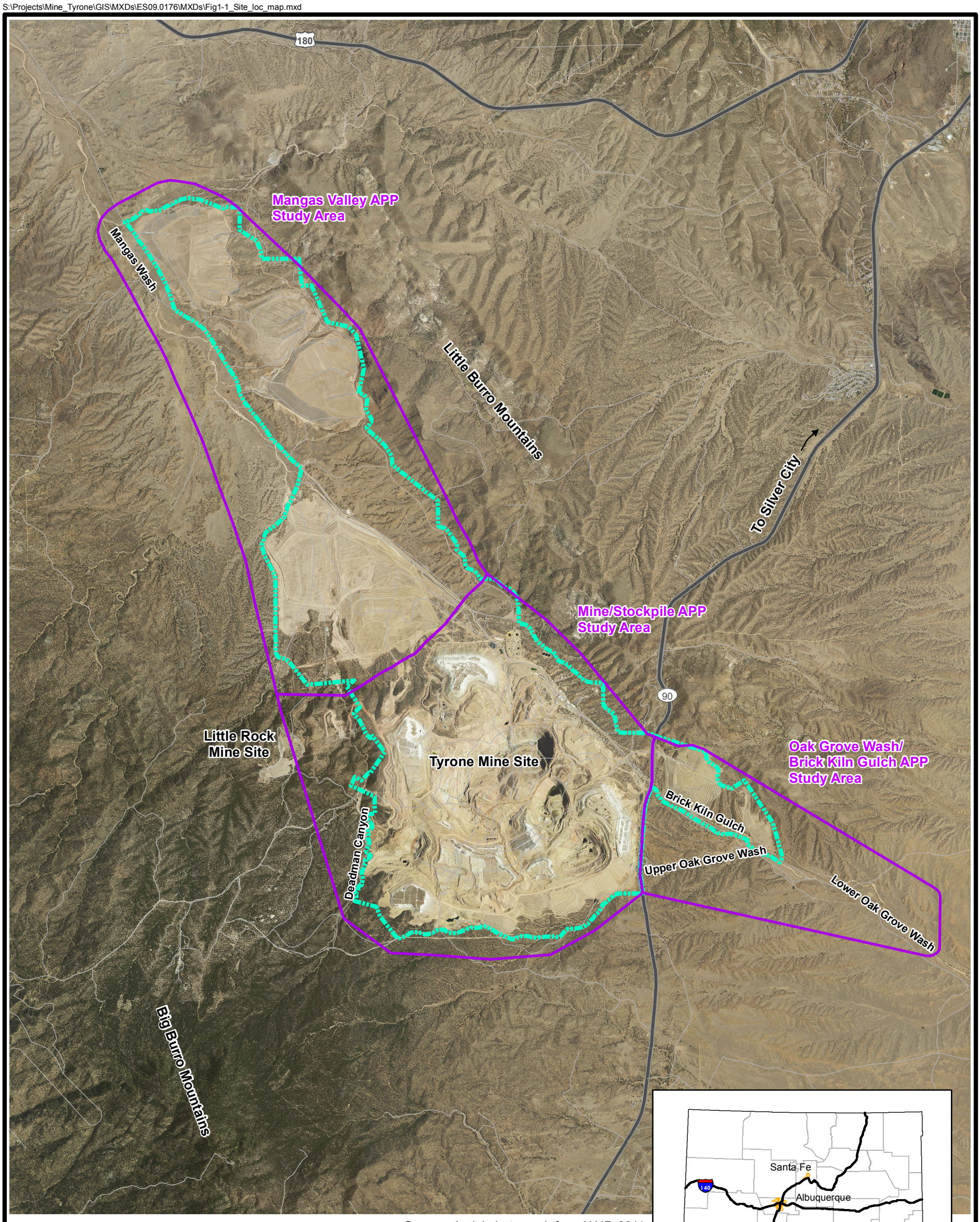
Figures

S:\Projects\Mine_Tyrone\GIS\MXDs\ES09.0176\MXDs\Fig1-1_Site_loc_map.mxd



Source: Aerial photograph from NAIP, 2011

N

0 3,000 6,000 Feet

Explanation

Tyrone Mine permit boundary

Study area boundary

Grant County

Figure 1-1

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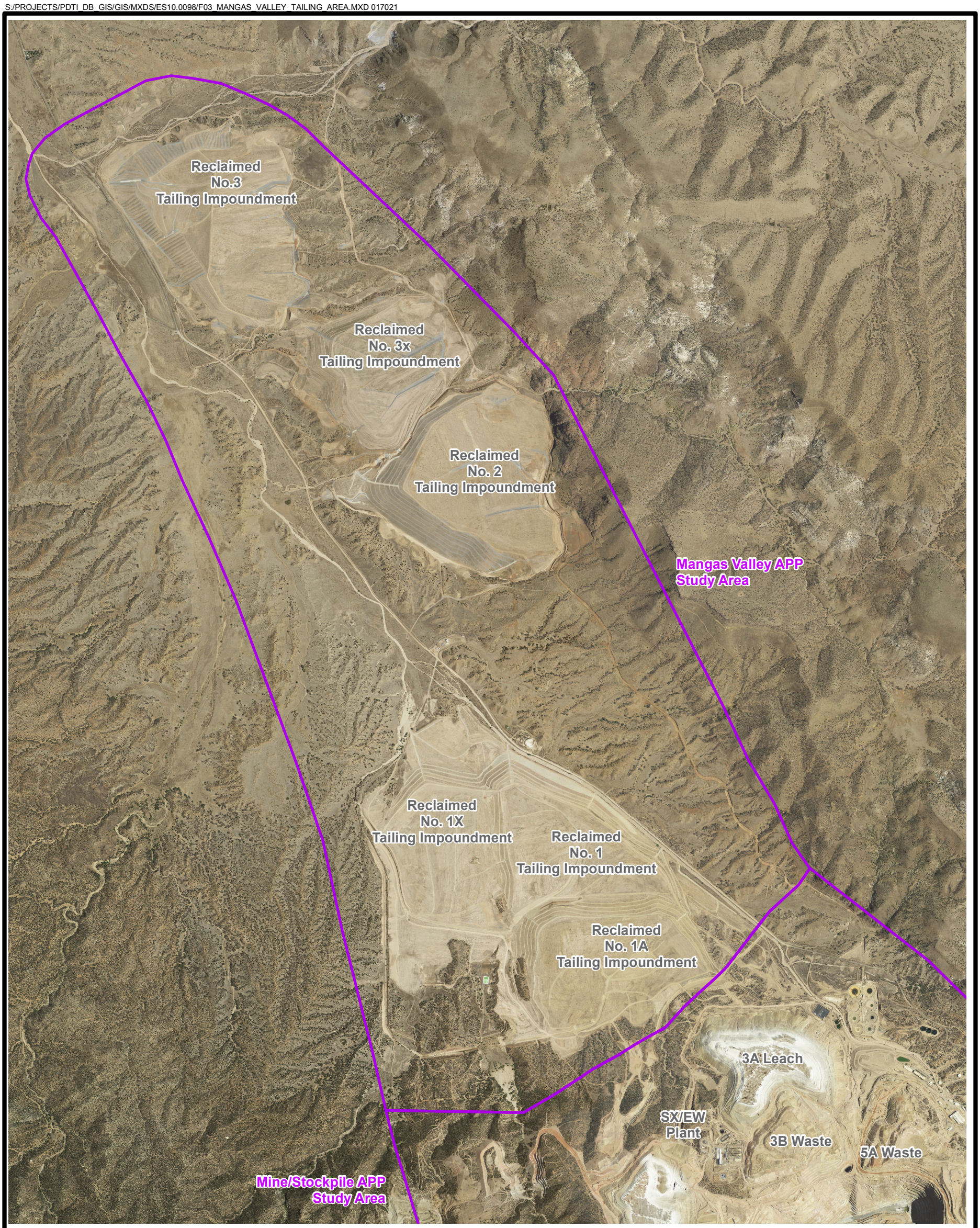
11/18/2011 JN ES09.0176

FREEPORT-MCMORAN COPPER & GOLD

TYRONE STAGE 2 APP
Site Location Map

S:/PROJECTS/PDTI_DB_GIS/GIS/MXDS/ES10.0098/F03_MANGAS_VALLEY_TAILING_AREA.MXD 017021



Source: Aerial photograph from NAIP, 2011

N

0 1,500 3,000 Feet

Explanation

Study area boundary

Notes: Leach = leach stockpile
Waste = waste rock pile

Figure 2-1

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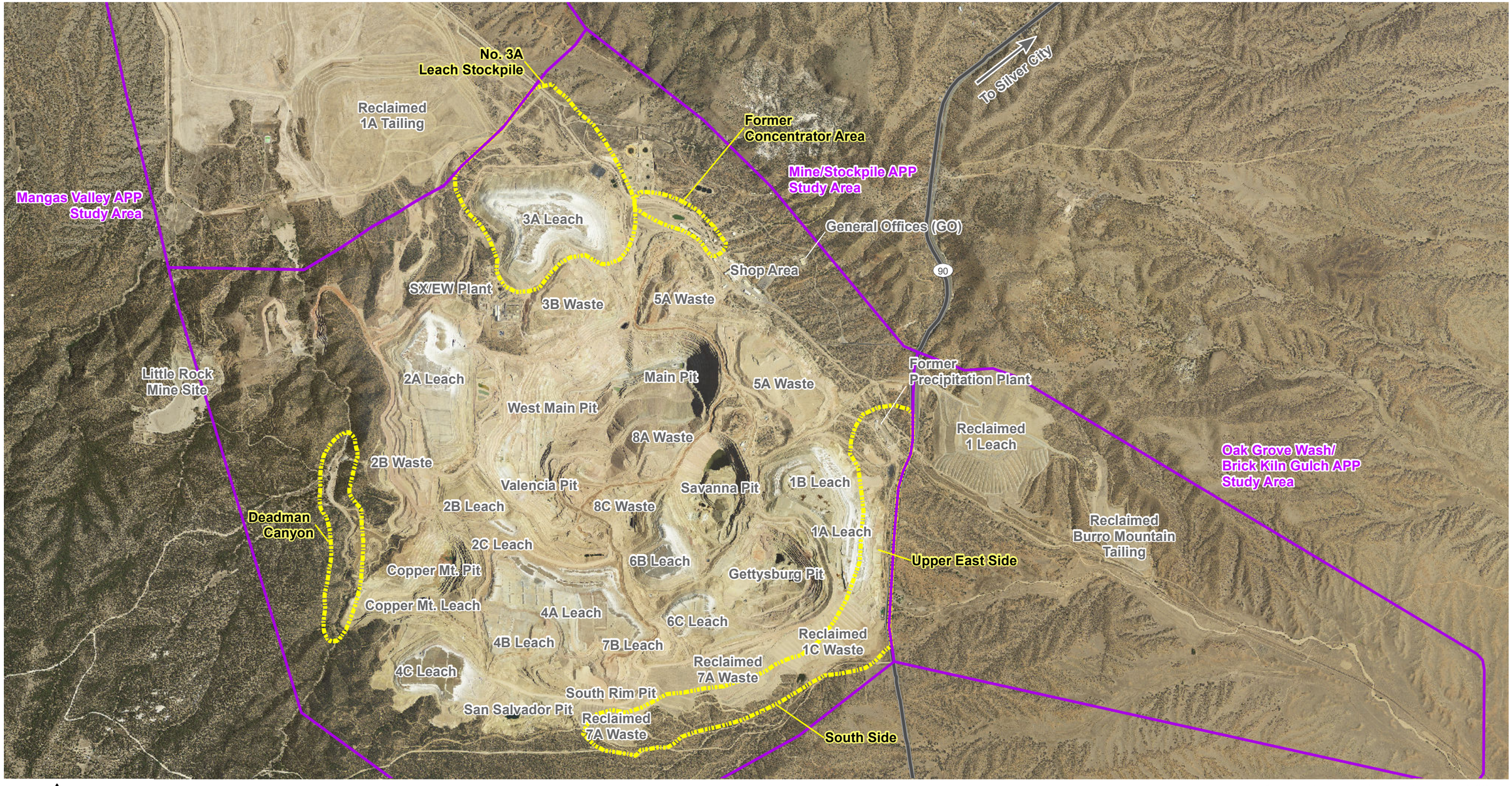
11/18/2011 JN ES09.0176

FREEPORT-MCMORAN COPPER & GOLD

TYRONE STAGE 2 APP

Tyrone Mangas Valley Tailing Area



Source: Aerial photograph from NAIP, 2011

N

0 1,500 3,000 Feet

Explanation

- Study area boundary
- Mine/Stockpile unit peripheral areas

Notes: Leach = leach stockpile
Waste = waste rock pile

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TYRONE STAGE 2 APP

Tyrone Mine and Stockpile Area Facilities

Figure 2-2

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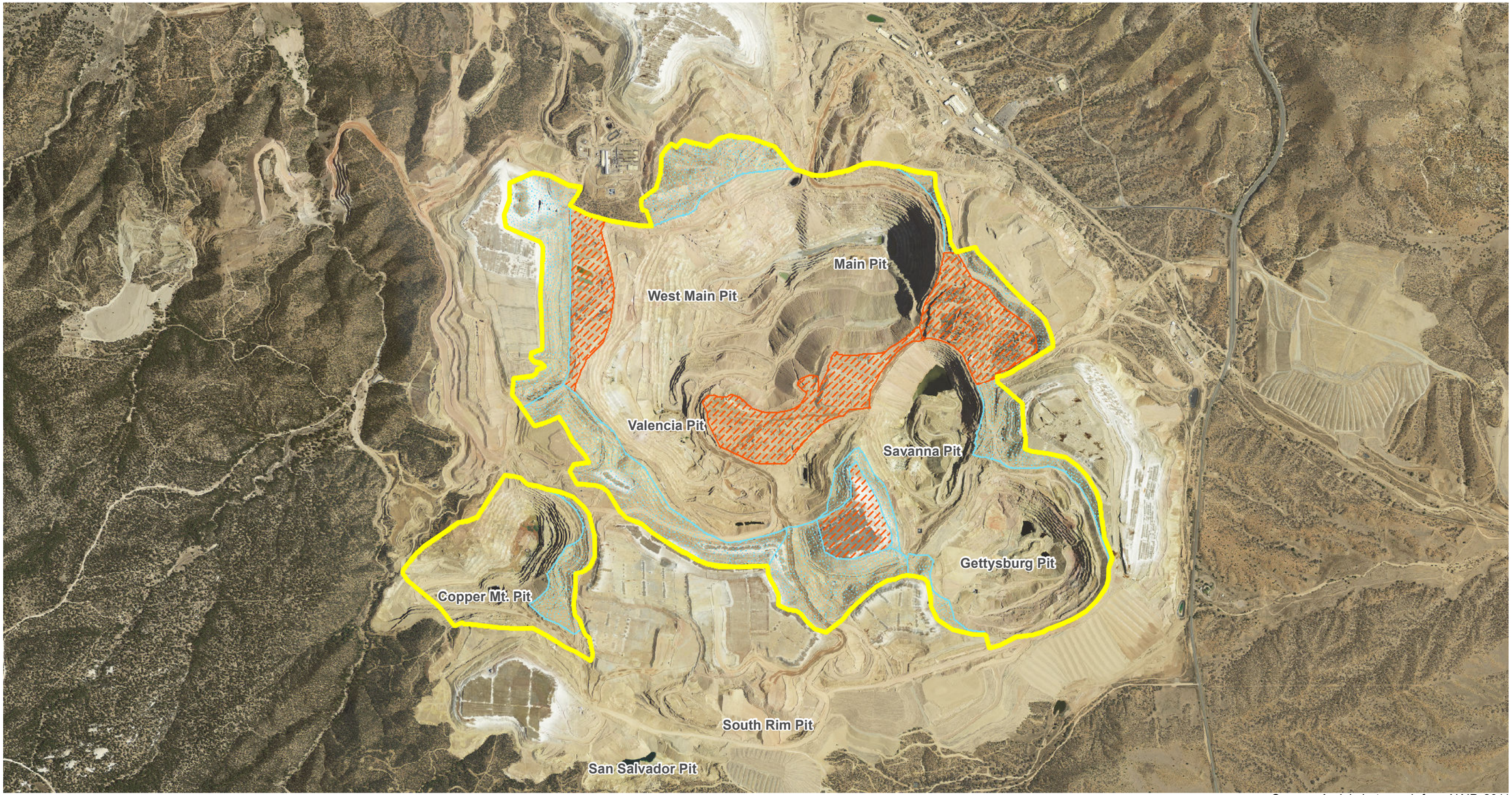
2/28/2012
JN ES09.0176

S:\Projects\Mine_Tyrone\GIS\MXDs\ES09.0176\MXDs\Stage_2_APP_Report_1-2012\Fig02-2_mine_stockpile_area.mxd



Source: Aerial photograph from NAIP, 2011

N

0 1,000 2,000 Feet

Explanation

- Open pit surface drainage area
- Flat reclaimed areas (store and release cover)
- Interior slope areas (no cover)

Notes: 1. Inside the open pit surface drainage areas, surface runoff will be to one of the pits.
2. Outside the open pit surface drainage areas, all stockpiles will be covered.

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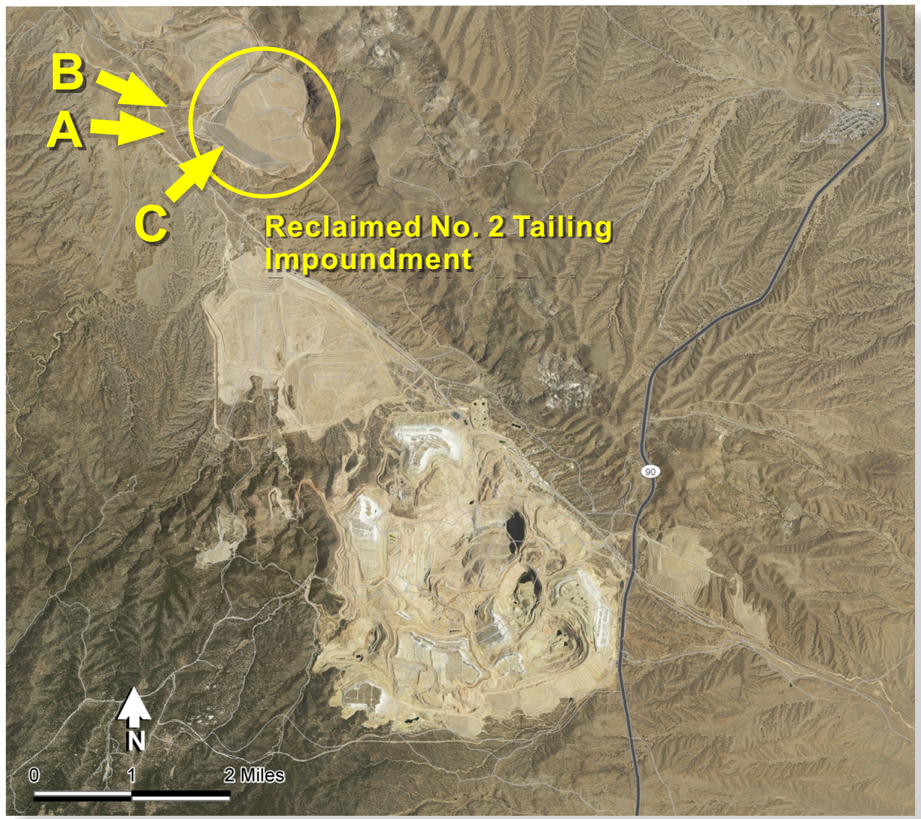
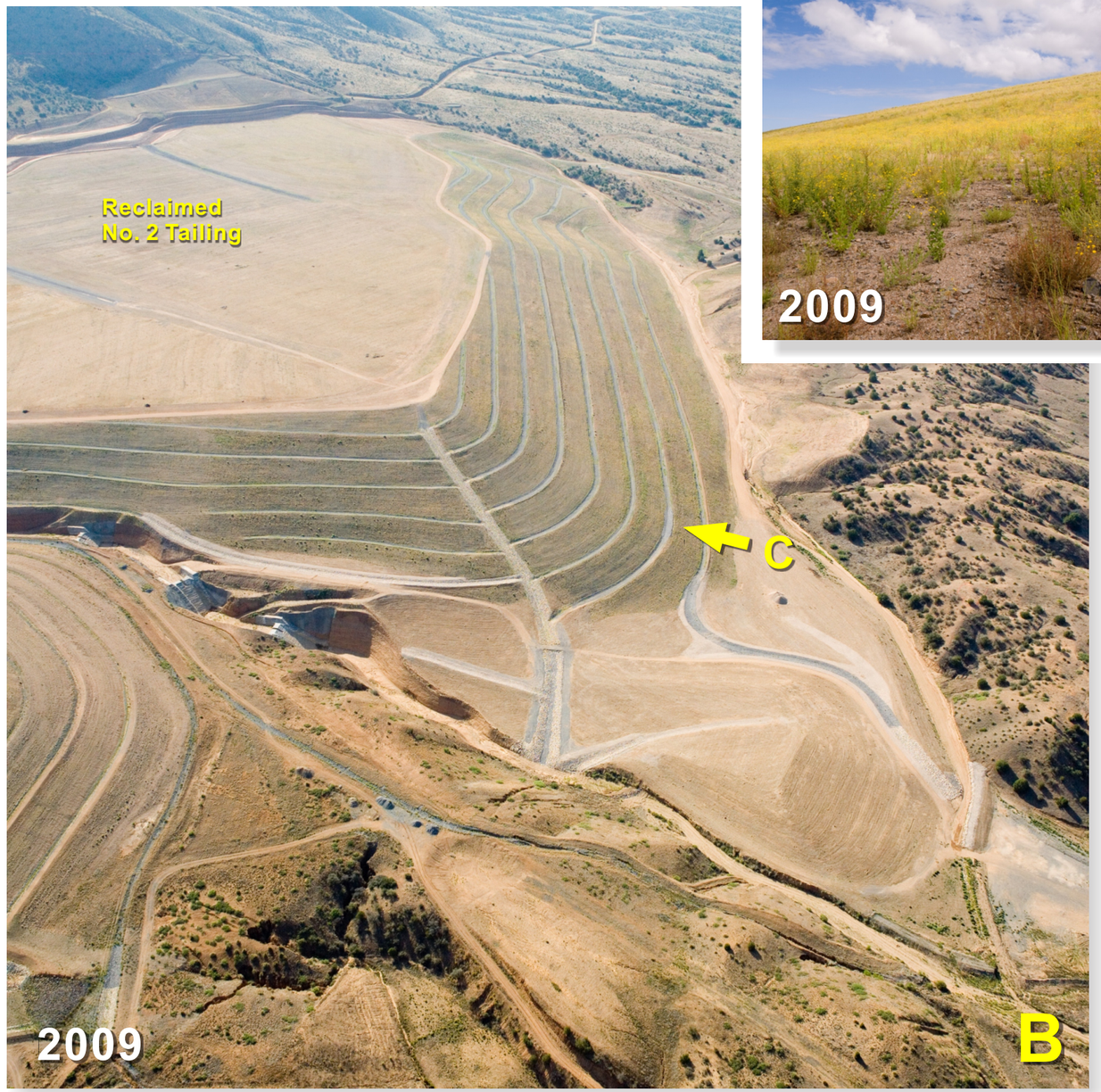
TYRONE STAGE 2 APP

Overview of Reclamation and Cover Requirements

Figure 3-1

S:\Projects\Mine_Tyrone\GIS\MXDs\ES09.0176\MXDs\Stage_2_APP_Report_1-2012\Fig03-1_overview.mxd





Explanation

A → Photograph viewing direction

FREEPORT-MCMORAN COPPER & GOLD

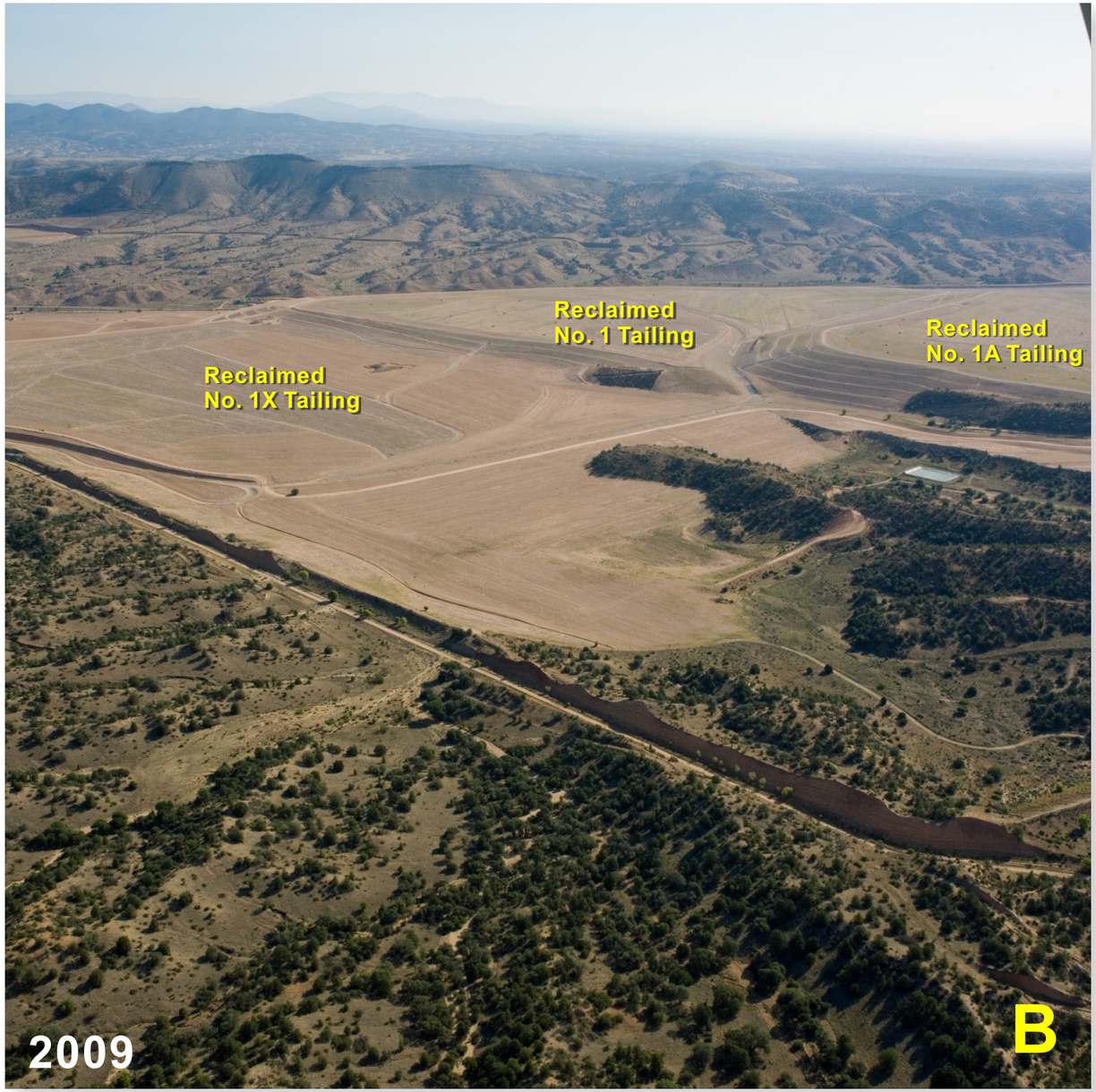
TYRONE STAGE 2 APP

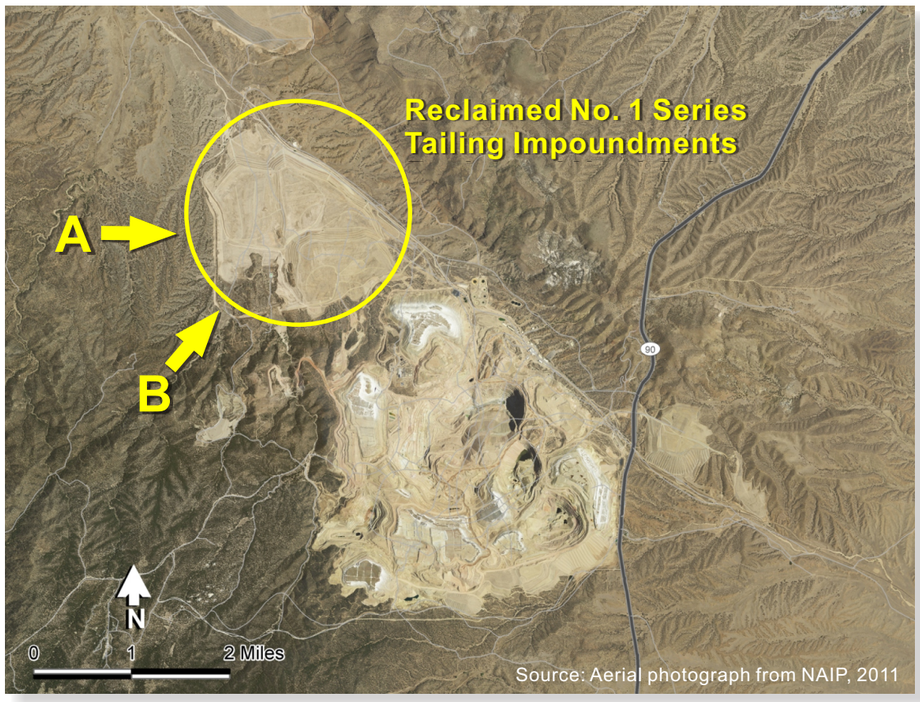
Reclaimed No. 2 Tailing Impoundment

Figure 3-2

Daniel B. Stephens & Associates, Inc.
2/3/2012 JN ES09.0176

S:\PROJECTS\MINE_TYRONE_VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS_3-2_3-3_7-1_RECLAIMED_TAILING_AND_STOCKPILES.CDR





Explanation

A → Photograph viewing direction

FREEPORT-McMoRAN COPPER & GOLD

TYRONE STAGE 2 APP

Reclaimed No. 1 Series Tailing Impoundments

Figure 3-3

Daniel B. Stephens & Associates, Inc.
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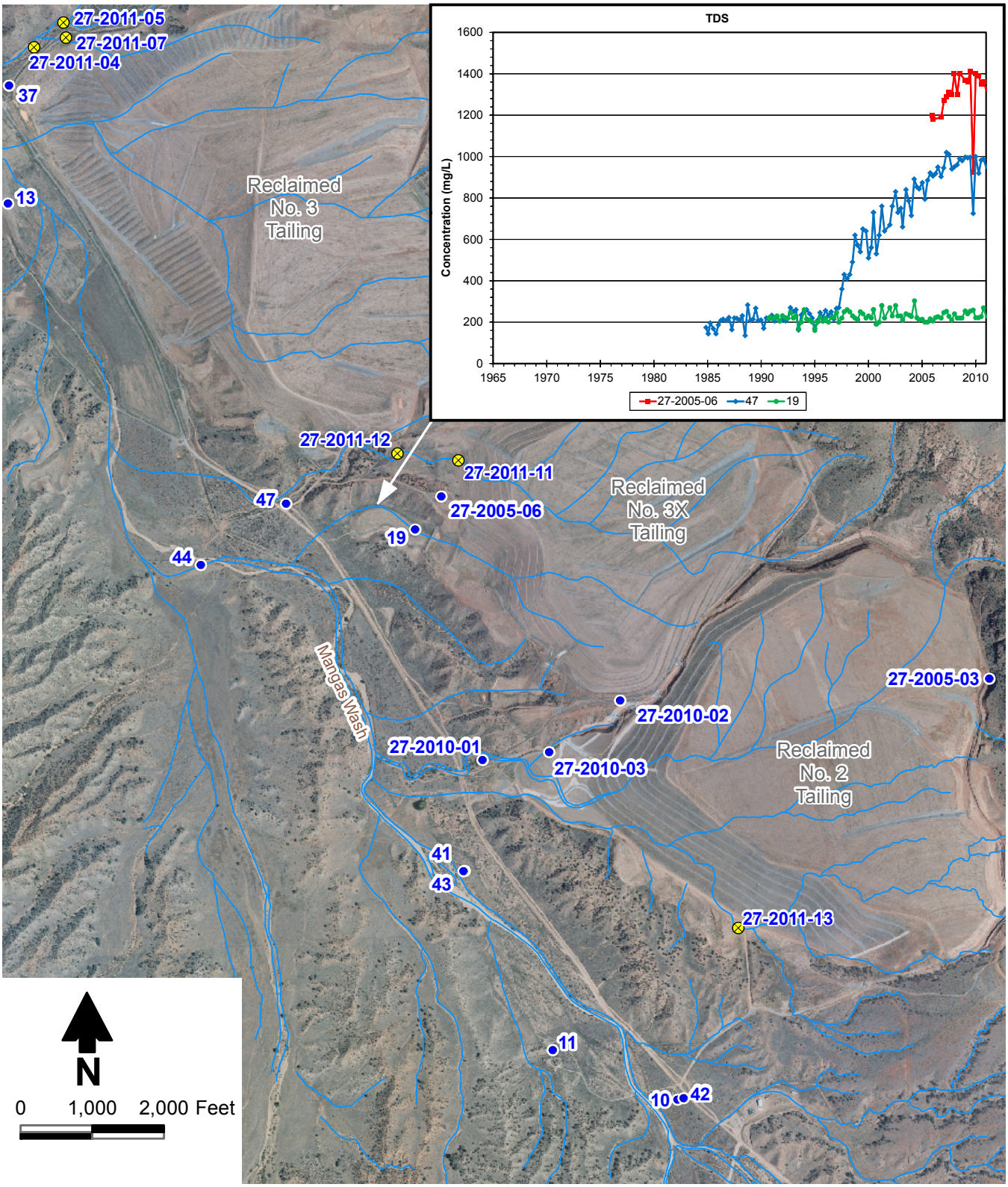
S:\PROJECTS\MINE_TYRONE_VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS_3-2_3-3_7-1_RECLAIMED_TAILING_AND_STOCKPILES.CDR



Explanation

- Temporary borehole from Stage 1 APP investigation
- Regional monitor well
- Pre-surface mining drainage

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TYRONE STAGE 2 APP

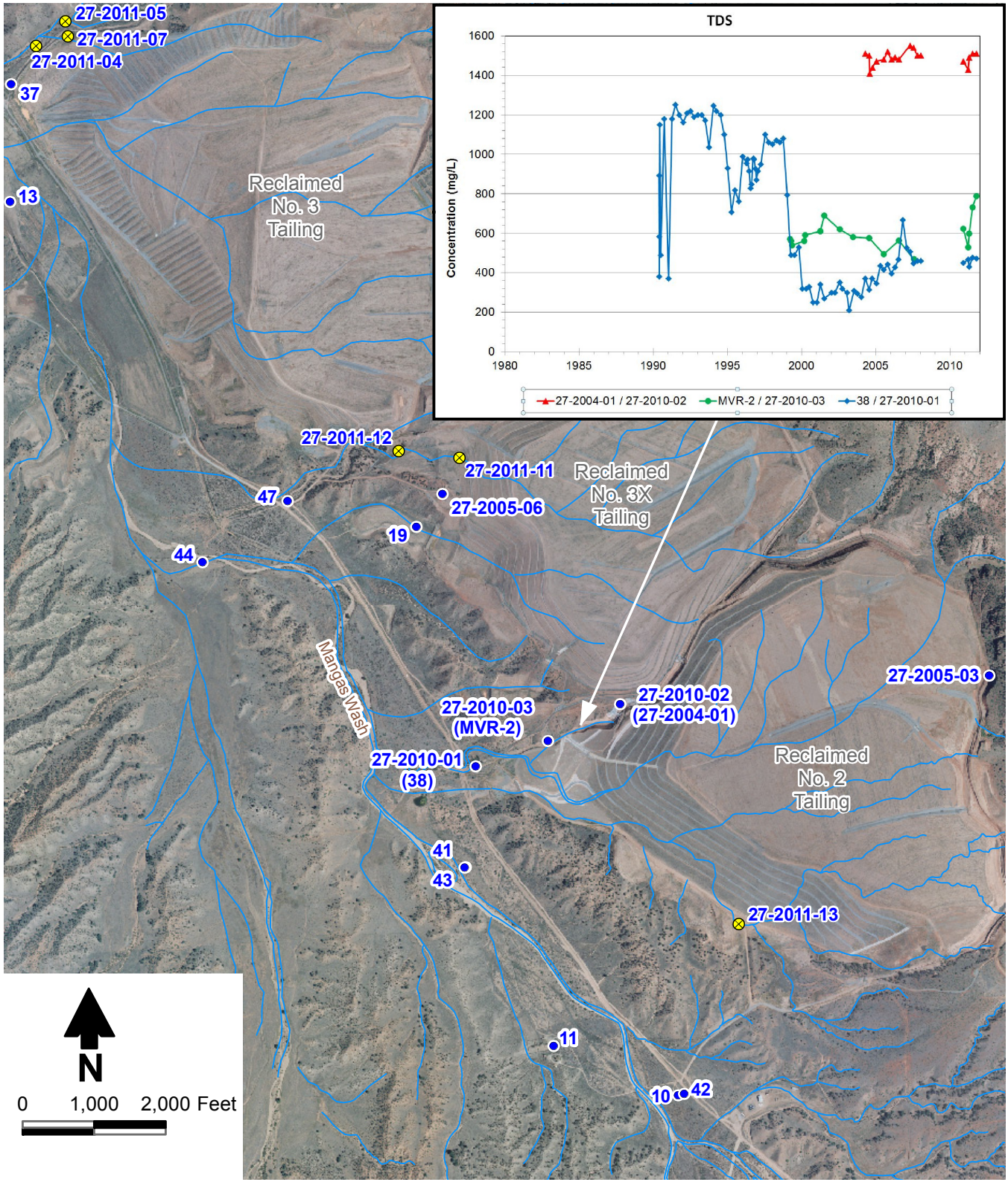
Water Quality at Wells Adjacent to No. 3X Tailing Impoundment

Daniel B. Stephens & Associates, Inc.

2/28/2012 JN ES09.0176

Figure 4-1

\\SHARE2ABQ\DATAS\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176MXDS\STAGE_2_APP_REPORT_1-2012FIG04-1_WATER_QUALITY_AT_WELLS_ADJACENT_TO_NO_3X_TAILING.MXD



Explanation

- Temporary borehole from Stage 1 APP investigation
- Regional monitor well; well that current well replaces shown in parentheses
- Pre-surface mining drainage

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TYRONE STAGE 2 APP

Water Quality at Wells Adjacent to No. 2 Tailing Impoundment

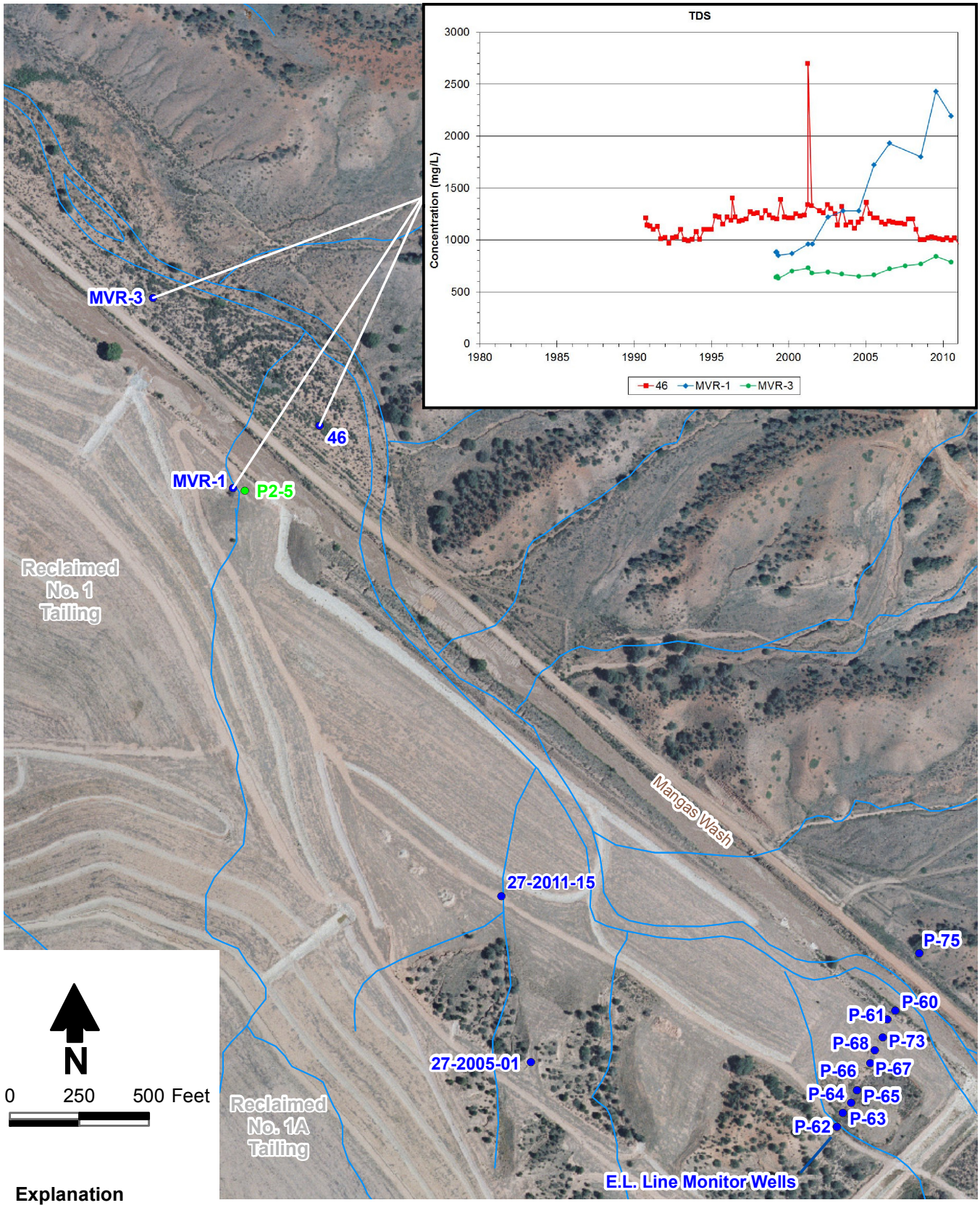
Daniel B. Stephens & Associates, Inc.

2/8/2012

JN ES09.0176

Figure 4-2

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG04-2_WATER_QUALITY_AT_WELLS_ADJACENT_TO_NO_2_TAILINGS.MXD



Explanation

- Perched zone monitor well
- Regional monitor well
- Pre-surface mining drainage

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TYRONE STAGE 2 APP

Water Quality at Wells Adjacent to Nos. 1 and 1A Tailing Impoundments

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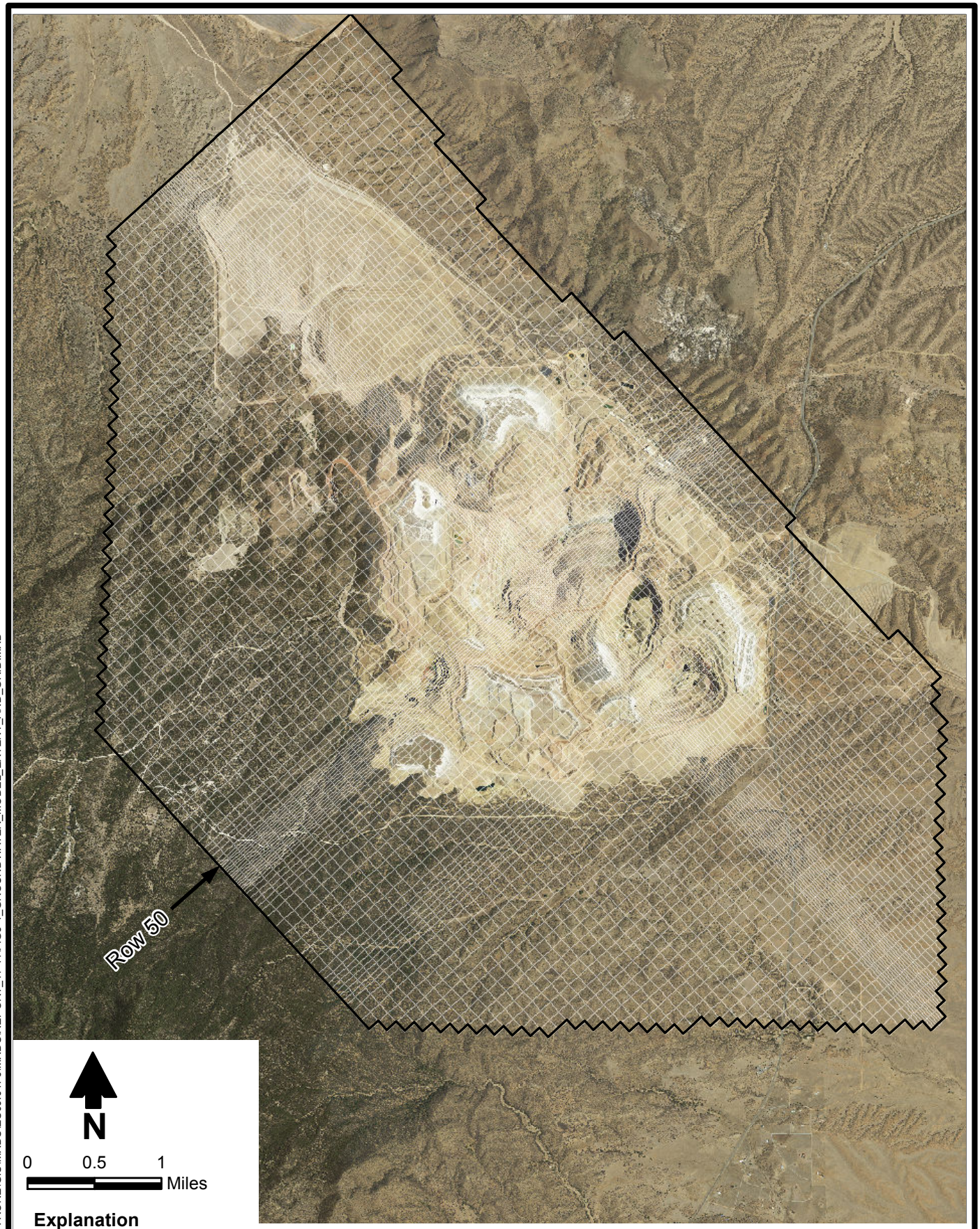
2/8/2012

JN ES09.0176

Figure 4-3

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG04-3_WATER_QUALITY_AT_WELLS_ADJACENT_TO_NO_1_AND_1A_TAILINGS.MXD



Source: Aerial photograph from NAIP, 2011

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TYRONE STAGE 2 APP

Groundwater Model Extent and Grid

Figure 5-1

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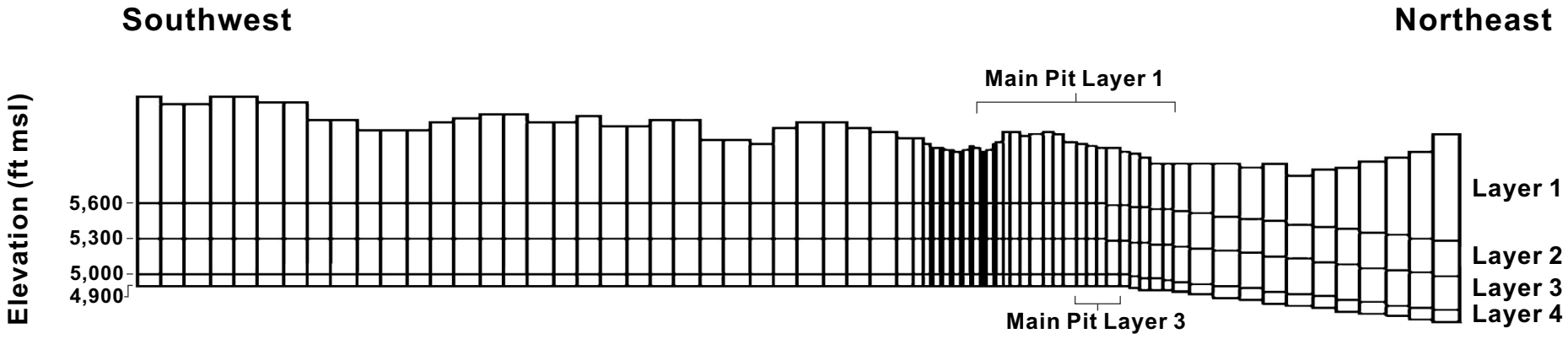
11/22/2011

JN ES09.0176

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\REPORT_11-11\FIG5-1_GROUNDWATER_MODEL_EXTENT_AND_GRID.MXD

S:\PROJECTS\MINE_TYRONE_VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-2_VERTICAL_PROFILE_MODEL_GRID.CDR



FREEPORT-McMoRan COPPER & GOLD

TYRONE STAGE 2 APP

0 4000 ft

Note: See Figure 5 for location of model row 50

Vertical Profile of Model Grid from Southwest to Northeast along Model Row 50 Through the Main Pit

Figure 5-2

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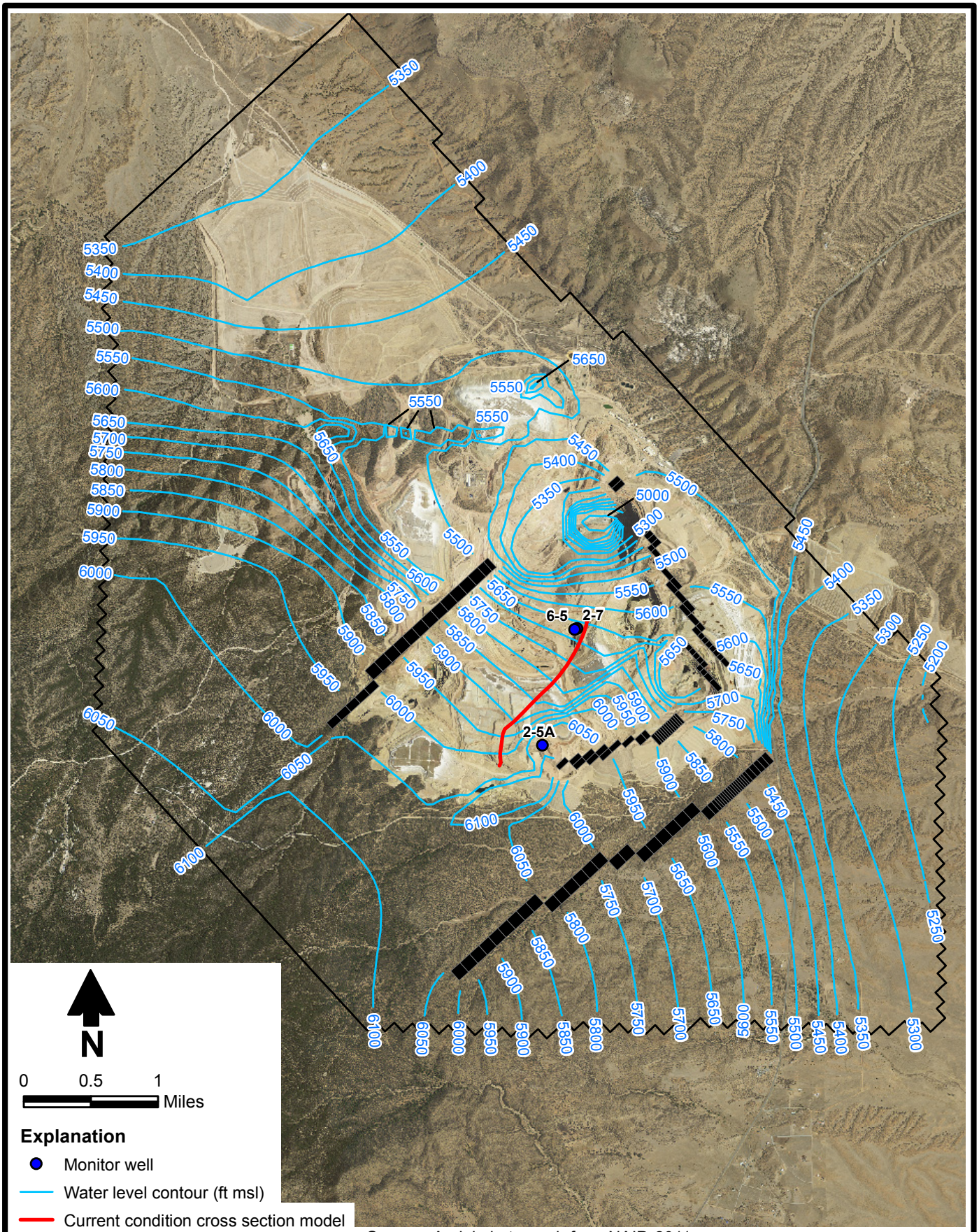
11-22-11 JN ES09.0176



Source: Aerial photograph from NAIP, 2011

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TYRONE STAGE 2 APP

Simulated 2010 Water Table

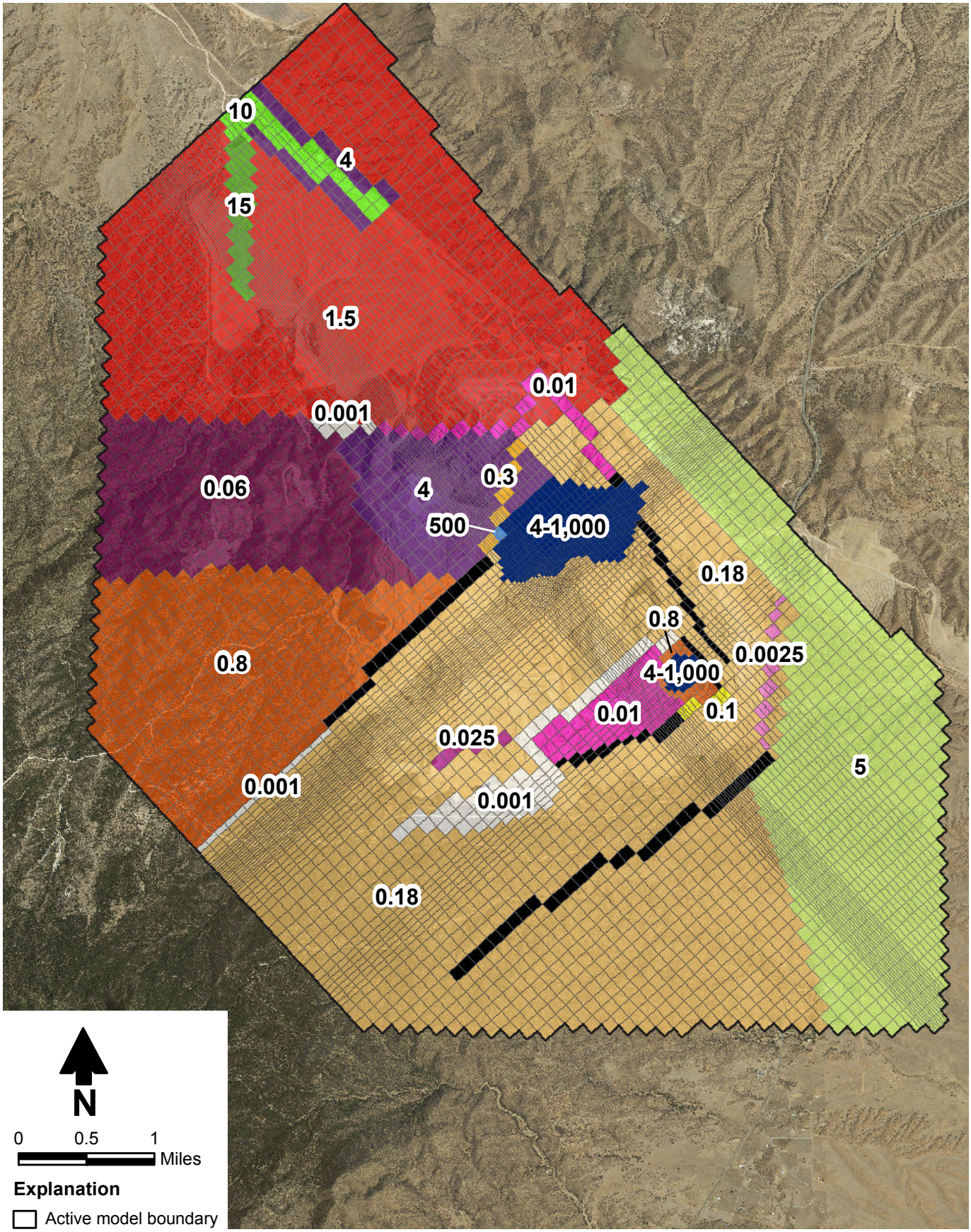
Daniel B. Stephens & Associates, Inc.

2/29/2012

JN ES09.0176

Figure 5-3

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG05-3_WATER_LEVEL_CONTOUR_2010.MXD



Source: Aerial photograph from NAIP, 2011

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\REPORT_11-11\FIG5-4_HYDRAULIC_CONDUCTIVITY_LAYER1.MXD

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TYRONE STAGE 2 APP

Hydraulic Conductivity in Model Layer 1

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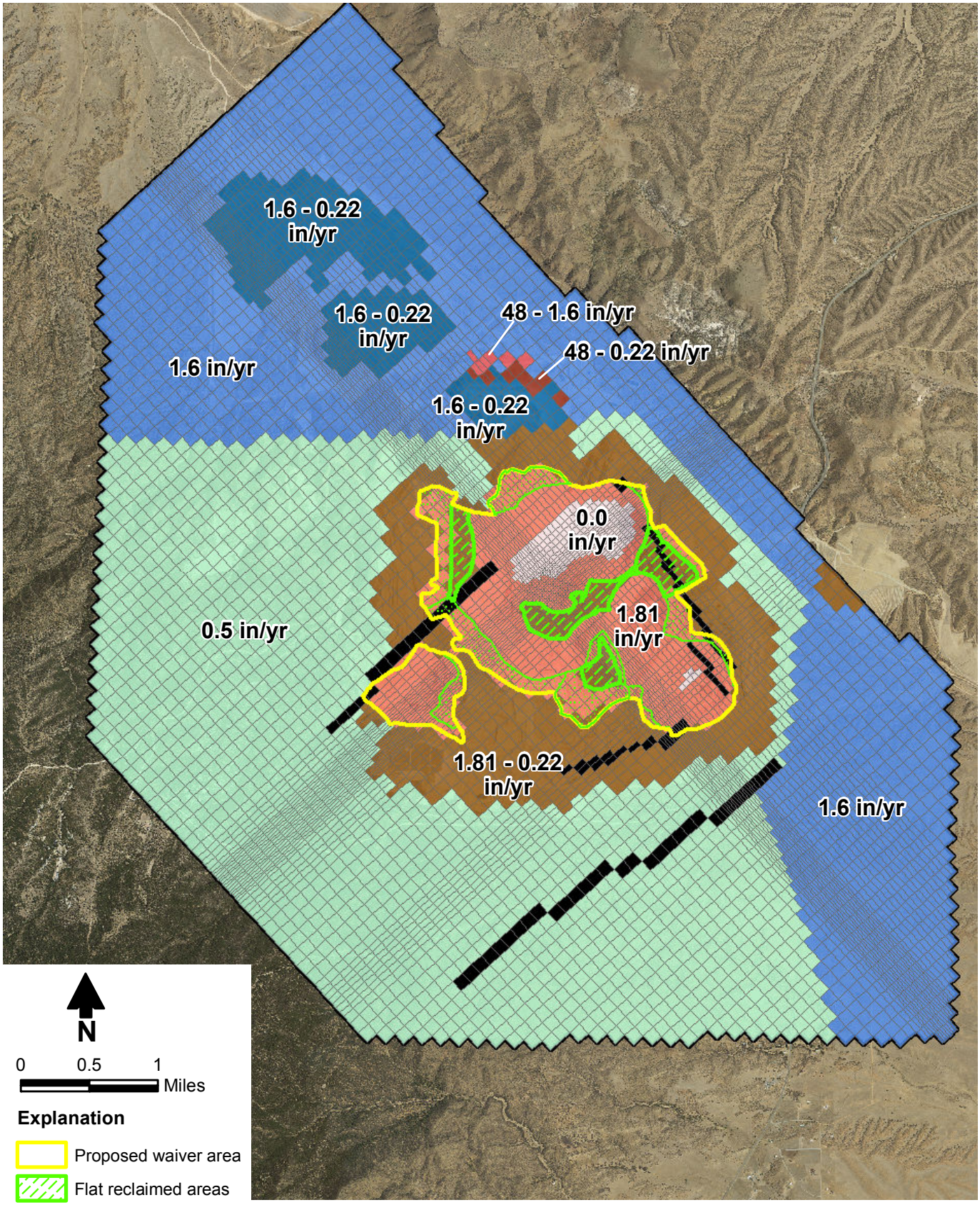
JN ES09.0176

Figure 5-4



Source: Aerial photograph from NAIP, 2011

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG05-5_PREDICTIVE_SIMULATED_RECHARGE_RATES.MXD

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TYRONE STAGE 2 APP

Predictive Simulation Recharge Rates

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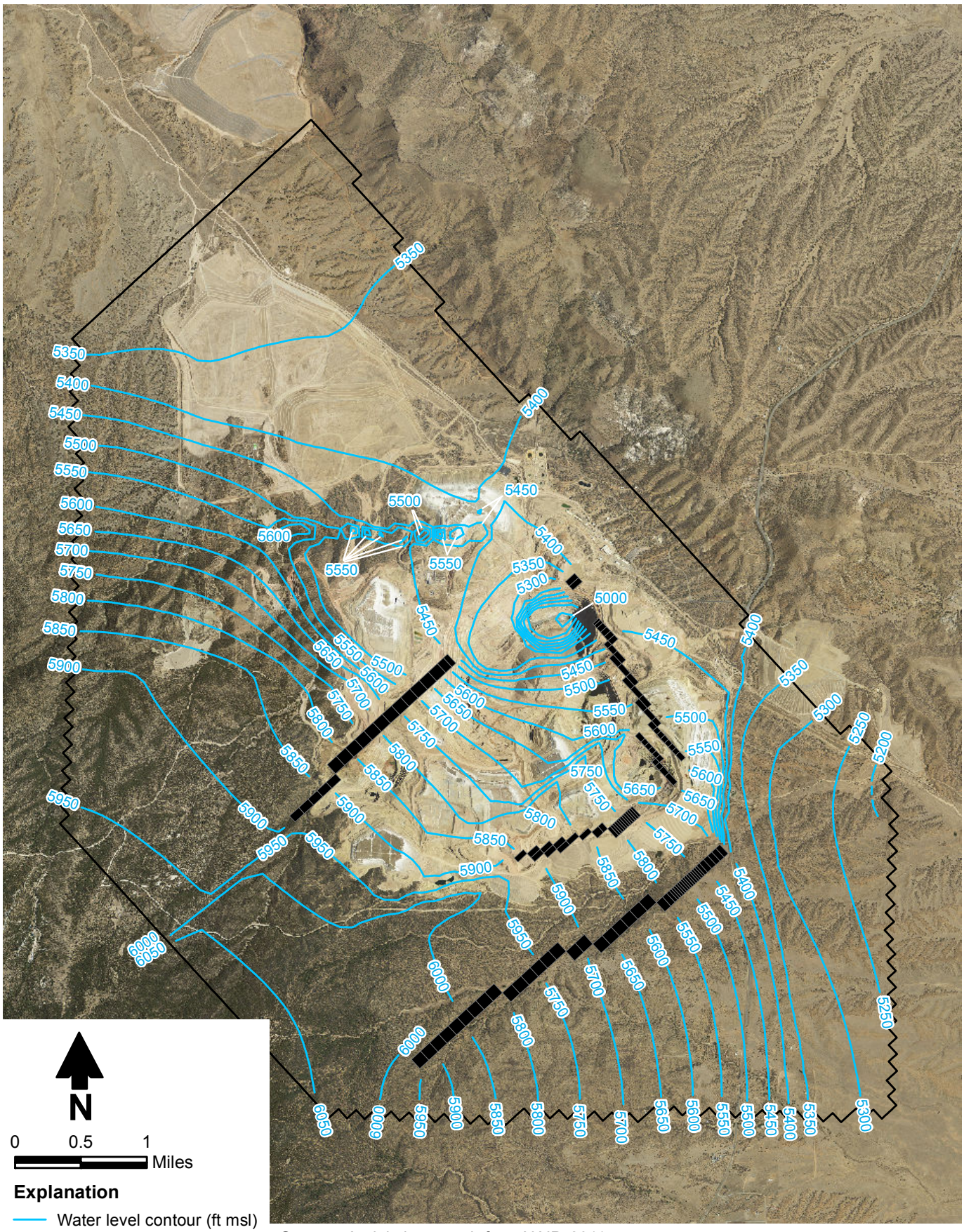
2/27/2012 JN ES09.0176

Figure 5-5



Source: Aerial photograph from NAIP, 2011

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG05-6_WATER_LEVEL_CONTOUR_2060.MXD

FREEPORT-McMoRan COPPER & GOLD

TYRONE STAGE 2 APP

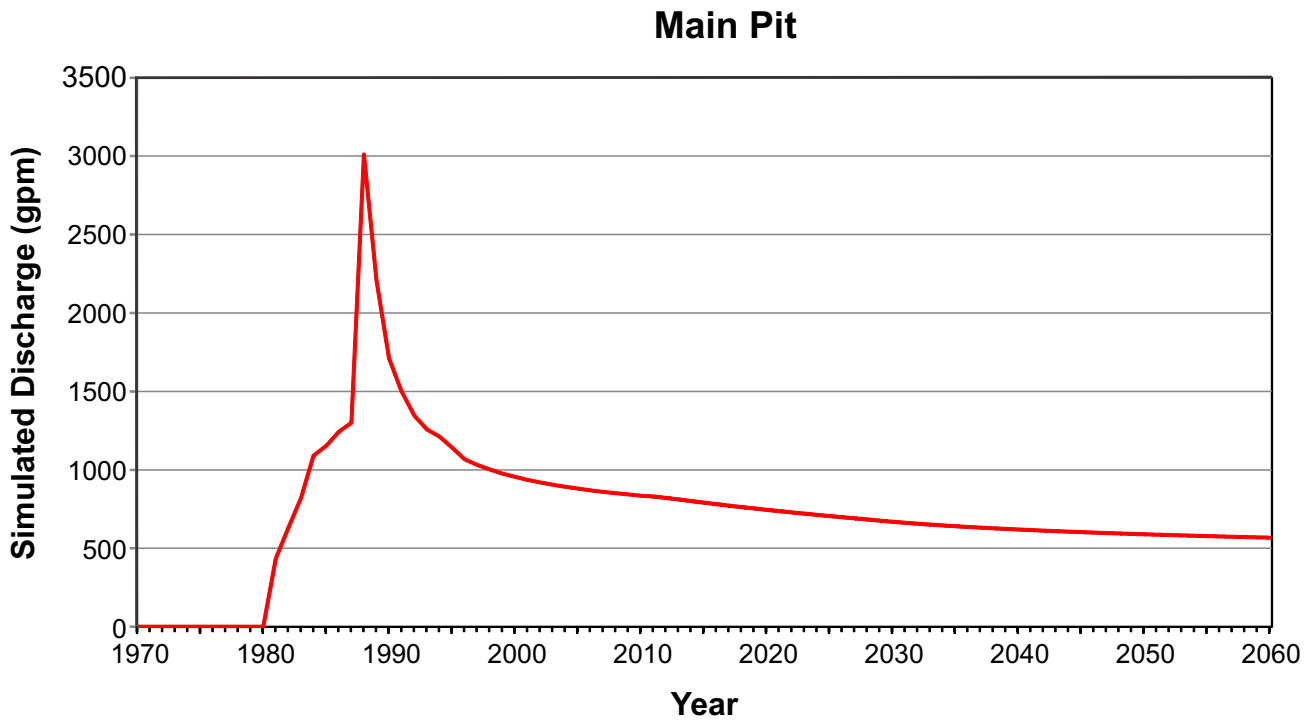
Simulated 2060 Water Table

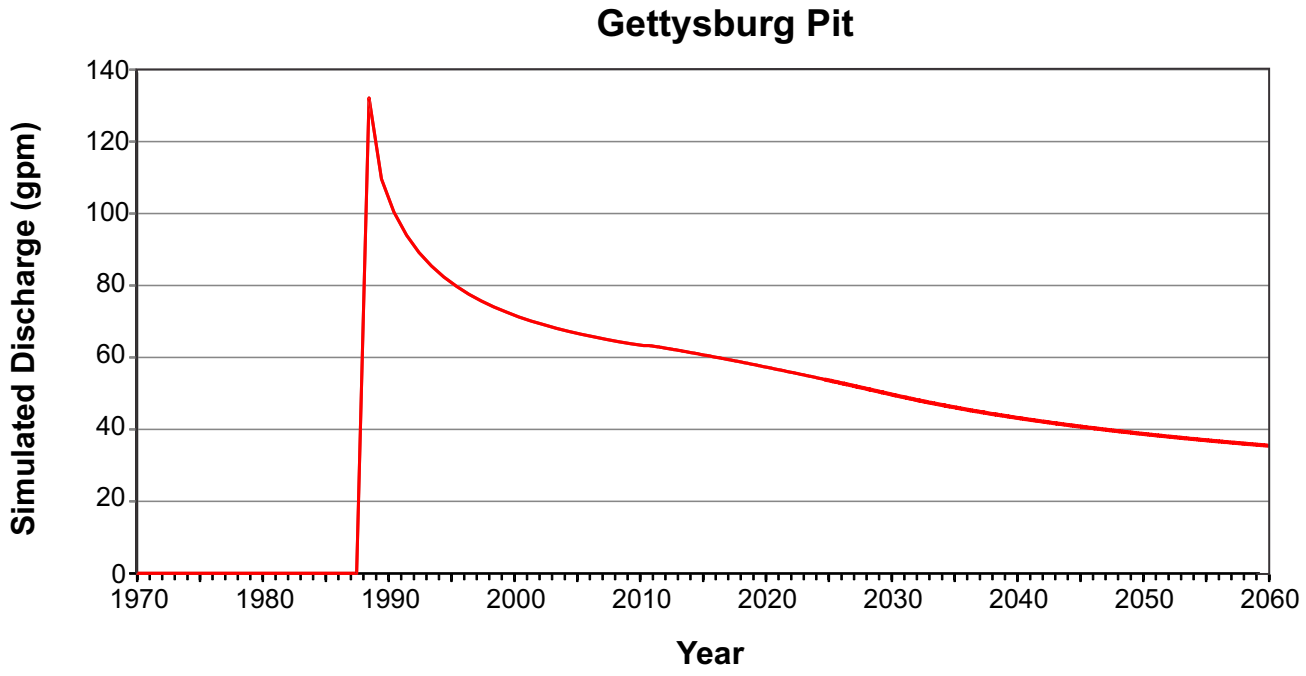
Daniel B. Stephens & Associates, Inc.

2/27/2012

JN ES09.0176

Figure 5-6





S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-7_SIM_FLOW_MAIN_GETTYSBURG_PITS.CDR

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TYRONE STAGE 2 APP

Simulated Flow to the Main and Gettysburg Pits

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2-24-12

JN ES09.0176

Figure 5-7

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012.dwg

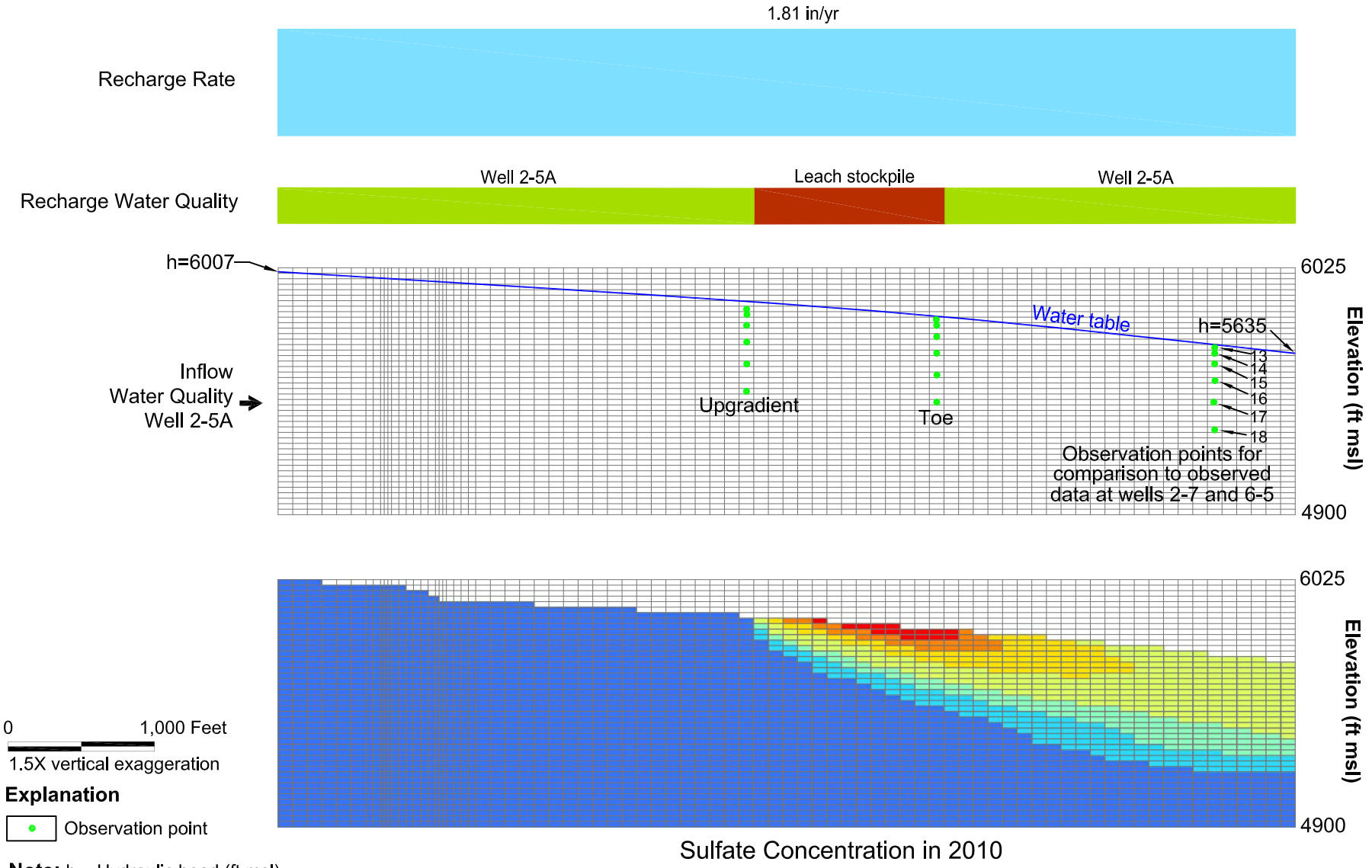

Figure 5-8

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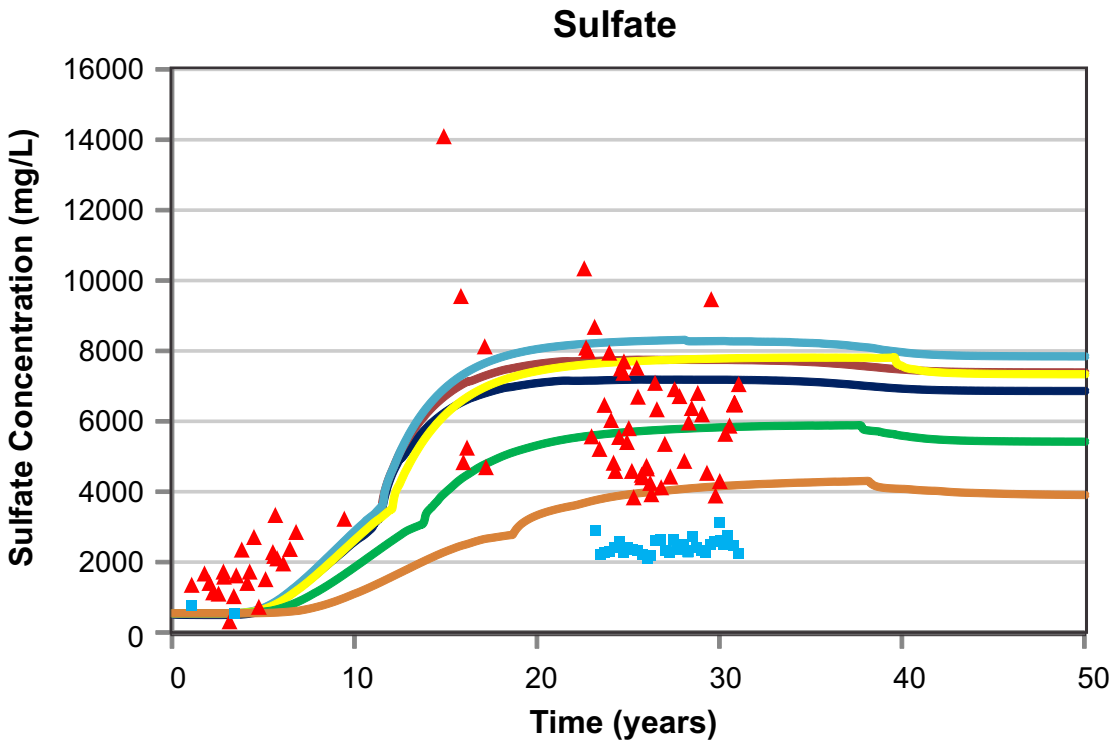
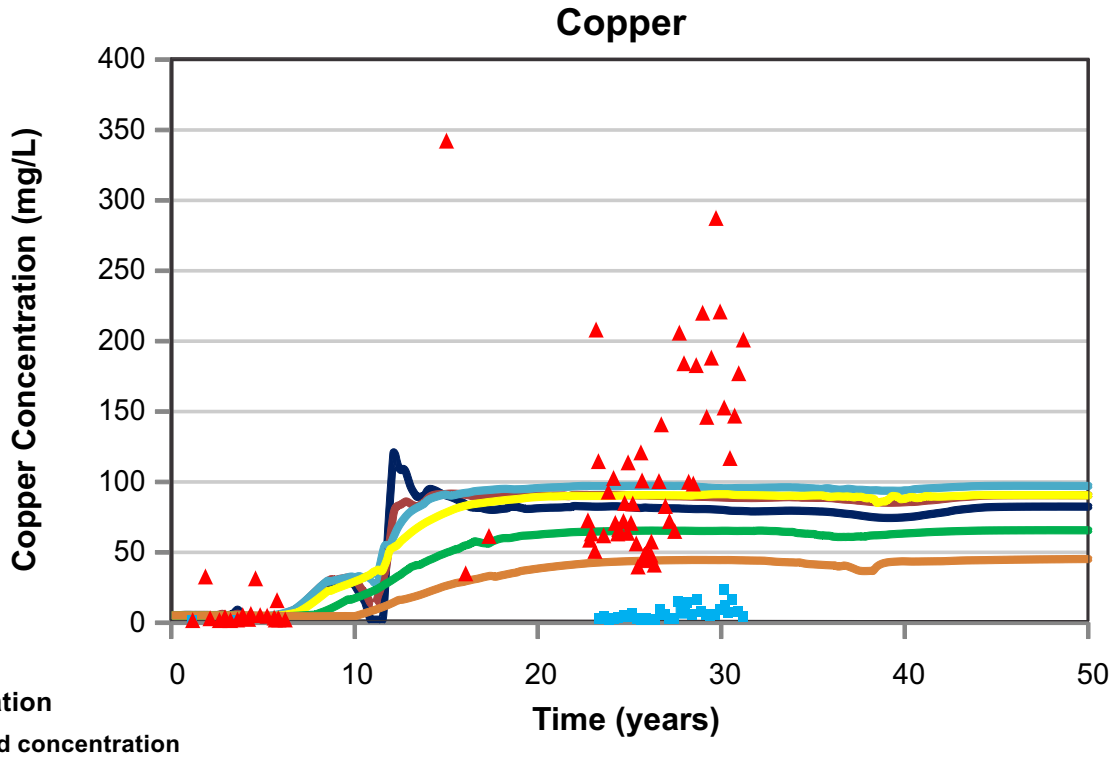
2/7/2012
JN ES09.176

Freeport-McMoRan Copper & Gold

TYRONE STAGE 2 APP

Current Condition Cross Section Model Description and Simulated 2010 Sulfate Concentrations





Explanation

Observed concentration

Well 2-7

Well 6-5

13 14 15 16 17 18

Simulated concentrations at observation points (mg/L) (see Figure 5-8)

FREEPORT-MCMORAN COPPER & GOLD

TYRONE STAGE 2 APP

Simulated Sulfate and Copper Concentrations Versus Observed Data at Wells 2-7 and 6-5

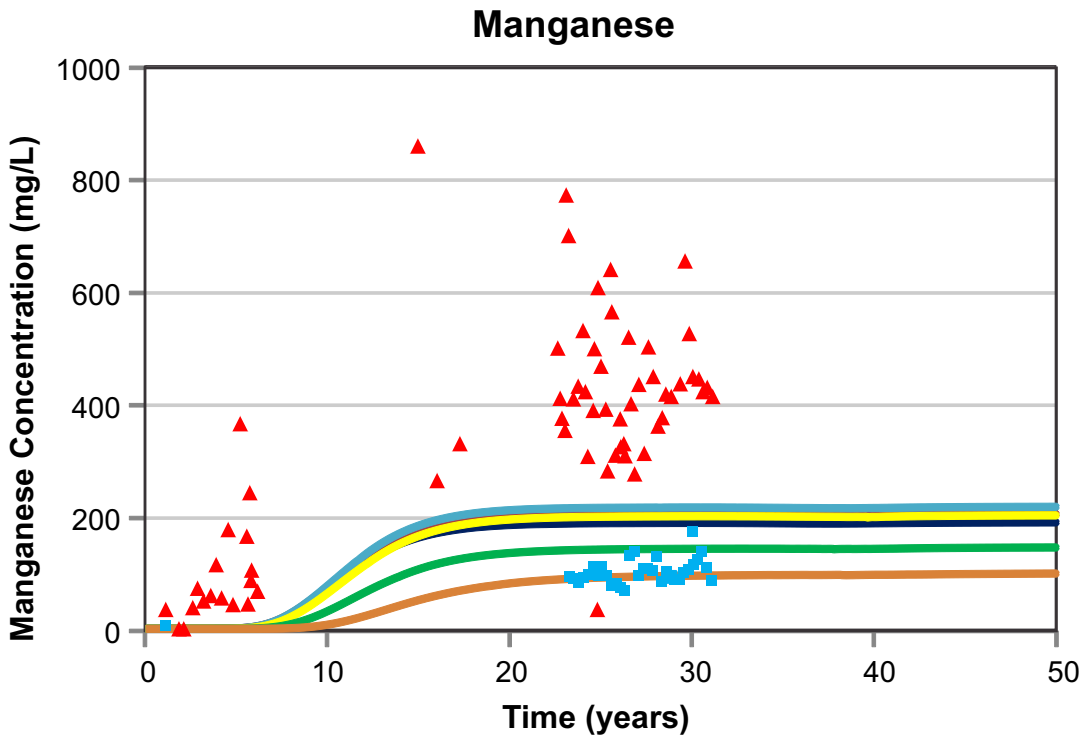
Daniel B. Stephens & Associates, Inc.

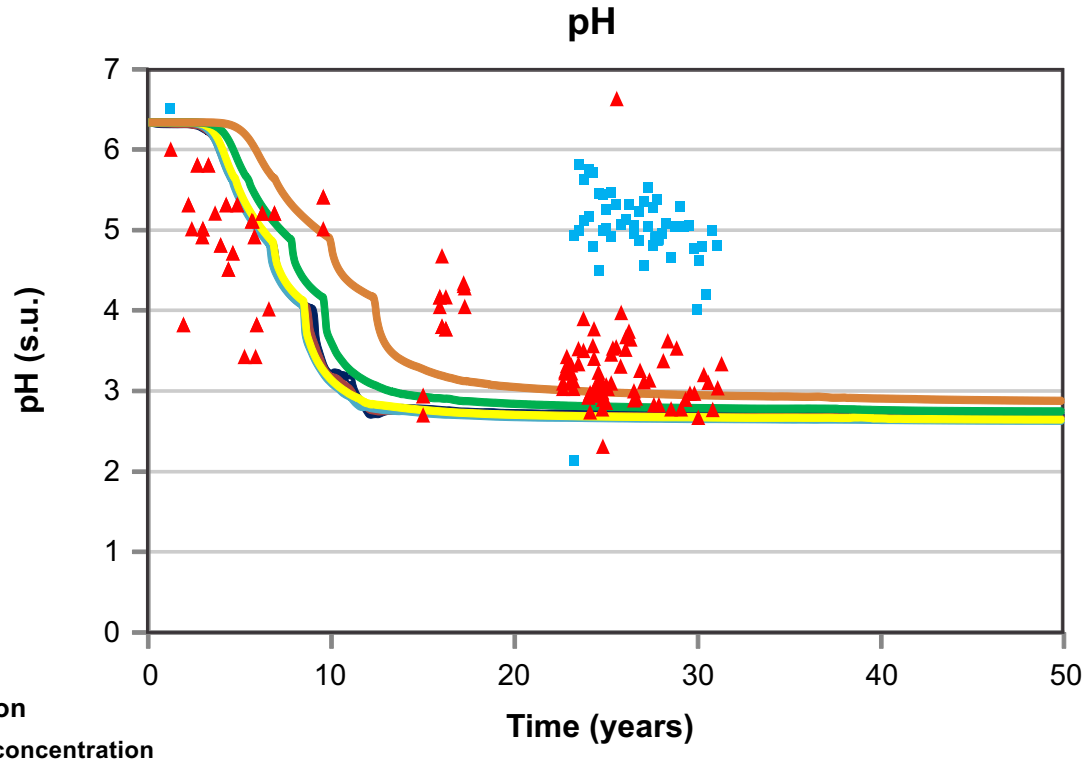
2-7-12

JN ES09.0176

Figure 5-9

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-9_SIM_VS_OBSER_SO4_CU_CONC.CDR





Explanation

Observed concentration

Well 2-7

Well 6-5

13

14

15

16

17

18

Simulated pH and manganese concentrations (mg/L) at observation points (see Figure 5-8)

FREEPORT-MCMORAN COPPER & GOLD

TYRONE STAGE 2 APP

Simulated Manganese Concentrations and pH Versus Observed Data at Wells 2-7 and 6-5

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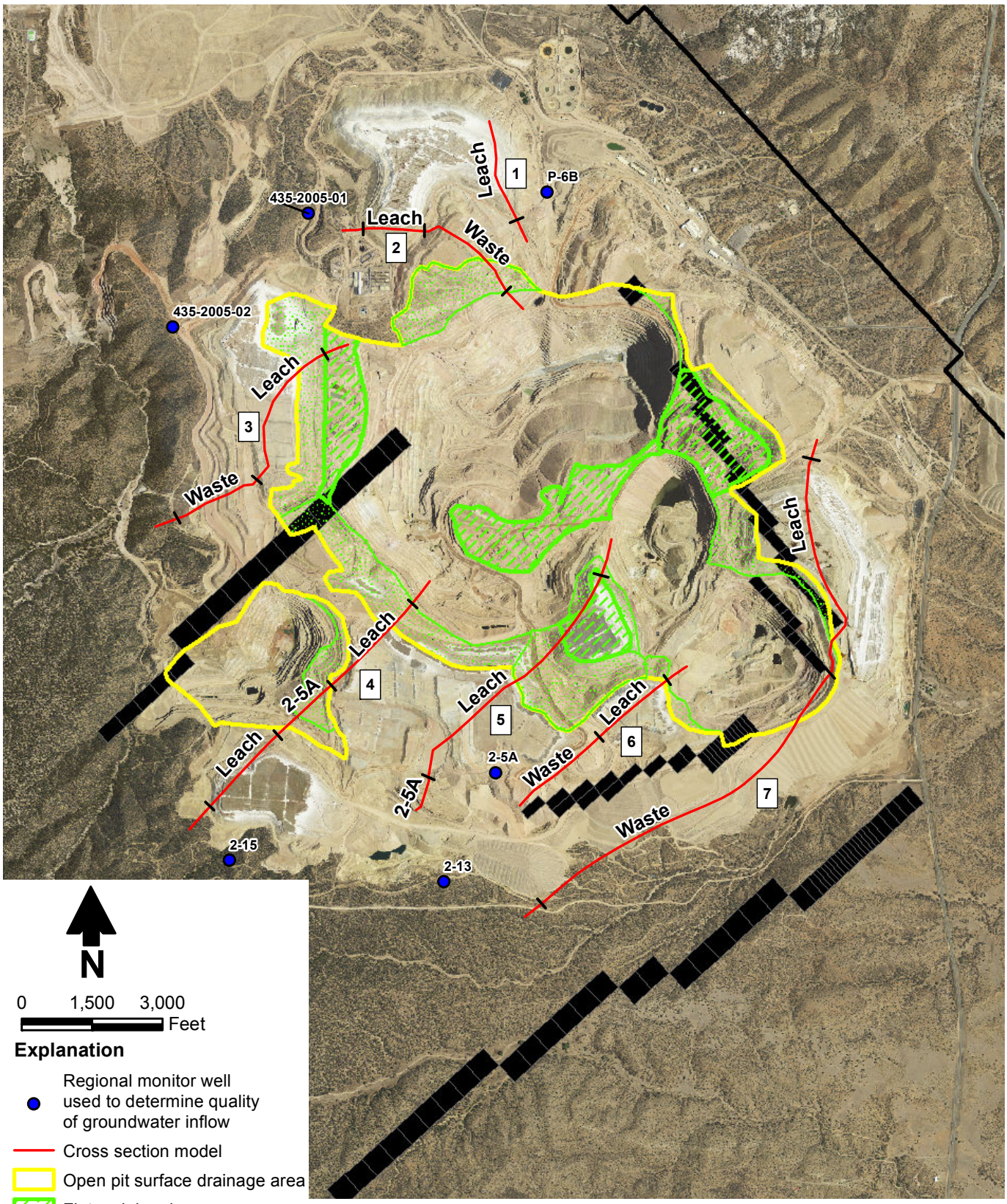
2-7-12

JN ES09.0176

Figure 5-10

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-10_SIM_VS_OBSER_PH_AND_MN_CONC.CDR



Source: Aerial photograph from NAIP, 2011

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG05-11_CROSS_SECTION_MODEL_LOCATIONS.MXD

Freeport-McMoRan Copper & Gold

TYRONE STAGE 2 APP

Cross Section Model Locations and Simulated Future Recharge

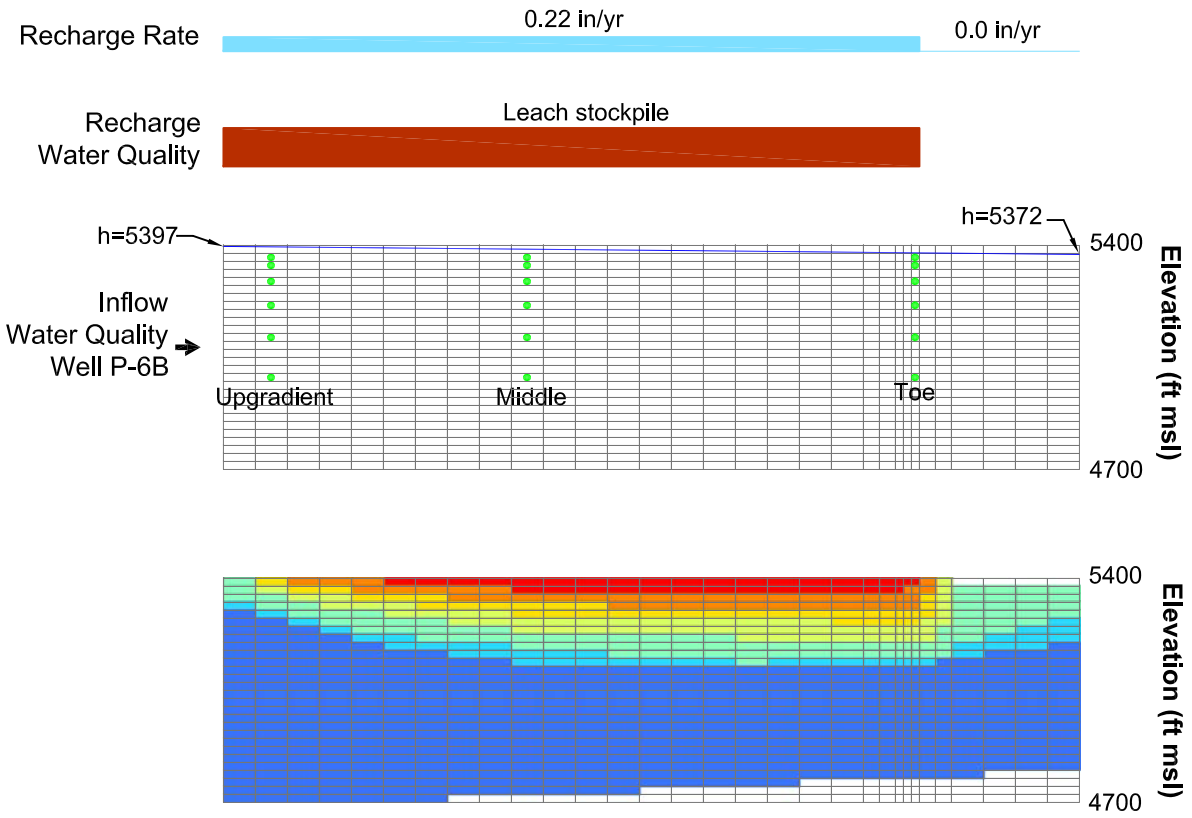
Daniel B. Stephens & Associates, Inc.

2/28/2012

JN ES09.0176

Figure 5-11

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



Sulfate Concentration after 50 Years

0 600 Feet

No vertical exaggeration

Explanation

Observation point

Note: h = Hydraulic head (ft msl)

Sulfate concentration (mg/L)

Dry	1,001-2,500	8,001-12,500
1-500	2,501-5,000	12,501-16,000
501-1,000	5,001-8,000	

FREEPORT-McMoRAN COPPER & GOLD

TYRONE STAGE 2 APP

Cross Section 1 Model Description and Simulated Sulfate Concentrations after 50 Years

Figure 5-12

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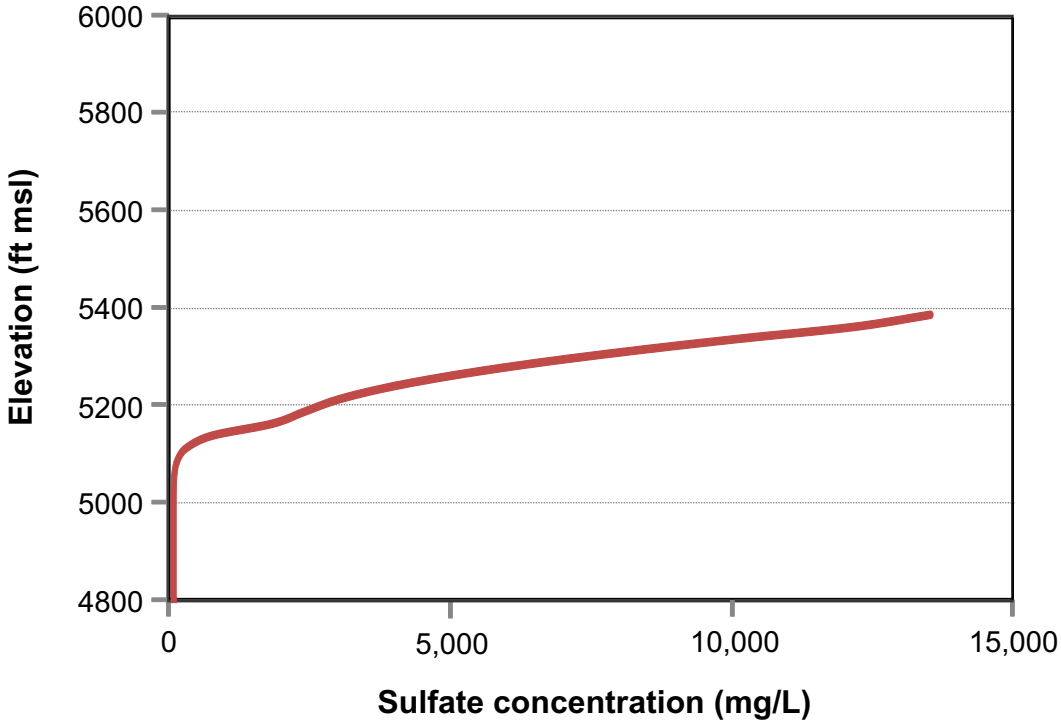
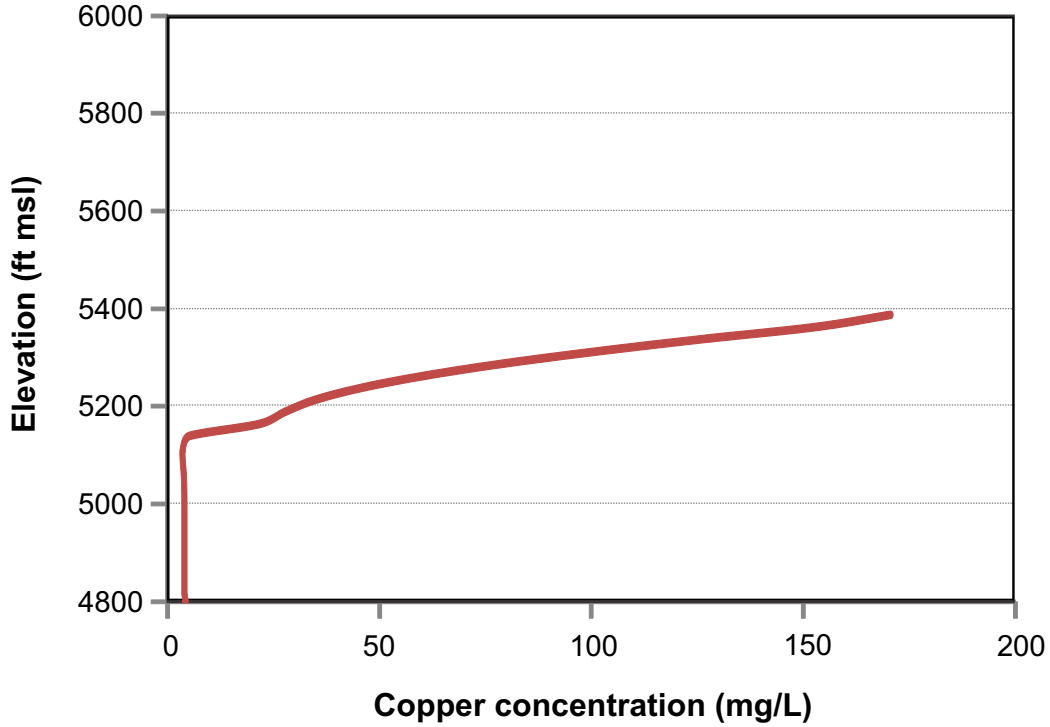
2/26/2012 JN ES09.176





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

FREEPORT-MCMORAN COPPER & GOLD

TYRONE STAGE 2 APP

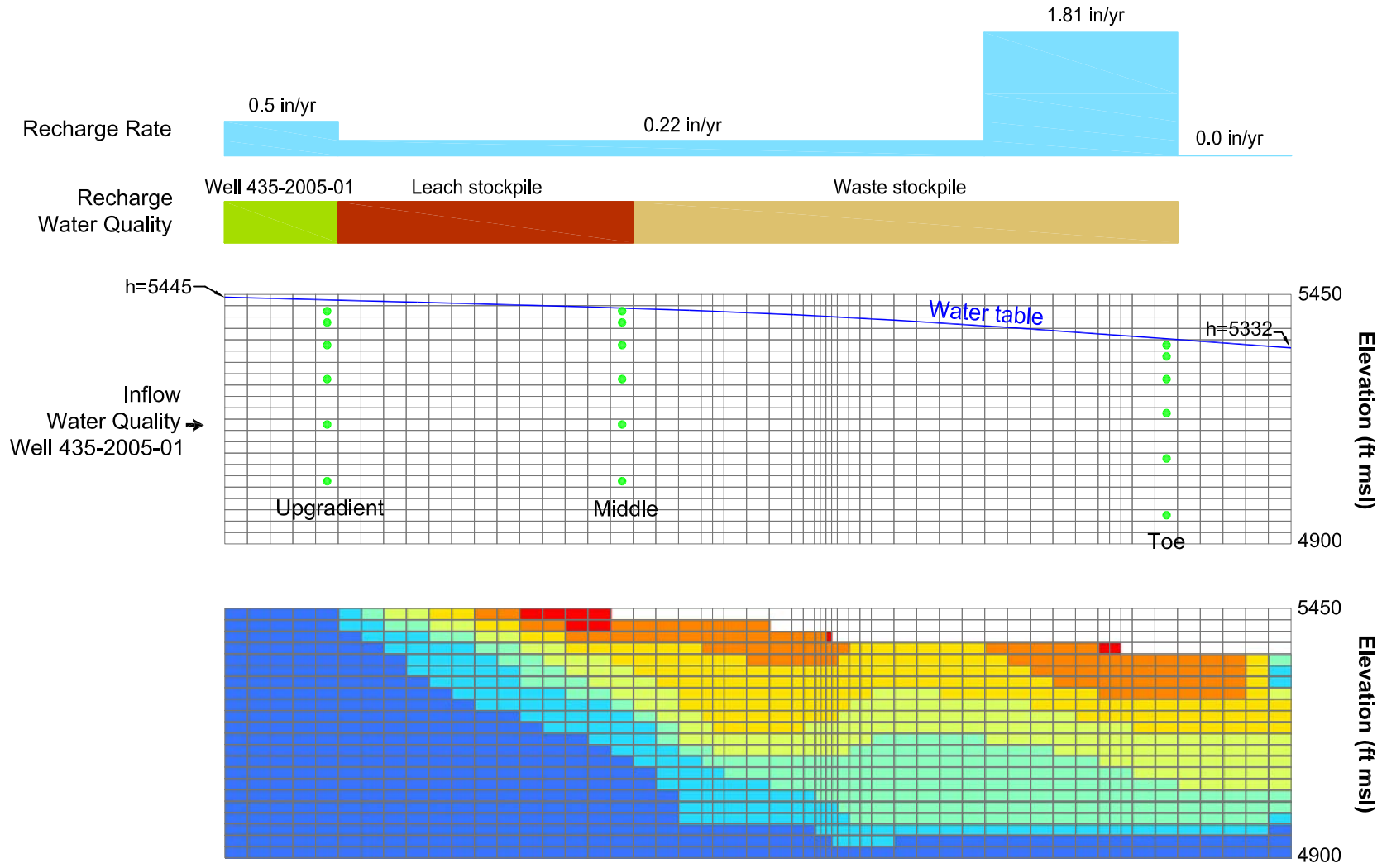
Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 1

Daniel B. Stephens & Associates, Inc.
2-27-12
JN ES09.0176

Figure 5-13

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-13_CS_1_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



Sulfate Concentration after 50 Years

Explanation

Observation point

Note: h = Hydraulic head (ft msl)

Sulfate concentration (mg/L)

Dry	301-400	601-700
1-150	401-500	701-930
151-300	501-600	

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TYRONE STAGE 2 APP

Cross Section 2 Model Description and Simulated Sulfate Concentrations after 50 Years

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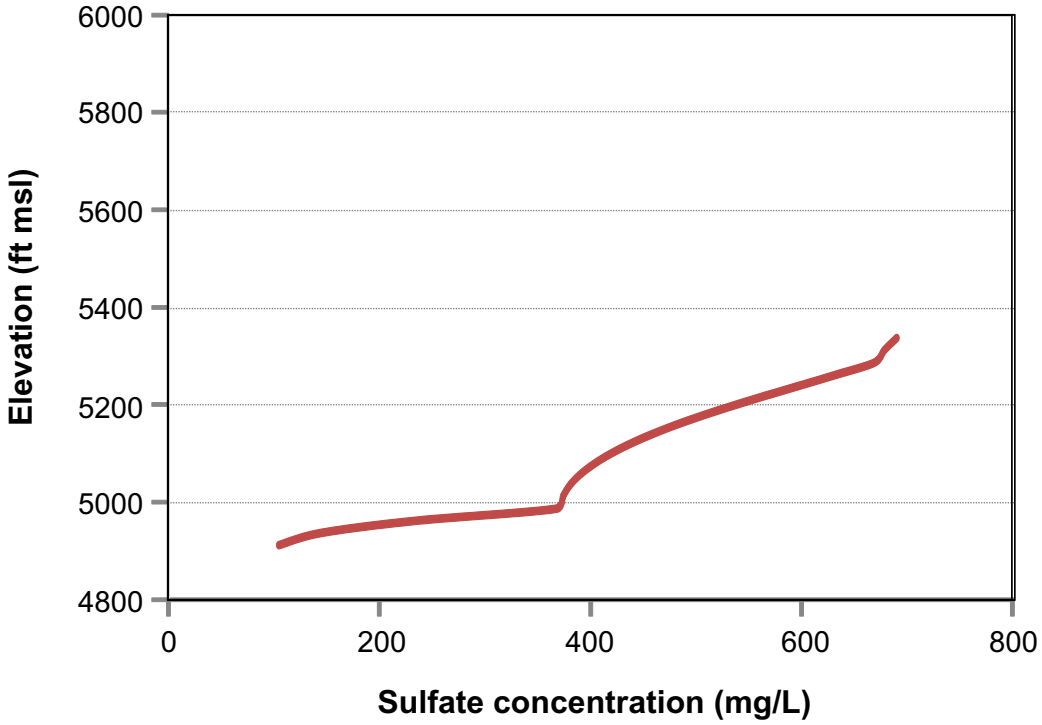
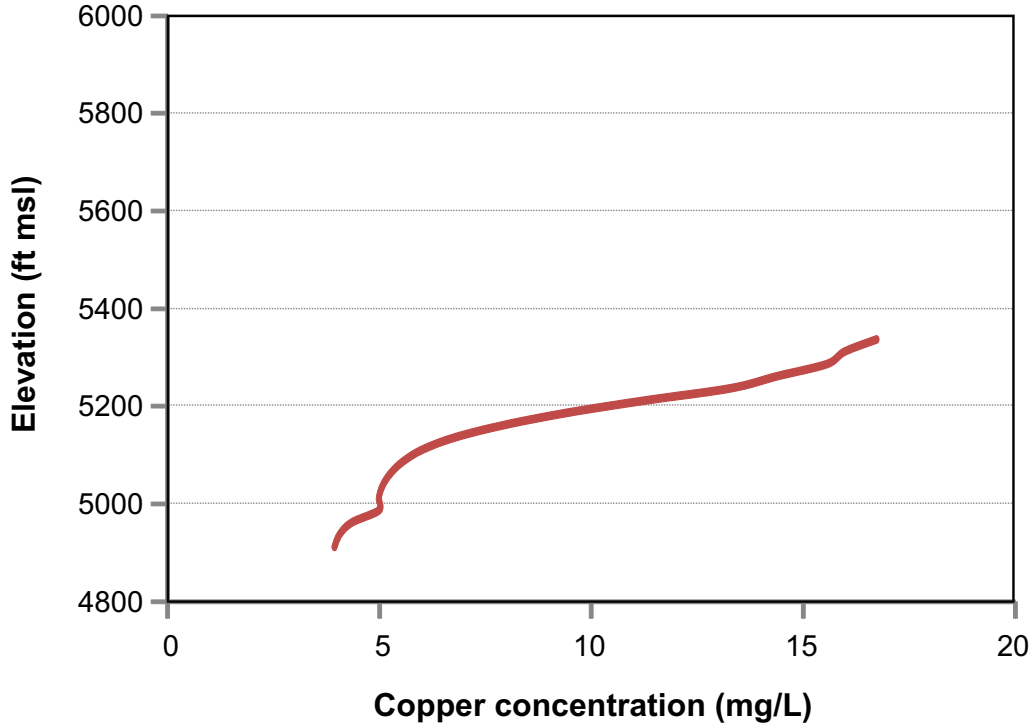
2/26/2012 JN ES09.176

Figure 5-14





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

FREEPORT-MCMORAN COPPER & GOLD

TYRONE STAGE 2 APP

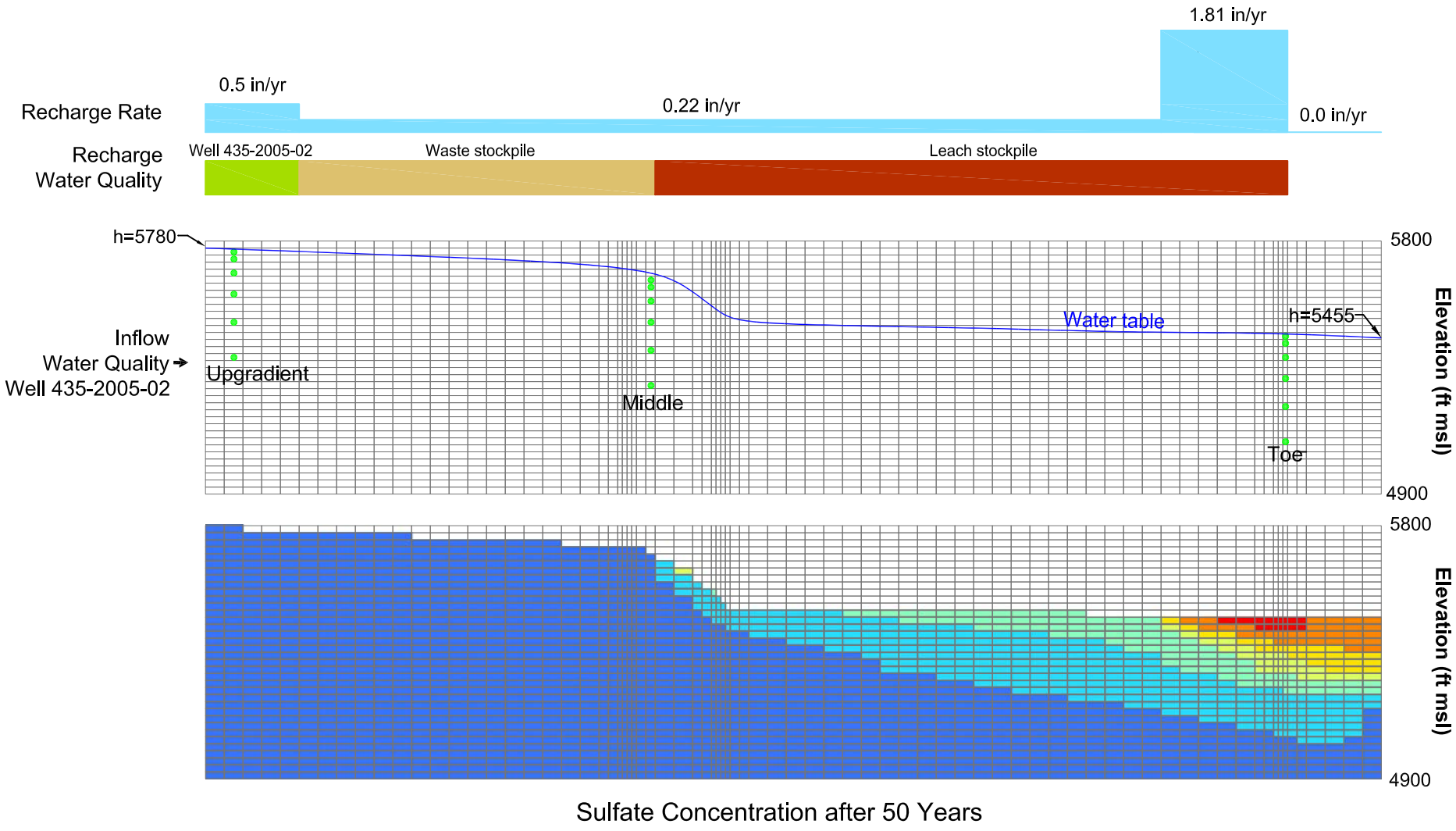
Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 2

Daniel B. Stephens & Associates, Inc.
2-27-12
JN ES09.0176

Figure 5-15

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-15_CS_2_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



Sulfate Concentration after 50 Years

0 800 Feet

1.5X verical exaggeration

Explanation

Observation point

Note: h = Hydraulic head (ft msl)

Sulfate concentration (mg/L)

Dry	1,001-1,500	2,501-3,500
1-500	1,501-2,000	3,501-4,500
501-1,000	2,001-2,500	

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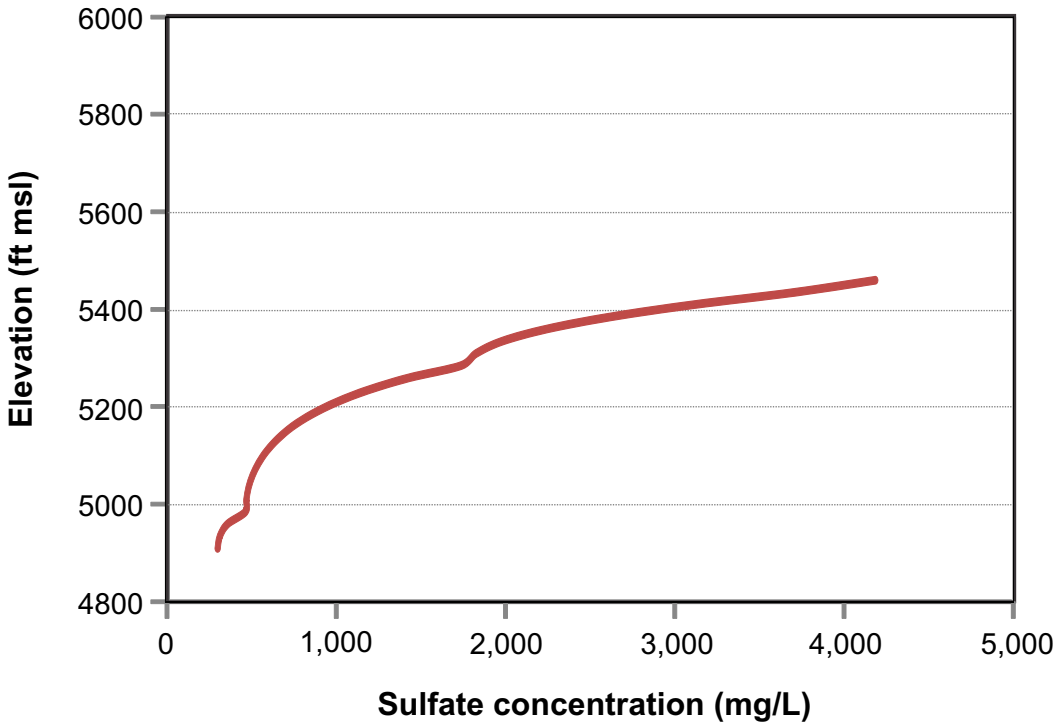
TYRONE STAGE 2 APP

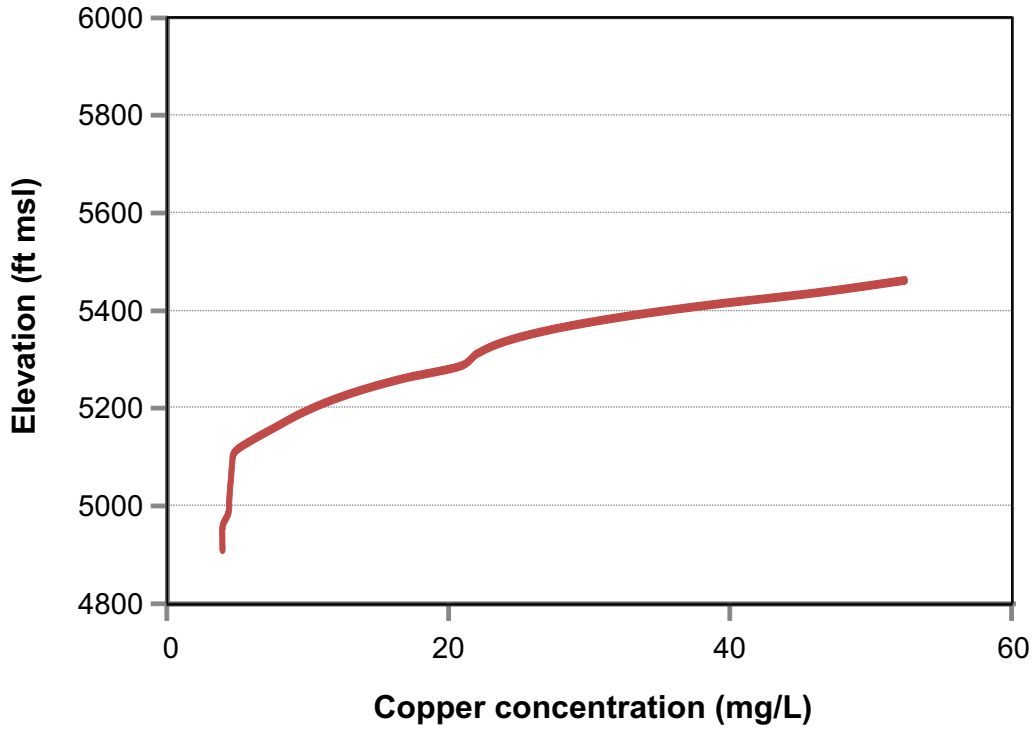
Cross Section 3 Model Description and Simulated Sulfate Concentrations after 50 Years

Figure 5-16

Daniel B. Stephens & Associates, Inc.

2/26/2012 JN ES09.176





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

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TYRONE STAGE 2 APP

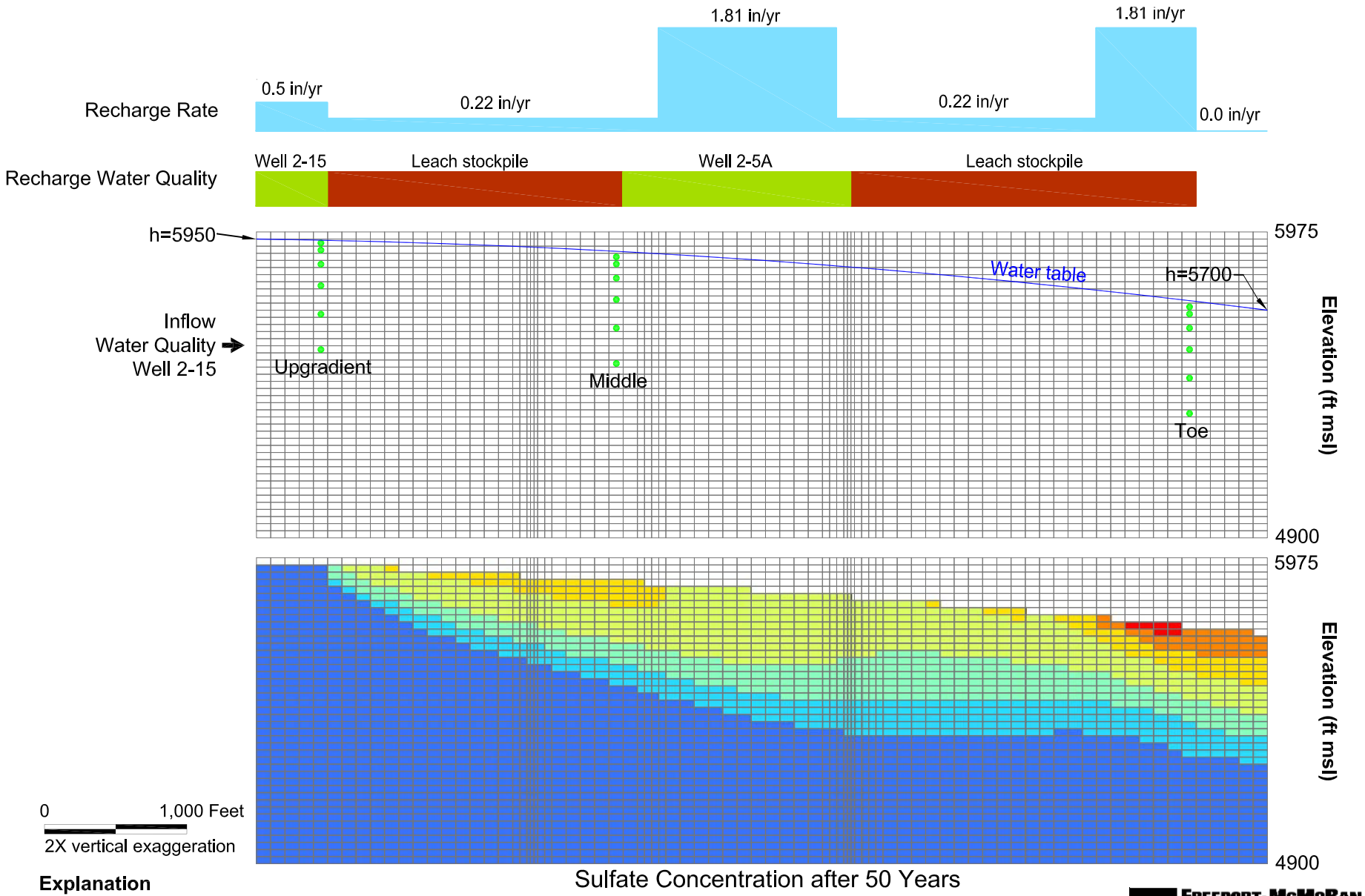
Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 3

Daniel B. Stephens & Associates, Inc.
2-27-12
JN ES09.0176

Figure 5-17

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS5-17_CS_3_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



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TYRONE STAGE 2 APP

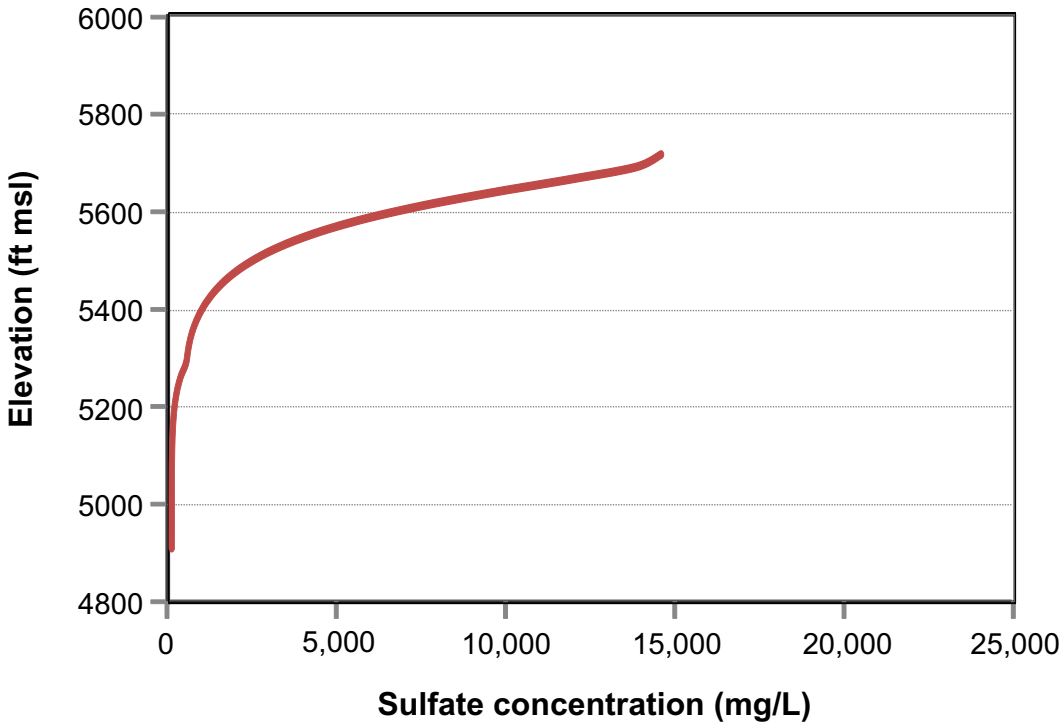
Cross Section 4 Model Description and Simulated Sulfate Concentrations after 50 Years

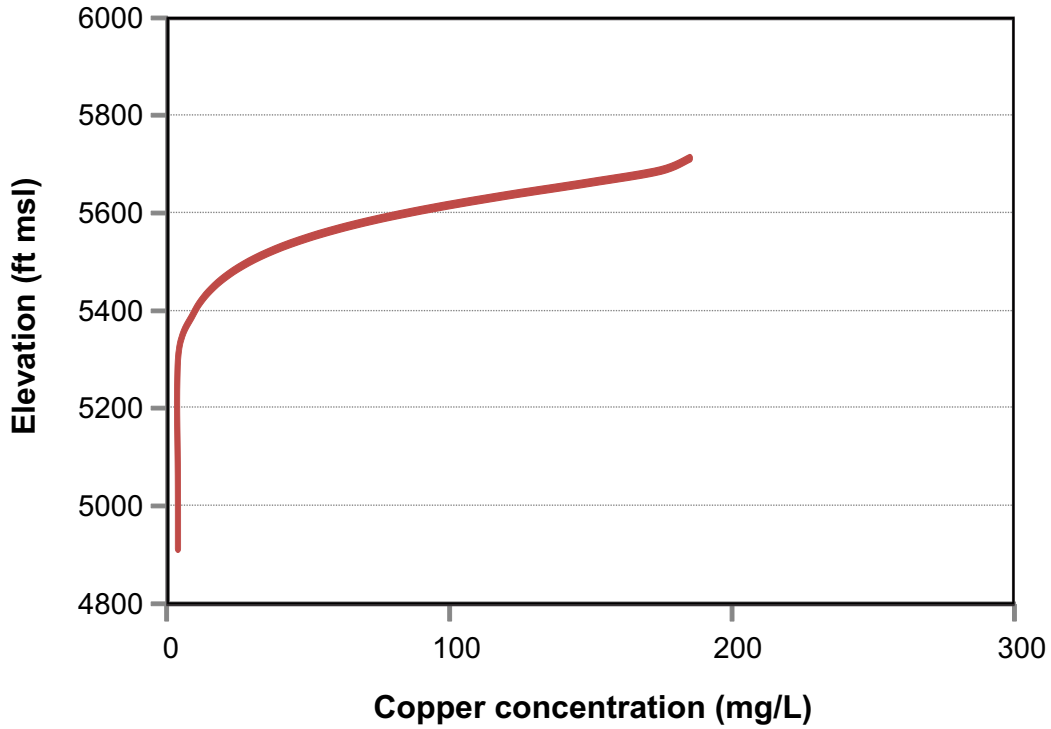
Figure 5-18

Daniel B. Stephens & Associates, Inc.

2/26/2012

JN ES09.176





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

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TYRONE STAGE 2 APP

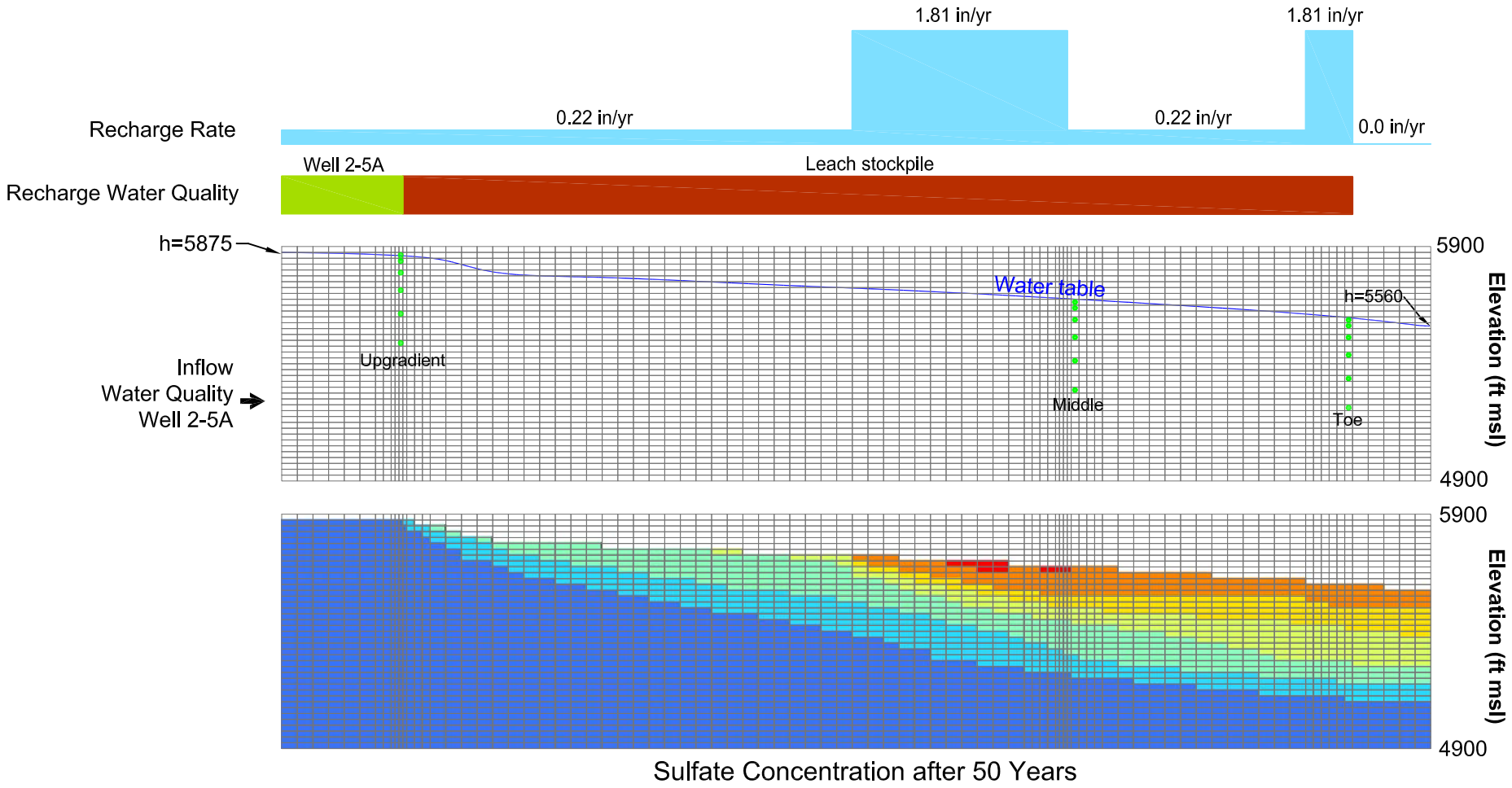
Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 4

Daniel B. Stephens & Associates, Inc.
2-27-12
JN ES09.0176

Figure 5-19

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-19_CS_4_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



Explanation

Observation point

Note: h = Hydraulic head (ft msl)

Sulfate concentration (mg/L)

Dry	5,001-10,000	20,001-30,000
1-2,500	10,001-15,000	30,001-36,000
2,501-5,000	15,001-20,000	

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TYRONE STAGE 2 APP

Cross Section 5 Model Description and Simulated Sulfate Concentrations after 50 Years

Figure 5-20

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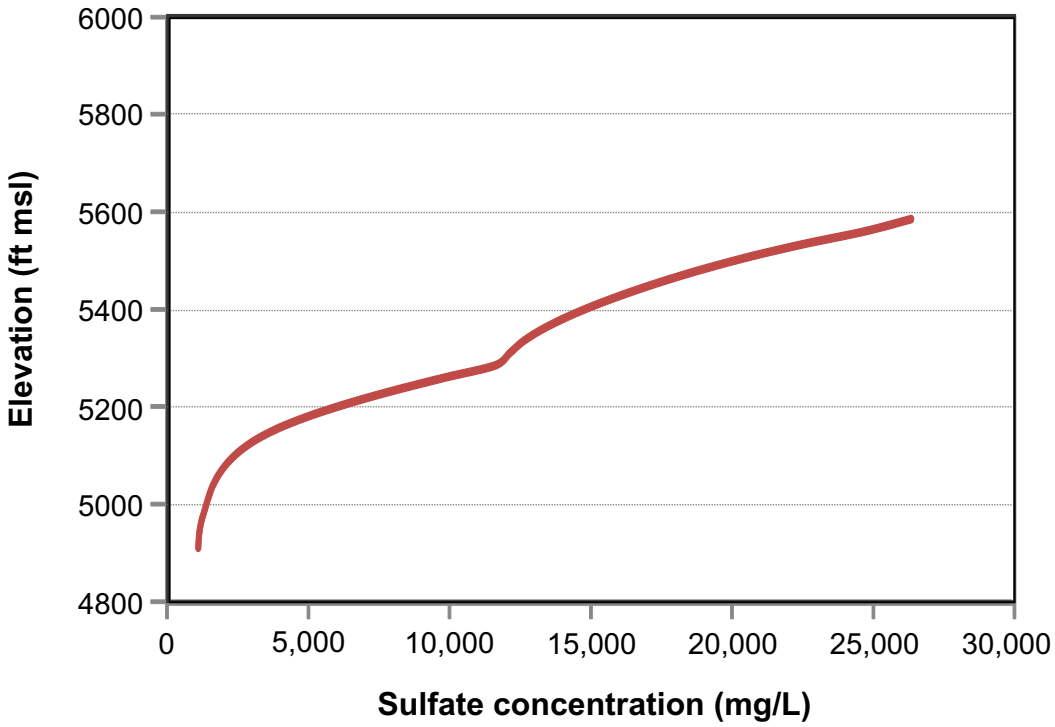
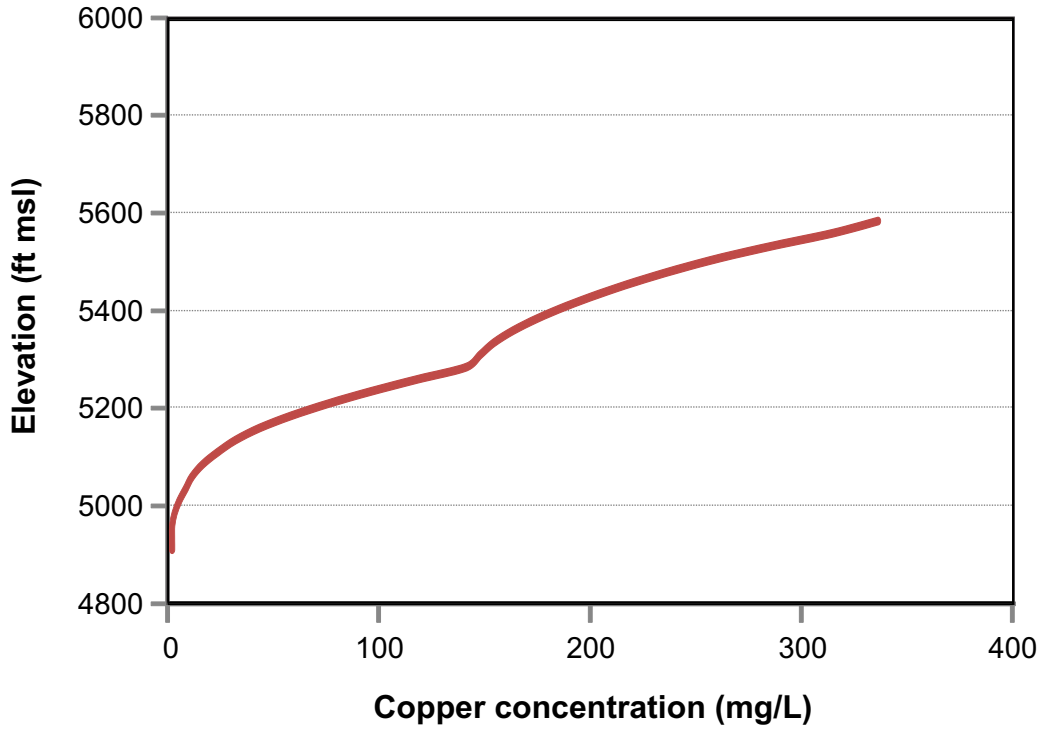
2/26/2012

JN ES09.176





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

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TYRONE STAGE 2 APP

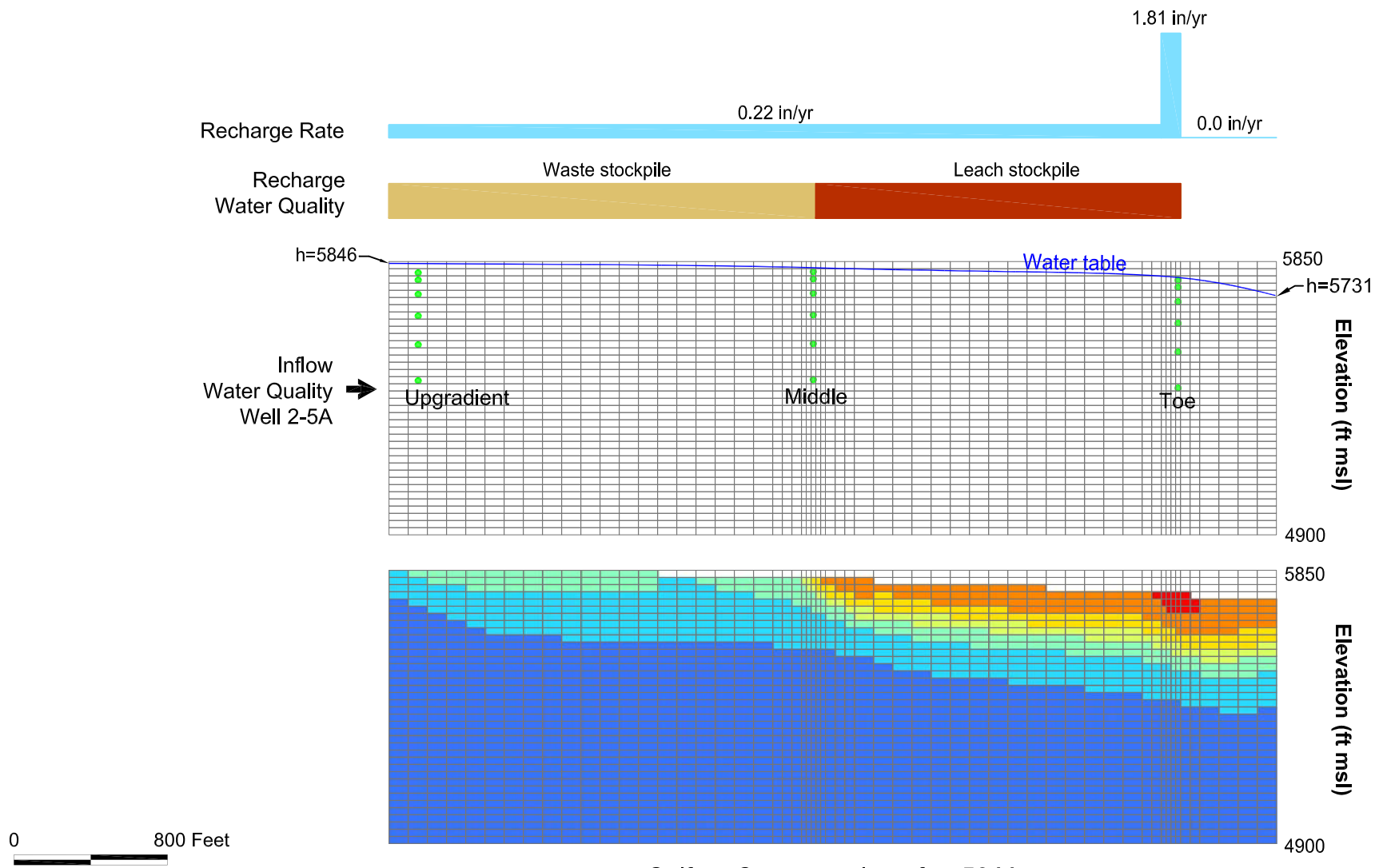
Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 5

Daniel B. Stephens & Associates, Inc.
2-27-12
JN ES09.0176

Figure 5-21

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS5-21_CS_5_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



Sulfate Concentration after 50 Years

Explanation

Observation point

Note: h = Hydraulic head (ft msl)

Sulfate concentration (mg/L)

Dry	2,001-5,000	20,001-40,000
1-1,000	5,001-10,000	40,001-50,000
1,001-2,000	10,001-20,000	

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TYRONE STAGE 2 APP

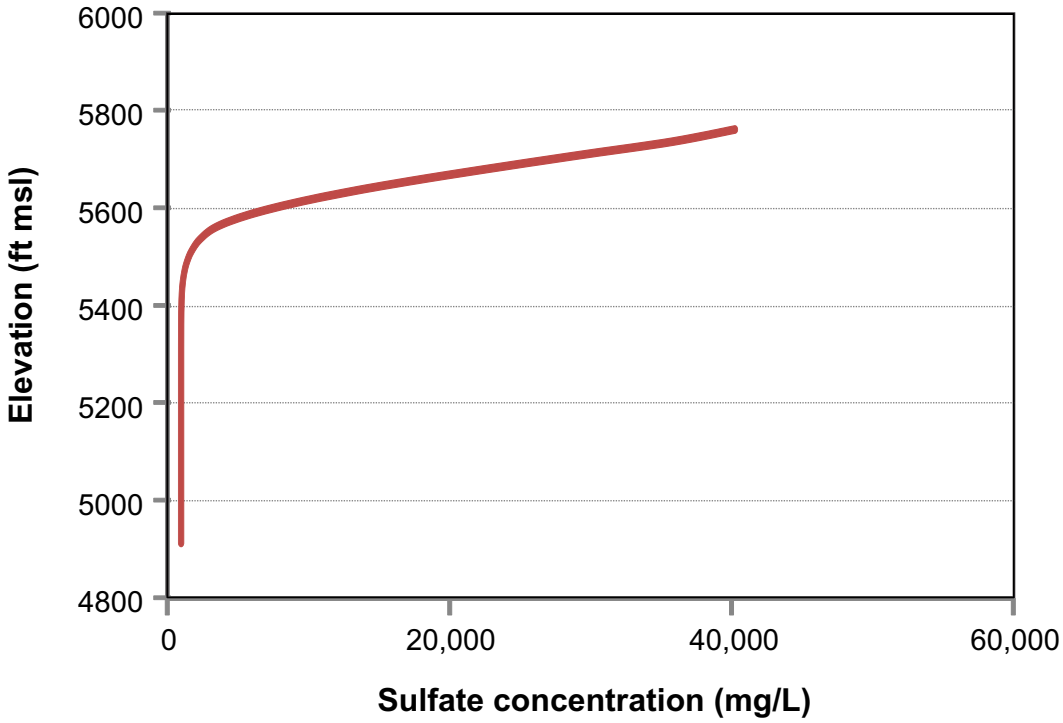
Cross Section 6 Model Description and Simulated Sulfate Concentrations after 50 Years

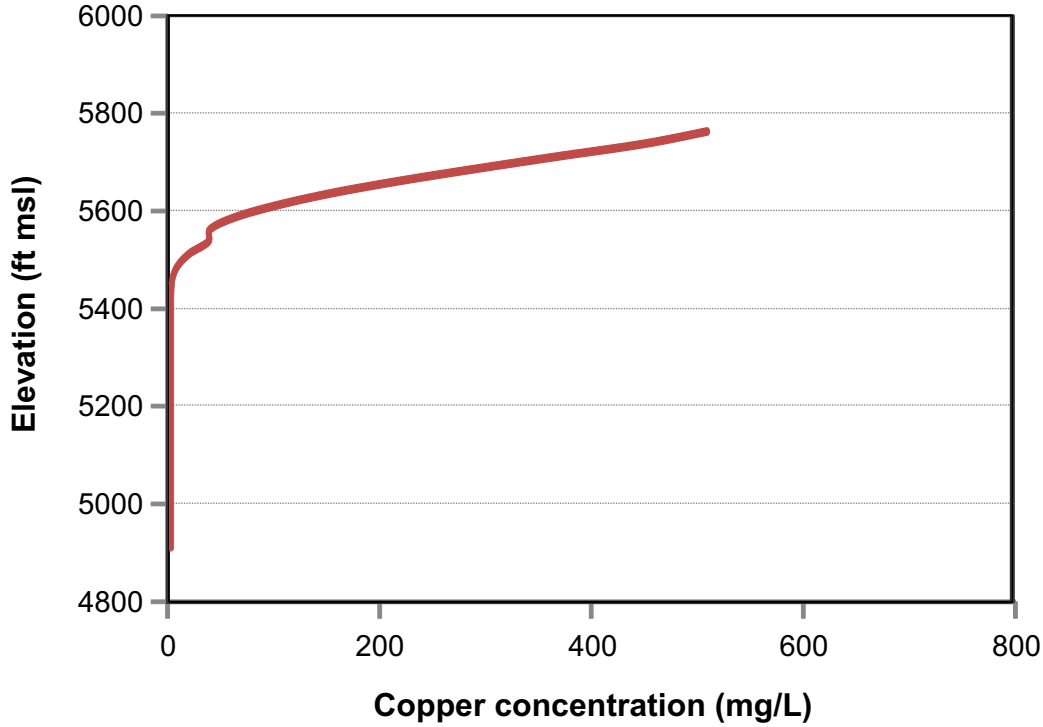
Figure 5-22

Daniel B. Stephens & Associates, Inc.

2/26/2012

JN ES09.176





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

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TYRONE STAGE 2 APP

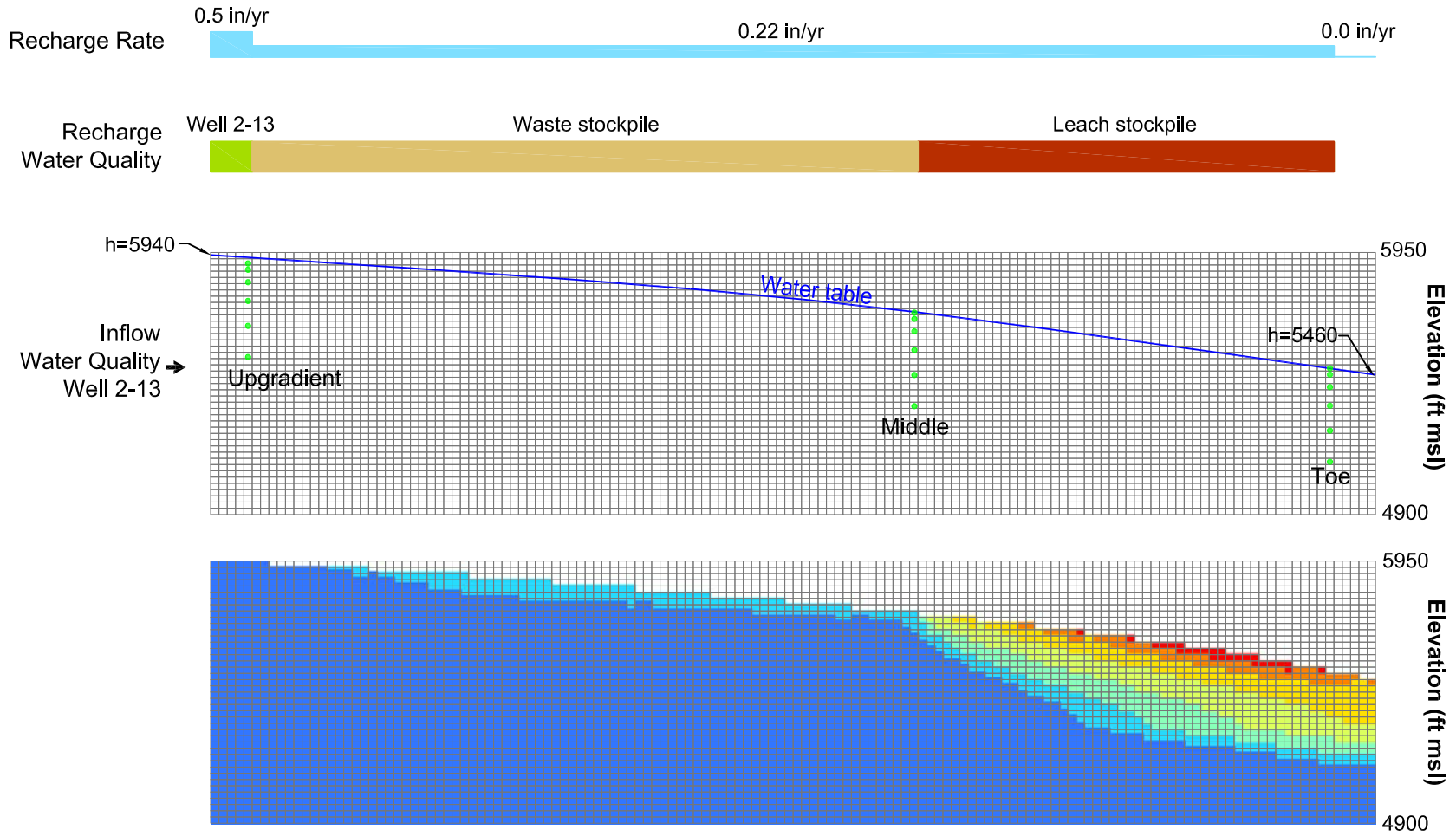
Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 6

Daniel B. Stephens & Associates, Inc.
2-27-12
JN ES09.0176

Figure 5-23

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-23_CS_6_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_03W_simulated_and_2010-observed_1-2012-a.dwg



Sulfate Concentration after 50 Years

0 2000 Feet

3X vertical exaggeration

Explanation

Observation point

Note: h = Hydraulic head (ft msl)

Sulfate concentration (mg/L)

Dry	1,001-2,000	5,001-6,000
1-500	2,001-3,500	6,001-7,500
501-1,000	3,501-5,000	

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TYRONE STAGE 2 APP

Cross Section 7 Model Description and Simulated Sulfate Concentrations after 50 Years

Figure 5-24

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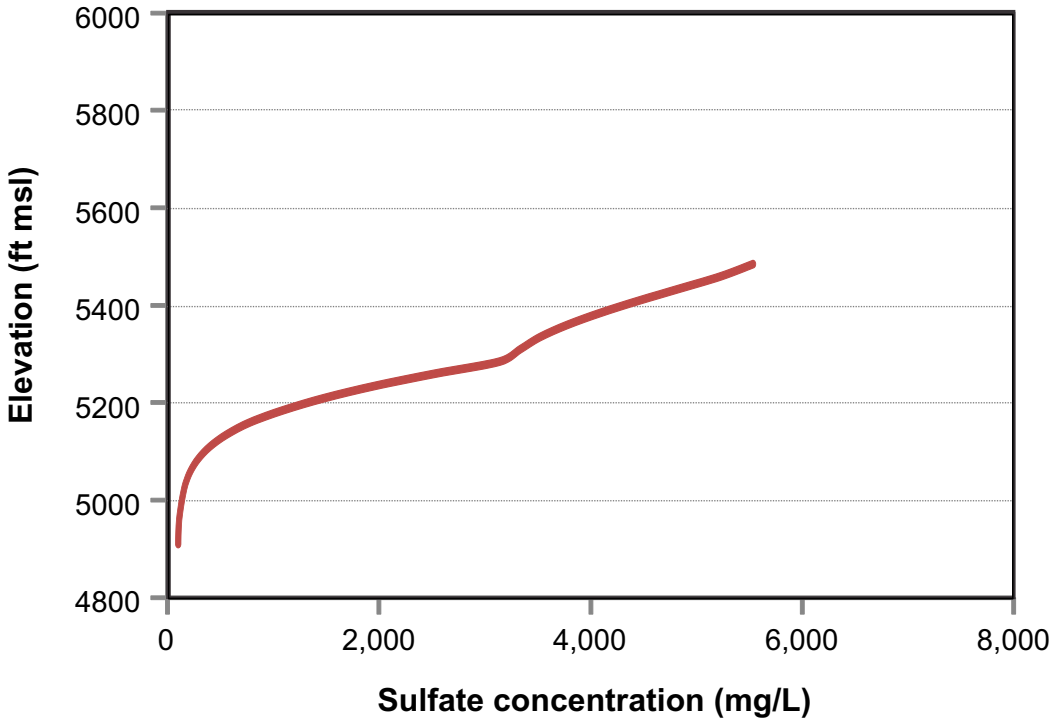
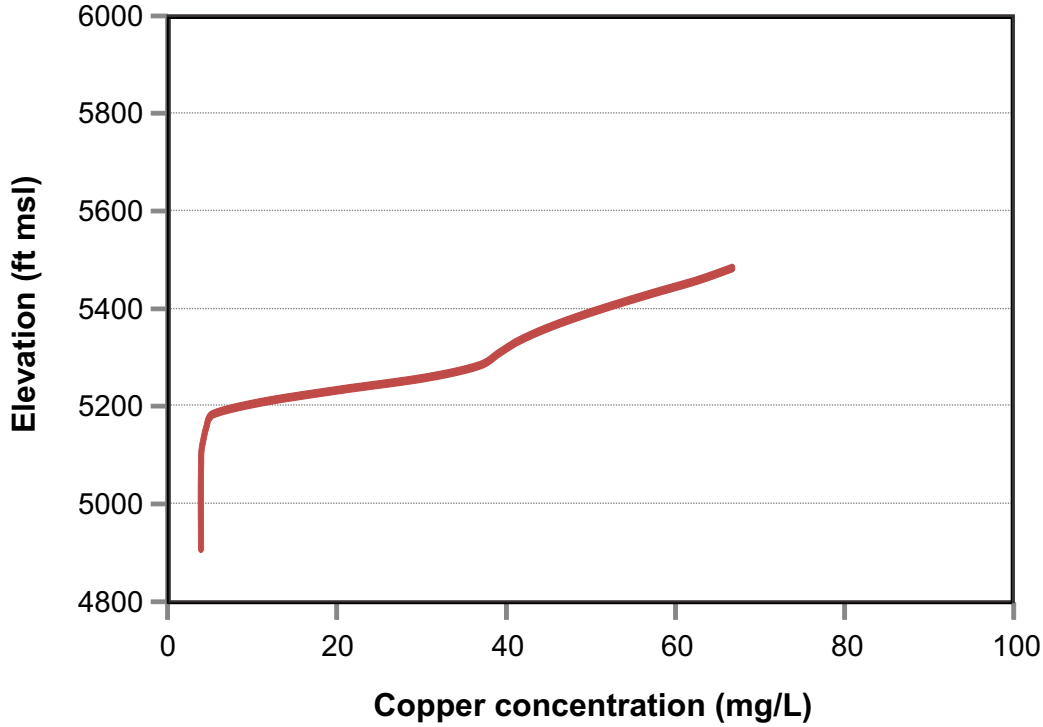
2/26/2012 JN ES09.176





Note: Lowest elevation point is 400 feet below simulated water table at stockpile toe.

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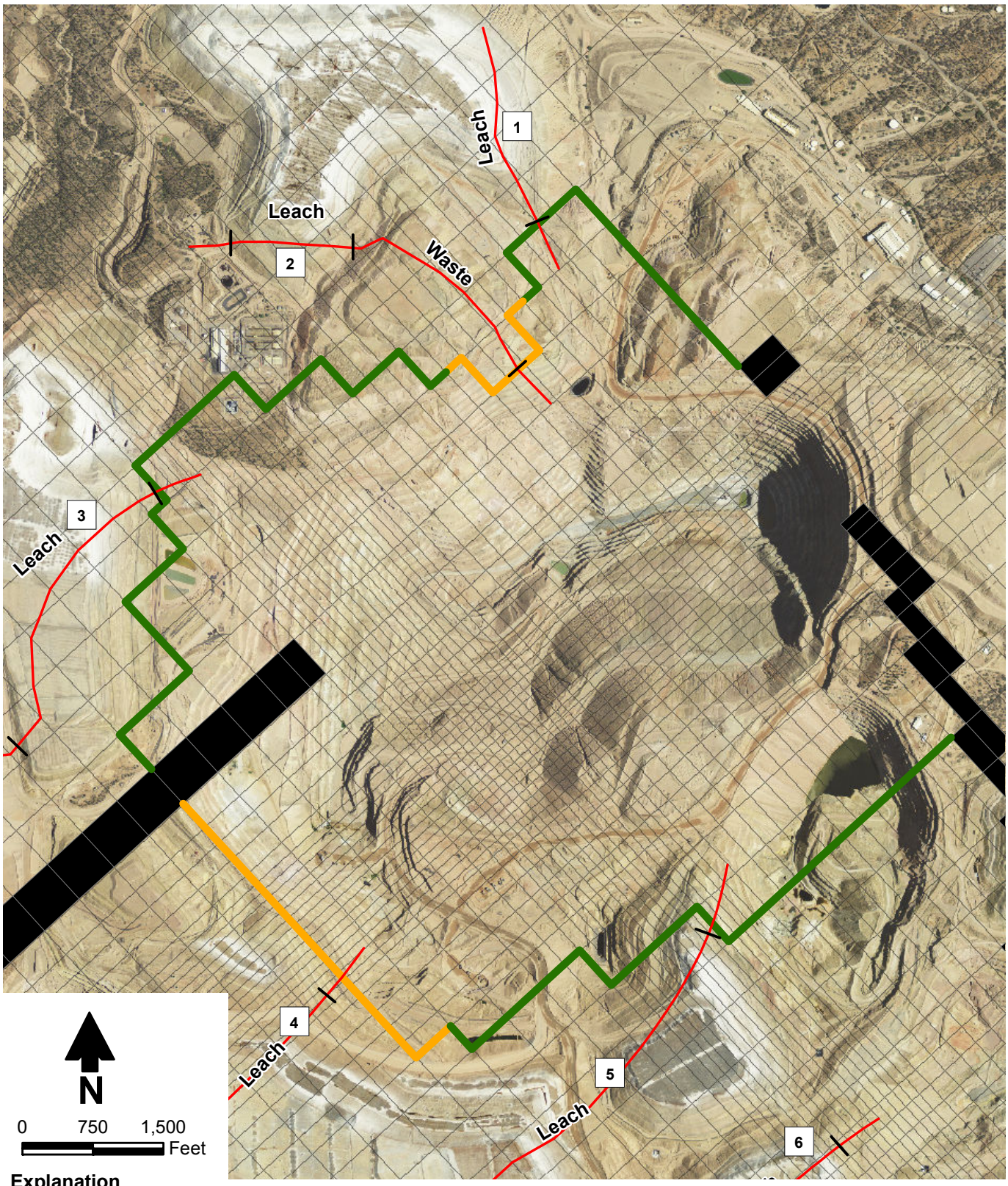
TYRONE STAGE 2 APP

Simulated 50-Year Sulfate and Copper Concentrations Versus Depth for Cross Section 7

Daniel B. Stephens & Associates, Inc.
2-7-12
JN ES09.0176

Figure 5-25

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIG5-25_CS_7_SULFATE_AND_COPPER_GRAPHS_UPDATED.CDR



Explanation

- Extent of representative cross section in groundwater flow model
- Groundwater flow model grid
- No-flow model cell
- Simulated cross section
- 1 Cross section designation

Source: Aerial photograph from NAIP, 2011

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TYRONE STAGE 2 APP

Extent of Groundwater Flow Contribution to Main Pit for Each Predictive Simulation Cross Section

Daniel B. Stephens & Associates, Inc.

2/27/2012

JN ES09.0176

Figure 5-26

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\FIG05-26_FLOW_TO_MAIN_PIT_CONTRIBUTION.MXD

West A — East A'

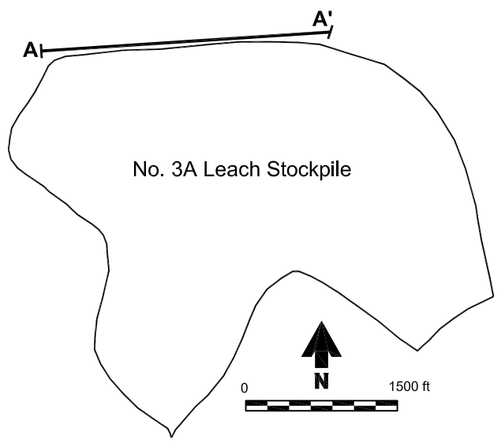
CANYON 11 | CANYON 10 | CANYON 9 | CANYON 8 | CANYON 7

Elevation (ft msl)

5900 5850 5800 5750 5700 5650 5600 5550 5500 5450

Well	TD (ft)	Qal	QTg	Water level
P-241	260			NM
P-229	Dry			
P-203	243			
P-228	245			2,960
P-239	255			3,010
P-240	244			NM
C11-19	31.5			
P-238	242			NM
P-237	235			NM
P-236	230			NM
P-181	229			NM
C10-8	193			2,470
C10-14	53			
C10-15	52.8			
P-224	225			2,800
P-218	260			1,430
C9-3	Dry			
P-180	198.5			2,000
C9-5	53			
P-234	220			2,850
P-185	185			2,410
P-222	210			NM
C8-8	200			3,330
C8-5	50			
P-178	46			
P-207	255			7,790
P-223	205			10,300
P-170	170			NM
P-179	226			2,580
C7-4	150			NM
C7-8	Dry			
P-196	185			832
P-204	125			
	29			
	170			21,700
	180			NM

Note: Figure will be updated using 2011 data



0 200 ft
Horizontal scale
0.5x Vertical exaggeration

Explanation

- Monitor well with screened interval
- Contact between fill material/alluvium and Gila Conglomerate or Qal–QTg contact
- September 2006 regional water level
- September 2006 perched water level

Notes: Qal= Fill material and alluvium
QTg= Gila Conglomerate
TD= Total depth
NM= Not measured

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TYRONE STAGE 2 APP

No. 3A Leach Stockpile Toe Cross Section A-A'

Daniel B. Stephens & Associates, Inc.
11/17/2011 JN ES09.0176

Figure 6-1

S:\Projects\Mine_Tyrone\VR_DWGS_ES05_THRU_ES11\ES09.0176\ES09_0176_01CS_west-east_cross_section.dwg

Explanation

- Perched zone monitor well with water level elevation (ft msl)
- Dry perched zone monitor well
- Alluvium
- Perched fluid extent
- General location of perched seepage interceptor/barrier trench

Note: Perched fluid data are from January 1 through March 31, 2011.

Source: Aerial photograph provided by Tyrone Mine (flown August 16, 2009)

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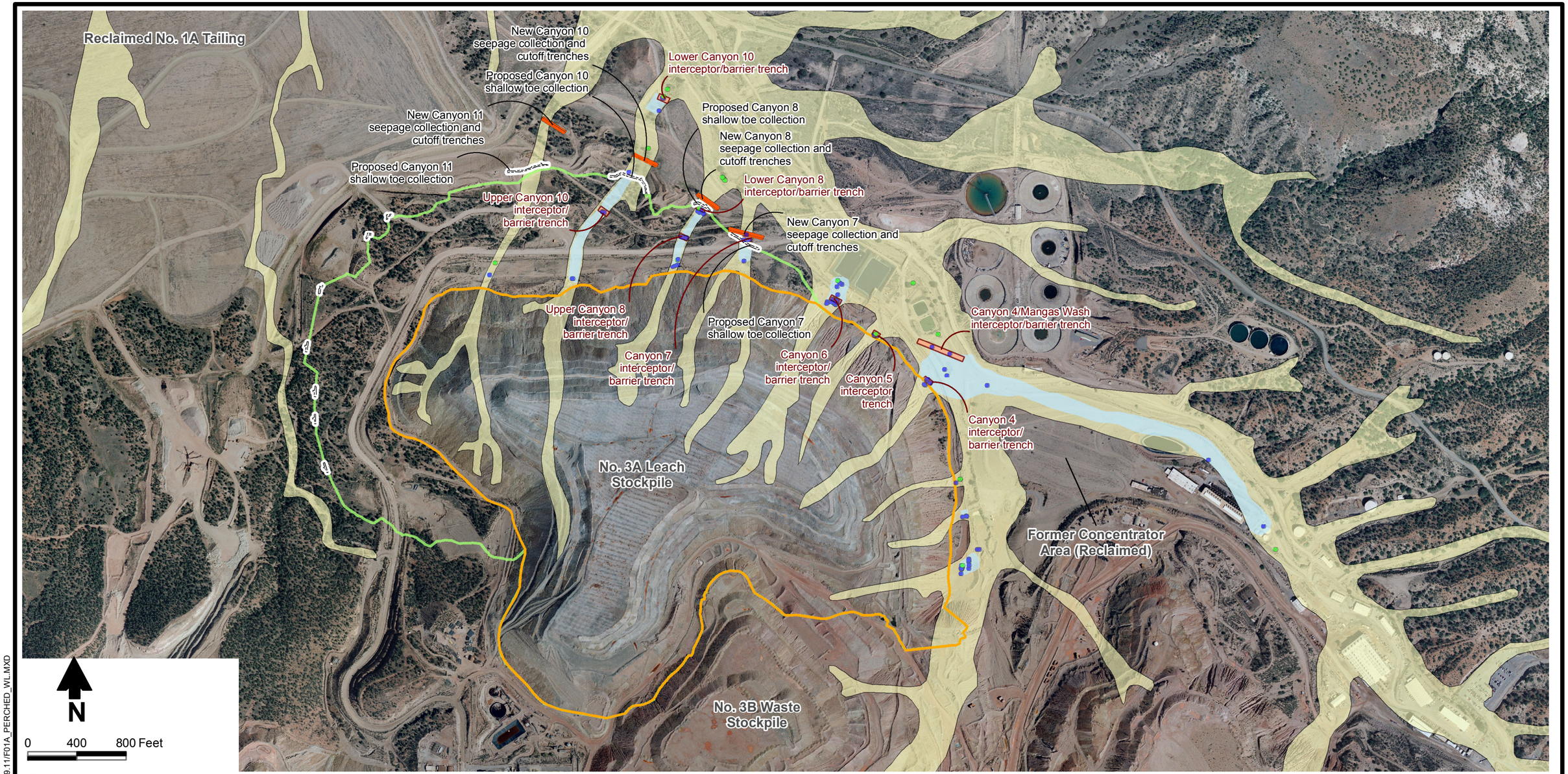
TYRONE STAGE 2 APP

First Quarter 2011 Perched Fluid Extent and Existing Seepage Collection Systems No. 3 Stockpile Area

Figure 6-2

Daniel B. Stephens & Associates, Inc.
11/18/2011 JN ES10.0199.11

S:/PROJECTS/MINE_TYRONE/GIS/MXDS/ES10.0199.11/F01A_PERCHED_WL.MXD



Explanation

- Perched zone monitor well with water level elevation (ft msl)
- Dry perched zone monitor well
- Alluvium
- Perched fluid extent
- General location of existing perched seepage interceptor/barrier trench
- Existing stockpile footprint
- Projected future reclaimed stockpile footprint
- Proposed future seepage collection and cutoff trench
- Proposed future shallow toe collection

Notes: 1) Perched fluid data are from January 1 through March 31, 2011.
2) Proposed future perched seepage collection systems may be adjusted based on final reclamation construction plans.

Source: Aerial photograph provided by Tyrone Mine (flown August 16, 2009)

S:/PROJECTS/MINE_TYRONE/GIS/MXDS/ES10.0199.11/F01A_PERCHED_WL.MXD

Daniel B. Stephens & Associates, Inc.
11/18/2011 JN ES10.0199.11

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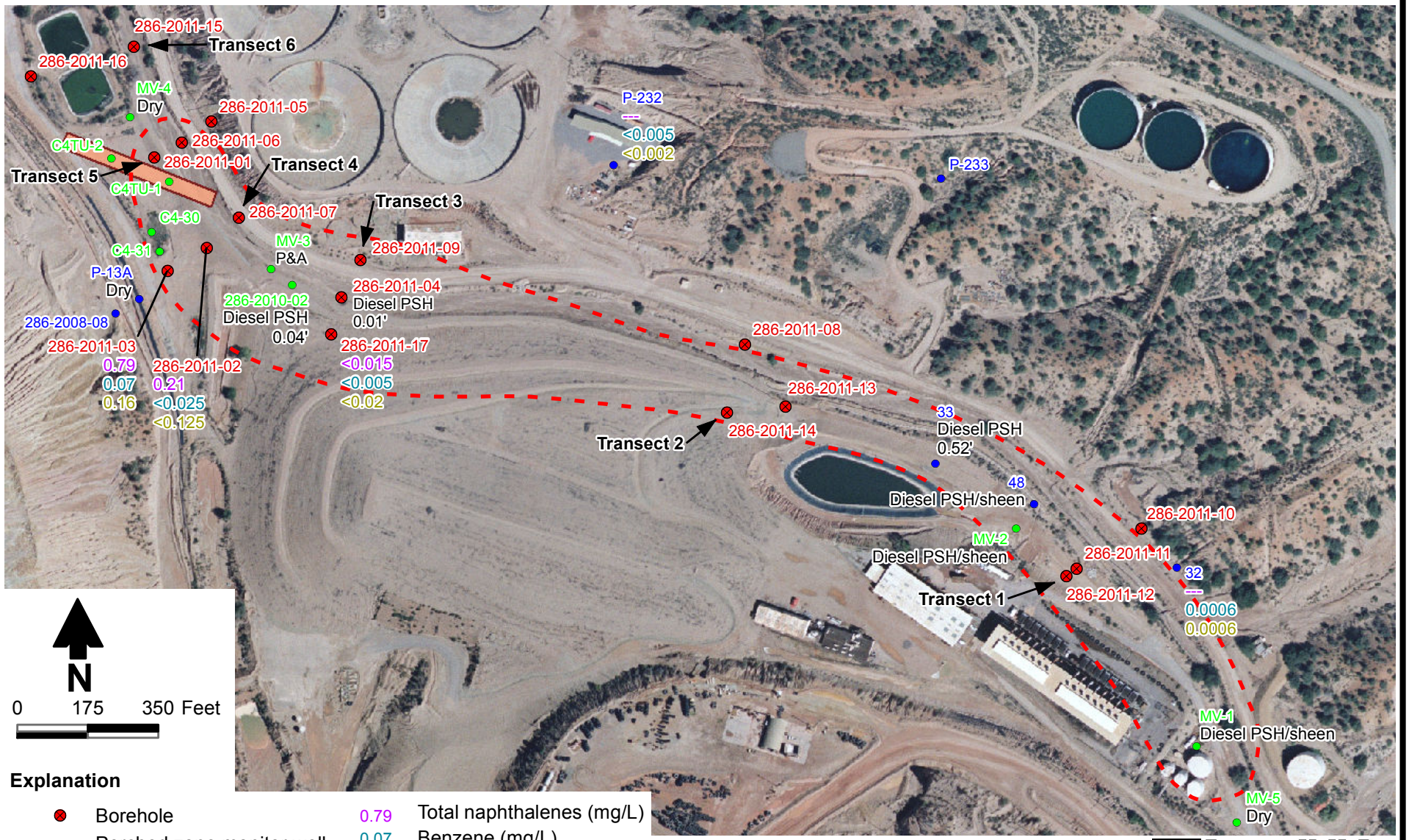
TYRONE STAGE 2 APP

Proposed Perched Fluid Seepage Collection Systems No. 3 Stockpile Area

Figure 6-3

Path: S:\Projects\Mine_Tyrone\GIS\MXDs\ES09.0176\MXDs\Stage_2_APP_Report_1-2012\Fig06-4_Temp_Borings_MW_locs_conc_area.mxd



Explanation

- Borehole
- Perched zone monitor well
- Regional monitor well
- General location of Canyon 4/Mangas Wash interceptor/barrier trench

- 0.79 Total naphthalenes (mg/L)
- 0.07 Benzene (mg/L)
- 0.16 BTEX (mg/L)
- Estimated extent of diesel-impacted soil

Note: MV-3 plugged and abandoned in September 2006

Source: Aerial photograph provided by Tyrone Mine (flown August 16, 2009)

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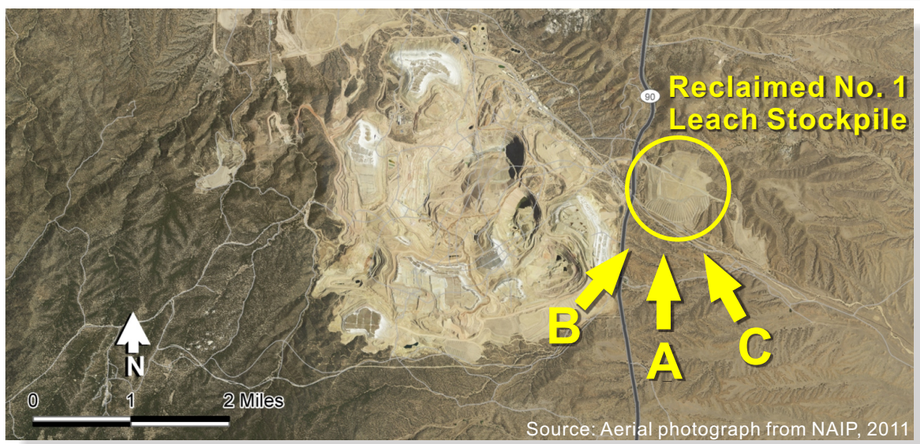
TYRONE STAGE 2 APP

Temporary Borings and Monitor Well Locations Former Concentrator Area

Figure 6-4

Daniel B. Stephens & Associates, Inc.
2/29/2012
JN ES09.0176



Explanation

A → Photograph viewing direction

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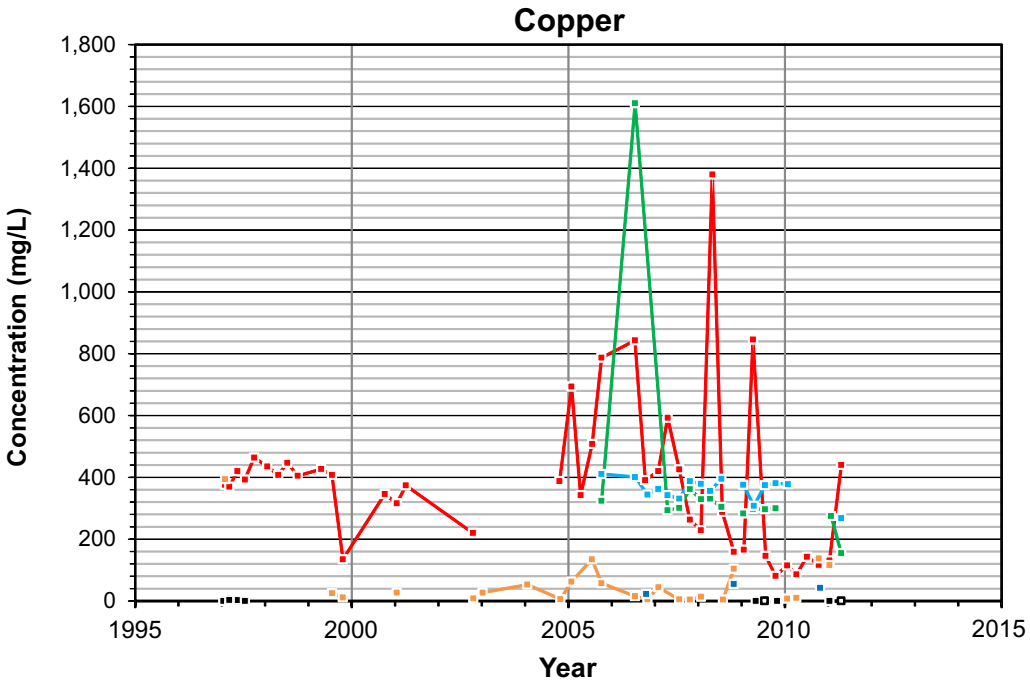
TYRONE STAGE 2 APP

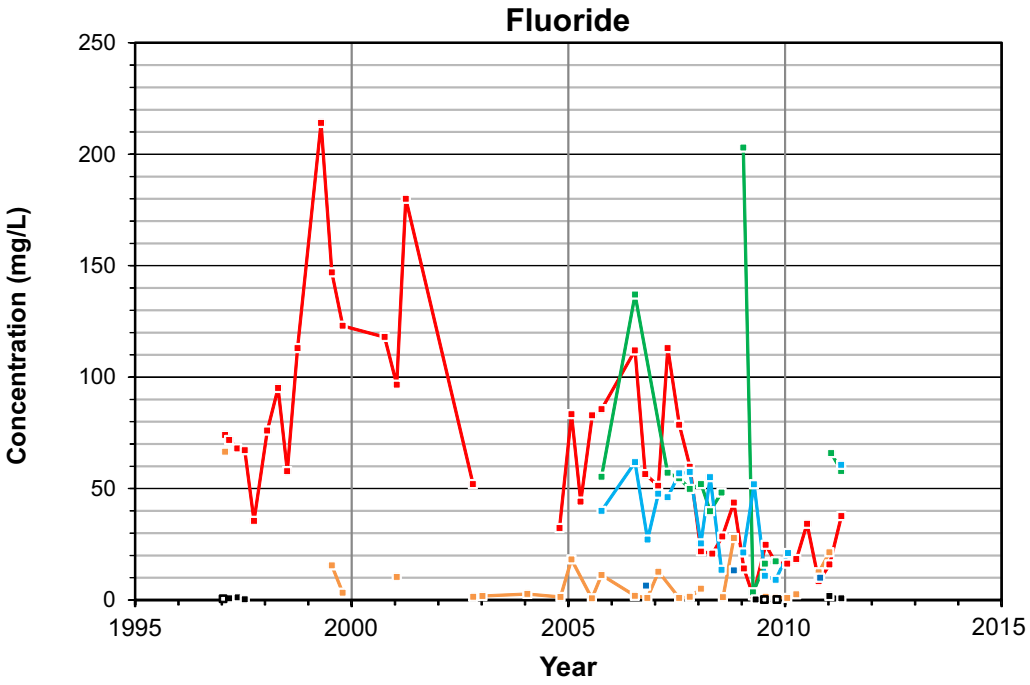
Reclaimed No. 1 Leach Stockpile

Daniel B. Stephens & Associates, Inc.
2/7/2012 JN ES09.0176

Figure 7-1

S:\PROJECTS\MINE_TYRONE_VR_DWGS_ES06_THRU_ES11\ES09.0176\FIGS_3-2_3-3_7-1_RECLAIMED_TAILING_AND_STOCKPILES.CDR





Explanation

OG-25 OG-23 OG-40

OG-46 OG-21 OG-20

Notes: 1. Open symbols show non-detections posted at reporting limits.
2. See Plate 7-1 for well locations.

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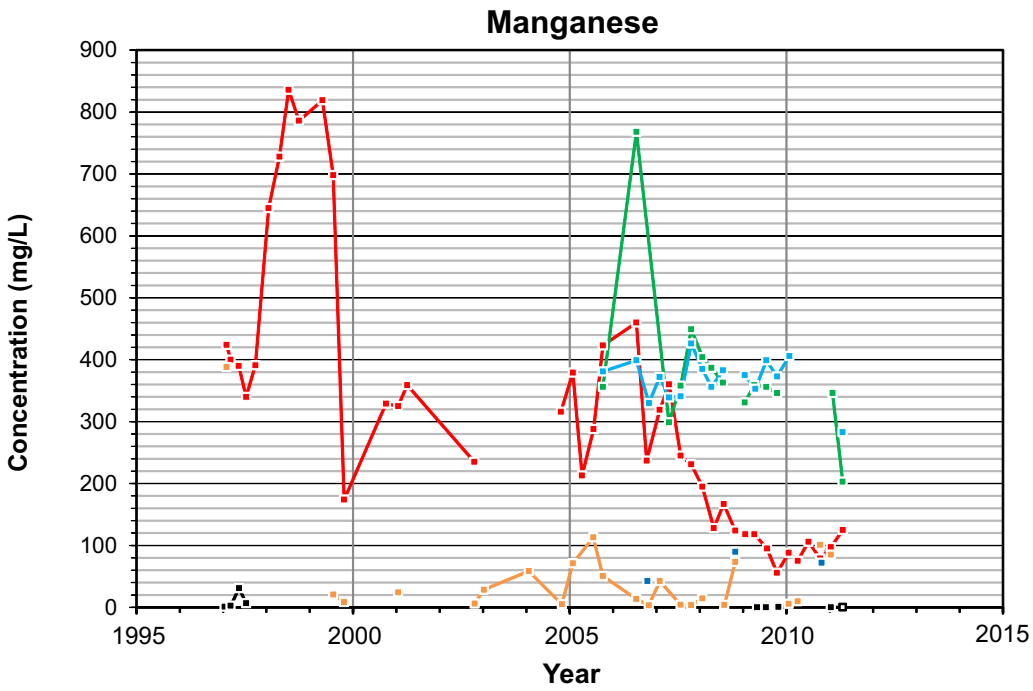
TYRONE STAGE 2 APP

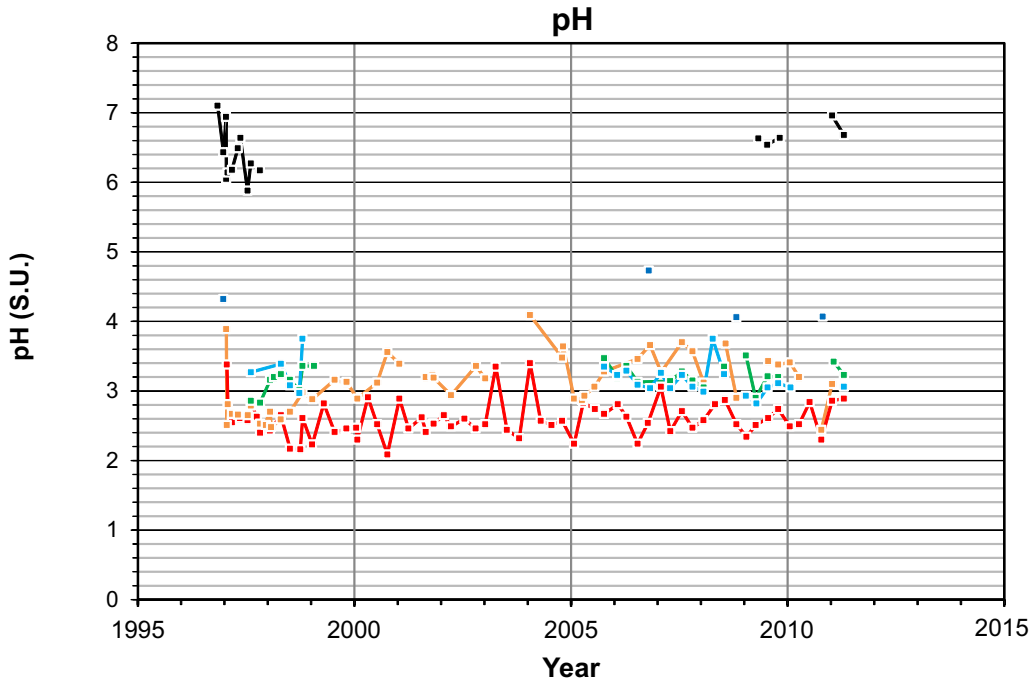
Copper and Fluoride Concentrations in Lower Oak Grove Wash Monitor Wells

Daniel B. Stephens & Associates, Inc.
2-7-12 JN ES09.0176

Figure 7-2

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS_7-2_TO_7-4_GRAPHS.CDR





Explanation

OG-25 OG-23 OG-40

OG-46 OG-21 OG-20

Notes: 1. Open symbols show non-detections posted at reporting limits.
2. See Plate 7-1 for well locations.

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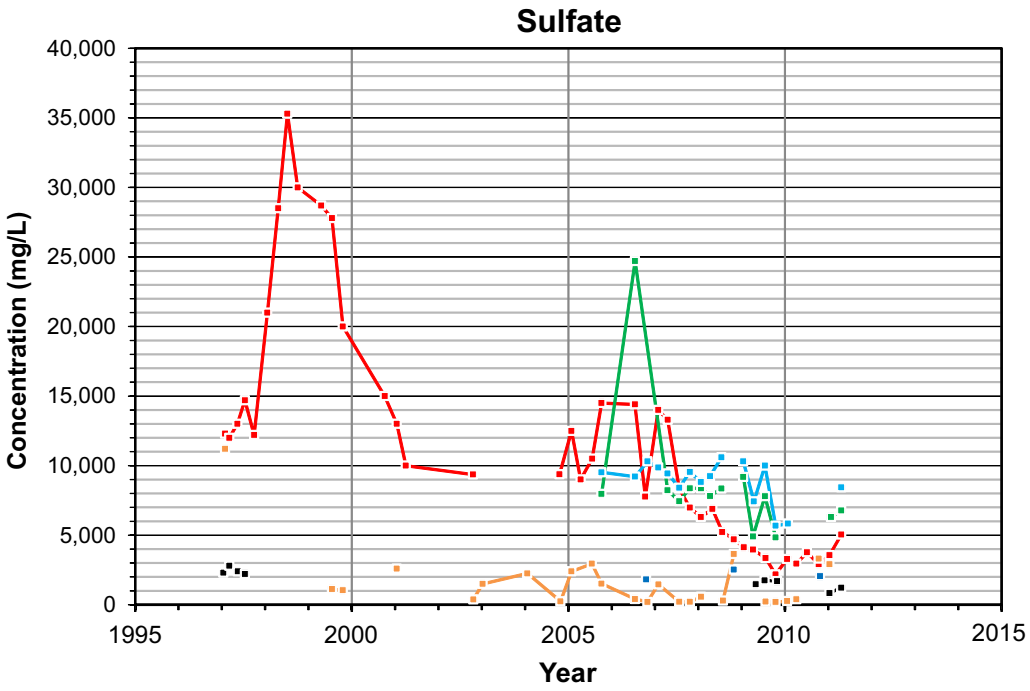
TYRONE STAGE 2 APP

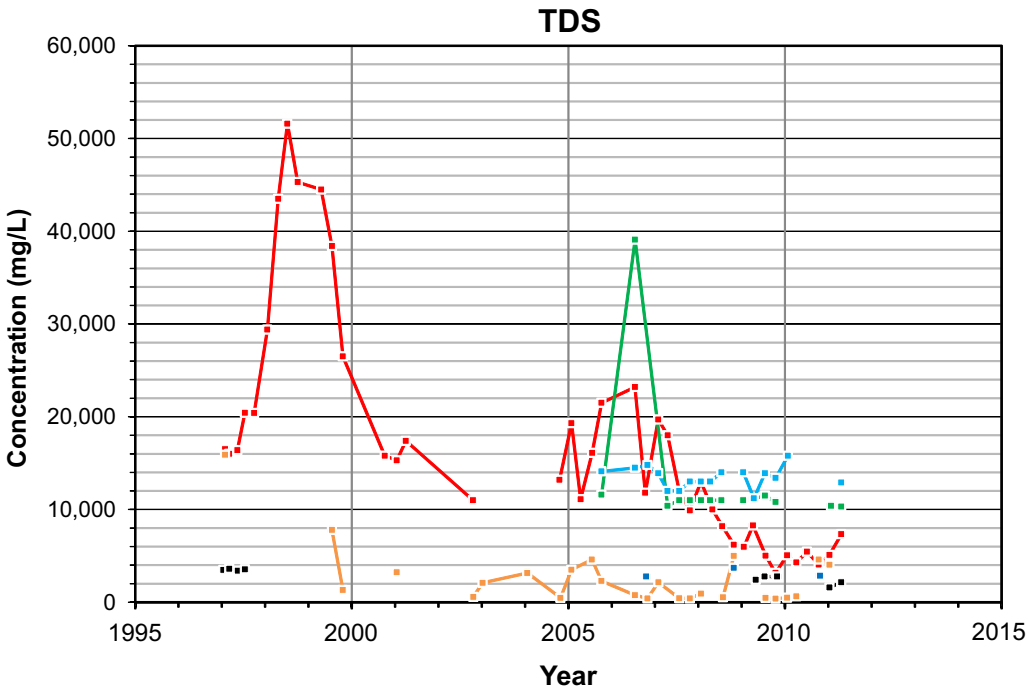
Manganese Concentrations and pH in Lower Oak Grove Wash Monitor Wells

Daniel B. Stephens & Associates, Inc.
2-7-12 JN ES09.0176

Figure 7-3

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS_7-2_TO_7-4_GRAPHS.CDR





Explanation

OG-25 OG-23 OG-40

OG-46 OG-21 OG-20

Notes: 1. Open symbols show non-detections posted at reporting limits.
2. See Plate 7-1 for well locations.

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TYRONE STAGE 2 APP

Sulfate and TDS Concentrations in Lower Oak Grove Wash Monitor Wells

Daniel B. Stephens & Associates, Inc.
2-7-12 JN ES09.0176

Figure 7-4

S:\PROJECTS\MINE_TYRONE\VR_DWGS_ES05_THRU_ES11\ES09.0176\FIGS_7-2_TO_7-4_GRAPHS.CDR

Tables

Table 5-1. Constituent Input Concentrations for Cross-Section Simulations
Page 1 of 2

Constituent	Concentration (mg/L [a])							
	Leach Stockpile Seepage	Waste Rock Pile Seepage	Cross Section 1	Cross Section 2	Cross Section 3	Cross Section 4	Cross Sections 5 and 6	Cross Section 7
Sampling Point	*Average of LD2P and 2A-PLS Collections*	*1C-2 Collection*	*Well P6-B*	*Well 435-2005-1*	*Well 435-2005-2*	*Well 2-15*	*Well 2-5A*	*Well 2-13*
Sampling Date	*2001-2009*	*11/10/2010*	*8/19/2010*	*10/19/2010*	*10/19/2010*	*9/15/2010*	*9/15/2010*	*9/15/2010*
Aluminum (Al)	5,939.10	123.00	0.08	0.08	0.08	0.08	0.08	0.08
Arsenic (As)	0.68	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Bicarbonate (HCO_3)	1.22	1.22	86.01	222.04	163.48	143.96	113.70	269.62
Cadmium (Cd)	16.45	0.19	0.00	0.00	0.00	0.00	0.00	0.00
Calcium (Ca)	499.14	512.00	32.20	56.10	113.00	28.60	254.00	76.10
Chloride (Cl)	114.61	46.10	6.08	10.00	10.90	5.64	5.79	21.30
Chromium (Cr)	0.90	0.06	0.01	0.01	0.01	0.01	0.01	0.01
Cobalt (Co)	25.73	1.08	0.01	0.01	0.01	0.01	0.02	0.01
Copper (Cu)	697.54	159.00	0.01	0.01	0.01	0.01	0.01	0.01
Fluoride (F)	463.68	23.00	1.20	2.38	1.34	1.83	1.73	0.53
Iron (ferrous) (Fe^{2+})	2,371.28	1.14	0.06	0.09	0.06	0.06	5.97	0.06
Iron (ferric) (Fe^{3+})	124.80	0.06	0.00	0.00	0.00	0.00	0.31	0.00
Lead (Pb)	0.29	0.15	0.01	0.01	0.01	0.01	0.01	0.01
Magnesium (Mg)	2,812.38	238.00	6.17	8.39	18.40	9.33	66.20	15.00
Manganese (Mn)	1,650.00	52.50	0.00	0.03	0.00	0.00	3.04	0.58
Nickel (Ni)	6.86	0.24	0.01	0.01	0.01	0.01	0.01	0.01
Oxygen (O(0))	0.00	0.00	2.00	2.00	2.00	2.00	2.00	2.00
Potassium (K)	15.61	13.50	2.68	2.00	1.78	1.28	4.89	1.86

[a] Unless otherwise noted mg/L = Milligrams per liter

Table 5-1. Constituent Input Concentrations for Cross-Section Simulations
Page 2 of 2

Constituent	Concentration (mg/L [a])							
	Leach Stockpile Seepage	Waste Rock Pile Seepage	Cross Section 1	Cross Section 2	Cross Section 3	Cross Section 4	Cross Sections 5 and 6	Cross Section 7
Sampling Point	*Average of LD2P and 2A-PLS Collections*	*1C-2 Collection*	*Well P6-B*	*Well 435-2005-1*	*Well 435-2005-2*	*Well 2-15*	*Well 2-5A*	*Well 2-13*
Sampling Date	*2001-2009*	*11/10/2010*	*8/19/2010*	*10/19/2010*	*10/19/2010*	*9/15/2010*	*9/15/2010*	*9/15/2010*
Silica (Si)	100.00	100.00	1.00	1.00	1.00	1.00	1.00	1.00
Sodium (Na)	23.73	108.00	14.20	26.00	33.80	22.90	59.30	24.40
Sulfate (SO_4)								
After charge balance adjustment	56,351.00	3,365.00	64.72	67.34	300.20	83.61	974.09	86.54
Before charge balance adjustment	56,716.00	3,730.00	55.20	32.10	291.00	29.60	877.00	50.90
pH (s.u.)	2.01	3.36	6.99	6.88	6.80	6.36	5.99	7.03
pe (s.u.)	8.00	6.00	4.00	4.00	4.00	4.00	4.00	4.00
Zinc (Zn)	1,962.04	24.20	0.01	0.01	0.01	0.01	0.45	0.01

[a] Unless otherwise noted

mg/L = Milligrams per liter
pe = Oxidation-reduction potential
s.u. = Standard units

Table 5-2. Simulated Range of Constituent Concentrations by Cross Section

Constituent	NMWQCC Standard (mg/L)	Concentration (mg/L [a]) in top 400 feet													
		Cross Section 1		Cross Section 2		Cross Section 3		Cross Section 4		Cross Section 5		Cross Section 6		Cross Section 7	
		Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Aluminum (Al)	5	1,621	0.003	68.5	0.004	416	0.000	2,344	0.082	3,765	0.081	5,179	0.057	750	0.000
Arsenic (As)	0.1	0.20	0.025	0.039	0.010	0.072	0.005	0.285	0.024	0.442	0.025	0.598	0.018	0.112	0.024
Cadmium (Cd)	0.01	4.39	0.000	0.25	0.002	1.19	0.002	6.43	0.001	10.4	0.002	14.3	0.001	2.06	0.001
Cobalt (Co)	0.05	7.06	0.006	0.40	0.006	1.87	0.006	10.2	0.006	16.3	0.018	22.4	0.018	3.38	0.006
Chromium (Cr)	0.05	0.25	0.006	0.02	0.005	0.071	0.002	0.357	0.006	0.571	0.006	0.78	0.006	0.123	0.006
Copper (Cu)	1	196	0.000	19.0	1.20	54.8	0.730	285	0.00	453	2.23	621	1.20	94.9	3.87
Fluoride (F)	1.6	448	3.86	49.8	3.36	47.7	2.80	458	4.60	431	2.64	731	2.40	262	2.79
Iron (Fe)	1	670	0.000	29.8	0.000	175	0.000	972	0.001	1,559	0.031	2,140	0.031	316	0.000
Lead (Pb)	0.05	0.081	0.002	0.021	0.003	0.029	0.001	0.115	0.002	0.185	0.006	0.253	0.003	0.041	0.004
Magnesium (Mg)	—	757	1.66	51.8	4.04	221	5.06	1,107	4.48	1,802	62.0	2,450	39.9	366	7.18
Manganese (Mn)	0.2	442	0.001	25.4	0.000	118	0.004	645	0.005	1,047	3.00	1,433	1.91	211	0.384
Nickel (Ni)	0.2	1.89	0.010	0.116	0.010	0.507	0.010	2.71	0.010	4.36	0.010	5.986	0.010	0.908	0.010
pH (s.u.)	6-9	6.99	2.42	6.88	3.30	6.80	2.78	6.36	2.30	5.75	2.13	5.75	2.02	7.03	2.27
Sulfate	600	15,509	70.4	926	70.1	4,372	118	22,450	86.7	35,910	959	48,819	975	7,466	88.1
Total dissolved solids [b] (TDS)	1,000	22,548	232	1,642	394	6,487	209	32,427	310	51,406	1,464	69,713	1,499	11,228	498
Zinc (Zn)	10	520	0.002	30.1	0.010	142	0.010	765	0.010	1,243	0.445	1,702	0.218	245	0.008

[a] Unless otherwise noted
[b] Calculated from sum of other simulated constituent concentrations

NMWQCC = New Mexico Water Quality Control Commission
mg/L = Milligrams per liter
— = No standard set
s.u. = Standard units

Table 5-3. Future Sources of Inflow to Main and Gettysburg Pits

Source of Inflow	Rate (gpm)	Percentage of Total Inflow
Main Pit		
Groundwater: Cross section 1	15.7	2.5
Cross section 2	57.2	9.0
Cross section 3	276.2	43.5
Cross section 4	94.1	14.8
Cross section 5	58.2	9.2
Surface water runoff	67	10.6
Near-pit recharge	66.3	10.4
Total Inflow	634.7	100.0
Gettysburg Pit		
Groundwater: Cross section 6	33.0	80.5
Surface water runoff	8.0	19.5
Total Inflow	41.0	100.0

gpm = Gallons per minute

Table 5-4. Water Quality for Future Sources of Pit Inflow

Constituent	Concentration (mg/L [a])								
	Main Pit							Gettysburg Pit	
	Cross Section 1	Cross Section 2	Cross Section 3	Cross Section 4	Cross Section 5	Surface Water Runoff	Near-Pit Recharge	Cross Section 6	Surface Water Runoff
Aluminum (Al)	555	27	203	456	1,604	143.2	0.08	607	209.7
Arsenic (As)	0.09	0.03	0.05	0.08	0.20	—	0.025	0.09	—
Bicarbonate (HCO_3)	78.1	205.7	155.8	126.6	81.2	—	113.7	102.3	—
Cadmium (Cd)	1.42	0.11	0.60	1.19	4.35	0.10	0.002	1.58	0.24
Calcium (Ca)	327	109	143	244	429	45.0	254	346	94.4
Chloride (Cl)	16.3	12.2	14.9	13.9	35.2	29.7	5.79	17.0	77.1
Chromium (Cr)	0.09	0.01	0.04	0.07	0.25	0.01	0.006	0.10	0.02
Cobalt (Co)	2.43	0.23	0.95	1.99	6.99	0.48	0.02	2.66	1.18
Copper (Cu)	66.6	13.0	28.7	54.6	194.2	1,164	0.01	70.4	3,023
Ferrous iron (Fe^{2+})	221	8	85	178	667	84.3	5.96	245	219.8
Ferric iron (Fe^{3+})	0	0	0	0	0	—	0.314	0	—
Fluoride (F)	213	28	27	151	310	5.63	1.73	176	13.9
Lead (Pb)	0.03	0.01	0.02	0.02	0.08	0.01	0.0075	0.03	0.03
Magnesium (Mg)	251	36	120	212	783	25.2	66.2	312	56.3
Manganese (Mn)	145	13	59	121	440	7.03	3.04	161	15.3
Nickel (Ni)	0.66	0.07	0.26	0.54	1.87	—	0.01	0.71	—
pH [b]	3.51	4.22	3.30	3.61	2.54	3.3	5.99	4.61	2.5
Potassium (K)	7.80	0.65	0.84	7.34	13.20	4.52	4.89	12.66	10.28
Silica (Si)	10.3	6.2	5.4	8.6	27.8	—	1	11.2	—
Sodium (Na)	15.6	29.1	33.8	26.3	47.7	6.82	59.3	54.2	15.0
Sulfate (SO_4)	5.382	597	2,358	4,489	15,588	2,405	974.1	6,270	6,131
Zinc (Zn)	167	13	71	142	516	15.36	0.445	185	38.3

[a] Unless otherwise noted
[b] Standard units

mg/L= Milligrams per liter
— = Not analyzed

Table 5-5. Predicted Average Future Water Quality at Main and Gettysburg Pits

Constituent	Concentration (mg/L [a])	
	Main Pit	Gettysburg Pit
Aluminum (Al)	338	534
Arsenic (As)	0.06	0.1
Bicarbonate (HCO_3)	104	68
Cadmium (Cd)	0.9	1.3
Calcium (Ca)	188	300
Chloride (Cl)	17	29
Chromium (Cr)	0.06	0.1
Cobalt (Co)	1.5	24
Copper (Cu)	165	653
Fluoride (F)	72	146
Iron (Fe)	142	242
Lead (Pb)	0.02	0.03
Magnesium (Mg)	177	264
Manganese (Mn)	91	134
Nickel (Ni)	0.4	0.6
pH [b]	3.2	3.3
Potassium (K)	4	12.3
Silica (SiO_2)	7.2	9.3
Sodium (Na)	33	47
Sulfate (SO_4)	3,709	6,244
TDS	5,675	9,753
Zinc (Zn)	108	158

[a] Unless otherwise noted
[b] Standard units

mg/L= Milligrams per liter
TDS = Total dissolved solids

Table 6-1. Observed Constituent Concentrations Near Toe of the No. 3A Leach Stockpile

Constituent	Well		
	P-178	P-196	P-11
Sample Date	*5/20/2010*	*5/20/2010*	*5/19/2010*
Aluminum (Al)	1,610	1,150	ND
Copper (Cu)	729	355	ND
Fluoride (F)	318	176	1.77
Iron (Fe)	3.41	ND	ND
Manganese (Mn)	736	447	0.0076
pH	3.33	3.48	5.89
Sulfate (SO_4)	19,000	11,800	1,060
Total dissolved solids (TDS)	29,500	18,400	2,080
Zinc (Zn)	1,000	592	ND

ND = Not detected

Table 7-1. Evaluation of Remedial Technologies
East Side Area, Perched Groundwater
Page 1 of 2

Technology	Site-Wide			Lower Oak Grove Wash		Upper Oak Grove Wash and Brick Kiln Gulch		
	Monitored Natural Attenuation	Continue Existing Groundwater Extraction System	Continue and Enhance Existing Groundwater Extraction System	Horizontal Extraction Wells	Low-Permeability Barrier and Extraction Well	Permeable Reactive Barrier (PRB)	Low-Permeability Barriers and Extraction Wells	Interceptor Trench
Description	Collect groundwater samples from existing wells to assess changes in water quality.	Continue to maintain and operate the existing groundwater extraction system (16 wells) without significant modification.	Install 4 additional extraction wells, along with the necessary telemetry to identify surges and pumps to extract groundwater. Retrofit pumps and controls in existing wells.	Install a horizontal extraction well along a significant length of Oak Grove Wash and convey water to a centralized treatment plant.	Install a-low permeability barrier perpendicular to the main reach of Oak Grove Wash to impede the flow of impacted groundwater. Extract water that collects behind the barrier using well(s) and convey it to a centralized treatment plant.	Install PRBs in Oak Grove Wash and Brick Kiln Gulch (depths of ~40 feet bgs) to passively precipitate metals from groundwater.	Install low-permeability barriers in Upper Oak Grove Wash and Brick Kiln Gulch to impede the flow of impacted groundwater. Extract water that collects behind the barrier(s) using well(s) and convey it to a centralized treatment plant.	Install trench filled with highly transmissive materials that drains toward one side. Extract water that collects in trench and convey it to a centralized treatment plant.
Overall protectiveness	*Low:* Groundwater will continue to be impacted until all metals and soluble salts are flushed from the sediments.	*Low to Moderate:* Groundwater will continue to be impacted until all metals and soluble salts are flushed from the sedi-ments. Effectiveness during and following significant recharge events uncertain.	*Moderate:* Groundwater will continue to be impacted until all metals and soluble salts are flushed from the sediments.	*Moderate to High:* There will be no unacceptable risk to human health or the environment once remediation is complete.	*High:* There will be no unacceptable risk to human health or the environment once remediation is complete.	*Moderate:* Groundwater may continue to have elevated concentrations of TDS, sulfate, and possibly other constituents. If selected, this technology would likely be used in conjunction with other technologies.	*High:* There will be no unacceptable risk to human health or the environment once remediation is complete.	*Moderate:* Groundwater beyond trench will continue to have elevated metals and inorganic salt concentrations. If selected, this technology would likely be used in conjunction with other technologies.
Long-term effectiveness and permanence	*Low:* Groundwater will continue to be impacted until all metals and soluble salts are flushed from the sediments.	*Moderate:* There will be no unacceptable risk to human health or the environment once the remediation is complete.	*Moderate:* There will be no unacceptable risk to human health or the environment once the remediation is complete.	*High:* There will be no unacceptable risk to human health or the environment once the remediation is complete.	*High:* There will be no unacceptable risk to human health or the environment once remediation is complete.	*High:* There will be no unacceptable risk to human health or the environment once the remediation is complete.	*High:* There will be no unacceptable risk to human health or the environment once remediation is complete.	*High:* There will be no unacceptable risk to human health or the environment once the remediation is complete.
Reduction of toxicity, mobility, or volume through treatment	*None:* Not effective in reducing the toxicity, mobility, and volume in the short term.	*High:* All extracted water will be treated.	*High:* All extracted water will be treated.	*High:* All extracted water will be treated.	*High:* All extracted water will be treated.	*Moderate:* Water will continue to have high concentrations of TDS and sulfate.	*High:* All extracted water will be treated.	*High:* All extracted water will be treated.
Short-term effectiveness	*None:* Not effective in reducing the toxicity, mobility, and volume in the short term.	*Moderate:* Effective in reducing the toxicity, mobility. and volume in the short term.	*Moderate to High:* Effective to very effective in reducing the toxicity, mobility, and volume in the short term.	*Moderate-High:* Effective to very effective in reducing the toxicity, mobility, and volume at low flows; may be less effective during peak surge events.	*High:* Very effective in reducing the toxicity, mobility, and volume in the short term. May require additional booster pumps for peak surge events.	*Moderate:* Effective in reducing the toxicity, mobility, and volume of metals in the short term. May not affect TDS or sulfate concentrations, and metals may not meet groundwater standards.	*High:* Very effective in reducing the toxicity, mobility, and volume in the short term.	*Moderate:* Effective in reducing the toxicity, mobility, and volume of metals in the short term. May not affect TDS or sulfate concentrations, and metals may not meet groundwater standards
Active source control	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.	*Low:* Impacted sediments will be flushed by natural recharge events.

NA = Not applicable

Table 7-1. Evaluation of Remedial Technologies
East Side Area, Perched Groundwater
Page 2 of 2

Technology	Site-Wide			Lower Oak Grove Wash		Upper Oak Grove Wash and Brick Kiln Gulch		
	Monitored Natural Attenuation	Continue Existing Groundwater Extraction System	Continue and Enhance Existing Groundwater Extraction System	Horizontal Extraction Wells	Low-Permeability Barrier and Extraction Well	Permeable Reactive Barrier (PRB)	Low-Permeability Barriers and Extraction Wells	Interceptor Trench
Risk to workers	NA	NA	*Low:* Workers can potentially be exposed to contaminated media during construction activities. Risk of exposure can be minimized by implementing controls.	*Low:* Workers can potentially be exposed to contaminated media during construction activities. Risk of exposure can be minimized by implementing controls.	*Low:* Workers can potentially be exposed to contaminated media during construction activities. Risk of exposure can be minimized by implementing controls.	*Low:* Workers can potentially be exposed to contaminated media during construction activities. Risk of exposure can be minimized by implementing controls.	*Low:* Workers can potentially be exposed to contaminated media during construction activities. Risk of exposure can be minimized by implementing controls.	*Low:* Workers can potentially be exposed to contaminated media during construction activities. Risk of exposure can be minimized by implementing controls.
Implementability	This technology is readily implementable.	This technology is readily implementable.	This technology is readily implementable.	This technology can be implemented. Technologies and services required for the implementation of this remedy are available.	This technology can be implemented. Technologies and services required for the implementtation of this remedy are available.	This technology can be implemented. Technologies and services required to implement this remedy are available.	This technology can be implemented. Technologies and services required for the implementation of this remedy are available.	This technology can be implemented. Technologies and services required for the implementation of this remedy are available.

NA = Not applicable

Table 10-1. Schedule for Stage 2 Abatement Actions
Page 1 of 4

Area	Source Controls and Existing Abatement Measures	Proposed Abatement Action	Anticipated Start Date	Duration
Mangas Valley APP Study Area				
No. 1X Capture System	Reclamation of Nos. 1, 1X and 1A tailing impoundments completed.	Extraction of impacted water through pumping wells.	In place/ongoing.	Will operate until Section 3103 standards are met at the extraction system wells.
Wells 27-2005-06, 27-2010-02, MVR-1, and 46	Reclamation of Nos. 3X, 2, 1, and 1A tailing impoundments completed.	Monitored natural attenuation.	In place/ongoing.	Will monitor until Section 3103 standards are met at monitor wells.
Mine/Stockpile APP Study Area				
Interior region	Source controls to be implemented at closure in accordance with the Settlement Agreement and CCP.	Implement CCP in accordance with Settlement Agreement.	At closure in accordance with DP-1341. Will apply for AAS in 2012.	Continue for at least 100 years after closure in accordance with DP-1341.
Deadman Canyon perched groundwater	Existing source controls include removal of the former USNR leach stockpile in 1998 and operation of an interceptor/ barrier trench and multiple seep collections. Closure of stockpiles east of Deadman Canyon to be implemented at closure in accordance with the Settlement Agreement and CCP.	• Continue existing measures • Implement additional Seep 5E area seepage collection trench. • Implement DC2-1 and Seep 3 seepage collection trenches if required based on monitoring data.	• In place/ongoing • Construct by end of 2013. • Construct well in 2012; construct trenches by end of 2013 if required.	Will operate existing and new seepage collection trenches until Section 3103 standards are met at monitor wells and trenches.
Deadman Canyon regional groundwater	See description under Deadman Canyon perched groundwater.	Monitored natural attenuation in conjunction with abatement measures proposed for perched groundwater.	See start dates under Deadman Canyon perched groundwater.	Will monitor until Section 3103 standards are met at monitor wells.

CCP = Closure/closeout plan developed and updated in accordance with DP-1341 AAS = Alternative abatement standards

Table 10-1. Schedule for Stage 2 Abatement Actions
Page 2 of 4

Area	Source Controls and Existing Abatement Measures	Proposed Abatement Action	Anticipated Start Date	Duration
Mine/Stockpile APP Study Area (continued)				
No. 3A leach stockpile perched groundwater	Existing abatement measures include operation of multiple interceptor/barrier trenches and seepage control systems. Source controls to be implemented at closure in accordance with Settlement Agreement and CCP include covering and regrading stockpile.	Continue operation of existing seepage collection systems. Construct new systems at stockpile closure.	New seepage collection systems will be constructed in accordance with the final design and construction schedule for stockpile reclamation.	Will operate the existing and new seepage collection systems so long as perched water that exceeds Section 3103 standards is present.
No. 3A leach stockpile regional groundwater	Existing abatement measures include operation of multiple groundwater extraction systems. Source controls to be implemented at closure in accordance with Settlement Agreement and CCP include covering and regrading stockpile.	Extraction of impacted water through pumping wells.	In place/ongoing. Will apply for AAS in 2012 for water beneath the stockpile and upgradient of regional groundwater capture systems.	Will operate capture systems until Section 3103 standards are met at extraction wells.
Former concentrator area perched groundwater	Former concentrator area already reclaimed. Leaking diesel pipeline replaced in 1998. Existing impacted water captured at the Canyon 4/Mangas Wash interceptor/ barrier trench	Monitored natural attenuation with plume front containment/ capture at existing systems.	In place/ongoing.	Will operate capture system until Section 3103 standards are met at monitor wells and the Canyon 4/Mangas Wash interceptor/barrier trench.
Former concentrator area regional groundwater	Former concentrator area already reclaimed. Leaking diesel pipeline replaced in 1998. Monitor wells 32 and 33 drilled out and replaced with proper annular seals.	Monitored natural attenuation with capture of impacted water at Main Pit.	In place/ongoing.	Will monitor until Section 3103 standards are met at monitor wells.

CCP = Closure/closeout plan developed and updated in accordance with DP-1341 AAS = Alternative abatement standards

Table 10-1. Schedule for Stage 2 Abatement Actions
Page 3 of 4

Area	Source Controls and Existing Abatement Measures	Proposed Abatement Action	Anticipated Start Date	Duration
Mine/Stockpile APP Study Area (continued)				
South Side/Upper East Side perched groundwater	Reclamation of the Nos. 1C and 7A waste stockpiles partially completed; full reclamation to be completed in 2012. Nos. 1A and 1B leach stockpiles will be reclaimed in accordance with Settlement Agreement and CCP; potentially as early as 2017. Existing abatement measures include multiple interceptor/barrier trenches.	Monitored natural attenuation with plume front containment/ capture at existing systems.	In place/ongoing.	Will operate seepage collection systems until Section 3103 standards are met at monitor wells and the interceptor/barrier trenches.
South Side/Upper East Side regional groundwater	See description under perched groundwater.	Install regional groundwater extraction wells along Upper Oak Grove Wash in vicinity of southeast toe of reclaimed No. 1C stockpile	Install by end of 2014.	Will operate capture system so long as extracted water exceeds Section 3103 standards. Operation of this system will be considered conjunctively with a second potential extraction system described below.
		Construct a second regional groundwater capture system if necessary based on observed groundwater concentrations at monitor wells. This system, if required, is expected to be in the vicinity of the former Precipitation Plant, east of the No. 1B leach stockpile.	Dependent on observed concen-trations at monitor wells; expected to be 2016 or later.	If installed, the capture system will be operated as long as Section 3103 groundwater standards are exceeded.

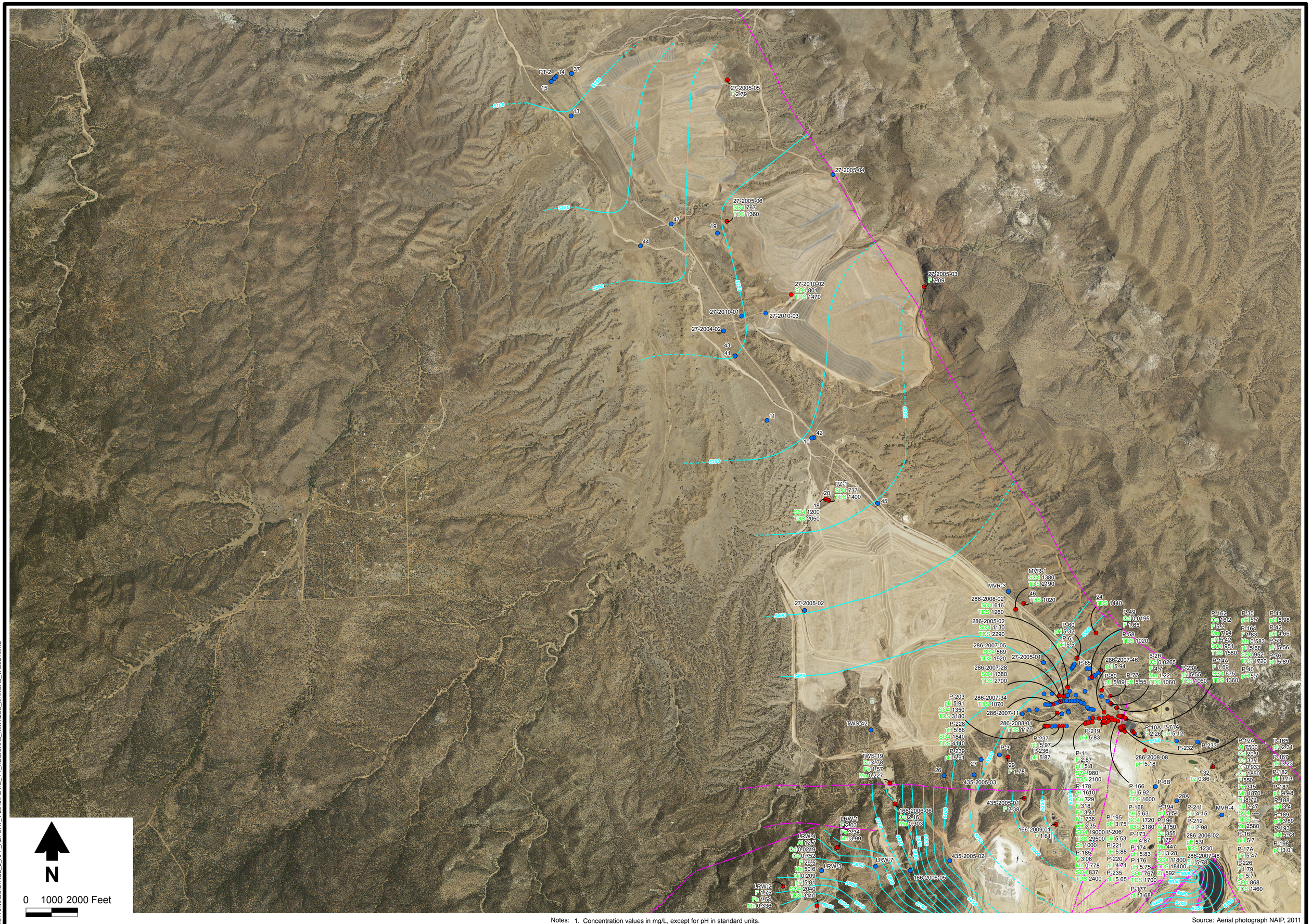
CCP = Closure/closeout plan developed and updated in accordance with DP-1341 AAS = Alternative abatement standards

Table 10-1. Schedule for Stage 2 Abatement Actions
Page 4 of 4

Area	Source Controls and Existing Abatement Measures	Proposed Abatement Action	Anticipated Start Date	Duration
Oak Grove Wash/Brick Kiln Gulch APP Study Area				
Perched groundwater	Reclamation of No. 1 leach stockpile and Burro Mountain tailing impoundment already completed. Reclamation of No. 1C waste stockpile to be completed in 2012. Nos. 1A and 1B leach stock-piles will be reclaimed in accordance with Settlement Agreement and CCP; potentially as early as 2017. Existing abatement measures include operation of multiple interceptor/barrier trenches and groundwater extraction at four well transects.	Construct low-permeability barrier downgradient of confluence of Upper Oak Grove Wash and Brick Kiln Gulch; construct production well(s) to extract impacted fluids that collect behind the barrier. Continue operation of existing well extraction systems downgradient of barrier.	Construct barrier and new extraction wells by end of 2014. Continue operation of all existing pumping systems in the interim. After 2014, continue operating only the pumping systems downgradient of barrier.	Will extract impacted perched water until Section 3103 groundwater standards are met at monitor and pumping wells.
Regional groundwater	See description under Oak Grove Wash/Brick Kiln Gulch perched groundwater and South Side/Upper East Side regional groundwater.	Monitored natural attenuation.	In place/ongoing.	Will operate until Section 3103 standards are met at monitor wells.

CCP = Closure/closeout plan developed and updated in accordance with DP-1341 AAS = Alternative abatement standards

Plates



N

0 1000 2000 Feet

Explanation

- Sample location equals or exceeds one or more standards (exceedances indicated)
- Sample location below all standards
- Water level elevation contour (ft msl), dashed where inferred (contour interval 50 ft)
- Fault

Notes:
1. Concentration values in mg/L, except for pH in standard units.
2. Exceedances based on Section 20.6.2.3103 NMAC List A, B, and C standards for most recent sample taken in 2010.

Source: Aerial photograph NAIP, 2011

Daniel B. Stephens & Associates, Inc.
2/17/2012
JN ES09.0176

FREEPORT-McMoRan COPPER & GOLD

TYRONE STAGE 2 APP

Regional Groundwater Elevation and Water Quality for Mangas Valley Tailing Area, 2010

Plate 4-1

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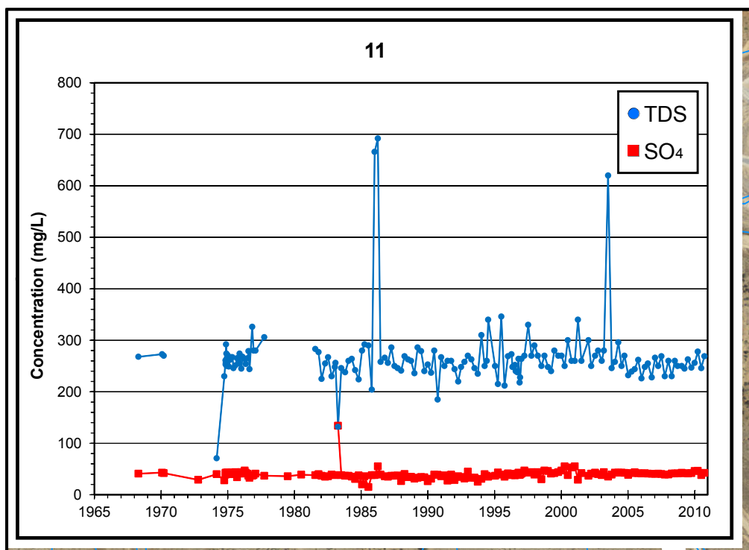

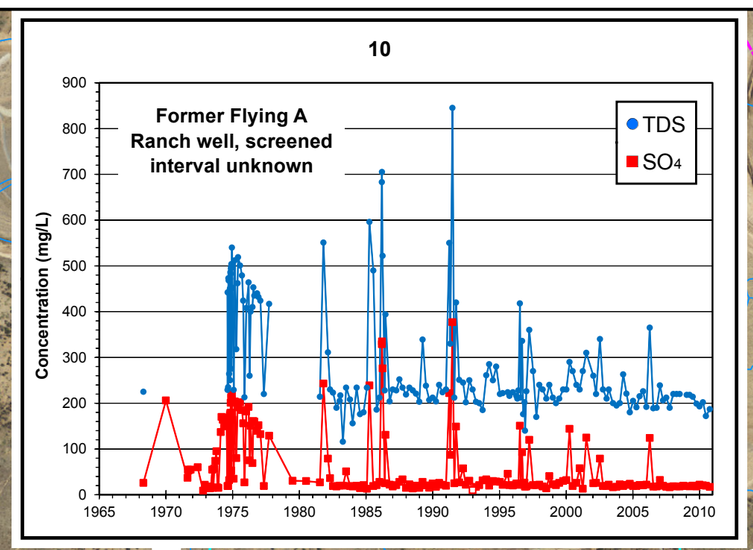

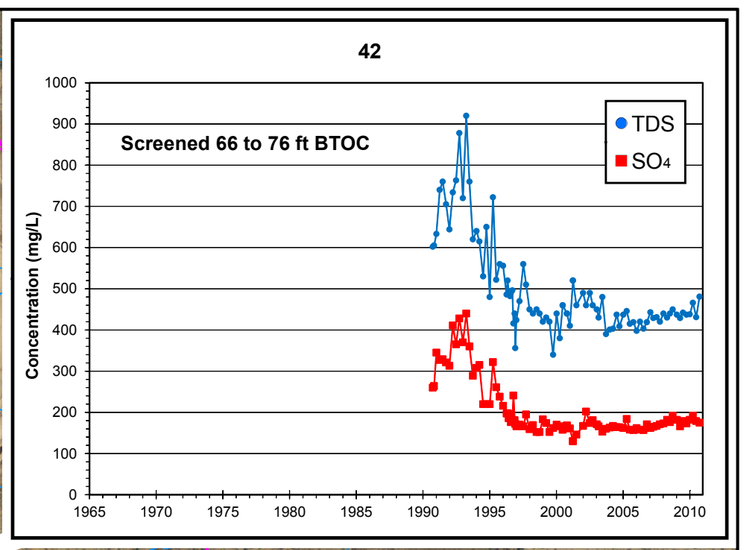

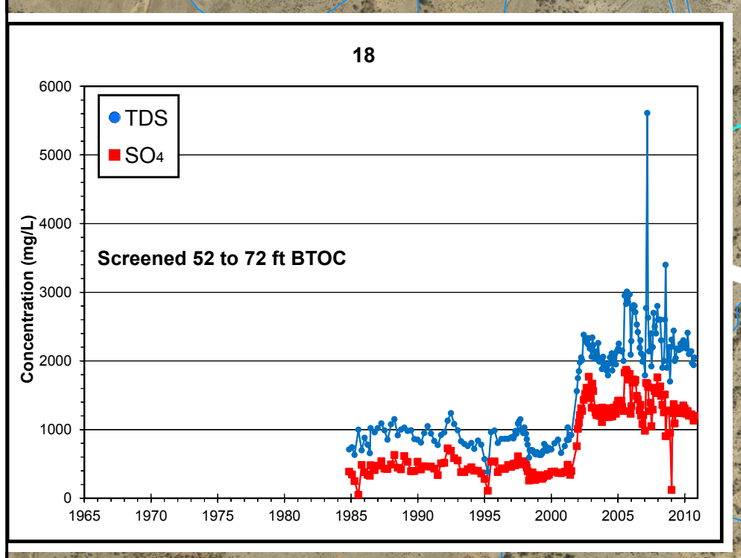

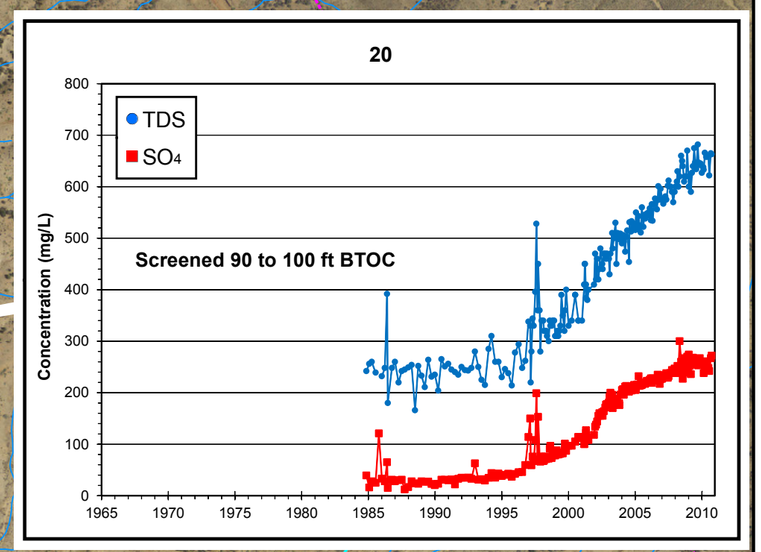

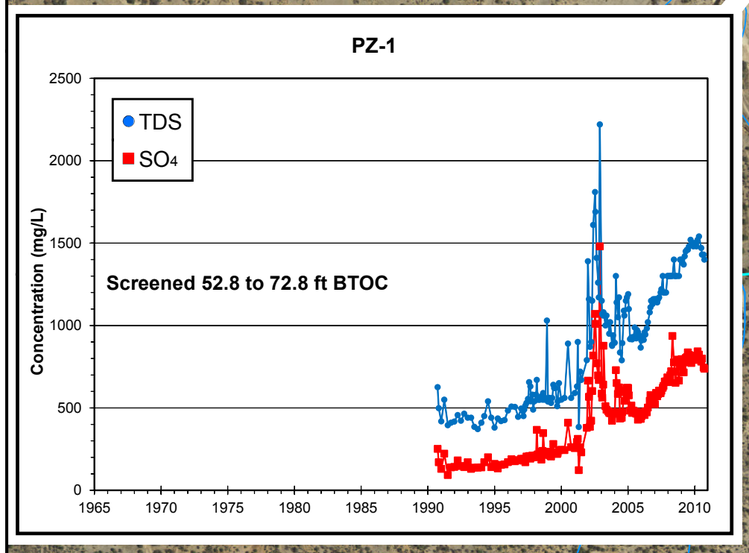

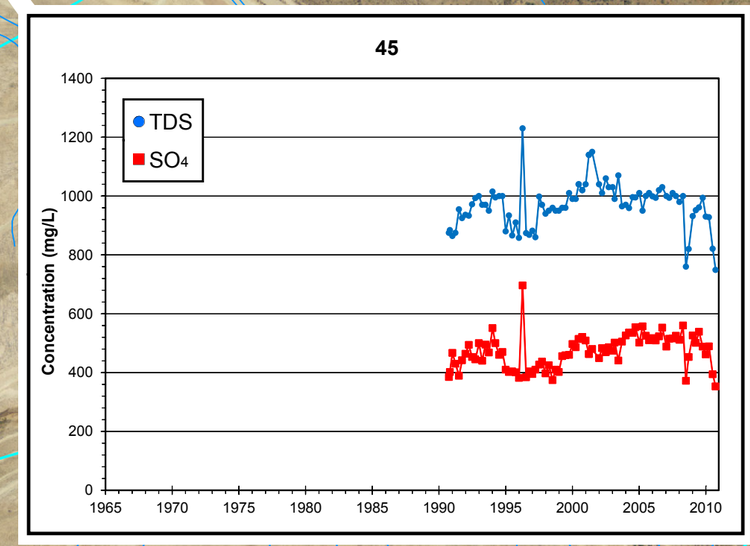

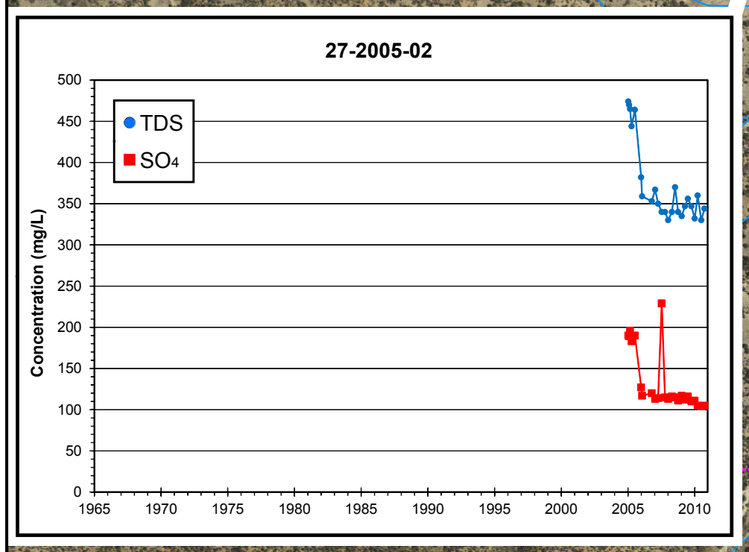

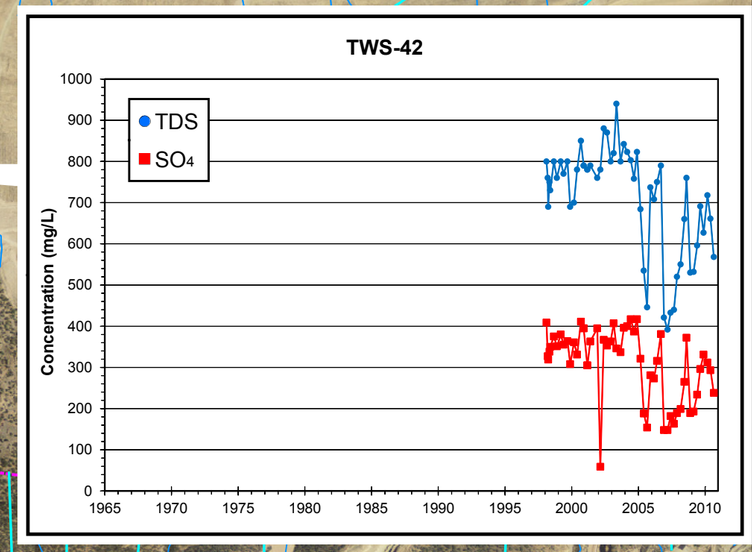

N

0 1000 2000 Feet

Explanation

- Regional well
- Temporary borehole from Stage 1 APP investigation
- Fault
- Pre-surface mining drainage
- Water level elevation contour (ft msl), dashed where inferred (contour interval 50 ft)

Notes:
1. Reclamation of Nos. 1X, 1, and 1A tailing impoundments completed in 2009
2. BTOC = below top of casing
3. NMWQCC standard for TDS = 1,000 mg/L
   NMWQCC standard for sulfate (SO_4) = 600 mg/L

Source: Aerial photograph NAIP, 2011

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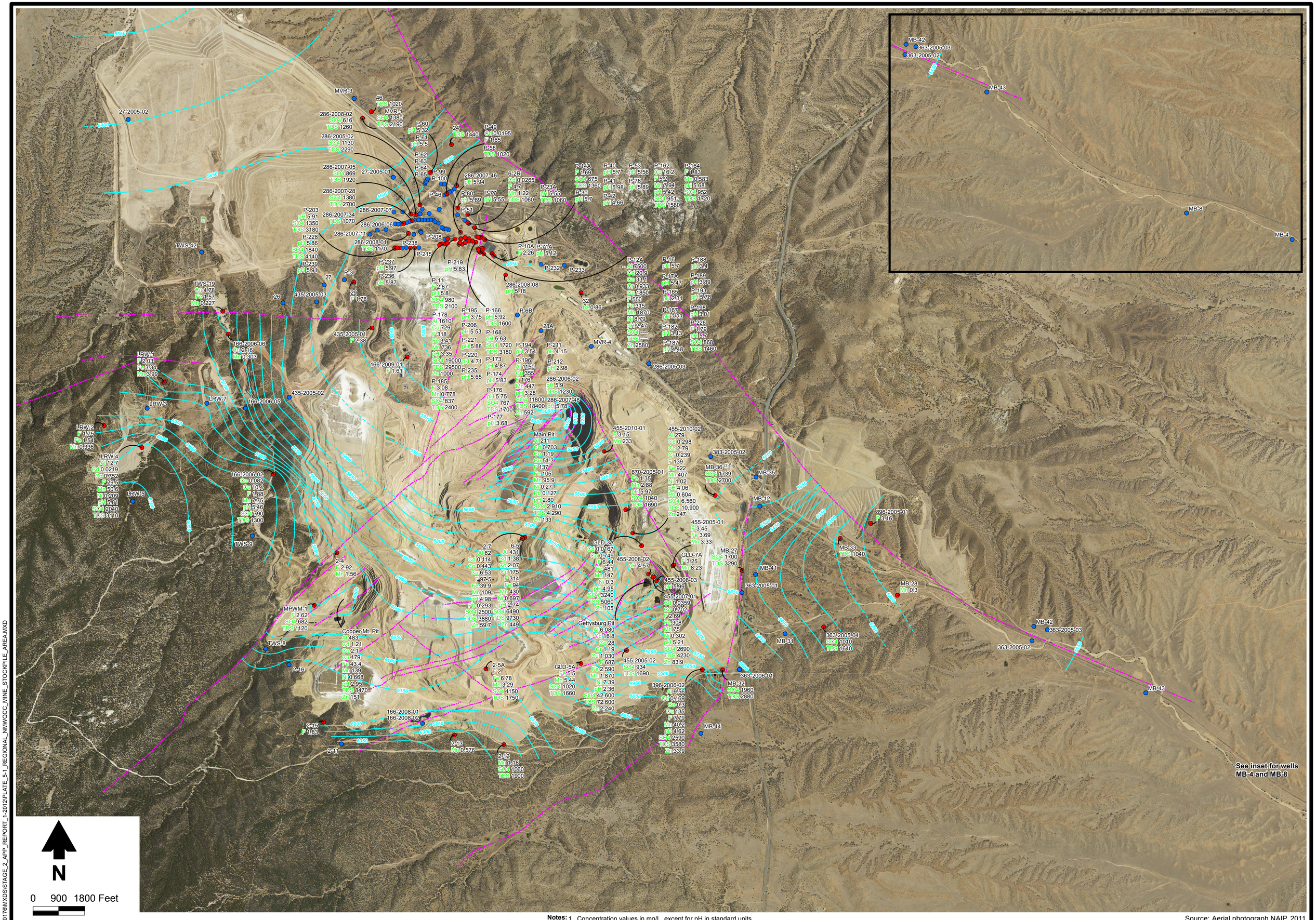
TYRONE STAGE 2 APP

Water Quality for No. 1X Capture System and Nearby Wells

Plate 4-2



Notes:
1. Concentration values in mg/L, except for pH in standard units.
2. Exceedances based on Section 20.6.2.3103 NMAC List A, B, and C standards for most recent sample taken in 2010.
3. Well MB-36 sampled on July 10, 2006, and plugged and abandoned September 14, 2006.

Source: Aerial photograph NAIP, 2011

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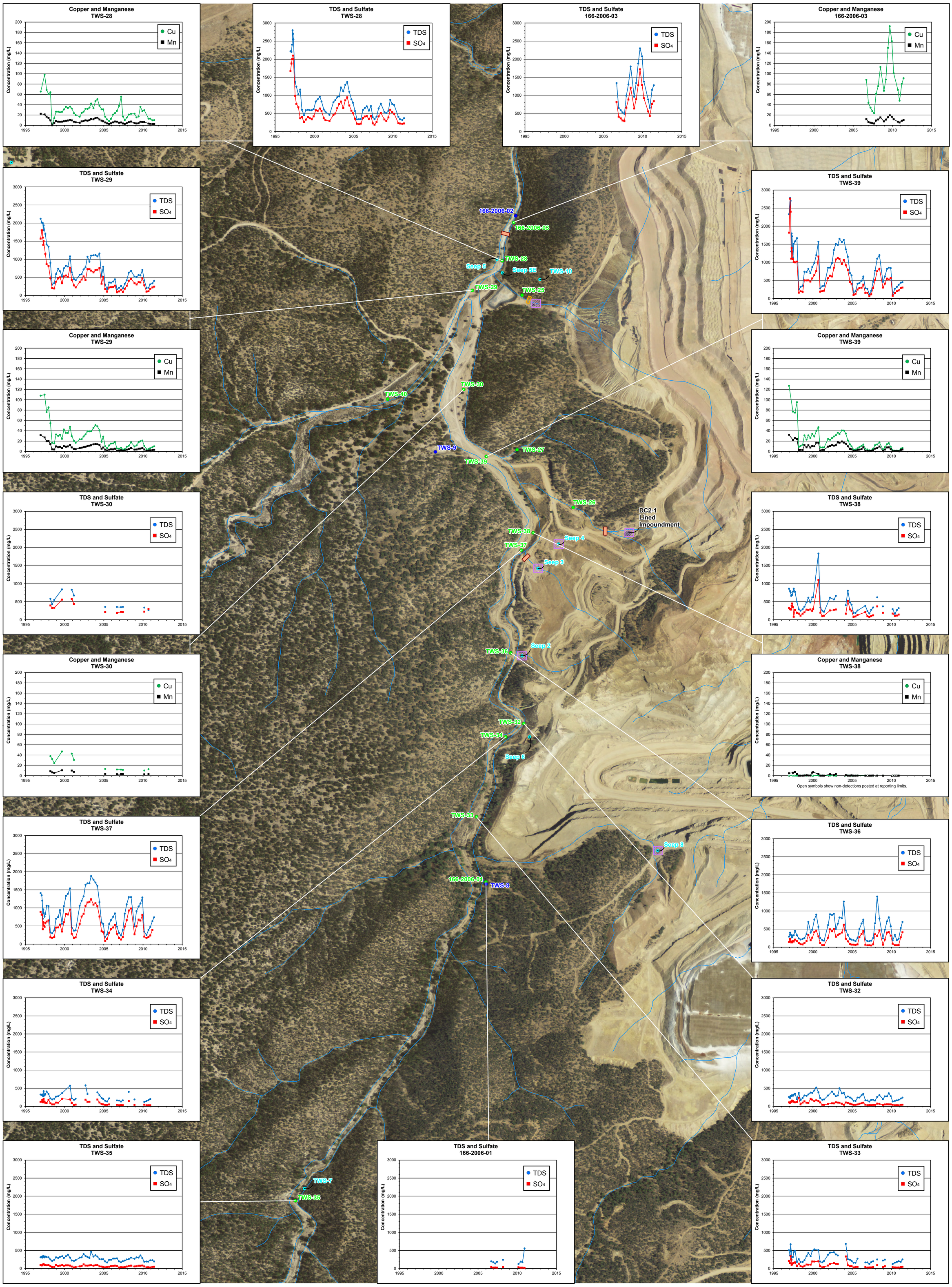
TYRONE STAGE 2 APP

Regional Groundwater Elevation and Water Quality for Mine and Stockpile Area, 2010

Plate 5-1

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\PLATE_6-1_DEADMAN_CANYON_AREA.MXD



Notes:
1. NMWQCC standard for TDS = 1,000 mg/L
2. NMWQCC standard for sulfate (SO_4) = 600 mg/L
3. NMWQCC standard for copper (Cu) = 1.0 mg/L
4. NMWQCC standard for manganese (Mn) = 0.2 mg/L

Source: Aerial photograph NAIP, 2011

N

0 400 800 Feet

Explanation

- Perched zone monitor well
- Regional monitor well
- Seep
- Pre-surface-mining drainage
- Existing perched seepage zone interceptor trench
- Existing seep collection impoundments
- Proposed collector trench (locations are approximate)

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TYRONE STAGE 2 APP

Deadman Canyon Perched Groundwater Quality and Proposed Abatement Measures

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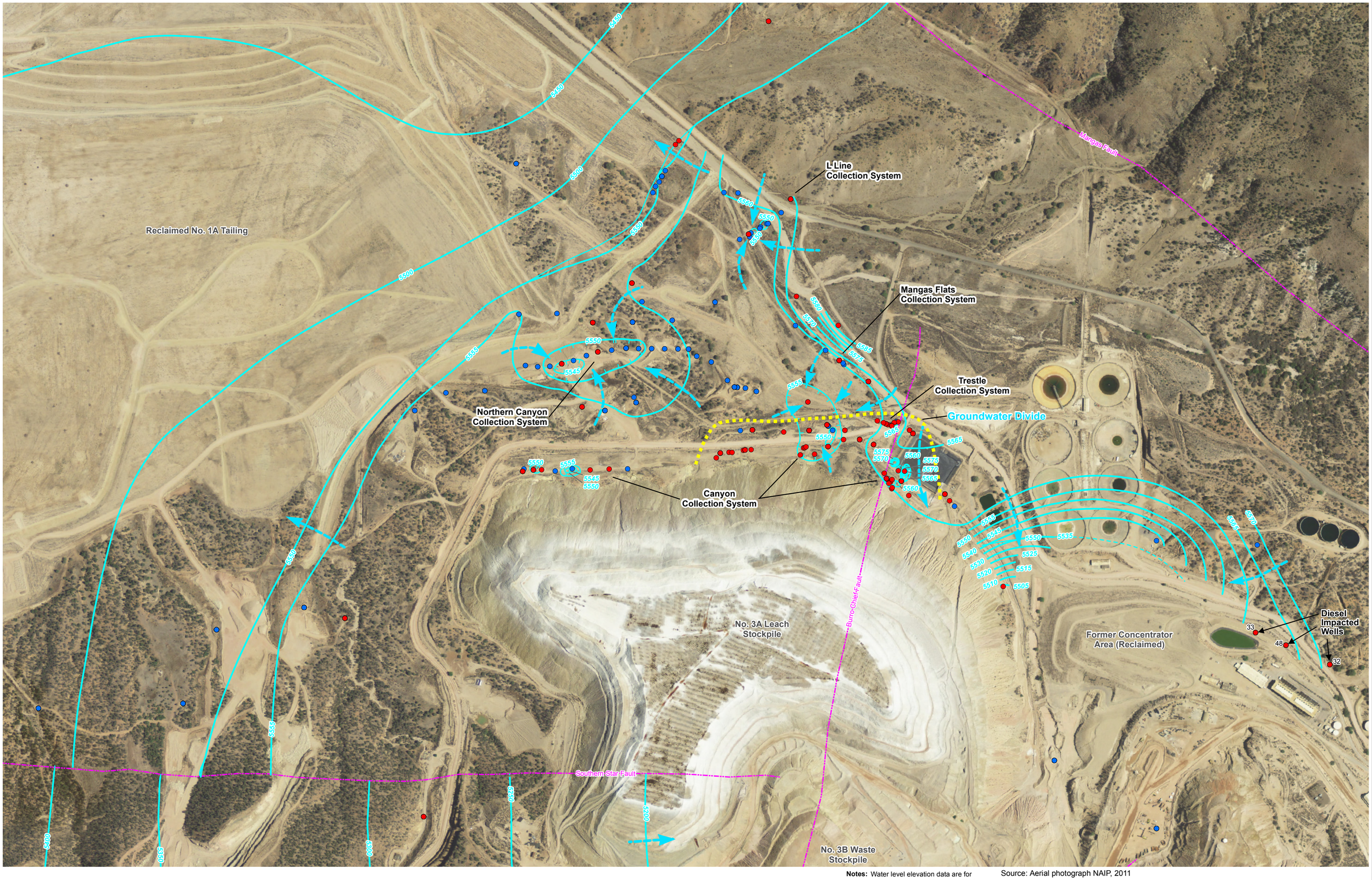
Plate 6-1



Notes: Water level elevation data are for January 1 through March 31, 2011.

Source: Aerial photograph NAIP, 2011

N

0 500 1000 Feet

Explanation

- Sample location equals or exceeds one or more standards
- Sample location below all standards
- Fault
- Water level elevation contour (ft msl)
- Approximate extent of regional groundwater that exceeds standards for constituents in addition to sulfate, TDS and pH
- Groundwater flow direction

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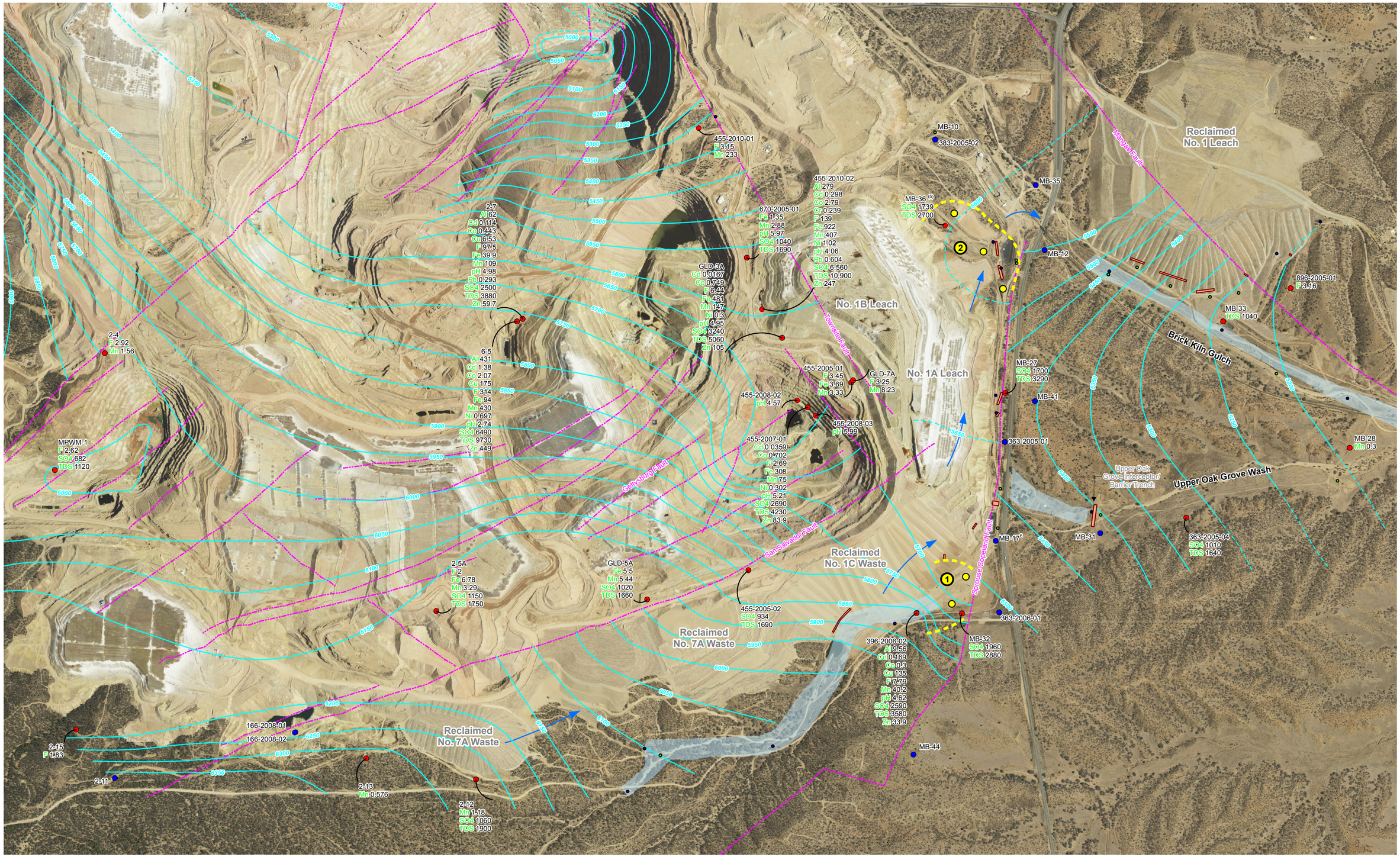
TYRONE STAGE 2 APP

Regional Groundwater Quality and Existing Collection Systems at No. 3 Leach Stockpile Area

Plate 6-2

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\SEEP COLLECIONS.MXD S:\PROJECTS\MINE_TYRONE\GIS\MXDS\STAGE 2 APP REPORT 1-2012\PLATE 6-3_TYRONE_SOUTH SIDE AND NO. 1 STOCKPILE SEEP_COLLECTIONS.MXD



N

0 500 1000 Feet

Explanation

- Monitor well with perched water
- Monitor well with no perched water
- Regional monitor well equals or exceeds one or more standards
- Regional monitor well below all standards
- Hypothetical pumping wells and approximate zone of capture for system pumping of 30 to 50 gpm
- Fault
- Regional water level elevation contour (ft msl), dashed where inferred (contour interval 50 ft)
- General direction of regional groundwater flow
- Existing collector trench
- Estimated extent of perched groundwater (2010)

Notes:
1. Water level elevation data are for October 31 through December 31, 2010.
2. Perched groundwater generally exceeds NMWQCC standards.
3. Concentration values in mg/L, except for pH in standard units.
4. Exceedances based on Section 20.6.2.3103 NMAC List A, B, and C standards for most recent sample taken in 2010.
5. Well MB-36 sampled on July 10, 2006 and plugged and abandoned September 14, 2006.
6. Well MB-17 last sampled on October 16, 2007, and plugged and abandoned on December 13, 2007.

Source: Aerial photograph NAIP, 2011

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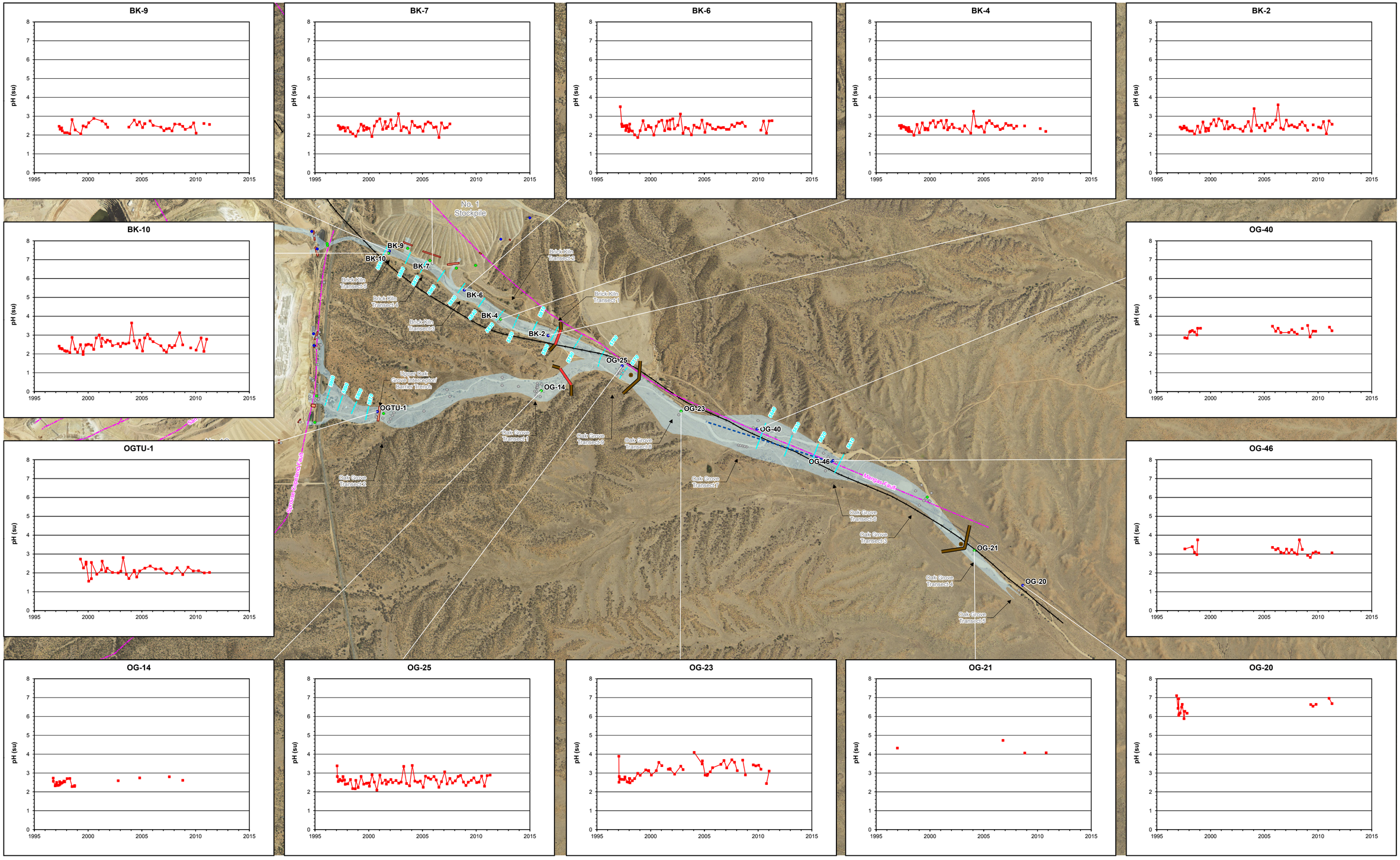
TYRONE STAGE 2 APP

Tyrone South Side and Upper East Side Groundwater Conditions

Plate 6-3



N

0 750 1500 Feet

Explanation

- Monitor well with perched water
- Monitor well with no perched water
- Monitor well (not measured)
- Conceptual horizontal extraction well
- Conceptual permeable reactive barrier or collector trench
- Conceptual low-permeability barrier
- Vertical extraction well
- Fault
- Water level elevation contour (ft msl), representing second quarter 2011 perched zone extent
- Railroad
- Existing collector trench
- Maximum estimated historical extent of perched seepage zone (1998)

Notes:
1. Water level elevation data are for April 1 through June 30, 2011
2. su = standard units
3. NMWQCC standard for pH = 6 to 9 su

Source: Aerial photograph NAIP, 2011

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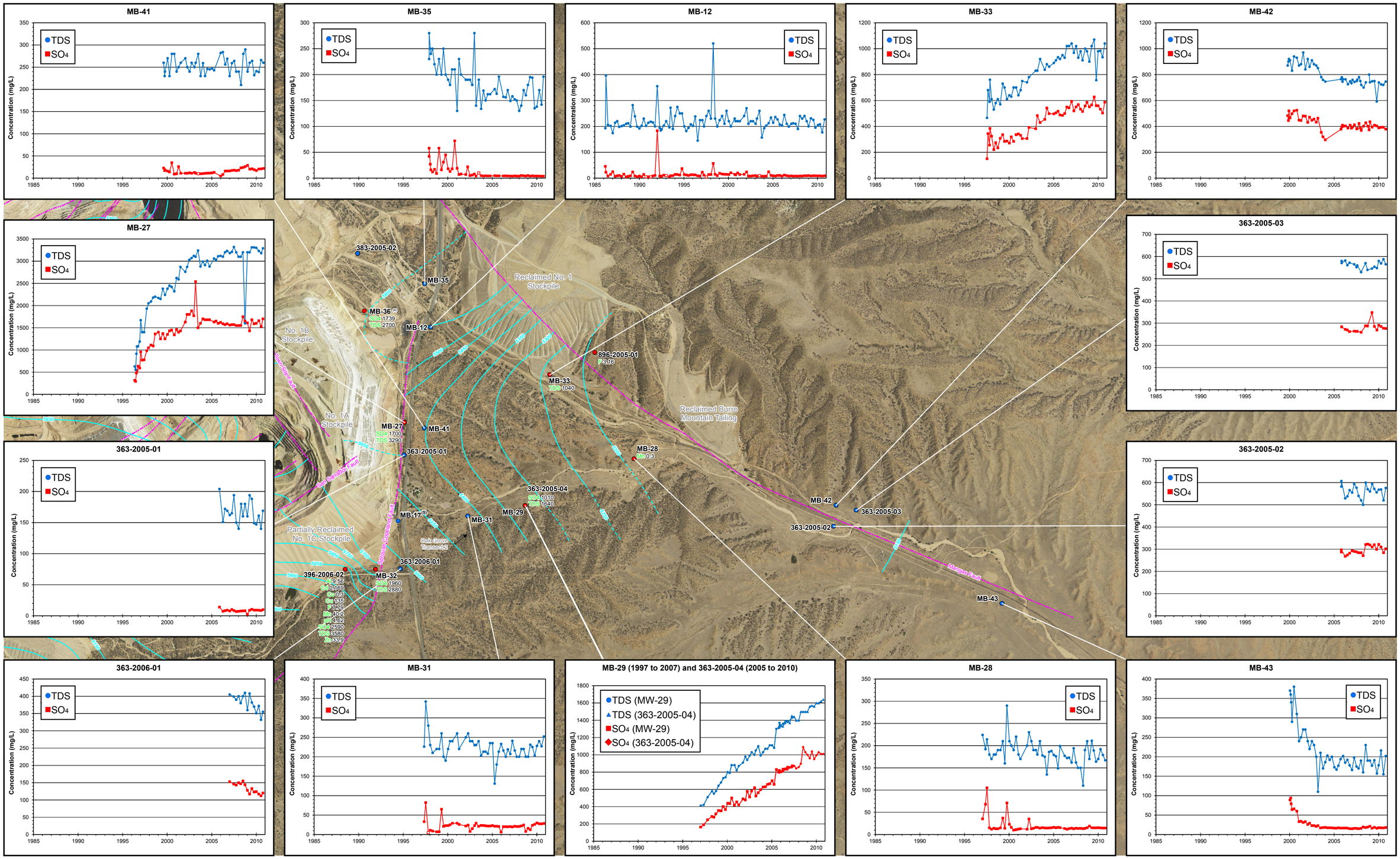
TYRONE STAGE 2 APP

East Side Perched Groundwater pH Time Series and Conceptual Abatement Options

Plate 7-1

S:\PROJECTS\MINE_TYRONE\GIS\MXDS\ES09.0176\MXDS\STAGE_2_APP_REPORT_1-2012\PLATE_7-1_EAST_SIDE_PERCHED_TIMESERIES_PH.MXD



N

0 750 1500 Feet

Explanation

- Sample location equals or exceeds one or more standards
- Sample location below all standards
- Fault
- Water level elevation contour (ft msl), dashed where inferred (contour interval 50 ft)

Notes:
1. Water level elevation data are for April 1 through June 30, 2011.
2. Concentration values in mg/L, except for pH in standard units.
3. Exceedances based on Section 20.6.2.3103 NMAC List A, B, and C standards for most recent sample taken in 2010.
4. Well MB-36 sampled on July 10, 2006, and plugged and abandoned on September 14, 2006.
5. Well MB-17 last sampled on October 16, 2007, and plugged and abandoned on December 13, 2007.
6. NMWQCC standard for TDS = 1,000 mg/L
   NMWQCC standard for sulfate (SO_4) = 600 mg/L

Source: Aerial photograph NAIP, 2011

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TYRONE STAGE 2 APP

East Side Regional Groundwater Quality

Plate 7-2