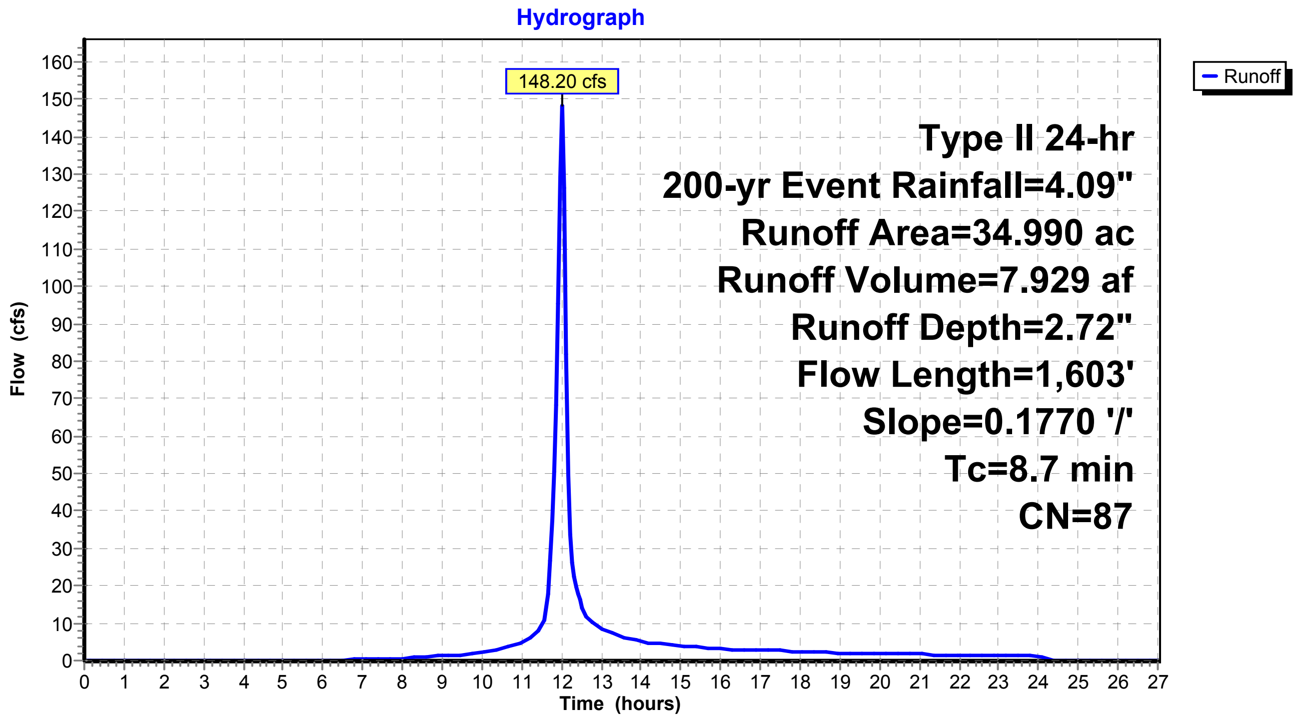
Runoff = 148.20 cfs @ 12.00 hrs, Volume= 7.929 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	31.490	86	Desert shrub range, Fair, HSG D
*	3.500	98	Impervious, HSG D
	34.990	87	Weighted Average
	31.490		90.00% Pervious Area
	3.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	1,603	0.1770	3.07		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

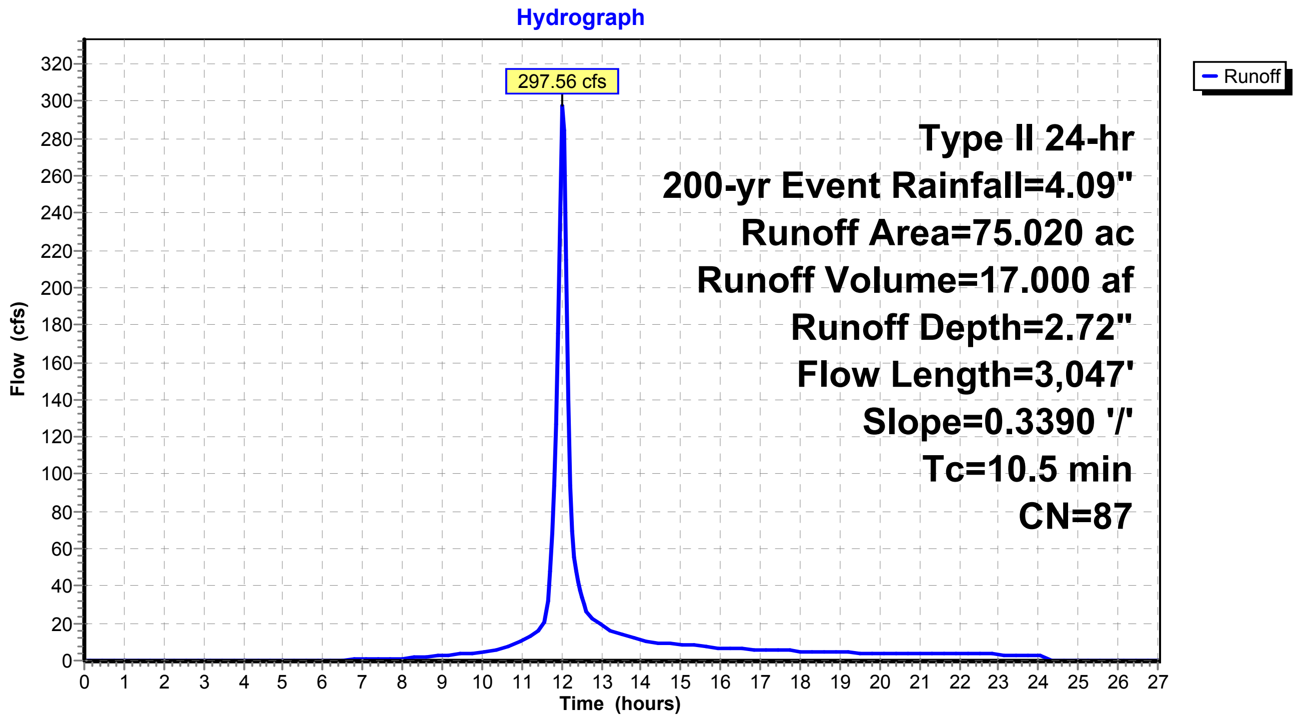
Runoff = 297.56 cfs @ 12.02 hrs, Volume= 17.000 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	67.520	86	Desert shrub range, Fair, HSG D
*	7.500	98	Impervious, HSG D
	75.020	87	Weighted Average
	67.520		90.00% Pervious Area
	7.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	3,047	0.3390	4.84		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

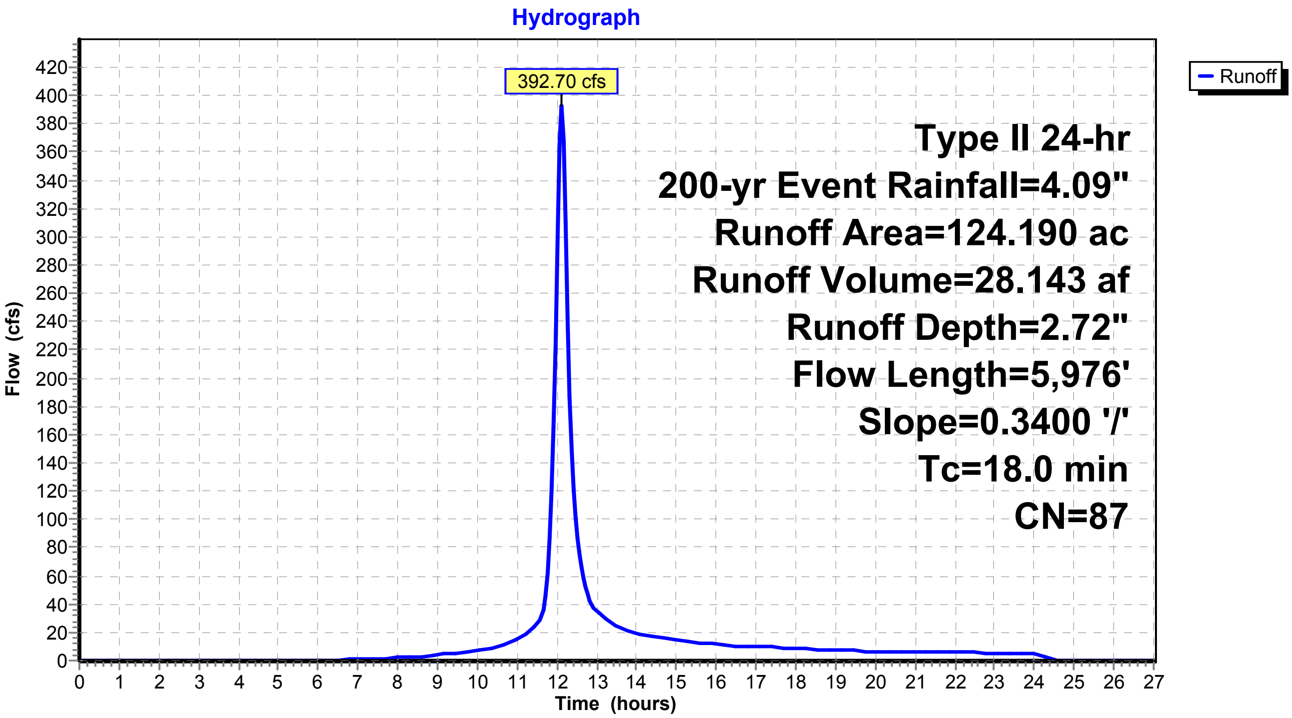
Runoff = 392.70 cfs @ 12.10 hrs, Volume= 28.143 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	111.770	86	Desert shrub range, Fair, HSG D
*	12.420	98	Impervious, HSG D
	124.190	87	Weighted Average
	111.770		90.00% Pervious Area
	12.420		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	5,976	0.3400	5.54		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

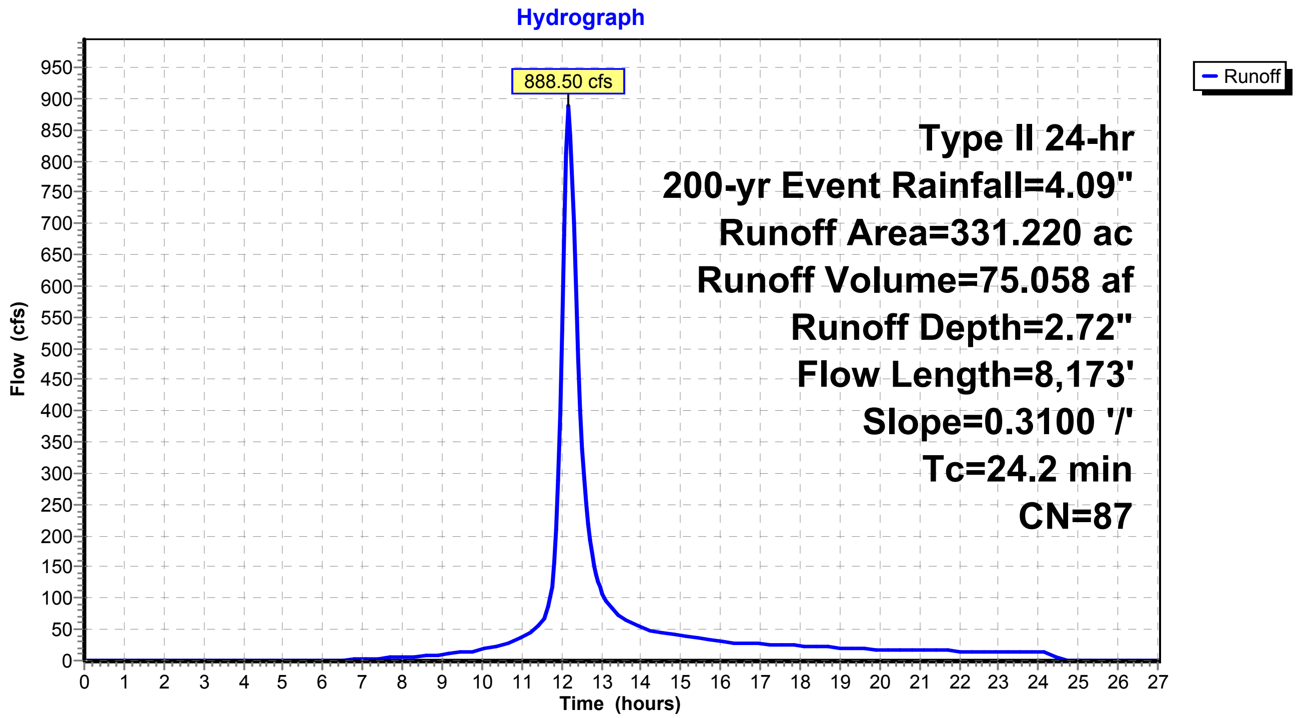
Runoff = 888.50 cfs @ 12.17 hrs, Volume= 75.058 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	298.100	86	Desert shrub range, Fair, HSG D
*	33.120	98	Impervious, HSG D
	331.220	87	Weighted Average
	298.100		90.00% Pervious Area
	33.120		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.2	8,173	0.3100	5.64		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

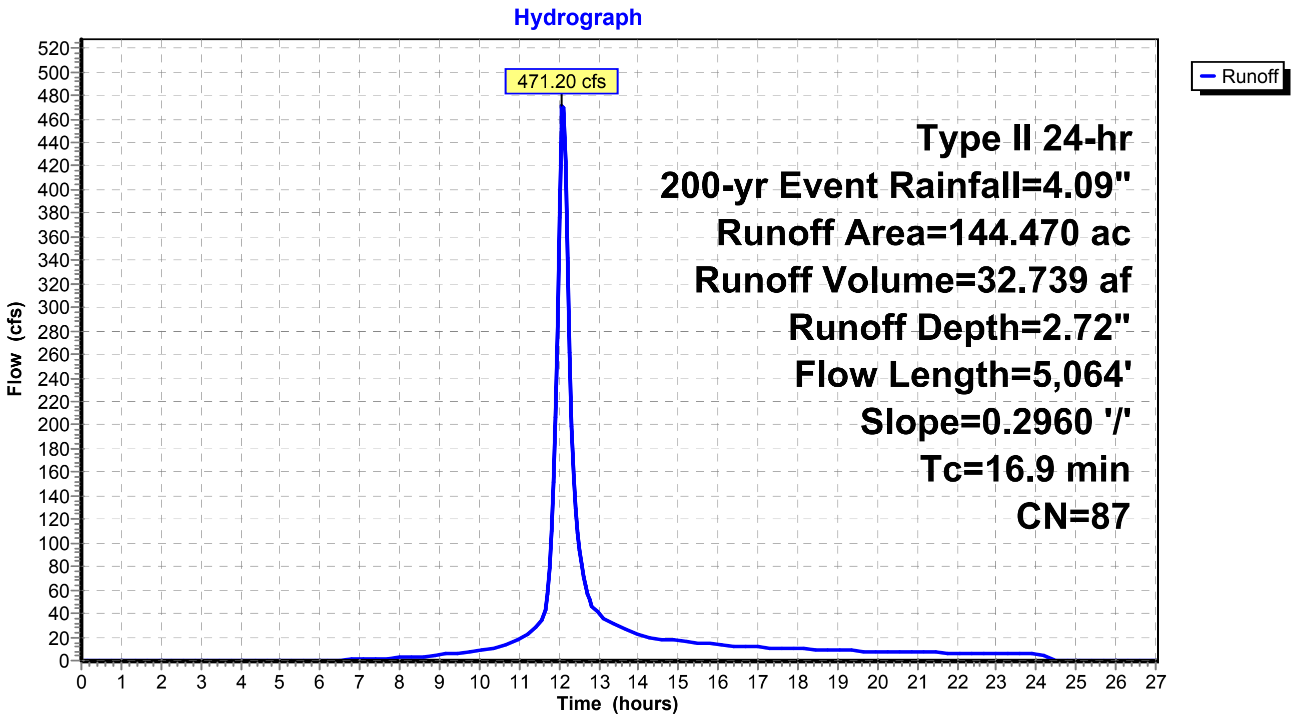
Runoff = 471.20 cfs @ 12.09 hrs, Volume= 32.739 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	5,064	0.2960	5.00		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

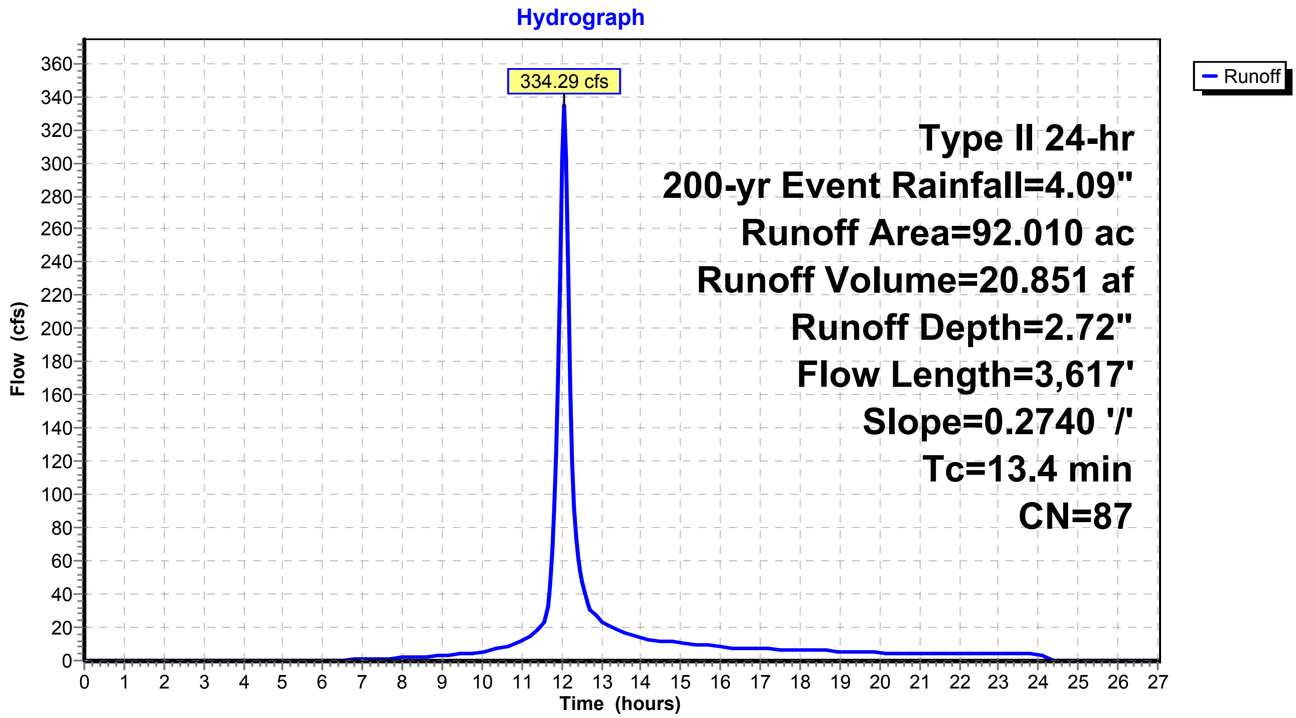
Runoff = 334.29 cfs @ 12.05 hrs, Volume= 20.851 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

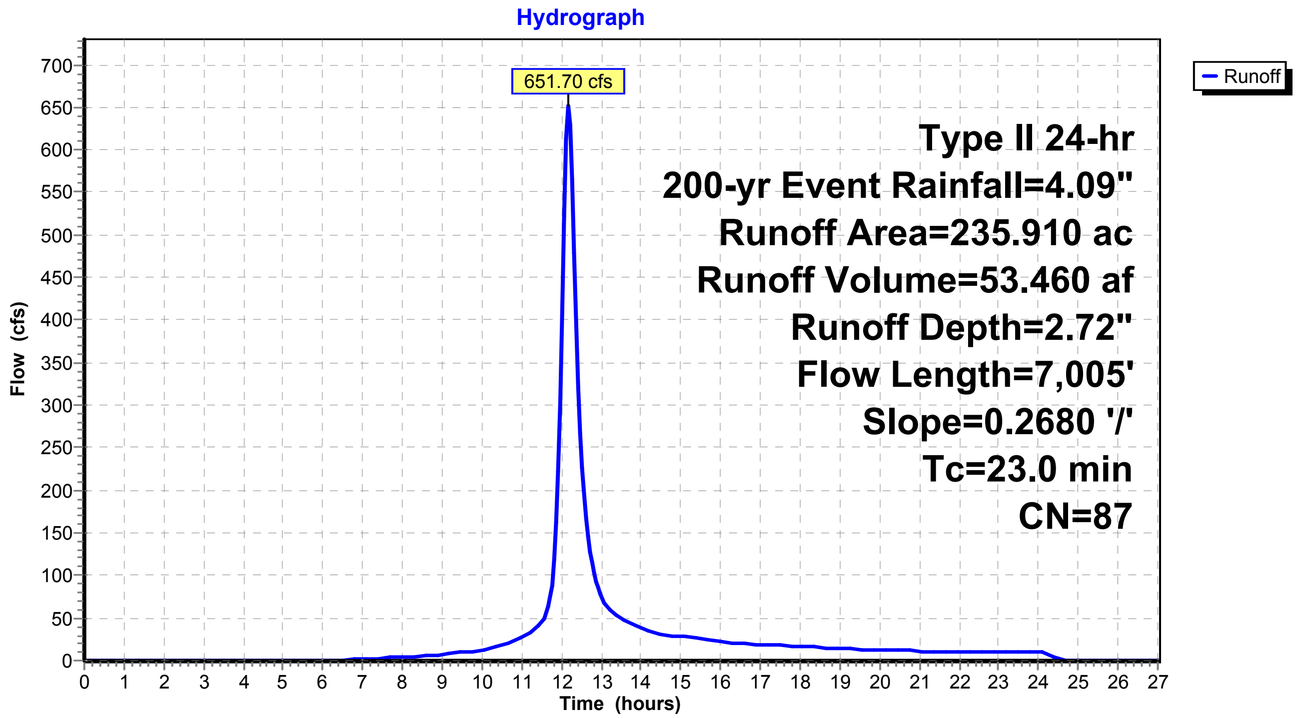
Runoff = 651.70 cfs @ 12.16 hrs, Volume= 53.460 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

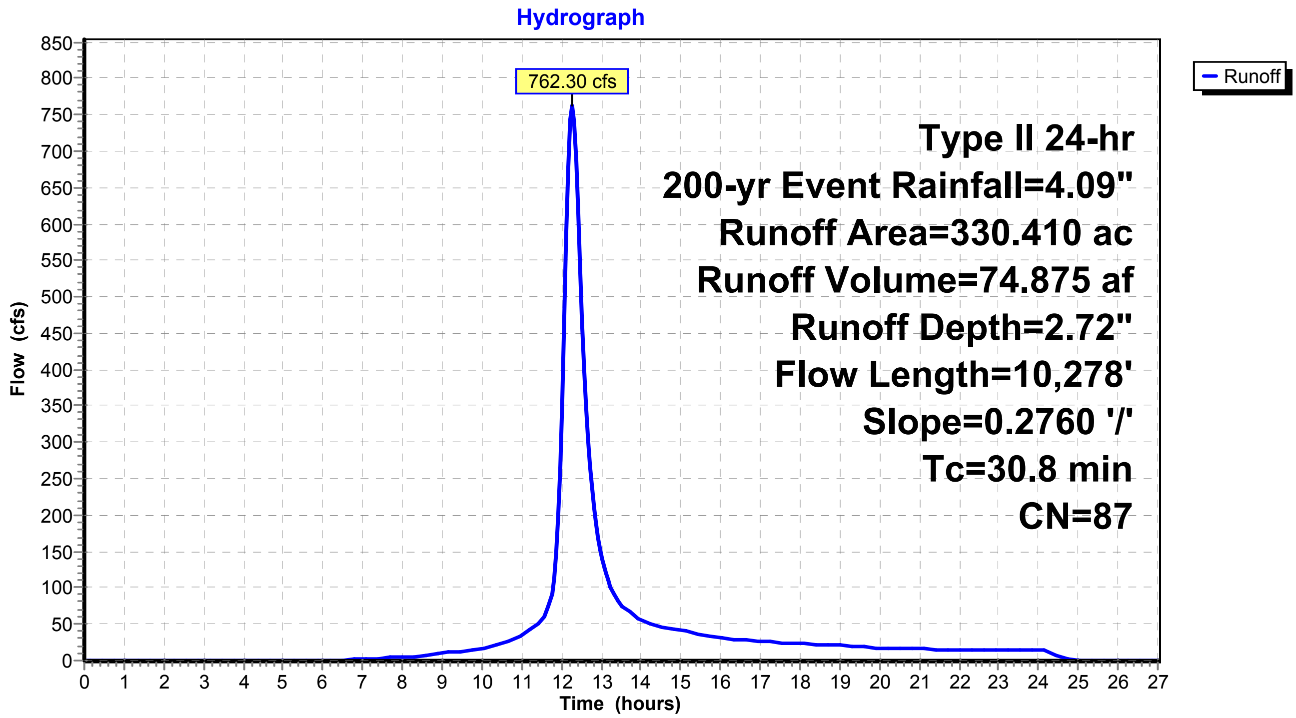
Runoff = 762.30 cfs @ 12.25 hrs, Volume= 74.875 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	297.370	86	Desert shrub range, Fair, HSG D
*	33.040	98	Impervious, HSG D
	330.410	87	Weighted Average
	297.370		90.00% Pervious Area
	33.040		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	10,278	0.2760	5.57		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

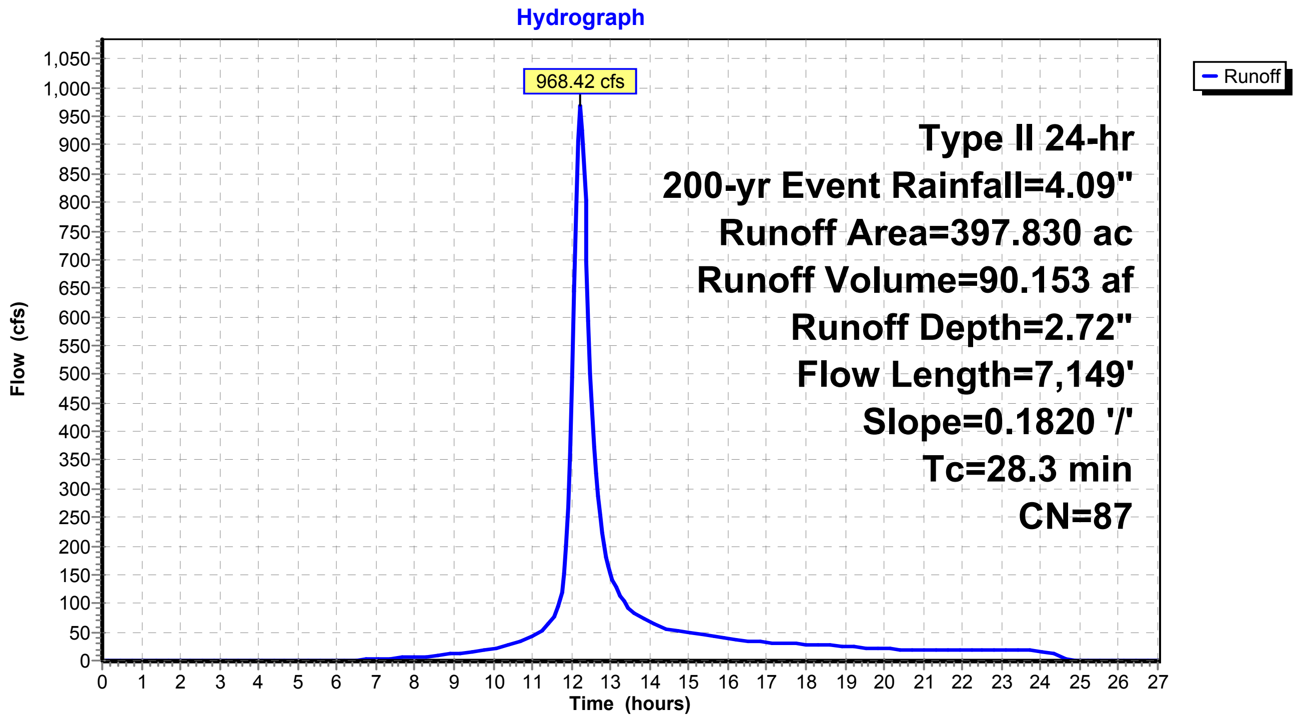
Runoff = 968.42 cfs @ 12.22 hrs, Volume= 90.153 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

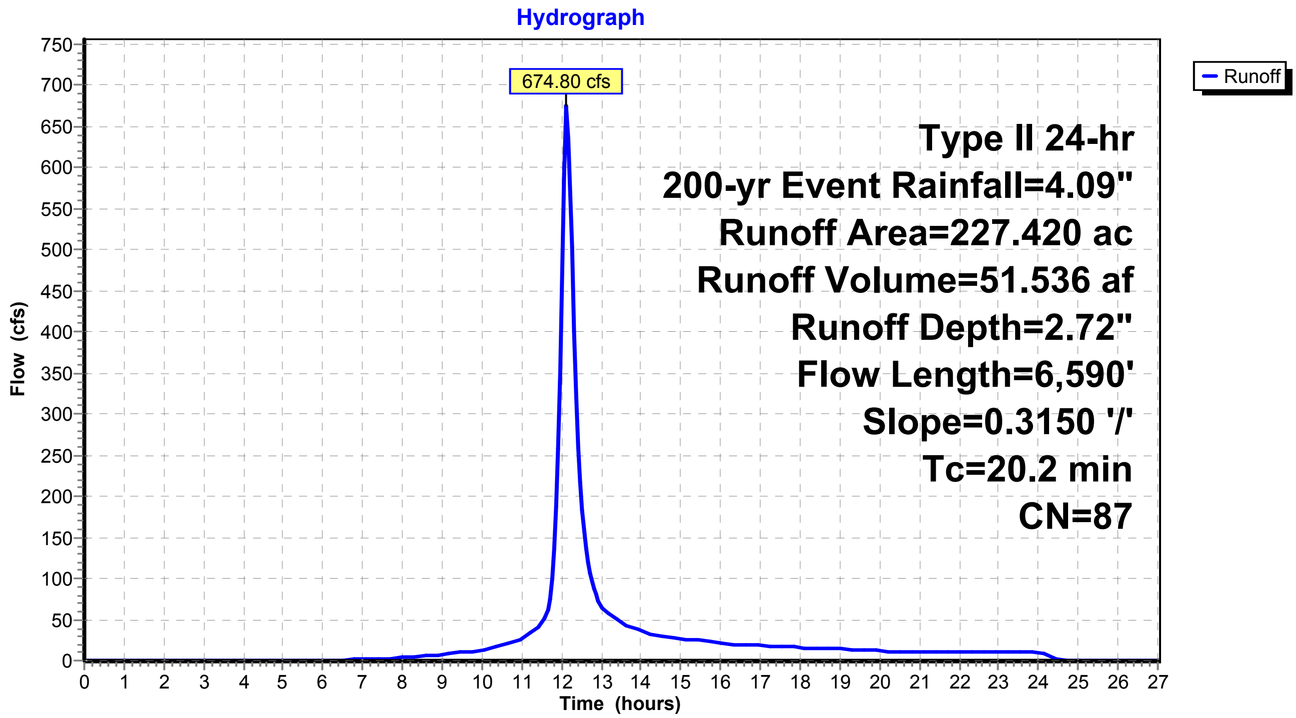
Runoff = 674.80 cfs @ 12.13 hrs, Volume= 51.536 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	204.680	86	Desert shrub range, Fair, HSG D
*	22.740	98	Impervious, HSG D
	227.420	87	Weighted Average
	204.680		90.00% Pervious Area
	22.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	6,590	0.3150	5.44		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

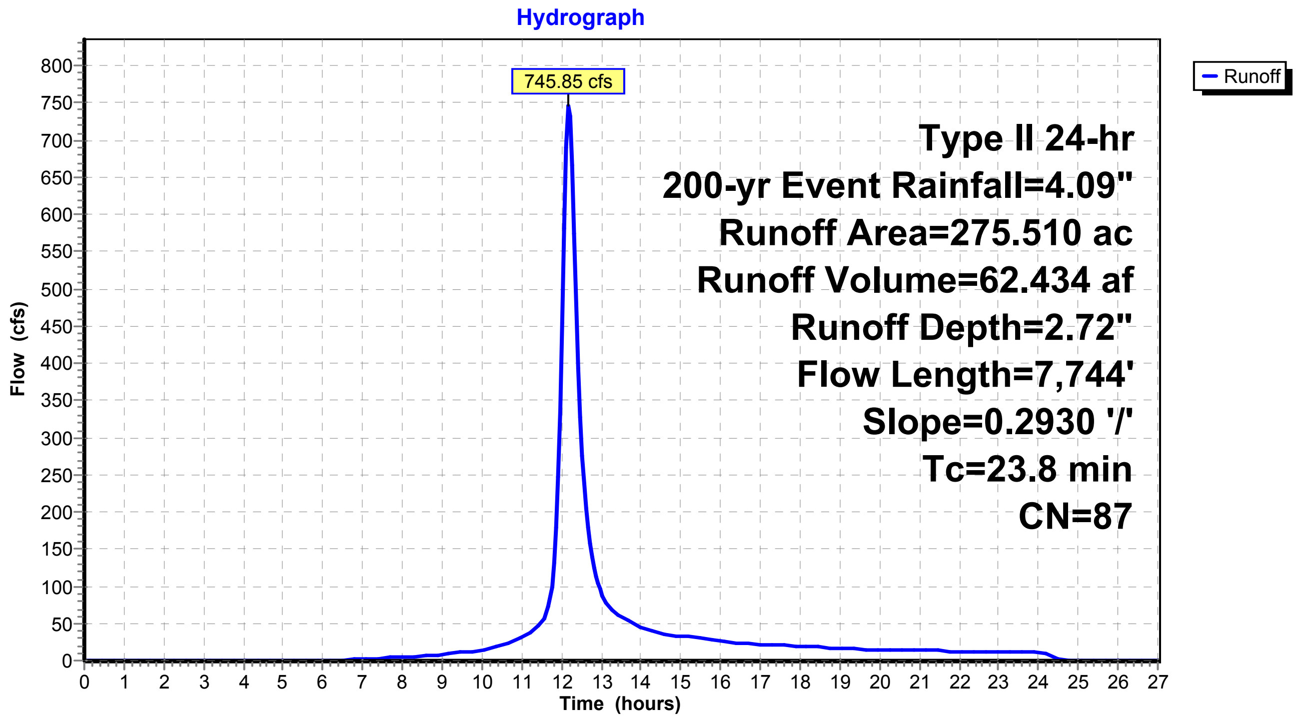
Runoff = 745.85 cfs @ 12.17 hrs, Volume= 62.434 af, Depth= 2.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 200-yr Event Rainfall=4.09"

	Area (ac)	CN	Description
	247.960	86	Desert shrub range, Fair, HSG D
*	27.550	98	Impervious, HSG D
	275.510	87	Weighted Average
	247.960		90.00% Pervious Area
	27.550		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	7,744	0.2930	5.42		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Reach CHNL 1: Channel 1

Inflow Area = 502.930 ac, 10.00% Impervious, Inflow Depth = 2.72" for 200-yr Event event
Inflow = 1,409.59 cfs @ 12.15 hrs, Volume= 113.970 af
Outflow = 1,364.28 cfs @ 12.24 hrs, Volume= 113.968 af, Atten= 3%, Lag= 5.8 min

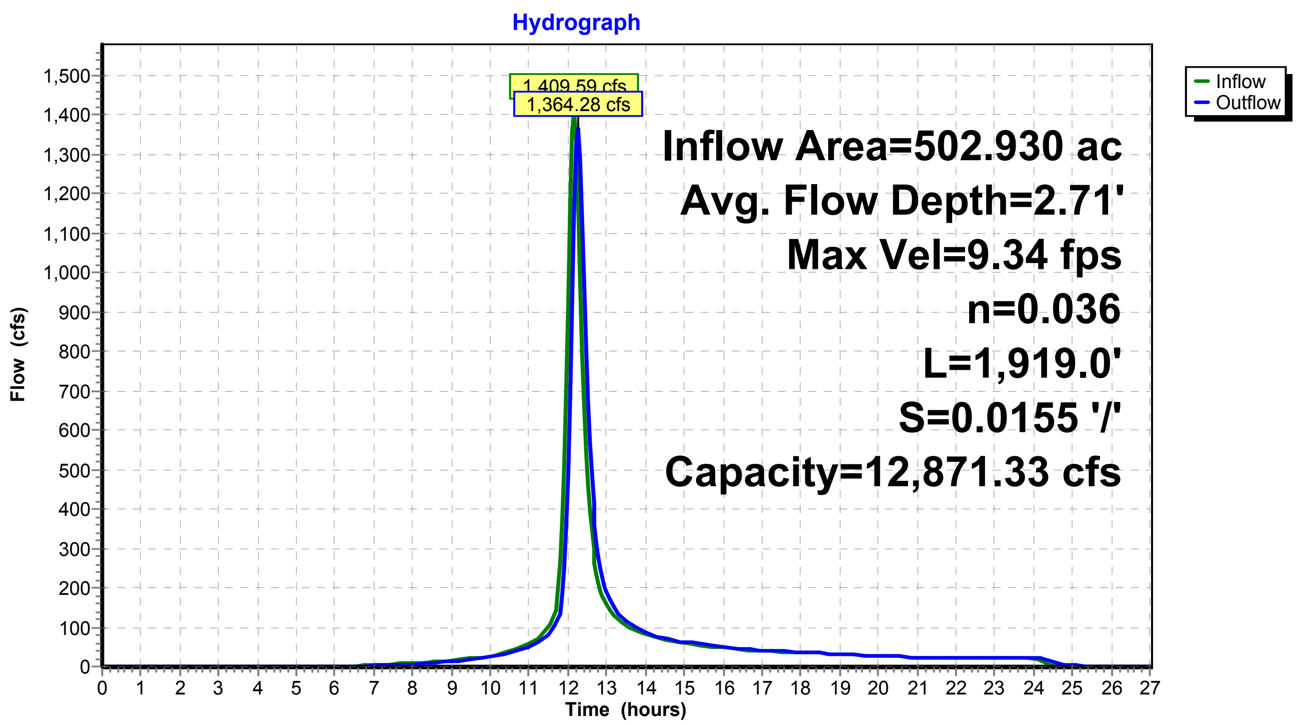
Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.34 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 2.31 fps, Avg. Travel Time= 13.9 min

Peak Storage= 281,335 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.71'
Bank-Full Depth= 10.00' Flow Area= 650.0 sf, Capacity= 12,871.33 cfs

50.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 80.00'
Length= 1,919.0' Slope= 0.0155 '/'
Inlet Invert= 5,569.50', Outlet Invert= 5,539.70'

‡

Reach CHNL 1: Channel 1



Summary for Reach CHNL 2: Channel 2

Inflow Area = 870.220 ac, 10.00% Impervious, Inflow Depth = 2.72" for 200-yr Event event
Inflow = 2,220.40 cfs @ 12.14 hrs, Volume= 197.202 af
Outflow = 1,835.68 cfs @ 12.47 hrs, Volume= 196.763 af, Atten= 17%, Lag= 20.0 min

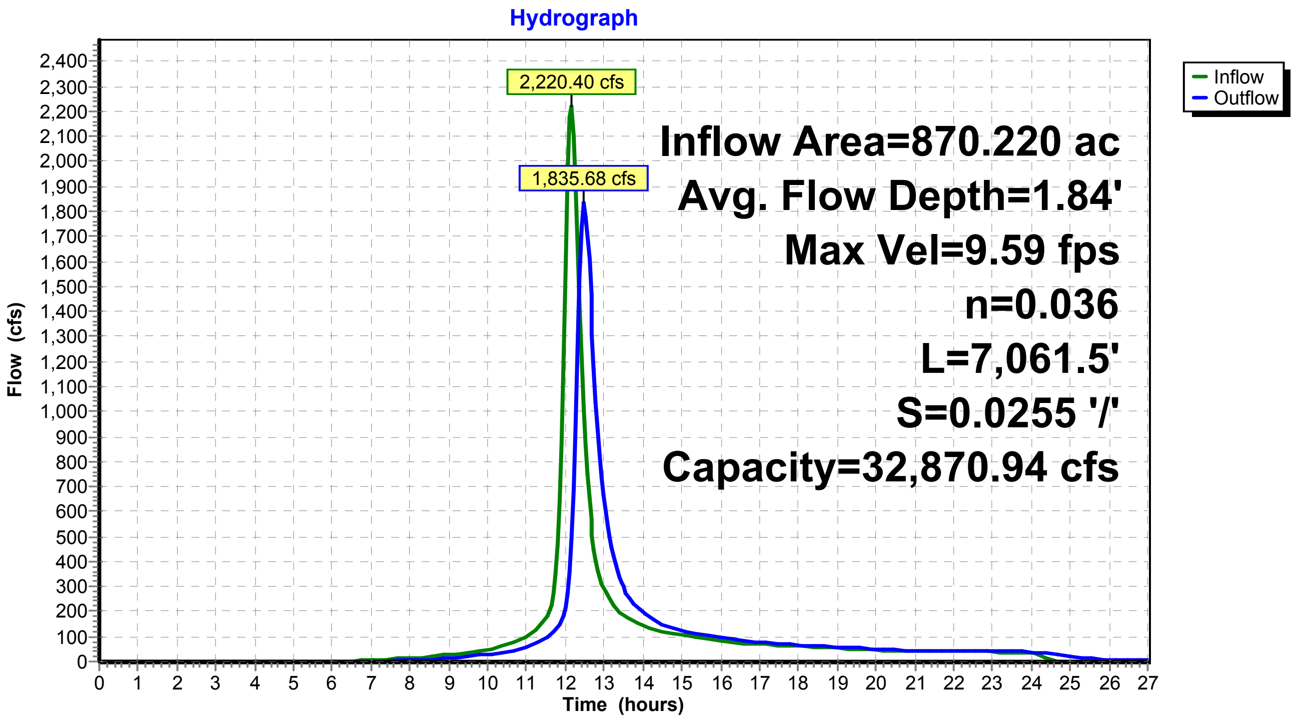
Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.59 fps, Min. Travel Time= 12.3 min
Avg. Velocity = 2.61 fps, Avg. Travel Time= 45.2 min

Peak Storage= 1,352,568 cf @ 12.27 hrs
Average Depth at Peak Storage= 1.84'
Bank-Full Depth= 10.00' Flow Area= 1,225.0 sf, Capacity= 32,870.94 cfs

100.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 2.5 2.0 '/' Top Width= 145.00'
Length= 7,061.5' Slope= 0.0255 '/'
Inlet Invert= 5,720.00', Outlet Invert= 5,539.70'

‡

Reach CHNL 2: Channel 2



Summary for Reach CHNL 3: Channel 3

[62] Hint: Exceeded Reach CHNL 1 OUTLET depth by 3.89' @ 12.45 hrs
[62] Hint: Exceeded Reach CHNL 2 OUTLET depth by 4.08' @ 12.40 hrs

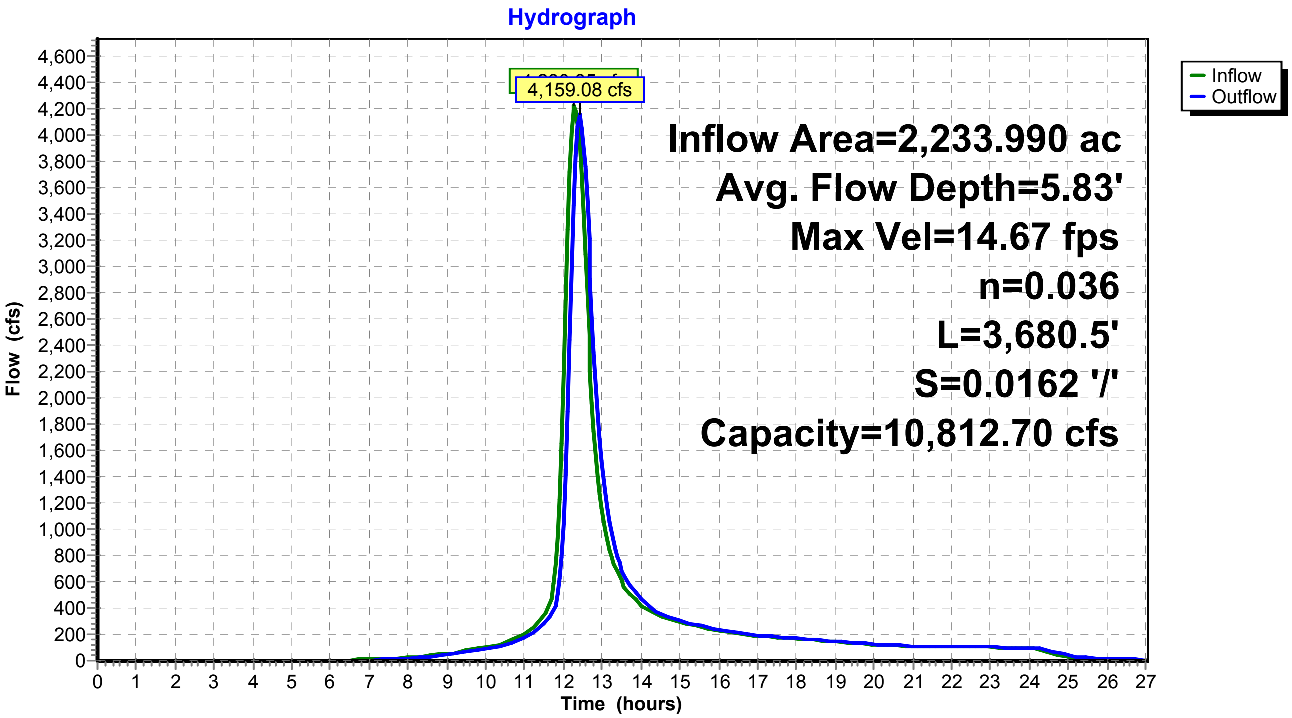
Inflow Area = 2,233.990 ac, 10.00% Impervious, Inflow Depth > 2.72" for 200-yr Event event
Inflow = 4,230.35 cfs @ 12.29 hrs, Volume= 505.807 af
Outflow = 4,159.08 cfs @ 12.41 hrs, Volume= 505.394 af, Atten= 2%, Lag= 7.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.67 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 4.37 fps, Avg. Travel Time= 14.1 min

Peak Storage= 1,046,926 cf @ 12.34 hrs
Average Depth at Peak Storage= 5.83'
Bank-Full Depth= 10.00' Flow Area= 550.0 sf, Capacity= 10,812.70 cfs

40.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 70.00'
Length= 3,680.5' Slope= 0.0162 '/'
Inlet Invert= 5,539.70', Outlet Invert= 5,480.00'

Reach CHNL 3: Channel 3



Summary for Reach CHNL 4: Channel 4

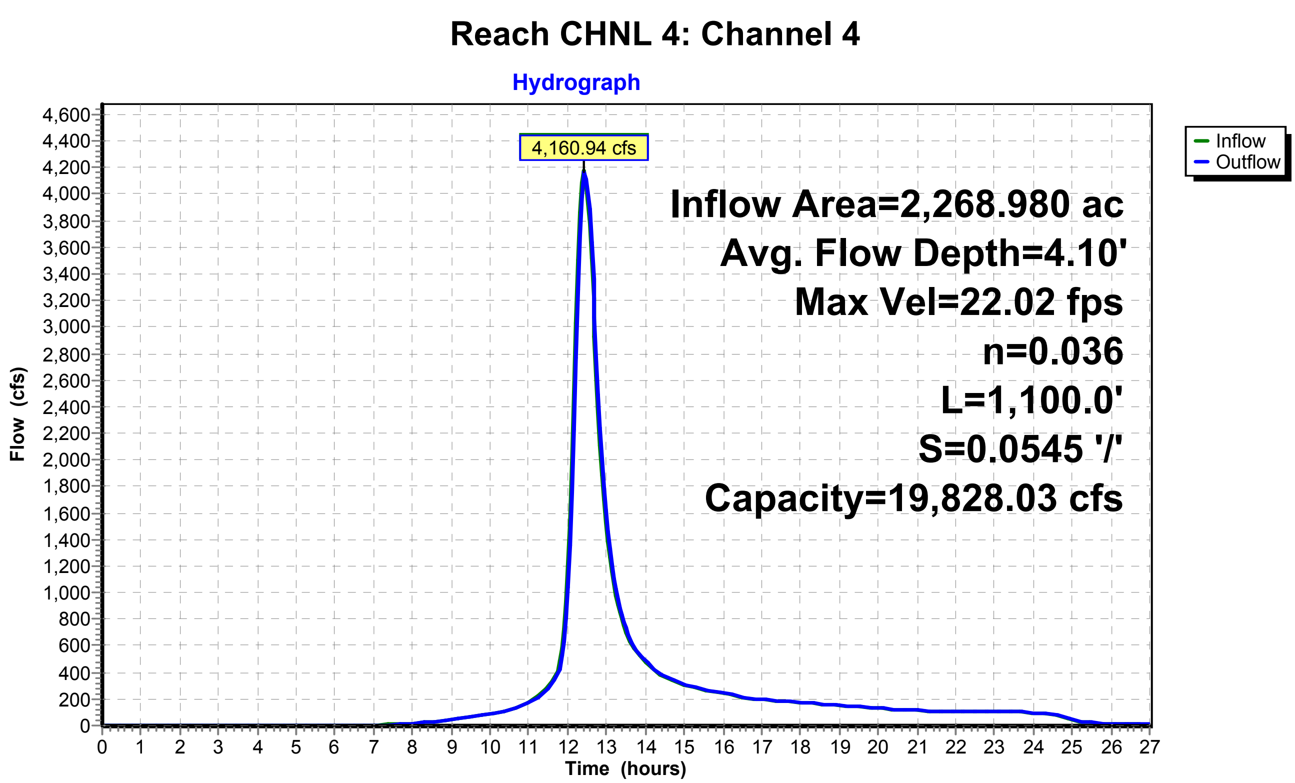
[61] Hint: Exceeded Reach CHNL 3 outlet invert by 4.10' @ 12.40 hrs

Inflow Area = 2,268.980 ac, 10.00% Impervious, Inflow Depth > 2.71" for 200-yr Event event
Inflow = 4,176.49 cfs @ 12.41 hrs, Volume= 513.323 af
Outflow = 4,160.94 cfs @ 12.43 hrs, Volume= 513.234 af, Atten= 0%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 22.02 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 6.44 fps, Avg. Travel Time= 2.8 min

Peak Storage= 208,374 cf @ 12.42 hrs
Average Depth at Peak Storage= 4.10'
Bank-Full Depth= 10.00' Flow Area= 550.0 sf, Capacity= 19,828.03 cfs

40.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 70.00'
Length= 1,100.0' Slope= 0.0545 '/'
Inlet Invert= 5,480.00', Outlet Invert= 5,420.00'



Summary for Reach CHNL 5: Channel 5

[62] Hint: Exceeded Reach CHNL 4 OUTLET depth by 2.66' @ 12.50 hrs

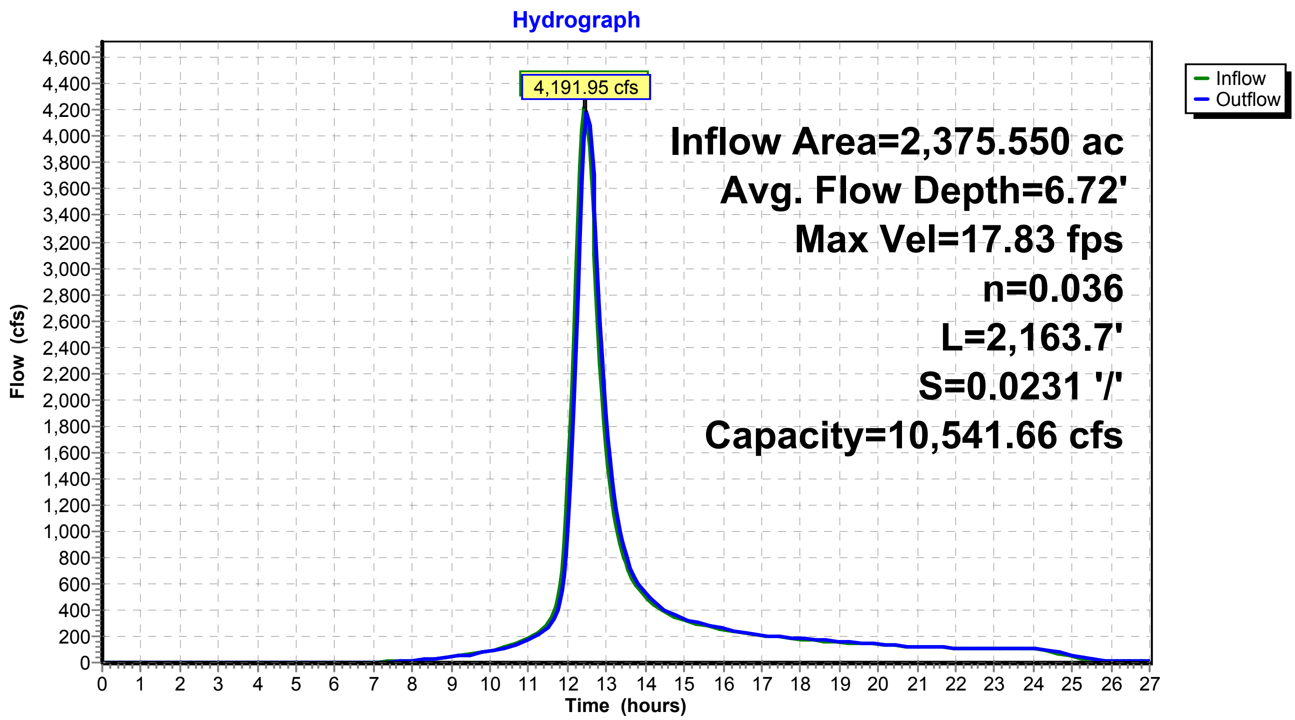
Inflow Area = 2,375.550 ac, 10.00% Impervious, Inflow Depth > 2.71" for 200-yr Event event
Inflow = 4,217.67 cfs @ 12.43 hrs, Volume= 537.384 af
Outflow = 4,191.95 cfs @ 12.49 hrs, Volume= 537.163 af, Atten= 1%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 17.83 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 5.77 fps, Avg. Travel Time= 6.2 min

Peak Storage= 510,334 cf @ 12.46 hrs
Average Depth at Peak Storage= 6.72'
Bank-Full Depth= 11.00' Flow Area= 456.5 sf, Capacity= 10,541.66 cfs

25.00' x 11.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 58.00'
Length= 2,163.7' Slope= 0.0231 '/'
Inlet Invert= 5,420.00', Outlet Invert= 5,370.00'

Reach CHNL 5: Channel 5



Summary for Pond CLVT 1: Culvert Crossing #1

[62] Hint: Exceeded Reach CHNL 5 OUTLET depth by 17.28' @ 12.75 hrs

Inflow Area = 2,375.550 ac, 10.00% Impervious, Inflow Depth > 2.71" for 200-yr Event event
Inflow = 4,191.95 cfs @ 12.49 hrs, Volume= 537.163 af
Outflow = 3,410.14 cfs @ 12.71 hrs, Volume= 537.020 af, Atten= 19%, Lag= 12.9 min
Primary = 3,410.14 cfs @ 12.71 hrs, Volume= 537.020 af

Routing by Stor-Ind method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Peak Elev= 5,392.92' @ 12.71 hrs Surf.Area= 0 sf Storage= 1,758,861 cf
Flood Elev= 5,419.00' Surf.Area= 0 sf Storage= 12,108,960 cf

Plug-Flow detention time= 4.1 min calculated for 537.020 af (100% of inflow)
Center-of-Mass det. time= 4.0 min (860.7 - 856.8)

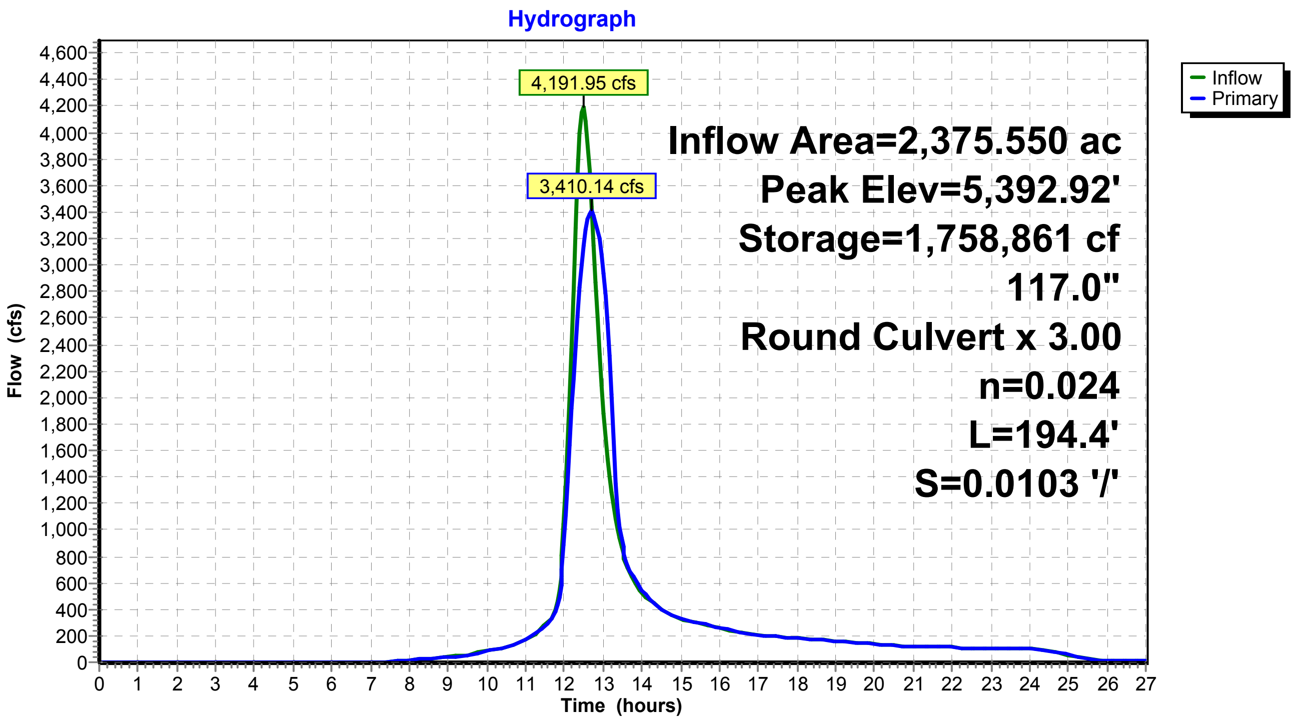
Volume	Invert	Avail.Storage	Storage Description
#1	5,370.00'	12,108,960 cf	**Culvert Crossing #1**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
5,370.00	0
5,371.00	1,264
5,372.00	4,909
5,373.00	7,513
5,374.00	16,645
5,375.00	29,237
5,376.00	46,725
5,377.00	71,156
5,378.00	103,816
5,379.00	144,375
5,380.00	193,809
5,381.00	252,611
5,382.00	321,098
5,383.00	399,998
5,384.00	488,627
5,385.00	587,544
5,386.00	697,578
5,387.00	818,723
5,388.00	950,841
5,389.00	1,094,170
5,390.00	1,248,216
5,391.00	1,412,011
5,392.00	1,587,481
5,393.00	1,774,410
5,394.00	1,971,598
5,395.00	2,046,356
5,396.00	2,266,171
5,397.00	2,498,604
5,398.00	2,742,207
5,399.00	2,998,577
5,400.00	3,272,610
5,401.00	3,564,605
5,402.00	3,875,249
5,403.00	4,205,411
5,404.00	4,554,001
5,405.00	4,921,330
5,406.00	5,306,733
5,407.00	5,710,058
5,408.00	6,132,117
5,409.00	6,572,849
5,410.00	7,032,579
5,411.00	7,512,479
5,412.00	8,012,116
5,413.00	8,533,107
5,414.00	9,078,172
5,415.00	9,647,155
5,416.00	10,235,642
5,417.00	10,841,380
5,418.00	11,465,162
5,419.00	12,108,960

Device	Routing	Invert	Outlet Devices
#1	Primary	5,372.00'	**117.0" Round Culvert X 3.00** L= 194.4' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,372.00' / 5,370.00' S= 0.0103 '/' Cc= 0.900 n= 0.024, Flow Area= 74.66 sf

Primary OutFlow Max=3,408.57 cfs @ 12.71 hrs HW=5,392.90' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3,408.57 cfs @ 15.22 fps)

Pond CLVT 1: Culvert Crossing #1



Summary for Pond CLVT 2: Culvert Crossing #2

[81] Warning: Exceeded Pond CLVT 1 by 11.78' @ 13.40 hrs

Inflow Area = 2,403.760 ac, 10.00% Impervious, Inflow Depth > 2.71" for 200-yr Event event
Inflow = 3,418.33 cfs @ 12.71 hrs, Volume= 543.413 af
Outflow = 1,658.81 cfs @ 13.25 hrs, Volume= 543.361 af, Atten= 51%, Lag= 32.8 min
Primary = 1,658.81 cfs @ 13.25 hrs, Volume= 543.361 af

Routing by Stor-Ind method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Peak Elev= 5,391.04' @ 13.25 hrs Surf.Area= 0 sf Storage= 6,444,314 cf
Flood Elev= 5,403.00' Surf.Area= 0 sf Storage= 10,142,539 cf

Plug-Flow detention time= 30.6 min calculated for 543.361 af (100% of inflow)
Center-of-Mass det. time= 30.5 min (890.6 - 860.1)

Volume	Invert	Avail.Storage	Storage Description
#1	5,352.00'	10,142,539 cf	**Existing Pond** Listed below

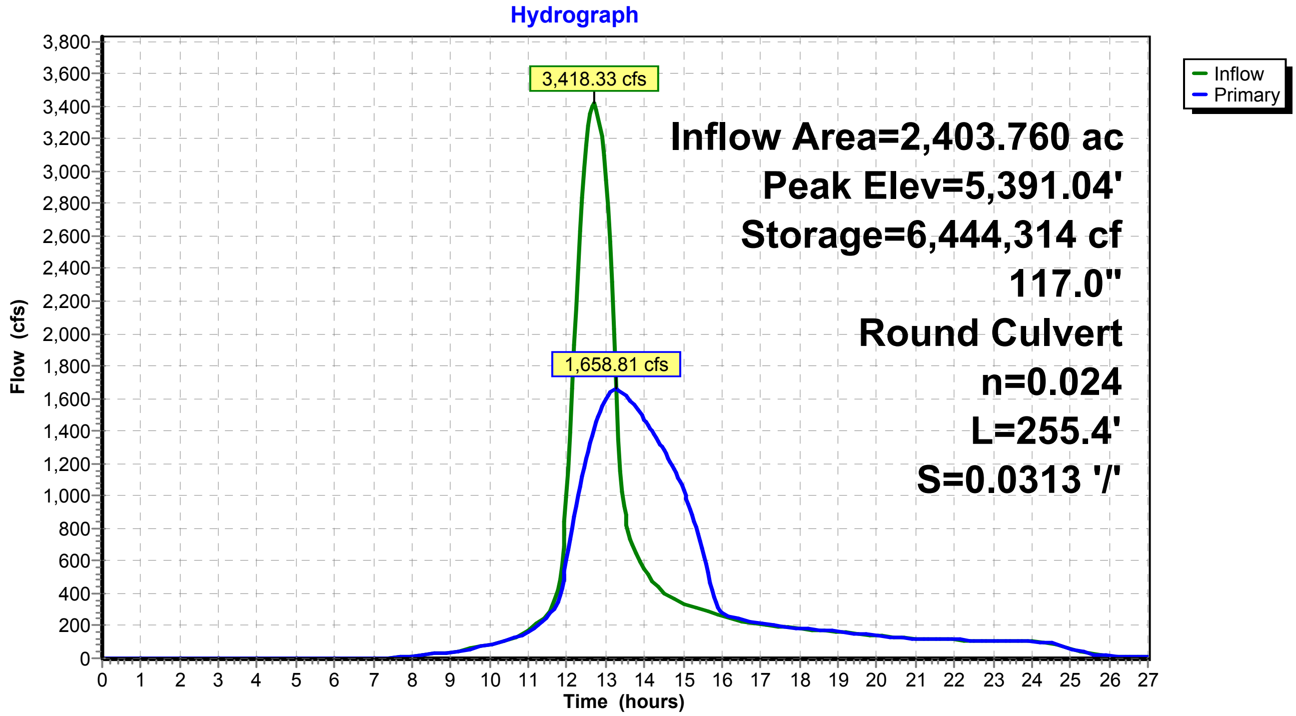
Elevation (feet)	Cum.Store (cubic-feet)
5,352.00	0
5,353.00	2,681
5,354.00	7,382
5,355.00	15,397
5,356.00	28,286
5,357.00	47,224
5,358.00	75,773
5,359.00	117,133
5,360.00	170,345
5,361.00	235,331
5,362.00	312,331
5,363.00	399,765
5,364.00	497,494
5,365.00	605,663
5,366.00	724,610
5,367.00	855,928
5,368.00	1,000,315
5,369.00	1,157,122
5,370.00	1,325,832
5,371.00	1,505,243
5,372.00	1,693,878
5,373.00	1,890,808
5,374.00	2,095,234
5,375.00	2,306,959
5,376.00	2,525,755
5,377.00	2,751,367
5,378.00	2,983,426
5,379.00	3,221,478
5,380.00	3,465,168
5,381.00	3,714,247
5,382.00	3,968,434
5,383.00	4,227,291
5,384.00	4,490,405
5,385.00	4,757,518
5,386.00	5,028,418
5,387.00	5,302,894
5,388.00	5,580,732
5,389.00	5,861,867
5,390.00	6,146,219
5,391.00	6,433,776
5,392.00	6,724,543
5,393.00	7,018,534
5,394.00	7,315,762
5,395.00	7,616,273
5,396.00	7,920,106
5,397.00	8,227,290
5,398.00	8,537,855
5,399.00	8,851,826
5,400.00	9,169,229
5,401.00	9,490,117

5,402.00	9,814,540
5,403.00	10,142,539

Device	Routing	Invert	Outlet Devices
#1	Primary	5,352.00'	**117.0" Round Culvert** L= 255.4' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,352.00' / 5,344.00' S= 0.0313 '/' Cc= 0.900 n= 0.024, Flow Area= 74.66 sf

Primary OutFlow Max=1,658.65 cfs @ 13.25 hrs HW=5,391.03' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1,658.65 cfs @ 22.22 fps)

Pond CLVT 2: Culvert Crossing #2



Time span=0.00-27.00 hrs, dt=0.05 hrs, 541 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: WS 1 Runoff Area=28.210 ac 10.00% Impervious Runoff Depth=3.19"
Tc=5.0 min CN=87 Runoff=155.94 cfs 7.504 af

Subcatchment2: WS 2 Runoff Area=106.570 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,068' Slope=0.3140 '/' Tc=11.0 min CN=87 Runoff=484.31 cfs 28.349 af

Subcatchment3: WS 3 Runoff Area=34.990 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=1,603' Slope=0.1770 '/' Tc=8.7 min CN=87 Runoff=172.66 cfs 9.308 af

Subcatchment4: WS 4 Runoff Area=75.020 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,047' Slope=0.3390 '/' Tc=10.5 min CN=87 Runoff=346.92 cfs 19.956 af

Subcatchment5: WS 5 Runoff Area=124.190 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=5,976' Slope=0.3400 '/' Tc=18.0 min CN=87 Runoff=458.61 cfs 33.036 af

Subcatchment6: WS 6 Runoff Area=331.220 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=8,173' Slope=0.3100 '/' Tc=24.2 min CN=87 Runoff=1,038.74 cfs 88.109 af

Subcatchment7: WS 7 Runoff Area=144.470 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=5,064' Slope=0.2960 '/' Tc=16.9 min CN=87 Runoff=550.14 cfs 38.431 af

Subcatchment8: WS 8 Runoff Area=92.010 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=3,617' Slope=0.2740 '/' Tc=13.4 min CN=87 Runoff=389.99 cfs 24.476 af

Subcatchment9: WS 9 Runoff Area=235.910 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,005' Slope=0.2680 '/' Tc=23.0 min CN=87 Runoff=761.76 cfs 62.755 af

Subcatchment10: WS 10 Runoff Area=330.410 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=10,278' Slope=0.2760 '/' Tc=30.8 min CN=87 Runoff=891.85 cfs 87.894 af

Subcatchment11: WS 11 Runoff Area=397.830 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,149' Slope=0.1820 '/' Tc=28.3 min CN=87 Runoff=1,132.73 cfs 105.828 af

Subcatchment12: WS 12 Runoff Area=227.420 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=6,590' Slope=0.3150 '/' Tc=20.2 min CN=87 Runoff=789.72 cfs 60.497 af

Subcatchment13: WS 13 Runoff Area=275.510 ac 10.00% Impervious Runoff Depth=3.19"
Flow Length=7,744' Slope=0.2930 '/' Tc=23.8 min CN=87 Runoff=871.93 cfs 73.289 af

Reach CHNL 1: Channel 1 Avg. Flow Depth=2.98' Max Vel=9.88 fps Inflow=1,647.46 cfs 133.786 af
n=0.036 L=1,919.0' S=0.0155 '/' Capacity=12,871.33 cfs Outflow=1,601.86 cfs 133.784 af

Reach CHNL 2: Channel 2 Avg. Flow Depth=2.04' Max Vel=10.26 fps Inflow=2,597.10 cfs 231.491 af
n=0.036 L=7,061.5' S=0.0255 '/' Capacity=32,870.94 cfs Outflow=2,180.53 cfs 231.028 af

Reach CHNL 3: Channel 3 Avg. Flow Depth=6.49' Max Vel=15.55 fps Inflow=5,094.93 cfs 593.807 af
n=0.036 L=3,680.5' S=0.0162 '/' Capacity=10,812.70 cfs Outflow=5,008.23 cfs 593.385 af

Reach CHNL 4: Channel 4 Avg. Flow Depth=4.57' Max Vel=23.45 fps Inflow=5,028.84 cfs 602.692 af
n=0.036 L=1,100.0' S=0.0545 '/' Capacity=19,828.03 cfs Outflow=5,012.38 cfs 602.599 af

Reach CHNL 5: Channel 5 Avg. Flow Depth=7.44' Max Vel=18.81 fps Inflow=5,080.00 cfs 630.949 af
n=0.036 L=2,163.7' S=0.0231 '/' Capacity=10,541.66 cfs Outflow=5,046.09 cfs 630.724 af

Pond CLVT 1: Culvert Crossing Peak Elev=5,397.29' Storage=2,570,184 cf Inflow=5,046.09 cfs 630.724 af
117.0" Round Culvert x 3.00 n=0.024 L=194.4' S=0.0103 '/' Outflow=3,847.35 cfs 630.580 af

Pond CLVT 2: Culvert Crossing Peak Elev=5,396.71' Storage=8,137,086 cf Inflow=3,856.73 cfs 638.084 af
117.0" Round Culvert n=0.024 L=255.4' S=0.0313 '/' Outflow=1,791.19 cfs 638.031 af

Total Runoff Area = 2,403.760 ac Runoff Volume = 639.433 af Average Runoff Depth = 3.19"
90.00% Pervious = 2,163.390 ac 10.00% Impervious = 240.370 ac

Summary for Subcatchment 1: WS 1

[49] Hint: Tc<2dt may require smaller dt

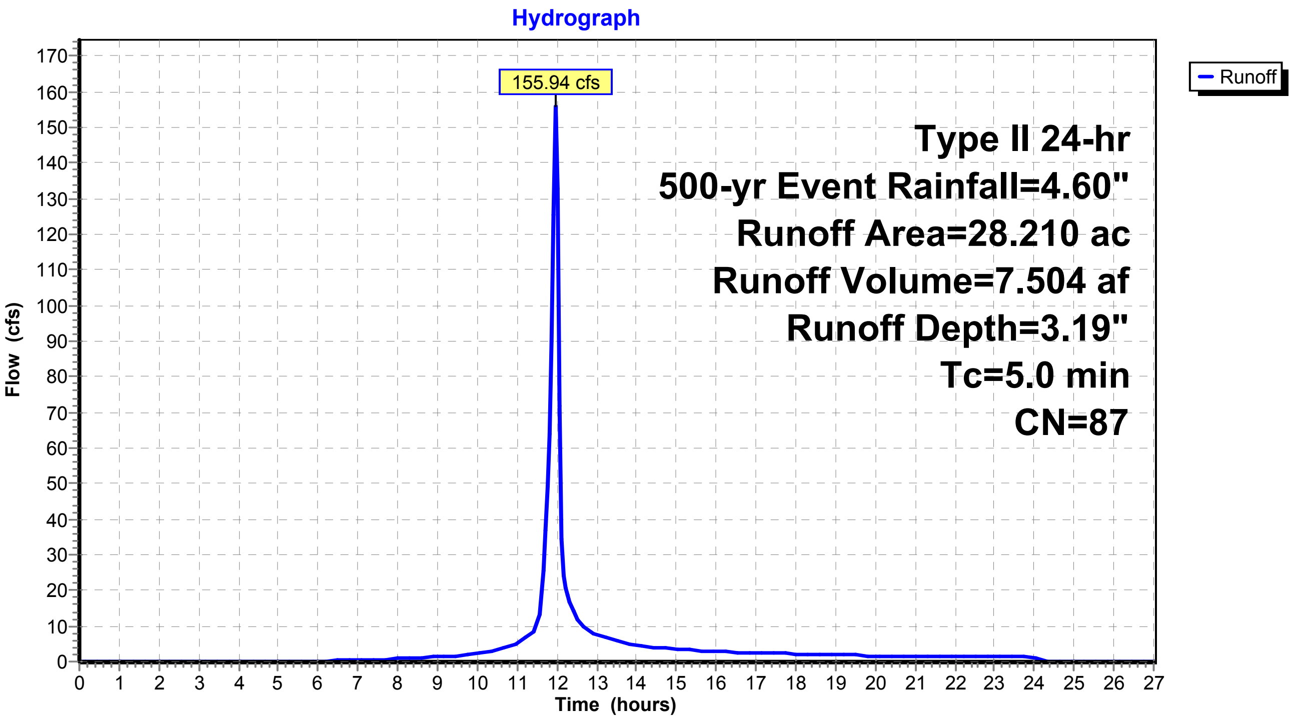
Runoff = 155.94 cfs @ 11.95 hrs, Volume= 7.504 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	25.390	86	Desert shrub range, Fair, HSG D
*	2.820	98	Impervious, HSG D
	28.210	87	Weighted Average
	25.390		90.00% Pervious Area
	2.820		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum Tc**

Subcatchment 1: WS 1



Summary for Subcatchment 2: WS 2

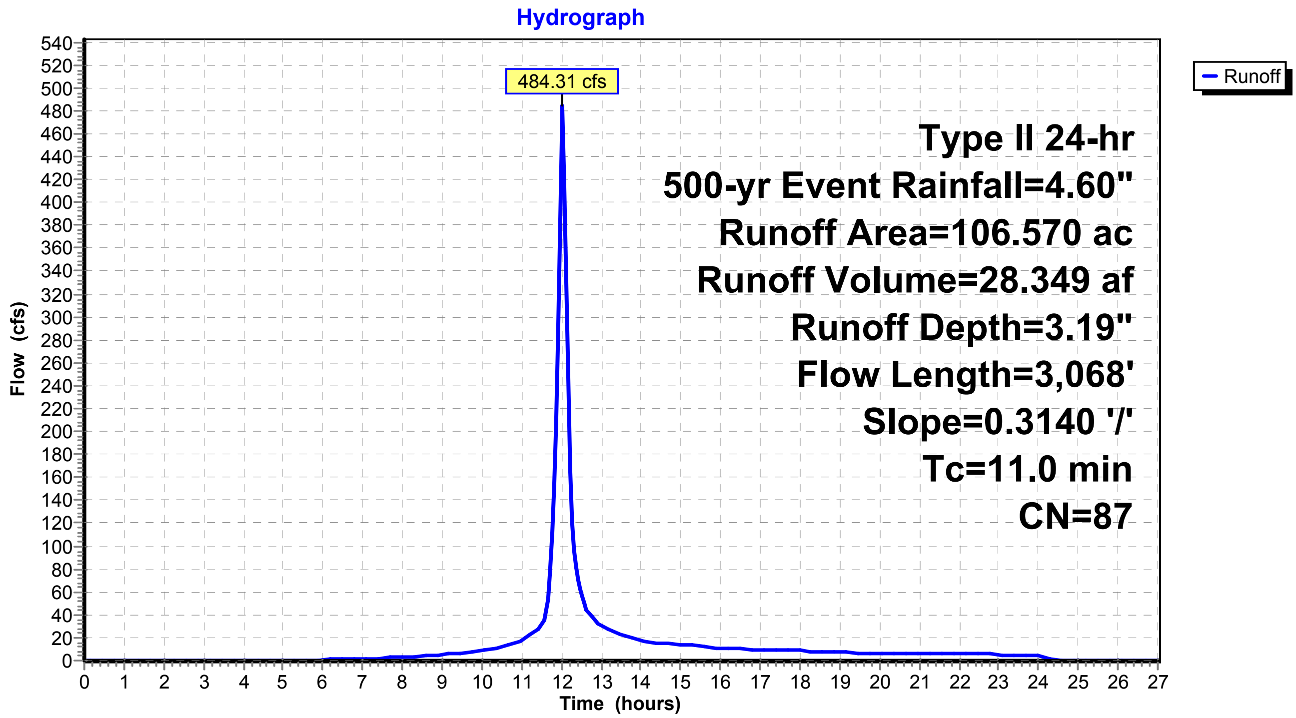
Runoff = 484.31 cfs @ 12.02 hrs, Volume= 28.349 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	95.910	86	Desert shrub range, Fair, HSG D
*	10.660	98	Impervious, HSG D
	106.570	87	Weighted Average
	95.910		90.00% Pervious Area
	10.660		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	3,068	0.3140	4.66		**Lag/CN Method,**

Subcatchment 2: WS 2



Summary for Subcatchment 3: WS 3

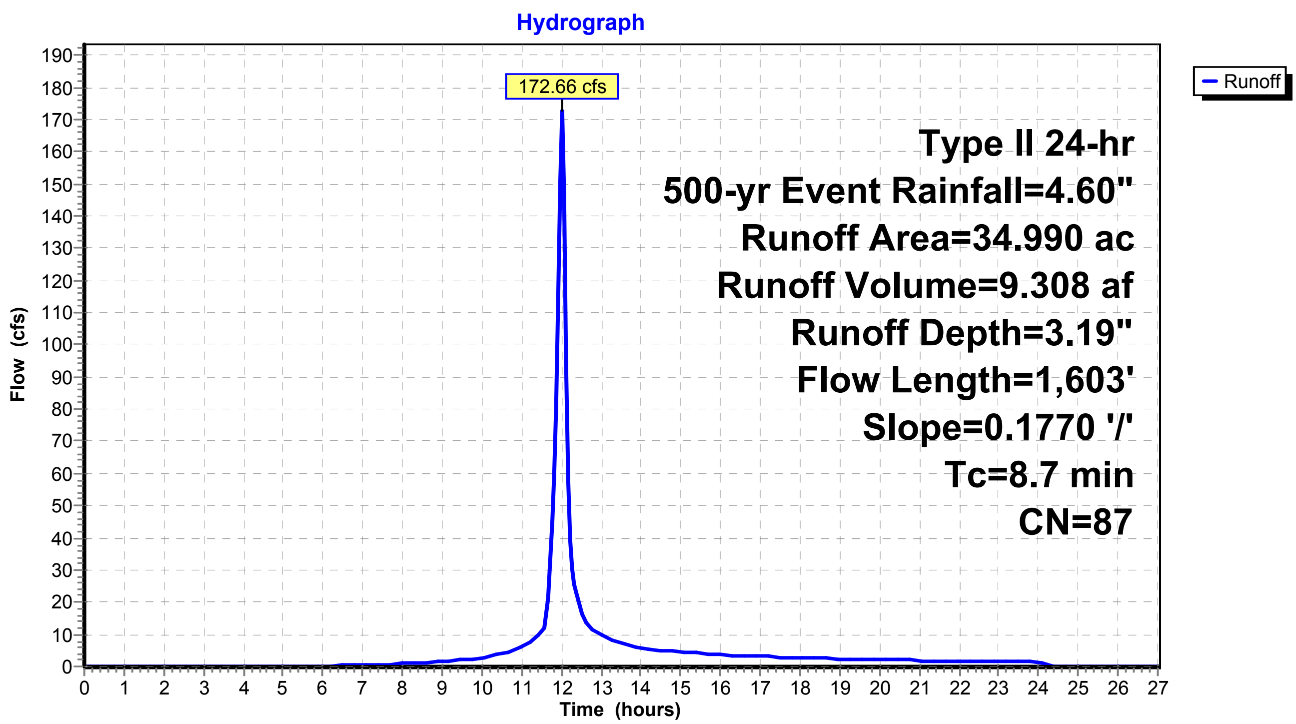
Runoff = 172.66 cfs @ 12.00 hrs, Volume= 9.308 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	31.490	86	Desert shrub range, Fair, HSG D
*	3.500	98	Impervious, HSG D
	34.990	87	Weighted Average
	31.490		90.00% Pervious Area
	3.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	1,603	0.1770	3.07		**Lag/CN Method,**

Subcatchment 3: WS 3



Summary for Subcatchment 4: WS 4

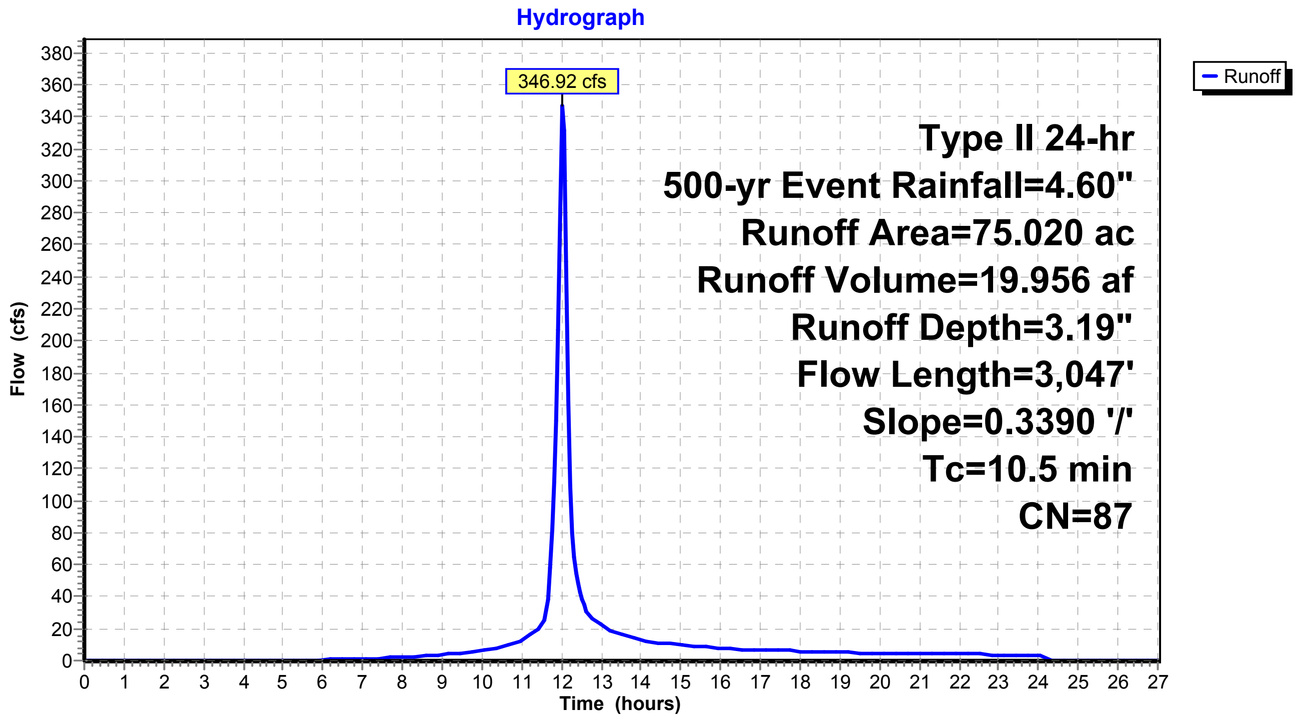
Runoff = 346.92 cfs @ 12.02 hrs, Volume= 19.956 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	67.520	86	Desert shrub range, Fair, HSG D
*	7.500	98	Impervious, HSG D
	75.020	87	Weighted Average
	67.520		90.00% Pervious Area
	7.500		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	3,047	0.3390	4.84		**Lag/CN Method,**

Subcatchment 4: WS 4



Summary for Subcatchment 5: WS 5

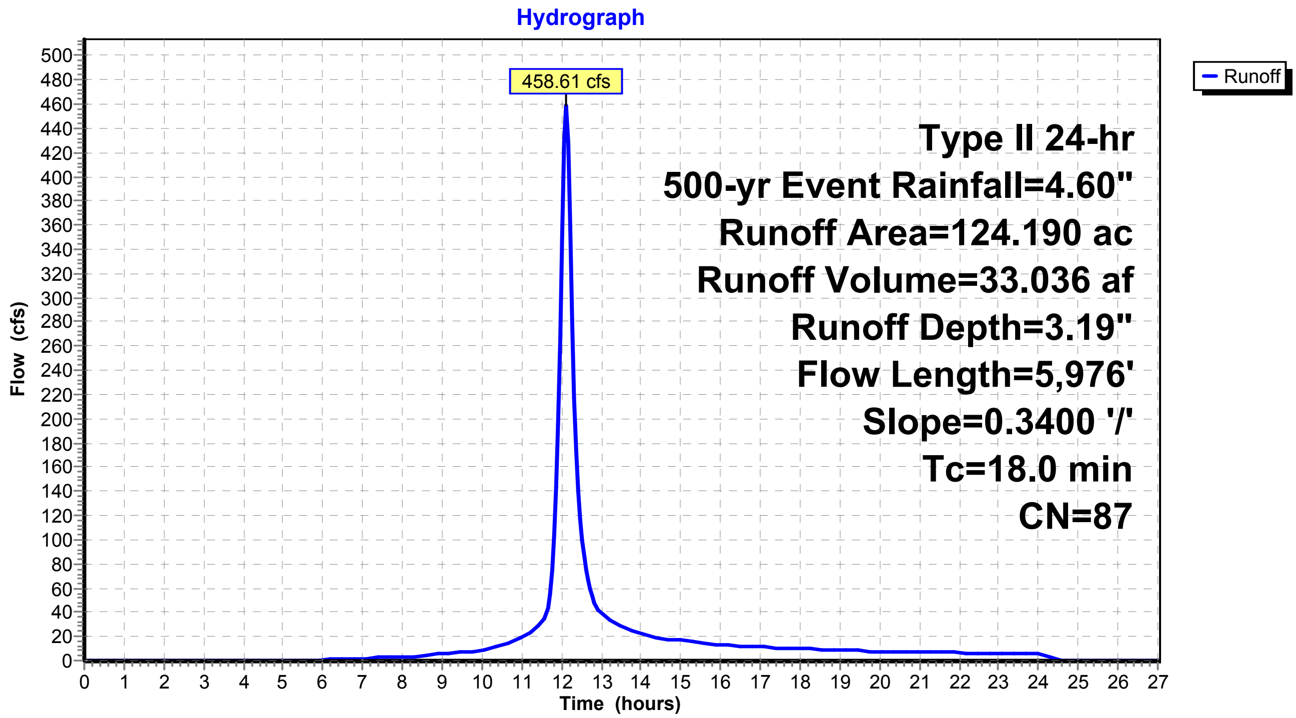
Runoff = 458.61 cfs @ 12.10 hrs, Volume= 33.036 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	111.770	86	Desert shrub range, Fair, HSG D
*	12.420	98	Impervious, HSG D
	124.190	87	Weighted Average
	111.770		90.00% Pervious Area
	12.420		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.0	5,976	0.3400	5.54		**Lag/CN Method,**

Subcatchment 5: WS 5



Summary for Subcatchment 6: WS 6

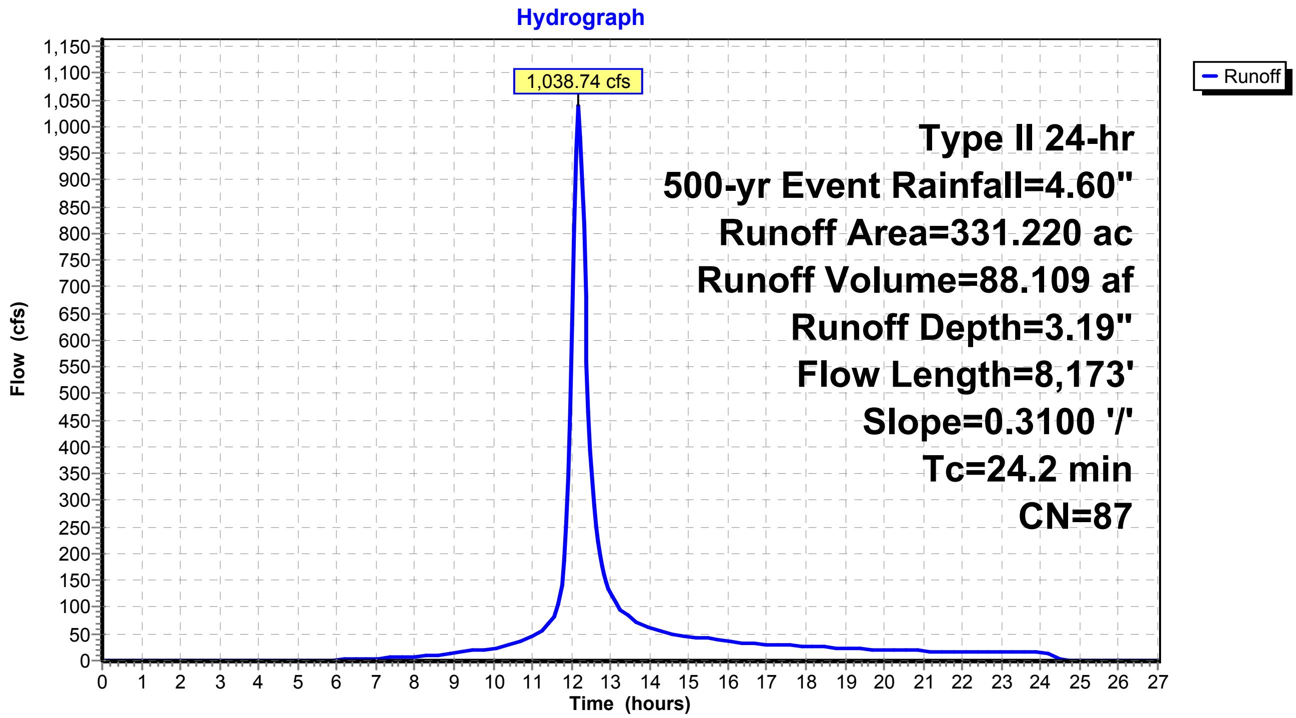
Runoff = 1,038.74 cfs @ 12.17 hrs, Volume= 88.109 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	298.100	86	Desert shrub range, Fair, HSG D
*	33.120	98	Impervious, HSG D
	331.220	87	Weighted Average
	298.100		90.00% Pervious Area
	33.120		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.2	8,173	0.3100	5.64		**Lag/CN Method,**

Subcatchment 6: WS 6



Summary for Subcatchment 7: WS 7

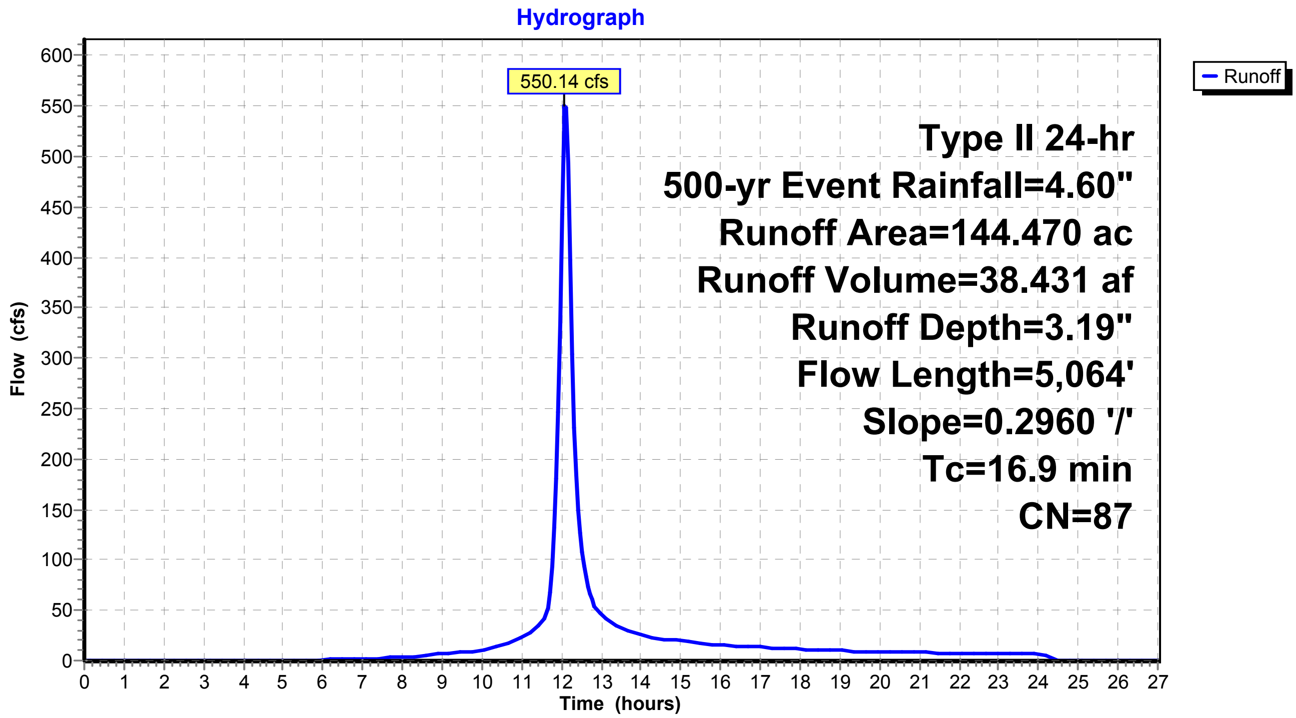
Runoff = 550.14 cfs @ 12.09 hrs, Volume= 38.431 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	130.020	86	Desert shrub range, Fair, HSG D
*	14.450	98	Impervious, HSG D
	144.470	87	Weighted Average
	130.020		90.00% Pervious Area
	14.450		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	5,064	0.2960	5.00		**Lag/CN Method,**

Subcatchment 7: WS 7



Summary for Subcatchment 8: WS 8

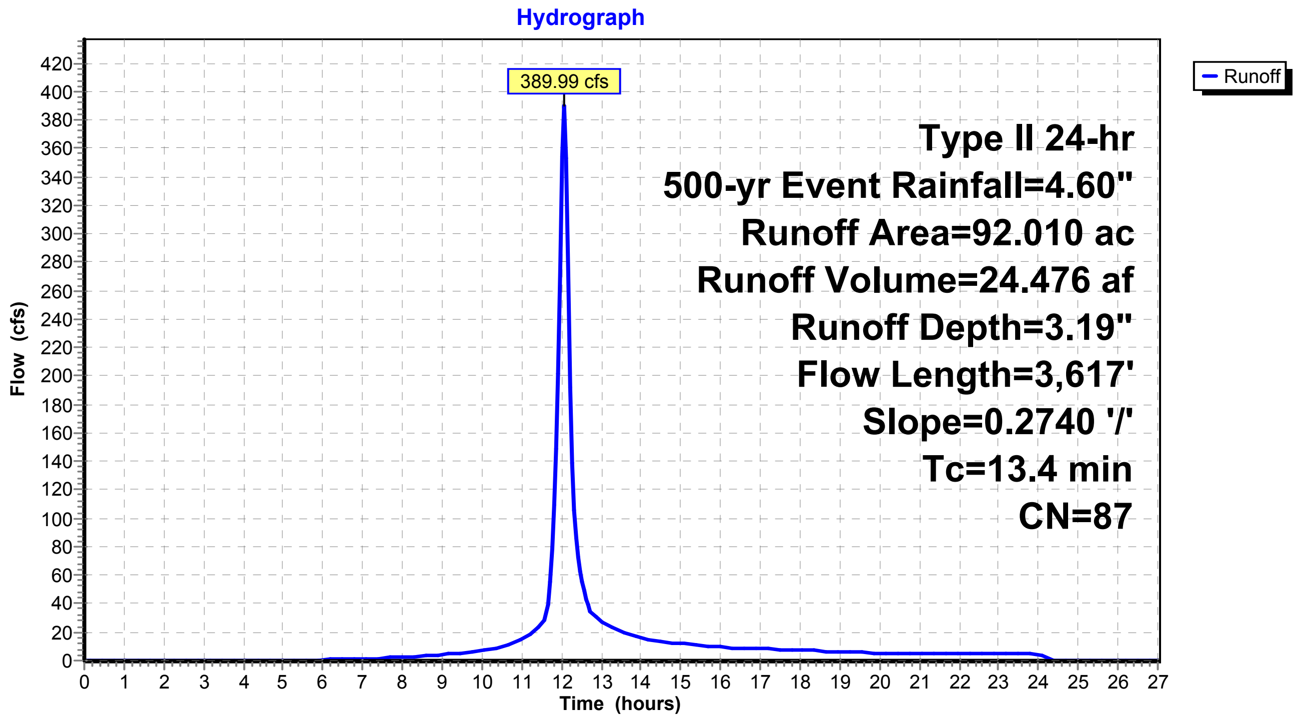
Runoff = 389.99 cfs @ 12.05 hrs, Volume= 24.476 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	82.810	86	Desert shrub range, Fair, HSG D
*	9.200	98	Impervious, HSG D
	92.010	87	Weighted Average
	82.810		90.00% Pervious Area
	9.200		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	3,617	0.2740	4.50		**Lag/CN Method,**

Subcatchment 8: WS 8



Summary for Subcatchment 9: WS 9

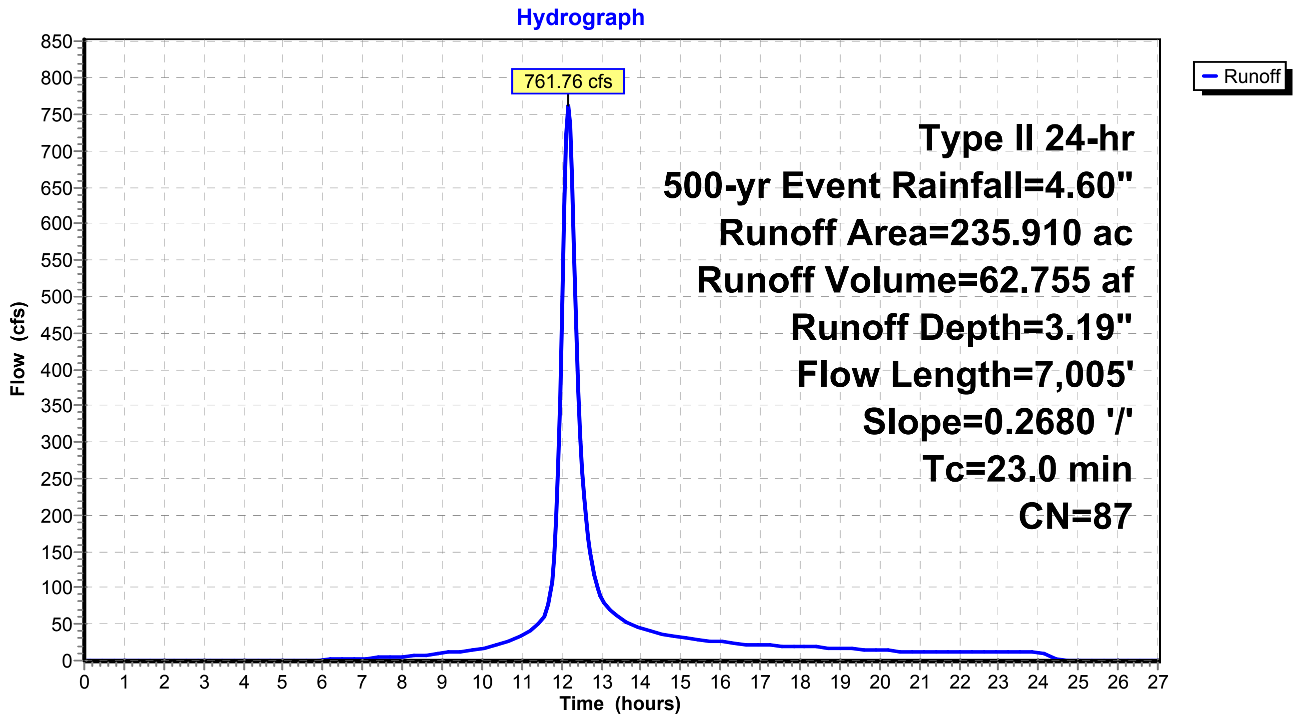
Runoff = 761.76 cfs @ 12.16 hrs, Volume= 62.755 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	212.320	86	Desert shrub range, Fair, HSG D
*	23.590	98	Impervious, HSG D
	235.910	87	Weighted Average
	212.320		90.00% Pervious Area
	23.590		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.0	7,005	0.2680	5.08		**Lag/CN Method,**

Subcatchment 9: WS 9



Summary for Subcatchment 10: WS 10

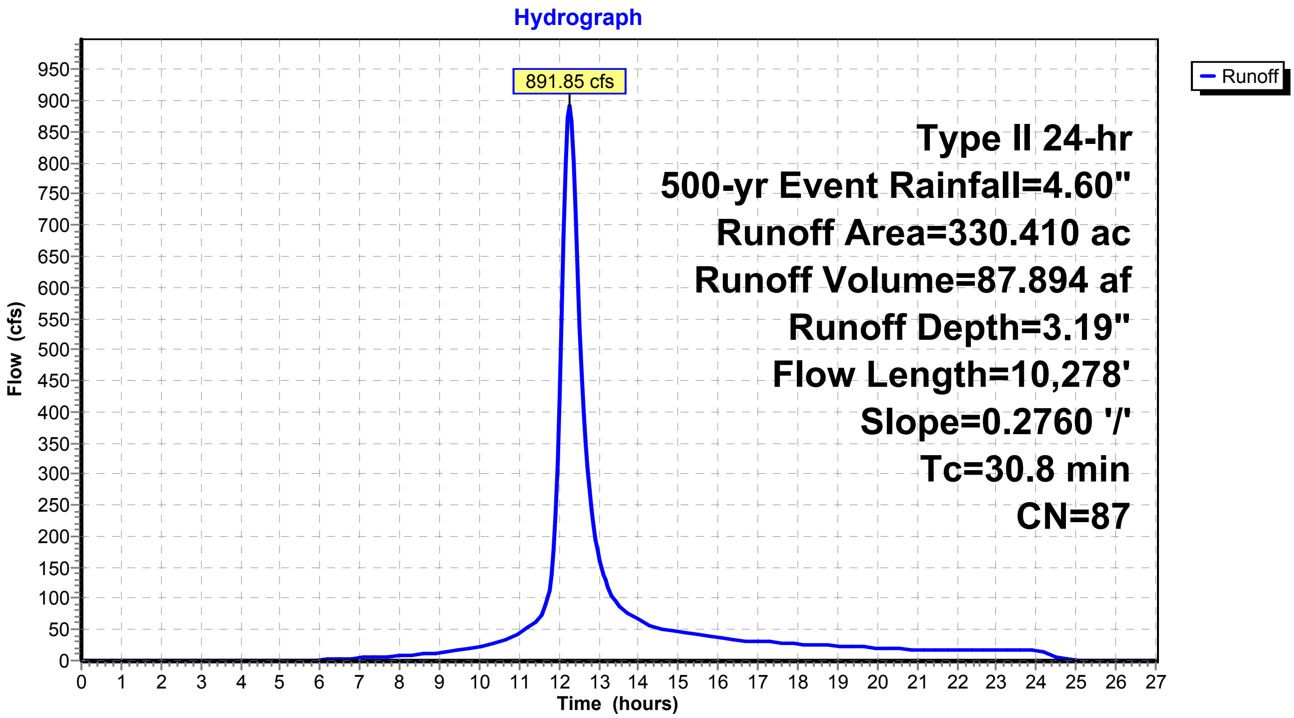
Runoff = 891.85 cfs @ 12.25 hrs, Volume= 87.894 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	297.370	86	Desert shrub range, Fair, HSG D
*	33.040	98	Impervious, HSG D
	330.410	87	Weighted Average
	297.370		90.00% Pervious Area
	33.040		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.8	10,278	0.2760	5.57		**Lag/CN Method,**

Subcatchment 10: WS 10



Summary for Subcatchment 11: WS 11

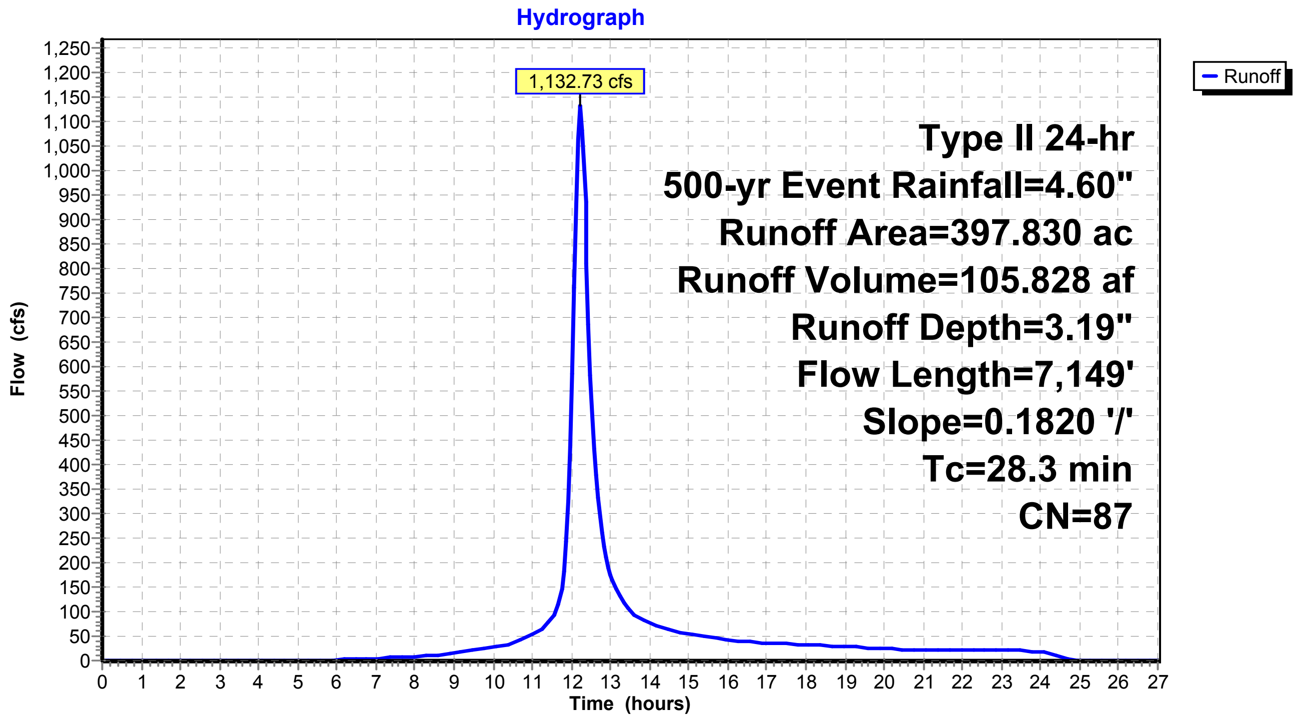
Runoff = 1,132.73 cfs @ 12.22 hrs, Volume= 105.828 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	358.050	86	Desert shrub range, Fair, HSG D
*	39.780	98	Impervious, HSG D
	397.830	87	Weighted Average
	358.050		90.00% Pervious Area
	39.780		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	7,149	0.1820	4.20		**Lag/CN Method,**

Subcatchment 11: WS 11



Summary for Subcatchment 12: WS 12

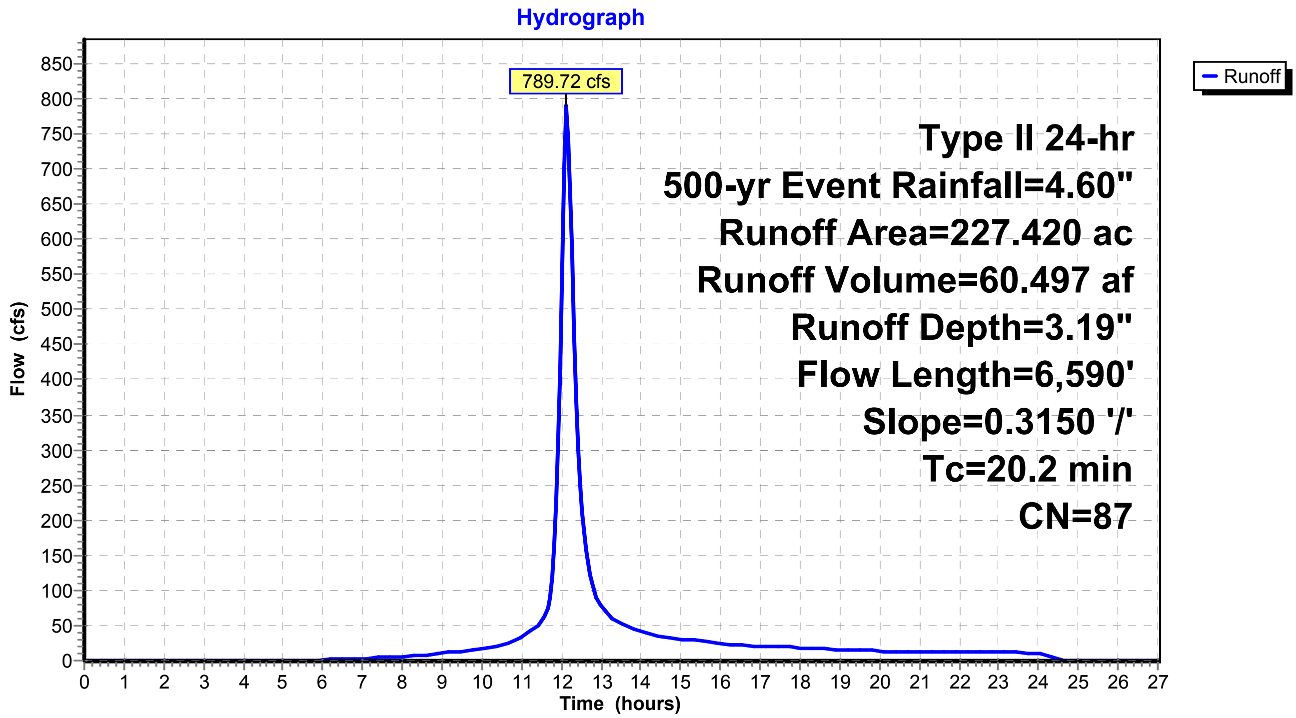
Runoff = 789.72 cfs @ 12.12 hrs, Volume= 60.497 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	204.680	86	Desert shrub range, Fair, HSG D
*	22.740	98	Impervious, HSG D
	227.420	87	Weighted Average
	204.680		90.00% Pervious Area
	22.740		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	6,590	0.3150	5.44		**Lag/CN Method,**

Subcatchment 12: WS 12



Summary for Subcatchment 13: WS 13

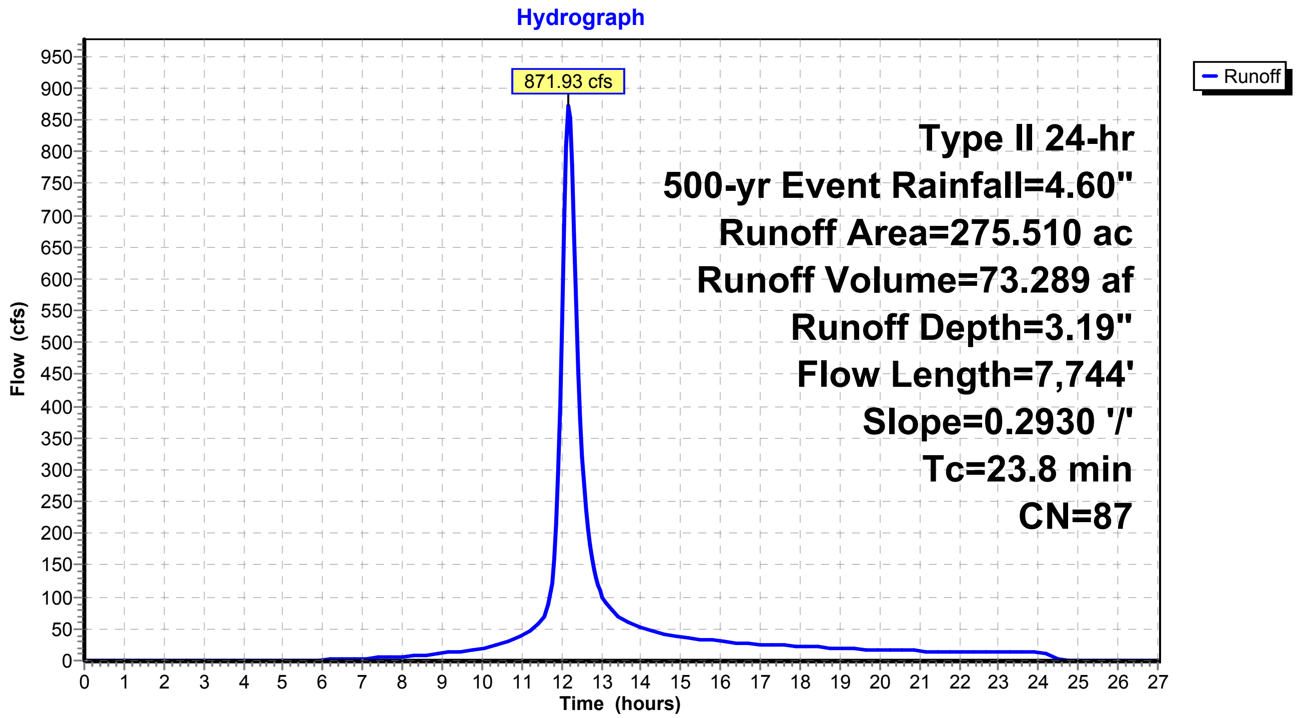
Runoff = 871.93 cfs @ 12.16 hrs, Volume= 73.289 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Type II 24-hr 500-yr Event Rainfall=4.60"

	Area (ac)	CN	Description
	247.960	86	Desert shrub range, Fair, HSG D
*	27.550	98	Impervious, HSG D
	275.510	87	Weighted Average
	247.960		90.00% Pervious Area
	27.550		10.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.8	7,744	0.2930	5.42		**Lag/CN Method,**

Subcatchment 13: WS 13



Summary for Reach CHNL 1: Channel 1

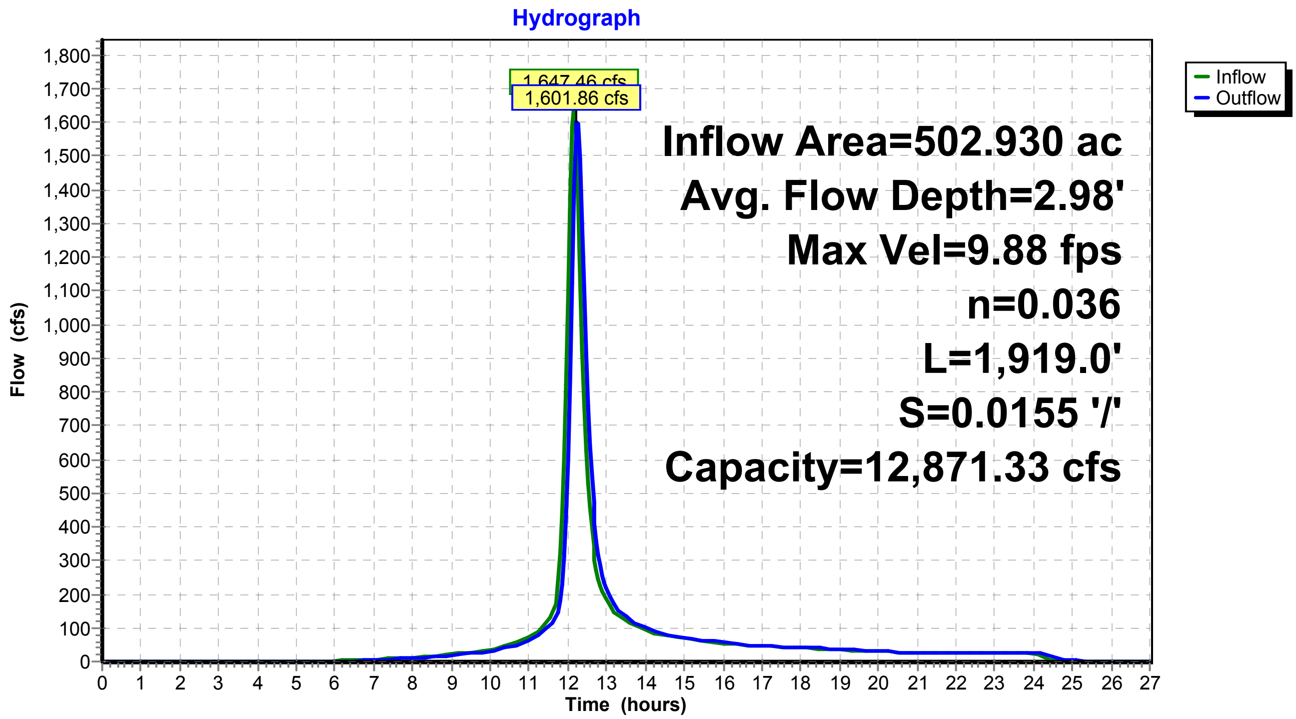
Inflow Area = 502.930 ac, 10.00% Impervious, Inflow Depth = 3.19" for 500-yr Event event
Inflow = 1,647.46 cfs @ 12.14 hrs, Volume= 133.786 af
Outflow = 1,601.86 cfs @ 12.23 hrs, Volume= 133.784 af, Atten= 3%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.88 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 2.42 fps, Avg. Travel Time= 13.2 min

Peak Storage= 311,381 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.98'
Bank-Full Depth= 10.00' Flow Area= 650.0 sf, Capacity= 12,871.33 cfs

50.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 80.00'
Length= 1,919.0' Slope= 0.0155 '/'
Inlet Invert= 5,569.50', Outlet Invert= 5,539.70'

Reach CHNL 1: Channel 1



Summary for Reach CHNL 2: Channel 2

Inflow Area = 870.220 ac, 10.00% Impervious, Inflow Depth = 3.19" for 500-yr Event event
Inflow = 2,597.10 cfs @ 12.14 hrs, Volume= 231.491 af
Outflow = 2,180.53 cfs @ 12.45 hrs, Volume= 231.028 af, Atten= 16%, Lag= 18.9 min

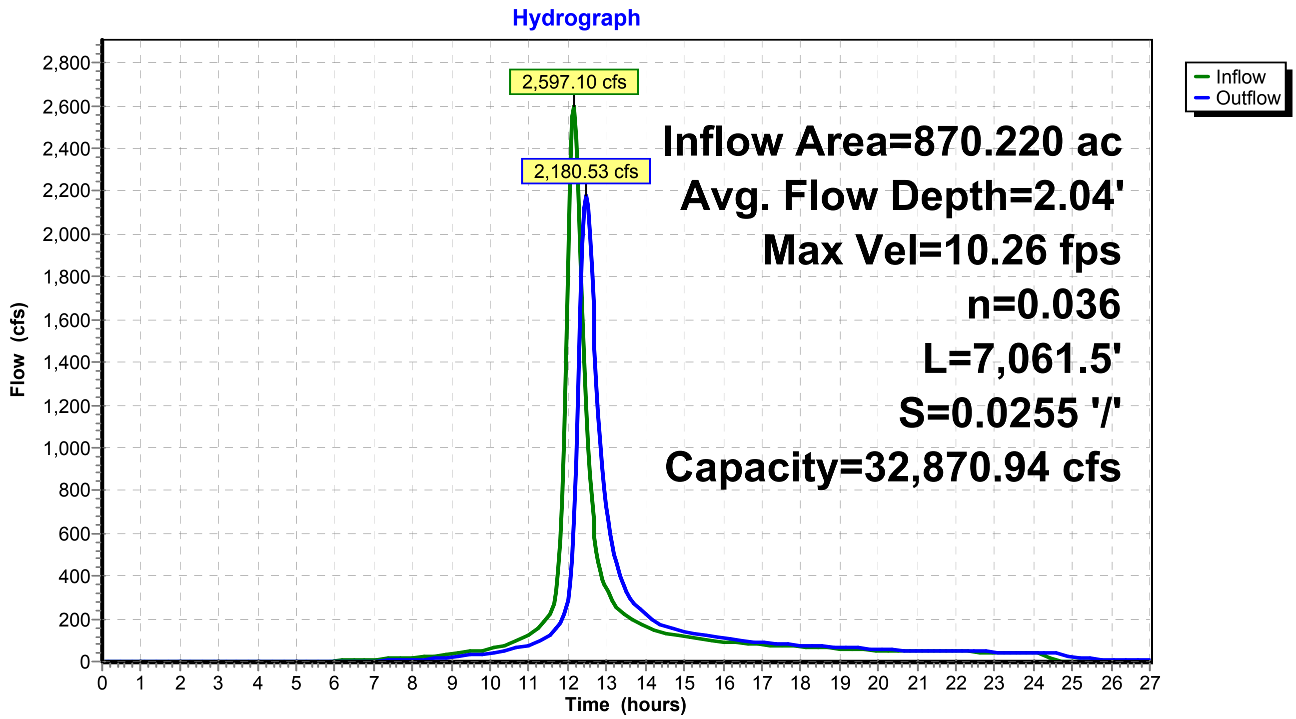
Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.26 fps, Min. Travel Time= 11.5 min
Avg. Velocity = 2.72 fps, Avg. Travel Time= 43.2 min

Peak Storage= 1,506,746 cf @ 12.26 hrs
Average Depth at Peak Storage= 2.04'
Bank-Full Depth= 10.00' Flow Area= 1,225.0 sf, Capacity= 32,870.94 cfs

100.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 2.5 2.0 '/' Top Width= 145.00'
Length= 7,061.5' Slope= 0.0255 '/'
Inlet Invert= 5,720.00', Outlet Invert= 5,539.70'

‡

Reach CHNL 2: Channel 2



Summary for Reach CHNL 3: Channel 3

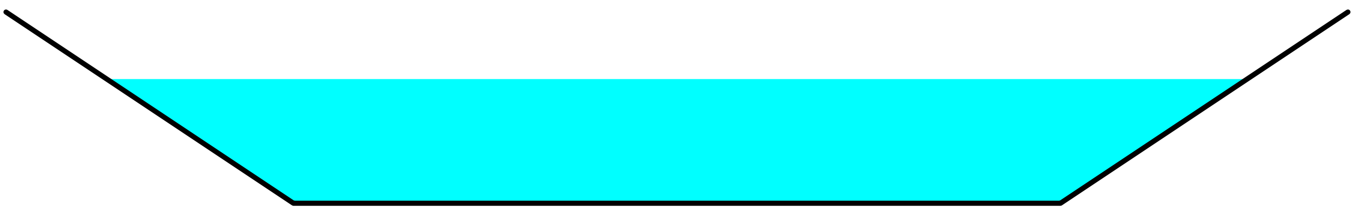
[62] Hint: Exceeded Reach CHNL 1 OUTLET depth by 4.30' @ 12.45 hrs
[62] Hint: Exceeded Reach CHNL 2 OUTLET depth by 4.53' @ 12.35 hrs

Inflow Area = 2,233.990 ac, 10.00% Impervious, Inflow Depth > 3.19" for 500-yr Event event
Inflow = 5,094.93 cfs @ 12.28 hrs, Volume= 593.807 af
Outflow = 5,008.23 cfs @ 12.40 hrs, Volume= 593.385 af, Atten= 2%, Lag= 6.9 min

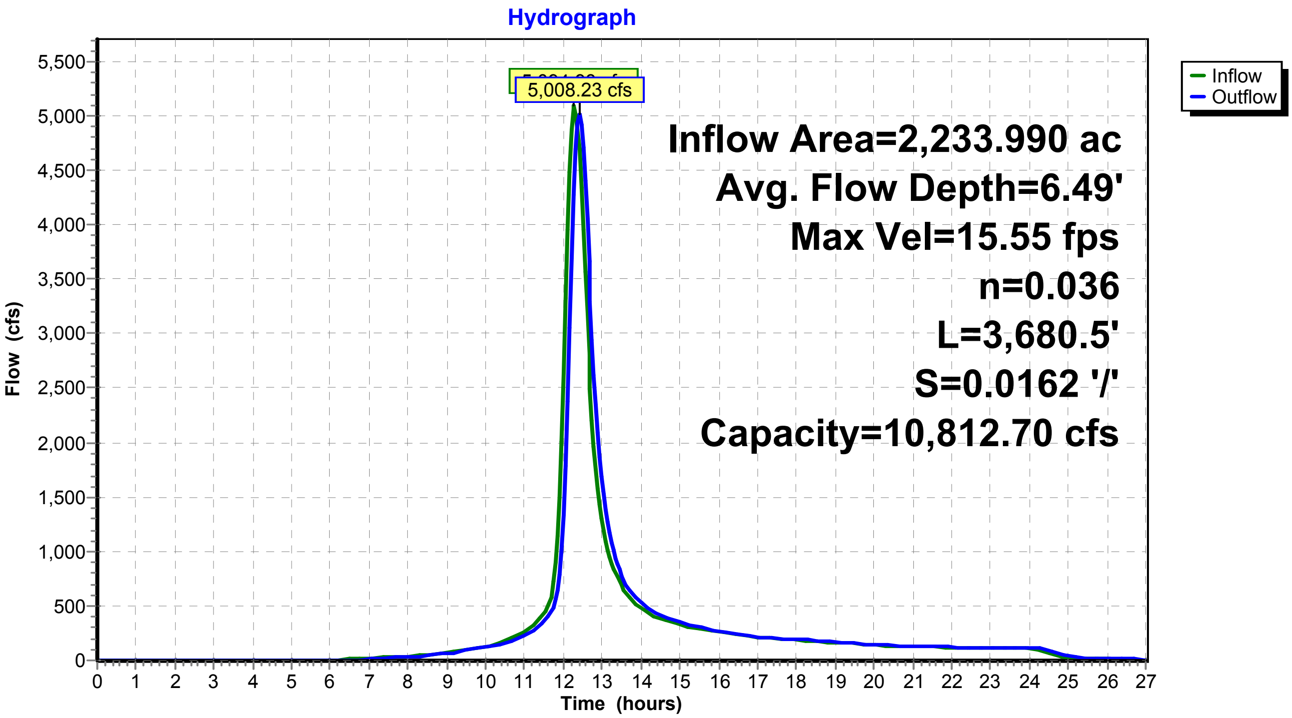
Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 15.55 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 4.58 fps, Avg. Travel Time= 13.4 min

Peak Storage= 1,188,451 cf @ 12.33 hrs
Average Depth at Peak Storage= 6.49'
Bank-Full Depth= 10.00' Flow Area= 550.0 sf, Capacity= 10,812.70 cfs

40.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 70.00'
Length= 3,680.5' Slope= 0.0162 '/'
Inlet Invert= 5,539.70', Outlet Invert= 5,480.00'



Reach CHNL 3: Channel 3



Summary for Reach CHNL 4: Channel 4

[61] Hint: Exceeded Reach CHNL 3 outlet invert by 4.57' @ 12.40 hrs

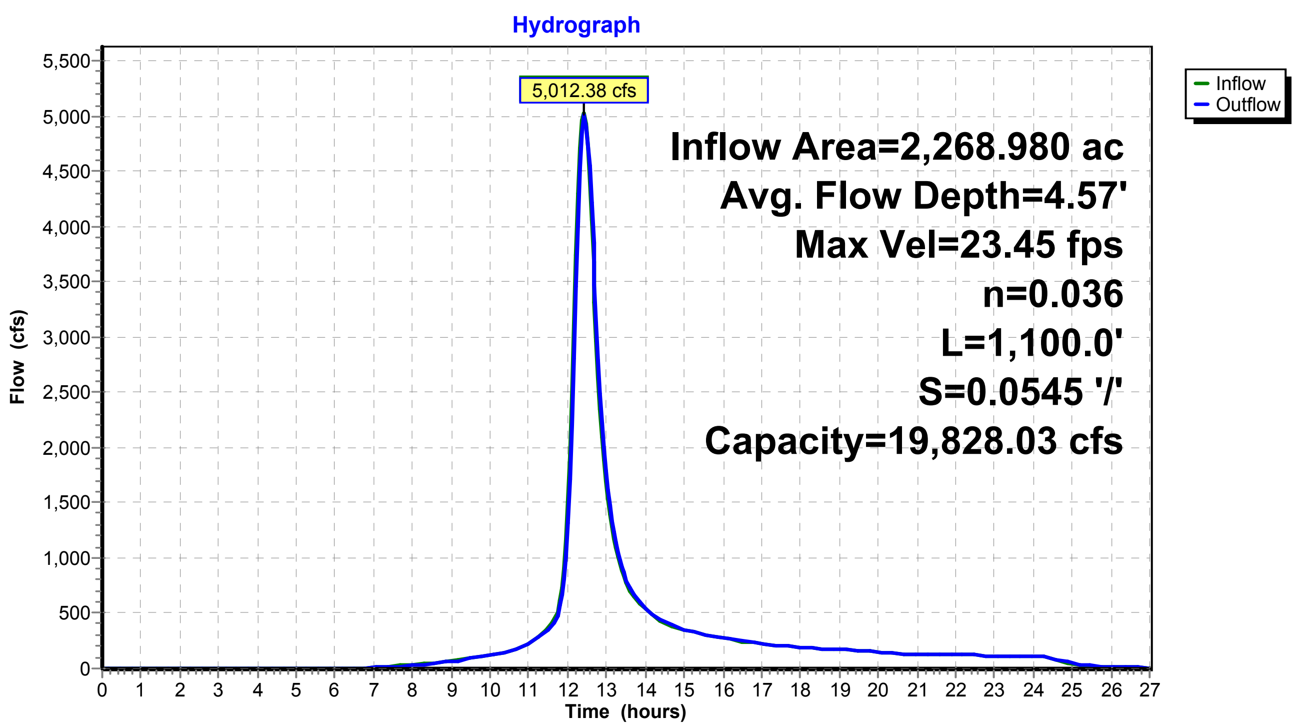
Inflow Area = 2,268.980 ac, 10.00% Impervious, Inflow Depth > 3.19" for 500-yr Event event
Inflow = 5,028.84 cfs @ 12.40 hrs, Volume= 602.692 af
Outflow = 5,012.38 cfs @ 12.42 hrs, Volume= 602.599 af, Atten= 0%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 23.45 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 6.76 fps, Avg. Travel Time= 2.7 min

Peak Storage= 235,792 cf @ 12.41 hrs
Average Depth at Peak Storage= 4.57'
Bank-Full Depth= 10.00' Flow Area= 550.0 sf, Capacity= 19,828.03 cfs

40.00' x 10.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 70.00'
Length= 1,100.0' Slope= 0.0545 '/'
Inlet Invert= 5,480.00', Outlet Invert= 5,420.00'

Reach CHNL 4: Channel 4



Summary for Reach CHNL 5: Channel 5

[62] Hint: Exceeded Reach CHNL 4 OUTLET depth by 2.92' @ 12.50 hrs

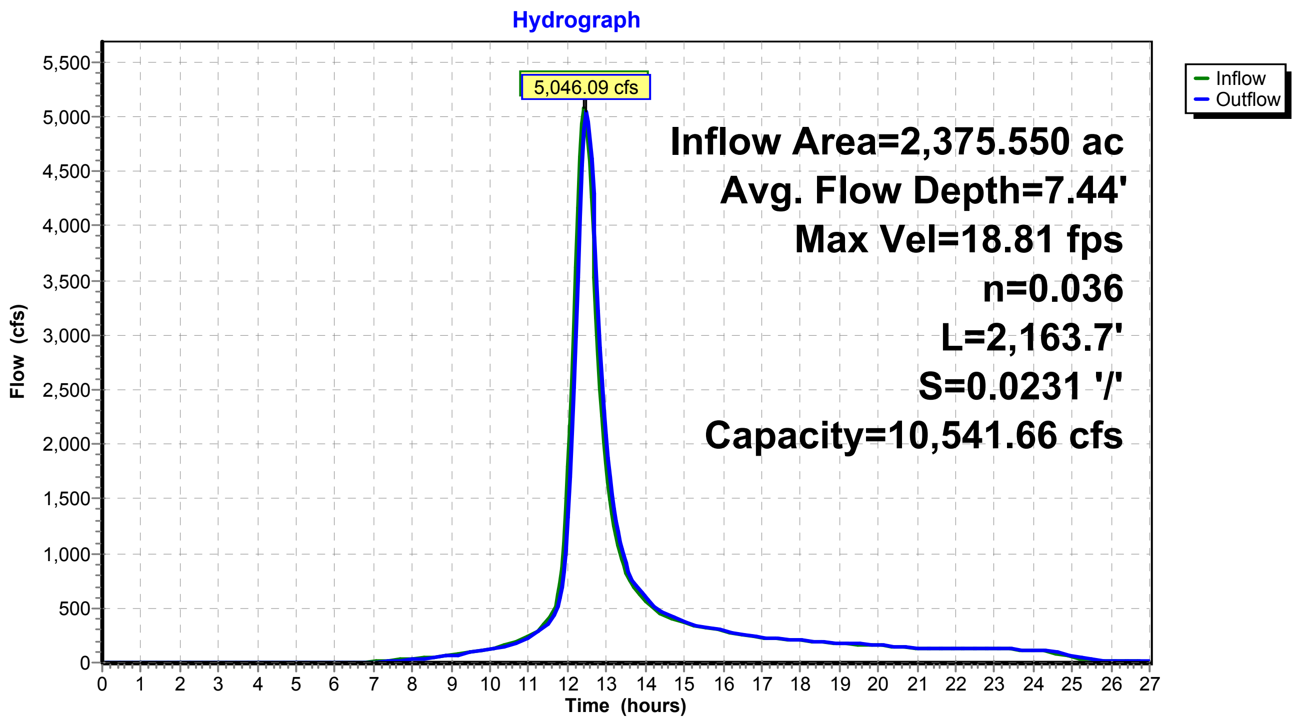
Inflow Area = 2,375.550 ac, 10.00% Impervious, Inflow Depth > 3.19" for 500-yr Event event
Inflow = 5,080.00 cfs @ 12.42 hrs, Volume= 630.949 af
Outflow = 5,046.09 cfs @ 12.47 hrs, Volume= 630.724 af, Atten= 1%, Lag= 3.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Max. Velocity= 18.81 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 6.05 fps, Avg. Travel Time= 6.0 min

Peak Storage= 582,162 cf @ 12.44 hrs
Average Depth at Peak Storage= 7.44'
Bank-Full Depth= 11.00' Flow Area= 456.5 sf, Capacity= 10,541.66 cfs

25.00' x 11.00' deep channel, n= 0.036
Side Slope Z-value= 1.5 '/' Top Width= 58.00'
Length= 2,163.7' Slope= 0.0231 '/'
Inlet Invert= 5,420.00', Outlet Invert= 5,370.00'

Reach CHNL 5: Channel 5



Summary for Pond CLVT 1: Culvert Crossing #1

[62] Hint: Exceeded Reach CHNL 5 OUTLET depth by 21.32' @ 12.80 hrs

Inflow Area = 2,375.550 ac, 10.00% Impervious, Inflow Depth > 3.19" for 500-yr Event event
Inflow = 5,046.09 cfs @ 12.47 hrs, Volume= 630.724 af
Outflow = 3,847.35 cfs @ 12.71 hrs, Volume= 630.580 af, Atten= 24%, Lag= 14.4 min
Primary = 3,847.35 cfs @ 12.71 hrs, Volume= 630.580 af

Routing by Stor-Ind method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Peak Elev= 5,397.29' @ 12.71 hrs Surf.Area= 0 sf Storage= 2,570,184 cf
Flood Elev= 5,419.00' Surf.Area= 0 sf Storage= 12,108,960 cf

Plug-Flow detention time= 5.1 min calculated for 629.414 af (100% of inflow)
Center-of-Mass det. time= 4.9 min (855.3 - 850.4)

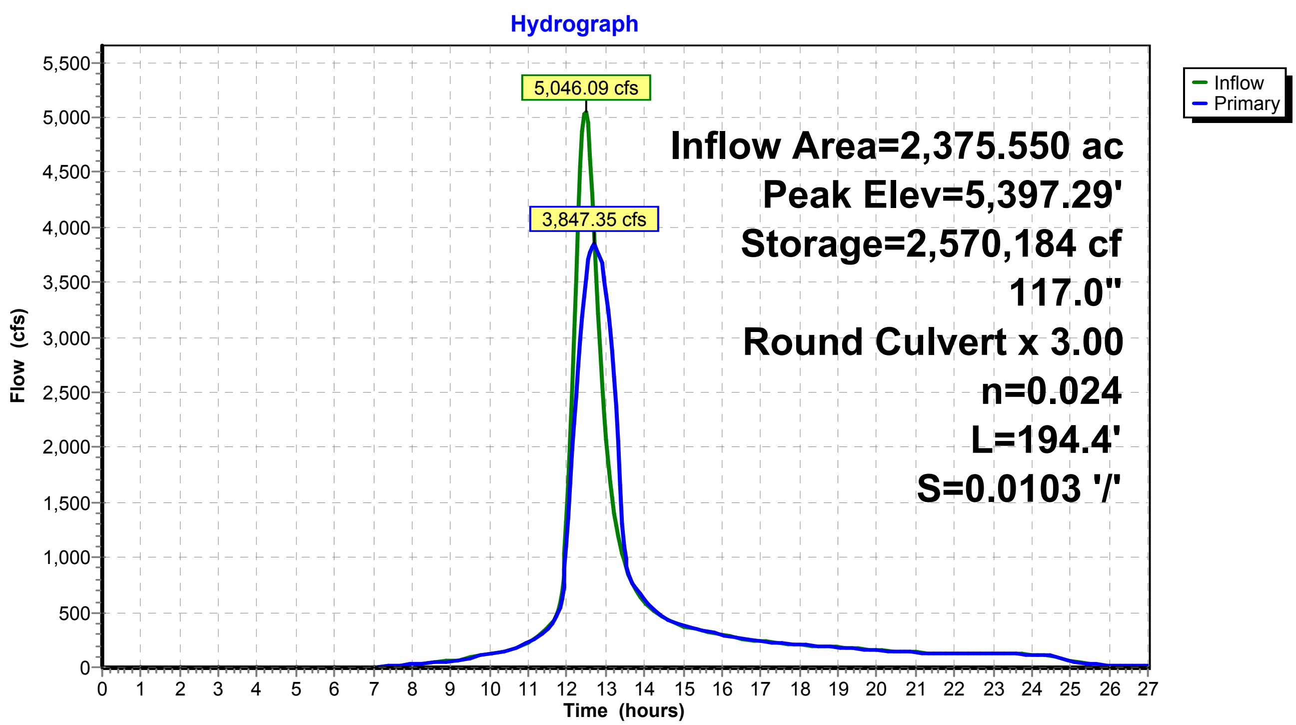
Volume	Invert	Avail.Storage	Storage Description
#1	5,370.00'	12,108,960 cf	**Culvert Crossing #1**Listed below

Elevation (feet)	Cum.Store (cubic-feet)
5,370.00	0
5,371.00	1,264
5,372.00	4,909
5,373.00	7,513
5,374.00	16,645
5,375.00	29,237
5,376.00	46,725
5,377.00	71,156
5,378.00	103,816
5,379.00	144,375
5,380.00	193,809
5,381.00	252,611
5,382.00	321,098
5,383.00	399,998
5,384.00	488,627
5,385.00	587,544
5,386.00	697,578
5,387.00	818,723
5,388.00	950,841
5,389.00	1,094,170
5,390.00	1,248,216
5,391.00	1,412,011
5,392.00	1,587,481
5,393.00	1,774,410
5,394.00	1,971,598
5,395.00	2,046,356
5,396.00	2,266,171
5,397.00	2,498,604
5,398.00	2,742,207
5,399.00	2,998,577
5,400.00	3,272,610
5,401.00	3,564,605
5,402.00	3,875,249
5,403.00	4,205,411
5,404.00	4,554,001
5,405.00	4,921,330
5,406.00	5,306,733
5,407.00	5,710,058
5,408.00	6,132,117
5,409.00	6,572,849
5,410.00	7,032,579
5,411.00	7,512,479
5,412.00	8,012,116
5,413.00	8,533,107
5,414.00	9,078,172
5,415.00	9,647,155
5,416.00	10,235,642
5,417.00	10,841,380
5,418.00	11,465,162
5,419.00	12,108,960

Device	Routing	Invert	Outlet Devices
#1	Primary	5,372.00'	**117.0" Round Culvert X 3.00** L= 194.4' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,372.00' / 5,370.00' S= 0.0103 '/' Cc= 0.900 n= 0.024, Flow Area= 74.66 sf

Primary OutFlow Max=3,844.98 cfs @ 12.71 hrs HW=5,397.27' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 3,844.98 cfs @ 17.17 fps)

Pond CLVT 1: Culvert Crossing #1



Summary for Pond CLVT 2: Culvert Crossing #2

[81] Warning: Exceeded Pond CLVT 1 by 17.33' @ 13.50 hrs

Inflow Area = 2,403.760 ac, 10.00% Impervious, Inflow Depth > 3.19" for 500-yr Event event
Inflow = 3,856.73 cfs @ 12.71 hrs, Volume= 638.084 af
Outflow = 1,791.19 cfs @ 13.33 hrs, Volume= 638.031 af, Atten= 54%, Lag= 37.4 min
Primary = 1,791.19 cfs @ 13.33 hrs, Volume= 638.031 af

Routing by Stor-Ind method, Time Span= 0.00-27.00 hrs, dt= 0.05 hrs
Peak Elev= 5,396.71' @ 13.33 hrs Surf.Area= 0 sf Storage= 8,137,086 cf
Flood Elev= 5,403.00' Surf.Area= 0 sf Storage= 10,142,539 cf

Plug-Flow detention time= 36.3 min calculated for 636.852 af (100% of inflow)
Center-of-Mass det. time= 36.2 min (890.9 - 854.7)

Volume	Invert	Avail.Storage	Storage Description
#1	5,352.00'	10,142,539 cf	**Existing Pond** Listed below

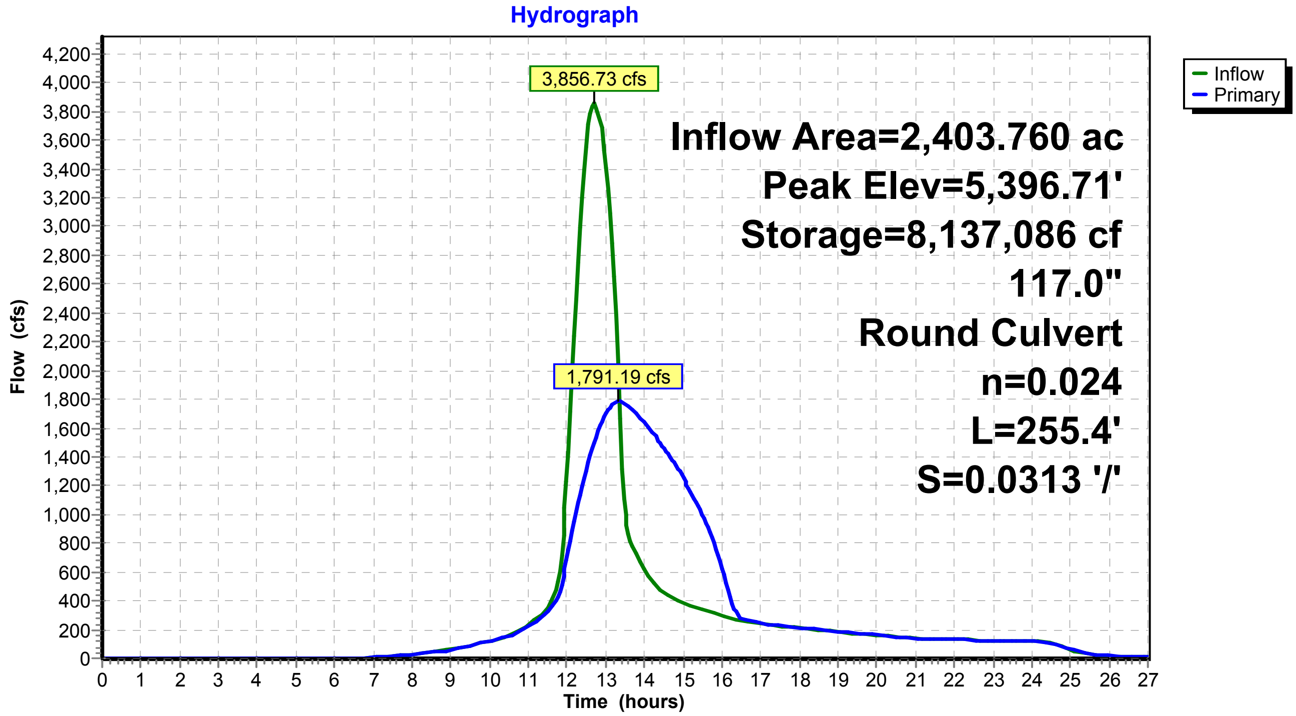
Elevation (feet)	Cum.Store (cubic-feet)
5,352.00	0
5,353.00	2,681
5,354.00	7,382
5,355.00	15,397
5,356.00	28,286
5,357.00	47,224
5,358.00	75,773
5,359.00	117,133
5,360.00	170,345
5,361.00	235,331
5,362.00	312,331
5,363.00	399,765
5,364.00	497,494
5,365.00	605,663
5,366.00	724,610
5,367.00	855,928
5,368.00	1,000,315
5,369.00	1,157,122
5,370.00	1,325,832
5,371.00	1,505,243
5,372.00	1,693,878
5,373.00	1,890,808
5,374.00	2,095,234
5,375.00	2,306,959
5,376.00	2,525,755
5,377.00	2,751,367
5,378.00	2,983,426
5,379.00	3,221,478
5,380.00	3,465,168
5,381.00	3,714,247
5,382.00	3,968,434
5,383.00	4,227,291
5,384.00	4,490,405
5,385.00	4,757,518
5,386.00	5,028,418
5,387.00	5,302,894
5,388.00	5,580,732
5,389.00	5,861,867
5,390.00	6,146,219
5,391.00	6,433,776
5,392.00	6,724,543
5,393.00	7,018,534
5,394.00	7,315,762
5,395.00	7,616,273
5,396.00	7,920,106
5,397.00	8,227,290
5,398.00	8,537,855
5,399.00	8,851,826
5,400.00	9,169,229
5,401.00	9,490,117

5,402.00	9,814,540
5,403.00	10,142,539

Device	Routing	Invert	Outlet Devices
#1	Primary	5,352.00'	**117.0" Round Culvert** L= 255.4' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 5,352.00' / 5,344.00' S= 0.0313 '/' Cc= 0.900 n= 0.024, Flow Area= 74.66 sf

Primary OutFlow Max=1,790.68 cfs @ 13.33 hrs HW=5,396.68' (Free Discharge)
↑—1=Culvert (Inlet Controls 1,790.68 cfs @ 23.98 fps)

Pond CLVT 2: Culvert Crossing #2



APPENDIX E

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 3552.39 cfs

Maximum Flow: 3552.39 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing #1 (Q100)

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5379.00	0.00	0.00	0.00	1
5379.14	355.24	355.24	0.00	1
5379.56	710.48	710.48	0.00	1
5380.24	1065.72	1065.72	0.00	1
5381.15	1420.96	1420.96	0.00	1
5382.25	1776.19	1776.19	0.00	1
5383.46	2131.43	2131.43	0.00	1
5384.93	2486.67	2486.67	0.00	1
5386.88	2841.91	2841.91	0.00	1
5389.10	3197.15	3197.15	0.00	1
5391.64	3552.39	3552.39	0.00	1
5419.00	6067.40	6067.40	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	5379.00	0.000	7.000	0-NF	0.000	0.000	9.000	9.000	0.000
	355.24	355.24	5379.14	3.732	7.141	1-S1t	2.429	2.542	9.000	9.000	1.661
	710.48	710.48	5379.56	5.429	7.560	1-S1t	3.514	3.636	9.000	9.000	3.322
	1065.72	1065.72	5380.24	6.895	8.241	1-S1t	4.391	4.498	9.000	9.000	4.983
	1420.96	1420.96	5381.15	8.285	9.153	1-S1t	5.196	5.224	9.000	9.000	6.645
	1776.19	1776.19	5382.25	9.701	10.246	7-M1t	5.989	5.872	9.000	9.000	8.221
	2131.43	2131.43	5383.46	11.227	11.459	7-M1t	6.823	6.452	9.000	9.000	9.865
	2486.67	2486.67	5384.93	12.934	12.754	7-M1t	7.797	6.982	9.000	9.000	11.509
	2841.91	2841.91	5386.88	14.878	14.187	3-M2t	9.750	7.458	9.000	9.000	13.153
	3197.15	3197.15	5389.10	17.102	16.162	7-M2t	9.750	7.882	9.000	9.000	14.797
	3552.39	3552.39	5391.64	19.638	18.453	7-M2t	9.750	8.252	9.000	9.000	16.441

****

Straight Culvert

Inlet Elevation (invert): 5372.00 ft, Outlet Elevation (invert): 5370.00 ft

Culvert Length: 194.41 ft, Culvert Slope: 0.0103

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5372.00 ft

Outlet Station: 194.40 ft

Outlet Elevation: 5370.00 ft

Number of Barrels: 3

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 9.75 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Crossing #1 (Q100))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	5379.00	9.00
355.24	5379.00	9.00
710.48	5379.00	9.00
1065.72	5379.00	9.00
1420.96	5379.00	9.00
1776.19	5379.00	9.00
2131.43	5379.00	9.00
2486.67	5379.00	9.00
2841.91	5379.00	9.00
3197.15	5379.00	9.00
3552.39	5379.00	9.00

Tailwater Channel Data - Crossing #1 (Q100)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 5379.00 ft

Roadway Data for Crossing: Crossing #1 (Q100)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 60.00 ft

Crest Elevation: 5419.00 ft

Roadway Surface: Paved

Roadway Top Width: 57.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 4191.95 cfs

Maximum Flow: 4191.95 cfs

Table 4 - Summary of Culvert Flows at Crossing: Crossing #1 (Q200)

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5379.00	0.00	0.00	0.00	1
5379.20	419.19	419.19	0.00	1
5379.78	838.39	838.39	0.00	1
5380.71	1257.59	1257.59	0.00	1
5381.93	1676.78	1676.78	0.00	1
5383.33	2095.97	2095.97	0.00	1
5385.08	2515.17	2515.17	0.00	1
5387.43	2934.36	2934.36	0.00	1
5390.18	3353.56	3353.56	0.00	1
5393.38	3772.76	3772.76	0.00	1
5397.05	4191.95	4191.95	0.00	1
5419.00	6067.40	6067.40	0.00	Overtopping

Table 5 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	5379.00	0.000	7.000	0-NF	0.000	0.000	9.000	9.000	0.000
	419.19	419.19	5379.20	4.077	7.197	1-S1t	2.671	2.769	9.000	9.000	1.960
	838.39	838.39	5379.78	5.973	7.777	1-S1t	3.833	3.962	9.000	9.000	3.920
	1257.59	1257.59	5380.71	7.648	8.708	1-S1t	4.827	4.903	9.000	9.000	5.881
	1676.78	1676.78	5381.93	9.297	9.926	7-M1t	5.767	5.696	9.000	9.000	7.761
	2095.97	2095.97	5383.33	11.067	11.334	7-M1t	6.738	6.397	9.000	9.000	9.701
	2515.17	2515.17	5385.08	13.080	12.862	7-M1t	7.879	7.022	9.000	9.000	11.641
	2934.36	2934.36	5387.43	15.428	14.613	3-M2t	9.750	7.573	9.000	9.000	13.581
	3353.56	3353.56	5390.18	18.179	17.154	7-M2t	9.750	8.052	9.000	9.000	15.521
	3772.76	3772.76	5393.38	21.377	19.962	7-M2t	9.750	8.453	9.000	9.000	17.461
	4191.95	4191.95	5397.05	25.048	23.060	7-M2t	9.750	8.776	9.000	9.000	19.402

****

Straight Culvert

Inlet Elevation (invert): 5372.00 ft, Outlet Elevation (invert): 5370.00 ft

Culvert Length: 194.41 ft, Culvert Slope: 0.0103

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5372.00 ft

Outlet Station: 194.40 ft

Outlet Elevation: 5370.00 ft

Number of Barrels: 3

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 9.75 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Crossing #1 (Q200))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	5379.00	9.00
419.19	5379.00	9.00
838.39	5379.00	9.00
1257.59	5379.00	9.00
1676.78	5379.00	9.00
2095.97	5379.00	9.00
2515.17	5379.00	9.00
2934.36	5379.00	9.00
3353.56	5379.00	9.00
3772.76	5379.00	9.00
4191.95	5379.00	9.00

Tailwater Channel Data - Crossing #1 (Q200)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 5379.00 ft

Roadway Data for Crossing: Crossing #1 (Q200)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 60.00 ft

Crest Elevation: 5419.00 ft

Roadway Surface: Paved

Roadway Top Width: 57.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 5046.09 cfs

Maximum Flow: 5046.09 cfs

Table 7 - Summary of Culvert Flows at Crossing: Crossing #1 (Q500)

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5379.00	0.00	0.00	0.00	1
5379.28	504.61	504.61	0.00	1
5380.12	1009.22	1009.22	0.00	1
5381.42	1513.83	1513.83	0.00	1
5383.06	2018.44	2018.44	0.00	1
5385.12	2523.05	2523.05	0.00	1
5388.00	3027.65	3027.65	0.00	1
5391.49	3532.26	3532.26	0.00	1
5395.63	4036.87	4036.87	0.00	1
5400.48	4541.48	4541.48	0.00	1
5406.01	5046.09	5046.09	0.00	1
5419.00	6067.41	6067.41	0.00	Overtopping

Table 8 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	0.00	0.00	5379.00	0.000	7.000	0-NF	0.000	0.000	9.000	9.000	0.000
	504.61	504.61	5379.28	4.496	7.284	1-S1t	2.918	3.045	9.000	9.000	2.360
	1009.22	1009.22	5380.12	6.670	8.116	1-S1t	4.252	4.370	9.000	9.000	4.719
	1513.83	1513.83	5381.42	8.649	9.424	3-M1t	5.404	5.401	9.000	9.000	7.006
	2018.44	2018.44	5383.06	10.725	11.064	7-M1t	6.552	6.274	9.000	9.000	9.342
	2523.05	2523.05	5385.12	13.121	12.892	7-M1t	7.902	7.033	9.000	9.000	11.677
	3027.65	3027.65	5388.00	16.003	15.097	3-M2t	9.750	7.686	9.000	9.000	14.013
	3532.26	3532.26	5391.49	19.485	18.319	7-M2t	9.750	8.233	9.000	9.000	16.348
	4036.87	4036.87	5395.63	23.634	21.878	7-M2t	9.750	8.665	9.000	9.000	18.684
	4541.48	4541.48	5400.48	28.477	25.882	7-M2t	9.750	8.986	9.000	9.000	21.019
	5046.09	5046.09	5406.01	34.012	30.317	7-M2c	9.750	9.218	9.218	9.000	23.018

****

Straight Culvert

Inlet Elevation (invert): 5372.00 ft,   Outlet Elevation (invert): 5370.00 ft

Culvert Length: 194.41 ft,   Culvert Slope: 0.0103

****

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5372.00 ft

Outlet Station: 194.40 ft

Outlet Elevation: 5370.00 ft

Number of Barrels: 3

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 9.75 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Crossing #1 (Q500))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	5379.00	9.00
504.61	5379.00	9.00
1009.22	5379.00	9.00
1513.83	5379.00	9.00
2018.44	5379.00	9.00
2523.05	5379.00	9.00
3027.65	5379.00	9.00
3532.26	5379.00	9.00
4036.87	5379.00	9.00
4541.48	5379.00	9.00
5046.09	5379.00	9.00

Tailwater Channel Data - Crossing #1 (Q500)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 5379.00 ft

Roadway Data for Crossing: Crossing #1 (Q500)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 60.00 ft

Crest Elevation: 5419.00 ft

Roadway Surface: Paved

Roadway Top Width: 57.00 ft

APPENDIX E

Revision 1

WATER-QUALITY MONITORING PLAN FOR THE COPPER FLAT MINE DISCHARGE PERMIT PURSUANT TO 20.6.7.11.R AND 20.6.7.28 NMAC

prepared by

Steven T. Finch, Jr., CPG, PG

Annie M. McCoy, CPG

JOHN SHOMAKER & ASSOCIATES, INC.
Water-Resource and Environmental Consultants
2611 Broadbent Parkway NE
Albuquerque, New Mexico 87107
505-345-3407
www.shomaker.com

prepared for

New Mexico Copper Corporation
4253 Montgomery Boulevard NE, Suite 130
Albuquerque, New Mexico 87109

June 2016

APPENDIX E

Revision 1

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June 2016

Certified Professional Geologist Seal

This report documents the work of the following Certified Professional Geologist:

Steven T. Finch, Jr., CPG, PG
Mr. Finch, Principal Hydrogeologist-Geochemist, was the Project Manager for this work and was responsible for preparing this report.

Signature

June 17, 2016
Date

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WATER-QUALITY MONITORING PLAN FOR THE COPPER FLAT MINE DISCHARGE PERMIT, PURSUANT TO 20.6.7.11.R AND 20.6.7.28 NMAC

1.0 INTRODUCTION

John Shomaker & Associates, Inc. (JSAI) has prepared this Water-Quality Monitoring Plan and has identified certain existing monitoring wells at the site in combination with proposed monitoring wells to comprise a monitoring well network to monitor water quality at Copper Flat Mine to fulfill the requirements of 20.6.7.11.R and 20.6.7.28 NMAC. The monitoring well network is based on the requirements set forth in 20.6.7.28 NMAC and takes into account surface topography, hydrogeologic conditions, geologic controls, infrastructure, engineering design plans, depth to groundwater, safe working distance, and land ownership.

The proposed mine facilities and well network locations are shown on Figure 1. The units of the mine facility that will be monitored include the following:

1. open pit
2. Waste Rock Stockpiles (WRSP)
3. Tailings Storage Facility (TSF) including the Tailings Impoundment, Underground Collection Pond, and Surge Pond
4. Process Water Reservoir
5. Impact Stormwater Impoundments A, B and C

Figure 1 also identifies inset Figures 4, 5, and 6. These figures show in more detail, areas of the site and the attendant monitoring network for each area. A checklist of 20.6.7.28 NMAC water-quality monitoring requirements is presented as Table 1 with a cross reference to corresponding report section. The monitoring plan is organized in a manner such that each component of the plan is identified together with the relevant regulatory requirement as outlined in Table 1.

The groundwater monitoring network will utilize certain existing monitoring wells and proposed new monitoring wells. The open pit surface drainage area, shown on Figure 1, is based on the depicted land surface contours. The land surface contours are based on current topographic features with some modifications that will take place at the beginning of mining (e.g., haul road improvements).

The well network locations, existing and proposed, were selected based on the groundwater-flow direction established during Baseline Data collection and Stage 1 Abatement data collection. Other than the area around the existing open pit, which is a hydraulic sink, the groundwater-flow direction is west-to-east. Figure 2 shows the direction of groundwater flow below the site.

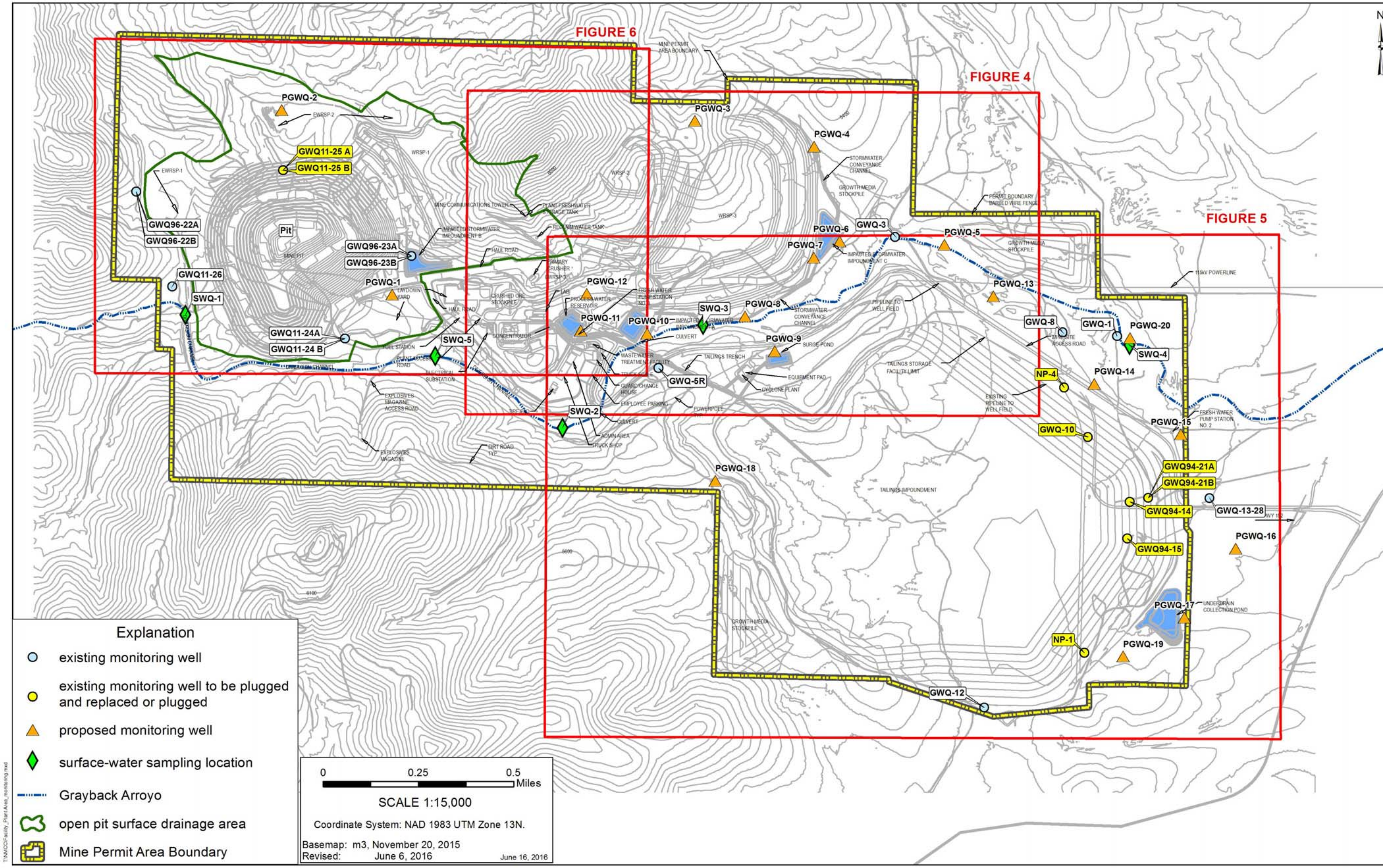


Figure 1. Proposed facility layout and proposed monitoring locations.

Table 1. Checklist for water-quality monitoring requirements in 20.6.7.28 NMAC

NMAC	requirement	report section
20.6.7.28.A.(1)	scaled map required by 20.6.7.11.J NMAC monitoring well location proposals *	Figure 1
20.6.7.28.A.(2)	map showing groundwater flow direction to determine monitor well locations	Figure 2
20.6.7.28.B.(1)	use of existing wells	2.1
20.6.7.28.B.(2)	groundwater monitoring for stockpiles and tailings impoundments	2.2
20.6.7.28.B.(3)	groundwater monitoring for process water and impacted stormwater impoundments	2.3
20.6.7.28.B.(4)	groundwater monitoring for open pit	2.4
20.6.7.28.B.(5)	groundwater monitoring up-gradient of each potential source	2.5
20.6.7.28.B.(6)	groundwater monitoring up-gradient of copper mine facility	2.6
20.6.7.28.C	monitoring well ID tags	3.0
20.6.7.28.D.(1) – (13)	monitoring well construction and completion	3.0
20.6.7.28.E	NMOSE permit requirements	3.0
20.6.7.28.F.(1) – (5)	groundwater sample collection procedures	4.0
20.6.7.28.G	groundwater sampling existing mine facilities	not applicable
20.6.7.28.H	groundwater sampling reduction of sampling analytes	not applicable
20.6.7.28.I	groundwater sampling for new monitoring wells	4.0
20.6.7.28.J	monitoring well survey and groundwater flow determination	5.0
20.6.7.28.K	monitoring well completion report	5.0
20.6.7.28.L	groundwater elevation contour maps	5.0
20.6.7.28.M	perennial stream sampling and reporting	not applicable
20.6.7.28.N	process water, tailings slurry, impacted storm water, seep, and spring sampling and reporting	6.0

* Figures 4 through 6 provide detailed insets of Figure 1.
NMOSE – New Mexico Office of the State Engineer

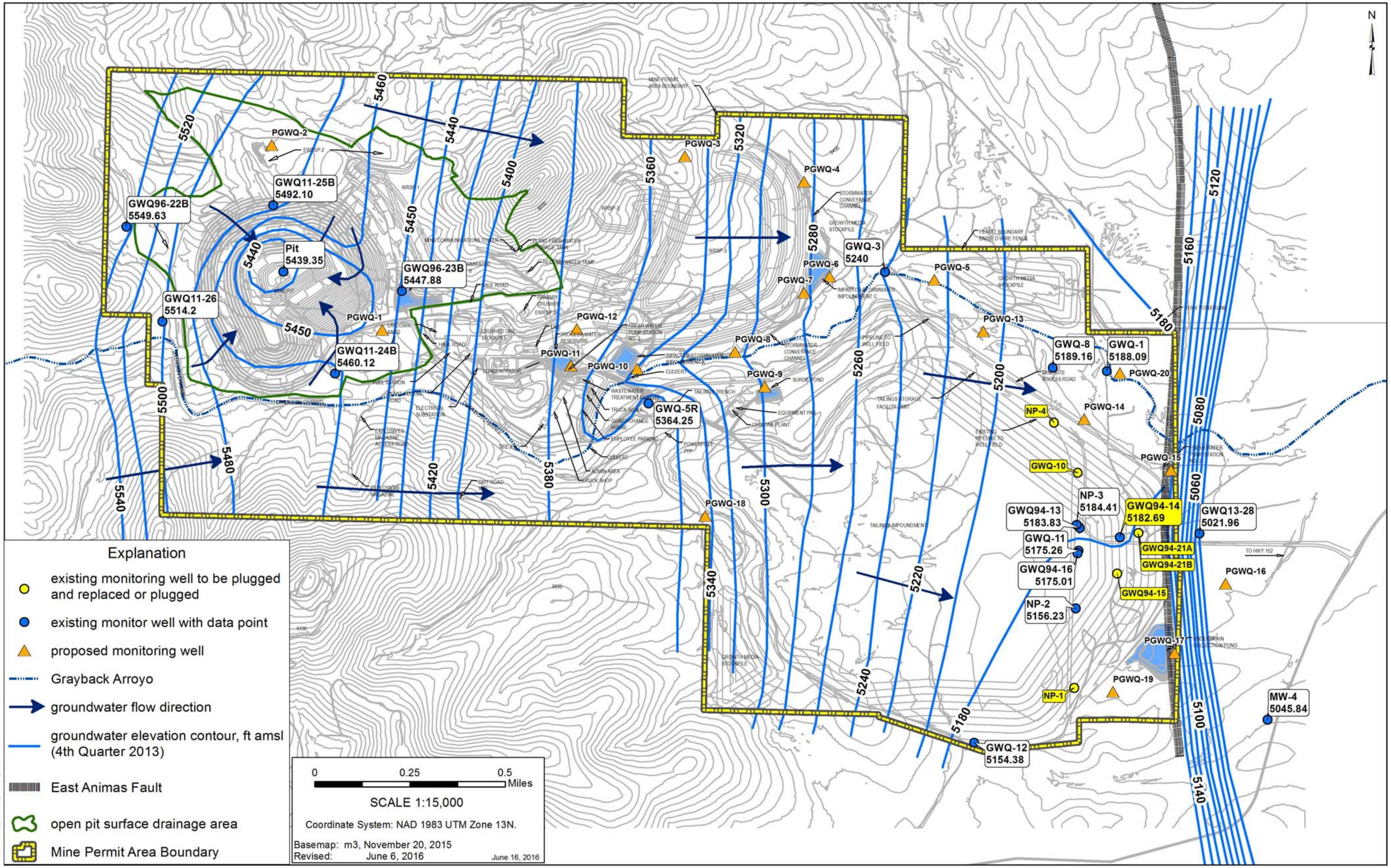


Figure 2. Groundwater flow direction.

2.0 MONITORING WELL NETWORK (20.6.7.28.A.(1) and (2))

The purpose of the monitoring well network is to monitor groundwater quality, potential discharges, and hydraulic-gradient as close as practicable up-gradient, around the perimeter and down-gradient of the mine pit, Waste Rock Stockpiles, Tailings Impoundment, Process Water Reservoir, and Impacted Stormwater Impoundments at Copper Flat as required by 20.6.7.28.B. The monitoring wells will be located in a manner to provide the best opportunity to detect exceedances or a trend toward exceedance of applicable standards as early as possible. The locations of the wells making up the network are identified in Figure 1, per 20.6.7.28.A.(1). Groundwater elevation contours and flow direction through the facility used to determine the well locations (pursuant to 20.6.7.28.A.(2) can be referenced from Figure 2. A more detailed explanation of the rationale used for the locations chosen for each well and the manner in which the new proposed monitoring wells will be completed is provided in the sections below.

A summary of all existing wells within the mine boundary that have been used for Baseline Data collection and Stage 1 abatement are summarized in Table 2 and shown on Figure 3.

The monitoring wells proposed for the monitoring network are presented in Table 3. The existing wells to be utilized in the network are identified in Table 3 by their current well name, i.e., "GWQ-##." The proposed wells are identified as "PGWQ-##." As indicated in Table 3, some of the existing monitor wells may go dry over time as a result of pit dewatering. As such the new proposed monitoring wells are designed to accommodate expected water-level declines and to provide groundwater monitoring for at least a 5-year period. As indicated previously and discussed with each relevant section of the monitoring plan later herein, Figures 4 through 6 are topographic maps showing a more detailed view of the units to be monitored and the proposed monitoring network.

Table 2. Summary of existing monitoring well data for the Copper Flat Mine, Sierra County, New Mexico

well name	well type	facility area	year drilled	casing diameter (inches)	total depth (ft bgl)	screen interval (ft bgl)	measuring-point elevation (ft amsl)	geologic unit	proposed use
GWQ96-22A	monitoring	pit	1996	2	244	174 to 244	5,596.17	andesite	monitor network
GWQ96-22B	monitoring	pit	1996	2	380	340 to 380	5,595.95	andesite	monitor network
GWQ96-23A	monitoring	pit	1996	2	101	50 to 100	5,489.84	quartz monzonite	monitor network
GWQ96-23B	monitoring	pit	1996	2	251	150 to 250	5,489.70	quartz monzonite	monitor network
GWQ11-24A	monitoring	pit	2011	2	90	60 to 90	5,517.37	quartz monzonite	monitor network
GWQ11-24B	monitoring	pit	2011	2	250	230 to 250	5,517.26	quartz monzonite	monitor network
GWQ11-25A	monitoring	pit	2011	2	100	70 to 100	5,533.60	quartz monzonite	monitor network
GWQ11-25B	monitoring	pit	2011	2	242	222 to 242	5,533.41	quartz monzonite	monitor network
GWQ11-26	monitoring	pit	2011	4	43	23 to 43	5,539.75	alluvium	monitor network
open pit	monitoring	pit	1982	-	-	-	5,430.00	quartz monzonite	monitor network
GWQ-1	supply	waste rock/mill site	1972	14/12	391	100 to 391	5,195.59	Santa Fe Group	monitor network
GWQ-3	supply	waste rock/mill site	1932	40 x 43	33	10 to 33	5,252.60	alluvium/andesite	monitor network
GWQ-5R	monitoring	waste rock/mill site	2011	4	120	80 to 120	5,412.80	andesite	monitor network
GWQ-6N	supply	Tailings Storage Facility (TSF)	na	8	85	na	5,395.36	andesite	water supply
GWQ-6S	supply	Tailings Storage Facility (TSF)	na	62	30	rocklined	5,382.77	andesite	water supply
GWQ-7	supply	Tailings Storage Facility (TSF)	1932	14	500	74 to 500	5,181.60	Santa Fe Group	water supply
GWQ-8	supply	waste rock/mill site	1931	8	148	81 to 148	5,216.94	Santa Fe Group	monitor network
GWQ-9	supply	Tailings Storage Facility (TSF)	1972	14	767	na	5,208.13	Santa Fe Group	water supply
GWQ-10	monitoring	Tailings Storage Facility (TSF)	1981	3	125	95 to 120	5,213.28	Santa Fe Group	monitor network
GWQ-11	monitoring	Tailings Storage Facility (TSF)	1981	3	70	40 to 65	5,196.44	alluvium/Santa Fe Group	plug and abandon
GWQ-12	monitoring	Tailings Storage Facility (TSF)	1981	3	110	80 to 105	5,237.28	Santa Fe Group	monitor network
GWQ94-13	monitoring	Tailings Storage Facility (TSF)	1994	5	106	74 to 104.5	5,200.47	Santa Fe Group	plug and abandon
GWQ94-14	monitoring	Tailings Storage Facility (TSF)	1994	5	159	127.5 to 157.5	5,192.69	Santa Fe Group	monitor network
GWQ94-15	monitoring	Tailings Storage Facility (TSF)	1994	4	142	112 to 142	5,183.21	Santa Fe Group	monitor network
GWQ94-16	monitoring	Tailings Storage Facility (TSF)	1994	5	46	25 to 45	5,197.41	alluvium	plug and abandon
GWQ94-17	monitoring	Tailings Storage Facility (TSF)	1994	4	150	120 to 150	5,198.14	Santa Fe Group	plug and abandon
GWQ94-18	monitoring	Tailings Storage Facility (TSF)	1994	4	51	10 to 50	5,194.83	alluvium	plug and abandon
GWQ94-19	monitoring	Tailings Storage Facility (TSF)	1994	4	53	10 to 50	5,203.36	alluvium	plug and abandon
GWQ94-20	monitoring	Tailings Storage Facility (TSF)	1994	4	338	288 to 338	5,203.94	Santa Fe Group	plug and abandon
GWQ94-21A	monitoring	Tailings Storage Facility (TSF)	1994	2	263	213 to 263	5,192.71	Santa Fe Group	monitor network
GWQ94-21B	monitoring	Tailings Storage Facility (TSF)	1994	2	315	285 to 315	5,192.22	Santa Fe Group	monitor network
GWQ13-28	monitoring	Tailings Storage Facility (TSF)	2013	4	198	150 to 190	5,178.16	Santa Fe Group	monitor network
IW-1	monitoring	Tailings Storage Facility (TSF)	1982	4	49	na	5,198.99	alluvium	plug and abandon
IW-2	monitoring	Tailings Storage Facility (TSF)	1982	4	46	na	5,208.01	alluvium	plug and abandon
IW-3	monitoring	Tailings Storage Facility (TSF)	1982	4	45	na	5,213.17	alluvium	plug and abandon
NP-1	monitoring	Tailings Storage Facility (TSF)	1981	2	110	90 to 105	5,188.75	Santa Fe Group	monitor network
NP-2	monitoring	Tailings Storage Facility (TSF)	1981	2	110	90 to 105	5,192.54	Santa Fe Group	plug and abandon
NP-3	monitoring	Tailings Storage Facility (TSF)	1981	2	90	70 to 85	5,199.73	Santa Fe Group	plug and abandon
NP-4	monitoring	Tailings Storage Facility (TSF)	1981	2	100	80 to 95	5,225.91	Santa Fe Group	monitor network
NP-5	monitoring	Tailings Storage Facility (TSF)	1981	2	90	70 to 85	5,199.21	Santa Fe Group	plug and abandon
MW-4	supply	off site	1975	6	1,500	123 to 1,500	5,146.12	Santa Fe Group	water supply

ft bgl – feet below ground level
ft amsl – feet above mean sea level
ft bmp – feet below measuring point
na – not available

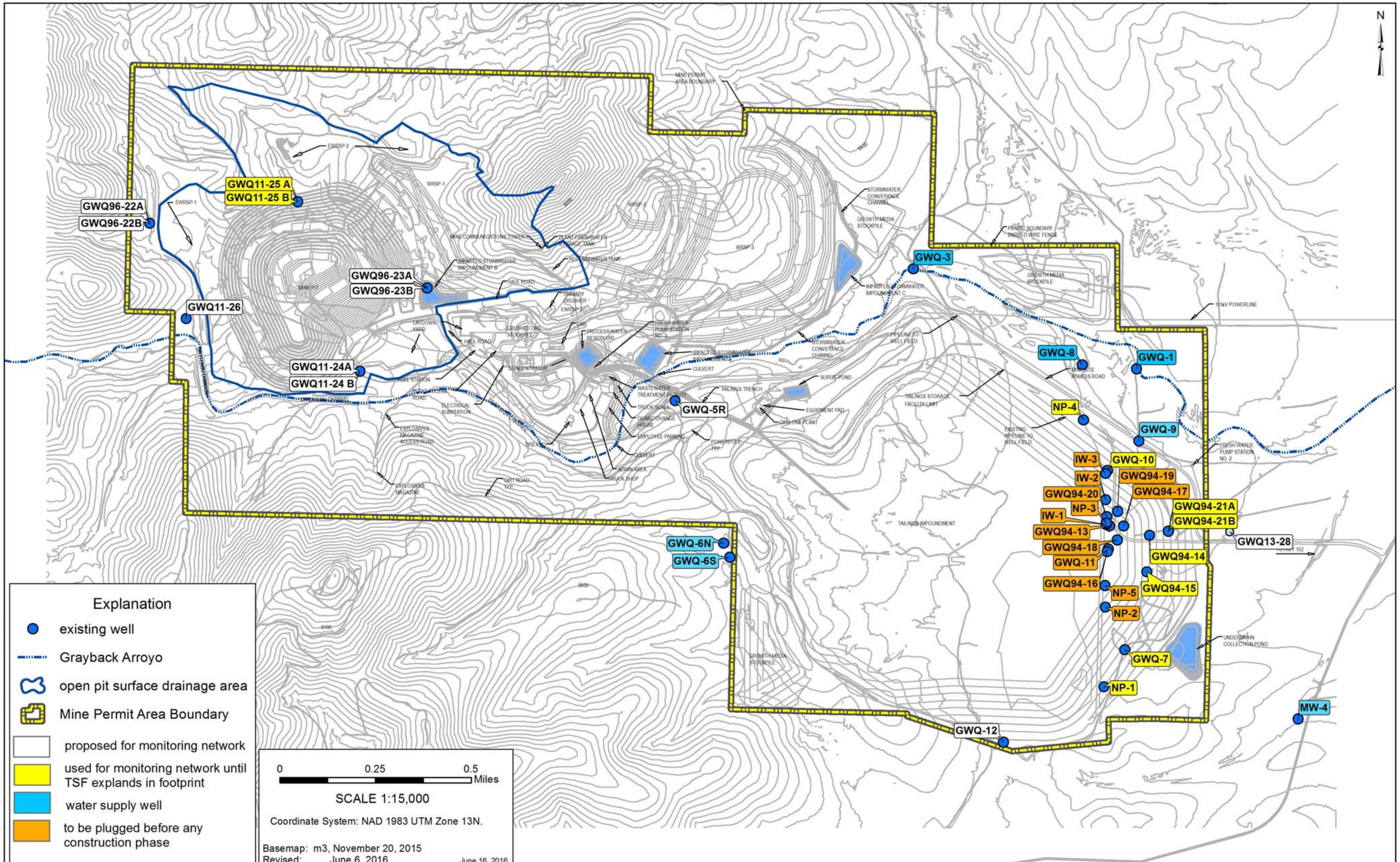


Figure 3. Map showing locations of existing wells colored coded for proposed use.

Table 3. Proposed water-quality well network for the Copper Flat Mine, Sierra County, New Mexico

well name[4]	unit(s) monitored	relation to unit(s) monitored	total depth[5] (ft)	screen interval[5] (ft)	screen length[5] (ft)	estimated maximum drawdown after first five years of mining(ft)	geologic unit	current depth to water (ft)
GWQ96-22A	entire site	up-gradient	244	174 to 244	70	100	andesite	55
GWQ96-22B	entire site	up-gradient	380	340 to 380	40	100	andesite	55
GWQ11-26[2]	entire site	up-gradient	43	23 to 43	20	150	alluvium	39
GWQ96-23(A)[3]	open pit	perimeter	251	150 to 250	100	200	quartz monzonite	41
GWQ96-23(B)[3]	open pit	perimeter						
GWQ11-24A[1]	open pit	perimeter	90	60 to 90	30	200	quartz monzonite	50
GWQ11-24B[2]	open pit	perimeter	250	230 to 250	20	200	quartz monzonite	57
GWQ-5R[2]	Surge Pond	up-gradient	120	80 to 120	40	< 10	andesite	99
GWQ-1	TSF	off-gradient	391	100 to 391	291	< 10	Santa Fe Group	5
GWQ-8	TSF	off-gradient	148	81 to 148	67	< 10	Santa Fe Group	7
GWQ-10	TSF	off-gradient	125	95 to 120	25	< 10	Santa Fe Group	23
GWQ-12	TSF	off-gradient	110	80 to 105	25	< 10	Santa Fe Group	83
NP-1	TSF	down-gradient	110	90 to 105	15	< 10	Santa Fe Group	30
NP-4	TSF	off-gradient	100	80 to 95	15	< 10	Santa Fe Group	34
GWQ94-14	TSF	down-gradient	159	127.5 to 157.5	30	< 10	Santa Fe Group	7
GWQ94-15	TSF	down-gradient	142	112 to 142	30	< 10	Santa Fe Group	5
GWQ94-21A	TSF	down-gradient	263	213 to 263	40	< 10	Santa Fe Group	8
GWQ94-21B	TSF	down-gradient	315	285 to 315	30	< 10	Santa Fe Group	8
GWQ13-28	TSF	down-gradient	190	150 to 190	40	< 10	Santa Fe Group	156
PGWQ-1	open pit	perimeter	250	150 to 250	100	200	quartz monzonite	40
PGWQ-2	open pit	perimeter	375	275 to 375	100	150	quartz monzonite	115
PGWQ-3	WRSP-2 and -3	up-gradient	150	130 to 150	20	< 10	andesite	130
PGWQ-4	WRSP-2 and -3	down-gradient	105	85 to 105	20	< 10	andesite	85
PGWQ-5	WRSP-2 and -3	down-gradient	35	15 to 35	20	< 10	alluvium/Santa Fe Group	15
PGWQ-6	WRSP-2 and -3	down-gradient	55	35 to 55	20	< 10	Santa Fe Group/andesite	40
	Impacted Stormwater Impoundment C	down-gradient						
PGWQ-7	WRSP-2 and -3	down-gradient	40	20 to 40	20	< 10	Santa Fe Group/andesite	20
	Impacted Stormwater Impoundment C	up-gradient						
PGWQ-8	WRSP-2 and -3	down-gradient	45	25 to 45	20	< 10	alluvium/andesite	25
PGWQ-9	Surge Pond	down-gradient	100	80 to 100	20	< 10	alluvium/andesite	80
PGWQ-10	Impacted Stormwater Impoundment A	down-gradient	50	30 to 50	20	< 10	alluvium/andesite	20
PGWQ-11	Process Water Reservoir	down-gradient	120	100 to 120	20	10	alluvium/andesite	100
PGWQ-12	Impacted Stormwater Impoundment A and Process Water Reservoir	up-gradient	120	100 to 120	20	20	alluvium/andesite	100
PGWQ-13	WRSP-2 and -3	down-gradient	35	15 to 35	20	< 10	alluvium/Santa Fe Group	15
	TSF	perimeter						
PGWQ-14	TSF	perimeter	35	15 to 35	20	< 10	alluvium/Santa Fe Group	20
PGWQ-15	TSF	down-gradient	50	30 to 50	20	< 10	alluvium/Santa Fe Group	30
PGWQ-16	TSF	down-gradient	180	160 to 180	20	< 10	Santa Fe Group	160
PGWQ-17	Underdrain Collection Pond	down-gradient	75	55 to 75	20	< 10	alluvium/Santa Fe Group	55
PGWQ-18	TSF	up-gradient	120	100 to 120	20	< 10	andesite	100
PGWQ-19	TSF	down-gradient	75	55 to 75	20	< 10	Santa Fe Group	50
PGWQ-20	WRSP-2 and -3	down-gradient	30	20 to 30	10	< 10	alluvium	10

[1] will likely go dry as a result of pit dewatering within first 5 years of mining
[2] may go dry towards the end of mining as a result of pit dewatering
[3] will likely go dry as a result of pit dewatering, but not within first 5 years of mining
[4] "GWQ" designation is for existing wells and "PGWQ" is for new proposed wells
[5] estimated for proposed new wells based on groundwater model (JSAI, 2014) results after 5 years of mining

TSF - tailings storage facility
WRSP – waste rock stockpile

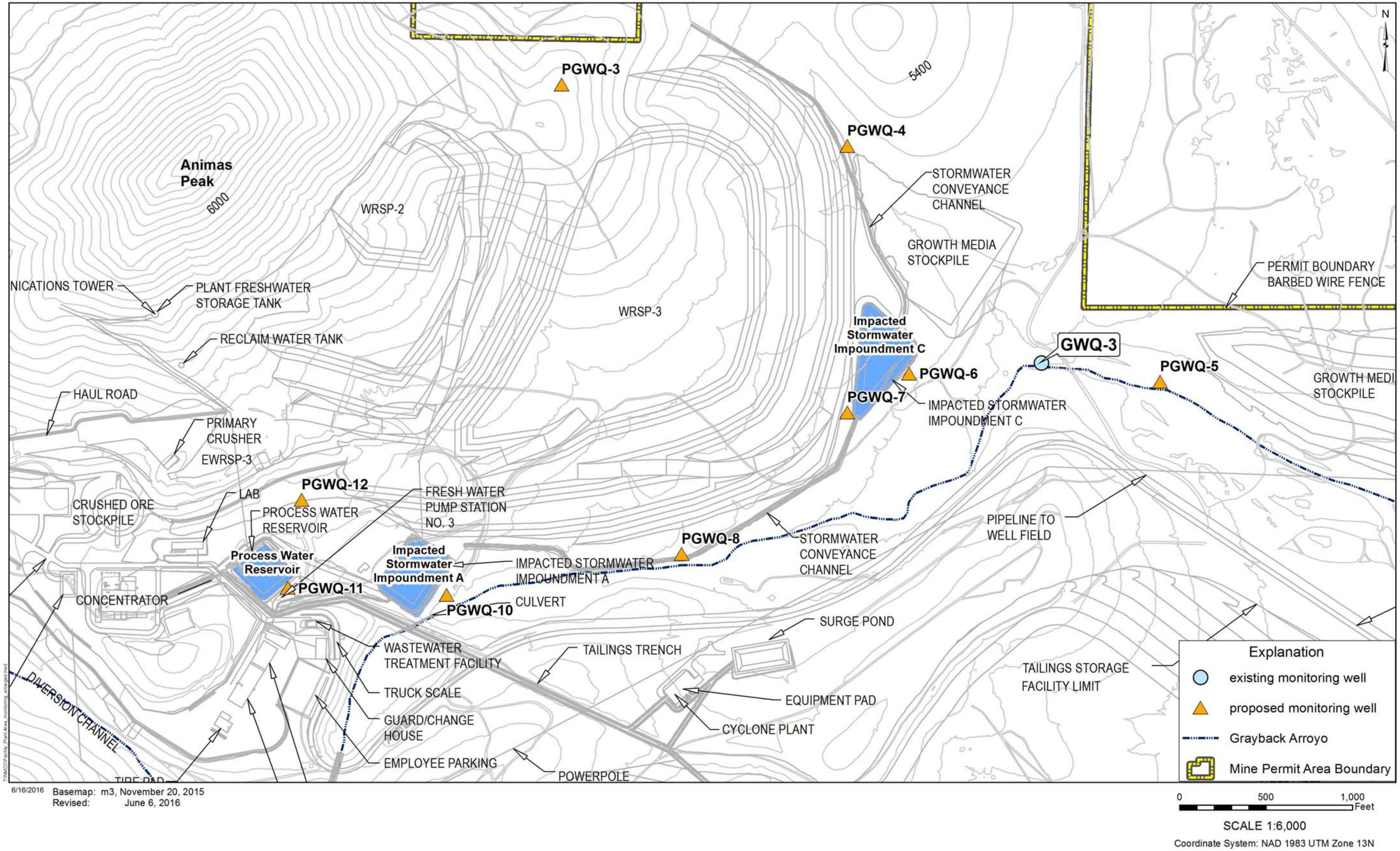


Figure 4. Monitoring wells location detail for WRSP-2 and -3, and Impact Stormwater Impoundments A and C.

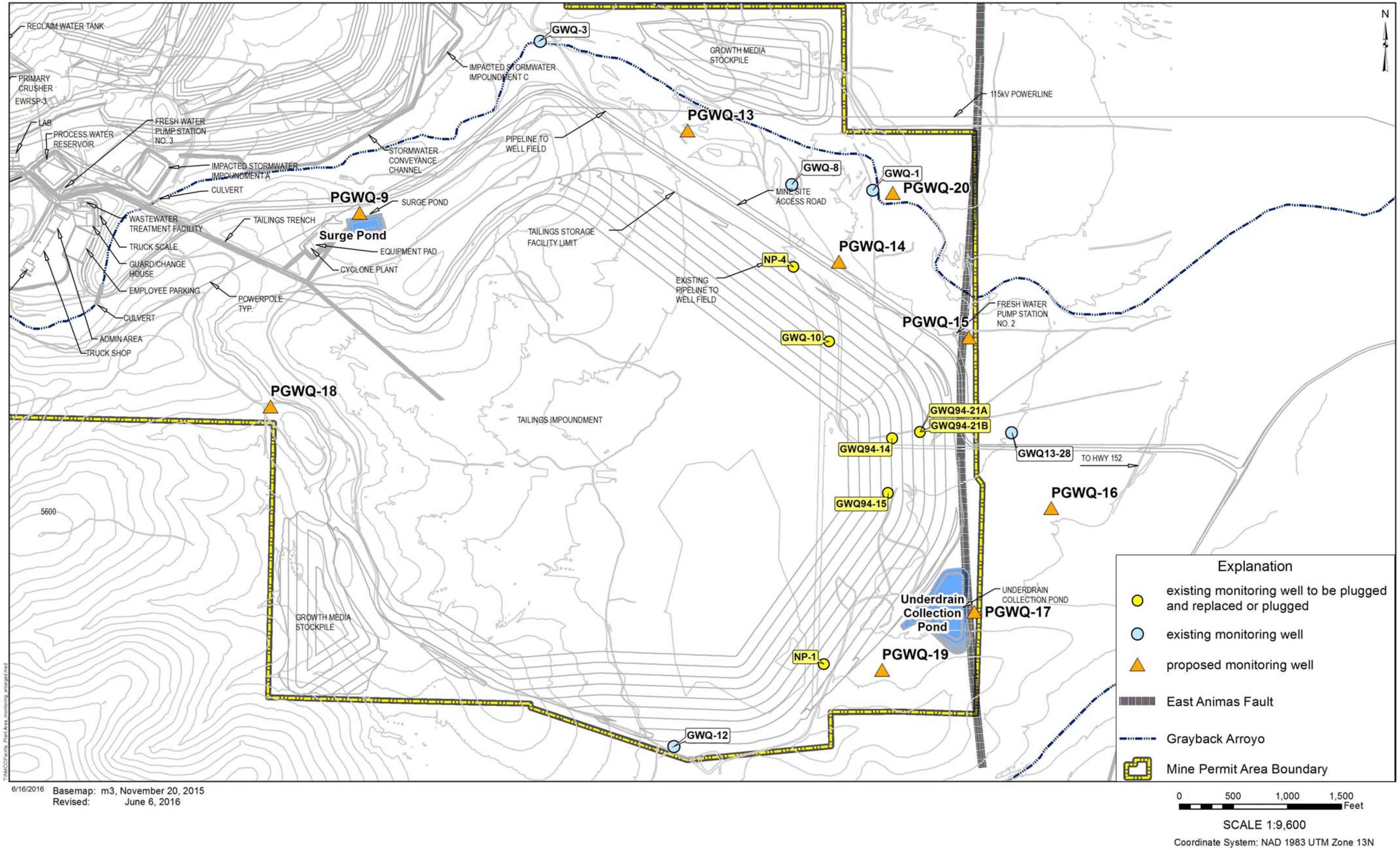


Figure 5. Monitoring wells location detail for Tailings Storage Facility, Underdrain Collection Pond, and Surge Pond.

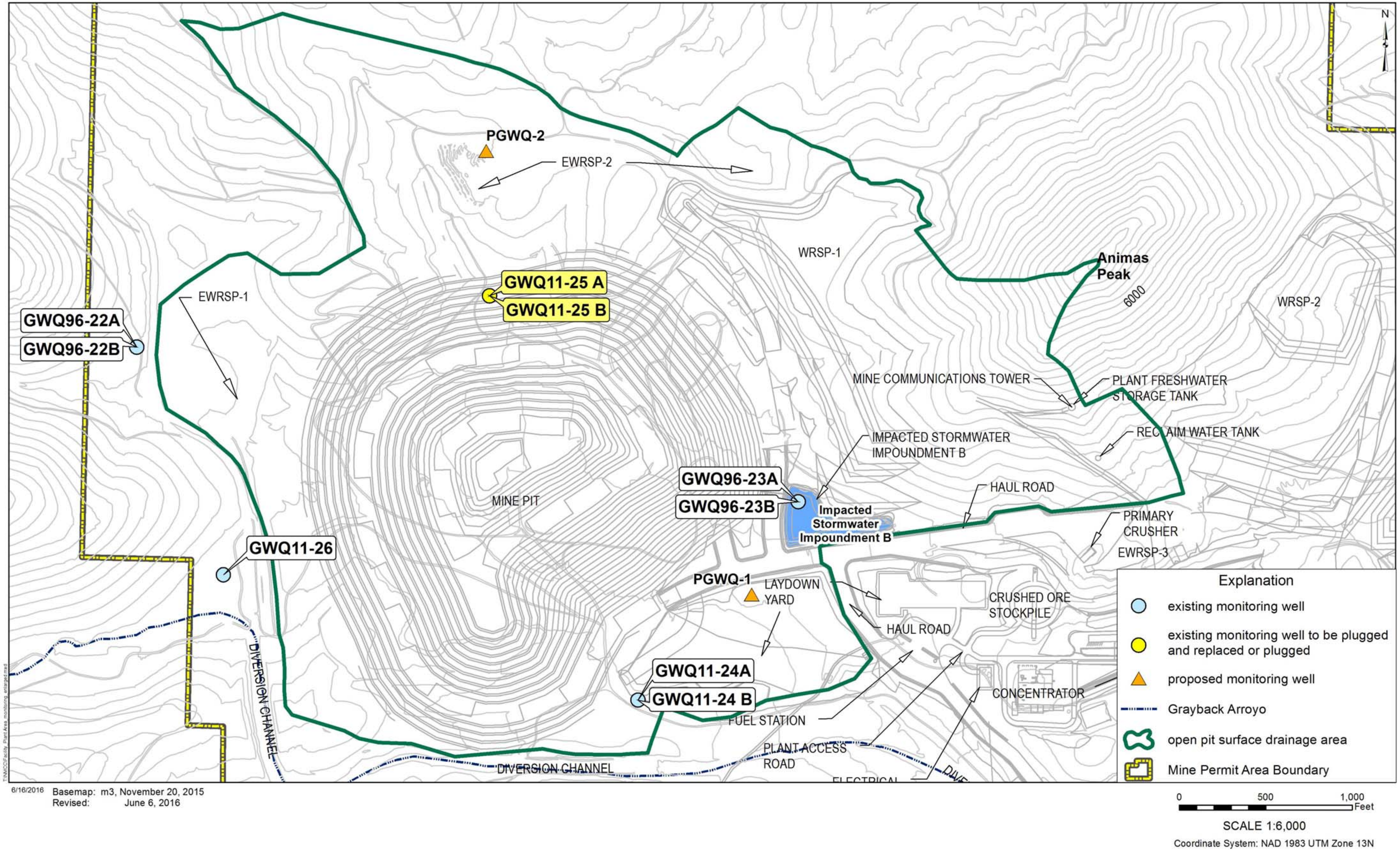


Figure 6. Monitoring wells location detail for mine pit and WRSP-1.

2.1 Existing Monitoring Wells (20.6.7.28.B.(1))

An existing monitoring well network has been used previously for Baseline Data assessment and Stage 1 Abatement plan monitoring (Table 2). The water-level data presented on Figure 2 were collected from the Stage 1 Abatement monitoring (JSAI, 2014b).

The Stage 1 Abatement monitoring network was previously approved by the New Mexico Environment Department (NMED). As noted above, JSAI has selected a subset of the existing well network to be included in this proposed Water-Quality Monitoring Plan as identified in Table 3. Subsection 20.6.7.B.(1) NMAC provides that an existing monitoring well can be an approved location for groundwater monitoring provided the monitoring well location was previously approved by the NMED. The wells selected by JSAI for inclusion in the network provide the best opportunity, in combination with the proposed wells, to provide data required by 20.6.7.28 NMAC. Some of the existing monitoring wells used in the previous studies will not be available for the long-term as they will be plugged and abandoned, so proposed mine facilities can be built. Others, such as GWQ-1, GWQ-3, and GWQ-8 may not be of the quality of construction or may have other operational issues making them less desirable for use in this proposed monitoring network.

The proposed use of the existing wells for the monitoring network is summarized in Table 2. Many of the existing monitoring wells are located within the footprint of the Phase 1 construction of the Tailings Storage Facility (TSF) and will be plugged and abandoned prior to construction. Some are water supply wells that will be maintained for mine site supply. Several of the existing monitoring wells will be used as part of the monitoring network described in the following sections.

2.2 Waste Rock Stockpiles and Tailings Impoundments (20.6.7.28.B.(2))

This section describes the proposed monitoring network for the Waste Rock Stockpiles (WRSP) and the TSF located outside of the open pit surface drainage area, pursuant to 20.6.7.28.B.(2).

2.2.1 Waste Rock Stockpile 1

The WRSP-1 (surface topography and under topography) is within the open pit surface drainage area, which does not require monitoring.

2.2.2 Waste Rock Stockpiles 2 and 3

Waste Rock Stockpiles 2 and 3 (WRSP-2 and -3), shown on Figure 4, are located outside the open pit surface drainage area. Because of their close proximity to each other, the Monitoring Plan will consider them as one WRSP regarding groundwater monitoring. The monitoring network in this area will monitor groundwater quality and potential discharges around and down-gradient of WRSP-2 and -3 with four proposed monitoring wells (PGWQ-4, PGWQ-7, PGWQ-8, and PGWQ-12) located around the perimeter of the WRSPs, close to the toe of the final configuration, as shown on Figure 4. Groundwater quality and hydraulic-gradient will also be defined by these four perimeter wells.

These perimeter wells are located to monitor groundwater below WRSP-2 and -3. For example, PGWQ-4 is located in the drainage channel along the northeast side of WRSP-2 and -3, and PGWQ-7 and PGWQ-8 will be located directly down-gradient of WRSP-2 and -3 in the channel of the largest drainages underlying the proposed stockpiles. Proposed monitoring well PGWQ-12 will be off-gradient of WRSP-2 and -3. Proposed monitoring well PGWQ-3 will be up-gradient of WRSP-2 and -3.

In addition to the four proposed perimeter wells, proposed monitoring wells PGWQ-5, PGWQ-13, and PGWQ-20 will monitor groundwater quality farther down-gradient of WRSP-2 and -3 (see Fig. 1). PGWQ-5 will replace GWQ-3, which is also shown on Figures 1 and 4 but is not part of this proposed Monitoring Plan. GWQ-3 is an existing well that has provided data for other purposes. The well is considered questionable for use in a long-term monitoring program as it is truly a historic cistern box. The immediate area around GWQ-3 is classified as a cultural property. Therefore, the proposed location of PGWQ-5 may vary slightly in the field based on access and cultural resource considerations.

The proposed monitoring wells will be installed at least 180 days before emplacement of waste rock to allow sampling prior to discharge, pursuant to 20.6.7.28.B.(2)(a).

2.2.3 Tailings Storage Facility (TSF)

The proposed groundwater monitoring network for the TSF is shown on Figure 5. Existing monitoring wells will be used to the maximum extent possible. Existing monitoring wells NP-1, NP-4, GWQ-10, GWQ-12, GWQ94-14, GWQ94-15, GWQ94-21(A and B), and GWQ13-28 will be used as the initial monitoring network for monitoring groundwater quality and potential discharges around and down-gradient of the TSF. As the TSF expands, monitoring wells in the expanded footprint will be plugged and abandoned and replaced by proposed monitoring wells. The replacement program is as follows:

- PGWQ-14 will replace NP-4
- PGWQ-15 will replace GWQ-10
- PGWQ-16 will replace GWQ94-14, GWQ94-15, and GWQ94-21(A and B)
- PGWQ-19 will replace NP-1

The proposed monitoring network will monitor groundwater quality and potential discharges around and down-gradient of the TSF with three perimeter wells (NP-4, GWQ-10, GWQ-12), and six down-gradient wells (NP-1, GWQ94-14, GWQ94-15, GWQ94-21(A and B), and GWQ13-28). Down-gradient well GWQ13-28 is located on the east and down-dropped side of the East Animas Fault identified in JSAI (2014b) (see Fig. 4). Existing supply wells GWQ-1 and GWQ-8 will be monitored for water levels to help define the direction of groundwater flow and hydraulic-gradient along Grayback Arroyo on the north side of the TSF. Groundwater quality and hydraulic-gradient will be defined by the proposed off-gradient and down-gradient monitoring wells.

All of the proposed monitoring wells will be installed at least 180 days before discharge of tailings to allow sampling prior to discharge, pursuant to 20.6.7.28.B.(2)(a).

2.3 Process Water and Impacted Stormwater Impoundments (20.6.7.28.B.(3))

Copper Flat will construct a number of impoundments and ponds to manage water as shown on Figure 1. There will be three impacted storm-water impoundments (Impoundments A, B, and C) constructed to control and manage storm-water runoff from the WRSPs. There will also be an underdrain collection pond to collect water from below the Tailings Impoundment and runoff from the exterior surface of the dam. There will be a Surge Pond location coincident with the cyclone plant at the TSF to manage potential process water upset conditions. There will be a Process Water Reservoir that will receive recycled water from the Tailings Impoundment, the Underdrain Pond, the Impacted Stormwater Impoundments, as well as fresh water from the facility well field.

With the exception of Impacted Stormwater Impoundment B, all of these ponds and impoundments containing process water or impacted water will have down-gradient monitoring wells located with 75 ft of the impoundment, pursuant to 20.6.7.28.B.(3). Down-gradient monitoring is shown on the figures identified as follows:

- PGWQ-11 down-gradient of the Process Water Reservoir (Fig. 4)
- PGWQ-10 down-gradient of Impacted Stormwater Impoundment A (Fig. 4)
- PGWQ-6 down-gradient of Impacted Stormwater Impoundment C (Fig. 4)
- PGWQ-9 down-gradient of the Surge Pond (Fig. 5)
- PGWQ-17 down-gradient of the Underdrain Collection Pond (Fig. 5)

Impacted Stormwater Impoundment B will collect storm-water runoff from WRSP-1. WRSP-1 and the Impacted Stormwater Impoundment B are located within the open pit surface drainage area as shown in Figures 1 and 6. As such, no down-gradient monitoring is required for these.

The proposed location for PGWQ-9 is down-gradient from the proposed Surge Pond with respect to land surface. While the location of PGWQ-9 appears to be off-gradient with respect to regional groundwater flow direction, it is important to locate the monitoring well down-gradient with respect to local groundwater gradient and to be able to monitor potential releases to groundwater as close to the pond as possible. Therefore, the proposed location of PGWQ-9 is in the best possible location for detecting potential discharges from the Surge Pond.

All of the proposed monitoring wells will be installed at least 180 days before discharging to the impoundments to allow sampling prior to discharge, pursuant to 20.6.7.28.B.(3)(a).

2.4 Open Pit (20.6.7.28.B.(4))

The proposed groundwater monitoring network will include a sufficient number of monitoring wells around the perimeter of the planned open pit to monitor groundwater quality and hydraulic-gradient around the open pit. The proposed open pit monitoring network includes three existing monitoring wells located up-gradient of the open pit (GWQ96-22A and B), and GWQ11-26), and six monitoring wells (four existing and two new) for the open pit perimeter (GWQ96-23(A and B); GWQ11-24(A and B), PGWQ-1, and PGWQ-2). The locations of these wells are shown on Figure 6. The location for PGWQ-2 is based on the closest location to the well being replaced (GWQ11-25(A and B)) that will not be in the way of other planned mine facilities. The other objective to monitoring the open pit is to maintain perimeter wells on the east, west, north, south, and southeast sides.

Proposed monitoring well PGWQ-1 will help define the hydraulic containment on the southeast corner of the open pit area. Proposed monitoring well PGWQ-2 will replace GWQ11-25(A and B), which will be destroyed during excavation of the open pit. The proposed location for PGWQ-2 will be off-gradient of the open pit as shown on Figure 6. GWQ96-23(A and B) will be maintained, but it is possible that the existing wells may be replaced so Impacted Stormwater Impoundment B can be constructed. If it is determined that GWQ96-23(A and B) need to be replaced, a monitoring well identical to PGWQ-1 will be drilled adjacent to the north side of Impacted Stormwater Impoundment B.

2.5 Up-Gradient of Each Potential Source (20.6.7.28.B.(5))

As specified in 20.6.7.28.B.(5), a minimum of one monitoring well shall be located up-gradient of each new unit to establish up-gradient groundwater quality conditions not likely to be affected by each contamination source that is being monitored. Using the groundwater elevation contours from Figure 2, the following monitoring is proposed:

- GWQ96-22(A and B) shown on Figures 1 and 6 will provide up-gradient monitoring for the open pit.
- PGWQ-3 shown on Figures 1 and 4 will provide up-gradient monitoring for the WRSP-2 and -3.
- Proposed groundwater monitoring well PGWQ-12 shown on Figures 1 and 4 will establish up-gradient groundwater quality conditions for the Process Water Reservoir and Impacted Stormwater Impoundment A.
- PGWQ-7 shown on Figures 1 and 4 will provide up-gradient monitoring of Impacted Stormwater Impoundment C below the WRSP-3.
- Monitoring well GWQ-5R shown on Figures 1 and 5 will provide up-gradient monitoring for the surge pond.
- PGWQ-18 shown on Figures 1 and 5 will establish up-gradient groundwater quality conditions for the Tailings Storage Facility and the Underdrain Collection Pond.

All of the proposed monitoring wells will be installed at least 180 days before discharge of tailings or other contaminants to allow sampling prior to discharge, pursuant to 20.6.7.28.B.(5)(a).

2.6 Up-Gradient of Copper Mine Facilities (20.6.7.28.B.(6))

NMAC 20.6.7.28.B.(6) requires up-gradient groundwater monitoring for a copper mine facility. Three existing monitoring wells located up-gradient of Copper Flat Mine will establish up-gradient groundwater quality conditions that are not affected by any potential contamination sources at Copper Flat Mine (GWQ96-22(A and B), GWQ11-26, and PGWQ-18). As shown on Figure 2, these wells are up-hydraulic-gradient of all proposed facilities.

All of the proposed monitoring wells will be installed at least 180 days before discharge of tailings or other contaminants to allow sampling prior to discharge, pursuant to 20.6.7.28.B.(6).

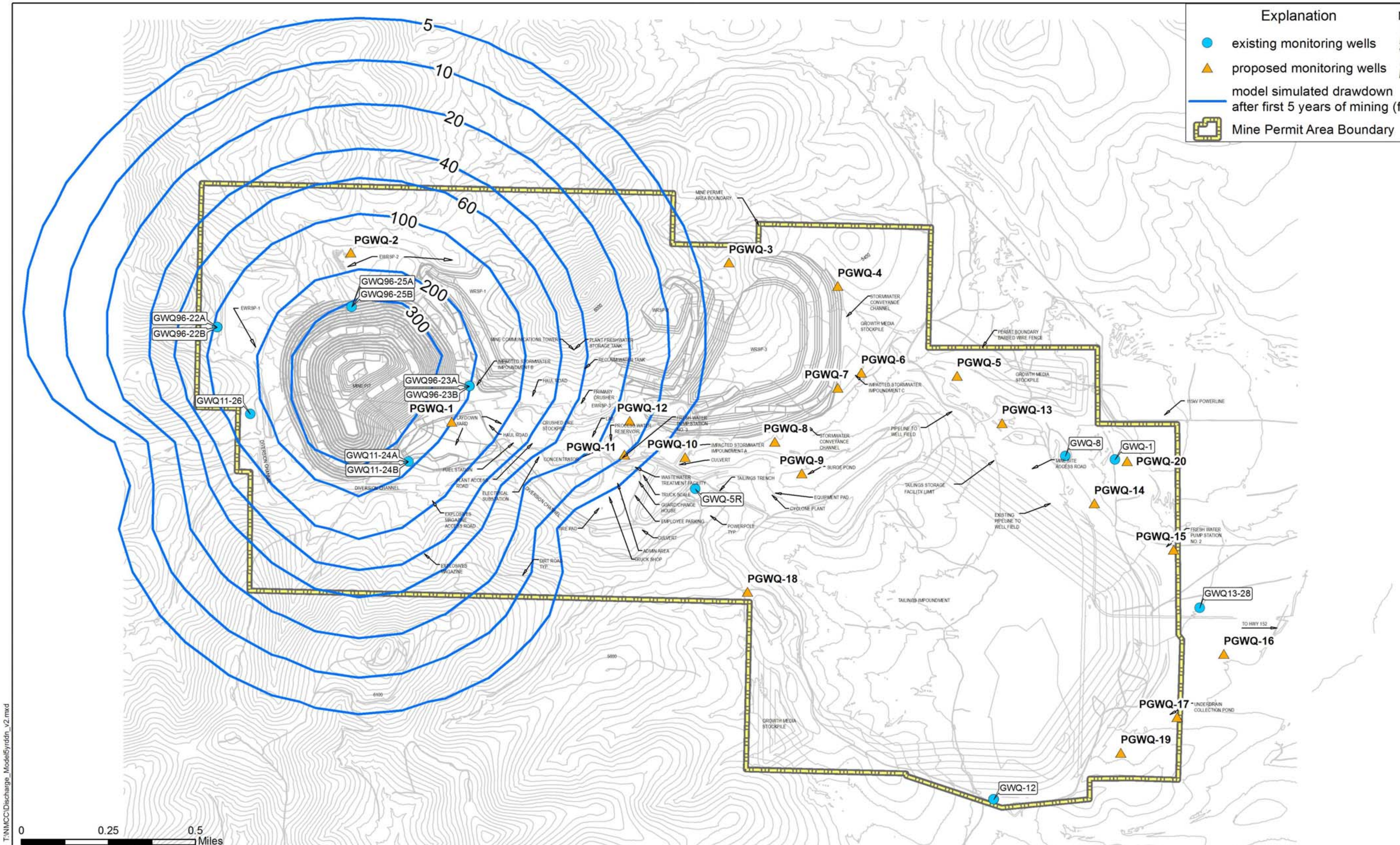
3.0 MONITORING WELL CONSTRUCTION AND COMPLETION 20.6.7.28.C, D & E

Monitoring well construction and completion requirement are specified in 20.6.7.28.D NMAC. The requirements as contained in Subsections 20.6.7.28.C, D, and E are well understood by New Mexico Copper Corporation (NMCC) and its drilling contractors. NMCC will ensure that its drilling contractors adhere to the construction and completion and well screening requirements set forth in paragraphs (1) through (13) of 20.6.6.28.D NMAC. Drilling specifications detailing these requirements will be prepared to solicit bids from qualified well drillers licensed in New Mexico. The drilling specifications will define drilling methods, well construction materials, and wellhead completion details that conform to the following:

- Monitoring well identification tags in 20.6.7.28.C NMAC
- Monitoring well construction and completion in 20.6.7.28.D NMAC.
- Monitoring well permits from the Office of the State Engineer in 20.6.7.28.E NMAC

3.1 Proposed Monitoring Well Depth and Screen Interval

Significant drawdown will occur around the open pit as a result of the first 5 years of open pit mining and dewatering. Model-predicted drawdown representative of the first 5 years of mining is illustrated on Figure 7. Proposed depths and screen intervals have been adjusted for monitoring wells within the 20-ft model-predicted drawdown contour. Proposed monitoring wells outside of the area of drawdown will be constructed with 20-ft screens spanning the water table as specified in 20.6.7.28.D.(7)(a) NMAC. Proposed well depths and screen intervals can be referenced from Table 3.



Basemap: m3, November 20, 2015
Revised: June 6, 2016

Figure 7. Model-predicted mine pit drawdown for the first 5 years.

Except for open pit perimeter monitoring wells, proposed monitoring wells will be located to detect a discharge to groundwater at the earliest possible occurrence. Depths and screen intervals for proposed monitoring wells are estimated to the nearest 5-ft increment (see Table 3).

Due to excessive model-predicted drawdown around the open pit, proposed perimeter monitoring wells (PGWQ-1 and PGWQ-2) will have a 100-ft screen length. It is anticipated that the water level will draw down to the top of the screen in these proposed open pit perimeter monitoring wells during the first few years of mining and open pit dewatering

4.0 GROUNDWATER SAMPLING 20.6.7.28.E THROUGH I

Existing monitoring wells were previously sampled as a result of Baseline Data assessment (INTERA, 2012) and Stage 1 Abatement (JSAI, 2014). However, more than half of the groundwater monitoring wells proposed for this Water-Quality Monitoring Plan will be new, and thus, have no background data. As required in 20.6.7.28. I. NMAC, a permittee shall submit a proposal for quarterly groundwater monitoring from each newly installed monitoring required pursuant to this section. Proposed analytes for quarterly monitoring are summarized in Table 4. The proposed analyte list is based on field parameters required in 20.6.7.28.F NMAC, analytes in 20.6.2.3103 NMAC applicable to expected discharges at Copper Flat Mine, and analytes required in 20.6.7.28.I NMAC.

Radioactive and hydrocarbon analytes will be analyzed from each well in the proposed monitoring network during the first year of the quarterly sampling event to establish background conditions. Subsequent sampling events will only include the field parameters and inorganic analytes listed in Table 4, unless background sampling or other potential discharge justifies sampling for the full list in Table 4.

Groundwater sampling procedures will be in accordance with 20.6.7.28.F NMAC, and include the following:

- Measurement of depth to water as specified in 20.6.7.28.F.(1) NMAC
- Proper purging of monitoring well prior to sampling as specified in 20.6.7.28.F.(2) NMAC
- Collection of field parameters following purging as specified in 20.6.7.28.F.(3) NMAC
- Collection of samples for laboratory analysis as specified in 20.6.7.28.F.(5) NMAC

Table 4. Proposed analytes for Water-Quality Monitoring Plan

analyte	unit	discharge standard	comment
pH	standard units	between 6 and 9	field measurement
specific conductance	µS/cm	none	field measurement
temperature	Celsius	none	field measurement
pH	standard units	between 6 and 9	lab measurement
alkalinity (HCO_3; CO_3)	mg/L as $CaCO_3$	none	inorganic
total dissolved solids (TDS)	mg/L	1,000	inorganic
chloride	mg/L	250	inorganic
fluoride	mg/L	1.6	inorganic
nitrate (NO_3 as N)	mg/L	10.0	inorganic
sulfate	mg/L	600	inorganic
arsenic	mg/L	0.1	inorganic
barium	mg/L	1.0	inorganic
cadmium	mg/L	0.01	inorganic
chromium	mg/L	0.05	inorganic
copper	mg/L	1.0	inorganic
iron	mg/L	1.0	inorganic
lead	mg/L	0.05	inorganic
manganese	mg/L	0.2	inorganic
total mercury	mg/L	0.002	inorganic
selenium	mg/L	0.05	inorganic
silver	mg/L	0.05	inorganic
uranium	mg/L	0.03	inorganic
zinc	mg/L	10.0	inorganic
radium 226 and 228	pCi/L	30.0	1st quarter only
benzene	mg/L	0.01	1st quarter only
ethylbenzene	mg/L	0.75	1st quarter only
toluene	mg/L	0.75	1st quarter only
total xylenes	mg/L	0.62	1st quarter only
PCB's	mg/L	0.001	1st quarter only
carbon tetrachloride	mg/L	0.01	1st quarter only
1,2-dichloroethane (EDC)	mg/L	0.01	1st quarter only
1,1-dichloroethane	mg/L	0.005	1st quarter only
1,1,2,2-tetrachloroethylene	mg/L	0.02	1st quarter only
methylene chloride	mg/L	0.1	1st quarter only
chloroform	mg/L	0.1	1st quarter only
1,1-dichloroethane	mg/L	0.025	1st quarter only
ethylene dibromide (EDB)	mg/L	0.0001	1st quarter only
1,1,1-trichloroethane	mg/L	0.06	1st quarter only
1,1,2-trichloroethane	mg/L	0.01	1st quarter only
1,1,2,2-tetrchloroethane	mg/L	0.01	1st quarter only
vinyl chloride	mg/L	0.001	1st quarter only
PAHs	mg/L	0.03	1st quarter only
benzo-a-pyrene	mg/L	0.0007	1st quarter only

µS/cm - microSiemens per centimeter pCi/L picocuries per liter
mg/L - milligrams per liter

5.0 REPORTING

There are several reporting requirements specified in 20.6.7.28 NMAC. The following is a summary of proposed reporting requirements:

- Monitoring well completion reports submitted 60 days after completion of newly installed monitoring well. The reports shall contain construction and lithologic logs, survey results, wellhead completion detail, map showing location, depth to water measurement(s), water-level elevation contour map, and results from groundwater samples. Other details can be referenced from 20.6.7.28 subsections J and K NMAC.
- Semi-annual groundwater elevation contour maps, as detailed in 20.6.7.28.L NMAC, will also include the extent of the existing open pit surface drainage area.

6.0 SURFACE-WATER SAMPLING

There are no perennial streams of the state within proposed Copper Flat Mine permit area that would require routine monitoring defined in NMAC 20.6.7.28.M; however, Grayback Arroyo is an ephemeral stream that drains the Copper Flat Mine site as shown in Figure 1.

A surface-water sampling network along Grayback Arroyo was established for Stage 1 Abatement data collection, and will be used as part of the monitoring network for the proposed Copper Flat Mine in fulfillment of 20.6.7.28.N NMAC. An additional storm-water sampling location (SWQ-5) is proposed in Grayback Arroyo between SWQ-1 and SWQ-2. The locations where auto-samplers (SWQ-1 though SWQ-4) have been installed to collect storm-water runoff samples are shown on Figure 1. Locations SWQ-1 through SWQ-3 are the same locations sampled from previous studies dating back to the 1970s, and subsequently have historical water-quality data. An auto-sampler was installed at SWQ-4 during 2014.

SWQ-1 will provide background storm water quality data, and SWQ-2 through SWQ-5 will provide down-gradient water-quality data (see Fig. 1). Collected storm-water samples will be analyzed for the list of inorganic analytes in Table 4.

In addition, 20.6.7.28.N NMAC requires the quarterly monitoring of process water, tailings slurry, impacted storm water, seeps, and springs at a copper mine facility. There are no seeps or springs at the site to be included in the sampling program, and the open pit will be dewatered during mining operations. The following surface waters at the site are proposed for quarterly sampling, to meet the requirements of 20.6.7.28.N NMAC:

1. Impacted Stormwater Impoundment A
2. Impacted Stormwater Impoundment B
3. Impacted Stormwater Impoundment C
4. Process Water Reservoir
5. Surge Pond
6. Underdrain Collection Pond
7. Mine Pit Water
8. Seeps or springs identified outside of the open pit surface drainage area

7.0 REFERENCES

INTERA, 2012, Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico: consultant's report prepared by INTERA for New Mexico Copper Corporation, June 2012.

[JSAI] John Shomaker & Associates, Inc., 2014, Model of groundwater flow in the Animas uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: consultant's report prepared by John Shomaker & Associates, Inc. for New Mexico Copper Corporation, March 2014.

[JSAI] John Shomaker & Associates, Inc., 2014b, Results from first year of Stage 1 abatement investigation at the Copper Flat Mine site near Hillsboro, New Mexico: consultant's report prepared by John Shomaker & Associates, Inc. for New Mexico Copper Corporation, May 2014.

Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico

Report Prepared for

THEMAC Resources Group Ltd.

Report Prepared by

SRK Consulting (U.S.), Inc.
SRK Project Number 191000.03
December 2017

Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico

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December 2017

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Executive Summary

SRK Consulting (SRK) has undertaken a predictive geochemical modeling exercise to assess future pit lake chemistry associated with the Copper Flat Project, Mew Mexico and to compare this to existing pit lake water quality. This work has been undertaken on behalf of New Mexico Copper Corporation (NMCC – a subsidiary of THEMAC Resources Group Ltd. [THEMAC]) to demonstrate compliance with New Mexico Mining Act regulations "Performance and Reclamation Standards for New Mining Operations" at 19.10.6.603 NMAC, applicable to the future pit water body, specifically that:

- The operations must be planned and conducted to minimize change in the hydrologic balance in both the permit and potentially affected areas; and
- Reclamation must result in a hydrologic balance similar to pre-mining conditions.

The work also forms part of the geochemical characterization study to assess the Acid Rock Drainage and Metal Leaching (ARDML) potential of the Project.

The Copper Flat Project is a porphyry copper-molybdenum deposit located on the western margin of the Rio Grande Rift. The deposit also contains minor, but potentially recoverable, gold and silver mineralization. The deposit is hosted by a quartz monzonite stock that intrudes a sequence of andesitic volcanic rocks.

Preliminary pit lake predictions for the Project were presented in the SRK December 2014 report entitled *'Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico'*, which was presented to Regulatory authorities to generate discussion and input. A number of modifications and refinements have been made to the pit lake models since this report was submitted, including:

- Incorporation of the Feasibility Study geologic block model;
- Incorporation of the current open pit design, which is detailed in the 2017 Mine Operation and Reclamation Plan (2017 MORP pit);
- Refinement of the pit wall composition to include delineation of material types by primary lithology, oxidation and mineralized versus weakly-mineralized material;
- Refinement of humidity cell test (HCT) inputs to include separate source terms for major and trace elements, reflecting the different processes that control their release;
- Refinement of mineral equilibrium phases based on predicted chemistry;
- Refinement of the water balance to use a reduced annual evaporation rate of 50 inches and to include a separate runoff term for reclaimed areas in the pit and the open pit watershed;
- Revisions to the groundwater chemistry inputs; and
- Incorporation of pit management and reclamation measures; including rapid fill of the pit and reclamation of the pit haul road and other areas within the pit and the pit watershed.

The objective of the report is to provide an analysis that demonstrates that future pit lake water quality results in a water body with similar chemistry to that of pre-mining conditions upon implementation of the reclamation actions proposed by NMCC in its MORP and Reclamation Plan, including rapid-fill of the open pit after closure of the mine.

Geochemical predictions were developed for three scenarios, including: (i) a calibration model for the existing pit lake; (ii) a natural fill model for the future unreclaimed pit; and (iii) a rapid fill model for the future reclaimed pit. Rapid fill has been proposed as the water quality component of NMCC's reclamation strategy for the future pit lake. It will include filling the pit with 2,202 acre-feet of good quality water from the production water supply wells during the first six months of groundwater recovery and pit infilling.

This report describes the approach taken for the revised pit lake predictive modeling effort, details the assumptions made, and presents the results of the revised pit lake geochemical predictions.

Model Calibration

The results of the existing pit lake model show good calibration of constituents, demonstrating water quality can be predicted with a good degree of accuracy for the future pit lake. The baseline water quality data utilized in the calibration model are data for existing water quality chemistry in the pit lake between 2010 and 2013. This is a subset of the entire baseline data generated between 1998 and July 2017. The full data set was utilized in comparing existing water quality chemistry to projected future water quality of the pit lake in discussed in Sections 5 and 6.

Unreclaimed Fill Scenario

In the unreclaimed pit scenario, allowing the pit to fill naturally will result in the pit walls and benches being exposed over a much longer period of time, i.e., approximately 150 years, before the pit lake reaches hydrologic equilibrium. In this scenario, the proposed future Copper Flat open pit is expected to be seasonally stratified but otherwise well-mixed, oxygenated and not acidic. Waters are predicted to be moderately alkaline (pH 7.9 – 8.2), primarily due to the buffering capacity of the inflowing groundwater. During the early stages of pit infilling (i.e., the first six months post-closure), removal/flushing of soluble salts from the pit walls is likely to result in a spike in boron, lead, mercury, manganese, molybdenum, nickel, selenium, vanadium, zinc and sulfate in the early pit lake. The effects of this initial flush will be dissipated by inflowing groundwater and precipitation, and pit lake chemistry will then evolve over time, with some parameters increasing in concentration as a result of evaporation effects. This is similar to the trends observed in the existing pit lake where elemental concentrations have increased since the start of pit infilling in response to evapoconcentration.

A comparison of predicted pit lake water chemistry for the unreclaimed fill scenario to chemistry measured in the existing pit lake between 1989 and 2017 demonstrates that the concentrations of the majority of constituents are comparable to existing concentrations, and therefore water quality of the future pit lake is expected to be similar to existing pit lake water quality.

Reclaimed Fill Scenario

Rapidly refilling the pit with water from the water supply wells during the first six months post-closure will result in a better initial water quality within the pit lake due to the good quality of the water that will be used. The long-term result is that the effects of evapoconcentration are not as pronounced as the pit lake reaches hydrogeologic equilibrium, and predicted concentrations of many major ions and trace elements will remain lower than in the unreclaimed fill scenario. This is particularly the case for constituents such as boron, sulfate and chloride, which are strongly influenced by evaporation effects and are predicted to be much lower in concentration for the rapid fill scenario compared to the natural fill scenario. In addition, the rapid fill will also quickly submerge walls and benches within six months and thus limit the exposure of sulfide minerals to oxygen, which will reduce trace element release into the pit lake. By contrast, the unreclaimed fill scenario allows the pit to fill naturally and results in the pit walls and benches being exposed over a much longer period of time, i.e., approximately 150 years, before the pit lake reaches hydrologic equilibrium. A comparison of predicted pit lake chemistry for the reclaimed pit rapid fill scenario to chemistry measured in the existing pit lake between 1989 and 2017 demonstrates that concentrations of the majority of predicted constituent concentrations are comparable to existing concentrations and therefore, water quality of the future pit lake is expected to be similar to existing pit lake water quality.

Conclusions

Based on the model results presented herein, the changes to the hydrologic balance of the future pit water body that will form post-mining will be nil or minimal and the water quality will be very similar to that of the existing pit lake. The existing pit lake at Copper Flat is an artificial water body created as a result of mineral extraction with little or limited ability to sustain aquatic life (Aquatic Consultants, Inc. 2014). The post-mining water body is anticipated to be similar to the existing pit lake and is not expected to be conductive to providing aquatic habitat or supporting fish life.

This geochemical modeling report demonstrates that the mine pit reclamation proposed for the Copper Flat mine that is outlined in Section 3.1.8 of this report meets the water quality similarity requirements of 19.10.6.603 NMAC.

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Appendices

1 Introduction

1.1 Purpose and Scope

SRK Consulting, Inc. (SRK) has undertaken a geochemical modeling assessment on behalf of New Mexico Copper Corporation (NMCC – a subsidiary of THEMAC Resources Group Ltd. [THEMAC]) to predict future pit lake chemistry associated with the Copper Flat Project (the Project), New Mexico. The purpose of the assessment is to evaluate the future environmental impacts of the Project as required by the New Mexico Mining Act and State environmental regulations. The work forms part of the geochemical characterization study to assess the Acid Rock Drainage and Metal Leaching (ARDML) potential of the Project.

Preliminary pit lake model results were presented in the December 18, 2014 report entitled *'Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico'* (SRK, 2014a). The purpose of this preliminary report was to outline the methodology for the pit lake modeling in order to seek feedback from the agencies, and to present the initial results of the pit lake modeling. Since this preliminary report was submitted, a number of modifications and refinements have been made to the pit lake models, including:

- Incorporation of the Feasibility Study geologic block model;
- Incorporation of the current open pit design, which is detailed in the 2017 Mine Operation and Reclamation Plan (2017 MORP pit);
- Refinement of the pit wall composition to include delineation of material types by primary lithology, oxidation and mineralized versus non-mineralized material;
- Refinement of humidity cell test (HCT) inputs to include separate source terms for major and trace elements, reflecting the different processes that control their release;
- Refinement of mineral equilibrium phases based on predicted chemistry;
- Refinement of the water balance to use a reduced annual evaporation rate of 50 inches and to include a separate runoff term for reclaimed areas in the pit and the open pit watershed;
- Revisions to the groundwater chemistry inputs; and
- Incorporation of pit reclamation measures, including rapid fill of the pit and reclamation of the pit haul road and other areas within the pit and the pit watershed.

This final report describes the approach taken for the revised pit lake predictive modeling effort, details the assumptions made, and presents the final results of the revised pit lake geochemical predictions.

Applicable standards to the post-mining Copper Flat pit lake are contained in the New Mexico Mining and Minerals Division (MMD) regulations administered under the Mining Act. Specifically, the performance and reclamation standards require that reclamation must result in a hydrologic balance similar to pre-mining conditions. With respect to water quality in the pit lake, post mining water quality must be similar to baseline pre-mining water quality in the pit lake. The model results presented herein have been compared to pre-mining baseline water quality of the existing pit lake.

1.2 Background

The Copper Flat Project is a porphyry copper/molybdenum deposit located in the Hillsboro Mining District in South Central New Mexico, in Sierra County located approximately 150 miles south of Albuquerque, New Mexico and approximately 20 miles southwest of Truth or Consequences, New Mexico straight-line distances). Access from Truth or Consequences is by 24 miles of paved highway and 3 miles of all-weather gravel road. The Copper Flat Project location is shown in Figure 1-1.

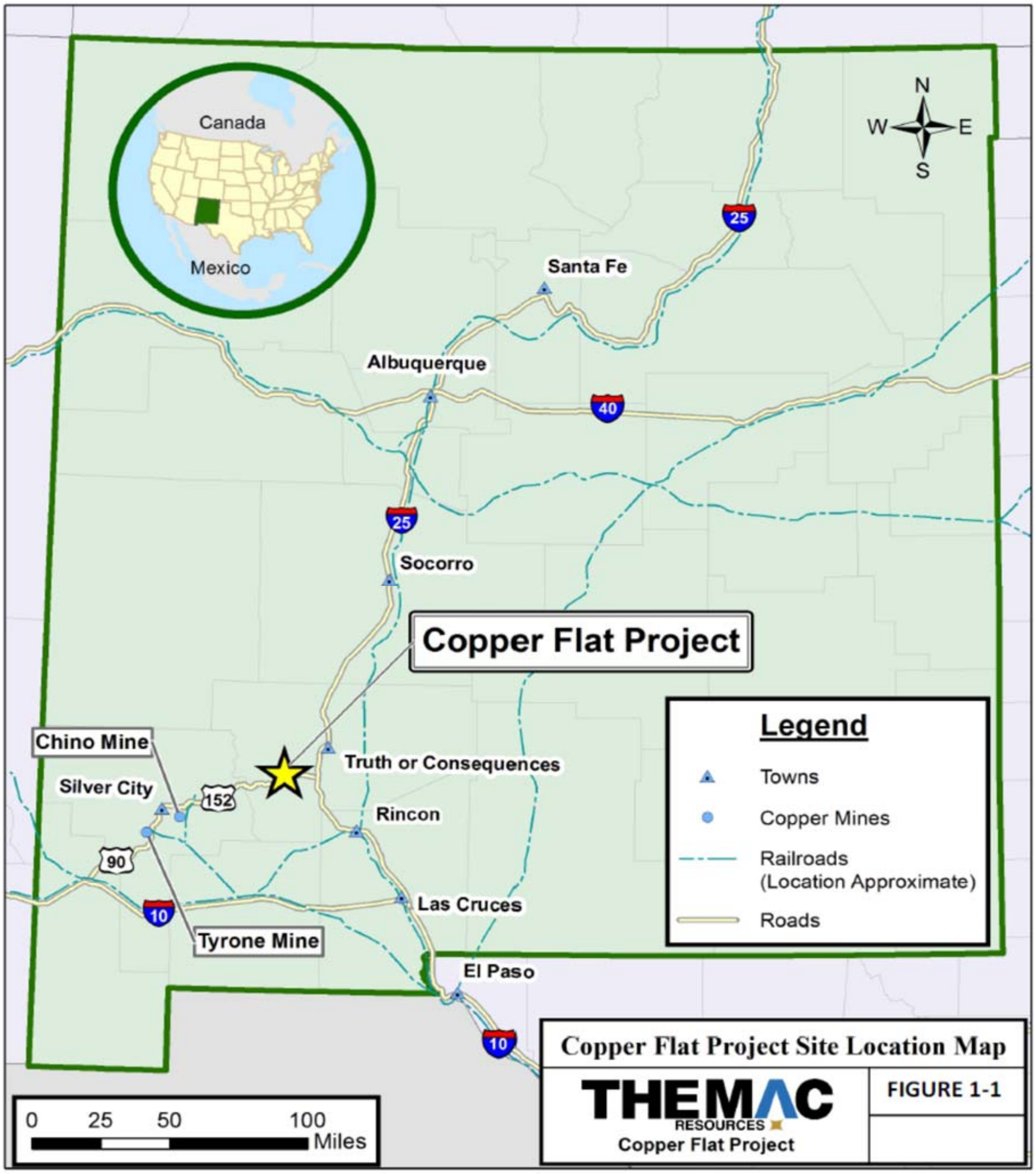

Figure 1-1: Project Location

1.2.1 Climate

The regional climate is high desert, and is generally hot with a July average of 76°F (record maximum 107°F), and January average of 39°F (record minimum 1°F). The area is generally dry with about 13 inches of average annual precipitation, which occurs mostly as rainfall during July to September.

Winters are cold and dry. Snowfall is possible from October through April, but more typically occurring between December and February. The average annual total is 8 inches of snowfall. Prevailing wind direction is predominantly from the west, and secondarily from the north, and averages 10 to 15 miles per hour. Wind speeds in excess of 50 mph may occur as major storms pass through the area.

1.2.2 Prior Mining Operations

Mining activities in the Hillsboro Mining District began in the late-1800s. Gold was mined from shafts and adits at Copper Flat and from placer workings developed along drainages to the east and southwest of Black and Animas Peaks. Gold mining was further developed during the early 1900s and continued until World War II. Today, small scale placer mining continues. Copper exploration began in the 1950s and continued to the early 1980s, when Quintana Minerals Corporation defined 60 Mt of reserves sufficient to operate for a 11-year mine life at an extraction rate of 15,000 tons of ore per day (tpd). Operations included the development of the open pit, waste rock stockpiles, TSF and other mine disturbances observed today, but mining stopped after three months due to low metal prices. Mine buildings and equipment were dismantled in 1985; however structural foundations, power lines, water wells, and in-ground infrastructure were left in-place for a future restart. During the 1990s, plans to reopen the mine were considered. Existing surface disturbances and facilities in the Project area include the following:

- A pit with a small pit lake;
- Waste rock stockpiles (WRSP);
- A 115-kilovolt power line from the Caballo Substation to the mine site;
- Production wellfield and 20-inch pipeline from the wellfield to the mine site;
- A diversion channel collecting stormwater from west and south of the pit and diverting unimpacted flows down Grayback wash;
- A diversion channel collecting stormwater from north of the pit and diverting unimpacted flows to the east;
- Existing concrete foundations and structures including:
    - Primary crusher structure and stacking conveyor tunnel
    - Coarse ore reclaim tunnel
    - Concentrator building foundation
    - Truck shop foundation
    - Administration building foundation
    - Concentrate storage foundation
    - Mine office and change house foundation.
- Site grading and roads; and
- A tailings storage facility (TSF) containing approximately 1.4 Mt of tailings from the Quintana mining operation.

1.2.3 Mine Plan

The proposed Project consists of an open pit mine, flotation mill, tailings storage facility, waste rock stockpiles and ancillary facilities. During the mine life, the proposed Project is expected to produce approximately 113 million tons of copper ore and 45 million tons of waste rock. Ore extraction will take place by conventional truck and loader methods using 25-foot high benches. Backfilling of the pit will not take place during or after mining.

Beneficiation will be achieved through the use of a conventional concentrator using standard crushing, grinding and flotation technologies. The operation is designed to recover copper, molybdenum, gold, and silver into separate copper and molybdenum concentrates. The nominal ore throughput rate is 30,000 tpd and an operational life of 11 to 12 years is currently projected. The proposed layout of the mine facilities is shown in Figure 1-2. The current pit configuration is modified from the pit design developed for the Copper Flat Feasibility Study (FS) published in November 2013 (M3, 2013) and matches the pit design presented in the 2017 MORP (THEMAC, 2017a).

EWRSP = EXISTING WASTE ROCK STOCKPILE
WRSP = WASTE ROCK STOCKPILE

SITE PLAN
SCALE: 1:500

500' 250' 0' 500' 1000'
1" = 500'
DO NOT SCALE 11x17 DRAWINGS

PRELIMINARY
FOR AGENCY REVIEW

THEMAC RESOURCES

REFERENCES		REFERENCES		REVISIONS						REVISIONS					
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT

SCALE: 1" = 500'		DATE
DESIGNED BY	SAM	DEC12
DRAWN BY	SAM	DEC12
CHECKED BY	TDL	JAN13
PROJECT MGR	RKZ	
CLIENT APPR.		

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COPPER FLAT PROJECT

SITE GENERAL CIVIL PROJECT AREA PROPOSED SITE PLAN

JOB NO. M3 PN-120085
DWG NO. **FIGURE 2-2**
REV NO. P18
DATE 16 NOV 15

1.2.4 Geology and Mineralization

The following description of geology and mineralization is from the Copper Flat Feasibility Study (FS) published in November 2013 (M3, 2013). The Copper Flat Project is a porphyry copper-molybdenum deposit located on the western margin of the Rio Grande Rift. The deposit also contains recoverable, gold and silver. The deposit is hosted by a small quartz monzonite stock having a porphyritic texture that intrudes a sequence of andesitic volcanic rocks of similar age covering an area approximately 4 miles in diameter.

Regional Geology

The Copper Flat Project lies within the Mexican Highlands portion of the Basin and Range Physiographic Province. The Project is located in the Hillsboro Mining District in the Las Animas Hills, which are part of the Animas Uplift, a horst on the western edge of the Rio Grande valley. The Animas Uplift is separated from the Rio Grande by nearly 20 miles of Santa Fe Group alluvial sediments, referred to as the Palomas Basin of the Rio Grande valley. To the west of the Animas Uplift is the Warm Springs valley, a graben that parallels the Rio Grande valley. Further west, the Black Mountains form the backbone of the Continental Divide, rising to about 9,000 feet above sea level. The regional geology is discussed in more detail in the *Baseline Data Report for the Copper Flat Mine* (BDR) (INTERA, 2012). The focus of this report is on the local and Copper Flat ore body geology.

Basement rocks in the area consist of Precambrian granite and Paleozoic and Mesozoic sandstones, shales, limestones, and evaporites. Sedimentary units that crop out within the Animas Uplift include the Ordovician Montoya Limestone, the Silurian Fusselman Dolomite, and the Devonian Percha Shale. The Cretaceous-age Laramide orogeny, which was characterized by the intrusion of magma associated with the subduction of the Farallon plate beneath the North American plate, affected this region between 75 and 50 million years ago (Ma). Volcanic activity during the late Cretaceous and Tertiary periods resulted in localized flows, dikes, and intrusive bodies, some of which were associated with the development of the nearby Tertiary Emory and Good Sight-Cedar Hills calderas. Later basaltic flows resulted from the tectonic activity associated with the formation of the Rio Grande rift. Tertiary and Quaternary alluvial sediments of the Santa Fe Group and more recent valley fill overlie the older Paleozoic and Mesozoic units in the area.

Local Geology

The district geology described below is modified from McLemore et al. (2000) and Raugust (2003). The predominant geologic feature of the Hillsboro Mining District is the Cretaceous Copper Flat stratovolcano, a circular body of Cretaceous andesite that is 4 miles in diameter (Figure 1-3). The Hillsboro Mining District comprises the Las Animas Hills, a low range formed by the Animas Hills horst at the western edge of the Rio Grande Rift. Faults that bound the Animas Hills horst are related to the tectonic activity of the Miocene-age Rio Grande Rift (Dunn, 1982). Due to the difference in ages and in spite of its close proximity, there is no known connection between the Rio Grande rift and the Copper Flat volcanic/intrusive complex. The Copper Flat volcanic/intrusive complex has been interpreted as an eroded stratovolcano based on the presence of agglomerate and flow band textures in some of the andesite (Richards, 2003).

The Copper Flat Quartz Monzonite (CFQM) intrudes the core of the volcanic complex. The CFQM stock has a surface expression of approximately 0.4 mi^2 and has been dated by the argon-argon (40Ar/39Ar) techniques to be 74.93 ±0.66 million years old (McLemore et al., 2000). The surrounding andesite has also been dated using argon-argon techniques to be 75.4 ±3.5 million years old (McLemore et al., 2000).

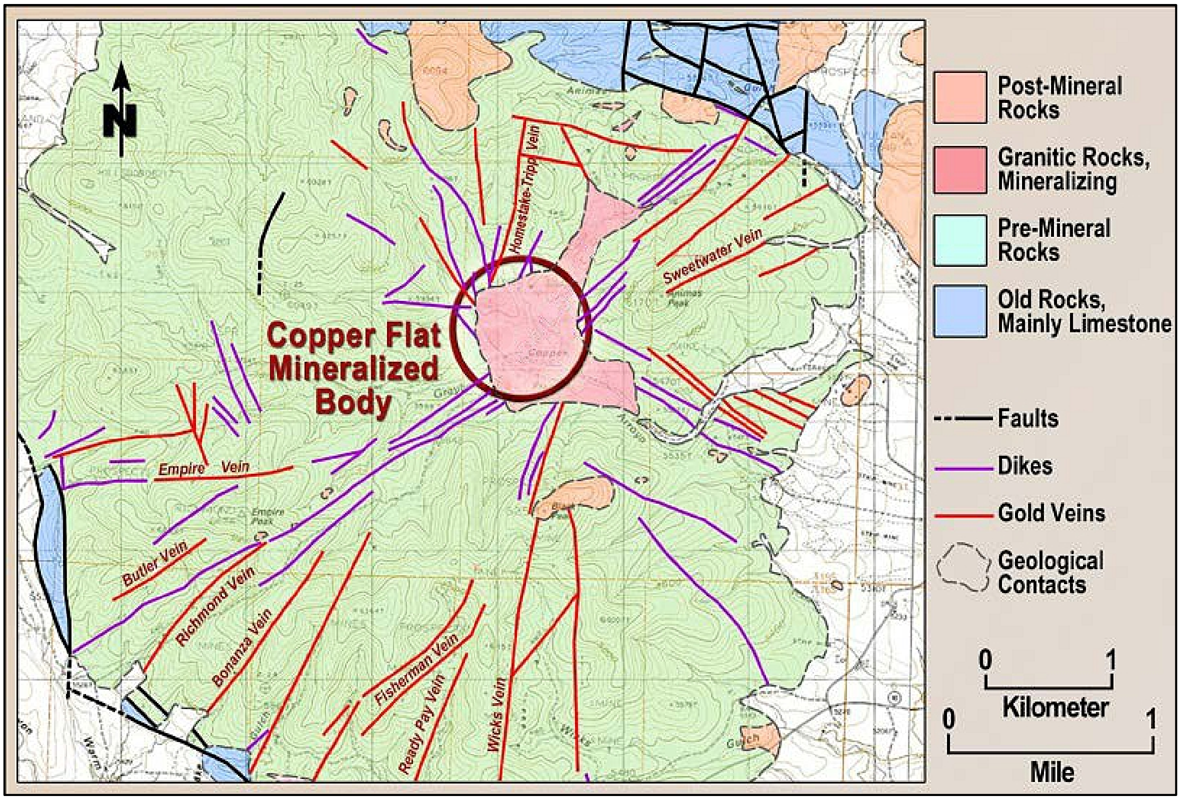


Figure 1-3: Geology of the Copper Flat Mine (Dunn, 1982)

Geology of the Copper Flat Orebody

The Copper Flat andesite is generally fine-grained with phenocrysts of plagioclase (andesine) and amphibole in a groundmass of plagioclase and potassium feldspar and rare quartz. Some agglomerates or flow breccias are locally present, but the andesite is generally massive. Magnetite is commonly associated with the mafic phenocrysts, and accessory apatite is commonly found.

Although the depth of erosion is uncertain, the center of the stratovolcano was eroded to form a topographic low. To the east of the site, this andesite body is in fault contact with Santa Fe Group sediments, which are at least 2,000 feet thick in the immediate Copper Flat area and thickening to the east. Near-vertical faults characterize the contacts on the remaining perimeter of the andesite body; these faults juxtapose the andesite with Paleozoic sedimentary rocks. Historical drill holes indicate the andesite is locally more than 3,000 feet thick. This feature, combined with the concentric fault pattern, indicate that the local geology represents a deeply eroded Cretaceous-age volcanic complex. A detailed geologic map of the Copper Flat orebody is provided in Figure 1-4 and a south-north geologic cross section through the Copper Flat orebody is provided in Figure 1-5.

Copper Flat Quartz Monzonite (CFQM) intrudes the core of the volcanic complex. Sulfide mineralization is present as veinlets and disseminations in the CFQM, but is most strongly developed in and adjacent to the west end of a steeply dipping breccia pipe that is centrally located within the CFQM stock and elongated in the northwest-southeast direction (Figure 1-5).

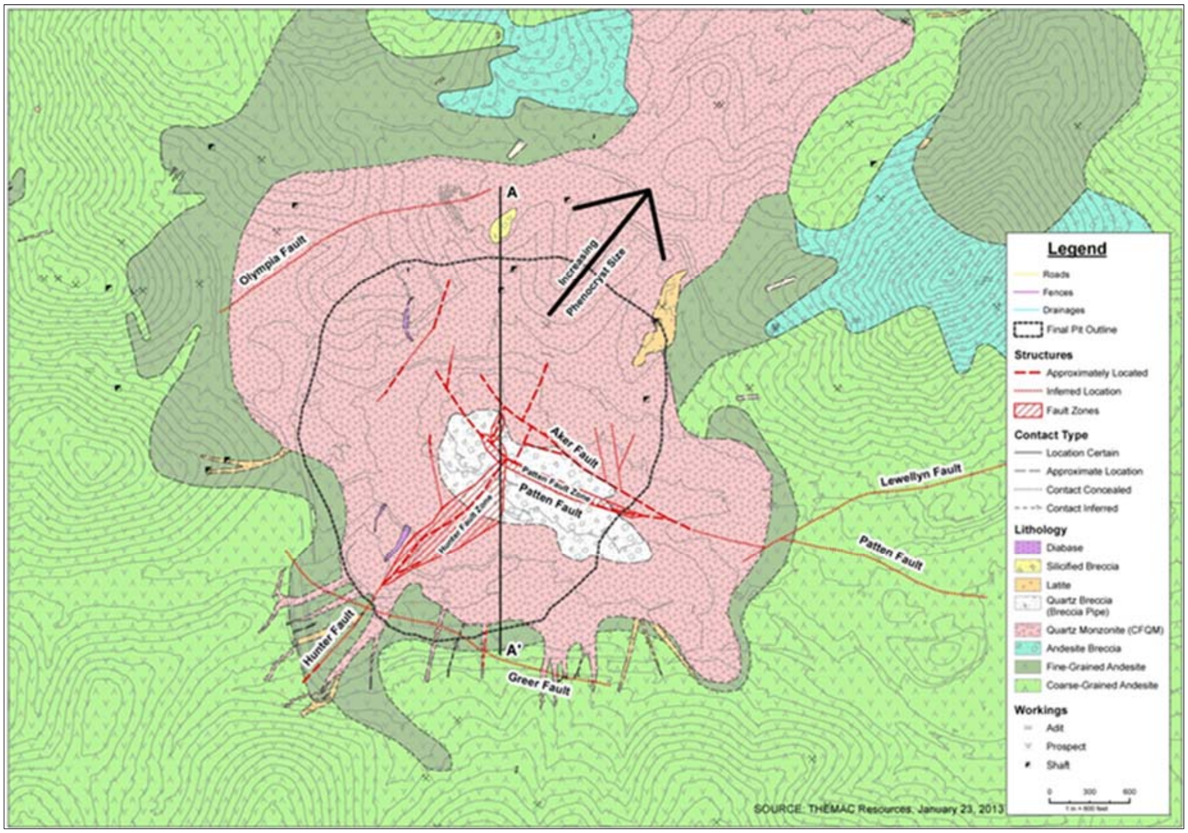


Figure 1-4: Detailed Geologic Map of the Copper Flat Orebody (M3, 2013)

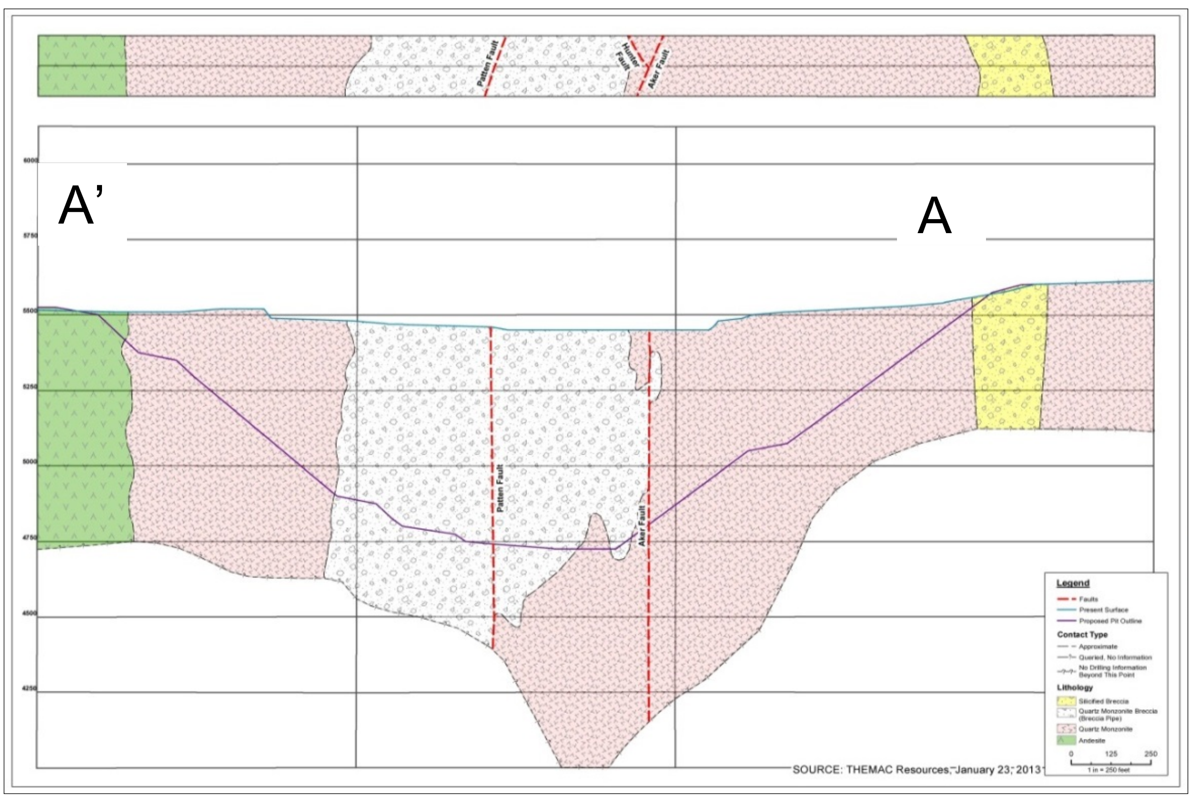


Figure 1-5: Geologic Cross Section through the Copper Flat Orebody (M3, 2013)

Lithology

The CFQM intruded into the center of the andesite sequence at the intersection of two principal structures that trend respectively N50°W and N20°E. The CFQM is an irregular-shaped stock underlying a surface area of approximately 0.40 square miles and has been dated to approximately 75 Ma. In the few exposures in which the CFQM is in contact with the andesite, the andesite shows no obvious signs of contact metamorphism. The CFQM is a medium- to coarse-grained, holocrystalline porphyry composed primarily of potassium feldspar, plagioclase, hornblende, and biotite; trace amounts of magnetite, apatite, zircon, and rutile are also present, along with localized mineralized zones containing pyrite, chalcopyrite, and molybdenite. About 15 percent of the monzonite is quartz, which occurs both as small phenocrysts and as part of the groundmass; however, quartz is absent in some parts of the stock.

Numerous dikes, some of which are more than a mile in length and mostly of latite composition, radiate from and cut the CFQM stock. Most of the dikes trend to the northeast or northwest and represent late stage differentiation of the CFQM stock. Diabase has been mapped in contact with the CFQM at Copper Flat. Immediately south of the quartz monzonite, the andesite is coarse-grained, perhaps indicating a shallow intrusive phase. An irregular mass of andesite breccia along the northwestern contact of the quartz monzonite contains potassium feldspar phenocrysts and andesitic rock fragments in a matrix of sericite with minor quartz. This may represent a pyroclastic unit. Magnetite, chlorite, epidote, and accessory apatite are also present in the andesite breccia.

Structure

Three principal structural zones are present at Copper Flat, the most prominent of which is a northeast-striking fault that trends N 20°-40°E that includes the Hunter and parallel faults or the Hunter fault zone. In addition, west-northwest striking zones of structural weakness (N50°-70°W) are marked by the Patten and Greer faults, and east-northeast striking zones are marked by the Olympia and Lewellyn faults. All faults have a near-vertical dip; the Hunter fault system dips 80°W, the Patten dips approximately 70°S-80°S, and both the Olympia and Lewellyn fault systems dip between 80°S and 90°S. These three major fault zones appear to have been established prior to the emplacement of the CFQM and controlled subsequent igneous events and in the case of the Patten and Hunter controlled mineralization.

As previously stated, the CFQM emplacement is largely controlled by the three structural zones. The southern contact parallels and is cut by the Greer fault, although the contact is cut by the fault, and the southeastern and northwestern contacts are roughly parallel to the Olympia and Lewellyn faults, respectively. The CFQM stock is principally elongated along the Patten fault, as well as along the Hunter fault zone.

Although latite dikes strike in all the three principal fracture directions, most of the dikes strike northeast. The northeast trending fault zones contain a high proportion of wet gouge, often with no recognizable rock fragments. Reportedly in underground exposures the material comprising the Hunter fault zone has the same consistency as wet concrete and has been observed to flow in underground headings. Based on recent drilling the Patten fault consists of a mixture of breccia and gouge. However, the material in the east-northeast fault zones contains only highly broken rock and minor gouge. The width of individual structures in all three systems varies along strike from less than a foot to nearly 25 feet in the Patten fault east of the Project. Despite intense brecciation, the total displacement along the faults does not appear to exceed a few tens of feet. At the western edge of the CFQM intrusion, a younger porphyritic dike was emplaced in a fault that offsets an early latite dike, indicating that fault movement occurred during the time that dikes were being emplaced.

Post-dike movement is evident in all the three principal fault zones, and both the Hunter and Patten fault systems show signs of definite post-mineral movement. Fault movement has smeared sulfide deposits and offset the breccia pipe as well as the zones within the breccia pipe. Post-mineral movement along faults has resulted in wide, strongly brecciated fault zones. Some of the post-mineral dikes have been emplaced within these fault zones.

NMCC has mapped the pit area and diversion cuts in detail at 1 inch equals 40 feet (1:480) and has examined the pre- and post-mineral stress orientations in the andesite and CFQM. Findings indicate no significant difference in the stress fields before and after mineralization. During NMCC's mapping efforts, the Greer and Olympia previously mapped fault locations could not be verified; therefore, these faults were labeled as inferred.

Mineralization

The CFQM hosts mineralization dominated by pyrite and chalcopyrite with subsidiary molybdenite, minor bornite and recoverable amounts of gold and silver. The mineralization is focused along intersecting northeast- and northwest-trending faults, and these intersections may have originally controlled emplacement of the CFQM.

Although copper occurs almost exclusively as chalcopyrite locally accompanied by trace amounts of bornite, minor amounts of chalcocite and copper oxide minerals are locally present near the surface and along fractures. The supergene enrichment typical of many porphyry copper deposits in the Southwest is virtually non-existent at Copper Flat. During the early mining days, a 20 to 50-foot leached oxide zone existed over the ore body, but this material was stripped during the mining activities that occurred in the early 1980s. Most of the remaining ore is unoxidized and consists primarily of chalcopyrite and pyrite with some molybdenite and locally traces of bornite, galena and sphalerite. Recently completed mineralogical studies indicate that fine grained disseminated chalcopyrite is often inter grown with pyrite and occurs interstitial to silicate minerals. Deposition of chalcopyrite and molybdenite (76.2 Ma) occurred within the same mineralizing event as the pyrite.

Sulfide mineralization is present as veinlets and disseminations in the CFQM, but is most strongly developed in and adjacent to the west end of a steeply dipping breccia pipe, that is centrally located within the CFQM stock and elongated in the northwest-southeast direction roughly along, but south of the Patten fault. The sulfide mineralization first formed in narrow veinlets and as disseminations in the quartz monzonite with weakly developed sericitic alteration. This stage of mineralization was followed by the formation of the breccia pipe with the introduction of coarse "clotty" pyrite and chalcopyrite along with veinlet controlled molybdenite and milky quartz, and the development of strong potassic alteration.

The breccia pipe, which can best be described as a crackle breccia, consists largely of subangular fragments of mineralized CFQM, with locally abundant mineralized latite where dikes exposed in the CFQM projected into the brecciated zone that range in size from an inch to several inches in diameter. Andesite occurs only as mixed fragments partially in contact with intrusive CFQM and appears to represent the brecciation of relatively unaltered andesite xenoliths in the CFQM. The matrix contains varying proportions of quartz, biotite (phlogopite), potassium feldspar, pyrite, and chalcopyrite, with magnetite, molybdenite, fluorite, anhydrite, and calcite locally common. Apatite is a common accessory mineral. Breccia fragments are rimmed with either biotite or potassium feldspar, and the quartz and sulfide minerals have generally formed in the center of the matrix.

Two types of breccia within the quartz monzonite breccia pipe have been identified as distinguishable units based on the dominant mineral filling the matrix between clasts. Recent drilling has shown that the two breccia types, biotite breccia and feldspar breccia, grade into one another as well as with the CFQM. Interestingly, from a recovery perspective, metallurgical testing has shown that the mineralization behaves virtually the same irrespective of the lithology.

The total sulfide content ranges from 1 percent (by volume) in the eastern part of the breccia pipe and the surrounding CFQM to 5 percent in the CFQM to the south, north, and west. Sulfide content is highly variable within the breccia, with portions in the western part of the breccia containing as much as 20 percent sulfide minerals. The strongest copper mineralization is concentrated in the western half of the breccia pipe and in the adjoining stockwork veined CFQM in the vicinity of the intersection of the Patten fault and the Hunter fault zone. Sulfide mineralization is concentrated in the CFQM and breccia pipe, and drops significantly at the andesite contact. Minor pyrite mineralization extends into the andesite along the pre-mineral dikes and in quartz-pyrite-bearing structures, some of which were historically prospected for gold.

Molybdenite occurs in some steeply dipping quartz veins or as thin coatings on fractures. Minor sphalerite and galena are present in both carbonate and quartz veinlets in the CFQM stock. Preliminary 2011 evaluations of the mineralization at Copper Flat indicate that copper mineralization concentrates and trends along the N50°W structural influences, whereas the molybdenum, gold and silver appear to favor a N10°-20°E trend.

1.2.5 Hydrology

Hydrological information pertaining to the Copper Flat Project has been summarized from the Baseline Data Report (INTERA, 2012) and is provided herein to provide a context for the pit lake modeling. The mine permit area is located in the Lower Rio Grande watershed, which includes approximately 5,000 square miles in Catron, Socorro, Sierra, and Doña Ana Counties and is dominated by the Rio Grande and its tributaries as well as the two large reservoirs of Elephant Butte and Caballo. Numerous tributaries drain into the Rio Grande from the west, but none contribute perennial flow to the Rio Grande. The mine permit area is drained by ephemeral streams (arroyos) within the Greenhorn Arroyo Drainage Basin. The Greenhorn Arroyo Drainage Basin is composed of Greenhorn Arroyo, Grayback Arroyo, and Hunkidori Gulch. The Grayback Arroyo passes through the permitted mine area and is diverted around the existing mine pit. Drainages within this watershed are ephemeral, flowing in response to heavy or sustained precipitation events. Water quality data for the Greyback Arroyo are summarized in Table 1-1.

Table 1-1: Summary of Hydrochemical Information in the Grayback Arroyo (INTERA, 2012)

Details	pH (s.u.)	Chloride (mg/L)	Sulfate (mg/L)	TDS (mg/L)
Min	7.42	0.71	11	78
Max	7.92	130	2,900	4,500

Surface waters in the Grayback Arroyo are typically characterized by higher major ion and trace element concentrations, with sulfate concentrations up to 2,900 mg/L and TDS up to 4,500 mg/L.

1.2.6 Hydrogeology

Hydrogeological information pertaining to the Copper Flat Project has been summarized from the Baseline Data Report (INTERA, 2012) and is provided herein. This report identifies three aquifers within the Copper Flat Project area (Figure 1-6) including:

1. Crystalline bedrock aquifer;
2. Santa Fe Group aquifer; and
3. Quaternary alluvial aquifer.

Details of these aquifers are provided below.

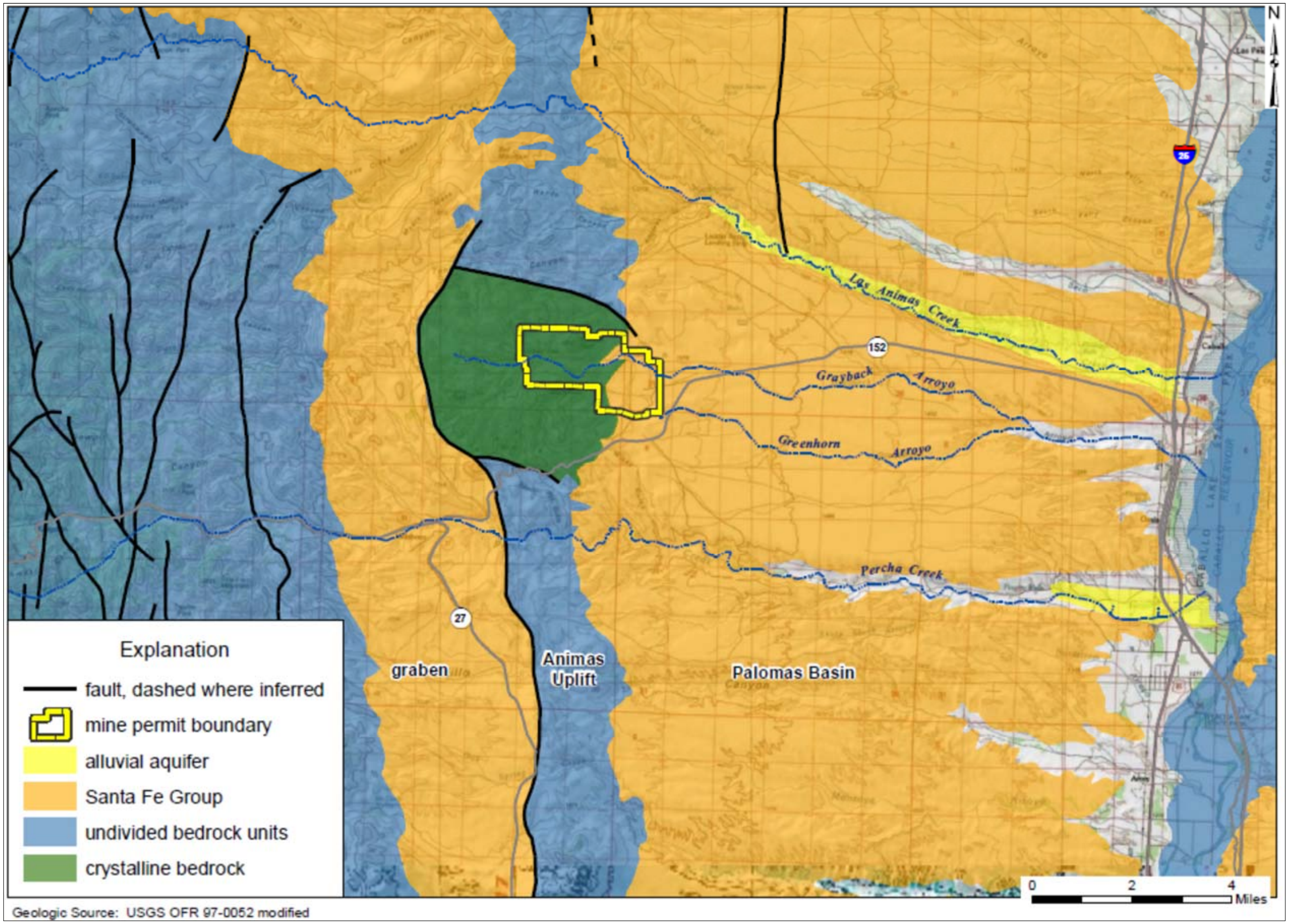


Figure 1-6: Map Showing Location of Crystalline Bedrock, Santa Fe Group Sediments and Alluvial Aquifer Zones (INTERA, 2012)

1. ***Crystalline Bedrock Aquifer:*** Groundwater is present within the crystalline volcanic rocks (quartz monzonite and andesite) that constitute much of the western portion of the mine permit area. Though the rocks themselves have practically no inter-granular permeability, faulting and jointing of the monzonite have created locally permeable zones through which water can move. Groundwater flow is generally from west to east, with the exception of the area surrounding the pit lake, which behaves as an evaporative sink. The permeability of the andesite is extremely low (<0.003 feet/day), whereas the permeability of the monzonite rocks averages 0.1 feet/day due to localized secondary porosity from fracturing. Groundwater in the Crystalline Bedrock Aquifer is characterized by moderately alkaline pH (~8 s.u.) and can generally be classed as sodium / calcium plus bicarbonate (Na / Ca + HCO_3) type waters based on their major ion signature (Figure 1-7).
2. ***Santa Fe Group Aquifer:*** Overlying and adjacent to the crystalline bedrock aquifer is the Santa Fe Group Aquifer system, which receives recharge from precipitation. The aquifer is located approximately 1 mile downgradient of the existing pit lake, and the low hydraulic conductivity of the andesite limits cross formational flow. The sediments of the Santa Fe Group are stratified, contain a wide variety of grain sizes, and, in general, dip to the east. The direction of groundwater flow is from west to east and the groundwater elevation contours indicate groundwater flows from the andesite to the alluvium and Santa Fe Group sediments. Groundwater in the Santa Fe Group Aquifer is characterized by circum-neutral to moderately alkaline pH (7 – 8 s.u.) and can generally be grouped into the calcium plus bicarbonate (Ca + HCO_3) or calcium plus sulfate (Ca + SO_4) hydrochemical facies based on major ion chemistry (Figure 1-7). The sulfate signature of some of the groundwater samples is associated with wells within the Santa Fe Group Aquifer near the existing TSF, which are known to be influenced by a sulfate plume from the historic tailings.
3. ***Quaternary Alluvial Aquifer:*** This aquifer is comprised of channel and floodplain gravels, sands and silts and represents the uppermost aquifer in the vicinity of the Copper Flat Project. The alluvial aquifer is typically recharged by infiltration of rainfall.

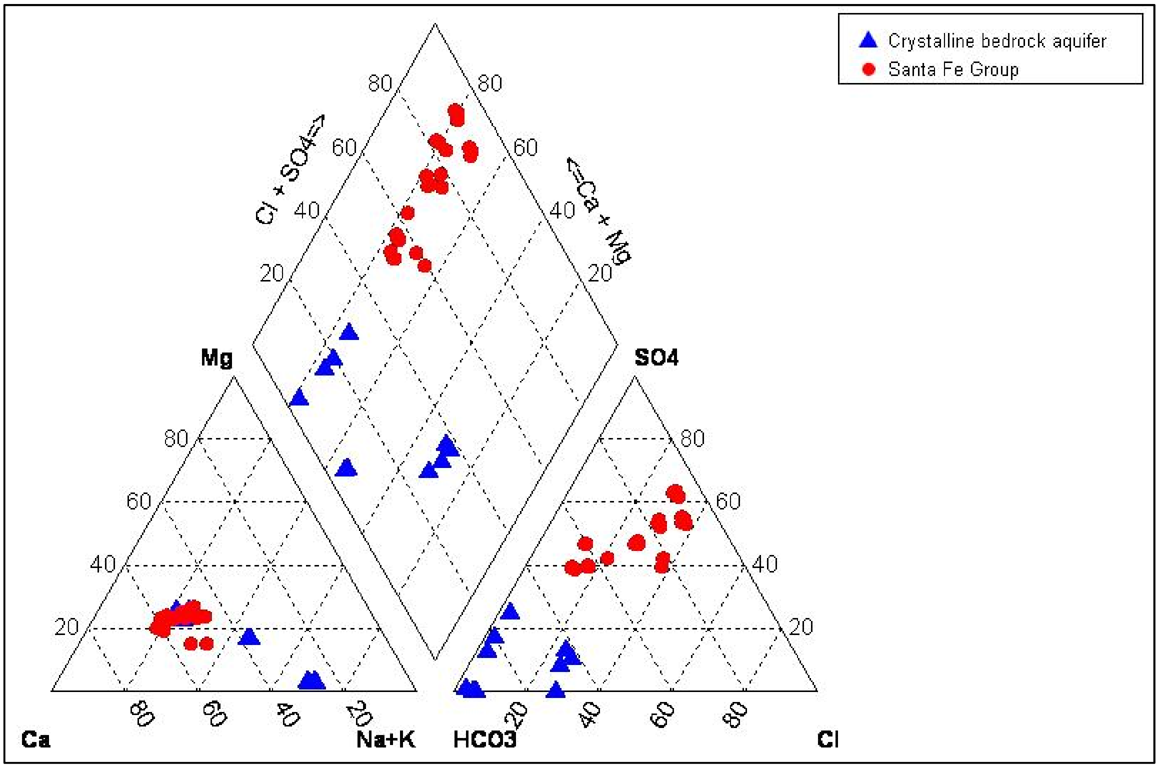


Figure 1-7: Piper Plot of Major Ion Chemistry of Groundwater in the Mine Permit Area (analyses from 2010 and 2011 only)

1.2.7 Existing Pit Lake

Beginning in the late 1980s, a pit lake formed in the existing pit. This lake represents an artificial water body that has formed in a man-made void. The surface area of the pit lake was approximately 13.8 acres at its maximum extent, but the lake has subsequently reduced in size as a result of evaporation and limited precipitation (i.e., drought conditions). A recent evaluation by John Shomaker and Associates (JSAI, who have been assisting THEMAC with site management of water resources) indicates that the pit lake currently covers an area of approximately 5.2 acres and contains approximately 70 acre-feet of water (NMCC estimate, 2015). Bathymetric measurements carried out as part of the INTERA (2012) baseline data collection program indicate that the depth of the existing pit lake varies between 10 and 35 feet. Water levels are typically highest in the winter month of January and lowest in the summer month of July. The analytical results do not indicate the presence of a chemocline or any chemical stratification in the lake. However, the temperature profiles for the winter and summer sampling showed a greater than 1°C per meter change, indicating the presence of a seasonal thermocline. The pit currently represents a hydraulic sink, with evaporation from the lake surface exceeding groundwater inflow, precipitation and surface runon (M3, 2012).

Monitoring of the existing pit lake water quality has taken place periodically between 1989 and present, with a total of 57 samples being collected for analysis. Monitoring took place on at least an annual basis between 1989 and 1997, with 26 samples collected during this period. The monitoring program was then re-established in 2010 as part of the INTERA (2012) baseline data collection program, which included collection of samples from the deepest part of the pit lake in September 2010, January 2011, April 2011 and July 2011. JSAI collected four quarters of additional data in 2013 as part of the Stage 1 abatement investigation (JSAI, 2014a). Monitoring of pit lake water quality is ongoing, with NMCC collecting three samples in 2014, two samples in 2015, 13 samples in 2016 and two samples to date in 2017.

The results of the existing pit lake monitoring are summarized in Table 1-2 and time-series plots of key parameters are provided in Appendix A. This demonstrates that the pH of the pit lake waters has been variable over the period of record, ranging from a minimum of pH 3.6 to a maximum of pH 8.3. In general, the pit lake waters are circum-neutral (average of pH 6.5); any periodic decreases in pH (for example between March and October 1992, June 2008 and June 2015 [Figure 1-10]) are associated with periodic Acid Wall Seep (AWS) events. Concentrations of sulfate, chloride, TDS, manganese, magnesium, cobalt, fluoride, sodium and potassium have increased between 1989 and 2017 (Appendix A). In particular, evapoconcentration effects have increased the concentrations of sulfate and chloride (Figure 1-8), resulting in supersaturation of pit lake waters and subsequent precipitation of salts (primarily gypsum) around the rim of the existing pit lake. These precipitated solids form a thick crust on the pit walls (Figure 1-11).

Copper concentrations in the open pit are influenced by AWS events (Figure 1-9). The elevated copper concentrations observed in 2010 are naturally mitigated to below analytical detection limits by 2011. This demonstrates that pit lake chemistry is temporally variable, with copper concentrations varying from below analytical detection limits up to a maximum of 26.5 mg/L.

Temperature and dissolved oxygen profiles for the existing pit lake (INTERA, 2012, Aquatic Consultants, 2014) show the pit water is not significantly stratified. The water stays well oxygenated for the entire depth for each season (6 to 8 mg/L dissolved oxygen). Thermal stratification requires a 1^{o}C change in temperature per meter (Wetzel, 2001), which can occur in the summer months as the upper water column heats up and the lower water column remains cool, and well oxygenated. Figure 1-12 also shows that there is no depth-dependent variation in key chemical constituents (pH, TDS, copper, iron, zinc, manganese). This supports the assumption that the current pit lake is not stratified and that no chemocline exists.

A biological assessment of the pit lake was performed by Aquatic Consultants, Inc. (Aquatic Consultants, 2014, Appendix J) as part of the baseline data gathering effort to determine if aquatic life was present in the existing pit lake. While some algae were identified in the waters, no zooplankton, macroinvertebrates and no fish species were recovered during sampling, indicating the pit lake does not provide a suitable aquatic habitat. The biological assessment in conjunction with the other information provided in this section demonstrates that the existing pit lake is an artificial water body created as a result of mineral extraction with little or limited ability to sustain aquatic life and should not be equated to conditions that may be encountered in natural lakes..

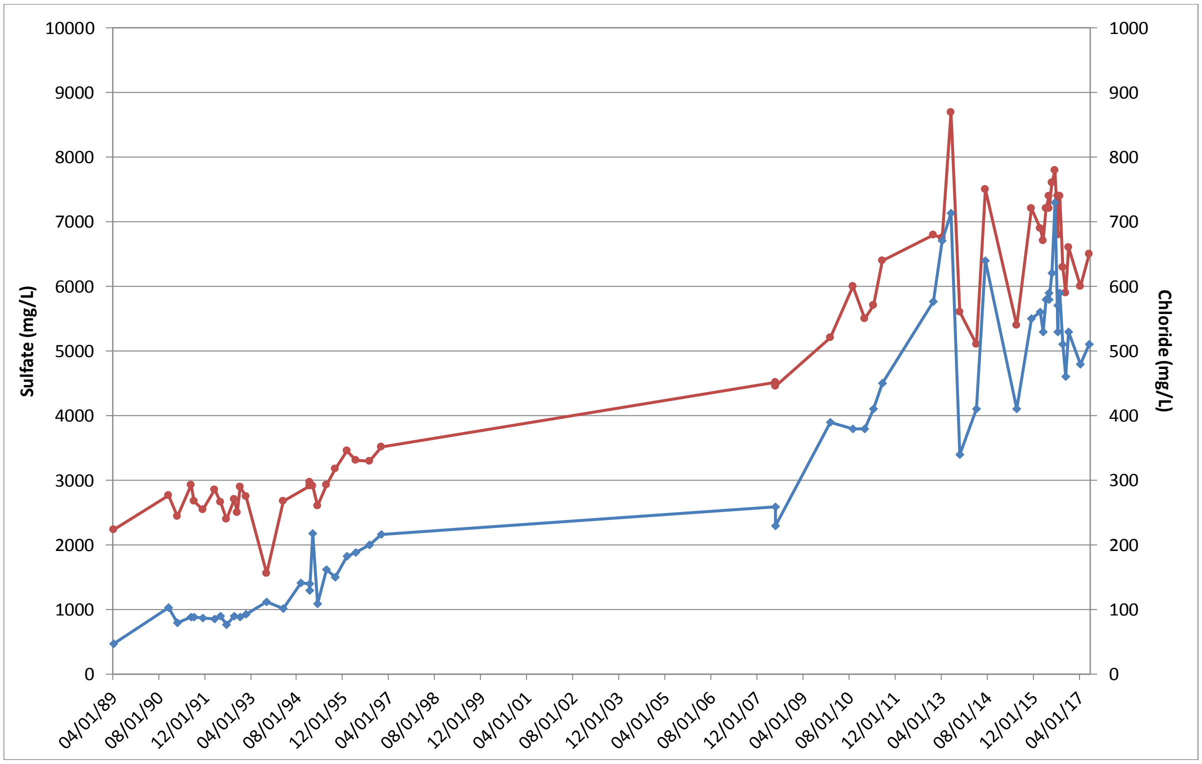


Figure 1-8: Plot of Sulfate and Chloride Concentrations in Existing Pit Lake

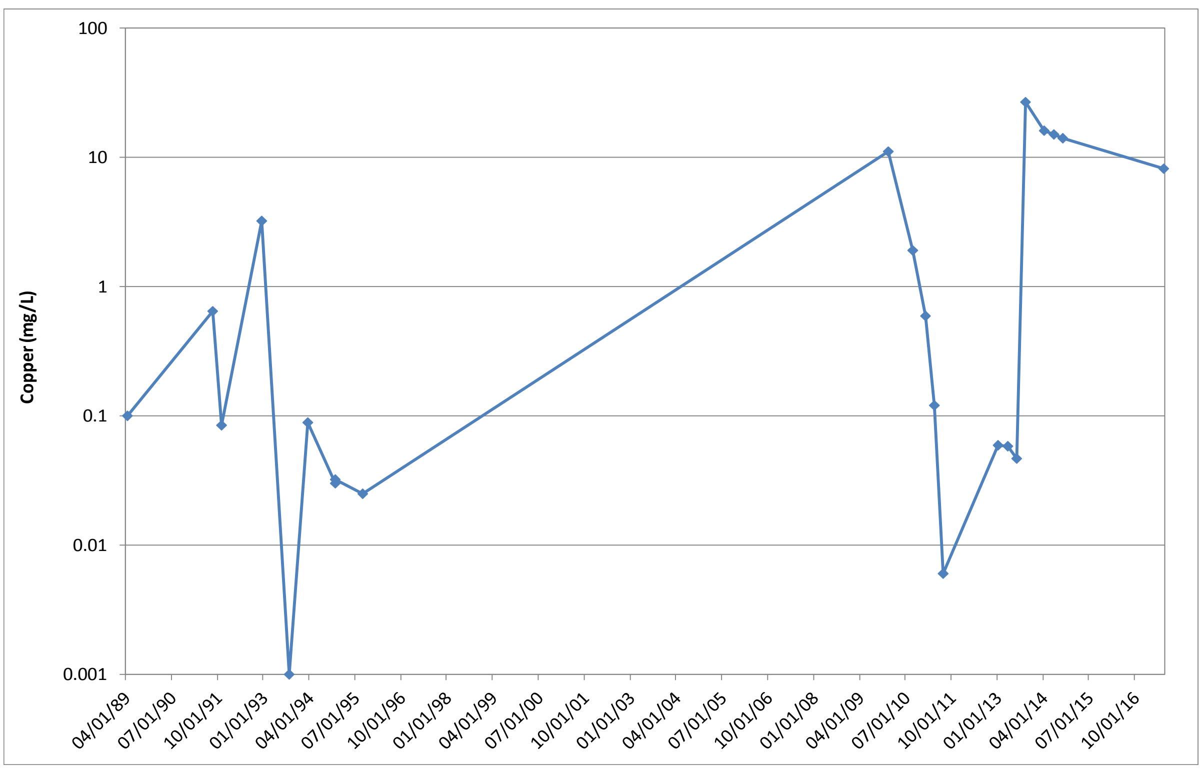


Figure 1-9: Plot of Copper Concentrations in Existing Pit Lake

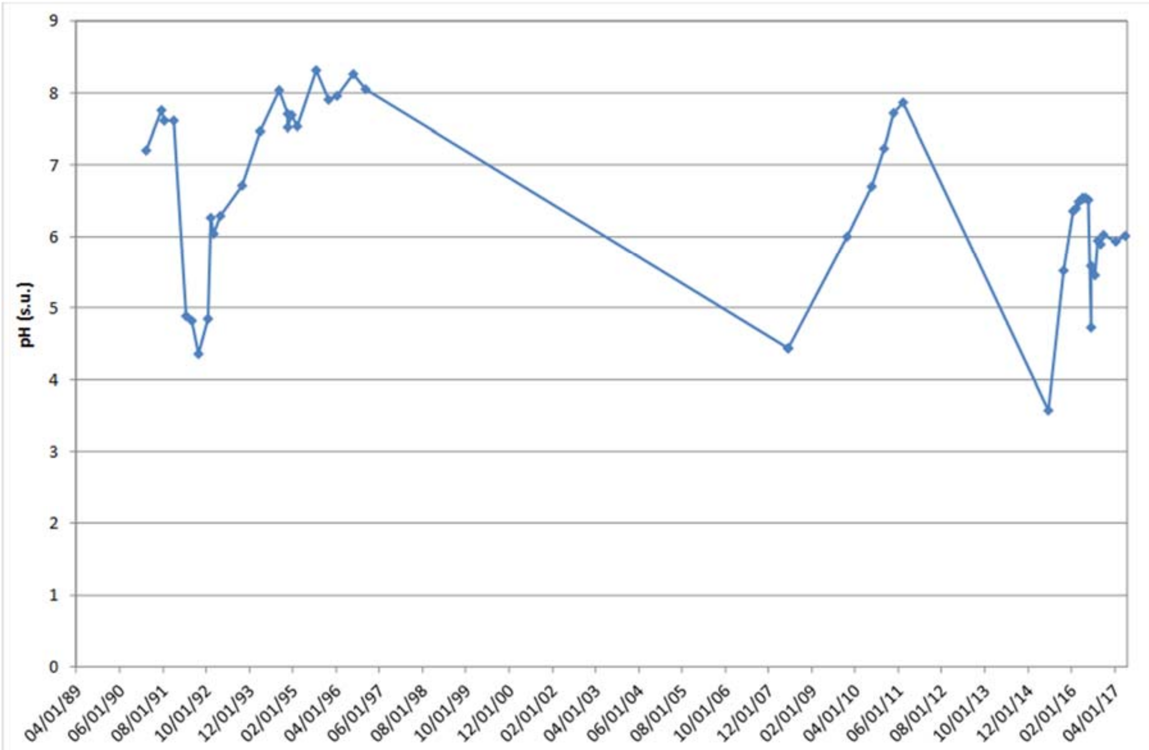


Figure 1-10: Plot of pH in Existing Pit Lake

Figure 1-11: Precipitated Salts around Rim of Existing Pit Lake

Table 1-2: Existing Pit Lake Chemistry (1989 – 2017)

Parameter	Units	n	Average	Minimum	Maximum
pH	s.u.	47	6.5	3.6	8.3
TDS	mg/L	56	7,538	2,711	14,800
Bicarbonate	mg/L	37	40.4	<3	122
Sulfate	mg/L	55	4,803	1,566	8,690
Chloride	mg/L	55	332	47.3	730
Fluoride	mg/L	33	19.2	4.8	34
Calcium	mg/L	37	550	455	684
Magnesium	mg/L	37	698	43	1,120
Sodium	mg/L	37	888	165	1,400
Potassium	mg/L	37	32.1	11	60.6
Aluminum	mg/L	33	10.4	<0.02	82.6
Antimony	mg/L	7	<0.001*		
Arsenic	mg/L	10	0.004	<0.001	0.006
Boron	mg/L	9	0.14	<0.1	0.2
Cadmium	mg/L	35	0.05	<0.005	0.1
Chromium	mg/L	11	0.03	<0.006	0.1
Cobalt	mg/L	32	0.29	<0.05	0.49
Copper	mg/L	22	4.44	0.001	26.5
Iron	mg/L	11	0.2	<0.02	1.3
Lead	mg/L	11	0.02	<0.005	0.1
Manganese	mg/L	35	34.8	0.02	59
Mercury	mg/L	10	0.0005	<0.0002	0.001
Molybdenum	mg/L	9	0.04	0.015	0.1
Nickel	mg/L	9	0.06	0.039	0.1
Selenium	mg/L	34	0.028	<0.001	0.25
Silver	mg/L	12	0.026	<0.005	0.1
Thallium	mg/L	8	0.0045	<0.001	0.005
Uranium	mg/L	4	0.11	0.11	0.12
Vanadium	mg/L	4	0.1	<0.05	0.25
Zinc	mg/L	33	5.4	0.01	9
Total Dissolved Solids	mg/L	56	7,538	2,711	14,800

n *Number of samples*

* *Indicates parameter was uniformly below analytical detection limits in pit lake water over monitoring period, but detection limit was variable. Concentration shown in table represents lower limit of analytical detection.*

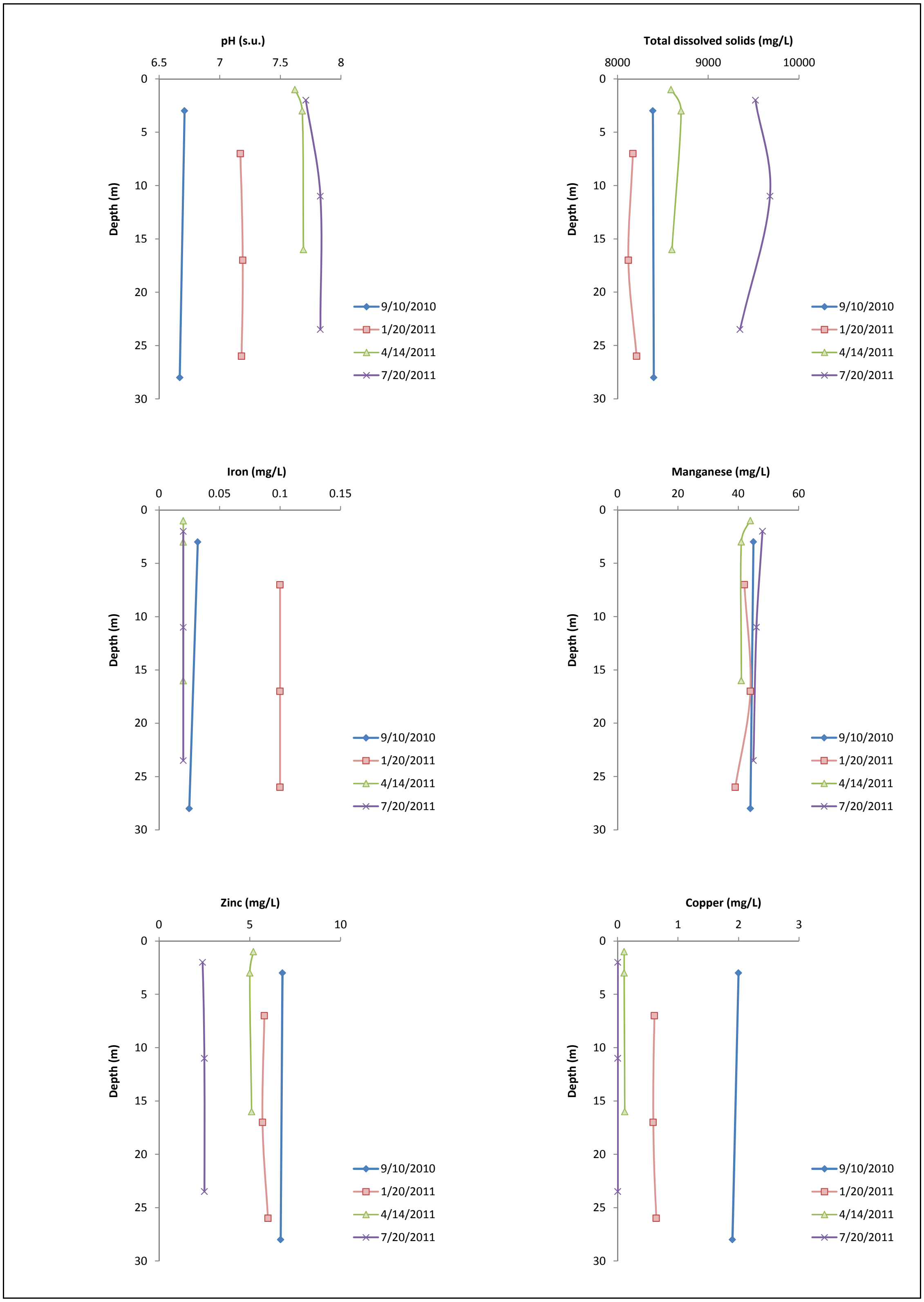


Figure 1-12: Depth Profiles of Key Constituents in Existing Pit Lake

2 Geochemical Characterization Testwork Summary

SRK has conducted a geochemical characterization program for the Copper Flat Project, which has included the testing of 91 waste rock samples, 41 samples representative of low grade ore and 11 samples of tailings material to investigate the potential for ARDML generation. The results of this program are presented in the *Geochemical Characterization Report for the Copper Flat Project, New Mexico* (SRK, 2012) and the main findings are summarized below.

Waste rock and ore sample intervals were selected from both exploration core holes drilled within the proposed pit boundaries in 2009, 2010 and 2011 and from the surface of existing WRSPs and pit walls on site. Samples were selected to represent the range of waste rock and ore material types that will be encountered during future mining. Tailings samples were collected from the metallurgical program and from the existing (historic) TSF on site. The static test methods used for the geochemical characterization program include multi-element analysis using four-acid digest and ICP-MS analysis, modified Sobek Acid Base Accounting (ABA), Net Acid Generation (NAG) test and the ASTM E2242-13 Meteoric Water Mobility Procedure (MWMP; ASTM, 2013). These static tests were selected to address total acid generation or neutralization potential of the samples and concentration of constituents in leachates derived from the material. However, these static tests do not consider the temporal variations that may occur in leachate chemistry as a result of long-term changes in oxidation, dissolution and desorption reaction rates. To address these factors, kinetic testing was also carried out as part of the geochemical characterization program and includes 32 humidity cell tests (HCTs) conducted on samples of waste rock, ore and tailings according to the ASTM D-5744-96 methodology (ASTM, 1996).

The results of the characterization program demonstrate that the acid generating potential of the Copper Flat waste rock is generally low and is largely dependent on the sulfide mineral content, with sulfide concentrations varying from less than analytical detection limits to a maximum of 2.52 wt%. The static testwork results indicate that the transitional waste material (i.e. mixed sulfide/oxide) is likely to be potentially acid forming based on a generally higher sulfide mineral content and the presence of secondary oxide minerals that formed as a result of supergene weathering. In contrast, the diabase, andesite and tailings are likely to be non-acid forming materials. The main material type for the Project consists of sulfide (i.e., non-oxidized) Quartz Monzonite and Breccia, which typically exhibited either non-acid forming characteristics or a low potential for acid generation. This is related to the encapsulation of sulfide minerals in a quartz matrix or occasionally in potassium feldspar. In addition, the sulfide minerals in the Copper Flat deposit are crystalline and often coarse grained and as such have slow weathering reaction kinetics. It is likely that the Copper Flat materials will offer limited silicate buffering (neutralizing) capacity; although this is unlikely to be high magnitude, it may modify/buffer pH in the near neutral range.

The Copper Flat waste rock and ore materials were found to be enriched in copper, sulfur and selenium in whole rock chemistry, which relates to the primary mineralization (predominantly chalcopyrite - $CuFeS_2$). Silver, arsenic, cadmium, molybdenum, lead, thallium, uranium, tungsten, and zinc were also found to be enriched in one or more material types, with the greatest levels of enrichment occurring in the sulfide and transitional ore material types. Many of these elements are typically associated with copper porphyry deposits, which explain their enrichment in the Copper Flat materials (and more specifically in the ore grade samples). The diabase and andesite material types typically showed much lower levels of elemental enrichment, which is likely related to the lack of primary mineralization in these lithological units.

MWMP tests were conducted on a total of 49 waste rock and tailings samples to provide an indication of elemental mobility and metal(loid) release from the Copper Flat materials during meteoric rinsing. Metal mobility and release was also assessed from the results of the HCT program, the results of which are summarized in Appendix B. In general, metal leaching from the Copper Flat materials was found to be low and the majority of leachates generated during the MWMP and HCT test programs could be classed as near-neutral, low-metal waters. However, several of the grab samples of transitional material collected from historic waste rock stockpiles produced acidic leachates and showed the potential for higher metal release than observed for the unoxidized sulfide materials. The higher release of acidity and metals from the transitional material likely represents the flushing of soluble acidic sulfate salts from the material surface that were produced by the prolonged weathering (over geological time) of the material.

3 Pit Lake Modeling

3.1 Summary of Modifications to Pit Lake Models since submittal of SRK (2014a) Preliminary Report

A number of modifications and refinements have been made to the Copper Flat pit lake models since the preliminary Pit Lake Geochemical Modeling Report was submitted in December 2014 (SRK, 2014a). These are detailed in Sections 3.1.1 to 3.1.8 below and are summarized in Table 3-1 at the end of this section.

3.1.1 Incorporation of Current Geologic Block Model

The revised models presented herein use the FS geologic block model to calculate the exposed surface areas of each lithology in the final pit walls. The FS block model represents the most up-to-date geological classification for the Project. Using the FS geologic block model results in minor changes to the relative proportions of each lithology that will be exposed in the final pit walls. In addition, the FS block model groups the biotite breccia and quartz feldspar breccia units together.

3.1.2 Incorporation of Current Pit Design

The revised models presented herein use the current pit design. The current pit design was developed along with the FS block model during the feasibility study and then modified to limit the future pit water body to private property with an expanded bench at the 4900 elevation in the NW corner of the pit (Figure 3-1). The current open pit design is detailed in the 2017 Mine Operation and Reclamation Plan (THEMAC, 2017a).

3.1.3 Refinement of Pit Wall Composition

The revised models include differentiation of the pit walls into mineralized and weakly to non-mineralized material, using a copper grade of 0.164% to differentiate between the two. This differentiation was used in addition to the lithology and oxidation classifications that were used in the original pit lake models (SRK, 2014a). The rationale for this refinement was based on a more in-depth review of the humidity cell chemistry data (see Appendix B), which showed that the release of certain parameters is greater from the mineralized material compared to weakly or non-mineralized material. As such, the source terms for these materials were defined separately. The redefinition and refinement of materials types within the pit walls provides a more representative calibration of existing pit lake conditions as described in Section 4 below.

3.1.4 Refinement of HCT Inputs

The revised models use different HCT inputs for trace elements and major ions to represent the different geochemical processes that control their release. An average of all weeks of humidity cell data were used for major ions (calcium, magnesium, sodium, potassium, aluminum, iron, manganese, chloride, sulfate, fluoride, bicarbonate) and an average of steady-state humidity cell data (i.e. minus the first 20 weeks of testing) were used for trace elements (silver, arsenic, boron, barium, cadmium, cobalt, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium, uranium, vanadium and zinc). The main driver for this change in the input of HCT data was based around the improved calibration to existing conditions obtained by using the different sources of data. The results indicate that soluble salts are important in the input of major elements to the existing lake and, as such, all weeks of humidity cell data are needed for a valid prediction. By contrast, the release of trace elements is predominantly associated with longer term weathering processes, possibly sulfide oxidation and as a result the initial HCT flush concentrations were not included in the source term chemistry. Consequently, a closer calibration between predicted and observed chemistry in the existing pit lake is achieved using this 'mixed' approach to humidity cell chemistry as described in Section 4.

3.1.5 Refinement of Mineral Equilibrium Phases

Minor modifications have been made to the mineral equilibrium phases specified in the PHREEQC model input file. This refinement was based on mineral phases that were observed to be close to saturation in the preliminary outputs to the refined model.

3.1.6 Refinement of Water Balance

Since submission of the December 2014 preliminary pit lake modeling report, JSAI has refined the pit lake water balance for the future pit lake to reflect an evaporation rate of 50 inches per year, compared to the 64 inch evaporation rate used previously. This refinement was based on the relationship between maximum ET (ET_0), meteorological parameters including temperature, relatively humidity and wind speed, and geographical parameters including altitude, latitude and time of year. Further details are provided in Appendix C.

In addition to the revised evaporation rate, the water balance and geochemical models were revised to reflect post-reclamation conditions for the proposed open pit and surface drainage area as presented in the 2017 MORP (THEMAC, 2017a) and summarized herein. The revised geochemical model includes separate source terms for reclaimed and unreclaimed areas of the pit and receiving watershed. Stormwater sourced from reclaimed pit areas is expected to have a chemistry similar to background surface water quality from SWQ-1.

Further details of how runoff coefficients were defined are provided in Appendix G.

3.1.7 Revisions to Groundwater Chemistry Inputs

JSAI developed a revised groundwater input chemistry from the available historic data. JSAI used the water quality database, well construction data and groundwater flow model results to determine the most representative groundwater flow chemistry to the existing and future open pits. Further details on how the groundwater chemistry inputs were refined are provided in Appendix D.

3.1.8 Incorporation of Pit Reclamation Measures

NMCC has developed a Mine Reclamation Plan for the Copper Flat Project (THEMAC, 2017a, THEMAC, 2017b, Golder, 2017). Pit reclamation aspects included in the MORP are:

- Reclamation of the pit haul road;
- Reclamation of the expanded section of the 4900 catch bench;
- Reclamation of benches at the crest of the pit; and
- Rapid fill of the open pit with fresh water from the production water supply wells after mining to create a pit lake with water surface at the 4987 feet elevation.

These reclamation measures are described in the following sections.

Pit Haul Road and Pit Bottom

The open pit will be mined in benches over a 12 year period to create a terraced pit wall (Figure 3-1). Access into the open pit during mining will be via a 90 foot wide haul road constructed in the pit wall as mining advances. After mining, the haul road from pit crest to pit bottom will be covered with a suitable reclamation material. In addition, several benches at the bottom of the pit will also be covered in a similar manner before pit flooding occurs (Figure 3-2). The section of haul road above the final pit lake water surface will be prepared for revegetation as described in the MORP (JSAI, 2017a).

The reclaimed haul road will be used to convey stormwater to the bottom of the pit in a controlled manner. A system of surface water conveyance channels will be constructed around the pit crest to intercept and direct stormwater to the bottom of the pit through an engineered stormwater channel that is constructed in the alignment of the pit haul road.

Expanded 4900 Catch Bench

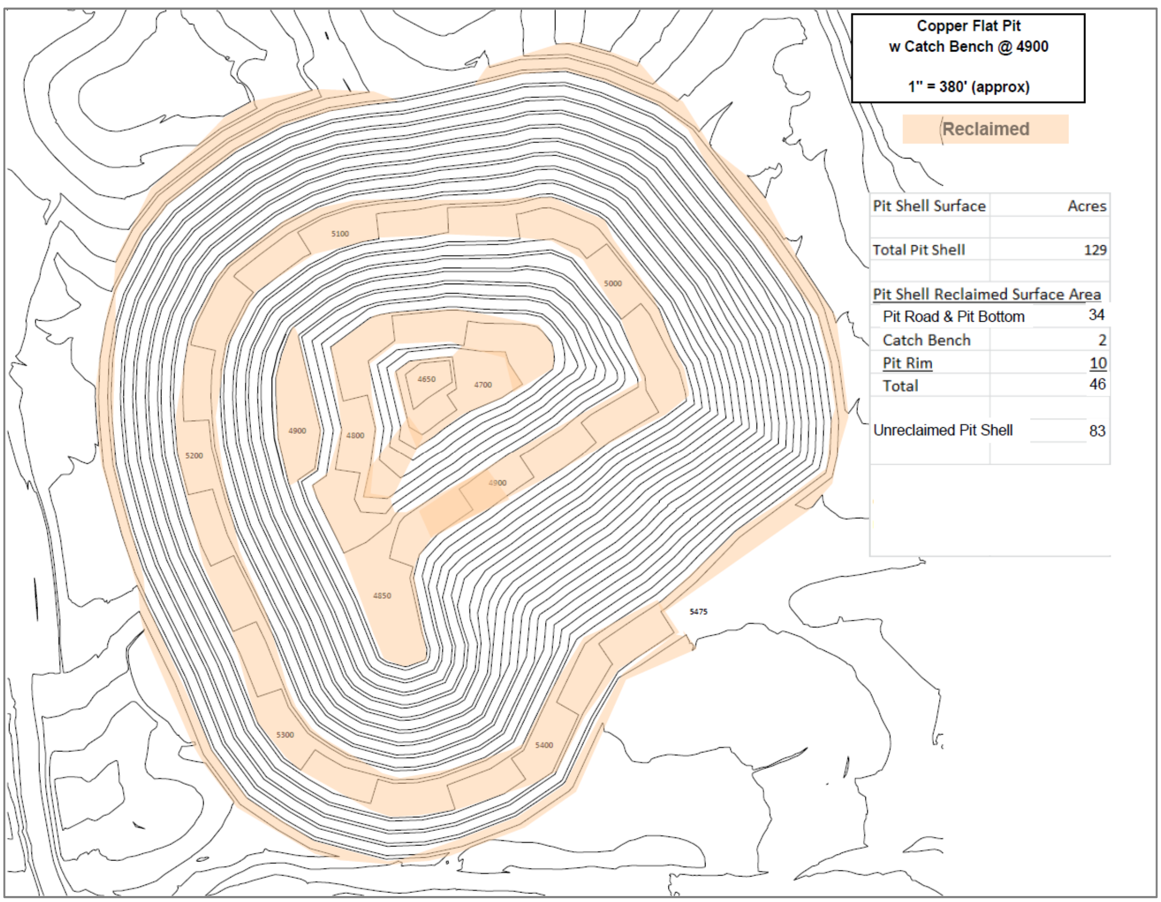
The 4900 elevation catch bench will be expanded to approximately 2 acres in size in the northwest corner of the pit (Figure 3-1). The surface of this catch bench will remain above water after rapid-fill is complete and the pit lake is established. The catch bench surface will be ripped and a growth media cover placed. The covered area will be revegetated.

Pit Crest

The upper benches of the pit shell will be laid back at an approximate 2:1 slope angle at the end of the mine operations to accommodate revegetation. The reclaimed benches will be blended into the surrounding reclaimed pit perimeter area described in the MORP. Revegetation will be accomplished by ripping the area and a growth media cover placed and re-contoured to blend with reclamation of the pit perimeter area and revegetated as described in the MORP.

Rapid Fill

After mining, the pit will be filled with fresh water coming from the mine freshwater production wells to rapidly create a pit lake (rapid fill). The rapid fill will begin immediately after mining and will be completed in approximately six months. The rapid fill requires pumping 2,200 acre-feet into the pit and will fill the pit to the 4894 ft elevation (JSAI 2017b).



Pit Shell Surface	Acres
Total Pit Shell	129
Pit Shell Reclaimed Surface Area	
Pit Road & Pit Bottom	34
Catch Bench	2
Pit Rim	10
Total	46
Unreclaimed Pit Shell	83

Figure 3-1: 2017 MORP Pit Showing Expanded 4900 Catch Bench and Pit Surfaces Scheduled for Cover

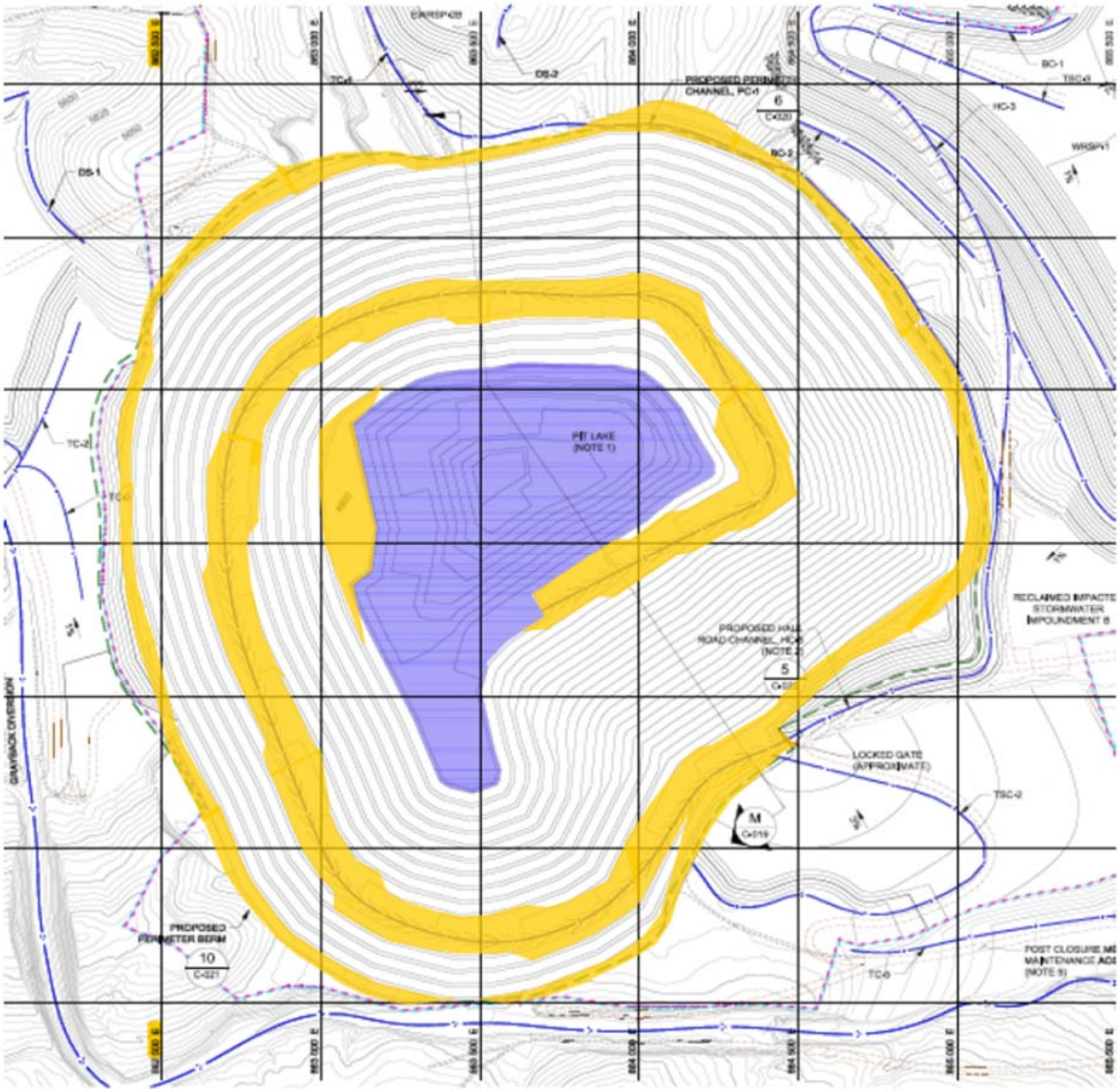


Figure 3-2: 2017 MORP Pit Showing Reclaimed Pit with Pit Lake

Table 3-1: Summary of Modifications to Pit Lake Models since Submittal of Preliminary SRK (2014a) Report

Component	Changed from (SRK, 2014a)	Changed to (current)
Geologic block model	PFS block model	FS block model
Pit shell	PFS pit shell	2017 MORP Pit
Pit wall composition	Delineated based on lithology and oxidation only	Delineated based on lithology, oxidation and mineralized versus weakly/non-mineralized
Source terms/HCT inputs	An average of all weeks of HCT data were used to develop source terms for each material type	Separate source terms were developed for major ions and trace elements. • **Major ions** (Ca, Mg, Na, K, Al, Fe, Mn, Cl, SO_4, F, HCO_3): used an average of all weeks of HCT data • **Trace elements** (Ag, As, B, Ba, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Se, U, V, Zn): used steady-state HCT chemistry (i.e., minus the first 20 weeks of testing).
Mineral equilibrium phases	Alunite, Ag_2Se, albite, anhydrite, azurite, barite, boehmite, brochantite, brucite, calcite, chrysotile, Cr_2O_3, diaspore, epsomite, ferrihydrite, fluoride, gypsum, gibbsite, gummite, kaolinite, magnesite, malachite, mirabilite, otavite, pyromorphite, rhodochrosite, rutherfordine, schoepite, sepiolite, SiO_2; tenorite, U_3O_8, UO_3, $UO_2(OH)_2$	Minor modifications were made to the equilibrium phases based on the predicted geochemical conditions. • **Phases added:** $CaMoO_4$, $CaSeO_3{:}2H_2O$, $CdMoO_4$, Cr2O3, $CuMoO_4$, Cu_2Se, $Mg_3(PO_4)_2$, $MnSeO_3$, $NiMoO_4$, $Ni(OH)_2$, $Ni_3(AsO_4)_2{:}8H_2O$, $PbMoO_4$, SbO_2, $ZnMoO_4$. • **Phases removed:** boehmite, diaspore, gibbsite, magnesite, malachite, pyromorphite, rhodochrosite, tenorite.
Water balance	Evaporation rate of 64 inches.	Evaporation rate of 50 inches. Separate water balance terms were also developed for run-off from reclaimed surfaces in the pit and pit catchment.
Groundwater chemistry	Average of data for wells GWQ96-22A, GWQ96-22B, GWQ96-23A, GWQ96-22B, GWQ11-24B and GWQ11-25B.	Average of data for wells GWQ96-22A, GWQ96-22B, GWQ96-23A, GWQ96-22B and GWQ11-24B. Different groundwater inputs were also developed for the current and future pits according to the relative contribution of flow from the Quartz Monzonite and Andesite units.
Pit reclamation	None	Haul road will be reclaimed and revegetated, pit shell crest and expanded 4900 catch bench will be revegetated. Pit void will be rapidly filled with water from water supply wells.

3.2 General Pit Lake Modeling Approach

The results of the geochemical characterization testwork have been coupled with site-specific hydrologic, hydrogeologic and mine plan information to develop geochemical predictions of pit lake water quality for the Copper Flat Project. Geochemical predictions have been developed for three scenarios, including:

(i) Calibration model for the existing pit lake;

(ii) Natural fill model for the future unreclaimed pit; and

(iii) Rapid fill model for the future reclaimed pit.

The conceptual models, inputs and assumptions for each of these model scenarios are presented in Sections 4, 5 and 6. The general approach to the modeling is provided in Sections 3.4 to 3.10 below.

Water chemistry predictions were made using the USGS code PHREEQC (Parkhurst and Appelo, 2010), which has been rigorously tested and is the industry standard for pit lake, waste rock dump and tailings facility geochemical predictions. The approach used herein is consistent with the industry-standard approach for modeling pit lake chemistry. Comparable approaches are reported in Tempel et al. (2000), Eary (1998) and Castendyk and Webster-Brown (2007).

The PHREEQC software uses thermodynamic equilibrium chemistry and solubility calculations to determine the residual concentration of mixing of solutions, allowing for mineral precipitation and attenuation of solutes through sorption reactions with specified mineral surface area. Furthermore, dissolution and oxidation can also be factored into the model to account for reaction with solid mineral phases which can be declared in the model in finite quantities. The resulting model output predicts not only the concentration of modeled elements but also the speciation of the aqueous solutes and the potential saturation indices of minerals of constituent components. This allows a geochemist to interpret trends in water quality data and to predict the resulting chemistry of the mixing reactions. These results are then compared to environmental and ecological risk water quality criteria to determine if a potential impact will result from the mineral-solute reactions. If appropriate, these data can also inform the development of mitigation strategies.

Data used as inputs to the models were derived from the following sources:

- Geological and mine planning information from the Baseline Data Report (INTERA, 2012), Feasibility Study (M3, 2013), the FS geologic block model, and the 2017 MORP (THEMAC, 2017a);
- Hydrologic and hydrogeologic information from the JSAI pit lake water balances developed for the three model scenarios;
- Geochemical data from laboratory humidity cell tests performed on representative mineralized and non-mineralized materials and then scaled to field conditions. These data were utilized to provide source term data for chemical leaching of exposed rock in the pit walls;
- Precipitation chemistry data from long-term monitoring at the Gila Cliff Dwellings National Monument meteorological station, New Mexico (NADP, 2012);
- Groundwater chemistry data from the groundwater monitoring program; and
- Published thermodynamic data provided with USGS PHREEQC and updated with additional sorption data for arsenic and manganese species.

These data were used to develop representative conceptual hydrogeochemical models for the three model scenarios.

3.3 Model Logic and Coding

The conceptual models developed for the Copper Flat pit lake were translated into numerical models using a geochemical thermodynamic equilibrium code and several limiting and simplifying assumptions. The Copper Flat models used a modified version of the minteq.v4 thermodynamic database supplied with the v3.3.12.12704 version of PHREEQC (released May 10th 2017). This database is widely used for geochemical modeling and was selected for this study because it includes the full range of elements for consideration in this water quality prediction as well as key sorption reactions for iron oxyhydroxides. The database was modified to include sorption data for arsenic and manganese species.

The PHREEQC model consists of several components including the input data file, the thermodynamic database, the executable code and the output file. The input file consists of a series of logic statements and commands that define each of the components of the system and explains how these components interact. The input file is read by the executable code and commands are executed in a stepwise manner. Influent component waters were speciated and mixed to generate a series of intermediate waters, solid phases, and adsorbed phases. Selected outputs are specified and parceled out to various output files for analysis of results.

A logic flow diagram for the structure of the input code is provided in Figure 3-3 and discussed below. The PHREEQC input code is provided in Appendix H.

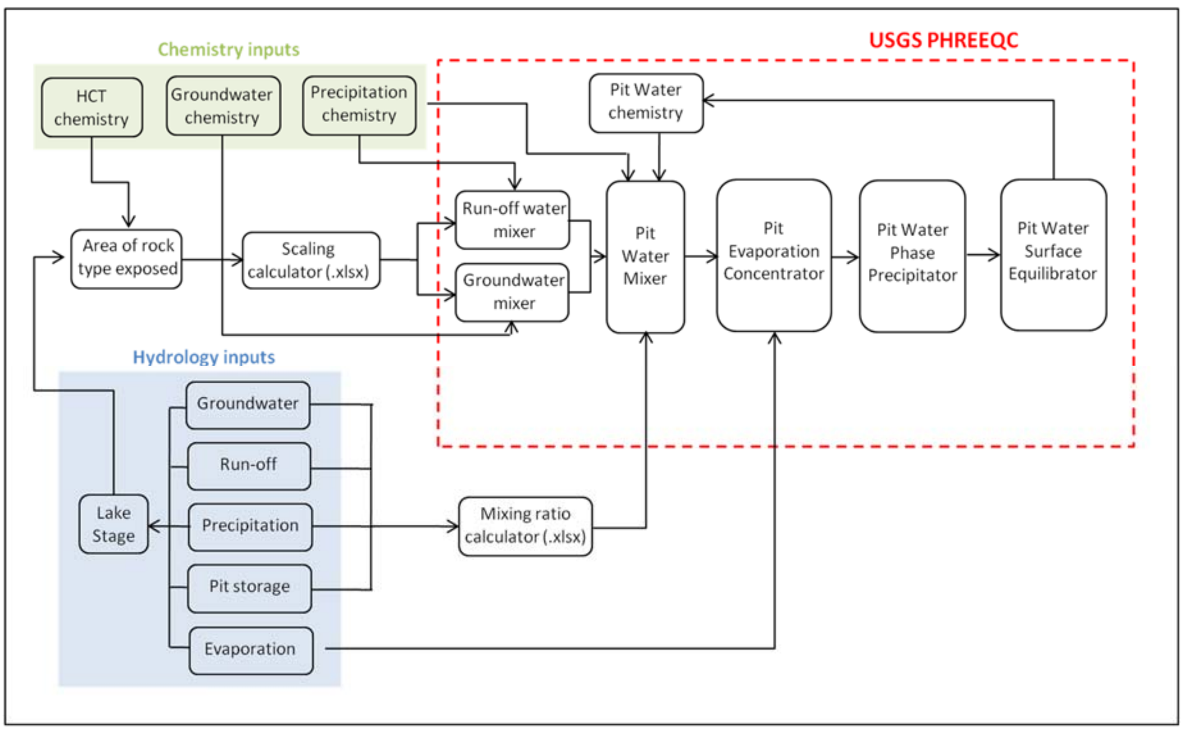


Figure 3-3: Copper Flat Pit Lake Model Execution Mechanics

The steps in the modeling process include the following items:

1. Define run-off water input specific to each exposed rock type. The run-off solution chemistries are comprised of scaled kinetic test cell leachate concentrations for each material type. These leachates are scaled to the water:rock ratio from the cell to the field based on the estimated presence of fractures in the wallrock and the thickness of the reaction rind.
2. Define the run-off solution mixing ratios. Mixing ratios are based on the amount of each material type that is sub-aerially exposed in the pit high wall at each time step.
3. Define the groundwater input. Groundwater chemistry is based on a mass addition function that combines the existing mass found within the groundwater with the mass of solute (per unit surface area and rock mass) released in the kinetic tests for specific material types exposed in the final pit walls. This is scaled to the water:rock ratio from the cell to the field, based on the estimated thickness of the reaction rind within the fractured wallrock.
4. Define groundwater solution mixing ratios based on the exposed surface area for each material type within the pit wall below the pit lake surface (i.e., within the submerged pit wallrock). As with the run-off mixing ratio, this ratio is dependent on the pit lake elevation and changes at each simulated time step.
5. Define precipitation water chemistry based on representative chemical analyses of rainwater.
6. Perform a master mixing calculation where run-off waters, groundwater, atmospheric precipitation and existing pit lake waters are mixed in ratios defined by the site-wide water balance for each time step.
7. Evapoconcentration. The resulting pit water is concentrated by a factor equivalent to the calculated evapoconcentration determined by the site-wide water balance for each determined time step. A fixed percentage of water is removed as a reverse titration of water. At the end of each titration, the volume of water is readjusted to one liter.
8. Equilibrate and precipitate. Once mixed, the model is equilibrated with atmospheric gases and select mineral phases are allowed to precipitate at the calculated pH, with pE fixed at a subatmospheric value equal to 12 minus pH. This represents a transitional equilibrium between mixed pit lake water and the atmosphere and is the most likely scenario based on the conceptual model.
9. Calculate sorption. After mineral precipitation, trace elements were allowed to adsorb onto iron oxyhydroxides (i.e., ferrihydrite). The total mass of ferrihydrite is equivalent to the mass predicted to be generated during the previous reaction step. This assumption is conservative in that it does not account for sorption to other minerals such as aluminum oxide or clay, or to iron oxides present in the pit wallrock.
10. Save chemistry for the next time step. At the end of each time step, the predicted pit water chemistry is exported to a spreadsheet for analysis.
11. The model was terminated after sufficient iterations to simulate water quality over a 100-year filling period.

3.4 Mineral and Gas Phase Equilibration

For the purpose of the Copper Flat geochemical models, it was assumed that any run-off, groundwater and precipitation entering the pit would mix evenly and completely. Under these circumstances the solutes in these waters will react with each other and may form chemical precipitates if the concentrations and geochemical conditions (Eh, pH, pCO_2, pO_2, and ionic strength) allow super saturation to occur. The geochemical models required the specification of a number of equilibrium phases that were allowed to precipitate if they become oversaturated. The suite of minerals chosen was based on the geology and mineralization of the deposit, an understanding of the types of minerals commonly observed in waste rock leachates and an assessment of mineral phases that were close to saturation based on the initial model iterations.

The relative saturation of all minerals was calculated by comparing the calculated concentration of dissolved ionic pairs with their theoretical thermodynamic limit. Where these values were equal, the saturation index was zero and the solution was said to be at equilibrium with that mineral. At equilibrium, any amount of the mineral that dissolves will precipitate to maintain the relative solute: mineral balance. The target saturation index was set to zero and the minerals that were allowed to form in the geochemical model are given in Table 3-2. These precipitates will sink to the bottom of the pit lake and be removed from future chemical interactions as a sediment layer accumulates on the pit bottom. The precipitated mineral phases are unlikely to re-dissolve unless the pH or redox conditions of the pit lake change substantially. As such, the model assumes that precipitated mineral phases are removed from the system and that subsequent re-dissolution of these phases does not occur. Sulfide mineral reactions are already accounted for in the model because HCT data were used as inputs. The HCT test provides an estimate of long-term accelerated rates of elemental release as a result of oxidation reactions, including sulfide mineral oxidation. Kinetic data for sulfide mineral phases are also limited, with data generally being limited to silicate mineral phases. Further, in evaluating long term changes to water chemistry it is reasonable to assume thermodynamic equilibrium will be attained by the system and as such the approach taken in this study is valid.

Table 3-2: Equilibrium Phases Included in the Pit Lake Geochemical Model

Equilibrium phase*	Ideal formula	Rationale for inclusion in PHREEQC model
Alunite	$KAl_3(SO_4)_2(OH)_6$	Mineral observed at Copper Flat (SRK, 1996; 1997)
Anhydrite	$CaSO_4$	Close to saturation in initial model runs.
Barite	$BaSO_4$	Primary control on barium at neutral to alkaline pH (Eary, 1999). Mineral observed in Copper Flat mineralogical study (SRK, 2014b)
$Ba_3(AsO_4)_2$	$Ba_3(AsO_4)_2$	Close to saturation in initial model runs.
Brochantite	$Cu_4^{2+}(SO_4)(OH)_6$	Primary control on copper at neutral to alkaline pH (Eary, 1999). Mineral observed at Copper Flat (SRK, 1996; 1997).
Brucite	$Mg(OH)_2$	Close to saturation in initial model runs.
Calcite	$CaCO_3$	Primary control on alkalinity at neutral to alkaline pH (Eary, 1999). Mineral observed at Copper Flat (SRK, 1996; 1997)
$CaMoO_4$	$CaMoO_4$	Close to saturation in initial model runs.
$CaSeO_3{:}2H_2O$	$CaSeO_3{:}2H_2O$	Close to saturation in initial model runs.
Carnotite	$K_2(UO_2)_2(VO_4)_2.H_2O$	Close to saturation in initial model runs.
Chrysotile	$Mg_3Si_2O_5(OH_4)$	Close to saturation in initial model runs.
$Cd(BO_2)_2$	$Cd(BO_2)_2$	Close to saturation in initial model runs.
Cr_2O_3	Cr_2O_3	Close to saturation in initial model runs.
$CuMoO_4$	$CuMoO_4$	Close to saturation in initial model runs.
Cu_2Se (alpha)	Cu_2Se (alpha)	Close to saturation in initial model runs.
Epsomite	$MgSO_4.7H_2O$	Close to saturation in initial model runs.
Ferrihydrite	$5Fe_2O_3.9H_2O$	Major control on iron. Thermodynamic properties well defined (Dzombak and Morel, 1990).
Fluorite	CaF_2	Primary control on fluoride (Eary, 1999). Mineral observed in Copper Flat mineralogical study (SRK, 2014b)
Gummite	UO_3	Close to saturation in initial model runs.
Gypsum	$CaSO_4.2H_2O$	Primary control on sulfate (Eary, 1999). Observed in significant quantities around existing pit lake (SRK, 1996; 1997; 2014b).
HgSe	HgSe	Close to saturation in initial model runs.
$Mg_3(PO_4)_2$	$Mg_3(PO_4)_2$	Close to saturation in initial model runs
Mirabilite	$NaSO_4.10H_2O$	Mineral observed at Copper Flat (SRK, 1996; 1997)
$MnSeO_3$	$MnSeO_3$	Close to saturation in initial model runs.
$NiCO_3$	$NiCO_3$	Primary control on nickel at neutral to alkaline pH
$NiMoO_4$	$NiMoO_4$	Close to saturation in initial model runs.
$Ni(OH)_2$	$Ni(OH)_2$	Close to saturation in initial model runs.
$Ni_3(AsO_4)_2{:}8H_2O$	$Ni_3(AsO_4)_2{:}8H_2O$	Close to saturation in initial model runs.
Otavite	$CdCO_3$	Primary control on cadmium at neutral to alkaline pH (Eary, 1999)
$PbMoO_4$	$PbMoO_4$	Close to saturation in initial model runs.
Rutherfordine	UO_2CO_3	Close to saturation in initial model runs.
SbO_2	SbO_2	Close to saturation in initial model runs.
Schoepite	$UO_2(OH)_2.H_2O$	Close to saturation in initial model runs.
Sepiolite	$Mg_4Si_6O_{15}(OH)_2.6H_2O$	Close to saturation in initial model runs.
SiO_2 (am-ppt)	SiO_2	Close to saturation in initial model runs.
Tyuyamunite	$Ca(UO_2)_2V_2O_8(5\text{-}8)H_2O$	Close to saturation in initial model runs.
U_3O_8	U_3O_8	Close to saturation in initial model runs.
UO_3	UO_3	Close to saturation in initial model runs.
$UO_2(OH)_2$ (beta)	$UO_2(OH)_2$ (beta)	Close to saturation in initial model runs.
$ZnMoO_4$	$ZnMoO_4$	Close to saturation in initial model runs.

3.5 Adsorption

In solution, trace element concentrations are mostly controlled by adsorption onto common mineral phases or are removed from solution through a process of co-precipitation. The Copper Flat pit lake models assumed that trace metals may be removed from solution via sorption onto freshly generated mineral precipitates such as iron oxides. Sorption is likely to represent an important metal removal mechanism at circum-neutral to moderately alkaline pH, with many metal ions sorbing more effectively under these pH conditions. Ferrihydrite ($5Fe_2O_3.9H_2O$) was selected as a sorption surface because it is a common sorption substrate in oxygenated natural waters and because the trace element sorption thermodynamic properties of these reactions are well defined by numerous empirical studies. Adsorption of soluble phases to hydrous ferric oxides (HFO) is highly pH dependent as is the solubility of HFO itself. Below a pH of around 4.5, only minimal sorption of most dissolved metal species is observed (Stumm and Morgan, 1996). The mass of ferrihydrite used in the models was assumed to be identical to the mass of the mineral phase ferrihydrite precipitated in the previous model reaction step and is controlled by the chemistry of the system. The model assumes that the ferrihydrite is characterized by both strong (HFO_s) and weak (HFO_w) surface adsorption sites. In order to be consistent with the properties of ferrihydrite published by Dzombak and Morel (1990) the geochemical models assumed a surface site density of 0.2 moles of weak sites and 0.005 moles of strong sites per mole of ferrihydrite. Because the future pit lake predictions start from time zero (i.e., cessation of mining), there will be no prior pit lake in the void at that point. Any HFO/ferrihydrite will therefore originate from the precipitation of oversaturated mineral phases that develop upon solution mixing.

As with mineral phase precipitation, the adsorbed mass of trace elements removed through this mechanism is assumed in the conceptual model to be permanently removed from the system following incorporation and co-precipitation with the HFO phase. In the case of a major shift in pH or redox conditions, it is possible that material adsorbed to the HFO surface may be released. However, based on the HCT results available to date, a major shift in pH conditions is not likely.

3.6 Evapoconcentration

The Copper Flat pit lake is an evaporative sink, both in its current state and under future post-operational conditions (JSAI, 2017b). There will be no outflow to groundwater and the only mechanism of water loss will be through direct evaporation from the pit lake surface. As such, solutes within the pit lake will evapoconcentrate and the only mechanism for removing solutes is the formation and settling of chemical precipitates and the adsorption of trace elements onto these particulates.

3.7 Treatment of Analytical Reporting Limits

The Copper Flat pit lake models incorporate groundwater and humidity cell data that have been collected over extended periods of time, including both detectable elemental concentrations and constituent concentrations that may be below analytical reporting limits (ARL). The treatment of analytical reporting limits within the geochemical model has important implications for the model results, particularly where the data are scaled to address the difference in solid:liquid ratio between the laboratory-scale test and field conditions.

When analysis of the humidity cell leachates identified certain elements to be below the ARL, the reporting limit was adjusted to 10% of the reported limit for the purpose of calculating the average release rate for the model input. Where a constituent was consistently below the ARL throughout the course of the humidity cell testwork, the constituent was excluded from the model input for that material type to limit overstating constituent concentrations that may arise as an artifact of the modeling exercise from the scaling of humidity cell data to field conditions or from equilibration of groundwater source data that are below ARLs.

Nitrate was excluded from the geochemical predictions due to the lack of mineralogical controls in PHREEQC code. The exemption of nitrate is supported by the data as this parameter is consistently below the ARL in both the humidity cell effluent leachates and the groundwater surrounding the pit. Nitrate is also below the ARL in the existing pit lake, supporting the assumption that this parameter is unlikely to be a problem during future operations.

3.8 Model Assumptions and Limitations

The pit water quality predictions presented herein are considered the best representation of likely future water quality associated with the Copper Flat pit lake. However, it is recognized that there are a number of assumptions and limitations associated with the predictive calculations including:

- The models have been developed using site-specific geochemical, hydrochemical, geological, hydrogeological and mine plan information. Therefore, changes in operational decisions may result in a change in the future pit lake water quality at Copper Flat.
- The models assume that groundwater and surface water input chemistry can be simulated using laboratory kinetic (humidity cell) leachate chemistries, which are appropriately scaled to field conditions. The reactive surface area, ratio of water-to-rock and flushing rates in laboratory tests are different from actual field conditions. Grain size is smaller in the kinetic and static test cells and the resulting surface area for reactivity is greater that field conditions. The laboratory test cells are operated at a higher water-to-rock ratio than would be expected in the field and are flushed more frequently, so that mineral-water reaction rates are enhanced. Because the future Copper Flat pit does not yet exist, field scale parameters cannot be measured, so scaling relies on published estimates of future groundwater flux and fracture density. These estimates and assumptions are supported by the geochemical model for the existing pit (Section 4), which shows good calibration to current conditions.
- Modeling was limited to predicting water quality within the pit lake for a 100-year time period. This length of time is not intended to imply that the pit lake geochemistry or hydrogeology for the natural fill scenario will achieve steady-state, hydrogeochemical equilibrium at 100-years.
- The models rely on an external database of thermodynamic constants for mineral phase precipitates and sorbed surface complexes. These thermodynamic constants are valid at 25°C and 1 atmosphere of pressure. The models do not consider the effects associated with the formation and precipitation of mineral species other than those specified. Due to kinetic constraints, a portion of the potentially oversaturated mineral phases will not actually precipitate. A select suite of minerals is therefore specified that are allowed to precipitate, based on relevance for the environment in question, site-specific knowledge, experience in evaluating kinetic constraints and relevance of key phases for given styles of mineralization, and literature review (Eary, 1999). The nature of the thermodynamic databases means that the constants for all major elements and a large number of trace elements are well understood and have been rigorously tested and verified. However, constants for certain parameters (for example vanadium, boron and nitrate) are not as well understood. As such, the mineralogical controls on these elements in PHREEQC are poorly defined, which may affect their precipitation (i.e., removal) from solution in the predictive calculations.
- The models assume atmospheric equilibrium with oxygen and carbon dioxide gas, with pH + pE equal to 12 (based on calculations by Baas-Becking et al., 1960 to define stability limits of natural waters).
- The models are limited to thermodynamic equilibrium reactions and do not simulate the effects of reaction kinetics and rates.
- The models are limited to inorganic reactions and do not take into account the complexities associated with biologically mediated reactions.

None of these limitations affect the ability to use model as intended, which is to assess potential future pit lake chemistry and evaluate the future environmental impacts of the Project.

3.9 Analysis of Model Input Variability

The various parameters that have been used as data inputs for the pit lake geochemical model have been assessed to determine their relative significance in influencing the model results. For the purpose of this exercise, each parameter has been assigned a qualitative value based on the degree to which it influences the final predicted solution chemistry:

- “Minor” represents less than 1% control on the final model output;
- “Moderate” represents between 1% and 10% control on the final model output; and
- “Significant” represents between 10% and 50% control on the final model output.

The results of this exercise are displayed in Table 3-3.

Table 3-3: Analysis of Pit Lake Model Input Variability

Category	Parameter	Assumptions / data used in model	Source	Control on final model results*
Hydrogeologic information	Pit lake water balances	Water balances provided by JSAI for the three model scenarios, including water elevation and surface area, groundwater inflows, direct precipitation, run-off and evaporation data.	JSAI, 2017	Significant. The water balances define the mixing ratios for the PHREEQC input solutions.
Chemical inputs	Groundwater chemistry	Baseline groundwater chemistry data from the ongoing monitoring program: average of data for wells GWQ96-22A, GWQ96-22B, GWQ96-23A, GWQ96-22B and GWQ11-24B.	INTERA, 2012; JSAI, 2017a	Significant during the early years post-closure when groundwater is likely to represent the dominant solution input to the pit lake.
	Precipitation chemistry	Averaged precipitation chemistry from Gila Cliff Dwelling National Monument Meteorological Station (1985-2011)	NADP, 2012	Minor. The precipitation chemistry represents a near-pure solution chemistry. In the absence of site-specific data, published precipitation chemistry from this meteorological station in New Mexico is the best representation of precipitation chemistry in the area.
	HCT chemistry	Averaged HCT chemistry from the HCT programs.	SRK 2012; 2014b	Significant. The solutions generated by the HCT programs represent the main chemical inputs for the pit wall source terms.
	Water Supply well chemistry (rapid fill model only)	Groundwater quality data from water supply wells PW-1 and PW-3	JSAI, 2017c	Significant. The water supply well chemistry represents the largest solution contributor to the pit lake during the first six months of filling.
Geological information	Pit wall surface area and lithologic composition	Pit wall surface areas were calculated for each simulated time step using the geologic block model and 2017 MORP pit	SRK/ NMCC	Significant. The lithological composition of the pit wall defines the mixing ratios for the PHREEQC input solutions.
Geochemical model assumptions	Mass of pit wall rock available for reaction	Mass of future pit wall available for reaction was calculated assuming an oxidized rind of 0.04 feet thickness and a fractured zone of 1 feet thickness (with 10% fractures).	SRK/ NMCC	Moderate. The values were assigned based on communication with NMCC regarding future blasting practices for the Project and are considered a conservative estimate and are consistent with industry practice.
	Equilibrium/mineral phases	The equilibrium/mineral phases listed in Table 3-2 were used as input to the models	SRK	Moderate. Mineral precipitation will influence final solution chemistry. Equilibrium phases were selected based on knowledge of site-specific geologic and mineralogic conditions and were then verified and refined by calibrating with the existing pit lake chemistry.

* Minor: <1%
Moderate: 1 - 10%
Significant: 10 - 50%

3.10 Comparative Guidelines

The standards that apply to the post-mining Copper Flat pit water body are contained in the regulations MMD administers under the Mining Act; specifically “Performance and Reclamation Standards for New Mining Operations” at 19.10.6.603 NMAC. These MMD standards require that the pit water body comply to the following performance standard:

- Operations must be planned and conducted to minimize change in the hydrologic balance in both the permit and potentially affected areas; and
- Reclamation must result in a hydrologic balance similar to pre-mining conditions.

MMD must determine that the NMCC mine operating and reclamation plan complies with these standards before a mining permit can be issued. The mine plan must take into account the site-specific characteristics of the mining operation and the site in meeting the standards and requirements. The MMD regulations require that the permit area be reclaimed to a self-sustaining ecosystem appropriate for the life zone of the surrounding area following closure unless conflicting with the approved post-mining land use. Specifically, NMAC 19.10.6.603.C.(4), Hydrologic Balance states that the performance and reclamation standards identified in this subsection require that, if not in conflict with the approved post-mining land use, reclamation must result in a hydrologic balance similar to pre-mining conditions. Section 19.10.6.602.D.(13)(g)(v) of the regulations identifies the environmental baseline information required to establish pre-mining conditions and outlines the hydrologic and water quality data requirements for baseline data.

There are several site-specific factors to consider regarding the Copper Flat Project in determining what standards apply. First, the existing pit water body is and the future pit water body will be fully confined to private land. The two-acre catch bench at the 4900 ft amsl elevation of the pit ensures that the future pit lake remains on private property. The pit is and will be a hydraulic evaporative sink in the future, and, as such, is not a flow-through system (INTERA, 2012; JSAI, 2017b). As a result of being confined to private land and remaining a hydrologic sink, the current and future pit water body will not be a water of the state and the surface water standards the NMED Surface Water Quality Bureau (SWQB) administers will not apply to the pit water. Because the pit is and will be a hydraulic evaporative sink in the future, NMED Groundwater Quality Bureau (GWQB) standards are also not applicable to the future pit water body.

Therefore, the applicable standard for the future pit water body as provided by the MMD regulations will be “similarity”, NMCC must demonstrate that post-mining hydrologic conditions, i.e., the post-mining hydrologic balance is similar to the pre-mining hydrologic conditions. The MMD regulations do not contain a definition of “hydrologic balance. Nonetheless, Section 19.10.6.602.D.(13)(g)(v) requires that a determination be made of the probable hydrologic consequences of the operation and reclamation, including water quality. These two regulatory requirements are interpreted to require the NMCC demonstrate that that the water quality of the future pit lake be similar to that of the pre-mining pit water quality and, thus, allow NMCC to demonstrate that the water quality hydrologic consequence is nil.

This report provides the required demonstration as to the similarity of the future pit lake water quality to present pit lake water quality. In this report, the pit lake predictive model results are compared to existing pit lake water quality to demonstrate that the anticipated post-mining water quality of the future pit is similar to pre-mining pit water body quality present at Copper Flat today. In addition, the existing pit water body has been previously studied by Aquatic Consultants, Inc. (Aquatic Consultants, 2014) and it has been determined that the environment within the existing water body does not reflect a natural lake environment. There are no fish in the existing pit water body and water quality reflects the mineralized nature of the surrounding pit walls. When mining is complete, the pit water body will re-form; the NMCC reclamation and closure plan is designed to leave the future pit water body in a condition similar to its current condition.

4 Existing Pit Calibration Model

Numerical predictions have been undertaken to model the current (i.e., existing) pit lake chemistry in order to calibrate and verify the future pit lake geochemical predictions. A water balance for the existing pit was provided to SRK by JSAI and this was coupled with the results of the HCT testwork and data relating to the existing pit wall geology to carry out numerical simulations of water quality in the existing pit lake.

4.1 Conceptual Model

A conceptual model for the existing pit lake at Copper Flat is provided in Figure 4-1. The inputs to the model are discussed in Sections 4.2 to 4.5 below.

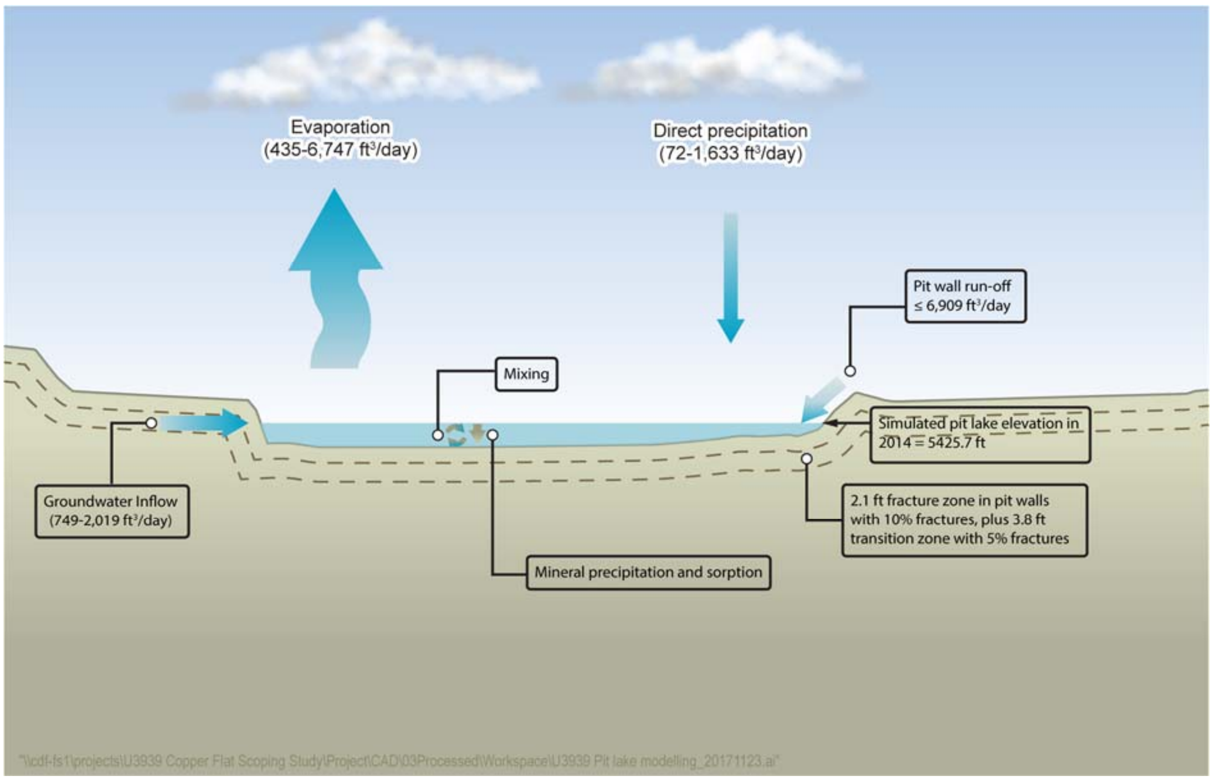


Figure 4-1: Existing Pit Conceptual Model

4.2 Pit Wall Surface Areas

The proportional surface areas of the main material types that are exposed in the existing pit walls have been calculated from the FS geologic block model. Material types have been delineated based on primary lithology, oxidation (redox) and mineralization (i.e., mineralized versus weakly/non-mineralized).

The three-dimensional surface areas used as input to the existing pit model are provided in Table 4-1 and are illustrated in Figure 4-2. This demonstrates that mineralized, oxidized quartz monzonite represents the dominant material type exposed in the existing pit walls.

Table 4-1: Pit Wall Surface Areas used in Existing Pit (Calibration) Model

Mineralization	Rock Type	Redox	Three-dimensional surface area	
			Square feet	%
Weakly/non-mineralized	Biotite Breccia	Oxide	88,213	8.5
		Sulfide (non-ox.)	5,073	0.5
	Quartz Monzonite	Oxide	171,155	16.5
		Sulfide (non-ox.)	27,011	2.6
Mineralized	Biotite Breccia	Oxide	118,474	11.4
		Sulfide (non-ox.)	153,348	14.8
	Quartz Monzonite	Oxide	291,547	28.1
		Sulfide (non-ox.)	184,085	17.1
		Total	**1,038,906**	**100%**

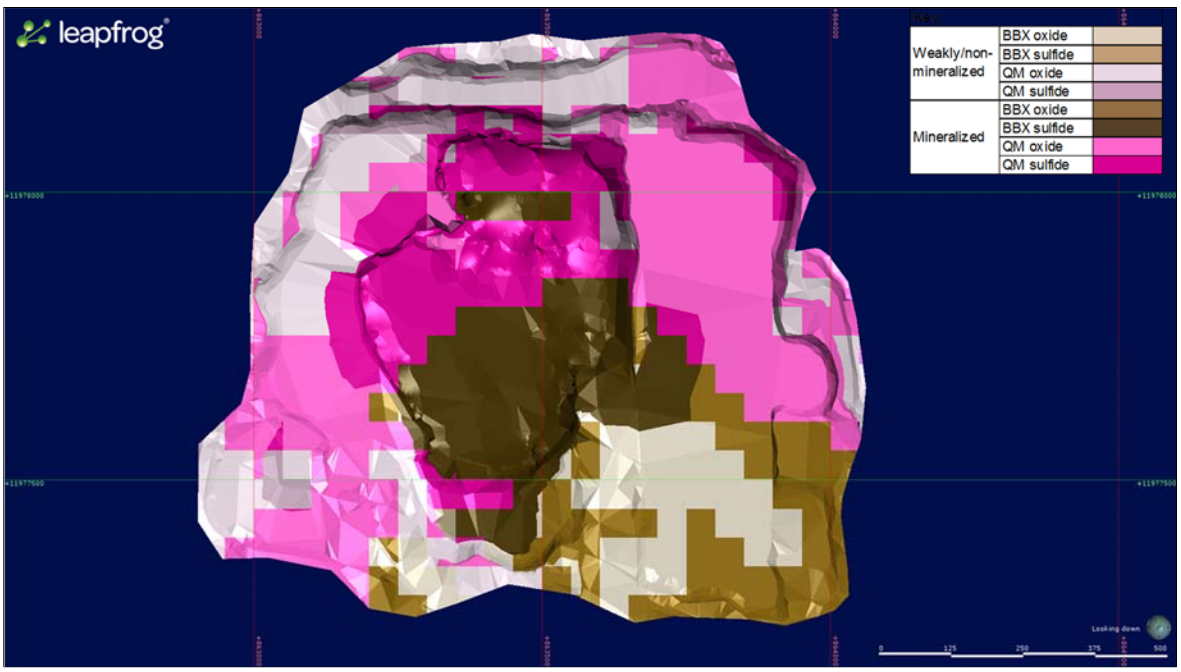


Figure 4-2: Material Types Exposed in Existing Pit (Calibration) Model

4.3 Calculation of Pit Wall Rock Available for Leaching

During Quintana's operations, the existing pit at Copper Flat did not reach its final configuration and the pit walls were not prepared using pre-split drilling and smooth wall blasting. Therefore, the existing pit wall has significantly deeper fracturing than predicted for the future final pit wall from the proposed operation. The literature demonstrates that open pit wall blast damage for granite, granodiorite and quartz monzonite rocks extends 2 to 4 ft in depth when assessing effects from production type blasting (e.g., Carroll and Scott, 1966; Siskind and Fumanti, 1974; Kelsall et al., 1984) (Appendix F).

For the existing pit lake scenario, an estimate of the reactive rind thickness is provided by results from a U.S. Bureau of Mines experimental study on fracturing produced in the vicinity of large-diameter blast holes in Lithonia granite (Siskind and Fumanti, 1974). From this study, a fractured zone ('fracture zone') was identified that extends approximately 2 feet into the pit wall and a second zone ('transition zone') characterized by a lesser degree of fracturing extends from approximately 2 to 4 feet (Figure 4-3). Oxygen infiltration extends no further than the predicted depth of fracturing of 2 feet, and that the percent of the rim rock mass fractured during mining will range from 10% within the fracture zone to 5% within the transition zone. This estimate of fracturing is supported by Atchison (1968). An oxidized rind of 0.04 feet thickness has also been assumed in the pit walls. This scenario is considered a conservative input of pit wall fracturing based on the information provided in Appendix F.

Using these assumptions for the fracture zone, transition zone and oxidized rind, the reactive mass (R_m) of each material type in the pit wall was calculated as:

$$R_m = (S \times F_{FZ} \times L_{FZ} \times D) + (S \times F_{TZ} \times L_{TZ} \times D) + (S \times L_{OR} \times D)$$

Where:

S is the three-dimensional pit wall surface area of the given material type in square meters (defined by the geological block model; see Table 4-1);

F_{FZ} is the fracture density in the fracture zone (10%);

L_{FZ} is the thickness of the fracture zone in meters (0.64m);

F_{TZ} is the fracture density in the transition zone (5%);

L_{TZ} is the thickness of the transition zone in meters (1.16m);

L_{OR} is the thickness of the oxidized rind in meters (0.012m);

D is the rock density in kg/m^3 (2700 kg/m^3, Young and Olhoeft, 1976).

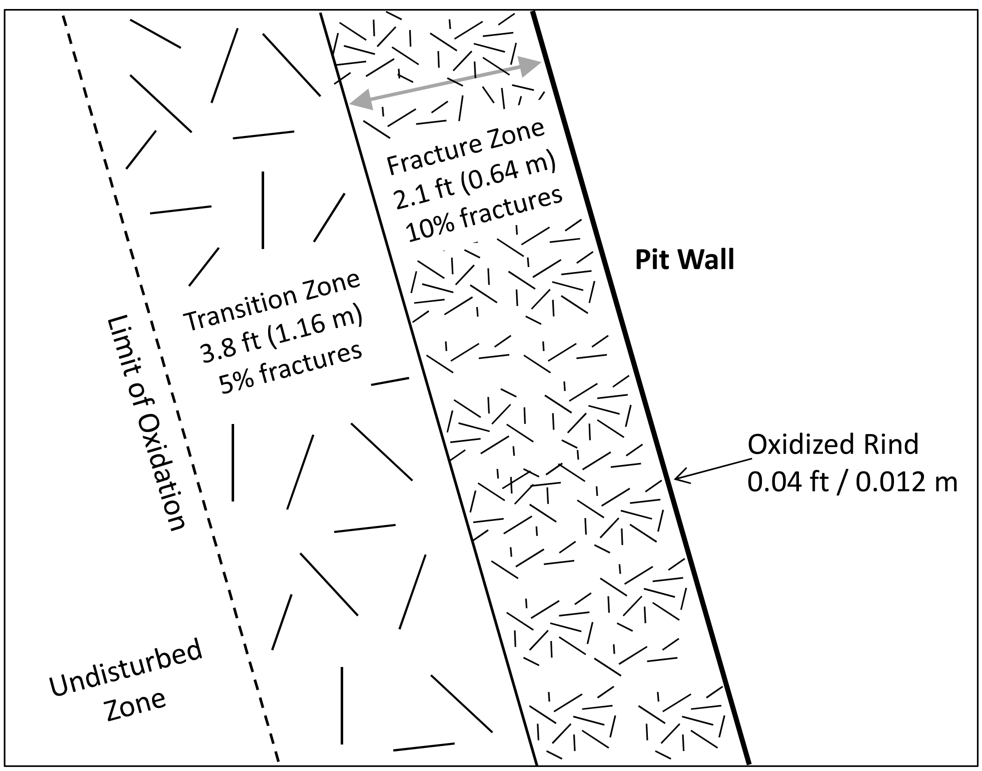


Figure 4-3: Existing Pit Wall Conceptual Model

4.4 Water Balance

A pit lake water balance for the existing pit lake was provided to SRK by JSAI. The water balance data used in the existing pit lake predictions are summarized in Figure 4-4 and Figure 4-5 below. Figure 4-4 shows the simulated pit lake elevation with time and Figure 4-5 shows the simulated inflows and outflows to the existing pit.

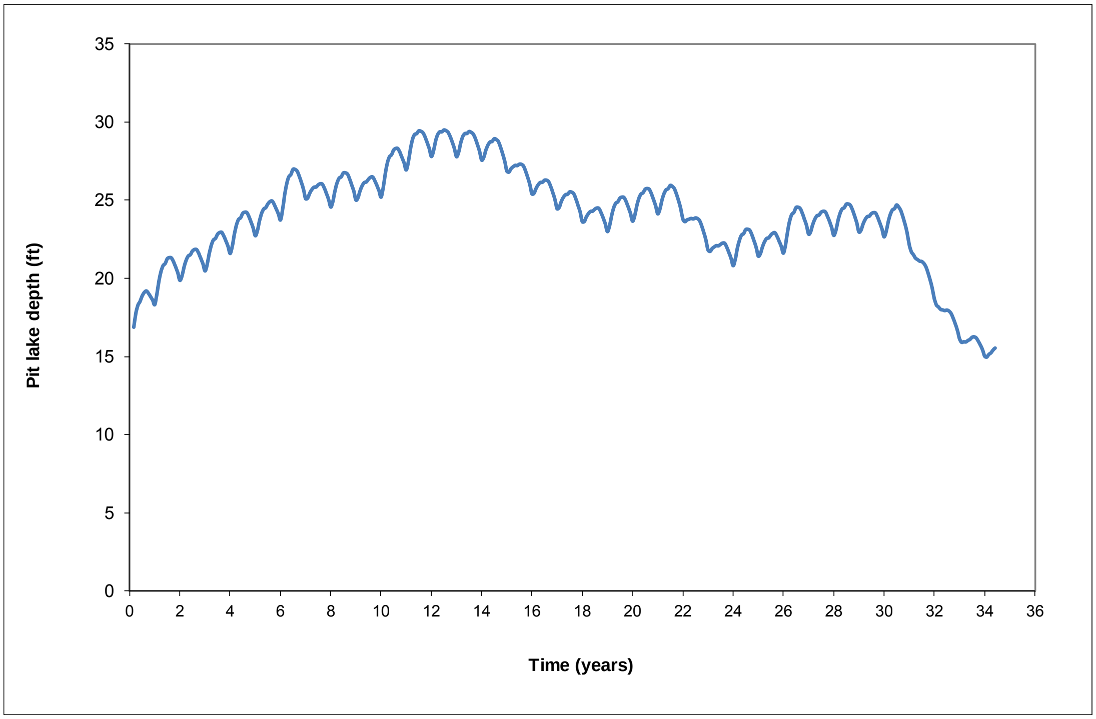


Figure 4-4: Simulated Water Level for the Existing Pit Lake

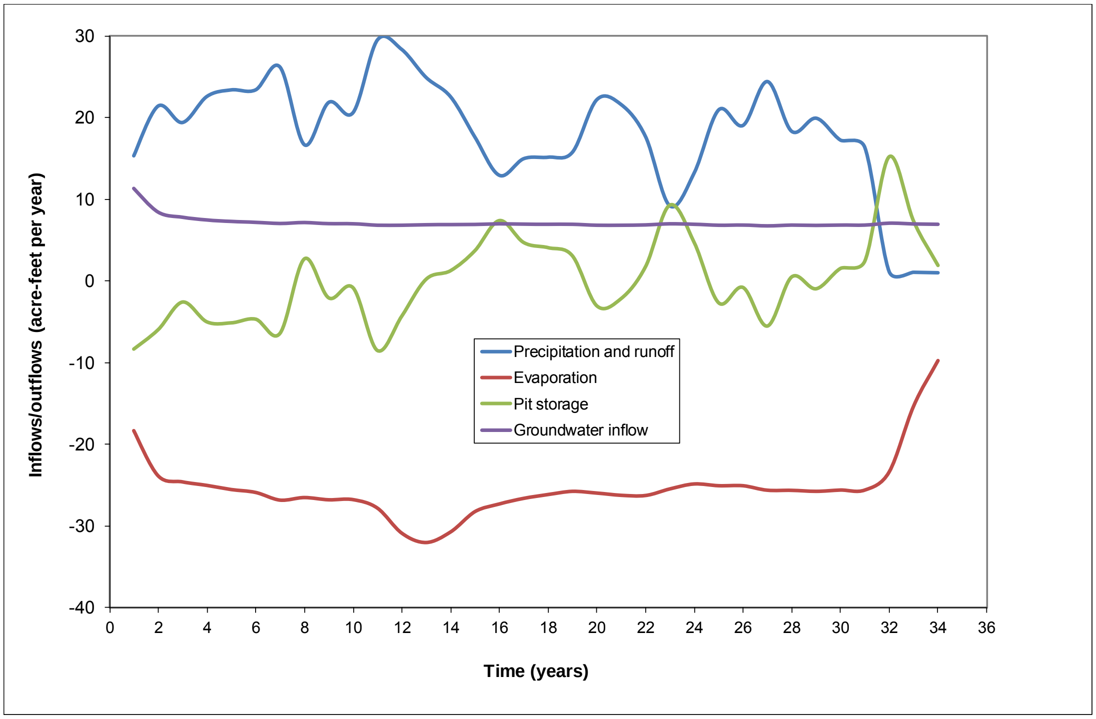


Figure 4-5: Existing Pit Lake Inflows/Outflows

4.5 Solution Inputs

4.5.1 Precipitation Chemistry

The primary wall rock lixiviant for the pit high walls in both the existing pit and the future pit is assumed to be rainwater (i.e. meteoric precipitation). Representative precipitation chemistry data were obtained from monthly monitoring carried out between 1985 and 2011 at the Gila Cliff Dwellings National Monument meteorological station, Catron County, New Mexico (NADP, 2012) (Figure 4-6). In the absence of any site-specific precipitation chemistry, this is considered the most representative precipitation chemistry available for use in both the existing and future pit lake models.

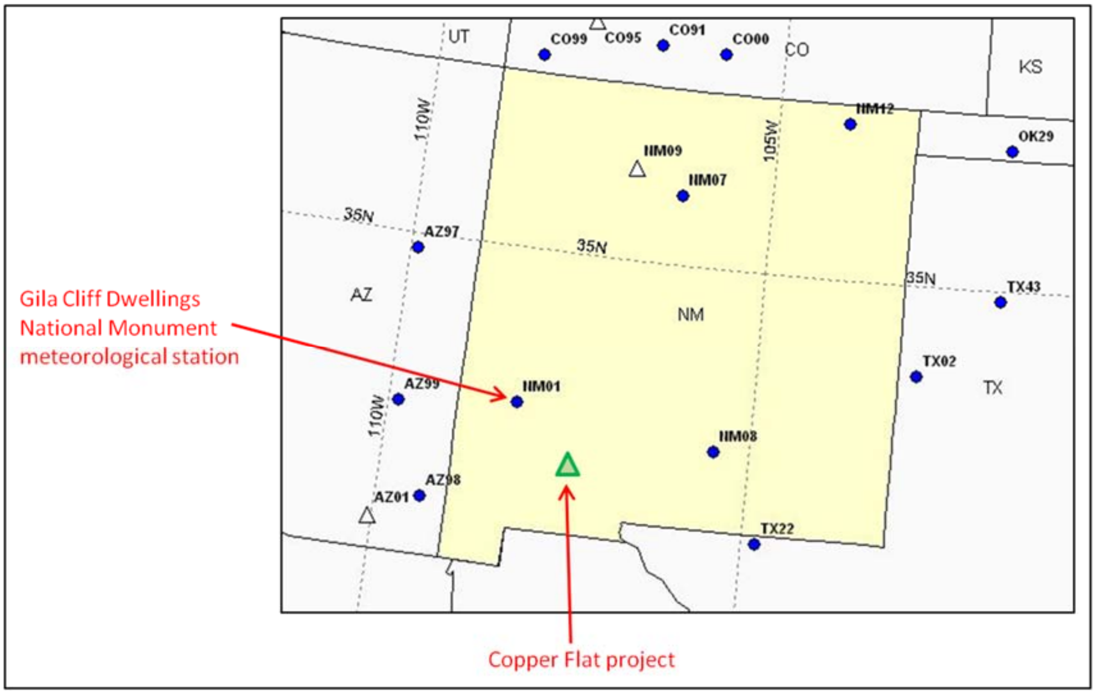


Figure 4-6: Location of Gila Cliff Dwellings National Monument Meteorological Station

4.5.2 Groundwater Chemistry

Representative groundwater chemistry data for the existing pit lake model were obtained from the historical data compiled by JSAI and NMCC. There are four sets of piezometers surrounding the existing pit that have been sampled, with two piezometer sets representing groundwater in the andesite (GWQ96-22[A,B] and GWQ96-23[A,B]), and two in the quartz monzonite (GWQ11-24[A,B] and GWQ11-25[A,B]). GWQ96-23(A,B) is located at the transition between andesite and quartz monzonite; however the water quality is similar to GWQ96-22(A,B) and indicative of andesite.

The results from wells GWQ96-22(A,B), GWQ96-23(A,B), GWQ11-24(B) and GWQ11-25(B) were averaged and used as input to the existing pit lake geochemical model (Table 4-2). Wells GWQ11-24A and GWQ11-25A were not used in the model input as they may have been affected by oxidation of sulfides in fractures during well development and may not be representative of groundwater reporting to the open pit. Furthermore, GWQ11-25A represents a localized and isolated fracture system recharged by oxygenated meteoric water that is not connected to the open pit (JSAI, 2017a). For these reasons, data from GWQ11-24(A) and GWQ11-25(A) were not considered as part of the groundwater inflow to the existing pit.

Further information on how the groundwater chemistry data were derived is provided in the JSAI technical memorandum in Appendix D.

4.5.3 Wall Rock Chemistry

Source term solutions for material types exposed in the existing pit walls at Copper Flat were developed from the results of site-specific HCT testing conducted as part of the SRK (2012) geochemical characterization program that were scaled to field conditions. The application of a scaling factor is necessary because laboratory tests are operated at a higher water-to-rock ratio than would be expected in the field, meaning that mineral-water reaction rates are enhanced in the laboratory. The scaling factor is based on site-specific information relating to the pit water balance, geological model, pit wall fracturing and wall rock density.

The reactive mass (R_m) of pit wall rock available for chemical weathering reactions in both the unsaturated high wall and the submerged pit wall was calculated using the methodology outlined in Section 4.3. The reactive mass for each material type was coupled with the pit water balance to determine the changes in run-off and groundwater chemistry as any water that interacts with the pit walls migrates through the reactive fracture zones. This is demonstrated by the equation below:

$$C_i = \frac{r_i . R_m}{Q}$$

Where:

C_i represents the predicted concentration (in mg/L) of element i;

r_i represents the average release rate of element i in mg/kg/week in the humidity cell tests;

R_m indicates the pit wall reactive mass in kg; and

Q represents either the rate of groundwater inflow into the pit or the rate of pit wall run-off in L/week.

The modified chemistry of the precipitation from these pit rim reactions was then used as the source term contribution to the pit. Separate source terms were developed for each of the material types exposed in the current pit walls (see Table 4-1).

Different HCT inputs were used for trace elements and major ions to represent the different geochemical processes that control their release. Soluble salts are important in the input of major elements to the existing lake and, as such, all weeks of humidity cell data are needed for a valid prediction. By contrast, the release of trace elements is predominantly associated with longer term weathering processes, possibly sulfide oxidation and as a result the initial HCT flush information does not contribute sufficiently. As such, an average of all weeks of humidity cell data were used for major ions (calcium, magnesium, sodium, potassium, aluminum, iron, manganese, chloride, sulfate, fluoride, bicarbonate) and an average of steady-state humidity cell data (i.e., minus the first 20 weeks of testing) were used for trace elements (silver, arsenic, boron, barium, cadmium, cobalt, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium, uranium, vanadium and zinc).

The solutions used as inputs to the geochemical model are provided in Table 4-2.

Table 4-2: Groundwater, Wall Rock and Precipitation Chemistry used as Input to the Existing Pit Model

Parameter		Units	Precipitation chemistry	Groundwater chemistry	Wall rock chemistry							
					Mineralized				Weakly/non-mineralized			
					Biotite breccia oxide	Biotite breccia sulfide	Quartz Monzonite oxide	Quartz Monzonite sulfide	Biotite breccia oxide	Biotite breccia sulfide	Quartz Monzonite oxide	Quartz Monzonite sulfide
			Gila Cliff Dwellings National Monument meteorological station	*Average of wells GWQ96-22(A,B), GWQ96-23(A,B), GWQ11-24(B) and GWQ11-25(B).*	*Average of HCT SRK 0854*	*Average of HCTs 604767, 604787, 604811, 604854, 604862, 604867 and 605033*	*Average of HCT SRK 0867*	*Average of HCTs 604652, 604606, 604653, 604656 and 604669*	*Average of HCT SRK 0872*	*Average of HCTs 604811, 604854, 604862, 604867 and 605033*	*Average of HCT 604569*	*Average of HCTs 604673 and 605153*
pH	pH	s.u	4.93	6.91	5.22	7.86	6.9	7.95	6.51	7.91	7.85	5.74
HCO_3	Bicarbonate	mg/L		316	0.47	45	9.27	38.2	6.4	54.9	22.6	12.3
Ag	Silver	mg/L		0.009	-	-	-	-	-	-	-	-
Al	Aluminum	mg/L		0.12	0.39	0.005	0.07	0.008	0.08	0.006	0.03	0.04
As	Arsenic	mg/L		0.0023	0.0011	0.00034	-	-	0.00095	0.00025	0.00025	-
B	Boron	mg/L		0.136	-	0.005	0.0047	0.0049	-	0.0049	0.005	0.005
Ba	Barium	mg/L		0.089	0.012	0.0091	0.0075	0.012	0.01	0.0062	0.0005	0.035
Ca	Calcium	mg/L	0.21	336	14.1	24.1	25.9	19.5	27.8	28	9.05	6.32
Cd	Cadmium	mg/L		0.001	0.0013	-	0.00005	-	0.00008	-	0.00005	0.00034
Co	Cobalt	mg/L		0.01	0.0009	-	0.0005	-	0.0005	-	-	-
Cr	Chromium	mg/L		0.0066	-	-	-	-	-	-	0.00025	-
Cu	Copper	mg/L		0.0037	18.2	0.0085	0.0056	-	0.0034	0.013	0.0025	0.38
F	Fluoride	mg/L		4.6	0.25	1.09	0.56	0.81	0.33	1.2	0.74	0.43
Fe	Iron	mg/L		1.48	0.7	0.001	0.1	0.001	0.1	0.001	0.001	0.004
Hg	Mercury	mg/L		0.000002	-	-	-	-	-	-	-	0.00002
K	Potassium	mg/L	0.03	4.39	1.42	3.75	1.08	3.84	0.48	4.43	2.5	1.84
Mg	Magnesium	mg/L	0.02	57.8	1.44	3.97	2.24	3.51	1.16	4	2.54	0.98
Mn	Manganese	mg/L		2.47	0.32	0.07	0.47	0.13	0.18	0.04	0.04	0.02
Mo	Molybdenum	mg/L		0.0119	-	0.0052	0.0051	0.0074	0.079	0.0056	0.0005	0.002
Na	Sodium	mg/L	0.08	115	0.61	2.41	0.93	3.46	0.45	2.6	3.23	1.69
Ni	Nickel	mg/L		0.0125	0.0005	-	0.0005	-	0.0005	-	0.0005	-
Pb	Lead	mg/L		0.0025	0.0034	-	-	0.00012	0.00012	-	0.00012	0.0016
Sb	Antimony	mg/L		0.0009	-	-	0.003	-	0.00051	-	-	-
Se	Selenium	mg/L		0.0022	0.00023	0.00031	0.00024	0.00032	0.00024	0.00035	0.00025	0.00025
U	Uranium	mg/L		0.0015	0.0013	0.0033	0.0005	0.0012	0.0013	0.0017	0.0005	0.0046
V	Vanadium	mg/L		0.0009	0.0005	0.001	0.0005	0.0005	0.0005	0.0015	0.0005	0.0005
Zn	Zinc	mg/L		0.08	0.088	0.0027	0.0016	0.0046	0.0013	0.0014	0.0023	0.015
SO_4	Sulfate	mg/L	0.86	954	99.6	44.5	72.3	38.7	74.4	47.3	21.6	14.9
Cl	Chloride	mg/L	0.12	34	0.69	1.3	0.74	2.17	0.6	1.34	1.07	0.71

\- Indicates parameter was uniformly below ARLs in the HCT effluent leachates and was excluded from the PHREEQC model input for the specified material type

4.6 Results

The results of the existing pit calculations are shown in Table 4-3. This shows predicated pit lake chemistry in 2014 (i.e., the final point in the simulated water balance). The predicted chemistry has been compared to average measured chemistry in the existing pit lake between 2010 and 2013 and also the range of chemistry observed during this time period. The PHREEQC model only predicts chemistry at a fixed point in time and does not account for seasonal or longer-term variations in chemistry that may occur. As such, comparison of predicted pit lake chemistry to the range of measured chemistry is likely a more reliable indicator of the accuracy of the model in predicting future chemical conditions.

The model results show good calibration for pH, bicarbonate, calcium, aluminum, cobalt, chromium, copper, mercury, manganese, sodium, nickel, selenium, uranium, zinc and TDS. Predicted concentrations of these constituents are within the range of chemistry measured in the existing pit lake between 2010 and 2013. This demonstrates that they can be predicted with a good degree of accuracy for the future pit lake. In comparison, a few constituents are either positively or negatively-biased in the pit lake calibration model.

Boron, potassium, molybdenum and antimony are slightly overestimated by the PHREEQC model. This likely relates to a combination of factors, including: evapoconcentration effects within the PHREEQC model and a lack of appropriate mineralogical controls in the thermodynamic code. This means the mechanisms that are responsible for removal of these constituents from solution in the existing pit lake (e.g., adsorption only clays or precipitation of mineralogical phases that are not included in the minteq database) are not accounted for in the geochemical model, resulting in concentrations of these constituents being artificially increased over time.

By contrast, concentrations of arsenic, barium, cadmium, fluoride and iron are slightly underestimated by the PHREEQC model. For iron, this underestimate likely relates to the fact that PHREEQC reports only truly dissolved phases. It is possible that iron in the existing pit lake may exist in the form of fine-grained colloids that pass through a 0.45 μm filter, which explains the high measured concentrations of iron in the existing pit lake. This has implications for arsenic concentrations due to the strong affinity of arsenic for Fe-oxyhydroxides (Bowell, 1994). The model predicts that arsenic concentrations will primarily be controlled by adsorption onto Fe-oxyhydroxides; however the calculations assume thermodynamic equilibrium and it may be that speciation of arsenic in the lake is more complex than predicted and adsorption may be limited as a result.

For fluoride and barium, the lower concentrations predicted by the model may relate to an over-estimate of fluorite and barite precipitation. Although both of these minerals have been observed around the existing pit lake at Copper Flat and are likely to form based on the predicted chemistry, the model may overestimate the mass of these minerals that will precipitate, resulting in lower predicted concentrations.

Despite these minor differences in predicted and measured concentrations for a small number of parameters, the existing pit lake model shows that the majority of parameters can be predicted with a good degree of accuracy for the future pit lake.

Table 4-3: Existing Pit (Calibration) Model Results

Parameter		Units	Average measured chemistry in existing pit lake (2010 - 2013)	Range of measured chemistry in existing pit lake (2010 - 2013)	PHREEQC predicted chemistry for existing pit lake
pH	**pH**	s.u.	7.30	6.0 – 7.9	7.94
pe	**pe**	s.u.	-	-	4.84
Alk	**Alkalinity as $CaCO_3$**	mg/L	-	-	65.1
HCO_3	**Bicarbonate**	mg/L	49.7	<20 – 123	37.8
Ag	**Silver**	mg/L	<0.005	<0.005	0.002
Al	**Aluminium**	mg/L	4.58	<0.02 – 82.6	0.02
As	**Arsenic**	mg/L	0.003	<0.001 – 0.0077	0.0001
B	**Boron**	mg/L	0.17	0.13 – 0.19	0.85
Ba	**Barium**	mg/L	0.012	<0.01 – 0.014	0.003
Ca	**Calcium**	mg/L	567	453 – 670	461
Cd	**Cadmium**	mg/L	0.055	0.038 – 0.064	0.007
Co	**Cobalt**	mg/L	0.29	0.049 – 0.49	0.06
Cr	**Chromium**	mg/L	<0.006	<0.006	0.0001
Cu	**Copper**	mg/L	2.21	<0.006 – 26.5	0.03
F	**Fluoride**	mg/L	18.4	15 – 29.8	4.74
Fe	**Iron**	mg/L	0.12	<0.02 – 1.3	0.0001
Hg	**Mercury**	mg/L	<0.0002	<0.0002	0.0002
K	**Potassium**	mg/L	33	24 – 49	397
Mg	**Magnesium**	mg/L	720	570 – 1120	524
Mn	**Manganese**	mg/L	41	28 - 48	38.7
Mo	**Molybdenum**	mg/L	0.02	<0.015 – 0.025	0.29
Na	**Sodium**	mg/L	871	604 – 1400	923
Ni	**Nickel**	mg/L	0.058	0.039 – 0.069	0.06
Pb	**Lead**	mg/L	0.011	<0.005 – 0.026	0.001
Sb	**Antimony**	mg/L	<0.001	<0.001	0.13
Se	**Selenium**	mg/L	0.027	0.013 – 0.059	0.03
U	**Uranium**	mg/L	0.12	0.11 – 0.12	0.10
V	**Vanadium**	mg/L	<0.05	<0.05	0.006
Zn	**Zinc**	mg/L	4.29	0.78 – 7.36	2.05
SO_4	**Sulfate**	mg/L	6,128	5,200 – 8,690	5,304
Cl	**Chloride**	mg/L	451	340 – 714	224
TDS	**Total Dissolved Solids**	mg/L	9,188	7,770 – 14,800	7,918

5 Unreclaimed Pit Model with Natural Fill

5.1 Conceptual Model

The unreclaimed model assumes that dewatering will occur during mining operations and limited water will pond within the pit itself. At the end of open pit mining operations, dewatering will cease and a pit lake will ultimately form by natural refill as a result of inflow of groundwater into the pit, direct precipitation onto the pit lake, run-off from the pit walls and runoff from the open pit surface drainage area. Predictions of future pit lake chemistry for this scenario were made at selected time intervals (beginning when the pit lake starts to fill after mining and dewatering operations cease). Water quality predictions were made for the time periods of 0.5, 1, 2, 5, 10, 25, 50, 75, and 100 years after the start of pit lake formation. These predictions were based on mass load mixing of waters from different sources and allowing the resulting mix to establish thermodynamic equilibrium under imposed conditions by dissolving or precipitating specified solids, with attenuation of trace elements through sorption reactions.

A conceptual geochemical model was developed for the unreclaimed pit model from a review of background and site-specific data in addition to experience with similar projects. The conceptual model is provided in Figure 5-1 and the inputs to the model are discussed in Sections 5.2 to 5.5, below.

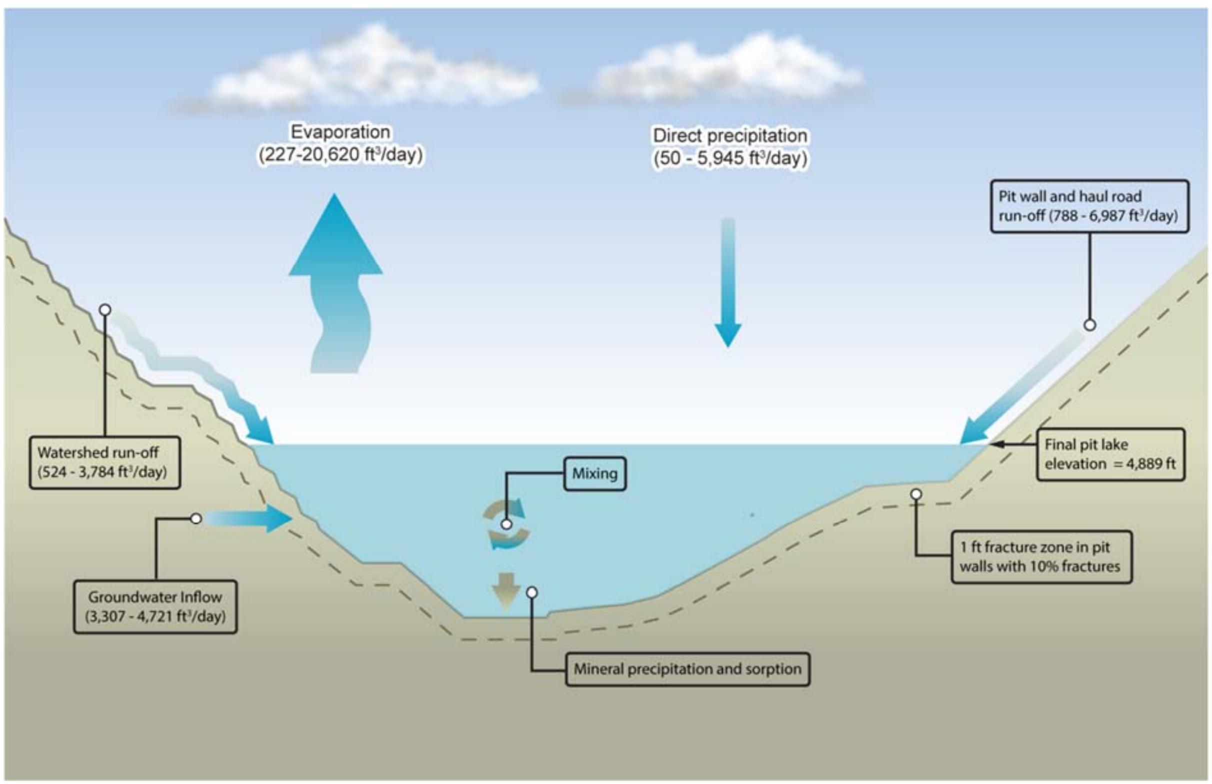


Figure 5-1: Conceptual Model for Unreclaimed Pit with Natural Fill

5.2 Pit Wall Surface Areas

The proportional surface areas of the main material types that will be exposed in the final walls of the unreclaimed pit have been calculated from the FS geologic block model and pit shell with expanded 4900 catch bench. The block model was used to calculate the three-dimensional surface area of each material type that will be exposed in the pit wall both above and below the water level as pit filling progresses. Three-dimensional surface areas were calculated for each of the modeled time steps (i.e., for 0.5, 1, 2, 5, 10, 25, 50, 75 and 100 years after the start of pit lake formation). Material types were delineated based on primary lithology, oxidation (redox) and mineralization (i.e., mineralized versus weakly/non-mineralized).

The three-dimensional surface areas of each material type in the unreclaimed pit at the end of mine life are provided in Table 5-1 and are illustrated in Figure 5-2. This demonstrates that unoxidized Quartz Monzonite will represent the dominant material type that will be exposed in the final walls of the unreclaimed pit.

Table 5-1: Three-dimensional Surface Areas of Pit Wall Rock Material Types for Final Unreclaimed Pit

Mineralization	Rock Type	Redox	Three-dimensional surface area	
			Square feet	%
Weakly/non-mineralized	Andesite	Oxide	4,150	0.05%
		Sulfide (non-ox.)	171,177	2.2%
	Biotite Breccia	Oxide	13,856	0.2%
		Sulfide (non-ox.)	340,496	4.4%
	Quartz Monzonite	Oxide	12,826	0.2%
		Sulfide (non-ox.)	2,823,022	36.3%
	Coarse Crystalline Porphyry	Oxide	8,874	0.1%
		Sulfide (non-ox.)	705,534	9.1%
Mineralized	Biotite Breccia	Sulfide (non-ox.)	813,861	10.5%
	Quartz Monzonite	Oxide	1,768	0.02%
		Sulfide (non-ox.)	2,543,813	32.7%
	Coarse Crystalline Porphyry	Oxide	77	0.001%
		Sulfide (non-ox.)	335,045	4.3%
		Total	**7,774,501**	**100%**

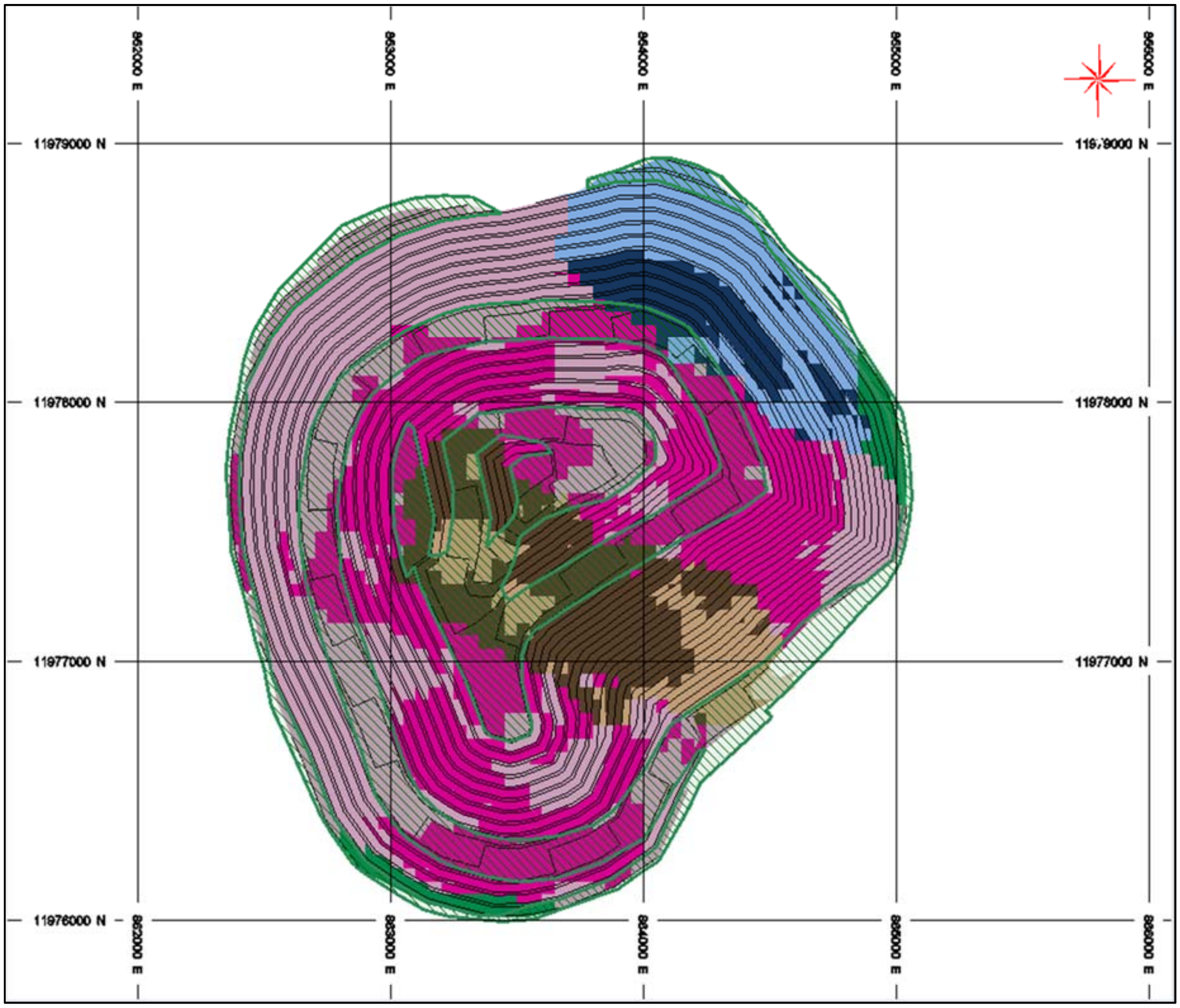


Figure 5-2: Exposed Material Types in Final Walls of Unreclaimed Pit

5.3 Calculation of Pit Wall Rock Available for Leaching

During the period of dewatering the pit walls will be exposed to oxygenated conditions and will weather to form secondary minerals, including soluble salts. As the pit wall resaturates during rebound of the groundwater table, soluble salts and other weathering products will dissolve into the ambient groundwater that drains into the pit. In addition, dissolution of these soluble salts by run-off waters in the unsaturated high wall of the pit may occur. In order that laboratory leach data can be used to determine the mass release of solutes under field leaching conditions, it was necessary to determine the total reactive mass (R_m) of material available for leaching in the pit walls based on the exposed surface areas of each lithology in both the unsaturated high wall and in the submerged pit walls. The reactive mass will be dependent on the density of the pit wall rocks, the density of any fractures produced by blasting, and the depth to which this fracturing penetrates in the pit walls.

A number of studies have evaluated the density and thickness of pit wall fracturing caused by blasting (e.g., Carroll and Scott, 1966; Siskind and Fumanti, 1974; Kelsall et al., 1984; Molebatsi et al., 2009). A detailed summary of this research is presented in Appendix F. This demonstrates that the depth of pit wall fracturing is found to be variable between 1 and 16 feet.

An estimate of the reactive mass in the future pit high wall at Copper Flat was made based on the review of the published information on pit wall fracturing (Appendix F) and from site-specific information provided by NMCC. Future blasting practices at Copper Flat will include pre-split drilling and smooth wall blasting to protect final pit walls, which is considered best practice for geotechnical stability and will effectively reduce fracturing within the final pit walls. Kelsall et al. (1984) studied blasting effects in granite and basalt wall rock and found that blasting enhances permeability by approximately 10 times near the blast face. However, the extent of blast effects is generally limited to <1m (<3.3ft), and as little as 0.3m (1ft) when using low-charge blast methods. Given that the future blasting techniques at Copper Flat will include protective measures such as smooth wall blasting at the final pit wall and that the pit wall composition (i.e., quartz monzonite) will be similar to the granitic material studied in Kelsall et al. (1984), a 1 foot thickness of reactive rock in the pit walls has been assumed for the purpose of the future pit lake model. It is assumed that fracturing in this zone will average 10% (Siskind and Fumanti, 1974; Kelsall et al., 1984). This assumption (i.e., 10% fractures) is considered conservative because the rock comprising the proposed pit shell has low fracture permeability and the limited natural fractures are mineralized (quartz and calcite are common minerals in fractures).

In addition to the fracture zone described above, mineralogy work carried out by SRK on humidity cell tests for previous projects indicates particles generally show water infiltration and products of reactivity up to 0.04 feet into the individual rock fragments. Therefore an oxidized rind of 0.04 feet (0.012 m) thickness has also been assumed on the surface of the pit walls (Figure 5-3).

Using these assumptions for the fracture zone and oxidized rind, the reactive mass (R_m) of each material type in the pit wall was calculated as:

$$R_m = (S \times F_{FZ} \times L_{FZ} \times D) + (S \times L_{OR} \times D)$$

Where:

S is the three-dimensional pit wall surface area of a given material type in square meters (defined by the geological block model; see Table 3-1);

F_{FZ} is the fracture density in the fracture zone (10%);

L_{FZ} is the thickness of the fracture zone in meters (0.3m);

L_{OR} is the thickness of the oxidized rind in meters (0.012m);

D is the rock density in kg/m^3 (2700 kg/m^3, Young and Olhoeft, 1976).

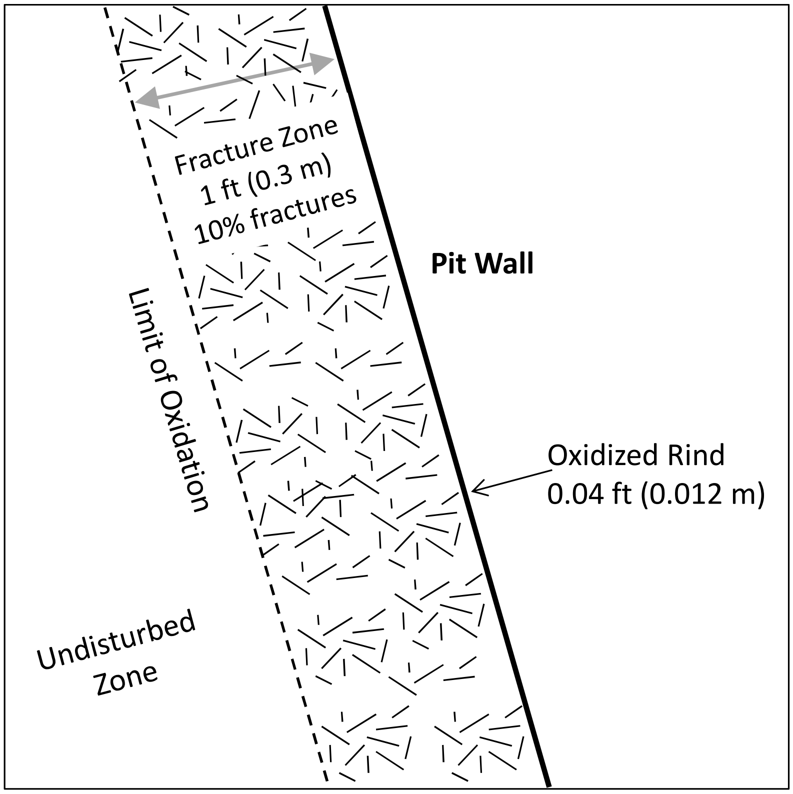


Figure 5-3: Future Pit Wall Conceptual Model

5.4 Water Balance

A pit lake water balance for the unreclaimed pit model was developed by JSAI; details of the groundwater flow model are presented in JSAI (2014b). The post-mining pit water levels and water balance for this scenario were simulated assuming the 2017 MORP pit geometry with expanded 4900 catch bench and watershed shown in Figure 3-1. The model assumes that upon cessation of mining, pumping will cease in and around the pit, allowing the pit to naturally refill over a number of years.

The water balance for the unreclaimed pit natural fill model is based on the following inputs/assumptions from JSAI (JSAI, 2014b; JSAI, 2015a; JSAI, 2017b):

- The primary solution inputs to the pit are assumed to be groundwater inflow, direct precipitation onto the high walls of the pit and run-off from the pit walls, haul road and receiving watershed;
- Evaporation will represent the dominant solution loss;
- The annual average precipitation rate is 12.5 inches per year; and
- The pit lake evaporation rate is 50 inches per year (JSAI, 2015a).

The JSAI water balance projects that the final pit lake elevation for the unreclaimed pit model will be 4,897 ft. The resulting lake will cover an area of approximately 20.7 acres with a depth of approximately 247 ft. The final pit water balance will be approximately 93 acre-feet per year, comprising 57 acre-feet of precipitation and run-off and 36 acre-feet per year of groundwater inflow.

The future pit will be a hydrologic sink, capturing groundwater flowing from all directions (INTERA, 2012; JSAI, 2017b). Surface water from within the footprint of the pit and runoff from the open pit surface drainage area will also be captured. Even with the surface water inflows, the pit will be a hydraulic sink with evaporation rates greatly exceeding precipitation and groundwater inflows on an annual basis (JSAI, 2017b). It is expected that the water levels of the lake will fluctuate seasonally by a few feet depending on precipitation and evaporation rates; rising during periods of lower evaporation (winter months) and decreasing during summer months.

The pit lake filling curve for the unreclaimed pit model is shown in Figure 4-4 and the various inputs/outputs to the pit are shown in Figure 5-5.

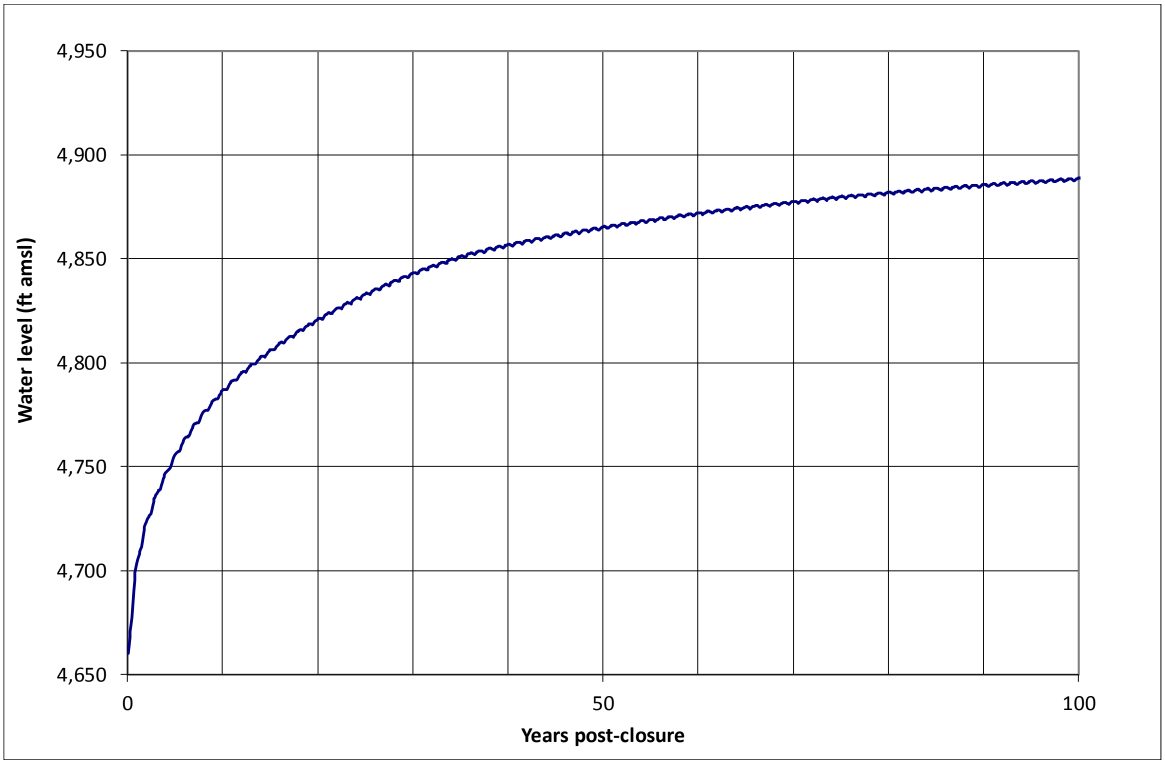


Figure 5-4: Pit Lake Elevation Curve for Unreclaimed Pit Model (source: JSAI)

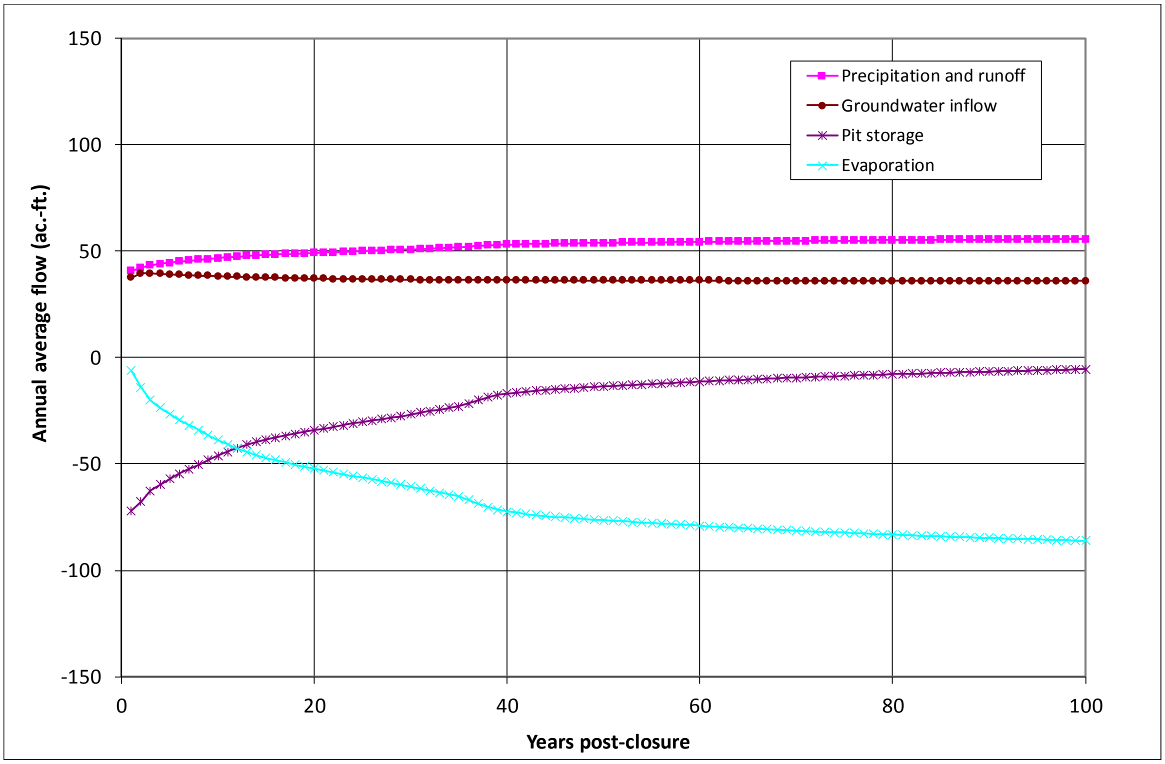


Figure 5-5: Pit Lake Flux for Unreclaimed Pit Model (source: JSAI)

5.5 Solution Inputs

5.5.1 Precipitation Chemistry

As with the existing pit model, the primary wall rock lixiviant for the future pit high walls is assumed to be precipitation. Representative precipitation chemistry data were obtained from monthly monitoring carried out between 1985 and 2011 at the Gila Cliff Dwellings National Monument meteorological station, Catron County, New Mexico (NADP, 2012) (Figure 4-6, Table 5-2).

5.5.2 Groundwater Chemistry

Representative groundwater chemistry data for the future pit lake model were obtained from the historical data compiled by JSAI and NMCC. Based on the current mine plan, a large proportion of the quartz monzonite is removed by mining and the remaining quartz monzonite is dewatered. Groundwater reporting to the future pit is therefore likely to be representative of the andesite rock. Based on this assumption, data from wells GWQ96-22(A), GWQ96-22(B) GWQ96-23(A) and GWQ96-23(B) were used as input to the future pit lake geochemical model.

Further information on how the groundwater chemistry data were derived is provided in the JSAI technical memorandum in Appendix D. The groundwater chemistry used as input to the unreclaimed pit model is presented in Table 5-2.

5.5.3 Wall Rock Chemistry

As with the existing pit model, source term solutions for the future pit lake were developed from the results of site-specific HCT testing conducted as part of the SRK (2012) geochemical characterization program and scaled to field conditions. The HCT testwork results were used to develop separate source terms for each material type that will be exposed in the final pit wall (see Table 5-1). The method used to scale the laboratory HCT data to field conditions was identical to that described in Section 4.5.3 and was based on site-specific information relating to the pit water balance, geological model, pit wall fracturing and wall rock density.

As with the existing pit lake model, different HCT inputs were used for trace elements and major ions to represent the different geochemical processes that control their release. An average of all weeks of humidity cell data were used for major ions (calcium, magnesium, sodium, potassium, aluminum, iron, manganese, chloride, sulfate, fluoride, bicarbonate) and an average of steady-state humidity cell data (i.e., minus the first 20 weeks of testing) were used for trace elements (silver, arsenic, boron, barium, cadmium, cobalt, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium, uranium, vanadium and zinc).

The solutions used as inputs to the geochemical model are provided in Table 5-2.

Table 5-2: Groundwater, Wall Rock, Haul Road and Precipitation Chemistry used as Input to the Unreclaimed Pit Model

Parameter		Units	Precipitation chemistry	Groundwater chemistry	Haul road and watershed run-off chemistry	Wall Rock Chemistry												
						Mineralized					Weakly/non-mineralized							
						Biotite breccia sulfide	Quartz Monzonite oxide	Quartz Monzonite sulfide	Coarse Crystalline Porphyry oxide	Coarse Crystalline Porphyry sulfide	Andesite oxide	Andesite sulfide	Biotite breccia oxide	Biotite breccia sulfide	Quartz Monzonite oxide	Quartz Monzonite sulfide	Coarse Crystalline Porphyry oxide	Coarse Crystalline Porphyry sulfide
			Gila Cliff Dwellings National Monument meteorological station	*Average of wells GWQ96-22(A,B) and GWQ96-23(A,B)*	*Average of SWQ-1*	*Average of HCTs 604767, 604787, 604811, 604854, 604862, 604867 and 605033*	*Average of HCT SRK 0867*	*Average of HCTs 604652, 604606, 604653, 604656 and 604669*	*Average of HCT CF-11-02 (0-27)*	*Average of HCT CF-11-02 (367-408)*	*Average of HCTs SRK 0864 and SRK 0866*	*Average of HCTs SRK 0864 and SRK 0866*	*Average of HCTs SRK 0872 and SRK 0854*	*Average of HCTs 604811, 604854, 604862, 604867 and 605033*	*Average of HCTs SRK 0858 604569*	*Average of HCTs 604673 and 605153*	*Average of HCT CF-11-02 (0-27)*	*Average of HCT CF-11-02 (367-408)*
pH	pH	s.u	4.93	7.85	8.3	7.86	6.90	7.95	7.92	7.74	7.32	7.32	5.50	7.91	2.99	5.74	7.92	7.74
HCO_3	Bicarbonate	mg/L		408	430	45.0	9.27	38.2	30.1	19.9	10.6	10.6	3.44	54.9	N/A	12.2	30.1	19.9
Ag	Silver	mg/L		0.009		-	-	-	-	-	-	-	-	-	-	-	-	-
Al	Aluminum	mg/L		0.029		0.0046	0.070	0.0078	0.019	0.050	0.0090	0.0090	0.237	0.0059	2.96	0.037	0.019	0.050
As	Arsenic	mg/L		0.0023		0.00034	-	-	-	-	-	-	0.0010	0.00025	0.00036	-	-	-
B	Boron	mg/L		0.136	0.02	0.0050	0.0047	0.0049	0.0049	0.0048	-	-	-	0.0049	0.018	0.0050	0.0049	0.0048
Ba	Barium	mg/L		0.089		0.0091	0.0075	0.012	0.00049	0.0028	0.0033	0.0033	0.011	0.0062	0.0021	0.035	0.00049	0.0028
Ca	Calcium	mg/L	0.21	85.8	109	24.1	25.9	19.5	9.95	7.36	8.36	8.36	20.9	28.0	9.59	6.32	9.95	7.36
Cd	Cadmium	mg/L		0.0008		-	4.72E-05	-	-	-	-	-	0.00068	-	0.0014	0.00034	-	-
Co	Cobalt	mg/L		0.008		-	0.00047	-	-	-	-	-	0.00070	-	0.015	-	-	-
Cr	Chromium	mg/L		0.0066		-	-	-	-	-	-	-	-	-	0.0056	-	-	-
Cu	Copper	mg/L		0.0061		0.0085	0.0056	-	-	0.0049	-	-	9.11	0.013	2.41	0.384	-	0.0049
F	Fluoride	mg/L		2.1	0.3	1.09	0.558	0.807	0.820	0.548	0.425	0.425	0.289	1.20	1.98	0.432	0.820	0.548
Fe	Iron	mg/L		1.48		0.00069	0.099	0.00087	0.0025	0.0022	0.0014	0.0014	0.400	0.00074	6.75	0.0039	0.0025	0.0022
Hg	Mercury	mg/L		0.000002		-	-	4.91E-06	9.97E-06	4.83E-06	-	-	-	-	-	1.62E-05	9.97E-06	4.83E-06
K	Potassium	mg/L	0.03	2.96	1.80	3.75	1.08	3.84	2.18	1.70	0.974	0.974	0.950	4.43	1.66	1.84	2.18	1.70
Mg	Magnesium	mg/L	0.02	19.3	36.0	3.97	2.24	3.51	1.74	0.570	1.27	1.27	1.30	4.00	1.64	0.978	1.74	0.570
Mn	Manganese	mg/L		0.66		0.072	0.468	0.130	0.019	0.0094	0.0095	0.0095	0.248	0.043	0.125	0.018	0.019	0.0094
Mo	Molybdenum	mg/L		0.012		0.0052	0.0051	0.0074	0.00049	0.00048	0.00046	0.00046	0.040	0.0056	0.0018	0.0020	0.00049	0.00048
Na	Sodium	mg/L	0.08	119	107	2.41	0.932	3.46	2.31	2.04	1.71	1.71	0.530	2.60	1.98	1.69	2.31	2.04
Ni	Nickel	mg/L		0.0125		-	0.00047	-	-	-	-	-	0.00047	-	0.0018	-	-	-
Pb	Lead	mg/L		0.0025		-	-	-	0.00012	0.00012	0.00012	-	0.0018	-	0.0019	0.0016	0.00012	0.00012
Sb	Antimony	mg/L		0.0009		0.00012	0.0030	0.00012	-	-	-	-	0.00040	0.00012	-	-	-	-
Se	Selenium	mg/L		0.0015		0.00031	0.00024	0.00032	0.00024	0.00024	0.00023	0.00023	0.00024	0.00035	0.00023	0.00025	0.00024	0.00024
U	Uranium	mg/L		0.0015		0.0033	0.00047	0.0012	0.0024	0.0024	-	-	0.0013	0.0017	0.0051	0.0046	0.0024	0.0024
V	Vanadium	mg/L		0.0009		0.0010	0.00047	0.00049	0.00049	-	0.00046	0.00046	0.00047	0.0015	0.0018	0.00050	0.00049	-
Zn	Zinc	mg/L		0.03		0.0027	0.0016	0.0046	-	-	-	-	0.045	0.0014	0.017	0.015	-	-
SO_4	Sulfate	mg/L	0.86	84	261	44.5	72.3	38.7	12.1	7.66	20.3	20.3	87.0	47.3	89.1	14.9	12.1	7.66
Cl	Chloride	mg/L	0.12	49	30	1.30	0.739	2.17	0.999	1.37	0.708	0.708	0.647	1.34	1.26	0.711	0.999	1.37

- Indicates parameter was uniformly below ARLs in the HCT effluent leachates and was excluded from the PHREEQC model input for the specified material type

5.6 Potential for Future Pit Lake Stratification

The existing Copper Flat pit lake contained approximately 70 acre feet of water in 2014 (NMCC estimate). The water surface measures 5.2 acres with an average diameter of 537 feet (Figure 8-8in INTERRA, 2012). The average depth is approximately 13 feet deep and the maximum depth is 35 feet (INTERRA, 2012), which results in a relative depth (RD) of 7%. Samples taken from various depths of the existing pit lake demonstrate that the pit lake is homogeneous and no stratification exists (SRK, 1996, INTERA, 2012, Aquatic Consultants Inc., 2014). Baseline data from the existing pit water body provides evidence that a thermocline develops in the summer and mixing occurs in the winter (INTERA, 2012). A chemocline does not appear to develop, and the water body remains oxygenated (DO = 6 to 9 mg/L) throughout the full water column year-round with similar chemistry throughout the lake (see JSAI, 2014c, Appendix F). Based on elevation and latitude, the Copper Flat open pit water body is classified as a warm monomitic type lake (Wetzel, 2001). A warm monomitic lake mixes freely once a year in the winter assuming the temperature is above 4°C. However, wind effects and water body geometry can have an effect on the magnitude and frequency of mixing (Castendyk, 2009).

Mine pit lakes can develop vertical density stratification that may be seasonal or permanent. The density of water is a function of both its temperature and its salinity or total dissolved solids (TDS) content. Freshwater is most dense at a temperature of about 4ºC. At a given temperature, water density increases with increasing TDS. As TDS increases, the temperature of the maximum density of water also decreases (Atkins et al., 1997; Parshley and Bowell, 2003).

Long-term (multi-year) or permanent density stratification can occur if a lake has a significant vertical variation in TDS due to large differences in the TDS of various source waters to the lake and/or to processes in the lake that increase the TDS. This in turn affects the density of the deeper water. For example, if a lake contains enough organic matter to deplete oxygen in the hypolimnion, then during the summer, ferric hydroxide that precipitates at the surface will sink, become reduced, and dissolve in the basal anoxic water, raising the TDS content and the density of the bottom water.

Water in the hypolimnion will generally become anoxic and will continuously dissolve any ferric hydroxide precipitates falling into it from above. This process further increases the TDS of the hypolimnion and strengthens the density gradient between it and the overlying layer, perpetuating the stratification. Sulfidization in the hypolimnion will lead to natural attenuation of metals and metalloids as well as sulfur. Few studies reporting site-specific limnological data have been published to date (Atkins et al., 1997; Parshley and Bowell, 2003). For Copper Flat, the presence of solute material that will modify pit lake chemistry (i.e., sulfide minerals and gypsum) will likely prevent permanent chemical stratification or layering of the lake. This was validated in the 1990s from depth sampling of the pit lake at Copper Flat (SRK, 1996), and in 2010 and 2011 from baseline data collection (INTERA, 2012). The results from this study demonstrated that the current pit lake is homogeneous and no stratification exists. Temperature and dissolved oxygen profiles for the existing pit lake (INTERA, 2012, Aquatic Consultants Inc., 2014) show the pit water is not significantly stratified. The water stays well oxygenated for the entire depth for each season (6 to 8 mg/L). Thermal stratification requires a 1ºC change in temperature per meter (Wetzel, 2001), which can occur in the summer months as the upper water column heats up and the lower water column remains cool, and well oxygenated.

When established, the future Copper Flat pit lake will contain approximately 2,300 acre feet of water. The water surface is projected to measure 22 acres with an average diameter of 1,105 feet. The average depth will be approximately 105 feet and the maximum depth will be 247 feet, which results in a relative depth (RD) of 22% (JSAI Pit Water Balance, 2017).

The 23% RD for the future Copper Flat pit lake is greater than the average value of 2% for natural lakes and suggests the lake may stratify. Such stratification may result in oxidizing conditions in the upper portions of the lake and more chemically reducing (oxygen-deprived) conditions at depth. However, this stratification is likely to be temporary and influenced by seasonal changes. A prerequisite for permanent stratification is that precipitation plus runoff is greater than evaporation during the summer months when the water body is potentially undergoing temporary thermal stratification (Jewell, 2009). This is not the case at Copper Flat, where annual evaporation from the pit lake (100 acre-feet per year) will greatly exceed precipitation plus run-off (63 acre-feet per year). As such, permanent stratification is unlikely for the current and future Copper Flat pit lake. Consequently, in keeping with many pit lakes in arid regions there is a lower potential for stratification than a single relative depth metric would imply (Jewell, 2009).

Jewell (2009) evaluated six permanently stratified and eight seasonally stratified open pit lakes, and concludes that permanently stratified lakes have vertical density contrast greater than 0.0005 g/cm^3 and a Wedderburn number greater than 1. The Wedderburn number considers thermocline depth, maximum lake length, water density, and wind speed. Jewell (2009) failed to note that most permanently-stratified open pit lakes receive AWS inputs and have resulting acidic water at the surface. A summary table of existing open pit water bodies and their characteristics is presented in Table 5-3.

The future Copper Flat open pit lake is expected to be well mixed, oxygenated, and not acidic, although seasonal stratification may occur. Relative depth does not appear to govern the conditions for creating a permanently stratified open pit water body; however acidic water and higher latitude are key conditions for creating permanent stratification. In addition, another related control is the total dissolved solids or salinity which will also exert control over the density or buoyancy of the mine pit lake. At Copper Flat, direct surface water inputs to the existing lake over time are unlikely to be significant and therefore the potential for turnover is less.

Stratification within the pit lake has implications for redox conditions, mineral solubility and sorption reactions. The pit lake model results presented herein assume the pit lake will be fully mixed. A number of studies on deep mine pit lakes, including Summer Camp Pit in Nevada (Parshley and Bowell, 2003) and unpublished reports on Lone Tree Mines, Yerrington mine and the Robinson Mining District, also in Nevada, have demonstrated the tendency for incomplete seasonal overturn.

Based on observations of the current Copper Flat pit lake, the development of a metal-rich brine in the hypolimnion of the future pit lake is unlikely. The conditions for this are summarized in Castendyk (2009). Rather, the future pit lake is expected to be mixed and well oxygenated because: (i) the existing and future pit lake can be classified as monomictic with frequent or continuous periods of circulation with no ice cover in the winter; and (ii) the existing and future pit lake can also be characterized as oligotrophic, i.e., having little to no nutrient input and organic production, with dissolved oxygen content regulated largely by physical processes.

While stratification of an open pit water body has implications for water chemistry at depth, particularly in terms of redox changes, the near surface waters of the future Copper Flat pit lake are expected to remain oxidizing. These near surface waters are considered the most critical from a perspective of potential ecological risks associated with the lake, reduced water quality that may develop at depth is less important since the proposed Copper Flat pit will remain a terminal sink post closure.

Table 5-3: Summary of open pit water bodies and stratification characteristics (JSAI, 2014c)

Open pit	Location	Effective length (ft)	Maximum depth (ft)	Relative depth (%)	Thermocline depth (ft)	Acidic
Permanently stratified						
Brenda	British Colombia	2,296	492	21	39	No
Spenceville	California	253	50	20	13	Yes
Berkeley	Montana	5,900	426	7	23	Yes
Seasonally stratified and well mixed						
Humbolt	Nevada	944	137	15	8	No
Blackhawk	Utah	492	na	na	33	No
Blowout	Utah	656	230	35	39	No
Colosseum	California	482	157	33	na	No
Cunningham	New Mexico	407	90	22	20	No
Copper Flat (existing)**	New Mexico	537	35	7	20	No*
Copper Flat (proposed)***	New Mexico	1105	247	22	TBD	No
Yerington	Nevada	5,412	400	13	49	No

* Predominantly circum-neutral with the development of occasional temporary acidity

** Updated from JSAI (2014c) to reflect Baseline Data Report (INTERA, 2012)

*** Updated from JSAI (2014c) to reflect current pit water balance and mine plan

TBD – to be determined

5.7 Results

The predicted pit lake chemistry for the unreclaimed pit model is summarized in Table 5-4 and illustrated in Figure 5-6 to Figure 5-19 for selected parameters. These show predicted pit lake chemistry at each of the modeled time steps (i.e., 0.5, 1, 2, 5, 10, 25, 50, 75 and 100 years post-closure). In each case, the predicted pit lake chemistry is compared to the chemistry measured in the existing pit lake between 1989 and 2017. The full PHREEQC output file is provided in Appendix I, which shows precipitating and dissolving mineral species at each time step as part of the mass transfer calculations.

Pit lake waters for the unreclaimed pit are predicted to be moderately alkaline (pH 7.9– 8.2) with a magnesium plus sulfate ($Mg + SO_4$) major ion signature. During the early stages of pit infilling (i.e., the first six months post-closure), the prediction is that an early flush will occur in boron, lead, mercury, manganese, molybdenum, nickel, selenium, vanadium, zinc and sulfate. This initial flush occurs due to dissolution of soluble sulfate salts that will have developed on the pit walls during the life of mine. This initial flush is only observed for the natural fill model, but the effects are dissipated in the rapid fill model and no initial flush is observed.

Inflowing groundwater and direct precipitation on the pit lake surface will then provide some dilution and the effects of this initial flush will be dissipated. Following this initial flush, pit lake waters are predicted to evolve over time, with increasing concentrations of chloride, sulfate, TDS and trace elements owing to the effects of evapoconcentration. This is similar to the trends observed in the existing pit lake, where elemental concentrations (particularly boron, cadmium, fluoride, magnesium, manganese, sodium and sulfate) have increased over time. The macrochemistry (Ng-Na-SO4) changes are reflected in the Piper plot in Figure 5-19, which shows a progressive change in pit lake major ion chemistry post-closure, with waters becoming increasingly dominated by sulfate and magnesium over time. However, pH remains moderately alkaline throughout pit infilling.

Pit lake chemistry is likely to be dominated by groundwater chemistry plus evapoconcentration effects. Over time, the groundwater contribution will decrease slightly as the pit lake is established. Both adsorption and secondary mineral precipitation are likely to be the major controls on trace element chemistry.

Pit lake waters for the unreclaimed pit are predicted to be 'near-neutral, low-metal' waters for years zero (i.e., end of mine life) to year 50, based on pH values between 7.9 and 8.2 and total Ficklin metal concentrations[1] less than 1 mg/L (Figure 5-18). The effects of evapoconcentration are predicted to result in increasing metal concentrations, with pit lake waters being classed as 'near-neutral, high metal' from year 75 onwards (Figure 5-18).

A comparison of predicted pit lake chemistry to chemistry measured in the existing pit lake between 1989 and 2017 demonstrates that concentrations of the majority of constituents are either comparable to or less than existing concentrations. In particular, predicted concentrations of arsenic, cadmium, copper, cobalt, chromium, fluoride, lead, manganese, nickel, zinc and sulfate in the future unmitigated pit are lower than those observed in the existing pit lake at Copper Flat. This relates to a number of factors, including:

- The future pit walls will be prepared using pre-split drilling and smooth wall blasting, which will reduce the depth of fracturing and oxidation, and consequently reduce solute loading to the pit lake;
- The future pit walls will contain less mineralized material than the existing Copper Flat pit, which will also reduce solute loading to the pit lake;
- The future pit walls will contain less transitional material than the existing Copper Flat pit, that is the source of the AWS events; and
- The dominant groundwater flow into the future pit will originate from the Andesite, which is typically characterized by lower constituent concentrations than the Quartz Monzonite groundwater (JSAI, 2017a).

The only constituents that are predicted to be higher in the future pit lake compared to the existing pit lake are boron, molybdenum, potassium and antimony. From the calibration model (Section 3.10) these constituents are known to be over-predicted by PHREEQC, and therefore the predicted concentrations of boron, molybdenum, potassium and antimony presented in Table 5-4 are likely to be an overestimate.

[1] Ficklin metals are the base metals copper, cobalt, cadmium, lead, nickel and zinc (Ficklin et al., 1992)

Table 5-4: Unreclaimed Pit Model Results

Parameter		Units	*Measured Chemistry in Existing Pit (1989 - 2017)*			Predicted Future Chemistry (Years Post-Closure)								
			Average	*Minimum*	*Maximum*	**0.5**	**1**	**2**	**5**	**10**	**25**	**50**	**75**	**100**
pH	**pH**	s.u.	*6.5*	*3.6*	*8.3*	8.2	8.1	8.1	8.0	8.0	8.0	7.9	7.9	7.9
HCO_3	**Bicarbonate**	mg/L	*40.4*	*<3*	*122*	54.8	45.4	42.6	40.6	39.3	37.3	35.2	33.8	34.6
Al	**Aluminium**	mg/L	*10.4*	*<0.02*	*82.6*	0.06	0.10	0.10	0.11	0.12	0.13	0.16	0.18	0.16
As	**Arsenic**	mg/L	*0.004*	*<0.001*	*0.006*	1.28E-05	1.07E-05	1.27E-05	1.58E-05	1.96E-05	3.07E-05	4.46E-05	5.86E-05	7.27E-05
B	**Boron**	mg/L	*0.14*	*<0.1*	*0.2*	0.44	0.30	0.31	0.34	0.38	0.49	0.67	0.85	1.04
Ca	**Calcium**	mg/L	*550*	*455*	*684*	99.8	127	150	177	202	262	360	460	489
Cd	**Cadmium**	mg/L	*0.05*	*<0.005*	*0.1*	0.0012	0.0014	0.0015	0.0017	0.0019	0.0025	0.0033	0.003	0.003
Co	**Cobalt**	mg/L	*0.29*	*<0.05*	*0.49*	0.008	0.005	0.006	0.006	0.007	0.009	0.01	0.02	0.02
Cr	**Chromium**	mg/L	*0.03*	*<0.006*	*0.1*	4.68E-05	5.14E-05	5.43E-05	5.73E-05	5.98E-05	6.53E-05	7.32E-05	8.05E-05	8.24E-05
Cu	**Copper**	mg/L	*4.44*	*0.001*	*26.5*	0.012	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	**Fluoride**	mg/L	*19.2*	*4.8*	*34*	3.30	3.02	3.34	3.83	4.25	4.11	4.00	3.95	4.16
Fe	**Iron**	mg/L	*0.2*	*<0.02*	*1.3*	4.64E-05	4.88E-05	5.03E-05	5.18E-05	5.30E-05	5.55E-05	5.88E-05	6.17E-05	6.20E-05
Hg	**Mercury**	mg/L	*0.0005*	*<0.0002*	*0.001*	0.0006	0.0004	0.0004	0.0004	0.0005	0.0006	0.0008	0.0011	0.0013
K	**Potassium**	mg/L	*32.1*	*11.0*	*60.6*	192	131	135	148	166	212	290	372	453
Mg	**Magnesium**	mg/L	*698*	*43*	*1,120*	171	121	125	136	152	194	266	341	416
Mn	**Manganese**	mg/L	*34.8*	*0.02*	*59.0*	4.66	3.19	3.30	3.62	4.04	5.15	7.04	9.02	11.00
Mo	**Molybdenum**	mg/L	*0.04*	*0.015*	*0.1*	0.26	0.18	0.19	0.20	0.23	0.28	0.36	0.45	0.53
Na	**Sodium**	mg/L	*888*	*165*	*1,400*	278	202	210	230	257	326	445	570	694
Ni	**Nickel**	mg/L	*0.06*	*0.039*	*0.1*	0.009	0.007	0.007	0.008	0.009	0.011	0.015	0.019	0.022
Pb	**Lead**	mg/L	*0.02*	*<0.005*	*0.1*	0.0005	0.0005	0.0007	0.0008	0.0008	0.0006	0.001	0.0005	0.0005
Sb	**Antimony**	mg/L		*<0.001**		0.005	0.003	0.003	0.004	0.004	0.005	0.007	0.009	0.011
Se	**Selenium**	mg/L	*0.028*	*<0.001*	*0.25*	0.015	0.011	0.011	0.012	0.013	0.016	0.022	0.028	0.034
U	**Uranium**	mg/L	*0.11*	*0.11*	*0.12*	0.073	0.051	0.049	0.05	0.06	0.08	0.11	0.15	0.18
V	**Vanadium**	mg/L	*0.1*	*<0.05*	*0.25*	0.0004	0.0004	0.0003	0.0003	0.0004	0.0005	0.0007	0.0009	0.001
Zn	**Zinc**	mg/L	*5.4*	*0.01*	*9*	0.52	0.36	0.37	0.40	0.45	0.58	0.79	1.01	1.23
SO_4	**Sulfate**	mg/L	*4,803*	*1,566*	*8,690*	1,505	1,196	1,284	1,441	1,626	2,096	2,887	3,708	4,353
Cl	**Chloride**	mg/L	*332*	*47.3*	*730*	135	95.6	99.1	109	121	154	210	269	328
TDS	**Total Dissolved Solids**	mg/L	*7,538*	*2,711*	*14,800*	2,446	1,926	2,053	2,291	2,573	3,293	4,507	5,770	6,786

** Indicates parameter was uniformly below analytical detection limits in pit lake water over monitoring period, but detection limit was variable. Concentration shown in table represents lower limit of analytical detection.*

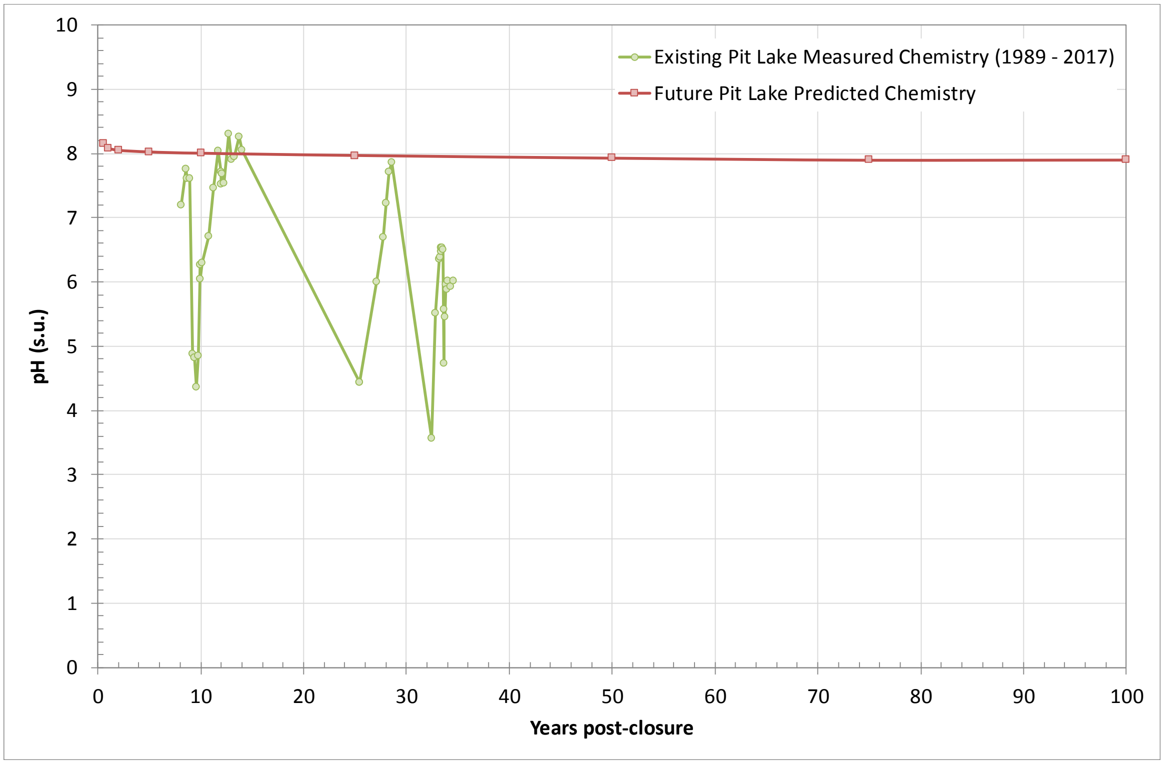


Figure 5-6: Time-series Plot of Predicted pH for the Unreclaimed Pit Model

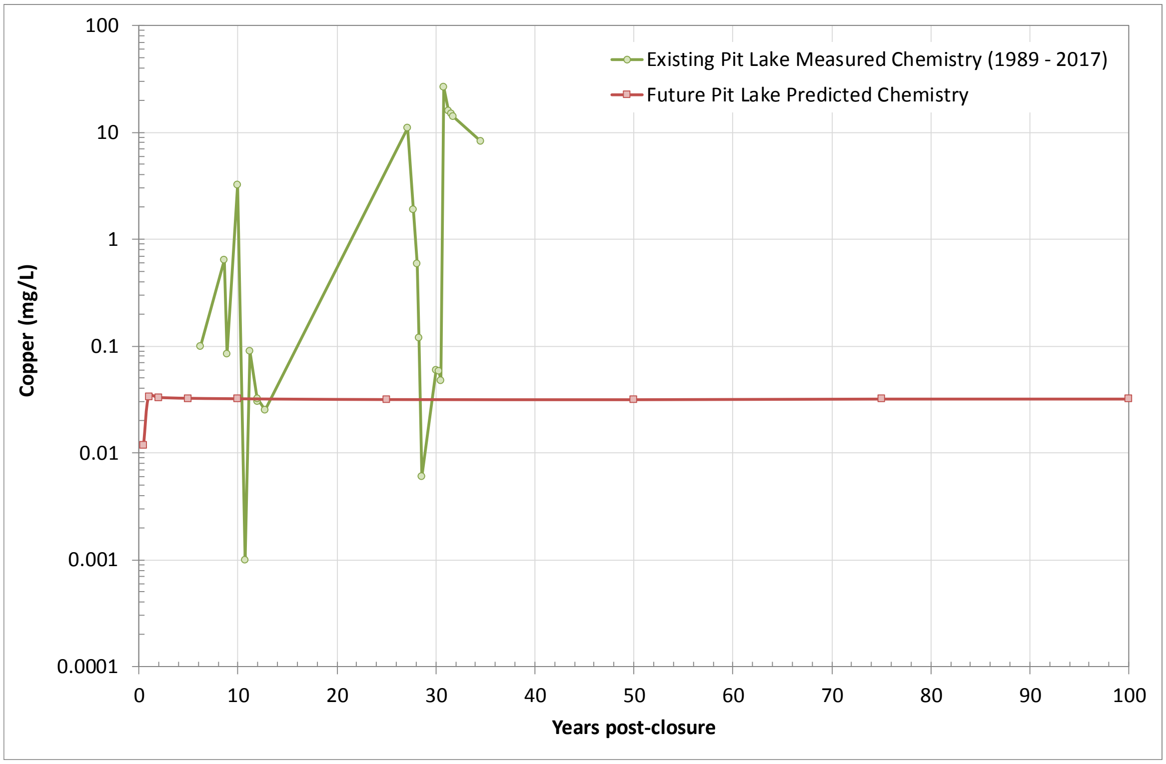


Figure 5-7: Time-series Plot of Predicted Copper for the Unreclaimed Pit Model

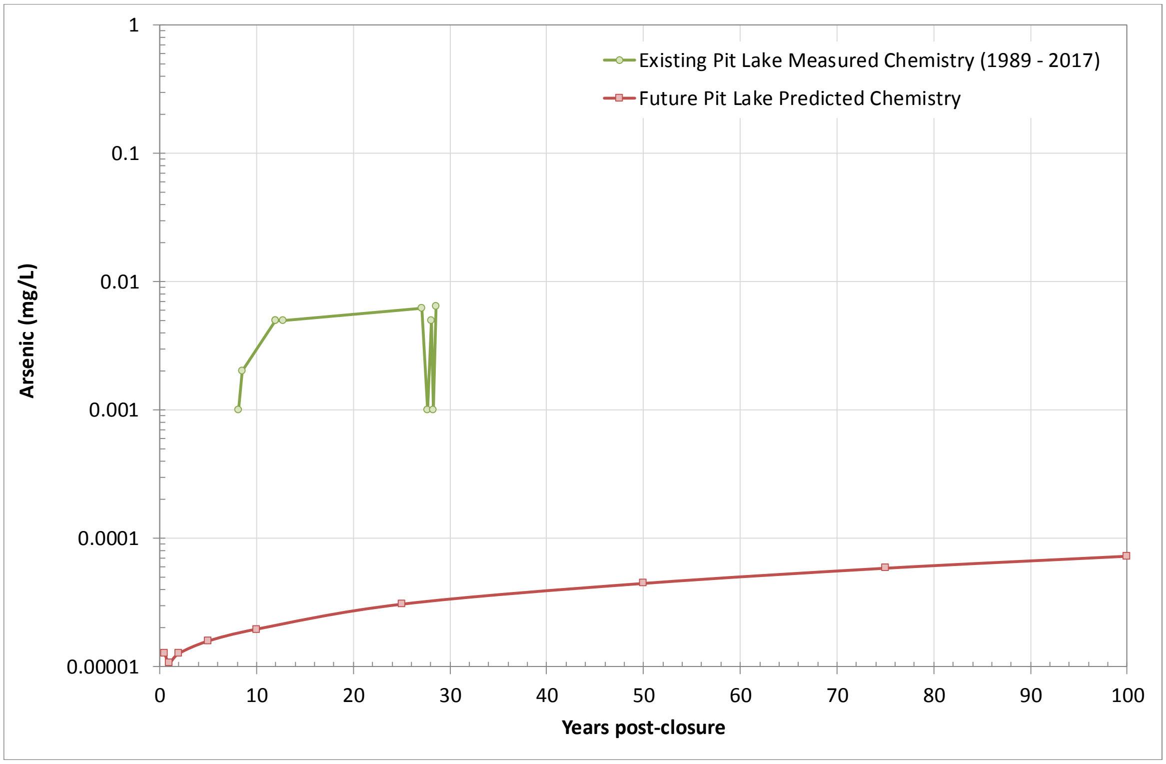


Figure 5-8: Time-series Plot of Predicted Arsenic for the Unreclaimed Pit Model

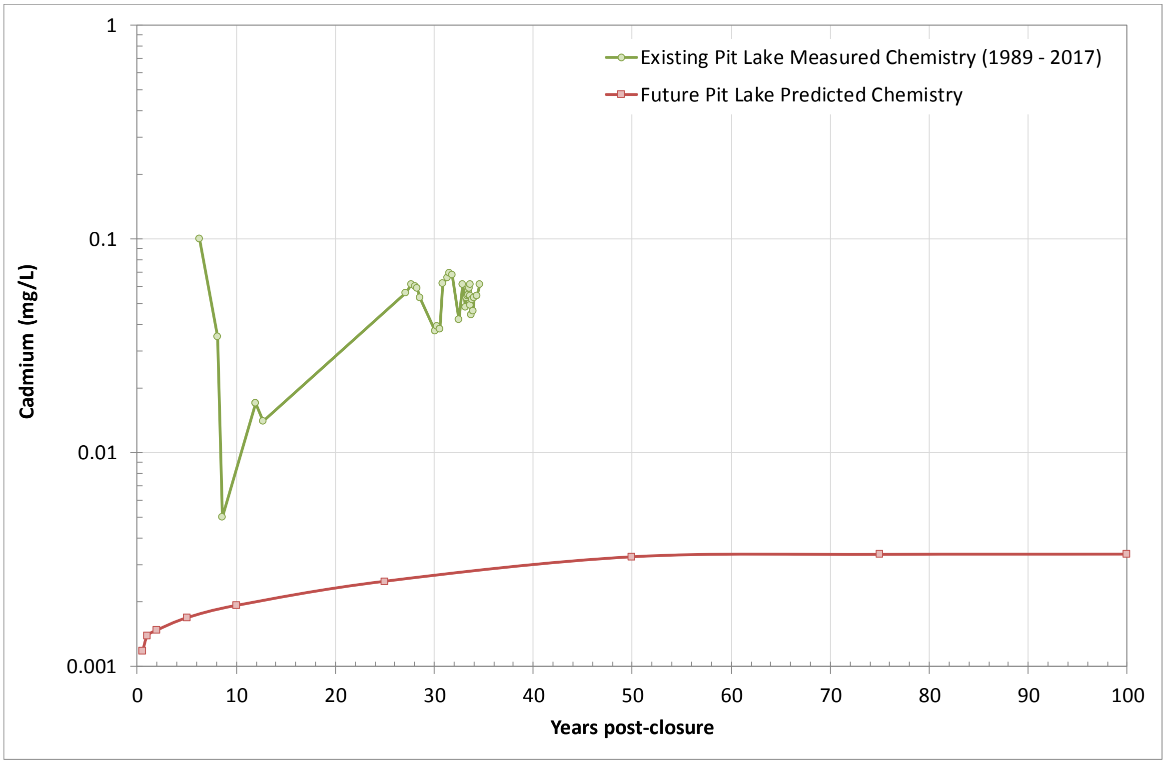


Figure 5-9: Time-series Plot of Predicted Cadmium for the Unreclaimed Pit Model

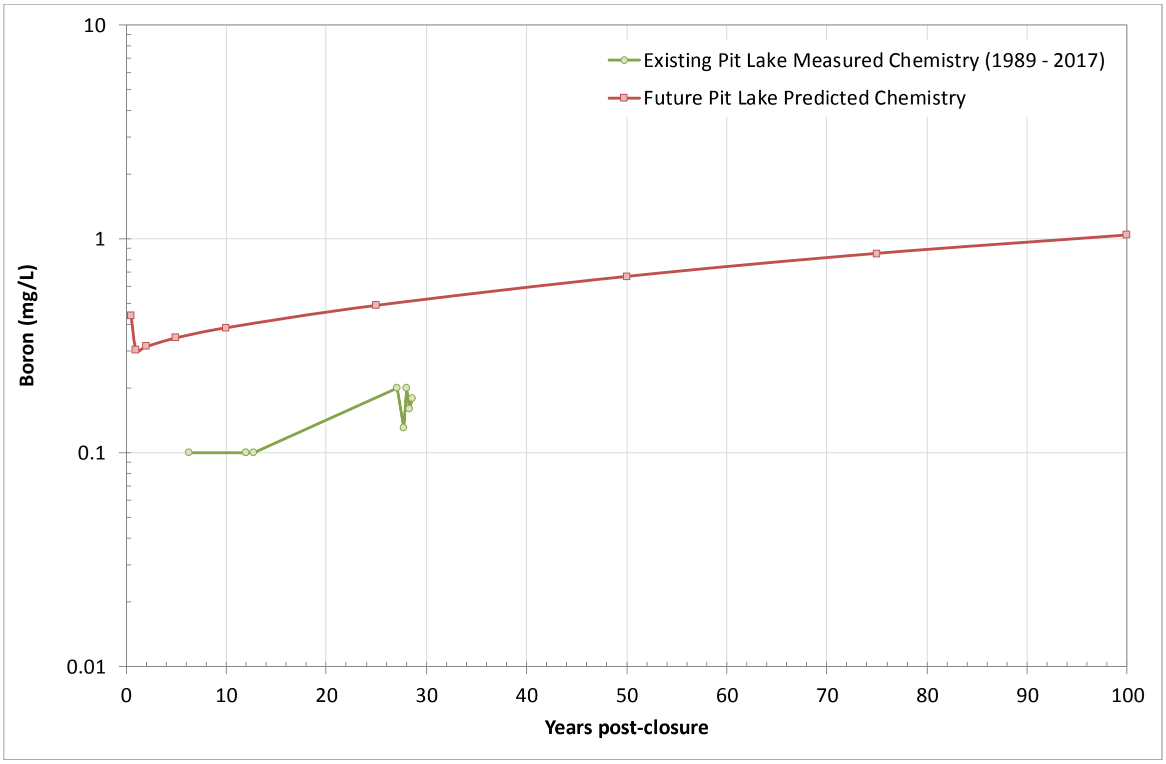


Figure 5-10: Time-series Plot of Predicted Boron for the Unreclaimed Pit Model

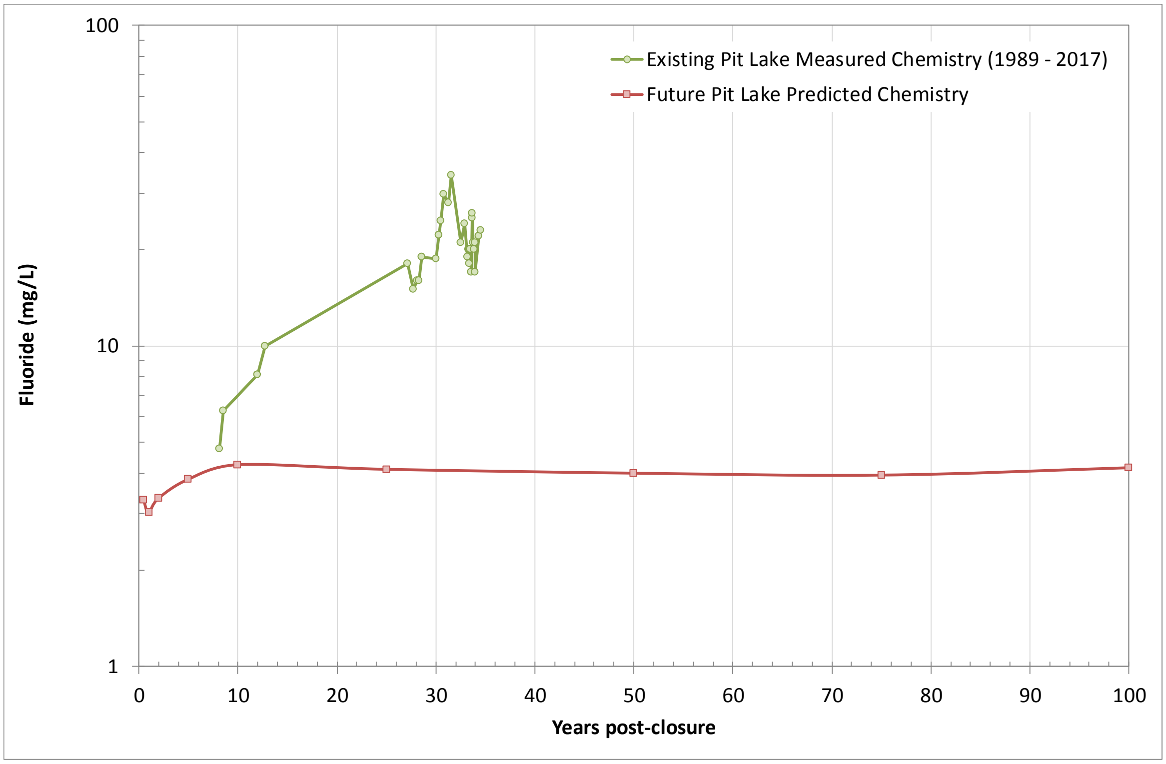


Figure 5-11: Time-series Plot of Predicted Fluoride for the Unreclaimed Pit Model

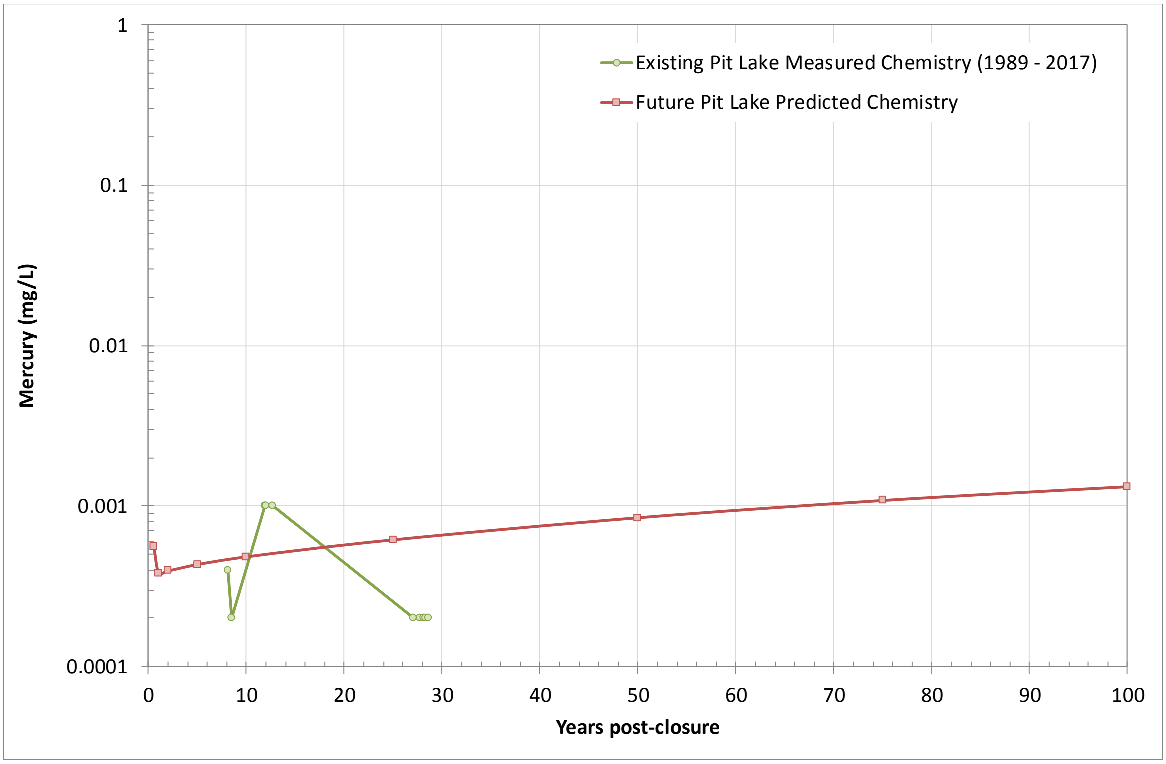


Figure 5-12: Time-series Plot of Predicted Mercury for the Unreclaimed Pit Model

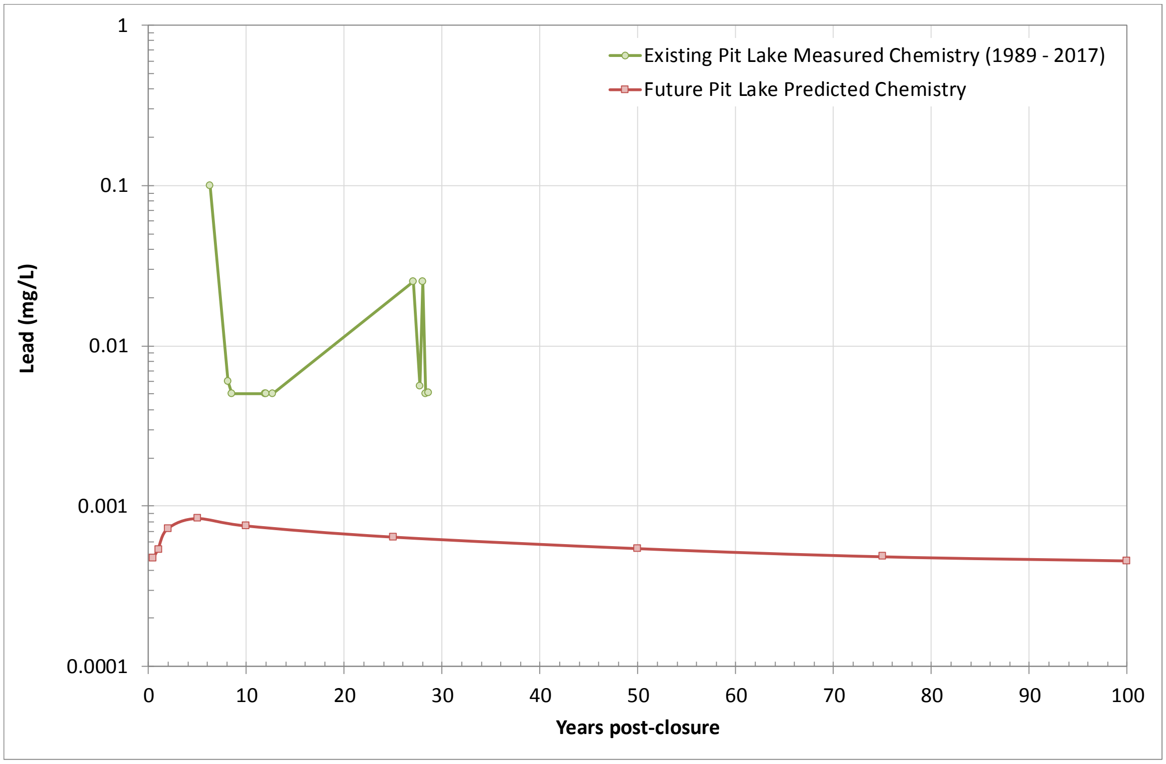


Figure 5-13: Time-series Plot of Predicted Lead for the Unreclaimed Pit Model

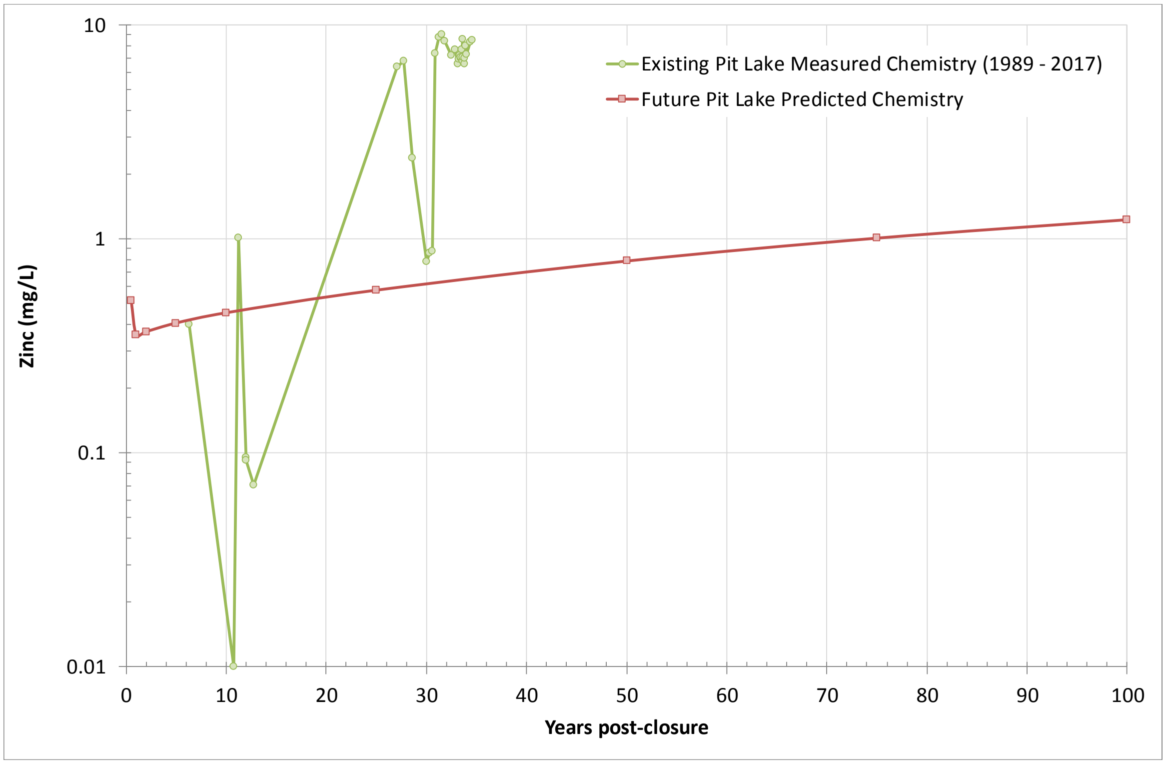


Figure 5-14: Time-series Plot of Predicted Zinc for the Unreclaimed Pit Model

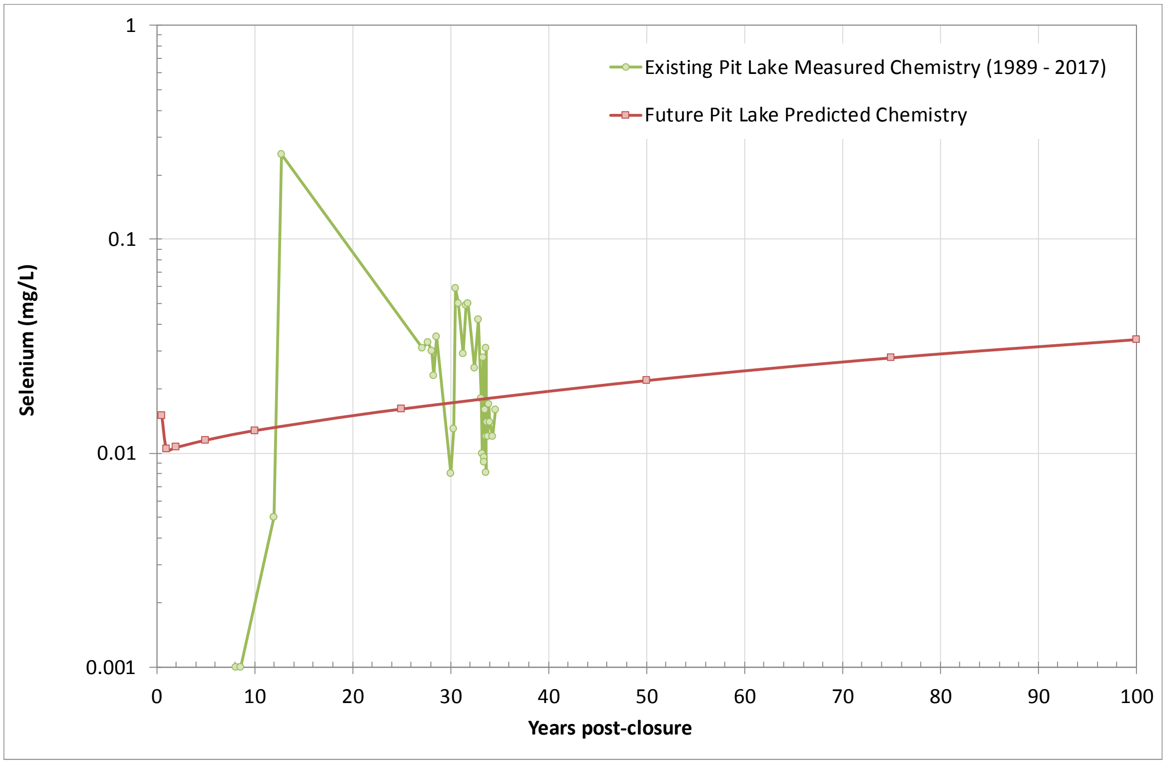


Figure 5-15: Time-series Plot of Predicted Selenium for the Unreclaimed Pit Model

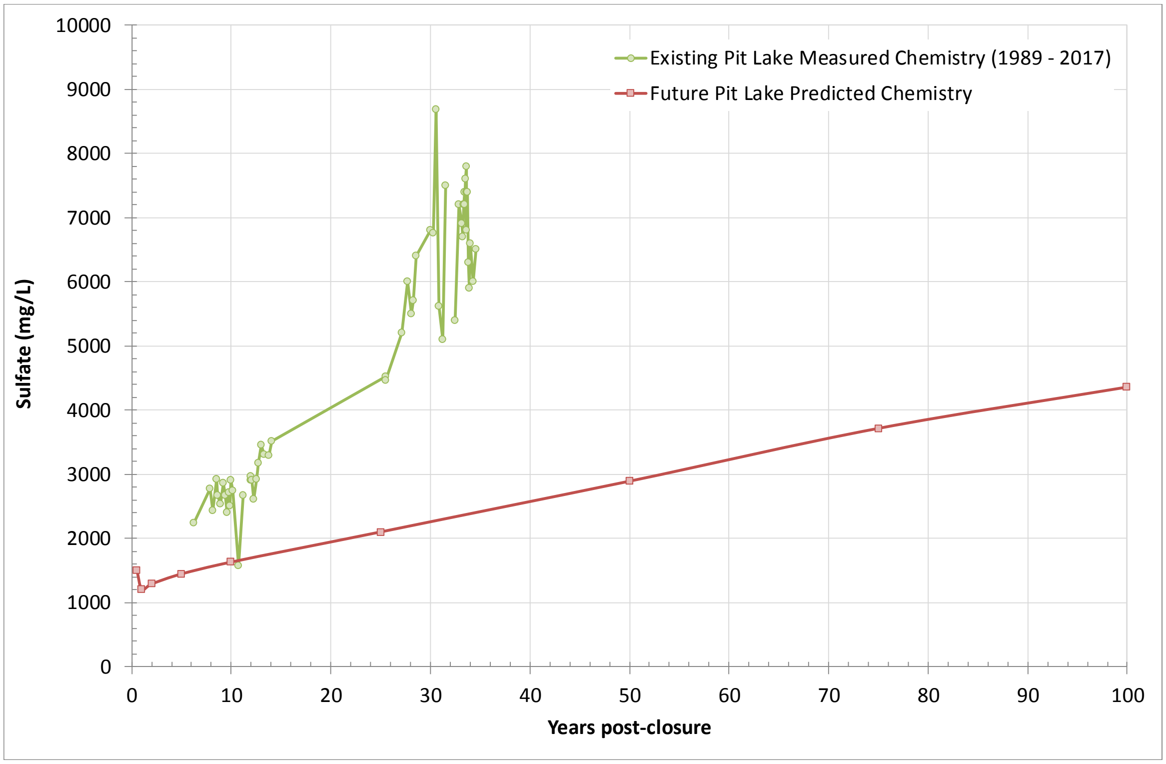


Figure 5-16: Time-series Plot of Predicted Sulfate for the Unreclaimed Pit Model

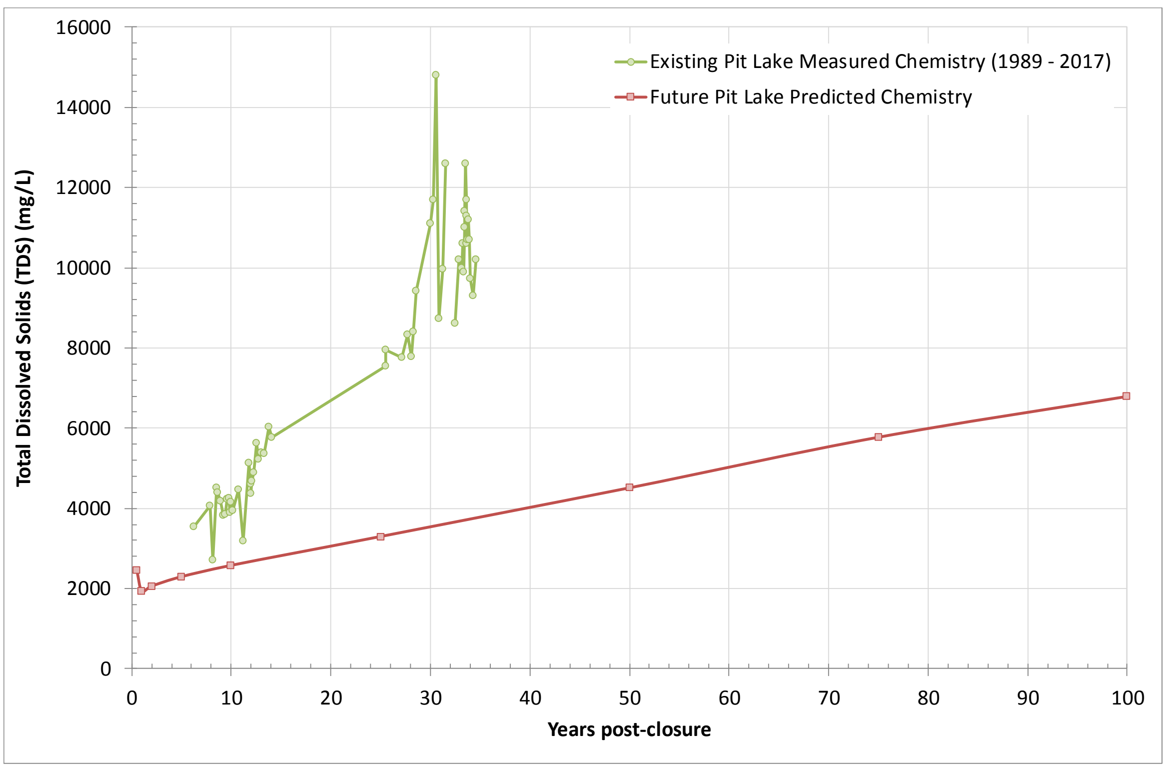


Figure 5-17: Time-series Plot of Predicted TDS for the Unreclaimed Pit Model

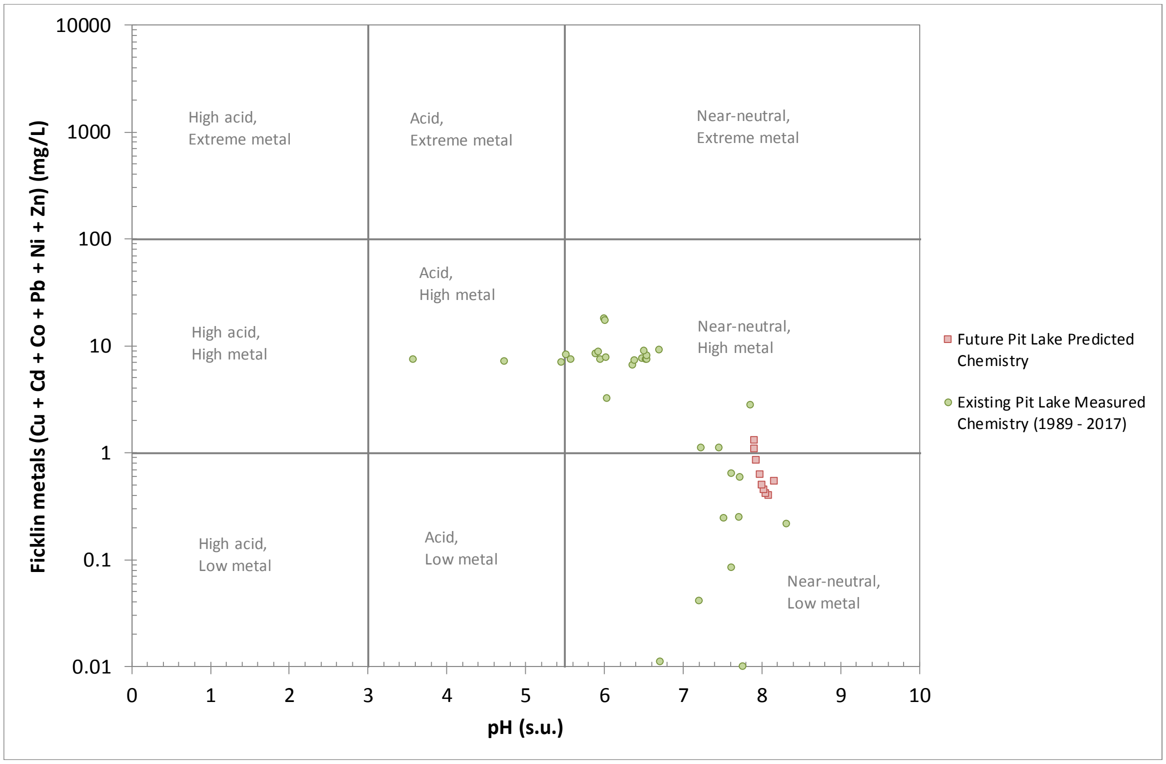


Figure 5-18: Ficklin Plot for the Unreclaimed Pit Model

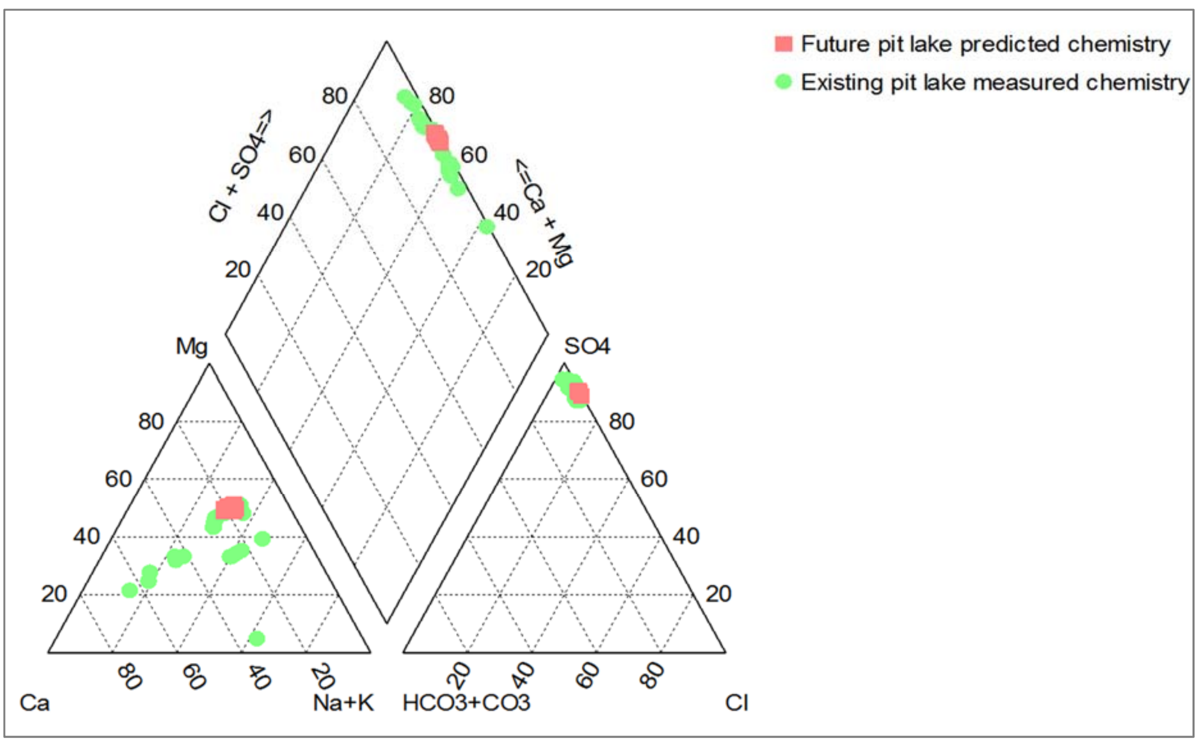


Figure 5-19: Piper Plot of Predicted Major Ion Chemistry for the Unreclaimed Pit Model

6 Reclaimed Pit Model with Rapid Fill

6.1 Conceptual Model

Rapid fill has been proposed as a reclamation strategy for the future pit and will dilute solutes derived from water-rock interaction. Rapid fill will quickly submerge walls and benches to limit the exposure of sulfide minerals to oxygen, and will reduce the effects of evapoconcentration over time. To assess the effects of initial rapid fill on predicted pit lake chemistry for the future pit, an alternative model has been run. This alternative fills the pit with 2,200 acre-feet from the water supply wells during the six months of pit filling. Rapid fill stops when the 4,897 ft water elevation is achieved. Additional reclamation activities for this scenario includes reclamation of the haul road, the expanded section of the 4900 catch bench and the pit shell crest (see Section 3.1.8).

Water quality predictions for this scenario were made for time periods of 0.5, 1, 2, 5, 10, 25, 50, 75, and, 100 years after the start of pit lake formation. A conceptual model for the reclaimed pit rapid fill scenario is presented in Figure 6-1 and inputs to the model are discussed in Sections 6.2 to 6.5.

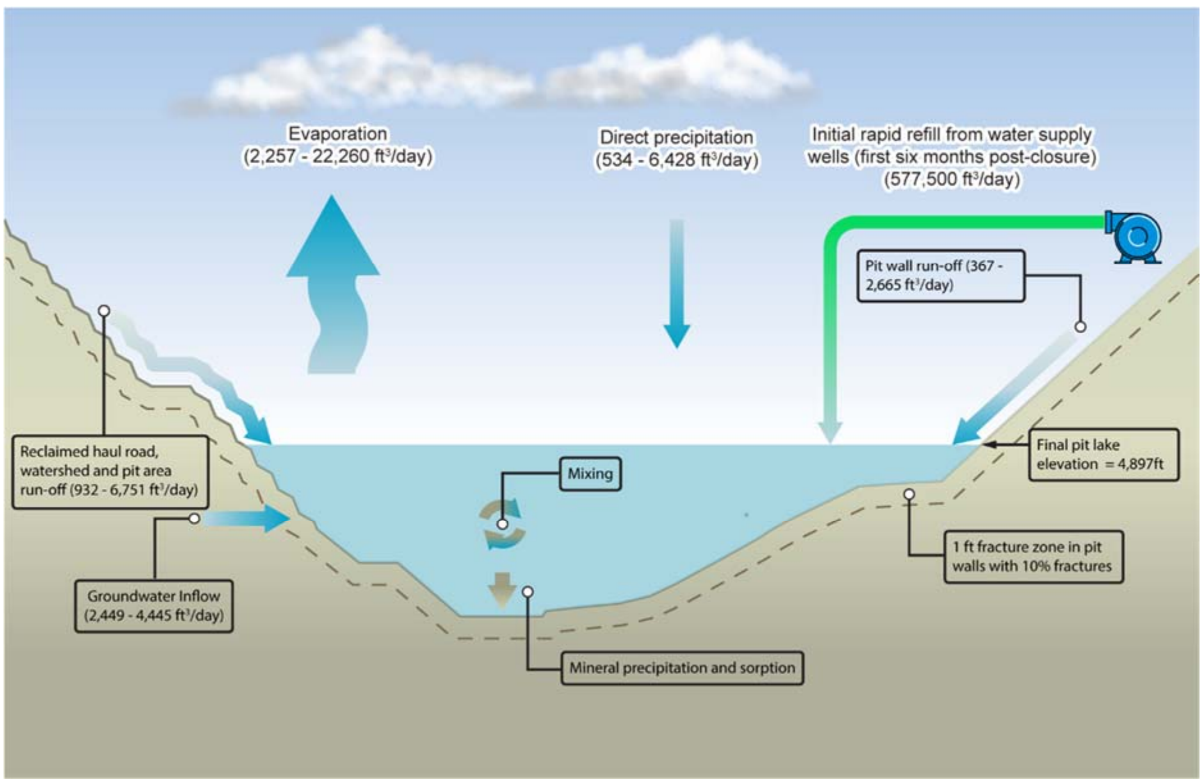


Figure 6-1: Conceptual Model for Reclaimed Pit with Rapid Fill

6.2 Pit Wall Surface Areas

The proportional surface areas of the main material types that will be exposed in the final walls of the reclaimed pit have been calculated from the FS geologic block model and the 2017 MORP pit. The block model was used to calculate the three-dimensional surface area of each material type that will be exposed in the pit wall both above and below the water level as pit filling progresses. Three-dimensional surface areas were calculated for each of the modeled time steps (i.e., for 0.5, 1, 2, 5, 10, 25, 50, 75 and 100 years after the start of pit lake formation). Material types were delineated based on primary lithology, oxidation (redox) and mineralization (i.e., mineralized versus weakly/non-mineralized). Areas proposed for cover and reclamation are excluded from the exposed surface areas.

The three-dimensional surface areas of each material type in the reclaimed pit at the end of mine life are provided in Table 6-1 and are illustrated in Figure 6-2. This demonstrates that unoxidized Quartz Monzonite will represent the dominant material type that will be exposed in the final walls of the reclaimed pit.

Table 6-1: Three-dimensional Surface Areas of Pit Wall Rock Material Types for Final Reclaimed Pit

Mineralization	Rock Type	Redox	Three-dimensional surface area	
			Square feet	%
Weakly/non-mineralized	Andesite	Oxide	41	0.001%
		Sulfide (non-ox.)	118,926	1.5%
	Biotite Breccia	Oxide	434	0.01%
		Sulfide (non-ox.)	206,789	2.7%
	Quartz Monzonite	Oxide	236	0.003%
		Sulfide (non-ox.)	2,052,482	26.4%
	Coarse Crystalline Porphyry	Oxide	790	0.01%
		Sulfide (non-ox.)	596,808	7.7%
Mineralized	Biotite Breccia	Sulfide (non-ox.)	526,770	6.8%
	Quartz Monzonite	Oxide	0	0%
		Sulfide (non-ox.)	1,777,718	22.9%
	Coarse Crystalline Porphyry	Oxide	0	0%
		Sulfide (non-ox.)	302,134	3.9%
		Reclaimed area	2,191,373	28.2%
		Total	**7,774,501**	**100%**

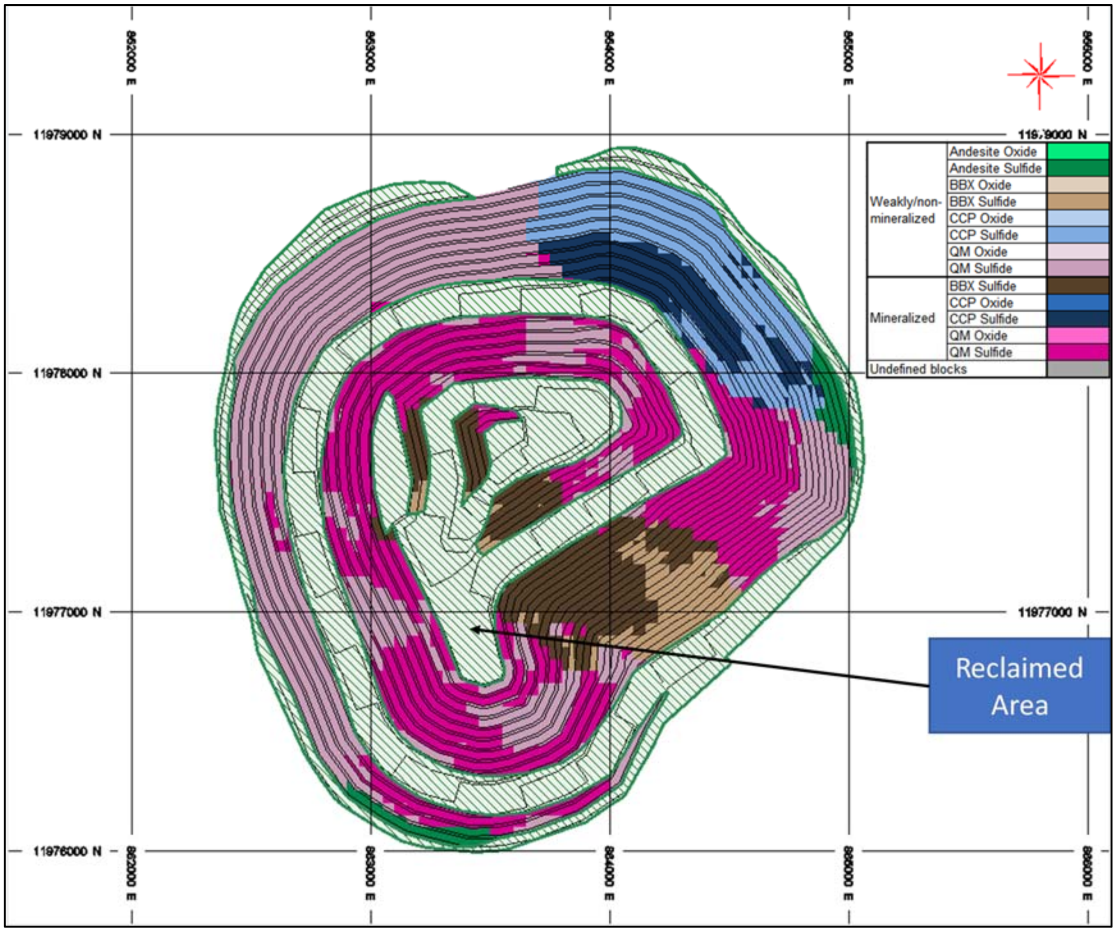


Figure 6-2: Exposed Material Types in Final Walls of the Reclaimed Pit

6.3 Calculation of Pit Wall Rock Available for Leaching

The blasting techniques that will be used for the reclaimed pit will be identical to those for the unreclaimed pit model. As such, a 1 foot thickness of reactive rock in the pit walls has also been assumed for the reclaimed pit model (Siskind and Fumanti, 1974; Kelsall et al., 1984). The method used to calculate the mass of pit wall available for leaching was identical to that used for the unreclaimed pit model (Section 5.3).

6.4 Water Balance

A pit lake water balance for the reclaimed pit model with rapid fill has been developed by JSAI and is based on the following inputs/assumptions (JSAI, 2017):

- The pit will be filled with 2,200 acre-feet from the water supply wells during the six months of pit infilling;
- Rapid fill stops when the 4,897 ft water elevation is achieved;
- Evaporation will represent the dominant solution loss; and
- The pit lake evaporation rate is 50 inches per year.

As with the unreclaimed pit model, the pit lake for the reclaimed pit model will also be a hydrologic sink. The pit lake filling curve is shown in Figure 6-3 and the various inputs/outputs to the pit are shown in Figure 6-4.

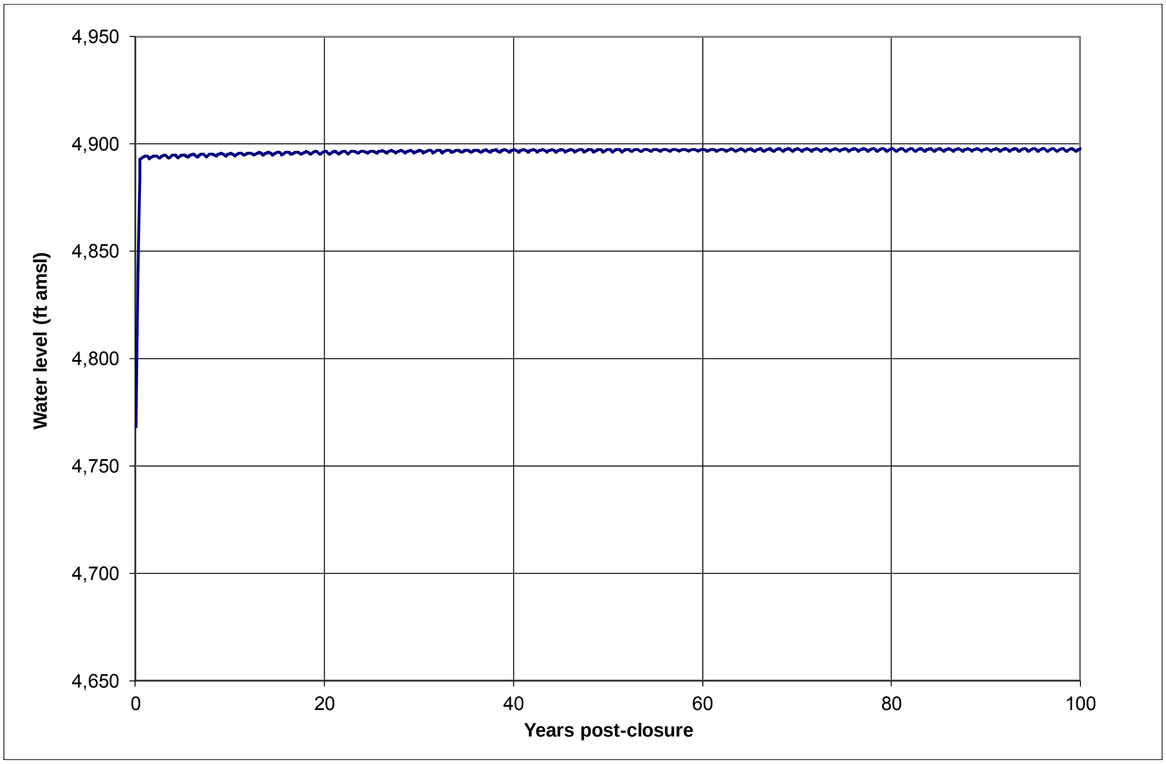


Figure 6-3: Pit Lake Elevation Curve for Reclaimed Pit Model with Rapid Fill

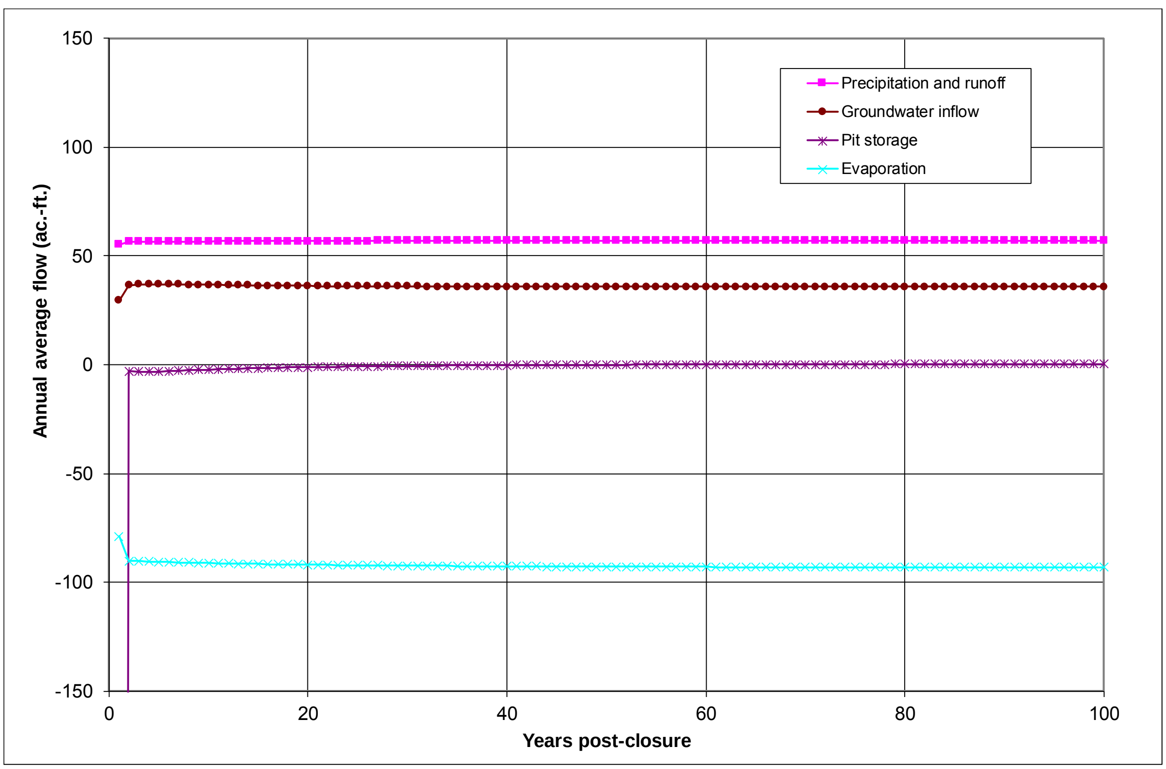


Figure 6-4: Pit Lake Flux for Reclaimed Pit Model with Rapid Fill

6.5 Solution Inputs

6.5.1 Precipitation Chemistry

As with the existing pit model (Section 4) and unreclaimed pit model (Section 5), the primary wall rock lixiviant for the pit high walls in the reclaimed pit model is assumed to be precipitation. Representative precipitation chemistry data were obtained from monthly monitoring carried out between 1985 and 2011 at the Gila Cliff Dwellings National Monument meteorological station, Catron County, New Mexico (NADP, 2012).

6.5.2 Groundwater Chemistry

Following the initial rapid fill with water from the supply wells, groundwater will continue to enter the pit. The groundwater chemistry used for the reclaimed pit model was identical to that used for the unreclaimed pit model (Section 5.5.2, Table 5-2).

6.5.3 Wall Rock Chemistry

The pit shell and exposed wall rocks for the reclaimed pit model will be identical to those in the unreclaimed model. As such, the same wall rock source terms were used in the model (Section 5.5.3, Table 5-2).

6.5.4 Water Supply Well Chemistry

Water used to rapidly fill the pit is represented by hydrochemical data from water supply wells PW-1 and PW-3 (Table 6-2; JSAI, 2017c; Appendix E).

Table 6-2: Water Supply Well Chemistry for PW-1 and PW-3 used to Represent Rapid Fill Water Quality in the Reclaimed Pit Model

Parameter		Units	Average Chemistry for PW-1 and PW-3
pH	pH	s.u.	8.03
HCO_3	Bicarbonate	mg/L	135
Ag	Silver	mg/L	<0.005*
Al	Aluminum	mg/L	<0.02*
As	Arsenic	mg/L	0.005
B	Boron	mg/L	0.08
Ba	Barium	mg/L	0.009
Be	Beryllium	mg/L	<0.002*
Ca	Calcium	mg/L	28
Cd	Cadmium	mg/L	<0.002*
Cl	Chloride	mg/L	41
Co	Cobalt	mg/L	<0.006*
Cu	Copper	mg/L	<0.006*
Cr	Chromium	mg/L	0.006
F	Fluoride	mg/L	1.45
Fe	Iron	mg/L	0.053
Hg	Mercury	mg/L	<0.0002*
K	Potassium	mg/L	3.35
Mg	Magnesium	mg/L	2.05
Mn	Manganese	mg/L	0.0025
Mo	Molybdenum	mg/L	<0.008*
Na	Sodium	mg/L	69.5
Ni	Nickel	mg/L	<0.01*
Pb	Lead	mg/L	<0.005*
SO_4	Sulfate	mg/L	27
Se	Selenium	mg/L	<0.001*
Si	Silica	mg/L	19
U	Uranium	mg/L	0.0023
V	Vanadium	mg/L	<0.05*
Tl	Thallium	mg/L	<0.001
Zn	Zinc	mg/L	0.023

* Parameters below analytical detection limits were not included in the input to the PHREEQC model

6.5.5 Reclaimed Surface Chemistry

At closure, several areas of the pit will be reclaimed. Water quality associated with run-off from these areas is therefore likely to have a different chemical composition from the rest of the pit walls. As such, the water balance provided by JSAI includes a separate input to the water balance for the reclaimed areas and receiving watershed. Conveyed stormwater is expected to have a chemistry similar to background surface water quality from SWQ-1 (Table 6-3; JSAI, 2015b).

Table 6-3: Water Supply Well Chemistry for SWQ-1 used to Represent reclaimed pit Run-off Water Quality in the Reclaimed Pit Model

Parameter		Units	Average Chemistry for SWQ-1
pH	pH	s.u.	8.3
HCO_3	Bicarbonate	mg/L	430
Al	Aluminum	mg/L	<0.1*
As	Arsenic	mg/L	<0.005*
B	Boron	mg/L	0.02
Ba	Barium	mg/L	<0.5*
Ca	Calcium	mg/L	109
Cd	Cadmium	mg/L	<0.002*
Cl	Chloride	mg/L	30
Co	Cobalt	mg/L	<0.05*
Cu	Copper	mg/L	<0.01*
Cr	Chromium	mg/L	<0.02*
F	Fluoride	mg/L	0.3
Fe	Iron	mg/L	<0.05*
Hg	Mercury	mg/L	<0.001*
K	Potassium	mg/L	1.8
Mg	Magnesium	mg/L	36
Mn	Manganese	mg/L	<0.02*
Mo	Molybdenum	mg/L	<0.02*
Na	Sodium	mg/L	107
Pb	Lead	mg/L	<0.02*
Se	Selenium	mg/L	<0.005*
SO_4	Sulfate	mg/L	261
Zn	Zinc	mg/L	<0.01*

* Parameters below analytical detection limits were not included in the input to the PHREEQC model

6.6 Results

The predicted pit lake chemistry for the reclaimed pit model is summarized in Table 6-4 and illustrated in Figure 6-5 to Figure 6-18 for selected parameters. These show predicted pit lake chemistry at each of the modeled time steps (i.e., 0.5, 1, 2, 5, 10, 25, 50, 75 and 100 years post-closure) compared to water quality in the existing pit lake. The full PHREEQC output file is provided in Appendix I, which shows precipitating and dissolving mineral species at each time step as part of the mass transfer calculations.

As with the unreclaimed pit model, pit lake waters for the reclaimed pit model are predicted to be moderately alkaline (pH 8.1 – 8.4) with a predominantly sodium + chloride/sulfate (Na + SO_4/Cl) major ion signature (Figure 6-18). Rapidly filling the pit with the water supply wells during the first six months post-closure results in a more dilute initial water chemistry with a sodium-chloride (Na+Cl) signature. The result is that the effects of evapoconcentration are not as pronounced as the pit lake reaches hydrogeologic equilibrium, and predicted concentrations of many major ions and trace elements at 100 years remain lower than if natural fill were used. This is particularly the case for constituents such as boron, sulfate and chloride, which are strongly influenced by evaporation effects and are predicted to be much lower in concentration for the rapid fill scenario compared to the natural fill scenario. The rapid fill will also quickly submerge walls and benches to limit the exposure of sulfide minerals to oxygen, which will reduce trace element release into the pit lake.

As with the unreclaimed model, concentrations of the majority of constituents are either comparable to or less than concentrations in the existing pit lake at Copper Flat. Pit lake waters for the reclaimed pit model are predicted to be ‘near-neutral, low-metal’ waters based on pH values between 8.1 and 8.4 and total Ficklin metal concentrations less than 1 mg/L (Figure 6-17).

Table 6-4: Reclaimed Pit Model Results

Parameter		Units	*Measured Chemistry in Existing Pit (1989 - 2017)*			Predicted Future Chemistry (Years Post-Closure)								
			Average	*Minimum*	*Maximum*	0.5	1	2	5	10	25	50	75	100
pH	pH	s.u.	*6.5*	*3.6*	*8.3*	8.4	8.4	8.4	8.3	8.3	8.2	8.2	8.1	8.1
HCO_3	Bicarbonate	mg/L	*40.4*	*<3*	*122*	85.3	83.6	81.3	72.6	65.9	58.9	54.0	51.5	49.7
Al	Aluminium	mg/L	*10.4*	*<0.02*	*82.6*	0.0004	0.001	0.003	0.008	0.02	0.04	0.07	0.11	0.15
As	Arsenic	mg/L	*0.004*	*<0.001*	*0.006*	5.22E-04	4.61E-04	3.63E-04	1.35E-04	2.75E-05	7.44E-06	1.19E-05	2.32E-05	3.81E-05
B	Boron	mg/L	*0.14*	*<0.1*	*0.2*	0.08	0.09	0.09	0.12	0.16	0.27	0.46	0.64	0.83
Ca	Calcium	mg/L	*550*	*455*	*684*	12.7	13.7	15.4	22.5	32.9	58.9	99.5	138	177
Cd	Cadmium	mg/L	*0.05*	*<0.005*	*0.1*	0.00001	0.00003	0.0001	0.0002	0.0003	0.0008	0.0016	0.002	0.003
Co	Cobalt	mg/L	*0.29*	*<0.05*	*0.49*	0.00005	0.0001	0.0002	0.0006	0.001	0.003	0.006	0.010	0.013
Cr	Chromium	mg/L	*0.03*	*<0.006*	*0.1*	3.07E-05	3.10E-05	3.16E-05	3.38E-05	3.64E-05	4.12E-05	4.70E-05	5.16E-05	5.57E-05
Cu	Copper	mg/L	*4.44*	*0.001*	*26.5*	0.002	0.01	0.01	0.03	0.05	0.04	0.03	0.03	0.03
F	Fluoride	mg/L	*19.2*	*4.8*	*34*	1.49	1.52	1.61	1.88	2.31	3.58	5.68	5.81	5.80
Fe	Iron	mg/L	*0.2*	*<0.02*	*1.3*	3.93E-05	3.94E-05	3.96E-05	4.05E-05	4.16E-05	4.39E-05	4.64E-05	4.84E-05	5.00E-05
Hg	Mercury	mg/L	*0.0005*	*<0.0002*	*0.001*	0.000005	0.00001	0.00002	0.0000	0.0001	0.0002	0.0004	0.0007	0.0009
K	Potassium	mg/L	*32.1*	*11.0*	*60.6*	4.91	6.39	9.43	18.5	33.4	77.7	151	224	298
Mg	Magnesium	mg/L	*698*	*43*	*1,120*	3.47	5.06	7.65	13.7	26.1	68.3	141	214	288
Mn	Manganese	mg/L	*34.8*	*0.02*	*59.0*	0.04	0.08	0.15	0.37	0.74	1.83	3.64	5.44	7.24
Mo	Molybdenum	mg/L	*0.04*	*0.015*	*0.1*	0.002	0.004	0.01	0.019	0.04	0.09	0.19	0.28	0.37
Na	Sodium	mg/L	*888*	*165*	*1,400*	72.6	74.9	80.6	97.6	126	209	348	486	625
Ni	Nickel	mg/L	*0.06*	*0.039*	*0.1*	0.0001	0.0002	0.000	0.001	0.002	0.005	0.010	0.015	0.020
Pb	Lead	mg/L	*0.02*	*<0.005*	*0.1*	0.00001	0.00003	0.0001	0.0002	0.0004	0.001	0.001	0.001	0.001
Sb	Antimony	mg/L		*<0.001**		0.00004	0.0001	0.0001	0.0004	0.001	0.002	0.004	0.005	0.007
Se	Selenium	mg/L	*0.028*	*<0.001*	*0.25*	0.0001	0.0003	0.001	0.001	0.003	0.007	0.013	0.019	0.026
U	Uranium	mg/L	*0.11*	*0.11*	*0.12*	0.002	0.002	0.003	0.01	0.01	0.02	0.04	0.06	0.07
V	Vanadium	mg/L	*0.1*	*<0.05*	*0.25*	2.84E-06	9.11E-06	2.00E-05	4.92E-05	9.63E-05	2.32E-04	4.57E-04	6.81E-04	9.06E-04
Zn	Zinc	mg/L	*5.4*	*0.01*	*9*	0.03	0.03	0.04	0.06	0.11	0.23	0.44	0.65	0.85
SO_4	Sulfate	mg/L	*4,803*	*1,566*	*8,690*	39.3	55.3	83.6	168	307	719	1,402	2,085	2,769
Cl	Chloride	mg/L	*332*	*47.3*	*730*	66.5	67.1	69.5	76.9	89.0	125	186	247	309
TDS	Total Dissolved Solids	mg/L	*7,538*	*2,711*	*14,800*	286	308	349	472	684	1,324	2,393	3,460	4,530

** Indicates parameter was uniformly below analytical detection limits in pit lake water over monitoring period, but detection limit was variable. Concentration shown in table represents lower limit of analytical detection.*

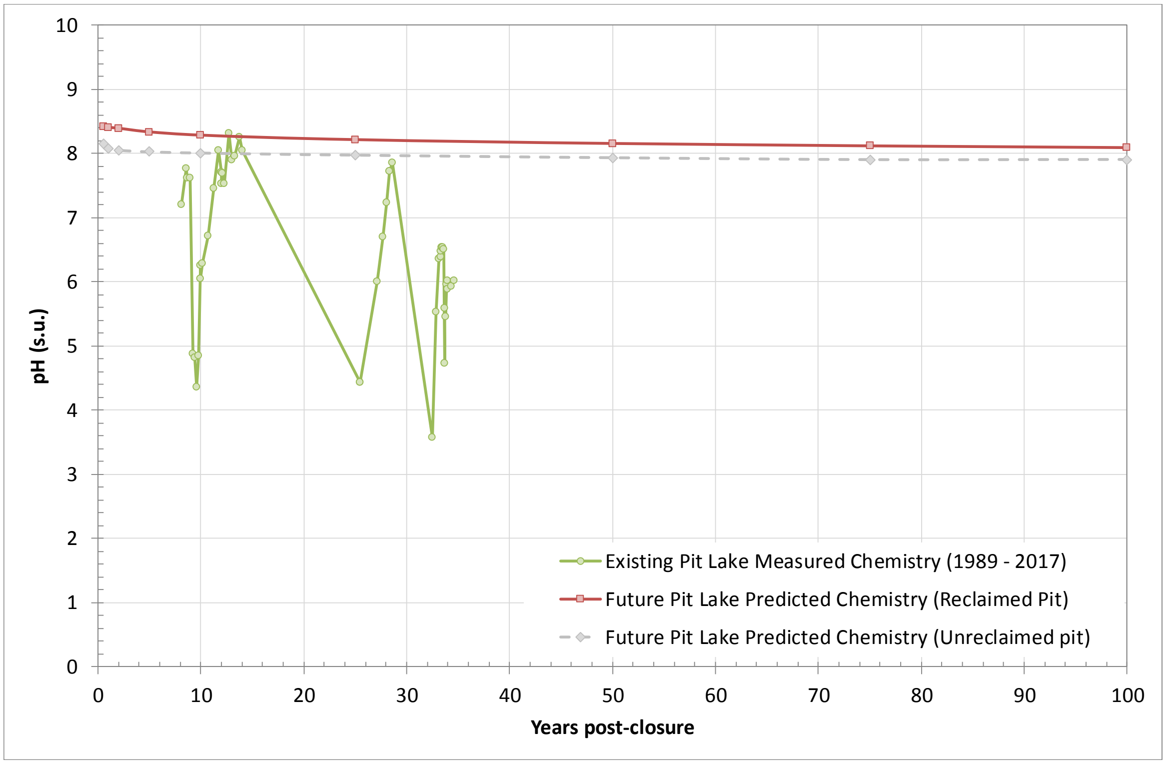


Figure 6-5: Time-series Plot of Predicted pH for the Reclaimed Pit Model

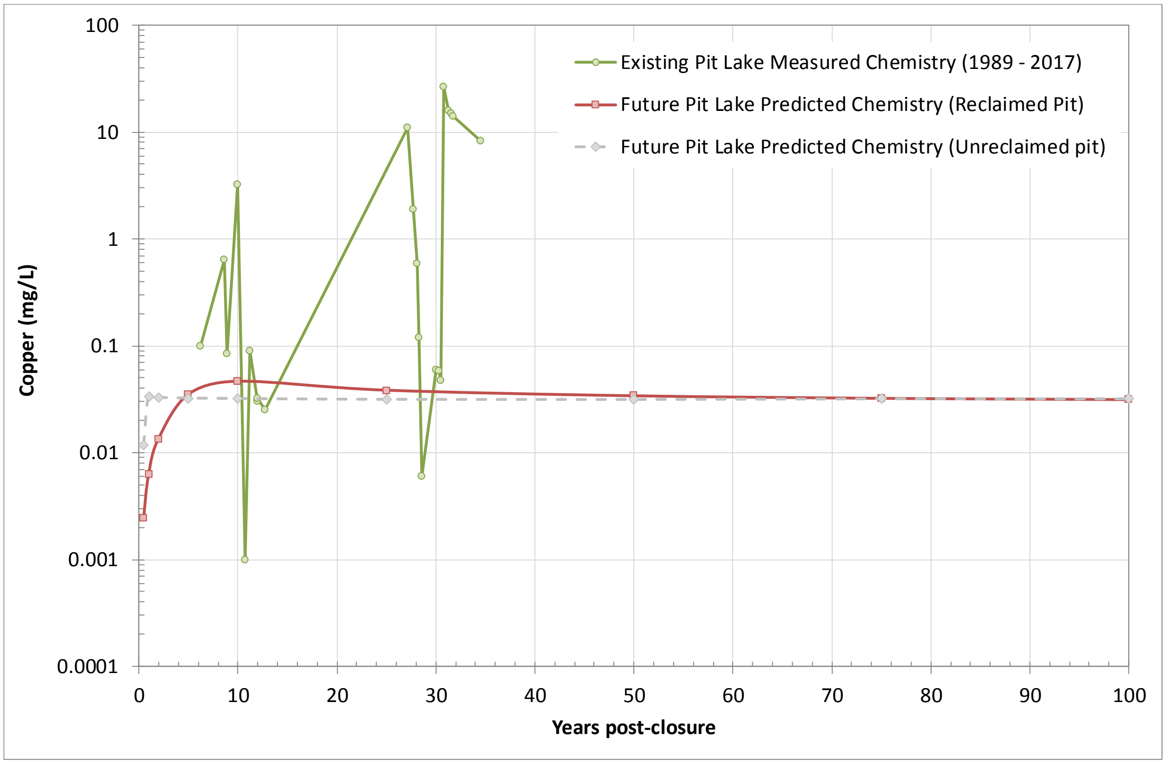


Figure 6-6: Time-series Plot of Predicted Copper for the Reclaimed Pit Model

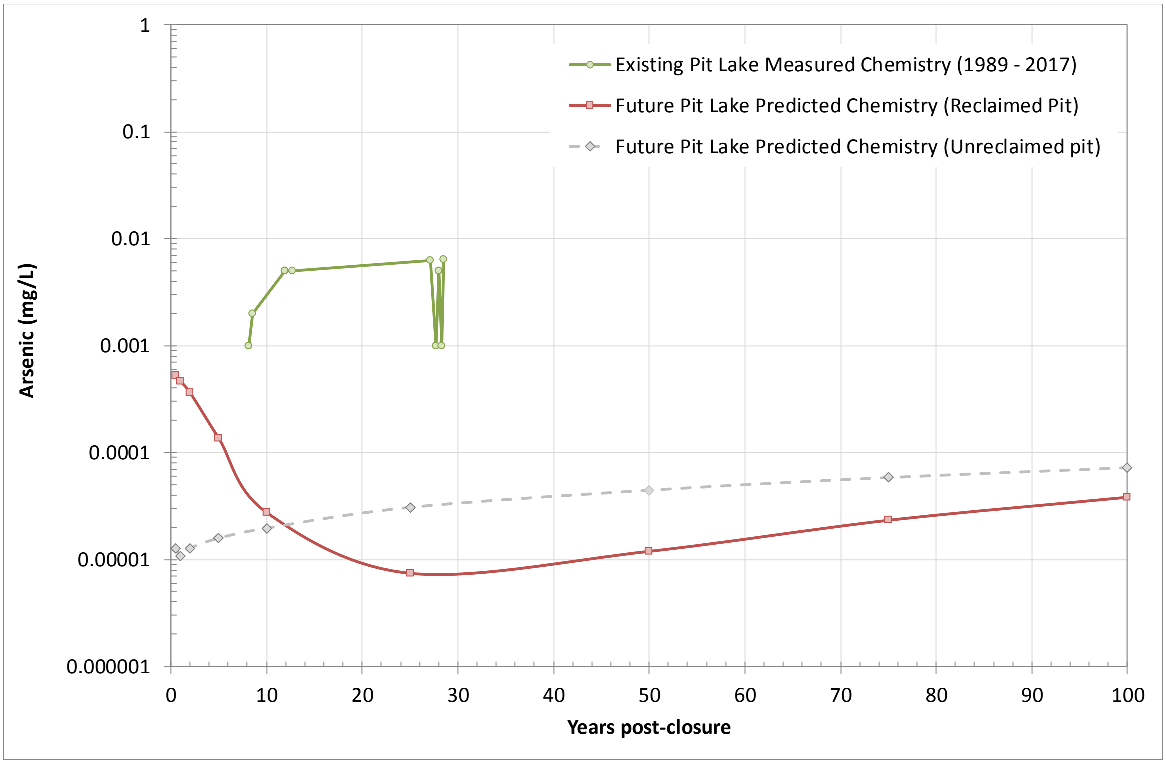


Figure 6-7: Time-series Plot of Predicted Arsenic for the Reclaimed Pit Model

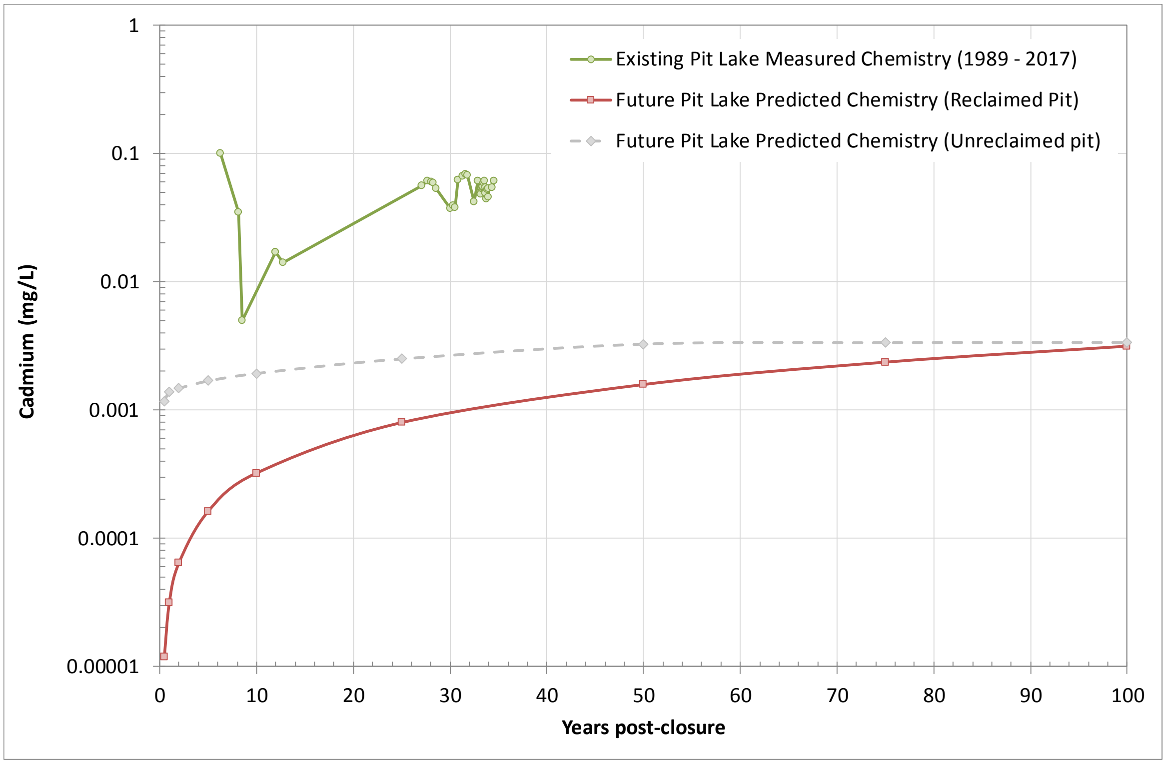


Figure 6-8: Time-series Plot of Predicted Cadmium for the Reclaimed Pit Model

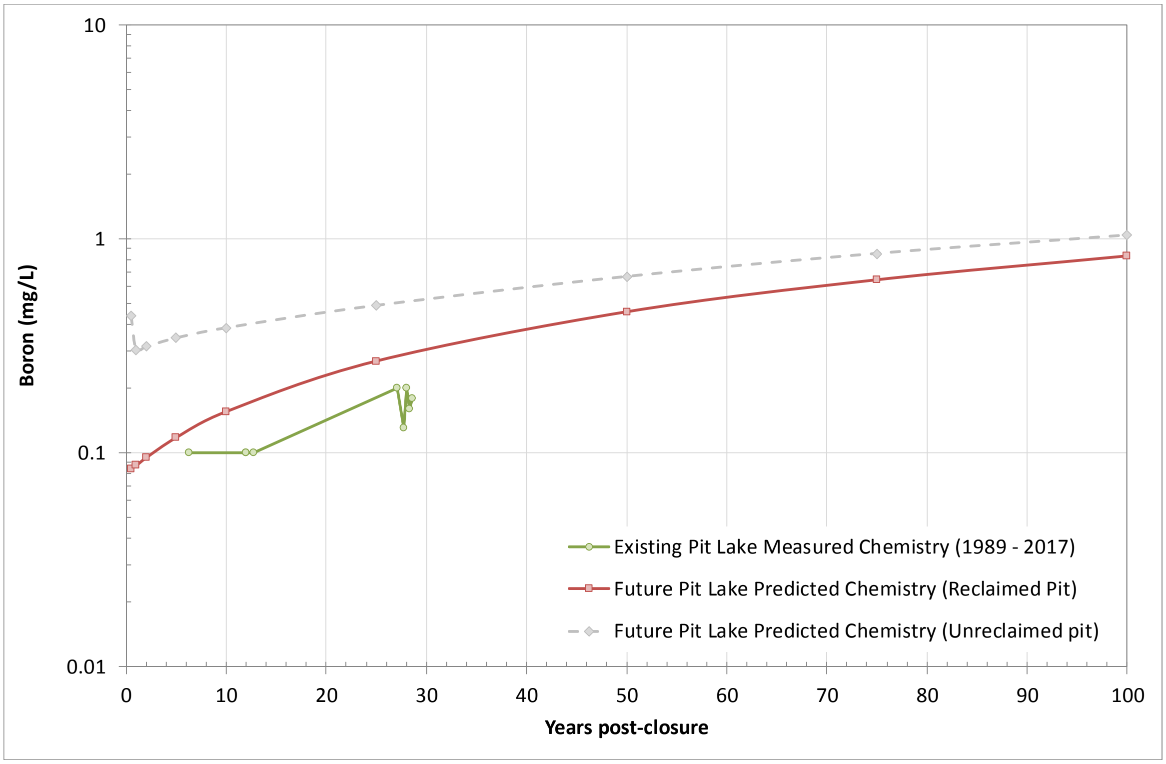


Figure 6-9: Time-series Plot of Predicted Boron for the Reclaimed Pit Model

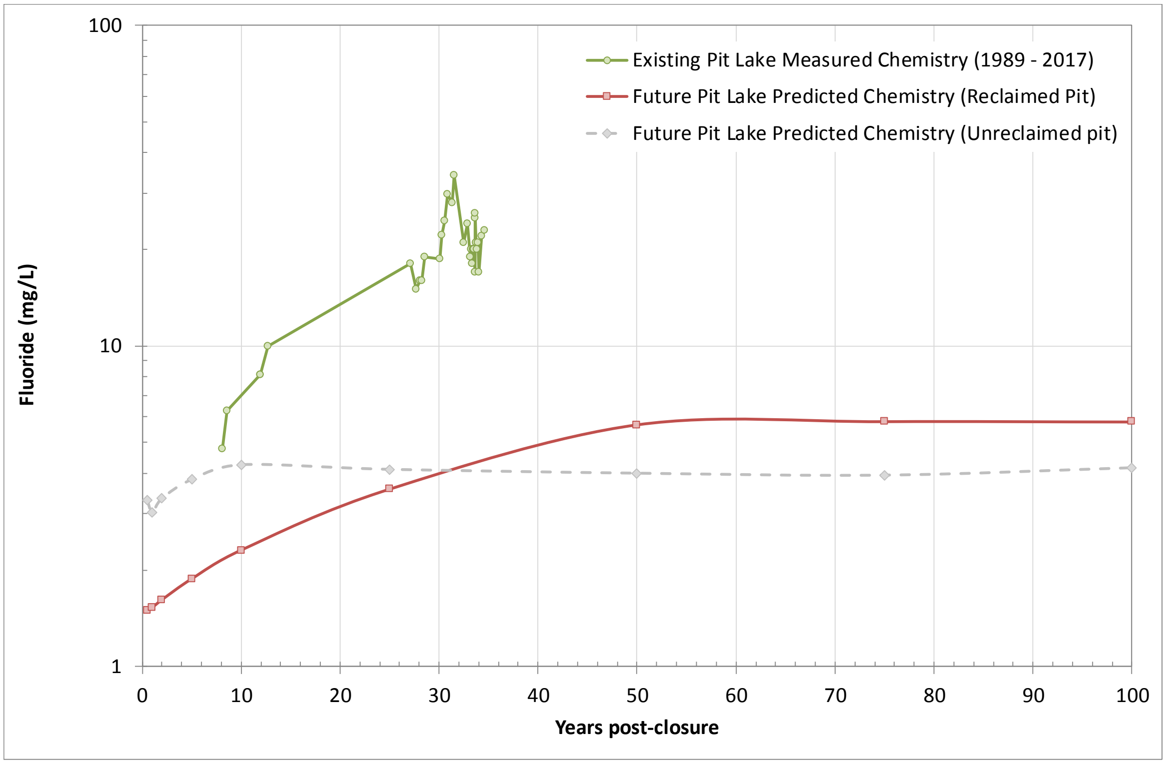


Figure 6-10: Time-series Plot of Predicted Fluoride for the Reclaimed Pit Model

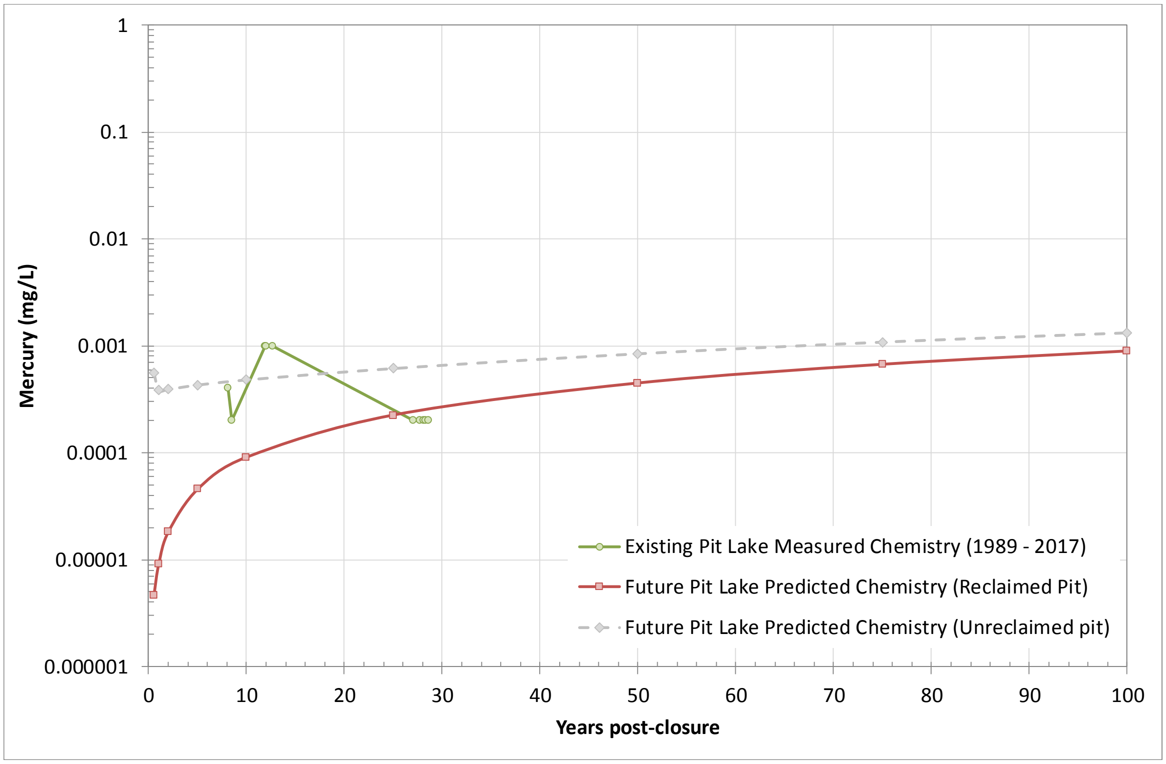


Figure 6-11: Time-series Plot of Predicted Mercury for the Reclaimed Pit Model

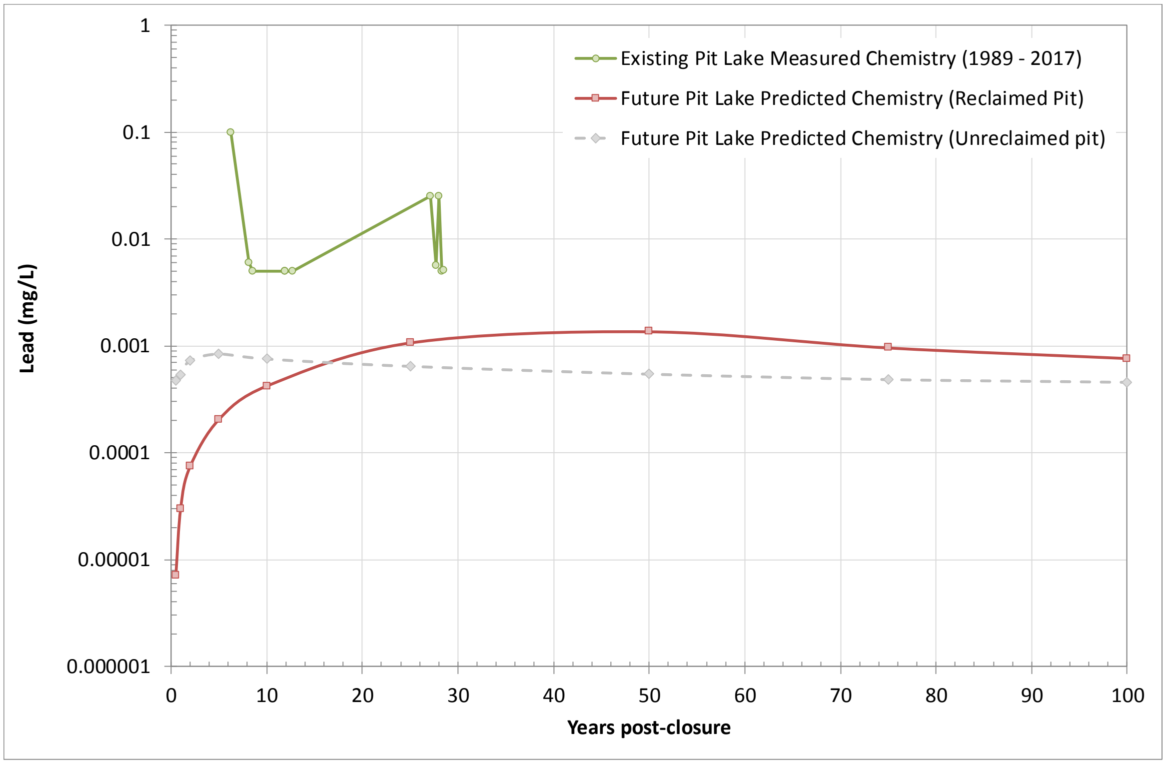


Figure 6-12: Time-series Plot of Predicted Lead for the Reclaimed Pit Model

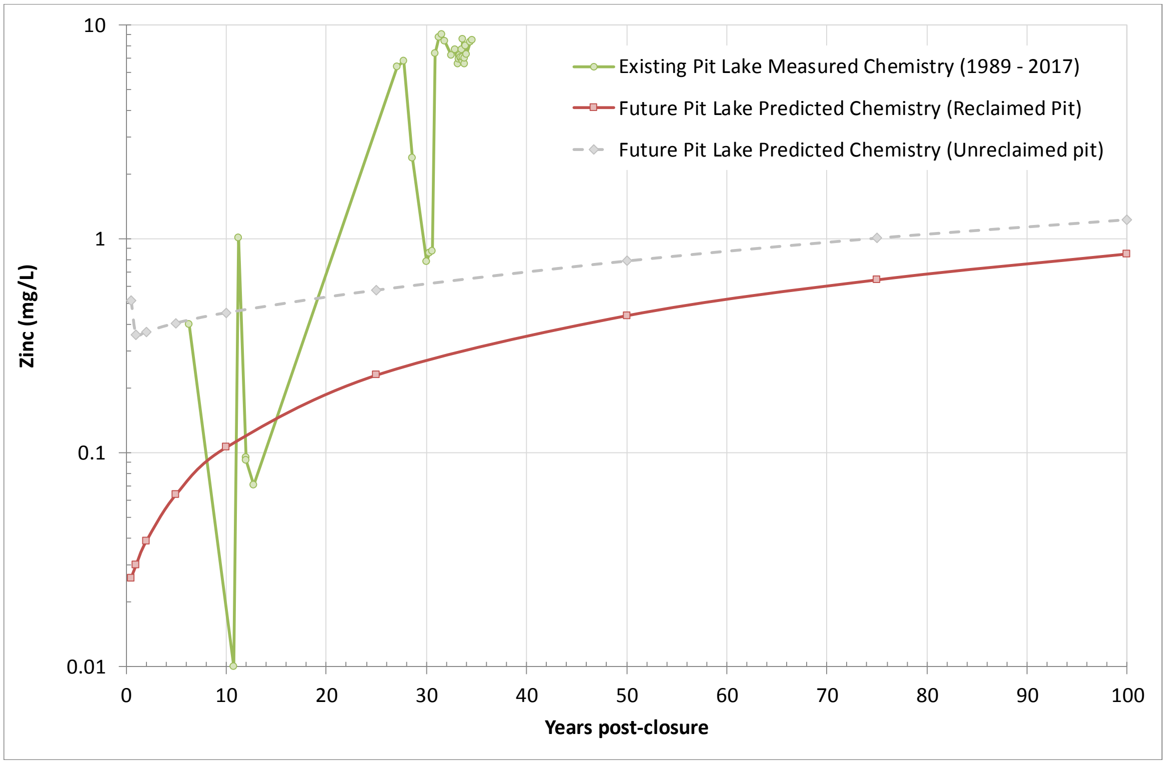


Figure 6-13: Time-series Plot of Predicted Zinc for the Reclaimed Pit Model

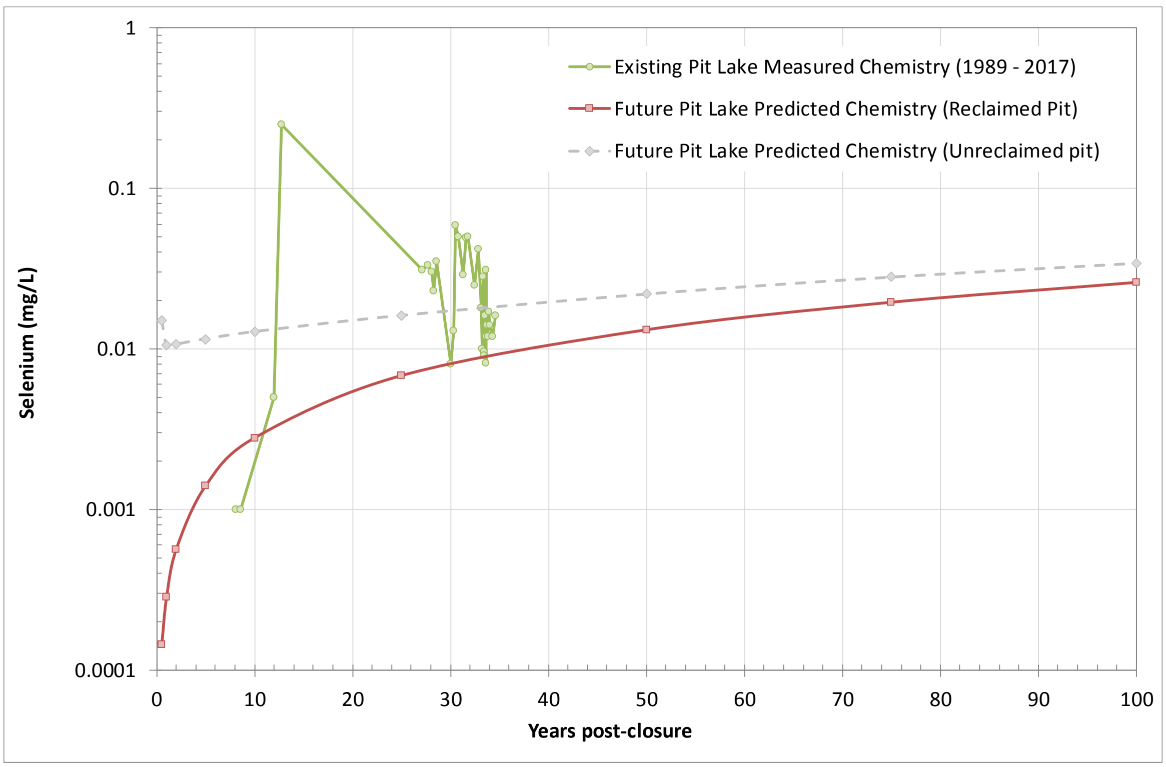


Figure 6-14: Time-series Plot of Predicted Selenium for the Reclaimed Pit Model

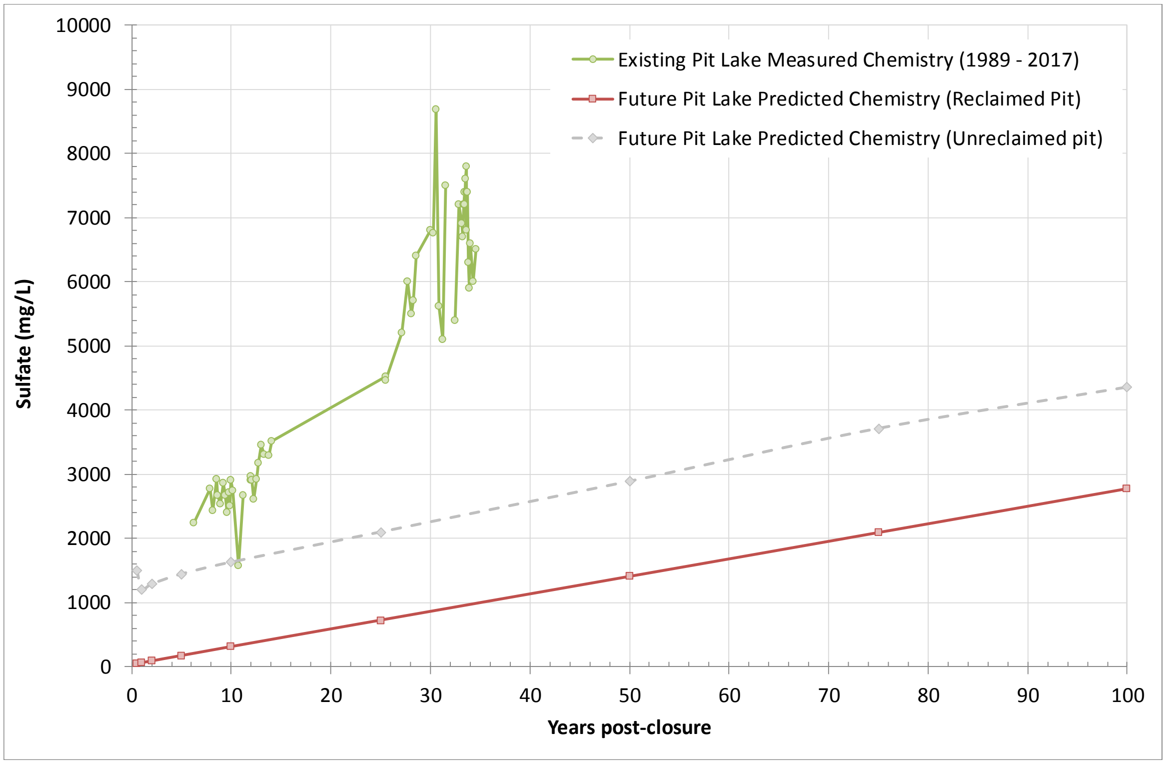


Figure 6-15: Time-series Plot of Predicted Sulfate for the for the Reclaimed Pit Model

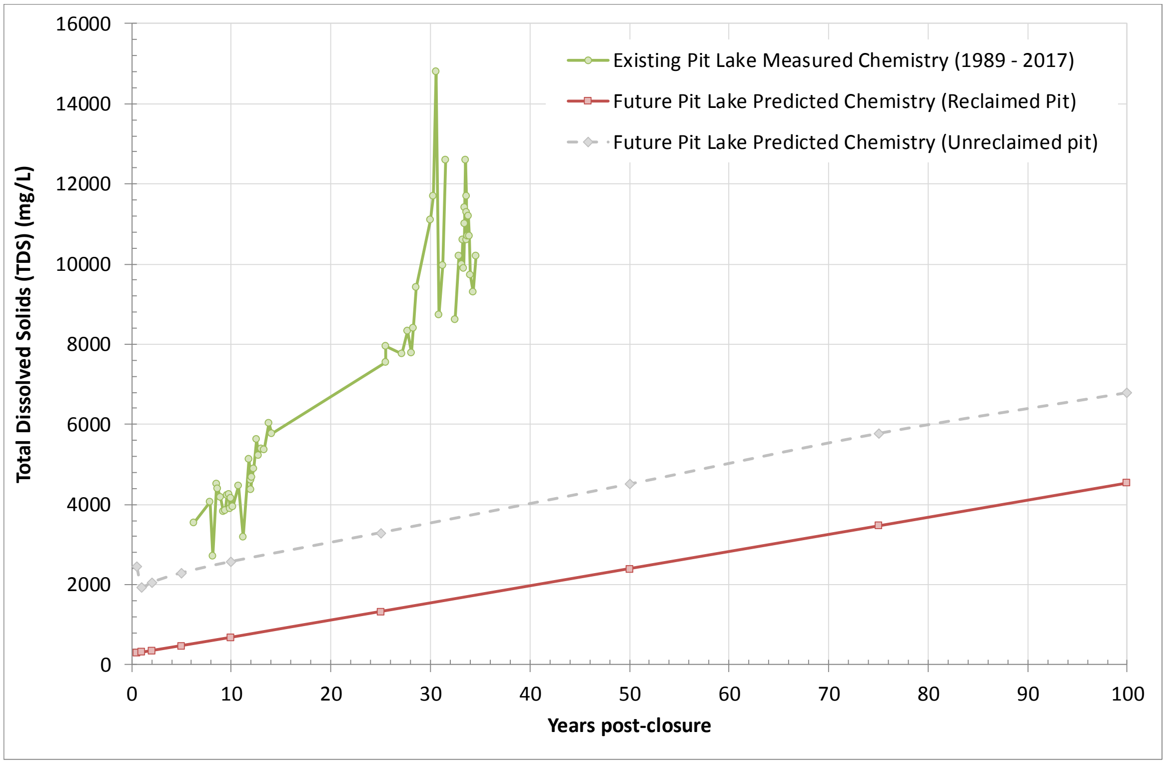


Figure 6-16: Time-series Plot of Predicted TDS for the for the Reclaimed Pit Model

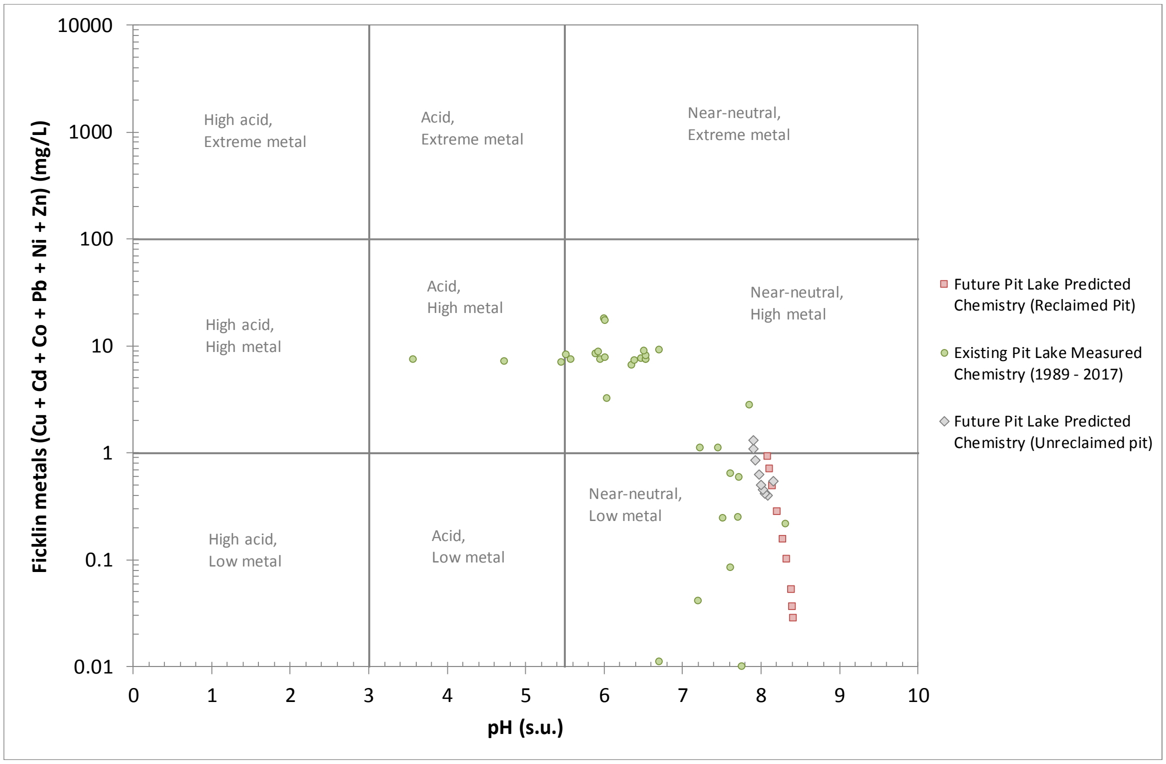


Figure 6-17: Ficklin Plot for the Reclaimed Pit Model

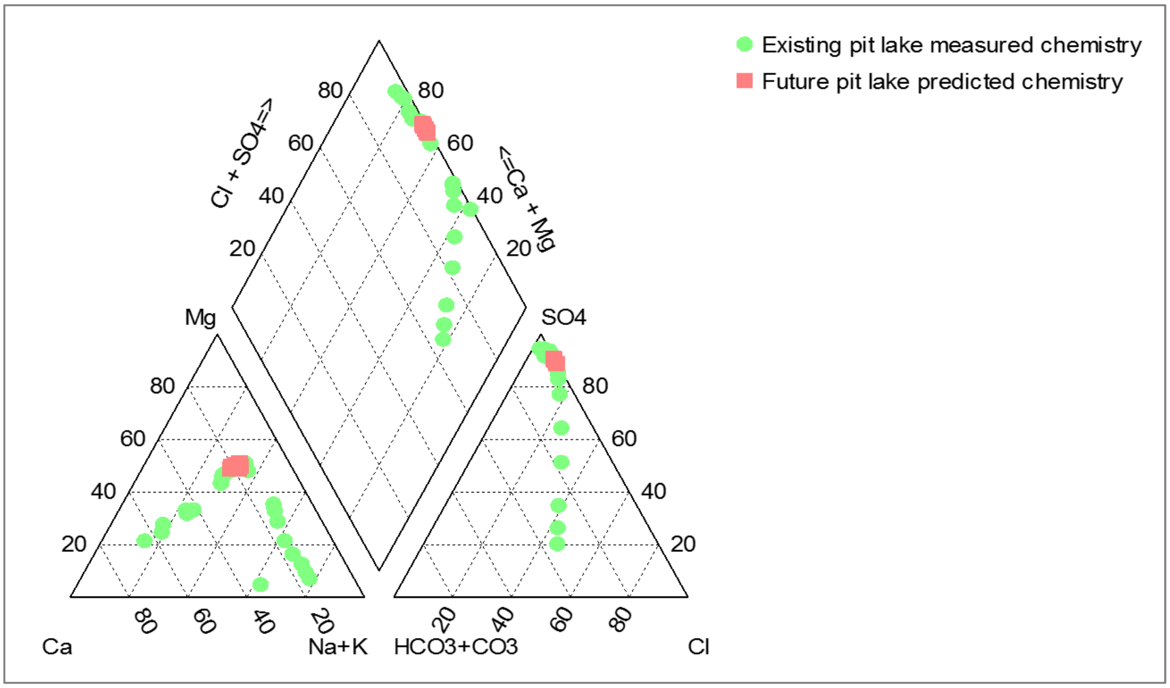


Figure 6-18: Piper Plot of Predicted Major Ion Chemistry for the Reclaimed Pit Model

7 Summary and Conclusions

SRK has undertaken a predictive geochemical modeling exercise to assess potential future pit lake chemistry associated with the Copper Flat Project in New Mexico and to compare this to the chemistry of the existing pit lake. The objective of this model and report is to provide the analysis that demonstrates that future pit lake water quality results in a hydrologic balance similar to that of pre-mining conditions upon implementation of the reclamation actions proposed by NMCC in its MORP and Reclamation Plan, including rapid fill of the open pit after closure of the mine.

Geochemical predictions were developed for three scenarios, including: (i) a calibration model for the existing pit lake; (ii) a natural fill model for the future unreclaimed pit; and (iii) a rapid fill model for the future reclaimed pit. Rapid fill has been proposed as the water component of NMCC's reclamation strategy for the future pit lake. It will include filling the pit with 2,202 acre-feet of good quality water from the production water supply wells during the first six months of groundwater recovery and pit infilling.

7.1 Model Calibration

The results of the existing pit lake model show good calibration for pH, bicarbonate, calcium, aluminum, cobalt, chromium, copper, mercury, manganese, sodium, nickel, selenium, uranium, zinc and TDS, demonstrating these constituents can be predicted with a good degree of accuracy for the future pit lake. The baseline water quality data utilized in the calibration model are data for existing water quality chemistry in the pit lake between 2010 and 2013, as discussed in Section 4. Model calibration was performed as part of the preliminary pit lake model results presented in the December 2014 report (SRK, 2014a). This is a subset of the entire baseline data generated between 1998 and July 2017. The full data set was utilized in comparing existing water quality chemistry to projected future water quality of the pit lake, as discussed in Sections 5 and 6.

7.2 Unreclaimed Fill Scenario

For the unreclaimed fill scenario, allowing the pit to fill naturally will result in the pit walls and benches being exposed over a much longer period of time, i.e., approximately 150 years, before the pit lake reaches hydrologic equilibrium. In the unreclaimed fill scenario, the proposed future Copper Flat open pit is expected to be seasonally stratified but otherwise well-mixed, oxygenated and not acidic. Waters are predicted to be moderately alkaline (pH 7.9 – 8.2), primarily due to the buffering capacity of the inflowing groundwater. During the early stages of pit infilling (i.e., the first six months post-closure), removal/flushing of soluble salts from the pit walls is likely to result in a flush in boron, lead, mercury, manganese, molybdenum, nickel, selenium, vanadium, zinc and sulfate in the early pit lake. The effects of this initial flush will be dissipated by inflowing groundwater and precipitation, and pit lake chemistry will then evolve over time, with some parameters increasing in concentration as a result of evapoconcentration effects. This is similar to the trends observed in the existing pit lake where elemental concentrations have increased since the start of pit infilling. However, the mineralized material to be mined and the future pit walls will be prepared using pre-split drilling and smooth wall blasting. This will reduce the depth of fracturing and oxidation and consequently reduce solute loading to the future pit lake.

A comparison of predicted pit lake water chemistry for the unreclaimed fill scenario to chemistry measured in the existing pit lake between 1989 and 2017 demonstrates that the predicted concentrations of the majority of constituents are comparable to existing concentrations.

7.3 Reclaimed Fill Scenario

Rapidly filling the pit with water from the production supply wells during the first six months post-closure will result in a better initial water quality within the pit lake due to the good quality of the water that will be used The long-term result is that the effects of evapoconcentration will not be as pronounced as the pit lake reaches hydrogeologic equilibrium. Predicted concentrations of many major ions and trace elements remain lower in the reclaimed fill scenario. This is the case for constituents such as boron, sulfate and chloride, which are strongly influenced by evaporation effects and are predicted to be much lower in concentration for the reclaimed pit rapid fill scenario compared to the unreclaimed pit natural fill scenario. In addition, the rapid fill will also quickly submerge walls and benches to limit the exposure of sulfide minerals to oxygen, which will reduce trace element release into the pit lake. By contrast, the unreclaimed fill scenario allows the pit to fill naturally and results in the pit walls and benches being exposed over a much longer period of time, i.e., approximately 150 years, before the pit lake reaches hydrologic equilibrium. As is the case in the unreclaimed fill scenario, the mineralized material to be mined and the future pit walls will be prepared using pre-split drilling and smooth wall blasting, which will also reduce the depth of fracturing and oxidation and consequently reduce solute loading to the pit lake.

A comparison of predicted pit lake chemistry for the reclaimed pit rapid fill scenario to chemistry measured in the existing pit lake between 1989 and 2017 demonstrates that concentrations of the majority of predicted constituent concentrations are either comparable to or less than concentrations in the existing pit lake.

7.4 Conclusions

Standards applicable to the post-mining Copper Flat pit lake are contained in the New Mexico Mining and Minerals Division (MMD) regulations administered under the Mining Act. Specifically, the performance and reclamation standards require that reclamation must result in a hydrologic balance similar to pre-mining conditions. With respect to water quality in the pit lake, post mining water quality must be similar to baseline pre-mining water quality in the pit lake. The predictive geochemical model results presented herein have been compared to pre-mining baseline water quality of the existing pit lake, which has been in existence for more than 35 years.

Based on the model results presented herein, the changes to the hydrologic balance of the future pit water body that will form post-mining will be nil or minimal, and the water quality will be very similar to that of the existing pit lake. As noted above, the existing pit lake at Copper Flat is an artificial water body created as a result of mineral extraction that has little or limited ability to sustain aquatic life (Aquatic Consultants, Inc. 2014). The post-mining water body is anticipated to be similar to the existing pit lake and is not expected to be conductive to providing aquatic habitat or supporting fish life.

This report demonstrates that implementation of either the unreclaimed fill or reclaimed fill scenario will provide compliance with water quality requirements discussed in Section 3.10 above. However, the reclaimed fill scenario leads to improved water quality during the modeled period. In addition, the overall performance and reclamation standards and requirements of the Mining Act regulations set forth additional standards, beyond those which are the subject of analysis in this report. In this regard, NMCC has committed to the reclamation plan as described in the MORP, including the pit reclamation measures outlined in Section 3.1.8 of this report.

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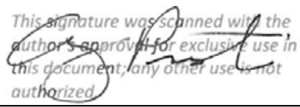

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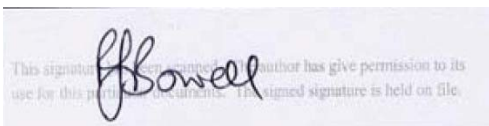

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8 References

ASTM, 1996, Method D5744-96. Standard Test Method for Accelerated Weathering of Solid Materials Using a Modified Humidity Cell

ASTM, 2013, Method E2242-13. Standard test method for column percolation extraction of mine rock by the meteoric water mobility procedure. ASTM International.

Atchison, T. (1968). Fragmentation Principles. Chapter 7-2, Surface Mining, 1st Edition. E.P Pfleider (ed). AIME, New York, pp 355-372.

Atkins, D., Kempton, J.H., and Martin, T., 1997, Limnologic conditions in three existing Nevada pit lakes: observations and modeling using CE-QUAL-W2. In: Proceedings 4th International Conference on Acid Rock Drainage, Vancouver, BC, May 31- June 6, 699-713.

Aquatic Consultants Inc., 2014, Copper Flat Mine Biological Assessment, November 2014.

Baas-Becking, L.G.M., Kaplan, I.R. and Moore, D., 1960, Limits of the natural environment in terms of pH and oxidation-reduction potentials. Journal of Geology 68(3), 24-284.

Bowell, R.J., 1994, Arsenic sorption by iron oxyhydroxides and oxides. Applied Geochemistry, 9, 279-286

Carroll, R.D. and Scott, J.H., 1966, Uphole seismic measurements as an indication of stress relief in granitic rock tunnels. US Geological Survey Professional Paper 550-D, ppD138-D143

Castendyk, D.N. and Webster-Brown, J.G., 2007, Sensitivity analyses in pit lake prediction, Martha mine, New Zealand 2: Geochemistry, water-rock reactions, and surface adsorption. Chemical Geology 244, pp56-73

Dunn, P.G., 1982, Geology of the Copper Flat porphyry copper deposit, Hillsboro, Sierra County, New Mexico. In: S.R. Titley (ed.) Advances in Geology of the Porphyry Copper Deposits, Southwestern North America: Tuscon, University of Arizona Press, pp313-326

Dzombak, D. and Morel, F., 1990. Surface Complexation Modeling: Hydrous Ferric Oxide. J. Wiley, New York.

Eary, L.E. 1998. Predicting the effects of evapoconcentration on water quality in mine pit lakes. Journal of Geochemical Exploration, 64, 223-236

Eary, L.E., 1999, Geochemical and equilibrium trends in mine pit lakes. Applied Geochemistry 15, pp963-987

Ficklin, W.H., Plumlee, G.S., Smith, K.S., and McHugh, J.B., 1992. Geochemical classification of mine drainages and natural drainages in mineralized areas: Proceedings, 7th International Symposium on Water-Rock Interactions, Park City, Utah, p. 381-384.

Golder Associates, 2017, Mine Reclamation and Closure Plan, Appendix E, Mine Operation and Reclamation Plan, Copper Flat Mine Project, Sierra County, New Mexico. Revision 1, July 2017

INTERA, 2012, Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico. Report prepared for New Mexico Copper Corporation, February 2012.

Jewell, P.W., 2009, Stratification Controls of Pit Mine Lakes. Mining Engineering 60, pp40-45

JSAI, 2014a, Results from the First Year of Stage 1 Abatement Investigation at the Copper Flat Mine Site near Hillsboro, News Mexico. May 2014.

JSAI, 2014b, Conceptual model of groundwater flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico. Prepared for New Mexico Copper Corporation, Albuquerque, New Mexico. August 2014.

JSAI, 2014c, Review of Methods and Assumptions for Predicting Open Pit Water Quality, Copper Flat Project, New Mexico. Technical Memorandum dated December 14, 2014

JSAI, 2015a, Estimated Evaporation Rate for Future Copper Flat Open Pit. Technical Memorandum dated September 1, 2015

JSAI, 2015b, Proposed Copper Flat Open Pit Reclamation Plan and Inputs for Evaluating Water Quality Predictions. Technical Memorandum dated March 25, 2015

JSAI, 2017a, Copper Flat open pit 1.1.1 Standard Test Method for Accelerated Weathering of Solid Materials Using a Modified Humidity Cell area groundwater chemistry data and application to SRK geochemistry model. Technical memorandum dated September 26, 2017

JSAI, 2017b, Hydrologic Effects of Proposed Rapid Fill Reclamation of Copper Flat Open Pit. Technical memorandum dated October 12, 2017.

JSAI, 2017c, Expected Selenium Concentrations from Supply Wells PW-1 through PW-4, Copper Flat Project, New Mexico Copper Corporation. Technical memorandum dated September 26, 2017.

Kelsall, P.C., Case, J.B. and Chabannes, C.R., 1984, Evaluation of excavation-induced changes in rock permeability. International Journal of Rock Mechanics and Mining Sciences, 21(3), pp123-135

M3 Engineering & Technology Corporation, 2013, Copper Flat Project Form 43-101 F1 Technical Report Feasibility Study, New Mexico, USA. Report prepared for THEMAC Resources, November 21 2013

McLemore, V.T., Munroe, E.A., Heizler, M.T., McKee, C., 2000. Geology and evolution of the mineral deposits in the Hillsboro District, Sierra County, New Mexico in Geology and Ore Deposits 2000, The Great Basin and Beyond: Geological Society of Nevada, Program with abstracts, p. 63

Molebatsi, T., Galindo Torres, S., Li, L., Bringemeier, D. and Wang, X., 2009, Effect of fracture permeability on connectivity of fracture networks: Abstracts of the International Mine Water Conference, 19 – 23 October 2009. Proceedings ISBN Number: 978-0-9802623-5-3, Pretoria, South Africa.

National Atmospheric Deposition Program (NRSP-3), 2012, NADP Program Office, Illinois State Water Survey, 2204 Griffith Dr., Champaign, IL 61820.

Parkhurst, D.L., Appelo, C.A.J. 2010. Users Guide to PhreeqC (Version 2)—A Computer Program for Speciation Batch-Reaction, One-Dimensional Transport and Inverse Geochemical Calculations. Distributed with PhreeqC interactive Version 2.17.5.4799. USGS.

Parshley, J.V. and Bowell, R.J., 2003, The limnology of Summer Camp Pit Lake: A case study. Mine Water and the Environment, 22, 170-186.

Raugust, J.S., 2003. The natural defenses of Copper Flat, Sierra County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-file report 475, Socorro, N. Mex., New Mexico Institute of Mining and Technology.

Richards, J.P., 2003, Tectono-magmatic precursors for geophysical data over a copper gold porphyry Cu-(Mo-Au) deposit formation. Journal of Economic Geology 96, pp1419-1431

Siskind, D.E. and R.R. Fumanti, 1974. Blast-produced fractures in Lithonia granite. Bureau of Mines Report BM-RI-7901. Twin Cities Mining Research Center.

SRK Consulting, 1996, Geochemical Review of Waste Rock, Pit Lake Water Quality and Tailings at the Copper Flat Project.

SRK Consulting, 1997, Copper Flat Mine Compilation of Pit Lake Studies. Report prepared for Alta Gold Co. December 1997

SRK Consulting, 2012, Geochemical Characterization Report for the Copper Flat Project, New Mexico. Prepared by SRK Consulting for THEMAC Resources Group Limited, May 2013.

SRK Consulting, 2014a, Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico. Prepared by SRK Consulting for THEMAC Resources Group Limited December 2014.

SRK Consulting, 2014b, Humidity Cell Termination Report for the Copper Flat Project, New Mexico. Report prepared for THEMAC Resources Group Ltd., February 2014.

Stumm, W. and Morgan, J.J., 1996, Aquatic Chemistry – Chemical Equilibria and Rates in Natural Waters. Wiley-Interscience, New York

Tempel, R.N., Shevenell, L.A., Lechler, P. and Price, J., 2000, Geochemical modeling approach to predicting arsenic concentrations in a mine pit lake.

THEMAC Resources Group Ltd, 2017a, Mine Operation and Reclamation Plan, Copper Flat Mine Project, Sierra County, New Mexico. Revision 01, July 2017

THEMAC Resources Group Ltd, 2017b, Open Pit Reclamation/Revegetation Plan Supplemental Information for Mine Operation and Reclamation Plan, Copper Flat Mine Project, Sierra County, New Mexico, Revision 1, July 2017

Wetzel, R.G., 2001, Limnology, Lake and River Ecosystems, 3rd Edition. Academic Press, San Diego, CA, 1006pp

Young, E.J. and Olhoeft, G.R., 1976, The relation of specific gravity to chemical composition for crystalline rocks. United States Department of Interior Geological Survey Open File Report.

Appendix A – Time-Series Plots of Existing Pit Lake Chemistry

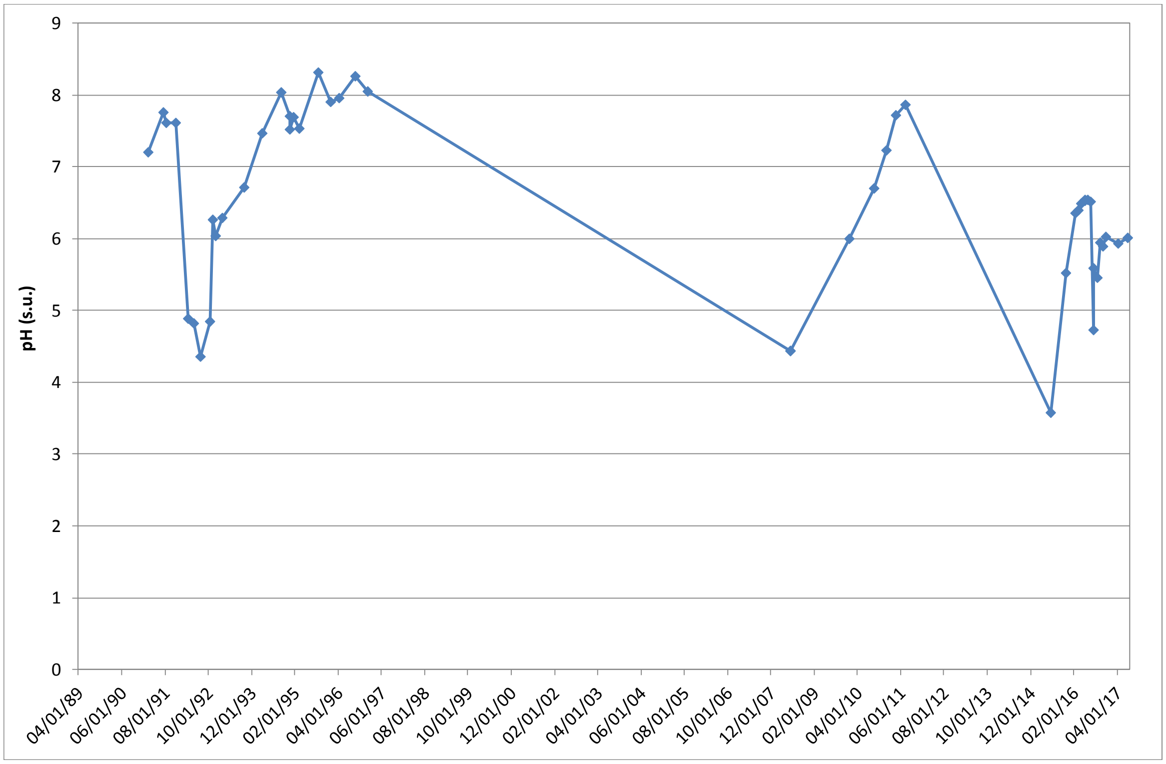

Figure A-1: pH Trends in Existing Pit Lake

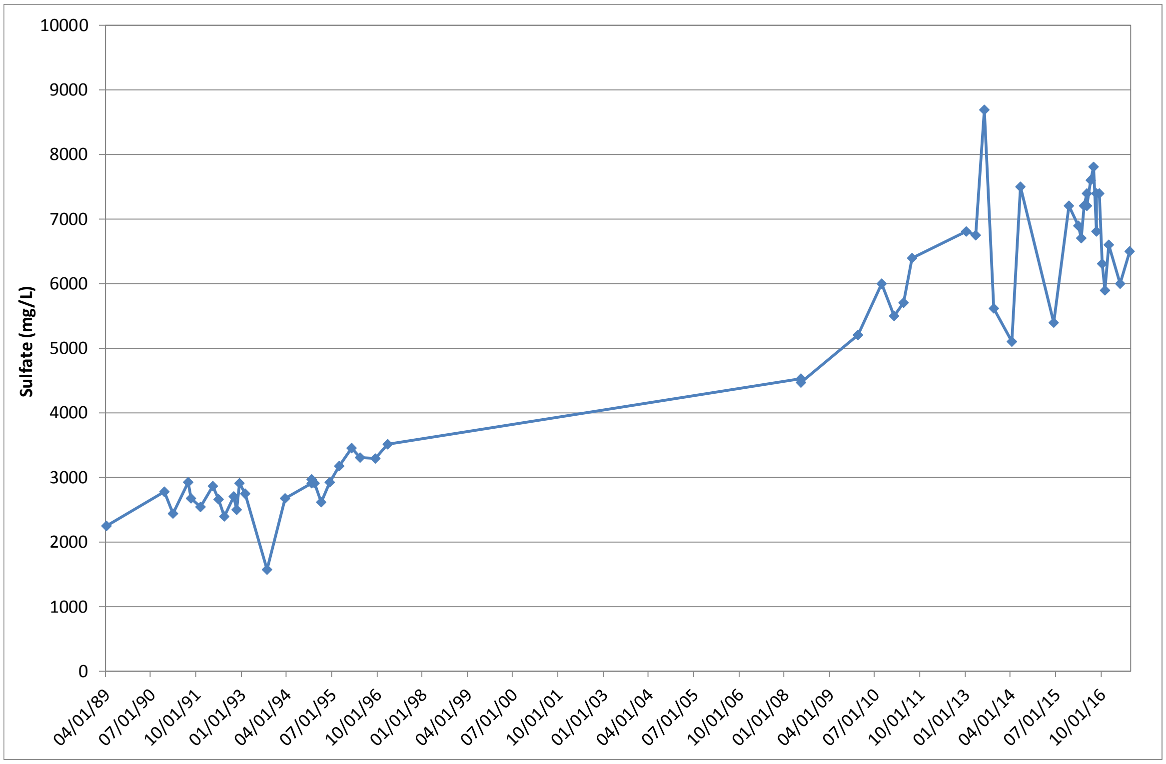

Figure A-2: Sulfate Trends in Existing Pit Lake

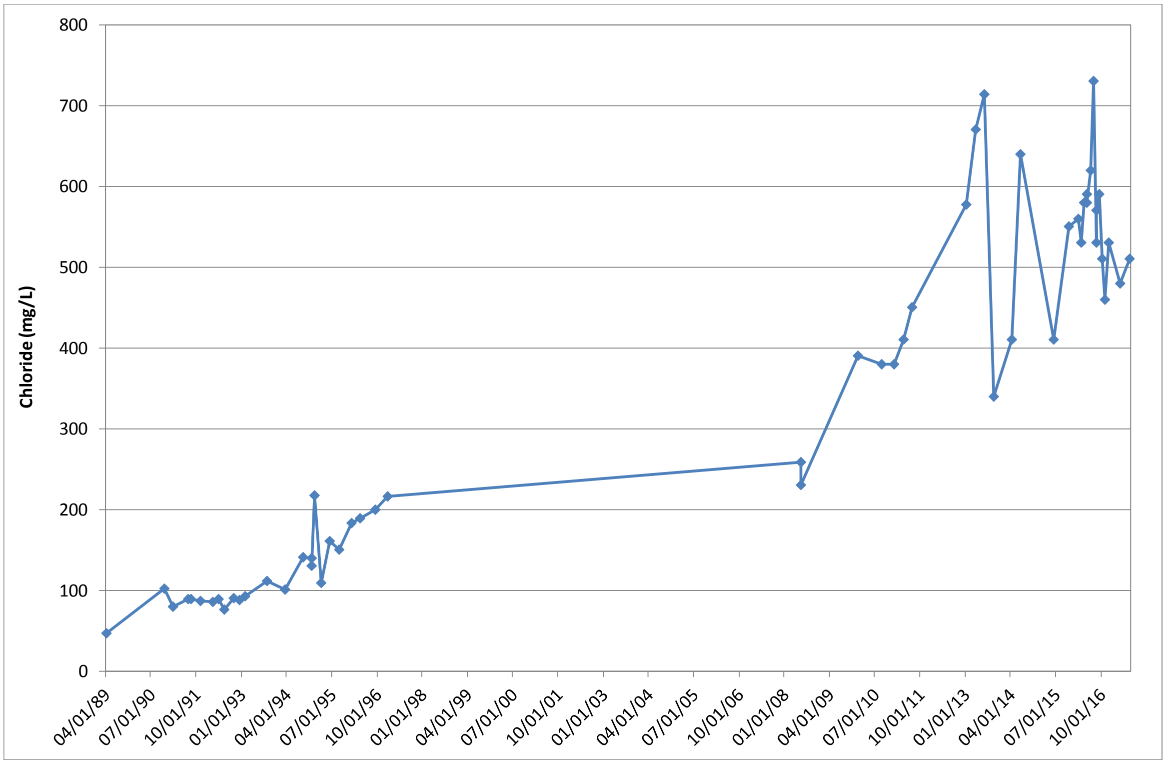

Figure A-3: Chloride Trends in Existing Pit Lake

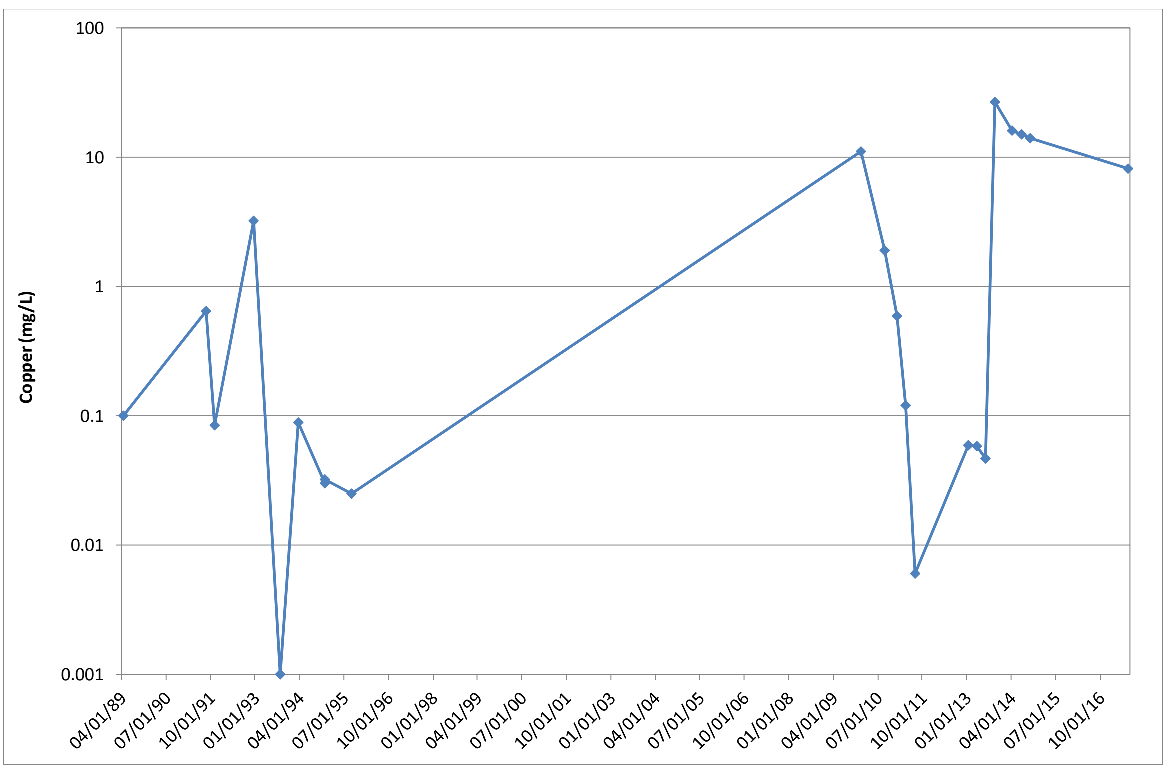

Figure A-4: Copper Trends in Existing Pit Lake

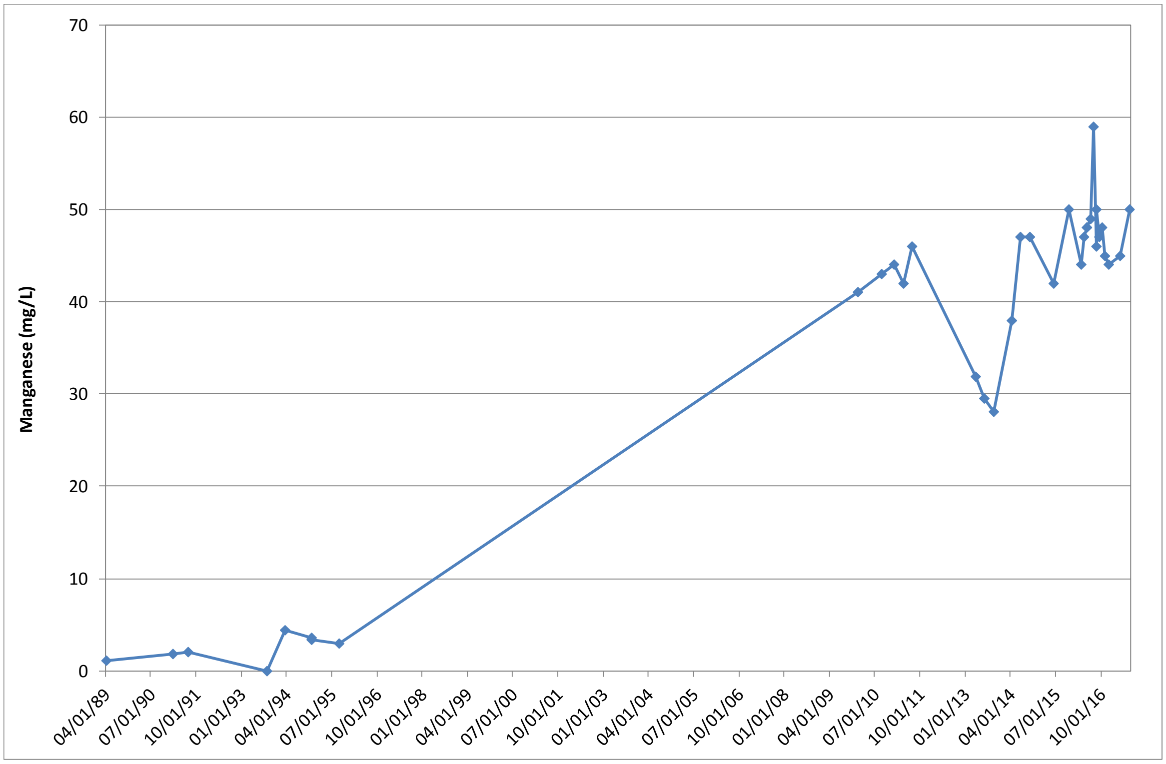

Figure A-5: Manganese Trends in Existing Pit Lake

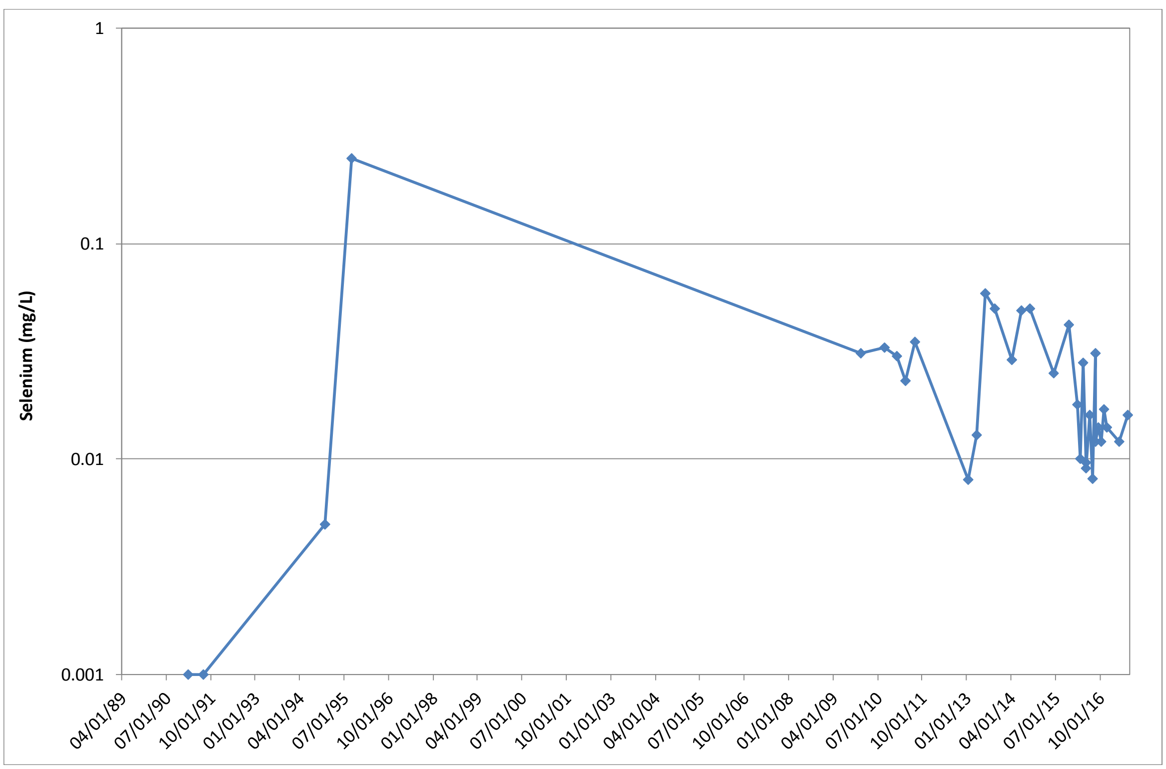

Figure A-6: Selenium Trends in Existing Pit Lake

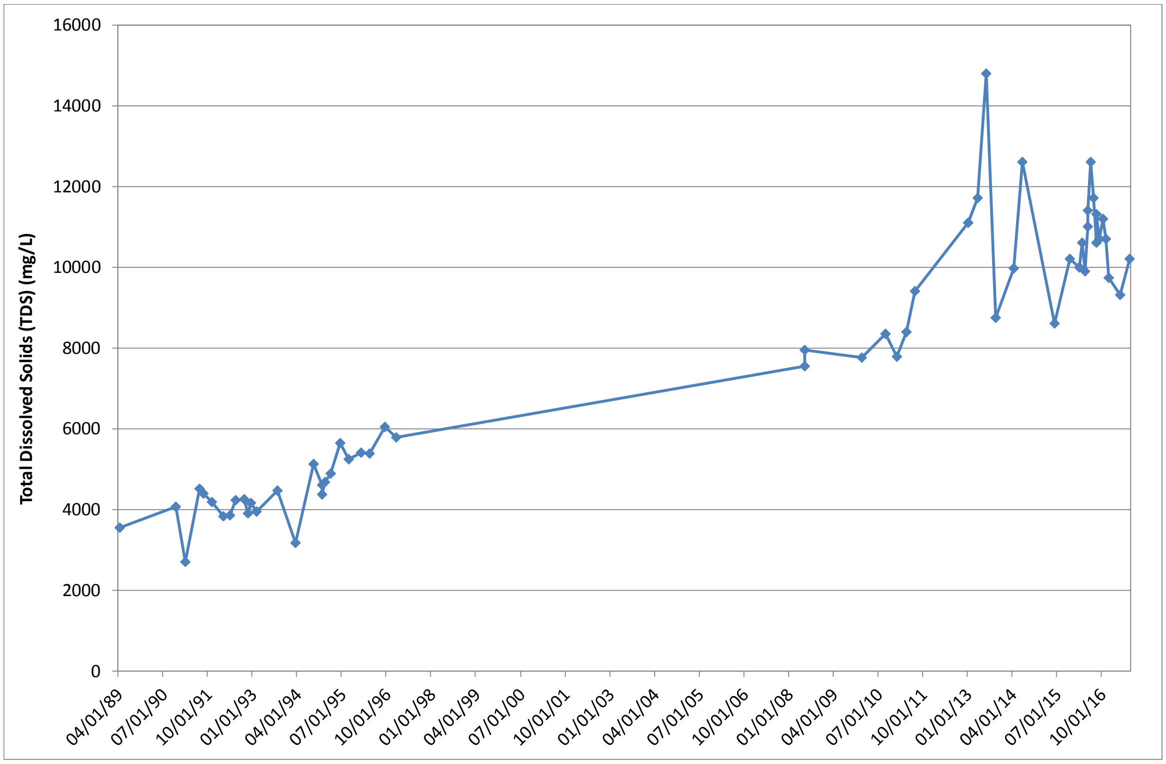

Figure A-7: TDS Trends in Existing Pit Lake

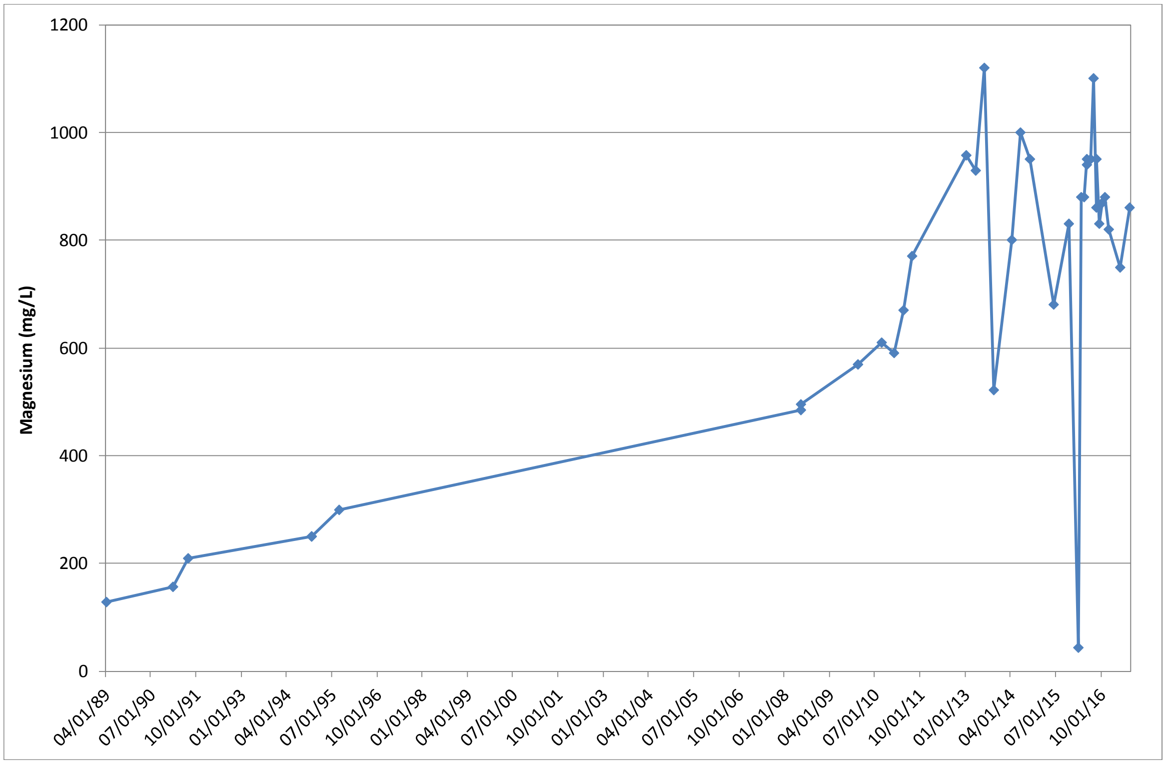

Figure A-8: Magnesium Trends in Existing Pit Lake

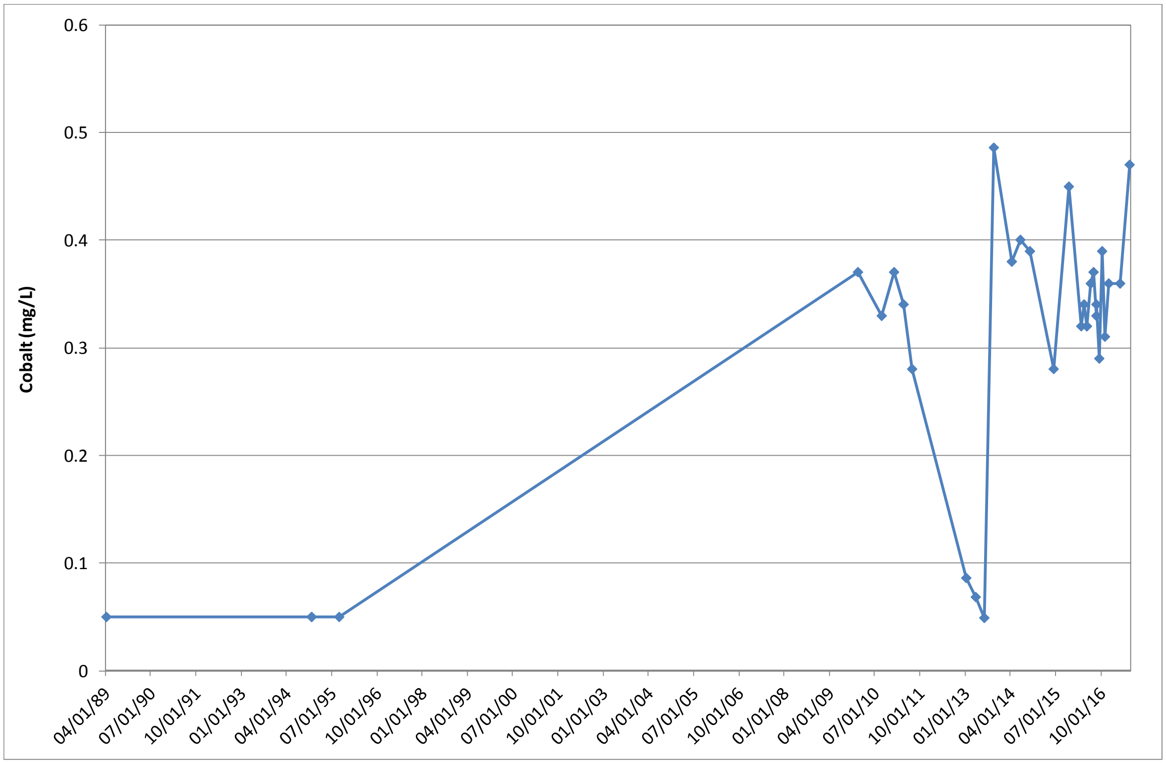

Figure A-9: Cobalt Trends in Existing Pit Lake

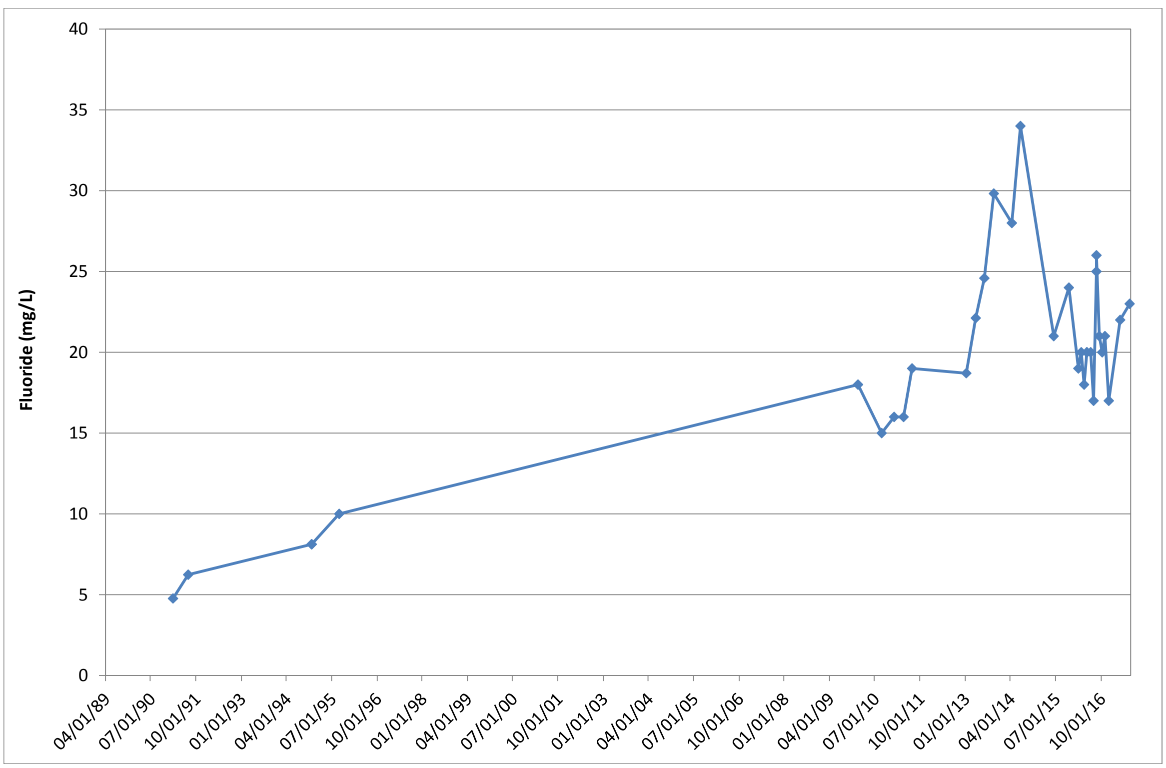

Figure A-10: Fluoride Trends in Existing Pit Lake

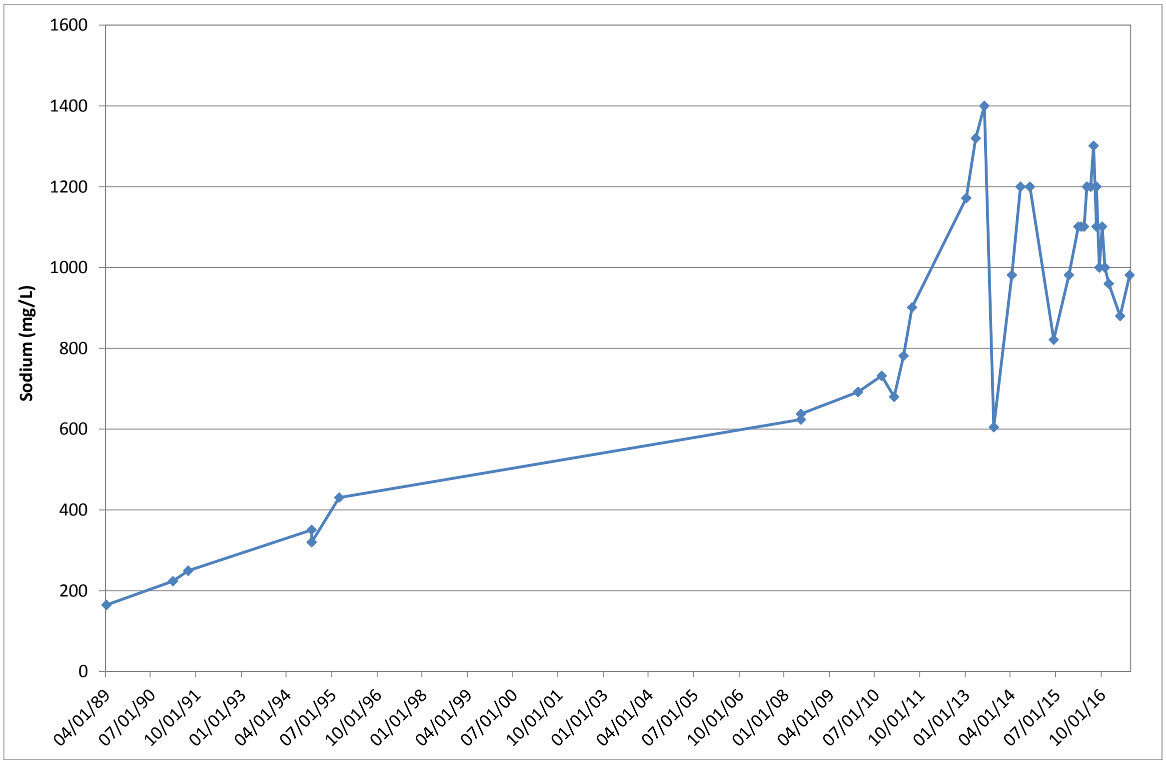

Figure A-11: Sodium Trends in Existing Pit Lake

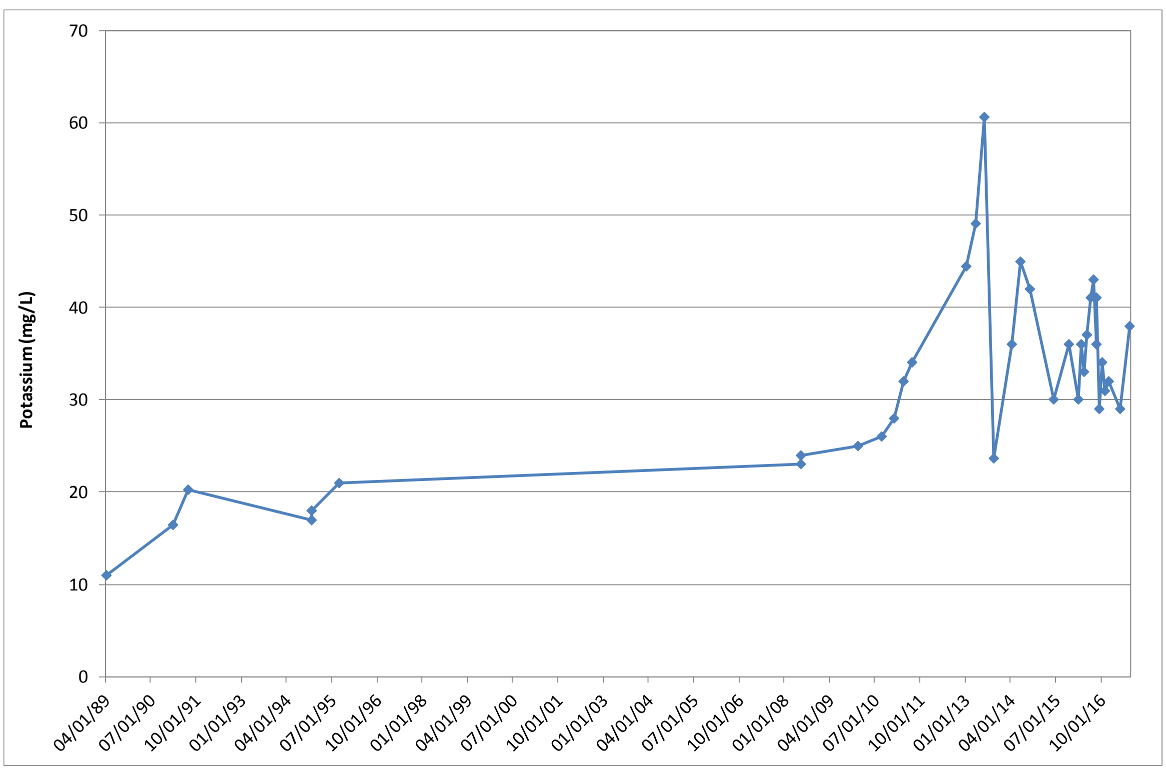

Figure A-12: Potassium Trends in Existing Pit Lake

Appendix B – Humidity Cell Elemental Release Rate Graphs

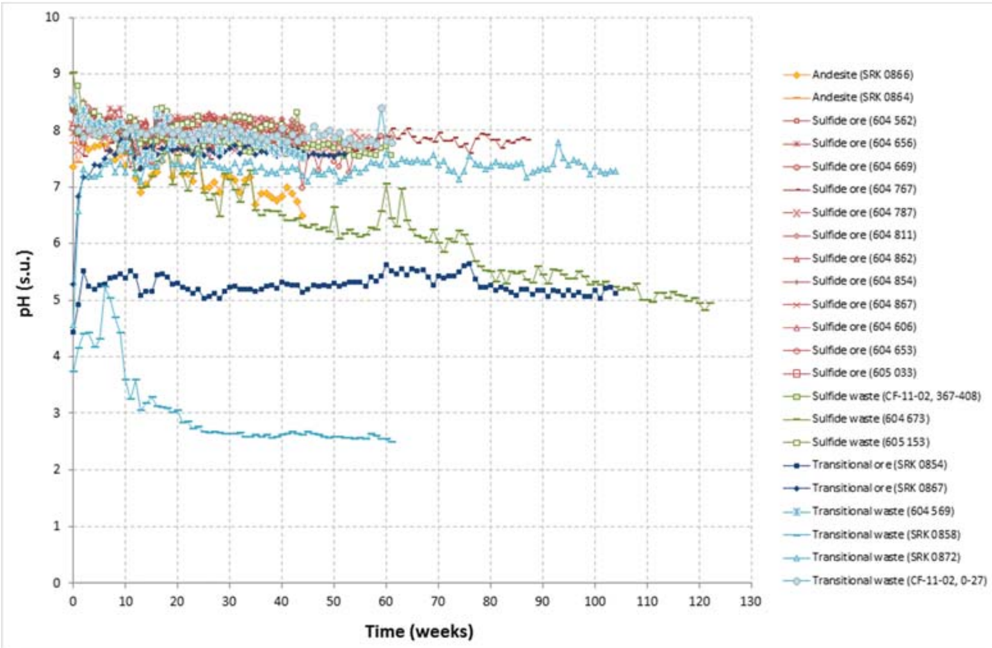

Figure B-1: Humidity Cell Effluent pH

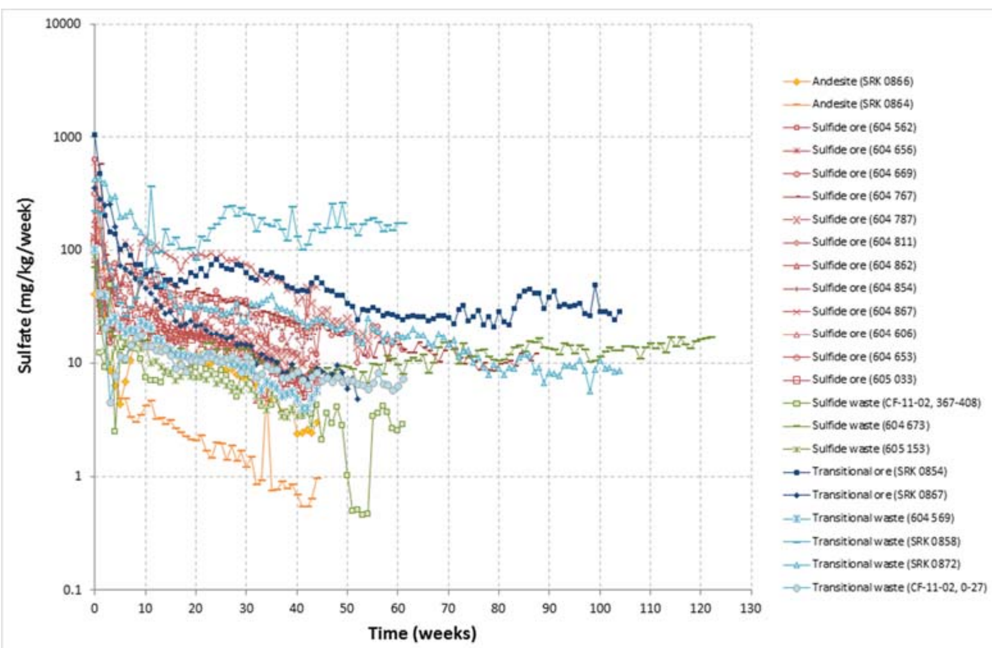

Figure B-2: Humidity Cell Effluent Sulfate

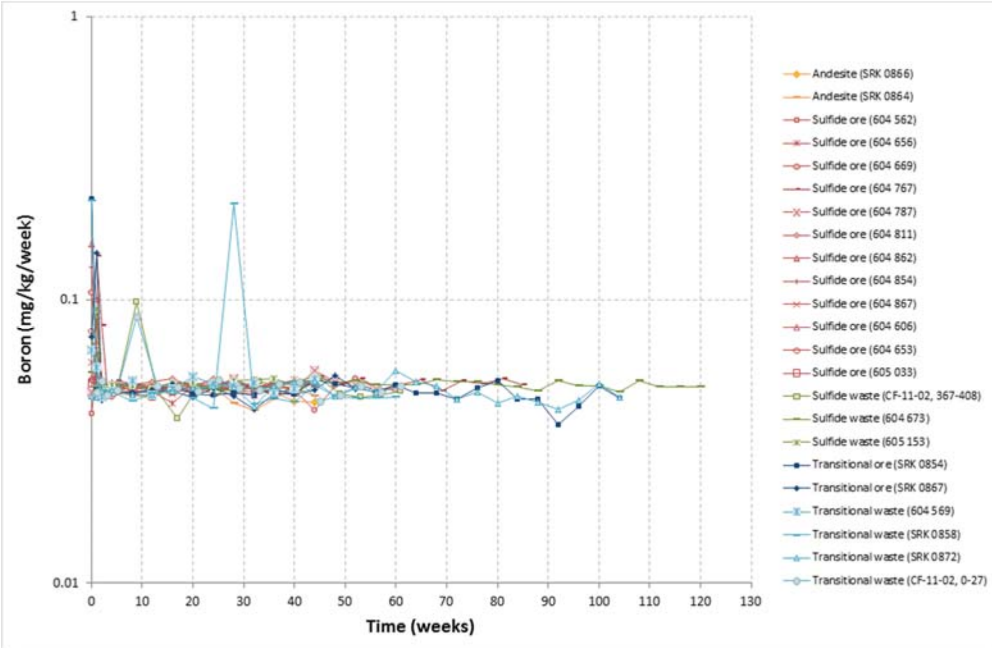

Figure B-3: Humidity Cell Effluent Boron

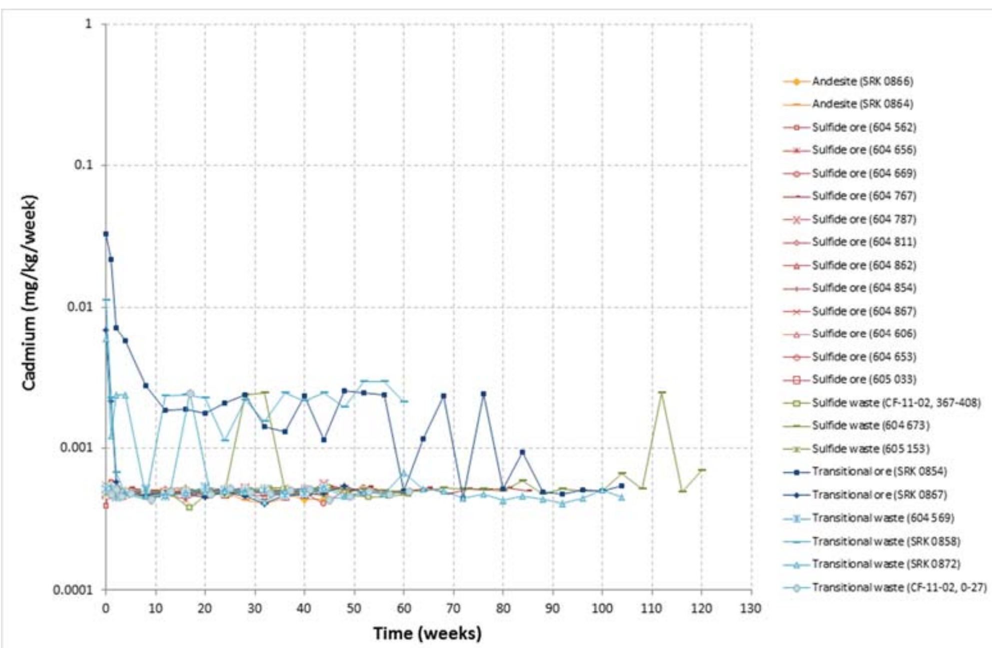

Figure B-4: Humidity Cell Effluent Cadmium

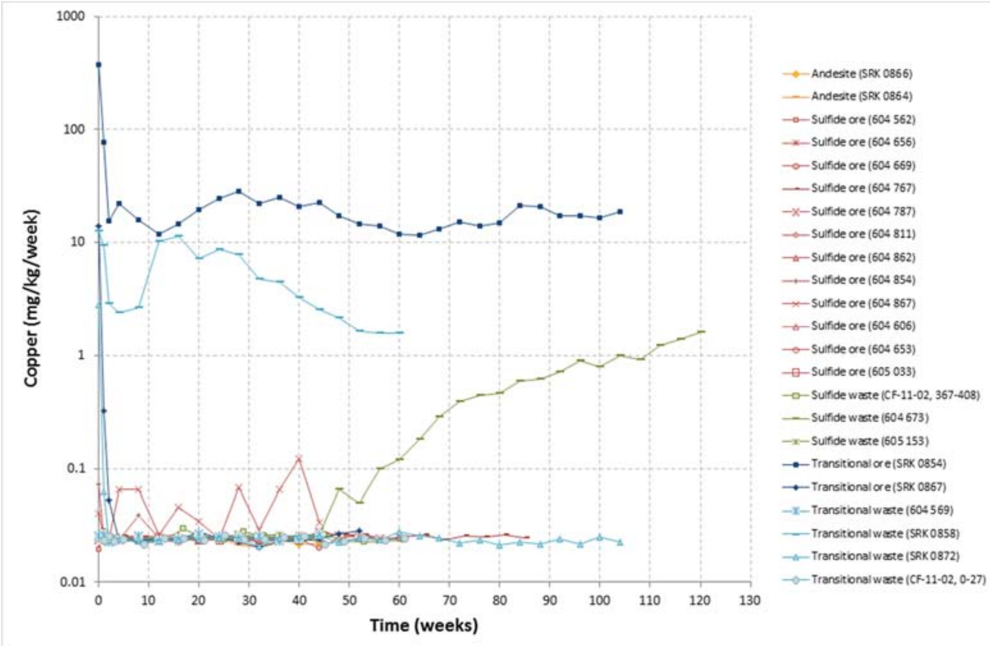

Figure B-5: Humidity Cell Effluent Copper

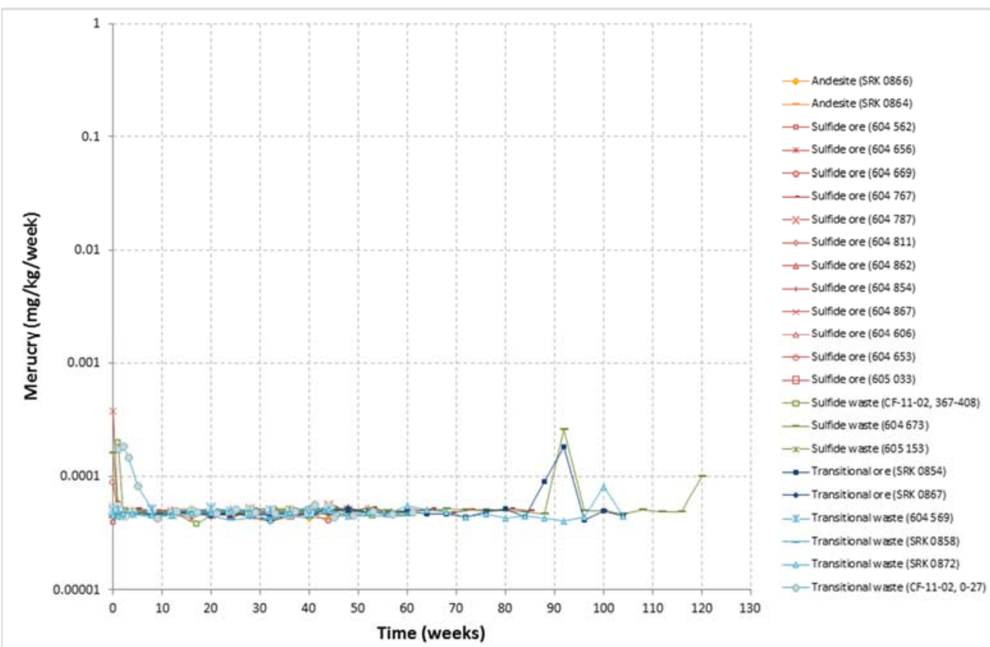

Figure B-6: Humidity Cell Effluent Mercury

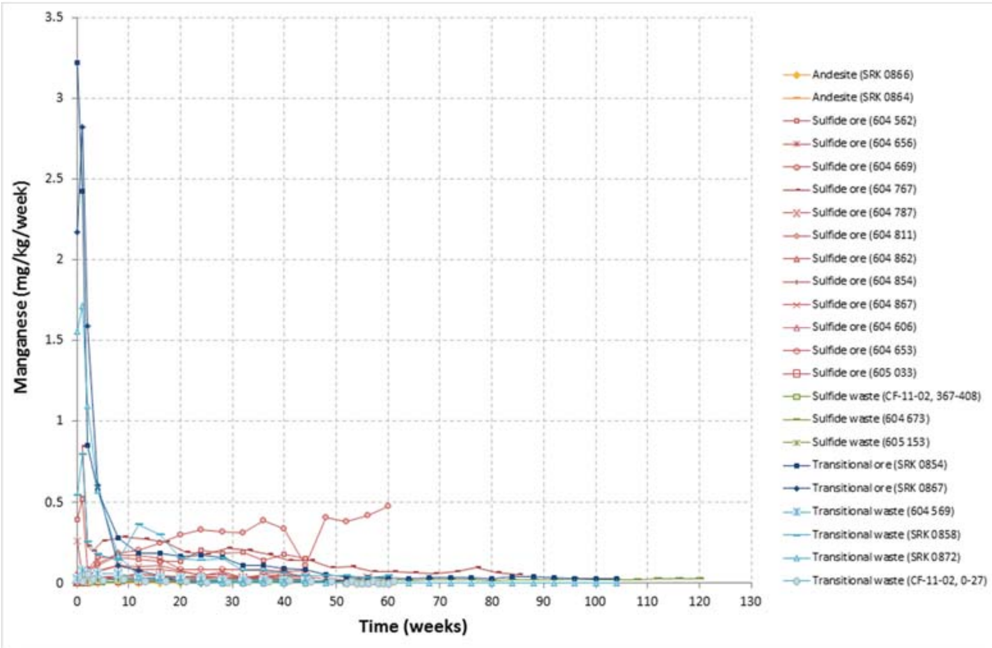

Figure B-7: Humidity Cell Effluent Manganese

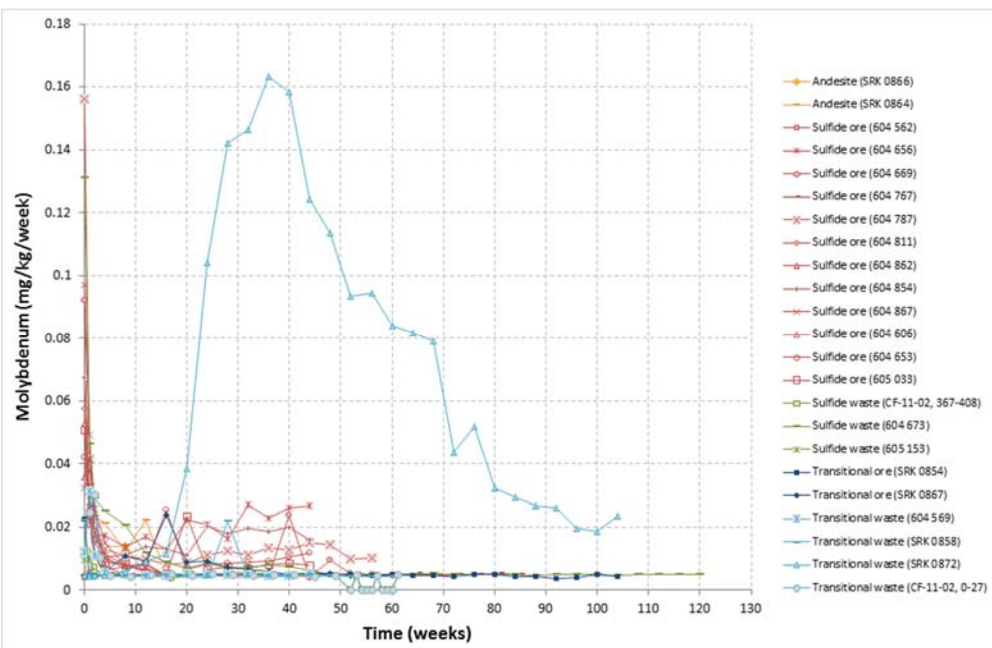

Figure B-8: Humidity Cell Effluent Molybdenum

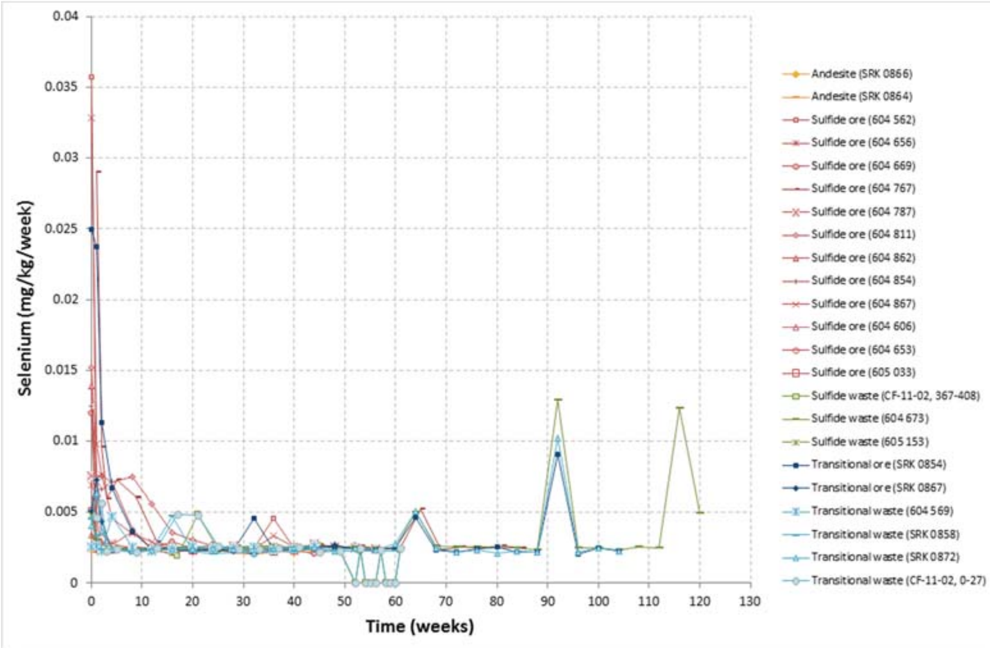

Figure B-9: Humidity Cell Effluent Selenium

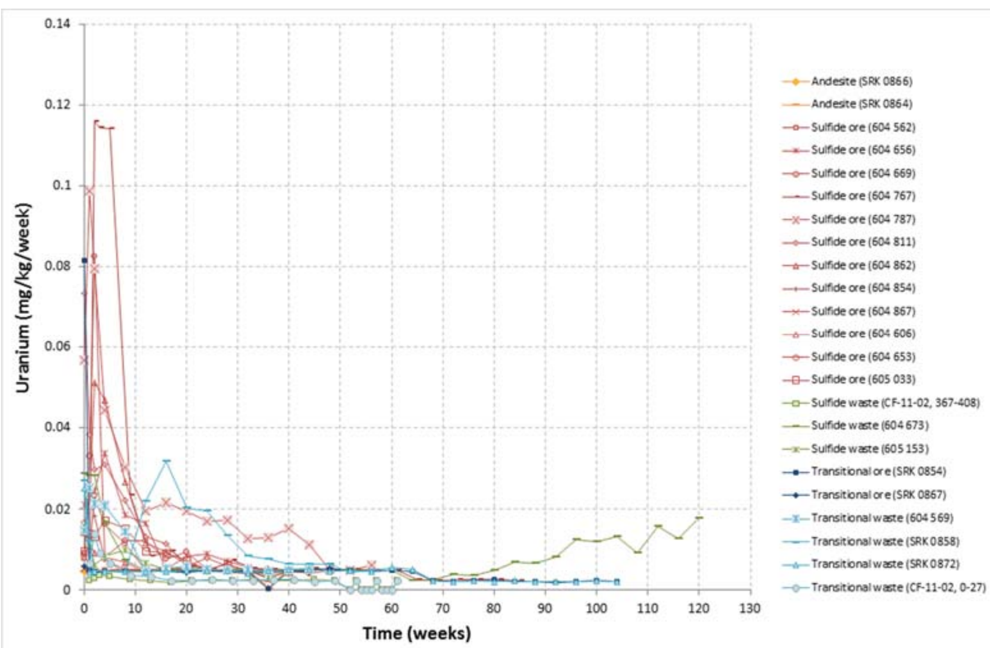

Figure B-10: Humidity Cell Effluent Uranium

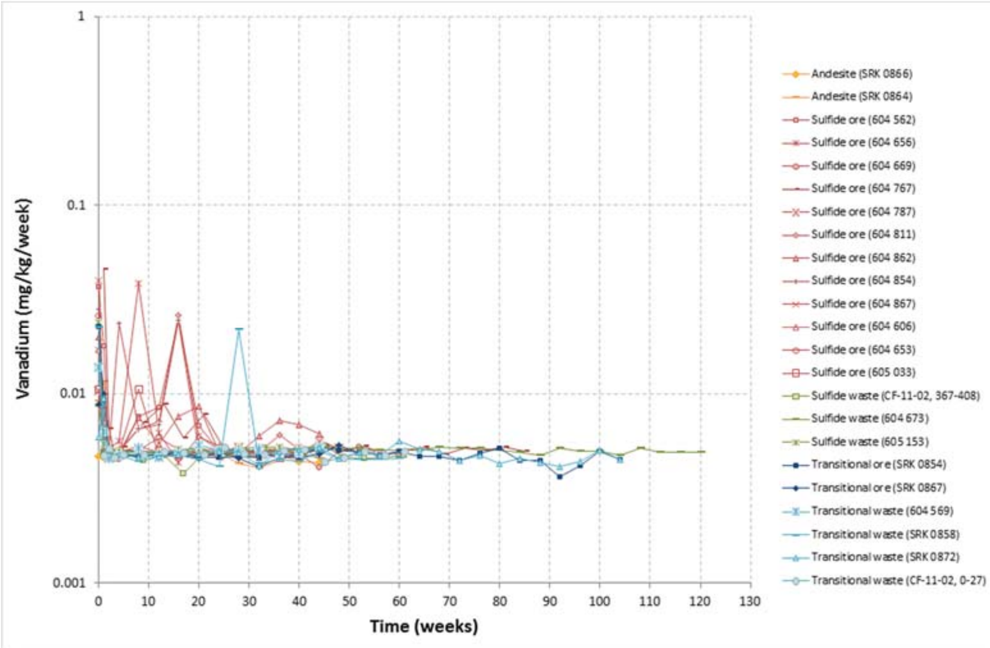

Figure B-11: Humidity Cell Effluent Vanadium

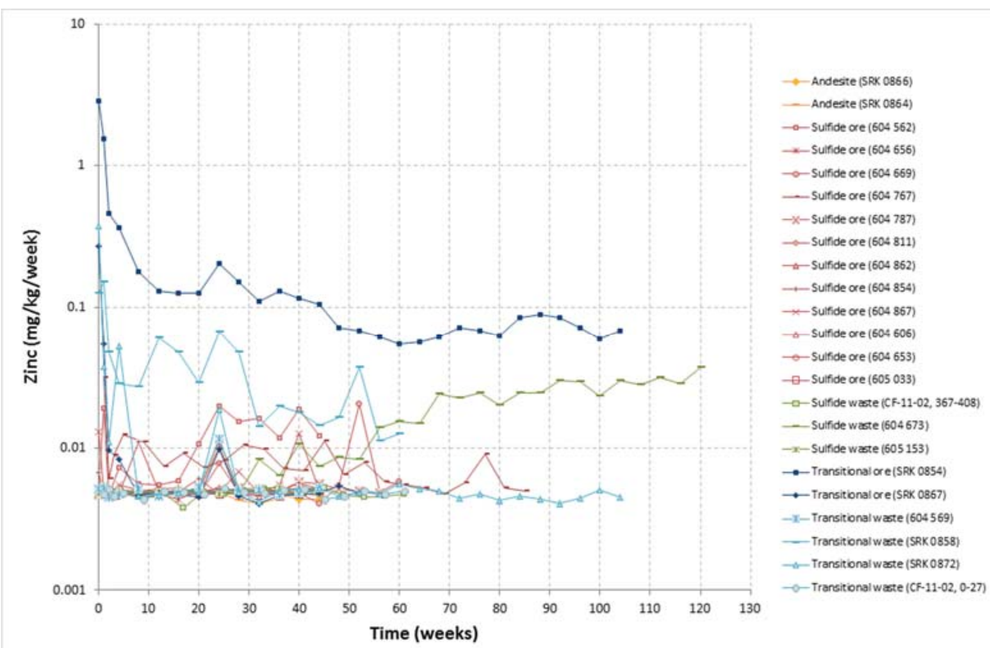

Figure B-12: Humidity Cell Effluent Zinc

Appendix C – JSAI Evaporation Rate Technical Memorandum

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2611 BROADBENT PARKWAY NE
ALBUQUERQUE, NM 87107
505-345-3407; 505-345-9920 FAX
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TECHNICAL MEMORANDUM

To: Steve Raugust, JS Raugust Consulting
Jeff Smith, New Mexico Copper Corporation

From: Steven T. Finch, Jr., Principal Hydrogeologist-Geochemist, JSAI
Annie McCoy, Senior Hydrogeologist, JSAI

Date: September 1, 2015

Subject: **Estimated evaporation rate for future Copper Flat open pit**

As discussed in the Copper Flat Project groundwater-flow model report (JSAI, 2014), potential evapotranspiration (ET), or the maximum evaporation and plant transpiration that can occur given full availability of water, is a function of geographical and climatic conditions, and is commonly estimated using the Penman-Monteith equations (Monteith, 1965). These relate maximum ET (ET_0) to meteorological parameters including temperature, relative humidity and wind speed, and to geographical parameters (altitude, latitude, and time of year). Annual ET_0 computed from results at Hillsboro meteorological station is about 60 in./yr, which compares well to previous estimates (SRK, 1997) of 65 in./yr of potential evaporation, and 64.6 in./yr estimated as 74 percent (an accepted conversion factor for the region (NOAA, 1982) between pan evaporation and evaporation from a normal open water surface) of Copper Flat pan evaporation. Actual evaporation or ET is less, depending on sun and wind exposure, ground conditions, and availability of water.

If ET_0 is estimated to be 60 to 65 in./yr at the rim of the ultimate Copper Flat open pit (where the prior land surface intersects the open pit), ET_0 will be somewhat less at the bottom of the ultimate open pit due to the fact that the bottom of the pit will have less exposure to sun and wind compared to the rim.

To estimate ET_0 for the bottom of the ultimate Copper Flat open pit, the duration of sunlight at analogous established open pits was evaluated using the "sunlight across the landscape" tool in Google Earth, for the date April 29, 2015. April is a month with close-to-average duration of sunlight (as are the months of March, September, and October; Dunne and Leopold, 1978). Table 1 presents a summary of hours of sunlight for analogous pits ranging in depth from 300 to 1,400 ft.

Table 1. Summary of hours of sunlight for selected open pits in New Mexico and California, April 29, 2015

pit	rim elevation, ft amsl	bottom elevation, ft amsl	sunlight at rim, hours	sunlight at bottom, hours	bottom / rim sunlight ratio
Cobre pit, SW NM	6,800	6,300	6:30 to 19:30 = 13 hours	9:30 to 18:30 = 9 hours	0.69
Santa Rita pit, SW NM	6,600	5,200	7:00 to 19:50 = 12.5 hours	9:30 to 16:30 = 7 hours	0.56
Tyrone main pit, SW NM	6,200	4,900	6:30 to 19:30 = 13 hours	8:30 to 17:30 = 9 hours	0.69
CHMRP pit, N. NM	7,100	6,800	7:30 to 19:30 = 12 hours	8:45 to 16:00 = 7.25 hours	0.60
Colosseum pit, S. CA	5,800	5,400	8:00 to 19:00 = 11 hours	9:00 to 16:00 = 7 hours	0.64
average			**12.3 hours**	**7.85 hours**	**0.64**

CHMRP – Cunningham Hill Mine Reclamation Project
ft amsl – feet above mean sea level
SW – southwest
N. – north
S. – south

Pan evaporation data were collected at the Cunningham Hill Mine Reclamation Project (CHMRP), near the rim of the open pit in June 2000, and at the bottom of the pit between April and July 2011 (JSAI, 2011). Pan evaporation was higher at the rim, despite higher summer precipitation in 2001 compared to 2011. The pan evaporation data were interpreted to represent an average evaporation rate of about 60 in./yr at the rim, and 54 in./yr at the bottom.

CHMRP evaporation data were used for an upper bound of 90 percent, in terms of percentage of evaporation at the rim that represents actual evaporation at the bottom of the pit, and the average sunlight ratio presented in Table 1 was used for a lower bound of 64 percent. For the ultimate Copper Flat open pit, actual evaporation at the bottom of the pit was assumed to be 50 in./yr, which is 77 to 83 percent of ET_0 values 60 to 65 in./yr estimated at the rim.

The estimate of 50 in./yr evaporation for the ultimate Copper Flat open pit is also in close agreement with the estimate of open water evaporation of 53 in./yr for the North Mine Area (Santa Rita pit) at Chino Mine in southwestern New Mexico (Golder, 2005).

STF:AMM

Enc: References

References

Dunne, T., and Leopold, L.B., 1978, Water in environmental planning: W.H. Freeman and Company, New York, 818 p.

[Golder] Golder Associates, Inc., 2005, Report on North Mine Area groundwater flow model: Chino Mine, New Mexico: consultant's report prepared for Chino Mines Company, January 13, 2005, 64 p. plus tables, figures, and appendices.

[JSAI] John Shomaker & Associates, Inc., 2011, Update and recalibration of groundwater-flow and solute-transport model for predicting potential effects from the Cunningham Hill Mine Open Pit, Santa Fe County, New Mexico: consultant's report prepared for LAC Minerals (USA) LLC, June 27, 2011, 29 p. plus figures and appendices.

[JSAI] John Shomaker & Associates, Inc., 2014, Model of groundwater flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: consultant's report prepared for New Mexico Copper Corporation, August 15, 2014, 89 p. plus figures and appendices.

Monteith, J.L., 1965, Evaporation and environment: Symp. Soc. Exp. Biol. 19, 205-224 obtained from Forest Hydrology and Watershed Management - Hydrologie Forestiere et Amenagement des Bassins Hydrologiques (Proceedings of the Vancouver Symposium, August 1987, Actes du Co11oque de Vancouver, Aout 1987): IAHS-AISH Publication No. 167, 1987, pp. 319–327.

[NOAA] National Oceanic and Atmospheric Administration, 1982, Evaporation atlas for the contiguous 48 United States: NOAA Technical Report NWS 33.

[SRK] Steffen Robertson and Kirsten, Inc., 1997, Copper Flat Mine compilation of pit lake studies: consultant's report prepared by Steffen Robertson and Kirsten, Inc. prepared for Alta Gold Co., December 1997.

Appendix D – JSAI Groundwater Chemistry Technical Memorandum

TECHNICAL MEMORANDUM

To: Jeff Smith, New Mexico Copper Corporation jsmith@themacresourcesgroup.com

From: Steve Finch, Principal Hydrogeologist-Geochemist

Date: September 26, 2017

Subject: Copper Flat open pit area groundwater chemistry data and application to SRK geochemistry model

John Shomaker & Associates, Inc. (JSAI) has evaluated the water quality data regarding Copper Flat open pit influent groundwater chemistry in order to assist SRK with completion of the open pit geochemistry model. All historical data and the Stage 1 abatement data were compiled and reported in JSAI (2014). JSAI used the water quality database, well construction data, and groundwater flow model results to determine the most representative groundwater flow chemistry to the existing and future open pits.

Groundwater quality data for the open pit area come from wells GWQ96-22(A,B), GWQ96-23(A,B), GWQ11-24(A,B), and GWQ11-25(A,B). Monitoring wells GWQ96-22(A,B) and GWQ96(A,B) represents groundwater in the andesite, where monitoring wells GWQ11-24(A) represents groundwater in the quartz monzonite ore body, and GWQ11-24(B) and GWQ11-25(B) represent parts of the quartz monzonite with lower grade of the ore body. Piezometers GWQ11-24(A) and GWQ11-25(A) may have been affected by oxidation of sulfides in fractures during well development, and not representative of groundwater reporting to the open pit. Further analysis of GWQ11-25(A) provided evidence that it represents a localized and isolated fracture system recharged by oxygenated meteoric water that is not connected to the open pit (JSAI, 2014).

Existing Open Pit Influent Groundwater Chemistry

Table 1 is a summary of groundwater chemistry potentially influencing the existing open pit. Individual samples with values less than detection limits were assigned a value of one-half the detection limit. Results for selenium, mercury, and vanadium were evaluated for the lowest possible detection limit. Not all of the constituents analyzed in the baseline data report were analyzed as part of the Stage 1 abatement investigation, so results for GWQ11-24(A,B) and GWQ11-25(A,B) are limited by the Stage 1 constituent list (see Table 1).

Future Post-Mining Open Pit Influent Groundwater Chemistry

Based on the mining plan, a good portion of the quartz monzonite is removed by mining and the remaining quartz monzonite is dewatered. The groundwater flow model simulates localized dewatering rates and volumes (JSAI, 2014a). Groundwater representative of the andesite rocks reports to the future pit, and all of the groundwater in the quartz monzonite surrounding the future pit is dewatered during mining and replaced with groundwater from the surrounding andesite (JSAI, 2014a). The calculated volume of groundwater in the quartz monzonite is removed and flushed three times by inflow of groundwater representative of andesite. A volume of 500 acre feet is calculated to be dewatered during mining of the proposed open pit of which 165 ac-ft represents groundwater stored in quartz monzonite.

A summary of groundwater chemistry potentially influencing the future open pit during post mining conditions is listed in Table 1. Groundwater chemistry representative of the future pit was determined by using data representative of the andesite rocks (column A). These “Column A” sample results represent groundwater from the andesite rocks after dewatering and mining to create the future pit.

Attachments

Table 1. Summary of groundwater chemistry for Copper Flat open pit area

References

JSAI, 2014, Results of first year of Stage 1 investigation at the Copper Flat Mine Site, Hillsboro, New Mexico: Consultant’s report prepared by Steven T. Finch of John Shomaker & Associates, Inc. for New Mexico Copper Corporation.

[JSAI] John Shomaker & Associates, Inc., 2014a, Model of groundwater flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: consultant’s report prepared for New Mexico Copper Corporation, August 15, 2014, 89 p. plus figures and appendices.

Table 1. Summary of Copper Flat open pit influent groundwater chemistry

		Column:	A	B	C	AVERAGE A-C	
parameter	parameter name	unit	Groundwater chemistry (average of samples collected from wells GWQ96-22(A,B), GWQ96-23(A,B) between 1996 and 2013)	GWQ11-24B 2013 average	GWQ11-25B 2013 average	Blended Groundwater chemistry representative of inflow to current open pit[b]	Groundwater chemistry representative of inflow to future open pit
pH	pH	s.u	7.85	6.44	6.45	6.91	7.85
HCO3	bicarbonate	mg/L	408	191	350	316.3	408
Ag	silver	mg/L	0.009	nm	nm	0.009	0.009
Al	aluminum	mg/L	0.029	0.013	0.308	0.12	0.029
As	arsenic	mg/L	0.0023	nm	nm	0.0023	0.0023
B	boron	mg/L	0.136	nm	nm	0.136	0.136
Ba	barium	mg/L	0.089	nm	nm	0.089	0.089
Ca	calcium	mg/L	85.8	442	481	336	85.8
Cd	cadmium	mg/L	0.0008	0.001	0.001	0.001	0.0008
Co	cobalt	mg/L	0.008	0.017	0.004	0.010	0.008
Cr	chromium	mg/L	0.0066	nm	nm	0.0066	0.0066
Cu	copper	mg/L	0.0061	0.0024	0.0026	0.0	0.0061
F	fluoride	mg/L	2.1	3.80	7.90	4.60	2.1
Fe	iron	mg/L	1.48	nm	nm	1.48	1.48
Hg	mercury[a]	mg/L	0.000002	nm	nm	0.000002	0.000002
K	potassium	mg/L	2.96	6.2	4	4.4	2.96
Mg	magnessium	mg/L	19.3	79	75	57.8	19.3
Mn	manganese	mg/L	0.66	3.5	3.25	2.47	0.66
Mo	molybdenum	mg/L	0.012	nm	nm	0.0119	0.012
Na	sodium	mg/L	119	94	131	114.5	119
Ni	nickel	mg/L	0.0125	nm	nm	0.0125	0.0125
Pb	lead	mg/L	0.0025	nm	nm	0.0025	0.0025
Sb	antimony	mg/L	0.0009	nm	nm	0.0009	0.0009
Se	selenium	mg/L	0.0015	0.0024	0.0028	0.0022	0.0015
U	uranium	mg/L	0.0015	nm	nm	0.0015	0.0015
V	vanadium[a]	mg/L	0.0009	nm	nm	0.0009	0.0009
Zn	zinc	mg/L	0.03	0.18	0.02	0.08	0.03
SO4	sulfate	mg/L	84	1408	1370	954	84
Cl	chloride	mg/L	49	27	27	34	49
TDS	total dissolved solids	mg/L	649	2,440	2,540	1,876	649

notes:

nm = not measured

[a] = results from sample analyzed for low detection limits for SRK geochemical model (samples collected July 10, 2013)

Appendix E – Water Supply Well Chemistry

Production Well Water Quality Samples				
Parameter		PW1 May 1, 2012	PW3 May 3, 2012	Average
pH	pH	8.02	8.03	8.025
HCO_3	Bicarbonate	150	120	135
Al	Aluminum	nd	nd	nd
As	Arsenic	0.0033	0.0074	0.00535
B	Boron	0.065	0.095	0.0800
Ba	Barium	0.011	0.0078	0.0094
Ca	Calcium	36	20	28
Cl	Chloride	32	50	41
Cu	Copper	nd	nd	nd
Cr	Chromium	nd	0.006	0.006
F	Fluoride	1	1.9	1.45
Fe	Iron	0.04	0.065	0.0525
Hg	Mercury	nd	nd	nd
K	Potassium	3.4	3.3	3.35
Mg	Magnesium	3.1	1	2.05
Mn	Manganese	0.0024	0.0026	0.0025
Mo	Molybdenum	nd	nd	nd
Na	Sodium	58	81	69.5
Ni	Nickel	nd	nd	nd
Pb	Lead	nd	nd	nd
SO_4	Sulfate	28	26	27
Se	Selenium	nd	nd	nd
Si	Silica	17	21	19
U	Uranium	0.0032	0.0013	0.00225
V	Vanadium	nd	nd	nd
Tl	Thallium	nd	nd	nd
Zn	Zinc	0.024	0.021	0.0225

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

May 14, 2012

Katie Emmer
New Mexico Copper Corp
2425 San Pedro Dr NE Ste 100
Albuquerque, New Mexico 87109
TEL: (505) 400-7925
FAX

RE: Cu Flat OrderNo.: 1205076

Dear Katie Emmer:

Hall Environmental Analysis Laboratory received 1 sample(s) on 5/2/2012 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1205076**

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **5/14/2012**

CLIENT: New Mexico Copper Corp
Client Sample ID: PW-1
Project: Cu Flat
Collection Date: 5/1/2012 2:00:00 PM
Lab ID: 1205076-001
Matrix: AQUEOUS
Received Date: 5/2/2012 7:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 300.0: ANIONS						Analyst: **BRM**
Fluoride	1.0	0.10		mg/L	1	5/2/2012 12:52:03 PM
Chloride	32	10		mg/L	20	5/2/2012 1:03:17 PM
Nitrogen, Nitrite (As N)	ND	0.10		mg/L	1	5/2/2012 12:52:03 PM
Nitrogen, Nitrate (As N)	0.59	0.10		mg/L	1	5/2/2012 12:52:03 PM
Sulfate	28	0.50		mg/L	1	5/2/2012 12:52:03 PM
EPA METHOD 200.7: DISSOLVED METALS						Analyst: **ELS**
Aluminum	ND	0.020		mg/L	1	5/8/2012 8:02:55 AM
Barium	0.011	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Beryllium	ND	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Boron	0.065	0.040		mg/L	1	5/9/2012 8:36:51 AM
Cadmium	ND	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Calcium	36	1.0		mg/L	1	5/9/2012 8:36:51 AM
Chromium	ND	0.0060		mg/L	1	5/8/2012 8:02:55 AM
Cobalt	ND	0.0060		mg/L	1	5/8/2012 8:02:55 AM
Copper	ND	0.0060		mg/L	1	5/8/2012 8:02:55 AM
Iron	0.040	0.020		mg/L	1	5/9/2012 8:36:51 AM
Lead	ND	0.0050		mg/L	1	5/8/2012 8:02:55 AM
Magnesium	3.1	1.0		mg/L	1	5/9/2012 8:36:51 AM
Manganese	0.0024	0.0020		mg/L	1	5/8/2012 8:02:55 AM
Molybdenum	ND	0.0080		mg/L	1	5/8/2012 8:02:55 AM
Nickel	ND	0.010		mg/L	1	5/8/2012 8:02:55 AM
Potassium	3.4	1.0		mg/L	1	5/9/2012 8:36:51 AM
Silicon	17	0.40		mg/L	5	5/8/2012 8:06:09 AM
Silver	ND	0.0050		mg/L	1	5/8/2012 8:02:55 AM
Sodium	58	1.0		mg/L	1	5/9/2012 8:36:51 AM
Vanadium	ND	0.050		mg/L	1	5/8/2012 8:02:55 AM
Zinc	0.024	0.010		mg/L	1	5/8/2012 8:02:55 AM
EPA 200.8: DISSOLVED METALS						Analyst: **SNV**
Antimony	ND	0.0010		mg/L	1	5/8/2012 1:15:26 PM
Arsenic	0.0033	0.0010		mg/L	1	5/8/2012 1:15:26 PM
Selenium	ND	0.0010		mg/L	1	5/10/2012 2:28:58 PM
Thallium	ND	0.0010		mg/L	1	5/8/2012 1:15:26 PM
Uranium	0.0032	0.0010		mg/L	1	5/10/2012 2:28:58 PM
EPA METHOD 245.1: MERCURY						Analyst: **ELS**
Mercury	ND	0.00020		mg/L	1	5/9/2012 11:59:45 AM
SM2340B: HARDNESS						Analyst: **ELS**
Hardness (As CaCO3)	100	6.6		mg/L	1	5/9/2012
EPA 120.1: SPECIFIC CONDUCTANCE						Analyst: **DBD**
Conductivity	450	0.010		µmhos/cm	1	5/7/2012 12:31:49 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **5/14/2012**

CLIENT: New Mexico Copper Corp | **Client Sample ID:** PW-1
Project: Cu Flat | **Collection Date:** 5/1/2012 2:00:00 PM
Lab ID: 1205076-001 | **Matrix:** AQUEOUS | **Received Date:** 5/2/2012 7:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM4500-H+B: PH						Analyst: **JLF**
pH	8.02	1.68	H	pH units	1	5/3/2012 1:22:52 PM
SM2320B: ALKALINITY						Analyst: **JLF**
Bicarbonate (As CaCO3)	150	20		mg/L CaCO3	1	5/3/2012 1:22:52 PM
Carbonate (As CaCO3)	ND	2.0		mg/L CaCO3	1	5/3/2012 1:22:52 PM
Total Alkalinity (as CaCO3)	150	20		mg/L CaCO3	1	5/3/2012 1:22:52 PM
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**
Total Dissolved Solids	294	20.0		mg/L	1	5/8/2012 3:12:00 PM
SM 2540D: TSS						Analyst: **KS**
Suspended Solids	ND	4.0		mg/L	1	5/3/2012 5:30:00 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	HALL ENVIRONMENTAL ANALYSIS LAB	**Batch #:**	120503026
Address:	4901 HAWKINS NE SUITE D ALBUQUERQUE, NM 87109	**Project Name:**	1205076
Attn:	ANDY FREEMAN		

Analytical Results Report

Sample Number	120503026-001	**Sampling Date**	5/1/2012	**Date/Time Received**	5/3/2012 12:24 PM
Client Sample ID	1205076-001D / PW-1	**Sampling Time**	2:00 PM	**Extraction Date**	
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Cyanide	ND	mg/L	0.01	5/11/2012	CRW	EPA 335.4	

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**
14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **PBW**	Batch ID: **R2622**	RunNo: **2622**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **72991** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020								
Barium	ND	0.0020								
Beryllium	ND	0.0020								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Cobalt	ND	0.0060								
Copper	ND	0.0060								
Lead	ND	0.0050								
Manganese	ND	0.0020								
Molybdenum	ND	0.0080								
Nickel	ND	0.010								
Silicon	ND	0.080								
Silver	ND	0.0050								
Vanadium	ND	0.050								
Zinc	ND	0.010								

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **LCSW**	Batch ID: **R2622**	RunNo: **2622**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **72992** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.52	0.020	0.5000	0	105	85	115			
Barium	0.49	0.0020	0.5000	0	98.9	85	115			
Beryllium	0.52	0.0020	0.5000	0	103	85	115			
Cadmium	0.50	0.0020	0.5000	0	99.2	85	115			
Chromium	0.49	0.0060	0.5000	0	98.5	85	115			
Cobalt	0.47	0.0060	0.5000	0	94.9	85	115			
Copper	0.50	0.0060	0.5000	0	99.9	85	115			
Lead	0.50	0.0050	0.5000	0	99.3	85	115			
Manganese	0.48	0.0020	0.5000	0	96.9	85	115			
Molybdenum	0.49	0.0080	0.5000	0.002030	98.4	85	115			
Nickel	0.47	0.010	0.5000	0	93.9	85	115			
Silicon	2.6	0.080	2.500	0	104	85	115			
Silver	0.094	0.0050	0.1000	0	94.1	85	115			
Vanadium	0.52	0.050	0.5000	0	104	85	115			
Zinc	0.50	0.010	0.5000	0	101	85	115			

Sample ID **1205193-005EMS**	SampType: **MS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC**	Batch ID: **R2622**	RunNo: **2622**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **73030** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205076**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2622** RunNo: **2622**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73030** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.54	0.020	0.5000	0	107	70	130			
Barium	0.52	0.0020	0.5000	0.02182	98.9	70	130			
Zinc	0.54	0.010	0.5000	0.03785	101	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2622** RunNo: **2622**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73031** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.53	0.020	0.5000	0	106	70	130	1.33	20	
Barium	0.51	0.0020	0.5000	0.02182	97.2	70	130	1.71	20	
Zinc	0.53	0.010	0.5000	0.03785	98.0	70	130	2.48	20	

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74182** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	56	1.0	50.00	4.808	102	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74183** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	57	1.0	50.00	4.808	104	70	130	2.44	20	

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74185** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Iron	4.5	0.10	2.500	2.034	99.6	70	130			
Magnesium	390	5.0	250.0	124.9	107	70	130			
Sodium	460	5.0	250.0	192.5	107	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74186** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Iron	4.6	0.10	2.500	2.034	101	70	130	1.03	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205076**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74186** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Magnesium	390	5.0	250.0	124.9	106	70	130	0.684	20	
Sodium	460	5.0	250.0	192.5	106	70	130	0.966	20	

Sample ID **MB** SampType: **MBLK** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **PBW** Batch ID: **R2670** RunNo: **2670**
Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74215** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	ND	0.040								
Calcium	ND	1.0								
Iron	ND	0.020								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **LCSW** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74216** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	0.51	0.040	0.5000	0	101	85	115			
Calcium	54	1.0	50.00	0	107	85	115			
Iron	0.47	0.020	0.5000	0.004190	93.2	85	115			
Magnesium	54	1.0	50.00	0	109	85	115			
Potassium	53	1.0	50.00	0	106	85	115			
Sodium	54	1.0	50.00	0	107	85	115			

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW**	Batch ID: **R2629**	RunNo: **2629**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **73283** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	0.023	0.0010	0.02500	0	92.8	85	115			
Arsenic	0.023	0.0010	0.02500	0	93.1	85	115			
Thallium	0.023	0.0010	0.02500	0	92.9	85	115			

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW**	Batch ID: **R2629**	RunNo: **2629**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **73284** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010								
Arsenic	ND	0.0010								
Thallium	ND	0.0010								

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW**	Batch ID: **R2708**	RunNo: **2708**
Prep Date:	Analysis Date: **5/10/2012**	SeqNo: **75447** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	0.026	0.0010	0.02500	0	104	85	115			
Uranium	0.025	0.0010	0.02500	0	99.2	85	115			

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW**	Batch ID: **R2708**	RunNo: **2708**
Prep Date:	Analysis Date: **5/10/2012**	SeqNo: **75448** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	ND	0.0010								
Uranium	ND	0.0010								

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB-1862** SampType: **MBLK** TestCode: **EPA Method 245.1: Mercury**

Client ID: **PBW** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74223** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020								

Sample ID **LCS-1862** SampType: **LCS** TestCode: **EPA Method 245.1: Mercury**

Client ID: **LCSW** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74224** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.4	80	120			

Sample ID **1204854-004AMS** SampType: **MS** TestCode: **EPA Method 245.1: Mercury**

Client ID: **BatchQC** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74226** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.2	75	125			

Sample ID **1204854-004AMSD** SampType: **MSD** TestCode: **EPA Method 245.1: Mercury**

Client ID: **BatchQC** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74227** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.1	75	125	0.0957	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB** SampType: **MBLK** TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70797** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70798** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.47	0.10	0.5000	0	93.8	90	110			
Chloride	4.6	0.50	5.000	0	92.9	90	110			
Nitrogen, Nitrite (As N)	0.93	0.10	1.000	0	92.9	90	110			
Nitrogen, Nitrate (As N)	2.4	0.10	2.500	0	97.4	90	110			
Sulfate	9.5	0.50	10.00	0	94.8	90	110			

Sample ID **1205075-001BMS** SampType: **MS** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70800** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.68	0.10	0.5000	0.1911	98.1	72.9	113			
Nitrogen, Nitrite (As N)	1.0	0.10	1.000	0	101	77.6	111			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	99.9	82.8	116			

Sample ID **1205075-001BMSD** SampType: **MSD** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70801** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.65	0.10	0.5000	0.1911	90.9	72.9	113	5.39	20	
Nitrogen, Nitrite (As N)	0.90	0.10	1.000	0	90.2	77.6	111	10.8	20	
Nitrogen, Nitrate (As N)	2.3	0.10	2.500	0	91.3	82.8	116	8.94	20	

Sample ID **1205079-001AMS** SampType: **MS** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70809** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	1.3	0.10	1.000	0	127	77.6	111			S
Nitrogen, Nitrate (As N)	2.4	0.10	2.500	0	97.8	82.8	116			

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205079-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC**	Batch ID: **R2544**	RunNo: **2544**
Prep Date:	Analysis Date: **5/2/2012**	SeqNo: **70810** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	1.2	0.10	1.000	0	122	77.6	111	4.14	20	S
Nitrogen, Nitrate (As N)	2.4	0.10	2.500	0	95.5	82.8	116	2.38	20	

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R2544**	RunNo: **2544**
Prep Date:	Analysis Date: **5/2/2012**	SeqNo: **70849** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R2544**	RunNo: **2544**
Prep Date:	Analysis Date: **5/2/2012**	SeqNo: **70850** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.50	0.10	0.5000	0	99.0	90	110			
Chloride	4.7	0.50	5.000	0	94.2	90	110			
Nitrogen, Nitrite (As N)	0.98	0.10	1.000	0	98.0	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	98.3	90	110			
Sulfate	9.6	0.50	10.00	0	95.7	90	110			

Sample ID **1205066-002AMS**	SampType: **MS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC**	Batch ID: **R2544**	RunNo: **2544**
Prep Date:	Analysis Date: **5/2/2012**	SeqNo: **70852** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	1.1	0.10	0.5000	0.5616	101	72.9	113			
Nitrogen, Nitrite (As N)	0.93	0.10	1.000	0	92.7	77.6	111			
Nitrogen, Nitrate (As N)	3.3	0.10	2.500	0.5059	111	82.8	116			
Sulfate	48	0.50	10.00	36.66	113	80.5	119			

Sample ID **1205066-002AMSD**	SampType: **MSD**	TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC**	Batch ID: **R2544**	RunNo: **2544**
Prep Date:	Analysis Date: **5/2/2012**	SeqNo: **70853** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	1.0	0.10	0.5000	0.5616	93.8	72.9	113	3.52	20	
Nitrogen, Nitrite (As N)	0.79	0.10	1.000	0	78.5	77.6	111	16.5	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205076**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205066-002AMSD** SampType: **MSD** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2544** RunNo: **2544**
Prep Date: Analysis Date: **5/2/2012** SeqNo: **70853** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrate (As N)	3.0	0.10	2.500	0.5059	98.7	82.8	116	10.2	20	
Sulfate	47	0.50	10.00	36.66	101	80.5	119	2.50	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205170-001D**	SampType: **DUP**	TestCode: **EPA 120.1: Specific Conductance**
Client ID: **BatchQC**	Batch ID: **R2646**	RunNo: **2646**
Prep Date:	Analysis Date: **5/7/2012**	SeqNo: **73516** Units: **µmhos/cm**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	610	0.010						0	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205005-001A DUP**		SampType: **DUP**			TestCode: **SM4500-H+B: pH**						
Client ID: **BatchQC**		Batch ID: **R2560**			RunNo: **2560**						
Prep Date:		Analysis Date: **5/3/2012**			SeqNo: **71363**		Units: **pH units**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual	
pH	3.92	1.68						0.762		H	

Sample ID **1205120-001B DUP**		SampType: **DUP**			TestCode: **SM4500-H+B: pH**						
Client ID: **BatchQC**		Batch ID: **R2560**			RunNo: **2560**						
Prep Date:		Analysis Date: **5/3/2012**			SeqNo: **71373**		Units: **pH units**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual	
pH	7.73	1.68						0.645		H	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID 1205005-001A MS		SampType: MS		TestCode: SM2320B: Alkalinity						
Client ID: BatchQC		Batch ID: R2560		RunNo: 2560						
Prep Date:		Analysis Date: 5/3/2012		SeqNo: 71221		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20	80.00	0	0	62.6	110			S

Sample ID 1205005-001A MSD		SampType: MSD		TestCode: SM2320B: Alkalinity						
Client ID: BatchQC		Batch ID: R2560		RunNo: 2560						
Prep Date:		Analysis Date: 5/3/2012		SeqNo: 71222		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20	80.00	0	0	59.9	111	0	10	S

Sample ID 1205120-001B MS		SampType: MS		TestCode: SM2320B: Alkalinity						
Client ID: BatchQC		Batch ID: R2560		RunNo: 2560						
Prep Date:		Analysis Date: 5/3/2012		SeqNo: 71242		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	360	20	80.00	299.4	70.9	62.6	110			

Sample ID 1205120-001B MSD		SampType: MSD		TestCode: SM2320B: Alkalinity						
Client ID: BatchQC		Batch ID: R2560		RunNo: 2560						
Prep Date:		Analysis Date: 5/3/2012		SeqNo: 71243		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	350	20	80.00	299.4	67.1	59.9	111	0.869	10	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205076**

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **MB-1832**	SampType: **MBLK**	TestCode: **SM2540C MOD: Total Dissolved Solids**								
Client ID: **PBW**	Batch ID: **1832**	RunNo: **2634**								
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73329**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID **LCS-1832**	SampType: **LCS**	TestCode: **SM2540C MOD: Total Dissolved Solids**								
Client ID: **LCSW**	Batch ID: **1832**	RunNo: **2634**								
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73330**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1,020	20.0	1,000	0	102	80	120			

Sample ID **1205078-002GMS**	SampType: **MS**	TestCode: **SM2540C MOD: Total Dissolved Solids**								
Client ID: **BatchQC**	Batch ID: **1832**	RunNo: **2634**								
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73337**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	4,890	20.0	1,000	3,791	110	80	120			

Sample ID **1205078-002GMSD**	SampType: **MSD**	TestCode: **SM2540C MOD: Total Dissolved Solids**								
Client ID: **BatchQC**	Batch ID: **1832**	RunNo: **2634**								
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73338**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	4,930	20.0	1,000	3,791	114	80	120	0.733	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205076**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **MB-1800** SampType: **MBLK** TestCode: **SM 2540D: TSS**
Client ID: **PBW** Batch ID: **1800** RunNo: **2570**
Prep Date: **5/3/2012** Analysis Date: **5/3/2012** SeqNo: **71656** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0								

Sample ID **LCS-1800** SampType: **LCS** TestCode: **SM 2540D: TSS**
Client ID: **LCSW** Batch ID: **1800** RunNo: **2570**
Prep Date: **5/3/2012** Analysis Date: **5/3/2012** SeqNo: **71657** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	93	4.0	96.60	0	96.3	82.9	110			

Sample ID **1205034-001BDUP** SampType: **DUP** TestCode: **SM 2540D: TSS**
Client ID: **BatchQC** Batch ID: **1800** RunNo: **2570**
Prep Date: **5/3/2012** Analysis Date: **5/3/2012** SeqNo: **71663** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0						0	15	

Qualifiers:

*/X Value exceeds Maximum Contaminant Level.
E Value above quantitation range
J Analyte detected below quantitation limits
R RPD outside accepted recovery limits
B Analyte detected in the associated Method Blank
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
RL Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name:	NEW MEXICO COPPER CORP	Work Order Number: 1205076	
Received by/date:	AT 05/02/12		
Logged By:	Anne Thorne	5/2/2012 7:30:00 AM	Anne Thorne
Completed By:	Anne Thorne	5/2/2012	Anne Thorne
Reviewed By:	AT 05/02/12		

Chain of Custody

1. Were seals intact? Yes ☐ No ☐ Not Present ☑
2. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
3. How was the sample delivered? Client

Log In

4. Coolers are present? (see 19. for cooler specific information) Yes ☑ No ☐ NA ☐
5. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
6. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
7. Sample(s) in proper container(s)? Yes ☑ No ☐
8. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
9. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
10. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
11. VOA vials have zero headspace? Yes ☑ No ☐ No VOA Vials ☐
12. Were any sample containers received broken? Yes ☐ No ☑
13. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
14. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
15. Is it clear what analyses were requested? Yes ☑ No ☐
16. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

\# of preserved bottles checked for pH: 1
(<2 or >12 unless noted)
Adjusted?
Checked by: AT 05/02/12

Special Handling (if applicable)

17. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:	Date
By Whom:	Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:	
Client Instructions:	

18. Additional remarks:

19. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.4	Good	Not Present			

Chain-of-Custody Record

Client: New Mexico Copper Corp	Turn-Around Time: ☐ Standard ☒ Rush Need Results by May 11 via email
Mailing Address: 2425 San Pedro Dr NE Suite 100, ABQ NM	Project Name: CuFlat
Phone #: 505.400.7925	Project #: Production Well Sampling
email or Fax#:	Project Manager: Katie Emmer
QA/QC Package: ☐ Standard ☐ Level 4 (Full Validation)	Sampler: CMC
Accreditation ☐ NELAP ☐ Other	On Ice: ☒ Yes ☐ No
☐ EDD (Type)	Sample Temperature: 3.7°

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1205076	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)	see enclosed list				Air Bubbles (Y or N)
5.1.12	1400	H_2O	PW-1	500		-001												X				
				125	H_2SO_4	-001																
				125	HNO3 + filter	-001																
				500	HNO3	-001																
				500	NaOH	-001																

Date	Time	Relinquished by:	Received by:	Date	Time
5/1/12	14:30	[signature]	[signature]	May 1 2012	14:30
5/2/12	07:50	[signature]	[signature]	05/02/12	0730

Remarks: Please email results to: Katie Emmer kemmer@themacresourcesgroup.com

Please add Hardness, per Katie. [initials] 5/3

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

NM Copper
May 1, 2012

Table 9-3
Analytical Parameters and Analysis Methods for Groundwater Samples

Analytical Parameter	Analysis Method	Lab Detection Limit (mg/L unless noted)
Anions		
Fluoride	EPA Method 300.0	0.1
Chloride	EPA Method 300.0	0.1
Nitrogen, Nitrite (as N)	EPA Method 300.0	0.1
Nitrogen, Nitrate (as N)	EPA Method 300.0	0.1
Sulfate	EPA Method 300.0	0.5
Dissolved Metals		
Aluminum	EPA Method 200.7	0.02
Antimony	EPA Method 200.8	0.005
Arsenic	EPA Method 200.8	0.02
Barium	EPA Method 200.7	0.002
Beryllium	EPA Method 200.7	0.002
Boron	EPA Method 200.7	0.04
Cadmium	EPA Method 200.7	0.002
Calcium	EPA Method 200.7	0.50
Chromium	EPA Method 200.7	0.006
Cobalt	EPA Method 200.7	0.006
Copper	EPA Method 200.7	0.0003
Iron	EPA Method 200.7	0.02
Lead	EPA Method 200.7	0.005
Magnesium	EPA Method 200.7	0.50
Manganese	EPA Method 200.7	0.002
Mercury	EPA Method 7470 CVAA	0.0002
Molybdenum	EPA Method 200.7	0.008
Nickel	EPA Method 200.7	0.01
Potassium	EPA Method 200.7	1.0
Selenium	EPA Method 200.8	0.02
Silicon	EPA Method 200.7	0.08
Silver	EPA Method 200.7	0.005
Sodium	EPA Method 200.7	0.5

NM Copper
May 1, 2012

Analytical Parameter	Analysis Method	Lab Detection Limit (mg/L unless noted)
Thallium	EPA Method 200.7	0.01
~~Titanium~~	~~EPA Method 200.7~~	~~0.005~~
Uranium	EPA Method 200.8	0.01
Vanadium	EPA Method 200.7	0.005
Zinc	EPA Method 200.7	0.005
Solids		
Total Suspended Solids (TSS)	SM 2540D	1.0 µg/L
Total Dissolved Solids (TDS)	SM 2540C	10
Alkalinity		
Alkalinity, total (as $CaCO_3$)	SM 2320B	20
Carbonate	SM 2320B	20
Bicarbonate	SM 2320B	20
Other		
pH	150.1	12.45
Specific Conductance	120.1	0.01 µS/cm
Cyanide	Kelada-01	0.005

Note: NA = not applicable as sample will not be analyzed for a given parameter.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

May 14, 2012

Katie Emmer
New Mexico Copper Corp
2425 San Pedro Dr NE Ste 100
Albuquerque, New Mexico 87109
TEL: (505) 400-7925
FAX

RE: Cu Flat OrderNo.: 1205153

Dear Katie Emmer:

Hall Environmental Analysis Laboratory received 1 sample(s) on 5/3/2012 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1205153**
Date Reported: **5/14/2012**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: New Mexico Copper Corp | **Client Sample ID:** PW-3
Project: Cu Flat | **Collection Date:** 5/2/2012 2:30:00 PM
Lab ID: 1205153-001 | **Matrix:** AQUEOUS | **Received Date:** 5/3/2012 8:35:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 300.0: ANIONS						Analyst: **BRM**
Fluoride	1.9	0.10		mg/L	1	5/3/2012 12:04:13 PM
Chloride	50	10		mg/L	20	5/3/2012 12:41:28 PM
Nitrogen, Nitrite (As N)	ND	0.10		mg/L	1	5/3/2012 12:04:13 PM
Nitrogen, Nitrate (As N)	0.70	0.10		mg/L	1	5/3/2012 12:04:13 PM
Sulfate	26	0.50		mg/L	1	5/3/2012 12:04:13 PM
EPA METHOD 200.7: DISSOLVED METALS						Analyst: **ELS**
Aluminum	ND	0.020		mg/L	1	5/8/2012 8:09:23 AM
Barium	0.0078	0.0020		mg/L	1	5/8/2012 8:09:23 AM
Beryllium	ND	0.0020		mg/L	1	5/8/2012 8:09:23 AM
Boron	0.095	0.040		mg/L	1	5/9/2012 8:40:03 AM
Cadmium	ND	0.0020		mg/L	1	5/8/2012 8:09:23 AM
Calcium	20	1.0		mg/L	1	5/9/2012 8:40:03 AM
Chromium	0.0060	0.0060		mg/L	1	5/8/2012 8:09:23 AM
Cobalt	ND	0.0060		mg/L	1	5/8/2012 8:09:23 AM
Copper	ND	0.0060		mg/L	1	5/8/2012 8:09:23 AM
Iron	0.065	0.020		mg/L	1	5/9/2012 8:40:03 AM
Lead	ND	0.0050		mg/L	1	5/8/2012 8:09:23 AM
Magnesium	1.0	1.0		mg/L	1	5/9/2012 8:40:03 AM
Manganese	0.0026	0.0020		mg/L	1	5/8/2012 8:09:23 AM
Molybdenum	ND	0.0080		mg/L	1	5/8/2012 8:09:23 AM
Nickel	ND	0.010		mg/L	1	5/8/2012 8:09:23 AM
Potassium	3.3	1.0		mg/L	1	5/9/2012 8:40:03 AM
Silicon	21	0.40		mg/L	5	5/8/2012 8:12:46 AM
Silver	ND	0.0050		mg/L	1	5/8/2012 8:09:23 AM
Sodium	81	1.0		mg/L	1	5/9/2012 8:40:03 AM
Vanadium	ND	0.050		mg/L	1	5/8/2012 8:09:23 AM
Zinc	0.021	0.010		mg/L	1	5/8/2012 8:09:23 AM
EPA 200.8: DISSOLVED METALS						Analyst: **SNV**
Antimony	ND	0.0010		mg/L	1	5/8/2012 1:19:22 PM
Arsenic	0.0074	0.0010		mg/L	1	5/8/2012 1:19:22 PM
Selenium	ND	0.0010		mg/L	1	5/10/2012 2:32:54 PM
Thallium	ND	0.0010		mg/L	1	5/8/2012 1:19:22 PM
Uranium	0.0013	0.0010		mg/L	1	5/10/2012 2:32:54 PM
EPA METHOD 245.1: MERCURY						Analyst: **ELS**
Mercury	ND	0.00020		mg/L	1	5/9/2012 12:01:31 PM
SM2340B: HARDNESS						Analyst: **ELS**
Hardness (As CaCO3)	53	6.6		mg/L	1	5/9/2012
EPA 120.1: SPECIFIC CONDUCTANCE						Analyst: **DBD**
Conductivity	460	0.010		µmhos/cm	1	5/7/2012 12:36:13 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **5/14/2012**

CLIENT: New Mexico Copper Corp | **Client Sample ID:** PW-3
Project: Cu Flat | **Collection Date:** 5/2/2012 2:30:00 PM
Lab ID: 1205153-001 | **Matrix:** AQUEOUS | **Received Date:** 5/3/2012 8:35:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM4500-H+B: PH						Analyst: **JLF**
pH	8.03	1.68	H	pH units	1	5/3/2012 5:14:04 PM
SM2320B: ALKALINITY						Analyst: **JLF**
Bicarbonate (As CaCO3)	120	20		mg/L CaCO3	1	5/3/2012 5:14:04 PM
Carbonate (As CaCO3)	ND	2.0		mg/L CaCO3	1	5/3/2012 5:14:04 PM
Total Alkalinity (as CaCO3)	120	20		mg/L CaCO3	1	5/3/2012 5:14:04 PM
SM2540C MOD: TOTAL DISSOLVED SOLIDS						Analyst: **KS**
Total Dissolved Solids	303	20.0		mg/L	1	5/8/2012 3:12:00 PM
SM 2540D: TSS						Analyst: **KS**
Suspended Solids	ND	4.0		mg/L	1	5/4/2012 4:36:00 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Anatek Labs, Inc.

1282 Alturas Drive • Moscow, ID 83843 • (208) 883-2839 • Fax (208) 882-9246 • email moscow@anateklabs.com
504 E Sprague Ste. D • Spokane WA 99202 • (509) 838-3999 • Fax (509) 838-4433 • email spokane@anateklabs.com

Client:	HALL ENVIRONMENTAL ANALYSIS LAB	**Batch #:**	120504004
Address:	4901 HAWKINS NE SUITE D	**Project Name:**	1205153
	ALBUQUERQUE, NM 87109		
Attn:	ANDY FREEMAN		

Analytical Results Report

Sample Number	120504004-001	**Sampling Date**	5/2/2012	**Date/Time Received**	5/4/2012	10:18 AM
Client Sample ID	1205153-001D / PW-3	**Sampling Time**	2:30 PM			
Matrix	Water	**Sample Location**				
Comments						

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Cyanide	ND	mg/L	0.01	5/8/2012	CRW	EPA 335.4	

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **PBW**	Batch ID: **R2622**	RunNo: **2622**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **72991** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	ND	0.020								
Barium	ND	0.0020								
Beryllium	ND	0.0020								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Cobalt	ND	0.0060								
Copper	ND	0.0060								
Lead	ND	0.0050								
Manganese	ND	0.0020								
Molybdenum	ND	0.0080								
Nickel	ND	0.010								
Silicon	ND	0.080								
Silver	ND	0.0050								
Vanadium	ND	0.050								
Zinc	ND	0.010								

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **LCSW**	Batch ID: **R2622**	RunNo: **2622**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **72992** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.52	0.020	0.5000	0	105	85	115			
Barium	0.49	0.0020	0.5000	0	98.9	85	115			
Beryllium	0.52	0.0020	0.5000	0	103	85	115			
Cadmium	0.50	0.0020	0.5000	0	99.2	85	115			
Chromium	0.49	0.0060	0.5000	0	98.5	85	115			
Cobalt	0.47	0.0060	0.5000	0	94.9	85	115			
Copper	0.50	0.0060	0.5000	0	99.9	85	115			
Lead	0.50	0.0050	0.5000	0	99.3	85	115			
Manganese	0.48	0.0020	0.5000	0	96.9	85	115			
Molybdenum	0.49	0.0080	0.5000	0.002030	98.4	85	115			
Nickel	0.47	0.010	0.5000	0	93.9	85	115			
Silicon	2.6	0.080	2.500	0	104	85	115			
Silver	0.094	0.0050	0.1000	0	94.1	85	115			
Vanadium	0.52	0.050	0.5000	0	104	85	115			
Zinc	0.50	0.010	0.5000	0	101	85	115			

Sample ID **1205193-005EMS**	SampType: **MS**	TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC**	Batch ID: **R2622**	RunNo: **2622**
Prep Date:	Analysis Date: **5/8/2012**	SeqNo: **73030** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2622** RunNo: **2622**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73030** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.54	0.020	0.5000	0	107	70	130			
Barium	0.52	0.0020	0.5000	0.02182	98.9	70	130			
Zinc	0.54	0.010	0.5000	0.03785	101	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2622** RunNo: **2622**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73031** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Aluminum	0.53	0.020	0.5000	0	106	70	130	1.33	20	
Barium	0.51	0.0020	0.5000	0.02182	97.2	70	130	1.71	20	
Zinc	0.53	0.010	0.5000	0.03785	98.0	70	130	2.48	20	

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74182** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	56	1.0	50.00	4.808	102	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74183** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Potassium	57	1.0	50.00	4.808	104	70	130	2.44	20	

Sample ID **1205193-005EMS** SampType: **MS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74185** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Iron	4.5	0.10	2.500	2.034	99.6	70	130			
Magnesium	390	5.0	250.0	124.9	107	70	130			
Sodium	460	5.0	250.0	192.5	107	70	130			

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74186** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Iron	4.6	0.10	2.500	2.034	101	70	130	1.03	20	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**
14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205193-005EMSD** SampType: **MSD** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74186** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Magnesium	390	5.0	250.0	124.9	106	70	130	0.684	20	
Sodium	460	5.0	250.0	192.5	106	70	130	0.966	20	

Sample ID **MB** SampType: **MBLK** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **PBW** Batch ID: **R2670** RunNo: **2670**
Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74215** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	ND	0.040								
Calcium	ND	1.0								
Iron	ND	0.020								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA Method 200.7: Dissolved Metals**
Client ID: **LCSW** Batch ID: **R2670** RunNo: **2670**
Prep Date: Analysis Date: **5/9/2012** SeqNo: **74216** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Boron	0.51	0.040	0.5000	0	101	85	115			
Calcium	54	1.0	50.00	0	107	85	115			
Iron	0.47	0.020	0.5000	0.004190	93.2	85	115			
Magnesium	54	1.0	50.00	0	109	85	115			
Potassium	53	1.0	50.00	0	106	85	115			
Sodium	54	1.0	50.00	0	107	85	115			

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205153**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **LCS** SampType: **LCS** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW** Batch ID: **R2629** RunNo: **2629**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73283** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	0.023	0.0010	0.02500	0	92.8	85	115			
Arsenic	0.023	0.0010	0.02500	0	93.1	85	115			
Thallium	0.023	0.0010	0.02500	0	92.9	85	115			

Sample ID **MB** SampType: **MBLK** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW** Batch ID: **R2629** RunNo: **2629**
Prep Date: Analysis Date: **5/8/2012** SeqNo: **73284** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Antimony	ND	0.0010								
Arsenic	ND	0.0010								
Thallium	ND	0.0010								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW** Batch ID: **R2708** RunNo: **2708**
Prep Date: Analysis Date: **5/10/2012** SeqNo: **75447** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	0.026	0.0010	0.02500	0	104	85	115			
Uranium	0.025	0.0010	0.02500	0	99.2	85	115			

Sample ID **MB** SampType: **MBLK** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW** Batch ID: **R2708** RunNo: **2708**
Prep Date: Analysis Date: **5/10/2012** SeqNo: **75448** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	ND	0.0010								
Uranium	ND	0.0010								

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB-1862** SampType: **MBLK** TestCode: **EPA Method 245.1: Mercury**

Client ID: **PBW** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74223** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	ND	0.00020								

Sample ID **LCS-1862** SampType: **LCS** TestCode: **EPA Method 245.1: Mercury**

Client ID: **LCSW** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74224** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.4	80	120			

Sample ID **1204854-004AMS** SampType: **MS** TestCode: **EPA Method 245.1: Mercury**

Client ID: **BatchQC** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74226** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.2	75	125			

Sample ID **1204854-004AMSD** SampType: **MSD** TestCode: **EPA Method 245.1: Mercury**

Client ID: **BatchQC** Batch ID: **1862** RunNo: **2669**

Prep Date: **5/9/2012** Analysis Date: **5/9/2012** SeqNo: **74227** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.1	75	125	0.0957	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB**	SampType: **MBLK**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW**	Batch ID: **R2561**	RunNo: **2561**
Prep Date:	Analysis Date: **5/3/2012**	SeqNo: **71254** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID **LCS**	SampType: **LCS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW**	Batch ID: **R2561**	RunNo: **2561**
Prep Date:	Analysis Date: **5/3/2012**	SeqNo: **71255** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.48	0.10	0.5000	0	95.5	90	110			
Chloride	4.8	0.50	5.000	0	96.2	90	110			
Nitrogen, Nitrite (As N)	0.98	0.10	1.000	0	98.2	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	101	90	110			
Sulfate	9.8	0.50	10.00	0	97.5	90	110			

Sample ID **1205153-001AMS**	SampType: **MS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PW-3**	Batch ID: **R2561**	RunNo: **2561**
Prep Date:	Analysis Date: **5/3/2012**	SeqNo: **71257** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	2.4	0.10	0.5000	1.941	84.8	72.9	113			
Nitrogen, Nitrite (As N)	0.96	0.10	1.000	0	96.5	77.6	111			
Nitrogen, Nitrate (As N)	3.3	0.10	2.500	0.7031	102	82.8	116			
Sulfate	37	0.50	10.00	26.34	106	80.5	119			

Sample ID **1205153-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 300.0: Anions**
Client ID: **PW-3**	Batch ID: **R2561**	RunNo: **2561**
Prep Date:	Analysis Date: **5/3/2012**	SeqNo: **71258** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	2.4	0.10	0.5000	1.941	84.1	72.9	113	0.155	20	
Nitrogen, Nitrite (As N)	0.92	0.10	1.000	0	92.4	77.6	111	4.30	20	
Nitrogen, Nitrate (As N)	3.1	0.10	2.500	0.7031	97.9	82.8	116	3.36	20	
Sulfate	37	0.50	10.00	26.34	102	80.5	119	1.04	20	

Sample ID **1205167-005AMS**	SampType: **MS**	TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC**	Batch ID: **R2561**	RunNo: **2561**
Prep Date:	Analysis Date: **5/3/2012**	SeqNo: **71285** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205167-005AMS** SampType: **MS** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2561** RunNo: **2561**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71285** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	0.94	0.10	1.000	0	94.4	77.6	111			

Sample ID **1205167-005AMSD** SampType: **MSD** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2561** RunNo: **2561**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71286** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	0.94	0.10	1.000	0	94.4	77.6	111	0.0232	20	

Sample ID **MB** SampType: **MBLK** TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW** Batch ID: **R2561** RunNo: **2561**
Prep Date: Analysis Date: **5/4/2012** SeqNo: **71314** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.10								
Chloride	ND	0.50								
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Sulfate	ND	0.50								

Sample ID **LCS** SampType: **LCS** TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW** Batch ID: **R2561** RunNo: **2561**
Prep Date: Analysis Date: **5/4/2012** SeqNo: **71315** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.51	0.10	0.5000	0	101	90	110			
Chloride	4.7	0.50	5.000	0	93.9	90	110			
Nitrogen, Nitrite (As N)	0.96	0.10	1.000	0	96.1	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	98.0	90	110			
Sulfate	9.5	0.50	10.00	0	94.7	90	110			

Sample ID **1205174-001BMS** SampType: **MS** TestCode: **EPA Method 300.0: Anions**
Client ID: **BatchQC** Batch ID: **R2561** RunNo: **2561**
Prep Date: Analysis Date: **5/4/2012** SeqNo: **71317** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	1.4	0.10	0.5000	0.9876	91.1	72.9	113			
Chloride	14	0.50	5.000	8.329	103	78	107			
Nitrogen, Nitrite (As N)	0.96	0.10	1.000	0	95.8	77.6	111			
Nitrogen, Nitrate (As N)	6.0	0.10	2.500	3.372	106	82.8	116			
Sulfate	45	0.50	10.00	35.20	102	80.5	119			

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID	1205174-001BMSD	SampType:	MSD	TestCode:	EPA Method 300.0: Anions		
Client ID:	BatchQC	Batch ID:	R2561	RunNo:	2561		
Prep Date:		Analysis Date:	5/4/2012	SeqNo:	71318	Units:	mg/L

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	1.4	0.10	0.5000	0.9876	90.1	72.9	113	0.330	20	
Chloride	13	0.50	5.000	8.329	103	78	107	0.0337	20	
Nitrogen, Nitrite (As N)	0.96	0.10	1.000	0	95.7	77.6	111	0.0653	20	
Nitrogen, Nitrate (As N)	6.0	0.10	2.500	3.372	106	82.8	116	0.00611	20	
Sulfate	45	0.50	10.00	35.20	101	80.5	119	0.199	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205153**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205170-001D**	SampType: **DUP**			TestCode: **EPA 120.1: Specific Conductance**						
Client ID: **BatchQC**	Batch ID: **R2646**			RunNo: **2646**						
Prep Date:	Analysis Date: **5/7/2012**			SeqNo: **73516**		Units: **µmhos/cm**				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Conductivity	610	0.010						0	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID	1205005-001A DUP	SampType:	DUP	TestCode:	SM4500-H+B: pH					
Client ID:	BatchQC	Batch ID:	R2560	RunNo:	2560					
Prep Date:		Analysis Date:	5/3/2012	SeqNo:	71363	Units:	pH units			
Analyte	**Result**	**PQL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPDLimit**	**Qual**
pH	3.92	1.68						0.762		H

Sample ID	1205120-001B DUP	SampType:	DUP	TestCode:	SM4500-H+B: pH					
Client ID:	BatchQC	Batch ID:	R2560	RunNo:	2560					
Prep Date:		Analysis Date:	5/3/2012	SeqNo:	71373	Units:	pH units			
Analyte	**Result**	**PQL**	**SPK value**	**SPK Ref Val**	**%REC**	**LowLimit**	**HighLimit**	**%RPD**	**RPDLimit**	**Qual**
pH	7.73	1.68						0.645		H

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205153**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp
Project: Cu Flat

Sample ID **1205005-001A MS** SampType: **MS** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71221** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20	80.00	0	0	62.6	110			S

Sample ID **1205005-001A MSD** SampType: **MSD** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71222** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20	80.00	0	0	59.9	111	0	10	S

Sample ID **1205120-001B MS** SampType: **MS** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71242** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	360	20	80.00	299.4	70.9	62.6	110			

Sample ID **1205120-001B MSD** SampType: **MSD** TestCode: **SM2320B: Alkalinity**
Client ID: **BatchQC** Batch ID: **R2560** RunNo: **2560**
Prep Date: Analysis Date: **5/3/2012** SeqNo: **71243** Units: **mg/L CaCO3**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	350	20	80.00	299.4	67.1	59.9	111	0.869	10	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1205153**

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB-1832**	SampType: **MBLK**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **PBW**	Batch ID: **1832**	RunNo: **2634**
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73329** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID **LCS-1832**	SampType: **LCS**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **LCSW**	Batch ID: **1832**	RunNo: **2634**
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73330** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1,020	20.0	1,000	0	102	80	120			

Sample ID **1205078-002GMS**	SampType: **MS**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **BatchQC**	Batch ID: **1832**	RunNo: **2634**
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73337** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	4,890	20.0	1,000	3,791	110	80	120			

Sample ID **1205078-002GMSD**	SampType: **MSD**	TestCode: **SM2540C MOD: Total Dissolved Solids**
Client ID: **BatchQC**	Batch ID: **1832**	RunNo: **2634**
Prep Date: **5/7/2012**	Analysis Date: **5/8/2012**	SeqNo: **73338** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	4,930	20.0	1,000	3,791	114	80	120	0.733	20	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

WO#: **1205153**

Hall Environmental Analysis Laboratory, Inc.

14-May-12

Client: New Mexico Copper Corp

Project: Cu Flat

Sample ID **MB-1808**	SampType: **MBLK**	TestCode: **SM 2540D: TSS**	
Client ID: **PBW**	Batch ID: **1808**	RunNo: **2606**	
Prep Date: **5/4/2012**	Analysis Date: **5/4/2012**	SeqNo: **72551**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0								

Sample ID **LCS-1808**	SampType: **LCS**	TestCode: **SM 2540D: TSS**	
Client ID: **LCSW**	Batch ID: **1808**	RunNo: **2606**	
Prep Date: **5/4/2012**	Analysis Date: **5/4/2012**	SeqNo: **72552**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	94	4.0	96.60	0	97.3	82.9	110			

Sample ID **1205122-001BDUP**	SampType: **DUP**	TestCode: **SM 2540D: TSS**	
Client ID: **BatchQC**	Batch ID: **1808**	RunNo: **2606**	
Prep Date: **5/4/2012**	Analysis Date: **5/4/2012**	SeqNo: **72556**	Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0						0	15	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: NEW MEXICO COPPER CORP   Work Order Number: 1205153

Received by/date: AT 05/03/12

Logged By: **Anne Thorne** 5/3/2012 8:35:00 AM *Anne Thorne*

Completed By: **Anne Thorne** 5/3/2012 *Anne Thorne*

Reviewed By: AT 05/03/12

Chain of Custody

1. Were seals intact? Yes ☐ No ☐ Not Present ☑
2. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
3. How was the sample delivered? Client

Log In

4. Coolers are present? (see 19. for cooler specific information) Yes ☑ No ☐ NA ☐
5. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
6. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
7. Sample(s) in proper container(s)? Yes ☑ No ☐
8. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
9. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
10. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
11. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☑
12. Were any sample containers received broken? Yes ☐ No ☑
13. Does paperwork match bottle labels? Yes ☑ No ☐
(Note discrepancies on chain of custody)
14. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
15. Is it clear what analyses were requested? Yes ☑ No ☐
16. Were all holding times able to be met? Yes ☑ No ☐
(If no, notify customer for authorization.)

# of preserved bottles checked for pH: 3 /
(<2 or >12 unless noted)
Adjusted?
Checked by: AT 05/03/12

Special Handling (if applicable)

17. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

18. Additional remarks:

19. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.6	Good	Not Present			

Chain-of-Custody Record

Client: NMCC

Mailing Address: 2425 San Pedro NE Ste 100
Albuquerque, NM

Phone #: 505-400-7925

email or Fax#:

QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other ____

☐ EDD (Type) ____

Turn-Around Time: Need Results May 11
☐ Standard ☒ Rush May 11

Project Name: Cu Flat

Project #: Production Well Sampling

Project Manager: Katie Emmer

Sampler: CMC

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.1°

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

- BTEX + MTBE + TMB's (8021)
- BTEX + MTBE + TPH (Gas only)
- TPH Method 8015B (Gas/Diesel)
- TPH (Method 418.1)
- EDB (Method 504.1)
- 8310 (PNA or PAH)
- RCRA 8 Metals
- Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)
- 8081 Pesticides / 8082 PCB's
- 8260B (VOA)
- 8270 (Semi-VOA)
- See attached list
- Air Bubbles (Y or N)

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1205153	See attached list
5.2.12	14:30	H_2O	PW-3	500	none	-001	↑
↓	↓	↓		125	H_2SO_4	-001	↓
↓	↓	↓		125	HNO_3 & filter	-001	↓
↓	↓	↓		500	HNO_3	-001	↓
↓	↓	↓		500	NaOH	-001	↓

Date	Time	Relinquished by	Received by	Date	Time
5-3-12	8:35	[signature]	[signature]	05/03/12	0835

Remarks: Please add Hardness per Andy of Katie 5/3
Need Results by May 11
Please email to: Kemmer@themacresourcesgroup.com

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Table 9-3

Analytical Parameters and Analysis Methods for Groundwater Samples

Analytical Parameter	Analysis Method	Lab Detection Limit (mg/L unless noted)
Anions		
Fluoride	EPA Method 300.0	0.1
Chloride	EPA Method 300.0	0.1
Nitrogen, Nitrite (as N)	EPA Method 300.0	0.1
Nitrogen, Nitrate (as N)	EPA Method 300.0	0.1
Sulfate	EPA Method 300.0	0.5
Dissolved Metals		
Aluminum	EPA Method 200.7	0.02
Antimony	EPA Method 200.8	0.005
Arsenic	EPA Method 200.8	0.02
Barium	EPA Method 200.7	0.002
Beryllium	EPA Method 200.7	0.002
Boron	EPA Method 200.7	0.04
Cadmium	EPA Method 200.7	0.002
Calcium	EPA Method 200.7	0.50
Chromium	EPA Method 200.7	0.006
Cobalt	EPA Method 200.7	0.006
Copper	EPA Method 200.7	0.0003
Iron	EPA Method 200.7	0.02
Lead	EPA Method 200.7	0.005
Magnesium	EPA Method 200.7	0.50
Manganese	EPA Method 200.7	0.002
Mercury	EPA Method 7470 CVAA	0.0002
Molybdenum	EPA Method 200.7	0.008
Nickel	EPA Method 200.7	0.01
Potassium	EPA Method 200.7	1.0
Selenium	EPA Method 200.8	0.02
Silicon	EPA Method 200.7	0.08
Silver	EPA Method 200.7	0.005
Sodium	EPA Method 200.7	0.5

Analytical Parameter	Analysis Method	Lab Detection Limit (mg/L unless noted)
Thallium	EPA Method 200.7	0.01
~~Titanium~~	~~EPA Method 200.7~~	~~0.005~~
Uranium	EPA Method 200.8	0.01
Vanadium	EPA Method 200.7	0.005
Zinc	EPA Method 200.7	0.005
Solids		
Total Suspended Solids (TSS)	SM 2540D	1.0 µg/L
Total Dissolved Solids (TDS)	SM 2540C	10
Alkalinity		
Alkalinity, total (as $CaCO_3$)	SM 2320B	20
Carbonate	SM 2320B	20
Bicarbonate	SM 2320B	20
Other		
pH	150.1	12.45
Specific Conductance	120.1	0.01 µS/cm
Cyanide	Kelada-01	0.005

Note: NA = not applicable as sample will not be analyzed for a given parameter.

Appendix F – JSAI Review of Methods and Assumptions for Predicting Open Pit Water Quality

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TECHNICAL MEMORANDUM

To: Steve Raugust, New Mexico Copper Corporation
Katie Emmer, New Mexico Copper Corporation

From: Steven T. Finch, Jr., Principal Hydrogeologist-Geochemist, JSAI

Date: December 17, 2014

Subject: Review of methods and assumptions for predicting open pit water quality, Copper Flat Project, New Mexico

New Mexico Copper Corporation (NMCC) is in the process of obtaining a mining permit for the Copper Flat property near Hillsboro, New Mexico. To determine if the proposed Copper Flat open-pit water would meet New Mexico Water Quality Control Commission (NMWQCC) standards for stock and wildlife use, SRK (2013) prepared a report titled *Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico*. The SRK (2013) geochemical model incorporated the water model developed by JSAI (2013). Reviewers of the SRK (2013) report have raised questions about the following issues:

1. More detail is needed to validate the assumption of 10-percent average fracture density in the pit walls and the amount of wall rock available for leaching.
2. More detail is needed to demonstrate that the proposed open pit water body will be well mixed, remain oxygenated, and not chemically stratify.
3. The geochemical model needs to be calibrated to chloride concentrations in the existing open pit to make sure the effects of evaporation are accounted for.

This Technical Memorandum consists of three sections for addressing the issues listed above. Sections 1.0 and 2.0 compare the SRK (2013) approach and assumptions to other open pit geochemical investigations, Section 3.0 presents calibration and sensitivity analysis results of the water model (JSAI, 2013) to historical water-quality data from the existing open pit, and Section 4.0 is a summary of findings.

1.0 REVIEW OF OPEN PIT WALL-ROCK STUDIES

1.1 SRK (2013) Copper Flat Model

SRK (2013) used different conceptual models of wall rock available for leaching: one for the existing and one for the future Copper Flat open pit. The difference is due to the blasting technique; the existing pit was mined in 1982 using production blasting similar to the blasting effects analyzed by Siskind and Fumanti (1974), and the proposed pit would be mined using presplit drilling and smooth wall blasting practices. The two conceptual models are summarized below.

1.1.1 Existing Open Pit

For the existing Copper Flat open pit, SRK (2013) estimated 10-percent fracturing in the first 2 ft of open pit wall rock (crushed zone) and 5-percent fracturing for a 3.8-ft-thick transition zone. The limit of oxidation and depth to undisturbed rock was assumed to be about 6 ft behind the pit wall (see fig. 3-9; SRK, 2013). A reactive rim of 0.04 ft around the fractures was assumed for the rock in the pit walls (based on HCT results).

Quintana Minerals only used production blasting to create the existing pit. Production blasting uses large widely-spaced explosive charges that are designed to fragment a large amount of *burden* (the rock that lies between the existing slope face and the blast hole). Production blasting is the most efficient way to remove large rock burdens, but it typically creates radial fractures around the blast hole and back break (fractures that extend into the final slope face), which reduce the strength of the remaining rock mass and increase its susceptibility to slope raveling and rock fall.

1.1.2 Proposed Open Pit

For the future Copper Flat open pit, SRK (2013) estimated fracturing is 10 percent of rock volume for the first 1 ft of open pit wall rock (crushed zone), with no transition zone between the crushed zone and undisturbed zone (see fig. 3-3; SRK, 2013). The open pit wall rock approximate 1 ft from the surface was assumed to be the limit of oxidation and the depth to undisturbed rock (see fig. 3-9, SRK, 2013). A reactive rim of 0.04 ft around the fractures was assumed for the rock in the pit walls. The 1-ft crushed zone and no transition zone represent presplit drilling and smooth wall blasting practices. Presplit holes are blasted before production blasts. Procedure uses small diameter holes at close spacing and lightly loaded with distributed charges. Presplit holes protect the final pit wall cut by producing a fracture plane along the final slope face that fractures from production blasts cannot pass.

1.1.3 Rock Mass Available for Leaching

For both scenarios, water flow is assumed to be mobile in the crushed zone and oxidized rind. The calculation of reactive mass was based on an average rock density of 169 lb/ft^3 (2,700 kg/m^3).

Chemistry of open pit run-off, for each pit wall material type, is estimated from scaled kinetic test cell (HCT) leachate concentrations. Average HCT solute concentrations are scaled up based on the pit wall water-rock ratio, and computed based on the estimated degree of fracturing and thickness of the reactive rind (SRK, 2013; p. 30).

1.2 Review of Pit Wall Fracturing References

1.2.1 Blasting Effects

Siskind and Fumanti (1974), a key reference used by SRK (2013), studied the fracturing produced in the vicinity of large-diameter blast holes (production blasting) in Lithonia Granite. The purpose of the Siskind and Fumanti (1974) study was to evaluate the use of production blasting to increase permeability for in-situ mining, where the amount of fracturing between holes is intended to be maximized for economic efficiency. A severely fractured zone was found to extend approximately 25 inches (64 cm) from the center of the 6-1/2-inch (16.5 cm) blast holes. A second zone, characterized by a lesser degree of fracturing, extended from 25 to 45 inches (64 to 114 cm). Beyond 45 inches (114 cm), the rock was undamaged. Carroll and Scott (1966) evaluated blasting effects on quartz monzonite and granodiorite (Climax Stock near Mercury, Nevada) and found that production blasting created an altered zone 0 to 8 ft in depth, and blast damage 2 to 4 ft in depth.

Kelsall and others (1984) found that in granite and basalt blasting enhanced permeability by about 10 times near the blast face, but the extent of blast effects were generally limited to <3.3 ft (<1 m), and possibly as little as 1 ft (0.3 m) when using low-charge blast methods.

It is important to note that granite, granodiorite, and quartz monzonite are similar intrusive rocks with similar rock properties. The primary difference is the quartz and feldspar content. The quartz monzonite at Copper Flat is therefore analogous to the granite and granodiorite in the blasting studies cited above. The Siskind and Fumanti (1974) study cites physical properties of the Lithonia Granite. Recent physical properties or the principal rock types of the Copper Flat Ore are presented in a 2013 report prepared by Mine Design Engineering of Kingston, Ontario, Canada for THEMAC Resources (Mine Design, 2013). The Mine Design report (2013) was prepared for the purposes of engineering the future pit walls for geotechnical stability. Table 1 presents a comparison of selected physical properties Lithonia Granite to the Copper Flat Quartz Monzonite and Quartz Monzonite Breccia.

Figure 1 presents the Copper Flat pit outline (Pre-Feasibility Study; PFS) from the 2013 Mine Design report, which shows the major rock types, their distribution, and the locations of the geotechnical drill holes where the samples from Table 1 were collected. From information presented in Mine Design (2013), and other available information, the Definitive Feasibility Study (DFS) pit geometry was developed. For geochemical characterization purposes, the PFS pit is very similar to the DFS Pit (SRK, 2014).

Table 1. Summary of the physical properties of the Lithonia Granite with Copper Flat Quartz Monzonite (QM) and Quartz Monzonite Breccia (QMBX)

Laboratory Analysis	Lithonia Granite (Tested by prevous investigators)	Lithonia Granite (Tested by authors at H-100 control hole)	QM (Average Values)	QM (Maximum Values)	QM (Minimum Values)	QMBX (Average Values)	QMBX (Maximum Values)	QMBX (Minimum Values)
Specific Gravity	2.63	-	2.68	-	-	2.57	-	-
Density (lb/ft^3)	164	-	167	-	-	160	-	-
Tensile Strength (lb/in^2)	450	-	2,132	3,075	493	1,247	1,697	653
Compressive Strength (lb/in^2)	30,000	28,000	18,490	29,400	11,810	6,614	6,614	6,614
Young's Modulus (lb/in^2)	3,000,000	6,400,000	5,018,000	6,135,000	3,626,000	2,973,000	2,973,000	2,973,000
Poisson's Ratio	0.26	-	0.10	0.09	0.11	0.12	0.12	0.12

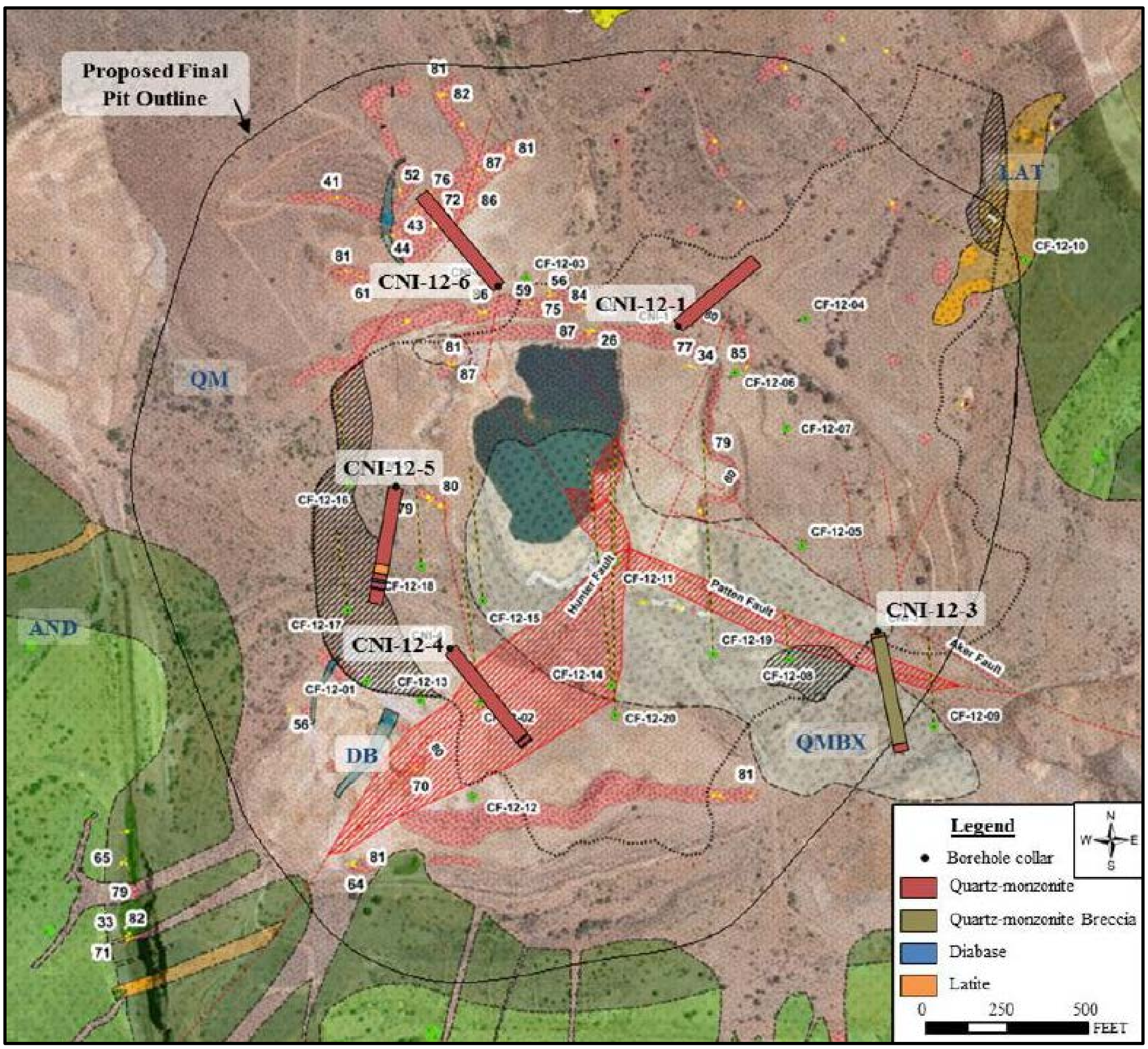


Figure 1. Geotechnical drill hole locations and the Pre-Feasibility Study pit outline (Mine Design, 2013).

1.2.2 Fracture Permeability

Molebatsi and others (2009) noted that many open-pit mines are located in fractured rock systems where water flow paths are complex and difficult to predict. These flow paths are typically controlled by a small subset of fractures that are permeable and interconnected. Most models of flow in fractured rock systems are based on a network of interconnected fractures that are all assumed to be permeable. However, this assumption is rarely observed in natural rocks where a significant number of the fractures within a connected cluster may be impermeable.

Field observations have shown that only a small proportion of fractures contribute to the overall flow, resulting in a complex and heterogeneous flow system. Up to 20 percent of the total number of fractures may contribute to overall flow (Bear et al., 1993). Although fracture connectivity has been used to explain heterogeneous phenomena (de Marsily, 1985), it is likely that additional aspects such as the effect of partial or total closure of individual fractures could further increase flow heterogeneity and tortuosity. Effectively impermeable fractures that (although mappable) will not conduct flow will thus need to be excluded from the conductive fracture cluster.

Not discussed in detail by Molebatsi and others (2009) is the rock type and mineralization of fractures, degree of fracturing, hydraulic conductivity in comparison to fracture density, and specific yield of rock. Obviously, fractured rock with low hydraulic conductivity would have more impermeable fractures than high hydraulic conductivity fractured rock that effectively behaves as a porous medium.

1.3 Other Open-Pit Geochemical Models

1.3.1 URS (2009) Little Rock Mine Post-Closure Pit Lake Model

The Little Rock open pit mine is located near Silver City, New Mexico, and is currently operating. URS (2009) assumed that a mixture of the in-situ field leaching tests and the HCT leachates represents the pit wall runoff. For the most likely case, an equal-weight mixture of the mean in-field leachate results, week-0 HCT results, and HCT results from the first 4-week idle period was used to represent run-on from the exposed pit walls above the pit lake. URS (2009) assumed: 1) rock samples collected within 100 ft of the final pit wall are representative of the exposed wall rock, and 2) a combination of the in-situ field leachates and the HCT leachates mimics weathering of pit wall rock. There is no discussion of blasting effects or increased fracture density on leaching of wall rock.

1.3.2 Tetra Tech (2010) Rosemont Copper Project

The Rosemont Copper project is located in southeastern Arizona. For simulating the initial flushing of blast-fractured pit walls, Tetra Tech (2010) used the first rinse from the HCTs to represent the chemical source terms. The HCT concentrations were generally higher than from the Synthetic Precipitation Leaching Procedure (SPLP) results, which generally correspond to rock that has had more time to weather before contacting water.

The near-surface wall rock of the anticipated ultimate pit shell is expected to be affected by blasting. An initial chemical flushing of the blast-affected pit wall rock was incorporated into the pit lake model. The near-pit wall rock is anticipated to have altered hydraulic properties and increased fracture density as a result of blasting and the extraction of surrounding rock. An increase in the porosity and specific yield (3 to 15 percent) of the near-surface wall rock is expected. The blast-affected wall rock was considered to extend for a distance of six (6) ft behind the ultimate pit wall; there was no basis provided for this assumption.

Where available, the chemical source terms used for flushing of the blast-affected wall rock for each formation were developed using the averaged first-rinse HCT data. Scaling of HCT data was not considered. For formations without HCT data, the concentrations of major cations and anions derived from SPLP tests were multiplied by a factor of three (3) and the trace metals were multiplied by a factor of two (2). Three (3) pore volumes of the blast-affected wall rock were considered in the model for the initial flush, after which standard groundwater inflow chemistry was assumed.

1.3.3 Schafer (2007) Betze Pit Lake Water Quality Predictions

Schafer (2007) estimated the thickness of the weathered zone behind the pit wall by applying the approximate analytical solution (shrinking core model) derived by Davis and others (1986). The shrinking core model considers that particle size and the reactive core shrink simultaneously; therefore, sulfide oxidation rates decrease over time. A porosity of 2 percent was used to represent the highwall, while the rate of interparticle diffusion was determined from historical humidity cell tests. The rate of interparticle diffusion was calculated using the Millington Quirk equation (Jury et al., 1991). For portions of the highwall with relatively low sulfide levels, oxygen can penetrate nearly 16.4 ft (5 m) after 400 years, while the depth of oxygen penetration is closer to 9.8 ft (3 m) after 400 years for higher sulfide zones. The overall average thickness of the oxidized wall rock was estimated to be 9.8 ft (3 m).

1.3.4 Schafer (2010) Dee Pit Lake, Arturo Mine

Schafer (2010) assumes the thickness of a weathered highwall increases with increasing exposure to oxidation. The thickness of the weathered zone was estimated for the Dee pit lakes by applying the approximate analytical solution derived by Davis and others (1986). A porosity of 3 percent was used to represent the highwall. Other data needed to calibrate the Davis and others (1986) equations were determined from pyrite weathering rates observed in humidity cell tests. The rate of interparticle diffusion was calculated using the Millington Quirk equation (Jury et al., 1991). For portions of the highwall with relatively low sulfide levels, oxygen can penetrate over 15 ft (5 m) after 400 years, while the depth of oxygen penetration is closer to 10 ft (3 m) after 400 years for higher sulfide zones (see Fig. 2 below).

1.3.5 Adrian Brown (1997) Cunningham Hill Mine Open Pit

A water model and geochemical model were coupled to predict open pit water quality. The model was calibrated to existing water levels and water-quality data (alkalinity, calcium, and sulfate). Inputs from existing acid wall seepage (AWS) were used to simulate open pit water-rock interactions. The water-quality model was simply a mixing model if open pit water quality remained under-saturated with respect to gypsum.

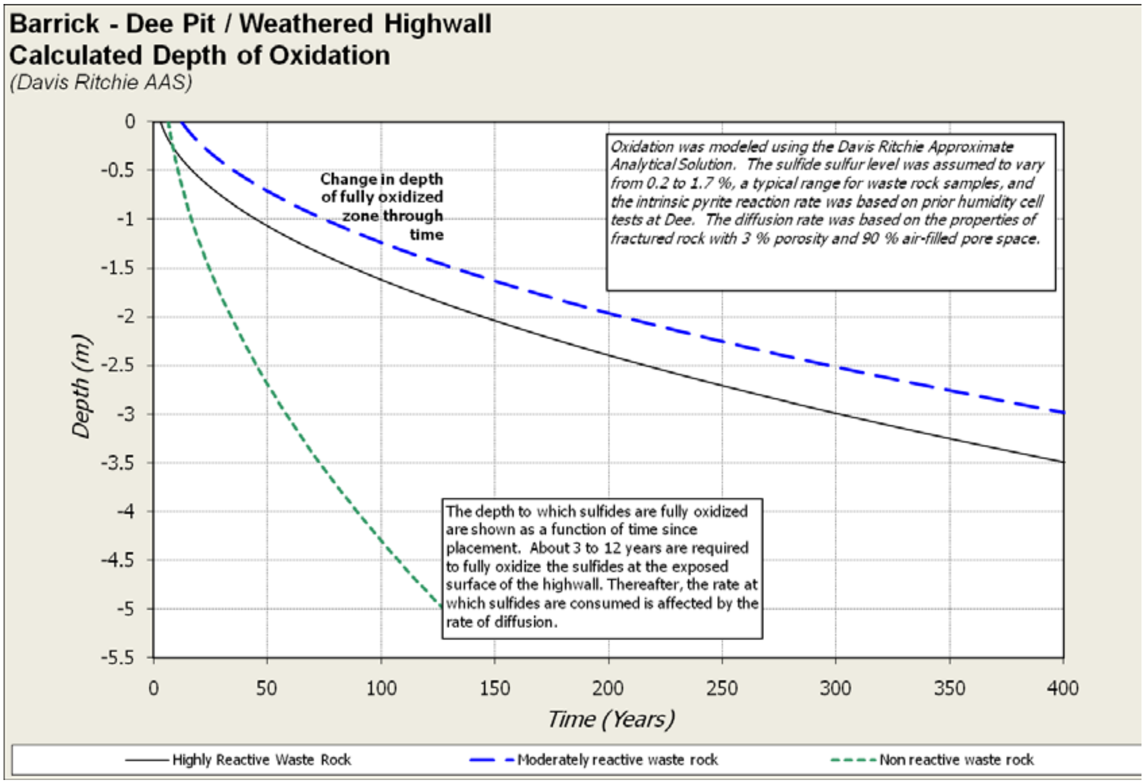


Figure 2. Graph showing depth of oxygen penetration based on the Davis and others (1986) approximate analytical solution (Schafer (2010) Fig. 13).

A groundwater flow and solute transport model of the open pit and surrounding groundwater system was developed by JSAI (1999), and later updated and recalibrated by JSAI (2011). It was demonstrated that the open pit general chemistry is more influenced by water budget components (mixing) than by mineral precipitation reactions.

1.3.6 Kempton and Atkins (2009)

Kempton and Atkins (2009) provide a review of methods for predicting water quality in open pits where sulfide oxidation is a major source term. Shrinking core models have been demonstrated to effectively simulate conditions in uniform materials, such as tailings. However, it is difficult to evaluate accuracy in the more heterogeneous pit benches and walls.

Kempton and Atkins (2009) evaluated a method for direct measurement of sulfide oxidation rates in mine pit benches by sealing a drape-chamber apparatus to the surface. They found that application of this method to benches and waste rock have not found the measured oxidation rates to be meaningfully correlated to sulfide sulfur, presence of surface rubble, moisture conditions, or carbonate content of the underlying rock. This suggests that physical processes such as blast-induced wall rock porosity and depth of pit-wall oxidation were more important than chemical processes. It was noted that fracturing is lower in competent rock, such as granite, and that careful blasting can reduce fracturing. Kempton and Atkins (2009) concluded that reliable comparisons of model-simulated versus observed pit lake water quality are needed to accurately assess model capabilities; this is exactly what SRK (2013) has done.

1.4 Discussion

Geochemical models for predicting open pit water quality are commonly most sensitive to the water budget components and the calculated solute contributions from sulfide oxidation. Open pit water-quality models with the least accurate predictions have under-estimated the potential for sulfide oxidation in wall rock and poorly represented water budget components (Kuipers and others, 2006). One reason for inaccurate water quality predictions is the lack of historical data for model calibration; most projects do not have an existing open pit water body with good time-series data. In contrast, the proposed Copper Flat open pit geochemical and groundwater flow model is calibrated to an existing open pit water body with 30 years of data.

Open pit wall blast damage for granite, granodiorite, and quartz monzonite rocks extends 2 to 4 ft in depth when assessing effects from production type blasting (Carroll and Scott, 1966; Siskind and Fumanti, 1974; and Kelsall and others, 1984).

Kelsall and others (1984) found that production blasting enhances permeability by about 10 times near the blast face. Molebatsi and others (2009) indicate that a small percentage (<20 percent) of the total fractures will contribute to permeability of the system. Typically, fractured rock groundwater systems are assumed to have a specific yield of less than 5 percent, and commonly less than 1 percent. The calibrated Copper Flat groundwater flow model simulates a specific yield of 0.001 (0.1 percent) in the quartz monzonite. If blast fracturing increased the effective porosity (specific yield) by an order of magnitude, the specific yield of the blast zone would be 1 percent. The 5 to 10 percent fracture density used by SRK (2013) can be considered conservative given the properties of the open pit wall rock estimated from the calibrated groundwater flow model.

A summary of the case studies reviewed is presented in Table 2. SRK (2013) is the only open pit water-quality model that includes blasting effects in the pit walls, scaled HCT data, and calibration to existing pit water chemistry.

Table 2. Summary of open pit water-quality prediction studies

reference	open pit	pit wall fracture assumptions	sulfide oxidation model	calibration to existing pit
SRK (2013)	Copper Flat	5 - 10 % fracture density (porosity) with depth based on blasting method; ranging from 1 to 6 ft	based on scaled HCT data	yes
Adrian Brown (1997)	Cunningham Hill	used measured acid wall seepage (AWS) data	used measured AWS data	yes
URS (2009)	Little Rock	none	based on HCT data	no
Tetra Tech (2010)	Rosemont	3 to 6% porosity, 6 ft depth	based on HCT data	no
Schafer (2007)	Betze	2 % porosity with oxidation depth increasing with time; 10 to 16 ft after 400 years	shrinking core model	no
Schafer (2010)	Dee	3 % porosity with oxidation depth increasing with time; 10 to 15 ft after 400 years	shrinking core model	no

2.0 STRATIFICATION OF OPEN PIT WATER BODIES

SRK (2013) concluded the proposed Copper Flat pit will not stratify, and will remain oxygenated. The proposed Copper Flat open pit water body will have a maximum depth of approximately 200 ft with a maximum surface area of about 22 acres.

2.1 Overview

Based on elevation and latitude, the Copper Flat open pit water body is classified as a warm monomitic type lake (Wetzel, 2001; fig 6-7). A warm monomitic lake mixes freely once a year in the winter at or above 4 °C. However, wind effects and water body geometry can have an effect on the degree and frequency of mixing. Baseline data (INTERA, 2012) from the existing pit water body provides evidence that a thermocline develops in the summer and mixing occurs in the winter. A chemocline does not develop, and the water body remains oxygenated (dissolved oxygen = 6 to 9 mg/L) throughout the full water column year-round. The existing open pit water body has an area of about 5 acres, maximum depth of 30 ft, and length of about 460 ft.

The relative depth (RD) of the predicted Copper Flat open pit water body at the maximum pit water stage is approximately 18 percent. RD relates the maximum depth of a lake (Z) to the width (d). Assuming an approximately circular lake, the width is a function of surface area (A) and can be determined from:

$$d = 2(A/\pi)^{0.5}$$

The percent RD is defined as:

$$RD = (Z/d)*100 \text{ percent}$$

The estimated RD of 18 percent is considerably greater than 5 percent, which typically suggests that the lake is likely to stratify. Such stratification may result in oxidizing conditions in the upper portions of the lake and more chemically reducing (oxygen-deprived) conditions at depth. However, pit lakes that form in arid regions are unlikely to stratify, relative to lakes that form in cooler, wetter climates (Jewell, 2009). A prerequisite for permanent stratification is that precipitation plus runoff is greater than evaporation during the summer months when the water body is potentially undergoing temporary thermal stratification (Jewell, 2009).

While stratification of an open pit water body has implications for water quality at depth, the near-surface waters will remain oxidized. These near-surface waters are considered the most important from an open pit water-quality perspective given the potential ecological risks associated with them. The water quality at depth is less important given the expected terminal nature of the open pit water body.

2.2 Case Studies

Jewell (2009) evaluated six permanently-stratified and eight open pit lakes with seasonal thermocline, and concludes that permanently stratified lakes have vertical density contrast greater than 0.0005 g/cm^3 and a Wedderburn number greater than 1. The Wedderburn number considers thermocline depth, maximum lake length, water density, and wind speed. Jewell (2009) failed to note that most permanently-stratified open pit lakes receive AWS inputs and have acidic water. A summary table of existing open pit water bodies and their characteristics is presented in Table 3.

Table 3. Summary of open pit water bodies and stratification characteristics

open pit	location	effective length (ft)	maximum depth (ft)	relative depth (percent)	thermocline depth (ft)	acidic
permanently stratified						
Brenda	B.C.	2,296	492	21	39	no
Spenceville	California	253	50	20	13	yes
Berkeley	Montana	5,900	426	7	23	yes
Seasonal thermocline and well mixed						
Humbolt	Nevada	944	137	15	8	no
Blackhawk	Utah	492	na	na	33	no
Blowout	Utah	656	230	35	39	no
Colosseum	California	482	157	33	na	no
Cunningham Hill	NM	407	90	22	20	no
Copper Flat (existing)	NM	537	30	6	20	no[1]
Copper Flat (proposed)	NM	1,105	200	18	TBD	no
Yerington	Nevada	5,412	400	13	49	no

[1] there have been temporary acidic conditions where the pit water naturally neutralizes over time
TBD - to be determined

2.3 Discussion

The proposed Copper Flat open pit is expected to have a seasonal thermocline, be well mixed, oxygenated, and not acidic. Relative depth does not appear to govern the conditions for creating a permanently stratified open pit water body; however, acidic water and higher latitude are key conditions for creating permanent stratification.

3.0 COPPER FLAT OPEN PIT WATER MODEL

The Copper Flat open pit and groundwater flow model (water model) developed by JSAI (2013) was calibrated to water levels, water budgets, and hydraulic properties. The water model was used by SRK (2013) in the geochemical model. The JSAI (2013) water model was an interim version that was finalized in 2014, but the pit water balance did not change.

The water model is used here to address calibration to the Copper Flat open pit evaporation. Evaporation accounts for all of the outflow from the open pit water body; however, the water model only simulates average climate conditions. Figures 3 through 5 illustrate the model-simulated effects of evaporation on total dissolved solids, (TDS), sulfate, and chloride concentrations in the open pit when considering mixing without mineral precipitation.

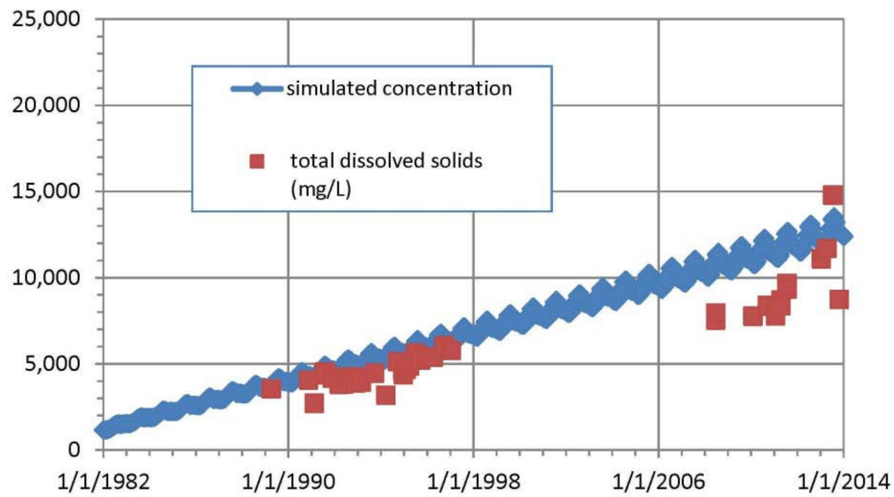


Figure 3. Graph showing water-model simulated and measured TDS concentrations for the Copper Flat open pit water body.

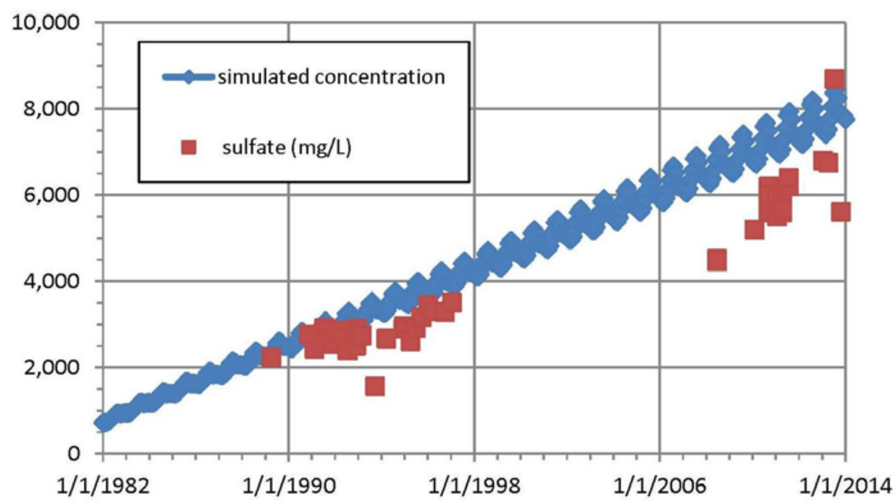


Figure 4. Graph showing water-model simulated and measured sulfate concentrations for the Copper Flat open pit water body.

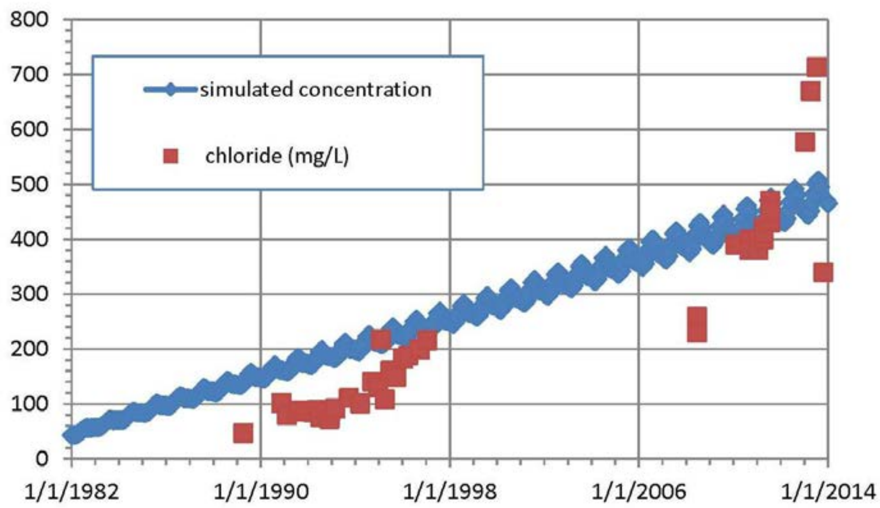


Figure 5. Graph showing water-model simulated and measured chloride concentrations for the Copper Flat open pit water body.

Data collected during 2013 show the evapo-concentration effects of extreme drought with concentrations well above the model-simulated concentrations, but 4th quarter 2013 concentrations were well below the model-simulated concentrations, due to a heavy monsoon period (Figs. 3 through 5). The model appears to reasonably simulate the average climate conditions.

SRK (2013) calibration of the geochemical model to existing pit conditions was performed for the 2011 dataset. The geochemical model considers mixing from the water model and mineral precipitation reactions. The geochemical model calibrates to TDS and sulfate better than the water model with mixing alone, but the water model calibrates better to chloride concentrations than the geochemical model (Table 4). The effects of evaporation are reasonably calibrated in the water model and reflected in the geochemical model.

Table 4. Comparison of water-model and geochemical-model simulated TDS, chloride, and sulfate concentrations to measured concentrations, Copper Flat open pit

constituent	2010-2011 measured range (mg/L)	geochemical-model results (mg/L)	water-model results (mg/L)
total dissolved solids (TDS)	7,770 to 9,410	7,751	11,621
sulfate	5,200 to 6,400	5,152	7,263
chloride	380 to 470	235	436

mg/L - milligrams per liter

4.0 SUMMARY OF FINDINGS

In summary, SRK (2013) assumptions used for reactive wall thickness and fracture density for the existing and proposed future pit are reasonable and supported by detailed studies pertaining to blasting effects on quartz monzonite rocks cited in Section 1.0. SRK (2013) used fracture-density results reflective of production blasting for the existing Quintana pit walls, and fracture density results reflective of low-charge blasting methods for the future open pit. Sensitivity of model results to fracture density and reactive wall thickness is reflected in these two simulations.

Out of the case studies reviewed (Table 2), SRK (2013) is the only open pit water quality model that considers blasting effects in the pit walls, scaled HCT data, and calibration to existing pit water chemistry. Calibration of the water model and geochemical model to existing data strengthens the ability to accurately predict future conditions.

Relative depth does not appear to govern the conditions for creating a permanently stratified open pit water body; however, significant acidic water inputs and higher latitude are key conditions for creating permanent stratification. The proposed Copper Flat open pit is expected to be seasonally stratified (thermocline only), well mixed, oxygenated, and not acidic. Baseline data from profiles in the existing pit at Copper Flat support the conclusion that the proposed pit will be well mixed and oxygenated.

Using the water model to simulate mixing and evapoconcentration effects on chloride, sulfate, and TDS demonstrates that the water model is calibrated to the effects of evaporation. The results in Table 4 compare simulated evapoconcentration with no mineral precipitation (water model only) to simulated evapoconcentration with mineral precipitation (water model and geochemical model). This comparison of model results to historical data is a sensitivity analysis that shows that the water and geochemical models are well calibrated to effects of evaporation.

The SRK (2013) geochemical model is representative of expected conditions at Copper Flat, and presents the best technical approach for predicting water quality at the future Copper Flat open pit.

5.0 REFERENCES

Adrian Brown, 1997, Effects of the proposed diversion of upper Cunningham Gulch to the Cunningham Hill Mine open pit: consultant's report prepared by Adrian Brown for LAC Minerals (USA) Inc.

Bear, J., Tsang, C.F., and Marsily, G.D., 1993, Flow and contaminant transport in fractured rocks: Academic Press, San Diego, CA (United States), United States, 560 p.

Carroll, R.D., and Scott, J.H., 1966, Uphole seismic measurements as an indication of stress relief in granitic rock tunnels: U.S. Geological Survey Professional Paper 550-D, pp. D138-D143.

Davis, G.B., Doherty, G., and Ritchie, A.I.M., 1986, A model of oxidation in pyritic mine wastes: Part 2: Comparison of numerical and approximate solutions: Appl. Math. Modelling 10:323-329.

de Marsily, G., 1985, Flow and transport in fractured rocks: connectivity and scale effects, International symposium on the hydrogeology of rocks of low permeability: International Association of Hydrogeologists, Tucson, AZ (USA), pp. 267-277.

INTERA, 2012, Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico: consultant's report prepared for New Mexico Copper Corporation, June 2012.

Jewell, P.W., 2009, Stratification controls of pit mine lakes: Mining Engineering, Feb 2009, Technical Papers, pp. 40-45.

[JSAI] John Shomaker & Associates, Inc., 1999, Groundwater-flow and solute-transport model for predicting potential effects from the Cunningham Hill Mine open pit, Santa Fe County, New Mexico: consultant's report prepared by John Shomaker & Associates, Inc. for LAC Minerals (USA) LLC.

[JSAI] John Shomaker & Associates, Inc., 2011, Update and recalibration of groundwater-flow and solute-transport model for predicting potential effects from the Cunningham Hill Mine open pit, Santa Fe County, New Mexico: consultant's report prepared by John Shomaker & Associates, Inc. prepared for LAC Minerals (USA) LLC, 29 p.

[JSAI] John Shomaker & Associates, Inc., 2013, Model of groundwater flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: consultant's report prepared by Jones, M.A., Shomaker, J.W., and Finch, S T. for New Mexico Copper Corporation, August 21, 2013

Jury, W.A., Gardner, W.R., and Gardner, W.H., 1991, Soil physics: John Wiley & Sons, NY.

Kempton, H., and Atkins, D., 2009, Direct measurement of sulfide mineral oxidation rates and acid rock drainage in wall rock of open pit mines: paper presented at Securing the Future and 8thICARD, June 23-26, 2009, Skellefteå, Sweden

Kelsall, P.C., Case, J.B., and Chabannes, C.R., 1984, Evaluation of excavation-induced changes in rock permeability: Int. J. of Rock Mech. Min. Science & Geomech. Abstr. 21(3), pp. 123 – 135.

Kuipers, J.R., Maest, A.S., MacHardy, K.A., and Lawson, G., 2006, Comparison of predicted and actual water quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements: Kuipers & Associates, PO Box 641, Butte, MT USA 59703, http://www.earthworksaction.org/pubs/ComparisonsReportFinal.pdf.

Mine Design, 2013, Feasibility level geotechnical analysis for the open pit mine plans of the Copper Flat copper-molybdenum project, Sierra County, NM: Mine Design Engineering, Kingston, Ontario, Canada.

Molebatsi, T., Galindo Torres, S., Li, L., Bringemeier, D., and Wang, X., 2009, Effect of fracture permeability on connectivity of fracture networks**:** Abstracts of the International Mine Water Conference 19th – 23rd October 2009, Proceedings ISBN Number: 978-0-9802623-5-3 Pretoria, South Africa.

Ouchterlong, F., Olsson, M., and Bavik, S.O., 1999, Bench blasting in granite with holes with axial notches and radial bottom slots: Fragblast, Johannesburg, South Africa, South African Institute of Mining and Metallurgy.

[Schafer] Schafer Limited LLC, 2007, Betze pit lake water quality predictions for Barrick Goldstrike Mining Inc: consultant's report prepared by Schafer Limited LLC for Barrick Goldstrike Mining Inc.

[Schafer] Schafer Limited LLC, 2010, Dee Arturo pit lake water quality predictions: consultant's report prepared by Schafer Limited LLC for Barrick Exploration & Goldcorp Inc.

Siskind, D.E., and Fumanti, R.R., 1974, Blast-produced fractures in Lithonia granite: Bureau of Mines Report BM-RI-7901, Twin Cities Mining Research Center.

SRK, 2013, Predictive geochemical modeling of pit lake water quality at the Copper Flat Project, New Mexico: consultant's report prepared by SRK Consulting, Reno, Nevada for New Mexico Copper Corporation.

SRK, 2014, Copper Flat PFS and DFS data gap analysis, Technical Memorandum prepared for THEMAC Resources Group, February 13, 2014: SRK Consulting, Cardiff, Wales, United Kingdom.

Tetra Tech, 2010, Geochemical pit lake prediction model revision 1, Rosemont Copper Project: consultant's report prepared by Tetra Tech for Rosemont Copper.

URS, 2009, Little Rock Mine post-closure pit lake model: consultant's report prepared by URS Corporation.

Wetzel, R.G., 2001, Limnology: Lake and River Ecosystems, 3rd ed. Academic Press.

Appendix G – JSAI Future Pit Water Balance

TECHNICAL MEMORANDUM

To: Jeff Smith, New Mexico Copper Corporation jsmith@themacresourcesgroup.com

From: Steve Finch, Principal Hydrogeologist-Geochemist
Michael A. Jones, Principal Hydrologist

Date: September 25, 2017

Subject: Post reclamation open pit surface area storm-water runoff calculations, Copper Flat Project, New Mexico Copper Corporation

John Shomaker & Associates, Inc. (JSAI) developed and calibrated a groundwater flow model for the New Mexico Copper Corporation (NMCC) Copper Flat project (JSAI, 2014), which included the proposed Copper Flat open pit. The model was calibrated to historical and current conditions at the Copper Flat Open Pit, and used to predict effects of the proposed mining plan.

The purpose of this technical memorandum is to establish storm-water runoff coefficients and watershed areas representative of the post-mining reclamation of the proposed Copper Flat Open Pit Surface Drainage Area (OPSDA). The post-mining OPSDA and watershed areas discussed in this memo are shown on Figure 1.

After reclamation, there will be three areas with different runoff coefficients inside the OPSDA:

1. Reclaimed watershed area surrounding the open pit;
2. Reclaimed sections of the Open Pit shell; and
3. Un-Reclaimed sections of the Open Pit shell.

Curve numbers for the different areas shown on Figure 1 and listed in Table 1 were derived from the NRCS Part 630 Hydrology National Engineering Handbook. The curve number equation (from NRCS, 2004) and precipitation statistics from the Hillsboro station were used to develop the assigned runoff coefficients presented in Table 1.

Post mining OPSDA reclamation will include re-contouring, placement of cover materials, and revegetation. As described in the NMCC Baseline Data Report, cover materials will resemble sandy to silty loam representative of Hydrologic Soil Group B (NRCS, 2009).

The hydrologic conditions of the reclaimed OPSDA will be classified as poor to fair, resembling desert shrub with less than 40 percent vegetative cover (NRCS, 2004). A Curve Number of 75 is representative of Desert Shrub landscape, Hydrologic Soil Group B, and less than 40 percent vegetative cover (NRCS, 2004; table 9-1).

Table 1. Summary of corresponding Curve Number and assigned Runoff Coefficient for sub-regions within the reclaimed Copper Flat Open Pit Surface Drainage Area

sub-region name	corresponding Curve Number	assigned Runoff Coefficient
Reclaimed OPSDA	75	0.071
Reclaimed Pit Shell	90	0.303
Un-Reclaimed Pit Shell	80	0.126

The reclaimed pit shell includes the haul road and potentially other accessible areas. Reclaimed surface is expected to resemble improved dirt road, and have a corresponding runoff curve number of 90 (NRCS, 2004; table 9-1).

The un-reclaimed pit shell was assigned a runoff curve number of 80, which has been derived from water balance studies for other open pits, such as the Cunningham Hill Mine Reclamation Project (JSAI, 2012).

Precipitation statistics were used with the runoff curve number to calculate the runoff coefficient presented in Table 1. Surface-water runoff is calculated from daily precipitation data, and soil conditions represented by a runoff curve number (NRCS, 2004a). Runoff is estimated using the following equations:

$$Ia = S*0.2$$

$$S = (1,000/CN)-10$$

$$Q = \frac{(P-Ia)^2}{(P-Ia)+S}$$

where,

Ia equals the initial abstraction including surface storage, interception by vegetation and infiltration prior to runoff, in inches depth over the drainage area.

S equals the potential maximum retention of water by the soil in equivalent inches depth over the drainage area.

CN equals the runoff curve number

P equals the accumulated rainfall in inches depth over the drainage area

Q equals the accumulate volume of runoff in inches depth over the drainage area

The runoff equations (above) are used to calculate the average annual runoff for the period of record from the Hillsboro Station. An example for Curve Number equal 90 is presented in Table 2. The calculated average annual runoff for period of record is divided by the average annual precipitation for period of record (12.5 in./yr) to derive the runoff coefficient.

Table 2. Summary of Hillsboro Station precipitation statistics and calculated runoff used to derive runoff coefficient for reclaimed pit shell area (CN=90)

Range in daily precipitati on events	No. of daily precipitation events within range for period of record*	Average number of precipitation events per year for period of record	average magnitude of precipitation event for range (in.)	P-Ia for CN =90	runoff per average event for range (in.)	average runoff per year (in.)
>3	3	0.031	3.29	3.070	2.86	0.090
2 - 3	21	0.219	2.31	2.090	1.89	0.414
1 - 2	168	1.752	1.32	1.100	0.92	1.606
0.5 - 1	490	5.109	0.7	0.480	0.33	1.682
					sum	3.79
Runoff coefficient (CN=90) = (3.79 in)/(12.5 in) = 0.303						

* Hillsboro station period of record equals 95.9 years or 35,037 days with average annual precipitation of 12.5 inches per year

Attachments

Figure 1. Map showing post-mining watershed areas for the Copper Flat Open Pit Drainage Area.

References

JSAI, 2012, Updated and re-calibrated groundwater flow and solute transport model for predicting potential effects from the Cunningham Hill Mine Open pit, Santa Fe County, New Mexico: Consultant's report prepared for LAC Minerals (USA), LLC.

[JSAI] John Shomaker & Associates, Inc., 2014a, Model of groundwater flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: consultant's report prepared for New Mexico Copper Corporation, August 15, 2014, 89 p. plus figures and appendices.

[NRCS] National Resources Conservation Service, 2004, Part 630 Hydrology Engineering Handbook, Chapter 9 Hydrologic Soil Groups, July 2004, 13 p.

[NRCS] National Resources Conservation Service, 2004a, Part 630 Hydrology Engineering Handbook, Chapter 10 Estimation of Direct Runoff from Storm Rainfall, July 2004, 79 p.

[NRCS] National Resources Conservation Service, 2009, Part 630 Hydrology Engineering Handbook, Chapter 7 Hydrologic Soil Groups, January 2009, 13 p.

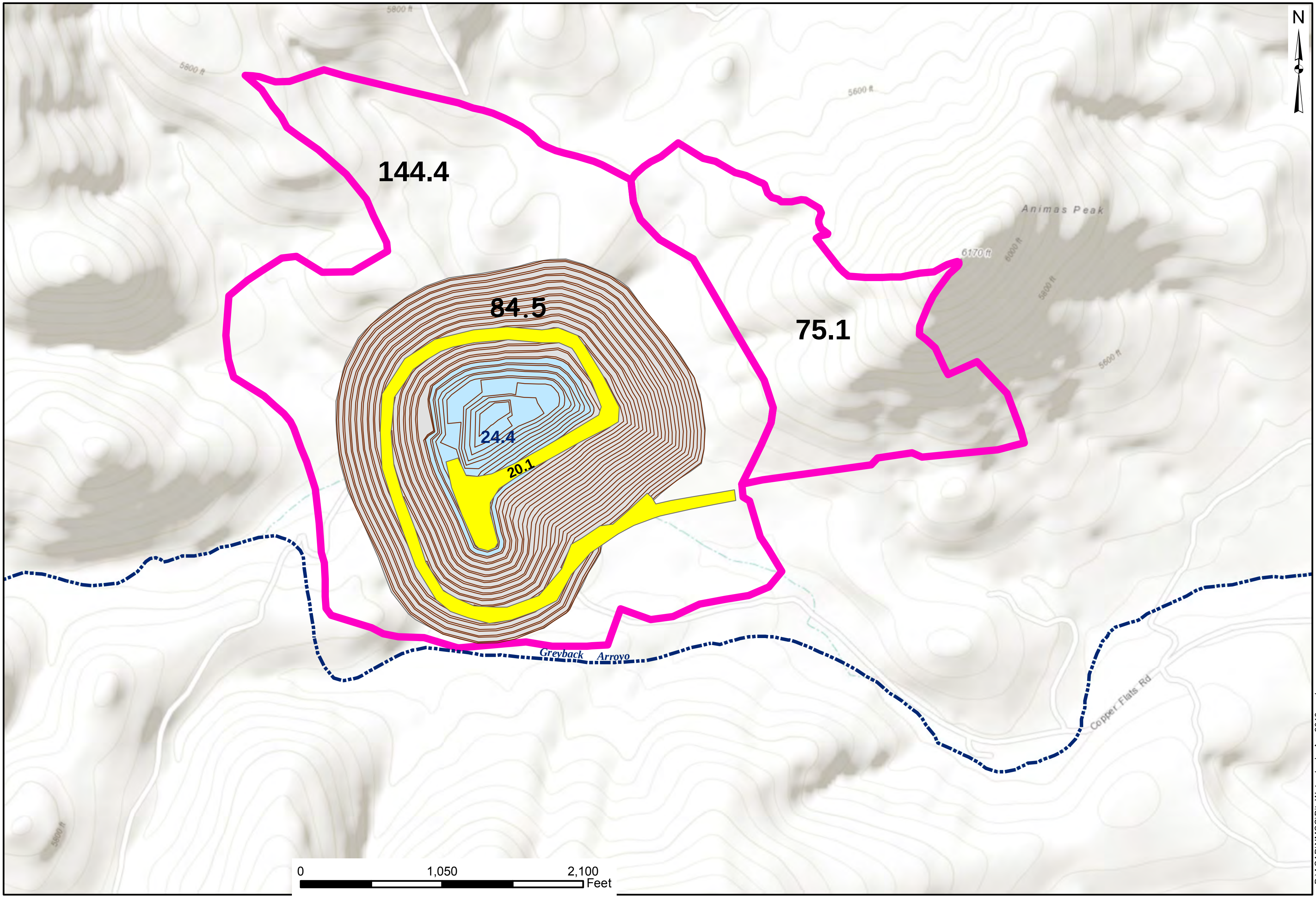


Figure 1. Map showing post-mining watershed areas for the Copper Flat Open Pit Drainage Area.

JSAI Pit Water Balance
Summary Statistics

Parameter	Units	Pit Model	
		Un Reclaimed	Reclaimed
Model Date		Jun 2017	Jul 2017
Pit Fill Method		Natural Fill	Rapid Fill
Total Pit Watershed	Acres	314	314
Watershed Ex-Pit	Acres	185	185
Watershed In-Pit	Acres	129	129
Pit Reclaimed Surfaces	Acres	0	46
Pit Unreclaimed Surfaces	Acres	0	83
Pit Lake Surface Area at Static Level	Acres	22	22
Annual Precipiation Rate	Inches	12	12
Annual Evaporation Rate	Inches	50	50
Runoff Coefficient, Ex-Pit Watershed		0.071	0.071
Runoff Coefficient, In-Pit Watershed Reclaimed		0.303	0.303
Runoff Coefficient, In-Pit Watershed Unreclaimed		0.126	0.126
Fresh Water Fill	Acre-Feet	0	2,201
Pit Lake Annual Evaporation @ Static Level	Acre-Feet	91	92
Annual Groundwater Inflow	Acre-Feet	36	36
Annual Stormwater Inflow, Total Watershed	Acre-Feet	54	57
Annual Stormwater Inflow, Ex-Pit	Acre-Feet	14	14
Annual Stormwater Inflow, In-Pit	Acre-Feet	41	43
Pit Lake Volume at Static Level	Acre-Feet	2,278	2,286
Pit Lake Depth at Static Level	Feet	247	248
Pit Lake Surface Elevation at Static Level	Feet AMSL	4,897	4,898

Appendix H – PHREEQC Input Files (electronic)

Appendix J – Aquatic Consultants Inc. Biological Assessment of the Existing Copper Flat Pit Lake

Copper Flat Mine

Biological Assessment
November 2014

Aquatic Consultants Inc.

"Your Lake & Stream Experts"

METHODS

All samples were collected and field measurements were completed on 06 November 2014. All testing was conducted by Aquatic Consulting & Testing, Inc. (Arizona Laboratory License No. AZ0004). Measurements and samples were collected from three locations (coordinates shown below) except where otherwise described.

Location 1:	N 32º58'11.97"	W 107º32'03.52"
Location 2:	N 32º58'15.24"	W 107º32'03.08"
Location 3:	N 32º58'14.48"	W 107º32'00.80"

Light transmission was measured using an Apogee MQ300 quantum meter and remote sensor. Transparency was measured using a standard Secchi Disk.

Temperature and oxygen profiles were measured using a YSI Model 550A dissolved oxygen meter with remote sensor. Light extinction coefficient was calculated using the quantum meter data and the following formula:

Light extinction coefficient $k = (\ln I_o - \ln I_d) \times 1/z$
Where k = extinction coefficient
I_o = light intensity at surface
I_d=light intensity at depth umhol/m^2/s [or uE]
Z= depth (m)

Water samples were collected from a depth of 0.5 meter at the three sampling locations and composited into a single sample. Depth-integrated samples were not required because the water was not vertically stratified. Sample preservation and chemical analyses were performed using EPA or APHA (Standard Methods) procedures licensed by Arizona Department of Health Services. Specific test methods are referenced in the attached laboratory reports. Algae identification and counts were made using a Nikon Diaphot phase/contrast inverted microscope. Samples were concentrated using an Utermohl settling chamber. Identifications were made using the following taxonomic references:

Baker, A.L. Algae, PS (Protista), Cyanobacteria, and Other Aquatic Objects. University of New Hampshire PhycoKey. http://www.cfb.unh.edu/phycokey/phycokey.htm.

Benson, C.E. and S.R. Rutherford. 1975. The Algal Flora of Huntington Canyon, Utah, U.S.A. A.R. Gantner Verlag, Germany. 177 pp.

Bold, H. and M.J. Wynne. 1985. Introduction to the Algae. Prentice Hall, Inc., Englewood, Cliffs, NJ. 720 pp.

Chapman, V.J. 1964. The Algae. St. Martin's Press, New York, NY. 472 pp.

Crawford, R.M., D.G. Mann, and F.E. Round. 1990. The Diatoms: Biology and Morphology of the Genera. Cambridge University Press, Cambridge, England. 747 pp.

Czarnecki, D.B. and D.W. Blinn. 1978. The Diatoms of the Colorado River. Strauss and Kramer. 181 pp.

Dillard, G.E. 1989. Freshwater Algae of the Southeastern United States. Vol. 1-6. J. Cramer, Berlin, Germany. 163 pp.

Dodd, J.F. 1987. Diatoms. Southern Illinois Press, Carbondale, IL. 477 pp.

Hein, M.K. 1990. Flora of Adak Island, Alaska: Bacillariophyceae (diatoms). J. Cramer. Stuttgart. 133 pp.

Patrick, R. and C.W. Reimer. 1966. The Diatoms of the United States. Monographs ANS No. 13, Vol. 1. Academy of Natural Sciences, Philadelphia, PA.

Patrick, R. and C.W. Reimer. 1975. The Diatoms of the United States. Monographs ANS No. 13, Vol. 2 Academy of Natural Sciences, Philadelphia, PA.

Prescott, G.W. 1978. How to Know the Freshwater Algae. William C. Brown Publishers, Dubuque, IA. 348 pp.

Prescott, G.W. 1962. Algae of the Western Great Lakes. William C. Brown Publishers, Dubuque, IA. 977 pp.

Rivers, I. 1978. Algae of the Western Great Basin. Desert Research Institute, Pub. 50008. University of Nevada, Las Vegas, NV. 390 pp.

Smith, G.M. 1950. Freshwater Algae of the United States. McGraw-Hill Book Company, Toronto,Canada. 719 pp.

Sze, P. 1986. The Biology of the Algae. William C. Brown Publishers, Dubuque, IA. 251 pp.

Tilden, J. The Myxophyceae of North America. Verlag Von J. Cramer, New York, NY. 328 pp.

University of Colorado. Diatoms of the United States. Diatom identification guide and ecological resource.

http://westerndiatoms.colorado.edu/

Warner, D. 1977. The Biology of the Diatoms. University of California Press, Berkley, CA. 498 pp.

Zooplankton was collected using an 80-um Wisconsin plankton net. A vertical tow from the bottom to top of the water column was made at each location and combined to produce a composite. At the laboratory, the concentrated sample volume was measured and recorded, an aliquot was transferred to a counting chamber, and the sub-sample was observed using a dissecting microscope. Zooplankton forms were identified and counted.

Benthic (sediment) samples were collected with a stainless steel Ponar dredge. The sediment was hand sorted and screened in the laboratory to retrieve and isolate macroinvertebrates. Particle size analysis was conducted using an ATM Arrow shaker equipped with stacked U.S. standard sieves.

Fish sampling was conducted using an 18' Smith-Root Electro-fishing Boat. Running Direct Current (DC) at 15 pulses per second. Percent of range selected was 40% with output at approximately 200 volts. Pulse width at 40% produced a pulse duration of 2.4 milliseconds. Electro-fishing amperage was between 8 and 10. Electro-fishing effort was continuous at 1800 seconds during daylight and 1800 seconds after dark. Additionally, three experimental mesh gill nets were deployed for 21 hours over night. Two sets were shoreline sets and one in the middle of the pit. Each net was 120ft long and made up of six monofilament 20ft sections with the following mesh sizes ½", 1",1 ½", 2", 2 ½", and 3".

RESULTS AND DISCUSSION

Physical Conditions

<u>Stratification</u>

Temperature and oxygen profiles are presented below. Water temperature measurements varied from 12.6 to 13.7 C and dissolved oxygen concentrations ranged from 8.9 to 9.4 mg/L. At the time of sampling, the pit water was vertically mixed. The greatest change in temperature with depth occurred at Location 2, with a change of only 0.7 C from top to bottom (7.5 m) of the water column. Accordingly, dissolved oxygen was essentially unchanged through the water column at each location, with only a 0.2 mg/L maximum change from surface to pit bottom. Raw data and profiles are presented in Figure 1.

The temperature and oxygen data, aside from other limiting factors, indicate the water should be supportive of a warm water or possibly a cold water fishery (summertime profiles were not available).

Transparency and Solar Radiation

The Secchi disk depth was approximately 4.0 m. PAR measurements indicated penetration through the entire water column. Approximately 110 umhol/m2/s PAR was available at the pit bottom (extinction coefficient 0.35). Sufficient light existed to support a phytoplankton population. Light intensity at the pit bottom was similar to the recommended light intensity for algae cultures (Lavens and Sorgeloos 1996) and possibly benthic algae, although the minimum light requirement for benthic algae is poorly understood (Stevenson et al 1996). Light extinction data and graph are presented in Figure 2.

Sedimentation and Substrate Type

The amount of compacted sediment on the pit bottom ranged from 4 to 6 inches, with up to a 20-inch covering of iron floc. The sediment contained a very low (0.21%) organic carbon concentration, but did contain organic nitrogen (2160 mg/kg) and phosphorus (880 mg/kg). These data indicate that benthic algae or even submerged rooted macrophytes could only exist in areas where the iron floc was limited (littoral zone).

Seive analysis (see Figure 3) indicated that all particles were less than 1.18 mm and 89 percent was finer than 0.6 mm. The sediment is classified as silt (all particles less than 2 mm). The silt provides little to no substrate for diversity in a macroinvertebrate population.

The sieve analysis is presented on the following page. Sediment chemistry data are presented as part of laboratory report package presented at the end of the narrative.

Nutrients

Low nutrient concentrations, typical of oligotrophic lakes, were measured. An available N:P ratio of 3:1 was found. Because of the low pH (4.6 SU) and reported (Hall Environmental Analysis Laboratory) acidity of the water (180 mg/L as $CaCO_3$), bicarbonate and carbonate ions would be essentially absent (Geller et al.). Sufficient inorganic carbon would be available to algae through the equilibrium reactions of absorbed atmospheric carbon dioxide and carbonic acid (University of Montana).

Biologically-available phosphorus (0.018 mg/L phosphate-P), nitrogen (0.24 mg/L NO_3-N and 0.03 NH_3-N) would be adequate to support a modest phytoplankton population. This projection was supported by the very low chlorophyll-a concentration measurement of 0.8 ug/L. At measured pH, no ammonia toxicity could exist. The low pH would be detrimental to cyanobacteria (blue-green algae growth, but not eukaryotic algae species (Brock 1973). The complete water quality report is provided at the end of the report narrative.

Biological Conditions

The pit waters contained a depauperate algal assemblage composed of only six genera of algae. The six consisted of the diatoms (Bacillariophyta) *Diatoma*, *Cymbella*, *Synedra,* and *Navicula*; the cryptomonad, *Cryptomonas*; and the blue-green (Cyanophtya) alga *Chroococcus*. *Cryptomonas* was the dominant organism and is common in cold, acidic waters (Holopaenin 1992; Ojala and Jones 1993). Diatoms have also been found in a number of acidic environments, especially where high concentrations of iron exist as in some pit water environments (Nicola 2000). *Chroococcus* has been reported to dominate acidified Canadian lakes (Seckbach 2007). The total cell count was 603 cells per mL. However, many of the diatoms were frustules only (no protoplasm or chlorophyll observed), suggesting that these were dead and settling cells. The viable cell count is estimated at 312 cells/mL. The algae composition is summarized below (Table 1).

Table 1. Algae composition of Copper Flat pit water 11/06/14

Genus	Division/ form	Count per mL	Percent Comp.
Diatoma	Bacillariophyta (diatom) unicell	22	3.7
Cryptomonas	Cryptophyta (cryptophytes) flagellate	223	37.0
Cymbella	Bacillariophyta (diatom) unicell	34	5.6
Synedra	Bacillariophyta (diatom) unicell	212	35.2
Navicula	Bacillariophyta (diatom) unicell	22	3.7
Chroococcus	Cyanophyta (blue-green) colony	89	14.8

Sediment samples, primarily in the littoral zone, contained diatom frustules (most void of protoplasm or chlorophyll) and a very small number of *Hormidium* (Chlorophyta) filaments. *Hormidium* grows in acid environments as low as pH 3.5 and is least susceptible to copper and zinc toxicity at the pH range of 3.5 to 4.0 SU (Hargraves and Whitton 1976).

No zooplankton were recovered from multiple vertical tows at each location.

No macroinvertebrates were recovered from the sediment.

No fish species were recovered from either electro-fishing or gill nets.

A very small stand (20 sq ft) of cattail (*Typha* sp.) was found along the lake edge, in the dampened soil. No floating or submerged macrophytes were present.

Integrated Conditions and Biological Integrity

Because of the limited variety of organisms recovered from the sampling activities, only a few basic indices were calculated to characterize the pit water. The indices typically characterize the pit water as oligotrophic, with insignificant amounts of organic pollution, but with one or more other water quality variables reducing productivity.

*Carlson Trophic Index (*Carlson 1976) uses chlorophyll-a, transparency and phosphorus concentration to quantitatively categorize the status of a lake ranging from oligotrophic (unproductive) to highly eutrophic (productive). The range of TSI was 28-69. Transparency and chlorophyll were indicative of an oligotrophic lake, but total phosphorus was characteristic of a eutrophic lake.

Nygaard Trophic Index (Nygaard 1976) proposed five indices to evaluate the organic pollution of water bodies based on the tolerance of various groups of planktonic algae occurring in them. These indices include Cyanophycean or Myxophycean index Chlorophycean index Bacillariophycean or Myxophycean index, Chlorophycean index, Bacillariophycean index, Euglenophycean index and a combination of these called compound coefficient index. Because of the paucity of phytoplankton, only the diatom index was appropriate. The Index value was 0, indicating oligotrophic conditions.

Palmer Organic pollution Index (Person 1989). The metric evaluates the degree of organic pollution based on pollution tolerance of key algal genera. The pit water score was 5 indicating minimal or no organic pollution, or that another variable is interfering with algae growth.

CONCLUSION

The collected and historic data demonstrate that the pit waters do not and cannot support a balanced ecosystem. Higher aquatic life forms are absent because of likely chemical toxicity, lack of suitable habitat, and lack of food resources.

The pH of the water is below the range (6.5 to 9.0 SU) typically considered supportive of aquatic ecosystems (EPA 1986). pH has been considered the most important determinant of water quality in a pit environment (Miller 2002), impacting divalent metals solubility and creating toxicity. Groundwater interaction with the walls and surrounding host rock of the pit create oxidation reactions that release sulfate, acid, and metals into the lake. Copper Flat Pit water pH (4.6 SU) is well below the typical tolerance range of most aquatic organisms and the copper concentration (18 mg/L) is well above minimum phytotoxic concentrations.

Although adequate light and some nutrients are available, there is a paucity of primary producers in the pit water. Without available food, zooplankton species are essentially absent. A high concentration of copper in the water and low pH appear likely factors limiting algal growth and survival.

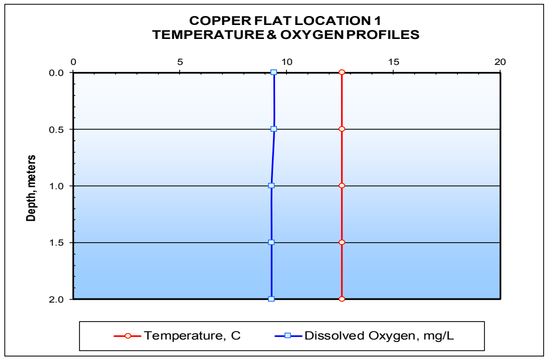
Macroinvertebrates are absent, including those typically considered tolerant of pollution. Habitat availability and diversity is limited. Most of the pit bottom and edge is composed of fine particulates; rocks and rubble are essentially absent. Organic matter is limited. The layer of precipitated iron covering a layer extremely fine silt is not suitable habitat for most benthic organisms. Food reserves for shredders and scrapers is highly limited, as the depauperate and sparse periphyton consisted of a single species of filamentous algae.

FIGURE 1

Copper Flat - 11/06/14
Aquatic Consulting & Testing, Inc.

Copper Flat - Location 1

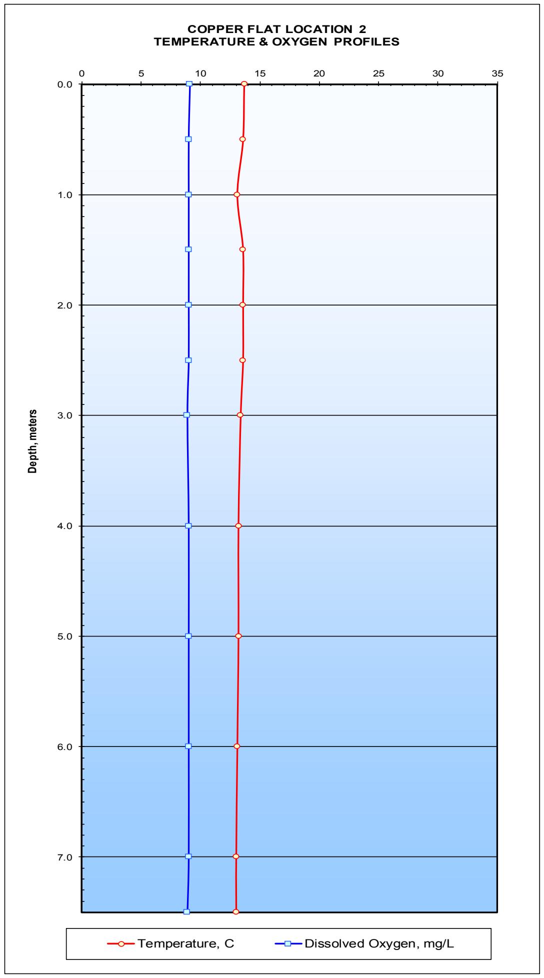
Depth, m	Temp. C	O2, mg/L
0.0	12.6	9.4
0.5	12.6	9.4
1.0	12.6	9.3
1.5	12.6	9.3
2.0	12.6	9.3



Copper Flat - 11/06/14
Aquatic Consulting & Testing, Inc.

Copper Flat - Location 2

Depth, m	Temp. C	O2, mg/L
0.0	13.7	9.1
0.5	13.6	9.0
1.0	13.1	9.0
1.5	13.6	9.0
2.0	13.6	9.0
2.5	13.6	9.0
3.0	13.4	8.9
4.0	13.2	9.0
5.0	13.2	9.0
6.0	13.1	9.0
7.0	13.0	9.0
7.5	13.0	8.9



Copper Flat - 11/06/14
Aquatic Consulting & Testing, Inc.

Copper Flat - Location 3

Depth, m	Temp. C	O2, mg/L
0.0	13.6	9.1
0.5	13.6	9.0
1.0	13.6	9.0
1.5	13.6	8.9
2.0	13.5	9.0
2.5	13.4	9.0
3.0	13.4	9.0
3.5	13.2	9.0
4.0	13.2	9.0

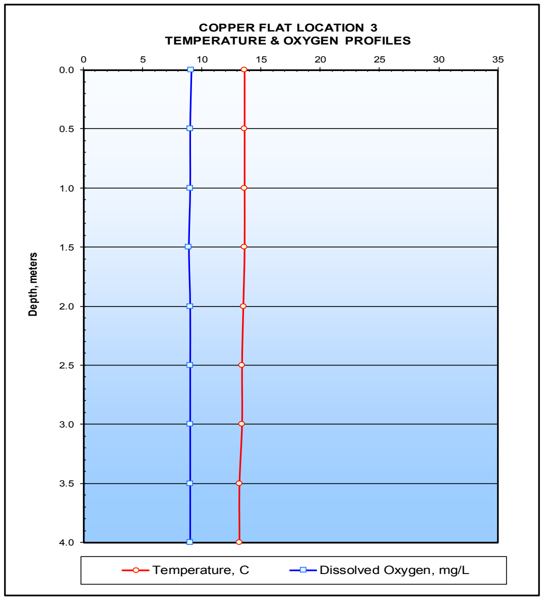
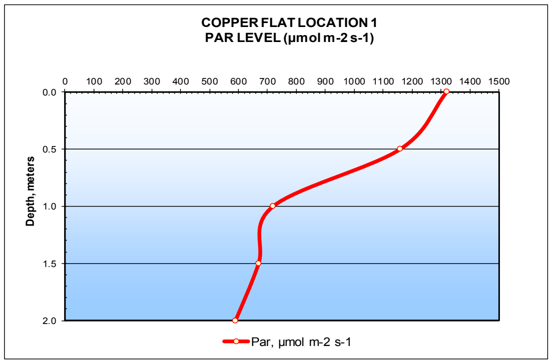


FIGURE 2

Copper Flat - 11/6/14
Aquatic Consulting & Testing, Inc.

Copper Flat - Location 1

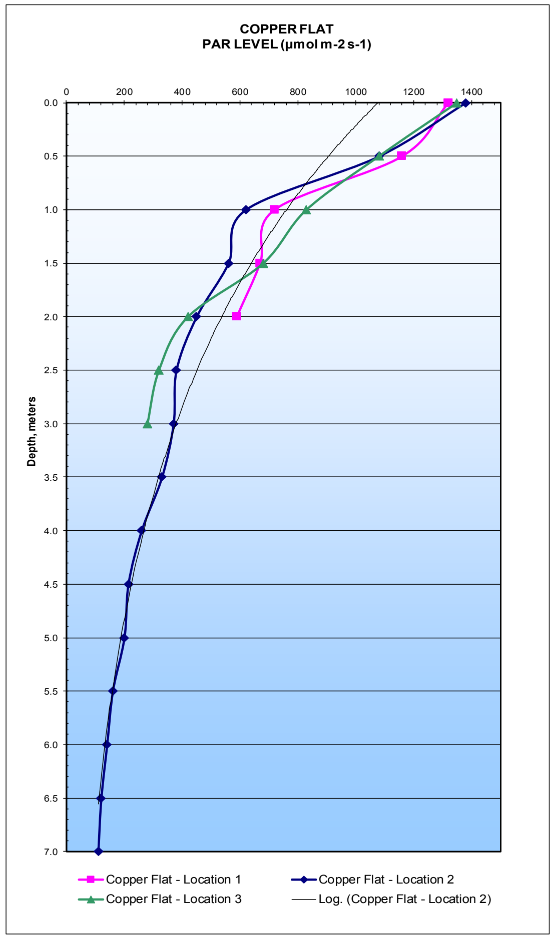
Depth, m	Par, µmol m-2 s-1
0.0	1320.0
0.5	1160.0
1.0	720.0
1.5	670.0
2.0	590.0



Copper Flat - 11/6/14
Aquatic Consulting & Testing, Inc.

Copper Flat - Location 2

Depth, m	Par, µmol m-2 s-1
0.0	1380.0
0.5	1080.0
1.0	620.0
1.5	560.0
2.0	450.0
2.5	380.0
3.0	370.0
3.5	330.0
4.0	260.0
4.5	214.0
5.0	200.0
5.5	160.0
6.0	140
6.5	120
7.0	110



Copper Flat - 11/6/14
Aquatic Consulting & Testing, Inc.

Copper Flat - Location 3

Depth, m	Par, µmol m-2 s-1
0.0	1350.0
0.5	1080.0
1.0	830.0
1.5	680.0
2.0	420.0
2.5	320.0
3.0	280.0

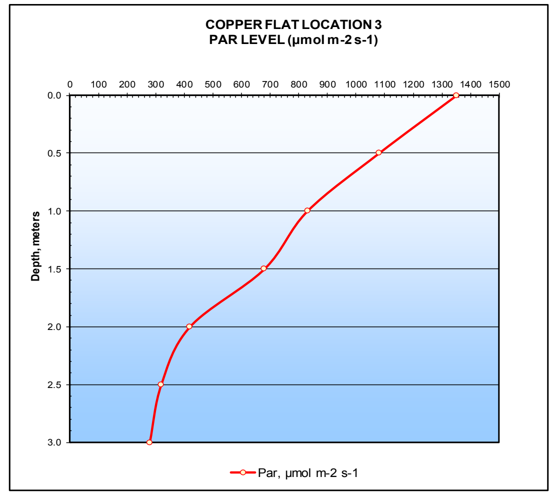
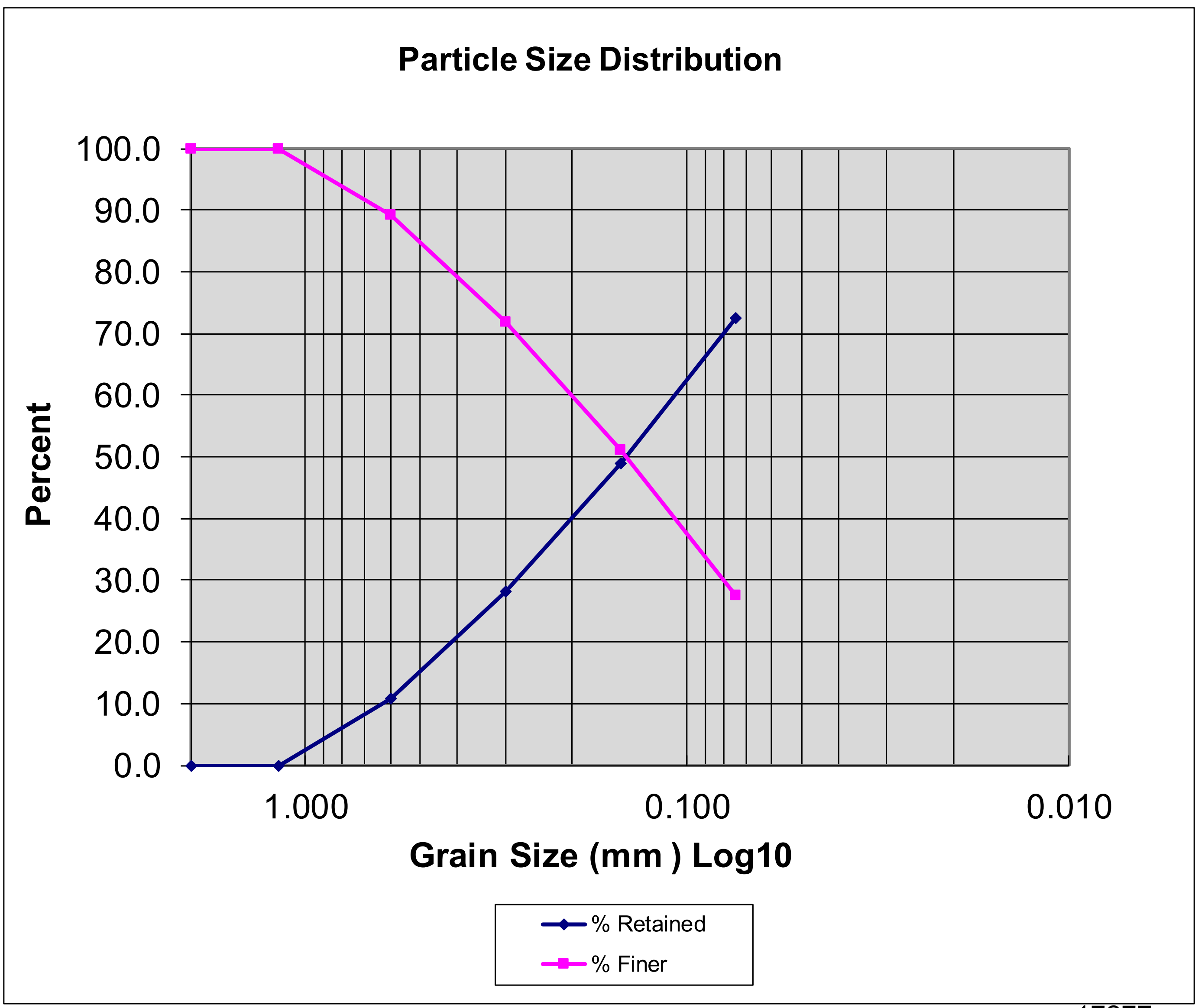


FIGURE 3

Laboratory ID: BW10543
Client ID: Aquatic Consultants - Copper Flat New Mexico

Mesh Size	Nominal Opening (inches)	Grain Size (mm)	Grams retained	Each sieve % Retained	Cumulative % Retained	% Finer
8	0.0937	2.360	0	0.0	0.0	100.0
10	0.0787	2.000	0	0.0	0.0	100.0
16	0.0469	1.180	0	0.0	0.0	100.0
30	0.0234	0.600	34.52	10.8	10.8	89.2
50	0.0117	0.300	55.01	17.3	28.1	71.9
100	0.0059	0.150	66.72	20.9	49.0	51.0
200	0.0029	0.075	74.76	23.5	72.5	27.5
	<0.0029		87.64	27.5	100.0	0.0



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Lic. No. AZ0003

LABORATORY REPORT

Client: Aquatic Consultants
4421 Irving Blvd. NW
Albuquerque, NM 87114

Date Submitted: 11/07/14
Date Reported: 12/02/14

Attn: Paul Cassidy

Project: Copper Flat

RESULTS

Client ID: H2O Comp. Loc 1-3
ACT Lab No.: BW10542

Sample Type: Surface Water
Sample Time: 11/06/14 14:30

Parameter	Analysis Date Start	Analysis Date End	Method No.	Result	Unit
Total Organic Carbon	11/24/14	11/24/14	SM 5310 C	0.7	mg/L
Algae Count	12/01/14	12/01/14	SM 10200 F	See Attached	cells/mL
Algae Identification	12/01/14	12/01/14		See Attached	
Chl/Pheo Ratio	11/25/14	11/25/14	SM10200 H	1.14	
Chlorophyll a	11/25/14	11/25/14	SM10200 H	0.80	ug/L
Pheophytin a	11/25/14	11/25/14	SM10200 H	3.12	ug/L
Zooplankton	11/20/14	11/20/14	SM10200 G	<10.	#/cu. meter
Oxygen, Dissolved Field	11/06/14	11/06/14	SM4500 O G	9.0	mg/L as O2
pH, Field	11/06/14	11/06/14	SM4500H+ B	4.6	SU
Secchi Disk Depth	11/06/14	11/06/14	NALMS	4.0	meters
Temperature, Field	11/06/14	11/06/14	SM2550 B	13.6	C
Ammonia - N	11/20/14	11/20/14	SM4500NH3 D	0.03	mg/L as N
Nitrate + Nitrite - N	11/26/14	11/26/14	SM4500NO3 E	0.24	mg/L as N
Phosphate, ortho	11/07/14	11/07/14	365.3	0.018 *	mg/L as P
Phosphorus, Total	11/25/14	11/25/14	365.3	0.067	mg/L as P
Total Inorganic Carbon	11/24/14	11/24/14	SM 5310 C	0.9	mg/L
Total Kjeldahl Nitrogen	11/20/14	11/20/14	SMNorg C,NH3 C/D	0.3	mg/L as N

* R12=RPD/RSD exceeded the method acceptance limit. Result <5 times the PQL.

RESULTS

Client ID: Sed Comp. Loc 1-3
ACT Lab No.: BW10543

Sample Type: Sediment
Sample Time: 11/08/14 14:30

Parameter	Analysis Date Start	End	Method No.	Result	Unit
Soil TOC	11/19/14	11/19/14	WalkleyBlack	0.21	% Org-C
Sieve Test	11/25/14	11/25/14	ASTM	See Attached	
Kjeldahl Nitrogen - Soil	11/19/14	11/19/14	SM4500NorgC mod.	2160.	mg/kg as N
Nitrate + Nitrite - N	11/18/14	11/18/14	SM4500NO3E mod.	<1.	mg/kg as N
Phosphorus, Total	11/23/14	11/24/14	365.3 mod.	550. *	mg/kg as P
Total Solids	11/10/14	11/14/14	SM2540 G	10.8	%

* R8-Sample RPD exceeded the method acceptance limit.

Client ID: Sed Floc
ACT Lab No.: BW10544

Sample Type: Sediment
Sample Time: 11/08/14 14:30

Parameter	Analysis Date Start	End	Method No.	Result	Unit
Microscopic Identification	12/01/14	12/01/14		See Attached	

Reviewed by:
Frederick A. Amalfi, Ph.D.
Laboratory Director

AQUA[illegible] CONSULTING & TESTING, INC.
1525 W. [illegible]versity Drive, Suite 106 • Tempe, AZ 85281
Phone: (480) 921-8044 • Fax: (480) 921-0049

CHAIN OF CUSTODY

PWS ID #______

PAGE___ OF___

Client Name: Aquatic Consultants, Inc.
Address: Street ______ City, State, Zip ______
Phone: ______
Fax: ______
Contact: Paul Cassidy
Sampler Signature: SPH

PO# Copper Flat
Project ______
Remarks:

SAMPLE ID	SAMPLE Date	SAMPLE Time	AM/PM	SAMPLE TYPE	Metals (See Below)	TDS / TSS / TS per / SETT / TVS / VSS	O+G / TPHC / MBAS / CN / Sulfide	BOD / COD / New Source	Tot P / O-PO4 / Diss. P	Nitrate + Nitrite / Nitrite	TKN / Ammonia	TOC, TOC	Phenol / 420.1 / 625 / 8270	TKN, Nitrate, TP	Perchlorate / Radio / Asbestos	Total Coliform / P/A / Colilert / MPN	TOC (w-s)	Fecal Coliform / MPN / MF	MICRO SCOPE ID	Particle Size	F-(pH, DO, T, SDE)	Periphyton	Macroinvert	Chl a, Algae ID Et	Zoop.	$Na_2S_2O_3$	H_2SO_4	HNO_3	NONE	Lugols	NaOH/ZnAc	Laboratory Number
H_2O Comp. Loc. 1-5	11/6/14	1430	PM	SW					X	X	X	X		X							X			X	X		1		5	2		BW-10542
Sed Comp. Loc. 1-3	↓	1430		Sed		X								X			X			X			X						1			43
Sed. Floc		1430		Sed															X										1			44
Edge Periphyton	↓	1540		Solid																X	X	X							1			45

Metals: ☐ Al ☐ Sb ☐ As ☐ Ba ☐ Be ☐ B ☐ Cd ☐ Ca ☐ Cr ☐ Co ☐ Cu ☐ Au ☐ Fe ☐ Pb ☐ Mg ☐ Mn ☐ Hg ☐ Mo ☐ Ni ☐ Se ☐ Ag ☐ Na ☐ Sr ☐ Tl ☐ Sn ☐ Ti ☐ V ☐ Zn

[ ] TOTAL [ ] DISSOLVED [ ] SDWA [ ] TCLP [ ] RCRA

Sample Types: DW, GW, SW, WW, AQ, Soil, Sludge or Solid

Sample Receiving: MLC
Intact: X Yes ___ No
Temp: 15C Auth Init: ___
Pres: 1 Yes/V 10 No/Lab
Sterile: ___ Yes X No
Total # containers: 11

1. Relinquished By: Sammy P. Hale	Date: 11/7/14	Time: 1507	AM/PM
1. Received By: T Johnson	Date: 11-7-14	Time: 15:07	AM/PM
2. Relinquished By:	Date:	Time:	AM/PM
2. Received By:	Date:	Time:	AM/PM
3. Relinquished By:	Date:	Time:	AM/PM
3. Received By:	Date:	Time:	AM/PM

Attn: Your signature on this document authorizes analysis regardless of sample condition at time of submittal

White-Laboratory Yellow-Report Pink-Client

Sample delivery group #: -023

December 2017

New Mexico Copper Corporation

PROBABLE HYDROLOGIC CONSEQUENCES OF THE COPPER FLAT PROJECT SIERRA COUNTY NEW MEXICO

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCCE AND ENVIRONMENTAL CONSULTANTS
PREPARED BY JSAI

17282

PROBABLE HYDROLOGIC CONSEQUENCES OF THE COPPER FLAT PROJECT, SIERRA COUNTY, NEW MEXICO

prepared by

Michael A. Jones

Steven T. Finch, CPG, PG

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prepared for

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a wholly owned subsidiary of THEMAC Resources Group, Ltd.
4253 Montgomery Blvd NE, Suite 130
Albuquerque, NM 87109

December 12, 2017

PROBABLE HYDROLOGIC CONSEQUENCES OF THE COPPER FLAT PROJECT, SIERRA COUNTY, NEW MEXICO

EXECUTIVE SUMMARY

The proposed Copper Flat Project includes a mine pit, supply wells, tailings facility, and waste rock facilities (Fig. 1.1) located in the Hillsboro Mining District, Sierra County, New Mexico.

Presented in this report is the evaluation of the hydrologic consequences of the proposed operating plan detailed in the New Mexico Copper Corporation (NMCC) Updated Mining Operation and Reclamation Plan for Copper Flat Mine, Rev. 1 (THEMAC, 2017a) and in the New Mexico Copper Corporation Discharge Permit Application, Rev. 1 (THEMAC, 2017b). The operating plan reviewed herein reflects a nominal processing rate of 30,000 tons of ore per day for 11.5 years and aligns with “Alternative 2” in the Copper Flat Draft Environmental Impact Statement (BLM, 2015).

The objective of this report is to develop a determination of the probable hydrologic consequences of the operation and reclamation on both the permit and affected areas with respect to the hydrologic regime, quantity and quality of surface and groundwater systems that may be affected by the proposed operations (NMAC 19.10.6.602.(13)(g)(v)) of the Mining Act regulations.

Groundwater systems include:

- The regional Santa Fe Group (SFG) aquifer.
- Quaternary-age alluvial aquifers along Animas Creek and Percha Creek.
- The crystalline bedrock of the Animas Uplift.

Surface water includes:

- Perennial flow in the Rio Grande and Caballo Reservoir that is supplied in part by discharge from the SFG aquifer.
- An area of perennial flow and riparian vegetation along Animas Creek where the Quaternary-age alluvial aquifer discharges to the surface.
- An area of perennial flow and riparian vegetation along Percha Creek, atop the crystalline bedrock.
- Springs discharging from the crystalline bedrock.
- Storm water flows in Grayback Arroyo.

“Consequences” considered here are the resulting effects on the hydrologic regime of NMCC’s proposed operation and reclamation including both water use, and surface and groundwater impact mitigation measures.

The sources of possible hydrologic consequences of the Project include:

1. Groundwater withdrawals from the SFG aquifer: The mine water supply will be withdrawn from pumping wells PW-1, PW-2, PW-3, and PW-4. Water level in the SFG aquifer will be lowered around the well field and then gradually recover after mining. Secondary effects evaluated include:
   a. Reduced groundwater discharge to Rio Grande and Caballo Reservoir.
   b. Reduced flow to artesian wells and other effects to local groundwater users.
   c. Potential reduced discharge to shallow aquifers along Animas Creek and Percha Creek, leading to lower alluvial water levels and reduced discharge to the perennial flow and riparian areas along Animas Creek.
   d. Potential ground subsidence.

2. Groundwater withdrawals from the crystalline bedrock associated with the open pit. Water levels in the bedrock around the pit will be permanently lowered, and groundwater will flow to the pit and evaporate. Groundwater flow rates to the pit and the future open pit water level and water balance area assessed. Secondary effects evaluated include:
   a. Potential groundwater discharge from the open pit.
   b. Potential effects on springs discharging from the crystalline bedrock and on the Percha Creek perennial (riparian) area.

3. Potential for groundwater discharge from the tailings storage facility (TSF) and waste rock stockpiles (WRSPs).

The consequences were evaluated using the numerical groundwater flow model (JSAI, 2014) developed for the Copper Flat Project. Effects include the following:

Santa Fe Group (SFG) Aquifer

- Water-level drawdown in the SFG aquifer is projected to reach a maximum of about 70 ft at the well field, at the end of mining. Drawdown will decrease with distance from the well field. Water levels will then recover over a period of about 20 to 30 years.
- Total reductions in discharge to the system from the SFG aquifer are projected to peak at a total of about 3,100 acre-feet per year (ac-ft/yr) shortly after the end of mining, then diminish to near-zero over about 30 years (Fig 3.3; Table 3.1).
- Flow induced from the Palomas Graben north of the study area is projected to reach a maximum of less than 800 ac-ft/yr at the end of mining, which is estimated to result in an additional reduction of discharge to the Rio Grande by a maximum of 275 ac-ft/yr.
- Potential impairment of existing water rights from reduced discharge to flowing wells may occur.
- Effects on shallow groundwater (riparian) systems along Las Animas Creek and Percha Creek are projected to be minimal, with a maximum of less than 2 ft of groundwater-level change on Percha Creek, less than 1 ft of groundwater-level change on Animas, and non-measureable small changes in surface flow and riparian evapotranspiration.
- Depletion to the Rio Grande is projected to peak around 2,080 ac-ft/yr at the end of mining, then reduce to 28 ac-ft/yr 100 years after mining (Fig. 3.3; Table 3.1)

As required by New Mexico Office of the State Engineer (NMOSE), NMCC will mitigate the effects of pumping of the SFG aquifer by offsetting reductions in discharge to the Rio Grande by lease or purchase of additional water rights in the amount of the model-simulated reductions to flow.

NMCC will work with the NMOSE to ensure that impairment to existing water rights (including permitted wells) according to NMOSE criteria, by NMCC pumping, will be appropriately mitigated.

- Pumping of the production water-supply wells is not expected to result in measurable ground subsidence. No water-quality effects are expected from pumping the proposed supply wells in the affected area.

Crystalline Bedrock

- At the end of mining, groundwater-level drawdown in the bedrock around the open pit is projected to reach a maximum of about 800 ft at the pit.
- A permanent cone of depression will form around the pit, with maximum drawdown of about 600 ft at the edge of the pit.
- The pit, which currently is an evaporative hydrologic sink, will form an evaporative hydrologic sink again in the future.

After mining, the pit will be filled with fresh water from the production water-supply wells to inundate portion of the pit walls and create a steady-state hydraulic sink with the surrounding groundwater system (rapid fill). The rapid fill will begin immediately after mining and will be completed in approximately 6 months. The rapid fill requires pumping 2,200 ac-ft into the pit and will fill the pit to elevation 4,894 ft amsl. At hydrologic equilibrium, the final pit water level is projected to be about 4,897 ft amsl, about 580 ft below the pit crest at the haul road entrance. The post-mining pit water body that forms after mining from rapid fill remediation will be about 250 ft in depth and have a steady-state surface area of about 22 acres. Steady state groundwater inflow is estimated at 36 ac-ft/yr and captured storm-water runoff is estimated at 57 ac-ft/yr. Pit water evaporation is projected to be about 93 ac-ft/yr. Evaporation will maintain the hydraulic sink in perpetuity.

Long-term, indirect effects to springs discharging in and around the Animas Uplift are projected to be minimal and not measureable. Water quality effects for the open pit water body are addressed in a separate report prepared for the project.

Storm-Water Flows

Storm-water flow through Grayback Arroyo will not be affected. During operations and after reclamation, storm-water flows from Grayback Arroyo will be conveyed around the open pit in the existing bypass channel and through the mine area with no expected hydrologic consequences.

TSF and WRSPs

Infiltration to groundwater from the tailings and waste rock storage areas is not expected due to installation of liner under the TSF and placement of WRSPs on low permeable crystalline bedrock. Any meteoric water that might infiltrate to groundwater is expected to remain in the immediate area for centuries, due to the low permeability of the SFG sediments near the Animas Uplift and due to the presence of flow-inhibiting faults. The impact to groundwater chemistry is expected to be minimal.

CONTENTS

TABLES

ILLUSTRATIONS

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APPENDICES
(follow text)

PROBABLE HYDROLOGIC CONSEQUENCES OF THE COPPER FLAT PROJECT, SIERRA COUNTY, NEW MEXICO

1.0 INTRODUCTION

This report presents an evaluation of the probable hydrologic consequences of the proposed Copper Flat Project (Project) in Sierra County, New Mexico. Hydrologic consequences refer to any changes, resulting from the Project, to groundwater and surface water systems, including changes to flow, water level, or chemical composition.

The Project is located in the Hillsboro Mining District, shown on Figure 1.1. Effects on both the mine permit area (Fig. 1.1) and the surrounding affected area are evaluated with respect to the hydrologic regime, quantity, and quality of surface and groundwater systems that may be affected by the proposed operations (NMAC 19.10.6.602.(13)(g)(v)).

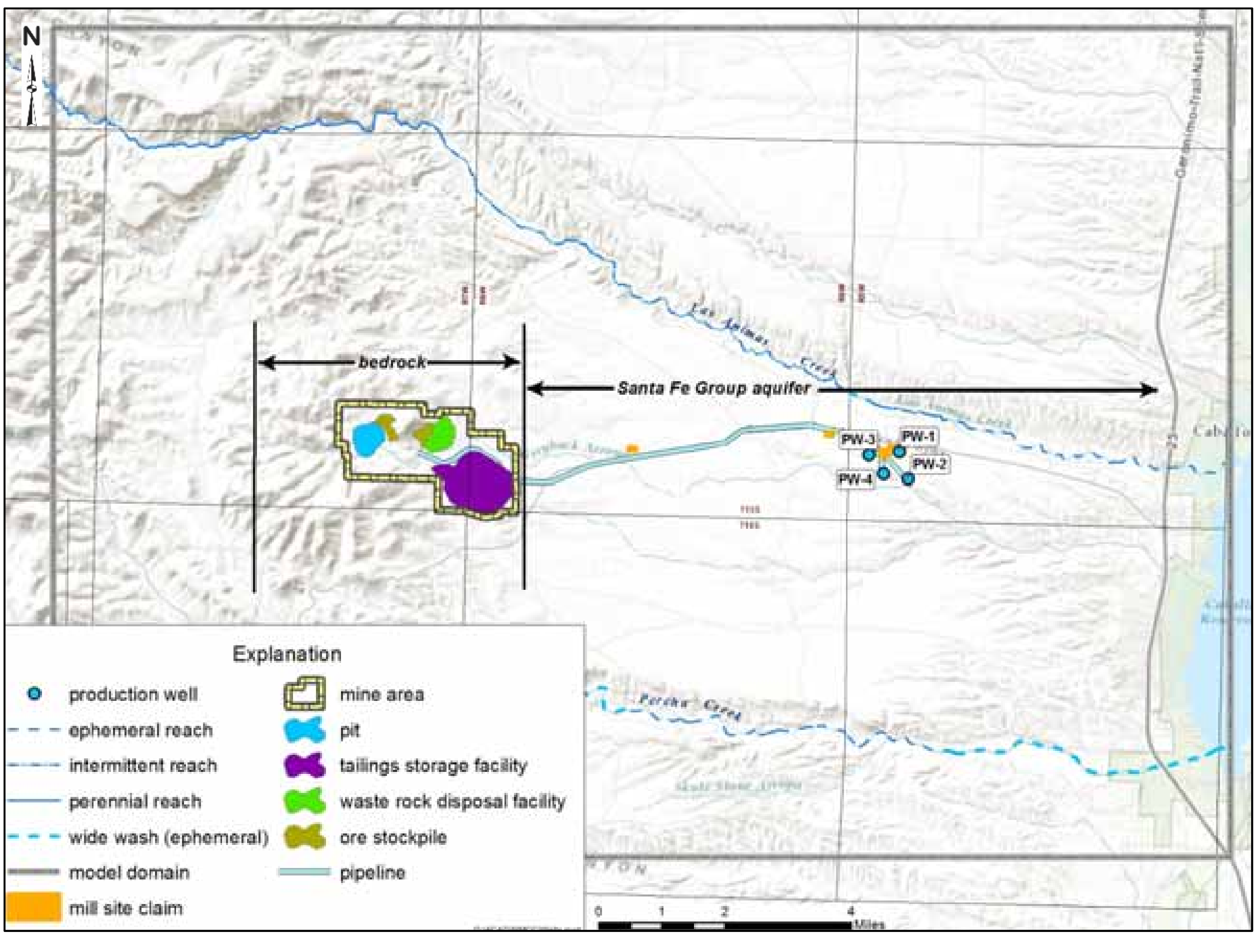

Figure 1.1. Map showing New Mexico Copper Corporation proposed mine facilities, mine area, and the affected area evaluated, Sierra County, New Mexico.

For the analysis of probable hydrologic consequences, the affected area includes the mine permit area containing the open pit and surrounding facilities, located on the andesite and quartz monzonite crystalline bedrock of the Animas Uplift (Fig. 1.1), as well as the affected area including the Santa Fe Group (SFG) aquifer around water supply wells PW-1 through PW-4 and surface and groundwater under Las Animas and Percha Creeks. The area evaluated for potential effects was the "model domain" shown on Figure 1.1.

1.1 Project Description

NMCC proposes to expand the existing open pit, previously developed by Quintana Minerals Corporation (Quintana) during a brief period of operation in 1982.

The existing pit was excavated to about 100 ft below original ground surface, with bottom elevation at about 5,400 feet above mean sea level (ft amsl). A permanent pool of water is present in the existing pit. The current water body has a surface area of about 5 acres, ranges from 10 to 35 ft deep, and contains 60 to 80 ac-ft of water. A diversion channel routes Grayback Arroyo around the pit.

Other facilities from 1982, including processing plant, waste rock storage and tailings storage, have been partially reclaimed. Water-supply wells PW-1, PW-2, PW-3, and PW-4 (Fig. 1.1) have been unused since 1982, except for pumping tests conducted by NMCC in 2012 to 2013.

Features of the Project include (Fig. 1.1) an expanded pit, processing plant, a lined tailings storage facility (TSF), and waste rock stockpiles (WRSPs). The water-supply wells will be re-activated. The Grayback Arroyo diversion would be maintained. Other diversions will route surface runoff around the processing plant and waste rock and tailings storage facilities.

The proposed operating scenario is detailed in NMCC's Updated Mining Operation and Reclamation Plan for Copper Flat Mine (MORP; THEMAC, 2017a, Rev. 1) and in NMCC's Discharge Permit Application (DP: THEMAC, 2017b, Rev 1). The planned scenario reflects a processing rate of 30,000 tons of ore per day for 11 to 12 years, and aligns with "Alternative 2" in the Copper Flat Draft Environmental Impact Statement (BLM, 2015). Upon receiving the required permit approvals, the Project will begin site preparation and construction, which will last approximately 2 years.

The operating life (period of mining) of the project is anticipated to be 11 to 12 years as noted in the MORP. NMCC will mine approximately 113 million tons of ore and 45 million tons of waste rock during the operating life of the mine (158 million tons). Depending on operational conditions, the mining operation will supply 8.9 to 10.8 million tons per year of copper ore to the mill for processing.

The pit will be expanded to occupy a footprint of 129 acres, reaching an ultimate bottom elevation of 4,650 ft amsl, about 825 ft below original ground surface. At the end of mining, the pit would be rapid-filled with good quality water from the production wells to the projected long-term stable water level and prevent oxidation of sulfates below the pit lake water line, thus optimizing pit water quality.

The WRSPs will be placed completely on crystalline bedrock, which provides a natural low-permeability liner. During operations, surface-water runoff collection trenches will be constructed, as needed, to collect and route runoff from the WRSPs to storm-water impoundments at the toe. These trenches will be constructed into the andesite bedrock to prevent water from entering the alluvial surface material down-gradient of the WRSPs. After mining ceases, the WRSPs will be reclaimed and covered with a 3-ft-thick engineered layered system of fill materials designed to store precipitation until it evaporates and prevent infiltration into the underlying WRSPs.

The TSF will be placed on an engineered liner system to prevent subsurface infiltration. The lined TSF will include an over-liner drainage system to maximize reclaim of water and minimize pressure on the liner. Underdrains beneath the dam will collect seepage and preserve dam stability. Water will be reclaimed from the surface of the tailings in a supernatant pond. After mining, the facility will be drained down reclaimed and covered with a 3-ft-thick layered system of fill materials to prevent infiltration into the tailings.

Ore will be trucked from the pit to the processing plant for crushing, grinding, and flotation recovery of copper. The mill will process ore at an average rate of 27,890 tons per day over the life of the operation. Milling will also include a molybdenum processing circuit and a gravity gold recovery circuit.

After mining, the site will be closed and reclaimed per an approved Reclamation and Closure Plan. NMCC has prepared a Reclamation and Closure Plan described in the Mine Operation and Reclamation Plan submitted to the Mining and Minerals Division as part of NMCC's Permit Application Package (THEMAC, 2017a; Golder, 2017).

The objective of the Reclamation and Closure Plan is to reclaim and close the facility in a manner protective of groundwater in conformance with the NM Copper Rules, meet the reclamation requirements of the New Mexico Mining Act, and return the mine area to conditions similar to those present before NMCC's re-establishment of the mine. The Reclamation and Closure Plan is designed to re-establish grazing in the area and allow for long-term use of the reclaimed areas by wildlife known to historically use the area without affecting the potential for other uses such as mining and recreation.

1.2 Analysis Method

The model of groundwater flow in the Animas Uplift and the Palomas Basin (JSAI, 2014) was used to project the hydrologic consequences of development of the Copper Flat Project. The numerical model was peer reviewed and adopted by the New Mexico Office of the State Engineer (NMOSE) in its deliberations regarding NMCC water rights declarations, and used for the Copper Flat Draft Environmental Impact Statement (BLM, 2015).

The mine site water balance developed for the proposed Mining Operation and Reclamation Plan (THEMAC, 2017a) was simulated in the numerical model to estimate potential effects on groundwater and surface-water levels and flows for the pre-mining, mining, and post-mining periods.

This analysis meets the requirements of NMAC 19.10.6.602.(13)(g)(v) by evaluating the probable hydrologic consequences of the operation and reclamation on both the permit and affected areas, with respect to the hydrologic regime, quantity, and quality of surface and groundwater systems that may be affected by the proposed operations.

The analysis takes into account both water use by the proposed operation and proposed mitigation strategies to reduce or eliminate the effects of the proposed operation. The "hydrologic regime" is considered to be surface and groundwater systems potentially affected by NMCC's proposed operation and reclamation of Copper Flat.

Surface and groundwater systems in the area include the following.

Groundwater is found in:

- The regional Santa Fe Group (SFG) aquifer.
- Quaternary-age alluvial aquifers along Animas Creek and Percha Creek.
- The crystalline bedrock of the Animas Uplift.

Surface water includes:

- Perennial flow in the Rio Grande and Caballo Reservoir that is supplied in part by discharge from the SFG aquifer.
- An area of perennial flow and riparian vegetation along Animas Creek where the Quaternary-age alluvial aquifer discharges to the surface.
- An area of perennial flow and riparian vegetation along Percha Creek, atop the crystalline bedrock.
- Springs discharging from the crystalline bedrock.
- Storm water flows in Grayback Arroyo.

"Consequences" considered here are the resulting effects on the hydrologic regime of NMCC's proposed operation and reclamation including both water use, and surface and groundwater impact mitigation measures.

The sources of possible hydrologic consequences of the Project include:

1. Groundwater withdrawals from the SFG aquifer: The mine water supply will be withdrawn from pumping wells PW-1, P W-2, P W-3, and P W-4. Water level in the SFG aquifer will be lowered around the well field and then gradually recover after mining. Secondary effects evaluated include:
    a. Reduced groundwater discharge to Rio Grande and Caballo Reservoir.
    b. Reduced flow to artesian wells and other effects to local groundwater users.
    c. Potential reduced discharge to shallow aquifers along Animas Creek and Percha Creek, leading to lower alluvial water levels and reduced discharge to the perennial flow and riparian areas along Animas Creek.
    d. Potential ground subsidence.

2. Groundwater withdrawals from the crystalline bedrock associated with the open pit. Water levels in the bedrock around the pit will be permanently lowered, and groundwater will flow to the pit and evaporate. Groundwater flow rates to the pit and the future open pit water level and water balance are assessed. Secondary effects evaluated include:
    a. Potential effects on springs discharging from the crystalline bedrock and on the Percha Creek perennial (riparian) area.

3. Potential for groundwater discharge from the WRSPs and TSF.

The consequences were evaluated using the numerical model (JSAI, 2014), which was developed using the United States Geological Survey (USGS) groundwater-flow modeling code MODFLOW (McDonald and Harbaugh, 1988).

Water supply pumping from the SFG aquifer was simulated at rates specified in the mine-site water balance using the MODFLOW module WEL. Pumping was simulated for the pre-mining period of construction, for the period of mining and for post-mining filling of the open pit. The period-of-pumping simulation is followed by simulation of the post-pumping recovery of water levels.

Pit-area dewatering is simulated initially as pumping from the open pit, represented using MODFLOW module LAK2 (JSAI, 2014, appendix D). After the initial dewatering of the existing pit, a set of drain boundary conditions (MODFLOW module DRN) simulate a lowering of groundwater levels as the open pit depth increases. The simulated drain elevations initially represent the extent and elevation of the current pit. The drain elevations are then lowered and new drains are added through the simulation time, to transform the boundary conditions to represent the ultimate pit. The post-mining pit filling and pit water balance is simulated using module LAK2.

Potential for groundwater discharge from the WRSPs and TSF are estimated independently of the numerical model.

1.3 Report Structure

The contents of the report are organized as follows:

Section 1.0 – Describes the Project and analysis methods and outlines the report

Section 2.0 – Projected water demand for mine water supply and rapid-filling in mine area, and estimated open-pit dewatering

Section 3.0 – Probable hydrologic consequences for mine area including the following:

- 3.1 Groundwater withdrawals from the SFG aquifer
  - 3.1.1 Regional groundwater level drawdown
  - 3.1.2 Effects on water balance
  - 3.1.3 Flow from north Palomas Graben
  - 3.1.4 Operational plans for no net effect on the Rio Grande
  - 3.1.5 Other water rights
  - 3.1.6 Effects of reduced flowing well pressure
  - 3.1.7 Effects on Quaternary-age alluvial aquifers and Animas Creek perennial flow and riparian zones
  - 3.1.8 Ground subsidence
- 3.2 Groundwater withdrawals from the crystalline bedrock
  - 3.2.1 End-of-mining groundwater drawdown
  - 3.2.2 Open pit water balance
  - 3.2.3 Potential open pit discharge to groundwater
  - 3.2.4 Effects on springs and on the Percha Creek perennial (riparian) area
- 3.3 Potential groundwater discharge from tailings and waste rock
  - 3.3.1 Tailings infiltration
  - 3.3.2 Waste rock infiltration
  - 3.3.3 Groundwater flow paths and travel times

Section 4.0 – Report conclusions with a summary of results

Section 5.0 – References

Appendix A – Additional results regarding projected groundwater-level hydrographs at different locations

Appendix B – Technical Memorandum regarding the analysis of liner leakage rates

2.0 PROJECT WATER DEMAND

The projected water demand is based on the proposed mine plan for Copper Flat as detailed in the Mining Operation and Reclamation Plan, Rev. 1 (THEMAC, 2017a), which includes a water balance accounting for seasonal effects of climate, recycled process water, makeup water from supply wells, open pit dewatering, and diverted and captured storm-water runoff from the mine area.

The projected monthly water demand was obtained in electronic form (spreadsheet file "Nov 2016 Water Balance Prod Well GPM.xlsx," NMCC personal communication, February 2017). Operational demand increases in summer and decreases in winter, averaging 6,105 ac-ft/yr over the 11.5-year life of the mining operation.

Water will be withdrawn from the SFG aquifer to provide the main water supply for the mine. Water will also be withdrawn from the crystalline bedrock, to dewater the pit. After mining, water will be withdrawn from the SFG aquifer to rapid-fill the open pit.

2.1 Water-Supply Pumping

The estimated rates of groundwater use are summarized on Table 2.1. Project water demand includes the mine construction and start up, 11.5-year mining period, and post-mining reclamation water demand requirements. Pumping for rapid fill reclamation of the open pit will require 2,200 ac-ft over 0.5 year.

Table 2.1. Projected water-supply pumping

component	unit	result
pumping duration (includes construction, operation, reclamation)	years	23.0
average pumping rate over full project duration	gpm	2,180
summer maximum pumping rate	gpm	4,224
winter minimum pumping rate	gpm	3,388
water removed from aquifer over pumping duration	ac-ft	73,856
average annual pumping rate over pumping duration	ac-ft/yr	3,211
maximum annual withdrawal rate	ac-ft/yr	6,095

gpm - gallons per minute ac-ft/yr - acre-feet per year

The Project water use is presented in more detail in Table 2.2, showing year-by-year projections of water needs. The table presents the water balance for the mine operation that has been provided to the U.S. Bureau of Land Management in response to comments on the Draft Environmental Impact Statement, with the exception in listing a smaller volume of water (2,200 ac-ft instead of 2,800 ac-ft) used for post-mining filling of the pit.

Table 2.2. Projected water-supply pumping (acre-feet per year)

year	production wells	operation	construction	startup	rapid fill	reclama tion
1	132	0	132	0	0	0
2	673	0	233	440	0	0
3	6,081	6,081	0	0	0	0
4	6,087	6,087	0	0	0	0
5	6,071	6,071	0	0	0	0
6	6,088	6,088	0	0	0	0
7	6,078	6,078	0	0	0	0
8	6,086	6,086	0	0	0	0
9	6,090	6,090	0	0	0	0
10	6,095	6,095	0	0	0	0
11	6,095	6,095	0	0	0	0
12	6,090	6,090	0	0	0	0
13	6,093	6,093	0	0	0	0
14	5,472	2,621	0	0	2,200	651
15	321	0	0	0	0	321
16	97	0	0	0	0	97
17	97	0	0	0	0	97
18	50	0	0	0	0	50
19	24	0	0	0	0	24
20	15	0	0	0	0	15
21	10	0	0	0	0	10
22	6	0	0	0	0	6
23	5	0	0	0	0	5
24	0	0	0	0	0	0
25	0	0	0	0	0	0
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Total	73,856	69,575	365	440	2,200	1,276

This smaller post-mining filling of the pit volume is a refinement of the plan that does not measurably change the effects of the Project. The revised pit water balance is reflected in the analysis of pit water (SRK, 2017). Other, smaller adjustments to the estimated water balance may arise as the Project develops, with no measureable change to the effects of the Project.

2.2 Open-Pit Dewatering and Refilling

Pit dewatering is simulated assuming initial pit sump pumping of 100 gallons per minute (gpm), projected to empty the existing pit, with a water volume of about 60 ac-ft (INTERA et al., 2012), in about 4-1/2 months. During operations, groundwater and runoff flowing to the pit will be collected in sumps and pumped out. Projected pit dewatering during mining is summarized in Table 2.3.

Table 2.3. Pit dewatering

pit dewatering duration	years	11.4
average pit dewatering rate	gpm	28
total water withdrawn by pumping over full project duration	ac-ft	499

gpm - gallons per minute ac-ft – acre-feet

The schedule of dewatering is shown on Figure 2.1 including projected pit bottom elevation, pit-area groundwater elevation, and dewatering rates. Long-term total flow is expected to range between about 35 and 65 gpm (56 and 105 ac-ft/yr) with an initial minimum of about 20 gpm (32 ac-ft/yr) and a maximum of about 70 gpm (113 ac-ft/yr), as the pit bottom approaches final elevation of 4,650 ft amsl.

After mining is complete, the pit will be rapid filled to the projected steady-state post-mining equilibrium water level.

Current and projected final pit geometry are summarized on Figure 2.2 showing the water surface area as a function of water level. The existing pit currently has a water surface area of about 5.2 acres. The proposed pit would have water surface area of about 22 acres, with a final water level near 4,897 ft amsl. Rainfall, runoff, and groundwater inflows to the ultimate pit are projected (Section 3.2 below) to be about 100 ac-ft/yr, sufficient to sustain evaporation from a water surface of about 22 acres.

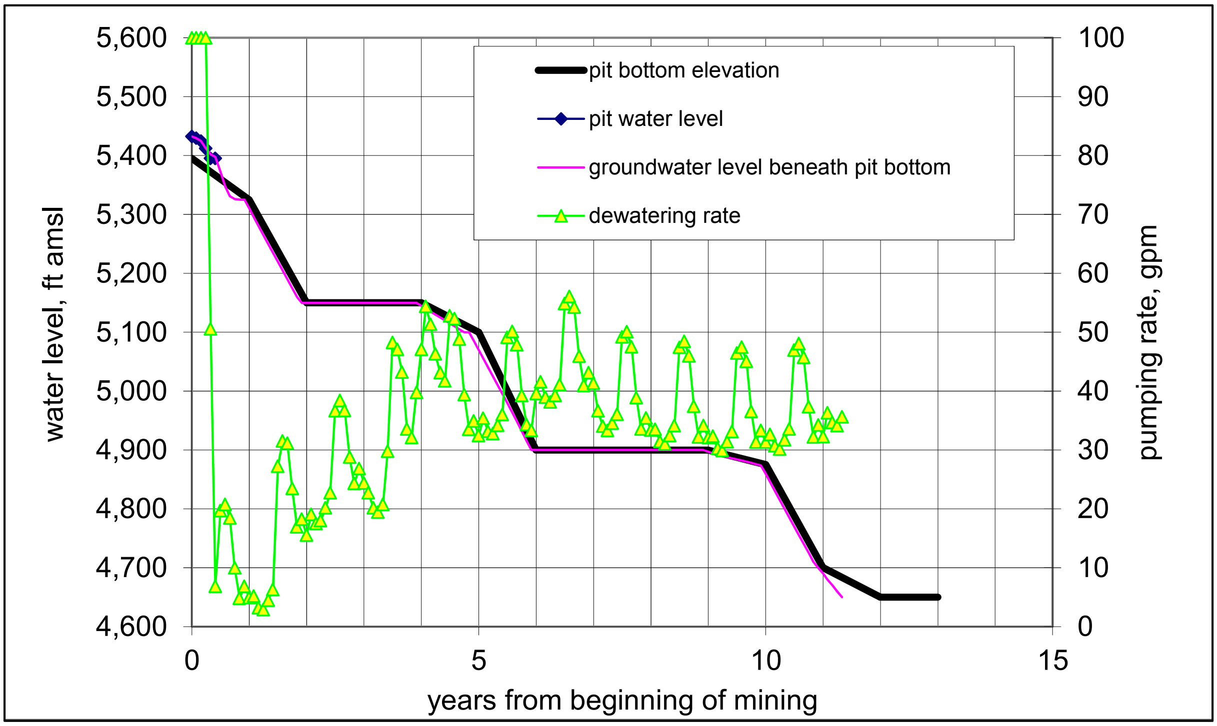

Figure 2.1. Projected pit bottom elevation, groundwater level, and dewatering rate.

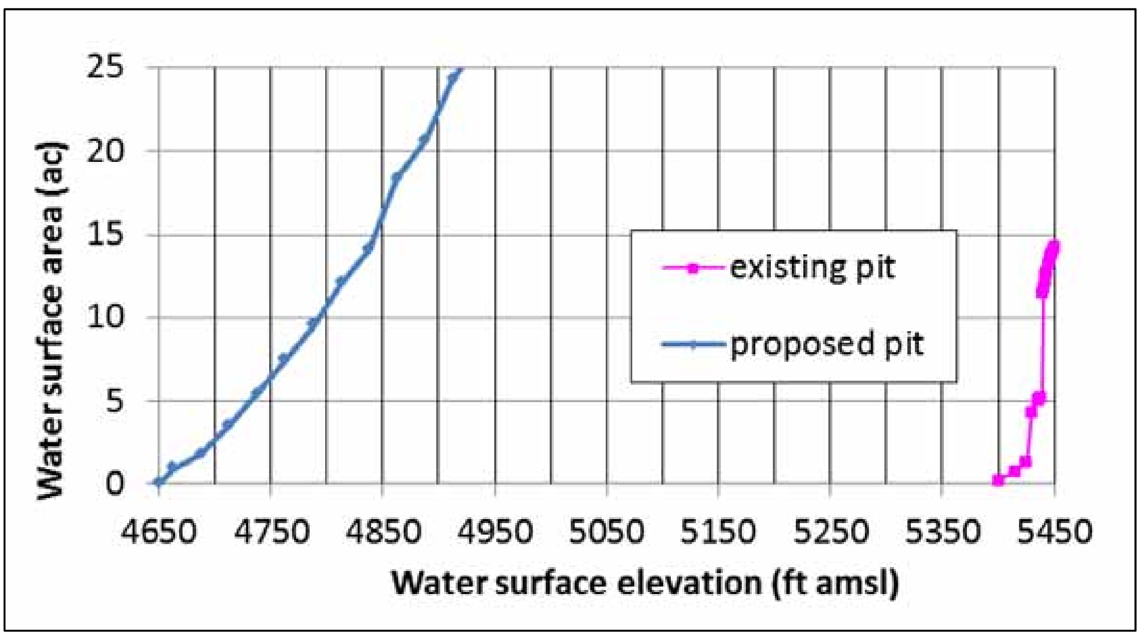

Figure 2.2. Current pit and final pit elevations and water-surface areas.

3.0 PROBABLE HYDROLOGIC CONSEQUENCES

Probable hydrologic consequences are related to the direct hydrologic consequences of the Project:

1. Groundwater withdrawal from the SFG aquifer for mine water supply.
2. Groundwater withdrawal from the crystalline bedrock around the open pit.
3. Potential for infiltration of water from the TSF and WRSPs to groundwater systems.

3.1 Groundwater Withdrawals From the SFG Aquifer

The most direct consequence of groundwater withdrawal from the SFG aquifer will be groundwater-level drawdown in the aquifer (Sec. 3.1.1). This will in turn result in changes to the aquifer water balance (Sec. 3.1.2), including increased inflow from the north Palomas Graben (Sec. 3.1.3), reduced discharge to the Rio Grande and Caballo Reservoir, reduced discharge to flowing wells, and reduced discharge to the Quaternary-age alluvial aquifers.

The consequences of reduced discharge to the Rio Grande and Caballo are discussed in Section 3.1.4. Potential consequences to other groundwater rights are discussed in Section 3.1.5, with the consequences of reduced discharge to flowing wells discussed in Section 3.1.6.

The potential consequences of reduced discharge to Quaternary-age alluvial aquifers, including reduced discharge to the perennial and riparian zone along Animas Creek, are discussed in Section 3.1.7.

Potential land subsidence, another possible consequence of groundwater drawdown, is discussed in Section 3.1.8.

3.1.1 Regional Groundwater Level Drawdown

Contours of projected groundwater-level drawdown at the end of mining in the SFG aquifer around the water-supply wells are shown on Figure 3.1. After the end of mining, water levels in the SFG aquifer will gradually recover to pre-mining levels over about 20 to 30 years.

The groundwater-level drawdown over time will in turn cause reduced discharge from the SFG aquifer to the Rio Grande and Caballo, and reduced discharge to other related hydrogeologic systems.

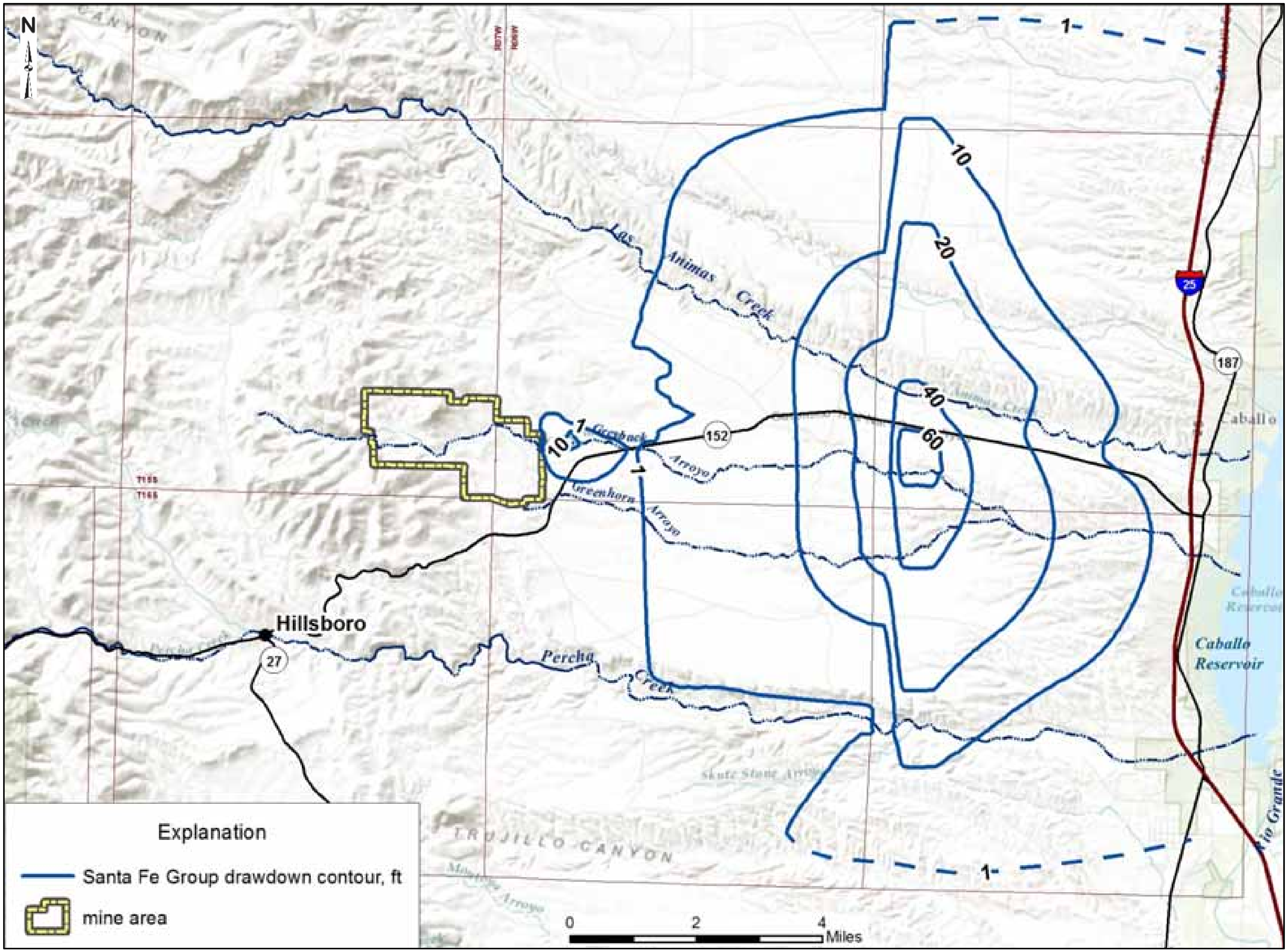

Figure 3.1. Projected end-of-mining groundwater drawdown in the SFG aquifer.

3.1.2 Effects on Water Balance

The groundwater pumped is initially removed from aquifer storage. Over time, more water is provided by increased inflow from the Palomas Graben north of the study area and by reduced discharge out of the study area. The sources of the water pumped are shown on Figure 3.2.

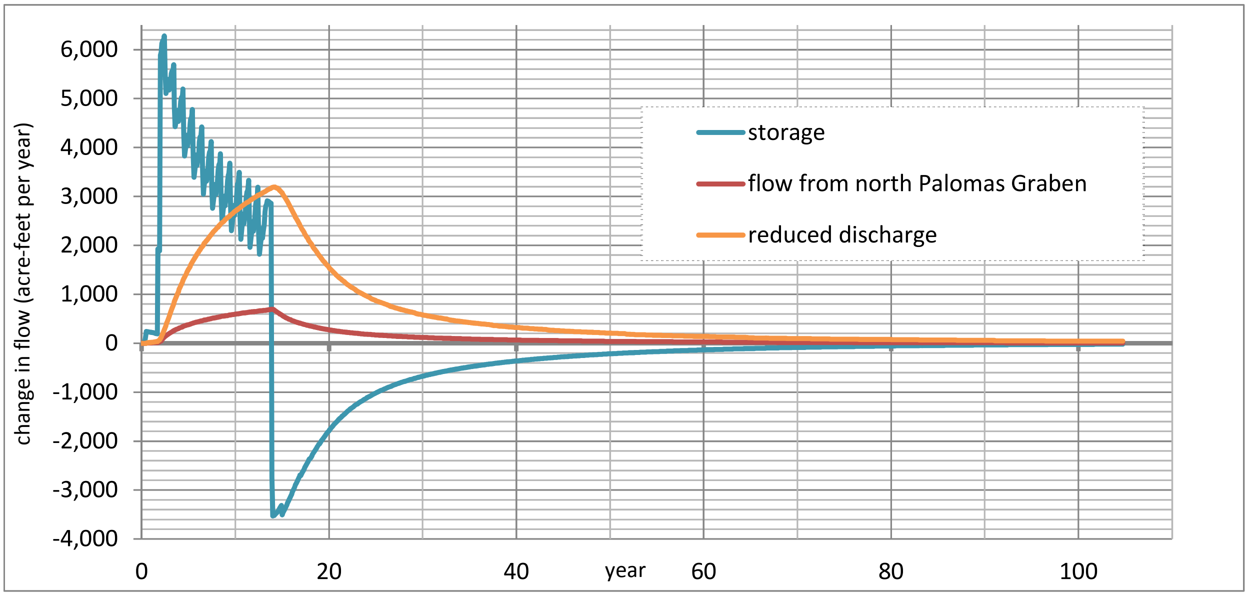

Figure 3.2. Projected sources of water pumped.

The hydrologic effect of additional inflow from the north Palomas Graben on the Rio Grande is estimated in Section 3.1.3.

The reductions in discharge are presented in detail on Figure 3.3, and include components of (1) reduced discharge to the Rio Grande both above and below Caballo Reservoir, (2) reduced discharge to flowing wells, and (3) reduced discharge to Quaternary-age alluvial aquifers and the Animas Creek perennial (riparian) zone.

The effects of reduced discharge to Caballo Reservoir and the Rio Grande are discussed in Section 3.1.4. The potential effects on other groundwater rights are discussed in Section 3.1.5. The potential hydrologic effects of reduced discharge to flowing wells are discussed in Section 3.1.6.

The potential hydrologic effects of reduced discharge to Quaternary-age alluvial aquifers and the Animas Creek perennial (riparian) zone are discussed in Section 3.1.7.

The projected water balance changes are summarized in Table 3.1.

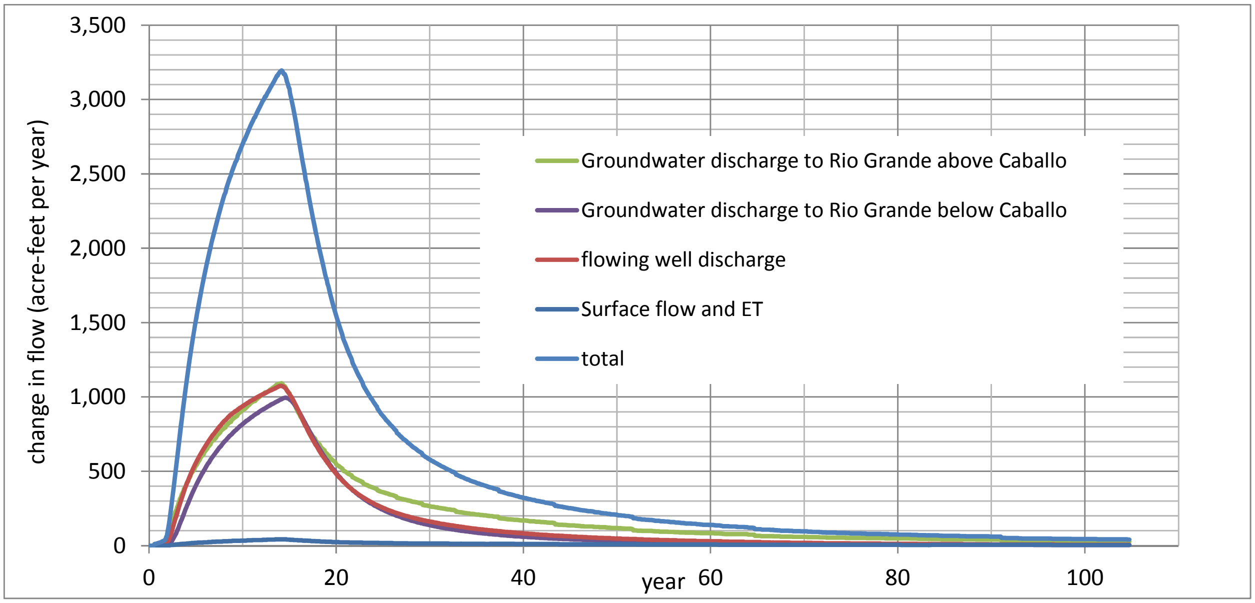

Figure 3.3. Projected reductions in discharge.

Table 3.1. Summary of results

change in flow, acre-feet/year		
parameter	**rate 3 months after pit filling**	**rate 100 yrs after mining**
storage	-3,525	-12
groundwater discharge to Rio Grande above Caballo Dam	1,089	25
groundwater discharge to Rio Grande below Caballo Dam	983	3
discharge from flowing wells	1,075	5
Animas Creek evapotranspiration and flow reduction	18	0
Percha Creek evapotranspiration and flow reduction	25	2
flow to open pit	28	29
inflow from graben north of study area	686	3

cumulated change in volume, acre-feet	
parameter	**volume change 3 months after pit filling**
storage	42,813
Rio Grande above Caballo Dam	8,878
Rio Grande below Caballo Dam	7,504
flowing wells	9,007
Animas Creek flow and evapotranspiration	147
Percha Creek flow and evapotranspiration	180
flow to open pit	-467
inflow from graben north of study area	5,924
total	**73,987**

3.1.3 Flow From North Palomas Graben

Induced groundwater flow from the Palomas Graben (Fig. 3.2) north of the study area would result in reduced discharge to the Rio Grande, beyond the reductions shown in Figure 3.3.

Based on discussions with the NMOSE, the effect of increased flow from north of the study area on the Rio Grande is estimated here using an analytical solution (Glover and Balmer, 1954; Theis, 1941) for the effect on streamflow of pumping a well.

The solution applied here simulates an impermeable barrier west of the Palomas Graben, reflecting the fault barrier and lack of aquifer transmissivity west of the graben.

A computer program employed by NMOSE (E. Keyes, personal communication, 2015) was used to compute the effect on the Rio Grande from removal of (the numerical model-computed) water from the graben, using assumptions listed in Table 3.2.

Table 3.2. Parameters for Glover-Balmer solution

transmissivity (ft^2/day)	3,700
storage coefficient (percent)	10
distance from well to river (miles)	6
distance from well to barrier (mile)	1

Results are shown on Figure 3.4 for a scenario pumping a constant 6,100 ac-ft/yr for 12 years. The computed effect on the Rio Grande would be added to the "Rio Grande above Caballo" effect shown on Figure 3.3.

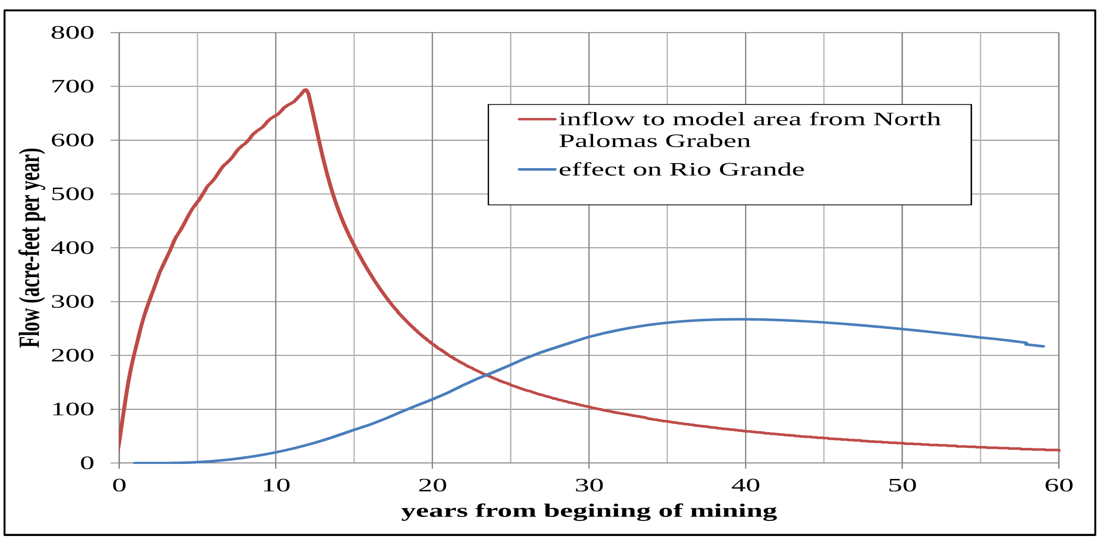

Figure 3.4. Projected effect on Rio Grande of increased flow from north Palomas Graben.

3.1.4 Operational Plans for No Net Effect on the Rio Grande

NMCC has committed to offset the effects of reduced discharge to the Rio Grande system (Figs. 3.3 and 3.4) during and after the operation of the Copper Flat Mine to ensure no net reduction in flows of the Rio Grande, in a manner approved by the NMOSE.

NMCC has procured a lease for water from the Jicarilla Apace Nation (Nation) that has been approved by the United States Secretary of the Interior.

The Nation is the owner of water rights through a water rights settlement agreement authorized and adopted by the United States Congress and the State of New Mexico in the Jicarilla Apache Tribe Water Rights Settlement Act of October 23, 1992 (Settlement Act).

The Settlement Act expressly permits trans-basin transfers and the Nation currently has the right to lease 6,500 ac-ft/yr. The Jicarilla lease water is diverted from three tributaries in Colorado, diverted through the San Juan Chama project tunnels and is stored in Heron Reservoir in northern New Mexico.

The water purchased by NMCC for offset purposes will travel down the Chama River and into the Rio Grande in the same manner that other Jicarilla-leased water is allowed with the approval of the Secretary of Interior and NMOSE.

Flow of Jicarilla lease water arriving at Caballo Reservoir will be computed based on agreed-upon evaporation and conveyance losses between Heron Reservoir and Caballo Dam. NMCC will provide sufficient water arriving at Caballo Dam to offset the groundwater-flow model-computed effects (Figs. 3.3 and 3.4) both above and below Caballo Dam.

The Jicarilla lease has been executed by NMCC and the Nation and the agreement has been reviewed and approved by the United States Bureau of Reclamation action with the full authority of the United States Secretary of Interior. The lease specifically allows water to be utilized at the locations where NMCC pumping effects on the Rio Grande are predicted to take place.

All that remains to allow the diversion of Jicarilla lease water is NMOSE approval of the NMCC plan to use wells LRG-4652 through LRG-4652-S-3 (PW-1 through PW-4), which is pending an on-going proceeding and negotiation. NMCC is working with NMOSE to incorporate into the permit all monitoring, offsets, and replacement requirements deemed necessary to avoid impairment to other water users and impacts to the Rio Grande.

When the permit is issued, the conditions of approval will include an express condition by NMOSE, that the pumping effect on the Rio Grande will be offset by the water purchased under the lease from the Nation. The permit will address the length of time offsets and monitoring are necessary to protect the Rio Grande and existing water users after mine operations cease.

If NMCC, at some point after mine operation ceases and impacts to the river are decreasing, elects to stop leasing water from the Nation to provide for offsets on the river, NMCC will either secure another lease of equally effectual water or secure and permanently retire water rights. NMCC will supply the offset water in the quantity and location sufficient to offset the effects of NMCC pumping, in a manner agreed by NMOSE.

In the case of the permanent retirement of water rights, the offset would continue to have a positive effect on the Rio Grande even after the NMCC effect ceases. In any case, NMCC will take steps to ensure that no net reduction of flow to the Rio Grande occurs.

3.1.5 Other Water Rights

The SFG aquifer will have a limited area of significant drawdown, which may directly affect a small number of private wells. During the operation of its production wells, NMCC will work with NMOSE to ensure that impairment to existing water rights, according to NMOSE criteria, shown to be caused by NMCC pumping, will be mitigated, as appropriate, so that there is no net loss of available water to the existing water right.

Flowing wells along the eastern ends of Animas Creek and Percha Creek will experience a reduction in artesian pressure and reduced flow, as described in Section 3.1.6.

Groundwater model projections indicate that private wells in the shallow aquifer along Animas Creek and Percha Creek will not be affected by the pumping of the NMCC production wells, as described in Section 3.1.7.

3.1.6 Effects of Reduced Flowing Well Pressure

The model estimates a peak reduction in discharge to flowing wells of 1,054 ac-ft/yr, out of a pre-mining discharge of 2,030 ac-ft/yr (Table 3.1). The effect builds gradually from zero, to a maximum of 1,054 ac-ft/yr shortly after the end of mining, then gradually diminishes to near-zero over 30 years (Fig. 3.3). The possible consequences of reduced discharge to flowing wells are discussed below.

The flowing wells are located in the lower (eastern) section of the study area, upstream of Caballo Reservoir. Most of the wells are located along Animas Creek, with the remainder along Percha Creek. Estimated pre-mining discharge to flowing wells of 2,030 ac-ft/yr consists of 1,750 ac-ft/yr of discharge to Animas Creek wells and 280 ac-ft/yr to wells along Percha Creek.

In general, discharge from the flowing wells is used to fill unlined ponds, which in turn serve as reservoirs for irrigation systems. Most wells are allowed to flow continually, maintaining permanent ponds; these are visible in Google Earth images taken both inside and outside the irrigation season.

The discharge from flowing wells to ponds can evaporate from the pond, infiltrate into the shallow groundwater system or be pumped to irrigate fields. Water applied to the fields may be discharged as evapotranspiration or infiltrate to the shallow groundwater system.

Discharge from the flowing wells does not contribute significantly to streamflow, as there are no perennial stream sections in the artesian zone of the lower Animas and Percha Creek basins (INTERA et al., 2012). Flowing well discharge instead contributes to the shallow groundwater systems along Animas Creek and Percha Creek.

The pond and field areas along Animas Creek were estimated based on Google Earth, at 3.9 and 125.8 acres, respectively. By comparison, the 1966 hydrographic survey indicates 8.4 acres of pond and 191.2 acres of field. The estimated discharge from flowing wells is larger than would be required to irrigate the areas indicated. Pond and field areas are listed in Table 3.3, along with the maximum rate of evaporation and evapotranspiration (JSAI, 2014, section 2.4) that could occur from the given areas.

Table 3.3. Areas and potential evapotranspiration for Animas Creek ponds and fields

	area (acres)	**maximum ET (in./yr)**	**ET (ac-ft/yr)**
ponds	3.9	65	21
fields	125.8	65	681
total	**130**		**703**

ac-ft/yr - acre-feet per year

As indicated in Table 3.3, the maximum evaporation and evapotranspiration that could occur from the given areas of pond and field is 703 ac-ft/yr. This implies that most of the 1,750 ac-ft/yr of flowing well discharge along Animas Creek infiltrates to the shallow aquifer, either from the fields or through the ponds.

Current water balance for Animas Creek flowing wells was estimated assuming (1) typical application of irrigation water, with 70-percent evapotranspiration of the water applied and 30-percent infiltration to the shallow groundwater system, and (2) infiltration of any remaining flowing well discharge through the ponds. Results are presented in Table 3.4.

Some wells with reduced artesian pressure may be pumped in order to maintain water supply. Model-projected additional drawdown at the end of mining, due to pumping flowing wells at pre-mining rates, is shown on Figure 3.5. Incremental drawdown reaches a maximum of less than 10 ft in the lower reach of Animas Creek basin.

Table 3.4. Estimated water balance for Animas Creek flowing wells

flowing well discharge	1,750
evapotranspiration (ET)	703
infiltration (fields)	301
infiltration (ponds)	746
Total (ac-ft/yr)	**1,750**

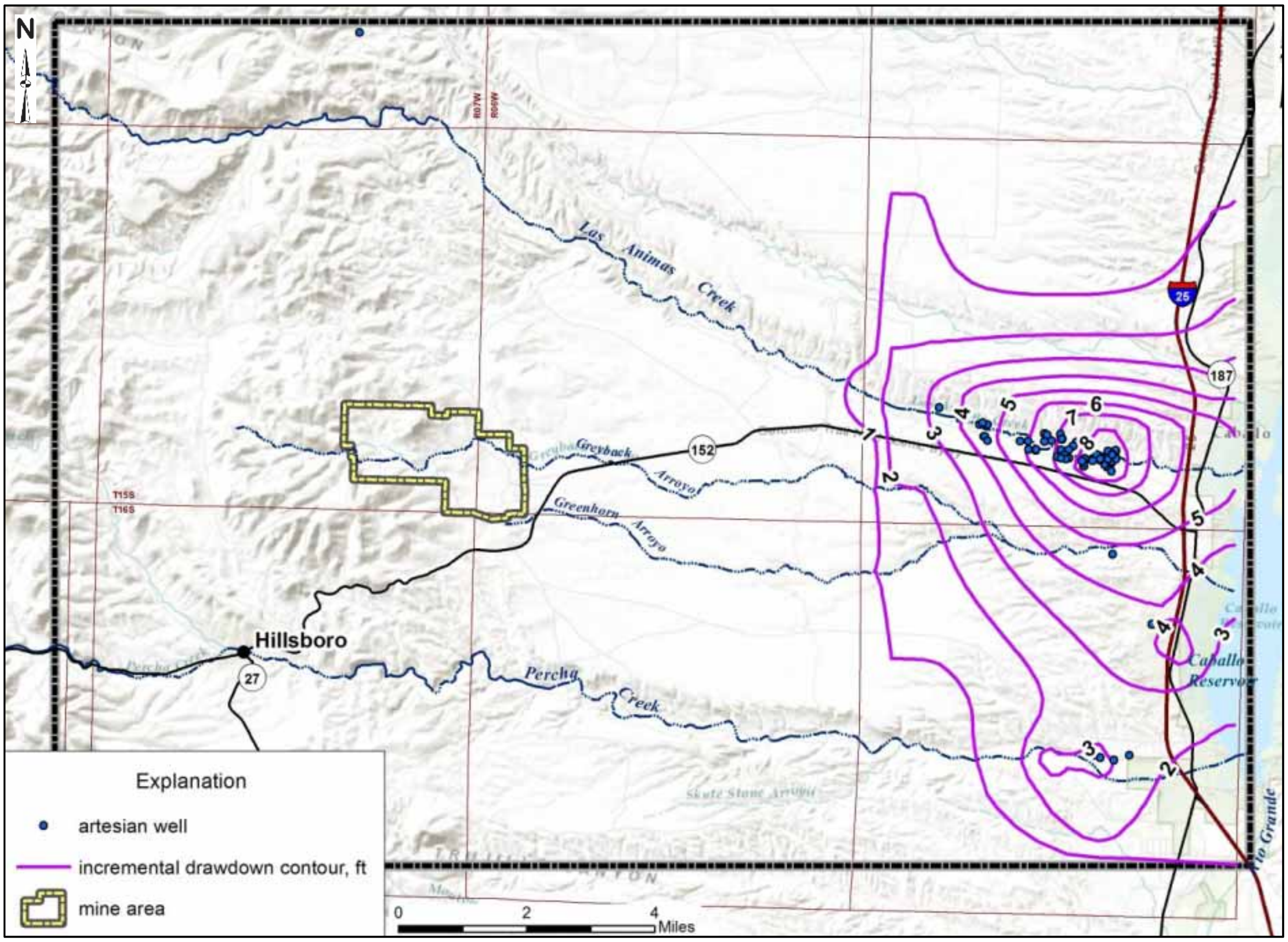

Figure 3.5. Projected incremental drawdown due to pumping of flowing wells at current flow rates.

3.1.7 Effects on Quaternary-Age Alluvial Aquifers and Animas Creek Perennial Flow and Riparian Zone

The shallow groundwater and riparian systems along Animas Creek and Percha Creek overlie the SFG sediments. Geology of the study area is shown on Figure 3.6, showing faulting within the SFG. An important fault-bounded feature is the Palomas Graben, in which the Copper Flat water-supply wells are completed.

West of the graben, the SFG sediments are thinner and less permeable, and do not yield substantial flow to wells. Within and east of the graben, the SFG forms an aquifer capable of yielding substantial flow. The hydrologic relationship of the shallow alluvial systems to the SFG is illustrated in cross-section C-C' (Fig. 3.7) along Animas Creek.

West of the graben, the low transmissivity of the SFG results in elevated water levels reaching the level of the shallow alluvium. Flow between the SFG and the alluvium is limited by low transmissivity and the small water-level gradient between the two.

Near the graben, the increased transmissivity of the SFG results in water levels dropping below the bottom of the alluvium, forming a hydraulic disconnection between the SFG aquifer and the alluvial groundwater system (Fig. 3.8). As a result, water flows from the alluvium to the SFG, through low-permeability clay beds, only by gravity; pumping from the SFG does not increase the flow or change water levels in the alluvium.

East of the graben, water flows down-dip along the permeable SFG beds. In the lower part of the basin, water level in the SFG pressurizes the confining clay beds from below. Water discharges from the SFG to the alluvium and to Caballo reservoir by flowing slowly across the resistant clay beds, or by discharging to flowing wells.

As a result, groundwater-level changes in the shallow alluvium, due to pumping in the SFG, will be highly attenuated. The main area of groundwater drawdown in the SFG (Fig. 3.1) will be in the graben, where the alluvium is disconnected from the SFG (Fig. 3.7).

Away from the graben, SFG drawdown will be smaller, and the connection to the alluvium is limited by low-permeability clay beds (Fig. 3.8).

A contour map of projected groundwater-level drawdown within Quaternary-age alluvial aquifers at the end of mining is shown on Figure 3.9. The figure indicates that peak groundwater-level drawdown along Animas Creek and most of Percha Creek will be less than 1 ft. Drawdown in a small area along lower Percha Creek is projected to be greater than 1 ft and less than 2 ft. The projected effects on evapotranspiration and surface discharge from the shallow aquifers are correspondingly small (Table 3.1). After mining ends water levels will slowly recover to pre-mining levels.

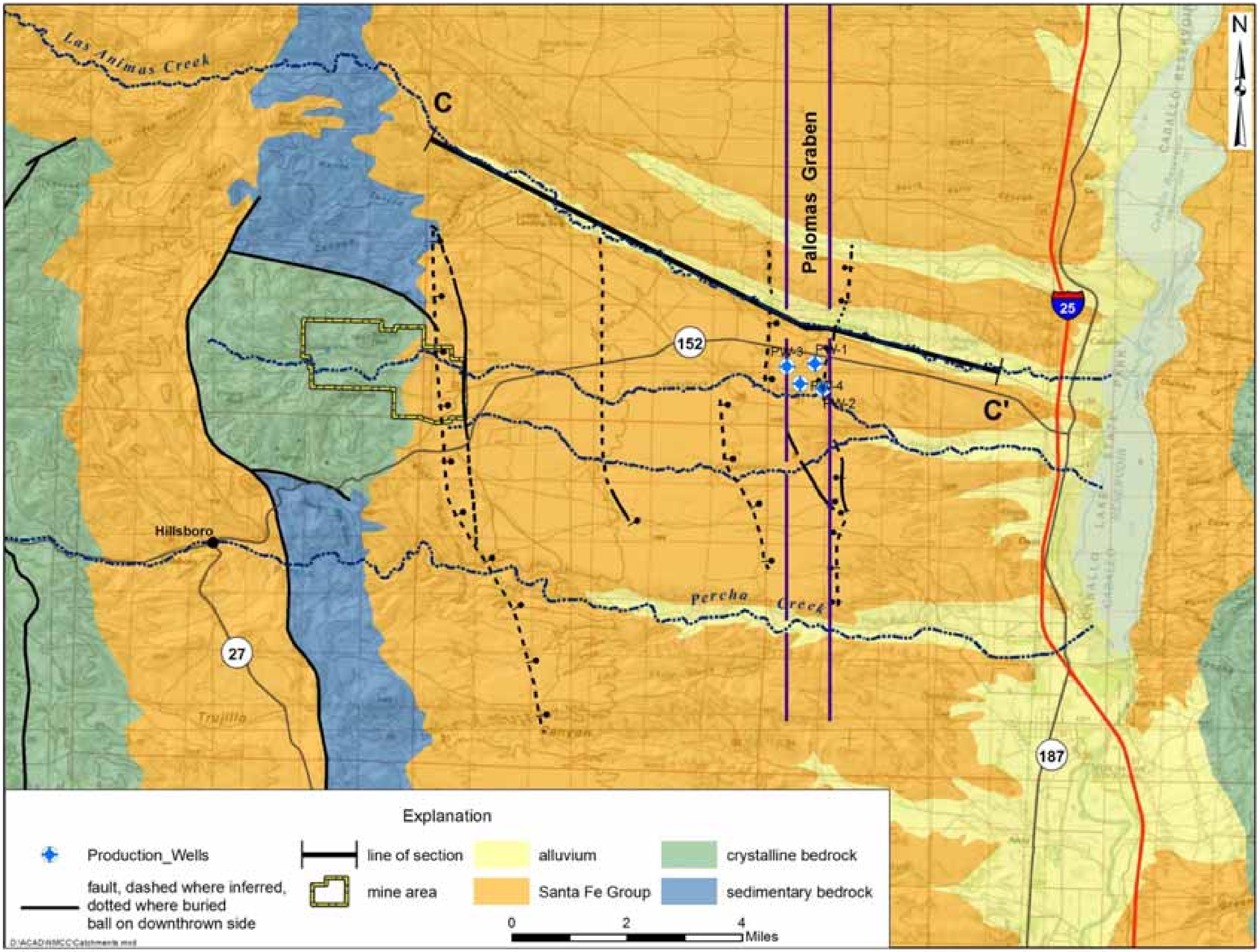

Figure 3.6. Geologic map.

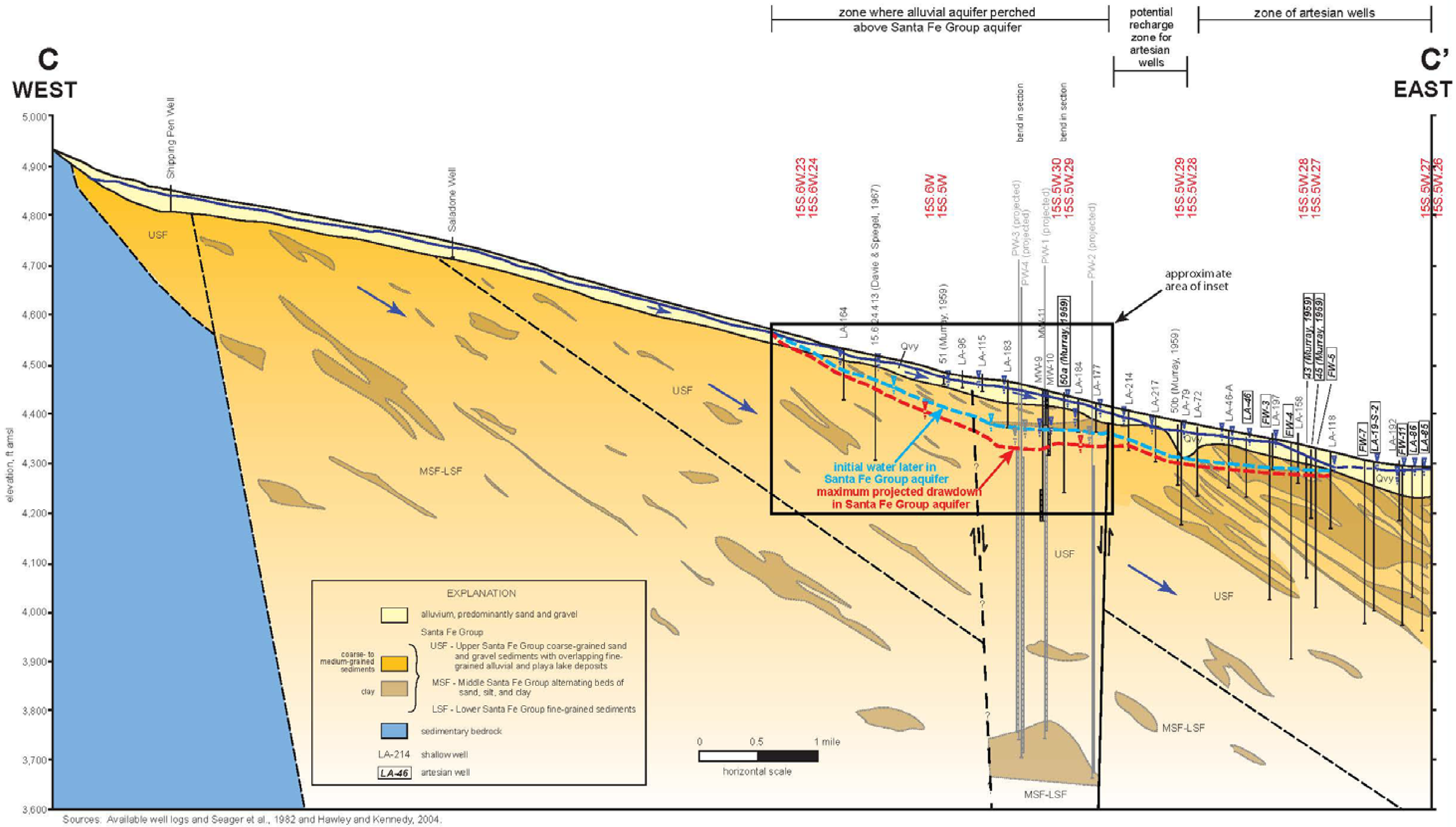

Figure 3.7. Cross-section C-C'.

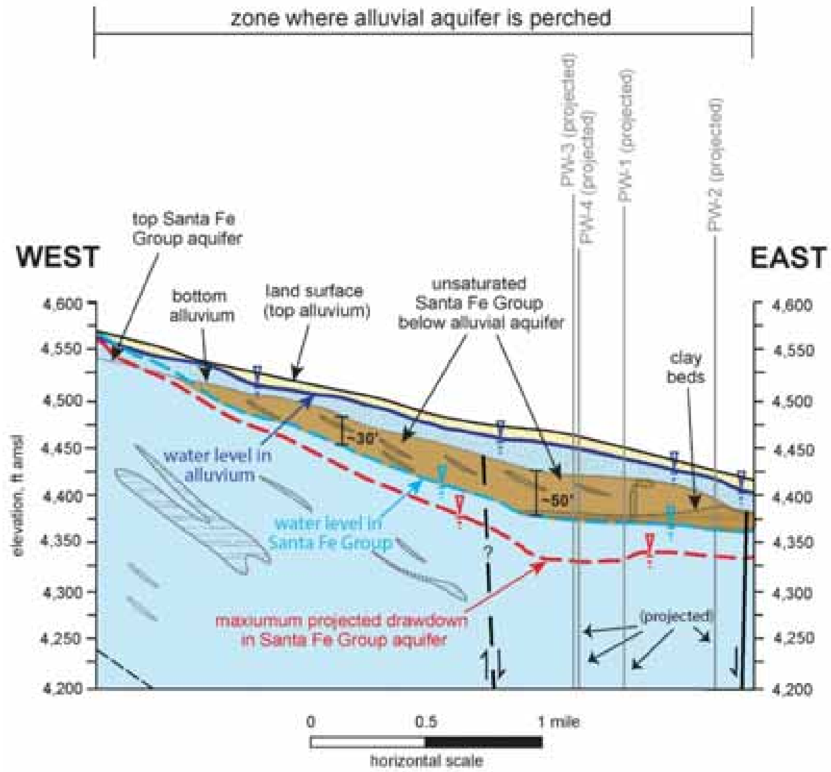

Figure 3.8. Section C-C', inset area of perched shallow aquifer.

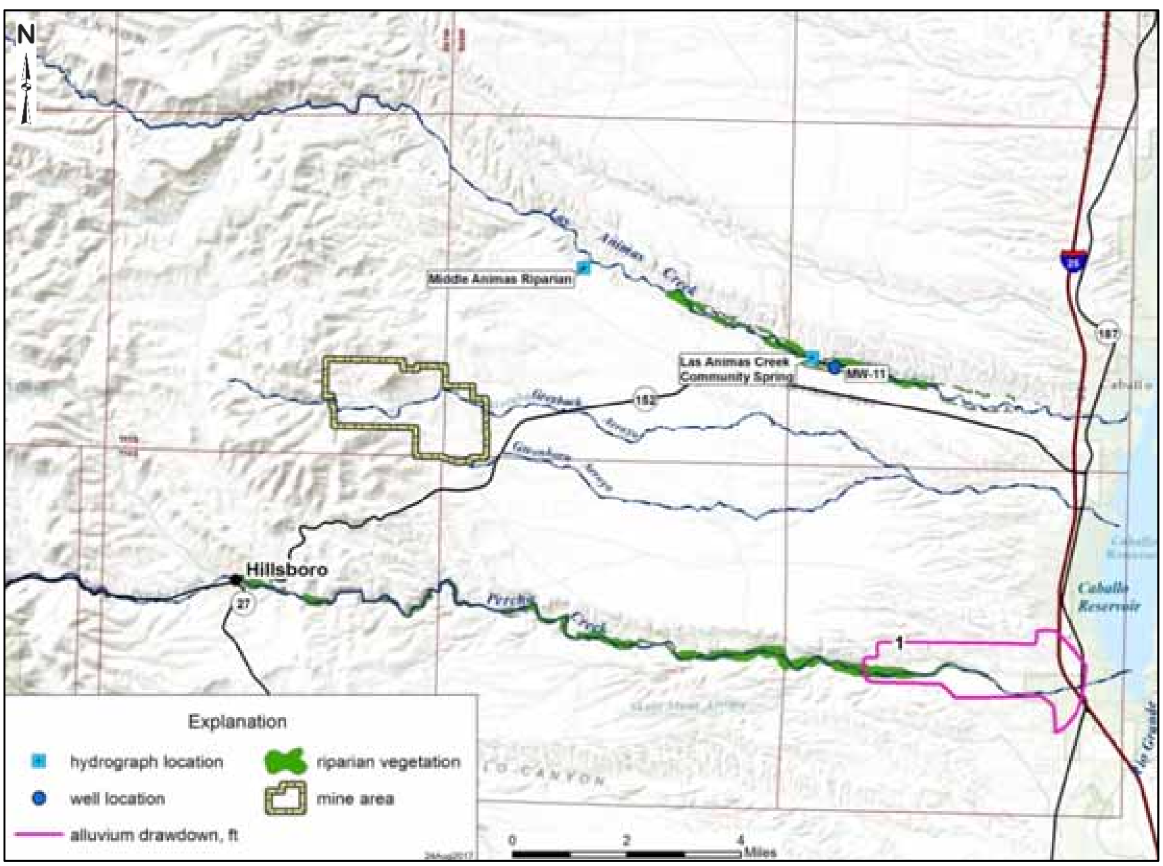

Figure 3.9. Projected end-of-mining groundwater drawdown, shallow aquifers.

3.1.8 Ground Subsidence

The potential for land surface subsidence due to groundwater-level drawdown was evaluated using the method of Hoffman and others (Hoffman et al., 2003). Potential subsidence due to dewatering of the crystalline bedrock is negligible; therefore, subsidence potential was evaluated only for the SFG aquifer around the well field.

Projected maximum drawdown (maximum drawdown near the well field occurs at the end of mining; maximum drawdown farther away may occur later) is shown on Figure 3.10, with an area-wide maximum drawdown of about 70 ft occurring at the well field.

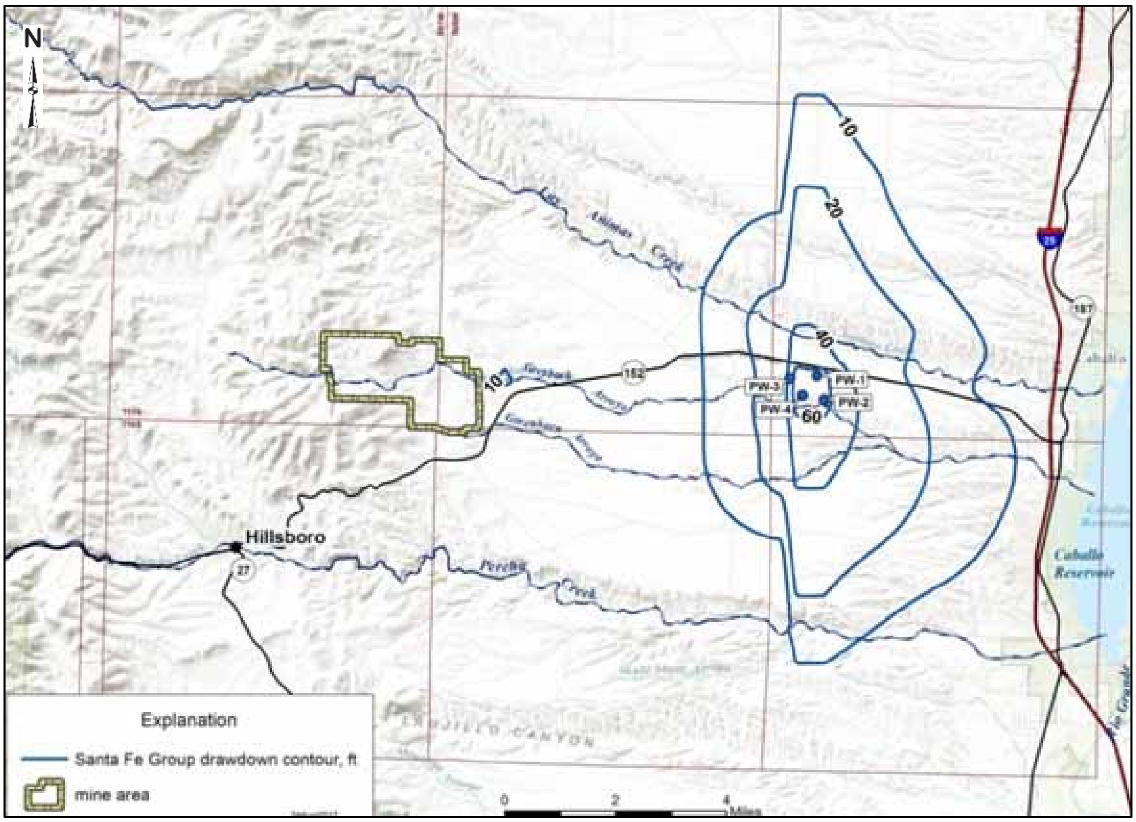

Figure 3.10. Projected maximum drawdown in Santa Fe Group aquifer.

Subsidence is estimated using equation (1) (Hoffman et al., 2003, equation 9):

$$\Delta b = S_s b \Delta h \qquad (1)$$

where, b is the saturated thickness of compressible beds
Δb is land surface subsidence
S_s is the specific storage of the compressible beds
Δh is drawdown

Thickness of compressible beds is assumed at 5,000 ft. Specific storage (storage coefficient per unit aquifer thickness) for SFG is modeled at 2.0 x 10-6/ft. Maximum subsidence is then estimated using equation (2):

$$\Delta b = (2 \times 10^{-6} \text{ /ft}) \times (5{,}000 \text{ ft}) \times (70 \text{ ft}) = 0.70 \text{ ft} \qquad (2)$$

By using conservative assumptions, a maximum potential subsidence of 0.7 ft is calculated for the immediate area of the well field, where drawdown reaches a maximum. Subsidence decreases with distance from the well field area in proportion to drawdown. Contours of maximum potential subsidence are illustrated on Figure 3.11.

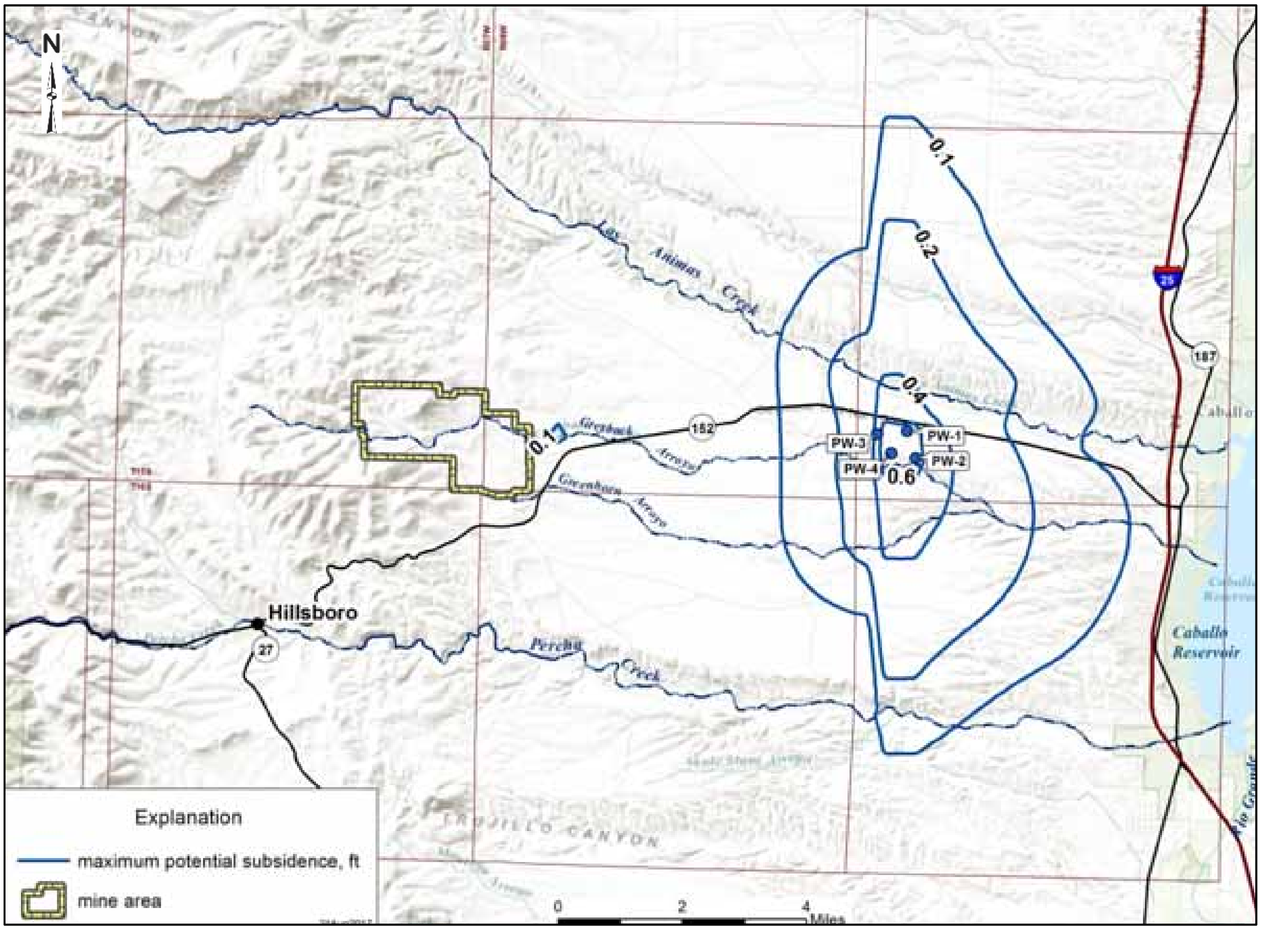

Figure 3.11. Projected worst-case potential maximum subsidence.

Outside of the well field area, the maximum potential subsidence shown on Figure 3.11 is less than about 0.4 ft (less than 5 inches), not noticeable over many years, but still over-estimated; it represents the total long-term subsidence that might be expected if groundwater drawdown is maintained.

Because the maximum groundwater drawdown would only occur near the end of mining, and would be immediately followed by post-mining water-level recovery, the drawdown would not persist for an extended period, and most of the potential subsidence would not occur. Actual subsidence is expected to be minimal at the well field and nil elsewhere.

3.2 Groundwater Withdrawals From the Crystalline Bedrock

Groundwater withdrawals from the crystalline bedrock will occur during dewatering of the open pit and after mining as groundwater flows into the pit. Consequences considered below include the following:

- Groundwater drawdown occurring during dewatering of the open pit is presented in Section 3.2.1.
- Groundwater discharge to the pit and the post-mining pit water balance are presented in Section 3.2.2.
- Potential discharge of groundwater from the open pit is discussed in Section 3.2.3.
- Long-term groundwater drawdown and potential effects on springs discharging from the crystalline bedrock are discussed in Section 3.2.4.

3.2.1 End-of-Mining Groundwater Drawdown

Groundwater drawdown in the crystalline bedrock at the end of mining is shown on Figure 3.12. Drawdown approaches a maximum of about 750 ft at the bottom of the dewatered pit. Drawdown of 1 ft extends for an approximately 2-mile radius around the pit.

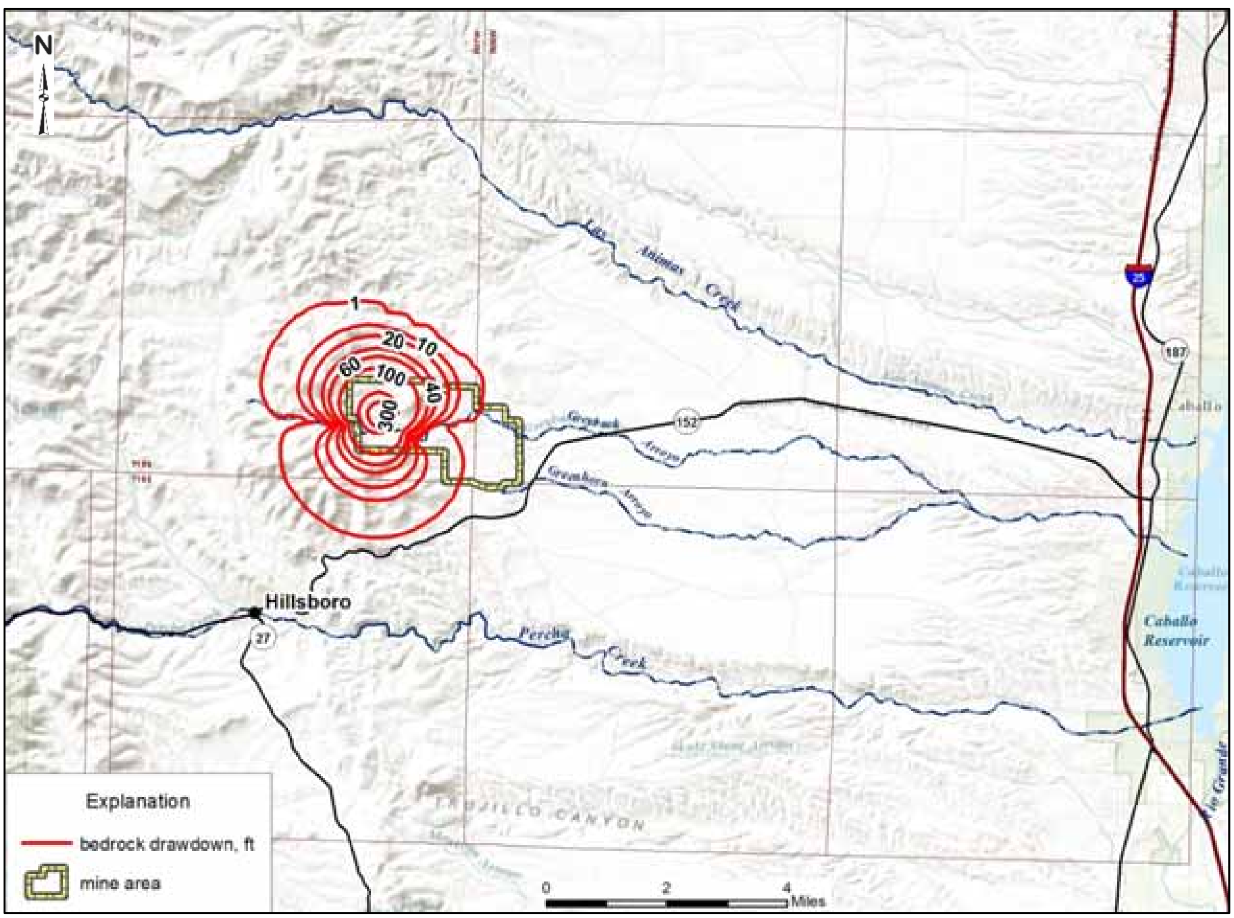

Figure 3.12. Projected end-of-mining groundwater drawdown in the crystalline bedrock.

3.2.2 Open Pit Water Balance

The post-mining pit water level and water balance were simulated assuming the pit geometry and watershed shown on Figure 3.13. The area within the pit highwall is about 129 acres, and the total pit watershed area is about 314 acres.

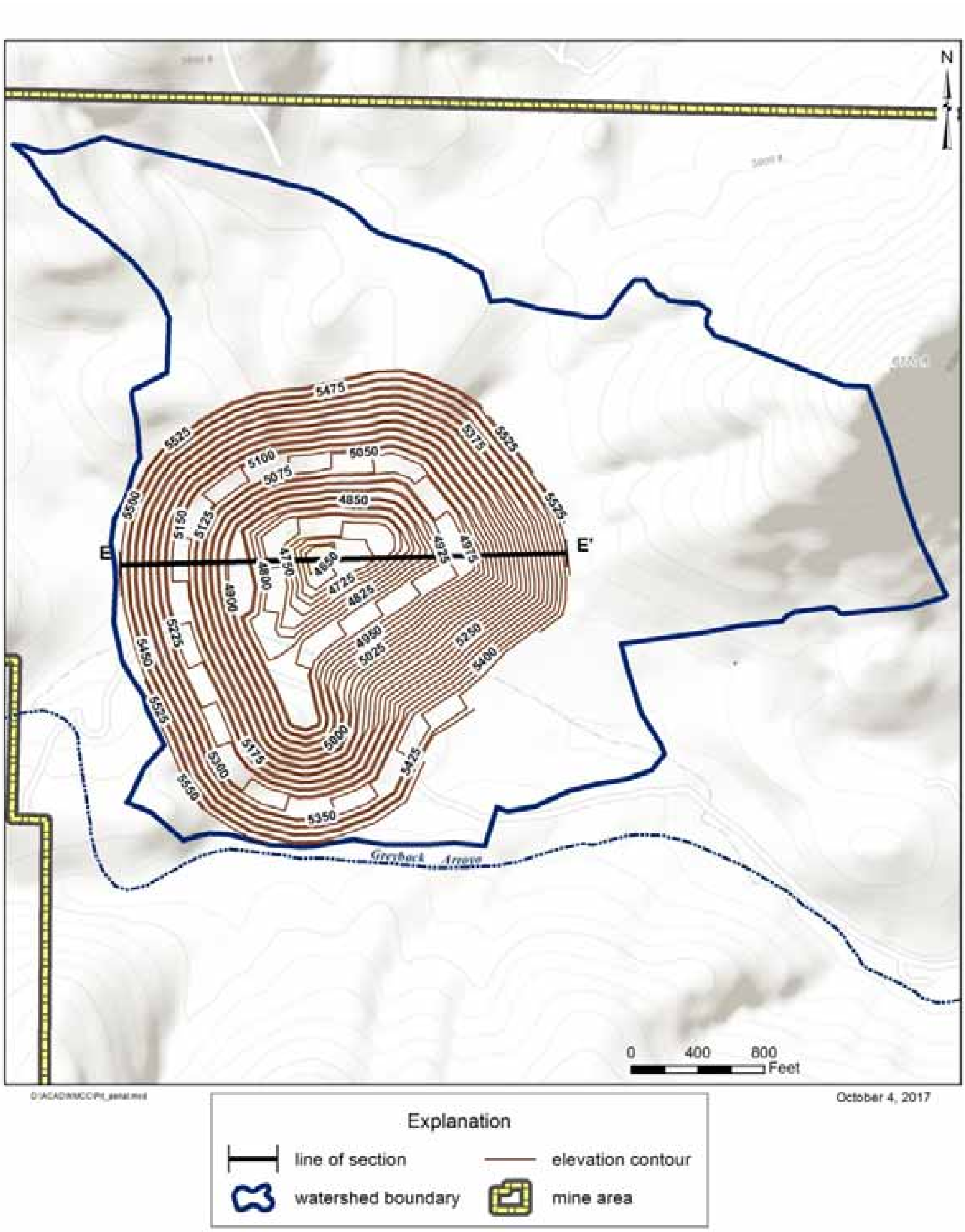

Figure 3.13. Ultimate open pit and watershed area.

Precipitation on the pit area was estimated for each month based on the record at Hillsboro (JSAI, 2014, section 2.0), with annual average precipitation of 12.5 in. Runoff from the un-reclaimed sections of the pit was simulated at 12.6 percent of precipitation, and runoff from reclaimed sections of the pit was simulated at 30.3 percent. Runoff from the remainder of the watershed was simulated at 7.1 percent of precipitation.

Evaporation from the open pit was assumed at 50 in./yr, less than the 65 in./yr estimated potential evaporation (JSAI, 2014, section 2.4) for the area. The lower rate reflects the wind and sun sheltering effects of the deep pit. Monthly evaporation rates based on the record at Hillsboro were scaled to match the annual rate of 50 in./yr.

Post-mining reclamation would include use of the water-supply wells PW-1 through PW-4, and a temporary pipeline to the bottom of the pit, to rapidly fill the pit to the expected long-term post-mining equilibrium water level. The post-mining simulation assumes this “rapid fill” scenario. Rapid filling will result in better water quality in the open pit by filling it with clean water and inhibiting oxidation of sulfide by submerging potential acid-generating sections of the pit wall (SRK, 2017).

A pumping rate of 2,726 gpm is simulated in the model, sufficient to fill the pit to elevation 4,894 ft amsl in 6 months. Total volume pumped from the supply wells will be 2,200 ac-ft. The open pit water body elevation of about 4,894 ft amsl corresponds to a water-surface area of about 21.7 acres. Water levels will fluctuate around this mean by a few feet, rising and falling seasonally and with wet and dry climatic conditions.

Simulated water level in the pit after the end of mining is presented on Figure 3.14. The final long-term water level of about 4,897 ft amsl corresponds to a water-surface area of about 22.3 acres. Water levels will fluctuate around this mean, rising and falling seasonally and with wet and dry climatic conditions.

The simulated annual pit water balance is presented on Figure 3.15, showing a final pit water balance of about 93 ac-ft/yr, with about 57 ac-ft/yr from precipitation and runoff, and 36 ac-ft/yr from groundwater inflow, all discharging as evaporation from the pit water surface.

After reclamation, groundwater levels in the bedrock around the open pit will remain below pre-mining levels, due to groundwater flowing to the open pit and discharging as evaporation from the hydrologic sink. Future water-level patterns can be seen in the hydrographs at selected locations, presented in Appendix A.

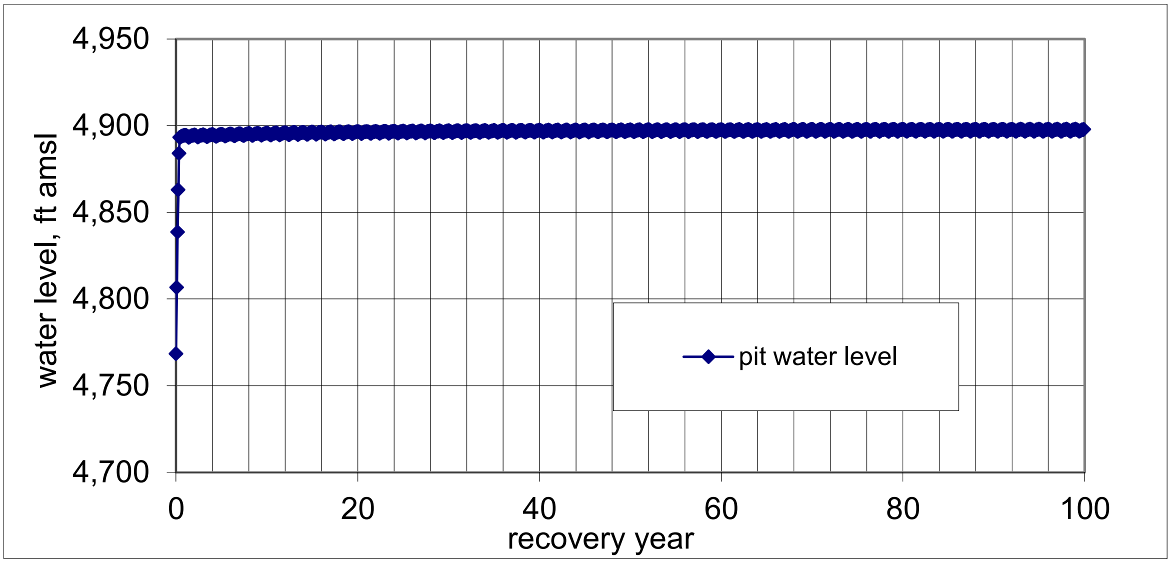

Figure 3.14. Projected open-pit water level (rapid fill in year 1).

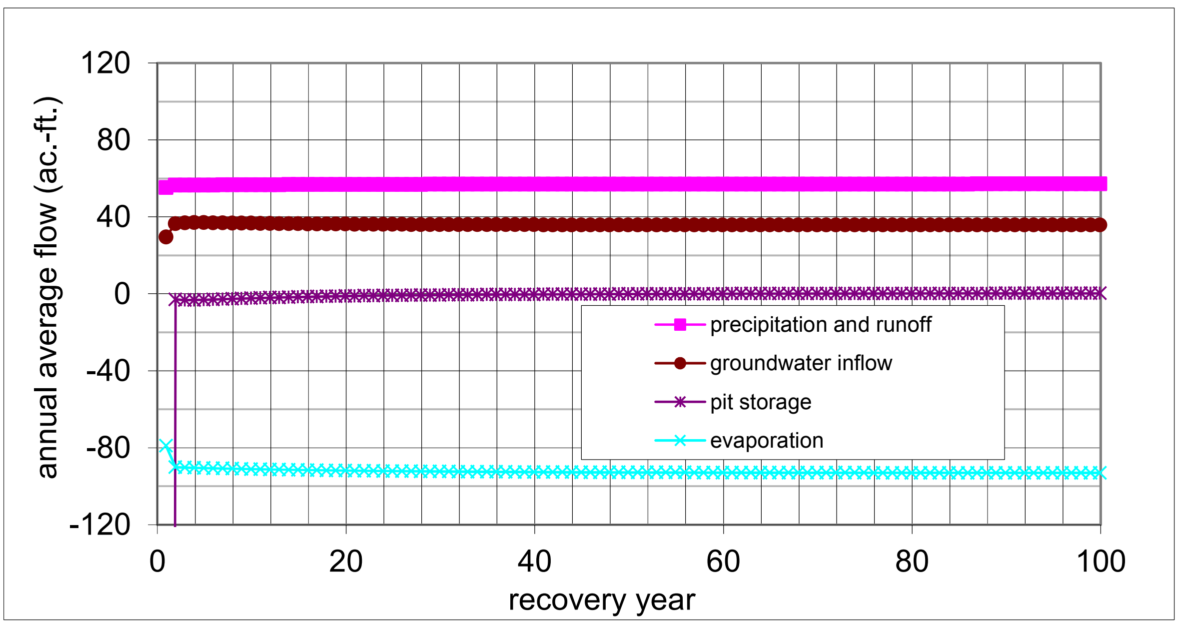

Figure 3.15. Projected open-pit water balance (rapid fill in year 1).

3.2.3 Potential Open Pit Discharge to Groundwater

The post-mining pit will be a groundwater sink, with the open pit water level below surrounding groundwater levels in the crystalline bedrock. The pit will remain a hydraulic sink after rapid filling of the pit during reclamation, and after precipitation events that raise the pit water level.

For a short period immediately following rapid fill, water may flow out of the pit into the dewatered space around it, then return to the pit as conditions equilibrate. Model-simulated flow to this dewatered space during the 6-month rapid filling totals 0.74 ac-ft. This water remains in the immediate vicinity of the pit wall before returning to the pit.

The hydraulic conditions around the pit are shown in cross-section on Figure 3.16 for pre-mining, end-of-mining, and 100-year post-mining conditions. The pit will remain as a hydraulic sink during temporary water level fluctuations because of the deep cone of depression caused by dewatering and maintained by water surface evaporation.

In order for it to be possible for water to flow from the pit to groundwater, the open pit water level would have to be higher than surrounding groundwater (>5,100 ft elevation). No conceivable storm event, wet year, or even wet decade could possibly add enough water to the pit to reach the water level required to achieve flow-through.

The projected post-mining potentiometric surface, including the closed contours around the hydraulic sink of the open pit, is shown in plan view on Figure 3.17.

3.2.4 Effects on Springs

Spring locations identified in the area (INTERA et al., 2012; BLM, 2015) are shown on Figure 3.18. The springs fall into several groups: (1) springs discharging on the Animas Uplift, (2) springs discharging in the Animas graben west of the uplift and (3) springs discharging to the Palomas Basin, at the eastern edge of the uplift and along parallel fault trends stepping down from the Uplift into the Basin.

The springs of the Animas Uplift (BG1, BG2 and other occasional seeps) are fed by local, perched groundwater systems or by near-surface circulation of local precipitation, and are ephemeral (INTERA et al., 2012), flowing only after precipitation events. These would not be affected by the flow of groundwater toward the open pit within the crystalline bedrock.

Springs of the Animas Graben, including Warm Spring (WS), WSCS-A, CSCS-B, CSCS-C and Cave Creek Spring, discharge from the SFG deposits west of the Animas Uplift. The source of their water is the Las Animas Creek and Percha Creek watersheds west of the Animas Uplift. The andesite of the uplift acts as a barrier to flow at depth (JSAI, 2014, p.24) and the groundwater systems of the graben and the uplift are separate. Flow at springs in the Animas Graben will therefore not be directly affected by the movement of groundwater in the Animas Uplift toward the open pit.

Springs discharging at the east edge of the Animas Uplift include Warm Spring on Animas Creek and PCS-A on Percha Creek. In the Palomas Basin east of the uplift, springs discharge from alluvium along Las Animas Creek, along a set of fault structures parallel to the uplift.

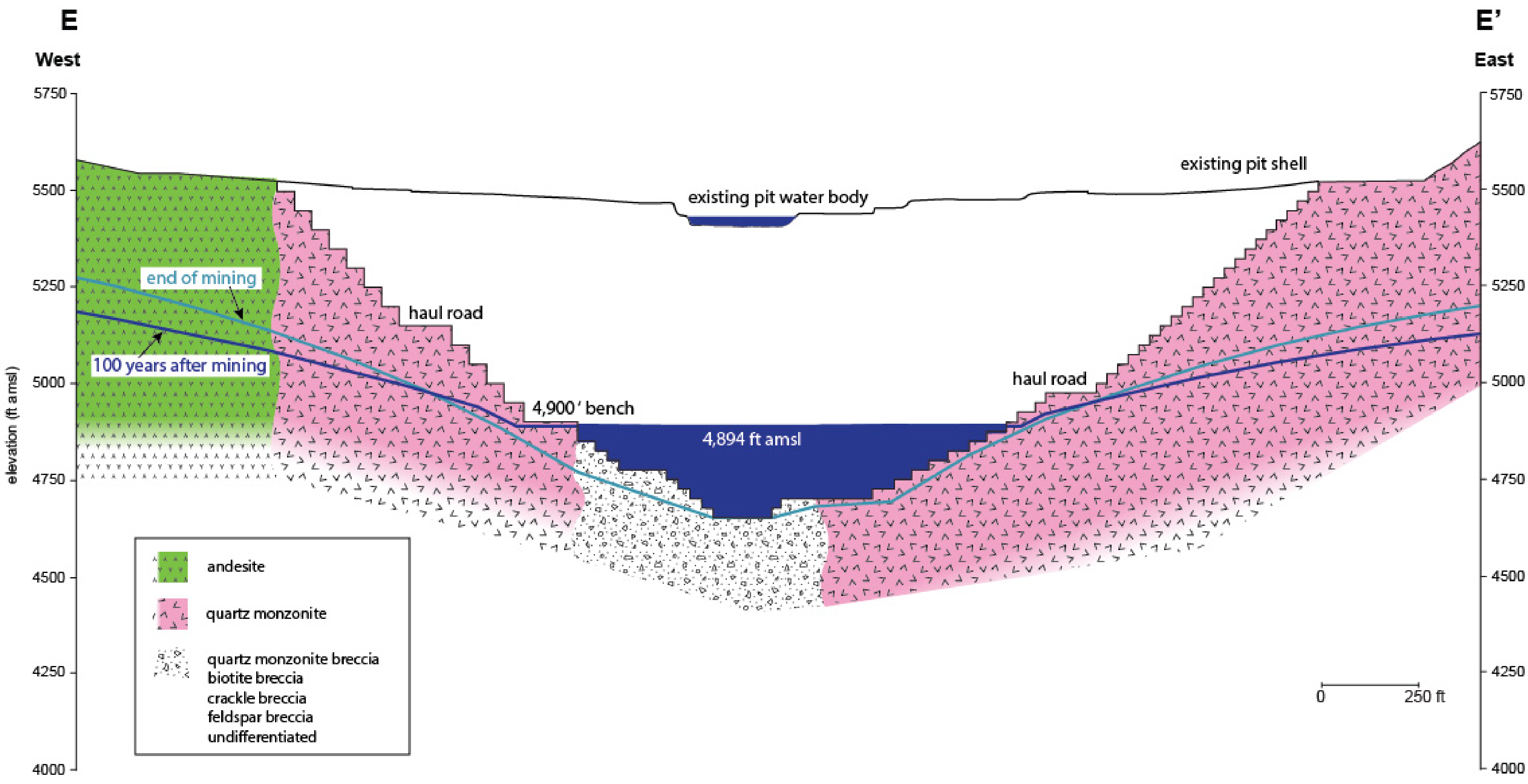

Figure 3.16. West-to-east hydrogeologic cross-section E-E' showing water-level profile across existing pit and proposed open pit after rapid fill.

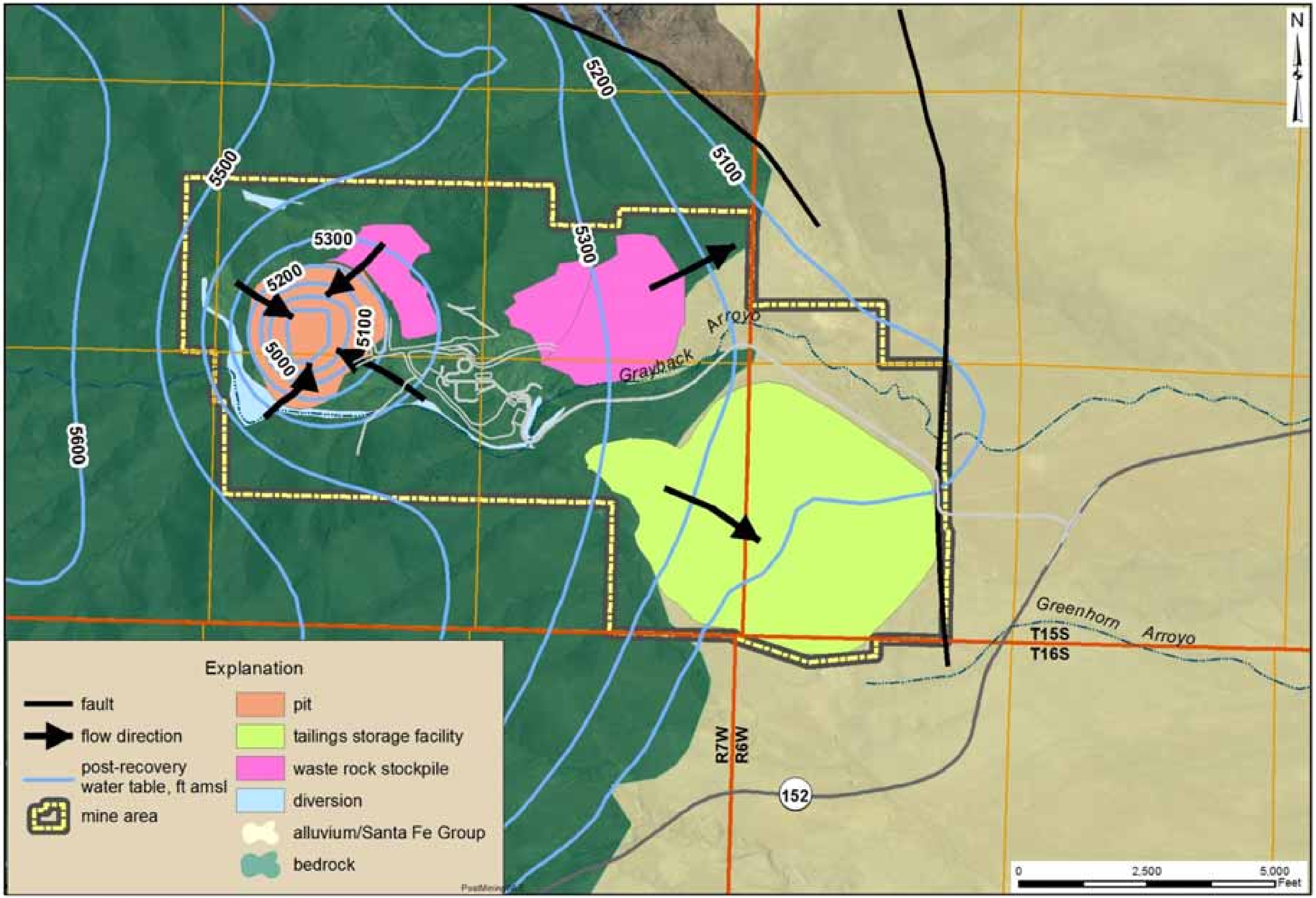

Figure 3.17. Proposed mine facilities and projected post-mining groundwater elevation.

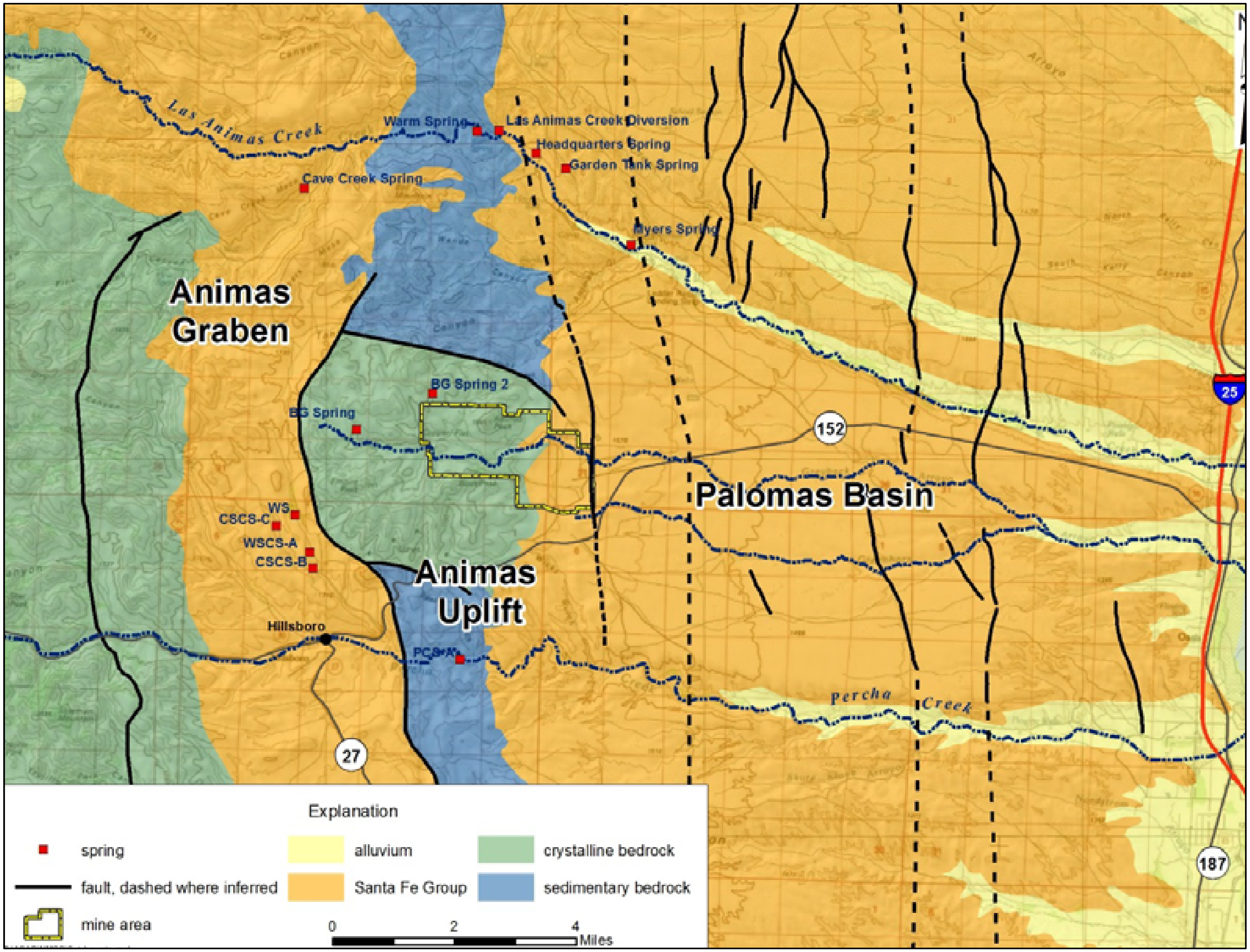

Figure 3.18. Locations of springs in and around the Animas Uplift.

The active springs of the Animas Graben and of the eastern edge of the uplift and the Palomas basin could be indirectly affected by the project if groundwater levels were lowered through indirect connection to the Animas Uplift. Future groundwater level change at each potentially affected location was evaluated using the numerical model. Results are summarized on Table 3.5.

Table 3.5. Projected groundwater-level change (in ft) at spring locations

	end of mining	100y post-mining
CSCS-C	0.01	0.16
WS	0.02	0.19
WSCS-A	0.01	0.13
CSCS-B	0.01	0.12
Cave Creek	0.05	0.15
PCS-A	0	0
(Animas) Warm	0.02	0.05
Myers	0.01	0.01

For the Animas Graben springs, groundwater level is projected to decline by up to 0.19 ft (2.3 in.), 100 years after the end of mining. Discharge is not expected to decrease because the source of water for these springs is west of the Animas Uplift (JSAI, 2014, p. 24). However, discharge locations could move a short distance due to a change in water level.

In the eastern part of the uplift, projected maximum change in water level is 0.05 ft (0.6 in.) at Animas Warm Spring. On Percha Creek, no water level change is projected at PCS-A, either during mining or in the 100 years following the end of mining. In the Palomas Basin, water level at Myers Spring is projected to decline by 0.01 ft (0.12 in.).

No direct effects to identified springs are predicted to occur as a result of the project, because (1) the springs of the Animas Uplift are ephemeral, precipitation-event-fed springs unrelated to the bedrock groundwater system, (2) the springs of the Animas Graben are fed by groundwater from the west and from depth, chemically unrelated to groundwater of the Uplift.

Small indirect effects may occur, however, due to lowering of groundwater levels in the Animas Graben or in the western edge of the Palomas Basin, due to an attenuated connection with the crystalline bedrock of the Animas Uplift. The small, long-term projected effects presented on Table 3.5 conservatively assume that these attenuated connections exist, although they have not been observed in reality.

In conclusion, the direct effects of the Project on mapped springs are projected to be zero. The long-term indirect effects presented (maximum of 2.3 inches over 100 years) are too small and manifest too slowly to be measureable or significant.

3.3 Potential Discharge From Tailings and Waste Rock Stockpiles

Potential for groundwater infiltration from the TSF is evaluated in Section 3.3.1. Potential for groundwater infiltration from the WRSPs is evaluated in Section 3.3.2. Groundwater flow paths and travel times down-gradient from the facilities are evaluated in Section 3.3.3.

The area of the mine including the open pit, waste rock storage facilities, and the tailings impoundment are shown above on Figure 3.17. The WRSPs lie on crystalline bedrock, while the TSF lies partially on SFG sediments.

Contours of the projected post-mining water-table surface, and arrows indicating the directions of groundwater flow, are also shown on Figure 3.17. Any infiltration from the WRSP around the pit would flow into the pit, while any infiltration from the eastern-most WRSP or from the TSF would flow northeast and southeast, respectively.

3.3.1 Tailings Infiltration

Because the tailings impoundment will be lined, infiltration from the tailings is not expected. However, unexpected sources of potential infiltration include manufacturing defects in the liner and other holes, in the liner and along the seams, developed during placement.

NMCC considers the potential for leaks in the liner to be very unlikely. Nonetheless, the potential occurrence of leaks in the tailings facility liner was evaluated based on previous analyses presented in Appendix B. An assumed liner leak occurrence for the purpose of evaluation is one circular defect per acre, with a standard defect area of 1.0 cm^2 (corresponding to a round hole diameter of 1.128 cm).

The rate of leakage through the defect, assuming a compacted bedding layer beneath the liner and an underdrain system above the liner (Golder, 2016), is given (Appendix B, equation 1) by

$$q=\beta_c[1+0.1(h_w/L_s)^{0.95}]a_d^{0.1}h_w^{0.9}K_s^{0.74}$$

where,
- q is flow through a circular defect
- β_c is the coefficient relating to liner contact with bedding material (0.21 for good contact)
- h_w is the depth of water above the geomembrane
- L_s is the thickness of bedding material
- a_d is the area of the defect (1 cm^2)
- K_s is the saturated hydraulic conductivity of bedding material

Because the impoundment is designed with a 1.5-ft-thick drainage layer above the liner (Golder, 2016), head on the liner h_w will be less than 1.5 ft. Assuming the standard defect size (a_d = 1.0 cm²) occurring once per acre and the design bedding layer conductivity (K_s =10^{-6} cm/s), leakage from the lined 536-acre (Golder, 2016) tailings storage facility is estimated in Table 3.6 at about 0.5 gpm. The total area of the tailings storage including surrounding facilities is approximately 630 acres, but the active storage area is 536 acres. As shown by the data in Table 3.6, the probable hydrologic consequence from a postulated leak in the liner is nil.

Table 3.6. Potential tailings liner leakage

B_c	0.21
h_w	1.5 ft
L_s	1 ft
a_d	1.0 cm²
K_s	1x10^{-6} cm/s
q	0.0009 gpm/acre
total flow	0.5 gpm

3.3.2 Waste Rock Stockpile Infiltration

Significant infiltration from the waste rock is unlikely because:

1. The waste rock lies on low-permeability (model-calibrated permeability < 10^{-6} cm/s) andesite bedrock. The andesite will function as a liner.
2. The waste rock will be deposited dry; precipitation infiltrating into the waste rock will tend to be held in storage above the water table. Depth to water in the area ranges from about 50 to 100 ft below ground level.
3. The waste rock deposits will be reclaimed and covered with a 3-ft-thick engineered low-infiltration store-and-release type cover. The cover will have the capacity to retain most precipitation events in storage, without percolation through to the waste rock below. Stored precipitation will eventually be released as evapotranspiration. The cover would only allow water into the waste rock after extreme precipitation events.

To summarize, the waste rock cover will prevent most precipitation from reaching the waste rock. The water infiltrating will be held in storage due to the unsaturated state of the waste rock. During operations, any water that flows through the waste rock will reach the low-permeability andesite liner, and will flow along the andesite surface to collection ponds at the base of the facility. Post-mining, the reclamation cover will prevent water infiltration into the waste rock. Surface water run-on will be diverted around and away from the reclaimed WRSPs.

Therefore, water available to enter the SFG aquifer is expected to not provide a significant probable hydrologic consequence.

Infiltration through the cover was evaluated based on reasonable hydraulic properties for a single-layer cover material, shown in Table 3.7, and on the distribution of daily evaporation and the more than 100-year record of daily precipitation at Hillsboro (JSAI, 2014, fig. 2.3), using a 1-dimensional model of variably saturated flow and infiltration (Niswonger et al., 2006).

Table 3.7. Waste rock cover properties

saturated water content (percent)	20
initial water content (percent)	6
residual water content (percent)	6
Brooks-Corey exponent	2.5
cover thickness (ft)	3.0
saturated hydraulic conductivity (cm/s)	1.0E-04
specific storage (ft^{-1})	1.00E-06

cm/s - centimeter per second

Results indicate long-term infiltration through the cover of about 2 percent of precipitation, or about 0.25 in./yr. Out of the total area of the waste rock stockpiles, approximately 287 acres is subject to infiltration. Over the 287 acres, total infiltration through the cover would be about 2.1 gpm.

Of the estimated infiltration through the cover, most is expected to be retained in the waste rock. Assuming field capacity (the water content retained before downward percolation begins) of the waste rock of 6 percent, 0.25 in. of infiltration would wet a 4.2-in. thickness of waste rock to field capacity. At this rate, it would require hundreds of years of repeated infiltration events to produce internal flow of water within the waste rock.

Of the infiltration through the cover that is not retained in the waste rock (discharging through preferential flow paths), most will flow on top of the andesite. Discharge into the groundwater system (SFG aquifer) is expected to be nil.

4.0 CONCLUSIONS

The probable hydrologic consequences from development of the Copper Flat Project were evaluated for the mine area and affected area using the numerical model of groundwater flow developed by JSAI (2014).

The objective of this report was to develop a determination of the probable hydrologic consequences of the operation and reclamation, on both the permit area and the affected area, with respect to the hydrologic regime, quantity and quality of surface and groundwater systems that may be affected by the proposed operations (NMAC 19.10.6.602.(13)(g)(v) of the Mining Act regulations).

Groundwater systems include:

- The regional SFG aquifer.
- Quaternary-age alluvial aquifers along Animas Creek and Percha Creek.
- The crystalline bedrock of the Animas Uplift.

Surface water includes:

- Perennial flow in the Rio Grande and Caballo Reservoir that is supplied in part by discharge from the SFG aquifer.
- An area of perennial flow and riparian vegetation along Animas Creek where the Quaternary alluvial aquifer discharges to the surface.
- An area of perennial flow and riparian vegetation along Percha Creek, atop the crystalline bedrock.
- Springs discharging from the crystalline bedrock.
- Storm water flows in Grayback Arroyo.

The sources of possible hydrologic consequences of the Project include:

1. Groundwater withdrawals from the SFG aquifer: The mine water supply will be withdrawn from pumping wells PW-1, PW-2, PW-3, and PW-4. Water level in the SFG aquifer will be lowered around the well field and then gradually recover after mining. Secondary effects evaluated include:
   a. Reduced groundwater discharge to Rio Grande and Caballo Reservoir.
   b. Reduced flow to artesian wells and other effects to local groundwater users.
   c. Potential reduced discharge to shallow aquifers along Animas Creek and Percha Creek, leading to lower alluvial water levels and reduced discharge to the perennial flow and riparian areas along Animas Creek.
   d. Potential ground subsidence.

2. Groundwater withdrawals from the crystalline bedrock associated with the open pit. Water levels in the bedrock around the pit will be permanently lowered, and groundwater will flow to the pit and evaporate. Groundwater flow rates to the pit and the future open pit water level and water balance area assessed. Secondary effects evaluated include:
   a. Potential groundwater discharge from the open pit.
   b. Potential effects on springs discharging from the crystalline bedrock and on the Percha Creek perennial (riparian) area.
3. Potential for groundwater discharge from the WRSPs and TSF.

4.1 Groundwater Withdrawals From the SFG Aquifer

Water-level drawdown in the SFG aquifer is projected to reach a maximum of about 70 ft at the well field, at the end of mining. Maximum drawdown decreases with distance from the well field. Water levels will then recover over a period of about 20 to 30 years.

Total reductions in discharge to the system are projected to peak at a total of about 3,100 ac-ft/yr shortly after the end of mining, then diminish to near-zero over about 30 years (Fig. 3.3).

- Flow induced from the Palomas Graben north of the study area is projected to reach a maximum of less than 800 ac-ft/yr at the end of mining, which is estimated to result in an additional reduction of discharge to the Rio Grande by a maximum of 275 ac-ft/yr.
- Effects on the shallow groundwater (riparian) systems along Las Animas Creek and Percha Creek are projected to be minimal, with a maximum of less than 2 ft of groundwater-level change on Percha Creek, less than 1 ft of groundwater-level change on Animas, and non-measureable small changes in surface flow and riparian evapotranspiration.
- Depletion to the Rio Grande is projected to peak around 2,080 ac-ft/yr at the end of mining, then reduce to 28 ac-ft/yr 100 years after mining (Fig. 3.3; Table 3.1)
- Groundwater withdrawals for water supply are not expected to result in measurable ground subsidence.

As required by NMOSE, NMCC will offset any reductions in discharge to the Rio Grande by lease or purchase of additional water rights in the amount of the model-simulated reductions to flow.

NMCC will work with the NMOSE to ensure that impairment to existing water rights by NMCC pumping, according to NMOSE criteria, will be mitigated, as appropriate, so that there is no net loss of available water to existing water rights.

No water-quality effects are expected from pumping the proposed supply wells in the affected area.

4.2 Groundwater Withdrawals From the Crystalline Bedrock

At the end of mining, groundwater-level drawdown in the bedrock around the open pit reaches a maximum of about 800 ft at the pit. A permanent cone of depression will form around the pit, with maximum drawdown of about 600 ft at the edge of the pit. The pit, which currently is an evaporative hydrologic sink, will form an evaporative hydrologic sink again in the future.

Final pit water level after mining is projected to be about 4,894 ft amsl, about 640 ft below the pit rim. The open pit water body that forms after mining and rapid fill remediation will be about 250 ft in depth and have a steady-state surface area of about 22 acres. Steady state groundwater inflow is estimated at 36 ac-ft/yr and captured storm-water runoff is estimated at 57 ac-ft/yr. Pit water evaporation is projected to be about 93 ac-ft/yr.

During operations and after reclamation, storm-water flows from Grayback Arroyo will be conveyed around the open pit in the existing bypass channel and through the mine area with no expected hydrologic consequences. Water quality effects for the open pit water body are addressed in a separate report prepared for the project.

Long-term, indirect effects to springs discharging in and around the Animas Uplift are projected to be minimal and not measureable.

4.3 Potential Groundwater Discharge From Tailings and Waste Rock

Infiltration to groundwater from the tailings and waste rock storage areas is not expected. The meteoric water that may infiltrate is expected to remain in the immediate area for centuries, due to the low permeability of the SFG sediments near the Animas Uplift and due to the presence of flow-inhibiting faults. The impact to groundwater chemistry is expected to be minimal.

5.0 REFERENCES

[BLM] U.S. Bureau of Land Management, 2015, Copper Flat Mine, Draft Environmental Impact Statement: U.S. Bureau of Land Management, November 2015.

[Golder] Golder Associates Inc., 2016, Appendix A, Feasibility Level Design, 30,000 TPD Tailings Storage Facility and Tailings Distribution and Water Reclaim Systems, Copper Flat Project Sierra County, New Mexico: consultant's report prepared by Golder Associates Inc. for New Mexico Copper Corporation, dated November 30, 2015, Revised June 2016, and Revised November 2016, 693 p.

[Golder] Golder Associates Inc., 2017, Appendix E Mine Reclamation and Closure Plan, Copper Flat Mine: consultant's report prepared by Golder for New Mexico Copper Corporation, dated October 7, 2016, Revision 1 dated July 17, 2017, 85 p., plus figures and attachments.

Glover, R.E., and Balmer, G.G., 1954, River Depletion Resulting from Pumping a Well Near a River: Transactions, American Geophysical Union, June 1954.

Hoffman, J.H., Leake, S.A., Galloway, D.L., and Wilson, A.M., 2003, MODFLOW-2000 ground-water model – User guide to the subsidence and aquifer-system compaction (SUB) package: U.S. Geological Survey Open-File Report 03-233.

INTERA, Parametrix, JSAI, Stetson Engineering, SRK, and Class One Technical Services, 2012, Baseline data characterization report for Copper Flat Mine, Sierra County, New Mexico: consultant's report prepared for New Mexico Copper Corporation, 214 p., plus table, figures, and appendices.

[JSAI] John Shomaker & Associates, Inc., 15 August 2014, Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: consultant's report prepared for New Mexico Copper Corporation.

[JSAI] John Shomaker & Associates, Inc., 2016, Appendix E, Revision 1, Water-quality monitoring plan for the Copper Flat Mine Discharge Permit Pursuant to 20.6.7.11.R and 20.6.7.28 NMAC: consultant's report prepared by Steve Finch and Annie McCoy with JSAI for New Mexico Copper Corporation, 23 p.

M3 Architecture Engineering Construction Management, 2015, Impoundment Design Report, Copper Flat Project: prepared by M3 Architecture Engineering Construction Management for THEMAC Resources, MP-PN120085, 11 p., plus table and figures.

M3 Architecture Engineering Construction Management, 2015, Site Diversion Analysis Report, Copper Flat Project: prepared by M3 Architecture Engineering Construction Management for THEMAC Resources, MP-PN120085, 15 p., plus drawings, tables, and appendices.

McDonald, M.G., and Harbaugh, A.W., 1988, A modular three-dimensional finite-difference ground-water flow model: U.S. Geological Survey, Techniques of Water Resources Investigations, Book 6, Chapter A1, 586 p.

Niswonger, R.G., Prudic, D.E., and Regan, R.S., 2006, Documentation of the unsaturated-zone flow (UZF1) package for modeling unsaturated flow between the land surface and the water table with MODFLOW-2005: U.S. Geological Survey, Chapter 19 of Section A, Ground Water, of Book 6, Modeling Techniques, 71 p.

SRK, 2017, Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico: consultant's report prepared by SRK for New Mexico Copper Corporation.

Theis, C.V., 1941, The Effect of a Well on the Flow of a Nearby Stream: Transactions, American Geophysical Union, 1941.

[THEMAC] THEMAC Resources, 2013, Copper Flat Mine Baseline Data Report Addendum: prepared by THEMAC Resources with contributions from GeoSystems Analysis, Inc.; Golder Associates Inc.; John Shomaker & Associates, Inc.; and M3, dated July 17, 2013, 210 p.

[THEMAC] THEMAC Resources New Mexico Copper Corporation, 2017, Letter regarding Oct. 5, 2017 Request for Additional Information, Updated MORP Rev. 1, 2017, New Mexico Copper Corporation, Copper Flat Mine, Permit Tracking No. SI027RN: letter prepared by Jeff Smith with New Mexico Copper Corporation to David Ennis, P.G. with New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division, dated October 13, 2017, 1 p., plus attachments.

[THEMAC] THEMAC Resources New Mexico Copper Corporation, 2017, Letter regarding Supplemental Information regarding open pit hydrologic sink, DP-1840, New Mexico Copper Corporation Copper Flat Project: letter prepared by Jeff Smith with New Mexico Copper Corporation to Brad Reid with New Mexico Environment Department, Ground Water Quality Bureau, dated October 13, 2017, 2 p., plus attachments.

[THEMAC] THEMAC Resources New Mexico Copper Corporation, 2017a, New Mexico Copper Corporation New Mine Permit No. SI27RN Updated Mining Operation and Reclamation Plan for its Copper flat mine: consultant's report prepared by VEMS and submitted to New Mexico Mining & Minerals Division Pursuant to 19.10.6.602.D.(15) and 19.10.6.603 NMAC for New Mexico Copper Corporation.

[THEMAC] THEMAC Resources New Mexico Copper Corporation, 2017b, Rev. 1 New Mexico Environment Department Ground Water Discharge Permit Application: signed and submitted by Copper Flat Mine Aug. 2017.

APPENDICES

Appendix A.

Projected Groundwater-Level Hydrographs at Selected Locations

APPENDIX A.

HYDROGRAPHS

Projected groundwater drawdown 100 years after mining is shown on Figure A1. Water-level change in the bedrock will be about 580 ft near the bottom of the pit.

Projected water-level hydrographs for most well locations shown on Figure A1 are shown on Figures A2 through A24.

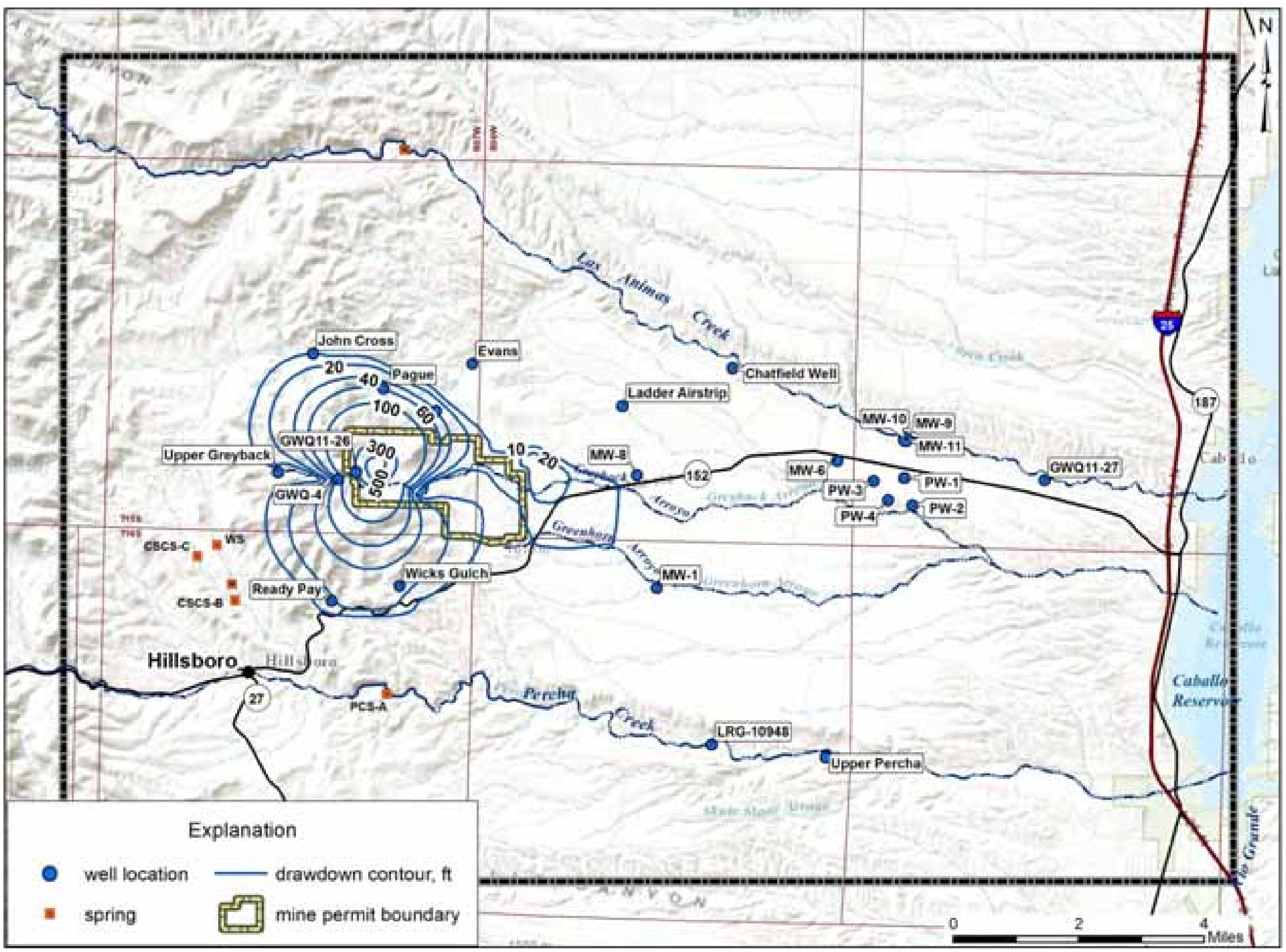

Figure A1. Projected groundwater drawdown 100 years after mining.

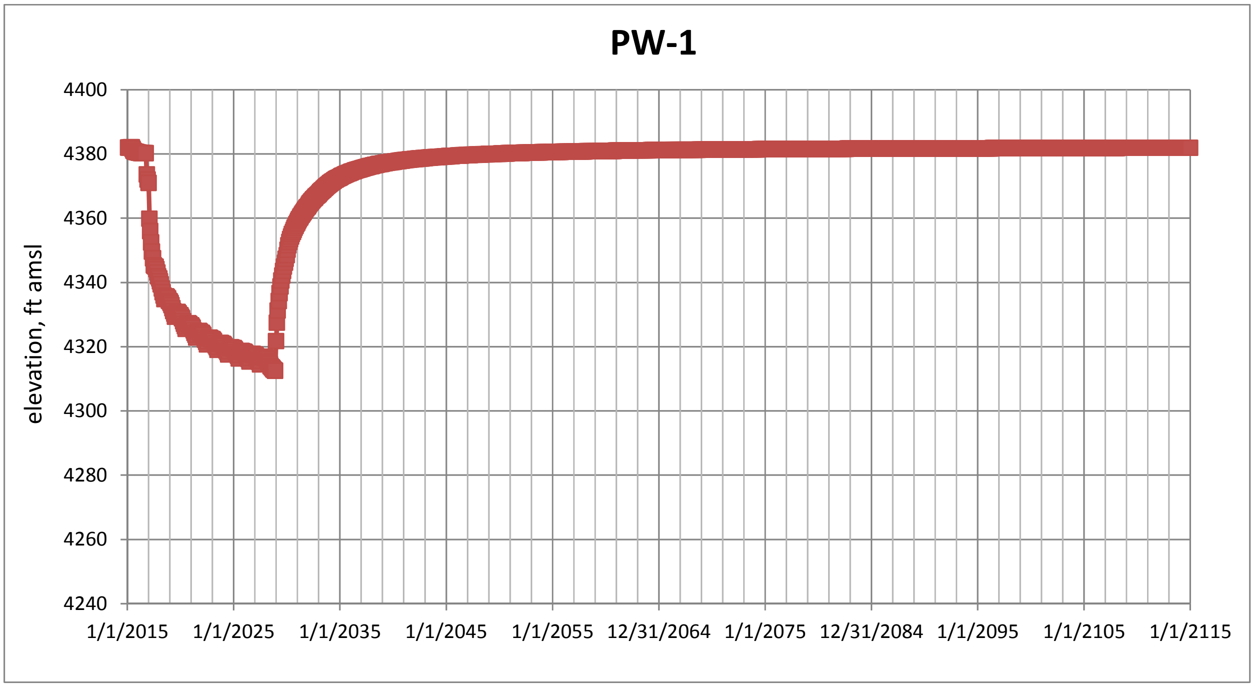

Figure A2. Projected water levels at PW-1.

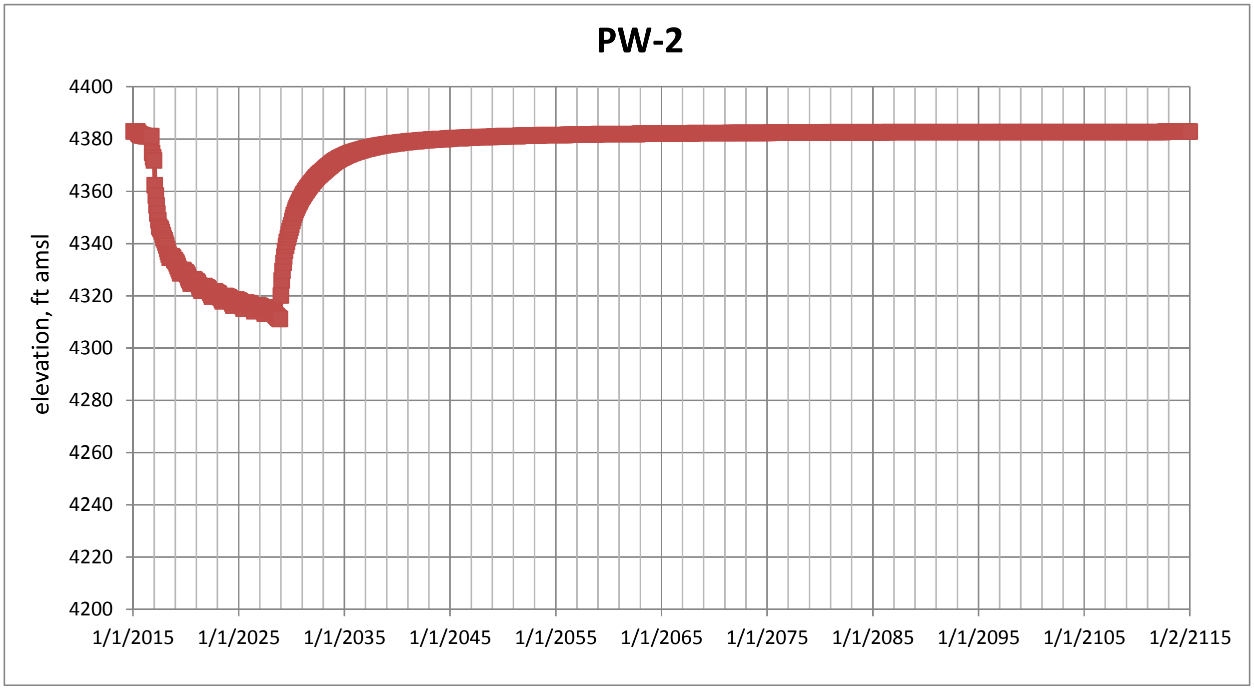

Figure A3. Projected water levels at PW-2.

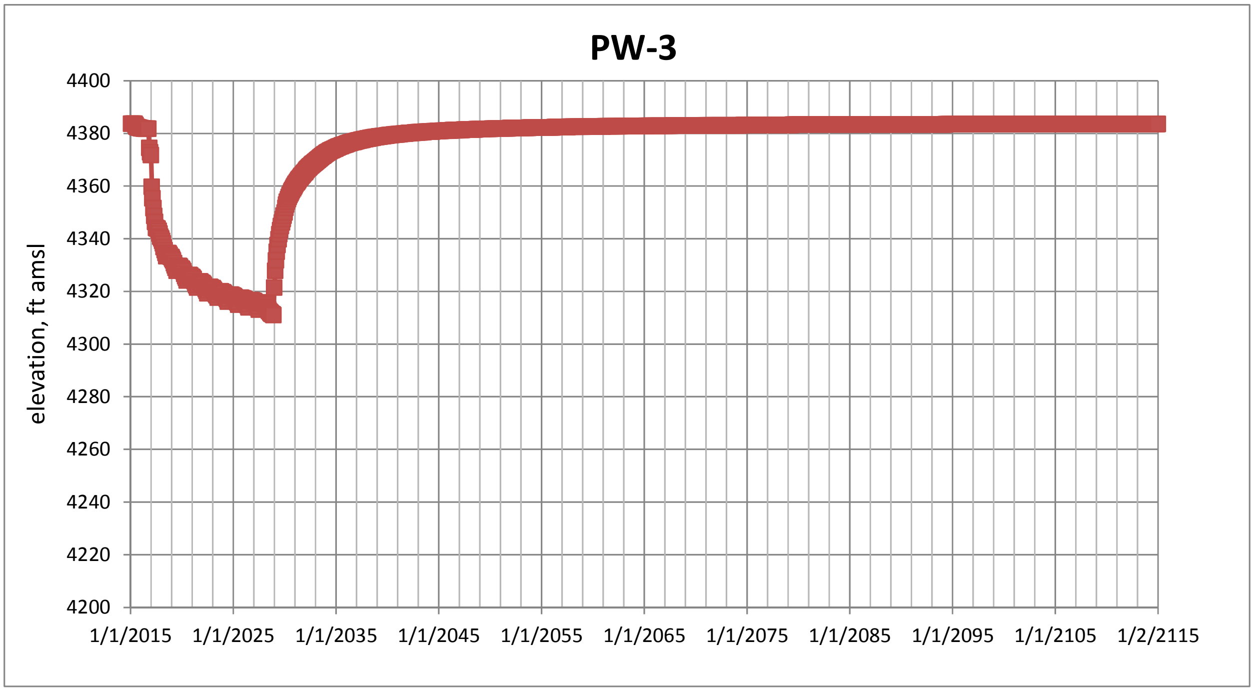

Figure A4. Projected water levels at PW-3.

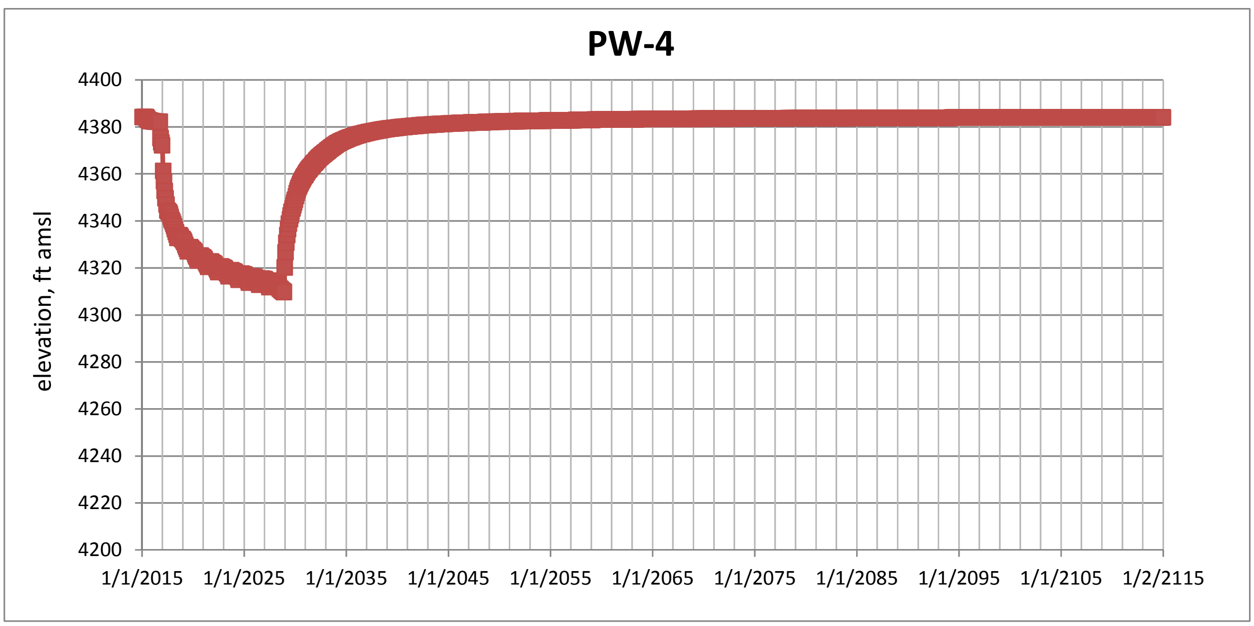

Figure A5. Projected water levels at PW-4.

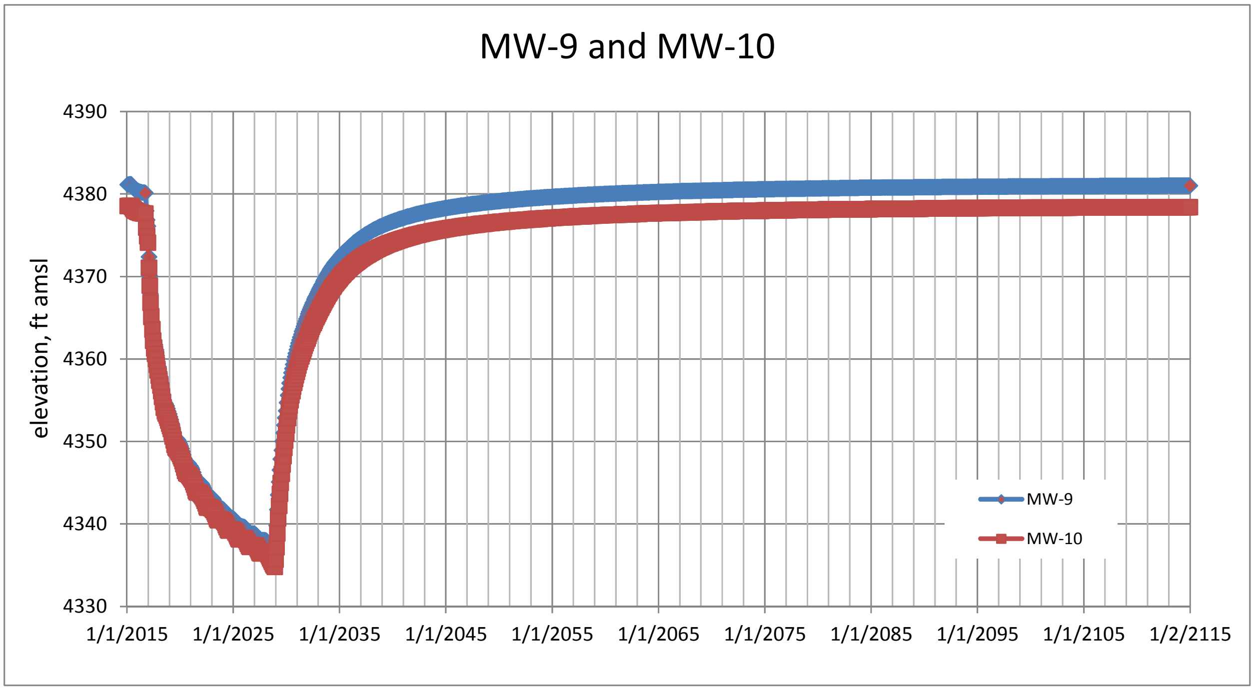

Figure A6. Projected water levels at MW-9 and MW-10.

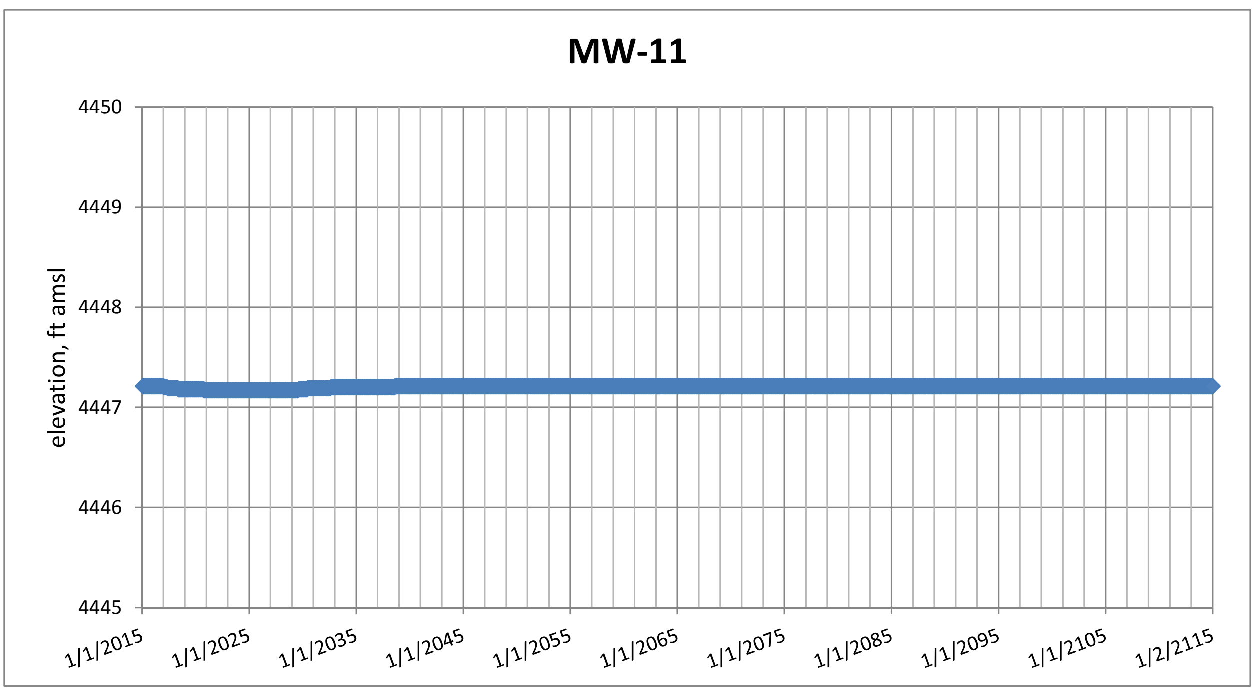

Figure A7. Projected water levels at MW-11.

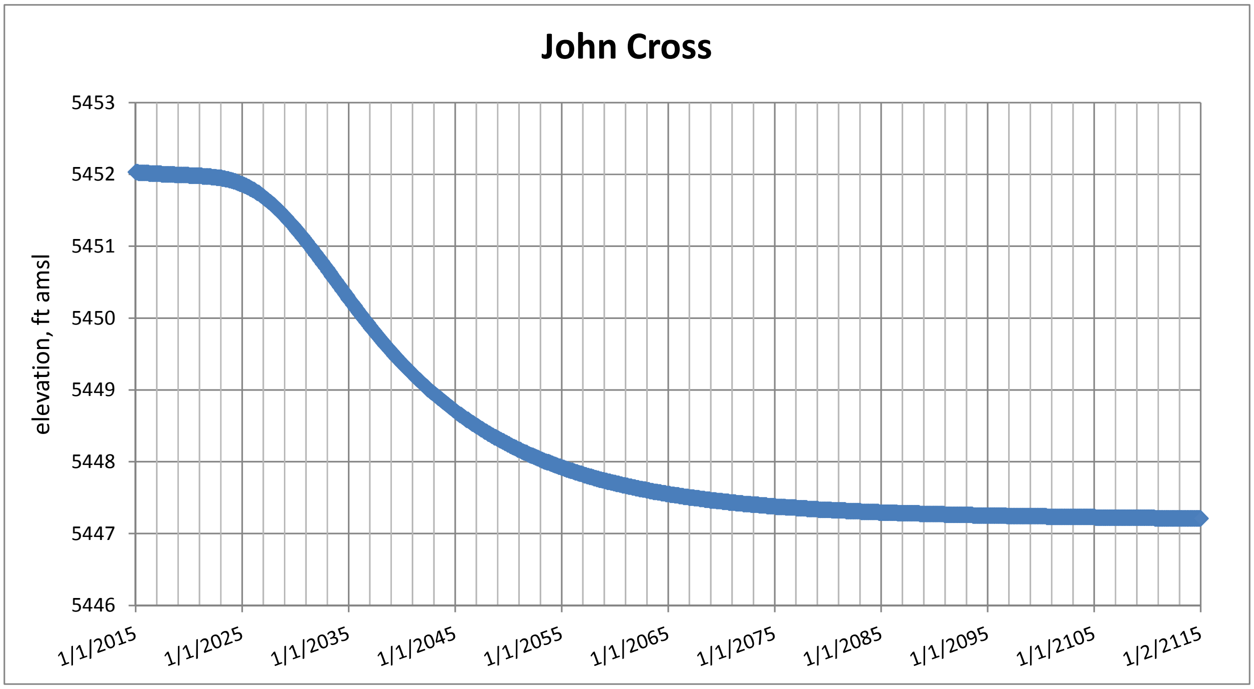

Figure A8. Projected water levels at John Cross.

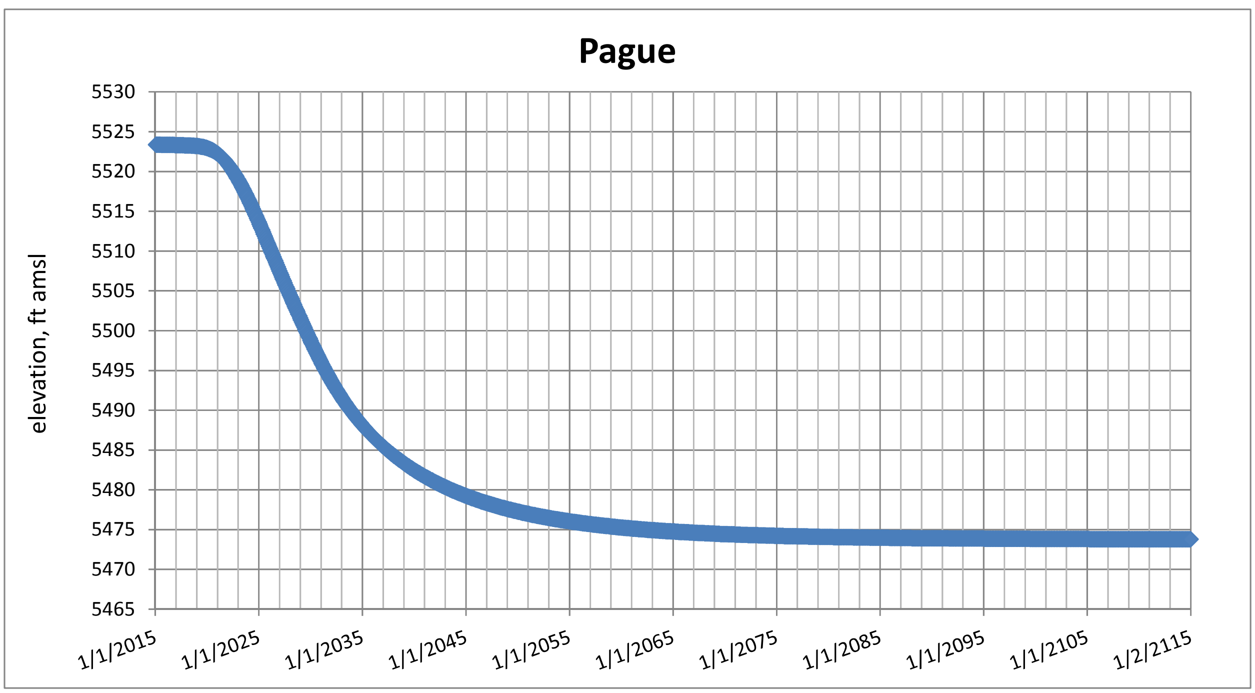

Figure A9. Projected water levels at Pague.

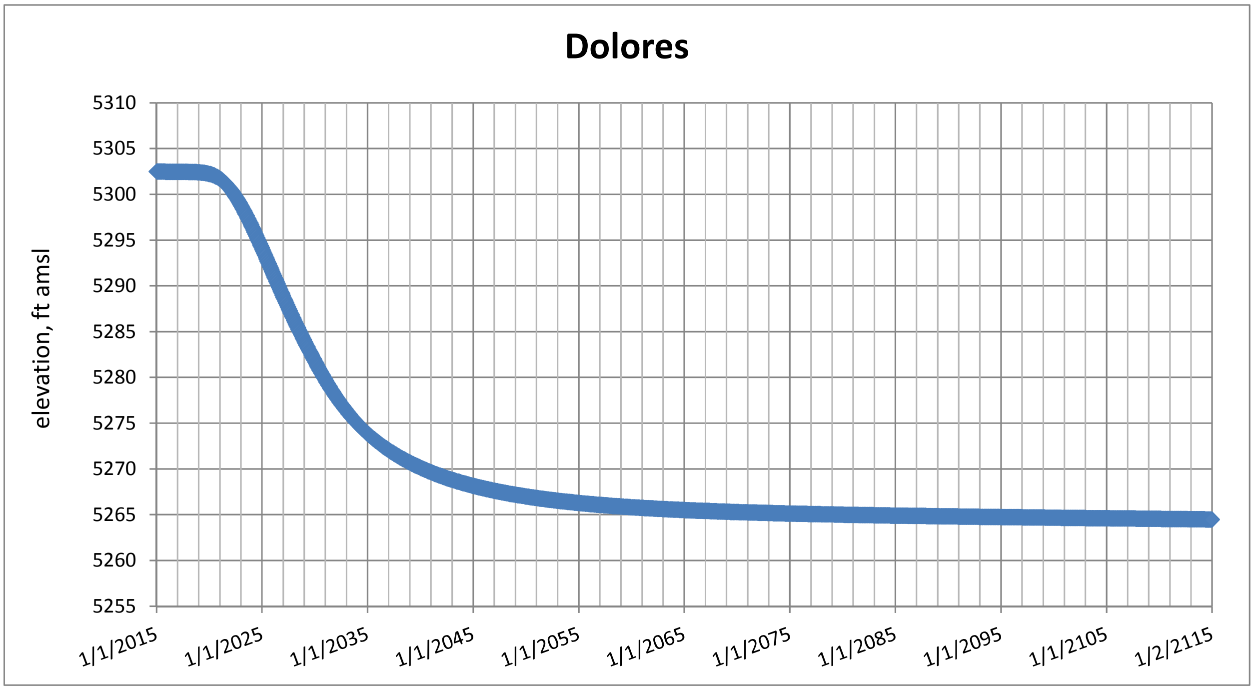

Figure A10. Projected water levels at Dolores.

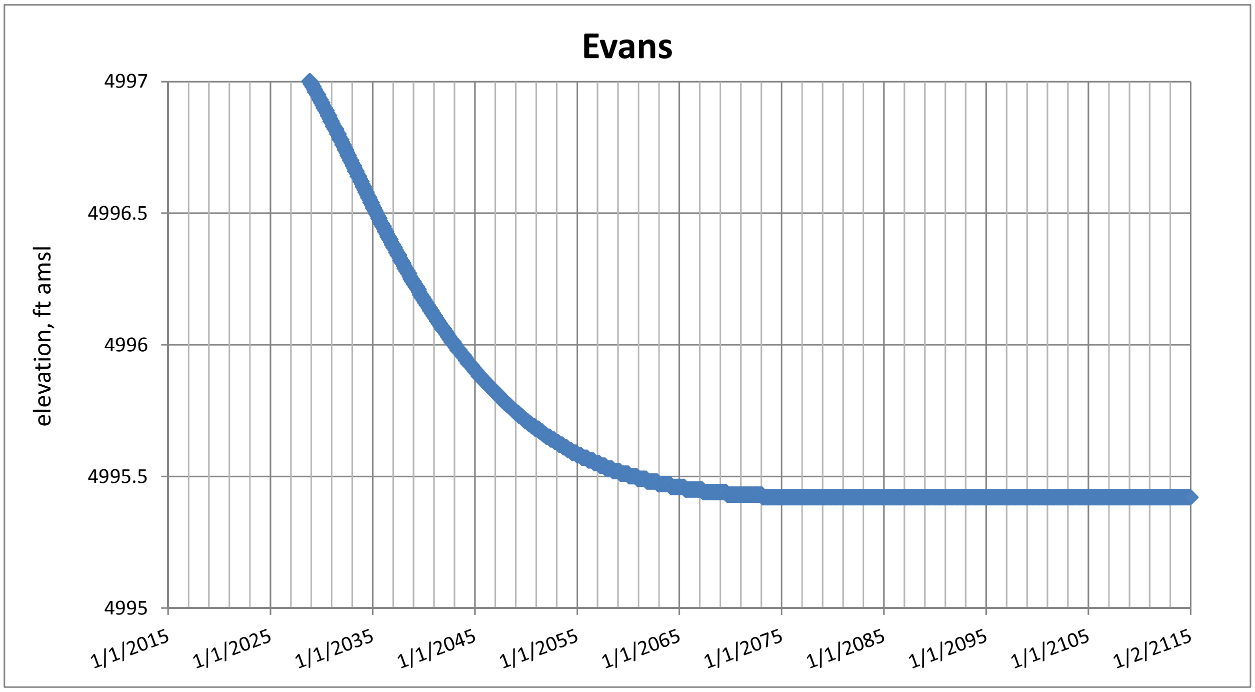

Figure A11. Projected water levels at Evans.

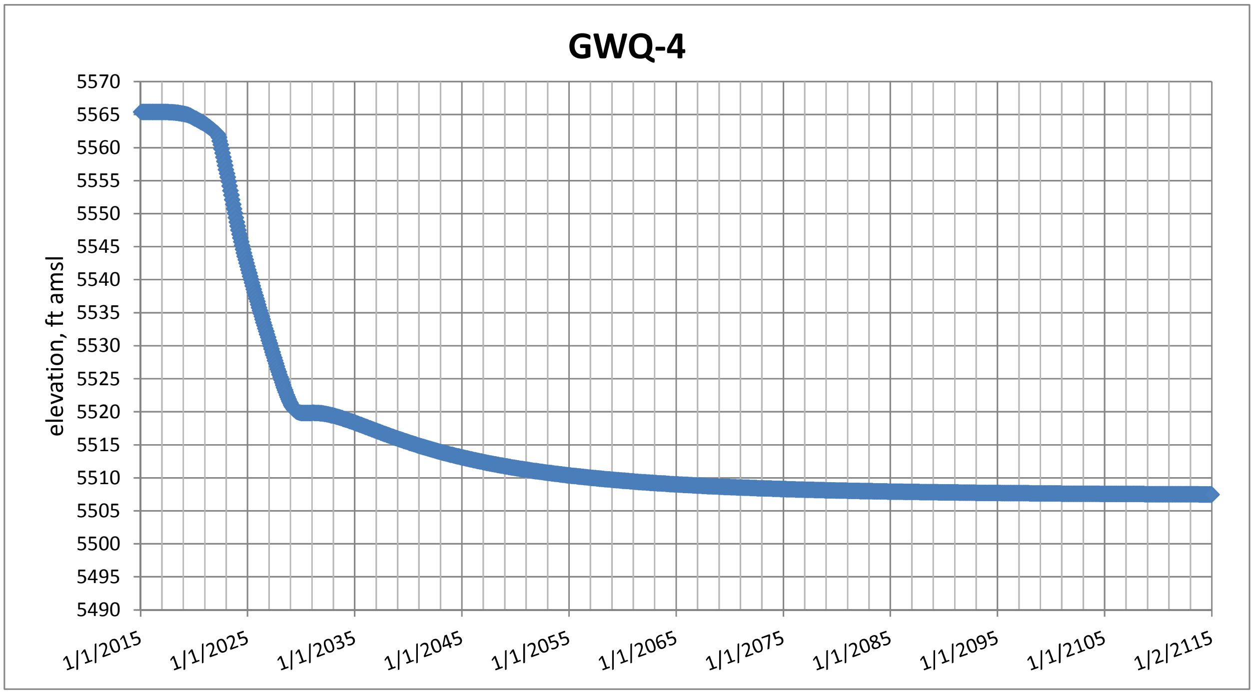

Figure A12. Projected water levels at GWQ-4.

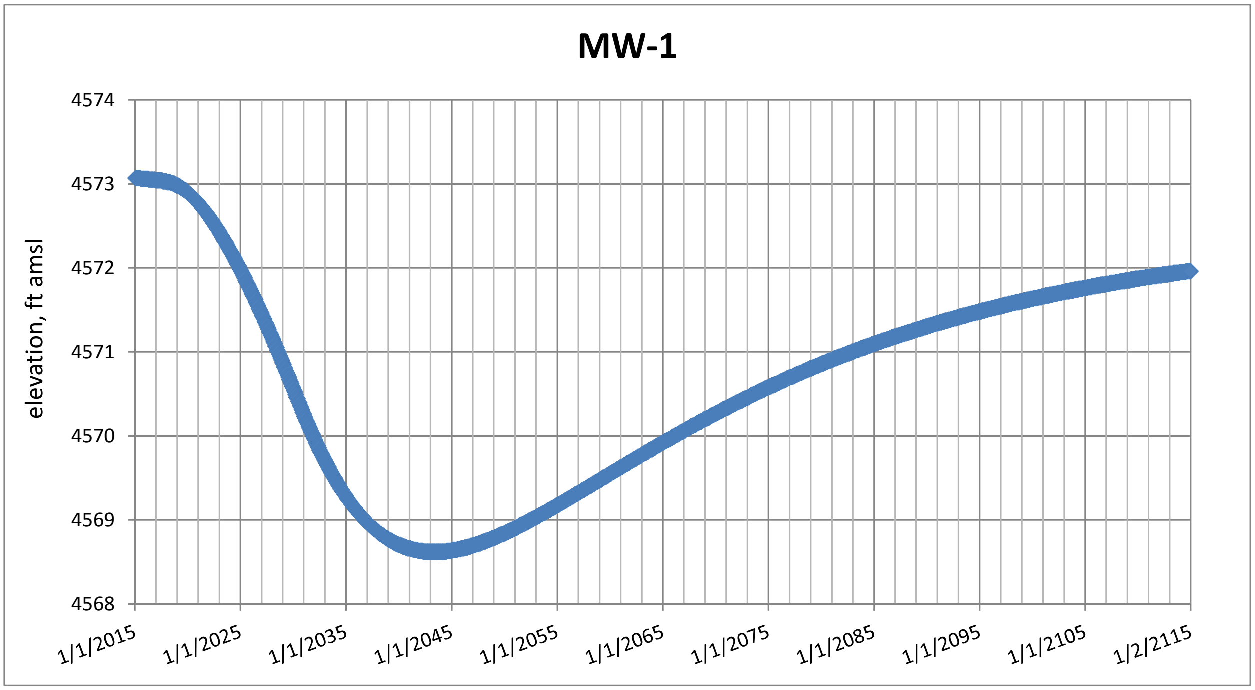

Figure A13. Projected water levels at MW-1.

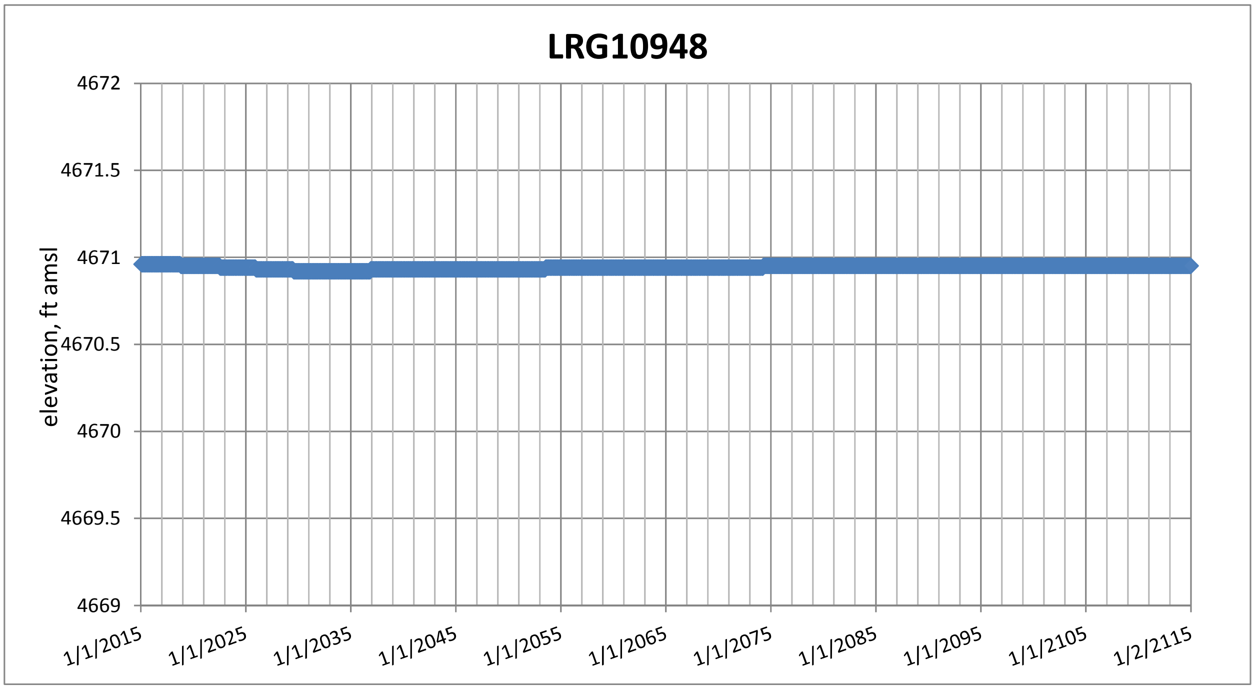

Figure A14. Projected water levels at LRG-10948.

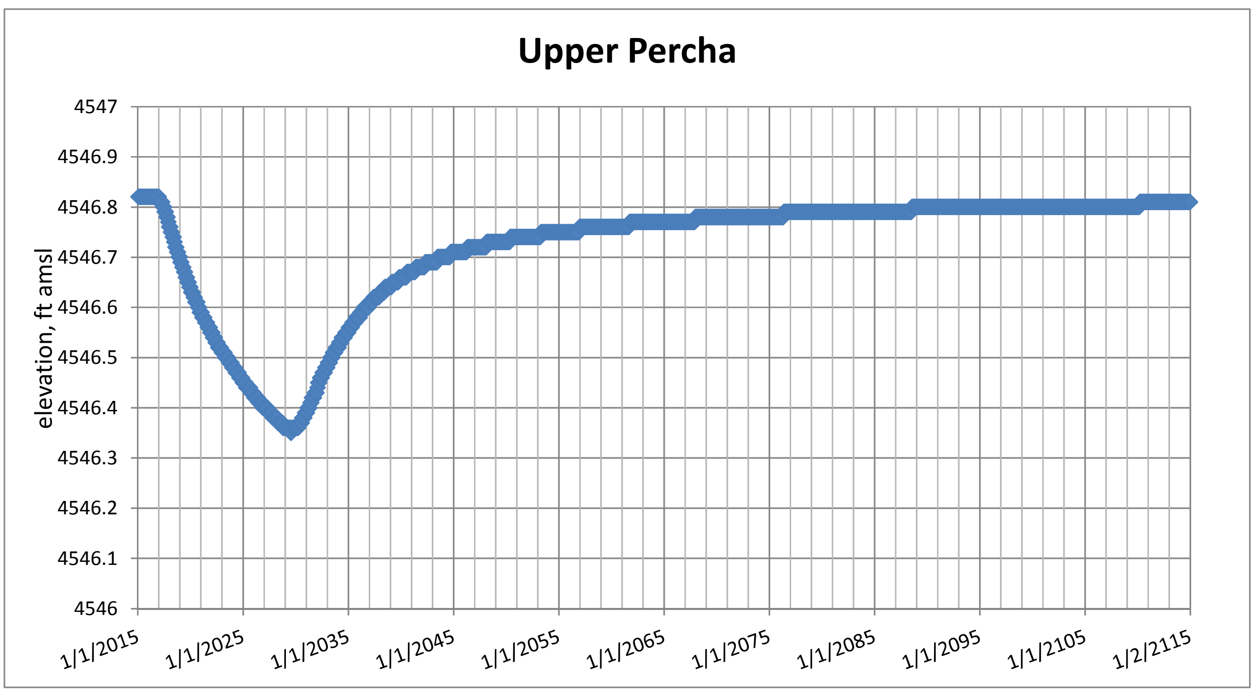

Figure A15. Projected water levels at Upper Percha.

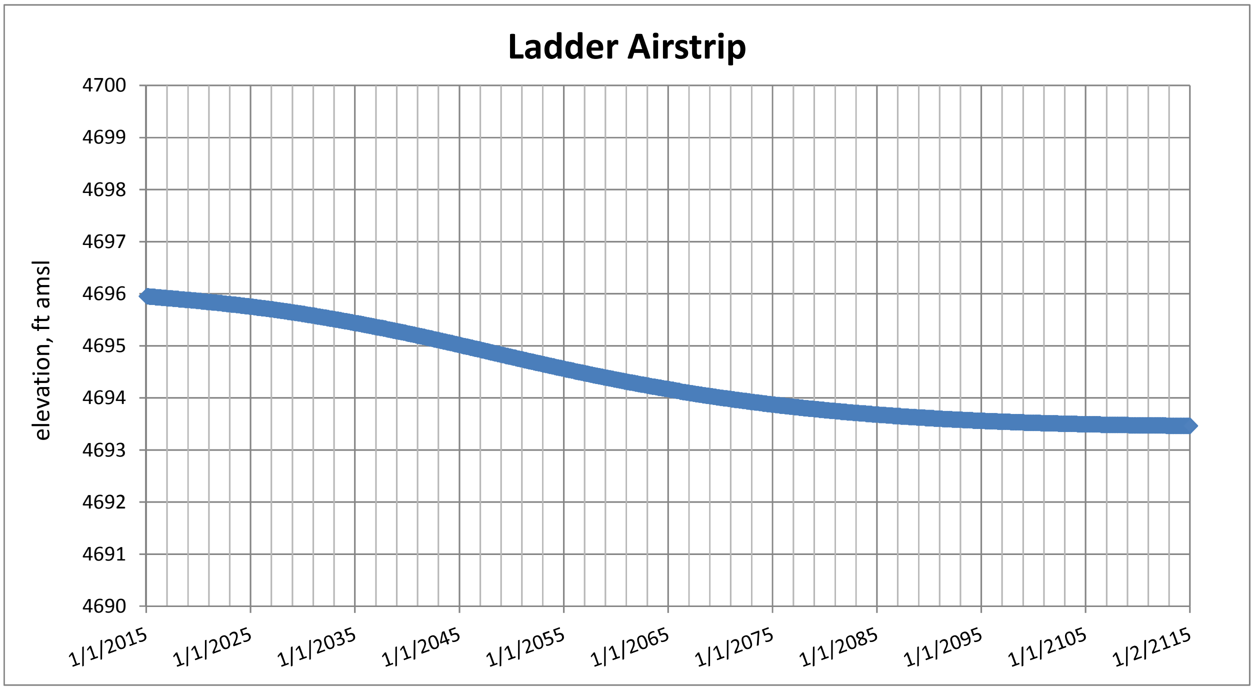

Figure A16. Projected water levels at Ladder Airstrip.

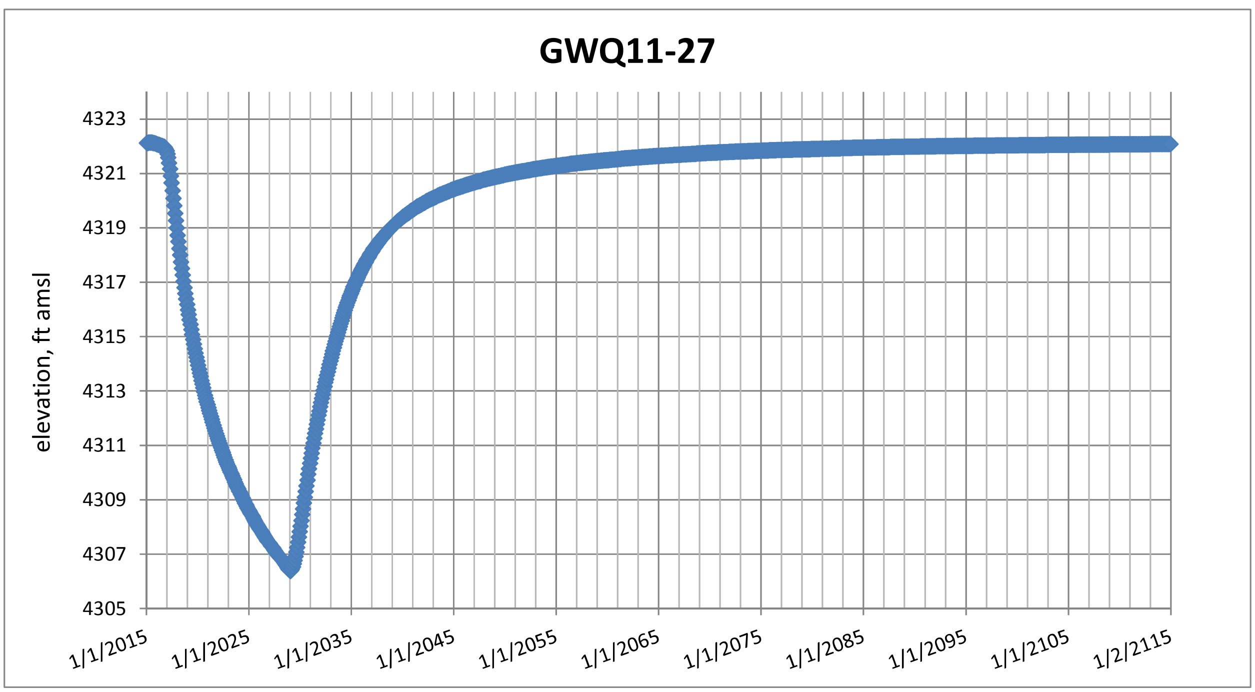

Figure A17. Projected water levels at GWQ11-27.

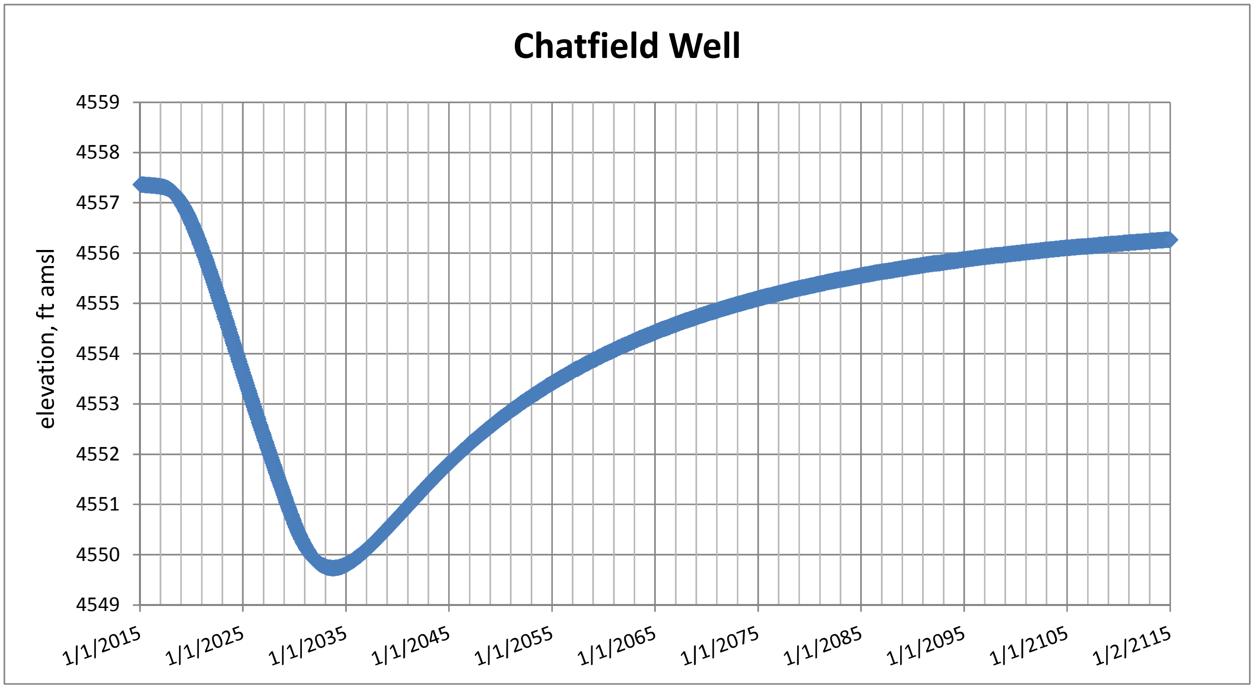

Figure A18. Projected water levels at Chatfield Well.

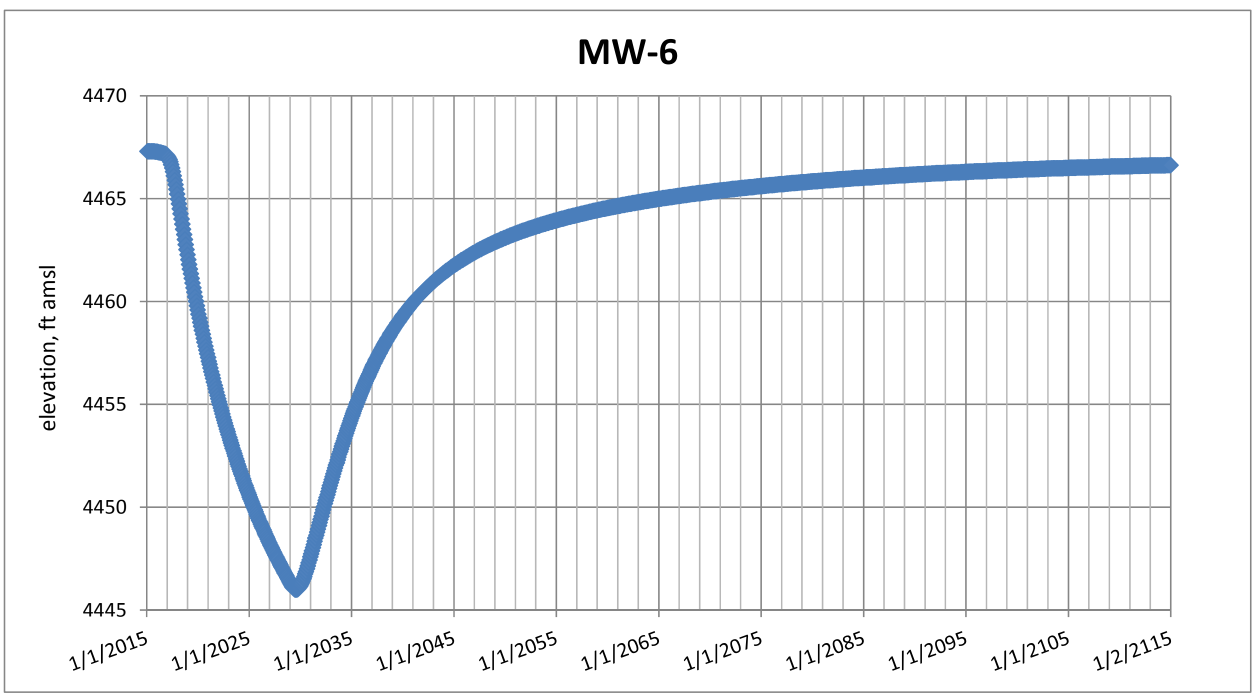

Figure A19. Projected water levels at MW-6.

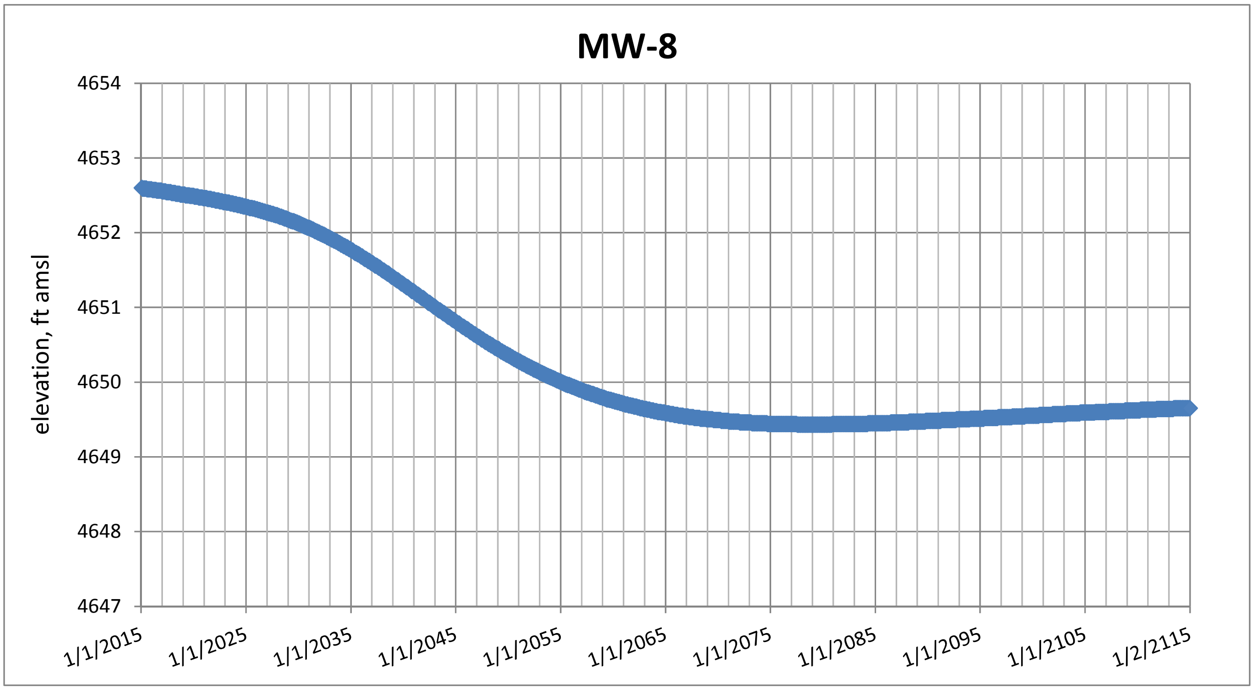

Figure A20. Projected water levels at MW-8.

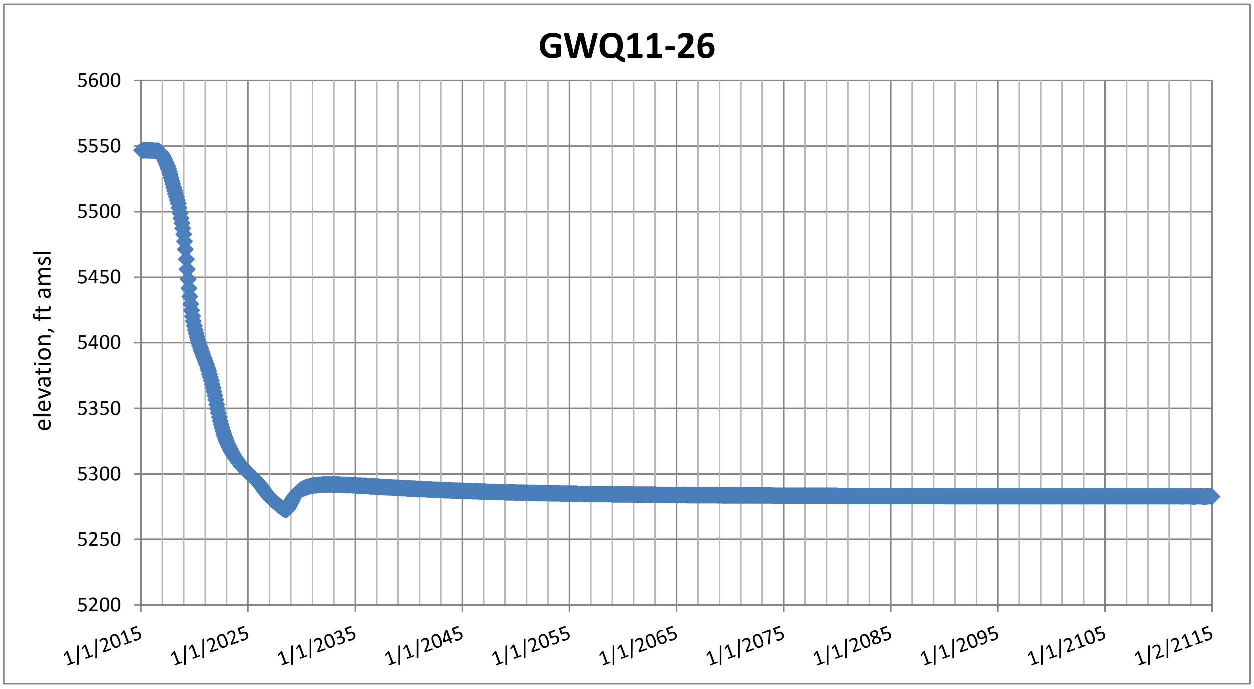

Figure A21. Projected water levels at GWQ11-26.

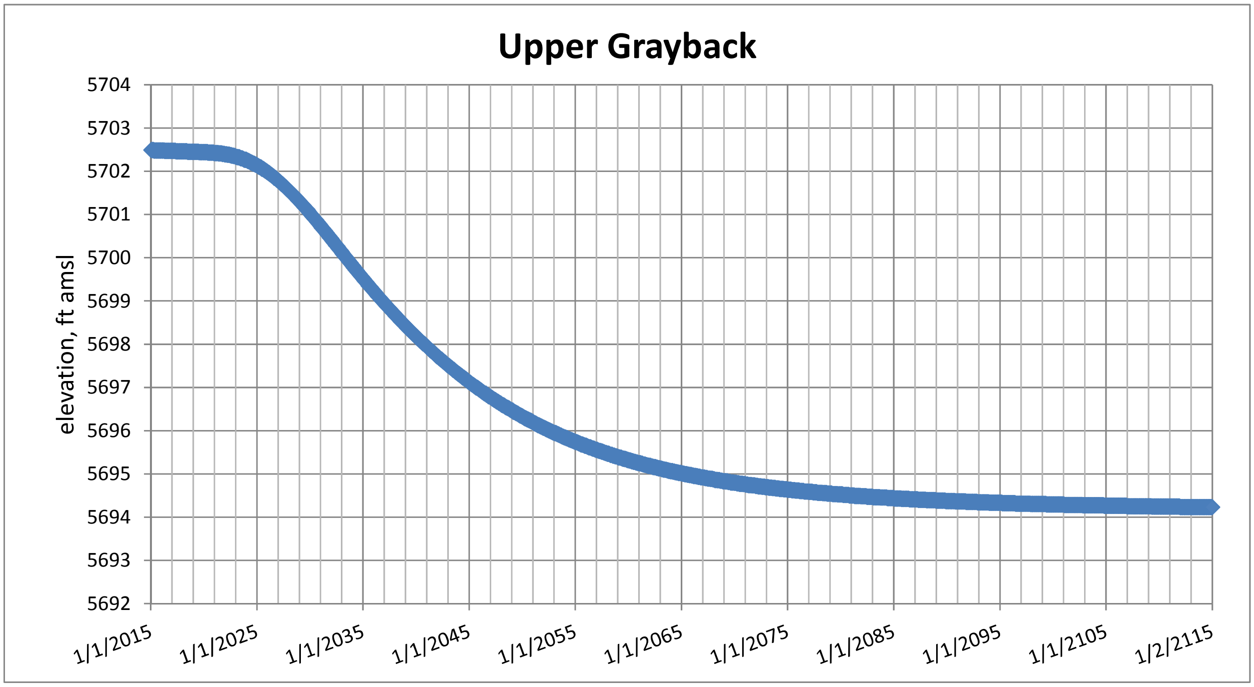

Figure A22. Projected water levels at Upper Grayback.

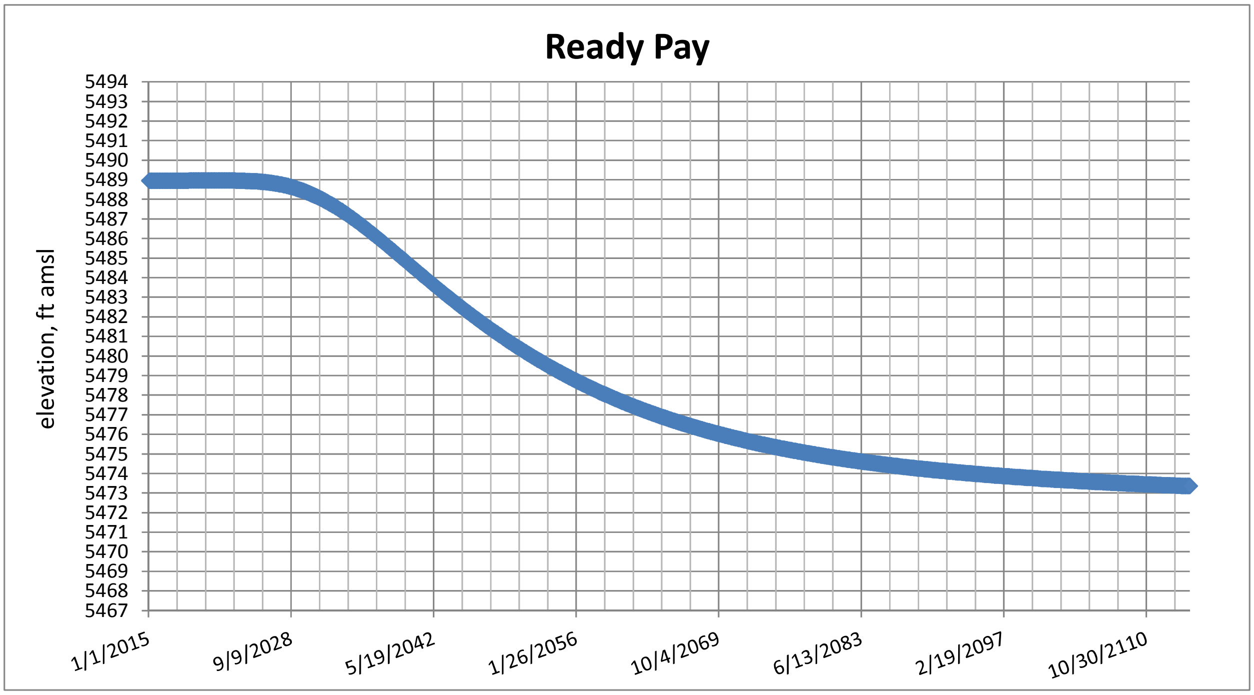

Figure A23. Projected water levels at Ready Pay.

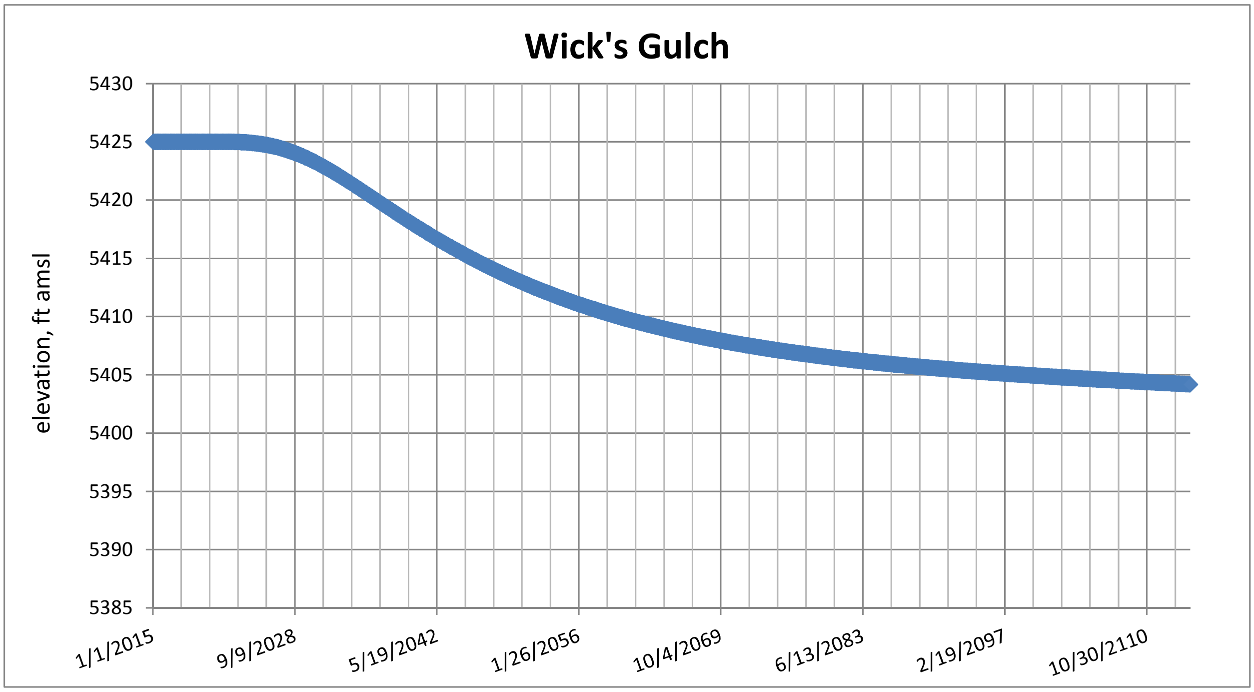

Figure A24. Projected water levels at Wick's Gulch.

Appendix B.

Technical Memo Regarding Liner Leakage Rates

JOHN SHOMAKER & ASSOCIATES, INC.
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MEMORANDUM

To: JSAI Internal Memo

From: Michael A. Jones, Principal Hydrologist

Date: December 8, 2010

Subject: liner leakage projection

Introduction

Synthetic liners have been widely used in the modern mining industry to minimize/eliminate mine contact water intrusion to the surrounding surface water and groundwater systems. Even though the liner materials are virtually impermeable, holes and tears regularly occur and synthetic liners leak. In general, the leakage rates depend on many factors including liner quality, installation quality, stress due to weight of the impounded material and traffic, water pressure on the liner, over-liner/under-liner material hydrogeologic and geotechnical properties and conditions, and so on.

Environmental Impact Assessment (EIS) on any new project always requires estimating leakage through the lined mine facilities including leach pads, tailing storage facilities (TSF), contact water ponds, and waste rock dumps. Based on the estimated seepage (source) and hydrologic properties of the underlying aquifers (receiver), evaluation of solute transport downstream can be carried out using numerical or analytical methods. In certain circumstances, the liner leakage must be estimated in order to properly design the seepage collection systems.

Various assumptions and methods have been used by different professionals to estimate liner leakage. Depending on which firm is contracted, different seepage estimates can be obtained for the same facility.

This memorandum intends to provide guidance on how to estimate liner leakage for future projects. Standardizing the approach will make the liner leakage estimates more defendable and irrelevant to the selection of consulting firm.

Liner Defect Assumptions

There are few papers on the size and frequency of occurrence of defects in liners (Erickson and Thiel, 2002; Colucci and Lavagnolo,1995; Rowel, 2005). The studies are generally in agreement. In a 3-year field study, Colucci and Lavagnolo (1995) found that the size of liner defects in waste landfills varies substantially with a median hole area of about 1 cm2 (Table 1).

Holes can be detected by electrical leak survey. Rowel et al. (2005) found that (1) no holes were detected for 30% of electrical leak surveys, and (2) fewer than 5 holes/ha were detected for 50% of the surveys with remaining 20% surveys having more than 5 holes/ha.

Some analyses have assumed a more frequent occurrence of smaller defects. In an EPA funded study, defect hole diameters were assumed to be 0.3 and 1 cm, but the corresponding numbers of holes were assumed to be 9 and 3.6 hole/ha, respectively (Barlaz et al., 2002).

Table 1. Reported size of holes in geomembranes (after Colucci & Lavagnolo, 1995)

Leak area (mm^2)	Equivalent radius for circular hole, r_o (mm)	Percentage (%)	Cumulative percentage (%)
0-20	0-2.5	23.2	23.2
20-100	2.5-5.64	26.3	49.5
100-500	5.64-12.6	28.2	77.7
500-1000	12.6-17.8	8.8	86.5
10^3-10^4	17.8-56.4	7.8	94.3
10^4-10^5	56.4-178	4.5	98.2
10^5-10^6	178-517	1.2	100

For estimating liner leakage, we recommend using the following assumptions for the occurrence and size of liner defects:

- 1 circular defect per acre (or 2.5 defects per hectare)
- Area of defect = 1 cm^2 (equivalent hole diameter of about 1.13 cm)

These recommendations are in agreement with Giroud and Bonaparte (1989) for calculations to size the components of the lining system, and have been used by some consulting firms.

Liner Leakage Equation 1 (for non TSF Facility)

We recommend an equation (Giruoud et al., 1997) to estimate liner leakage for non TSF facilities. The equation represents an impeded flow condition with a geomembrane underlain by a low permeable medium such as a (compacted) soil foundation.

The Giruoud et al. (1997) Equation is listed below:

$$q = \beta_c \left[1 + 0.1 \left(\frac{h_w}{L_s} \right)^{0.95} \right] a_d^{\ 0.1} h_w^{\ 0.9} K_s^{\ 0.74}$$

q =	leakage through a circular defect in composite liner (m^3/sec)
β_c =	coefficient relating to liner contact (0.21 for good and 1.15 for poor)
h_w =	depth of water above the geomembrane (m)
L_s =	thickness of soil liner (m)
a_d =	area of defect (m^2)
K_s =	saturated hydraulic conductivity of soil liner (m/s)

It should be noted that, in the above equation, the leakage rate has a non-linear relationship with the area of the defect. Therefore, the leakage through a single hole should be calculated first; then total leakage through the facility should be calculated based on the total number of defect holes within the facility footprint.

Liner Leakage Equation 2 (for TSF Facility)

The Giruoud et al. (1997) Equation is only suitable for lined leach pads, waste dumps and landfills where leakage is only impeded by defect size and conductance of the underlying soil liner. In a TSF, however, seepage through a liner defect will be most likely restricted by the permeability of tailings around the hole. In other words, hydraulic properties of both the over-liner tailings and the under-liner soil restrict the flow of water through the defect.

Coffey (Appendix A) has proposed an analytical solution to calculate liner leakage through a defect confined by both aquifers:

$$Q = (h_T - h_A)\, \pi D_H / (1/k_T + 1/k_A) \qquad (1)$$

Where, Q is leakage rate through a defect; hT and hA are, respectively, total head in the tailings and in the underlying soil; kT and kA are, respectively, hydraulic conductivity of the tailings and underneath soil; and DH is the diameter of the defect.

If the underlying soil is not pressurized, i.e., in an unsaturated condition, the above equation can be simplified to:

$$\boldsymbol{Q} = h_T \, \pi \, D_H \, k_T \tag{2}$$

Derivation of equations is provided in Appendix A. We have reviewed and verified the Coffey work and found it is correct mathematically.

The analytical solution proposed by Coffey was also validated by John Shomaker & Associates, Inc. (JSAI) using a spreadsheet-based numerical model and U.S. Geological Survey (USGS) finite difference code MODFLOW. Results obtained for an example problem, using both analytical and numerical solutions, are compared in Table 2. Apparently, they are in close agreement.

Table 2. Calculated seepage through a defect - numerical and analytical solutions

	Case
D_H (cm)	1.128
A (cm^2)	1.000
h_T(m)	30
K_T (cm/s)	1.00E-06
Coffey - Eq2 Q (cm^3/s)	0.011
JSAI - Spreadsheet Q (cm^3/s)	0.011
JSAI - MODFLOW Q (cm^3/s)	0.012

Discussion

Rowe (2005) reports landfill liner seepage as detected by liner detection systems (LDS) for various liner configurations (Table 3). It was found that (1) average leakage rates through single geomembrane liners were between 130-190 liters per ha per day (lphd), and (2) average leakage rates through geomembrane plus compacted clay liners were between 50- 90 lphd.

The following assumptions were used in an example calculation:

β_c = 0.21, h_w = 60 cm, L_s = 30 cm, a_d = 0.0001 m^2, K_s =1.00E-7 m/s, and defect frequency (n) is 1 hole/acre,

Estimated liner leakage from the Giruoud et al. (1997) Equation is:

$$Q = n \times q = 36 \text{ liters/acre/day} = 89 \text{ liters/ha/day (lphd)}$$

The calculated result is in close agreement with the Rowe (2005) field measurements. Therefore, we suggest a general rule that leakage of a lined leach pad (or waste dump) is likely about 100 lphd.

Table 3. Field-measured liner seepage (after Rowe, 2005)

Liner/stage	No. of cells	Average monthly flows: lphd			Peak monthly flows: lphd		
		Mean*	SD†	Max‡	Mean*	SD†	Max‡
Single liner: GM alone							
Active	25	190	330	1600§ 790¶	360	610	3070§ 1830¶
Post-closure	6	130	120	330	330	30	1130
Composite GM/GCL liner							
Active	22	1·5	2·7	11¶	9	16	54¶
Post-closure	5	0·6	0·9	2	4	5	10
Composite GM/CCL or GM/GCL/CCL liner							
Active	11	90	90	370§ 260¶	250	370	1990§ 1240¶
Post-closure	3	50	50	220	60	90	250

*Mean and †standard deviation of reported average and peak average monthly flows: these were obtained for different cells over different periods, and include data obtained for systems with sand, gravel and GN LDS.
‡Maximum value reported.
§Largest value reported, but it is for sand LDS and so may reflect stored water in the LDS shortly after construction.
¶Largest value for liner system with GN LDS.

References

Barlaz, M.A., Gabr, M.A., and Mohammed, P.E., 2002, Final Report: Closing the gaps in the regulation of municipal solid waste landfills: Defining the end of the post-closure monitoring period and the future stability of leachate recirculation landfills: EPA Grant Number: R827580.

Colucci, P., and Lavagnolo, M.C., 1995, Three years field experience in electrical control of synthetic landfill liners: Proc. 5th Int. Landfill Symp., Cagliari, pp 437-452.

Erickson, R.B., and Thiel, R., 2002, Design and application of the geomembrane supported GCL in one-product and encapsulated composite liner systems: Clay Geosynthetic Barriers, Zanzinger, Koerner & Gartung (eds), Swets & Zeitlinger, Lisse, ISBN 90 5809 380 8, pp 31-40.

Giroud, J.P., and Bonaparte, R., 1989, Leakage through liners constructed with geomembranes – Part I. Geomembrane liners, geotextiles and geomembranes Vol 8, pp 27-67.

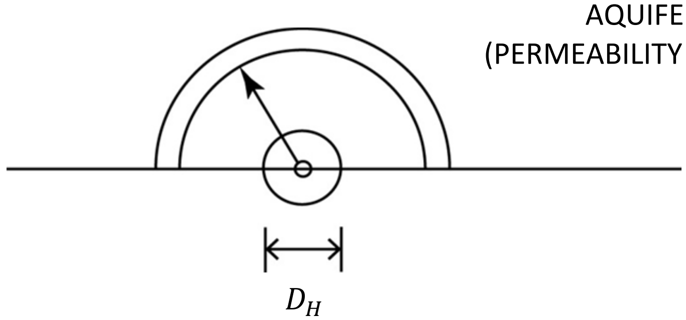
Giroud, J.P., Khire, M.V., and Soderman, K.L., 1997, Liquid migration through defects in a geomembrane overlain and underlain by permeable media: Geosynthetics International, Vol. 4, Nos. 3-4, pp 293-321.

Rowe, R.K., 2005, Long-term performance of contaminant barrier systems: Ge´otechnique 55, No. 9, pp 631-678.

Appendix A

Seepage Loss through a Circular Hole in Geomemberance
(Coffey, 2010)

CONSIDER SEEPAGE LOSS THROUGH A CIRCULAR HOLE OF DIAMETER D_H
IN A MEMBRANE SEPARATING TWO MATERIALS OF DIFFERENT PERMEABILITY.

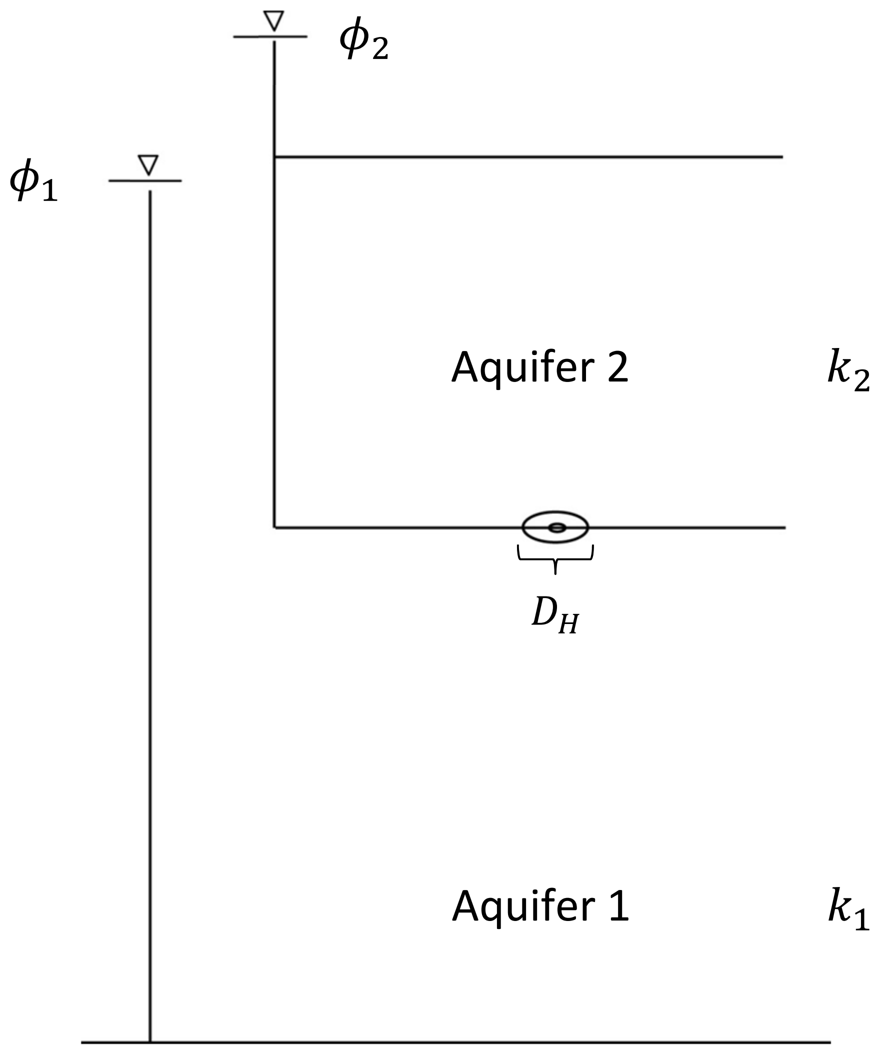


$$Q = k \overbrace{2\pi r^2}^{\textit{area of half sphere}} \frac{d\phi}{dr}$$

Under steady state, Q is uniform over r

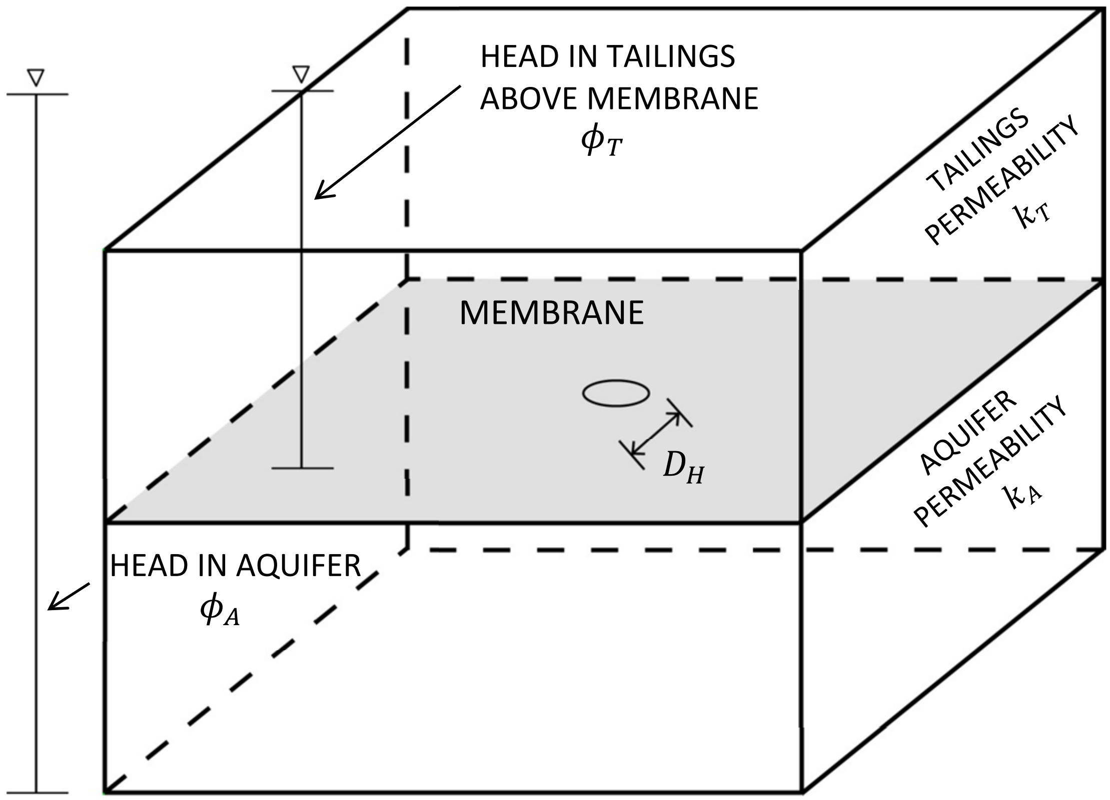
$$\phi = \int_{r_a}^{\infty} \frac{Q}{2\pi k r^2} dr = -\left[\frac{Q}{2\pi k r}\right]_{r_a}^{\infty} = \frac{Q}{2\pi k r_a}$$

Head loss to hole: $\Delta\phi = \frac{Q}{\pi k D_H}$ (noting $2r_H = D_H$)



$$\phi_2 - \phi_1 = \frac{Q}{\pi D_H k_2} + \frac{Q}{\pi D_H k_1} = \frac{Q}{\pi D_H}\left(\frac{1}{k_2} + \frac{1}{k_1}\right)$$

$$Q = \frac{\pi D_H(\phi_2 - \phi_1)}{\left(\frac{1}{k_2} + \frac{1}{k_1}\right)}$$



LEAKAGE THROUGH HOLE OF DIAMETER D_H:

$$Q = \frac{\pi D_H(\phi_T - \phi_A)}{\left(\frac{1}{k_A} + \frac{1}{k_T}\right)}$$

$Q = \pi \phi_T k_T D_H$ for fully drained layer below