DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

8 April 2020

Colonel David S. Miller
Commander
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland AFB NM 87117

Mr. Kevin M. Pierard, Chief
Hazardous Waste Bureau (HWB)
New Mexico Environment Department (NMED)
2905 Rodeo Park Drive East, Building 1
Santa Fe NM 87505-6303

Dear Mr. Pierard

Attached please find the Operations and Maintenance Plan Revision 3, Groundwater Treatment System, Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111, Kirtland Air Force Base, New Mexico, dated April 2020. This plan outlines the groundwater treatment system operations, maintenance, monitoring, waste management, and reporting requirements related to the remediation of contaminated groundwater at the Bulk Fuels Facility release site. This updated plan includes documentation for groundwater treatment system upgrades including the installation of a sodium hypochlorite generator, discussion of the granular activated carbon change-outs that were performed last year, and the installation of a supervisory control and data acquisition system.

If you have any questions or concerns, please contact Mr. Sheen Kottkamp at commercial line (505) 846-7674 or email sheen.kottkamp.1@us.af.mil.

Sincerely

DAVID S. MILLER, Colonel, USAF
Commander

Attachment:
Operations and Maintenance Plan Revision 3, Groundwater Treatment System, Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111, Kirtland Air Force Base, New Mexico, dated April 2020; 2 Hard Copies/2 CDs

cc:
NMED-OOTS (Pruett), letter
NMED-OOTS (McQuillan), letter and CD
NMED HWB (Cobrain), letter and CD
NMED GWQB (Hunter), letter and CD
NMED Resource Protection Division (Stringer), letter and CD
EPA Region 6 (King, Ellinger), letter and CD
COA (Ziegler), letter and CD
ABCWUA (Agnew), letter and CD
SAF-IEE (Lynnes), electronic only
AFCEC/CZ (Cash, Clark, Kottkamp, Segura, Fitzner), electronic only
USACE-ABQ District Office (Moayyad, Phaneuf, Dreeland, Cordova, Kunkel), electronic only
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

OPERATIONS AND MAINTENANCE PLAN
GROUNDWATER TREATMENT SYSTEM
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111
REVISION R3

APRIL 2020

377 MSG/CEI
2050 Wyoming Boulevard Southeast
Kirtland Air Force Base, New Mexico 87117-5270

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

OPERATIONS AND MAINTENANCE PLAN
GROUNDWATER TREATMENT SYSTEM
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111

April 2020

Revision 3

Prepared for
Kirtland Air Force Base
2050 Wyoming Boulevard SE
Kirtland Air Force Base, New Mexico 87117-5270

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9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Corps of Engineers–Albuquerque District 4101 Jefferson Plaza Northeast Albuquerque, New Mexico 87109-3435	**10.SPONSOR/MONITOR'S ACRONYM(S)** **11. SPONSOR/MONITOR'S REPORT NUMBER(S)**
12. DISTRIBUTION/AVAILABILITY STATEMENT	
13. SUPPLEMENTARY NOTES	

14. ABSTRACT

This Operations and Maintenance (O&M) Plan for the groundwater treatment system (GWTS) was prepared for the Kirtland Air Force Base Bulk Fuels Facility (BFF), Solid Waste Management Units ST-106/SS-111 located in Albuquerque, New Mexico. This Plan was prepared in accordance with all applicable federal, state, and local laws and regulations, including the New Mexico Hazardous Waste Act (and regulations) and the New Mexico Water Quality Act (and regulations). The GWTS has been installed as an interim measure to collapse and contain the ethylene dibromide groundwater plume from the BFF site in order to protect Albuquerque, Kirtland Air Force Base, and the Raymond G. Murphy Veterans Affairs Medical Center drinking water supply wells. The GWTS currently includes groundwater extraction wells and groundwater treatment using carbon adsorption. Treated groundwater is utilized for irrigation or injected into the aquifer under an approved underground injection control discharge permit. This O&M Plan is intended to assist personnel in successfully operating the GWTS and serves as a resource for equipment information, operational procedures, inspections and maintenance, repairs, recordkeeping, and waste management.

15. SUBJECT TERMS
Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111, interim measures, RCRA, groundwater sampling, groundwater treatment system operation, granular activated carbon, ethylene dibromide, underground injection control

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a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			Scott Clark
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DAVID S. MILLER, Colonel, U.S. Air Force
Commander, 377th Air Base Wing

8 April 2020
Date

This document has been approved for public release.

KIRTLAND AIR FORCE ~~BASE~~
377th Air Base Wing Public Affairs

8 APR 20
Date

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PREFACE

This Operations and Maintenance Plan for the groundwater treatment system (GWTS) was prepared for the U.S. Army Corps of Engineers. It pertains to the Kirtland Air Force Base Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111 located in Albuquerque, New Mexico. This Plan was prepared in accordance with all applicable federal, state, and local laws and regulations, including the New Mexico Hazardous Waste Act and the New Mexico Water Quality Act (New Mexico Statutes Annotated 1978), the New Mexico Hazardous Waste Management Regulations, and the Water Quality Control Commission Regulations.

This Operations and Maintenance Plan for the GWTS contains the necessary information to conduct operations at the GWTS.

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REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
8/2016	0	Baseline document	None
9/2017	1	Front Matter	Added notice and revised preface
		Executive Summary	Revised permit and agreement citations
		Section 1 – Introduction	Revised all subsections to include KAFB-106239, operational changes, and permit requirements (DP-1839)
		Section 2 – Operation of the Groundwater Treatment System	Revised all subsections to reflect changes in system programming; added pending installation items and system utilities information
		Section 3 – Inspection and Preventative Maintenance	Added subsections for additional maintenance activities including pending installation items
		Section 4 – System Troubleshooting	Added this section to document nonstandard operational procedures
		Section 5 – Process Monitoring	Revised all subsections to provide more accurate description of process monitoring activities
		Section 6 – Recordkeeping	Revised all subsections to provide compliance with DP-1839
		Section 7 – Waste Management	Revised text and added subsections for additional waste streams identified and created with pending installation items
		References	Revised references
		Figures	Removed Figure 1-1 extent of ethylene dibromide plume as updated plume maps are provided in quarter monitoring reports, Figure 1-2 Site Map was revised to include new proposed conveyance line
		Tables	Added the following tables: 1-1 Applicable Permits 1-2 Permit Terms and Conditions, Operations and Maintenance Plan Cross References 2-2 Permitted Extraction Well Flow Rates 2-3 Standard Operational Set Points 3-1 Groundwater Treatment System Routine Maintenance Schedule 3-2 Specific Consumable Product Codes, Suppliers, and Recommended On-Hand Inventory 3-3 Consumable Supply Inventory 3-4 Large Item Inventory 5-1 Influent Criteria 6-1 Reports and Recipients

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
9/2017	1	Appendix A – Permits and Agreements	Revised to contain copies of regulatory approvals and permits as well as access agreements instead of a description of those items
		Appendix B – Health and Safety	Added the following to the list of hazards: Hearing damage hazards Pinch points (lift gates, vault lids) Hand tool use Respiratory hazards (granular activated carbon fines)
		Appendix C – Organization and Responsibilities	Updated organization structure
		Appendix D – Description of Groundwater Treatment System Equipment and Facilities	Revised to reflect equipment adjustments, added pending installation equipment descriptions, and references
		Appendix E – Description of Groundwater Treatment System Equipment/Instrument Location Pictures	Revised to reflect equipment adjustments
		Appendix F – Process Control Description	Revised to reflect equipment adjustments, programming changes, and added pending installation equipment control descriptions
		Appendix G – Human Machine Interface Screens	Revised to reflect programming changes
		Appendix H – Design Calculations for Carbon Vessel Media Beds	Added manufacturer modeled granular activated carbon usage rates at two theoretical higher influent concentrations
		Appendix I – Groundwater Treatment System Operations Log Sheets and Record Forms	Revised to reflect Train 2 expansion and new equipment
		Appendix J – Manufacturers' Literature	Revised by adding in the Train 2 expansion equipment literature
		Appendix K – Contingency Plan	Revised to maintain compliance with DP-1839, access agreements, update emergency response table, and added references
		Appendix L – Sampling and Analysis Plan	Revised for compliance with DP-1839 and provide more detailed description of driving factors as well as monitoring locations and added references
		Appendix N – User Operational Adjustments Documentation	Added to provide documentation of changes made to the system that deviate from as-built drawings or operational set points
		Appendix O – Well Construction Diagrams and Borehole Logs	Added to provide extraction and injection well information readily to operators
9/2017	1	Appendix P – Example Reports	Added to provide examples of report structures and ensure compliance with relevant permits
		Appendix Q – Technical Memorandum	Added to provide approved technical memoranda that are applicable to the groundwater treatment system.

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
5/2018	2	Front Matter	Added revision tracking table
		Section 1 – Introduction	Revised to include newly installed equipment
		Section 2 – Operation of the Groundwater Treatment System	Revised to include newly installed Treatment Train 2 equipment and equipment pending installation
		Section 3 – Inspection and Preventative Maintenance	Revised to include newly installed equipment maintenance and maintenance for equipment pending installation; added flowmeter verification testing Subsection 3.17
		Section 4 – System Troubleshooting	Added Subsections 4.3 KAFB-7 Hydraulic Pump Overload Reset and 4.4 KAFB-106233 and KAFB-106234 Start Order
		Section 5 – Process Monitoring	Minor text revisions
		Section 6 – Recordkeeping	Minor text revisions
		Section 7 – Waste Management	Added Kirtland Air Force Base Hazardous Materials Group management information
		Figures	Revised Figure 1-1 to show KAFB-106239 conveyance line as installed
		Tables	Revised the following tables: Added clarification to Table 2-2 Revised Table 2-3 to reflect required operational and programing changes Added skimming to Table 3-1 Added sand filter consumables to Table 3-2 Added tools to Table 3-3
		Appendix A – Permits and Agreements	No revisions
		Appendix B – Health and Safety	Added the following hazards: Exposure to oxidants (sodium hypochlorite) Respiratory hazards (sand filter media [DMI-65])
		Appendix D – Description of Groundwater Treatment System Equipment and Facilities	Revised text to properly refer to newly installed equipment as installed rather than pending installation.
		Appendix E – Description of Groundwater Treatment System Equipment/Instrument Location Pictures	Added photographs of newly installed equipment including sand filters, clarifier, KAFB-196239 wellhead and control panel
		Appendix F – Process Control Description	Revised the control description to reflect programming changes
		Appendix G – Human Machine Interface Screens	Revised the screens to reflect programming changes
		Appendix I – Groundwater Treatment System Operations Log Sheets and Record Forms	Revised forms to reflect equipment additions
		Appendix J – Manufacturers' Literature	Added construction as-builts, basis of design (includes manufacturers' literature) for sand filters, and manufacturers' literature for equipment associated with KAFB-106239

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
5/2018	2	Appendix L – Sampling and Analysis Plan	Clarified requirements that result in extraction well sampling; revised to ensure compliance with DP-1839
		Appendix O – Well Construction Diagrams and Borehole Logs	Updated KAFB-106239 construction diagram
		Appendix P – Example Reports	Revised to most recent report examples
		Appendix R – Approved Standard Operating Procedures	New appendix added to provide approved standard operating procedures that are applicable to the groundwater treatment system
6/2019	3	Front matter	Updated name of responsible person. Removed Notice page
		Section 1 – Introduction	Added sodium hypochlorite generator to list of GWTS expansion items, and added bulletin board to Health and Safety section
		Section 2 – Operation of the Groundwater Treatment System	Added special GAC sampling procedure reference, KAFB-7 V-smart valve updates, and minor text edits
		Section 3 – Inspection and Preventative Maintenance	Added details on sodium hypochlorite generator and associated shutdown procedure, and added reference for TIGG GAC change-out procedure
		Section 4 – System Troubleshooting	Added preface to KAFB-7 V-smart valve section indicating its absence in the system
		Section 5 – Process Monitoring	Revised for new water level transmitters in extraction wells and injection well
		Section 8 – References	Revised references
		Figures	Updated Figure 1-1 for updated EDB plume
		Tables	Revised the following tables: Included set points on Table 2-1 Updated set point ranges on Table 2-3 Updated Table 3-1 for regular disinfection Added food grade salt for brine tank to Table 3-2 Updated Table 3-3 Added emergency conveyance line material and water trailer to Table 3-4
		Appendix A – Permits and Agreements	Added three NMED approval letters
		Appendix C – Organization and Responsibilities	Revised for staffing changes, general edits
		Appendix D – Description of Groundwater Treatment System Equipment and Facilities	Added details on sodium hypochlorite generator, removed KAFB-7 V-smart valve descriptions, and added documents for water trailer as attachments; updated extraction well pump depths; updated for new SCADA system and clarifier drain line
		Appendix E – Description of Groundwater Treatment System Equipment/Instrument Location Pictures	Updated for sodium hypochlorite generator, and associated equipment; updated for basket strainers, SCADA computer, bypasses, and clarifier drain line
		Appendix F – Process Control Description	Added sodium hypochlorite generator controls and interlocks, and removed KAFB-7 V-smart control valve descriptions; updated language for SCADA

REVISION TRACKING

Date	Revision	Section Changed	Description of Changes
		Appendix G – Supervisory Control and Data Acquisition and Human Machine Interface Screens	Included SCADA screenshots
		Appendix I – Groundwater Treatment System Operations Log Sheets and Record Forms	Updated field forms
		Appendix J – Manufacturers' Literature	Added sodium hypochlorite generator documentation, the TIGG GAC change-out procedure as an attachment, the new basket strainers, and a procedure for emergency conveyance line repairs
		Appendix L – Sampling and Analysis Plan	Added GAC special sampling flow chart as attachment, and reference within appendix text; extraction well annual sampling data change. Added Table L-6 Field Measurement Frequency
		Appendix O – Well Construction Diagrams and Borehole Logs	Updated KAFB-7 well construction diagram; updated KAFB-106228, KAFB-106234, and KAFB-106239 construction diagrams. Added conceptual design schematics for new UIC wells.
		Appendix P – Example Reports	Updated reports and recipients list
		Appendix R – Approved Standard Operating Procedures	Updated for new revision 1 of Standard Operating Procedure for Cleaning and Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells
3/2020	3	Appendices	Removed Appendices B, K, and R as directed

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F Supervisory Control and Data Acquisition and Human Machine Interface Screens

G Design Calculations for Carbon Vessel Media Beds

H Groundwater Treatment System Operations Log Sheets and Record Forms

I Manufacturers' Literature

J Sampling and Analysis Plan

K Waste Characterization Documentation

L User Operational Adjustments Documentation

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AWWA	American Water Works Association
BFF	Bulk Fuels Facility
CFR	Code of Federal Regulations
DP	discharge permit
EDB	ethylene dibromide
GAC	granular activated carbon
GCMP	Golf Course main pond
gpm	gallon(s) per minute
GWTS	groundwater treatment system
HDPE	high density polyethylene
mg/L	milligram(s) per liter
NMED	New Mexico Environment Department
No.	Number
O&M	operations and maintenance
PLC	programmable logic controller
psi	pound(s) per square inch
psig	pound(s) per square inch gauge
RCRA	Resource Conservation and Recovery Act
SCADA	supervisory control and data acquisition
SWMU	Solid Waste Management Unit
UIC	underground injection control
VFD	variable frequency drive
WCH	well control house

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EXECUTIVE SUMMARY

This Operations and Maintenance (O&M) Plan for the groundwater treatment system (GWTS) was prepared for the Bulk Fuels Facility (BFF), Solid Waste Management Units (SWMUs) ST-106/SS-111 located at Kirtland Air Force Base (AFB), New Mexico. The GWTS was installed as part of the ongoing interim measures for groundwater remediation at SWMUs ST-106/SS-111 pursuant to the Resource Conservation and Recovery Act Hazardous Waste Treatment Facility Operating Permit Number NM9570024423 (New Mexico Environment Department, 2010). This Plan was prepared in accordance with all applicable federal, state, and local laws and regulations.

The GWTS has been installed as an interim measure to collapse and contain the ethylene dibromide groundwater plume from the BFF site, in order to protect Albuquerque Bernalillo County Water Utility Authority, Kirtland AFB, and the Raymond G. Murphy Veterans Affairs Medical Center drinking water supply wells. The GWTS currently includes groundwater extraction wells and groundwater treatment using carbon adsorption. Treated groundwater is utilized for irrigation or injected into the aquifer. This O&M Plan is intended to assist personnel in successfully operating the GWTS and serves as a resource for equipment information, operational procedures, inspection and maintenance, repairs, recordkeeping, and waste management.

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1. INTRODUCTION

This Operations and Maintenance (O&M) Plan is intended to assist personnel in successfully operating the groundwater treatment system (GWTS) to treat and collapse the ethylene dibromide (EDB) groundwater plume from the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF) site. This Plan serves as a resource for the following:

- Equipment information (one-stop for manufacturer-supplied catalog cuts and O&M manuals)
- Operational procedures
- Inspections and maintenance
- Troubleshooting
- Repairs
- Recordkeeping
- Waste management.

This O&M Plan contains the following appendices to support the above items:

- Appendix A – Permits and Agreements
- Appendix B – Organization and Responsibilities
- Appendix C – Description of GWTS Equipment and Facilities
- Appendix D – Process Drawings and GWTS Equipment/Instrument Location Pictures
- Appendix E – Process Control Description
- Appendix F – Supervisory Control and Data Acquisition (SCADA) and Human Machine Interface Screens
- Appendix G – Design Calculations for Carbon Vessel Media Beds
- Appendix H – GWTS Operations Log Sheets and Record Forms
- Appendix I – Manufacturers' Literature
- Appendix J – Sampling and Analysis Plan
- Appendix K – Waste Characterization Documentation
- Appendix L – User Operational Adjustments Documentation
- Appendix M – Well Construction Diagrams and Borehole Logs
- Appendix N – Example Reports
- Appendix O – Technical Memorandum.

A copy of the most recent version of this Plan is kept onsite at the GWTS at all times.

1.1 Site Description

Kirtland AFB is located in Bernalillo County in central New Mexico, southeast of the City of Albuquerque and adjacent to the Albuquerque International Sunport. The BFF is located in the northwestern portion of Kirtland AFB and is the source for the Solid Waste Management Units (SWMUs) ST-106/SS-111. The overall layout of the extraction wells, conveyance lines, GWTS, the Tijeras Arroyo Golf Course main pond (GCMP), injection well KAFB-7, and proposed Underground Injection Control (UIC) well KAFB-106IN2 are shown on Figure 1-1.

1.2 Overall System Description

The system currently includes four extraction wells located north of Kirtland AFB (Figure 1-1). Contaminated groundwater from the extraction wells is pumped to the GWTS through double-walled, high density polyethylene (HDPE) pipe equipped with leak detection. Off-Base, the influent piping is installed below ground along rights-of-way and alleys and on-Base in existing utility corridors. The conveyance line from extraction well KAFB-106239 is connected below grade with a Y-junction to the conveyance line for extraction well KAFB-106228 that runs directly to the GWTS. The conveyance lines from wells KAFB-106233 and KAFB-106234 run to a well control house (WCH) located on-Base. The combined flow from KAFB-106233 and KAFB-106234 is conveyed from the WCH through a single conveyance line to the GWTS. Construction diagrams and borehole logs for extraction wells are provided in Appendix M.

The GWTS treatment plant is located on Ridgecrest Drive Southeast on Kirtland AFB in the former Zia Park housing neighborhood. The building has three entrances, which are all locked to prevent unauthorized access. The system is designed to treat up to 800 gallons per minute (gpm) of non-hazardous, contaminated groundwater; each of two treatment trains can treat up to 400 gpm. Each treatment train is comprised of the following (Appendix D):

- Pre-treatment influent equalization tank (6,000-gallon capacity)
- Pre-treatment free chlorine analyzer and dosing station
- Two pre-treatment influent pumps (400-gpm combined flow capacity)
- Two pre-treatment sand filters (477-gpm combined flow capacity)
- Two pre-treatment bag filter units (six bag filters per unit)
- Two carbon vessels (20,000 pounds of carbon per vessel)
- One treated water storage tank (6,000-gallon capacity)
- One treated effluent pump (400-gpm flow capacity)
- Two post-treatment bag filter units for treated water (six bag filters per unit).

Multiple improvements have been performed to the GWTS in accordance with the approved work plan (Kirtland AFB, 2017). These improvements did not result in changes to effluent concentrations of remedial goals. The GWTS was expanded with a second treatment train in 2017. In 2018, pretreatment sand filters were installed to sequester any excess dissolved iron or manganese and suspended solids, including biological material entering the system. Extraction well KAFB-106239 was connected to the GWTS in 2018 via double-walled HDPE, well extraction equipment, and wellhead instrumentation for flow control and communication. In addition, significant upgrades were made to monitoring devices and transmitters (flow, pressure, etc.) as well as the programmable logic controller (PLC) and the SCADA system. The SCADA system replaced the human machine interface system in 2019. A sodium hypochlorite generator system was installed in 2018 to facilitate pretreatment sodium hypochlorite injection, and to negate the need for the Operator to handle high concentrations of sodium hypochlorite. Basket strainers replaced the influent Y-strainers in 2019, which increases the ease of cleaning the screens and negates the need to shut down either or both trains. Additionally, in 2019, bypass lines were installed around the sand filters and the influent tree, and a drain line was installed at the clarifier to prevent high-leveling the clarifier and negate the need to manually pump the clarifier. In 2020, check valves were installed on the effluent lines of Trains 1 and 2.

The treated groundwater is transported via a single-walled HDPE pipe to a junction with an existing pipeline that connects well KAFB-7 to the GCMP. Treated water can also be diverted to UIC well KAFB-106IN2 (once in operation) from the main effluent conveyance line via piping to the well. During the summer months, the treated water is predominantly used to irrigate the golf course. During the winter months, when the demand for irrigation water is reduced, the excess treated water is injected into the

aquifer through KAFB-7 and KAFB-106IN2 in accordance with an UIC Discharge Permit (DP)-1839 (Appendix A-1; New Mexico Environment Department [NMED], 2017). A schematic of the injection equipment in KAFB-7 and conceptual schematics of KAFB-106IN2 are provided in Appendix M.

1.3 Discharge Requirements

The GWTS supports a groundwater treatment interim measure that is being implemented pursuant to the Resource Conservation and Recovery Act (RCRA) corrective action provisions in Part 6 of Kirtland AFB's Hazardous Waste Treatment Facility Operating Permit (Permit Number [No.] NM9570024423 [RCRA Permit]). Applicable state permits pertaining to GWTS effluent discharge are provided in Appendix A. Treated groundwater is either injected into the aquifer in accordance with DP-1839 or discharged to the GCMP in accordance with the April 4, 2016 letter from the NMED Hazardous Waste Bureau (NMED, 2016) (Table 1-1). All requirements from the associated applicable permits are strictly adhered to, such as discharge time limits or flow rates to any specific location. Table 1-2 provides each relevant permit term and condition and where each of the applicable items is addressed in this O&M Plan.

The GWTS has been designed to treat groundwater to meet the New Mexico Water Quality Control Commission water quality standards (20.6.2.3103 and 20.6.2.4103 New Mexico Administrative Code) and the drinking water maximum contaminant levels adopted by the U.S. Environmental Protection Agency under the Federal Safe Drinking Water Act (42 U.S. Code §§ 300f to 300j-26). GWTS effluent must comply with any applicable permit or regulatory requirements. The Sampling and Analysis Plan (Appendix J) contains the necessary reporting requirements, while Appendix C within the DP-1839 permit provides corrective actions to be enacted in the event of an exceedance of the discharge criteria.

1.4 Health and Safety

The foremost priority in operating the GWTS is to ensure the health and safety of the GWTS control operators (Operators), visitors, and nearby residents. Activities follow health and safety guidelines of a U.S. Air Force or U.S. Army Corps of Engineers-approved safety plan or other approved safety document. Emergency contact information placards are placed on all doors of the GWTS and WCH, and on a bulletin board installed within the GWTS. Copies of the Contingency Plan and its map of evacuation routes and mustering area are attached to the inside surface of all doors of the GWTS.

1.5 Organization and Responsibilities

The organization chart and roles and responsibilities for the operation of the GWTS are provided in Appendix B.

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2. OPERATION OF THE GROUNDWATER TREATMENT SYSTEM

Descriptions of the GWTS equipment and facilities are provided in Appendix C. A flow diagram and piping and instrumentation diagrams for the GWTS are provided in Appendix D. The GWTS is highly automated. The GWTS control system is programmed to automatically perform normal plant operations and to safely shut down the system under fault conditions. The PLC notifies the Operators of fault conditions and shutdowns via email. A summary of main alarms is provided in Table 2-1.

This section is intended to provide only an overview of system operation. Appendix E provides a more detailed account of the function of all instruments and control elements in the system and the actions of all interlocks and shutdowns. Screen capture printouts of the SCADA screens are provided in Appendix F. The PLC and SCADA are installed in the treatment plant's main control panel (CP-100).

2.1 Groundwater Treatment System Operational Approach

Groundwater pumped from the extraction wells is collected into the GWTS influent tanks (TK-110 and TK-210). The GWTS influent pumps (P-112 A/B and P-212 A/B) transfer the water from the influent tank through the pre-treatment sand filters (SF-101 and SF-102), bag filters (F-112 A/B and F-212 A/B), carbon beds (V-114 A/B and V-214 A/B), and into the treated water tanks (TK-116 and TK-216). The treated effluent pumps (P-118 and P-218) transfer the water through the post-treatment bag filters (F-118 A/B and F-218 A/B) and the effluent conveyance line to either the GCMP, KAFB-7, KAFB-106IN2, or a future UIC well.

As the aquifer responds to extraction well operation, adjustments to the extraction well operation are made to ensure plume containment. Plume containment is evaluated in the Kirtland AFB BFF Quarterly Reports and recommendations for changes in extraction well operation are provided therein to comply with DP-1839 (Table 1-2; Condition No, 22.e). NMED is notified of any planned long-term adjustments via email prior to such changes being implemented. Temporary adjustments associated with an emergency, GWTS O&M, or system testing may occur, and NMED is notified of these changes during the following weekly status update.

The control mode for the feed rate to the carbon vessels depends on the amount of groundwater produced by the extraction wells. The minimum recommended groundwater flow rate into the carbon vessels is 120 gpm, which provides uniform flow distribution through the carbon bed. The feed rate to the carbon beds is controlled by a preset influent flow rate set by the Operator. The combined flow rate through the influent skids of both treatment trains is set to exceed the incoming flow rate produced by the extraction wells to ensure that the extraction wells remain online constantly during operation. The PLC controls the level in the tanks by cycling the pumps immediately downstream of the tank off or on when a preset tank level is reached. If only one extraction well is online, groundwater flow to the GWTS may be below 120 gpm. In this case, one treatment train can be placed in operation at an operator specified flow rate and the PLC cycles the influent pumps on and off to maintain adequate flow through the carbon bed. The effluent flow rate is set by the Operator to exceed the influent pumping rate to ensure that the effluent tank does not overfill. The effluent train discharge pressure is controlled by an electronically actuated valve that provides backpressure on the effluent pumps to limit cavitation.

2.2 Groundwater Well Pumps and Flow Control

Under normal conditions, well pumps are typically started by activating either train control switch with the well pumps placed in sequence mode on the SCADA. Well pumps cannot start and, if running, shut down under the following conditions:

- Switched on the SCADA to the Off position
- Low water level in the well
- Low current draw by the pump (for P-101 only, indicating run-dry condition)
- Leak detection in any vault or conveyance line associated with that well
- High-high water level in the GWTS influent tank or clarifier
- High-high water level in either GWTS building sumps
- Loss of power at the GWTS or wellhead
- Leak detection in the WCH (for KAFB-106233 and KAFB-106234).

Manual on/off switches for the well pumps are available in the SCADA and in the electrical shed at well KAFB-106228, the control panel at KAFB-106239, and at the WCH for KAFB-106233 and KAFB-106234. These local switches may be used for maintenance and troubleshooting pump problems but shall not be used during unmanned operation as they override PLC interlocks. Each extraction well has a maximum flow rate that can be extracted from the well, as permitted by the New Mexico Office of the State Engineer (Table 2-2). Extraction wells are equipped with totalizing, magnetic flowmeters and have been constructed to maximize water conservation to the maximum extent practical. Extraction wells cannot be operated in the event that a malfunction is detected with the totalizing flowmeter until the flowmeter is repaired or replaced.

2.3 Influent Tank, Pumps, and Pretreatment Sand Filters

The GWTS influent pumps, level in the GWTS influent tanks, and differential pressure across the pre-treatment bag filters are controlled and monitored by the PLC. The only Operator actions required during normal operations are to set the influent pump flow rates for the influent pump skids, put the control of the influent pumps into sequence using the SCADA, and change bag filters when the differential pressure across the pretreatment bag filters exceeds the differential pressure threshold (10-15 pounds per square inch [psi]). Pump sequence number determines which pump (A or B) is active during times when only a single influent pump is required to provide the preset system flow rate (<200 gpm per train). If the pump first in the sequence fails, the pump second in the sequence activates and continues processing water. In the event that one influent pump cannot satisfy the preset system flow rate (>200 gpm per train), the second pump is placed into the same sequence number as the operating pump; this activates the second pump and balances the flow load between the two pumps. Manual on/off switches for the GWTS influent pumps are provided in the SCADA and on the variable frequency drive (VFD) panels to the pumps to aid with maintenance and troubleshooting but cannot be used during unmanned operation as they override PLC interlocks. The GWTS influent pumps are interlocked to shut down under the following conditions:

- Switched to the Off position on the SCADA
- Switched both pumps on the SCADA to the zero sequence
- High-high water level in treated water storage tank or clarifier
- High-high water level in GWTS building sumps
- Low-low water level in GWTS influent tank
- High pump-outlet pressure
- High inlet pressure to the carbon vessels.

Pre-treatment sand filters are installed on each train between the influent pumps and the pre-treatment bag filters to remove excess dissolved iron and manganese as well as capture any suspended solids, including biological material, entering the system. The sand filters can be bypassed by the isolation of butterfly valves at the inlets and outlets of the sand filters and by opening the butterfly valve at the bypass line. The sand filters remove excess dissolved metals by advanced oxidation processes that occur on the

surface of catalytic media that causes the precipitation of metal oxides. Further description of these advanced oxidation processes is provided in Appendix I. The metal oxides are then captured by the filter and removed from the system via backwashing. Backwashing is manually activated by the Operator or occurs when differential pressure across a sand filter unit exceeds 10 psi from the clean operating differential pressure. Once activated, the sand filter controller actuates the appropriate valves to backwash the system for 4 minutes per sand filter vessel (two vessels per train). The system issues an alarm through the SCADA that backwash is occurring, and backwash water is transferred and stored in a clarifier located on top of the truck sump outside of the GWTS. The clarifier is equipped with a high-water level switch that alerts Operators that the clarifier is nearing capacity and results in a system-wide shutdown. Water is automatically drained from the clarifier to the internal sump through a drain line that runs through the southern wall of the GWTS building to the western edge of the internal sump. If necessary, water can be manually transferred from the clarifier to the internal sump by the Operator. Hoses for manually transferring water from the clarifier to the GWTS sump are stored in the GWTS building.

Dosing pumps are installed upstream of the influent tanks, on the influent pipe tree, and dose the influent water with sodium hypochlorite, an oxidant and disinfectant solution. The dosing pumps can be manually calibrated by the Operator to yield an influent concentration of free chlorine between 0.1 and 0.3 milligrams per liter (mg/L) or utilize a 4- to 20-milliamp signal from free chlorine analyzers installed immediately downstream of the influent equalization tanks to reach the same range. The dosage is calibrated by adjusting the injection rate of the dosing pumps and monitoring the free chlorine concentration read by the chlorine analyzers, readjusting until the free chlorine concentration is read at the correct range. Post-sand filter free chlorine concentration is monitored with a handheld analyzer as needed. The sodium hypochlorite maintains the function of the sand filters and disinfects the sand filter media and water, which minimizes the need to skim or backwash the granular activated carbon (GAC) vessels due to the formation of biofouling. The dosing pumps are controlled by the primary system PLC and are only in operation during times that the extraction wells are in operation; this means that the dosing pumps respond to shutdowns incurred by the fault conditions that halt the extraction wells. The dosing pumps are designed to deliver between 9 milliliters and 9 liters of sodium hypochlorite solution per hour and can be adjusted manually depending upon extraction well operation or utilizing a 4- to 20-milliamp signal from the free chlorine analyzers. The dosing pump reservoir is designed to hold 90 gallons of solution. The reservoir's solution level is checked by a level-switch within the tank and is maintained by the self-contained PLC within the sodium hypochlorite generator.

The sodium hypochlorite generator supplies the dosing pumps with a stock solution of sodium hypochlorite solution. The sodium hypochlorite generator is comprised of a brine tank, water softener, electrode panel, and oxidant tank. The brine tank holds food grade salt and water supplied from the softened Base water supply. The brine is then pumped into the electrode panel where it is converted into dilute sodium hypochlorite solution. That solution is then stored in the oxidant tank until it is fed into the dosing pump tanks. A vent has been installed on the oxidant tank to relieve excess pressure and gas byproducts produced during sodium hypochlorite generation.

The pre-treatment bag filters on the GWTS influent pump skid are equipped with differential pressure transmitters (both pre-treatment and post-treatment bag filters are equipped with 10-micron bag filters). If pressure drop across the filters increases to 10-15 psi, the filters need to be changed. If the differential pressure exceeds 4 psi, the system sends an alarm to the Operator indicating that the bag filters need to be changed soon. If plugging occurs in the bag filters or a valve in the outlet piping is inadvertently shut, a deadhead situation could occur at the pump. To prevent a no-flow (deadhead) condition, a high-pressure switch is installed immediately downstream of the pump discharge. The switch shuts down the pump and alerts the Operator of the fault. High pressure set points are detailed in Appendix E.

2.4 Carbon Vessels

The only automatic control for each set of GAC vessels is a high-pressure switch on the inlet to the system. High inlet pressure to the GAC vessels causes a shutdown of the associated GWTS influent pumps. In order to prevent air from building up in the inlet piping and to prevent siphoning of water from the GAC vessels, there are air/vacuum relief valves on the inlet and outlet piping into the vessel valve manifold. A pressure relief valve and manual air vent valve are installed on the top of each GAC vessel. During initial startup and once each week, the Operator partially opens the manual vent valve to remove any air that may have accumulated in the GAC vessel (Train 2 only). In order to monitor pressure drop across the two carbon beds, each GAC vessel is fitted with a local pressure gauge on its outlet nozzle and on the inlet branch of the valve manifold. At a feed rate of 400 gpm, the pressure drop through each carbon bed should be less than 2 pounds per square inch gauge (psig), and the total system pressure drop should be less than 5 psig. The carbon beds are inspected to determine if skimming or backwashing is required when the pressure drop increases to 10 psig above ambient operating differential pressure.

Each of the carbon vessels is sized to provide 12 minutes of empty bed contact time at 400 gpm. With this extended contact time, the lead carbon bed can lower an EDB concentration in 400 gpm of groundwater from 2 micrograms per liter to below the discharge limit.

Higher concentrations of EDB or the presence of additional volatile organic compounds at a contact time of 12 minutes or longer will still result in full sequestration of those compounds onto the carbon. That is, the additional volatile organic compounds are treated to applicable standards as long as the concentration(s) and loading are consistent with the Technical Memorandum Establishing the Basis of Design Maximum Concentration Limits for the Kirtland BFF GWTS (Appendix O). The treatment of higher concentrations does, however, decrease bed life.

The lag GAC vessel provides a backup in the event of breakthrough of the lead vessel. When water leaving the lead GAC vessel contains EDB concentrations of 90 percent of the effluent limit, that GAC vessel undergoes GAC change-out and the lag carbon vessel is placed into the lead position. Valve alignment figures for the carbon beds are provided in Appendix D. These figures show valve alignment for operation of the carbon beds in lead-lag, backwash, and carbon change-out configurations. If water leaving the lead GAC vessel contains EDB concentrations of *less* than 90 percent of the effluent limit, then a special sampling procedure will be followed month to month to keep track of where vertically in the lag GAC vessel the breakthrough is reaching. This sampling procedure can be found in Appendix J.

2.5 Treated Water Tank and Pump

The effluent pumps and level in the treated water tanks are controlled and monitored by the PLC. The only Operator actions required during normal operations are to set the effluent pumps to their appropriate flow rate, put the controls of the effluent pumps into sequence using the SCADA, and change bag filters when the differential pressure across the post-treatment bag filters exceeds the differential pressure threshold (10-15 psi). Manual on/off switches for the treated water pumps in the SCADA and on the motor starter panel are provided for maintenance and troubleshooting but cannot be used during unmanned operation as they override PLC interlocks. The treated effluent pumps are interlocked to shut down under the following conditions:

- Switched to the Off position on the SCADA
- High-high level in the GCMP or the injection well
- High-high level in GWTS building sumps or clarifier
- Low-low level in treated water storage tank

- High pump-outlet pressure
- High pressure at the injection well or in the discharge line.

The post-treatment bag filters on the treated effluent pump skids do not have automatic controls but are equipped with local differential pressure gauges. If pressure drop across the filters increases to 10-15 psi (differential pressure), the filters need to be changed.

On the treated effluent line, between the post-treatment bag filters and the underground effluent pipeline leaving the building, there are two actuated valves that are used to deliver water to the truck bay to wet newly delivered GAC as part of the GAC change-out process and to provide backpressure on the effluent pumps. The valves are controlled by the PLC and can operated by utilizing an access code and keypad located on the exterior of the building in the truck bay. A timer on this switch returns the valves to their normal position after 30 minutes of being activated. The valves can also be set to their normal position by inputting the access code prior to the 30-minute cutoff. The main line valve's normal position is variable and is adjusted by the PLC in response to the pressure reading from the pressure transmitter located just upstream of the valve. The PLC is currently set to maintain 20 psi of back pressure on the effluent pumps to mitigate cavitation at the pump impellers.

2.6 Operation and Maintenance of Discharge Locations

Currently, the GCMP and KAFB-7 are the only two approved discharge locations for treated effluent. Other UIC wells, including currently proposed KAFB-106IN2, may be added to supplement discharge options. As future UIC well(s) are brought on-line, all O&M forms, tables, monitoring, and reporting requirements associated with UIC wells will be updated. The GCMP consists of a lined pond that stores water for irrigation of the golf course. The liner extends up the sides of the pond and the water level in the pond cannot not exceed the high-level set point of 5.5 feet with respect to the GCMP pump house transducer. The 5.5-foot-level set point provides an adequate safety factor to ensure that the pond is not overfilled. The pond also has a stadia rod in place near the intake of the GCMP pump house and the stadia rod level of 3.5 feet corresponds to a transducer reading of 5.5 feet. Currently, if the pond level exceeds 5.5 feet with respect to the transducer while the GCMP is selected as the discharge location, the system sends an alarm email and shuts down the effluent pumps at the GWTS. If this condition occurs, the effluent flow is redirected to KAFB-7, KAFB-106IN2, or a future UIC. At this time, the redirection of flow requires a manual valve switch by the Operator.

Maintenance of the five golf course ponds includes performing semiannual inspections (spring and fall). Any new vegetative growth around the ponds (5 feet from edge of pond) and any new growth within the ponds will be removed using large rakes or a floating cutter for cattails. Evaluation for the need of a chipper for new growth removal will be made. If, during these inspections, evidence of leaks in the liner is observed, or if alerted to such evidence by golf course personnel, minor repairs will be implemented to restore liner integrity.

KAFB-7 (and proposed UIC well KAFB-106IN2) is a gravity fed permitted UIC well that is equipped with a dedicated flowmeter and water level transducer to ensure that the well will not be overfilled (Table 1-2; DP-1839 Condition No. 14). The flowmeter is inspected and calibrated as scheduled per the manufacturer's recommendations. After the downhole control valve (V-smart valve) was determined to be malfunctioning due to a hydraulic line failure, the control valve and all components associated with the valve were removed. A replacement flow control valve may be installed in a future phase of work (ORCOM, 2019). The PLC monitors the water level, effluent line pressure at the control valve in KAFB-7 (or proposed UIC KAFB-106IN2), and effluent line pressure just downstream of the control valve at the GWTS. The system is set to alarm if the water level exceeds that associated with the top of the louvered screen of the well or if the pressure downstream of the GWTS control valve exceeds 45 psi.

Any of these conditions cause a shutdown of the GWTS effluent pumps and send an alarm to Operators indicating that the UIC well has experienced a fault condition. Operators then manually divert flow to the GCMP, if there is adequate capacity, and inspect UIC wells for malfunctions. Discharge to UIC wells is not to exceed 1,440,000 gallons per day (1,000 gpm continuous flow) and records are maintained of all volumes injected into this well for reporting to the New Mexico Office of the State Engineer (Table 1-2; DP-1839 Condition No. 9).

2.7 Groundwater Treatment System Building Containment Sumps

A sump is installed in the GWTS building floor slab as part of the building's secondary containment system. This sump collects any spilled, leaked, or washdown water produced within the GWTS building, and any water that contains fines or particulates is first filtered through a 10-micron bag filter. The sump water is then pumped by a submersible centrifugal sump pump (P-111) into the Train 1 GWTS influent tank (TK-110) ensuring all water collected undergoes treatment. This pump is controlled by a float switch. The float switch can be overridden to pump water out of the sump, if entry to the sump is required. A high-high level switch shuts down the GWTS if the water level in the sump becomes too high. A truck sump is located outside of the building in the truck bay; this sump is also equipped with a high-high level switch that shuts down the GWTS if the water level in this sump becomes too high. In order to pump water out of the truck sump, the grating of the sump must be removed to allow temporary installation of a sump pump into the sump. The water pumped by the temporary sump pump is then discharged to the GWTS building sump.

2.8 Startup Sequence

Prior to startup, ensure that all set points are set to appropriate values. Table 2-3 provides a list of standard operational set points. Prerequisites for normal startup of the GWTS include the following:

- Perform the valve lineup for normal operation as shown on the piping and instrumentation diagrams for the GWTS (Appendix D).
- Confirm that no maintenance activities are occurring at the extraction wells, the golf course, or UIC wells.
- Confirm there is communication (telemetry) between the WCH, GCMP, UIC wells, and the GWTS.
- Place local disconnects for pumps in the closed position.
- Place local switches for the well pumps, GWTS influent pumps, and treated water pump in the SEQ or AUTO position.
- Confirm that manual valves on the UIC well pipelines and SCADA distribution switch are set to send the treated water to the desired destination (GCMP or a UIC well).

The SCADA has color codes for quick reference to let the Operator know the status of system equipment.

The color codes are as follows:

- Blue = Standby and ready.
- Green = In operation using automated sequence.
- Yellow = Uncommanded and running, manual control assumed.
- Red = Fault or alarm condition exists.

At the SCADA, perform the following checks and setup steps:

- Verify there are no pumps or treatment trains in alarm on the Overview screen (any item in red may require to be reset) and on the train control screen.

- Verify that all required pumps and wells are indicating that they are in REMOTE AUTO mode on the SCADA screen.

- Verify on the alarm page that there are no active alarms (active alarms are highlighted in red). Clear or acknowledge any alarms or correct any false alarm conditions.

- Verify that all of the proportional-integral-derivative blocks for the active Wells/Pump Skids are in AUTO (this can be verified by viewing the proportional-integral-derivative block is green).

- Verify on the train control screen that the pumps for the system are in SEQ mode and that they have a sequence number (O = Off, 1 = Lead, 2 = Lag).

- Verify where the water is to be discharged to on the distribution screen. When the golf course or a UIC well is selected, a pop up appears reminding the Operator to verify that the correct valves are opened in the field.

- Verify all tank level transmitters are operational and that the water levels are acceptable to run the system. If the tank levels are not at acceptable levels to be in automated control, run the pumps manually to adjust water within the system to allow for automated control.

- Verify that all of the tank level float (LSH/LSL) devices are green on the overview and tank screens. If any of these devices are red, correct the alarm condition before proceeding.

- Set flow rates for the groundwater extraction wells to the values specified by the GWTS Project Manager. This may require that the system be in operation and for staff to be at the wellhead for wells that require manual valve closing to control flow rate. The flow rate from extraction wells equipped with VFDs can be manipulated using the SCADA.

To initiate system start, complete the following steps:

- On the train control screen, set each treatment train's influent flow set point to a flow rate exceeding 360 gpm but less than 400 gpm. Running the influent pumps above 360 gpm ensures that enough flow is supplied to maintain the minimum 120 gpm of flow to the GAC vessels as well as 239 gpm in the event that the sand filters require backwashing. This O&M Plan recommends exceeding the extraction flow rate entering the train's influent tank by at least 5 gpm to ensure that the system properly compensates for slight variations in flowmeter readings. Then set the effluent flow set point(s) to at least 5 gpm greater than the influent skid flow rates for the same reason as the previously mentioned offset. This O&M Plan also recommends that the influent tanks remain isolated during normal operations to minimize the risk of preferential draining of either influent tank.

- Select the "ON" button for the trains intended for operation. The system starts the extraction wells in the sequence previously selected. After the system has verified that the extraction wells are operating, the influent train and effluent train skid pumps start up and run at the set point selected in previous setup (tanks first have to reach their high set point before starting).

- At any time during water processing, a train can be turned on or off and taken out of the AUTO sequence. It is the responsibility of the Operator to change the required flow set point on the trains to offset the incoming flow.

- Confirm proper operation of all equipment.

2.9 Normal Shut Down Procedure

When it is necessary to shut the entire system down, perform the following:

- On the train control screen, select the off button for both trains. If the extraction well pumps are expected to be shut down for more than 24 hours, put the manual switches in the WCH, the electrical rack at KAFB-106239, and the electrical shed at KAFB-106228 into the Off position. Open the electrical disconnects at those locations and lock them open.

- Confirm that the PLC shuts down the GWTS influent pump and treated effluent pump.

- If the system is going to be down for more than 24 hours, put the local switches on the motor starter panel for the GWTS influent pumps and the treated water pump into the Off position. Additionally, notify Kirtland AFB and NMED point(s) of contact.

2.10 Emergency Shutdown Procedure

In case of fire, leak, or other emergency condition, any person can activate one of the local emergency shutdown buttons (one located inside the building on the east wall between the eastern entry and overhead door, and one located on the exterior of the building next to the keypad west of the southwestern-most entry), or on the train control screen select the off button for both trains, and notify the GWTS Project Manager, who notifies the appropriate Kirtland AFB contacts and regulatory agencies as described in the GWTS-specific Contingency Plan (found within the GWTS), immediately.

In the event of a spill, leak, or unplanned release to the environment associated with the treated effluent from the GWTS or the treated effluent conveyance system, Kirtland AFB will follow the release reporting requirements in 20.6.2.1203(A) New Mexico Administrative Code. These requirements are fundamentally equivalent to the Twenty-Four Hour and Subsequent Reporting requirements in Part 1.27 of the RCRA Permit. The NMED Hazardous Waste Bureau will be copied on all notifications and any subsequent reports.

If a power outage occurs, the system shuts down. The Operator is notified of the shutdown condition. Upon power returning, the system automatically restarts in standby and ready mode. Once in this mode, the system can be restarted as described in Section 2.7. Further information regarding the control of the system is explained in Appendix E.

2.11 System Utilities

Only extraction well KAFB-106228 operates using off-Base power. It is the GWTS operating Contractor's (Contractor) responsibility to set up or take ownership of the Public Service Company of New Mexico account associated with powering extraction well KAFB-106228. Extraction wells KAFB-106233, KAFB-106234, and KAFB-106239; WCH; GWTS; UIC wells; and GCMP are all powered using on-Base utilities.

All PLCs, SCADA, and control panel power receptacles (telemetry and modem) are equipped with uninterruptable power supplies that keep the attached items online for a short period following a loss of power at the GWTS. This ensures that all equipment responds properly in the event of a loss of power anywhere in the system.

The GWTS is supplied with non-potable water from the on-Base community water system. This non-potable water is supplied at a pressure of 100 psi and can be used for various O&M activities.

Remote communications to the GWTS are transmitted using a cellular modem. It is the Contractor's responsibility to set up or take ownership of the cellular data account associated with the GWTS. Currently, the GWTS utilizes a 5-gigabyte per month cellular data plan provided by AT&T Inc. Additionally, the Contractor needs to support alarm email distribution from the GWTS PLC. Email distribution may require the use of a third-party email hosting service if hosting cannot be supplied by the Contractor's own email hosting service.

To ensure that off-Base conveyance lines are secure, the conveyance lines are registered under Kirtland AFB as a line-owner with New Mexico 811. Kirtland AFB is responsible for off- and on-Base line locates. Off-Base line locates may be the Contractor's responsibility depending on the terms of the contract. On-Base conveyance lines are secured as Kirtland AFB issues permits after performing line locates on-Base for all excavation projects. Additionally, the influent lines are marked with monuments at a maximum of 400-foot intervals. In the event of a conveyance line breach, the Contractor is required to perform emergency response to minimize the release of any contaminated water. This O&M Plan recommends that the Contractor have a subcontractor or an internal department ready to perform emergency response in the event of a conveyance line breach. Off-Base owners of property containing an influent line are notified in accordance with executed access agreements provided in Appendix A-2 and summarized in the Contingency Plan (found within the GWTS) Section K.6 in the event of a breach.

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3. INSPECTION AND PREVENTATIVE MAINTENANCE

This section presents instructions for routine inspection and normal equipment servicing and lubrication. The purpose of preventative maintenance is to ensure steady operation and to extend the life of equipment. The following text summarizes inspection and preventative maintenance frequencies and actions. Pertinent vendor or manufacturer information and manuals are provided in Appendix I. Appendix B provides an organization chart and roles and responsibilities for system operation.

In the event that an Operator-initiated system shutdown is needed for routine maintenance, non-routine maintenance, or any other nonemergency reason, the GWTS Project Manager must be contacted, and they will notify the designated Kirtland AFB points of contact. The NMED point(s) of contact is notified for any shutdowns of longer than 24 hours by U.S. Air Force personnel.

For all maintenance activities, the Operator always reviews the appropriate U.S. Air Force, U.S. Army Corps of Engineers, or other approved health and safety documents that are available onsite, and follows the requirements for additional personal protective equipment, equipment lock-out/tag-out, confined space entry, fall protection equipment, etc. Additional safety documentation for maintenance operations can be developed on an as-needed basis and be on file in the GWTS building. These requirements are always considered prior to initiating the task. The Operators perform maintenance tasks that do not require factory-authorized service on a routine basis. If factory-authorized service is required, it is pre-scheduled to ensure minimal disruption of the plant operating schedule.

3.1 Scheduled Inspection and Routine Maintenance Activities

Table 3-1 provides a comprehensive list of routine maintenance activities. Inspection and preventative maintenance forms are provided in Appendix H. In general, the overall system does not have extensive preventative maintenance requirements. Most equipment requires inspection with periodic cleaning and repair as needed. The only recurring routine preventative maintenance operations are to change the oil in the influent and effluent pumps, grease pump bearings, and change the air filter on the air conditioner for the control room every 3 months. Requirements for calibration and inspection of flowmeters that measure groundwater feed and discharge flow rates are covered later in this section and inspection forms are provided in Appendix H.

3.2 Influent and Effluent Pump Monitors

All influent and effluent pumps in the GWTS are equipped with i-ALERT® Condition Monitors. These devices record pump operational metrics (i.e., vibration, temperature, and run-time) and can provide early detection of pump failures and metric trending. Treatment Train 2 and the effluent pump for Train 1 are equipped with i-ALERT® devices that can be connected to using a Bluetooth-enabled device with the i-ALERT® application. The Train 1 influent pumps are outfitted with i-ALERT® devices currently incapable of Bluetooth communication and only utilize light indictors to alert Operators to possible pump concerns. All i-ALERT® light indicators are inspected weekly.

3.3 Bag Filter Change-Out

Bag filters require replacement as needed to correct a pressure drop across the pre- and post-treatment bag filters. Two bag filter housings are located on each skid with six 10-micron bag filters in each housing; this allows for continuous operation of the plant during bag filter change-out. Once the Operator has deemed that a change-out is required, the system remains on and the Operator isolates the filter housing needing change-out. The filters are replaced and the offline filter housing is reinstated into the treatment

train. In the event that both bag filter housings on one skid require change-out, flow can be diverted to the other train (if less than 400 gpm) in order to avoid a system shutdown. If the flow is greater than 400 gpm on a single train, the entire system is shut down to avoid unnecessary strain on the system.

To change the filters, all flow is directed to the filter vessel not requiring maintenance (close valves leading to the vessel requiring change-out). The air vent and drain valves are opened to drain water from the top half of the filter housing. After the head bolts are loosened and disengaged, the davit jack is used to raise the filter lid and swing it out of the way. The filter bags can then be replaced. The O-ring on the top of the filter vessel is then inspected to see if it requires replacement and is aligned properly. The lid is then swung back into place and the head bolts are tightened. Head bolts on opposite sides of the lid will be alternately tightened. Do not overtighten the bolts and inspect the filter for leaks upon restart. The flow is then reinstated to the filter vessel with new bags and the procedure can be repeated for the second filter vessel if necessary. After replacement, the old filter bags are disposed of as described in Section 6 and characterization information is provided in Appendix K.

3.4 Basket Strainer and Y-Strainer Cleaning

Eaton Duplex Model 50 Basket Strainers are present between the influent tanks and their respective pump skids. The strainers require cleaning and maintenance on an as needed basis. If the influent tanks are not effectively equalizing, the most likely culprit is that one or both basket strainers between the two tanks has become clogged with fine sediment pumped from the extraction wells. Another indication that the basket strainer may need to be cleaned is when cavitation is heard at the pump impeller housing. The basket strainers can be cleaned while in operation and do not require a system or train shutdown. In order to clean the strainer, rotate the plug lift handle counter-clockwise to release the diverter plug, switch the diverter handle from one side to the other to divert water into the clean basket, and rotate the plug lift handle clockwise to set the diverter in place. Loosen the yoke screw of the clogged basket's housing until the cover can be lifted. The basket can then be removed, brushed, and rinsed to remove any collected debris. Once cleaned, the screen is reinserted, cover replaced, and yoke screw retightened. Documentation for the Eaton Duplex Model 50 Basket Strainers is provided in Appendix I.

Y-strainers are present between the effluent tanks and their respective pump skids. The strainers require cleaning and maintenance on an as needed basis. The Y-strainer may need to be cleaned when cavitation is heard at the pump impeller housing. In order to clean the strainer, lock-out the appropriate pump skid so that the pumps cannot be remotely started while the butterfly valves are closed. The line is then isolated by closing all incoming butterfly valves and then drained, and the Y-strainer blind flange is removed. The Y-strainer screen can then be removed, brushed, and rinsed to remove any collected debris. Once cleaned, the screen is reinserted, blind flange replaced, drain valves closed, butterfly valves reopened, and pump skid reinstated into operation.

This O&M Plan suggests that the influent basket strainers are inspected and cleaned weekly and the effluent Y-strainers are inspected and cleaned biannually.

3.5 Discharge Changeover

Currently, the treated effluent can be discharged to either the GCMP or a UIC well. The entire system is shut down (Section 2.9) prior to performing a discharge change-over. Once the system is offline, change the discharge location as indicated on the SCADA on the Distribution screen. This causes the SCADA to display a reminder window regarding valve positioning. Commute to the effluent changeover location shown on Figure 1-1 and close the valve where the system was previously discharging and open the valve leading to the new discharge location. It takes approximately **38.5 turns** of each post indicator to completely close or open the resilient wedge gate valve. After the valves have been switched, proceed to

a UIC well and record the totalizer reading at the well head. Return to the GWTS building, record both treatment train effluent totalizers, shutdown time, and reinstate the system into operation (Section 2.8).

3.6 Granular Activated Carbon Backwashing, Skimming, and Change-Out

Before initial startup and following each carbon change-out (prior to re-start), the carbon beds must be backwashed. In order to perform the backwashing process, refer to the manufacturer O&M Manuals located in Appendix I and valve alignment figures in Appendix D. Backwashing the TIGG carbon beds requires at least 700 gpm of clean water, which can be provided from the fire hydrant near the GWTS building. Backwashing the Calgon carbon beds requires at least 150 gpm of clean water, which can be provided from the TIGG treatment train, if the TIGG treatment train is processing water. Note that backwashing either train requires a temporary 21,000-gallon tank be available directly to the south of the GWTS building to store any produced backwash water. This tank doubles as a clarifier for settling out fines produced during the backwash process. Sand filters pretreat the water for dissolved iron and manganese and suspended solids, including biological solids, which should mitigate scaling, biofouling, and plugging of the carbon beds. In the unlikely event that scale and fouling cause the pressure differential across the GAC vessels to exceed 10 psi before a change-out is required, either backwashing or, if the pressure loss is associated with the upper most layer of the GAC within the vessel, skimming the upper few inches of GAC removes limited scaling and fouling.

If a pressure drop of 10 psi or greater is primarily associated with the lead GAC vessel, vacuum skimming the top several inches of the lead carbon bed is a viable remedy instead of backwashing. Before skimming operations commence, lift equipment (e.g., scaffolding, scissor lift) is set up to access the top of the tank needing skimming of the GAC surface. Skimming requires that the system be shut down (Section 2.9) and the lead GAC vessel be drained so that the water level is below the bed surface. The vessel is then opened and the top several inches of the GAC are visually inspected. A sample can be collected by affixing a clear bailer, with its bottom removed, to a pole and pressing the open end of the bailer into the top several inches of the GAC. The sample is then removed to determine the depth of the fouling and extent of the skimming required. The top layer of the GAC is then vacuumed until only non-fouled GAC is visible from the vessel entrance. GAC skimmed from the lead GAC vessel must be containerized and removed as solid waste. Skimming is often much more cost effective than performing a full GAC change-out and produces minimal investigation-derived waste compared to backwashing.

GAC needs to be changed out once breakthrough by the contaminants (defined in Section 2.4) occurs in the lead GAC vessel. In order to perform the GAC change-out process, refer to the manufacturer O&M Manuals provided in Appendix I. A procedure for the GAC change-out for the carbon vessels can be found in Appendix I. In addition, the Operator performs a visual inspection of the vessel's interior when the vessel is empty to determine if there is any plugging or damage of the inlets, distribution manifold, or feed and drain lines. Clean water from the plant hose connections can be pushed into the vessel to aid with visual inspections of all internal components. Only preconditioned GAC media are used to refill the GAC vessels during a change-out as this eliminates the need to store and dispose of conditioning reagents. When scheduling for the 7-day/4-week sampling required after a GAC changeout (as described in Appendix I), allow 2 full days between when the GAC is changed out and the first day of daily sampling as the slurry will need to sit for 24 hours before the backwashing process.

3.7 Dosing Pump, Chlorine Analyzer, and Sodium Hypochlorite Generator Maintenance

The pre-treatment dosing pumps that supply sodium hypochlorite solution to the influent water are sourced from a reservoir that holds approximately 90 gallons of generated solution. The usage of solution

is dependent upon influent flow rates as well as sodium hypochlorite concentration in the dosing solution. Dosing rates must be adjusted to result in a concentration of sodium hypochlorite concentration upstream of the sand filters of 0.1-0.3 mg/L free chlorine. The free chlorine concentrations upstream and downstream of the sand filters should be measured and recorded at least once a month to ensure that the dosing pumps are supplying adequate volumes of oxidant and the sand filters are catalyzing oxidant to precipitate dissolved metals.

The pipe conveying water from the influent tanks to the influent skids is equipped with two free chlorine analyzers. The analyzers require weekly inspection and monthly replenishment of reagents in order to function properly.

The pre-treatment dosing pumps are supplied with a constant stream of freshly produced sodium hypochlorite solution created by the sodium hypochlorite generator. The generator requires weekly inspection and addition of food grade salt to the brine tank to provide a constant stream of sodium hypochlorite solution into the oxidant reservoir.

The Operator should refer to the manufacturer's recommendations in order to perform any additional maintenance on any of the dosing pumps, chlorine analyzers, or sodium hypochlorite generator.

If the sodium hypochlorite generator is off-line for more than 2 weeks, the following procedure should be initiated:

- Place the MIOX sodium hypochlorite generator on standby by pressing STOP on the generator's SCADA screen. DO NOT turn off the generator. Doing this will reset the PLC settings to factory defaults.

- Remove all salt from the brine tank and containerize for waste disposal.

- Drain the tank of all brine solution and containerize for waste disposal. To drain the tank correctly, isolate the tank's drain by closing both valves on the outlet pipe. Attach a hose to the drain tee, open the first valve (immediately after the outlet of the tank), and let the brine solution drain through the hose and into an appropriate bucket or drum.

- Thoroughly rinse the brine tank and its filter pack with softened water through the internal spray ring at least twice. Drain the rinsate and containerize for waste disposal. Remove the drain hose from the drain tee and reopen the second valve on the outlet pipe. Both valves on the outlet pipe should now be open.

- Refill the brine tank with softened water. This will be used to rinse the electrolytic cell.

- Detach the outlet tube of the solenoid brine pump from the rest of the system. The brine pump is located in the bottom cabinet of the sodium hypochlorite generator. Prime the brine pump with the prime bulb (located on the outside of the generator to the left), then manually run the pump until the majority of the air is removed from the brine line. To manually run the pump, press the green button below the SCADA screen, and press DIAGNOSTICS. Within the Diagnostics page, change the voltage of the brine pump to 2 volts (no greater than 3 volts is recommended), and press the solenoid brine pump button at the top of the screen. The pump will run for approximately 10 minutes before needing to be turned on again. As the pump runs, air bubbles and leftover brine solution will drain from the detached outlet tube. This should be containerized for waste disposal.

- When little to no air bubbles remain in the brine line, turn the brine pump off and reattach the outlet line to its original placement. Turn the brine pump back on as before, and let it run for 40 minutes to rinse the electrolytic cell free of all brine solution. The rinsate from this process will be discharged to the sodium hypochlorite storage tank (reservoir), which stands on a secondary containment pallet and does not need to be moved or stored elsewhere and can be held for future use.

- Once the electrolytic cell is thoroughly rinsed, turn off the brine pump, and drain the cell of all liquid by opening the small blue valve below the cell. Collect these liquids and containerize for waste disposal (nonhazardous solid waste). A pipe union above the electrolytic cell can be opened to facilitate the draining process. After all liquid within the cell has been drained, close the blue valve and reattach the pipe union.

- Drain the brine tank of any remaining softened water, following similar valve and drain tee procedures as before.

- Isolate the water softeners from the source water by closing its inlet valve.

- Keep the generator online, even throughout its shutdown period, as turning it off will reset the PLC settings to factory default.

3.8 Sand Filter Maintenance

The pre-treatment sand filters require occasional backwashing and infrequent replacement of filter media. Backwashing is required when differential pressure across a sand filter unit exceeds 10 psi from the clean operating differential pressure. The Operator first adjusts the backwash throttling valve (red handled valve located above the sand filter vessels on the backwash line) to provide 239 gpm throughput in the backwash line during a backwash cycle. The throttling valve must be manually adjusted at each different flow condition; thus, this O&M Plan recommends that flow conditions do not be frequently modified by the Operator. Once the flow requirement is met, the system can be set to automatically initialize the sand filter into backwash mode once a certain differential pressure is reached across the sand filters. The PLC is programmed to lock in the influent pump VFD frequency when a backwash cycle (alarm) is received from the sand filter control unit. The VFD maintains the locked frequency until one of following three conditions occurs:

- The backwash cycle is completed (the VFD frequency remains locked for approximately 30 seconds following completion of the cycle).

- The low-level set point in the influent tank is reached (deactivating the influent pumps).

- Any alarm condition resulting in influent pump shutdown is received.

This O&M Plan recommends that the automatic backwashing differential pressure be set to no more than 10 psi above the clean operating differential pressure as differential pressures exceeding 10 psi, above background, results in significantly higher flow rates through the first sand filter vessel backwashed during backwash of the second vessel. Additionally, these conditions can result in flow rates that exceed design flow rates of the GAC vessels. Backwashing each vessel takes approximately 4 minutes to perform (8 minutes per skid). Backwash can only be performed on one sand filter housing per skid at a

time as the second filter vessel supplies pretreated water to perform the backwashing of the first unit. Backwash water is transferred to the backwash clarifier located above the external truck sump.

Each sand filter vessel is loaded with the manufacturer's recommended amount of crushed gravel, garnet, and IMA-65 (or DMI-65) media. In the event that the removal efficiency of the sand filter begins to diminish, then media change-out may be required. The media manufacturer recommends that media be changed out regardless of a loss in removal efficiency following between 5 and 10 years of operation due to media degradation by particle contact and mechanical abrasion. Emptying and reloading of sand filter vessels is performed by following the manufacturer's instructions provided in Appendix I.

3.9 Clarifier Maintenance

The sand filter clarifier is designed to hold 8,000 gallons of backwash water (approximately 8 backwash cycles) and is automatically drained in order to provide space for additional backwashing. A drain line runs from the clarifier's last chamber, through the southern wall of the GWTS building, and to the western section of the internal sump. Flow through the drain line can be adjusted with the inline ball valve. Inline filtration of the draining water is recommended to collect fines that may not have settled out; for this purpose, a bag filter can be tied to the outlet of the drain line and should be replaced every three to four backwash cycles, or as needed.

If manual removal of clarifier water is necessary, the Operator first ensures that the clarifier has been allowed adequate time to settle out any fines backwashed from the sand filters. Once settling has occurred, the Operator sets up appropriate pumps and hoses to transfer clarified water to the GWTS internal sump for re-treatment through the system. Inline filtration of the clarified water is recommended in the event that some backwash fines may not have settled out. The clarified water is then discharged and, following this discharge, the clarifier is returned to its normal operating state and all equipment used is stored in the GWTS building.

3.10 Effluent Line Integrity Testing

The effluent line running between the GWTS and a UIC well requires integrity testing in accordance with DP-1839 (Table 1-2; Condition No. 15). The line must be tested in year one of DP-1839 approval (by April 28, 2018) and in year five of the approval before a renewal application is submitted (2022).

Effluent line integrity testing is performed by hydrostatic leak testing the line.

3.11 Well Pump Pulling

The extraction well pumps are designed for little to no maintenance when properly installed and monitored. Removal of the extraction well pumps for inspection or cleaning on a regular basis is not cost effective and should only be considered in the event of a catastrophic failure or decrease in pump performance. Extraction well pumps are pulled for inspection and maintenance only after a minimum of 10 years in the absence of documented performance issues.

Prior to pulling any pump, ensure that the appropriate permits (barricade, etc.) have been obtained. Access to the well is made through the vault doors or manhole directly above the well head. Disconnection of electrical and control wiring must be performed by a licensed electrician. After disconnection at the wellhead from piping/equipment in the vault, the well casing, gauge lines, and pump columns are disinfected with a solution of potable water and WEL-CHLOR (calcium hypochlorite) or equivalent. The solution is mixed at the surface and introduced through the top of the casing, gauge lines,

and pump discharge piping. An example mix of solution could consist of 1 pound of 65 percent dry granular, calcium hypochlorite and 500 gallons of clear water mixed until the chlorine is completely dissolved. After completely dissolving, this solution is poured into the casing, gauge lines, and pump column. This example is sufficient to initially produce a chlorine concentration of approximately 50 mg/L throughout the entire water column. A field chlorine test kit (Hach DR 900 Handheld Colorimeter, or equivalent) is utilized to monitor free chlorine concentrations. All field meters are calibrated in accordance with manufacturer's recommended procedures.

Following disinfection, all existing downhole piping (approximately 520 feet of 3-inch galvanized steel drop pipe), the submersible pump, and all associated wiring are removed. The pump is inspected for damage and replaced with a new pump, if required. Both 1.25-inch sounding tubes (for transducer and manual water level) are also removed. All pipes are stacked on a pipe trailer prior to storage, in order of retrieval, for subsequent inspection for corrosion and/or damage. All damaged materials are replaced prior to redeployment. Trailers with well equipment are stored and covered at the appropriate yard until needed for reinstallation. All pipe and wiring removed can be reinstalled at the completion of any work being performed, so care is taken during handling and storage. Photographs are taken of all corrosion or damage on pipe, pumps, or other downhole materials for documentation purposes and identification of any replacement requirements.

An optional well inspection can be performed with a downhole video camera after the pump and piping equipment are removed and suspended solids have settled back into the well, if required. MUD-NOX (mud deflocculant/detergent) or equivalent may be added to the well to decrease solids suspension prior to the camera survey. Residual chlorine is measured downhole prior to deployment of the camera to ensure camera integrity. This camera survey can be used to evaluate the nature and extent of screen fouling, screen integrity, or other downwell characteristic.

Prior to the reinstallation of pumps and downhole equipment into a well (disinfection, redevelopment, etc.), cathodic protection is also added to the pump, if not already installed, prior to redeployment. Cathodic protection can potentially consist of adding three 18-foot lengths of magnesium strips strapped to the stainless steel drop pipe above the submersible pump. These example strips are 3/8-inch thick by 0.75-inch wide and can be covered with a poly mesh sleeve and secured via stainless steel straps. Other cathodic protection options may be considered.

Prior to reinstallation of the downhole equipment, the original or new drop pipe, submersible pump, transducer, drop tubes, and wiring are disinfected aboveground following standard practices (i.e., American Water Works Association [AWWA] Standard for Disinfection of Wells (AWWA, 2003). After the pump is installed, the gauge lines and pump column are disinfected as previously described. The wellhead is then reconnected to the conveyance line within the vault, restoring the system to the original configuration. The system is then tested for operational readiness to ensure proper pump operation, valve and meter operation, and verification and that there are no leaks or physical or electrical problems with the system.

3.12 Well and Conveyance Line Disinfection

Well and conveyance line disinfection is described in the following sections.

3.12.1 Well Disinfection

Extraction and monitoring wells may occasionally require disinfection to improve pumping and monitoring performance. Well disinfection is performed by adding disinfectant directly to the well at the wellhead.

3.12.2 Conveyance Line Disinfection

In order to perform conveyance line disinfection, the conveyance lines need to receive a dose of chlorine fed at a constant rate. An example target concentration of free chlorine throughout the conveyance line is 25 mg/L. To ensure that the appropriate concentration of free chlorine is provided, the chlorine concentration is measured at regular intervals in accordance with standard practices (i.e., AWWA Manual M12 procedures [AWWA, 1975]). Chlorine application is typically supplied through a temporary connection to the conveyance line and does not cease until the entire conveyance line is filled with chlorinated water. The chlorinated water is retained in the line to provide the appropriate amount of contact time (e.g., 24 hours). After, the chlorinated water is pumped from the line to a storage container(s) or the GWTS depending on water characterization.

3.13 Well Shocking

If iron-related and sulphate-reducing bacteria are suspected culprits of well biofouling or calcareous materials are observed on the well screen, well shocking may be used in addition to the above disinfection treatment. Shocking can be performed with a hydroxyacetic acid blend product Cotey Chemical Corporation BIOCLEAN or equivalent. Shocking can only be performed once all residual treatment chemicals have been removed from the well. The disinfectant solution is mechanically agitated into the well and gravel pack using a jetting or swabbing tool. An example treatment schedule is to perform agitation every 2-4 hours (during daylight hours) for a 24- to 36-hour period. The solution is worked across the entire length of the water column to ensure proper mixing and distribution through the well and gravel pack.

The well screen interval is then jetted or swabbed a final time before pumping fluids out of the well. Shock treatment fluids pumped from the well can be stored in temporary storage containers provided onsite. Pumping continues until all shock treatment fluids have been removed or a preset volume has been reached. All stored shock treatment liquids are sampled for waste characterization and held pending analytical results and final waste disposition.

3.14 Well Cleaning and Redevelopment

Once the well pump has been removed, physical or chemical cleaning/redevelopment processes, or a combination of these two processes, can be used to address well performance problems. General descriptions of these processes are provided below.

3.14.1 Physical Cleaning

Mechanical cleaning may be performed to remove any physical buildup such as iron or calcium deposits on the well screens. In addition, biologic films present on well casing and screen surfaces are physically removed during the initial mechanical cleaning. The mechanical cleaning process consists of a combination of swabbing, bailing, surging, pumping, and jetting. All water generated from this cleaning needs to be temporarily containerized until it is sampled and analyzed for appropriate waste disposition. Note that the process presented below is for general guidance and may be modified based on actual field observations.

- The redevelopment work may include the use of a mud deflocculant/detergent such as Cotey Chemical Corporation MUD-NOX or equivalent. Mud deflocculant/detergent is mixed with water at the surface and subsequently injected into the well in an attempt to disperse any

remaining drilling mud that may remain in the gravel pack since well installation. The solution is mechanically worked into the gravel pack using a surge block in order to maximize effective distribution in the annular space.

- A bailer with a toggle valve or equivalent is lowered into the well and used to gently surge the screen interval to remove any accumulated sand, silt, and debris accumulated in the well bore. When the bailer is brought to the surface, an Imhoff cone or equivalent is used to collect water from the bailer to evaluate the amount of silt and sediment in the water. This process is repeated after each cycle of surging and jetting.

- Following bailing, a surge block is used to surge the screened interval. The screen is surged at set intervals with strokes repeated for a set time period per interval (e.g., 5-foot intervals for 5 minutes per interval). Following the surging cycle, the well bore is bailed again to remove any accumulated sand and silt. Bailing is repeated until the discharged water has reached a set sediment volume per volume of water (e.g., less than 2 milliliters of sediment per 1 liter of water) measured using an Imhoff cone or equivalent.

- Following the surging cycle, a temporary pump is installed in the well and used to remove silt loosened during surging and settle the filter pack. Pumping follows a predetermined schedule. An example pumping schedule is lowering the pump across the saturated screen in 10-foot sections (10 positions in 100-foot screen), pumping each area for approximately 5 minutes at 100 gpm. While pumping, temperature, pH, specific conductivity, and turbidity are monitored.

- Following pumping, a jet is installed in the well screen interval to jet increments of the screened interval. The jetting device is capable of injecting water at a predetermined flow rate applicable for the well screen and filter pack. A pump attached to the jet is used to pump at a rate slightly higher rate than the injection rate used for jetting. Each increment will be jetted for a set amount of time (e.g., 5-foot increment jetted for 5 minutes). Water used in jetting is clean potable water or it may be recirculated water from the well if allowed to settle to remove fines and keep from reintroducing solids to the screen before being reinjected. The proposed potable water source is identified during the readiness review meeting.

All water generated during the mechanical well development process is containerized onsite in temporary storage until characterized and determination of final disposition.

3.14.2 Chemical Cleaning

Acid treatments may be used to remove and weaken existing biologic colonies and remove biologically-induced iron deposits and chemical crusts. Well acidification is performed using commercially available acid with inhibitors to minimize corrosive effects on metal components of the well (e.g., sulfamic acid, Dry Acid Special®). Ensure that, if using chemical cleaning with any other chemical disinfection or other treatment, there are no adverse reactions between chemical additions or mitigate the possibility that an adverse reaction could occur.

Introduction of the acid solution into the well water column is performed using a tremie pipe or jetting tool. The solution remains in the well for a preset contact time with preset agitation intervals (e.g., 24-36 hours of contact time, agitated every 2-4 hours) with a bailer or surge block during daylight hours. Chemical additives are to be used per manufacturer recommendations for mixing, installation, retention time, pH monitoring, removal, and safety.

After the acid treatment is completed, a preset volume is mechanically bailed or pumped from the well and placed into a lined roll-off or equivalent. Acidic water is recovered after completion of each acid treatment; therefore, initial and periodic pH readings of the purged water are measured during removal to determine if purging has been adequately completed. For any acid treatment, pH values after purging are targeted to be similar to the pre-treatment pH (e.g., within 1.0 pH units). Acidifying chemicals are selected that result in the production of minimal hazardous waste. If characteristic hazardous waste is produced, the waste is managed as described in the Contractor's Work Plan. All acid treatment waste solutions may be stored in lined 20-yard roll-off bins pending sampling, waste characterization, and disposal.

3.15 Well Step-Testing

A step-test may be performed to evaluate well yield or the effectiveness of the well rehabilitation on the well screens and filter pack to improve well yield. Following pump removal and any other optional activities, a rest period is allowed for aquifer recovery to steady state conditions (e.g., 12 hours).

An initial static water level measurement is taken prior to pump removal to reference as the baseline static water level. Prior to the start of a step-test, the water level is measured and compared to the baseline level to see that static water level conditions have been obtained within a reasonable amount of error (e.g., ± 0.5 feet). Since a step-test is a single well test to record drawdown levels at various steady-state pumping rates, the initial static level in the well is not critical for hydraulic analyses. Other extraction wells do not need to be shut down during the testing, as the impact from other extraction wells is relatively insignificant compared to the drawdown measured during the step-test and the sensitivity of the step-test analysis.

A temporary submersible pump/piping is installed into the well capable of producing the highest step flow rate under an expected total dynamic head. An inline flowmeter is necessary to monitor pumping rate. A pipe connection from the pump drop pipe to the existing conveyance line pipe in the vault may need to be fabricated for the step-test. Appropriate connector flanges, piping, and gaskets are to be provided to connect the temporary pump to the existing conveyance line. Disassembly and removal of vault instrumentation, equipment, and associated piping may be necessary to access the desired conveyance line hook-up point.

Once all physical and electrical connections are made and initial pump operational tests are complete, a water level probe(s) is installed within the sounding tube to record water level readings throughout the test. The step-test follows a pumping schedule without interruption based on field observations and equipment constraints. Below is an example pumping schedule:

- 100 gpm for 60 minutes
- 150 gpm for 60 minutes
- 200 gpm for 60 minutes
- 250 gpm for 60 minutes.

Records of the time, pump flow rate, water levels in the well, and time for each step are recorded. Water level readings are to be taken at set intervals. An example of reading intervals is 1 reading per minute for the first 5 minutes and every 5-minute intervals thereafter for each step. The test water is pumped directly to the GWTS for treatment. At the completion of the test, all temporary piping, pump, and associated equipment are removed from the well and the original equipment can be installed provided there are no additional work requirements for the well.

3.16 Alarm Testing

Operators perform alarm testing at least annually to ensure that: (1) alarm equipment has not failed; and (2) during an alarm condition, the system responds properly to the alarm. Alarm testing occurs on equipment affected by programming changes that may affect alarm equipment or response. Alarm testing typically consists of manually faulting or simulating fault conditions in order to have the system exhibit a fault alarm and response. Manual faulting is recommended on alarm equipment that is accessible and can be easily faulted (leak detectors). Leak detectors are tested by completing their circuit either using water, voltage meter, or conductors, but using water from the well(s) associated with the leak detector is recommended as this most closely resembles real-world conditions in the case of a leak. Certain equipment can be manually tested to see if they alarm; however, manual testing cannot be performed during normal operations (high pressure switches and tank level sensors). High pressure switches can be tested by isolating the location of the pressure switch and pressuring the line with potable water. The Operator ensures there is a gauge on the isolated line to test the switch pressure set point at the same time. Tank level sensors can be tested by manually operating the extraction well, influent, and effluent pumps to bring the tank levels above or below the level needed to cause the alarm condition.

Items that are inaccessible, difficult to fault under normal operating conditions (tank level sensors, high pressure switches), or could pose risk to equipment or personnel (skid power loss, extraction well alarms) can be tested for system response by simulating an alarm condition either through the software or by tripping breakers in the PLC panel. While simulation does not test the alarm equipment for function, conditions that typically cause these types of alarms result in shutdown of the affected system regardless of PLC shutdown commands, except for the tank level sensors and high pressure switches (which can be tested manually for equipment function as described in the previous paragraph).

3.17 Flowmeter Verification Testing

Operators perform flowmeter verification testing at least annually to ensure that extraction well, influent, and effluent flowmeters are providing accurate flow information and totalized volumes. Flowmeter verification testing is typically performed by the following steps:

- Isolate the influent tanks.

- Shut down a treatment train and its respective extraction wells (KAFB-106233 and KAFB-106234 for Train 1; KAFB-106228 and KAFB-106239 for Train 2).

- Operate well pumps individually for the shutdown train using the “ON” mode on the SCADA for approximately 5-10 minutes each (as tank capacity allows), noting the following three items once flow has reach its maximum: (1) the start and end times of operation, (2) average flow rate of the flowmeter (taken from the flowmeter directly), and (3) initial and final tank levels on the flowmeter verification form (Appendix H).

- The average flow rate from the flowmeter is then compared to the tank volume change (calculated from the tank level change) divided by the change in time. If the flowmeter average flow varies by more than 5 percent from the tank calculated flow rate, the tested flowmeter requires recalibration. Recalibration is performed in accordance with manufacturer’s specifications provided in Appendix I. Any recalibrated flowmeter is retested following recalibration. In the event that the recalibrated flowmeter fails to produce less than 5 percent error using the method described above, the flowmeter is replaced, and the replacement flowmeter tested.

- This process is then repeated for each flowmeter throughout the train. Note that effluent pumps use the loss of water from the effluent tanks in order to calculate the change in level and influent flowmeters can be tested using either change in influent or effluent tank level. Once all testing on a train has been completed, the other train then undergoes the same testing procedure until all of the flowmeters of the GWTS have been tested and verified.

3.18 Maintenance Logs

The Operators maintain logs that document and record all routine and non-routine maintenance activities. Forms used for recording general inspection, calibration of instruments, maintenance, and repair of equipment are provided in Appendix H. An example log sheet for lock-out/tag-out activities that may be required for equipment maintenance and repair activities is provided in Appendix H. Additionally, any records for repair of equipment (service invoices, spare parts orders and invoices, and service reports) are retained in an equipment file for individual pieces of equipment. Separate forms for maintenance and calibration of flowmeters are provided in Appendix H. The Contractor maintains hard copies of these records onsite in the GWTS building control room or the Contractor's office. If hard copies of records are kept offsite, electronic copies of the maintenance records are available to the Operator at the GWTS.

3.19 Non-Routine Maintenance and System Adjustments

Certain non-routine maintenance activities are uncommon. In the case that these activities occur, generalized procedures can be referenced here.

3.19.1 Emergency Conveyance Line Repairs

If the influent conveyance line is damaged, a current contract in place holds that the subcontractor will follow a general guideline, which is summarized below.

In the case that a damaged line results in water loss, NMED will be verbally notified as soon as possible after learning of the release, but no more than 24 hours thereafter.

The subcontractor will locate the damaged section of GWTS conveyance line and excavate the dirt to expose the damaged line. If the extraction well(s) associated with the damaged line have not already been automatically shut down due to a conveyance line leak detect, the well(s) in question will be shut down manually following immediate identification of the well(s). The subcontractor will make temporary emergency repairs to prevent further water loss and will remove any standing water and containerize for pending disposal. Contaminated soil will also be containerized for pending disposal. Site security and safety will be maintained, and proper documentation of the incident will be completed. The subcontractor will then provide the necessary plans, drawings, and other documentation to properly repair the damaged conveyance line. Once repairs are completed, the newly repaired line and its alarms will be tested. The excavation will be backfilled and compacted; roadways, sidewalks, or landscapes will be reconstructed; and any remaining waste will be removed and held offsite. A full detailed list of the procedure is provided in Appendix I.

An emergency replacement double-wall conveyance line for all four extraction wells (KAFB-106228, KAFB-106233, KAFB-106234, and KAFB-106239) and for combined lines (KAFB-106233/234 and KAFB-106228/239) is stored in the GWTS yard (Table 3-2). Note that the conveyance line material for KAFB-106228 is separate from the other extraction wells and must only be used with KAFB-106228.

3.19.2 Single Train Diversion

If a train (Train 1 or 2) is damaged, undergoing servicing, or is otherwise unable to operate under normal conditions, the influent water for that train can be diverted into the other train to continue to pump a maximum number of extraction wells as possible through the GWTS.

To divert influent water for one train into the other, shut down the GWTS and ensure all four extraction wells are offline. Place the inoperable train's influent pump skid VFDs into manual to prevent accidental pump operation. At the influent tree, isolate the influent from the operable train by closing the train's valve above the bypass. If only the wells from one train will be pumped into the other train (e.g., pumping KAFB-106228 and KAFB-106239 through Train 1, or pumping KAFB-106233 and KAFB-106234 through Train 2), isolate the wells not to be pumped through by closing the respective train's valve *below* the influent tree bypass. Lastly, open the butterfly valve at the influent tree bypass to combine the flows from the influent of both trains. Ensure that the valves are in their correct opened or closed positions. Restart only the operable train and extraction wells and adjust the throughput gallons per minute as necessary.

3.20 Groundwater Treatment System Consumables and Small Parts Information

The GWTS contains materials and supplies needed for occasional O&M activities. Table 3-2 provides a list of large items, such as replacement pumps. A recommended inventory of on-hand specific consumable supplies, recommended supplier, and part numbers is provided in Table 3-3. A list of tools and small parts that are present in the GWTS to perform various O&M activities is provided in Table 3-4. Several items that are required for GWTS operations need to be provided by the Contractor. Tables 3-2 through 3-4 denote items that are transferable between Contractors and non-transferable items that are the responsibility of the Contractor to purchase.

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4. SYSTEM TROUBLESHOOTING

Occasionally, during day-to-day GWTS operations, certain system-specific issues may occur. This troubleshooting section exists to remedy such issues. User operational adjustments are provided in Appendix L.

4.1 Influent Valve Set Points

During times when wells are offline, the valves on the influent tree may require adjustment to keep from preferentially filling one influent tank over the other, especially when the influent tanks are not open to equalization or equalization is hampered (as described below). This can cause operational issues and downtime as the tanks may activate a high- or low-level switch. For instance, when operating wells KAFB-106228, KAFB-106233, and KAFB-106234, the valve on the influent tree associated with KAFB-106228 is closed to approximately 60 percent to obtain similar flow rates to the influent tanks. Set points have been marked on the influent valve indicators; however, it is important that the Operator be aware of the need to adjust these valves in order to maintain consistent flow. Fine tuning of the valves may be required when the system is operating under a different influent flow condition.

4.2 Influent Tank Equalization

The influent tanks are connected by a 6-inch pipe that contains two basket strainers and feeds to both influent skids. Over time, the levels in the influent tanks may begin to deviate as there is a loss of equalization, preferentially pulling water from one tank with both skids. This can cause operational issues and downtime as the tanks may activate a high- or low-level switch. In this instance, the basket strainers are cleaned and inspected.

4.3 UIC Hydraulic Pump Overload Reset

The V-smart valve located at KAFB-7 was removed after a hydraulic line failed (ORCOM, 2019).

Due to power fluctuations associated with on-Base utilities at a UIC, an automated flow control valve located at a UIC well may become to be unresponsive to SCADA/PLC controls. In the event that the smart valve becomes unresponsive, power loss to the hydraulic pump that actuates the valve has likely been interrupted. The first troubleshooting step to determine a loss of power to the hydraulic pump is to ensure that a power outage is not occurring at the UIC. This is accomplished by opening the control panel and seeing if the uninterruptable power supply lights are illuminated. If none of the uninterruptable power supply lights are illuminated, then an outage has likely occurred. Base utilities need to be contacted to resolve the outage. If the uninterruptable power supply lights indicate that power is being supplied to the UIC well equipment, but the hydraulic pump lights are not illuminated, the hydraulic pump needs to have its overload protector reset. The overload protector is reset by first opening the hydraulic pump cabinet. Next the Operator disconnects power to the cabinet. The Operator then removes the cover over the overload switch and presses the reset button. Once reset, the cover is returned and the unit is reenergized.

4.4 KAFB-106233 and KAFB-106234 Start Order

Occasionally, when KAFB-106233 is offline and KAFB-106234 is started, KAFB-106233 initializes and then fails. The easiest way to correct this is by setting KAFB-106233 before KAFB-106234 in the startup sequence. If KAFB-106233 is not intended to operate at the same time as KAFB-106234, then

KAFB-106233 should be deenergized prior to startup of KAFB-106234. In the event that KAFB-106233 needs to be initialized following KAFB-106234, then the system should undergo a standard startup; and, following failure of KAFB-106233, the alarm condition can be reset by manually opening the remotely actuated valve, resetting the alarm on the SCADA, running KAFB-106233 locally, and then returning KAFB-106233 to the auto mode on the motor starter. KAFB-106233 must now be restarted using the "on" button on the SCADA. Once in operation, press the "auto" button to return the well into PLC controlled operation.

5. PROCESS MONITORING

This section provides an overview of the monitored operating parameters and sampling used to determine the performance of the carbon treatment system and quality of treated water discharged to the GCMP or a UIC well. The full requirements for sampling and analysis are covered in the Sampling and Analysis Plan (Appendix J). The results of the process monitoring sampling are used to evaluate performance of the carbon beds and determine if the online beds require carbon change-out. The analytical results are reviewed to confirm that the contaminant concentrations meet the discharge criteria provided in Appendix J.

Analytical results will be reported in routine monitoring reports (e.g., Quarterly Monitoring Report) to NMED as required in any approved permit. Each reporting event consists of a Data Quality Summary Report and laboratory data packages. For details on sampling and analysis procedures, refer to the Sampling and Analysis Plan (Appendix J). The Sampling and Analysis Plan includes laboratory testing requirements and the achievable laboratory limits.

Operational parameters for the treatment system are monitored by the SCADA. The SCADA records the output of automated flow and level instruments communicating with the PLC. The SCADA also records alarms and operating time totals for the influent pumps. These data are downloaded monthly and stored electronically by the Contractor for use in generating any system-related reports. System shutdowns are recorded on the shutdown logs provided in Appendix H.

5.1 Extraction Wells

The water level in the well casing, pump status, wellhead pressure, and groundwater flow rate at the extraction wells is monitored and recorded by the SCADA as part of normal process monitoring. Filter pack level at all extraction wells is monitored and recorded, at a minimum, annually. Laboratory analysis samples are collected in accordance with the Sampling and Analysis Plan (Appendix J). In addition to the information collected by the SCADA, the Operators record the readings of the local instruments in the well vaults for KAFB-106228 and KAFB-106239 as well as in the WCH for wells KAFB-106233 and KAFB-106234. These include any manual gauges located at the wellheads, WCH, and conveyance line vaults. These readings are recorded at least once per month using the forms provided in Appendix H.

Water level transmitters were installed in KAFB-106233, KAFB-106234, and KAFB-106239 to replace the transducers. Water level data from the new transmitters are automatically recorded by the GWTS SCADA.

5.2 Treatment System

As noted above, GWTS operational parameters are recorded by the SCADA. These parameters include the following:

- Extraction well flow rates
- Extraction well head pressures
- Extraction well water levels
- Influent skid flow rates
- Effluent skid flow rates
- Total system flow rate
- Upstream distribution pressure
- UIC well flow rates

- UIC wellhead pressures
- UIC well water levels
- GCMP level.

In addition to the SCADA data, the Operators record the readings of the differential pressure gauges on all four of the influent bag filter housings (PDI-112 A/B and PDI-116 A/B) and record the inlet and outlet pressure gauge readings on all carbon beds and pump skids (PI-3104 A/B and PI-3105). The Operator also records the totalizer readings from all flowmeters. These readings are recorded on the forms provided in Appendix H. All data from the GWTS, including run data gathered from the wells, WCH, vaults, and treatment plant operation logs, maintenance, and regular inspections, are reviewed quarterly by project engineering personnel and provided in the quarterly reports. This review identifies trending details of the performance of wells, pumps, and treatment equipment.

The Operators must specifically collect the following information relevant to KAFB-7 and any additional UIC wells installed in the future in accordance with DP-1839 Condition 21 (Table 1-2):

- Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well

- The totalized monthly volume of treated effluent transferred to all UIC wells

- Monthly average, maximum, and minimum head values of injection water for each UIC well.

A transmitter is installed in a UIC well to monitor water level and ensure that the well is not overfilled during injection. The transmitter replaced the previous transducer. The PLC is programmed to shut down the well if the water level in the well exceeds the high-level set point. Water level data from the transmitter are automatically recorded by the GWTS SCADA.

5.3 Influent and Effluent Monitoring

Influent water to be processed by the GWTS must meet certain standards prior to processing to mitigate the potential release of partially treated water to select discharge locations. Influent water concentrations have been established for water that reaches the lead GAC vessel; these concentrations are presented in Table 5-1 and are based upon manufacturer models provided in Appendix G.

GWTS effluent must comply with any approved federal, state, or local permits. Effluent discharged from the GWTS must not exceed the discharge criteria identified in Appendix J. Extraction well, influent, post-lead GAC vessel, and effluent sampling locations are described below.

Extraction Wells—Samples are collected from a sample port located at the wellhead and/or the WCH just downstream of the flowmeter. All of the extraction wells are capable of being sampled individually.

Samples are obtained at six locations throughout the plant. Each train can be sampled at each location individually.

Influent—Samples are collected at the combined outlet of the influent pumps, but prior to the pre-treatment bag filters on the influent pump skids.

Post-Lead GAC Vessel—Samples are collected at the outlet of the lead carbon vessels. Each train can be sampled individually.

Effluent—Samples are collected at the outlet of the effluent pump, but prior to the post-treatment bag filters on the effluent pump skids.

Extraction well and GWTS sampling schedules and analytes are described in Appendix J.

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6. RECORDKEEPING

Records of the GWTS O&M and monitoring are maintained for use by operating personnel, management, and appropriate regulatory agencies. The proper collection and archiving of information are essential as the GWTS is intended for multiple years of operation. These records are used to establish a baseline and performance history of the GWTS. Records may be used for the following reasons:

- Evaluate plant performance
- Assist in troubleshooting operational problems at the GWTS
- Ensure the preventative maintenance schedule is performed
- Provide information for reports to regulatory agencies
- Comply with relevant permits and regulations.

Records are maintained by the Contractor onsite in the GWTS building control room or in the Contractor's office. Operators have access to electronic copies of the records if the hard copies are maintained in the Contractor's office. Records include hard copies of the O&M log sheets included in Appendix H and computerized operating records. Copies of reports are available to Operators electronically and at the Contractor's office. Waste characterization, generation, and waste records are maintained by the Contractor in accordance with the RCRA Permit.

6.1 Reporting

The Contractor submits weekly performance updates, monthly New Mexico Office of the State Engineer extraction/injection volumes, monthly Kirtland AFB Civil Engineering updates, and quarterly and annual performance reports, as required. Table 6-1 provides a list of reports, report contents, regulatory permits and/or documents requiring the reporting, and entities to which these reports need to be submitted. Examples of weekly and monthly reports are provided in Appendix N. All quarterly and annual reports are submitted to Kirtland AFB for review, approval, and submittal to NMED and can be found on the most recent project website (hosted and updated by Kirtland AFB or Contractor support). The quarterly and annual reports must include the items listed in Table 5-1 as well as the following:

- Monthly average, minimum, and maximum flow rate values collected throughout the system
- Total monthly/quarterly/annual treatment volumes
- Monthly volumes distributed to each discharge location
- Total monthly volumes extracted from extraction well(s)
- Monthly average, minimum, and maximum head values from extraction well(s)
- Percent system runtime per quarter/annum
- Average operational groundwater extraction rates for individual wells per quarter/annum
- Average specific capacities for individual extraction wells per quarter/annum
- Analytical metrics including system sampling forms, analytical results, with laboratory and data quality reports, and estimated EDB removal per quarter/annum

- Summary of routine and non-routine equipment maintenance activities, repairs, and modifications if performed, including but not limited to the following:

  — Bag filter change-outs
  — GAC change-outs
  — Mechanical integrity evaluations
  — Well rehabilitation
  — Malfunction, repair, or replacement of a flowmeter
  — Operational changes with the potential to affect discharge quality

- Status of off-Base conveyance line security and administrative controls per quarter/annum

- Summary of shutdown and alarm events, including O&M issues that contributed to significant downtime for the GWTS.

The quarterly and annual performance reports of the GWTS are incorporated into the Quarterly Reports, which are submitted at the following frequency:

- Report inclusive of January 1 through March 31 is due June 30 of the same year
- Report inclusive of April 1 through June 30 is due September 30 of the same year
- Report inclusive of July 1 through September 30 is due December 31 of the same year
- Report inclusive of October 1 through December 31 is due March 31 of the next year.

The Operator makes any required notifications to the GWTS Project Manager, who then notifies Kirtland AFB, who must then make any required regulatory notifications to NMED. Specific to the discharge requirements, the Contractor provides validated monitoring data in the Quarterly Reports to NMED.

The entire system performance is evaluated by a qualified engineer and/or hydrologist, at a minimum, annually. Well performance parameters (flow rates, drawdown, changes in water chemistry, as well as performance of the carbon beds and mechanical/electrical systems) are evaluated quarterly. Trending data are incorporated from sampling, run logs, maintenance activities, and Operator feedback. The evaluations are included in the appropriate report and provide direction for further maintenance or optimization of the system and its components.

6.2 Equipment Warranties

Manufacturer's warranties for GWTS equipment are included with the manufacturers' information in Appendix I. The Contractor monitors system performance and identifies the need for additional spare parts based on assessing the likelihood of component failures and consequences. Spare parts and consumables are addressed in Section 3.15. Subcontractors for construction and installation of GWTS components provide guarantees that all work and services performed are in accordance with accepted standards and practices. These subcontractors also guarantee that all equipment and materials are furnished against defects in construction and/or workmanship for a period of 1 year following completion of its work and acceptance.

7. WASTE MANAGEMENT

Onsite waste management is performed by the Operator or other designated waste management person. Bag filters, water from monitoring wells, backwash water, depleted GAC, and pH adjustment solutions are the primary waste items requiring management at the GWTS facility. All waste requiring specialized disposal is disposed of in accordance with applicable permits.

7.1 Bag Filters

Spent bag filters are produced after any bag filter change-out occurs. The bag filters are dried prior to disposal and disposed of as non-hazardous solid waste; supporting documentation for this disposal decision is provided in Appendix K.

7.2 Monitoring Well and Maintenance Activity Water

All groundwater generated during well installation, development, or routine groundwater monitoring events and all well maintenance activities are 100 percent captured and contained during generation. The following categories of water are discussed in the paragraphs below:

- **Non-hazardous water** generated from:
  - Water from wells for which the sampling data for two consecutive preceding sampling events document no contaminants are present at concentrations that meet the definition of characteristic hazardous waste (40 Code of Federal Regulations [CFR] Part 261).
- **Hazardous/potentially hazardous water** generated from:
  - Water from wells for which any data from two consecutive preceding sampling events document contamination is present at concentrations that exceed the characteristic hazardous waste toxicity criteria (40 CFR Part 261.24) that have not been characterized.
  - Water from wells for which historical data show water quality fluctuating between non-hazardous and hazardous classification over the past four quarters that have not been characterized.
  - Water that had concentrations relatively close to the regulatory standard in 40 CFR part 261.24 (e.g., water that exhibited benzene above 0.4 mg/L in at least one of the previous two events that has not been characterized).
  - Decontamination water from equipment cleaning across all hazardous or potentially hazardous well activities that has not been characterized.
- **Water of unknown quality** generated from installation, development, decontamination, sampling, maintenance, or other activities for which data are not available for two sampling events and that has not been characterized.

7.2.1 Non-Hazardous Water

Based on the previous sampling data as described above, non-hazardous water generated from well sampling activities do not require segregation either at the point of generation or while in storage. Water generated at these wells is discharged to the GWTS in-floor sump if they meet the investigation-derived waste requirements provided in Appendix O and summarized in Table 6-1. Water that does not meet the requirements outlined in Appendix O is disposed of at an offsite location. Water discharged to the GWTS in-floor sump is pumped from the sump to the Train 1 influent tank for treatment through the system. The quantity of water generated from each well and the total quantity of water transferred to the GWTS in-floor sump is recorded. A minimal quantity of fines is anticipated to be present in this water and pre-filtering before batching into the GWTS is not anticipated. At the discretion of the Operator, the unfiltered water may be run through a 50-, 10-, or 1-micron bag filter as a pretreatment step.

If, for any reason, the GWTS cannot accept water as it is generated (e.g., shut down for maintenance, improper flow condition, etc.), the water is temporarily stored in the investigation-derived waste area on pallets and properly labeled until it can be discharged to the GWTS in-floor sump.

7.2.2 Hazardous/Potentially Hazardous Water

Based on the previous quarterly sampling event as described above, characteristically hazardous water generated from well sampling activities is kept segregated by point of origin both during transport and in storage. Upon generation, the water is placed in dedicated drums and transported to the less than 90-day accumulation area where the drums are labeled and stored pending receipt of laboratory analytical results. This water is profiled for disposal based on the analytical data from the sample collected from the generating well. If the water is determined to be non-hazardous following characterization and meets the criteria identified in Appendix O, then that water is processed as described in the above section. Water generated from uncharacterized sources is treated the same way as the hazardous water until proven that the water is non-hazardous. The quantity of water generated from each well or activity is recorded.

Drums containing hazardous purge water are labeled with standard “Hazardous Waste” labels with RCRA waste code identified on the label and a separate label with the identifying hazard(s) of the waste. For the BFF hazardous purge water, the RCRA code is D018 and the hazard identification is “Toxic.” Updated labeling requirements are found in 40 CFR 262.17(a)(5) which were promulgated by EPA under the Generator Improvement Rule in May 2017 and adopted by NMED in December, 2018 (20.4.3 New Mexico Administrative Code).

Drums that contain potentially hazardous purge water are labeled with “This Container ON HOLD Pending Analysis.” Upon receipt of analytical data, the drum is either relabeled as hazardous or non-hazardous as dictated by the analytical results. Once classified as non-hazardous purge water, the drum is moved out of the <90-day accumulation area to the BFF non-hazardous investigation-derived waste yard.

7.2.3 Water of Unknown Quality

Water of unknown quality associated with installation, development, maintenance, or other activities is initially placed in portable tanks located at the wellhead where it is produced. Any fines are allowed to settle before the water is transported, on a daily basis, using vacuum trucks from the wellhead to a centralized storage area where it is pumped into storage tanks. The quantity of water generated, and the total quantity of water transferred into any storage tanks is recorded. Upon conclusion of an activity, or when a storage tank reaches capacity, one water sample is collected from the tank; proper disposal takes place upon receipt of the analytical results. Upon receipt of the analytical results confirming that the

water is non-hazardous and conforms to the requirements identified in Appendix O, the water is processed as described in Section 6.2. If the water is hazardous based on toxicity characteristics or does not conform to the requirements identified in Appendix K, the water is disposed of offsite in accordance with appropriate regulations.

7.3 Pre-Treatment pH Adjustment and Disinfection

Sodium hypochlorite solution (8.25 percent) is used for two pre-treatment processes: (1) injection as an oxidant, disinfectant upstream of the pre-treatment sand filters; and (2) to adjust the pH, disinfect investigation-derived waste monitoring network purge water prior to disposal. The sodium hypochlorite solution is stored in the GWTS building on secondary containment pallets. The GWTS is registered with the Kirtland AFB Hazardous Materials Group as Shop Number 1706A. Any hazardous materials, such as sodium hypochlorite solution or calibration gas for instruments, must be tracked and tagged with a Hazardous Waste Group label, use recorded, and storage capacities must not exceed the prescribed limits outlined in Kirtland AFB Hazardous Materials Group's Shop Number 1706A database. Monthly reports are provided to the Kirtland AFB Hazardous Materials Group documenting chemical usage and restocking orders that occurred during the month.

7.3.1 Sand Filter Pre-Treatment

Following installation of the pre-treatment sand filters, dosing pumps were installed to inject commercially available sodium hypochlorite solution into the influent water. The sodium hypochlorite solution container is emptied directly into the dosing pump hopper. No sodium hypochlorite waste is expected from this process.

7.3.2 Investigation-Derived Waste Purge Water

Some monitoring network purge water may contain below neutral pH that requires adjustment or biological materials that need to be removed. A pH adjustment can be performed on water less than neutral to neutral conditions by adding commercially available sodium hypochlorite solution to the water. Additionally, sodium hypochlorite can be used as a disinfectant on waters with the potential to introduce high quantities of unwanted organisms into the system. When performing a pH adjustment or disinfection with sodium hypochlorite solution, ensure that the pH of the water being adjusted is continuously monitored. Once adjusted, the water can be disposed of per the investigation-derived waste processing requirements provided in Section 7.2. No sodium hypochlorite waste is expected from this process.

7.4 Backwash Water

Backwash water from GWTS components (GAC vessels, tanks, etc.) is created when the components require backwashing or during change-out of the GAC. Backwash water is characterized prior to disposal through the GWTS. Backwash water likely requires settling of fines and pre-filtration before being discharged to the GWTS. In the event that the backwash water cannot be filtered effectively, the backwash water is disposed of offsite in accordance with appropriate regulations. Backwash water sampling requirements are described in the Sampling and Analysis Plan (Appendix J).

7.5 Depleted Granular Activated Carbon

Eventual depletion of the ability of the GAC to remove contaminants of concern will require removal of the depleted GAC from their associated vessels. Depleted GAC is removed from the GAC vessels and regenerated offsite by a third party for reuse in accordance with appropriate permits and regulations.

7.6 Used Pump Oil

Used pump oil and oil-contaminated materials including gloves, paper towels, or plastic bags are stored in labeled, lined 5-gallon buckets placed on polyethylene pallets with secondary containment in the GWTS building's southwest corner. Once the containers are near to being full, the oil and materials are recycled or disposed of, in accordance with approved Base requirements.

8. REFERENCES

American Water Works Association (AWWA). 1975. Simplified Procedures for Water Examination, AWWA Manual M12 Including Supplement on Instrumentation Methods.

AWWA. 2003. C654-03: AWWA Standard for Disinfection of Wells.

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New Mexico Environment Department (NMED). 2010. Hazardous Waste Treatment Facility Operating Permit, EPA ID Number NM9570024423, issued to U.S. Air Force for the Open Detonation Unit Located at Kirtland Air Force Base, Bernalillo County, New Mexico, by the New Mexico Environment Department Hazardous Waste Bureau. July.

NMED. 2016. Correspondence from Trais Kliphuis, Director, Water Protection Division to Mr. Wayne L. Bitner, Chief, Environmental Restoration, Kirtland Air Force Base, New Mexico, regarding DP-1770 Modification Application and Termination. April 4.

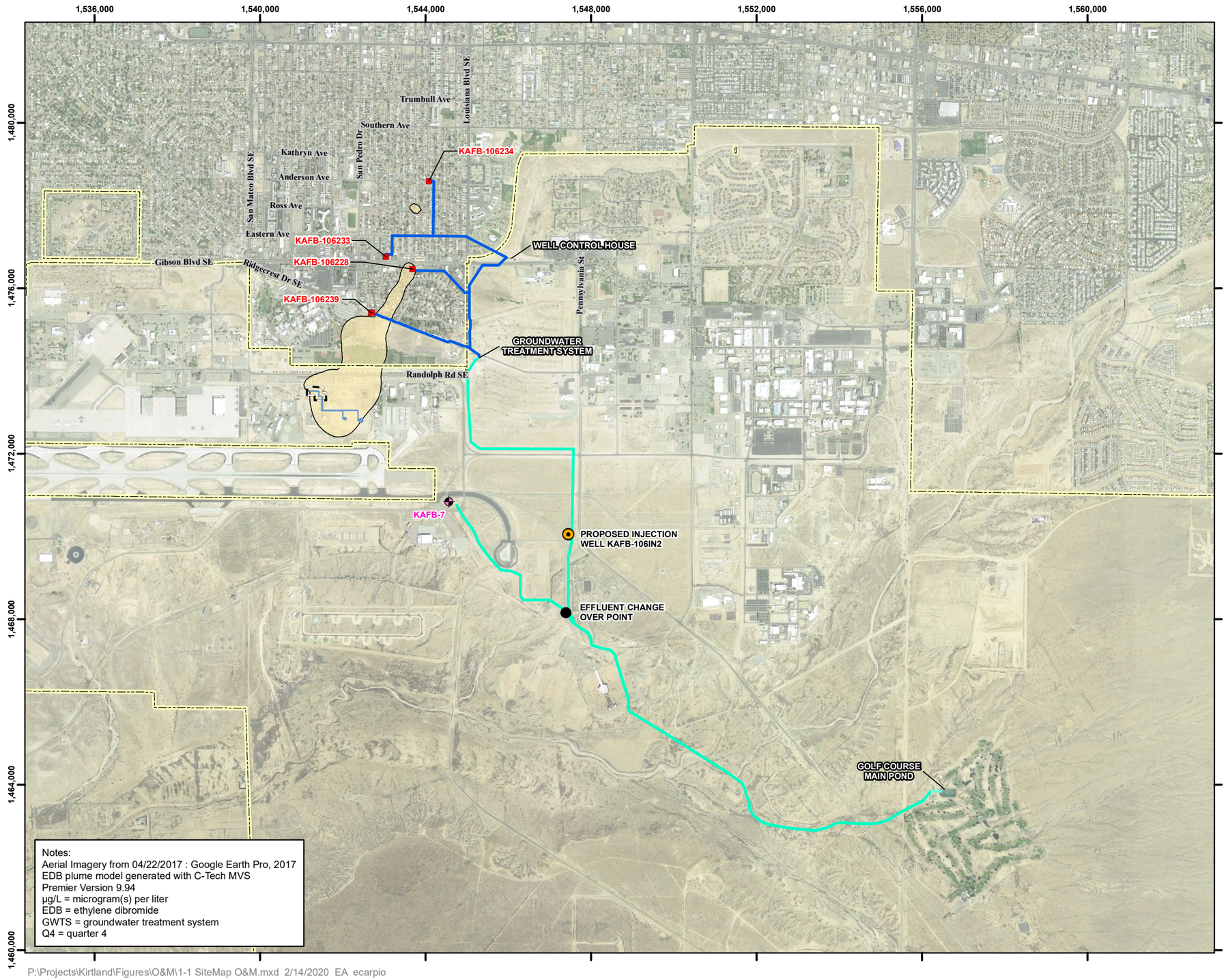
NMED. 2017. Discharge Permit Issuance DP-1839, Kirtland Air Force Base, Bernalillo County, New Mexico, by the New Mexico Environment Department Groundwater Quality Bureau. April.

ORCOM. 2019. KAFB-7 Injection System Repair and Improvement, Bulk Fuels Facility Report, Kirtland Air Force Base, New Mexico. May.

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FIGURE

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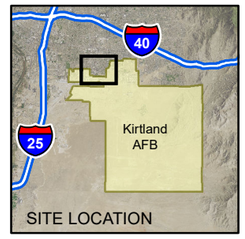


Notes:
Aerial Imagery from 04/22/2017 : Google Earth Pro, 2017
EDB plume model generated with C-Tech MVS Premier Version 9.94
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GWTS = groundwater treatment system
Q4 = quarter 4

P:\Projects\Kirtland\Figures\O&M\1-1 SiteMap O&M.mxd 2/14/2020 EA ecarpio

Legend

- Proposed Underground Injection Control Well KAFB-106IN2 Location
- Extraction Well
- Injection Well
- Former Aboveground Storage Tank
- Former Fuel Transfer Line
- GWTS Influent Piping
- GWTS Effluent Piping
- Installation Boundary
- Source Area
- EDB Plume Q4 2019 (>0.05 µg/L)



N

0 1,250 2,500 5,000

Feet

1 inch = 2,500 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

OPERATIONS AND MAINTENANCE PLAN
REVISION 3
GROUNDWATER TREATMENT SYSTEM
SOLID WASTE MANAGEMENT UNITS ST-106/
SS-111 KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1-1

SITE MAP

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TABLES

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Table 1-1
Applicable Permits

Permit	Issuing Agency	Date Issued	Date Expires	Permitted Activities
New Mexico Environment Department Permits				
Discharge Permit, DP-1839	Ground Water Quality Bureau New Mexico Environment Department 1190 South St. Francis Drive Santa Fe, NM 87502-5469	28 April 2017	28 April 2022	Discharge Permit for treated effluent maximum discharge of 1,000 gallons per minute to maximum of five underground injection control wells
Hazardous Waste Treatment Facility Operating Permit U.S. Environmental Protection Agency Identification Number NM9570024423	Hazardous Waste Bureau New Mexico Environment Department 2905 Rodeo Park Drive E, Building 1, Santa Fe, NM 87505	July 2010	Permit is administratively extended	The Bulk Fuels Facility corrective action, including the design and operation of the groundwater treatment system, is being implemented pursuant to the Resource Conservation and Recovery Act corrective action provisions in Part 6 of the Resource Conservation and Recovery Act Permit
State of New Mexico Office of the State Engineer Permits				
RG-1587	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	10 December 2015	1 December 2025	Allows for the injection of 1239 gpm (2,000 acre-feet per annum) into injection well KAFB-7
RG-1587 POD 376-379	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	9 January 2020	9 January 2050	Allows for the installation of four additional underground injection control wells with a total quantity of injection not to exceed 4,500 acre-feet per annum for all wells combined.
RG-1579 POD 292	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	17 June 2015	15 June 2025	Allows for the extraction of 250 gpm (403 acre-feet per annum) from extraction well KAFB-106228
RG-1579 POD 309	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	29 October 2015	1 November 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106233
RG-1579 POD 310	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	29 October 2015	1 November 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106234
RG-1579 POD 319	State of New Mexico Office of the State Engineer District I 5550 San Antonio NE Albuquerque, NM 87109	7 December 2016	1 December 2025	Allows for the extraction of 200 gpm (323 acre-feet per annum) from extraction well KAFB-106239

Table 1-1
Applicable Permits

Permit	Issuing Agency	Date Issued	Date Expires	Permitted Activities
Right of Entry Agreements				
Christ United Methodist Church License to Kirtland Air Force Base	Christ United Methodist Church 6200 Gibson Boulevard SE, Albuquerque, NM 87108	9 January 2015	8 January 2020	Allows for the entry and performance of tasks in an around extraction well KAFB-106228
License Agreement Between the City of Albuquerque and Kirtland Air Force Base	Chief Administrative Officer, City of Albuquerque City-County Government Center, #1 Civic Plaza P.O. Box 1293 Albuquerque, NM 87103	21 September 2016	20 September 2026	Allows for the entry and performance of tasks in an around extraction wells KAFB-106233, KAFB-106234, and KAFB-106239 as well as off-Base conveyance lines and various monitoring wells
New Mexico Veterans Administration Health Care System Permit	New Mexico VA Health Care System 1501 San Pedro SE Albuquerque, NM 87108	28 January 2016	27 January 2021	Allows for the entry and performance of tasks in an around extraction well KAFB-106239 and various monitoring wells
Gibson Medical Center License to Kirtland Air Force Base	Gibson Medical Center 5400 Gibson Boulevard SE Albuquerque, NM 87108	15 July 2016	14 July 2021	Allows for the entry and performance of tasks in an around monitoring wells

gpm = gallon(s) per minute.
KAFB = Kirtland Air Force Base.
Copies of all permits are provided in Appendix A.

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	Discharge Permit, DP-1839	
	A. Operational Plan	
1	The Permittee shall implement the following operational plan to ensure compliance with Title 20, Chapter 6, Parts 2 and 4 NMAC. [20.6.2.3109.C NMAC]	NA
2	The Permittee shall operate in a manner such that standards and requirements of Sections 20.6.2.3101 and 20.6.2.3103 NMAC are not violated. [20.6.2.3101 NMAC,20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	NA
3	The Permittee shall ensure that the most recent versions of all Work Plans associated with the GWTS, the effluent conveyance pipeline, and the UIC well(s) are consistent with the requirements of this Discharge Permit. [20.6.2.3101 NMAC,20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	NA
4	The Permittee shall ensure all discharges associated with this Discharge Permit are located within the Designated UIC Area within Section 01 of T9N R3E; Sections 05, 06, 07, 08, and 09 of T9N R4E; and Section 31 of T10N R4E (see Appendix B). [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	Appendix D - System Description
5	The Permittee shall ensure that proposed UIC well locations (see Appendix B) and associated discharges are consistent with the most recent approved Stage 2 Abatement Plan for SWMU ST-105. [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]	NA
6	The Permittee shall ensure that discharged groundwater effluent is less than or equal to the effluent standards for all constituents referenced in 20.6.2.3103 NMAC. The term "effluent standard" is used in this Discharge Permit to refer to the New Mexico Water Quality Control Commission (WQCC) groundwater standard or the federal U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL); whichever is more stringent. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Appendix L - Sampling and Analysis Plan
7	The Permittee shall ensure that GWTS influent chemistry is consistent with the design basis of the GWTS. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Section 5.3 - Influent and Effluent Monitoring
8	The Permittee is authorized to install and operate not more than five UIC wells. Authorized UIC wells are listed in Table 1. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	NA
9	The Permittee shall ensure that the total discharge from the facility via UIC wells does not exceed 1,440,000 gpd. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]	Section 2.6 - Discharge Locations
10	Prior to the installation of a new UIC well, the Permittee shall submit a Work Plan for NMED approval that satisfies the requirements of this Discharge Permit and the corrective action provisions at Part 6 of the RCRA Permit. This Work Plan shall, at a minimum, include the following information unless the Permittee can demonstrate to NMED that an item is not applicable or appropriate under the proposed activity or if an item has been provided separately under another submission: a. A statement of purpose and need for the additional UIC well(s); b. A list of groundwater monitoring wells which may be added to the monitoring program to effectively monitor performance of the new UIC well(s); c. A map showing the location of the proposed UIC well(s) and the location of all associated monitoring well(s); d. The geographic coordinates of the location of the UIC well(s) including township/range and section; e. A map showing the location of the nearest production well; f. A proposal of how the structural integrity of the treated effluent conveyance system between the GWTS and the new well will be demonstrated; g. Existing data showing the depth to water and general groundwater quality at the proposed new UIC well discharge location; h. A detailed description of groundwater flow modeling (numeric or analytical) predicting the effect of injection on the groundwater flow direction at the discharge location; i. A detailed description of geochemical modeling (numeric or analytical) evaluating the interaction between the treated effluent and receiving groundwater. Prior to any such geochemical modeling the treated effluent and receiving groundwater shall be tested for the analytes listed in Table 5 unless the Permittee can demonstrate that testing for a particular analyte is unnecessary; j. A detailed description of the impact that the proposed injection will have on any known groundwater contaminant plumes, e.g., the nitrate plume(s) addressed in the Site ST-105 Stage 2 Abatement Plan for Nitrate Contaminated Water; k. Maximum estimated monthly discharge volume to the UIC well(s); l. Project schedule, including the date the discharge is to commence and the anticipated duration; and m. Necessary changes to this Discharge Permit's language should the proposal be approved, e.g., the listing of authorized injection wells and associated monitoring wells in Table 1. These Work Plans shall be submitted for NMED approval at least 90 days prior to the scheduled installation of any UIC well. Proposed changes to this Discharge Permit constituting a "permit modification" as defined at 20.6.2.7.P NMAC shall not be submitted as a Work Plan, but shall instead be submitted as a discharge permit modification request as specified at 20.6.2.3109.G NMAC. A proposal to locate a discharge at a location outside the areas specified in Permit Condition #4 shall be considered a permit modification. A proposal to locate a UIC well at a location within the Designated UIC Area shall not be considered a permit modification unless the discharge quality or quantity is modified from that permitted herein. The Permittee shall post the approved Work Plan to the appropriate web site, i.e., KAFB/Environment/Kirtland AFB Fuel Plume Project Documents. [20.6.2.7(P) NMAC, 20.6.2.3107(A) NMAC, 20.6.2.3109(G) NMAC, 20.6.2.5003 NMAC]	NA
11	Prior to discharging to a newly installed UIC well, the Permittee shall submit written notification to NMED stating the date that the discharge is to commence. [20.6.2.3107(A) NMAC]	NA
12	The Permittee shall ensure that the GWTS is secured to control access by the general public. [20.6.2.3109(B) and (C) NMAC, NMSA 1978, §74-6-5(D)]	Section 1.2 - Overall System Description

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
13	The Permittee shall maintain signs in English and Spanish (unless otherwise prohibited by KAFB policy) at appropriate locations indicating that the GWTS effluent is non-potable. Signs shall be posted at the UIC wellheads, at the GWTS, and any associated UIC well related infrastructure. [20.6.2.3109(B) and (C) NMAC, NMSA 1978, § 74-6-S(D)]	NA
14	The Permittee shall ensure that the UIC well(s) include monitoring devices, i.e., water level and pressure head transducers, to prevent overfilling of the well. The Permittee shall measure the volume of treated effluent discharged to each UIC well and maintain a record of these volumes. [20.6.2.3107 and 20.6.2.3109(C)(3)(c)(i) NMAC]	Section 2.6 - Discharge Locations
15	The Permittee shall ensure the treated effluent conveyance system, i.e., piping, between the GWTS and the UIC well(s) does not leak and shall report any such leakage to the NMED GWQB in accordance with 20.6.2.1203(A) NMAC and copy the NMED HWB. Within one year of the effective date of this Discharge Permit, the Permittee shall demonstrate the structural integrity of the treated effluent conveyance system between the GWTS and KAFB-7. Prior to testing, the Permittee shall propose for NMED approval the test method to be used. The results of the mechanical integrity testing shall be submitted to NMED within 60 days of test completion. The Permittee shall integrity test the treated effluent conveyance system between GWTS and the UIC well(s) prior to submitting a permit renewal application. [20.6.2.3106(C) NMAC, 20.6.2.3107(A) NMAC]	Section 3.10 Effluent Line Integrity Testing
16	Prior to an initial discharge from the GWTS of treated effluent associated with a new extraction well, the Permittee shall submit documentation to NMED demonstrating that the treated effluent is at or below the effluent standards specified for the contaminants of concern listed in Table 2. [20.6.2.1202(A) and (C) NMAC, 20.6.2.3109(C) NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]	Appendix L - Sampling and Analysis Plan
	B. Monitoring, Reporting, and Other Requirements	
17	The Permittee shall conduct the monitoring, operations, and reporting listed below. Unless otherwise specified, all periodic monitoring results or general information obtained shall be reported in the forthcoming quarterly report. [20.6.2.3107 NMAC]	Section 6.1 - Reporting
18	Unless otherwise approved by NMED, the Permittee shall conduct sampling in accordance with standard industry practice. Sampling in accordance with the most current version of the GWTS Sampling and Analysis Plan (Appendix L of the O&M Plan), which includes sampling locations, procedures, field measurements, quality control samples, handling and custody, analytical methods, quality control, analytical validation, and reporting requirements, satisfies this Condition. [20.6.2.3107(B) NMAC]	Appendix L - Sampling and Analysis Plan
19	The Permittee shall submit quarterly and annual reports to NMED pursuant to the most recent NMED HWB approved Work Plans. The Permittee shall identify the portions of these reports pertaining to this Discharge Permit with a table in the reports that identifies those portions. Quarterly reports shall be submitted as specified below unless otherwise authorized by NMED: • January 1st through March 31st - due by June 30th • April 1st through June 30th_ due by September 30th • July 1st through September 30th_ due by December 31st • October 1st through December 31st - due by March 31st Annual reporting requirements for the previous year, i.e., January 1st through December 31st, shall be reported in the March 31st quarterly report. [20.6.2.3107(A) NMAC]	Section 6.1 - Reporting
20	The Permittee shall monitor the concentration of all contaminants of concern listed on Table 2 in GWTS treated effluent. Associated sampling and analysis shall be performed monthly at a minimum. When groundwater from a new extraction well is first introduced to the GWTS, contaminant of concern monitoring of the GWTS treated effluent shall occur daily for the first week of treatment, weekly for the first month of treatment, and monthly thereafter. If alterations to, or conditions at, the GWTS result in a potential impact to effluent quality, the Permittee will repeat this sampling sequence as directed by NMED. A representative sample of GWTS influent and effluent shall be analyzed annually for the constituents identified in Table 3. A representative sample of GWTS influent and effluent shall be analyzed every five years for the constituents identified in Table 4. The first analysis of the five-year constituent list shall occur in July 2017. Any newly identified constituents detected during the five-years sampling events will be added to the annual sampling constituent list in Table 3. All analysis of GWTS influent and effluent shall utilize analytical methods with detection limits that are sufficiently low to allow comparison to the standards included in the above referenced state and federal regulations. All sampling, analysis, and reporting shall comply with the most recent approved Work Plans. [20.6.2.3107(A) NMAC and 20.6.2.3107(B) NMAC]	Appendix L - Sampling and Analysis Plan
21	The Permittee shall report the volume of treated GWTS effluent discharged to each UIC well each quarter. This report shall include the following: a. Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well; b. The totalized monthly volume of treated effluent transferred to all UIC wells; and c. Monthly average, maximum, and minimum head values of injection water for each UIC well. The Permittee shall monitor the GWTS effluent volume utilizing an effluent flow meter installed on the effluent pump skid after the GAC units. Each UIC well shall have a dedicated flow meter. Flow meters shall be inspected and calibrated in accordance with the associated manufacturer's recommendations. [20.6.2.3107 NMAC]	Section 2.6 Discharge Locations, Section 6.1 - Reporting

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
22	The Permittee shall include the following results and general information in quarterly reports to NMED: a. Any mechanical integrity conducted on either the GWTS or a UIC well; b. Any replacement of GAC media and the associated data that initiated the decision to replace the media; c. Any UIC well rehabilitation conducted; d. Any malfunction, repair, or replacement of a flow meter; and e. Any additional operational changes with the potential to affect the discharge. [20.6.2.3107 NMAC]	Section 6.1 - Reporting
23	The Permittee shall monitor the groundwater wells in the vicinity of KAFB-7 and in the vicinity of any newly installed UIC well(s) to determine any change to aquifer chemistry that may be the result of injection. This monitoring shall be performed annually, shall conform to the procedures of the most current approved Work Plan, and shall measure the contaminants of concern listed in Table 2. This chemistry will be reported in the Annual Report for BFF. ST-105 Annual Report includes elevation contour mapping and analytical parameters identified in the Stage 2 Abatement Plan. The Permittee shall develop a groundwater elevation contour map depicting the groundwater flow direction in the vicinity of each UIC well and report it in the ST-105 Annual Report. If the chemical quality of the treated groundwater being injected changes over time, NMED may require the Permittee to repeat geochemical modeling (numeric or analytical) to predict the interaction between the treated effluent and receiving groundwater. [20.6.2.3107 NMAC]	NA
24	The Permittee shall post all reports required by this Discharge Permit on KAFB's most current web site (e.g., https://kirtlandafb.tlisolutions.com/main.aspx.) [20.6.2.3107(A) NMAC]	Section 6.1 - Reporting
C. Contingency Plan		
25	If the automated monitoring system records a system alarm indicating a threat condition to a UIC well, and that threat condition is confirmed, at a minimum the affected UIC well will be taken off-line. If the alarm condition is confirmed during the response investigation, the UIC well(s) will be taken off-line and the discharge to the UIC well(s) will not be resumed until the problem is identified and corrected. [20.6.2.3107(A) NMAC]	Appendix D - System Description, Appendix K - Contingency Plan
26	In accordance with this Discharge Permit, if the discharge to a UIC well exceeds effluent standards, the Permittee shall enact the Contingency Plan (Appendix C). The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. [20.6.2.3107(A) NMAC, 20.6.2.3109(E) NMAC, 20.6.2.4105(A)(2) and (3) NMAC]	Appendix K - Contingency Plan
27	In the event that a release or a spill occurs that is not authorized under this Discharge Permit, the Permittee shall notify the NMED GWQB in accordance with 20.6.2.1203(A) NMAC, shall include any additional reporting requirements specified at RCRA Permit Section 1.27, and shall copy the NMED HWB. The Permittee shall also take measures to mitigate damage from the unauthorized discharge and initiate corrective actions specified in the Contingency Plan (Appendix C). The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. Nothing in this condition shall be construed as relieving the Permittee of the obligation to comply with all requirements of Section 20.6.2.1203 NMAC. [20.6.2.1203 NMAC, 20.6.2.4105(A)(2) and (3) NMAC]	Appendix K - Contingency Plan
28	In the event that information indicates that a UIC well referenced at Table 1 is not constructed in a manner consistent with its intended use or is not completed in a manner that is protective of groundwater quality, the Permittee shall submit a Work Plan to the NMED with a proposal for well rehabilitation, abandonment only, or abandonment and replacement. This Work Plan shall include a project schedule and shall be submitted for NMED approval within 120 days following confirmation of the above referenced problems. The Permittee may propose an alternate use for the well. The UIC well requiring replacement shall be properly plugged and abandoned in accordance with Part 6.5.17.10.9 of the RCRA permit. [20.6.2.3107(A) NMAC, 20.6.2.5005 NMAC]	Appendix K - Contingency Plan
29	In the event that NMED or the Permittee identifies any failures of the Application or this Discharge Permit not specifically noted herein, NMED may require the Permittee to submit a corrective action plan and a schedule for completion of corrective actions to address the failures. Additionally, NMED may require a modification to this Discharge Permit to achieve compliance with 20.6.2 NMAC. [20.6.2.3107(A) NMAC, 20.6.2.3109(E) NMAC]	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	D. Closure Plan	
30	Upon permanent cessation of discharge to a UIC well(s), the Permittee shall perform the following closure measures upon NMED approval, unless UIC well(s) and/or conveyance pipelines are needed for another use: a) Cap, plug, or remove all conveyance pipelines to prevent the discharge of GWTS treated effluent to all UIC well(s); b) Abandon UIC well(s) in accordance with Part 6.5.17.10.9 of the RCRA permit, which reference OSE regulation 19.27.4.30 and 31 NMAC and associated well abandonment guidance; and c) Appropriately dispose of any wastes associated with UIC well plugging and abandonment. The Permittee may, instead of abandoning a UIC well, propose an alternate use for the well. Upon cessation of the closure measures, the Permittee shall perform the following post-closure measures: a) Continue monitoring contaminants of concern in groundwater for at least 2 years, or as appropriate and in concurrence with NMED; and b) Enact the release notification requirements of the Contingency Plan if groundwater standards are exceeded. The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. When all post-closure requirements have been met, the Permittee may request to terminate the Discharge Permit. [20.6.2.3107 (A) 11 NMAC]	NA
	E. General Terms and Conditions	
31	The Permittee shall maintain a written record of the following information: a) Information and data used to complete the Application for this Discharge Permit; b) Records of any releases or spills not authorized under this Discharge Permit and reports submitted pursuant to 20.6.2.1203 NMAC; c) Records of the operation, maintenance, and repair of all facilities/equipment used to treat, store, or inject the treated groundwater; d) Facility record drawings (plans and specifications) showing the actual construction of the facility and that the construction complies with all applicable statutes, regulations, and codes including applicable Department of Defense Engineering Standards; e) Copies of quarterly reports completed and/or submitted to NMED pursuant to this Discharge Permit; t) The volume of treated water discharged pursuant to this Discharge Permit; g) Groundwater quality and injected water quality data collected pursuant to this Discharge Permit; h) Copies of construction records and well logs for all groundwater monitoring wells required to be sampled pursuant to this Discharge Permit; i) Records of the maintenance, repair, replacement, or calibration of any monitoring equipment or flow measurement devices required by this Discharge Permit; and j) Data and information related to field measurements, sampling, and analysis conducted pursuant to this Discharge Permit. The following information shall be recorded and made available to NMED upon request: i) The dates, location, and times of sampling or field measurements; ii) The sample analysis date of each sample; iii) The name and address of the laboratory, and the name of the signatory authority for the laboratory analysis; iv) The analytical technique or method used to analyze each sample or collect each field measurement; v) The results of each analysis or field measurement; vi) The results of any split, spiked, duplicate or repeat sample; and vii) A copy of the laboratory analysis chain-of-custody as well as a description of the quality assurance and quality control procedures used. The written record shall be maintained by the Permittee so that it is accessible within a reasonable time period during or following a facility inspection by NMED through the post-closure period and shall be made available to NMED upon request. [20.6.2.3107(A) and (C) NMAC]	Section 6 - Recordkeeping
32	The Permittee shall allow NMED representatives to inspect the facility and its operations which are subject to this Discharge Permit and the WQCC regulations. NMED representatives may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which any records are located regarding this discharge permit or related discharges required to be maintained by regulations of the federal government or the WQCC. The Permittee shall allow NMED representatives to have access to any copy of the records, and to perform assessments, sampling, or monitoring during an inspection for the purpose of evaluating compliance with this Discharge Permit and the WQCC regulations. Nothing in this Discharge Permit shall be construed as limiting in any way the inspection and entry authority of NMED under the WQA, the WQCC Regulations, or any other local, state, or federal regulations. [20.6.2.3107(D) NMAC, NMSA 1978, §§ 74-6-9(B) and 74-6-9(E)]	NA
33	The Permittee shall, upon NMED's request, allow for NMED's duplication of records required by this Discharge Permit and/or furnish to NMED electronic copies of such records. [20.6.2.3107(D) NMAC]	NA
34	In the event the Permittee proposes a change to the facility or the facility's discharge that would result in a change in the volume discharged; the location of the discharge; or in the amount or character of water contaminants received, treated, or discharged by the facility that differs from the terms and conditions in this Discharge Permit, the Permittee shall notify NMED prior to implementing such changes. The Permittee shall obtain approval (which may require modification of this Discharge Permit) by NMED prior to implementing such changes. [20.6.2.7(P) NMAC, 20.6.2.3107(C) NMAC, 20.6.2.3109(E) and (G) NMAC]	Table 6-1 - Reports and Recipients

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
35	In the event the Permittee proposes to construct or change an existing system such that the quantity or quality of the discharge will change substantially from that authorized by this Discharge Permit, the Permittee shall submit construction plans and specifications to NMED for the proposed system or process unit prior to the commencement of construction. In the event the Permittee implements changes to an existing system authorized by this Discharge Permit which will result in only a minor effect on the quality of the discharge, the Permittee shall report such changes (including the submission of record drawings, where applicable) in the next quarterly report to NMED. [20.6.2.1202(A) and (C) NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]	NA
36	Any violation of the requirements and conditions of this Discharge Permit, including any failure to allow properly credentialed NMED staff to enter and inspect records or facilities, or any refusal or failure to provide NMED with records or information required to be maintained by this Discharge Permit or related regulation may subject the Permittee to a civil enforcement action. Pursuant to WQA 74-6-1 O(A) and (B), such action may include a compliance order requiring compliance immediately or in a specified time, assessing a civil penalty, modifying or terminating the Discharge Permit, or any combination of the foregoing; or an action in district court seeking injunctive relief, civil penalties, or both. Pursuant to WQA 74-6-lO(C) and 74-6-10.1, civil penalties of up to $15,000 per day of noncompliance may be assessed for each violation of the WQA 74-6-5, the WQCC Regulations, or this Discharge Permit, and civil penalties of up to $10,000 per day of noncompliance may be assessed for each violation of any other provision of the WQA, or any regulation, standard, or order adopted pursuant to such other provision. In any action to enforce this Discharge Permit, the Permittee waives any objection to the admissibility as evidence of any data generated pursuant to this Discharge Permit. [20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10 and 74-6-10.1]	NA
37	No person shall: 1) make any false material statement, representation, certification, or omission of material fact in an application, record, report, plan, or other document filed, submitted, or required to be maintained under the WQA; 2) falsify, tamper with, or render inaccurate any monitoring device, method, or record required to be maintained under the WQA; or 3) fail to monitor, sample, or report as required by a permit issued pursuant to a state or federal law or regulation. Any person who knowingly violates or knowingly causes or allows another person to violate the requirements of this condition is guilty of a fourth degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who is convicted of a second or subsequent violation of the requirements of this condition is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition or knowingly causes another person to violate the requirements of this condition and thereby causes a substantial adverse environmental impact is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition and knows at the time of the violation that he is creating a substantial danger of death or serious bodily injury to any other person is guilty of a second degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. [20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10.2(A) through 74-6-10.2.F]	NA
38	Nothing in this Discharge Permit shall be construed in any way as relieving the Permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits, or orders. [NMSA 1978, § 74-6-5.L]	NA
39	The Permittee may file a petition for review before the WQCC on this Discharge Permit. Such petition shall be in writing to the WQCC within thirty days of the receipt of postal notice of this Discharge Permit and shall include a statement of the issues to be raised and the relief sought. Unless a timely petition for review is made, the decision of NMED shall be final and not subject to judicial review. [20.6.2.3112 NMAC, NMSA 1978, § 74-6-5.O]	NA
40	Prior to the transfer of any ownership, control, or possession of this facility or any portion thereof, the Permittee shall: 1) notify the proposed transferee in writing of the existence of this Discharge Permit; 2) include a copy of this Discharge Permit with the notice; and 3) Deliver or send by certified mail to NMED a copy of the notification and proof that such notification has been received by the proposed transferee. Until both ownership and possession of the facility have been transferred to the transferee, the Permittee shall continue to be responsible for any discharge from the facility. [20.6.2.3111 NMAC]	NA
41	Payment of permit fees is due at the time of Discharge Permit approval. Permit fees shall be paid in a single payment or shall be paid in equal installments on a yearly basis over the term of the Discharge Permit. Single payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date. Initial installment payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date; subsequent installment payments shall be remitted to NMED no later than the anniversary of the Discharge Permit effective date. Permit fees are associated with issuance of this Discharge Permit. Nothing in this Discharge Permit shall be construed as relieving the Permittee of the obligation to pay all permit fees assessed by NMED. A Permittee that ceases discharging or does not commence discharging from the facility during the term of the Discharge Permit shall pay all permit fees assessed by NMED. An approved discharge permit shall be suspended or terminated if the facility fails to remit an installment payment by its due date. [20.6.2.3114(F) NMAC, NMSA 1978, § 74-6-5(K)]	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	RG-1587 (KAFB-7)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit No: RG-1587 Application File Date: September 17, 2015 Notice for Publication Issued: October 13, 2015 Affidavit of Publication Filed: November 4, 2015, The Albuquerque Journal published on October 16, 23, and 30, 2015 Priority: March 1, 1949 Source: Groundwater Point of Diversion: RG-1587: Located at a point where X=1,544,731.13 feet and Y=1,470,756.22 feet, NMSPCS, Central Zone, NAD83, on land owned by the Kirtland Air Force Base, Bernalillo County, New Mexico. Purpose of Use: Extraction/Production, Injection, and Irrigation Place of Use: NE1/4 NE1/4, Section 1, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection wells on land owned by the Kirtland Air Force Base.	NA
2	The total diversion of water from well RG-1587 under this permit shall not exceed 4,500 acre-feet per annum.	Table 2-2
3	The total injection of water from well RG-1587 under this permit shall not exceed 2,000 acre-feet per annum.	Table 2-2
4	Well RG-1587 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped and injected shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of January, April, July and October of each year. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.	Section 2.2, Section 6.1
5	The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.	Section 2.2
6	This Permit will expire on December 1, 2025.	Table 1-1
	RG-1579 POD 292 (KAFB-106228)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit Number: RG-1579 POD 292 Application File Date: November 13, 2014 Notice for Publication: February 10, 2015 Affidavit of Publication: May 1, 2015 from the Albuquerque Journal Priority: March 1, 1949 Source: Groundwater Points of Diversion: RG-1581 POD 292, located at a point where X=1,543,677 feet and Y=1,476,476 feet, NMSPCS, Central Zone, NAD 83, within the NE 1/4 NE 1/4 of Section 36, Township 10 North, Range 3 East, NMPM, Bernalillo County New Mexico. Purpose of Use: Pollution control and recovery, specifically extraction of groundwater for remediation Place of Use: Land within Kirtland Air Force Base, and land within Section 36, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico. Amount of Water: 403 acre-feet per annum	NA
2	The total diversion of groundwater from well RG-1579 POD 292 shall be limited to 403 acre-feet per annum, measured at the well, a portion of the 6,398 acre-feet per annum, which includes the water right of 4,500 acre-feet per annum from well Numbers RG-1581 through RG-1589 (Kirtland East), and 1,898 acre-feet per annum from Numbers RG-1579, RG-1580 and RG-1579 and RG-1580 Combined-S (Kirtland West).	Table 2-2
3	The total amount of water pumped from well RG-1579 POD 292 shall be measured by a totalizing meter of a type, at a location, and installed in a manner acceptable to the State Engineer. The Permittee shall provide the make, model, serial number, initial reading, units, multiplier, data of installation, and dates of recalibration to the State Engineer prior to any diversion of water under this permit.	Section 2.2, Section 6.1
4	Records of the quantity of water diverted from well RG-1579 POD 292 shall be submitted to the District 1 Office via mail, e-mail, or facsimile on or before the 10th day of the months of January, April, July, and October for the preceding 3 calendar months, i.e., quarterly.	Table 6.1
5	None	NA
6	The Permittee shall utilize the highest and best technology available to assure conservation of water to the maximum extent practical.	Section 2.2
7	This permit shall automatically expire on June 15, 2025 or upon completion of the intended purpose of use. If the intended purpose of use is completed prior to June 15, 2025, the permittee shall notify the State Engineer by certified letter.	Table 1-1
8	Proof of Completion of Well shall be filed on or before June 15, 2017.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	RG-1579 POD 309 (KAFB-106233) and POD 310 (KAFB-106234)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit No: RG-1579 POD 309 and POD 310 Application File Date: July 10, 2015 Notice for Publication Issued: August 25, 2015 Affidavit of Publication Filed: September 14, 2015, The Albuquerque Journal published on August 28, September 5, and September 11, 2015 Priority: March 1 , 1949 Source: Groundwater Point of Diversion: RG-1579 POD 309: Located at a point where X=1,543,061 feet and Y=1,476,824 feet, NMSPCS, Central Zone, NAD 83, on land owned by the City of Albuquerque, Bernalillo County, New Mexico. RG-1579 POD 310: Located at a point where X=1,544,083 feet and Y=1,478,577 feet, NMSPCS, Central Zone, NAO 83, on land owned by the City of Albuquerque, Bernalillo County, New Mexico. Purpose of Use: Pollution Control and Recovery, and Irrigation Place of Use: SE 1/4 SE 1/4, Section 25, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection wells on land owned by the Kirtland Air Force Base.	NA
2	The total diversion of water from wells RG-1579 POD309 and RG-1579 POD310 under this permit shall not exceed 636 acre-feet per annum.	Table 2-2
3	Wells RG-1579 POD309 and RG-1579 POD310 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of January, April, July and October of each year. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.	Section 2.2, Section 6.1
4	The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.	Section 2.2
5	This Permit will expire on November 1, 2025.	Table 1-1

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	RG-1579 POD 319 (KAFB-106239)	
1	This application is approved as follows: Permittee: Kirtland Air Force Base Permit No: RG-1579 POD319 Application File Date: August 25, 2016 Notice for Publication Issued: September 14, 2016 Affidavit of Publication Filed: October 6, 2016, The Albuquerque Journal published on September 18, 25, and October 2, 2016 Priority: March 1, 1949 through March 6, 1956 Source: Groundwater Point of Diversion: RG-1579 POD319: (KAFB-106239) Located at a point where X=1,542,707.9 feet and Y=1,475,412 feet, NAD 83, SPCS, Central Zone, on land owned by the City of Albuquerque, Bernalillo County, New Mexico. Purpose of Use: Pollution Control and Recovery Place of Use: SE 1/4 SE 1/4,, Section 25, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection well, RG-1587, on land owned by Kirtland Air Force Base.	NA
2	The total diversion of water from well RG-1579 POD319 under this permit shall not exceed 323 acre-feet per annum consumptive use.	Table 2-2
3	The new well shall be drilled by a well driller licensed in the State of New Mexico, and a well record for new well RG-1579 POD319 shall be filed with the Office of the State Engineer within twenty (20) days of drilling the well.	NA
4	Well RG-1579 POD319 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of each month. No water shall be diverted from any well unless equipped with a functional totalizing meter. The permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.	Section 2.2, Table 6.1
5	The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.	Section 2.2
6	This permit will expire on December 1, 2025.	Table 1-1
7	The State Engineer retains jurisdiction over this permit.	NA
8	Pursuant to Section 72-8-1 NMSA, the permittee shall allow the state engineer and his representative's entry upon private property for the performance of their respective duties, including access to the wells for meter readings and water level measurements.	NA
	Christ United Methodist Church License to Kirtland Air Force Base	
1	The LICENSOR hereby grants unto the LICENSEE a no-rent license to enter upon the LICENSOR's real property located at 6200 Gibson Boulevard, S.E., Albuquerque, Bernalillo County, New Mexico, which real property is also known as: Tract C, as shown on the Replat of Tracts B, C, D and E, Siesta Hills No. 2, recorded November 25, 1980 in Book B18, Page 84, records of Bernalillo County, New Mexico, as more specifically identified on the general location map, attached hereto and incorporated herein as Attachment A, for the express purpose of: 1) constructing, drilling, installing, operating, maintaining and removing one (1) bulk fuels facility (BFF) interim fuel remediation extraction well, extraction well pipeline and associated electrical power lines, pole, transformer and junction boxes; 2) depending upon the depth of the ethylene-di-bromide plume, constructing, drilling, installing, operating, maintaining and removing no more than two (2) BFF regional deep monitoring wells; and 3) parking well drilling and construction equipment, to include a fork lift, water truck, other miscellaneous work pickups, hopper, lined waste roll-off bin and daily construction supplies, to include well casing; and 4) collecting ground water monitoring samples from the regional deep monitoring well and extracting and pumping ethylene-dibromide contaminated groundwater through the extraction well pipeline to Kirtland AFB for treatment during the term of the Kirtland AFB BFF fuel release remediation; in that area of the LICENSOR's west parking lot located immediately adjacent to the city alley right-of-way at the south boundary of the parking lot, as shown on the aerial photograph attached hereto and incorporated herein as Attachment B.	NA
2	The term of this license is five (5) years, beginning on January 9, 2015 and ending January 8, 2020.	Table 1-1
3	The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns, shall use the area described above, and as shown in Attachments A and B, for the purposes described above and not for any other purpose without first obtaining the written consent of the LICENSOR. The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns shall comply with the following additional LICENSOR use restrictions: 3.1. LICENSEE shall conduct no activities on LICENSOR's property on any Saturday or Sunday during the term of this License; 3.2. LICENSEE shall remove the basketball board standard from the west parking lot and reinstall it at a location on the parcel to be specified by the LICENSOR; 3.3. LICENSEE shall provide for city waste disposal truck access to the LICENSOR's trash dumpster located at the SE corner of the west parking lot to facilitate waste collection and disposal; 3.4 LICENSEE shall provide access to the west door of the Church through the west parking lot for Food Band truck deliveries on the first Tuesday of each month; 3.5. LICENSEE shall provide access to the west door of the Church through the west parking lot to LICENSOR's contractor(s) for the construction and installation of an ADA compliant wheelchair ramp; and 3.6. LICENSEE shall provide day and night access to the west door through the west parking lot for groups, including church members, using church facilities.	NA
4	All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the LICENSOR's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within seven (7) days after the installation of the extraction and/or ground water monitoring wells or the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
5	Liability and Insurance. 5.1 Liability 5.1.1 As between the PARTIES, the LICENSEE, its agents, representatives, contractors and/or sub-contractors assume all risk of loss or damage to property and injury or death to persons, whether to its officers, employees, contractors of any tier, agents, invitees or others, by reason of or incident to LICENSEE's use of the licensed area, and its activities conducted under this LICENSE. The LICENSEE agrees to hold harmless the LICENSOR, and its officials, agents and employees from any claims, actions, suits or other proceedings arising from or out of the acts or omissions of the LICENSEE, its agents, representatives, contractors or sub-contractors or arising from the failure of the LICENSEE, its agents, representatives, contractors or sub-contractors to perform any act or duty required of the LICENSEE herein. To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. 5.1.2. The LICENSEE hereby undertakes a contractual obligation to repair all actual damages to LICENSOR's property and improvements caused by LICENSEE's operation(s). Upon completion of the repairs, LICENSEE shall repave the west parking lot ensuring said paving is on-grade with the LICENSEE installed well casings and/or vaults. In lieu of performing such repair, LICENSEE may, at its discretion, pay for said repairs and parking lot repaving. To the extent provided by law, the Licensee's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR may have to make a claim for damages under applicable laws. 5.1.3. Claims for damages, personal injury or death arising from negligent or wrongful act of LICENSEE, its officers, employees, contractors of any tier, agents or invitees (but specifically excluding contractual claims arising under paragraph 6.1 .2 above) shall be subject to the provisions of the Federal Tort Claims Act (28 USC §§ 2671 et seq.). 5.2 Insurance Requirement. LICENSEE shall require its agents, representatives, contractors or sub-contractors to obtain insurance coverage for the specific protection and benefit of the LICENSOR, including but not necessarily limited to, the following coverage: 5 .2.1. Comprehensive General Liability Insurance. Comprehensive general liability insurance with liability limits in an initial amount not less than $1 ,000,000 aggregate limit of liability for bodily injury, including death, and property damage in any one occurrence. 5.2.2. Automobile Liability Insurance. An automobile liability policy with liability limits in amounts not less than $1 ,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. Said policy of insurance must include coverage for the use of all owned, non-owned, hired automobiles, vehicles and other equipment both on and off work and is in addition to the Comprehensive General Liability Coverage. 5.2.3. Proof of Insurance: During the term of this Agreement, not less than once each year, on or before 9 January 2015 and 9 January of each succeeding year, LICENSEE shall cause its primary contractor to provide to the LICENSOR without demand, or more frequently upon demand, proof of all required insurance coverage. Prior to expiration or exchange of any policy, LICENSEE shall cause its primary contractor to furnish the LICENSOR evidence satisfactory to the LICENSOR that the policy has been renewed or replaced or is no longer required by this Agreement. All policies required hereunder shall provide that the LICENSOR shall be given thirty (30) days prior written notice of cancellation, non-renewal or material alteration of coverage. Provisions that the insurance company shall "endeavor to give the LICENSOR notice" shall not be allowed.	NA
6	The LICENSEE shall be solely responsible for maintaining the premises upon which LICENSEE's equipment is being stored in a safe condition during the term of this License.	NA
7	The LICENSEE will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and incorporated herein as Attachment C, and an Environmental Baseline Survey (EBS), which is attached hereto and incorporated herein as Attachment D. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments C and D, the LICENSOR's land will be returned in the same environmental condition as received, but without the contamination conditions for which the LICENSEE is performing the remediation, which shall be documented in a final closeout EBS, a copy of which shall be provided to the LICENSOR.	NA
8	In connection with its use of or any other activity on the property, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.	NA
9	The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.	NA
10	For purposes of giving formal written notice, the points of contact are as follows: LICENSOR: CHRIST UNITED METHODIST CHURCH Attn: Ms. Vicki Chronister 6200 Gibson Blvd., SE Albuquerque, NM 87108 LICENSEE: Installation Commander 2000 Wyoming Blvd, SE Kirtland AFB, NM 87117	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
11	Claims. 11.1 Point of Contact. The Permittee point of contact for all damages, whether to real or personal property, will be submitted to: AFNWC/JA 2000 Wyoming Blvd., SE Building 20604, Room B-36 Kirtland AFB, NM 87117 (505) 846-4217 11.2 Claims Process: To file a claim for damage and/or injury due to LICENSEE"s operations, the claimant, or his/her authorized agent, must file a properly signed SF-95, Claim for Damage, Injury or Death, setting forth a sum certain for damage to or loss of property, personal injury or death, to the POC identified in 11.1 above, within two (2) years of the incident causing the damage or injury. The claim form is available at the website www.claims.jag.af.mil.	NA
12	This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.	NA
13	This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.	NA
14	If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.	NA
15	Index of Attachments Attachment A - Description of Licensed Premises Attachment B - Map Attachment C - AF-813 Attachment D - EBS	NA
License Agreement Between The City of Albuquerque and Kirtland Air Force Base		
1	Subject to the terms and conditions of this License, and as set forth in the Vadose Zone Investigation Work Plan Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011 and Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011, which are attached hereto and incorporated herein as Attachments A and B, respectively, the final revised plans will be attached and incorporated herein upon approval and signature by New Mexico Environment Department (NMED), the LICENSOR grants to LICENSEE this License to: a. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon soil vapor and ground water monitoring wells for the collection of groundwater samples and conducting aquifer tests. Wells are identified as shallow (groundwater surface), intermediate (45-60 feet below groundwater surface) and deep (85-100 feet below groundwater surface). Existing and currently proposed monitoring wells subject to the terms of this permit are: b. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon groundwater extraction wells, and their associated pipeline and infrastructure, to include underground power lines, for the extraction and transport of influent (LNAPL, and/or its various constituents, to include ethylene-di-bromide (EDB)), to the Kirtland AFB groundwater treatment facility for treatment. Existing and currently proposed extraction wells and extraction well pipelines subject to the terms of this permit are: c. Respond to and conduct emergency response activities at all current and future monitoring and extraction well locations and extraction well pipeline locations identified herein. d. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon additional groundwater extraction wells, and their associated pipeline and infrastructure, to include underground power lines additional groundwater monitoring wells, influent extraction wells, and/or influent extraction pipelines required by NMED/HWB to complete the Bulk Fuels Facility fuel plume remediation. All such activity shall occur within the area of investigation described in Condition 1 herein and as more fully depicted in Attachment D herein, such construction and installation being subject to the terms and conditions herein, or as otherwise agreed to by the PARTIES by written agreement and submission of well permits and other drawings, plans and schematics as determined necessary by the City and the City manuals. e. Coordinate all LICENSOR well location deviation requests with the NMED/HWB. f. Construct, install, operate, maintain, modify, repair, replace, remove, plug and abandon a core drilling borehole, as more fully depicted in Attachment G herein, for the collection of a continuous core sample extending from a borehole depth of 350 feet to 500 feet below ground level. The final core depth will depend upon observed LNAPL concentrations. A second alternate core drilling borehole may be necessary, if the first borehole LNAPL is observed in the first core sample. Specific borehole latitude/longitude location coordinates will be provided upon determination of the final borehole location and engineering specifications will be submitted prior to drilling. If the location of boreholes is within the confines of Bullhead park, the borehole location, core drilling time of year and other logistic considerations must be discussed with Park personnel well in advance of any activity planned for the Park and written approval by the Parks and Recreation Director must be obtained. g. Conduct all remediation activities set forth in Clauses 1 (a) through 1 (f) herein on City property, including rights of ways, within the following general area within the municipal boundaries of the City of Albuquerque and City-owned property in the County of Bernalillo, excluding all City-owned parks except Bullhead Park, Phil Chacon Park and the Veterans Memorial: and as more fully identified in Attachments D and E attached hereto and incorporated herein. Final locations of each well described and shown in the attachments, any changes in location and any future wells determined to be necessary to the investigation and remediation of the fuel plume shall be approved by the LICENSOR, as follows: new or additional sampling wells determined to be necessary during the term of this license that are located within the license agreement area in city rights-of-way need prior approval of the City Environmental Health Department, Environmental Services Division. All wells and construction need to be addressed by amending this License and approval by the City of Albuquerque Chief Administrative Officer. Additionally, all wells must be processed through the Well Permit approval process prior to LICENSEE commencing construction. Final locations of all pipelines described and shown in the attachments, any changes in location and any future wells, extraction pipelines or other infrastructure determined to be necessary to the investigation and remediation of the fuel plume shall be approved by the LICENSOR prior to LICENSEE commencing construction.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
2	The LICENSEE shall use the area described in Clause 1 (g) herein and as shown in Attachments D and E for the purposes described in Clause 1 herein and not for any other purpose without first obtaining the written consent of the LICENSOR and shall adhere to the following use conditions: a. As to the underground extraction pipeline, LICENSEE shall: i. Obtain written preconstruction approval of the location of the pipeline, which written approval will be documented on the underground influent pipeline map attached hereto and incorporated herein as Attachment F; a. Future Underground Influent Extraction Pipeline Locations: Reserved. ii. Conduct all construction, installation, maintenance, operation modification, repair, replacement, removal and abandonment activities to minimize impacts to the LICENSOR's property and minimize construction related noise and dust; iii. Backfill the pipeline trench immediately and in such a manner as to retard soil subsidence; iv. Inspect and repair any subsequent subsidence occurring along the length of the pipeline; v. Coordinate with the City Engineering Department when initiating horizontal drilling under city streets, particularly Louisiana Avenue, for pipeline installation to minimize traffic flow interruptions and damage to the surface of any city street; vi. Repair immediately all damage to city streets and/or alleys along the entire length of the pipeline; vii. Provide an as-built schematic to the LICENSOR to eliminate potential damage to the influent extraction pipeline system during any LICENSOR maintenance and/or construction activities, or any other LICENSOR subsurface activities, which schematic shall be attached hereto and incorporated herein as part of Attachment K when construction is completed; b. Future As Builts Schematic and Cross Sections of Wells and Extraction Pipeline Reserved viii. Coordinate all extraction pipeline deviations with the LICENSOR; ix. Register the influent extraction pipeline with New Mexico One Call to eliminate inadvertent line ruptures or breaks during LICENSOR and/or third party digging or excavation activities; and x. Remove said influent extraction pipeline upon New Mexico Environment Department's approved closure of the LICENSEE's bulk fuel release remediation. c. As to the monitoring and extraction well locations, LICENSEE shall: i. Obtain a City of Albuquerque Well Permit for each well by making application to the Development and Building Services Division. One permit may be used for multiple wells, grouped by type of well, by installation priority, by cluster or by location; a. Future Well Permits: Reserved. ii. Ensure that the LICENSEE's Contractor complies with the terms of all issued well permits and coordinates field activities with the Development and Building Services Division; iii. Ensure that the LICENSEE's Contractor complies with permitting and traffic/safety control requirements of the City's Department of Municipal Development (DMD), including but not limited to obtaining an excavation and barricade permit at each cluster; iv. Ensure that the LICENSEE's Contractor complies with permitting and environmental Health protections requirements of the City of Albuquerque Environmental Health Department, including but not limited to air quality and noise remediation; v. Restore all well heads to pre-existing grades in compliance with City ordinances, codes and guidelines and according to the approved work plans; vi. Coordinate all well installations within City Parks with the City's Department of Parks and Recreation (Parks) to implement adequate safety control measures prior to and during well drilling and construction activities and to minimize disruption to activities and uses scheduled by Parks;	NA
	vii. Revegetate the soil surface immediately consistent with the landscaping specifications contained in the City's Standard Specifications for Public Works Construction, Section 1000 - Landscaping and coordinate all surface restoration with Parks to allow on-site pre-construction field inspections by Parks with the KAFB contractor and a post construction field inspection by Parks following the restoration activities; and viii. Ensure LICENSEE's Contractor contacts the Bullhead Park Superintendent and/or park personnel to coordinate all sampling at wells 106028, 106065 and 106066 within Bullhead Park prior to traversing the park with vehicles to conduct the sampling. ix. Coordinate all monitoring and sampling activity affecting the Cesar Chavez Community Center facility with the facility's site manager to implement adequate safety control measures prior to and during well monitoring and sampling activities to minimize disruption to activities and uses scheduled by Family and Community Services. x. Restore any surface disturbance created by monitoring and sampling activities at the Cesar Chavez Community Center to its pre-disturbance condition. xi. Repair or replace any curbing or other vehicular access facility infrastructure affected by monitoring and sampling activities at the Cesar Chavez Community Center to restore it to its pre-disturbance condition. d. Miscellaneous locations: all ingress, egress and miscellaneous sites disturbed by the LICENSEE during the construction, installation, maintenance, operation, repair and/or removal of wells and underground pipeline shall be returned to pre-construction condition or as mutually agreed by the Parties. e. Before commencing or resuming any construction and repairs in USS Bullhead Park and/or the Veterans Memorial, LICENSEE shall coordinate with the Director of Parks and Recreation Department to schedule LICENSEE's activities so as to not interfere with activities and uses scheduled by Parks. The decision of the Director of Parks and Recreation as to when LICENSEE's construction and repairs may occur shall be final. f. In addition to the foregoing, LICENSEE shall, during and after the installation of its remediation infrastructure, ensure that the City property continues to be usable for its intended uses reasonably to the same extent as before the installation of the remediation infrastructure.	NA
3	This License shall remain in effect for a period of ten (10) years beginning on the date of execution by the LICENSEE, with multiple options to renew in five-year increments thereafter, corresponding with, but not to exceed, the New Mexico Environment Department Hazardous Waste Bureau remediation timetable, as set forth in Attachments A through D incorporated above in Clause 1, unless revoked as provided herein, or extended by the mutual written consent of both parties.	Table 1-1
4	Either Party may revoke this License upon providing written notice to the other party thirty (30) days prior to such revocation.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
5	All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the City's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within thirty (30) days after the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.	NA
6	Damages. a. If any action of the LICENSEE's officers, employees, or authorized representatives including contractors and subcontractors) in the exercise of this license results in damage to the Property, or any other property of the LICENSOR or LCENSOR's tenants, including but not limited to water lines, sanitary and storm sewers, and other utilities and services, caused by LICENSEE's Operation(s), to include but not limited to damage caused by vibration during well and pipeline drilling and installation, the LICENSEE will either repair such damage or make an appropriate settlement with the LICENSOR. Upon completion, expiration or termination of this license, LICENSEE shall make all reasonable efforts to restore the Property to its original condition in accordance with section 9. The LICENSEE's liability under this clause may not exceed appropriations available for such payment and nothing contained in this license may be considered as implying that Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this paragraph are without prejudice to any rights the LICENSOR may have to make a claim under applicable laws for any other damages than provided herein. b. The LICENSEE shall respond to claims repair or pay for all actual damages done to City Property and improvements, or to the improvements of the City's tenants. All claims for damage to adjacent properties caused by LICENSEE's Operations, to include damage caused by vibration during well and pipeline drilling and installation, brought by third parties shall be subject to the claims process set forth in Condition 13 herein and as limited by the provisions of the Federal Tort Claims Act (28 USC §§ 2671 et seq.). To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR or any third party may have to make a claim for damages under applicable laws.	NA
7	The LICENSEE shall be solely responsible for maintaining in a safe condition the premises upon which the LICENSEE's remediation operations, to include but not limited to construction of improvements, subsequent well monitoring events effluent pipeline transport from well sites to the LICENSEE groundwater treatment facility, are being conducted and the property of the LICENSOR or LICENSOR's tenants within the premises, including but not limited to water lines, sanitary and storm sewer and other utilities and services. To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. Nothing herein is intended to impair any right or immunity under the laws of the State of New Mexico.	NA
8	The hold harmless provisions contained herein shall not apply to any liability, claims, damages, losses or expenses, including reasonable attorney's fees, arising out of bodily injury to persons or damage to property caused by or resulting from, in whole or in part, the negligent act or omission of the City, or the agents or employees of the City. Furthermore, LICENSEE shall require its agents, representatives, contractors or sub-contractors to obtain insurance for the specific protection and benefit of the City, including but not necessarily limited to, the following coverage: a. Comprehensive General Liability Insurance. Comprehensive general liability insurance with liability limits in an initial amount not less than $1,000,000 aggregate limit of liability for bodily injury, including death, and property damage in any one occurrence. b. Automobile Liability Insurance. An automobile liability policy with liability limits in amounts not less than $1,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. Said policy of insurance must include coverage for the use of all owned, non-owned, hired automobiles, vehicles and other equipment both on and off work and is in addition to the Comprehensive General Liability Coverage. c. Workers' Compensation Insurance. Workers' Compensation Insurance for its employees in accordance with the provisions of the Workers' Compensation Act of the State of New Mexico. d. Owner's Protective Public Liability Insurance. During any period of construction or major renovation, an owner's protective public liability insurance policy with liability limits in an amount not less than $1,000,000 combined single limit of liability for bodily injury, including death and property damage in any one occurrence. e. Builder's Risk and Property insurance. During any period of construction or major renovation, until completion of the construction, builder's risk, vandalism and malicious mischief insurance for the value of the property. Alternatively, Contractor shall procure and maintain insurance against loss or damage to the Project by fire, lightning, vandalism, and malicious mischief with the uniform extended coverage endorsement limited only as may be provided in the standard form or extended coverage endorsement at the time in use by the State of New Mexico to provide for not less than 90% recovery of the market value of the buildings and other improvements. f. Increased Limits. The City may require the LICENSEE's Contractor to reasonably increase the maximum limits of any insurance required herein and LICENSEE's Contractor shall promptly comply. g. No Subrogation. LICENSEE's Contractor and its surety shall and hereby do waive any right of subrogation they may acquire against the City, its officers, agents and employees by reason of any ·payment made on account of injury, including death, sustained by any employee of the insured arising out of performance of this Agreement. Neither the LICENSEE's Contractor nor its employees are considered to be employees of the City of Albuquerque for any purpose whatsoever. h. The LICENSEE's Contractor shall be and is an independent contractor at all times in the performance of this Agreement. Neither the LICENSEE's Contractor nor its employees are entitled to any benefits from the City under the provisions of the Worker's Compensation Act of the State of New Mexico, nor to any of the benefits granted to employees of the City under the provisions of the Merit System Ordinance or any other law or provision, as now enacted or hereafter amended. i. Proof of Insurance: During the term of this Agreement, not less than once each year, on or before May 31, LICENSEE's Contractor shall provide to the City without demand, or more frequently upon demand, proof of all required insurance coverage. Prior to expiration or exchange of any policy, LICENSEE's Contractor shall furnish the City evidence satisfactory to the City that the policy has been renewed or replaced or is no longer required by this Agreement. All policies required hereunder shall provide that the City shall be given thirty (30) days prior written notice of cancellation, non-renewal or material alteration of coverage. Provisions that the insurance company shall "endeavor to give the City notice" shall not be allowed. j. Application of Net Proceeds of Insurance. The Net Proceeds of builder's risk insurance and of fire and other hazard and casualty insurance, carried pursuant to the provisions of this Agreement hereof, shall be applied first to the payment of the interests of the City as it may be from time to time, and only after such payment, to the interests of Contractor and others, and otherwise as provided in this Agreement and the Net Proceeds of liability insurance carried pursuant to the provisions of this Agreement hereof shall be applied toward extinguishment or satisfaction of the liability with respect to which such insurance proceeds have been paid. k. Additional Provisions Respecting Insurance. All insurance required of Contractor pursuant to this Agreement shall be obtained by Contractor from and maintained in generally recognized responsible insurance authorized to do business in the State of New Mexico. All applicable policies evidencing such insurance shall name both the City and Contractor as named insured and the City shall be named as loss payee as to the City's Mortgage under the builder's risk and property insurance required by this Agreement.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
9	The LICENSEE will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and made a part of this License as Attachment H, and two Environmental Baseline Survey (EBS), which are to be attached hereto and made a part of this License as Attachments I and J when completed. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments H, I and J herein, the LICENSOR's land will be returned in the same environmental condition as received but without the contamination conditions for which the LICENSEE is performing the remediation. a. Final EBS Reserved	NA
10	In connection with its use of or any other activity at the Location, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.	NA
11	The LICENSEE and its agents, representatives, contractors or sub-contractors shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.	NA
12	For purposes of giving formal written notice, the points of contact are as follows: For the City: Chief Administrative Officer, City of Albuquerque City-County Government Center, #1 Civic Plaza P.O. Box 1293 Albuquerque, NM 87103 For Kirtland: Installation Commander 2000 Wyoming Blvd, SE Kirtland AFB, NM 87117	NA
13	Claims. a. Point of Contact. The LICENSEE's point of contact for all damages, whether to real or personal property, will be submitted to: 377 ABW/JA Attention: Claims Division 2000 Wyoming Blvd., SE Building 20604, Room B-36 Kirtland AFB, NM 87117-5000 (505) 846-4217 http://www.claims.jag.af.mil b. Claims Process. As set forth in License #LIC/I-KI-11-0001 Condition 6, Damages, a claim for damage and/or injury due to LICENSEE's operations, a claimant, or his/her authorized agent, must file a properly signed SF-95, Claim for Damage, Injury, or Death, setting forth a sum certain for damage to or loss of property, personal injury or death, to the point of contact identified in Condition 7(a) above. The claim form is available at the website provided herein in Condition 7(a) above. To the extent provided by law, the LICENSEE's liability under this Condition 13 is subject to the availability of funds, as set forth in 31 USC§ 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this Condition 13 are without prejudice to any rights the LICENSOR or any third party may have to make a claim for damages under applicable laws.	NA
14	Index of Attachments referred to in License, copies of which are on file with LICENSOR Attachment A - Vadose Zone Investigation Work Plan - Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011 Attachment B - Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 - March 2011 Attachment C - Well Permits for wells identified under clauses 1 (a) and 1 (b) on file with LICENSOR'S City Engineer Attachment D - General Location Map of License Area Attachment E - Off Installation Well Location Map 2015 Attachment F - City of Albuquerque Well Locations with LNAPL Containment System Attachment G - Coring Borehole location map Attachment H - Requests for Environmental Impact Analysis (AF Form 813) dated 2/17/09 and 3/18/10 (Attachments H-1 and H-2, respectively) Attachment I - Initial Environmental Baseline Survey (EBS) dated 2/22/11, 3/2/10, 3/3/10, and 2/4/09 (Attachments 1-1, 1-2, 1-3, and 1-4, respectively) Attachment J - Final Environmental Baseline Survey February 2012 Attachment K - As built schematics and cross sections of wells and extraction pipeline (to be attached and incorporated herein when completed)	NA
15	This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.	NA
16	This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.	NA
17	If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
	New Mexico Veterans Administration Health Care System Permit	
1	PURPOSE: This Permit outlines the grant of right of entry and agreement between the New Mexico VA Health Care System (NMVAHCS) and Kirtland Air Force Base (KAFB) for disclosure of results of environmental services on NMVAHCS property . NMVAHCS has granted permission for KAFB to use a con tractor to conduct environmental services and remediation on NMVAHCS property. The contractor selected by KAFB to conduct environmental services and remediation is CH2MHill . KAFB agrees to allow NMVAHCS direct access to any information and outcomes regarding environmental services and remediation performed on NMVAHCS property by CH2MHill .	NA
2	BACKGROUND: In 2001, KAFB completed delineation of contaminated soil and groundwater discovered in 1999 as part of the Stage 1 Abatement Plan. In February 2007, KAFB discovered fuel product on the groundwater at another location near the Bulk Fuels Facility, which is being investigated as part of a Modification to the Stage 2 Abatement Plan. KAFB has delineated the contaminated areas on its property in the first and second stages of their abatement plan . The proposed next step in the Stage 2 Abatement Plan Modification is to investigate the land both within and outside of the KAFB boundaries, to determine if, and to what extent the fuel product has migrated outside of KAFB boundaries. Subsequent to the investigation, KAFB may be required to install remediation systems to remove the fuel product. As part of these efforts, KAFB has retained the services of an environmental contractor, CH2MHill, to perform environmental services on land both inside and outside of the KAFB boundary. The land proposed to be tested includes an 11 .5 acre plot of land on VA property or other areas identified and agreed upon that are owned by NMVAHCS. KAFB is required by the New Mexico Environment Department to define the extent of the fuel product on and off of KAFB. KAFB may therefore be required to install groundwater monitor wells on other VA property, specifically within the parking lots south and east of the VA Hospital to complete the investigation. This has been presented to the VA Engineering Staff in previous meetings. These 11 .5 acres of VA owned land are currently vacant, but the NMVAHCS has future plans to develop this land under the Federal Enhanced Use Lease (EUL) authority. The NMVAHCS needs assurance that any environmental contamination on its 11 .5 acre property has been addressed, and will be remediated before proceeding further with its EUL project plans. Thus, the NMVAHCS has granted permission to KAFB to conduct environmental services on the property proposed for use in the EUL or other areas identified and agreed upon that are owned by NMVAHCS. This testing is projected to include the drilling and testing of monitoring wells, in order to explore the quality of the groundwater beneath the 11 .5 acre parcel, to determine whether the leaked fuel product has migrated to affect the 11 .5 acre parcel or other VA property. The NMVAHCS needs to have unrestricted access to any and all results of the testing, conducted by CH2MHill, on its 11 .5 acre parcel of land and on all other VA property.	NA
3	RESPONSIBILITIES: a. Kirtland Air Force Base: 1) Allows NMVAHCS full, unrestricted access to any and all results of environmental services performed on NMVAHCS (VA) property. 2) Coordinates communication between NMVAHCS and KAFB to ensure that NMVAHCS is provided full access to all environmental services results derived from activities on NMVAHCS property. 3) Agrees to provide a written copy of any final environmental assessment reports produced by CH2MHill, once all testing on NMVAHCS property is complete. 4) Agrees to maintain open communication with the Engineering Staff of the NMVAHCS regarding environmental services performed on NMVAHCS property, and promptly informs them of any proposed changes to the initial testing protocols and schedules. b. New Mexico VA Health Care System: 1) Grants KAFB or its contractor/subcontractor permission to conduct environmental services on NMVAHCS property, to include drilling monitoring wells on NMVAHCS property to determine the quality of the groundwater at the well sites located on NMVAHCS property. 2) Grants KAFB or its contractor/subcontractor permission to temporarily install and use remediation equipment such as soil vapor extraction systems currently installed on KAFB, to remove any leaked fuel product. When remediation equipment is used by KAFB or its subcontractor, KAFB agrees to adhere to the following: a. Remediation equipment will be secured using a secured chain-link fencing system. b. Remediation equipment located in residential areas will be soundproofed. c. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the remediation equipment is deployed. d. KAFB will be responsible for meeting any and all applicable air emission standards for the remediation equipment. e. KAFB agrees to comply with any and all applicable city, state or federal laws and regulations regarding EPA permitting. f. All tools, equipment, and other property taken upon, placed upon, or installed on VA property by KAFB, or its contractor/subcontractor, excluding the installed monitoring wells, shall remain the property of KAFB, or its contractor/subcontractor, and may be removed by KAFB, or its contractor/subcontractor, at any time within a reasonable period after the expiration of this right-of-entry. g. Monitoring wells drilled and installed on VA property will remain in place until groundwater remediation activities are completed consistent with the terms of Paragraph 6, Terms of Agreement, contained herein, at which time NMVAHCS will determine which monitoring wells will be removed and/or abandoned in place. All monitoring well removal and/or abandonment activities will comply with the provisions of Title 19, Chapter 27 and Title 20, Chapter 6 of the New Mexico Administrative Code (NMAC).	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
3	3) Grants KAFB permission to erect a temporary equipment staging area on VA property in an area within the 11 .5 acre plot of land, not to exceed 50 feet by 100 feet for the purpose of housing supplies needed for the environmental services effort. When a temporary equipment staging area has been established by KAFB, KAFB agrees to adhere to the following: a. The temporary storage area located on VA property within the 11 .5 acre plot of land will be secured using a secured chain-link fencing system. b. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the remediation equipment is deployed. c. KAFB agrees to maintain oversight of and responsibility for all items placed in the designated temporary storage area. d. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the temporary storage area is deployed. e. All tools, equipment, and other property taken upon the land and housed or placed on VA property within the temporary equipment staging area by KAFB, or its contractor/subcontractor, shall remain the property of KAFB, or its contractor/subcontractor, and may be removed by KAFB, or its contractor/subcontractor, at any time within a reasonable period after the expiration of this right-of-entry. 4) Receives copies of all environmental services performed by CH2MHill, reviews them, and promptly provides comment back to KAFB regarding any concerns, questions, or issues involving the environmental services so that if changes need to be made to the environmental services schedule and/or protocols, this information can be communicated to KAFB and CH2MHill. 5) Maintains open communication with the KAFB Natural Resource Management Restoration Section concerning the environmental services on NMVAHCS property. 6) Informs KAFB of any access and/or scheduling issues with the environmental services performed by CH2MHill. 7) Grants KAFB, via VA Form 10-6215, "Permit for Use of Real Property by Federal Agency," a five (5) year "Right of Entry" for the installation of and collection of data from groundwater monitoring wells designed to both delineate and remediate any leaked groundwater fuel product.	NA
4	PROCEDURES: Standard procedures and timelines for receiving regular updates on the progress of environmental services, as well as periodic written reports and the final written report produced by CH2MHill will be developed and adhered to.	NA
5	PAYMENT I REIMBURSEMENT: No payment or reimbursement will be made or exchanged between NMVAHCS and KAFB for environmental services conducted, or copies of testing results shared between the two organizations in accordance with this Permit.	NA
6	TERMS OF AGREEMENT: This five (5) year agreement may be modified or revised by written amendment, provided such revision or modification is mutually agreed upon and signed by the authorized representative of Kirtland Air Force Base and the New Mexico VA Health Care System. This agreement will remain in effect during the period stated unless terminated at the request of either party after thirty (30) days notice in writing. The parties involved shall review this agreement annually. No later than twelve (12) months prior to the expiration of this Permit, NMVAHCS and KAFB officials will review the status of groundwater monitoring and remediation efforts and determine whether the Permit and Right of Entry shall both expire or be renewed for an additional term not to exceed five (5) years.	NA
7	PROTECTION OF RESOURCES a. GRANTEE will use all reasonable means available to protect the environment and natural resources from damage arising from this Right of Entry or activities incident to it. Where damage nonetheless occurs, GRANTEE shall be liable to restore the damaged resources. Upon termination of this Right of Entry, the land shall be returned to GRANTOR in the same environmental condition as received, as documented in the Request for Environmental Impact Analysis (AF Form 813) and Environmental Baseline Survey (EBS) Waiver for Right of Entry attached hereto and made a part hereof as Exhibit Band C respectively. · b. To the extent provided by law and subject to the availability of funds, KAFB agrees to use its appropriations and resources, as required, to repair damages to said parcel and pay any awards, claims, settlements or judgments rising out of its use of said parcel, or routes of ingress or egress therefrom, including reimbursement of the Judgment Fund, 31 USC§ 1304; provided however, that NMVAHCS or another agency of the Government may, as a matter of its internal policy, assume responsibility for certain claims of that agency's personnel while assigned or detailed to the KAFB, or otherwise present on the said parcel.	NA
8	EFFECTIVE DATE: This agreement is effective for the period 09/12/2008 through 08/31 /2013.	NA
New Mexico Veterans Administration Health Care System Permit Amendment No. 2		
1	The Permit shall be amended to extend the permit term for a five (5) year term beginning on 28 January 2016 and ending on 27 January 2021.	Table 1-1
2	All Permit references to "PERMITTEE's contractor" shall refer to any of the PERMITTEE's contractors/subcontractors conducting environmental services for the KAFB bulk fuels release investigation and remediation.	NA
3	Permit§ 8(8), Effective Date, shall be amended to read as follows: "This Agreement is effective for the period 28 January 2016 through 27 January 2021."	NA
4	All other terms and conditions of the NMVAHCS Permit shall be and remain the same.	NA
Gibson Medical Center License to Kirtland Air Force Base		
1	The LICENSOR hereby grants unto the LICENSEE a license to enter upon the LICENSOR's real property located at 5400 Gibson Blvd SE, Albuquerque, Bernalillo County, New Mexico, which real property is also known as: SWIFT ADDITION, LOT 1,BERNALILLO COUNTY & LOVELACE HOSPITAL, LOT A 1 A, BERNALILLO COUNTY and more specifically identified on the attached general location map, which is attached hereto and incorporated herein as Attachment A, for the express purpose of: constructing, installing, operating, maintaining, modifying, repairing, replacing and/or removing soil vapor and ground water monitoring wells for the collection of soil and groundwater samples; and collecting quarterly well samples as more fully identified in Attachments Band C, attached hereto and incorporated herein.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
2	The LICENSEE shall use the area described above and as shown in Attachments A and B, for the purposes described above and not for any other purpose without first obtaining the written consent of the LICENSOR and shall adhere to the following use conditions: a. LICENSEE shall obtain a City of Albuquerque Well Permit for each well by making application to the Development and Building Services Division. One permit may be used for multiple wells grouped by type of well, by installation priority, by cluster or by location. b. Ensure that the LICENSEE's Contractor complies with the terms of the well permit Division. c. Ensure that the LICENSEE's Contractor complies with permitting and environmental health protections requirements of the city of Albuquerque Environmental Health Department, including but not limited to air quality and noise remediation; d. Restore all well heads to pre-existing grades and restore any surface disturbance created by the well installation process; e. At each successive License renewal, or upon request. provide the LICENSOR a well status update as set forth in the annual monitoring reports submitted to the New Mexico Environment Department Hazardous Waste Bureau f. Provide the LICENSOR a 48 hour notice, as set forth in Condition 11 herein before the Contractor enters the property to conduct sampling.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
3	This License shall remain in effect for a period of five (5) years beginning on the date of execution by the PARTIES, with multiple options to renew thereafter, corresponding with, but not to exceed, the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) remediation timetable, which timetable will be attached and incorporated herein as Attachment D when approved by the NMED-HWB, unless revoked as provided herein, or extended by the mutual written consent of both parties.	Table 1-1
4	Either Party may revoke this License upon providing written notice to the other party thirty (30) days prior to such revocation.	NA
5	All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the LICENSOR's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within thirty (30) days after the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.	NA
6	Damages and Indemnity. The LICENSEE shall repair or pay for all actual damages done to LICENSOR's property and improvements caused by LICENSEE's operation(s), to include damage caused by vibration during well drilling and installation. All claims for damage to LICENSOR's property and improvements shall be subject to the provisions of the Federal Tort Claims Act (28 USC§§ 2671 et seq.). To the extent provided by law, the Licensee's liability under this clause is subject to the availability of funds, as set forth in 31 USC§ 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR may have to make a claim for damages under applicable laws.	NA
7	The LICENSEE shall be solely responsible for maintaining the premises upon which the Improvements are being constructed in a safe condition during construction and subsequent well monitoring events.	NA
8	The Licensee will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and incorporated herein as Attachment E, and two Environmental Baseline Surveys (EBS), which are attached hereto and incorporated herein as Attachments F and G. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments E, F and G, the LICENSOR's land will be returned in the same environmental condition as received but without the contamination conditions for which the LICENSEE is performing the remediation.	NA
9	In connection with its use of or any other activity on the property, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.	NA
10	The LICENSEE and its contractors shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.	NA
11	For purposes of giving formal written notice, the points of contact are as follows: LICENSOR: GIBSON MEDICAL CENTER 2009 EUBANK NE Albuquerque, NM 87112 LICENSEE: Installation Commander 2000 Wyoming Blvd, SE Kirtland AFB, NM 8711 7	NA
12	Claims. a. Point of Contact. The Permittee point of contact for all damages, whether to real or personal property, will be submitted to: 377 ABW/JA Attention: Claims Division 2000 Wyoming Blvd., SE Kirtland AFB, NM 87117-5000 (505) 846-4217 http://www.kirtland.af.mil/Organizations/StaffJudge/index.htm b. Claims Process: To file a claim for damage and/or injury due to Permittee's operations, the claimant, or his/her authorized agent, must file a properly signed SF-9S, Claim for Damage, Injury or Death, setting forth a sum certain for damage to or loss of property, personal injury or death, to the POC identified in Condition 13(a) above, within two (2) years of the incident causing the damage or injury. The claim form is available at the website provided herein in paragraph a.	NA
13	This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.	NA
14	This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.	NA
15	If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.	NA

Table 1-2
Permit Terms and Conditions, Operations and Maintenance Plan Cross References

Condition No.	Terms and Conditions	Reference Location in O&M Plan
16	Index of Attachments Attachment A- General Location Map Attachment B-Well Permits as Developed Attachment C -Sampling Schedule Attachment D -NMED-HWB Remediation Plan and Timetable Attachment E-Request for Environmental Impact Analysis (AF Form 813) Attachment F -Initial Environmental Baseline Survey (EBS) Attachment G-Final EBS	NA

$ = dollar(s)
AF = Air Force
AFB = Air Force Base
BFF = Bulk Fuels Facility
EBS = environmental baseline survey
EDB = ethylene dibromide
EPA = U.S. Environmental Protection Agency
EUL = enhanced use lease
GAC = granular activated carbon
gpd = gallon per day
GWQB = Groundwater Quality Bureau
GWTS = groundwater treatment system
HWB = Hazardous Waste Bureau
KAFB = Kirtland Air Force Base
LNAPL = light non aqueous phase liquid
MCL = maximum contaminant level
NA = not applicable
NM = New Mexico
NMAC = New Mexico Administrative Code
NMED = New Mexico Environment Department
NMPM = New Mexico Principal Meridian
NMSA = New Mexico Statutes Annotated
NMSPCS =
NMVAHCS = New Mexico Veterans Administration Health Care System
O&M = operations and maintenance
OSE = Office of the State Engineer
POC =point of contact
POD = point of diversion
RCRA = Resource Conservation and Recover Act
SWMU = solid waste management unit
UIC = underground injection control
USC = United States Code
VA = Veterans Administration
WQA = Water Quality Act
WQCC = Water Quality Control Commission

Table 2-1
Alarm Conditions, Interlocks, and System Responses

Alarm Condition	Set Point
Leak detected in an extraction well vault or well control house	1 foot (approximate)
Leak detected in a double walled pipe	NA
High water level in groundwater treatment system building sump or truck bay sump	Building sump: 1 foot (approximate) Truck bay sump: 3 feet (approximate)
Water level too high in influent tank	9.5 feet (approximate)
Water level too low in influent tank or too high in effluent tank	Influent low: 1.5 feet (approximate) Effluent high: 9.5 feet (approximate)
Water level too low in effluent tank	1.5 feet (approximate)
Influent skid or granular activated carbon pressure exceeds set point	55 psig (approximate)
Effluent skid pressure exceeds set point	55 psig (approximate)
Intrusion alert, power loss, low temperature detected, or high influent bag filter differential pressure	Bag filter pressure: 4 psi
Smoke detected in groundwater treatment system	NA
High water level or high pressure in well KAFB-7	Water level: 150 feet Pressure: 45 psi
High water level in Golf Course Main Pond	5.5 feet
Activation of emergency stop	NA
High water level in sand filter clarifier	6 feet (approximate)

Table 2-1
Alarm Conditions, Interlocks, and System Responses

Interlock	System Response
Disables extraction pumps associated with the affected vault	Email and shutdown of the affected equipment
Disables all extraction pumps	Email and shutdown of the affected equipment
Disables all extraction pumps and all skid pumps	Email and immediate Full system shutdown
Disables all extraction pumps	Email and eventual Full system shutdown
Disables influent skid pumps	Email and eventual Full system shutdown
Disables effluent skid pump	Email and eventual Full system shutdown
Disables influent skid pumps	Email and eventual Full system shutdown
Disables effluent skid pump	Email and eventual Full system shutdown
None	Email
None	Email and notifies Kirtland Air Force Base Fire Department
Disables effluent skid pump	Email and eventual Full system shutdown
Disables effluent skid pump	Email and eventual Full system shutdown
Disables all extraction pumps and all skid pumps	Email and immediate Full system shutdown
Entire system shutdown	Email and immediate Full system shutdown

Table 2-2
Permitted Extraction Well Flow Rates

Well ID	Permit No.	Extraction Flow Rate Not to Exceed (gpm, continuous for 24 hours)
KAFB-106228	RG-1579 POD 292	250
KAFB-106233	RG-1579 POD 309	197
KAFB-106234	RG-1579 POD 310	197
KAFB-106239	RG-1579 POD 319	200
KAFB-7	RG-1587	2,790 (1,239[a])

[a] Injection flow rate for KAFB-7.
ID = identification
gpm = gallon per minute
No. = number

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Table 2-3
Standard Operational Set Points

PID Set Points			
Item		**Set Point**	**Units**
Groundwater Influent Pump 112	Flow Rate	Varies	gpm
	KP	1.5	--
	KI	0.05	--
	KD	0	--
Groundwater Influent Pump 212	Flow Rate	Varies	gpm
	KP	1.5	--
	KI	0.05	--
	KD	0	--
Treated water Effluent Pump 118	Flow Rate	Varies	gpm
	KP	1.25	--
	KI	0.09	--
	KD	0	--
Treated water Effluent Pump 218	Flow Rate	Varies	gpm
	KP	1.25	--
	KI	0.09	--
	KD	0	--
System Distribution Pressure Control	Pressure	20	psi
	KP	2	--
	KI	0.02	--
	KD	0	--
KAFB-7 Injection Pressure	Pressure	15	psi
	KP	1.5	--
	KI	0.2	--
	KD	0.02	--

Train Control Set Points		
Item	**Set Point**	**Units**
Extraction Well Drawdown	1.0 - 5.0	ft
Influent Bag Filter High Differential Pressure	4	psid
Downstream Distribution High Pressure	45	psid
KAFB-7 High Level	200	ft
Golf Course High Level	5.3 - 5.7	ft
Groundwater Influent Pumps - Level Stop	3.5 - 4.5	ft
Groundwater Influent Pumps - Level Start	7.0 - 8.0	ft
Treated water Effluent Pumps - Level Stop	3.5 - 4.5	ft
Treated water Effluent Pumps - Level Start	7.0 - 8.0	ft

Manual Alarm Set Points		
Item	**Set Point**	**Units**
Influent Skid High Pressure Switches	40	psi
Carbon Absorber High Pressure Switches	40	psi
Effluent Skid High Pressure Switches	50	psi
Tank High Level Switches	11	ft
Tank Low Level Switches	2	ft

gpm = gallon per minute
ft = foot/feet
PID = proportional–integral–derivative
psi = pound per square inch
psid = pound per square inch differential

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Table 3-1
Groundwater Treatment System Routine Maintenance Schedule

	Frequency			
Maintenance Activity	**Daily**	**Weekly**	**Monthly**	**As Needed**
Recording and inspecting influent, GAC vessel, and effluent skid pressure, flow rate, and totalizer readings from their respective gauges and the human machine interface	X			
Recording extraction well pressure, flow rate, and totalizer readings from the human machine interface	X			
Recording extraction well pressure, flow rate, and totalizer readings from the gauges at the well vaults		X		
Inspecting well control house and recording well control house pressure, flow rate, and totalizer		X		
Recording totalizer reading at KAFB-7		X		
Running and inspecting the GWTS air compressor		X		
Inspecting extraction well, conveyance line, and air release valve vaults			X	
Inspecting wellhead and associated equipment of injection well KAFB-7			X	
Inspecting and performing maintenance of flowmeters throughout the system			X	
Inspecting and performing maintenance on actuating valves throughout the system			X	
Performing confined space entries			X	
Gauging extraction well filter pack			X	
Semiannual inspections and maintanence of Tijeras Arroyo Gold Course ponds				X
Logging lockout-tagout entries				X
Logging system shutdowns				X
Emptying storm water runoff flooded vaults				X
Performing air compressor maintenance				X
Cleaning GWTS sumps				X
Draining air release valve containment vessels				X
Grounds keeping including vegetation control				X
Inspecting and cleaning the GWTS Y-strainer				X
Performing flow meter calibration				X[a]
Greasing pump bearings				X[b]
Changing process pump oil				X[b]
Changing air filter on control room air conditioner				X[b]
Changing bag filters				X[c]
Changing out GAC				X[c]
Disinfection of extraction wells and conveyance lines				X[d]
Testing of alarms and interlocks				X[e]
Cleaning coils and replacing air filter for the Well Control House air conditioner				X[f]
GAC Skimming of the lead GAC vessel				X[g]

[a] Flowmeters are calibrated at a minimum of once per year, but may be calibrated more often as needed.

[b] Changing of process pump oil, greasing pump bearings, and replacing the air filter in the air conditioning unit are required every 3 months, but may be changed more often as needed.

Table 3-1
Groundwater Treatment System Routine Maintenance Schedule

[c] Bag filters are scheduled for change out when the pressure differential across a bag filter vessel exceeds 15 psi

[d] Disinfection of extraction wells and conveyance lines occurs semiannually or more often as needed.

[e] Testing of alarms and interlocks occurs annually or more often as needed.

[f] Cleaning of the coil and replacing of the air filter are scheduled as quarterly activities, but frequency may be adjusted as necessary.

[g] GAC skimming is performed when the differential pressure in the lead GAC vessel has increased from the

GAC = granular activated carbon
GWTS = groundwater treatment system
KAFB = Kirtland Air Force Base
psi = pound per square inch

Table 3-2
Large Item Inventory

Item	Item Description	Quantity in Inventory	Owner
Replacement Transducer and Cable	In-Situ Level TROLL 700, 30 pounds per square inch gauge with 500+ foot rugged, vented, TEFZEL cable	5	Government
Replacement Pump and Motor for Extraction Wells KAFB-106233 and KAFB-106234	Grundfos 13B63622 150S400-22 60 Hertz	0	Government
Replacement Skid Pump and Motor	Goulds Pumps Model 3196 Sti Size 2 x 3-6 i-FRAME with 15-horsepower, 3,600 revolutions per minute motor	1	Government
Replacement Variable Frequency Drive for Pump Skids	Allen-Bradley PowerFlex 700 Adjustable Frequency AC Drive	0	Government
Replacement Magnetic Flowmeter	Siemens SITRANS F M MAG 5100 W	0	Government
Replacement Dosing Pump	Pumps and tanks for injection and storage of oxidants	2	Government
Replacement Production Pump for KAFB-7	HydrofloPumps Model 11ML-9, SN: CA21506	1	Government
Replacement Pump and Motor for Extraction Well KAFB-106239	Grundfos 25HP 460V 3PH 6-inch Motor and Frantklin 100 FA25S6PE Pump End	1	Government
Replacement emergency conveyance line for KAFB-106233, KAFB-106234, and KAFB-106239	ASAHI 4" SDR-11 X 8" SDR-17 HDPE Double Containment Pipe by 20' Length; 2 4"x8" HDPE SDR 11x17 Cap; 8 4"x8" Centralizer Dbl Cont BF HDPE 11x17 STD SDR Fluid-Lok; 1 4"x8" 45 Elbow DBL Cont BF HDPE 11x17 STD SDR Fluid-lok; 1 4"x8" 90 Elbow DBL Cont BF HDPE 11x17 STD SDR Fluid-lok. ASAHI 8"x12" Pipe Simult DBL Cont BF HDPE 11x17 STD SDR Fluid-lok; 2 8"x12" HDPE IPS SDR11x17 Fluidlok Cap; 8 8"x12" Centralizer DBL Cont BF HDPE 11x17 STD SDR Fluid-lok; 1 8"x12" 45 Elbow DBL Dont BF HDPE 11x17 STD SDR Fluid-lok; 1 8"x12" 90 Elbow DBL Cont BF HDPE 11x17 STD SDR Fluid-lok	1	Government
Replacement emergency conveyance line for KAFB-106228	SECOR 4" SDR-11 X 8" SDR-17 IPS HDPE Dual Containment Pipe by 20' Length; 2 Dual Containment BF End Cap; 8 Dual Containment Centralizer; 1 Dual Containment BF 45 degree Elbow; 1 Dual Containment BF 90 degree Elbow	1	Government
Dust Supression Water Trailer	2018 Wylie EXP-500L-E Tank Trailer for dust supression	1	Government

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Table 3-3
Specific Consumable Product Codes, Suppliers, and Recommended On-Hand Inventory

Consumable Item	Product Ordering Code	Supplier[a]	Recommended On-hand Inventory
10-micrometer bag filters	PES10P2S-H	Baker Corp 2400 South Cedar ST Borger, TX 79007 Phone: (806) 273-3747	48+
Bag Filter Housing O-Rings	CB26LB O Ring, Buna, LR6/C26	Pentair Residential Filtration, LLC. 5730 North Glen Park Road Milwaukee, WI 53209	8
Culinox 999 Food Grade Salt	Culinox 999 Food Grade Salt	Univar USA Inc. P.O. Box 34325 Seattle, WA 98124	500 pounds
GAC Vessel Manway O-Rings	14- X 18-inch Elliptical Manway Gasket (TIGG) 14- X 18-inch Elliptical Manway Gasket, G46, EPDM, Off-White (Calgon Carbon)	TIGG LLC (for Train 1) 1 Willow Avenue Oakdale, PA 15071 Calgon Carbon Corporation (for Train 2) 3000 GSK Drive Moon Township, PA 15108	2 per train
KAFB-7 Hydraulic Oil filter	Filter P551551	Grainger 3901 Osuna Rd. NE Albuquerque, NM 87109	1
Pump grease	Mobile PolyRex EM	Grainger 3901 Osuna Rd. NE Albuquerque, NM 87109	3 tubes
Pump oil	DTE 26 Mobile hydraulic oil	Grainger 3901 Osuna Rd. NE Albuquerque, NM 87109	5 gallons
Sand Filter Media	GRAVEL #3 CRUSHED 5/8 inches	Yardney Water Filtration Systems, Inc. 6666 Box Springs Blvd. Riverside, CA 92507	None
	8/12 GARNET		None
	SILICA BASE QUANTUM DMI 65		None
VFD Fuses	FLSR 100, 100 A, 600 VAC	Littelfuse, Inc. 8755 West Higgins Road Suite 500 Chicago, IL 60631	4

[a] Supplier listed or equivalent.
GAC = granular activated carbon
VFD = variable frequency drive

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Table 3-4
Consumables Supply Inventory

Item	Item Description/Intended Use	Quantity Needed Onsite	Owner
Laptop	Laptop for various calculations and data collection	1	Contractor
In-Situ TROLLCOM	Communication device used to communicate with downhole transducers	1	Contractor
Emergency contact signage	A sign of current emergency contacts	4	Contractor
Well control house key	Well control house door key	2	Government
Master lock keys	Key for locks on well vaults	2	Government
Vault keys	Keys to open well vaults	1	Government
Locks	For well vaults, electric panels, and other items	6	Government
5-gallon bucket	Water collection under air release valves both in plant and in vaults	16	Contractor
Sump pump	7-gallon per minute/quick water transfer	3	Contractor
Extension cord	Various applications and lengths	3	Contractor
Surge protector	Various applications	3	Contractor
Flex hose	For quick draining of bag filter housings	2	Government
Garden hoses	Various applications and lengths	3	Government
Hose nozzle attachment	Controlled water usage with hose	1	Government
Diffusers for carbon vessels	Replacement for inside vessels	2	Government
Pipe drop sump pump configuration	Liberty B39676506X /for truck sump drainage with associated piping to camlock fitting	1	Government
Cam fitted hose	2-inch identification cam fitted hose for moving water, 25-foot sections	4	Government
Cam fitted hose	1.5-inch identification cam fitted hose for moving water, various length	2	Government
Cam fitted hose	6-inch cam fitted hose for moving water, 10-foot sections	3	Government
Shop vac	Various applications	1	Contractor
Shop vac wet filter	Vacuuming water	2	Contractor
Shop vac dry filter	Vacuuming particulate	2	Contractor
Truck sump grate lift	Chain and rigid wood configuration used in conjunction with lift gates on a truck	1	Contractor
Teflon thread tape roll	Protective thread tape needed to ensure fittings seal	2	Contractor
Air hose	1-inch hose for air compressor with Chicago fittings, 50-foot sections	2	Government
Air nozzle	Nozzle for controlled air from compressor	1	Government
Heat gun	Various applications	1	Contractor
Lockout/tagout tags and locks	Electrical panel safety	1 package	Contractor
Zip ties	Various applications and lengths	2 packages	Contractor
Contractor bags	Various uses	1 package	Contractor
Ladder	4-foot and 8-foot, various uses	2	Contractor
Pens	Various uses	1 package	Contractor
Permanent markers	Various uses	1 package	Contractor
Brooms	GWTS maintenance	2	Contractor
First aid kits	GWTS safety	2	Contractor
Trash cans	Store trash prior to disposal	3	Contractor
Traffic cones	Various uses, for barricading vaults and denoting exclusion zones	10	Contractor
Caution tape	Taping off exclusion zones	3 rolls	Contractor
Fire extinguisher	GWTS safety	3	Government
Eyewash	GWTS safety	2	Government
Secondary containment pallets	GWTS safety	3	Government
2-inch valve key	Effluent line integrity testing	1	Contractor
Food grade salt	50 lb Morton Culinox 999 Food Grade Salt for brine tank for sodium hypochlorite generator	10	Contractor

GWTS = Groundwater treatment system

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Table 5-1
Influent Criteria

Parameter	Analytical Method	Analyte	Maximum Influent Concentrations Reaching the Lead Granular Activated Carbon Vessel	Maximum Single Extraction Well Concentrations[1]	Small Volume IDW Concentrations at Minimum Flow Conditions[2]	Small Volume IDW Concentrations at Maximum Flow Conditions[3]	Large Volume IDW Concentrations at Minimum Flow Conditions[4]	Large Volume IDW Concentrations at Maximum Flow Conditions[5]
Ethylene Dibromide	Method SW8011 (µg/L)	1,2-Dibromoethane	20	41	1,100	1,250	88	225
Volatile Organic Compounds	Method SW8260C (µg/L)	Benzene	450	405	499	499	499	499
		Ethylbenzene	102	210	5,500	6,000	450	1,150
		Toluene	212	436	12,000	13,250	935	2,400
		Xylenes, Total	110	226	5,750	6,500	485	1,225
Dissolved Metals	Method SW6010C (µg/L)	Iron	1,000	20,571 (2,057)	570,000 (57,000)	625,000 (62,500)	44,250 (4,425)	112,500 (11,250)
		Manganese	200	20,571 (411)	570,000 (11,000)	625,000 (12,000)	44,250 (880)	112,500 (2,250)
Field Parameters		Temperature (°C)	NS	NS	NS	NS	NS	NS
		Spec Cond (µS/cm)	NS	NS	NS	NS	NS	NS
		pH (S.U.)	NS	NS	NS	NS	NS	NS
		ORP (mV)	NS	NS	NS	NS	NS	NS
		DO (mg/L)	NS	NS	NS	NS	NS	NS

Simple continuous mixing calculations and AQUASIM model descriptions are further described in Appendix M of this Operations and Maintenance Plan.

Values in parentheses indicate values calculated assuming the sand filters are not installed or otherwise offline.

[1] Maximum concentrations of water produced from a single well were calculated assuming a maximum well flow rate of 175 gpm, maximum system flow rate of 400 gpm, installation of the sand filters, and using a simple continuous mixing calculation.

[2] Maximum concentrations of 55 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a minimum system flow rate of 120 gpm, installation of the sand filters, and using the AQUASIM model.

[3] Maximum concentrations of 55 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a maximum system flow rate of 365 gpm, installation of the sand filters, and using the AQUASIM model.

[4] Maximum concentrations of 21,000 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a minimum system flow rate of 120 gpm, installation of the sand filters, and using the AQUASIM model.

[5] Maximum concentrations of 21,000 gallons of IDW water that can be discharged to the GWTS sump, which were calculated assuming a maximum system flow rate of 365 gpm, installation of the sand filters, and using the AQUASIM model.

°C = degree Celsius
µg/L = microgram(s) per liter
µS/cm = microsiemen(s) per centimeter
gpm = gallon per minute
GWTS = groundwater treatment system
IDW = investigation-derived waste
mg/L = milligram per liter
mV = millivolt
NS = not specified
ORP = oxidation reduction potential
Spec Cond = specific conductivity
S.U. = standard unit

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Table 6-1
Reports and Recipients

Report Title	Regulatory Permit/Document Requiring	Report Contents	Responsible Party	Recipients	Transmission Method
Greater than 24-Hour Shutdown Notification	Operations and Maintenance Plan	- Notification of greater than 24-hour shutdown	Operator	AFCEC and USACE	Email
			AFCEC	NMED HWB	Email
Notification of Change resulting in change in volume of discharge, location of discharge, or amount or character of contaminants received, treated, or discharged outside of DP-1839 scope	DP-1839 issued by NMED GWQB, Condition 22.e	- Notification of change in volume of discharge, location of discharge, or amount or character of contaminants received, treated, or discharged outside of DP-1839 scope	Operator	AFCEC and USACE	Email
			AFCEC	NMED GWQB	Email
Kirtland BFF - Weekly Update-W/E mm/dd/yy	USACE Contract Requirement	- Site Monitoring Status - Weekly GWTS Operational Values - Current Discharge Location - Recent Effluent Analytical Results - Weekly Maintenance Information	Operator	**List of Individual emails provided in Appendix P** Kirtland Air Force Base Civil Engineering Group AFCEC/USACE City of Albuquerque NMED Albuquerque Bernalillo County Water Utility Authority	Email
Kirtland BFF - GWTS Monthly Water Summary - month year	Kirtland Air Force Base Water Use/conservation Internal Reporting	- Table containing monthly total extracted and discharged by Discharge Location	Operator	**List of Individual emails provided in Appendix P** Kirtland Air Force Base Civil Engineering Group AFCEC/USACE	Email
Kirtland BFF - NMOSE Monthly Reporting for GWTS - month year	Kirtland Air Force Base NMOSE Quarterly Reporting for all NMOSE Permits	- Table containing monthly extraction totals per well and injection volume	Operator	**List of Individual emails provided in Appendix P** Kirtland Air Force Base Civil Engineering Group AFCEC/USACE	Email
			Kirtland Air Force Base Civil Engineering Group	NMOSE	Email
Kirtland BFF Quarterly/Annual Report	DP-1839 issued by NMED GWQB	- Summarize ongoing site monitoring and interim measure activities (Condition 17) - Any mechanical integrity testing conducted on either the GWTS or a UIC well (Condition 22.a) - Any replacement of granular activated carbon media and the associated data that initiated the decision to replace the media (Condition 22.b) - Any UIC well rehabilitation conducted (Condition 22.c) - Any malfunction, repair, or replacement of a flow meter (Condition 22.d) - Any additional operational changes with the potential to affect the discharge (Condition 22.e) - Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well (Condition 21.a) - The totalized monthly volume of treated effluent transferred to all UIC wells (Condition 21.b) - Monthly average, maximum, and minimum head values of injection water for each UIC well (Condition 21.c)	Operator	AFCEC/USACE	Electronic Deliverable
			AFCEC	NMED GWQB	Hardcopy and Electronic
	HWTF Interim Measure Resource Conservation and Recovery Act Permit Section 6.2.4.4 Periodic Monitoring Reports Approved Work Plans USACE Contract Requirements	- A description of the work completed and an estimate of the percentage of total planned work completed - Summaries of all findings, including summaries of laboratory data - Summaries of all problems or potential problems encountered during the reporting period and actions taken to rectify problems - Planned work for the next reporting period - Summaries of contacts pertaining to corrective action with representatives of the local community, public interest groups, or State government during the reporting period - Changes in key project personnel during the reporting period - Summaries of any variances from approved investigation or remediation work plans - Brief summaries of any periodic monitoring reports prepared in accordance with the requirements in Permit Section 6.2.4.4.	Operator	AFCEC/USACE	Electronic Deliverable
			AFCEC	NMED HWB	Hardcopy and Electronic

AFCEC = Air Force Civil Engineer Center
BFF = Bulk Fuels Facility
DP = discharge permit
GWQB = Ground Water Quality Bureau
GWTS = groundwater treatment system
HWB = Hazardous Waste Bureau
HWTF = Hazardous Waste Treatment Facility
NMED = New Mexico Environment Department
NMOSE = New Mexico Office of the State Engineer
UIC = underground injection control
USACE = U.S. Army Corps of Engineers

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APPENDICES
(Provided Electronically via Compact Disc)

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APPENDICES

A Permits and Agreements

A-1 Regulatory Permits
A-2 Access Agreements

B Organization and Responsibilities

C Description of Groundwater Treatment System Equipment and Facilities

D Process Drawings and Groundwater Treatment System Equipment/Instrument Location Pictures

E Process Control Description

F Supervisory Control and Data Acquisition and Human Machine Interface Screens

G Design Calculations for Carbon Vessel Media Beds

H Groundwater Treatment System Operations Log Sheets and Record Forms

I Manufacturers' Literature

J Sampling and Analysis Plan

K Waste Characterization Documentation

L User Operational Adjustments Documentation

M Well Construction Diagrams and Borehole Logs

N Example Reports

O Technical Memorandum

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APPENDIX A

REGULATORY REQUIREMENTS

LIST OF PERMITS AND AGREEMENTS

A-1 Regulatory Approvals and Permits

Groundwater Treatment System Design Approvals

New Mexico Environment Department Permits
- Hazardous Waste Treatment Facility Operating Permit EPA ID No. NM9570024423
- DP-1770 Modification Application and Termination
- Discharge Permit Issuance, DP-1839, Kirtland Air Force Base

State of New Mexico Office of the State Engineer Permits
- RG-1587 - KAFB-7
- RG-1587 - POD 376-379 KAFB-106IN2
- RG-1579 POD 292
- RG-1579 POD 309 and 310
- RG-1579 POD 319

A-2 Access Agreements

Right of Entry Agreements
- Christ United Methodist Church License to Kirtland Air Force Base
- Permit Amendment No. 2 to the New Mexico Veterans Administration Health Care System
- Gibson Medical Center License to Kirtland Air Force Base
- License Agreement between the City of Albuquerque and Kirtland Air Force Base

GROUNDWATER TREATMENT SYSTEM DESIGN APPROVALS

NEW MEXICO
ENVIRONMENT DEPARTMENT

SUSANA MARTINEZ
Governor
JOHN A. SANCHEZ
Lieutenant Governor

Harold Runnels Building
1190 Saint Francis Drive (87505)
P.O. Box 5469, Santa Fe, NM 87502-5469
Phone (505) 827-0419 Fax (505) 827-0310
www.nmenv.state.nm.us

RYAN FLYNN
Cabinet Secretary
BUTCH TONGATE
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

June 30, 2015

Colonel Eric H. Froehlich
Base Commander
377 ABW/CC
2000 Wyoming Blvd. SE
Kirtland AFB, NM 87117-5606

John Pike
Director, Environmental Management Services
377 MSG
2050 Wyoming Blvd. SE, Suite 116
Kirtland AFB, NM 87117-5270

RE: REVISED BASIS OF DESIGN – MID-PLUME PUMP AND TREAT SYSTEM, BULK FUELS FACILITY SPILL
SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111
KIRTLAND AIR FORCE BASE
EPA ID# NM9570024423
HWB-KAFB-15-MISC

Dear Colonel Froehlich and Mr. Pike:

The New Mexico Environment Department (NMED) is in receipt of the Kirtland Air Force Base (the Permittee) *Revised Final Basis of Design (BOD) – Mid-Plume Pump and Treat System*, dated June 12, 2015. The revised BOD addresses the issues identified in NMED's conditional BOD approval letter of April 24, 2015.

The Permittee's revised final BOD is hereby approved with the following condition:

1. The Permittee shall submit, upon completion of construction, photographic documentation that a backflow preventer or other means to prevent backflow of treated water from the force main line into well KAFB-7 has been installed.

NMED technical staff will assist you and your contractor in any way possible to achieve this interim measure.

If you have any questions, please contact me at 505-827-2855.

Sincerely,

Kathryn Roberts
Director
Resource Protection Division

KR/DM

cc: Col. T. Haught, KAFB
D. Wilson, KAFB
M.L. Leonard, AEHD
F. Shean, ABCWUA
L. King, EPA-Region 6 (6PD-N)
J. Kieling, NMED-HWB

File: KAFB 2015 Bulk Fuels Facility Spill Library and Reading File

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.env.nm.gov

SUSANA MARTINEZ
Governor
JOHN A. SANCHEZ
Lt. Governor

RYAN FLYNN
Cabinet Secretary
BUTCH TONGATE
Deputy Secretary

ENTERED

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

December 16, 2015

Colonel Eric H. Froehlich
Base Commander
377 ABW/CC
2000 Wyoming Blvd.SE
Kirtland AFB, NM 87117-5606

John Pike
Director, Environmental Management Services
377 MSG
2050 Wyoming Blvd. SE, Suite 116
Kirtland AFB, NM 87117-5270

Re: KIRTLAND AIR FORCE BASE BULK FUEL FACILITY MID-PLUME PUMP AND TREAT SYSTEM BASIS OF DESIGN – ADDENDUM #1
BULK FUELS FACILITY SPILL
SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111
KIRTLAND AIR FORCE BASE
EPA ID#NM9570024423, HWB-KAFB-13-MISC

Dear Colonel Froehlich and Mr. Pike:

The New Mexico Environment Department (NMED) has received the Kirtland Air Force Base (AFB) (Permittee) *Kirtland Air Force Base Bulk Fuel Facility Mid-Plume Pump and Treat System Basis of Design – Addendum #1* dated December 13, 2015. The Mid-Plume Pump and Treat Basis of Design Addendum #1 proposes:

- The addition of a pH adjustment system to the groundwater treatment system (GWTS) in order to control the pH of treated water.
- The pH adjustment system will include the addition of National Sanitary Foundation (NSF) certified 20° Baume hydrochloric acid (32% HCl) solution to the effluent water at a rate of 2 gallons per day (or 306 milliliters per hour).
- Twice daily measurement of effluent pH, or more frequently if required, in order to monitor and adjust the HCl addition rate.

The acid addition pump will only operate if the discharge pumps are running. The GWTS has been designed to automatically shut down the discharge pump, and therefore the pH adjustment

KAFB4362

system, if any part of the treatment system shuts down. This provides a safe-guard against the addition of acid when any part of the GWTS is not operational. The Permittee anticipates the need to adjust pH because new GAC units typically increase the pH of treated water by about 1 unit for a temporary period after system startup. The Permittee estimates that the pH adjustment system will not be required after two weeks of operation at 100 gallons per minute (gpm). It is noted that additional pH adjustment may be required when operational extraction rates increase above 100 gpm.

The Mid-Plume Pump and Treat System Basis of Design – Addendum #1 is hereby approved.

Should you have any questions regarding this letter please contact Diane Agnew of my staff at (505) 222-9555.

Sincerely,

Kathryn Roberts
Director
Resource Protection Division

KR/DA

Cc: Col. T. Haught, KAFB
K. Lynnes, KAFB
A. Bodour, KAFB-AFCEC
L. Bitner, KAFB
M.L. Leonard, AEHD
F. Shean, ABCWUA
L. King, EPA-Region 6 (6PD-N)
J. Kieling, NMED-HWB
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File: KAFB 2015 Bulk Fuels Facility Spill

ENTERED

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

March 25, 2016

Colonel Eric H. Froehlich
Base Commander
377 ABW/CC
2000 Wyoming Blvd.SE
Kirtland AFB, NM 87117-5606

John Pike
Director, Environmental Management Services
377 MSG
2050 Wyoming Blvd. SE, Suite 116
Kirtland AFB, NM 87117-5270

Re: BULK FUELS FACILITY EXPANSION OF THE DISSOLVED-PHASE PLUME GROUNDWATER TREATMENT SYSTEM DESIGN
SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111
KIRTLAND AIR FORCE BASE
EPA ID#NM9570024423, HWB-KAFB-13-MISC

Dear Colonel Froehlich and Mr. Pike:

The New Mexico Environment Department (NMED) is in receipt of the Kirtland Air Force Base (KAFB) (the Permittee) *Work Plan for Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design* (Work Plan), dated January 19, 2016. The work plan addresses activities to be performed at the Bulk Fuels Facility site, including:

- Installation of extraction well(s);
- Installation of observation and groundwater monitoring wells;
- Installation of well vaults and conveyance lines associated with new extraction well(s);
- Expansion of the existing Groundwater Treatment System (GWTS);
- Installation of regional injection well(s);
- Operation and maintenance of the GWTS; and
- Performance of groundwater monitoring.

Future revisions and updates of this Work Plan are anticipated to provide the required information on groundwater monitoring well design and installation; extraction well design and

KAFB4404

installation; vault and conveyance line construction and installation; expansion of the groundwater treatment system (GWTS) and installation; and injection well location, design, and installation. The work plan tasks, procedures, and quality control are hereby approved with the following conditions:

1. Section 3.1.5 references depths below ground surface for the tops of screens in the data gap groundwater monitoring wells. Screens should be placed relative to the depth to groundwater, and not a standard depth below ground surface, so that wells adequately screen the shallow, intermediate, and deep intervals represented by other wells in the monitoring network.
2. Aquifer testing of the new extraction well(s) is required in order to continue refinement of the site conceptual model and understanding of aquifer characteristics. The Permittee must submit a separate work plan outlining aquifer testing procedures and analysis for NMED review and approval. This work plan must be submitted a minimum of 60 days prior to the planned start of aquifer testing.
3. The Work Plan needs to be updated to provide a discussion of procedures and decision making criteria that will be followed to determine if/when additional treatment equipment is necessary to augment the current GWTS. This discussion should specifically address manganese and iron. If changes to the GWTS are required, those changes shall be documented in revisions and updates to this Work Plan, submitted to the NMED for review and approval.
4. In addition to the design and installation of injection wells and the associated conveyance line, future revisions to this Work Plan shall also include design information on the effluent manifold to be used to distribute treated groundwater to the golf course and multiple injection wells (Section 3.1.8). Additionally, future revisions shall include the engineering detail on the Golf Course Tie-In Connection referenced in Section 3.1.8.2.
5. The NMED understands that the Air Force would like to use the treated water generated by the GWTS for dust suppression on base. The Air Force shall revise the subject Work Plan to describe the dust suppression mechanisms and application areas
6. Proposal of long-term monitoring, system optimization, and exit strategy are not appropriate for an interim measure and should be completed as part of the Corrective Measures Evaluation and Corrective Measures Implementation phases of the corrective action process. The Final Report referenced in Section 3.1.9 of the Work Plan should meet the permit requirements for an Interim Measure Report (Permit Section 6.2.2.2.12.5).
7. Groundwater monitoring well water levels must be gaged on a quarterly basis and not on a semi-annual basis. This information is vital to understanding changing aquifer conditions and to evaluating performance of the dissolved-phase plume collapse interim measure.
8. Section 3.1.10 (and other sections, as appropriate) will ultimately, if not now, need to address the following items, as discussed on February 17, 2016:
    a. Discussion of discharge of treated water (e.g., land application, injection);
    b. Reference to the measurement and reporting of effluent volumes and discharge locations; and
    c. Discussion of aquifer monitoring activities associated with injection.

9. Table 3-6 shall be revised to include discharge permit DP-1839 as a regulatory driver for injection of treated groundwater.
10. Section 3.1.11.2 states that production wells will be sampled on a semiannual basis. Production wells must continue to be sampled on a monthly basis for EDB, benzene, toluene, ethylbenzene, and xylene.
11. Section 3.1.11.3 does not reflect the approved optimization of periodic monitoring. The Permittee should follow reporting requirements proposed in the *Technical Memorandum: Requested Optimization of Monitoring and Reporting, Second Phase, Bulk Fuels Facility Spill Site,* dated December 9, 2015 and approved on January 20, 2016.
12. Section 3.2.16 needs to be revised to clarify "periodic sampling" of extraction wells and to indicate that the sampling will comply with Ground Water Quality Bureau (GWQB) permit requirements.
13. The U.S. Geological Survey (USGS) is currently conducting a base-wide survey of groundwater monitoring wells. As part of the USGS survey, it is NMED understands that the USGS will develop a standard operating procedure (SOP) for the surveying of monitoring wells for KAFB. The NMED requests that the Permittee consider incorporation of the SOP into the survey procedures outlined in Section 3.2.20 of the work plan.
14. Mineralogy can be an indicator of depositional environment and a way to correlating geologic units across monitoring wells. The NMED requests that the Permittee consider including mineralogy in the geologist boring logs during groundwater monitoring well, observation well, and extraction well drilling and logging.
15. The NMED requests that the Permittee review and revise, as necessary, the investigation derived waste (IDW) categories in Section 8.1 of the work plan to better clarify the categories of waste anticipated and to better align them with the GWQB decision flow chart for disposal of IDW water. For example, based on technical discussions the NMED understands that the nonhazardous water category encompasses the following:
    a. IDW water that is nondetect for all constituents;
    b. IDW water that has detections of constituents that are below the New Mexico Water Quality Control Commission (NMWQCC) standards and/or U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs); and
    c. IDW water that has constituent concentrations greater than NMWQCC standards and/or EPA MCLs but are not characteristic hazardous waste.

    As written, the text in Section 8.1 does not clearly indicate these three scenarios for IDW water and the plan for disposition.
16. The nonhazardous IDW water may be treated at the GWTS for discharge, as discussed in Section 8.1.1 provided that the Permittee obtain the necessary permissions from the NMED GWQB.
17. Figure 1-1 in the Quality Assurance Project Plan shows two injection well target areas near the Golf Course. The NMED has not received sufficient data to approve these areas for injection and requires that the figure be updated to remove them.

The NMED understands that the Air Force intends for this Work Plan to be a single source for details related to work conducted under the dissolved-phase plume collapse interim measure. As

such, this Work Plan shall be updated, as necessary, to reflect changes resulting from new or modified permitting requirements; revisions to GWTS monitoring and contingency plans; and modifications to scope and detail of identified tasks. Future revisions to the work plan are subject to NMED review and approval. Please submit a revised Work Plan that addresses the conditions identified in this approval.

Should you have any questions regarding this letter please contact Ms. Diane Agnew at (505) 222-9555.

Sincerely,

Kathryn Roberts
Director
Resource Protection Division

KR/DM

cc: Col. T. Haught, KAFB
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File: KAFB 2015 Bulk Fuels Facility Spill Library and Reading

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

November 16, 2016

Colonel Eric H. Froehlich
Base Commander
377 ABW/CC
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Mr. John Pike
Director, Environmental Management Services
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Re: BULK FUELS FACILITY EXPANSION OF THE DISSOLVED-PHASE PLUME GROUNDWATER TREATMENT SYSTEM DESIGN, REVISION 1
SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111
KIRTLAND AIR FORCE BASE
EPA ID#NM9570024423, HWB-KAFB-13-MISC

Dear Colonel Froehlich and Mr. Pike:

The New Mexico Environment Department (NMED) received the Kirtland Air Force Base (KAFB) (the Permittee) *Work Plan for Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design Revision 1* (Work Plan), dated September 20, 2016. The revised work plan addresses the conditions in the NMED conditional approval letter dated March 25, 2016 as well as additional site activities to be performed at the Bulk Fuels Facility site, including:

- Installation of External Controls for Variable Frequency Drives on Existing Skid Pumps;
- Miscellaneous Building Changes at the Groundwater Treatment Facility (GWTS); and
- GWTS Sand Filter Design.

Revisions of this Work Plan are anticipated to provide the required information on aquifer testing of existing and newly installed extraction wells; final design drawings for the pre-treatment sand filter(s); conveyance lines for future injection wells; injection well location, design, and installation; and updates to monitoring requirements in the final discharge permit for underground injection (NMED Ground Water Quality Bureau Discharge Permit [DP] 1839). The

work plan tasks, procedures, and quality control are hereby approved with the following conditions:

1. Section 3.1.4 refers to a fifth extraction well, KAFB-106240, and working group approval of the location and design of this well. The working group and NMED have not approved the location and design of a fifth extraction well. The working group decision was to wait for a year of operation of the initial four extraction wells so that site-specific data could be evaluated to determine the optimal location, pumping rate, and well design. Therefore, the proposed location and design of KAFB-106240 listed in this revision of the work plan is not approved pending additional data collection and analysis.
2. Section 3.1.4 states that extraction wells will be logged using dual resistivity, Self Potential, and gamma logging tools. The work plan must be revised to include information on what methods and practices are to be followed for borehole logging, as well as information on equipment calibration, equipment decontamination, and quality control metrics. Additionally, Appendix A must be revised to include field forms and logs to be used during geophysical borehole logging.
3. Before the start of well construction, NMED requires that the Permittee provide a PDF copy of the lithologic log on a daily basis and the proposed screen interval via email to NMED for approval, ahead of the start of well construction. The NMED will provide approval of the proposed screen within 24-hours of receipt. If the geophysical logging data is used for final design of the extraction well, NMED requests that the geophysical data be provided with the proposed screen intervals.
4. Section 3.1.5 must be revised to reflect the changes made to the groundwater monitoring well design as described in email correspondence dated October 20, 2016 (Permittee to NMED). The Permittee cites changes to the well construction design based on a *Final Constructability Review* with the contracted drilling company.
5. The proposed nested well design is approved with the understanding that adjustments may be necessary based on changed conditions in the field. NMED requests an email notification of any deviations from the submitted well design which includes the proposed well design/screen interval for NMED approval a minimum of 24 hours ahead of the start of well construction. The proposed well design can be submitted via email in PDF format. NMED requests the proposed well design be sent no sooner than 24 hours ahead of start of well construction.
6. Section 3.1.7 includes the conceptual design of sand filters for pre-treatment at the GWTS. The Permittee must provide the final sand filter design and specifications to NMED a minimum of 30 days prior to the start of construction. NMED will notify the Permittee within 2 weeks of receipt whether the design is approved or if a period of further review is required.
7. Section 3.1.7 references daily, weekly, and monthly sampling that will occur with the "shakedown and QC functions of the expanded GWTS." It is not clear how shakedown is defined and what actions will initiate the sampling frequency. Additionally, the NMED requires that the treatment system be sampled daily for one week, weekly samples for one month, and monthly samples thereafter once a new extraction well has been brought online. The Permittee shall revise the work plan to clarify shakedown and actions that will trigger the sampling frequency.

8. Section 3.1.11.1 states that 19 newly installed groundwater monitoring wells have completed the quarterly baseline sampling as of Q1 2016 and are now going to a semi-annual monitoring frequency. The Permittee has reclassified all 19 newly installed wells as "Extended Network" wells as defined in *Requested Optimization of Monitoring and Reporting, Second Phase, Bulk Fuels Facility Spill Site* dated December 9, 2015. This categorical change to reclassify the 19 wells is not approved. Eleven of the newly installed wells are in sentinel well locations and therefore meet the definition of "Downgradient Proximal Wells." The work plan and Table 3-2 shall be revised to reflect the well classification and sampling frequency below:

Well ID	Updated Well Classification	Sample Frequency
KAFB-106216	Downgradient Proximal Wells	EDB and field parameters – quarterly Metals, Anions, Alkalinity – Semi-annually VOCs – Annually
KAFB-106217		
KAFB-106218		
KAFB-106222		
KAFB-106223		
KAFB-106224		
KAFB-106231		
KAFB-106232		
KAFB-106212	Extended Network Wells	EDB, Metals, Anions, Alkalinity – Semi-annually VOCs – Annually
KAFB-106213		
KAFB-106214		
KAFB-106215		
KAFB-106219		
KAFB-106220		
KAFB-106221		
KAFB-106225		
KAFB-106226		
KAFB-106227		
KAFB-106230		

9. The Permittee shall revise Table 3-2 to indicate that the two new groundwater monitoring well nests, KAFB-106235 and KAFB-106236, will be sampled quarterly as "Newly Installed Monitoring Wells" in accordance with the approved *Requested Optimization of Monitoring and Reporting, Second Phase, Bulk Fuels Facility Spill Site* dated December 9, 2015.
10. Section 3.2.15 states that extraction well development will follow KAFB Standard Operating Procedures and a 2004 update to the Base-Wide Plans. NMED requests that these documents be made available for reference/review.
11. Conditions defined in the discharge permit DP-1839 for underground injection at KAFB-7 and future injection wells must be incorporated and addressed in the work plan. Specifically, the work plan and the Quality Assurance Project Plan must include the

permit sampling and monitoring requirements for the GWTS; requested information on the scope, purpose, location, and design of future injection wells and the associated conveyance piping; reporting requirements; and any other conditions in DP-1839 relevant to the tasks in the work plan.

Section 3.2.16.5, *Collection of Groundwater Sampling from Monitoring Wells Not Equipped with Dedicated Pumps Using Passive Sampling Techniques* is not approved at this time, and is pending NMED review and analysis of validation study data provided in the *Quarterly Report – April-June 2016, Bulk Fuels Facility, Solid Waste Management Unit ST106/SS-11, Kirtland Air Force Base, New Mexico* dated September 23, 2016.

The NMED understands that the Air Force intends for this Work Plan to be a single source for details related to work conducted under the dissolved-phase plume collapse interim measure. As such, this Work Plan shall be updated, as necessary, to reflect changes resulting from new or modified permitting requirements; revisions to GWTS monitoring and contingency plans; and modifications to scope and detail of identified tasks. Future revisions to the work plan are subject to NMED review and approval. Please submit a revised Work Plan that addresses the conditions identified in this approval.

Should you have any questions regarding this letter please contact Ms. Diane Agnew at (505) 222-9555.

Sincerely,

Kathryn Roberts
Director
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File: KAFB 2016 Bulk Fuels Facility Spill

NEW MEXICO ENVIRONMENT DEPARTMENT PERMITS

HAZARDOUS WASTE TREATMENT
FACILITY OPERATING PERMIT
EPA ID No. NM9570024423

issued to

UNITED STATES AIR FORCE

for the

OPEN DETONATION UNIT

located at

KIRTLAND AIR FORCE BASE
BERNALILLO COUNTY, NEW MEXICO

issued by the

NEW MEXICO ENVIRONMENT DEPARTMENT
HAZARDOUS WASTE BUREAU
2905 RODEO PARK DRIVE EAST, BUILDING 1
SANTA FE, NEW MEXICO, 87505

July 2010

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ACRONYMS AND ABBREVIATIONS

ACM	accelerated corrective measure
AK	acceptable knowledge
AOC	area of concern
ARCH	air rotary casing hammer
ASTM	American Society for Testing and Materials
CAC	Corrective Action Complete
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
CMI	corrective measures implementation
CME	corrective measures evaluation
DQOs	data quality objectives
DOT	United States Department of Transportation
EC	Emergency Coordinator
ECO-SSLs	Ecological Soil Screening Levels (EPA)
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
GC/ECD	gas chromatograph/electron-capture device
GC/MS	gas chromatograph/mass spectrometry
HE	high explosive(s)
HI	hazard index
HWA	New Mexico Hazardous Waste Act
HWB	Hazardous Waste Bureau
HWMR	New Mexico Hazardous Waste Management Regulations
HQ	hazard quotient
ICP	inductively coupled plasma
IDW	investigation derived waste
KAFB	Kirtland Air Force Base
KCP	KAFB Command Post
kg	kilogram
LDR	land disposal restrictions
m^3	cubic meters
MCL	maximum contaminant level
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter

mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
OD	open detonation
PCBs	polychlorinated biphenyls
PPE	personal protective equipment
QA	quality assurance
QAPP	quality assurance program plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPD	relative percent difference
RSL	regional screening level
SAP	sampling and analysis plan
SAR	SWMU Assessment Report
SSAP	Soil Sampling and Analysis Plan
SSL	soil screening levels
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TAG	Tijeras Arroyo Groundwater
TKN	total Kjeldahl nitrogen
TSDF	treatment, storage and disposal facility
UCL	upper confidence limit of the mean
ug	microgram
ug/L	microgram per liter
UHC	underlying hazardous constituent
U.S.C.	United States Code
UXO	unexploded ordnance
VOC	volatile organic compound
WQCC	New Mexico Water Quality Control Commission
XRF	x-ray fluorescence

PERMIT PART 1: GENERAL PERMIT REQUIREMENTS

1.0 INTRODUCTION

This Permit Part (1) contains general requirements pertaining to hazardous waste management and treatment at the Open Detonation (OD) Unit and corrective action at the Kirtland Air Force Base (KAFB) Facility (see Figures 1-1 and 1-2, of this Permit Part, for a map view of the Facility and an aerial view of the OD Unit), as permitted under the New Mexico Hazardous Waste Act (HWA), New Mexico Statutes Annotated (NMSA) 1978, §§ 74-4-1 to 74-4-14.

1.1. LEGAL AUTHORITY

Pursuant to § 74-4-10 of the HWA, the New Mexico Environment Department (the Department) issues this Permit to the U.S. Air Force, hereafter referred to as the Permittee, the owner and operator of the OD Unit, with U.S. Environmental Protection Agency (EPA) ID Number NMD9570024423, located in Bernalillo County, New Mexico.

Section 6001 of the Resource Conservation and Recovery Act (RCRA) provides, in part, that "each department, agency, and instrumentality of the executive branch of the Federal Government (1) having jurisdiction over any solid waste management facility or disposal site, or (2) engaged in any activity resulting, or which may result, in the disposal or management of solid waste or hazardous waste shall be subject to, and comply with, all Federal, State, interstate, and local requirements, both substantive and procedural, respecting control and abatement of solid waste or hazardous waste disposal and management in the same manner, and to the same extent, as any person is subject to such requirements." [42 U.S.C. § 6961].

1.2. ENFORCEMENT

Any violation of any requirement of this Permit may subject the Permittee, and its officers, employees, successors, and assigns, to a compliance order under § 74-4-10 of the HWA or § 3008(a) of RCRA, 42 U.S.C. § 6928(a); to an injunction under § 74-4-10 of the HWA, § 3008(a) of RCRA, 42 U.S.C. § 6928(a), or § 7002(a) of RCRA, 42 U.S.C. § 6972(a); to civil penalties under § 74-4-10 of the HWA, § 3008(a) and (g) of RCRA, 42 U.S.C. § 6928(a) and (g), or § 7002(a) of RCRA, 42 U.S.C. § 6972(a); to criminal penalties under § 74-4-11 of the HWA or § 3008(d), (e), and (f) of RCRA, 42 U.S.C. § 6928(d), (e), and (f); or to some combination of the foregoing. The list of authorities in this Permit Section (1.2) is not exhaustive, and the Department reserves the right to take any action authorized by the law to enforce the requirements of this Permit.

1.3. PERMITTED ACTIVITY

This Permit authorizes the Permittee to treat hazardous wastes at the OD Unit, and establishes the general and specific standards for these activities, as required by the HWA and the Hazardous Waste Management Regulations (HWMR) 20.4.1 New Mexico Administrative Code (NMAC). The OD Unit is classified as a miscellaneous unit under 40 C.F.R. Part 264 Subpart X. This Permit also establishes standards for closure and sets forth the requirements for corrective action to address releases of hazardous waste and hazardous constituents into the environment pursuant to the HWA and the HWMR.

The Permittee shall not treat, without a permit, hazardous wastes at any other location at this Facility, except as provided in 40 C.F.R. § 270.1(c)(2).

The Permittee shall not store for more than 90 days any hazardous waste at any location at this Facility except as provided in 40 C.F.R. § 262.34(b).

This Permit does not authorize the treatment of firearms or contraband that are not reactive or ignitable hazardous waste.

1.4. COMPLIANCE WITH PERMIT

Compliance with this Permit during its term constitutes compliance, for purposes of enforcement, with 40 C.F.R. Parts 264 and 268, only for those management practices specifically authorized by this Permit. The Permittee must also comply with 40 C.F.R. Parts 260 through 273 to the extent the requirements of those sections are applicable. The Permittee must also comply with all applicable self-implementing provisions imposed by statute or rule. Compliance with this Permit shall not constitute a defense to any order issued or any action brought under HWA, NMSA 1978, § 74-4-10(E), § 74-4-10.1, or § 74-4-13; RCRA § 3008(a), § 3008(h), § 3013,
§ 7002, or § 7003; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. §§ 9601 to 9675, or any other law providing for protection of public health or the environment.

This Permit does not convey any property rights of any sort or any exclusive privilege, nor does this Permit authorize any injury to persons or property, any invasion of other private rights, or any infringement of State or local laws or regulations in accordance with 40 C.F.R. § 270.4(b) and (c) and § 270.30(g).

1.5. EFFECT OF INACCURACIES IN PERMIT APPLICATION

This Permit is based on the information submitted in the Part B Permit application dated December 2005 and subsequent information, referred to as the Application. Any inaccuracies found in the Application may be grounds for the termination, revocation and reissuance, or modification of this Permit pursuant to 40 C.F.R. § 270.43(a)(2). Where and when the Permittee becomes aware that it failed to submit any relevant facts in the Application, or submitted incorrect information in the Application or in any report to the Department, it shall promptly submit such facts or corrected information pursuant to 40 C.F.R. § 270.30(l)(11).

1.6. PERMIT CITATIONS

Whenever the Permit cites a provision of 20.4.1 NMAC or 40 C.F.R. or Part or Section of this Permit, the Permit shall be deemed to incorporate the citation by reference, including all subordinate provisions of the cited provision, and make binding the full text of the cited provision.

Hazardous waste management regulations are frequently cited throughout this Permit. The Federal hazardous waste management regulations, 40 C.F.R. Parts 260 through 273, are generally cited rather than the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC. The Federal regulations are cited because only the Federal regulations set forth the

detailed regulatory requirements; the State regulations incorporate by reference, with certain exceptions, the Federal regulations in their entirety. Citing only the federal regulations also serves to avoid encumbering each citation with references to two sets of regulations. However, it is the State regulations that are legally applicable and enforceable. Therefore, for the purpose of this Permit, and enforcement of its terms and requirements, all references to provisions of Federal regulations that have been incorporated into the State regulations shall be deemed to include the State incorporation of those provisions.

1.7. SEVERABILITY

The provisions of the Permit are severable, and if any provision of this Permit, or any application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby.

1.8. DEFINITIONS

For purposes of this Permit, terms used herein shall have the same meanings as those in HWA, RCRA, and their implementing regulations, unless this Permit specifically provides otherwise. Where a term is not defined in HWA, RCRA, pursuant regulations, or this Permit, the meaning associated with such a term shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

"Area of Concern" (AOC) means any area of the Facility under the control or ownership of the Permittee, which is not a solid waste management unit where a release of a hazardous waste or hazardous constituent has occurred, or is suspected to have occurred regardless of the frequency or duration of the release. An area of concern includes areas and structures at which releases of hazardous waste or hazardous constituents were not fully remediated, including one time and accidental events.

"Corrective Measures" means all corrective action necessary to protect human health and the environment for all releases of hazardous waste or hazardous constituents from any Solid Waste Management Unit or AOC at the Facility, regardless of the time at which waste was placed in the unit, as required under § 74-4-4.2(B) of the HWA and 40 C.F.R. § 264.101. Corrective Measures may address releases to air, soil, sediment, surface water, or groundwater.

"Days" refers to calendar days unless specified otherwise in this Permit.

"Department" means the New Mexico Environment Department and any successor agencies.

"EOD" means Explosives Ordnance Disposal

"**EPA**" means the United States Environmental Protection Agency and any successor agencies.

"Extent of contamination" means the horizontal and vertical area in which the concentrations of waste or hazardous constituents in the environmental media being investigated are above detection limits or background concentrations indicative of the region, whichever is appropriate, as determined by the Department.

"Facility" or "KAFB" means Kirtland Air Force Base, including all contiguous land, structures, other appurtenances, and improvements on the land. For the purpose of implementing corrective action under 40 C.F.R. § 264.101, RCRA § 3008(h), or the HWA, NMSA 1978, § 74-4-10(E),

the Facility includes all contiguous property under the control of the owner or operator seeking a permit under the HWA.

"Hazardous constituent" means any constituent identified in Appendix VIII of 40 C.F.R. Part 261, or any constituent identified in Appendix IX of 40 C.F.R. Part 264, incorporated by 20.4.1 NMAC.

"Hazardous waste" means a solid waste that is not excluded from regulation under 40 C.F.R. § 261.4(b), and that either is listed in 40 C.F.R. Part 261, Subpart D, exhibits any of the characteristics identified in 40 C.F.R. Part 261, Subpart C, or is a mixture of solid waste and one or more wastes listed in 40 C.F.R. Part 261, Subpart D. However, for purposes of corrective action, "hazardous waste" shall have the meaning set forth in the HWA, § 74-4-3(K).

"**Hazardous waste regulations**" or "**Hazardous Waste Management Regulations**" means the New Mexico Hazardous Waste Management Regulations, 20.4.1 NMAC and all provisions of 40 C.F.R. Parts 260 through 273 incorporated therein.

"**Interim measures**" means actions necessary to minimize or prevent the further migration of contaminants and limit actual or potential human and environmental exposure to contaminants while long-term corrective action remedies are evaluated and, if necessary, implemented.

"NMED" means New Mexico Environment Department.

"Off-site source" means a generator of Hazardous Waste located within the United States but outside the Permittee's Facility.

"**Open Detonation**" means the treatment of ignitable or reactive hazardous waste in accordance with the requirements of this Permit. Treatment by open detonation is accomplished by the detonation of hazardous waste in open pits using a counter charge to initiate the explosion.

"**Permit**" means this Permit, issued to the Permittee for the Facility, pursuant to the HWA and the New Mexico Hazardous Waste Management Regulations to conduct corrective action and to operate the OD Unit at the Facility, EPA ID No. NM9570024423, as it may be modified or amended.

"**Permittee**" means U.S. Air Force, a part of the U.S. Department of Defense, which is a Department in the U.S. Government, and any successor.

"**RCRA**" means the Resource Conservation and Recovery Act of 1980, as amended, 42 U.S.C. §§ 6901 to 6992k.

"**Release**" means any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of any hazardous waste or hazardous constituents into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing hazardous waste or hazardous constituents).

"Remediation waste" means all solid and hazardous wastes, and all media (including groundwater, surface water, soil, and sediment) and debris, which contain listed hazardous wastes or which exhibit a hazardous waste characteristic, that are managed for the purpose of implementing corrective action requirements. Remediation wastes may originate from releases that extend beyond the Facility boundaries.

"Secretary" means the Secretary of the New Mexico Environment Department or his designee or authorized representative.

"**Solid waste**" means a solid waste as defined in the HWA, § 74-4-3(O).

"Solid waste management unit" (**SWMU**) means any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at the Facility at which solid wastes have been routinely and systematically released.

1.9. THE COMPLETE PERMIT

The complete Permit consists of the regulations incorporated by reference into this Permit (see Permit Section 1.6), the Permit requirements in Permit Parts 1 through 6, and Permit Attachments A through L:

Part 1 - General Permit Requirements
Part 2 - General Facility Requirements
Part 3 - Open Detonation Unit
Part 4 - Closure
Part 5 - Post Closure
Part 6 - Corrective Action
Attachment A - General Facility Information
Attachment B - List of Authorized Hazardous Wastes
Attachment C - Waste Analysis Plan
Attachment D - Annual Soil Sampling and Analysis Plan
Attachment E - Inspection Plan
Attachment F - Contingency Plan
Attachment G - Personnel Training Plan
Attachment H - Closure Plan
Attachment I - Compliance Schedules
Attachment J - List of Hazardous Waste Management Units
Attachment K - List of SWMUs and AOCs for which Corrective Action is Complete
Attachment L - Reserved for Groundwater Sampling and Analysis Plan

1.10. TERM OF THE PERMIT

This Permit shall be effective for a fixed period of 3 years in accordance with 40 C.F.R. § 270.50(a), subject to Permit Sections 1.5, 1.12 and 1.15.

1.11. ALTERNATIVE ASSESSMENT FOR WASTE TREATMENT

The Permittee shall submit an alternative treatment assessment report to the Department no later than the first anniversary of the effective date of this Permit. The report shall document the

Permittee's evaluation of the range of possible treatment technologies for waste that is authorized for treatment by open detonation under this Permit. The assessment report shall include identification and discussion of the alternative treatment technologies and for the technologies presented models of air emissions, contaminant dispersal, and risk to human and ecological receptors. Each alternative treatment technology, including open detonation, shall be evaluated for cost and the technology's ability to protect human health and the environment to include, but not be limited to the:

1. Ability of the technology to reduce or control emissions,
2. Ability of the technology to monitor emissions,
3. Ability of the technology to control noise, and
4. Ability of the technology to control ground vibrations.

The purpose of the alternative treatment assessment shall be to phase out open detonation of hazardous waste at the Facility as soon as practicable.

1.12. PERMIT ACTIONS

1.12.1. Permit Modification, Suspension, Revocation, and Termination

1. This Permit may be modified, suspended, revoked or terminated for cause in accordance with the provisions of HWA, NMSA 1978, § 74-4-4.2 and 40 C.F.R. §§ 270.41 through 270.43. The filing of a request by the Permittee for a Permit modification or the notification of planned changes or anticipated noncompliance or, if suspension, or revocation is ordered by the Department, shall not stay any Permit requirement, in accordance with 40 C.F.R. § 270.30(f).
2. If at any time for any of the reasons specified in 40 C.F.R. § 270.41, the Department determines that modification of this Permit is necessary, the Department may initiate a Permit modification or require the Permittee to request a Permit modification.
3. The Permittee may request permit modifications in accordance with 40 C.F.R. § 270.42. All applicable requirements specified in 40 C.F.R. § 270.42 and 20.4.1.900 NMAC shall be followed.
4. Modifications to the Permit do not constitute a reissuance of the Permit.

1.12.2. Unclassified Permit Modifications

Unless a permit modification is explicitly listed in Appendix I of 40 C.F.R. 270.42 as a Class 1 or 2 permit modification, the Permittee shall not submit the proposed permit modification as a Class 1 or 2 permit modification. The Permittee may only submit such a permit modification request as a Class 3 modification, or may request a determination from the Department that the proposed permit modification be reviewed and approved as a Class 1 or 2 modification pursuant to the requirements specified in 40 C.F.R. 270.42(d)(1).

1.13. TRANSFER OF LAND OWNERSHIP

The Permittee shall submit a permit modification request, in compliance with all requirements of 40 C.F.R. § 270.42, at least 180 calendar days prior to the proposed effective date of transfer of

ownership of any land which is part of the Facility (see also Permit Section 6.1.12). The permit modification request may be submitted as a Class 3 permit modification, or the Permittee may request a determination that the modification is a Class 1 or 2 pursuant to the requirements of 40 C.F.R. § 270.42(d). In addition to the requirements of 40 C.F.R. § 270.42, a permit modification request for transfer of land that is part of the Facility shall:

1. Identify the boundaries of the land proposed for transfer;
2. Describe the location and identity of any existing or prior SWMU, AOC, or hazardous waste management unit on the land proposed for transfer;
3. Describe any known or suspected presence of hazardous waste or hazardous constituents in soil, groundwater, or any other media at any depth within the boundaries of the land proposed for transfer;
4. Describe the status of any past, present, or planned investigations or remediation of any release of hazardous waste or hazardous constituents within the boundaries of the land proposed for transfer;
5. Include a revised map of the Facility;
6. Propose and describe all provisions necessary to ensure that the Permittee can meet the corrective action obligations, the HWA, and the Hazardous Waste Management Regulations (e.g., covenants, deed restrictions, proposed replacement of monitoring wells or enforceable agreements for access to monitoring wells on transferred land) [40 C.F.R. § 264.101; 40 C.F.R. §§ 270.30(l)(1), 270.32(b) and 270.42; and 20.4.1.901 NMAC]; and
7. Describe all measures taken to comply with § 120(h) of CERCLA, 42 U.S.C. § 9620(h).

1.14. PERMIT RENEWAL

If the Permittee wishes to continue the activities authorized by this Permit after the expiration date of this Permit, in accordance with 40 C.F.R. § 270.30(b), the Permittee must apply for and obtain a new permit. The Permittee may request renewal of this Permit by submitting an application for a new permit at least 180 calendar days before the expiration date of this Permit as required by 40 C.F.R. § 270.10(h).

1.15. CONTINUATION OF EXPIRING PERMIT

Pursuant to 40 C.F.R. § 270.51, if the Permittee has submitted a timely and complete application for renewal of this Permit as specified in 40 C.F.R. §§ 270.10, 270.11, 270.12 (as applicable), and §§ 270.13 through 270.29 (as applicable), this Permit shall remain in effect until the effective date of the new permit if, through no fault of the Permittee, the Department has not issued a new permit on or before the expiration date of this Permit. [40 C.F.R. § 270.51].

1.16. TRANSFER OF PERMIT

The Permittee may only transfer this Permit after providing notice to and receiving approval from the Department. The prospective new owner or operator must file a disclosure statement with the Department as specified at HWA, NMSA 1978, § 74-4-4.7. The Department may require modification or revocation and reissuance of this Permit in accordance with 40 C.F.R.

§ 270.40(b) and § 270.41(b)(2).

Before transferring ownership or operation of the Facility or any SWMUs or AOCs during its operating life, the Permittee shall notify the new owner or operator in writing of the requirements of 40 C.F.R. Part 264, and Part 270, and the HWA, pursuant to 40 C.F.R. § 264.12(c), and 40 C.F.R. § 270.30(l)(3), and shall provide the Department with a copy of this notice.

1.17. PERMIT REVIEW

The Department may review this Permit at any time after the effective date of Permit issuance, and may modify this Permit as necessary pursuant to § 74-4-4.2 of the HWA and 40 C.F.R. §§ 270.41, 270.50(b), and 270.50(d). Such modification shall not extend the effective term of this Permit as specified in requirements of Permit Section 1.10.

1.18. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for the Permittee in an enforcement action that it would have been necessary for the Permittee to halt or reduce the permitted activities in order to maintain compliance with the terms of this Permit. [40 C.F.R. § 270.30(c)].

1.19. DUTY TO MITIGATE

In the event of noncompliance with this Permit, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment. [40 C.F.R. § 270.30(d)].

1.20. PROPER OPERATION AND MAINTENANCE

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the requirements of this Permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures. This requirement includes the operation of back-up or auxiliary facilities or similar systems when necessary to achieve compliance with the requirements of this Permit. [40 C.F.R. § 270.30(e)].

1.21. DUTY TO PROVIDE INFORMATION

The Permittee shall furnish to the Department, within a reasonable time as specified by the Department, any relevant information which the Department may request to determine whether cause exists for modifying, revoking, reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee shall also furnish to the Department, upon request, copies of records required to be kept by this Permit. [40 C.F.R. § 264.74(a), and 40 C.F.R. § 270.30(h)].

The Permit requirements of this Section (1.21) shall not be construed to limit, in any manner, the Department's authority under the HWA, NMSA 1978, § 74-4-4.3, or RCRA § 3007(a), 40 C.F.R. § 270.30(i), or any other applicable law or regulation.

1.22. INSPECTION AND ENTRY

In accordance with 40 C.F.R. § 270.30(i), the Permittee shall allow the Department, or authorized representatives, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter at reasonable times into the Permittee's premises where the regulated facility or activity is located or conducted, or where records must be kept under the requirements of this Permit;
2. Have access to and copy, at reasonable times, any records that must be kept under the requirements of this Permit;
3. Inspect at reasonable times the Facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and
4. Sample or monitor at reasonable times, for the purposes of assuring Permit compliance or as otherwise authorized by RCRA or HWA, any substances or parameters at any location, including waste, air, soil, sediment, surface water, and groundwater at the Facility.

The Permit requirements of this Section (1.22) shall not be construed to limit, in any manner, the Department's authority under the HWA, NMSA 1978, § 74-4-4.3, or RCRA, § 3007(a), 40 C.F.R. § 270.30(i), or any other applicable law or regulation.

1.23. MONITORING AND RECORDS

1.23.1. Representative Sampling

The Permittee shall take representative samples and measurements in accordance with the procedures in this Permit and 40 C.F.R. § 264.13(a)(1). All samples and measurements taken by the Permittee under any requirement in this Permit shall be representative of the waste, media, equipment or structure being sampled. This includes, but is not limited to, sampling and analysis of waste, treatment residues, soil, groundwater, spills, and includes sampling of media for purposes of conducting corrective action pursuant to Part 6 of this Permit. To obtain a representative sample of a waste stream the Permittee shall use an appropriate method from Appendix I of 40 C.F.R. Part 261 or an equivalent method approved by the Department. Laboratory methods must be those specified in the current edition of the EPA publication *Test Methods for Evaluating Solid Waste Physical/Chemical Methods SW-846*, or an equivalent method, as specified in the *Waste Analysis Plan* in Permit Attachment C. [40 C.F.R. § 270.30(j)(1)]. At a minimum, these analyses shall contain all of the information which must be known to treat, store, or dispose of the wastes properly. [40 C.F.R § 264.73(b)].

1.23.1.1. Monitoring Records Contents

Monitoring records, including those required for corrective action under Part 6 of this Permit, shall contain:

1. The dates, exact place, and times of sampling or measurements;
2. The names of the individuals who performed the sampling or measurements;
3. The name and address of the laboratory that performed the analysis;

4. The date on which analyses were performed;
5. The analytical techniques or methods used;
6. The results of such analyses including units of measurement;
7. Calibration data;
8. Quality control data;
9. Detection limits;
10. Data qualifiers; and
11. Data validation results.

[40 C.F.R. § 270.30(j)(3)].

1.23.2. Operating Record

The Permittee shall maintain a written Operating Record at the EOD Shop and the EM Branch Office as required by 40 C.F.R. § 264.73. The Permittee shall maintain all records in the Operating Record until completion of closure and, if necessary, post closure care, unless specified otherwise in this Permit. The retention period for all records is extended automatically during the course of any unresolved enforcement action regarding the Facility, or as may be requested by the Department, as required by 40 C.F.R. § 264.74(b). The Permittee shall make the Operating Record available at all reasonable times for inspection by any officer, employee, or authorized representative of the Department or EPA, upon request, or shall furnish copies of documents within the record, as required by 40 C.F.R. § 264.74.

The following operating records and documents shall be maintained at the Facility EOD Shop:

1. A current copy of this Permit including the closure plan (Permit Attachment H);
2. A written Operating Record that describes:
    a. The type and quantity of each hazardous waste received and treated at the OD Unit, and the date the hazardous waste was treated,
    b. The location of hazardous waste at the OD Unit,
    c. The method(s) of treatment of hazardous waste,
    d. Training records for EOD personnel,
    e. Written inspection log and schedule;
3. Training records for former EOD employees (maintained for a minimum of three years from the date the employee last worked at the OD Unit);
4. Current training records (including refresher seminars) for current EOD employees;
5. Inspection logs for the last three years;
6. A copy of the Contingency Plan;
7. A copy of the Waste Analysis Plan;
8. The name(s), address(es), and telephone number(s) of the Emergency Coordinator(s) and all such information for persons designated as alternate Emergency Coordinators;
9. A list of all equipment listed in Permit Attachment F, as required by 40 C.F.R. Part 264, Subpart C; and

10. A current file of pertinent material safety data sheets and records of all wastes that have been treated at the OD Unit.

The following operating records and documents shall be maintained at the Facility EM Branch Office:

1. Treatment facility notices and certifications;
2. Storage facility notices and certifications;
3. Air emissions records;
4. Correspondence and other documents from government agencies;
5. Notices to off-site generators;
6. Waste minimization certification.
7. Manifest documents for hazardous waste shipped off-site;
8. A copy of the Hazardous Waste Biennial Report;
9. Copies of unmanifested waste reports;
10. Copy of the Contingency Plan for the OD Unit and any revisions to the plan;
11. Waste characterization information and data;
12. A copy of the Waste Analysis Plan;
13. Reports of any incidents that required activation of the Contingency Plan;
14. Records of soil and groundwater monitoring, testing, analytical data, and any corrective actions taken to prevent or mitigate releases of hazardous waste or hazardous constituents to the environment;
15. All documents related to corrective action including, but not limited to, work plans, reports, and sampling and analysis plans;
16. The Permit Application;
17. Inspection Plan set forth in Permit Attachment E;
18. Closure Plan set forth in Permit Attachment H, as required by 40 C.F.R. § 264.112(a), and this Permit; and
19. All monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation;

A current copy of the Contingency Plan shall also be maintained at the EOD Range personnel bunker, and the KAFB Command Post.

1.24. REPORTING PLANNED CHANGES

The Permittee shall give advance notice to the Department as soon as possible, but no less than one week in advance of any planned physical alterations or additions to the OD Unit. [40 C.F.R. § 270.30(l)(1)]. Some alterations or additions may be subject to the requirements of Permit Section 1.12.

1.25. REPORTING ANTICIPATED NONCOMPLIANCE

The Permittee shall give advance notice to the Department as soon as possible, but no less than

one week in advance of any planned physical alterations or additions to the OD Unit or of any activities, which may result in noncompliance with the requirements of this Permit. [40 C.F.R. § 270.30(l)(2)]. Some alterations or additions may be subject to the requirements of Permit Section 1.12.

1.26. CERTIFICATION OF CONSTRUCTION OR MODIFICATION

If the OD Unit is modified, the Permittee shall not treat or analyze hazardous waste in the modified portion of the OD Unit, except as provided in 40 C.F.R. § 270.42, unless the following requirements have been satisfied:

1. The Permittee has submitted to the Department, by certified mail or hand delivery, a letter signed by the Permittee and an independent professional engineer registered in New Mexico stating that the modification meets the requirements of this Permit; and
2. The Department has:
    a. Inspected the modified or newly constructed portion of the OD Unit and finds it meets the requirements of this Permit; or
    b. Waived the inspection or, within 15 calendar days from the date of receipt of the letter required by paragraph 1, has not notified the Permittee of its intent to inspect.

[40 C.F.R. § 270.30(1)(2)].

1.27. TWENTY-FOUR HOUR AND SUBSEQUENT REPORTING

1. **Oral Report** - The Permittee shall report to the Department any noncompliance which may endanger human health or the environment. Any such information shall be reported orally within 24 hours from the time the Permittee becomes aware of the circumstances. The oral report shall include:
    a. Information concerning release of any hazardous waste or constituents that may cause an endangerment to public drinking water supplies; and
    b. Any information about a release or discharge of hazardous waste or hazardous constituent or of a fire or explosion which could threaten the environment or human health including:
        i. A description of the noncompliance and its cause;
        ii. The name, address, and telephone number of the owner, operator, and name of responsible official;
        iii. The name, address, and telephone number of the Facility;
        iv. The period of the occurrence including exact date and time and, if the noncompliance has not been corrected, the anticipated time it is expected to continue;
        v. The name and quantity of materials involved;
        vi. The extent of injuries, if any;

vii. An assessment of actual or potential hazards to the environment and human health at and outside the Facility, where this is applicable;

viii. The estimated quantity and disposition of recovered material that resulted from the incident; and

ix. The steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

[40 C.F.R. § 270.30(l)(6)(i and ii)].

2. **Non-Compliance Written Report** - The Permittee shall also submit a written report within five calendar days from the time the Permittee becomes aware of the circumstance of any noncompliance. The written report shall contain the information required for an oral report under this Permit Section (1.27).

The Department may extend the time for submitting the written report up to 15 calendar days upon written request by the Permittee prior to the end of the five calendar days allowed under Permit Section 1.27.2. [40 C.F.R. § 270.30(l)(6)(iii)].

1.28. REPORTS REQUIRED BY THE CONTINGENCY PLAN

If any incident requires implementation of the Contingency Plan provided in Permit Attachment F, the Permittee shall comply with the reporting requirements of 40 C.F.R. § 264.56(d).

1.29. CORRECTIVE ACTION

Corrective action required pursuant to 40 C.F.R. § 264.101, shall continue under this Permit for any period necessary to comply with the requirements specified in Part 6 of this Permit.

1.30. ADMISSIBILITY OF DATA

The Permittee waives any objection to the admissibility as evidence of any data required by this Permit in any administrative or judicial action to enforce a condition of this Permit.

1.31. OTHER NONCOMPLIANCE

The Permittee shall report all instances of noncompliance not otherwise required to be reported under this Permit at the time monitoring reports are submitted. The reports shall contain the information listed in Permit Section 1.27.1. [40 C.F.R. § 270.30(l)(10)].

1.32. SIGNATORY AND CERTIFICATION REQUIREMENTS

The Permittee shall sign and certify all applications, reports, or other information submitted to the Department or required by this Permit, in accordance with 40 C.F.R. § 270.11(a)(3).

The Permittee shall provide, upon request by the Department, notification and certification statements associated with the treatment of hazardous wastes in compliance with 40 C.F.R. § 268.7 and § 268.9.

1.33. MONITORING REPORTS

The Permittee shall submit Monitoring Reports to the Department as specified in the

requirements of Permit Sections 1.23 and 1.36. [40 C.F.R. § 270.30(l)(4)].

1.34. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with this Permit, any progress reports on activities conducted under this Permit, and interim and final requirements contained in any compliance schedule of this Permit shall be submitted to the Department no later than 14 calendar days following each schedule date set forth in this Permit. [40 C.F.R. § 270.30(l)(5)].

1.35. INFORMATION REPOSITORY

Upon written notification, the Department may require the Permittee to establish and maintain an information repository at any time, based on the factors set forth in 40 C.F.R. § 124.33(b) and 40 C.F.R. § 270.30(m). The information repository shall be governed by the provisions in 40 C.F.R. § 124.33(c).

1.36. REPORTS, NOTIFICATIONS, AND INFORMATION SUBMITTALS TO THE DEPARTMENT

The Permittee shall submit to the Department by certified mail or hand delivery all reports, notifications, or other submittals that are required by this Permit to be sent or given to the Department, at the following address:

Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Telephone Number: (505) 476-6000
Facsimile Number: (505) 476-6030

Two hard (paper) copies and one electronic copy of these plans, reports, notifications, or other submissions shall be submitted to the Department.

1.37. POINTS OF CONTACT FOR THE FACILITY

Points of contact for the Facility during the term of the Permit are identified below.

Base Commander
377 ABW/CC
2000 Wyoming Blvd. SE
Kirtland AFB, NM 87117-5606

and

Director
Environmental Management
377 MSG/CEANR
2050 Wyoming Blvd. SE

Kirtland AFB, NM 87117-5270

All reports required by the permit shall be signed by a principal executive officer or their duly authorized representatives in accordance with 40 C.F.R. § 270.11(b).

The Permittee shall inform the Department in writing of changes in its principal executive officers (or their duly authorized representatives) within 30 days of the changes, and Emergency Coordinators and their telephone numbers and addresses within 15 calendar days of the changes. Changes to the principal executive officers (or their duly authorized representatives) are not permit modifications. Changes in name, address, or phone number for Emergency Coordinators are Class 1 permit modifications under 40 C.F.R § 270.42.

1.38. WORK PLANS AND OTHER DELIVERABLE DOCUMENTS

All documents that the Permittee prepares under the terms of this Permit and submits to the Department that are subject to the requirements of 20.4.2 NMAC shall be subject to the procedures set forth therein. Documents requiring Department approval that are not subject to the requirements of 20.4.2 NMAC may be reviewed and approved, approved with modifications or directions, disapproved, denied, or rejected by the Department.

Upon the Department's written approval, all submittals and associated schedules shall become enforceable under this Permit in accordance with the terms of the Department's written approval, and such documents as approved, shall control over any contrary or conflicting requirements of this Permit.

This provision does not affect any public process that is otherwise required by this Permit, the HWA, or its implementing regulations.

Failure to submit any of the work plans, schedules, reports, and other deliverable documents that the Permittee is required to prepare under this Permit in substantial compliance with this Permit, and according to the schedules or deadlines in this Permit, may subject the Permittee to enforcement action under § 74-4-10 of the HWA, or other applicable provisions of law, which may include fines, civil penalties, or suspension or revocation of the Permit.

Any noncompliance with approved plans and schedules shall be noncompliance with this Permit. The Department may grant extensions of written requests for due dates for submittals of reports and other deliverables, provided that the Permittee includes a written justification showing good cause and a proposed schedule for submittal.

1.39. CONFIDENTIAL INFORMATION

The Permittees may claim that any information required by this Permit or otherwise submitted to the Department is confidential pursuant to the provisions of §§ 74-4-4.3(D) and (F) of the HWA and 40 CFR §§ 260.2 and 270.12.

Figure 1-1

Figure 1-2

PERMIT PART 2: GENERAL FACILITY REQUIREMENTS

2.0 INTRODUCTION

Permit Part 2 contains general requirements applicable to the Facility.

2.1. SECURITY

In order to prevent the unknowing entry and to minimize the possibility of unauthorized entry of persons into the OD Unit, the Permittee shall comply with the security provisions and procedures described in this Permit Section (2.1), and in Permit Attachment A, and as required by 40 C.F.R. § 264.14.

The entrance gate to the EOD Range (see Figure 2-1, this Permit Part) shall be locked except when EOD personnel enter the area for inspections or for treatment operations, or for purposes of conducting repairs or maintenance to the OD Unit, or for conducting military training.

Warning signs shall be posted at the entrance gate and at a maximum spacing of 300-foot intervals along the fence. The signs shall be legible from a distance of 25 feet and shall be large enough to be seen from any approach toward the EOD Range. The warning signs shall state “Danger--Explosive Disposal Range--Keep Out” in English and Spanish. A sign indicating "No Smoking" in English and Spanish shall be placed conspicuously at the entrance to the EOD Range.

During treatment operations, the gate shall remain open in case emergency vehicle access is required; however, unauthorized entry must be prevented.

2.2. INSPECTIONS

The Permittee shall inspect the OD Unit for malfunctions and deterioration, operator errors, and discharges which may cause a release of hazardous waste or hazardous constituents into the environment or a threat to human health, as required by 40 C.F.R. § 264.15, and according to the Inspection Plan (Permit Attachment E). The Permittee shall remedy any such deterioration or malfunction, operator error, or discharge, as required by 40 C.F.R. § 264.15(c). Inspections shall be conducted often enough to identify problems in time to correct them before they harm human health or the environment. The Permittee shall maintain records of all such inspections in the Operating Record, as required by 40 C.F.R. § 264.15(d).

Pursuant to the miscellaneous unit requirements found in 40 C.F.R. Part 264 Subpart X, inspections must meet the inspection requirements in 40 C.F.R. § 264.15 and the equipment testing and maintenance requirements in 40 C.F.R. § 264.33, as well as any additional requirements needed to protect human health and the environment. The OD Unit inspection procedures for communication and fire-protection equipment shall include provisions for equipment testing and maintenance to ensure that the equipment will function properly in an emergency.

If an inspection of the OD Unit reveals that a non-emergency problem has developed, remedial action, including repairs, maintenance, and replacement, shall be completed as soon as practicable to protect human health and the environment and to preclude further damage and to reduce the need for emergency repairs. If a hazard appears imminent or if a hazardous situation

already exists, operations at the OD Unit shall stop, and remedial action shall be initiated immediately. These measures to implement remedial actions shall satisfy the requirements of 40 C.F.R. § 264.15(c). Any remedial action taken pursuant to an inspection shall be noted on the inspection log in accordance with 40 C.F.R. § 264.15(d).

In accordance with 40 C.F.R. § 264.15(b)(1), a written schedule shall be followed at the OD Unit to routinely inspect for problems or potential problems with safety and emergency equipment, security devices, and operating and other equipment for preventing, detecting, or responding to hazards to the environment or human health. The Permittee shall use an inspection log based on the schedule shown in Table E-1 to document inspection of all items listed on Table E-1**.** The inspection logs shall include the date and time of the inspection, the name of the inspector, a notation of the observations made, and the date and nature of any repairs or other remedial actions taken.

2.3. PERSONNEL TRAINING

The Permittee shall follow the personnel training procedures specified in Permit Attachment G. [40 C.F.R. § 264.16].

The Permittee shall comply with 40 C.F.R. § 264.16(d) by maintaining the following documentation at the Facility: a job title for each position and the name of each employee filling each position; a written description for each position including the requisite skill, education, or other qualifications, and duties; and a written description of introductory and continuing training for each person filling each position.

2.4. PREPAREDNESS AND PREVENTION

2.4.1. Required Equipment

As required by 40 C.F.R. § 264.32, the OD Unit shall be equipped with or personnel shall have access to adequate emergency equipment, which includes an internal communication equipment or alarm system, telephone or two-way radio, fire extinguishers, and fire control, spill control, and decontamination equipment. The emergency equipment available for use at the OD Unit is summarized in Tables F-2 and F-3 in the Contingency Plan under Permit Attachment F.

An internal communications or alarm system capable of providing immediate emergency instructions (voice or signal) to Facility personnel shall be available on-site. In addition, a telephone or two-way radio capable of summoning emergency assistance shall also be available on-site. Treatment activities at the OD Unit shall be conducted only after notifying the KAFB Command Post (KCP).

All vehicles used at the OD Unit shall carry a portable fire extinguisher and a shovel. At least two portable fire extinguishers and at least two shovels shall also be kept at the EOD personnel bunker for response to fires or spills.

Appropriate personal protective equipment shall be available for use at the OD Unit to clean up spills should any occur.

Eyewash solutions shall be included in the first-aid kits carried in the vehicles used at the OD Unit.

The KAFB Fire Department shall be on call during treatment operations to provide fire fighters, tanker trucks equipped with water at adequate volume and pressure to extinguish fires at the OD Unit, and other fire-fighting equipment, if any fires should occur.

2.4.2. Testing and Maintenance of Equipment

The Permittee shall test and maintain the equipment specified in the Contingency Plan in Permit Attachment F, as necessary, to assure its proper operation in time of emergency, as required by 40 C.F.R. § 264.33.

All communications systems, fire protection equipment, and decontamination equipment associated with the OD Unit shall, at a minimum, be tested and maintained according to the inspection schedule set forth in Permit Attachment E. Damaged or defective emergency equipment, communications equipment, fire protection equipment, and decontamination equipment shall be repaired or replaced immediately upon discovery.

2.4.3. Required Aisle Space

At a minimum, the Permittee shall maintain enough aisle space to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of the OD Unit, as required by 40 C.F.R. § 264.35.

2.4.4. Arrangements with Local Authorities

The Permittee shall attempt to enter into coordination agreements for emergency response, i.e., medical, ambulance, and fire protection services, with the City of Albuquerque Fire Department, the Bernalillo County Fire Department, the Albuquerque Police Department, and Albuquerque Regional Medical Center, as described in the Contingency Plan (Permit Attachment F), and as required by 40 C.F.R. § 264.37. Copies of all such agreements and documentation showing any unsuccessful attempts to enter into such an agreement shall be maintained at the Facility EM Branch Office as part of the Operating Record.

The Permittee shall provide the Chiefs of the City of Albuquerque Fire Department (AFD) and the Bernalillo County Fire Department (BCFD) with information that would ensure that emergency response personnel are at all times familiar with the potential hazards in performing their duties associated with the hazardous wastes at OD Unit. This information shall at a minimum include:

1. Waste types, *e.g*., ignitable, reactive, corrosive;
2. Waste names that identify principle hazardous chemical constituents;
3. Approximate quantities of each waste type; and
4. General location of wastes types.

The Permittee shall annually sign a certification stating that the AFD and BCFD have been provided with this information. These certification statements shall be maintained in the Facility EOD Shop as part of the Operating Record.

2.4.5. Preventive Procedures, Structures, and Equipment

Descriptions of the preventive procedures, structures, and equipment at the OD Unit are

presented below. Adherence to the procedures and proper use of the structures and equipment shall be done to prevent hazards associated with unloading operations, prevent runoff from escaping hazardous waste management areas, prevent contamination of water supplies, mitigate the effects of equipment failures and power outages, prevent undue exposure of personnel to hazardous waste, prevent releases of hazardous wastes or hazardous constituents to soil, sediment, surface water, and groundwater, and prevent unacceptable releases of contaminants to the atmosphere.

Only properly trained personnel shall transport waste to the OD Unit for treatment. Unloading of the waste may be performed only by EOD Technicians/Specialists either manually or with appropriate heavy equipment, such as forklifts. At the OD Unit, vehicles shall park adjacent to the pit where the waste is to be treated, and the waste shall then be unloaded and placed into the pit. Additionally, personnel involved in waste management at the OD Unit shall be knowledgeable about the physical and chemical properties of the waste managed and shall take all precautions, as necessary, to ensure that wastes are managed safely.

Engineering and operational controls shall ensure that run-on and run-off are minimized to protect human health and the environment. A two-foot high earthen berm shall surround the OD Unit to prevent run-off from the OD Unit from flowing to other areas outside of the treatment area.

Because no electrical power is supplied to the EOD Range, equipment used at the OD Unit for unloading or placement of wastes (i.e., forklifts) is self-contained. If such heavy equipment experiences failure, the equipment shall be repaired or replacement equipment shall be obtained immediately.

Personnel exposure shall be minimized by restricting the handling of hazardous waste. EOD Technicians/Specialists shall wear appropriate protective clothing, which may include safety glasses. In case of exposure to the hazardous waste, first aid equipment, which includes eyewash solutions, shall be readily available.

Operations at the OD Unit shall be conducted in a manner to prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents in the air as required under 40 C.F. R. § 264.601(c). Treatment at the OD Unit shall be performed under the requirements in the applicable permit obtained from the City of Albuquerque Environmental Health Department Air Pollution Control Division and under the requirements of this Permit.

The Permittee shall clear and keep clear, at all times, all combustible materials, including wood, grass, brush, and trees located within 200 feet of the OD Unit. The cleared area shall be bladed routinely to minimize fire danger, and a series of at least three concentric firebreaks (at least 20-feet wide each) shall be maintained.

2.5. CONTINGENCY PLAN

2.5.1. Implementation of the Plan

The Permittee shall immediately implement the Contingency Plan contained in Permit Attachment F, whenever there is a release of hazardous waste or hazardous constituents or there is a fire or explosion that could threaten human health or the environment, as required by

40 C.F.R. § 264.51(b).

2.5.2. Copies of the Plan

The Permittee shall maintain copies of the current Contingency Plan and all revisions and amendments to the plan at the EOD Shop and at the EOD Range bunker as required by 40 C.F.R. § 264.53(a). The Permittee shall provide copies of the current Contingency Plan and all revisions and amendments to the plan to the Department and to each entity with which the Permittee has an emergency agreement pursuant to the Permit requirements of Permit Section 2.4.4, as required by
40 C.F.R. § 264.53(b).

2.5.3. Amendments to the Plan

The Permittee shall review at least annually and immediately amend, if necessary, the Contingency Plan, as required by 40 C.F.R. § 264.54.

2.5.4. Emergency Coordinator

Either the Emergency Coordinator (EC) or an alternate EC, as specified in Permit Attachment F, shall be available at all times in case of an emergency. The EC and alternate EC shall be thoroughly familiar with the Contingency Plan and shall have the authority to commit the resources needed to implement the Contingency Plan. [40 C.F.R. § 264.55]. In the event of an imminent or actual emergency, the EC shall activate the internal emergency alarm or emergency communication device, notify the appropriate State or local government agencies and implement other procedures, as required by 40 C.F.R. § 264.56, and as described in Permit Attachment F (*Contingency Plan*).

The Permittee shall submit to the Department a revised Table F-1, Permit Attachment F, within 30 days of the issuance of this Permit. The revised table shall contain the following emergency coordinator contact information in compliance with 40 C.F.R. 264.52(d): names, office addresses, and the home and office telephone numbers of all persons qualified to act as an EC. When more than one person is listed, one must be named as the primary EC and the others must be listed in the order in which they will assume responsibility as alternates. The Permittee shall not treat any hazardous waste at the OD Unit until this Permit requirement is fully satisfied as determined by the Department.

2.6. WASTE CHARACTERIZATION

2.6.1. General Requirements

The Permittee shall not treat any hazardous waste at the OD Unit unless the hazardous waste has been characterized pursuant to the requirements of this Permit. [40 C.F.R. Part 264 and 40 C.F.R. Part 268]. The Permittee shall characterize waste as required under the Permit requirements of Permit Section 2.6.3 by sampling and analysis or by use of acceptable knowledge (AK) of the process that generated the waste, as appropriate.

2.6.2. Characterization of Waste by Acceptable Knowledge

"Acceptable Knowledge" means generator knowledge of the process that generated a waste,

including but not limited to process knowledge, waste analysis data from generators of similar wastes, and facility records of analysis that is used by a generator to characterize wastes.

Acceptable knowledge may be used as the sole method to characterize waste only when the waste is generated from a process that is consistent and well-documented. Documentation of the process must include information that meets all characterization requirements of this Permit, including the requirement to determine the status of the waste for the purposes of the RCRA Land Disposal Restrictions (LDRs) as specified in the Permit requirements of Permit Section 2.6.3.2.

The Permittee shall maintain documentation used to support acceptable knowledge of a waste stream in the Operating Record in accordance with 40 C.F.R. § 268.7(a)(6) and 40 C.F.R. § 264.73(b)(3). This documentation must be readily retrievable upon request during a Department or United States Environmental Protection Agency (EPA) inspection, and must be maintained in the Operating Record for a minimum of three years from the date the waste was last managed at the Facility. For each waste stream characterized by acceptable knowledge, the Permittee shall maintain in the Operating Record, at a minimum, the following process knowledge information.

1. The location where the waste stream is generated,
2. The waste stream volume and time period of generation,
3. A description of the waste generating process, and
4. All material inputs or other information that identifies the chemical content, physical properties and physical form of the waste stream.

2.6.3. Characterization by Sampling and Analysis

2.6.3.1. Sampling

The Permittee shall establish and utilize a Sampling and Analysis Plan (SAP) for each waste stream for which sampling is required. The SAP shall identify the appropriate sampling methods to characterize the waste stream in accordance with the requirements of Permit Section 2.6.1. The Permittee shall maintain the SAP and all documents showing compliance with the SAP, in the Operating Record for a minimum of three years from the date the waste was last managed at the Facility.

The SAP shall identify the sample container types, preservation techniques, and holding times for each waste sampled. The SAP must conform to the most recent version of EPA's publication *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (Publication SW-846) Chapter 9, Sampling Plan.* The SAP must ensure collection of a representative sample of waste by means that preserve its original physical form and composition, and the SAP shall ensure that sample collection meets the quality assurance objectives required in Section 1.3 of Permit Attachment D. The number of samples of each waste shall be sufficient to demonstrate that the Upper Confidence Limit of the mean (UCL), based on at least a 95% confidence level, is less than the applicable regulatory threshold.

2.6.3.2. Laboratory Analysis

The SAP shall identify the appropriate laboratory analytical methods to characterize the waste

stream in accordance with the Permit requirements of Permit Section 2.6.1. The Permittee shall perform or obtain laboratory analysis of wastes in accordance with the requirements of this Permit, and the *Waste Analysis Plan* (WAP) contained in Permit Attachment C. The SAP shall include the appropriate laboratory analytical methods, detection limits, and reporting limits. The Permittee shall maintain the SAP in the Operating Record.

To use any alternative analytical method, the Permittee must submit to the Department a petition for approval of such method in accordance with 40 C.F.R. § 260.21.

If the Permittee uses an independent contract laboratory to perform analyses, the Permittee shall inform the laboratory in writing that it must operate under the waste analysis requirements set forth in this Permit.

When using laboratory analysis as part of a hazardous waste determination, the Permittee shall require the laboratory to report concentrations of *all* hazardous constituents that the analytical test method is capable of measuring as identified in analytical method specific tables in the most current version of the EPA's *Test Method for Evaluating Solid Wastes (SW-846), Chapter 2*. When using laboratory analysis to demonstrate that the waste meets its applicable Land Disposal Restriction (LDR) treatment standard concentrations (specified at 40 C.F.R. § 268.40), the Permittee shall demonstrate that the analytical method detection limit is not higher than the treatment standard for each hazardous constituent that can reasonably be expected to be present.

2.6.3.3. Quality Assurance/Quality Control (QA/QC)

The Permittee shall perform and record all waste characterization QA/QC procedures in accordance with SW-846 for the data used to support waste characterizations required under this Permit. The precision, accuracy, completeness, comparability, and representativeness of the analytical data shall be addressed. The Permittee shall maintain a record of all QA/QC determinations in a manner traceable to specific wastes in the Operating Record.

When performing waste sampling required under this Permit, the Permittee shall use the applicable sample collection QA/QC procedures specified in EPA's *Field QA and QC Requirements Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (Publication SW-846), Chapter 1, Section 3.4,* including, but not limited to those dealing with equipment preparation and field equipment maintenance, calibration, and cleaning. The SAP shall identify and the Permittee shall collect the appropriate number of quality control samples associated with each waste sampled.

When performing laboratory analysis required under this Permit, method blanks, laboratory duplicates, and other laboratory control samples shall be analyzed to assess the quality of the data resulting from laboratory analytical programs. The results of both field and laboratory quality control data shall be reported to the Department with the results of waste characterization samples.

2.6.4. Re-evaluation of Characterization Information

The Permittee shall re-evaluate the characterization of routinely generated wastes to ensure that the characterization remains accurate and up to date for subsequent batches of waste, in compliance with 40 C.F.R. § 264.13(b)(4). The results of the re-evaluation shall be thoroughly documented and placed in the Operating Record.

The Permittee shall perform re-evaluation of a waste in accordance with these minimum requirements:

1. Re-evaluation shall be performed at least annually to verify the accuracy of initial characterization. For wastes originally characterized through sampling and analysis, re-evaluation shall be achieved using the same sampling and analysis methods used in the initial analysis unless otherwise required by the Department. For wastes characterized through acceptable knowledge of waste generation processes, re-evaluation may be achieved through a review of that information supporting acceptable knowledge.
2. Re-evaluation shall be performed whenever there is a change in waste-generating processes. Any information that indicates a change in the process that generates the waste and may affect the waste shall cause the waste to be re-characterized.
3. Re-evaluation shall be performed when the Permittee is notified by an off-site facility receiving hazardous waste from the Facility that the characterization of the waste received at the receiving facility does not match a pre-approved waste analysis certification or accompanying waste manifest or shipping paper. The Permittee shall notify the Department within 24 hours of its receipt of such a discrepancy notice.

2.6.5. Characterization of Specific Wastes

2.6.5.1. Waste Received From Off-Site

The Permittee shall obtain a detailed chemical and physical analysis of any hazardous waste received at the Facility from an off-site facility, in compliance with 40 C.F.R. § 264.13(c). This characterization may be in the form of documented acceptable knowledge if all applicable waste characterization requirements specified in this Permit are met and documented. This includes, but is not limited to, identification of underlying hazardous constituents.

The Permittee shall physically examine the shipment of waste from the off-site facility at the time of acceptance for correct documentation, including appropriate waste container identification and labeling. The Permittee shall not accept at the Facility a hazardous waste shipment from an off-site facility without Uniform Hazardous Waste Manifests and LDR Notification Forms, as applicable. If discrepancies are found for waste shipped to the Facility, the Permittee shall immediately return the waste to the generator.

2.6.5.2. Waste to Be Shipped Off-Site

Prior to shipping any hazardous waste off-site, the Permittee shall characterize the waste as necessary for treatment and disposal and to ensure proper packaging, labeling, marking, and placarding in accordance with the Department of Transportation regulations at 49 C.F.R. Parts 172, 173, 178, and 179.

2.6.5.3. Remediation Waste

The Permittee shall characterize remediation waste (as defined at 40 C.F.R. § 260.10) in compliance with all waste characterization requirements in this Permit. The characterization information shall be included in the Operating Record, shall be maintained as required under Permit Section 1.23.2, and include at a minimum: a hazardous waste determination, an identification of all applicable hazardous waste numbers, a LDR status determination, the origin

of the waste and how it was subsequently managed, the time and circumstances of the release that created the waste, and any investigation or other reports describing the release.

2.6.5.4. Additional Characterization Requirements for Containerized Waste

The Permittee shall characterize hazardous wastes placed inside containers, including over packed drums, to ensure that the wastes do not react dangerously with, decompose, or ignite sorbent material in the container, in compliance with 40 C.F.R. § 264.316(c), and to ensure that the wastes are not incompatible or reactive with one another, in compliance with 40 C.F.R. § 264.316(d) and § 264.316(e). The Permittee shall characterize laboratory packs, if they are intended to undergo the alternative treatment standards at 40 C.F.R. § 268.42(c), to determine whether they contain any prohibited hazardous wastes.

2.6.6. Records of Waste Characterization

The Permittee shall record and maintain in the Operating Record the results of waste analyses and waste determinations performed by acceptable knowledge, and sampling and analysis, as specified in this Permit Part (2) in compliance with 40 C.F.R. §§ 264.73(b)(3), (b)(7), (b)(10), (b)(15), and (b)(16), and copies of notices and certifications required in Permit Sections 2.7.2.1 and 2.7.2.2. The requirement to record and maintain in the Operating Record the results of waste analyses, waste determinations, and copies of notices and certifications applies to solid wastes even when the hazardous characteristic is removed prior to disposal, or when waste is excluded from the definition of hazardous or solid waste under 40 C.F.R. § 261.2 through § 261.6, or exempted from Subtitle C regulation, subsequent to the point of generation. [40 C.F.R. § 268.7(a)(8)].

2.7. WASTE MANAGEMENT

2.7.1. Authorized Wastes and Waste Sources

2.7.1.1. Permitted Waste

The Permittee shall not treat at the OD Unit any wastes not included in the *List of Authorized Hazardous Wastes* under Permit Attachment B.

2.7.1.2. Prohibited Waste

The Permittee shall not treat any radioactive or mixed waste, any waste containing polychlorinated biphenyls, or any other wastes not listed in the *List of Authorized Hazardous Wastes* contained in Permit Attachment B. The Permittee shall not treat hazardous wastes by any other means not authorized by this Permit.

2.7.1.3. Waste from Foreign Sources

The Permittee shall not accept hazardous wastes from a foreign source (a hazardous waste source outside the United States).

2.7.1.4. Waste from Off-site Sources

The Permittee shall receive from off-site sources only hazardous waste that are to be treated at the OD Unit and only if such receipt is in compliance with the requirements of this Permit. The

Permittee shall receive for treatment at the OD Unit only the hazardous wastes listed in Permit Attachment B (*List of Authorized Hazardous Wastes*) and only from the sources listed in Table 2-1 of this Permit Part.

2.7.1.5. Incompatible Wastes

Incompatible wastes shall not be managed at the OD Unit.

2.7.2. Provisions for Complying with LDR Requirements

The Permittee shall comply with the restrictions for land disposal at 40 C.F.R. Part 268.

The Permittee shall not arrange for the disposal at an off-site land disposal facility any hazardous waste restricted from land disposal under 40 C.F.R. Part 268, unless:

1. The waste meets treatment standards specified in 40 C.F.R. § 268.40, § 268.41, § 268.42, or § 268.43; or
2. A variance from the treatment standards has been granted pursuant to 40 C.F.R. § 268.44.

This Permit does not authorize land disposal of hazardous waste at any location at the Facility.

2.7.2.1. Generator Requirements

Generators of hazardous waste must determine, based on the characteristics of the waste at the point of generation, if the waste must be treated before it can be land disposed.

Generators are required to send a one-time written notice to the Facility for the treatment of hazardous waste at the OD Unit for each exact type of waste stream. This includes the Permittee as a "generator" of waste to be treated at the OD Unit. A copy of the one-time notice shall be maintained at the EM Branch Office. The notice shall include:

1. The applicable EPA Hazardous Waste Numbers and the manifest number of the initial shipment;
2. A statement that the waste is subject to LDRs;
3. The UHCs and their concentrations in the wastes, if any;
4. The applicable treatability group category (normally as a non-wastewater);
5. Waste code subdivisions based on waste-specific criteria, if appropriate; and
6. Waste analysis data, if appropriate.

For wastes that do not meet treatment standards, the one-time written notice shall include the generator paperwork requirements information referenced in 40 C.F.R. § 268.7(a)(2).

For wastes that meet treatment standards at the original point of generation, the one-time notice shall include the generator paperwork regulatory requirements information and the certification statement referenced in 40 C.F.R. § 268.7(a)(3).

All of the supporting data used to determine that a waste is restricted from land disposal, either based on acceptable knowledge of waste generation processes or on sampling and analysis of the waste, shall be retained at the EM Branch Office, as required in 40 C.F.R. § 268.7(a)(6).

2.7.2.2. Treatment Facility Requirements

Treatment residues generated at the OD Unit are subject to LDR requirements, as well as other applicable requirements in 40 C.F.R. Parts 261-263 and this Permit.

If an analysis indicates that a treatment residue does not fully meet the treatment standards for hazardous waste in 40 C.F.R. § 268.40 and universal treatment standards of 40 C.F.R. § 268.48, the residue shall be sent to an offsite facility for additional treatment, including any necessary treatment of UHCs to meet the applicable standards, and disposal. The Permittee must comply with the notice and certification requirements in accordance with 40 C.F.R. § 268.7(b)(5) as well as Permit Section 2.6.5.2 and any other applicable requirements of this Permit. Untreated waste that is a result of kick-out may be collected and retreated at the OD Unit.

If analysis indicates that a treatment residue meets the treatment standards, it shall be sent offsite for disposal. In accordance with 40 C.F.R. § 268.7(b)(3) and (4), a notification and certification signed by an authorized representative shall be submitted to the offsite treatment facility with the initial shipment of treatment residue.

If a waste is determined to be no longer hazardous, a one-time notification and certification shall be placed in the files at the EM Branch Office, as required by 40 C.F.R. § 268.9(d). The notification and certification shall be updated if the process or operation generating the waste changes and/or if the Subtitle D facility receiving the waste changes. The notification shall include:

1. The name and address of the Subtitle D facility receiving the waste shipment; and

2. A description of the waste (e.g., the treatment residue) as initially generated, including EPA Hazardous Waste Number(s), treatability group(s), and UHCs.

An authorized Facility representative shall sign the certification.

2.8. WASTE MINIMIZATION

The Permittee shall submit to the Department a report annually by December 1, for the year ending the previous September 30, certifying that the Permittee has a program in place to reduce the volume and toxicity of all hazardous wastes that are generated by the Facility to the degree determined to be economically practicable, and that the proposed method of treatment is the practicable method currently available to the Permittee which minimizes the present and future threat to human health and the environment [see 40 C.F.R. § 264.73(b)(9)]. This certified report must include these items:

1. Any written policy or statement that outlines goals, objectives, and methods for source reduction and recycling of hazardous waste at the Facility;
2. Any employee training or incentive programs designed to identify and implement source reduction and recycling opportunities for all hazardous wastes;
3. Any source reduction or recycling measures implemented in the last five years or planned for the near future;

4. An itemized list of the dollar amounts of capital expenditures (plant and equipment) and operating costs devoted to source reduction and recycling of hazardous waste;
5. A discussion of factors that have prevented implementation of source reduction or recycling;
6. Sources of information on source reduction or recycling received at the Facility (e.g., local government, trade associations and suppliers);
7. An investigation of additional waste minimization efforts that could be implemented at the Facility, which investigation shall analyze the potential for reducing the quantity and toxicity of each waste stream through production process change, production reformulation, recycling, and all other appropriate means, including an assessment of the technical feasibility, cost, and potential waste reduction for each option;
8. A flow chart or table detailing all hazardous wastes the Facility produces, by quantity and type, and by building or area, and program if consistent with security considerations; and
9. A demonstration of the need to use those processes which produce a particular hazardous waste due to a lack of alternative processes, available technology, or available materials that would produce less volume of hazardous waste.

The Permittee shall include the report in the Operating Record.

2.9. IMPERMISSIBLE DILUTION

The Permittee shall not dilute a restricted waste as a substitute for treatment. [40 C.F.R. § 268.3]. Impermissible dilution to avoid an applicable treatment standard includes, but is not limited to, the addition of solid waste to reduce a hazardous constituent's concentration, or an ineffective treatment method that does not destroy, remove, or permanently immobilize hazardous constituents. Aggregating or mixing wastes as part of a legitimate treatment process are not considered impermissible dilution for purposes of this Permit requirement.

2.10. DUST SUPPRESSION

The Permittee shall not use waste or used oil or any other material which is contaminated with dioxin, polychlorinated biphenyls (PCBs), or any other hazardous waste, other than a waste identified solely on the basis of ignitability, for dust suppression or road treatment. [40 C.F.R. § 266.23(b)].

2.11. IGNITABLE AND REACTIVE WASTES

The Permittee shall take precautions to prevent accidental ignition or reaction of ignitable or reactive wastes, as required by 40 C.F.R. § 264.17.

Ignitable or reactive wastes shall be located at least 50 feet from the boundary of the OD Unit at all times and shall be protected from any sources of ignition, such as open flames, or reaction with other wastes or products, and shall be separated and protected from welding activities, hot surfaces, frictional heat, and sources of sparks.

Only containers made of or lined with materials that will not react with and are otherwise compatible with the waste to be managed shall be used to contain waste.

2.12. AIR EMISSIONS FROM THE OD UNIT

The Permittee shall comply with all air emission limitations and air monitoring requirements for the OD Unit set forth in the air quality permit for the OD Unit issued by the City of Albuquerque Environmental Health Department and as required by Permit Section 3.3. The Permittee shall also comply with the applicable requirements of 40 C.F.R. Part 264, Subpart BB. The Permittee shall maintain all records relating to the air quality permit in the Operating Record for the Facility.

2.13. OFF-SITE SHIPMENTS

Prior to shipping any hazardous waste off-site, the Permittee shall comply with all applicable generator requirements at 40 C.F.R. Part 262, as required by 40 C.F.R. §§ 262.10(h) and 264.71(c).

2.14. STORAGE OF RESTRICTED WASTE

The Permittee shall comply with 40 C.F.R. Part 268, Subpart E for any storage of hazardous waste restricted from land disposal under 40 C.F.R. Part 268, Subpart C.

2.15. MANIFEST SYSTEM

The Permittee shall comply with the manifest requirements of 40 C.F.R. § 264.71 and § 264.72. With the exception of waste shipments from conditionally exempt small quantity generators, the Permittee shall not accept for treatment any hazardous waste from an off-site source without an accompanying manifest.

If the Permittee accepts any hazardous wastes for treatment from an off-site facility without an accompanying manifest, if required, or without an accompanying shipping paper as described in 40 C.F.R. § 264.76, the Permittee shall prepare and submit an Unmanifested Waste Report to the Department within 15 calendar days after receiving the waste. The report shall include the following.

1. EPA identification number, name, and address of the off-site facility;
2. The date the Facility received the waste;
3. EPA identification number, name, and address of the generator and transporter;
4. A description and the quantity of each unmanifested hazardous waste received;
5. The method of treatment for each hazardous waste;
6. The certification signed by an authorized representative of the Facility; and
7. An explanation of why the waste was unmanifested, if known.

2.16. BIENNIAL REPORT

The Permittee shall prepare and submit to the Department two copies of a biennial report by March 1 of each even numbered year, as required by 40 C.F.R. § 264.75. The report shall document Facility activities during the previous calendar year and shall include.

1. EPA identification number, name, and address of the Facility;
2. The calendar years covered by the report;

3. A description and the quantity of each hazardous waste type the Facility received or generated that year;
4. The method of treatment for each hazardous waste type;
5. A description of the efforts undertaken during the year to reduce the volume and toxicity of waste generated;
6. A description of the changes in volume and toxicity of waste actually achieved during the year in comparison to previous years to the extent such information is available for the years prior to 1984; and
7. Treatment notices and their certifications signed by responsible Facility representatives.

2.17. LIABILITY INSURANCE REQUIREMENTS

Pursuant to 40 C.F.R. § 264.140(c), as a Federal entity, the Permittee is exempt from the requirement to have and to maintain liability coverage for sudden and accidental occurrences as specified at 40 C.F.R. § 264.147(a).

2.18. INCAPACITY OF OWNERS OR OPERATORS, GUARANTORS, OR FINANCIAL INSTITUTIONS

Pursuant to 40 C.F.R. § 264.140(c), as a department of the federal government, the Permittee is exempt from the requirement to notify the Department of the commencement of bankruptcy as specified at 40 C.F.R. § 264.148.

2.19. DISCLOSURE STATEMENT

Pursuant to NMSA 1978, § 74-4-4.7(F)(1), as a department of the federal government, the Permittee is not required to file a disclosure statement.

2.20. ADDITIONAL REPORTS

In accordance with the requirements of 40 C.F.R. § 264.77, the Permittee shall also report the following to the Department.

1. Releases of hazardous waste, hazardous constituents or contaminants, or any fires at or within 0.25 mile of the OD Unit or any SWMU or AOC,
2. Manifest discrepancies that cannot be resolved within 15 calendar days after receiving the waste,
3. Occurrences, if any, when hazardous waste is transported to the OD Unit in a container in noncompliance with regulatory requirements and the requirements of this Permit,
4. Treatment unit closures (40 C.F.R. §§ 264.77(b) and 264.115).

Table 2-1 **Off-Site Generators**
New Mexico State Police
Albuquerque Police Department
Bernalillo County Sheriff's Office
Sandia National Laboratories/New Mexico
Kirtland Air Force Base
University of New Mexico
New Mexico Institute of Mining and Technology

Figure 2-1

PERMIT PART 3: OPEN DETONATION UNIT

3.0 INTRODUCTION

This Permit Part (3) contains requirements that set forth the authorized waste types and maximum quantities of hazardous waste allowed to be treated at the Open Detonation (OD) Unit. It also contains other requirements, including those related to the design, construction, and operation of the Unit, and soil and groundwater monitoring.

3.1. AUTHORIZED WASTE AND MAXIMUM QUANTITY OF WASTE

The Permittee shall not treat more than 1,500 lbs of wastes per treatment event, 18,000 lbs per calendar year, or 180,000 lbs for the term of the Permit. The Permittee shall not treat more than the above quantities, except in case of an emergency and only after authorization by the Department. The Permittee shall not treat any wastes that are not authorized under Permit Attachment B.

3.2. DESIGN, CONSTRUCTION, OPERATION, AND MAINTENANCE

3.2.1. General Requirements

The Permittee shall design, construct, operate, and maintain the OD Unit in accordance with the requirements of this Permit to minimize noise and the possibility of an accidental fire, explosion, or any sudden or nonsudden release of hazardous waste or hazardous constituents into air, soil, sediment, surface water, or groundwater which could threaten human health or the environment, as required by 40 C.F.R. §§ 264.31 and 264.601.

The Permittee shall mark the boundary of the OD Unit with signs or structures such that the boundary is clearly discernible.

3.2.2. Run-Off and Run-On Controls

The Permittee shall design, construct, operate, and maintain run-off control systems (protective berm) at the OD Unit to prevent precipitation run-off from leaving the Unit and the migration of hazardous waste or hazardous constituents off-Unit, as required by 40 C.F.R. § 264.601(b).

The Permittee shall design, construct, operate, and maintain run-on control systems (protective berm) at the OD Unit to prevent precipitation from entering the Unit as overland run-on, as required by 40 C.F.R. § 264.601(b).

3.2.3. Restrictions on Operations

3.2.3.1. Hours of Operation

The Permittee shall conduct treatment operations only between sunrise and sunset, except in an emergency [see 40 C.F.R. § 264.1(g)(8)(i)(D)]. If the Permittee conducts treatment operations in response to an emergency before sunrise or after sunset on a given day, the Permittee shall notify the Department of this fact in writing within 3 days of conducting such treatment.

3.2.3.2. Weather Conditions

Treatment operations shall not be conducted during adverse climatic conditions. Operations shall not be conducted if lightning is within 10 miles (16 kilometers) of the OD Unit, when the cloud ceiling is less than 1,000 feet or when visibility is less than five miles.

The Permittee shall not conduct treatment operations when wind speed exceeds 15 miles per hour (24 kilometers per hour).

The Permittee shall not conduct treatment operations when a thunderstorm is imminent or within 10 miles (16 kilometers) of the OD Unit, or during a snowstorm, a dust storm, or sandstorm.

3.2.3.3. Range Fire

The Permittee shall not conduct treatment operations when extreme fire hazard conditions exist or if a range fire has the potential to reach the boundary of the Explosive Ordnance Disposal (EOD) Range.

3.2.3.4. Other Restrictions

Wastes shall be treated promptly upon transport to and acceptance at the OD Unit.

The Permittee shall cease treatment operations immediately upon the discovery of an unsafe situation including but not limited to an aircraft in dangerous proximity to the EOD Range or loss of communication with the EOD Shop.

The Emergency Coordinator (EC) shall remain on site at the personnel bunker for the duration of the treatment operation.

Waste shall not be stored at the OD Unit and shall be present at the Unit only during a planned treatment operation.

If a treatment event at the OD Unit is aborted, the waste shall be immediately sent back to the generator.

The maximum extent of hazardous waste operations at the OD Unit shall be confined to the OD Unit.

3.2.4. Operation Safety

3.2.4.1. Personnel Safety

When escorted visitors are present to observe treatment operations, there shall be at least one EOD Technician or Specialist present for every three visitors.

The Permittee shall not conduct treatment operations if unauthorized personnel are within 1500 feet of the OD Unit. The Permittee shall ensure that at least two authorized persons are present during any treatment operation.

Following a treatment operation, no personnel shall enter the OD Unit until the explosive ordnance Team Chief/Range Safety Officer determines that it is safe to enter.

3.2.4.2. Safety Precautions

The Permittee shall conduct all treatment operations in accordance with all the safety precautions required by this Permit.

3.2.5. Maintenance

3.2.5.1. Accumulated Precipitation

The Permittee shall not allow standing water in any pit (crater). The Permittee shall remove any standing water within 24 hours after a precipitation event, or within 24 hours of when impassible access roads become passable should inclement weather preclude access to the OD Unit. The Permittee shall analyze any water removed from the OD Unit to determine whether it is a hazardous waste in accordance with the *Waste Analysis Plan* (Permit Attachment C), and shall manage it appropriately.

3.2.5.2. Untreated Waste (Kick-Out) and Treatment Residues

Within 24 hours after each treatment operation, the Permittee shall inspect the entire OD Unit area for untreated waste (kick-out) or treatment residues (such as shrapnel, metal fragments) originating from treatment operations. This inspection shall be conducted only after it has been determined that it is safe for the purpose of conducting inspections. Any untreated waste or treatment residues shall be placed in appropriate containers and managed as hazardous waste or solid waste, as appropriate. Kick-out and treatment residues shall not be stored at the OD Unit.

3.3. AIR MONITORING

The Permittee shall evaluate the potential impact of the air pollutants on human health before, during, and after treatment operations by screening and assessment, in compliance with 40 C.F.R. § 264.601(c)(5). The Permittee shall not proceed with a treatment event if meteorological conditions or ambient air quality conditions do not meet the requirements of the City of Albuquerque air quality permit for the OD Unit and the requirements of this Permit Part.

The Permittee shall specify in an annual sampling and analysis report on air quality the types and schedules of air monitoring required by the Albuquerque Environmental Health Department, and the instrumentation required. The Permittee shall submit this report to the Department and include in the report any air monitoring data from the previous calendar year, and estimated monthly emissions based on the amounts of waste treated. The report is due by March 31 of each calendar year.

3.4. SOIL MONITORING AND HUMAN RISK SCREENING

The Permittee shall conduct an annual soil sampling and analysis program in accordance with Permit Attachment D, and as required by 40 C.F.R. § 264.601(b).

In order to monitor soil contamination resulting from open detonation operations at the OD Unit, the Permittee shall implement the *Soil Sampling and Analysis Plan* (SSAP), which is described in Permit Attachment D.

3.5. GROUNDWATER MONITORING

The OD Unit is subject to the environmental performance standards of 40 C.F.R. § 264.601. Groundwater monitoring shall be conducted during the entire period of operations, including the period for closure, to ensure the protection of groundwater. Groundwater monitoring shall also be conducted during post-closure care, if post-closure care is required.

3.5.1. Installation of Monitoring Wells

The Permittee shall install at least one well upgradient at the boundary of the OD Unit, and at least three wells downgradient at the boundary of the Unit. Within 90 days after the effective date of this Permit, the Permittee shall submit to the Department for approval a proposed monitoring well installation plan as a Class 3 Permit Modification to this Permit, which, at a minimum, shall include well locations, drilling specifications, well construction specifications, well development procedures, and a schedule for implementation and completion of the well installations and submittal of a well completion report. Upon Department approval of the plan, the Permittee shall implement the monitoring well installation plan according to the approved schedule. Within 30 days of completion of well installation, the Permittee shall submit to the Department for approval a well completion report. The well completion report shall include the information required in Permit Section 6.5.17.10.8. The Department may require additional wells to be installed at the OD Unit if the Department determines that the number or function of the existing wells is insufficient.

All wells installed at the OD Unit must meet the general groundwater monitoring requirements of 40 C.F.R. §§ 264.97(a)(2), (b), and (c).

If any of the wells at the OD Unit cannot be sampled due to a declining water table or for any other reasons, the Permittee shall apply for a permit modification to modify this Permit to propose replacement wells.

3.5.2. Sampling and Analysis

Within 90 days after the effective date of this Permit, the Permittee shall submit to the Department for approval a proposed groundwater sampling and analysis plan as a Class 3 modification to this Permit. Upon approval, the groundwater sampling and analysis plan and the monitoring well installation plan of Permit Section 3.5.1 shall become Permit Attachment L (reserved).

The groundwater sampling and analysis plan shall require:

- That at least one sequence of samples be collected from each well at least semiannually.
- That samples of groundwater be collected from each of the monitoring wells and field and laboratory analysis of the samples be conducted for the parameters listed in Table 3-1 of this Permit Part (3).
- That the groundwater flow rate and direction in the uppermost aquifer be determined at least annually.
- That a report on the field and laboratory analytical data shall be submitted to the Department within 90 days after the samples have been collected.

- That a determination be made whether there is statistically significant evidence of contamination at each monitoring well after each sampling event.
- That the method used to make the statistical determination is identified.
- That the applicable groundwater investigation requirements of Permit Section 6.4.1.3 be met, including, but not limited to, the requirements for the collection and analysis of quality control samples, proper selection and use of sampling equipment, labeling, containers, preservatives, and analytical methods, use of chain-of-custody procedures, validation of analytical data, and reporting of data.

Table 3-1 Groundwater Monitoring Parameters
Volatile organic compounds
Semi-volatile organic compounds
Perchlorate
White Phosphorus
Explosives
Metals (all metals listed in Appendix IX to 40 C.F.R. Part 264, including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, and zinc)
Dioxins and Furans
General chemistry parameters in Table 6-1 of Permit Part 6, except phosphorus/phosphate, TKN, ferric/ferrous iron, dissolved CO_2, silicon, suspended sediment, stable isotopes

Upon Department approval of the plan, the Permittee shall implement the groundwater sampling and analysis plan according to the schedule in the plan. The schedule in the plan shall at a minimum set forth the time of sampling and when the data are to be reported to the Department.

If the Permittee or the Department determines that there is statistically significant evidence of contamination at any monitoring well, the Permittee shall notify the Department of this fact within 15 days of this discovery. The Department may itself make such a determination.

Should corrective action be required, the Permittee shall meet the requirements of Part 6 of this Permit, and shall implement corrective action as necessary to protect human health and the environment from all releases of hazardous waste or hazardous constituents.

If the Permittee determines that the monitoring program no longer satisfies the HWMR, the Permittee shall within 90 days submit to the Department an application for a Class 3 modification to this Permit to make any appropriate changes to the program.

3.6. ORGANIC AIR EMISSIONS REQUIREMENTS

This Permit Section contains requirements for air emissions.

3.6.1. Additional Waste Characterization Requirements for Air Emissions

The Permittee shall characterize hazardous waste to ensure compliance with applicable emission requirements of 40 C.F.R. Part 264, Subpart BB.

3.6.2. Equipment Containing or Contacting Hazardous Waste

Each piece of equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight shall be marked in such a manner that it can be distinguished readily from other pieces of equipment in accordance with 40 C.F.R. § 264.1050(d).

Pursuant to 40 C.F.R. § 264.1050(f), equipment that contains or contacts hazardous waste with an organic concentration of at least 10 percent by weight for less than 300 hours per calendar year is excluded from the requirements of 40 C.F.R. §§ 264.1052 through 264.1060 if it is identified, as required in 40 C.F.R. § 264.1064(g)(6). Such equipment shall be identified in writing in a log that shall be kept with the Operating Record in accordance with 40 C.F.R. § 264.1064(g)(6). The information required pursuant to 40 C.F.R. § 264.1064(k)(1), (2), (3) shall also be recorded in a log that is kept with the Operating Record.

The Permittee shall comply with all applicable requirements of 40 C.F.R. §§ 264.1052 through 264.1060 for any equipment that contains or contacts hazardous waste with an organic concentration of at least 10 percent by weight for 300 or more hours per calendar year. The log shall note the total time elapsed that any equipment contains or contacts hazardous waste with an organic concentration of at least 10 percent by weight.

3.7. PRE-TREATMENT PREPARATION

Prior to a treatment operation, upon arrival at the OD Unit, an inspection of the OD Unit shall be conducted. The range flag shall be raised. The Team Chief shall then identify the designated EC and brief other EOD team members and escorted visitors (if present) on the treatment operation to be performed, required safety precautions, emergency procedures, and instruct all those present to be watchful for unsafe conditions at all times.

3.8. TRANSPORTATION OF WASTE TO THE OD UNIT AND CONTAINER SPECIFICATIONS

Hazardous wastes shall be packaged for transport to the OD Unit in appropriate containers that provide protection equivalent to U.S. Department of Transportation (DOT)-authorized containers. Appropriate containers include:

- Reinforced ammunition containers;
- Strong fiberboard boxes; or
- Strong, cleated wooden boxes.

Waste to be treated shall be transported to the OD Unit only on the day of the planned treatment event. Waste containers shall be secured to the vehicle during transport. Vehicles transporting hazardous wastes for treatment shall bear the appropriate “Explosives” placard and/or other necessary placards at the front, on both sides, and at the rear of the vehicle. These signs may be covered or removed when the vehicle no longer carries the hazardous wastes. Each transport vehicle shall, at minimum, carry one ABC-type portable fire extinguisher that is in operational

condition. Each transport vehicle shall have equipment to communicate with the KAFB Command Post and the emergency coordinator.

3.9. WASTE STAGING

Hazardous wastes shall only be transported to the OD Unit and unloaded and staged for treatment by appropriately trained EOD personnel. Wastes shall be treated as soon as possible after arrival at the OD Unit, provided the requirements of this Permit are met.

Outer waste containers are to be removed, and the waste placed into a pit (crater) for treatment by qualified EOD personnel. Outer containers may be returned to the generator for reuse. Outer and inner containers shall be managed appropriately as waste if not reusable.

If waste is placed in the OD Unit for treatment and site conditions are deemed unsafe to treat the waste, the waste shall be immediately removed and sent back to the generator.

3.10. WASTE TREATMENT

Prior to the treatment of hazardous waste, the Team Chief shall ensure that the EOD Range is clear of unauthorized personnel, that aircraft are not approaching, and that unauthorized vehicles and persons are not within or in the vicinity of the EOD Range as required under Section 3.2.4.1 of this Permit Part. The Team Chief shall also ensure that all persons at the EOD Range have relocated to the personnel bunker. In addition, the Team Chief shall obtain wind-speed information at or near the personnel bunker. The Team Chief shall also ensure that treatment operations comply with all restrictions in this Permit, including Permit Section 3.2.3.

Treatment of waste in the OD Unit shall be performed using explosives to countercharge the hazardous waste. Ignition of the explosives shall be done from the personnel bunker.

3.11. POST TREATMENT

After a treatment operation, the Permittee shall comply with the requirements of Permit Section 3.2.5.2, Permit Section 2.2, Permit Section 2.6.5.2, and any other requirement of this Permit applicable to post-treatment of waste.

The EOD Team Chief or his designee shall be responsible for clearing any misfires, should one occur. In such an event, a second qualified person shall serve as a safety backup for the EOD Team Chief.

If complete destruction of hazardous wastes is not achieved at the OD Unit, these wastes shall be treated again or shall be removed for appropriate treatment and disposed of at an off-site facility.

PERMIT PART 4: CLOSURE

4.0 GENERAL CLOSURE REQUIREMENTS

After receipt of the last hazardous waste to be treated at the OD Unit, or if required to cease operations as specified in Permit Section 1.10 and Permit Section 4.4, the Permittee shall close the OD Unit following the procedures described in the *Closure Plan* (Permit Attachment H), this Permit, and as required by 40 C.F.R. § 264.111.

4.1. SUBMITTAL OF REVISED CLOSURE PLAN

The Permittee shall submit to the Department for approval a revised Closure Plan within 60 days after discovering that a revised Closure Plan is required in accordance with this Permit, or the regulations at 40 C.F.R. § 264.112(c), or within 60 days after receiving written notification by the Department whichever is earlier. The Permittee shall amend the Closure Plan whenever changes in circumstances necessitate a modification of the Closure Plan, as required by 40 C.F.R.
§ 264.112(c). The Permittee shall amend the Closure Plan for any other reasons set forth in 40 C.F.R. 264.112(c) or if there are changes in state law that affect the Closure Plan. The Permittee shall comply with all the requirements of 40 C.F.R. 264.112(c) in amending the Closure Plan.

When amending or revising the Closure Plan, the Permittee shall submit to the Department for approval detailed, and as necessary, updated procedures and methods describing the procedures and sampling methods to verify removal of all structures and equipment and removal of treatment residues and any hazardous or solid wastes. At a minimum, the Permittee shall include in the revised Closure Plan:

1. Unit history and description, identifying, at a minimum, the following:
    a. Constituents of concern, including all hazardous waste and hazardous constituents managed at the Unit, listed by category of constituent subject to the same sampling methods,
    b. Spills or other releases of hazardous waste and hazardous constituents during operation of the Unit, and
    c. Visible staining or other conditions indicating potential release locations;
2. Proposed procedures for removal of all structures and equipment;
3. Proposed sample locations;
4. Sample methods, equipment, and procedures;
5. Analytes and analytical methods;
6. Detection limits;
7. QA/QC procedures; and
8. Sample management and preservation procedures.

4.2. CLEAN CLOSURE

The Permittee shall close the OD Unit by removing all hazardous waste residues and hazardous constituents and all structures and equipment from the OD Unit (clean closure).

However, if the OD Unit cannot be clean closed as determined by the Department, post-closure care is required and the Closure Plan shall be amended. If post-closure care is required, closure of the OD Unit shall include the construction of a final cover to be placed over the ground surface occupied by the Unit and construction of drainage structures to minimize the infiltration and percolation of water into and beneath the final cover. The final cover shall be of a design equivalent to that which would be required for a hazardous waste landfill. If groundwater is contaminated or soil contamination poses a threat to groundwater, the Permittee shall also immediately implement corrective action to remediate the contamination or prevent the contamination threat pursuant to the requirements of Part 6 of this Permit.

If a cover is required because the OD Unit cannot be clean closed, the revised Closure Plan shall meet all of the applicable closure requirements of 40 C.F.R. §§ 264.111 through 264.116 and 264.310, including the applicable closure requirements for landfills. The revised Closure Plan shall also include, at minimum:

1. The results of performance modeling of the final cover;
2. A description of the design (including engineering drawings) and material specifications for construction of the final cover and drainage structures;
3. A description of how the closure performance standards under 40 C.F.R. §§ 264.111 and 264.310(a)(1) through (5) will be met by the design;
4. A construction quality-assurance plan;
5. A description of the construction procedures and equipment to be used;
6. A description of the qualifications of those responsible for the design and oversight of the construction of the cover and the drainage structures; and
7. A schedule to construct and complete the final cover and drainage structures.

The Permittee shall implement the revised Closure Plan within 90 days after approval by the Department and shall complete construction of the final cover and drainage structures by the deadlines in the approved Closure Plan. The Permittee shall also submit to the Department a request to extend the closure period in accordance with 40 C.F.R. § 264.113(b)(1) and (c)(2).

4.3. NOTIFICATION OF CLOSURE

The Permittee shall notify the Department in writing at least 45 calendar days prior to the date on which it expects to begin closure of the OD Unit, as required by 40 C.F.R. § 264.112(d).

4.4. TIME ALLOWED FOR CLOSURE

Within 90 calendar days after the final volume of hazardous waste is received at the OD Unit, the Permittee shall remove all treatment residues and all other hazardous and solid waste from the Unit. The waste shall be sent to an off-site permitted treatment or disposal facility, as applicable. The Permittee shall complete closure activities for the Unit within 180 days, as required by
40 C.F.R. § 264.113, following the schedule and requirements in the Closure Plan, Permit Attachment H, and as required by this Permit Part.

If this Permit is terminated, or if the Facility is otherwise ordered, by judicial decree or final order under the HWA or § 3008 of RCRA, to cease treating hazardous wastes or to close the OD Unit, then the Permittee shall close the Unit in accordance with the deadlines established in 40 C.F.R. § 264.113.

4.5. DISPOSAL/DECONTAMINATION OF EQUIPMENT, STRUCTURES, AND SOILS

The Permittee shall remove and dispose of all equipment and structures, and shall decontaminate soil, as specified in the Closure Plan, Permit Attachment H. [40 C.F.R. § 264.114].

4.6. MANAGEMENT OF REMEDIATION WASTE

By removing hazardous waste or hazardous constituents or contaminated media during closure activities, the Permittee becomes a generator of hazardous waste, and shall manage that waste in accordance with all applicable requirements of 40 C.F.R. Part 262.

4.7. CERTIFICATION OF CLOSURE

Within 60 calendar days from the date of completion of closure of the OD Unit, the Permittee shall submit to the Department a final closure report and written certification signed by the Permittee and an independent professional engineer registered in the State of New Mexico, that the OD Unit was closed as required by the procedures specified in the Closure Plan (Permit Attachment H) and this Permit. [40 C.F.R. § 264.115].

4.8. FINANCIAL RESPONSIBILITY

4.8.1. Cost Estimate for Closure

Pursuant to 40 C.F.R. § 264.140(c), as a department of the federal government, the Permittee is exempt from the requirement to provide a cost estimate for closure as specified at 40 C.F.R. § 264.142.

4.8.2. Financial Assurance for Closure

Pursuant to 40 C.F.R. § 264.140(c), as a department of the federal government, the Permittee is exempt from the requirement to submit a signed duplicate original of the closure financial assurance instrument as specified at 40 C.F.R. § 264.143.

PERMIT PART 5: POST CLOSURE

5.0 POST-CLOSURE CARE

The Department assumes that the OD Unit will be clean closed.

However, pursuant to 40 C.F.R. § 264.603, if any OD Unit operations release hazardous waste or hazardous constituents into soil, sediment, or groundwater that cannot be completely removed or decontaminated during closure (clean closed), then the OD Unit shall be subject to the requirements for closure and post-closure care for landfills in 40 C.F.R. §§ 264.117 through 120, and 264.310. The Permittee shall also meet the requirements of 40 C.F.R. § 264.601 during post-closure care for the OD Unit. The post-closure plan required under 40 C.F.R. § 264.118 must specify the procedures that will be used to satisfy these requirements.

PERMIT PART 6: CORRECTIVE ACTION

6.0 INTRODUCTION

Pursuant to § 3004(u) and (v) of RCRA, 42 U.S.C. § 6924(u) and (v); NMSA 1978, § 74-4-4.2(B) and 40 C.F.R. Part 264, Subparts F and G, the Permittee shall implement corrective action as necessary to protect human health and the environment from all releases of hazardous waste or hazardous constituents from operating or closed hazardous waste management units, and from any releases of hazardous waste or hazardous constituents from any Solid Waste Management Unit (SWMU) or Area of Concern (AOC) at the Facility.

6.1. GENERAL PROVISIONS

6.1.1. Offsite Access

To the extent any requirement of this Permit, including any work plan approved under this Permit, requires access to property not owned or controlled by the Permittee, the Permittee shall use its best efforts to obtain access from the present owners of such property to conduct required activities. In the event that access is not obtained when necessary, the Permittee shall immediately notify the Department in writing regarding its best efforts and its failure to obtain such access.

6.1.2. Field Activities

The Permittee shall notify the Department in writing of any field sampling or other field activities undertaken pursuant to any work plan or requirement of this Permit, and shall provide the Department the opportunity to collect split samples upon request by the Department. For such sampling or other field activities, the Permittee shall provide the Department with as much advance notice as is practicable, but no less than 15 days prior to the conduct of such sampling.

The Permittee shall notify the Department in writing a minimum of 15 days prior to the implementation of any work plan required under this Permit. Notification of sampling or other field activities may be made by email, fax, or letter.

6.1.3. Record Preservation

Until 10 years after the Permittee's receipt of the Department's written notice that corrective action has been completed for all SWMUs and AOCs listed on Table I-3 of Permit Attachment I, the Permittee shall maintain all records, documents, data, and other information that are required to be prepared under this Permit for corrective action.

6.1.4. Releases Beyond Facility Boundary

The Permittee shall notify the Department orally, within 24 hours of discovery, of any release of hazardous waste or hazardous constituent that has the potential to migrate beyond the Facility boundary or has migrated beyond the Facility boundary.

In the event that a hazardous waste or a hazardous constituent migrates beyond the Facility boundary, the Permittee shall implement corrective actions beyond the Facility property boundary as necessary to protect human health and the environment, unless the Permittee can

demonstrate to the Department that, despite the Permittee's best efforts, the Permittee is unable to obtain the necessary permission to undertake such actions. The Permittee is not relieved of any responsibility to clean up a release that has migrated beyond the Facility boundary where offsite access has been denied. On-site measures to address such releases will be determined on a case-by-case basis and will be subject to the approval of the Department.

6.1.5. Work Plans and Other Deliverable Documents

All work plans, schedules, reports, and other deliverable documents that the Permittee is required to prepare under this Part (6) shall be submitted to the Department for review and approval as detailed in Permit Section 1.38.

6.1.6. Quarterly Progress Reports

The Permittee shall submit to the Department quarterly reports summarizing all corrective action activities conducted pursuant to this Permit by January 31, April 30, July 31, and October 31 of each year. Each report shall summarize the corrective action activities for the quarter (i.e., 3 month time period) ending the month preceding the due date of the report. The content of these reports shall include the information specified in Permit Section 6.2.4.1.

6.1.7. Lists of SWMUs and AOCs and Annual Reporting of Outdoor Activities

Plate 1 is a map showing the locations of SWMUs and AOCs at the Facility. Corrective action is required for all SWMUs and AOCs identified in Table I-3 of Permit Attachment I. Table K-1 of Permit Attachment K contains a listing of all SWMUs and AOCs for which the Department has determined that corrective action is complete without controls.

Given the need to monitor current and future activities that could lead to creation of new SWMUs and AOCs, the Permittee shall submit to the Department an annual report containing a brief summary of outdoor testing and training activities. The report shall list the name, location, and a general description of the type or types of testing (e.g., firing site, explosives testing, drop testing, burn testing) and training conducted at each outdoor area. The first annual report shall be submitted to the Department within 90 days of the effective date of this Permit; subsequent reports shall be submitted annually thereafter by March 31 of each year.

6.1.8. Newly discovered SWMUs, AOCs, and Releases

The Permittee shall notify the Department orally, within 24 hours of discovery, of any newly identified SWMU or AOC. Within 15 days after the discovery of any newly identified or suspected SWMU or AOC, the Permittee shall notify the Department in writing of such discovery. The notification shall include, at a minimum, the location of the SWMU or AOC and all available information pertaining to the nature of any release of contaminants from the SWMU or AOC, including the contaminants that were released, the magnitude of the release, and the media affected by the release.

Within 90 days after submitting such written notification, the Permittee shall submit to the Department for approval a SWMU Assessment Report (SAR) for each newly identified or suspected SWMU or AOC. At a minimum, the report shall provide the following information, to the extent available:

1. Location of each newly identified or suspected SWMU or AOC on a topographic map of appropriate scale;
2. Designation of type and function of each newly identified or suspected SWMU or AOC;
3. General dimensions, capacities and structural description of each newly identified or suspected SWMU or AOC (including any available plans and drawings);
4. Dates of operation for each newly identified or suspected SWMU or AOC;
5. Identification of all wastes that have been managed at or in each newly identified or suspected SWMU or AOC, including any available data on hazardous constituents in the waste; and
6. All available information pertaining to any release of contaminants from each newly identified or suspected SWMU or AOC, including analytical data for groundwater, soil, sediment, rock, air, and surface water.

Based on the results of the report and any other relevant information, the Department will determine the need for further investigations at the SWMUs or AOCs covered in the report, including the need for an investigation report. The Department may also require corrective measures of the SWMU or AOC, based on a finding that releases of contaminants have occurred, are occurring, or are likely to occur.

Within 15 days after the discovery of any previously unknown release of a contaminant into soil, sediment, surface water, or groundwater, the Permittee shall notify the Department in writing of such discovery. Based on the results of the report and any other relevant information, the Department may determine that further investigation of the release of contaminants is needed, including the need for an Investigation Report. The Department may also require corrective measures, based on a finding that releases of contaminants have occurred, are occurring, or are likely to occur from the unit.

6.1.9. Determination of Corrective Action Complete (No Further Action)

Based on the results of an Investigation Report or other relevant information, the Permittee may submit a request to the Department for a Class 3 permit modification under 40 C.F.R. § 270.42(c) to terminate corrective action for a specific SWMU or AOC. This permit modification request must contain information demonstrating that there are no releases of hazardous waste including hazardous constituents from a particular SWMU or AOC at the Facility that pose a threat to human health or the environment, as well as any additional information required in 40 C.F.R. § 270.42(c).

A determination of Corrective Action Complete shall not preclude the Department from requiring continued or periodic monitoring of air, sediment, soil, groundwater, or surface water, when site-specific circumstances indicate that releases of hazardous waste or hazardous constituents may occur or have occurred, and it is necessary to protect human health or the environment.

A determination of Corrective Action Complete shall not preclude the Department from requiring further investigations, studies, or remediation at a later date, if new information or subsequent analysis indicates a release or likelihood of a release from a SWMU or AOC at the Facility that may pose a threat to human health or the environment. In such a case, the Department may initiate a modification to the Permit according to the requirements of Permit Section 1.12.1.

6.1.10. Health and Safety Plan

The Permittee shall maintain a Facility Health and Safety Plan, which shall include:

1. A description of the Facility including availability of resources such as roads, water supply, electricity and telephone service;
2. A description of the known hazards and evaluation of the risks associated with each activity conducted, including, but not limited to, on and off-site exposure to contaminants during implementation of interim or final corrective measures, site characterization, or monitoring activities;
3. A list of key personnel and alternates who are responsible for site safety, response operations, and protection of public health;
4. A delineation of the work area;
5. A description of levels of protection to be worn by personnel in the work area;
6. Procedures established to control site access;
7. Decontamination procedures for personnel and equipment;
8. Site emergency procedures;
9. Emergency medical care procedures for injuries and toxicological problems;
10. Requirements for an environmental field-monitoring program;
11. Routine and special training requirements for responders; and
12. Procedures for protecting workers from weather-related problems.

The Facility Health and Safety Plan shall be in accordance with:

1. National Institute of Occupational Safety and Health (NIOSH) Occupation Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
2. EPA Order 1440.1 - Respiratory Protection;
3. EPA Order 1440.3 - Health and Safety Requirements for Employees engaged in Field Activities;
4. Facility Contingency Plans included in this Permit;
5. EPA Operating Safety Guide (1984);
6. Occupational Safety and Health Administration regulations, particularly 29 C.F.R. § 1910 and 1926;
7. State and local regulations; and
8. Other applicable EPA guidance.

6.1.11. Community Relations Plan

The Permittee shall maintain a plan for dissemination of information to the public regarding investigation and remediation activities and results. The plan shall:

1. Require the creation and maintenance of an active mailing list of interested parties, to be updated annually, including those on the official mailing list in accordance with 40 C.F.R. § 124.10;
2. Require informal meetings, including briefings and workshops as appropriate, with the public and local officials before and during the corrective action process, which shall be held at least twice every calendar year for as long as corrective action is required;
3. Require that news releases, fact sheets, work plan submittals, report submittals, and publicly available quarterly progress reports that explain the progress and conclusions of investigations and clean-ups be timely posted on the Permittee's website and timely provided to interested citizen groups and the public as requested;
4. Require the creation and maintenance of a public information repository and reading room;
5. Require that public tours and briefings be conducted to inform and to listen to public concerns, and to answer questions related to environmental monitoring, characterization, and remediation;
6. Require immediate written and, if possible, oral notification to affected parties of any discovered off-site release that could impact them; and
7. Require that interested community groups be notified of and be given opportunities to observe field data gathering activities conducted during the corrective action process (notices shall specify the time and need for any required safety and security training).

6.1.12. Land Transfer

In transferring land to another entity, the Permittee shall comply with the terms of § 120(h) of CERCLA, as amended, 42 U.S.C. § 9620(h), and as implemented in 40 C.F.R. Part 373. These provisions apply to any property owned by the Permittee on which any hazardous substance was stored for one year or more, known to have been released, or disposed of, subject to the limitations of 40 C.F.R. § 373.2. Consistent with CERCLA § 120(h)(3)(A), the Permittee shall include in any deed that transfers property, the information required by CERCLA § 120(h)(3)(A)(i), the covenant required by CERCLA § 120(h)(3)(A)(ii), and the access clause required by CERCLA § 120(h)(3)(A)(iii). The Permittee may defer the requirement of § 120(h)(3)(A)(ii)(I), consistent with the terms of CERCLA § 120(h)(3)(C).

For any deed transferring title from the Permittee that contains a restriction on future land use, the Permittee shall, within 90 days of transfer of the property, notify the Department of the transfer and identify for the Department the location of the property that is the subject of the transfer.

6.1.13. Abandoned Septic Systems

In addition to the corrective action specified in this Permit, the Permittee shall close all abandoned septic systems in accordance with the Department's Liquid Waste Disposal System Regulations 20.7.3.307 NMAC.

6.2. SPECIAL REQUIREMENTS

6.2.1. Special Information Submittals

6.2.1.1. General Facility Information

The Permittee shall submit in a report to the Department, within 90 days of the effective date of this Permit, the following information:

1. Maps and tables indicating the surveyed coordinates and locations of all existing springs, wells, and surface water gaging stations;
2. Water-level contour map of known radii-of-effects from pumping of municipal and Facility supply wells;
3. Water level data presented graphically and in tabular format; and
4. Maps showing the boundaries of all Facility SWMUs and AOCs.

This report is a one-time submittal, unless new information becomes available; in that case, the report shall be updated and resubmitted at least annually by March 31 of each year for each case that new information becomes available.

6.2.1.2. Potential Human Receptors Information

The Permittee shall, within 90 days of the effective date of this Permit, submit a report to the Department describing human populations that are susceptible to contaminant exposure from the Facility. At a minimum, the following information shall be gathered and reported:

1. Local uses and possible future uses of groundwater, including:
   a). Type of use (for example., potable, domestic, agricultural, residential, industrial, municipal) and
   b). Locations of all groundwater wells, names of owners or tenants at those locations, and current use of those wells within one mile of the Facility; and
2. Human use of or access to the Facility and adjacent lands, including but not limited to recreational, residential, commercial, and industrial.

This report is a one-time submittal, unless new information becomes available; in which case, the report shall be updated and resubmitted at least annually by March 31 of each year for each case that new information becomes available.

6.2.1.3. Information on Surface Water

The Permittee shall submit a report to the Department pertaining to surface water bodies at the Facility, within 90 days of the effective date of this Permit. The report shall at minimum include:

1. A description of each surface water body, including location (Coyote Springs and associated wetlands are examples of surface water at the Facility); and
2. A description of the chemistry of the surface waters, including pH, temperature, total dissolved solids, total suspended solids, alkalinity, conductivity, dissolved oxygen, total organic carbon, and any specific contaminant concentrations.

6.2.2. Corrective Action Procedures

The corrective action process for a given SWMU or AOC begins with a site investigation to characterize any releases of contaminants. If there has been a release of hazardous waste or hazardous constituents into the environment and corrective action is necessary to protect human health or the environment from the release, corrective measures shall be conducted at the contaminated site to remove or isolate the contaminants that pose the human health or environmental risk. Verification sampling is required to determine if cleanup levels have been successfully achieved.

6.2.2.1. Site Investigations

The Permittee shall conduct a site investigation for each SWMU and AOC listed on Table I-3 of Permit Attachment I. The Department may determine that further investigation is needed at any SWMU or AOC at the Facility. If the Department determines that such further investigation is needed, it will notify the Permittee in writing.

The Permittee shall perform the site investigations only in accordance with approved Investigation Work Plans.

6.2.2.1.1. Investigation Work Plans

The Permittee shall submit to the Department for approval an Investigation Work Plan, in the format and with the content described in Permit Section 6.2.4.2, for each SWMU and AOC needing further investigation, including those listed on Table I-3 of Permit Attachment I. An individual Investigation Work Plan may cover several SWMUs or AOCs. The Investigation Work Plans shall be submitted by the date specified in the Department's written notification or in accordance with the schedule in Table I-3 of Permit Attachment I. Additional characterization required by the Department that is not already covered in an approved Investigation Work Plan, or that is not addressed during implementation of field activities conducted under an existing approved Investigation Work Plan, shall be proposed in a supplemental Investigation Work Plan submitted to the Department for approval. The supplemental Investigation Work Plan may reference a prior approved Investigation Work Plan and any corresponding Investigation Report for background information.

6.2.2.1.2. Investigation Reports

The Permittee shall submit to the Department for approval an Investigation Report, in the format and with the content described in Permit Section 6.2.4.3, that presents the results of field activities, summarizes the data collected, and presents the recommendations and conclusions of each investigation conducted pursuant to an approved Investigation Work Plan. An individual Investigation Report may cover several SWMUs or AOCs.

6.2.2.2. Corrective Measures

6.2.2.2.1. General

The Department will require corrective measures if the Department determines, based on an Investigation Report or other relevant information available to the Department, that there has been a release of hazardous waste or hazardous constituents into the environment and that corrective action is necessary to protect human health or the environment from such a release. Upon making such a determination, the Department will notify the Permittee in writing.

6.2.2.2.2. CME Work Plans

If the Department requires corrective measures, the Permittee shall submit to the Department for approval a Corrective Measures Evaluation (CME) Work Plan, in the format and with the content described in Permit Section 6.2.4.6, within 90 days of notification by the Department that a CME Work Plan is required or by such other due date as is stated in the notification. The CME Work Plan shall contain a schedule to conduct the CME. Upon approval of the CME Work Plan by the Department, the Permittee shall implement the work plan.

The CME shall evaluate potential remedial alternatives and shall recommend a preferred remedy that will be protective of human health and the environment and that will attain the appropriate cleanup levels.

6.2.2.2.3. CME Reports

The Permittee shall submit a CME Report, in the format and with the content described in Permit Section 6.2.4.7, to the Department within 90 days of completion of the CME. When the Department determines that there are no deficiencies in the CME Report, the Department will seek and consider public comment prior to selecting a remedy.

In selecting a remedy, the Department may select a remedy for a particular SWMU or AOC that encompasses several separate actions. The use of the term “remedy” refers to all such actions.

6.2.2.2.4. Cleanup Standards

The Permittee shall evaluate corrective measures and propose a preferred remedy that is capable of achieving the cleanup levels outlined in Permit Section 6.2.3 including, as applicable, any approved alternate cleanup goals established by a risk assessment.

6.2.2.2.5. Remedy Evaluation Criteria

6.2.2.2.5.1. Threshold Criteria

The Permittee shall evaluate each of the remedy alternatives against the following threshold criteria. To be selected, the remedy alternative must:

1. Be protective of human health and the environment;
2. Attain media cleanup standards within a reasonable timeframe;
3. Control the source or sources of releases so as either to reduce to the extent practicable, or to eliminate, further releases of hazardous waste or hazardous constituents that may

pose a threat to human health and the environment; and

4. Comply with applicable standards for management of wastes.

6.2.2.2.5.2. Remedial Alternative Evaluation Criteria

The Permittee shall evaluate each of the remedial alternatives for the factors described in this Permit Section (6.2.2.2.5.2). These factors shall be balanced in proposing a preferred remedy.

Long-Term Reliability and Effectiveness

The remedy shall be evaluated for long-term reliability and effectiveness. This factor includes consideration of the magnitude of risks that will remain after implementation of the remedy; the extent of long-term monitoring, or other management that will be required after implementation of the remedy; the uncertainties associated with leaving wastes in place; and the potential for failure of the remedy. The Permittee shall give preference to a remedy that reduces risks with little long-term management and that has proven effective under similar conditions.

Reduction of Toxicity, Mobility, or Volume

The remedy shall be evaluated for its effectiveness in reducing the toxicity, mobility, and volume of hazardous wastes and hazardous constituents. The Permittee shall give preference to a remedy that will more completely, permanently, and promptly reduce the toxicity, mobility, and volume of hazardous wastes and hazardous constituents.

Short-Term Effectiveness

The remedy shall be evaluated for its short-term effectiveness in reducing the toxicity, mobility, and volume of hazardous wastes and hazardous constituents. This factor includes considerations of the short-term reduction in existing risks that the remedy would achieve; the time needed to achieve that reduction; and the short-term risks that might be posed to the community, workers, and the environment during implementation of the remedy. The Permittee shall give preference to a remedy that quickly reduces short-term risks, without creating significant additional risks.

Implementability

The remedy shall be evaluated for its implementability or the difficulty of implementing the remedy. This factor includes consideration of potential installation and construction difficulties; operation and maintenance difficulties; difficulties with cleanup technology; permitting and approval requirements; and the availability of necessary equipment, services, expertise, and waste storage and disposal capacity. The Permittee shall give preference to a remedy that can be implemented quickly and easily, and poses fewer and lesser difficulties.

Cost

The remedy shall be evaluated for its cost. This factor includes a consideration of both capital costs, and operation and maintenance costs. Capital costs shall include, without limitation, construction and installation costs; equipment costs; land development costs; and indirect costs including management costs, engineering costs, legal fees, permitting fees, startup and shakedown costs, and contingency allowances. Operation and maintenance costs shall include,

without limitation, operating labor and materials costs; maintenance labor and materials costs; replacement costs; utilities; monitoring and reporting costs; administrative costs; indirect costs; and contingency allowances. All costs shall be calculated based on their net present value. The Permittee shall give preference to a remedy that is less costly, but does not sacrifice protection of human health and the environment.

6.2.2.2.6. Remedy Selection

Upon deeming the CME Report to be complete, the Department will select a proposed remedy or remedies for the SWMU or AOC. The Department may propose a different remedy from that recommended by the Permittee in the CME Report. The Department will issue a Statement of Basis for the proposed remedy, and will receive public comment on the remedy. The public comment period will extend for at least 45 days from the date of the public notice of the Statement of Basis. As provided in 20.4.1.901(A)(5)(a) through (c) and 20.4.1.901(B)(5), the Department will provide an opportunity for a public hearing on the proposed remedy, at which all interested persons will be given a reasonable chance to submit data, views or arguments orally or in writing and to examine witnesses testifying at the hearing. The comment period will automatically be extended to the close of the public hearing, if a hearing is held. The public hearing will follow the requirements under 20.4.1.901.F NMAC. The Department will select a final remedy and issue a response to public comments to all commenters, after the end of the public comment period. In selecting a remedy, the Department will follow the public participation requirements applicable to remedy selection under 20.4.1.901 NMAC and 40 C.F.R. Part 270.

6.2.2.2.7. CMI Work Plans

Within 90 days after the Department's selection of a final remedy, or as otherwise specified by the Department in writing, the Permittee shall submit to the Department for approval a Corrective Measures Implementation (CMI) Work Plan describing the design, construction, operation, maintenance, and performance monitoring for the selected remedy, and a schedule for its implementation. The CMI Work Plan shall be submitted to the Department for review in accordance with the requirements in Permit Section 1.38. Upon approval of the work plan by the Department, the Permittee shall implement the work plan.

The CMI Work Plan shall, at a minimum, include the elements found in the format provided in Permit Section 6.2.4.8.

6.2.2.2.8. Corrective Measures Implementation

The Permittee shall implement the final remedy selected by the Department according to the approved CMI Work Plan and implementation schedule.

6.2.2.2.9. Progress Reports

The Permittee shall submit to the Department progress reports in accordance with the schedule approved in the CMI Work Plan. The progress reports shall, at a minimum, include the information specified in Permit Section 6.2.4.9.

6.2.2.2.10. CMI Reports

Within 90 days after completion of a remedy, the Permittee shall submit to the Department for approval a CMI Report. The CMI Report shall include the information specified in Permit Section 6.2.4.10.

6.2.2.2.11. Accelerated Cleanup Process

6.2.2.2.11.1. General

If the Permittee identifies a corrective measure that, if implemented voluntarily, will reduce risks to human health and the environment to levels acceptable to the Department, will reduce cost or will achieve cleanup of a SWMU or AOC ahead of schedule, the Permittee may implement the corrective measure as provided in this Permit Section, in lieu of the process established in Permit Section 6.2.2.2.12.4. The accelerated cleanup process shall be used only at sites to implement presumptive remedies at small-scale and relatively simple sites where groundwater contamination is not a component of the accelerated cleanup, where the remedy is considered likely to be the final remedy for the site, and where the field work will be accomplished within 180 days of the commencement of field activities.

6.2.2.2.11.2. ACM Work Plans

The Permittee shall submit to the Department for approval a proposed Accelerated Corrective Measures (ACM) Work Plan, which shall include the following:

1. A description of the proposed remedial action, including details of the unit or activity that is subject to the requirements of this Permit;
2. An explanation of how the proposed cleanup action is consistent with the overall corrective action objectives and requirements of this Permit;
3. The sampling and analytical methods and procedures for characterization and remediation verification; and schedule for implementation and reporting on the proposed cleanup action.

The Permittee shall obtain approval of an ACM Work Plan from the Department prior to implementation of the work. The Permittee shall prepare the ACM Work Plan in accordance with the requirements of this Permit Section (6.2.2.2.11.2), and shall include a proposed implementation schedule. In accordance with Permit Section 1.38, if the Department disapproves the ACM Work Plan, the Department will notify the Permittee in writing of the work plan deficiencies and will specify a due date for submittal of a revised ACM Work Plan.

6.2.2.2.11.3. ACM Implementation

The Permittee shall implement the accelerated cleanup measure according to the approved ACM Work Plan. Within 90 days of completion of the ACM, the Permittee shall submit to the Department for approval a CMI Report that is written in a format in accordance with Permit Section 6.2.4.10. If upon review, the Department identifies any deficiencies in the CMI Report, the Department will notify the Permittee in writing and will specify a due date for submittal of a revised CMI Report.

6.2.2.2.12. Interim Measures

6.2.2.2.12.1. General

The Department may require interim measures, if the Department determines that such measures are necessary, to reduce or prevent migration of hazardous wastes or hazardous constituents that have, or may result in, an unacceptable human or environmental receptor exposure to hazardous wastes or hazardous constituents while long-term corrective action remedies are being evaluated and implemented. Upon making such determination, the Department will notify the Permittee in writing. Alternatively, the Permittee may identify the need to implement interim measures and may submit an Interim Measures Work Plan in writing to the Department for approval. The Permittee may initiate emergency interim measures without prior approval of the Department pursuant to Permit Section 6.2.2.2.12.4.

6.2.2.2.12.2. Interim Measures Work Plans

Within 60 days after receiving notification from the Department that interim measures are required, or such other period as stated in the notification, the Permittee shall submit to the Department for approval an Interim Measures Work Plan. The Interim Measures Work Plan shall include the same elements as specified in Permit Section 6.2.4.8.

6.2.2.2.12.3. Interim Measures Implementation

The Permittee shall implement the interim measures in accordance with an approved Interim Measures Work Plan and implementation schedule unless the Permittee is implementing an emergency interim measures without prior Department approval in accordance with Permit Section 6.2.2.12.4.

6.2.2.2.12.4. Emergency Interim Measures

The Permittee may determine during implementation of site investigation activities that emergency interim measures are necessary to address an immediate threat of harm to human health or the environment. The Permittee shall notify the Department within three business days of discovery of the facts giving rise to the threat, and shall propose emergency interim measures to address the threat. If the Department approves the emergency interim measures in writing, the Permittee may implement the proposed emergency interim measures without submitting an Interim Measures Work Plan. If circumstances arise resulting in an immediate threat to human health or the environment such that initiation of emergency interim measures are necessary prior to obtaining written approval from the Department, the Permittee shall notify the Department within one business day of taking the emergency interim measure. The notification shall contain a description of the emergency situation, the types and quantities of contaminants involved, the emergency interim measures taken, and contact information for the emergency coordinator who handled the situation. The notification shall also include a written statement justifying the need to take the emergency action without prior written approval from the Department.

6.2.2.2.12.5. Interim Measures Reports

Within 60 days after completion of interim measures, or as otherwise specified in the implementation schedule contained in the approved Interim Measures Work Plan, the Permittee

shall submit to the Department for approval an Interim Measures Report summarizing the results of the interim measures, that shall include copies of the results of all field screening, monitoring, sampling, analyses, and other data generated as part of the interim measures implementation. The Interim Measures Report shall include the same elements as specified in Permit Section 6.2.4.10.

6.2.3. Cleanup Levels

The Permittee shall adhere to the requirements of this Permit Section (6.2.3) for implementing and completing cleanup of groundwater, surface water, and soil at all SWMUs and AOCs at the Facility. All proposed cleanup levels will be subject to the Department's review and approval.

6.2.3.1. Cleanup Levels for Contaminants in Groundwater (other than Perchlorate)

The cleanup levels for groundwater shall be the New Mexico Water Quality Control Commission (WQCC) water quality standards (20.6.2.3103 and 20.6.2.4103 NMAC) and the drinking water maximum contaminant levels (MCLs) adopted by EPA under the Federal Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26). If both a WQCC standard and a Maximum Contaminant Level (MCL) have been established for a contaminant, then the most stringent of the two levels shall be the cleanup level for that contaminant.

If a WQCC standard or MCL has not been established for a contaminant, the EPA Regional Screening Level (RSL) (EPA, 2009) for tap water shall be used as the cleanup level. If an RSL for tap water does not exist for a contaminant, and toxicological information is available, the Permittee shall propose a cleanup level based on a residential scenario, a total target human health excess cancer risk level of 10^{-5}, and for non-carcinogenic contaminants a HQ of one (1.0).

6.2.3.2. Cleanup Levels for Perchlorate in Groundwater

As described in Permit Section 6.4.1.4, the Permittee shall determine the nature extent, and rate of migration of any perchlorate contamination in groundwater. If the New Mexico WQCC adopts a groundwater standard for perchlorate, or if EPA adopts a MCL for perchlorate, then the standard or MCL will become the cleanup level. Pending WQCC or EPA adoption of a groundwater standard or MCL, if perchlorate is detected in groundwater at a concentration greater than or equal to 4 ug/L, the Permittee shall, through a Corrective Measures Study, propose a cleanup level based on a risk assessment using a Hazards Index of 1.0 and a residential-use scenario. The proposed cleanup level shall be subject to approval by the Department.

6.2.3.3. Cleanup Levels for Soil Contaminants (Other than PCBs and Lead)

For contaminants in soil (other than PCBs and lead), the Permittee shall propose a cleanup level based on a total human health excess cancer risk level of 10^{-5}, and for noncarcinogenic contaminants a total HQ of one (1.0) for residential land use. Alternatively, the Permittee may propose cleanup levels using the screening levels and procedures listed in the Department's most current version of "*Technical Background Document for Development of Soil Screening Levels*" (as it may be updated) for a residential land use scenario.

6.2.3.4. Cleanup Levels for Polychlorinated Biphenyls (PCBs) in Soil

For PCB contamination in soil, the Permittee shall propose a cleanup level based on the Department's Position Paper "*Risk-based Remediation of Polychlorinated Biphenyls at RCRA Corrective Action Sites*" (March 2000), as it may be updated. The soil cleanup level for PCBs is either a default concentration of 1.00 milligram per kilogram (mg/kg) or a risk-based PCB concentration level established through performing a human-health risk assessment assuming a residential land use scenario.

6.2.3.5. Cleanup Levels for Lead in Soil

The lead concentration in soil shall not exceed 400 mg/kg.

6.2.3.6. Cleanup Levels for Surface Water

The Permittee shall comply with the surface water quality standards outlined in the Clean Water Act (33 U.S.C. §§ 1251 to 1387), the New Mexico WQCC Regulations (20.6.2 NMAC), and the State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC), and the procedures for alternate abatement standards (20.6.2.4103 NMAC).

6.2.3.7. Ecological Risk Evaluation and Cleanup Levels

Ecological risk shall be evaluated for any SWMU or AOC where there has been a release of contaminants. The Permittee shall evaluate ecological risk and propose a cleanup level derived using the methods in the Department's most current version of *"Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment"* (March 2000, as it may be updated). The Permittee may use EPA's ECO-SSLs (EPA, 2005) with Department approval if a substance is not addressed in the Department's guidance on ecological risk.

6.2.3.8. Requests for Variance from Cleanup Levels

The Permittee may request a variance from a particular cleanup level. The nature of the request shall differ depending on whether a WQCC standard is involved. If a WQCC standard is involved, the Permittee may request an alternative abatement standard in accordance with the process specified in the WQCC Regulations at 20.6.2.4103.E and F NMAC.

For all other instances in which the Permittee requests a variance from a cleanup level, the Permittee shall submit a demonstration to the Department that achievement of the cleanup level is impracticable. In making such demonstration, the Permittee may propose consideration of such factors as technical or physical infeasibility of the project, ineffectiveness of proposed solutions, cost of the project, potential hazards to workers or to the public, and any other basis that may support a finding of project impracticability. In addition to demonstrating the basis for its impracticability request, the Permittee's written submittal shall propose the action to be taken by the Permittee if the Department approves the impracticability demonstration. Such action shall include, but is not limited to, completion of a site-specific risk assessment and identification of alternate clean-up levels. The proposed alternative cleanup level will be subject to the Department's review and approval.

6.2.4. Reporting Requirements

The purpose of this Permit Section (6.2.4) is to provide reporting requirements for corrective action activities required under this Permit. This Permit Section is not intended to provide reporting requirements for every potential type of activity conducted at the Facility; therefore, other formats or types of reports may be necessary or better suited for some activities. Described below are general reporting requirements and formats for Quarterly Reports, Investigation Work Plans, Investigation Reports, periodic monitoring reports, risk assessment reports, CME Work Plans, CME Reports, CMI Work Plans, CMI Work Plan Progress Reports, and CMI Reports. All Work Plans and Reports shall be prepared with technical and regulatory input from the Department. All Work Plans and Reports shall be submitted to the Department in the form of one electronic copy in a format acceptable to the Department and two paper copies.

6.2.4.1. Quarterly Reporting

Quarterly reports, as specified in Permit Section 6.1.6 shall include the following information:

1. A description of the work completed and an estimate of the percentage of total planned work completed;
2. Summaries of all findings, including summaries of laboratory data;
3. Summaries of all problems or potential problems encountered during the reporting period and actions taken to rectify problems;
4. Planned work for the next reporting period;
5. Summaries of contacts pertaining to corrective action with representatives of the local community, public interest groups, or State government during the reporting period;
6. Changes in key project personnel during the reporting period;
7. Summaries of any variances from approved investigation or remediation work plans; and
8. Brief summaries of any periodic monitoring reports prepared in accordance with the requirements in Permit Section 6.2.4.4.

6.2.4.2. Investigation Work Plans

The Permittee shall prepare an Investigation Work Plan using the format set forth below. All research, locations, depths and methods of exploration, field procedures, analytical requirements, data collection methods, and schedules shall be included in a work plan. Required sections for an Investigation Work Plan are:

1. Title Page and Signature Block (for the name, title, and organization of the preparer and the responsible Facility representative);
2. Executive Summary (Abstract);
3. Table of Contents;
4. Introduction;
5. Background Information;
6. Site Conditions;
7. Scope of Activities;
8. Investigation Methods;

9. Monitoring and Sampling;
10. Schedule;
11. Tables;
12. Figures; and
13. Appendices (e.g., Investigation–Derived Waste Management Plan).

The Permittee may insert figures and tables within the text sections of a work plan instead of in a separate section.

6.2.4.3. Investigation Reports

The Permittee shall prepare an Investigation Report using the format set forth below. This Permit Section (6.2.4.3) describes the minimum requirements for reporting. All data collected during investigation of a SWMU or AOC shall be included in the Investigation Report. Requirements for an RFI report are:

1. Title Page and Signature Block (for the name, title and organization of the preparer and the responsible Facility representative);
2. Executive Summary (Abstract);
3. Table of Contents;
4. Introduction;
5. Background Information;
6. Scope of Activities;
7. Field Investigation Results – Including, but not limited to (as applicable): surface conditions, subsurface conditions, monitoring well construction, boring or excavation abandonment, groundwater conditions, materials testing results, and pilot testing results;
8. Regulatory Criteria;
9. Site Contamination – Including as applicable, but not limited to: soil, rock and sediment sampling analytical results, soil, rock and sediment sample field screening results, groundwater sampling results, surface water sampling results, and subsurface vapor sampling results; and conclusions;
10. Conclusions and Recommendations;
11. Tables - An explanation shall be provided on each table for all abbreviations, symbols, acronyms, and qualifiers;
12. Figures - All map figures shall include an accurate bar scale and a north arrow, other types of figures shall include a bar scale, if appropriate, and an explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers; and,
13. Appendices - Including, as appropriate, field methods, boring/test pit logs and well construction diagrams, chemical analytical reports, and other appendices as required by the Department.

The Permittee may insert figures and tables within the text sections of an investigation report instead of in a separate section.

6.2.4.4. Periodic Monitoring Reports

The Permittee shall prepare a Periodic Monitoring Report using the format set forth below. The reports shall present the results of periodic or routine groundwater and remediation system monitoring at the Facility. All data collected during each monitoring and sampling event in the reporting period shall be included in a periodic monitoring report. In general, interpretation of data should be presented only in the background, conclusions, and recommendations sections of a report. The other text sections of a report should be reserved for presentation of facts and data without interpretation or qualifications. Requirements for a Periodic Monitoring Report are:

1. Title Page and Signature Block (for the name, title and organization of the preparer and the responsible Facility representative);
2. Executive Summary (Abstract);
3. Table of Contents;
4. Introduction;
5. Scope of Activities;
6. Regulatory Criteria;
7. Monitoring Results;
8. Conclusions and Recommendations;
9. Tables - An explanation shall be provided on each table for all abbreviations, symbols, acronyms, and qualifiers;
10. Figures - All map figures shall include an accurate bar scale and a north arrow; other types of figures shall include a bar scale, if appropriate, and an explanation shall be provided on each figure for all abbreviations, symbols, acronyms, and qualifiers; and,
11. Appendices - Including, as appropriate, field methods, boring/test pit logs and well construction diagrams, chemical analytical reports, and other appendices as required by the Department.

The Permittee may insert figures and tables within the text sections of a periodic monitoring report instead of in a separate section.

6.2.4.5. Risk Assessment Reports

The Permittee shall prepare a Risk Assessment Report using the format set forth below. Risk Assessment Reports may be appended to or combined with a CME Report or an Investigation Report to create a single document for a given SWMU or AOC. Human health and ecological risk assessments should be presented in separate sections, but the general risk assessment outline applicable to both sections is provided below. The conceptual site model shall be discussed in all risk assessments. Requirements for a Risk Assessment Report are:

1. Title Page and Signature Block (for the name, title and organization of the preparer and the responsible Facility representative);
2. Executive Summary (Abstract);
3. Table of Contents;
4. Introduction;

5. Background Information -- Including site description and sampling results;
6. Conceptual Site and Risk Exposure Models;
7. Risk Screening Results;
8. Conclusions and Recommendations;
9. Tables;
10. Figures; and
11. Appendices.

A section in the risk assessment report shall summarize the analytical results of sampling at the SWMU or AOC. It shall include a description of the history of releases of contaminants, the known and possible sources of contamination, the vertical and lateral extent of contamination present in each medium, and a discussion of any uncertainties that are associated with contaminant characterization. Sources that are no longer considered to be ongoing but represent the point of origination for contaminants transported to other locations shall be included. This section shall reference any pertinent figures, data summary tables, and references in other reports. References made to other reports shall include page number, table numbers, and figure numbers for the referenced information. Page numbers for references made to other reports may be presented in a formal reference section of a risk assessment report. Summaries of data for each contaminant shall include the maximum value detected, the detection limit, and the upper confidence limit of the mean (UCL) based on a 95% confidence level (if applicable to the data set) with a notation for the statistical method used to calculate the UCL. Background values used for comparison to inorganic constituents and discussion of how “non-detect” analytical results were handled in the statistical analysis of data shall also be included.

Another section in the report shall present the conceptual site and risk exposure models. It shall include information on the expected fate and transport of contaminants detected at the SWMU or AOC. The discussion of fate and transport shall address potential migration of each contaminant in each medium, potential breakdown products and their migration, and anticipated pathways of exposure for human or ecological receptors. Diagrammatic representations of the conceptual site and risk exposure models shall appear in the figures section of the document. For human health risk assessments, the conceptual site and risk exposure models shall include the current and foreseeable future land use (such as industrial or recreational) for all risk assessments. Cleanup levels for the Facility shall be based on a residential land-use scenario, even if the current use of the land is for other scenarios.

All values for exposure parameters and the source of those values shall be included in table format and presented in the Tables section of the document. Conceptual site and risk exposure models presented for ecological risk assessments shall identify assessment endpoints and measurement receptors for the SWMU or AOC. The discussion of the models shall explain how the measurement receptors are protective of the ecological receptors.

If risk screening is utilized, a section in the report shall present the actual screening values used for each contaminant for comparison to all applicable human health and ecological risk screening levels. Other regulatory levels that are applicable to screening the site, such as drinking water MCLs or WQCC standards shall also be included in this section.

For risk assessments a section of the report shall present risk values, HQs, and hazard indexes

(HI) for human health under projected future land use and residential scenarios and any site-specific scenarios. A similar section shall also present for each contaminant the HQ for each ecological receptor.

Finally, a section shall also be included in the report that contains a discussion of qualitative, semi-quantitative, and quantitative uncertainty in the risk assessment and provides estimates of the potential impact of the various uncertainties. Appendices may include the results of statistical analyses of data sets and comparisons of data, full sets of results of all sampling investigations at the site, or other data as appropriate.

6.2.4.6. CME Work Plans

The Permittee shall prepare a CME Work Plan using the format set forth below. Required sections for a CME Work Plan are:

1. Title Page and Signature Block (for the name, title, and organization of the preparer and the responsible Facility representative);
2. Executive Summary;
3. Table of Contents;
4. Introduction;
5. Background Information;
6. Identification of Potential Remedies;
7. Analysis of Potential Remedies;
8. Proposed Remedy;
9. Schedule to complete CME;
10. Estimated Cost to Conduct CME;
11. Qualifications of Personnel who will conduct the CME;
12. Tables;
13. Figures; and
14. Appendices.

The Permittee may insert figures and tables within the text sections of a CME Work Plan instead of in a separate section.

6.2.4.7. CME Reports

The Permittee shall prepare a CME Report using the format set forth below. Investigation summaries, site condition descriptions, corrective action goals, corrective action options, selection criteria, and schedules shall be included in the CME Report. At a minimum, detections of contaminants encountered during site investigations shall be presented in table format with an accompanying site map showing sample locations. The required format for CME Reports is:

1. Title Page and Signature Block (for the name, title and organization of the preparer and the responsible Facility representative);
2. Executive Summary (Abstract);
3. Table of Contents;

4. Introduction;
5. Background Information;
6. Site Conditions -- Including, as appropriate, surface, subsurface, and groundwater conditions;
7. Potential Receptors -- Including sources, pathways, and receptors;
8. Regulatory Criteria;
9. Identification of Corrective Measures Options;
10. Evaluation of Corrective Measures Options -- Including the required information in Permit Section 6.2.2.2.5.2;
11. Selection of a proposed preferred remedy;
12. Design Criteria to Meet Cleanup Objectives;
13. Schedule;
14. Tables;
15. Figures; and
16. Appendices.

The Permittee may insert figures and tables within the text sections of a CME Report instead of in a separate section.

A CME Report shall include the following information:

1. A description of the location, status, and current use of the site;
2. A description of the history of site operations, including an identification of hazardous and solid wastes managed at the site, and any releases of hazardous waste or hazardous constituents;
3. A description of site surface conditions;
4. A description of site subsurface conditions;
5. A description of on-site and any off-site contamination in all affected media;
6. An identification and description of all sources of contaminants;
7. An identification and description of contaminant migration pathways;
8. An identification and description of potential contaminant receptors;
9. An identification and description of applicable cleanup standards or other regulatory criteria;
10. An identification and description of remedial alternatives;
11. Remedial alternative pilot or bench scale testing results, if applicable;
12. A detailed evaluation and rating of each of the remedial alternatives, applying the criteria set forth in Permit Section 6.2.2.2.5.2;
13. An identification of a proposed preferred remedy;
14. Basic design criteria of the proposed preferred remedy; and
15. A schedule for implementation of the proposed preferred remedy.

6.2.4.8. CMI Work Plans

The Permittee shall prepare a CMI Work Plan using the format set forth below. The CMI Work Plan shall provide details on the design, construction, operation, maintenance, and performance monitoring for the selected remedy, and a schedule for implementation. The CMI Work Plan shall, at a minimum, include as necessary depending on the type of remedy to be implemented:

1. A description of the selected remedy;
2. A description of the remediation system objectives;
3. An identification and description of the qualifications of key persons, consultants, and contractors that will be implementing the remedy;
4. Detailed engineering design drawings and systems specifications for all elements of the remedy;
5. A construction quality assurance plan;
6. An operation and maintenance plan, if applicable;
7. The results of any remedy pilot tests, such as landfill cover test plots;
8. A schedule for submission to the Administrative Authority of periodic progress reports
9. A schedule for implementation of the remedy; and
10. A health and safety plan.

6.2.4.9. CMI Work Plan Progress Reports

The Permittee shall make progress reports on the execution of the CMI Work Plan to the Department, as described in this Permit Section (6.2.4.9). At a minimum, a progress report shall include the following information:

1. A description of the remedy work completed during the reporting period;
2. A summary of problems, potential problems, or delays encountered during the reporting period;
3. A description of actions taken to eliminate or mitigate the problems, potential problems, or delays;
4. A discussion of the remedial work projected for the next reporting period, including all sampling events;
5. Copies of the results of all monitoring, including sampling and laboratory analyses, and any other data generated during the reporting period; and
6. Copies of all waste disposal records generated during the reporting period.

6.2.4.10. CMI Reports

A CMI Report shall, at a minimum, include the following information.

1. A summary of the work completed;
2. A statement, signed by a registered professional engineer, that the remedy has been completed in accordance with the Department approved CMI Work Plan for the remedy;
3. As-built drawings and specifications signed and stamped by a registered professional engineer;

4. Copies of the results of all monitoring, including sampling and laboratory analyses, and other data generated during the remedy implementation, if not previously submitted in a progress report; and
5. Copies of all waste disposal records, if not previously submitted in a progress report.

6.2.4.11. Certification

Pursuant to 40 C.F.R. § 270.11(d)(1), all corrective action documents shall include a certification, signed by a responsible official of the Facility, stating:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

6.3. COMPLIANCE SCHEDULE TABLES

The Permittee shall meet the specified compliance schedules for all actions and deliverables required by this Permit. Corrective action is required for all SWMUs and AOCs identified in Table I-3 of Permit Attachment I.

6.4. SPECIAL REQUIREMENTS FOR INFORMATION SUBMITTALS AND CORRECTIVE MEASURES

6.4.1. Special Investigation Requirements

6.4.1.1. Landfills to Be Closed with Waste Left in Place

For each landfill that the Permittee proposes to leave all or a portion of the contents of the landfill in place, the Permittee shall implement the corrective action procedures set forth in Permit Section 6.2.2. Within 180 days after the effective date of this Permit, the Permittee shall submit to the Department for approval in accordance with Permit Section 6.2.4.6 a CME Work Plan for each such landfill unless a CME Work Plan has been previously submitted to the Department for the landfill.

6.4.1.2. Military Munitions Ranges

The Permittee has conducted operations at areas that were used to research, develop, test, and evaluate military munitions and explosives, and other ordnance, or weapons systems, or to train military personnel in their use and handling. The Facility contains numerous military ranges where explosives are and were used for the purpose of conducting military exercises, munitions testing, research development, and demonstrations. These military ranges may include firing lines and positions, maneuver areas, firing lanes, test pads, impact areas, simulator sites, training

sites, research facilities, and buffer zones.

This Permit Section (6.4.1.2) applies to military munitions that meet the statutory definition of "solid waste" in NMSA 1978, 74-4-3(M), whether or not they also meet the regulatory definition of "solid waste" in 40 C.F.R. § 261.2.

Within 90 days of the effective date of this Permit, the Permittee shall submit to the Department for approval a Military Range Assessment Report that contains the following information:

1. A list of all active, inactive, and closed military ranges located on Facility property;
2. A list of any military ranges located on property that has been transferred from the Facility to another federal, private, or other entity;
3. An identification of those military ranges that are active, inactive, or closed;
4. For each inactive and closed military range, a description of the current use of the property;
5. Maps (or a map) that clearly illustrate the boundaries of all active, inactive, and closed military ranges, including transferred ranges, and the map must also illustrate any buffer zone around the ranges;
6. A qualitative assessment of the nature and extent of contamination at each active, inactive, and closed military range, including the potential risk to human health and the environment from the military munitions and other contamination;
7. A recommendation for further investigation necessary to fully characterize the nature and extent of the contamination on each of the active, inactive, and closed military ranges; and
8. A proposed schedule for implementation of the recommended investigation.

6.4.1.3. Areas with Groundwater Contamination

Groundwater contamination or the potential for groundwater contamination has been identified at the following areas:

1. Tijeras Arroyo Groundwater (TAG) Area – trichloroethylene (TCE) and nitrate;
2. Landfills #4, #5, and #6, LF-008 (SWMU 6-4)–potential for contamination by selenium and TCE;
3. Manzano Base Groundwater – TCE;
4. Sewage Lagoons and Golf Course Pond, WP-026 – TCE, nitrate;
5. Manzano Sewage Treatment Facility, WP-16 (SWMU 6-24) – potential for contamination;
6. Monitoring well WYO-4 area – TCE;
7. McCormick Ranch -- Nitrate;
8. Bulk Fuels Facility, ST-106 and SS-111 -- Fuel (JP-4, JP-8, and Aviation Gas) Contamination; and
9. EOD Hill – perchlorate contamination.

The Permittee shall complete an Investigation Work Plan, Investigation Report, or CME Report

for each of the nine areas of groundwater contamination in accordance with the compliance schedules in Table I-3 of Permit Attachment I. The Permittee shall complete a CME Report for each area of groundwater contamination that requires remediation, as determined by the Department. In addition, Permittee shall investigate other areas of the Facility, in addition to those listed above, where the Department determines that either groundwater is contaminated or there is potential for groundwater contamination.

6.4.1.4. Perchlorate Screening in Groundwater

Monitoring for perchlorate is required for eight consecutive quarters in groundwater monitoring wells installed at the Facility after the effective date of this Permit and in the following existing wells or their replacements: KAFB-1001 through KAFB-1007 (McCormick Ranch/Range wells), KAFB-1901 through KAFB-1904 (Lake Christian wells), and EOD Hill well. The Department reserves the right to include additional wells for perchlorate monitoring. The Permittee shall report all monitoring results on January 31, April 30, July 31, and October 31 of each year for at least 8 consecutive quarters to the Department, unless the Department agrees in writing to a longer reporting period.

The Permittee shall determine the nature, extent, and rate of migration of any perchlorate contamination in groundwater at the Facility and, if necessary, down gradient of the Facility. The detection limit for the monitoring of perchlorate in groundwater shall not exceed 1 ug/L.

If perchlorate is detected in a groundwater at a concentration greater than or equal to 1 ug/L in a groundwater monitoring well, monitoring of perchlorate in such well must continue at a frequency determined by the Department. The frequency shall not exceed one year.

6.4.1.5. Sanitary Sewer Line at LF-002 (SWMU 6-2)

The sanitary sewer line that passes through LF-002 shall be removed in accordance with the Department's instructions (letters from NMED to Carl Lanz: July 16, 2004; September 13, 2004; and March 10, 2005). Instead of removing the sanitary sewer line, the Permittee may abandon the sanitary sewer line in place, provided that the sewage within the line is completely drained when the line is abandoned. The sewer line shall be taken out of service within two years of the effective date of this Permit.

Within 180 days after the effective date of this Permit, the Permittee shall submit to the Department for approval - in accordance with Permit Section 6.2.2.2.7 - a CMI Work Plan with a schedule for removing or abandoning the sewer line. After completion of the work, the Permittee shall augment the CMI Report for LF-002 by describing the removal or abandonment of the sewer line.

6.5. TECHNICAL REQUIREMENTS

The methods used to conduct investigation, remediation, and monitoring activities shall be sufficient to fulfill the requirements of this Permit, and to provide accurate and representative data for the evaluation of site conditions, the nature, concentration, rate of migration, and extent of contamination, and for remedy selection and implementation, where necessary. The methods presented in this Permit are minimum requirements for environmental investigation and sampling, and are not intended to include all methods that may be necessary to fulfill the

requirements of this Permit. The methods for conducting investigations, corrective actions, and monitoring at the Facility must be determined based on the conditions and contaminants that exist at each SWMU or AOC.

The Permittee shall provide a description of investigation, sampling or analytical methods and procedures in documents submitted to the Department that includes sufficient detail to evaluate the quality of the acquired data. The Department must approve any proposed combinations of SWMUs and AOCs that are grouped for the purpose of site investigation, remediation, and/or monitoring activities.

6.5.1. Standard Operating Procedures

The Permittee may reference relevant Facility Standard Operating Procedures, provided that copies of these procedures are also submitted to the Department for review. If any requirement or procedure in a Standard Operating Procedure is found by the Department to be unacceptable for reasons including, but not limited to, that the requirement or procedure will or could prevent the acquisition of representative and reliable sampling results, the requirement or procedure shall be replaced by the Permittee with a different requirement or procedure that is acceptable to the Department.

6.5.2. Documentation of Field Activities

Daily field activities, including observations and field procedures, shall be recorded on appropriate forms. The original field forms shall be retained at the Facility and made available to the Department upon request. Completed forms shall be maintained in a bound and sequentially numbered field file (logbook) for reference. Indelible ink shall be used to record all field activities. Photographic documentation of field activities shall be performed, as appropriate. The daily record of field activities shall include, at minimum:

1. SWMU or AOC designation;
2. Date;
3. Time of personnel arrival and departure;
4. Field investigation team members who are present, including subcontractors and visitors;
5. Weather conditions;
6. Daily activities conducted and times of performance;
7. Observations;
8. Record of samples collected with sample designations and locations specified;
9. Photographic log;
10. Field monitoring data, including health and safety monitoring if conditions arise that threaten worker or public safety, or the environment;
11. Equipment used and calibration records, if appropriate;
12. List of additional data sheets and maps completed;
13. An inventory of the waste generated and the method of storage and/or disposal; and
14. Signature of personnel completing the field record.

6.5.3. Decontamination Procedures

The objective of the decontamination procedures described below is to minimize the potential for cross-contamination. A designated area shall be established for decontamination of drilling equipment, reusable sampling equipment, and well materials. Drilling rigs and other equipment shall be decontaminated prior to entering a SWMU or AOC. Drilling equipment or other exploration equipment that may come in contact with a borehole shall be decontaminated by steam cleaning, by hot-water pressure washing, or by another method approved by the Department prior to drilling each boring.

Sampling or measurement equipment, including but not limited to, stainless steel sampling tools, split-barrel or core samplers, well development or purging equipment, groundwater quality measurement instruments, and water level measurement instruments, shall be decontaminated in accordance with the following procedures or other methods approved by the Department before each sampling event:

1. Brush equipment with a wire or other suitable brush, if necessary or practicable, to remove large particulate matter;
2. Rinse with potable tap water;
3. Wash with non-phosphate detergent or other detergent approved by the Department (e.g., Fantastik™ and Liqui-Nox®) followed by a tap water rinse;
4. Rinse with 0.1 M nitric acid to remove trace metals, if necessary, followed by a tap water rinse;
5. Rinse with methanol to remove organic compounds, if necessary;
6. Rinse with potable tap water; and
7. Double rinse with deionized water.

All decontamination solutions shall be collected and stored temporarily as Investigation Derived Waste (IDW) as described in Permit Section 6.5.7. Decontamination procedures and the cleaning agents used shall be documented in the daily field log.

6.5.4. Field Equipment Calibration Procedures

Field equipment requiring calibration shall be calibrated before use in the field to known standards, in accordance with the manufacturers' recommended schedules and procedures. Calibration measurements shall be recorded in the daily field logs. If field equipment becomes inoperable, its use shall be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument shall be used.

6.5.5. Sample Handling, Shipping, and Custody Requirements

The Permittee shall follow all procedures for sampling activities that are detailed in this Permit Section.

6.5.5.1. Sample Handling

At a minimum, the following procedures shall be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves shall be worn when collecting samples. New disposable gloves shall be used to collect samples. If any glove is contaminated by touching the sampled material, or other material that could contaminate or dilute the sample, the glove shall be replaced before taking another sample;
2. All samples collected of each medium shall be transferred into clean containers with the exception of soil, rock, and sediment samples obtained in brass sleeves or in Encore™ samplers. Sample container volumes and preservation methods shall be in accordance with EPA SW-846 and established industry practices; and
3. Sample labels and documentation shall be completed for each sample following procedures included in the site-specific work plans that are to be approved by the Department. Immediately after the samples are collected, they shall be stored either in a cooler with ice or by other appropriate storage method until they are delivered to the analytical laboratory. Chain-of-custody procedures, as described in this Permit Section (6.5.5.1) and Section 1.3.2.4 of Permit Attachment C shall be followed for all samples collected. All samples shall be submitted to the laboratory in an appropriate timeframe that will allow the laboratory to conduct the specified analyses within the method holding times.

6.5.5.2. Sample Shipment Procedures

Shipment procedures shall include:

1. Individual sample containers shall be packed to prevent breakage, and transported in a sealed cooler with ice or other suitable coolant or as otherwise approved by the Department. Any drainage hole at the bottom of the cooler shall be sealed and secured to prevent leakage;
2. Each cooler or other container shall be delivered in a timely manner to the analytical laboratory;
3. Glass bottles shall be separated in the shipping container by cushioning material to prevent breakage;
4. Plastic containers shall be protected from possible puncture during shipping using cushioning material;
5. The chain-of-custody form and analytical request form shall be shipped inside the sealed storage container to be delivered to the laboratory; and
6. Chain-of-custody seals (signed and dated) shall be used to seal individual sample containers and the sample-shipping container in conformance with EPA guidance.

6.5.5.3. Sample Custody

All samples collected for analysis shall be recorded in the field report or data sheets. Chain-of-custody forms shall be completed prior to the transfer of samples off-site, and shall accompany the samples during shipment to the laboratory. Upon receipt of the samples at the laboratory, the custody seals will be broken by laboratory personnel, the chain-of-custody form shall be signed as received by the laboratory, and the conditions of the samples shall be recorded on the form. The original chain-of-custody form shall remain with the laboratory and copies shall be returned to the relinquishing party. The Permittee shall maintain copies of all chain-of-custody forms

generated as part of sampling activities. Copies of the chain-of-custody records (either paper copies or electronically scanned in PDF format) shall be included with final reports submitted to the Department.

A chain-of-custody form shall be used to track samples from collection through analysis to ensure the integrity of analytical results. A chain-of-custody form shall include:

1. Sample identification number;
2. Signature of sample collector;
3. Date and time of sample collection;
4. Location at which sample was collected;
5. Type of media sampled (e.g., soil);
6. Type of preservation;
7. Analysis required;
8. Signature of all persons that have had custody of the samples;
9. Dates and times of possession; and
10. Signature, date and time of breaking the custody seal.

An individual in custody of any sample must comply with the procedures identified in SW-846 Chapter Nine (EPA, 1986) and those included here.

6.5.5.4. Sample Labels

Sample labels or tags are necessary to prevent misidentification. Gummed paper labels or tags are adequate and shall include at a minimum:

1. Sample identification number;
2. Name or initial of collector;
3. Sample location;
4. Sample date and time;
5. Analytical method or parameter to be analyzed for (e.g., VOCs, SVOCs, metals);
6. Preservation method; and
7. Other remarks.

Labels shall be affixed to sample containers before sampling, and they shall be immediately completed with the above information after the samples are collected.

The Permittee shall adhere to the following field custody procedures:

1. When collecting samples, as few people as possible should handle them;
2. Sampling personnel are responsible for the care and custody of samples until they are transferred or properly dispatched to the laboratory in accordance with the procedures described herein; and
3. Sample tags or labels shall be completed for each sample using waterproof ink, or covered by transparent waterproof tape.

6.5.6. In-Situ Testing and Other Tests

In-situ permeability tests, remediation system pilot tests, stream flow tests, and other tests conducted to evaluate site, surface, and subsurface conditions shall be designed to accommodate specific site conditions and to achieve test objectives. The testing methods must be approved, in writing, by the Department prior to implementation. The tests shall be conducted in accordance with Department, EPA, United States Geological Survey, ASTM International (ASTM - http://www.astm.org/) or other methods generally accepted by industry that will allow information representative of site conditions to be obtained. Detailed logs of all relevant site conditions and measurements shall be made during the testing events. A summary of the general test results, including unexpected or unusual test results and equipment failures or testing limitations shall be reported to the Department. The summary shall be presented in a format acceptable to the Department and in general accordance with the report formats outlined in Permit Section 6.2.4.

6.5.7. Collection and Management of Investigation Derived Waste

IDW includes, but is not limited to, general refuse, drill cuttings, excess sample material, water (e.g., decontamination, development and purge), spent materials, and used disposable equipment generated during the course of investigation, corrective action, or monitoring activities. All IDW shall be properly characterized and disposed of in accordance with Permit Attachment C (Waste Analysis Plan) and all federal, state, and local laws and regulations for storage, labeling, handling, transport, and disposal of waste. The Permittee shall include a description of the anticipated IDW management process as part of any work plan submitted to the Department for approval.

All waste generated during sampling and decontamination activities shall be temporarily stored in containers appropriate for the waste.

6.5.8. Surveying Sample, Well, and Site Feature Locations

The horizontal and vertical coordinates of the top of each monitoring well casing and the ground surface elevation at each monitoring well location shall be determined by a registered New Mexico professional land surveyor or licensed Professional Engineer. Horizontal coordinates shall be measured in accordance with the State Plane Coordinate System (NMSA 1978, 47-1-49-56 [Repl. Pamp. 1993]). The surveys shall be conducted in accordance with 12.8.2 NMAC -- *Minimum Standards for Surveying in New Mexico*. Horizontal positions shall be measured to the nearest 0.1 foot, and vertical elevations shall be measured to the nearest 0.01 foot. The Permittee shall prepare site map(s), certified by a registered New Mexico professional land surveyor or licensed Professional Engineer, presenting all surveyed locations and elevations of wells and relevant site features and structures for submittal with all associated reports to the Department.

Site attributes (e.g., soil sample locations, sediment sample locations, springs, outfalls, pertinent structures, monitoring stations, as well as staked-out sampling grids), shall be located by using the global positioning system (GPS), an electronic total station with prism reflectors, transit with stadia rod or tape, or a combination of these surveying systems, or by a registered New Mexico Registered Land Surveyor or licensed Professional Engineer using the methods described in the paragraph above. Horizontal locations of site attributes shall be measured to the nearest 1.0-foot.

The Permittee shall provide the Department with a statement of accuracy for survey data upon request.

6.5.9. Requirements for Exploratory and Well Installation Borings and Exploratory Excavations

Borings shall be completed at locations specified in this Permit or as approved by the Department in Investigation Work Plans. The Department may require additional exploratory or well borings as needed to ensure protection of human health and the environment. Any additional boring locations will be determined, and approved, by the Department. The anticipated depths and locations of exploratory and well borings shall be specified in work plans submitted to the Department for approval prior to the start of the field activities.

Borings that are not completed as permanent groundwater or soil-vapor monitoring wells shall be properly abandoned. Borings completed as either groundwater monitoring or soil-vapor wells shall be completed in accordance with the requirements described in this Permit Section (6.5.9).

Exploratory and monitoring well borings shall be drilled using the most effective, proven, and practicable method for recovery of undisturbed samples and potential contaminants. The drilling method selected must be approved by the Department prior to the start of field activities. Based on the drilling conditions, the borings shall be completed using one of the following methods:

1. Hollow-stem auger;
2. Air rotary;
3. Mud rotary (generally will not be approved by the Department);
4. Percussion hammer;
5. Dual wall air rotary;
6. Direct Push Technology;
7. Cable tool;
8. Sonic; or
9. Air Rotary Casing Hammer (ARCH).

Hollow-stem auger or Direct Push Technology drilling methods are preferred if vapor-phase or volatile organic compound (VOC) contamination is known or suspected to be present. Air rotary, hollow stem auger, percussion hammer, dual wall air rotary, direct push technology, cable tool or sonic drilling are preferred for borings intersecting the saturated zone of any aquifer. The type of drilling fluids or additives used, if necessary, must be approved by the Department prior to the start of drilling activities. The use of drilling fluids, especially other than air and potable water, is discouraged.

All drilling equipment shall be in good working condition and capable of performing the assigned task. Drilling rigs and equipment shall be operated by properly trained, experienced, and responsible crews. The Permittee is responsible for ensuring that contaminants from another site or facility are not introduced into the SWMU or AOC under investigation due to equipment malfunction or poor equipment decontamination. Drilling equipment shall be properly decontaminated before initiation of drilling for each boring.

Exploratory borings shall be advanced to the depths specified or approved by the Department. The Permittee shall propose drilling depths in the site-specific work plans submitted for each subject area where subsurface investigations are needed. Unless otherwise specified in this Permit or approved by the Department in work plans, the borings shall be advanced to the following minimum depths (see also Permit Section 6.5.11):

1. In all borings, 25 feet below the deepest detected contamination;
2. Twenty-five feet below the base of disposal units;
3. Five feet below the base of shallow structures such as piping or building sumps, or other building structures; and
4. Depths specified by the Department based on regional, or on SWMU or AOC specific data needs.

The Permittee shall notify the Department as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the depths specified or approved by the Department so that alternative actions may be approved. Precautions shall be taken to prevent the migration of contaminants between geologic, hydrologic, or other identifiable zones during drilling and well installation activities. Contaminant zones shall be isolated from other zones encountered in the borings.

The drilling and sampling shall be conducted under the direction of a qualified engineer or geologist who shall maintain a detailed log of the materials and conditions encountered in each boring. Both sample information and visual observations of the cuttings and core samples shall be recorded on a boring log. Known site features and/or site survey grid markers shall be used as references to locate each boring prior to surveying the location. The boring locations shall be located to the nearest foot of their planned location, and locations shall be recorded on a scaled site map upon completion of each boring.

Trenching and other exploratory excavation methods shall follow the applicable general procedures outlined in this Permit. Methods proposed by the Permittee for exploratory excavation and sampling at any SWMU or AOC shall be included in a site-specific Investigation Work Plan submitted to the Department.

6.5.10. Requirements for Geophysical Surveys

Where necessary, the Permittee shall conduct geophysical surveys to locate underground utilities, pipelines, drums, debris, and other buried features, including buried waste, in the shallow subsurface. The methods used to conduct the surveys, such as magnetometer, ground penetrating radar, resistivity, or other methods, shall be selected based on the characteristics of the site and the possible or suspected underground features. Results of the surveys shall be included in Investigation Reports submitted to the Department.

The Department may require the Permittee to excavate test pits or trenches to identify targets located by geophysical surveys.

The Permittee shall conduct geophysical logging of boreholes using techniques such as acoustic televiewer, spinner flow, acoustic velocity/full wave form acoustic, density/porosity, gamma, neutron, single point resistance or electric (long/short normal or inductance) methods as required by the Department.

6.5.11. Requirements for Deep Subsurface Soil, Rock, and Sediment Sampling

Deep subsurface samples are those collected at depths that generally require the use of power equipment. Relatively undisturbed discrete soil and rock samples shall be obtained, where possible, during the advancement of each boring for the purpose of logging, field screening, and analytical testing. Generally, samples shall be collected at the following intervals and depths:

1. At five-foot intervals, ten-foot intervals, continuously, or as approved by the Department;
2. At the depth immediately below the base of the disposal unit or facility structure;
3. At the maximum depth of each boring or excavation;
4. At the depths of contacts or first encounter with geologic units of different lithology, structural or textural characteristics, or of relatively higher or lower permeability that are observed during drilling or excavating;
5. At depths where soil or rock types are more likely to sorb or retain contaminants as compared to surrounding lithologic units;
6. At the depth of the first encounter of any saturated zones;
7. At intervals suspected of being source or contaminated zones; and
8. At other intervals approved or required by the Department.

Additional samples may be obtained from any depth based on field observations. A split-barrel sampler lined with brass sleeves, a coring device, or other method approved by the Department shall be used to obtain samples during the drilling of each boring.

A split barrel sampler lined with brass sleeves is the preferred sampling method for borehole soil and sediment; a coring device is the preferred sampling method for rock sampling. The following procedures should be followed if a split barrel sampler is used. Upon recovery of the sample, the brass sleeves shall be removed from the split barrel sampler, and the open ends of the sleeves covered with Teflon tape or foil and sealed with plastic caps fastened to the sleeves with tape for shipment to an analytical laboratory. If brass sleeves are not used, a portion of the sample shall be placed in clean containers for laboratory analysis. The remaining portions of the sample shall be used for field screening and logging, as described in Permit Sections 6.5.13 and 6.5.15, respectively.

Discrete samples shall be collected for field screening and laboratory analyses. For analyses other than that for VOCs and semivolatile organic compounds (SVOCs), the Permittee may submit site-specific, alternative methods for homogenization of samples in the field to the Department for review and written approval.

Samples to be submitted for laboratory analyses shall be selected based upon: 1) the results of the field screening or mobile laboratory analyses; 2) the position of the sample relative to

groundwater, suspected releases, or site structures; 3) the sample location relative to former or altered site features or structures; 4) the stratigraphy encountered in the boring; and 5) the specific objectives and requirements of this Permit and the approved work plan for the SWMU or AOC under investigation. The proposed number of samples and analytical parameters shall be included as part of the site-specific work plan submitted to the Department for approval prior to the start of field investigation activities.

6.5.12. Surface and Shallow Subsurface Soil and Sediment Sampling Procedures

Surface soil samples are those collected at depths of 0 to 6 inches. Shallow subsurface samples are those collected at depths that do not require the use of power equipment. Surface and shallow subsurface soil and sediment samples shall be collected in accordance with the procedures described below.

Samples that are collected for analyses other than for VOCs or SVOCs shall be obtained using a hand-held stainless steel coring device, Shelby tube, thin-wall sampler, or other device approved by the Department. The samples shall be transferred to clean containers for submittal to the laboratory.

Samples obtained for VOC or SVOC analysis shall be collected using Shelby tubes, thin-wall samplers, or other device approved by the Department. The ends of the samplers shall be lined with Teflon tape or aluminum foil and sealed with plastic caps fastened to the sleeves with tape for shipment to the analytical laboratory.

6.5.13. Field Screening of Soil, Rock, and Sediment Samples

Samples shall be screened in the field for the presence of contaminants, if required by the Investigation Work Plan or other sampling and analysis plan. Field screening results shall be recorded on the exploratory boring and excavation logs or other field logs. Field screening results are used as a general guideline to determine the nature and extent of possible contamination. In addition, screening results shall be used to aid in the selection of soil, rock, sediment, and vapor-phase samples for laboratory analysis.

The primary screening methods to be used shall include:

1) Visual examination;
2) Headspace vapor screening for VOCs; and
3) Metals screening using X-ray fluorescence (XRF).

Additional screening for characteristics such as pH, high explosives, or for other specific compounds using field test kits shall be conducted where appropriate.

Headspace vapor screening shall target VOCs and shall be conducted by placing a soil, sediment, or rock sample in a plastic sample bag or a foil-sealed container, allowing head space for ambient air. The container shall be sealed and then shaken gently to expose the sample to the air trapped in the container. The sealed container shall be allowed to rest for a minimum of five minutes while vapor concentrations equilibrate. Vapor concentrations present within the headspace will then be measured by inserting the probe of the monitoring instrument into a small opening in the bag or through the foil. The maximum value and the ambient air temperature shall be recorded on the log for each sample. A photo-ionization detector equipped with a 10.6

or higher electron volt (eV) lamp, combustible gas indicator, or other instrument approved by the Department shall be used for VOC field screening. The limitations, precision, and calibration procedures of the monitoring instrument to be used for VOC field screening shall be included in the Investigation Work Plan prepared for each SWMU or AOC.

XRF shall target metals. XRF screening requires proper sample preparation and instrument calibration. Sample preparation and instrument calibration procedures shall be documented in the field logs. The methods and procedures for sample preparation and instrument calibration shall be approved by the Department prior to the start of field activities.

The Permittee shall record on the field logs all conditions capable of influencing the results of field screening. The Permittee shall submit to the Department a report detailing any conditions potentially influencing field screening results. This report shall be included in any report where the field screening results are presented.

At a minimum, the Permittee shall submit the samples with the greatest apparent degree of contamination, based on field observations and field screening, for laboratory analysis. In addition, the Permittee shall submit the samples with no or little apparent contamination, based on field screening, for laboratory analysis if the intention is to confirm that the base (or other depth interval) of a boring or other sample location is not contaminated.

6.5.14. Field Quality Control for Soil, Rock, and Sediment Sampling

The Permittee shall collect Quality Control (QC) samples to monitor the quality of sample collection and laboratory analysis.

Field duplicates shall consist of two samples either split from the same sample device or collected sequentially. Field duplicates shall be collected at a rate of at least 10 percent of the total number of environmental samples submitted for analysis. At a minimum, one duplicate sample shall always be collected and analyzed for the appropriate contaminants.

The Permittee shall prepare and analyze equipment blanks from all sampling apparatus at a frequency of at least five percent of the total number of samples submitted for analysis. Equipment blanks shall be generated by rinsing decontaminated sampling equipment with deionized water, and capturing the rinsate water in an appropriate sample container.

In the case of VOC analyses, the Permittee shall prepare and analyze field blanks at a frequency of at least one per day for each medium sampled at each SWMU, AOC, or other site.

Reagent blanks shall be prepared and analyzed if chemical analytical procedures requiring reagents are employed in the field as part of the investigation or monitoring program.

Each type of QC sample shall be submitted for laboratory analyses, and analyzed in the same batch that the environmental samples they represent.

6.5.15. Logging of Soil, Rock, and Sediment Samples

The physical characteristics of soil, rock, and sediment samples, such as mineralogy, ASTM soil classification, American Geological Institute rock classification, moisture content, texture, color, presence of stains or odors, field screening results, depth, location, method of sample collection, and other observations shall be recorded in a field log. Samples shall be visually inspected and

the soil, sediment, or rock type classified in general accordance with ASTM D2487 (Unified Soil Classification System) and ASTM D2488 (Standard Practice for Description and Identification of Soils), or American Geological Institute Methods for soil and rock classification or in other ways approved by the Department. Detailed logs shall be completed in the field by a qualified geologist. Additional information, such as the presence of water-bearing zones and any unusual or notable conditions encountered during drilling shall be recorded on the logs. Field boring logs, test pit logs, and field well construction diagrams shall be converted to a format acceptable for use in final reports submitted to the Department.

6.5.16. Requirements for Soil-Vapor Monitoring

Samples of subsurface vapors shall be collected from vapor monitoring points where required by the Department. The Permittee shall, as required by the Department, collect soil-vapor samples for field measurement of:

1. Percent oxygen;
2. Organic vapors (using a photo-ionization detector with a 10.6 eV lamp, a combustible vapor indicator or other method approved by the Department);
3. Percent carbon dioxide;
4. Static subsurface pressure; and
5. Other parameters, such as carbon monoxide and hydrogen sulfide.

The Permittee also shall collect soil-vapor samples for laboratory analysis of the following:

1. Percent moisture;
2. VOCs; and
3. Other analytes required by the Department.

When collecting soil-vapor samples for laboratory or field analysis, the Permittee shall continually monitor the concentrations of soil vapor from a given monitoring point with an appropriate field instrument (e.g., photoionization detector). The Permittee shall collect soil-vapor samples after the field instrument readings have stabilized and after the sampling tubing and soil-vapor monitoring well have been appropriately purged to remove all stagnant vapor. Soil-vapor samples for laboratory analysis shall be collected using SUMMA canisters[1] or other sample collection method approved by the Department. The samples shall be analyzed for VOC concentrations by EPA Method TO-15 (as it may be updated) or equivalent VOC analytical method approved by the Department.

In the field, soil-vapor measurements, the date and time of each measurement, and the type and

1 The term “SUMMA” Canister is a trademark that refers to electropolished, passivated stainless steel vacuum sampling devices, such as TO canisters, SilcoCans, MiniCans, etc, which are cleaned, evacuated, and used to collect whole-air samples for laboratory analysis

serial number of field instrument used shall be recorded in a field log book. The method used to obtain soil-vapor field measurements and samples must be approved by the Department in writing prior to the start of monitoring.

Soil vapor wells shall not be installed with the use of any fluids. Soil vapor wells may be completed by backfilling with native materials. If a soil vapor well is installed as a permanent monitoring point, the Permittee shall not sample the well before the expiration of the 24-hour equilibration period following completion of installation. Information on the design and construction of soil-vapor monitoring wells shall be recorded as for groundwater monitoring wells (Permit Section 6.5.17.10) as applicable.

Soil-vapor monitoring wells shall be designed and constructed in a manner that will yield high-quality samples. The design and depth of installation must be approved by the Department.

6.5.17. Technical Requirements for Groundwater Investigations

The Permittee shall conduct investigations of groundwater in accordance with Department approved work plans to fully characterize the nature, vertical and lateral extent, concentration, rate of migration, fate, and transport of groundwater contamination originating from the Facility to determine the need for, and scope of, corrective action. The investigation shall include an evaluation of the physical, biological, and chemical factors influencing the transport of hazardous constituents and other contaminants in groundwater. The Permittee shall implement the groundwater investigation requirements in accordance with the requirements set forth in this Permit Section (6.5.17) and in approved work plans. All data shall be collected according to Department, EPA and industry accepted methods and procedures, and in accordance with this Permit Section (6.5.17) and any other requirements of this Permit.

6.5.17.1. Objectives

The Permittee shall implement groundwater investigations to determine the following as required by the Department:

1. Nature, extent, rate of migration, and concentration of historical and current releases of contaminants to groundwater;
2. Fate and transport, including boundary conditions, of contaminants releases within groundwater;
3. The depth to groundwater, water table elevations, potentiometric surfaces, and any seasonal variations;
4. Groundwater flow directions and velocities;
5. Migration of groundwater across hydrostratigraphic and structural boundaries;
6. Watershed and regional water balance information for evaluating contaminant fate and transport including:
    - recharge and discharge locations, rates, and volumes,
    - evapotranspiration data,
    - stream-flow data;

7. Water supply well pumping influences, including data for wells not owned by the Permittee, if available;
8. Saturated and unsaturated hydraulic-conductivity ($K_{x,y,z}$), porosity, effective porosity, permeability, transmissivity, particle-size, storage coefficients, and estimated fracture/secondary porosity;
9. Contaminant concentrations in soil, rock, sediment, air, and vapor; and absorption coefficients (K_{ds});
10. Changes in groundwater chemistry and the causes;
11. Regional and perched aquifer boundaries;
12. Geologic, hydrostratigraphic, and structural relationships; and,
13. General water chemistry.

In selecting a site for a new well, the Permittee shall consider paleotopography, fracture density and orientation, source areas, contaminant characteristics, geologic structures, groundwater flow direction, and the known occurrences of groundwater. All existing and newly installed wells and piezometers shall be surveyed in accordance with the requirements described in Permit Section 6.5.8.

6.5.17.2. Groundwater Levels

The Permittee shall obtain groundwater levels in all wells from which the Permittee is collecting groundwater samples and from other wells as specified by the Department, the schedule for which shall be provided in the Investigation Work Plans or other work plans.

Groundwater levels shall be measured in monitoring wells at frequencies required by the Department and within 24 hours from the start of monitoring the water level in the first well, unless another time frame is specified in the work plan and approved by the Department. Groundwater levels also shall be obtained prior to purging for any sampling event. Measurement data and the date and time of each measurement shall be recorded on a field log. The depth to groundwater shall be measured to the nearest 0.01 foot. The depth to groundwater shall be recorded relative to the surveyed well casing rim or other surveyed datum, as appropriate.

6.5.17.3. Groundwater Sampling

Initial groundwater samples shall be obtained from newly-installed monitoring wells within 30 days after completion of well development. Subsequent groundwater monitoring and sampling shall be conducted at frequencies approved by the Department. All monitoring wells specified in a Department approved Investigation Work Plan shall be sampled within 21 calendar days from the start of the groundwater sampling event. The Permittee shall sample all groundwater in all wells as specified in a Department-approved Investigation Work Plan. Any requests for variances from the approved groundwater sampling plan or schedule shall be submitted to the Department in writing 90 days prior to the start of scheduled monitoring and sampling events.

Groundwater samples shall be collected from all saturated zones including from exploratory borings that are not intended to be completed as monitoring wells prior to abandonment of the borings.

In addition to other required analyses, water samples shall be analyzed in accordance with approved work plans for one or more of the following general chemistry parameters in Table 6-1 below. The Department will specify through approved work plans which parameters in Table 6-1 that the Permittee must analyze for in water samples.

TABLE 6-1.
Groundwater General Chemistry Parameters

nitrate/nitrite	sulfate	chloride	sodium
dissolved CO2	alkalinity	carbonate/bicarbonate	boron
fluoride	manganese	calcium	silicon
ferric/ferrous iron	ammonia	potassium	phosphorus/phosphate
strontium	lithium	magnesium	molybdenum
Total Kjeldahl Nitrogen (TKN)	total organic carbon	suspended sediment concentration*	
total dissolved solids	bromide	stable isotopes (as required by the Department)	
Other parameters indicating oxidation/reduction conditions			
Eh	pH	dissolved oxygen	specific conductivity
dissolved manganese		dissolved iron	
sulfide		alkalinity	
temperature			

*ASTM Method D3977-97 standard test for determining sediment concentration in water samples

6.5.17.4. Well Purging

All screened zones in each monitoring well shall be purged by removing groundwater prior to sampling in order to ensure that fresh formation water is sampled. Purge volumes shall be as required by the Department. Field parameters that shall be monitored while purging are: groundwater pH, specific conductance, dissolved oxygen concentrations, turbidity, redox potential, and temperature. Field parameters shall be recorded at intervals approved by the Department. Measuring instruments are to be approved by the Department and are to be specified in the Investigation Work Plan or other sampling and analysis plan. The volume of groundwater purged, the readings obtained at each interval, and the instruments used shall be recorded on the field monitoring log. Water samples shall be obtained from a well only after the measured values of purge water field parameters have stabilized to within 10 percent for three consecutive measurements and after purging at least 75 percent of one well-bore volume. A well-bore volume is herein defined as the volume of water in the saturated filter pack plus the volume of all standing water within the well screen and casing including the sump. The Permittee may submit to the Department for approval, a written request for a variance from the described method of well purging for individual wells no later than 90 days prior to scheduled

sampling activities.

6.5.17.5. Groundwater Sample Collection

Groundwater samples shall be obtained using methods approved by the Department within eight hours of the completion of well purging. Groundwater in monitoring wells with low recharge rates and that purge dry shall be sampled when the water level in the well has recovered sufficiently to collect the required samples. Sample collection methods shall be documented in field monitoring logs. The samples shall be transferred to appropriate clean containers. Sample handling and chain-of-custody procedures that shall be implemented are described in Permit Sections 6.5.5. Decontamination procedures shall be established and, implemented, for non-dedicated water sampling equipment as described in Permit Section 6.5.3.

Groundwater samples intended for metals analysis shall be submitted to the laboratory for analyses of total metals; the samples shall not be filtered in the field or laboratory, unless the Department requires analyses for dissolved metals concentrations. If dissolved metals concentrations are required by the Department, the Permittee shall obtain groundwater samples for dissolved metals analysis; said samples shall be filtered using disposable in-line filters with a 0.45 micron or other mesh size approved by the Department.

6.5.17.6. Field QC for Groundwater Sampling

Field duplicates, field blanks, equipment rinsate blanks, reagent blanks, and trip blanks (the latter required for VOC analyses only) shall be collected or prepared and analyzed for quality control purposes. The samples shall be managed as described in Permit Section 6.5.5.

Field duplicates shall consist of two samples collected sequentially. Field duplicate samples shall be collected and analyzed at a frequency of at least 10 percent of the total number of environmental samples submitted for analysis. At a minimum, one duplicate sample per sampling event shall always be collected and analyzed.

In the case of VOC analyses, field blanks shall be prepared and analyzed at a frequency of no less than one per day per SWMU or AOC. Field blanks shall be generated by filling sample containers in the field with deionized water and submitting the field blank, along with the groundwater samples, to an analytical laboratory.

Equipment blanks shall be prepared and analyzed at a rate of at least five percent of the total number of environmental samples submitted for analysis, but no less than one equipment blank per sampling day. Equipment blanks shall be generated by rinsing decontaminated sampling equipment with deionized water, and capturing the rinsate water in an appropriate clean container. The equipment blank then shall be submitted with the groundwater samples to the analytical laboratory for the same analyses as the environmental samples.

Reagent blanks may be required by the Department if chemical analyses requiring the use of chemical reagents are conducted in the field during water sampling activities. Reagent blanks shall be prepared and analyzed at a frequency of at least 10 percent of the total number of media samples, but no less than one per day per SWMU or AOC.

Trip blanks shall be prepared using deionized water. Trip blanks shall be managed exactly the same as environmental samples. Trip blanks shall accompany sampling personnel into the field

throughout sampling activities, and then shall be placed into a shipping container with environmental samples for shipment to the analytical laboratory. Trip blanks shall be analyzed at a frequency of one for each shipping container holding samples for VOC analysis.

6.5.17.7. Periodic Monitoring Report

The Permittee shall submit to the Department periodic monitoring reports providing the results of the monitoring and sampling of groundwater, surface water, and springs over the previous reporting period. The reports shall be prepared in accordance with Permit Section 6.2.4.4. The reports shall be submitted within 90 days after completion of the monitoring fieldwork or in accordance with the schedule set forth in the approved monitoring work plans.

6.5.17.8. Springs

The sampling and analysis requirements for groundwater found in this Permit shall also apply to springs. Additionally:

1. Springs shall be sampled as close to the point of discharge as possible and shall be sampled at the same locations during each sampling event. If field conditions change, the spring shall be sampled as close to the original location as possible, and the Permittee shall notify the Department in the periodic monitoring report that the sampling location for the spring has changed;
2. The sampling point for each spring shall be located in accordance with the survey methods described in Permit Section 6.5.8 or by other survey methods approved by the Department;
3. Spring water flow rates shall be measured. In addition, as required by the Department, pH, specific conductance, dissolved oxygen, turbidity, temperature, and oxidation-reduction potential of the spring water shall be measured during each sampling event;
4. Spring samples shall be submitted to an analytical laboratory for analyses of the general chemistry parameters listed in Permit Section 6.5.17.3, as required by the Department and in accordance with approved work plans; and
5. The Permittee shall perform the same field QC procedures as are described in Permit Section 6.5.17.6 and Section 1.3 of Permit Attachment D for groundwater.

6.5.17.9. Surface Water

Surface water samples shall be collected using methods approved by the Department. Samples shall be collected and placed into clean containers. Field parameters and the methods and instruments used to measure them shall be approved by the Department prior to conducting surface water sampling. The sampling and monitoring techniques used and the measurements obtained shall be recorded in field monitoring logs. Stream flow rates shall be measured in conjunction with surface water sampling events.

The Permittee shall perform the same field QC procedures as are detailed in Permit Section 6.5.17.6 and Section 1.3 of Permit Attachment D for groundwater.

6.5.17.10. Groundwater Monitoring Well Construction Requirements

Groundwater monitoring wells shall be designed and constructed in a manner that will yield high

quality samples, ensure that the well will last the duration of the project or other specified time period, and ensure that the well will not serve as a conduit for hazardous constituents to migrate between different stratigraphic units or aquifers. The design and construction of groundwater monitoring wells shall comply with the guidelines established in various RCRA guidance, including, but not limited to:

1. EPA, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September, 1986; and
2. Aller, L., Bennett, T.W., Hackett, G., Petty, R.J., Lehr, J.H., Sedoris, H., Nielsen, D.M., and Denne, J.E., *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells*, EPA 600/4-89/034, 1989.

All well construction and installation shall be conducted in accordance with this Permit Section (6.5.17.10) of this Part and in accordance with approved work plans. All monitoring and sampling shall be conducted in accordance with Permit Section 6.5.17 and in accordance with approved work plans.

The Department must approve in writing all drilling locations, monitoring well and piezometer construction and installation details, sampling depths, and abandonment activities prior to the start of these activities.

6.5.17.10.1. Drilling Methods

A variety of methods are available for drilling monitoring wells. While the selection of the drilling procedure is usually based on the site-specific geologic conditions, the following issues shall be considered:

1. Drilling shall be performed in a manner that minimizes impacts to the natural properties of the subsurface materials;
2. Drilling shall be performed in a manner that contamination and cross-contamination of groundwater and aquifer materials is avoided;
3. The drilling method shall allow for the collection of representative samples of rock, unconsolidated sediment, and soil;
4. The drilling method shall allow the Permittee to determine when the appropriate location for the screened interval(s) has been encountered;
5. The drilling method shall allow for the proper placement of a filter pack and annular sealant for each monitored zone, and the borehole diameter shall be at least four inches larger in diameter than the nominal diameter of the well casing and screen to allow adequate space for emplacement of the filter pack and annular sealants;
6. The drilling method shall also allow for the collection of representative groundwater samples, and drilling fluids, including air, shall be used only when minimal impact to the surrounding formation and groundwater can be ensured (in general the Department discourages the use of drilling mud and drilling additives for groundwater monitoring well installations); and,
7. Requirements specified in Permit Section 6.5.9.

Justification for the drilling method used must be provided in writing to the Department for approval prior to well installations.

6.5.17.10.2. Monitoring Wells and Piezometers Construction

The Permittee shall submit to the Department for approval work plans for construction of wells and piezometers that meet the following requirements:

1. If required by the Department, well and piezometer borings targeting the contact between alluvium and bedrock shall be advanced to a minimum depth of five feet below the alluvium-bedrock interface;
2. Samples of sediment, bedrock, soil, and soil vapor shall be collected as appropriate for hydraulic and soil property testing and for analysis to determine the presence of hazardous waste and constituents at depths or intervals approved by the Department;
3. Samples shall at a minimum be obtained from each boring between the ground surface and one foot below the ground surface (0.0-1.0 foot interval), at subsequent five-foot intervals, at any alluvium-bedrock contact, and at the maximum depth of each boring. For sites where drilling depths exceed 50 feet, the Permittee may propose for Department approval alternative sampling intervals in work plans;
4. Field screening and chemical analyses of collected samples shall be conducted in accordance with Permit Section 6.5.13 and in accordance with approved work plans;
5. Groundwater, soil, soil vapor, rock, and sediment samples collected during drilling activities shall be delivered to an analytical laboratory for the required analyses;
6. No borehole shall be left open or cased with temporary casing for longer than five days;
7. The Department may impose specific requirements for well construction, require borings to be extended to the regional aquifer, or require the drilling of additional borings that intersect perched saturated zones or the regional aquifer based on investigation results;
8. The proposed locations, depths and details of drilling, sampling, and well construction shall be described in work plans prepared in accordance with this Permit Section (6.5.17.10.2) and Permit Section 6.2.4.2 or other document approved by the Department prior to well installation;
9. Geophysical measurements shall be collected from the borings in accordance with Permit Section 6.5.10 and as required by the Department;
10. Where appropriate, the borings shall be monitored for the presence of vapor-phase hazardous constituents prior to well construction; and
11. Based on the results of subsurface soil-vapor monitoring, the Department may require that the Permittee construct the wells to accommodate subsurface soil-vapor monitoring in addition to groundwater monitoring and sampling.

6.5.17.10.3. Well and Piezometer Construction Materials

Well and piezometers construction materials shall be selected based on the goals and objectives of the proposed monitoring program and the geologic conditions at the site. When selecting

construction materials, the primary concern shall be selecting materials that will not contribute to or remove hazardous waste or constituents from groundwater samples. Other factors to be considered include the tensile strength, compressive strength, and collapse strength of the materials; the length of time the monitoring well or piezometer will be in service; and the material's resistance to chemical and microbiological corrosion.

6.5.17.10.4. Design and Construction of Screens and Filter Packs

Screens and filter packs shall be designed to allow accurate sampling of the saturated zone that the well is intended to sample, minimize the passage of formation materials (turbidity) into the well, and ensure sufficient structural integrity to prevent the collapse of the intake structure.

The filter pack shall be installed in a manner that prevents bridging and particle-size segregation. Filter packs shall be installed by the tremie pipe method. At least two inches of filter pack material shall be installed between the screen and the borehole wall, and two feet of filter pack material shall extend above the top of the screen. A minimum of six inches and a maximum of two feet of filter pack material shall also be placed under the bottom of the screen to provide a firm footing. The precise volume of filter pack material required shall be calculated and recorded before placement, and the actual volume used shall be determined and recorded during construction. Any significant discrepancy between the calculated and actual volume shall be explained. Prior to installing the filter pack annular seal, a one to two-foot layer of chemically inert fine sand shall be placed over the filter pack to prevent the intrusion of annular sealants into the filter pack. The use of pre-fabricated screens and filter packs shall be approved in advance of well installation by the Department.

6.5.17.10.5. Design and Construction of Annular Seals

The annular space between the casing and the borehole wall shall be properly sealed to prevent cross-contamination. The materials used for annular sealants shall be chemically inert with respect to the highest anticipated concentration of chemical constituents expected in the groundwater. The precise volume of annular sealant required shall be calculated and recorded before placement, and the actual volume shall be determined and recorded during construction. Any significant discrepancy between the calculated volume and the actual volume shall be explained.

During construction, an annular seal shall be placed on top of the filter pack. This seal shall normally consist of a high solids (10 to 30 percent) bentonite material in the form of bentonite pellets, granular bentonite, or bentonite chips. The seal shall be placed in the annulus through a tremie pipe. A tamping device shall be used to ensure that the seal is emplaced at the proper depth. The bentonite seal shall be placed above the filter pack with a minimum of two-foot vertical thickness. The bentonite seal shall be allowed to completely hydrate in conformance with the manufacturer's specifications prior to installing the overlying annular grout seal.

A grout seal shall be installed on top of the filter pack seal. The grout shall be placed into the annular space by the tremie pipe method, from the top of the filter pack annular seal to within a few feet of the ground surface; however, the grout shall be installed at intervals necessary to allow it time to cure and not damage the filter pack or filter pack annular seal during installation of the grout. The tremie pipe shall be equipped with a side discharge port (or bottom discharge for grouting at depths greater than 100 ft) to minimize damage to the filter pack or filter pack

annular seal during grout placement. The grout seal shall be allowed to cure for a minimum of 24 hours before the concrete surface pad is installed. All grouts shall be prepared in accordance with the manufacturer's specifications. High solids (30 percent) bentonite grouts shall have a minimum density of ten pounds per gallon (as measured by a mud balance) to ensure proper setup. Cement grouts shall be mixed using six and one-half to seven gallons of water per 94-pound bag of Type I Portland cement. Bentonite (five to 10 percent) may be added to delay the setting time and reduce the shrinkage of the grout.

6.5.17.10.6. Well and Piezometer Development Methods

All monitoring wells and piezometers shall be developed to create an effective filter pack around the screen, correct damage to the formation caused by drilling, remove residual drilling mud or other drilling additives, if present, and fine particles from the formation near the borehole, and assist in restoring the original water quality of the aquifer in the vicinity of the well or piezometer. Monitoring wells and piezometers shall be developed until the column of water in each well or piezometer is free of visible sediment, and the pH, temperature, turbidity, and specific conductance have stabilized to within 10%.

If a well or piezometer is pumped dry, the water level shall be allowed to sufficiently recover before the next development period is initiated.

Approval shall be obtained from the Department prior to introducing air, water, or other fluids into a well or piezometer for the purpose of development. If water is introduced to a borehole during drilling and completion, then at minimum the same volume of water shall be removed from the well or piezometer during development. In addition, the volume of water withdrawn from or introduced into a well or piezometer during development shall be recorded.

6.5.17.10.7. Surface Completion Methods

Monitoring wells and piezometers may be completed either as flush-mounted wells or piezometers, or as above-ground completions. A surface seal shall be installed over the grout seal and extended vertically up the well annulus to the land surface. The lower end of the surface seal shall extend a minimum of one foot below the frost line to prevent damage from frost heaving. The composition of the surface seal shall be neat cement or concrete. In above-ground completions wherein the well casing rises or sticks up above ground level, a three-foot square by four-inch thick concrete surface pad shall be installed around the well immediately after the protective casing is installed. The surface pad shall be sloped so that drainage will be off the pad and away from the protective casing. In addition, a minimum of one inch of the finished pad shall be below grade or ground elevation to prevent washing and undermining by soil erosion.

Protective casing with a locking cover shall be installed around the well or piezometer casing (stickup or riser) to prevent damage or unauthorized entry. The protective casing shall be anchored in the concrete surface pad below the frost line and extend at least several inches above the casing stickup. A weep hole shall be drilled into the protective casing just above the top of the concrete surface pad to prevent water from accumulating and freezing inside the protective casing. A cap shall be placed on the well riser to prevent the entry of foreign materials into the well or piezometer, and a lock shall be installed on the cover of the protective casing to provide security against tampering. If a well or piezometer is located in an area that receives vehicular

traffic, a minimum of three bumper guards consisting of steel pipes three to four inches in diameter and a minimum of five-feet in length shall be installed next to the concrete surface pad. The bumper guards shall be installed to a minimum depth of two feet below the ground surface in a concrete footing and extend a minimum of three feet above ground surface. The pipes that form the bumper guards shall be filled with concrete to provide additional strength, and shall be painted a bright color to make them readily visible.

If flush-mounted completions are required (e.g., in active roadway areas), a protective structure such as a traffic-rated utility vault or meter box shall be installed around the casing. In addition, measures should be taken to prevent the accumulation of surface water in the protective structure and around the well or piezometer intake. These measures shall include outfitting the protective structure with a steel lid or manhole cover that has a rubber seal or gasket, and ensuring that the bond between the cement surface seal and the protective structure is watertight. A lock shall be installed on the lid or cover of the protective structure to prevent unauthorized access to the well or piezometer.

6.5.17.10.8. Well and Piezometer Completion Reports

For each monitoring well or piezometer completed under this Permit, the Permittee shall submit to the Department a completion summary report within 30 days of completing installation which shall include a construction log and diagram, a boring log, and a development log. The construction log and diagram and the boring log shall contain at a minimum the information required under Permit Section 6.5.17.10.10.Well or piezometer development must be completed within 30 days of installation.

6.5.17.10.9. Well or Piezometer Abandonment

Wells and piezometers shall be abandoned when they are no longer required to address corrective action requirements or when they are damaged beyond repair; however, no well or piezometer shall be abandoned without prior approval by the Department. Well abandonment must comply with current State Engineer well abandonment guidance (19.27.4.30 and 31 NMAC)

For wells and piezometers with small diameter casing (i.e., two-inch or less), abandonment shall be accomplished by over drilling with a large diameter hollow-stem auger. After the well or piezometer has been over drilled, the casing and grout shall be removed from the ground with a drill rig, and the remaining filter pack shall be drilled out. The open borehole shall then be pressure-grouted via the tremie pipe method from the bottom of the borehole to the ground surface. After the grout has cured, the top two feet of the borehole shall be filled with concrete to insure a secure surface seal.

For larger-diameter wells (i.e. greater than 2-inch), the Permittee may attempt to remove the well casing or grout the well in place. To abandon a well or piezometer in place, a tremie pipe shall be placed at the lowest point in the well or piezometer (i.e., at the bottom of the screen or in the sump). The entire well or piezometer shall then be pressure grouted from the bottom upward to force grout out through the screen into the filter pack and up the inside of the casing, sealing off all breaks and holes in the casing. Once the well or piezometer is grouted, the casing shall be cut off even with the ground surface and covered with concrete.

6.5.17.10.10. Well and Piezometer Construction Diagrams, Logs, and Boring Logs

Information on the design, construction, and development of each monitoring well or piezometer shall be recorded. Construction and boring logs and diagrams shall include the following information:

1. Well, boring or piezometer name/number;
2. Date/time of construction;
3. Borehole diameter and casing diameter;
4. Surveyed location coordinates;
5. Total depth, expressed both as depth below ground surface and elevation above sea level;
6. Name of drilling contractor;
7. Casing length;
8. Casing materials;
9. Casing and screen joint type;
10. Screened intervals, expressed both as depth(s) below ground surface and elevation(s) above sea level;
11. Screen materials;
12. Screen slot size and design;
13. Filter-pack material and size;
14. Filter-pack volume (calculated and actual);
15. Filter-pack placement method;
16. Filter-pack interval(s), expressed both as depth(s) below ground surface and elevation(s) above sea level;
17. Annular sealant composition;
18. Annular sealant placement method;
19. Annular sealant volume (calculated and actual);
20. Annular sealant interval, expressed both as depth below ground surface and elevation above sea level;
21. Surface sealant composition;
22. Surface seal placement method;
23. Surface sealant volume (calculated and actual);
24. Surface sealant interval, expressed both as depth below ground surface and elevation above sea level;
25. Surface seal and well apron design and construction;
26. Development procedure and turbidity measurements;
27. Well development purge volume(s) and stabilization parameter measurements;
28. Type, design, and construction of protective casing;
29. Type of cap and lock;

30. Ground surface elevation above sea level;
31. Survey reference point elevation above sea level on well casing;
32. Top of casing elevation above sea level;
33. Top of protective steel casing elevation above sea level;
34. Drilling method(s); and
35. Types, quantities, and dates/times that additives were introduced, if any.

6.5.18. Laboratory Analyses Requirements for all Environmental Media

The Permittee shall submit all samples for laboratory analysis to laboratories within the EPA Contract Laboratory Program. The laboratories shall use the most recent EPA and industry-accepted extraction and analytical methods as the testing methods for each medium sampled.

The Permittee shall submit a list of analytes and analytical methods to the Department for review and written approval as part of each site-specific investigation, corrective action, or monitoring work plan. The analyte detection limit for each analytical method shall be less than applicable background or regulatory cleanup level as applicable. Analyses conducted with detection limits that are greater than applicable background or regulatory cleanup levels as applicable shall be considered data quality exceptions, and the reasons for use of the elevated detection limits shall be reported to the Department; results based on these data quality exceptions may not be accepted by the Department. All analytical data (including non-detects, estimated values, and detects) shall be included in the electronic copy of the Investigation Report or other report in Microsoft™ Excel format with any qualifiers as attached from the analytical laboratory. The Permittee shall not censor data based on detection limits, quantitation limits, or measurement uncertainty. The Permittee shall also report whether any dilution of the sample was needed prior to laboratory analysis, and the amount of dilution, if any. The Department will not accept J-coded (estimated) results for samples requiring dilution prior to laboratory analysis.

6.5.18.1. Laboratory QA/QC Requirements

The following requirements for laboratory QA/QC procedures shall be considered the minimum QA/QC standards for the laboratories employed by the Permittee. The Permittee shall provide to the Department the names of the contract analytical laboratories within 45 days of awarding a contract for analytical services to any contract laboratory. The Permittee shall maintain copies of laboratory QA/QC manuals in the Operating Record and they shall be subject to inspection by the Department.

6.5.18.1.1. Quality Assurance

The Permittee shall ensure that contract analytical laboratories maintain internal quality assurance programs in accordance with EPA and industry-accepted practices and procedures. At a minimum, the laboratories shall use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), and other laboratory control samples to assess data quality. The laboratories shall establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories shall establish internal QA/QC procedures that meet EPA's laboratory certification requirements. Specific procedures to be completed are identified in the following sections. If a laboratory is

unable or unwilling to meet the requirements of this Permit, the Permittee shall select a different laboratory that can and will meet the requirements.

6.5.18.1.2. Equipment Calibration Procedures and Frequency

The laboratories' equipment calibration procedures, calibration frequency, and calibration standards shall be in accordance with the EPA test method requirements and documented in quality assurance and standard operating procedures manuals. All instruments and equipment used by laboratories shall be operated, calibrated, and maintained according to manufacturers' guidelines and recommendations. Operation, calibration, and maintenance shall be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance shall be kept on file at the laboratories.

6.5.18.1.3. Laboratory QC Samples

Analytical procedures shall be evaluated for quality by analyzing reagent blanks or method blanks, surrogates, MS/MSDs, and laboratory duplicates, as appropriate for each method. Laboratory QC samples and frequency of analysis are documented in EPA test methods. At a minimum, laboratories shall analyze laboratory blanks, MS/MSDs, and laboratory duplicates at a frequency of at least one in 20 for all batch runs requiring EPA test methods and at a frequency of at least one in 10 for non-EPA test methods. All laboratory quality control data reported with the Facility's sample analysis results must be related to the analysis of the Facility's samples.

6.5.18.2. Laboratory Deliverables

Laboratory analytical data packages shall be prepared in accordance with EPA-established Level III or IV analytical support protocols. The following shall be provided in the analytical laboratory reports submitted to the Permittee either electronically or in hard (paper) copy:

1. Transmittal letter, including information about the receipt of samples, the testing methods performed, any deviations from the required procedures, any problems encountered in the analysis of samples, any data quality exceptions and qualifiers, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report;
2. Holding times and requirements;
3. Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; soil, rock, or sediment sample results in consistent units (such as mg/kg in dry-weight basis); water sample results in consistent units (such as milligrams/liter); soil-vapor sample results in consistent units (such as ug/m^3); and detection limits; results shall be reported for all samples, including field duplicates, blanks, and other QC samples;
4. Method blank results, including detection limits;
5. Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only);
6. MS/MSD concentrations, percent recoveries, relative percent differences (RPDs), and corresponding control limits;
7. Laboratory duplicate results, including RPDs and corresponding control limits;

8. Sample chain-of-custody documentation;
9. Instrument calibration; and
10. Discussion of completeness.

The following data deliverables for organic compounds shall also be required from the laboratory:

1. A cover letter referencing the analytical procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;
2. Data qualification in conformance with EPA protocol, and definition of data descriptor codes;
3. Reconstructed ion chromatograms for gas chromatograph/mass spectrometry (GC/MS) analyses for each sample and standard calibration;
4. Selected ion chromatograms and mass spectra of detected target analytes (GC/MS) for each sample and calibration with associated library/reference spectra;
5. Gas chromatograph/electron-capture device (GC/ECD) and/or gas chromatograph/flame ionization detector (GC/FID) chromatograms for each sample and standard calibration;
6. Raw data quantification reports for each sample and calibrations, including areas and retention times for analytes, surrogates, and internal standards;
7. A calibration data summary reporting calibration range used and a measure of linearity (include decafluorotriphenylphosphine and p-bromofluorobenzene spectra and compliance with tuning criteria for GC/MS);
8. Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitation limit for each analyte;
9. Analyte concentrations with reporting units identified, including data qualification in conformance with the CLP Statement of Work, including definition of data descriptor codes; and
10. Report of tentatively identified compounds with comparison of mass spectra to library/reference spectra.

The following data deliverables for inorganic compounds shall also be required from the laboratory.

1. A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported;
2. Results of all method QA/QC checks, including inductively coupled plasma (ICP) Interference Check Sample and ICP serial dilution results;
3. Raw data quantification report for each sample;
4. A calibration data summary reporting calibration range used and a measure of linearity, where appropriate; and
5. Final digestate volumes (and dilutions required), sample size, and wet-to-dry weight ratios.

The Permittee shall present summary tables of these data and Level II QC results to the Department in reports or other documents prepared in accordance with Permit Section 6.2.4. Raw analytical data, including calibration curves, instrument calibration data, data calculation work sheets, and other laboratory supporting data for samples from this project, shall be compiled and kept on file at the Facility for reference. The Permittee shall make all data available to the Department upon request.

6.5.18.3. Review of Field and Laboratory QC Data for all Media

6.5.18.3.1. General QC Review Process

The Permittee shall require the laboratory to notify the Permittee of data quality exceptions within three working days of discovery in order to allow for sample re-analysis, if possible. The Permittee shall contact the Department within three working days of receipt of the laboratory notification of data quality exceptions to discuss the implications to the sampling data, and to determine whether the data will still be considered acceptable or if sample re-analysis or resampling is necessary. The Permittee shall summarize the results of this discussion with Department personnel in a letter. The Permittee shall submit the letter to the Department by fax or electronic mail within five working days of the conclusion of the data quality discussion and shall mail the original signed copy of the letter to the Department within 10 days of the conclusion of the data quality discussion.

The Permittee shall evaluate all sample data, and all field and laboratory QC results for acceptability. Each group of samples shall be evaluated using data validation guidelines contained in EPA guidance documents, the latest version of SW-846, and industry-accepted methods and procedures. Additionally, the Permittee shall evaluate all data for compliance with the following parameters:

1. Representativeness -- the Permittee shall implement procedures to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. The Permittee shall note any procedures or variations that may affect the collection or analysis of representative samples and shall qualify the data accordingly;
2. Comparability -- to assure comparability of data, the Permittee shall implement standard collection and analytical procedures, and shall report analytical results in appropriate units for comparison with other data (e.g., past studies, comparable sites, screening levels, and cleanup standards). Any procedure or variation that may affect comparability shall be noted, and the data shall be qualified appropriately;
3. Completeness -- the Permittee shall evaluate all laboratory data for completeness with respect to data quality objectives. The degree of completeness shall be reported with the data in any reports in which the data are referenced;
4. Accuracy -- the Permittee shall evaluate all data for accuracy with respect to percent recovered of spiked samples. Results shall be reported for each analyte in any report in which the data are cited; and
5. Precision -- the Permittee shall evaluate all data for precision with respect to RPDs of duplicate samples. Results shall be reported for each analyte in any report in which the data are cited.

6.5.18.3.2. Review of Laboratory Reporting, Documentation, Data Reduction, and Corrective Action Process

Upon receipt of each laboratory data package, the Permittee shall evaluate the data against the criteria outlined in this Permit. Any deviation from the established criteria shall be noted and the data will be qualified appropriately. A full review and discussion of QC data and all data qualifiers shall be submitted with Investigation Reports or other reports prepared in accordance with Permit Section 6.2.4. Data validation procedures for all samples shall include review of the following, as appropriate:

1. Holding times;
2. Detection limits;
3. Field equipment rinsate blanks;
4. Field blanks;
5. Field duplicates;
6. Trip blanks;
7. Reagent blanks;
8. Laboratory duplicates;
9. Laboratory blanks;
10. Laboratory matrix spikes;
11. Laboratory matrix spike duplicates;
12. Surrogate recoveries; and
13. Representativeness, comparability, completeness, accuracy, and precision as required in Permit Section 6.5.18.3.1 above.

If quality control problems are encountered, appropriate corrective action shall be implemented. All corrective action shall be defensible and the corrected data shall be qualified as appropriate or rejected.

6.5.18.3.2.1. Blanks

The analytical results of field blanks and equipment blanks shall be reviewed to evaluate ambient site conditions and the adequacy of equipment decontamination, respectively. The analytical results of trip blanks shall be reviewed to evaluate the possibility for contamination of samples resulting from improperly cleaned sample containers or transport containers. The analytical results of laboratory blanks shall be reviewed to evaluate the possibility of contamination of a sample caused by analytical procedures. If reagent blanks are required, the analytical results of reagent blanks shall be reviewed to evaluate whether the reagents were contaminated prior to use. If contaminants are detected in any blanks, the sample data shall be qualified, as appropriate.

6.5.18.3.2.2. Field and Laboratory Duplicates

RPDs for field and laboratory duplicates shall be calculated and reported.

6.5.18.3.2.3. Laboratory Spikes

Percent recovered for laboratory spikes shall be calculated and reported.

6.5.18.3.2.4. Holding Times

The Permittee shall review the sampling, extraction, and analysis dates to confirm that extraction and analyses were completed within the recommended holding times, as specified by EPA protocol. Appropriate data qualifiers shall be noted if holding times were exceeded.

REFERENCES

New Mexico Environment Department (NMED), 2000. Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment, as updated, New Mexico Environment Department, Santa Fe, New Mexico, March 2000.

New Mexico Environment Department (NMED), 2009. Technical Background Document for Development of Soil Screening Levels, Rev. V, New Mexico Environment Department, Santa Fe, New Mexico, December 2009.

U.S. Environmental Protection Agency (EPA), 1980. Samplers and Sampling Procedures for Hazardous Waste Streams; Municipal and Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio, EPA-600/2-80-018, January 1980.

U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; 3rd edition, update 3, SW-846, Office of Solid waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2005. Guidance for Developing Ecological Screening Levels, Office of Solid waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., OSWER Directive 9825.7-55, Revised February 2005.

U.S. Environmental Protection Agency (EPA), 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites, December, 2009.

U.S. Environmental Protection Agency (EPA), 1996. Soil Screening Guidance: User's Guide, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., EPA-9355.4-23, July 1996.

PERMIT ATTACHMENT A: GENERAL FACILITY INFORMATION

1.0 INTRODUCTION

This Permit Attachment (A) presents a general description of Kirtland Air Force Base (KAFB-the Facility) and KAFB's Explosive Ordnance Disposal (EOD) Range. It also presents general information on wastes treated at the Open Detonation (OD) Unit.

1.1. GENERAL DESCRIPTION OF THE FACILITY AND THE EOD RANGE

KAFB, which is owned and operated by the U.S. Department of Defense (the Permittee), is located in Bernalillo County, adjacent to Albuquerque in north-central New Mexico. An estimated 24,000 people are employed at the Facility and at the U.S. Department of Energy and with other tenants located within the Facility. The Facility comprises an area of approximately 52,233 acres (about 82 square miles). The location of KAFB is shown on Figure 1-1 (Permit Part 1). The central mission of KAFB is the administration of defense programs for the U.S. Department of Defense.

The OD Unit is located on the EOD Range in the south-central portion of KAFB. The EOD Range is southeast of the former Manzano Base, east of Demolition Range Road, and approximately two miles north of the southern perimeter of KAFB (Figure 1-1, Permit Part 1). The OD Unit is circular in shape with a diameter of 1,500 feet Figure 2-1, Permit Part 2). Typical excavations (craters, pits) where treatment takes place are rectangular and are about 30 feet long, 15 feet wide and about 12 feet deep. The EOD Range occupies generally flat, gently west-sloping land located between the Rio Grande Valley to the west and the base of the Manzano Mountains to the east. The nearest major surface water body is the Rio Grande, located about 10 miles west of the EOD Range.

1.2. PURPOSE OF THE OD TREATMENT UNIT

The Permittee treats hazardous wastes by open detonation at the OD Unit located at the EOD Range, which is located in a remote, sparsely populated area within the KAFB Facility boundary. The wastes treated at the OD Unit are assigned U.S. Environmental Protection Agency (EPA) Hazardous Waste Numbers D001 (ignitability) and/or D003 (reactivity). The wastes may also carry EPA Hazard Waste Numbers D002 (corrosivity), D005, D007, D008, and D009 (toxicity characteristic metals), D018 (benzene), D030 (2,4-dinitrotoluene), D034 (hexachloroethane), and D040 (trichloroethylene) and various underlying hazardous constituents. Wastes may be stabilized with safing fluids (i.e., a substance, such as hydraulic fluid or diesel fuel, with a specific gravity between a liquid and a solid used to desensitize explosives, making them safer to handle).

Treatment is performed by detonating explosives to countercharge hazardous wastes to remove their characteristics of reactivity and/or ignitability. The frequency of operations at the OD Unit varies, as treatment events are conducted on an as-needed basis.

All hazardous waste treated by the OD Unit has the potential to detonate or is a propellant. In accordance with 40 C.F.R. § 261.23(a)(6), the high explosive (HE) waste streams are capable of detonation if subjected to a strong initiating source or if heated under confinement. The remaining waste streams have the potential to detonate because they are explosives as defined in

49 C.F.R. §173.53, pursuant to 40 C.F.R. §261.23(a)(8). As stated in Chapter 7, Section 7.3, of SW-846 (EPA, 1986), as amended, the definition of reactivity "is intended to identify wastes that, because of their extreme instability and tendency to react violently or explode, pose a problem at all stages of the waste management process."

HE, when accidentally exposed to even a small initiating source such as friction, a pinch point, electrical discharge, heat, or impact, can potentially detonate. HEs typically managed at the OD Unit have detonation velocities averaging four to six miles per second and pressures as high as 300,000 times atmospheric pressure for short periods. Fickett and Davis (1979) explain that a good solid explosive converts energy at a rate of 10^{10} watts per square centimeter at its detonation front.

1.3. ROUTES OF TRAVEL

A system of interior roads, shown on Figure 1-1 (Permit Part 1), is maintained at KAFB. About 78 total miles of roadway exist, of which about 33 miles are paved.

Traffic access to and egress from the OD Unit is along the roads shown on Figure 1-1 (Permit Part 1). The roads along which wastes are transported to the EOD Range within KAFB include Southgate Avenue, Hardin Boulevard, Pennsylvania Street, Wyoming Boulevard, Lovelace Road, and Demolition Range Road.

1.4. SECURITY

1.4.1. Introduction

The following paragraphs describe the site-wide and OD Unit-specific security provisions at the KAFB Facility that shall be implemented to prevent unknowing or unauthorized entry of persons or livestock onto the OD Unit. Additional requirements are found in Permit Section 2.1.

1.4.2. Barriers and Means to Control Entry

The OD Unit, situated within the EOD Range is located within KAFB, which has 24-hour security surveillance and controls entry at all times to the Facility through entrance gates. Access to the KAFB Facility is provided through five controlled entrance gates. Access control procedures are designed to ensure that only properly identified and authorized persons, vehicles, and property are allowed entrance to and exit from KAFB. Surveillance is provided by KAFB Security Police, who continuously monitor and control entry inside the KAFB perimeter. The major duties of the KAFB security personnel are to control vehicle, personnel, and material access/egress. KAFB is enclosed by a 7.5-foot chain-link fence and by barbed wire fence. During non-working hours, security personnel routinely patrol the KAFB perimeter fence.

A fence is also located along the perimeter of the EOD Range. A gate is located at the entrance road to the EOD Range and OD Unit. The locations of the security fence and the access gate for the EOD Range and OD Unit are shown on Figure 2-1, in Permit Part 2.

Only personnel with appropriate clearance and escorted visitors are allowed access to the EOD Range. Vehicles and personnel entering the EOD Range are subject to search by security personnel. The EOD Range and OD Unit are surrounded by a three-strand barbed-wire fence, which limits any traffic through or other access to these areas.

REFERENCES

U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; 3rd edition, update 3, SW-846, Office of Solid waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

W. Fickett and W. Davis, 1979. Detonation: University of California Press, Berkeley, CA.

PERMIT ATTACHMENT B: LIST OF AUTHORIZED HAZARDOUS WASTES

1.0 INTRODUCTION

Table B-1 lists the hazardous wastes that the Permittee is authorized to treat at the Open Detonation (OD) Unit. Wastes carrying Environmental Protection Agency (EPA) Hazardous Waste Numbers D002, D005, D007 through D009, D018, D030, D034, and D040 shall not be treated at the OD Unit unless, at the point of generation, the wastes are also reactive and/or ignitable. Wastes that are not reactive and/or ignitable shall not be mixed with reactive or ignitable wastes for the purpose of generating a hazardous waste that is authorized for treatment at the OD Unit. Hazardous wastes that are not authorized by this Permit for treatment shall not be accepted by the Facility for treatment and shall be returned to the generator. The Permittee shall also comply with Permit Section 2.7.

TABLE B-1 List of Hazardous Wastes Authorized to be Treated at the OD Unit	
Common and/or Chemical Name – Symbol	**EPA Hazardous Waste Number(s)**
ALSC, HNS	D001, D003
ALSC (RDX)	D001, D003
Amatol (AN, TNT)	D001, D003
Ammonium Nitrate (AN)	D003
Ammonium Perchlorate (AP)	D003
Ammonium Picrate	D001, D003
ANFO	D001, D003
APEX 1220	D001, D003
APEX 1320	D001, D003
ARTEC (HMX-water)	D001, D003
ATX-M	D001, D003
ATX 25RM Slurry	D001, D003
AWH Shape Charge	D001, D003
Baratol (HE)	D001, D003, D005
Barium Nitrate	D001, D003, D005
Barium Peroxide	D001, D003, D005
Barium Potassium Nitrate	D001, D003, D005
Barium Soluble Compounds	D001, D003, D005
BCTK Explosives	D001, D003
Benzene	D001, D018
BKN03 Propellant	D001, D003
Black Powder (Low Explosive)	D001, D003
Blasting Agent	D001, D003
Chromium	D007
CLSC (Copper Linear Shaped Charge)	D001, D003
Composition A (HE)	D001, D003
Composition B (HE)	D001, D003
Composition B/Baratol Mixture (HE)	D001, D003, D005
Composition C4 Class 3 (HE)	D001, D003
Cordite (Double-base gum)	D001, D003
CP (2-[5-cyanotetrazolato] pentamine cobalt (III) perchlorate)	D001, D003
Cyclonite (HE, RDX)	D001, D003
Cyclotol (RDX, TNT)	D001, D003
C-1 Detasheet	D001, D003
C-3	D001, D003
C-4	D001, D003
C-6 Discs	D001, D003
DACP Powder	D001, D003
TABLE B-1	

(continued)	
Common and/or Chemical Name - Symbol	**EPA Hazardous Waste Number(s)**
Detaflex	D003
Detasheet A	D001, D003
Detasheet A4	D001, D003
Detasheet A5	D001, D003
Detasheet C	D001, D003
Detasheet C1	D001, D003
Detasheet C2	D001, D003
Detasheet C3	D001, D003
Detasheet C4	D001, D003
Detasheet C5	D001, D003
Detasheet C6	D001, D003
Detasheet D	D001, D003
Detasheet L	D001, D003
DetCord (PETN)	D001, D003
Detonators	D001, D003, D008
Detonators EBW	D001, D003
Detonators HBW, Ensign Bickford	D001, D003
Dinitrotoluene (DNT)	D001, D003, D030
Dipicrylamide	D001, D003
DBX	D003
Diazodinitrophenol (DDNP)	D003
Double Base Smokeless Powder	D001, D003
DNP	D001, D003
DNPT	D003
Dynamite	D003
Ednatol	D003
EL-506A (HE, PETN)	D001, D003
EL-506D (HE, PETN)	D001, D003
Extex 3003	D001, D003
Extex 8003	D001, D003
Explosive D	D001, D003
Explosive Piston Motors	D003
Flex Linear Shaped Charge	D001, D003, D008
Gas Pressure Generator	D001, D003
Heat Powder	D001, D003
Hexachlorethane (HC Smoke)	D034
Hexanitroazobenzene	D001, D003
HMX (octogen) High Melting Explosive	D001, D003
HNAB	D001, D003
Hexanitrostilbene (HNS)	D001, D003
TABLE B-1	

(continued)	
Common and/or Chemical Name - Symbol	**EPA Hazardous Waste Number(s)**
HNS I	D001, D003
HNS II	D001, D003
HNS Titanium Powder	D001, D003
Holex 2506	D001, D003
Improved Military Rifle (IMR) propellant 4350	D001
IMR 4064	D001
Iremite 60	D001, D003
Iremite 80	D001, D003
Iragel	D001, D003
Ireco Booster 2-C, 3-C, 4-C	D001, D003
Iron Perchlorate	D003
Iron Potassium Perchlorate	D003
JPN Propellant	D001, D003
Kinestik Part A, B	D001, D003
Lead Azide (HE)	D001, D003, D008
Lead Case Flexible Linear Shaped Charge	D001, D003, D008
Lead Mononitraresorcinate (LMNR)	D001, D003, D008
Lead Sulfocyanate	D001, D003, D008
Lead Styphnate (HE)	D001, D003, D008
LX-04	D001, D003
LX-10	D001, D003
LX-13	D001, D003
LX-14	D001, D003
LX-15	D001, D003
LX-16	D001, D003
LX-17	D001, D003
M-6 Propellant	D001, D003
M-77 Water Gel Explosives	D001, D003, D005
MDF (RDX, HNS)	D001, D003
Mercury Fulminate (HE)	D001, D003, D009
Minol	D001, D003
N-5 Sheet Propellant	D001, D003
Nitrocellulose	D001, D003
Nitroglycerin	D001, D003
Nitroguanidine	D001, D003
Nitromethane	D001, D003
NQ	D001, D003
Octol LGE Cast	D001, D003
PBX 9010	D001, D003
PBX 9205	D001, D003
TABLE B-1	

(continued)	
Common and/or Chemical Name - Symbol	**EPA Hazardous Waste Number(s)**
PBX 9404	D001, D003
PBX 9407	D001, D003
PBX 9504	D001, D003
PBXN-5	D001, D003
PBXN-6	D001, D003
PBXN-301	D001, D003
Pentaerythritol Tetranitrate (PETN) (HE)	D001, D003
PETN/Titanium Mix	D001, D003
PETN Zirconium	D001, D003
PETRIN	D001, D003
Pentolite (PETN/TNT) (HE)	D001, D003
Photo Flash Powder (simulators)	D001, D003
Picric Acid	D001, D002, D003
Picritol	D001, D003
Plain Wave Generator (PBX 9404)	D001, D003
Plasticized White Phosphorous	D001
Plasticizer	D001, D003
Polysulfide Prepolymer	D001, D003
Potassium Chlorate	D003
Potassium Nitrate	D003
Potassium Perchlorate (initiator)	D001, D003
Primacord (PETN)	D001, D003
Propellant HPC-95, HPC-60	D001, D003
Propellant M-30, M1, M6	D001, D003
Propellant MC-1951	D001, D003
Propellant (TPH1207C)	D001, D003
RDX	D001, D003
RDX #5	D001, D003
Red Phosphorous	D001
RL-5-X Detcord	D001, D003
Rocket Motor Double Base Propellant	D001, D003
RP-2	D001
RP-87	D001
Separation Explosives (RDX)	D001, D003
Semtex	D001, D003
Smokeless Powder	D003
Sodium Azide	D001, D003
Sodium Nitrate	D003
Strontium Nitrate	D003
Strontium Peroxide	D003
TABLE B-1	

(continued)	
Common and/or Chemical Name - Symbol	**EPA Hazardous Waste Number(s)**
Tetryl (HE)	D001, D003
Tetrytol	D001, D003
TH-1	D001, D003
TH-3	D001, D003
Thermite Powder	D003
TH/KP	D001, D003
Titanium Tetrachloride	D003
TPH 3442 (propellant)	D003
Titanium Boron Powder	D001
Titanium Hydride	D001
Titanium Subhydride	D001
TLX	D001, D003
Trinitrotoluene (TNT)	D001, D003
Tritonal	D001, D003
TATB Pellets, Pad	D001, D003
Toluene (nitrated forms)	D001, D003
Torpex	D003
Tovex	D003
TPH 3386 (propellant)	D003
Triaminotrinitrobenzene (TATB)	D001, D003, D018
Trichloroethylene	D040
WAK 2, TP-H12	D001, D003
XTX 8003	D001, D003
Aluminum	D001, D003
Iron	D001
Lead	D008
Lead Alloy	D008

DEFINITIONS

ALSC aluminum linear shaped charge
AN ammonium nitrate
Anfo ammonium nitrate-fuel oil
AP ammonium perchlorate
CLSC copper linear shaped charge
DDNP Diazodinitrophenol
DNT Dinitrotoluene
HC hexachlorathane
HE high explosive
HMX cyclotetramethylene-tetranitramine; octohydro-1,3,5,7-tetranitro 1,3,5,7-tetrazocine
HNS hexanitrostilbene
IMR improved military rifle
LMNR lead mononitraresorcinate
PBX plastic-bonded explosive; RDX and plasticizer
PETN nitropentaerythrite; pentaerythrite tetranitrate; pentaerythritol
RDX cyclotrimethylenetrinitramine
TATB triaminotrinitrobenzene
TNT trinitrotoluene

PERMIT ATTACHMENT C: WASTE ANALYSIS PLAN

1.0 INTRODUCTION

This Waste Analysis Plan (WAP) describes the procedures that shall be used at the Facility to characterize waste to be treated at the Open Detonation (OD) Unit.

1.1. HAZARDOUS WASTES TREATED AT THE OD UNIT

Hazardous wastes treated at the OD Unit are classified as a non-wastewater waste under the Land Disposal Restrictions (LDR) regulations at 40 C.F.R. Part 268. Knowledge of the chemical and physical properties of hazardous wastes to be treated at the OD Unit is essential for proper waste management. The hazardous wastes treated at the OD Unit exhibit the characteristic of reactivity (D003). Some of these wastes also exhibit the characteristics of ignitability (D001). These wastes may also potentially contain the following toxicity characteristic metals and organic compounds, identified by specific U.S. Environmental Protection Agency (EPA) Hazardous Waste Numbers: barium (D005), chromium (D007), lead (D008), mercury (D009), benzene (D018), 2,4-dinitrotoluene (D030), hexachloroethane (D034), and trichloroethylene (D040). They may also contain underlying hazardous constituents (UHCs) such as chromium, lead, nickel, vanadium, and zinc. The characteristics of hazardous wastes treated at the OD Unit shall be identified using Acceptable Knowledge (AK) or sampling and analysis, as appropriate, and shall be documented in writing. Incompatible wastes shall not be accepted for treatment at the OD Unit. It may be necessary to saturate the wastes with a safing fluid (e.g., water, acetone, alcohol, hydraulic fluid) before treatment.

Categories of hazardous waste that may be accepted for treatment include, for example, explosives, propellants, and pyrotechnics in the form of pure substances and explosives-contaminated wastes. Waste that may be treated at the OD Unit shall include only the waste types authorized in Permit Attachment B. Corrosive (D002) wastes (e.g., picric acid) that are also reactive may be treated at the OD Unit. The hazardous wastes to be treated at the OD Unit are mostly in solid form, however, on occasion, wastes in liquid form (e.g., picric acid) may be treated.

Barium (D005), chromium (D007), lead (D008), and mercury (D009) are toxicity characteristic metals that may be in the wastes or in the casings surrounding the wastes to be treated. The toxicity characteristic organic compounds benzene (D018), 2,4-dinitrotoluene (D030), hexachloroethane (D034), and trichloroethylene (D040) may also be present.

1.2. WASTE ANALYSIS PARAMETERS

Explosive Ordnance Disposal (EOD) personnel shall review characterization information to ensure that hazardous wastes are properly characterized for their physical and chemical properties and can be managed safely and in accordance with the requirements of this Permit. AK shall only be used in lieu of sampling and analysis when the composition and physical characteristics of the waste are exactly known and well controlled.

Waste characterization information must include all necessary information on the presence of toxicity characteristic metals and organic compounds, as defined in 40 C.F.R. Part 261, Subpart C, and data on the presence of any UHCs listed in 40 C.F.R. § 268.48 in accordance with 40 C.F.R. § 268.9(a).

1.3. WASTE CHARACTERIZATION PROCEDURES

The approach to characterization shall be based on the chemical and physical nature of the waste. Characterization procedures used at the Facility require all generators to provide AK, related technical information, and/or sampling and analysis results (including information on UHCs) as appropriate. Accurate characterization is necessary for appropriate waste classification and assignment of EPA Hazardous Waste Numbers, in the preparation of LDR documentation, and ensuring proper management of waste.

1.3.1. Characterization Strategy

The characterization strategy for hazardous wastes to be treated at the OD Unit is described below.

1.3.1.1. Wastes to be Treated

Prior to accepting waste for treatment at the OD Unit, a detailed chemical and physical description of the waste shall be provided by the generator.

Ensuring that detailed and accurate waste characterization exists shall include the steps outlined below in Permit Sections 1.3.1.2 through 1.3.1.4. Hazardous waste destined for treatment shall be packaged in containers; both the waste and the containers shall be inspected before acceptance for treatment and again before loading the waste into the treatment unit.

1.3.1.2. Verification

All waste shipments to the OD Unit shall be verified in two phases prior to treatment to ensure that the waste is authorized for treatment in accordance with Permit Attachment B. Phase 1 will be conducted to ensure shipping documentation completeness, and Phase 2 is to ensure that the waste delivered corresponds to the documentation provided for that waste. Waste shall not be accepted for treatment until all verification is complete.

1.3.1.3. Phase 1 Verification

Screening is performed by the appointed EOD Team Chief. Documentation may include, but is not limited to, a completed Ammunition Disposition Request (ADR), a hazardous waste manifest, a material safety data sheet, a description of the process generating the waste, and sampling and analysis data.

Upon receipt of a waste shipment at the OD Unit, a determination of shipping documentation (hazardous waste manifest) completeness shall be made by EOD personnel. Each shipping document that accompanies an off-site waste shipment shall be checked to ensure that the following information is present and complete:

- The shipment identification number.

- The proper U.S. Department of Transportation basic description.
- The quantity (weight) of waste in the shipment.
- The number and type of containers in the shipment.
- A signed and dated certification of the shipment's content.
- The shipment labels and placards which match the shipping document.

If documentation is incomplete or inadequate, EOD personnel shall contact the generator for clarification and require that the generator correct the situation. Only waste that meets the requirements of this Permit shall be transported to the OD Unit for treatment.

Containers will be visually examined for defects such as dents, cracks, and corrosion. Conditionally exempt small quantity generators do not need a hazardous waste manifest. If there are discrepancies, they shall be resolved by contacting the generator before EOD personnel sign the shipping document. If the discrepancies cannot be resolved, EOD personnel shall reject the shipment. Rejected waste shall be returned to the generator.

1.3.1.4. Phase 2 Verification

The EOD Team Chief, with assistance from other EOD personnel, shall compare the contents of waste shipments received with the description on the documentation provided by the generator to ensure that they match. The visual inspection shall include content identification and quantity estimation. If any waste fails verification, it shall be returned to the generator to resolve the discrepancy.

1.3.2. Sampling and Analysis of Waste

Sampling and analysis of waste for purposes of characterization shall be conducted in accordance with the procedures outlined in Sections 1.3.2.1 through 1.3.2.4 of this Permit Attachment (C) and Permit Section 2.6.3.

1.3.2.1. Sampling Equipment

Each sample of waste requiring sampling and analysis shall be collected using appropriate sampling equipment, as recommended in SW-846 (EPA, 1986) or other Department-approved sampling guidance.

1.3.2.2. Equipment Decontamination

Disposable, clean equipment shall be used to eliminate the potential for cross contamination during sampling. Therefore, maintaining and decontaminating sampling equipment will not be necessary.

1.3.2.3. Sample Preservation and Storage

Waste samples shall be collected in clean containers and preserved, as appropriate, to ensure that their integrity remains intact prior to, during, and after transport to the analytical laboratory. Container types, preservation techniques, and holding times for expected analytes of interest are presented in Table C-1.

1.3.2.4. Quality Assurance/Quality Control

The Permittee shall implement a quality assurance (QA) process designed to obtain high quality data. Quality control (QC) procedures shall be employed to measure the degree to which this QA objective is fulfilled. At a minimum, the QA process shall meet the requirements of Permit Sections 6.5.17.6, 6.5.18.1, and 6.5.18.3.

QC samples shall be collected as part of sampling activities. Duplicates shall be collected and analyzed for all constituents of concern. A chain-of-custody form shall be completed and shall include the type of sample collected; the names and signatures of the sampler(s); sample identification numbers, date, and time of collection; the designation as a grab or composite sample; the names, dates, times, and signatures of any persons involved in transferring samples; and the shipping number. Personnel shall be properly trained in the use of sampling equipment, sample containers, and sampling methods to ensure that sampling activities are conducted appropriately.

1.4. ANALYTICAL LABORATORY AND TESTING/ANALYTICAL METHODS SELECTION

An EPA-certified analytical laboratory shall be selected to perform laboratory analysis of waste. The laboratory shall be required to have a comprehensive QA/QC program, technical analytical expertise, and an effective information management system.

The selection of analytical testing methods for waste is based on the following.

- The physical state of the waste.
- The analytes of interest.
- The required detection limits (i.e., regulatory thresholds).
- Information requirements (e.g., to ensure compliance with LDR treatment standards).

1.5. WASTE RE-EVALUATION FREQUENCIES

A re-evaluation of waste characterization data shall be conducted as necessary but at least annually to ensure that data are accurate, in accordance with 40 C.F.R. § 264.13(a)(3). Updates of waste characterization information are required when:

- A change occurs in the process or operation generating the hazardous waste, and
- Hazardous waste received from an off-site facility does not match the waste specified on the accompanying manifest or shipping papers.

Waste characterization data for the wastes treated at the OD Unit shall be re-evaluated at least annually. This information shall be used to determine if waste characterization data are accurate and to determine the appropriateness of current waste management practices and characterization methods, and shall be documented in the Operating Record.

REFERENCE

U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; 3rd edition, update 3, SW-846, Office of Solid waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

TABLE C-1 Sample Containers, Preservation Methods, and Holding Times for Analysis of Waste[a]			
Sample Type	**Container Type[b]**	**Preservation Method**	**Holding Time**
Volatile Organics	4 oz glass jar with Teflon cap	Cool to 4 ºC	14 days
Semivolatile Organics	4 oz glass jar with Teflon cap	Cool to 4ºC	14 days
Metals			
(except hexavalent chromium and mercury)	4 oz glass jar with Teflon cap	Cool to 4ºC	180 days
(Hexavalent chromium)	4 oz glass jar with Teflon cap		28 days
(Mercury)	4 oz glass jar with Teflon cap		28 days

a. Containers, methods and holding times from most current version of SW-846 (EPA, 1986)
b. Other container types may be used depending upon the laboratory or the method, with prior NMED approval.

DEFINITIONS
NMED New Mexico Environment Department
oz ounces
ºC degrees Celsius

PERMIT ATTACHMENT D: ANNUAL SOIL SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

The purpose of this sampling and analysis plan is to ensure that accurate data are collected to determine whether a release of hazardous waste or hazardous constituents has occurred during the operating period of the Open Detonation (OD) Unit that may pose a threat to human health. Any corrective action that may be required for the OD Unit shall be conducted in accordance with Part 6 of this Permit.

The OD Unit is located at the Kirtland Air Force Base (KAFB) Explosive Ordnance Disposal (EOD) Range and is permitted as a Resource Conservation and Recovery Act (RCRA) Subpart X miscellaneous unit. The OD Unit is used to treat hazardous waste to remove the hazardous characteristics of reactivity and ignitability. The Permittee shall perform soil monitoring at the OD Unit during operations to assess whether or not contaminants are being released to soil at levels that could endanger human health. This soil sampling and analysis shall be performed on an annual basis in accordance with the procedures described in this Annual Soil Sampling and Analysis Plan (SSAP).

1.1. SAMPLING PROCEDURES

This Section (1.1) describes procedures and methods for sampling soil at the OD Unit. Other applicable procedures or methods provided in the most current version of *SW-846* (EPA, 1986) may be used if conditions or experience show the alternate method(s) to be more appropriate and if approved by the Department. All sampling procedures used will be documented in a field logbook. Sampling shall be performed in accordance with procedures given in *Samplers and Sampling Procedures for Hazardous Waste Streams* (EPA, 1980), or SW-846, and in accordance with this SSAP.

1.1.1. Sampling Schedule and Frequency

Soil samples shall be collected annually at the OD Unit during the month of June. Sampling shall be conducted at the OD Unit before any backfilling, excavation, or grading is performed at the site since the last treatment event. If no treatment events have occurred during a particular annual period, annual sampling will not be conducted for that annual period. The Department shall be notified if this circumstance occurs.

1.1.2. Sampling Strategy and Analytical Parameters

For the OD Unit, four soil samples shall be collected from the zero- to six-inch depth and analyzed for total metals, explosives and other constituents listed in Table D-1. The sampling location strategy depends on the physical characteristics of the OD Unit. If only one crater (pit) is present during the sampling event, then four soil samples shall be taken from the walls of the crater at each of the four primary compass directions (Figure D-1). If more than one crater is present, a grid (with a minimum of 100 possible locations) that encompasses all of the craters shall be established, and four random sample locations within the grid will be selected for the sampling event (Figure D-2). The grid will be square in shape and its overall maximum size shall be established using the maximum distance between the walls of the craters that are present

at the site. If no craters are present, then a 150-foot by 150-foot grid shall be established at the center of the cleared area which composes the OD Unit, and four soil sample locations shall be randomly selected from within the grid.

Each sample location shall be located by reference to a surveyed grid datum, prominent site features, or from some documented reference point that can be located in the field. Sample locations shall be recorded in the field logbook, and shall be shown on a figure depicting the OD Unit in the annual reports (see Section 1.7 of this Permit Attachment).

1.1.3. Sample Collection

Qualified personnel shall collect soil samples. Sample collection procedures, types of containers and storage procedures specific to each SW-846 method shall be strictly adhered to. Prior to collecting a soil sample, sampling personnel shall scrape aside loose materials (e.g., rocks, litter) from the sampling location. Personnel shall collect soil samples using metal or plastic scoops, wooden or disposable plastic hand trowels, or similar equipment. Non-sparking equipment shall be used whenever required by EOD personnel for worker safety. Excess soil generated at each soil sampling location may be used as backfill. Samples shall be representative of the site. Cross-contamination of samples shall be prevented. Sample collection activities shall also conform to these requirements:

1. Personnel shall schedule sampling activities with EOD Range Control;
2. Personnel shall obtain clearance from an EOD Technician/Specialist for the selected location of each sample;
3. Personnel shall wear clean gloves before collecting each individual sample;
4. Personnel shall use clean sampling equipment to collect soil samples. (Note: A disposable sampler may be presumed clean if it is still in a factory-sealed wrapper. Reusable samplers will be scraped to remove any loose material, washed with a detergent and water solution, rinsed several times with tap water, rinsed with deionized water, drained of excess water, and air-dried or wiped dry.);
5. Personnel shall clear each sample for shipment to the analytical laboratory by an EOD Technician/Specialist; and
6. Personnel shall check out with EOD Range Control when sampling has been completed.

Samples collected for analysis of white phosphorous must the follow the special sample collection procedures in SW-846, Method 7580.

1.1.3.1. Sample Containers and Preservatives

Samples shall be placed in appropriate containers, compatible with the intended analysis. All containers shall be new and certified clean to ensure the integrity of samples collected. Samples shall be properly prepared and preserved as necessary to maintain sample integrity. Table D-1 lists the proper container, preservative, and holding time for each chemical parameter of interest.

1.1.3.2. Sample Identification

Sample identification numbers shall be assigned by alpha/numeric characters corresponding to the last two digits of the calendar year (YY), two digits of the month (MM), two digits of the day

of the month (DD), a code indicating soil sample (SS), and a unique number (##) designating the sample location. Thus, a complete format of a sample identification number is: YYMMDDSS##. For example, soil sample number two collected on 3rd of June 2007 would be labeled: 070603SS02.

1.1.3.3. Sample Handling, Documentation, and Custody Procedures

Chain-of-custody procedures shall be followed in accordance with Permit Section 6.5.5.3. Labels shall be affixed to sample containers in accordance with Permit Section 6.5.5.4.

The chain-of-custody form shall be signed upon receipt at the laboratory, and the original or a copy returned to the KAFB Environmental Management (EM) Branch Office for inclusion in the Operating Record. The Chain-of-custody form shall include or be accompanied by a request-for-analysis form that lists all analyses to be performed for the samples and all special instructions related to sample management or analysis. Any potential hazards posed by the samples shall be listed on the request-for-analysis form.

The sample container shall be sealed with a gummed paper seal or tag attached to the container in such a way that the seal must be broken in order to open the container.

A field logbook shall be kept and shall contain information pertinent to field surveys and sampling. Entries in the logbook shall be conducted in accordance with Permit Section 6.5.2.

The analytical laboratory shall be required to have procedures for minimizing cross contamination of samples and securing sample custody within the laboratory.

Samples relinquished to the laboratory shall be subject to the following procedures for transfer of custody and shipment.

1. When transferring the possession of samples, the individuals relinquishing and receiving them shall sign, date, and note the time on the Chain-of-custody form.
2. Shipping containers such as coolers shall be custody-sealed for shipment to the laboratory.

Laboratory personnel shall verify that samples are correctly labeled, that documentation is correct, and shall inspect the physical condition of the containers. Any discrepancies are to be resolved between laboratory and sampling personnel at this time. The laboratory portion of the form shall be completed by the laboratory personnel and shall include at a minimum:

1. The name of the person receiving the sample,
2. Laboratory accession (identification) number,
3. The date and time of sample receipt, and
4. Sample condition

1.1.3.4. Sample Shipping

Sample shipment shall be conducted in accordance with Permit Section 6.5.5.2.

1.2. INVESTIGATION-DERIVED WASTE

Investigation–derived waste shall be managed in accordance with Permit Section 6.5.7.

1.3. QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Because important decisions will be based on the data collected as part of this SSAP, a program to ensure that data are of high quality is essential. The Permittee shall follow a quality assurance/quality control (QA/QC) program that mandates documentation of the precision and accuracy of laboratory analyses as well as other aspects of quality assurance.

1.3.1. Quality Control Targets

For metals, quality control targets for accuracy and precision shall be 75-125% recovered and ±35% relative percent difference (RPD), respectively. The laboratory reporting limits for metals shall be at or below the respective background level for each metal subject to analysis.
For high explosives (HE), quality control targets for accuracy and precision shall be 20-120% recovered and ±50% RPD, respectively. The laboratory reporting limits for HE compounds shall be at or below the appropriate human risk industrial screening level for each HE compound (NMED, 2009).

1.3.2. Field Quality Control

Field quality control shall be conducted in accordance with Permit Section 6.5.14 and Table D-2 of this Permit Attachment.

1.4. LABORATORY ANALYSIS

Laboratory analysis shall be conducted in accordance with Permit Section 6.5.18.

1.5. DATA VALIDATION

Data validation shall be conducted in accordance with Permit Section 6.5.18.3.

1.6. HUMAN RISK SCREENING

If a sample result for a metal exceeds the applicable background level listed in Table D-4, the result shall be compared to the most current EPA Regional Screening Levels (RSLs) and Department soil screening levels (SSLs-NMED, 2009) for an industrial land use scenario. The industrial land use scenario shall only apply to risk screening under this SSAP, and not for purposes of closure or corrective action. Analytical results for explosives and SVOCs shall be compared to the SSLs. EPA RSLs and Department SSLs for industrial scenarios are presented in Table D-4 for the metals, SVOCs, and HE compounds that are to be evaluated.

Sample results for arsenic shall be compared with the approved background level because the natural background concentration of arsenic in this area exceeds the EPA human health medium-specific screening level. Additionally, the screening level for thallium shall be set equal to the Department soil screening level for this constituent.

If a Department SSL or EPA RSL does not exist for a substance, the Permittee shall calculate a screening level based on an industrial scenario and a cancer risk of 10^{-5} for carcinogens, and a hazard quotient (HQ) of 1.0 for noncarcinogens. This calculated screening level shall be subject to Department approval and shall be revised if determined by the Department not to be protective of human health.

Any exceedance of an EPA RSL, Department SSL, or calculated screening level shall be

reported to the Department in writing within 15 calendar days. The Department will review the information and, at its discretion, may require additional site characterization to protect the health and safety of site workers. If the Department requires additional site characterization, the Permittee shall prepare a sampling and analysis plan (SAP) for Department approval. The SAP shall be prepared and submitted to the Department within 60 calendar days of the request. Upon Department approval of the SAP, the Permittee shall implement the plan within 30 days. Upon completion of the field investigation, the Permittee shall report the results of the additional site characterization effort in writing to the Department within 90 calendar days. The Department will then determine if additional sampling is required, if the site must be remediated immediately to protect workers, or if no corrective action is required.

1.7. REPORTING

The Permittee shall submit two copies of each annual report to the Department within 90 days of completion of each sampling event. Each annual report shall include:

1. A summary cover letter.
2. Copies of all laboratory reports associated with the sampling event, including the analytical results for each sample.
3. A summary of any constituents detected at concentrations exceeding human risk levels including any exceeding a screening level calculated by the Permittee when a Department SSL or EPA RSL is unavailable. The method and data used by the Permittee to calculate a screening level must also be reported.
4. A summary of field and laboratory QC sample results.
5. A summary of whether the data meet the data quality objectives listed in this Permit Attachment. And,
6. A scaled, oriented map showing the location of the OD Unit sampling grid (if any), craters (if any), and all sample locations.

REFERENCES

New Mexico Environment Department (NMED), 2009. Technical Background Document for Development of Soil Screening Levels, Rev, V, New Mexico Environment Department, Santa Fe, New Mexico, December 2009.

U.S. Environmental Protection Agency (EPA), 1980. Samplers and Sampling Procedures for Hazardous Waste Streams; Municipal and Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio, EPA-600/2-80-018, January 1980.

U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; 3rd edition, update 3, SW-846, Office of Solid waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2002. RCRA Waste Sampling Draft Technical Guidance; Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., EPA530-D-002, August 2002.

Table D-1
Analytical Parameters and Methods, Container Types, Preservation Methods, and Holding Times for Soil Samples[a]

Parameter	Analytical Method[b]	Container Type and Preservation Method[c]	Holding Time
Total Metals: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium (total), Cobalt, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Tin, Vanadium, Zinc	6010C or 7000 Series	4 oz plastic or glass jar, stored at <4ºC	180 days; 28 days for Mercury and Chromium
High Explosives (HEs): 1,3,5-Trinitrobenzene; 1,3-Dinitrobenzene; TNT (2,4,6-trinitrotoluene); 2,4-Dinitrotoluene; 2,6-Dinitrotoluene; 2-Amino-4,6-Dinitrotoluene; 4-Amino-2,6-Dinitrotoluene; HMX (octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine); 2-Nitrotoluene; Nitrobenzene; 3-Nitrotoluene; 4-Nitrotoluene; Tetryl; RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), 3,5-Dinitroaniline, PETN (pentaerythritol nitrate), nitroglycerine	8330B	4 oz glass jar, stored at <4ºC	14 days
White Phosphorous	7580	4 oz glass jar with PTFE lid, fill to top to minimize air in jar, stored at <4ºC	Indefinite (if preserved at <4ºC, kept in dark and tightly sealed)
Dioxins and Furans	8280B or 8290A	250 mL wide mouth amber glass jar with PTFE lid, stored at <4ºC	30 days
Perchlorate	6850	4 oz glass jar, stored at <4ºC	28 days

a. Analytical methods, preservation methods, and holding times are from most current version of Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846 (EPA, 1986).
b. Another applicable or newer method may be used with prior NMED approval.
c. Other container types may be used depending upon the laboratory or the method used with prior NMED approval.

DEFINITIONS:

mL	milliliters
NMED	New Mexico Environment Department
oz	ounces
PTFE	polytetrafluoroethylene
ºC	degrees Celsius
<	less than

TABLE D-2
Field Quality Control Samples

Quality Control Sample Type	Sample Matrix	Applicable Analytes	Frequency	Purpose
Field duplicate	Soil	Metals, HE, White Phosphorus, Perchlorate, Dioxins and Furans	One sample per sampling event	Document precision of the sampling process
Equipment blank	Water	Metals, HE, White Phosphorus, Perchlorate, Dioxins and Furans	One sample per day (if using non-disposable equipment)	Document if equipment is being properly decontaminated between samples

DEFINITION
HE high explosive

TABLE D-3
Background Concentrations Of Naturally Occurring Metals in Soil at Kirtland Air Force Base

Metal	Surface Soil (mg/kg)
Antimony	3.9
Arsenic	5.6
Barium	130
Beryllium	0.65
Cadmium	<1
Chromium (total)	17.3
Cobalt	5.2
Copper	15.4
Lead	21.4
Mercury	<0.25
Nickel	11.5
Selenium	<1
Silver	<1
Thallium	<1.1
Tin	<10
Vanadium	20.4
Zinc	62

DEFINITIONS
mg/kg milligrams per kilogram
< less than

TABLE D-4
List of Analytical Parameters and Industrial Soil Screening Levels

Analytical Parameters	EPA Regional RSL[a] (mg/kg)	NMED SSL[b] (mg/kg)
Metals		
Antimony	410	454
Arsenic	1.6	17.7
Barium	190,000	224,000
Beryllium	2,000	2,260
Cadmium	810	1,120
Chromium (Total)	1,400	Not established
Cobalt	300	20,500
Copper	41,000	45,400
Lead	800	800
Mercury (methyl)	100	114
Nickel	20,000	22,700
Selenium	5,100	5,680
Silver	5,100	5,680
Thallium	66	74.9
Tin	610,000	Not established
Vanadium	5,200	5,680
Zinc	310,000	341,000
High Explosives (HE)		
1,3,5-Trinitrobenzene	27,000	Not established
1,3-Dinitrobenzene	62	Not established
TNT (2,4,6-Trinitrotoluene)	79	469
2,4-Dinitrotoluene	1,200	103
2,6-Dinitrotoluene	620	687
2-Amino-4,6-Dinitrotoluene	2,000	Not established
4-Amino-2,6-Dinitrotoluene	1,900	Not established
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	49,000	34,200
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	24	174
m-Nitrotoluene	12,000	22,700
Nitrobenzene	280	277
o-Nitrotoluene	13	145
p-Nitrotoluene	110	1,200
Tetryl	2,500	2,740
3,5-Dinitroaniline	Not established	Not established
PETN (pentaerythritol tetranitrate)	Not established	Not established
Nitroglycerine	62	68.4
Other Analytes		
White phosphorous	20	Not established
Perchlorate	720	795
Dioxins and Furans (in TEQ TCDD)	0.000018	0.000204

a. Values from "Regional Screening Levels for Chemical Contaminants at Superfund Sites" (EPA, 2009).

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration-table/index.htm
b. Values from "Technical Background Document for Development of Soil Screening Levels", Rev. 5 (NMED, 2009).
c. The toxicity of dioxins and furans will be measured in relation to the most toxic form of dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD]) by calculating the toxic equivalent (TEQ).

DEFINITIONS

mg/kg	milligram per kilogram
NMED	New Mexico Environment Department
RSL	Regional Screening Level
SSL	soil screening level

Figure D-1

Figure D-2

PERMIT ATTACHMENT E: INSPECTION PLAN

1.0 INTRODUCTION

This Permit Attachment addresses general inspection requirements of 40 C.F.R. § 264.15.

1.1. INSPECTION SCHEDULE

The inspection schedule is presented in Table E-1 and shall be maintained at the Explosive Ordnance Disposal (EOD) Shop, as required by 40 C.F.R. § 264.15(b)(2).

1.2. SCOPE OF INSPECTIONS

At a minimum, the items listed in Table E-1 shall be inspected at the indicated frequencies.

1.3. FREQUENCY OF INSPECTIONS

Items listed in Table E-1 shall be inspected at the frequencies indicated in the table.

TABLE E-1
Inspection Schedule for the OD Unit

Item Number	Inspected For	Frequency
1	Are warning signs posted on the Explosive Ordnance Disposal Range boundary fence at 300-foot intervals?	Monthly
2	Is the EOD Range flag serviceable/posted?	Immediately before treatment operations
3	Are all combustibles clear of the OD Unit to 200 feet, including vegetation?	Immediately before treatment operations
4	Are firebreaks clear of combustibles, including vegetation?	Within 24 hours before treatment operations
5	Is a first-aid kit available?	Immediately before treatment operations
6	Is the OD Unit clear of explosives from previous treatment activities including the loading and unloading areas?	Immediately before treatment operations and within 24 hours after treatment operations
7	Are the EOD Range gates working properly?	Monthly
8	Is the Contingency Plan available at the EOD Range personnel bunker?	Immediately before treatment operations
9	Are all fire-protection and communication equipment operational?	Immediately before treatment operations
10	Is the OD Unit area in good condition?	Monthly and within 24 hours before treatment operations
11	Are metal fragments cleaned up?	Monthly and within 24 hours after treatment operations
12	Is the EOD Range boundary fence in good condition?	Monthly
13	Are the EOD Range roads and firebreaks in good condition?	Monthly
14	Is the personnel bunker in good condition?	Monthly
15	Is the runoff berm around the OD Unit in good condition?	Monthly
16	Is there standing water in a pit or crater at the OD Unit?	Immediately before treatment operations and within 24 hours of a precipitation event
17	Is there kick out or treatment residues following OD operations?	Within 24 hours after treatment operations

PERMIT ATTACHMENT F: CONTINGENCY PLAN

1.0 INTRODUCTION

This Contingency Plan has been prepared for the Open Detonation (OD) Unit located at the Explosive Ordnance Disposal (EOD) Range at the Kirtland Air Force Base (KAFB) Facility in compliance with 40 C.F.R. Part 264, Subpart D, as applicable. This plan consists of emergency response procedures and activities specific to the OD Unit.

1.1. PURPOSE AND IMPLEMENTATION

The purpose of this Contingency Plan is to define the responsibilities and provide for coordination of activities to minimize hazards to human health or the environment from fires, explosions, or any sudden or non-sudden release of hazardous waste or hazardous constituents. In accordance with 40 C.F.R. § 264.51(b), the provisions of this plan shall be carried out immediately whenever there is a fire, explosion, or a release of hazardous waste or hazardous constituents that could threaten human health or the environment.

In the case of major incidents or emergencies that cannot be controlled with EOD Range resources, the Emergency Coordinator (EC) shall notify the KAFB Fire Department and the KAFB Command Post (KCP). The KCP shall assume primary responsibility for response coordination in the case of such major incidents or emergencies or delegate that responsibility to the KAFB Fire Chief. Once the KCP or KAFB Fire Chief completes its response, the EC shall assume responsibility to ensure compliance with all the provisions of this Contingency Plan, including post-emergency inspections and reporting.

1.2. DISTRIBUTION

To assure proper implementation, this Contingency Plan shall be studied and understood by all personnel involved in the management of hazardous waste at the OD Unit and by all personnel required to respond to emergency situations at the OD Unit.

A copy of this Contingency Plan and any subsequent revisions to the plan shall be maintained at the Environmental Management (EM) Branch Office and a current copy shall be maintained at the KCP, and at the personnel bunker at the EOD Range. Copies and subsequent revisions shall be distributed to the KAFB Fire Department, the Albuquerque Fire Department, and the New Mexico Environment Department in the event that they are called upon to assist with or provide emergency services.

1.3. CHARACTERISTICS OF WASTES MANAGED AT THE OD UNIT

The Permittee treats reactive (D003) and ignitable (D001) hazardous wastes. These hazardous wastes include explosives, propellants, and pyrotechnics.

1.4. SUPPORT AGREEMENTS WITH OUTSIDE FACILITIES

The Permittee shall maintain support agreements in accordance with Permit Section 2.4.4.

1.5. EMERGENCY COORDINATOR

An EC (see Table F-1 of this Permit Attachment) shall be on site during treatment activities to coordinate emergency response measures. The EC shall be thoroughly familiar with this Contingency Plan, this Permit, characteristics of the hazardous wastes managed at the OD Unit, the hazardous waste management operations and activities conducted at the OD Unit, the location of hazardous wastes managed at the OD Unit when treatment operations are in progress, the location of the Operating Record at the Facility, and the EOD Range layout. The Base Civil Engineer shall also serve as the functional equivalent of an alternate EC. If the Base Civil Engineer becomes the EC (because the primary EC is not available), the Base Civil Engineer shall be present at the OD Unit for the entire duration of the treatment event.

The EC shall ensure that personnel assigned to the EOD Range are trained in the location and use of eyewash solutions, fire extinguishers, and emergency protective clothing; in emergency procedures; and in evacuation procedures before starting any treatment operations.

The EC has three primary responsibilities. They are:

1. Assess the situation. By observing the scene, interviewing personnel, and/or reviewing records, the EC shall gather information relevant to the response, such as the type of event, quantity and type of released material, and actual or potential hazards to human health or the environment.
2. Protect personnel. The EC shall take reasonable measures to ensure the safety of personnel, such as accounting for EOD Range personnel, attending to injuries, or coordinating the evacuation of EOD Range personnel, if necessary. If evacuation is indicated for personnel, the KCP shall be informed.
3. Contain or mitigate the hazards. The EC shall take reasonable measures to ensure that fires, explosions, or releases do not occur, recur, or spread.

1.6. RESPONSE PROCEDURES

When the EC is notified of an incident or emergency, he shall first determine the scale of the incident or emergency and decide if the incident or emergency is minor or major. In the case of minor incidents or emergencies, the EC shall coordinate the response. In the case of major incidents, the EC shall relinquish control to the KCP, which may in turn relinquish control to the KAFB Fire Chief when he arrives to handle the emergency; however, the EC shall remain available to provide technical guidance and information.

If necessary to protect human health, personnel shall evacuate the OD Unit during an emergency in accordance with the requirements of Section 1.6.5 of this Permit Attachment.

In the event that the EC determines an incident to be minor, a person shall be assigned to stand by at a safe distance with a two-way radio. At the first indication of an escalation in the degree of the incident, the standby person shall be instructed to notify the KCP.

The EC or EM Branch Chief of Compliance shall notify the National Response Center (1-800-424-8802 or current phone number) and the Department with the details of the incident or emergency as soon as possible after being notified of the incident or emergency.

After any incident or emergency, the EC shall ensure that the OD Unit and emergency

equipment are cleaned, waste is properly managed and disposed of, and the OD Unit is safe to resume operation. Before operations are resumed, the EC shall contact the EM Branch Chief of Compliance, who shall inform the appropriate agencies. The EC shall also ensure that the emergency recovery inspections and activities described in Section 1.8.1 of this Permit Attachment are conducted. The EC shall also be responsible for preparing post-emergency or post-incident reports, as presented below in Section 1.8.2 of this Permit Attachment.

1.6.1. Spills

The first priority in dealing with any spill is protection of personnel. If any hazardous waste is spilled during transfer to a treatment unit, transfer of the waste shall be discontinued immediately. The Range Supervisor shall notify the EC, proper personal protective equipment (PPE) shall be donned, and the spilled material and potentially contaminated media (e.g., soil) shall be contained, removed, and managed appropriately as solid or hazardous waste. Wastes not authorized for treatment at the OD Unit shall be removed and treated or disposed of at an off-site facility, as appropriate. If appropriate, the waste shall be saturated (e.g., with water) as a precautionary measure. The incident, including details of the spill and cleanup, shall be noted in the Operating Record.

1.6.2. Personnel Exposure

In the event of personnel exposure to hazardous waste, including, but not limited to, irritation of the eyes, breathing passages, or skin; difficulty in breathing; and/or nausea, light-headedness, vertigo, or blurred vision, personnel shall immediately take the following measures.

1. Notify the EC immediately.
2. The EC shall attempt to ascertain what, if any, chemical exposure occurred and what corrective measures are appropriate.
3. Transport the affected person to a medical facility for evaluation.
4. Evacuate and barricade the area to prevent unauthorized entry.

1.6.3. Explosion and/or Fire Involving Ordnance

EOD personnel shall implement operating practices designed to minimize the risk of fires and explosions that endanger human health or the environment at the OD Unit.

1.6.4. Natural Disasters

After any natural disaster in the vicinity of the OD Unit (e.g., earthquake, floods, lightning strike), the EC shall inspect the OD Unit for any signs of damage, leakage, and land movement and initiate any necessary corrective measures to rectify potential or actual problems. Inspection findings and corrective measures shall be recorded in the Operating Record.

1.6.5. Evacuation

Personnel shall evacuate the EOD Range upon voice command or by notification over two-way radio or other communication device.

1.6.5.1. Evacuation Procedure

The following procedure shall be implemented for evacuation:

1. When an evacuation is announced, stop work.
2. Assist injured personnel to evacuate, if possible.
3. Report to the designated assembly area outside the EOD Range personnel bunker for roll call to be taken by the EC or his designee.
4. Be continually cognizant of wind directions (stay upwind, if possible) and emergency equipment.
5. Do not reenter the affected area until the EC or KAFB Fire Chief authorizes reentry.

1.6.5.2. Evacuation Route

The EC shall be responsible for ensuring that all EOD personnel and site visitors are familiar with evacuation procedures and routes. A map showing the evacuation route is provided as Figure F-1. The map shall be posted at the EOD Range personnel bunker and carried by the EC on all treatment operations.

1.7. EMERGENCY EQUIPMENT

Emergency equipment shall be available for use at the OD Unit. The emergency equipment listed in Table F-2 shall be repaired, replaced, and/or upgraded with functionally equivalent components and equipment, as necessary.

1.8. EMERGENCY AND INCIDENT RECOVERY PROCEDURES

The recovery procedures that shall be followed after a minor or major incident or emergency at the OD Unit are described below.

1.8.1. Post-Emergency Inspections and Activities

The following post-emergency incident inspections and activities shall be conducted:

1. The EC will assure that the time, date, and details of any incident or emergency are noted in the Operating Record in accordance with 40 C.F.R. § 264.56(i).
2. The EC shall inspect the premises for leaks or ruptures of equipment, and shall ensure that all recovered material and waste is managed properly. The results of the inspection shall be recorded in the Operating Record. Only containers made of or lined with materials that will not react with and are otherwise compatible with the waste resulting from cleanup procedures shall be used.
3. Emergency response equipment shall be carefully inspected and the equipment decontaminated, replaced, or refurbished, if needed. Fire extinguishers shall be checked for adequate charge. PPE shall be checked for contamination. Remedial equipment shall be inspected for contamination and proper operation. The supply of eyewash solution and other expendable items used for first aid or cleanup shall be checked and replaced, as necessary.

4. Within 24 hours of an emergency or incident, fire extinguishers shall be replaced or recharged and PPE decontaminated, repaired, or replaced as necessary.
5. Within three days of an emergency or incident, other equipment and structures shall be decontaminated. Decontamination wastes shall be collected and managed appropriately. Appropriate PPE shall be worn during decontamination procedures.
6. Within 30 days of an emergency or incident, other equipment shall be repaired or replaced as necessary.

1.8.2. Post-Emergency or Incident Reports

The following post-emergency or incident reports shall be made:

1. A verbal report of any incident or emergency shall be reported promptly to the EM Branch Chief of Compliance if he was not informed during its occurrence.
2. A written emergency or incident report shall be prepared jointly by the EC and the EM Branch Chief of Compliance and forwarded to the Department within 15 working days, as required by 40 C.F.R. § 264.56(i). The written report shall include, at a minimum, the following.
    a. Name, address, and telephone number of the Commander of KAFB, the EC, and the EM Branch Chief of Compliance;
    b. Name, address, and telephone number of the responsible official;
    c. Date, time, and the type of emergency or incident;
    d. Name and quantity of material and waste involved;
    e. Extent of injuries, if any;
    f. Assessment of actual or potential hazards to human health or the environment; and
    g. Estimated quantity and disposition of recovered material and waste.
3. Before operations are resumed at the OD Unit, the Department shall be notified that the OD Unit is in compliance with 40 C.F.R. §§ 264.56(h) and 264.56(i) and the requirements of this Permit. The notification shall address the fact that no new waste shall be treated that may be incompatible with released material and waste until cleanup procedures are completed and that all emergency equipment is cleaned and fit for its intended use.

1.8.3. Emergency/Incident Response Evaluation

The Permittee shall be responsible for annual evaluations of the KAFB Facility emergency response plans and for evaluation of the response to any incident or emergency. If these evaluations reveal that changes to the emergency response plans are necessary, they shall be amended by the Permittee and distributed to the appropriate organizations.

This Contingency Plan shall be reviewed and, if necessary, amended by the Permittee whenever:

1. The Permit, or applicable regulations, is revised.
2. The plan fails in an incident or emergency.

3. The design, construction, operation, and/or maintenance of the OD Unit or other circumstances change in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous constituents, or changes the response necessary in an incident or emergency.
4. The list of emergency equipment changes.

Whenever any of the EC contact information in Table F-1 changes, a revised table shall be provided to the Department and distributed to all Contingency Plan holders. A copy of the revised table shall also be maintained at the EOD Range personnel bunker. A revision of Table F-1 constitutes an amendment to this Contingency Plan. The Permittee shall request a modification to this Permit should it become necessary to amend this Contingency Plan for any reason.

TABLE F-1
Emergency Coordinator Contact Information for the OD Unit

Contact or Name	Address	Office Phone	Home Phone
D. Brent Wilson, Base Civil Engineer	Building 20684, KAFB, NM 87117	846-7911 or 846-0411	281-5857

TABLE F-2
Type and Location of Emergency Equipment Available for Use at the OD Unit

Emergency Item or Equipment	Description	Location	Contact
Emergency Vehicles	Emergency Response Vehicle: Mobile Command Post equipped with communications equipment.	KAFB Civil Engineer Readiness	846-9196
	Ambulances	KAFB Fire Department	911 or 846-8069
	Security Vehicles: Vans and trucks equipped with communications equipment and utilized for transportation of personnel and equipment.	KAFB Security Police	846-7926
	Fire Trucks: Fire-fighting vehicles outfitted with equipment for fighting fires and with self-contained breathing apparatuses (SCBAs).	KAFB Fire Department	911 or 846-8069
	Helicopter: Rotary-wing aircraft for transportation of personnel to or from site.	KAFB Command Post	846-3777
Medical Supplies	First aid kit	EOD Range personnel bunker or vehicle	EC or Range Safety Officer
	Stretchers/Stokes Litter: Equipment for movement of injured personnel.	KAFB Fire Department	846-8069
	Blankets: Normal blankets.		
	Medical Kits: Emergency first-aid supplies.		
	Oxygen: Medical grade oxygen in compressed cylinders equipped for personnel use.		
Safety Supplies	Fire Extinguisher (ABC)	EOD Range personnel bunker or vehicle	EC or Range Safety Officer
	Eye Wash Kit		
	Spill Containment Kit		
	Decontamination Kit		
	Air Packs: SCBAs equipped with positive pressure mode for use by personnel entering hazardous atmospheres.	KAFB Fire Department	846-8069
	Monitoring Instruments		
General Supplies	Two-Way Radio	EOD Range personnel bunker or vehicle	EC or Range Safety Officer
	Shovels		
	Hand Tools		
	Broom(s)		
Transportation	Tractor-trailer combinations,	KAFB Logistics Readiness Squadron	853-7843
	Flat-bed trucks		
	Enclosed panel vans		
	Passenger vehicles, including sedans and vans		
	Passenger buses		

DEFINITIONS
SCBA self contained breathing apparatus

Figure F-1

PERMIT ATTACHMENT G: PERSONNEL TRAINING PLAN

1.0 INTRODUCTION

The primary objective of the Explosives Ordnance Disposal (EOD) training program shall be to prepare personnel to conduct operations at the Open Detonation (OD) Unit in a safe and environmentally sound manner and in compliance with this Permit and the New Mexico Hazardous Waste Management Regulations (HWMR), 20.4.1 NMAC. To achieve this objective, the program provides personnel with training relevant to their positions.

All personnel shall complete initial training within six months of assignment to EOD Range duty. Personnel shall not work at the OD Unit until they have completed training on the Contingency Plan (Permit Attachment F). Personnel shall be given, at a minimum, a basic understanding of the regulatory requirements of hazardous waste management, this Permit, and emergency response procedures. Personnel shall receive additional classroom and on-the-job training designed specifically to teach them how to perform their duties safely and in conformance with regulatory requirements and this Permit. All personnel shall receive the required training prior to being allowed to work unsupervised.

1.1. TRAINING PROGRAM

Training for personnel is the overall responsibility of the EOD Flight Chief. All training shall be conducted by qualified EOD Technicians and includes formal classroom sessions, on-the-job training, and review of written procedures and plans. A summary of the training program for personnel is shown in Table G-1.

1.1.1. Job Title/Job Description

As required by 40 C.F.R. § 264.16(d)(1) and (2), records of each job title related to hazardous waste management at the OD Unit, a list of employees for each job title, and job descriptions for each job title shall be maintained at the EOD Shop. Job descriptions shall include hazardous waste management duties, and required skills, experience, and education.

Records relating to the training program shall be maintained at the EOD Shop. The records shall also include a list of courses required for each position, course descriptions, documentation that each employee has received and completed appropriate training, and information regarding qualifications.

1.1.2. Relevance of Training to Job Position

The training program shall provide employees with training to respond effectively to emergencies at the OD Unit. Personnel shall receive relevant training on the requirements of this Permit (including Contingency Plan implementation), OD Unit operations (including emergency procedures, equipment, and systems), and in management of hazardous wastes.

1.1.3. Training Content, Frequency, and Techniques

The training program shall include a comprehensive combination of internal training courses and on-the-job training. Each training course shall be developed carefully to support the goal of safe and environmentally sound operations at the OD Unit in compliance with this Permit and the

HWMR. Course outlines shall be maintained in the Training Section at the EOD Shop. The general training content and frequency of training are presented in Table G-1.

1.2. TRAINING DIRECTOR

The Training Director (EOD Flight Chief) shall direct the training program and shall be responsible for establishing training requirements for personnel. The EOD Flight Chief shall be required to be knowledgeable of the applicable hazardous waste management regulations and specific processes employed at the OD Unit, pursuant to the HWMR and this Permit.

1.3. IMPLEMENTATION OF TRAINING PROGRAM

The training program shall be implemented to ensure that all personnel who work at the OD Unit receive the training indicated in Table G-1. All personnel shall participate annually in a training refresher. Visitors shall be provided instruction commensurate with the nature of their visit.

TABLE G-1
Training Program for the OD Unit

Course	Content	Frequency
Basic EOD Course	Covers all aspects of positions and duties associated with EOD and OD Unit operations	Initial
Explosive Safety	General Safety Requirements, Motor Vehicle Transportation, Disposal Range Requirements, Disposal Range Procedures, Range Safety, Standard Safety Guidelines, Site Entry, Site Control, Personal Protective Equipment, Contingency Plan, Implementation, Procedures for Using Emergency Equipment, Procedures for Shutdown of Operations, Responses(s) to Emergencies, Emergency Coordinator(s), Evacuation Route and Procedures, Post-emergency Procedures	Initial/Annual
Relevant In-House Training	General Overview of Procedures to Perform Operations at the EOD Range and OD Unit; Waste Analysis Plan; Identification of Waste to be Managed; Waste Screening and Verification; Range Operation; Safety Practices; Security; Range Inspections; Preventive Procedures, Structures, and Equipment; Prevention of Reaction of Reactive Waste, Ignitable and Incompatible Waste; Authorized Wastes	Initial/Annual
Resource Conservation and Recovery Act Training	Hazardous Waste Management and Regulations – Overview, Hazardous Substances and Properties, General Facility Standards, Preparedness and Prevention, Contingency Plan and Emergency Procedures, Record Keeping and Reporting	Initial/Annual

PERMIT ATTACHMENT H: CLOSURE PLAN

1.0 INTRODUCTION

This Closure Plan describes the activities necessary to close the Open Detonation (OD) Unit at the Explosive Ordnance Disposal (EOD) Range, Kirtland Air Force Base (KAFB). Until final closure is complete in accordance with the New Mexico Hazardous Waste Management Regulations and certification of closure has been approved by the Department, a copy of the approved Closure Plan and all approved revisions shall be maintained in the Operating Record. This Closure Plan and any revisions thereof shall be made available, upon request, to the Department.

If the OD Unit can not be cleaned closed, the Permittee shall amend this plan in accordance with Permit Section 4.2 and implement the new plan upon obtaining approval from the Department.

1.1. GENERAL CLOSURE INFORMATION

This Closure Plan has been prepared in accordance with the requirements of 40 C.F.R. § 270.14(b)(13), and 40 C.F.R. Part 264, Subparts G and X.

1.1.1. Closure Performance Standard

The OD Unit shall be closed to meet the following performance standards:

- Minimize the need for further maintenance;
- Control, minimize, or eliminate, to the extent necessary to protect human health and the environment, the post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to ground or surface waters or to the atmosphere; and
- Comply with the requirements of 40 C.F.R Subpart G and § 264.601.

1.1.2. Final Closure Activities

The Permittee shall notify the Department, in writing, at least 45 calendar days before the date on which final closure of the OD Unit will commence. Partial closure (i.e., closure of just one part of the Unit) shall not occur unless directed otherwise by the Department.

Final closure shall consist of:

1. Removing all structures and equipment used at the OD Unit;
2. Removing soil and debris that have contaminant concentrations that pose unacceptable risk to human health or the environment; and
3. Sending for treatment and disposal any solid and hazardous waste, including any treatment residues, to a permitted treatment, storage, or disposal facility (TSDF) in accordance with applicable regulatory requirements.

Final closure shall be complete when:

1. All solid and hazardous waste have been treated and disposed of off-site as required by law;

2. All structures and all equipment have been removed from the OD Unit;
3. Sampling demonstrates that no unacceptable risk to human health or the environment exists in soil or groundwater at the OD Unit and surrounding areas of the EOD Range that was caused by contamination from the OD Unit;
4. A Certification of Closure and Closure Report have been submitted to the Department; and
5. The Department has approved the Closure Report and Certification of Closure.

1.1.3. Maximum Extent of Operations

Closure activities and any corrective action that may be required shall not be limited to the OD Unit if contamination occurs or could occur beyond the boundary.

1.1.4. Schedule for Closure

Closure of the OD Unit shall comply with the schedule presented in Table H-1.

1.2. CLOSURE REPORT

Upon completion of the closure activities, a Closure Report shall be submitted to the Department with a Certification of Closure (see Permit Section 4.7). The Closure Report shall document the closure activities conducted and contain, at a minimum, the following information:

1. The certification described in Permit Section 4.7;
2. A summary of closure activities;
3. Any significant variance from the approved plan and the reason for the variance;
4. A summary of all sampling data associated with the closure, including analytical results for all field and laboratory quality control samples;
5. A statement indicating whether the quality of data is adequate to support closure in accordance with the Performance Standards of this Closure Plan (see Section 1.1.1 of this Permit Attachment);
6. The location of the file of supporting documentation (e.g., memos, logbooks, laboratory sample analysis data); and
7. Disposal location of all solid and hazardous waste, including decommissioned equipment and structures and any contaminated debris and soil, and any treatment residues.

1.3. CLOSURE PROCEDURES

All hazardous waste present at the OD Unit shall be treated before closure activities commence, provided such waste is authorized to be treated at the OD Unit or, the waste shall be treated and disposed of at an offsite facility as permitted by law. Structures and equipment shall be removed. Structures and equipment shall be dismantled, placed into containers, and managed as solid or hazardous waste, as applicable, and disposed of as permitted by law.

The first phase of closure shall consist of a hazards survey of the OD Unit conducted by qualified health physics and industrial hygiene personnel. The purpose of the survey shall be to locate and remove any “kick-out” (untreated waste, waste fragments, or unexploded ordnance)

and to identify potential contamination concerns that may present hazards to workers during closure activities and to specify any control measures necessary to reduce worker risk. This survey shall provide the information necessary for health physics and industrial hygiene personnel to identify worker qualifications, personal protective equipment (PPE), safety awareness, work permits, exposure control programs, and emergency coordination that may be required to perform closure activities. All workers involved in the closure activities shall be required to have training and medical monitoring, in accordance with applicable regulations. Personnel performing closure activities shall be required to wear PPE as specified by health physics and industrial hygiene personnel.

Surface and subsurface soil and any debris at the OD Unit shall be characterized by sampling and analysis. Soil sampling shall follow the procedures described in Section 1.4 of this Permit Attachment (H). Soil shall be analyzed for the parameters listed in Tables H-2, H-3, and H-4. If sampling and analysis of soil indicates the presence of hazardous waste or hazardous constituents above background levels, a risk assessment shall be conducted based on a residential land-use scenario to determine whether the contaminants pose an unacceptable risk to human health or the environment. In lieu of a baseline risk assessment, the Permittee may compare the soil sampling results to the soil screening levels using the procedures listed in the Department's most current version of "Technical Background Document for Development of Soil Screening Levels" (as it may be updated), provided the soil screening levels are based on a residential land use scenario. If the risk assessment demonstrates that the level of contamination is unacceptable, the contaminated soil exhibiting unacceptable risk shall be subject to corrective action under Permit Part 6 and shall be excavated and removed. The excavated soil shall be collected, transferred to containers, and, if applicable, managed and disposed of as hazardous waste.

The Permittee shall conduct corrective action activities at the OD Unit using the cleanup levels in Permit Section 6.2.3 if corrective action is necessary. Clean up levels shall be based on a residential land use scenario.

Background soil concentrations for metals are those approved by the Department for the KAFB Facility, and are listed in Table D-4 of Permit Attachment D.

1.4. SAMPLING, DECONTAMINATION PROCEDURES, AND PPE

This Section describes procedures and methods for sampling soil and liquid. Other applicable procedures or methods given in the most current version of *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)* (EPA, 1986) and all approved updates) may be used at the time of actual closure if conditions or experience show the alternate method(s) to be more appropriate, and if approved by the Department. All sampling methods and procedures used shall be described in the Closure Report. Sampling of waste shall be conducted in accordance with procedures given below in this Permit Attachment (H) and in *Samplers and Sampling Procedures for Hazardous Waste Streams (EPA, 1980)* or *SW-846*.

Reusable tools and equipment shall be scraped as necessary to remove any contaminated soil, debris, or residue; cleaned with detergent and water solution; and rinsed with clean water. The wash and rinse water shall be collected and sampled and analyzed for characterization as waste.

All PPE worn by personnel performing closure activities will be disposable and after use shall be placed into containers and managed as solid or hazardous waste, as applicable.

1.4.1. Soil Sampling

Soil samples shall be collected on a 25-foot by 25-foot grid spacing from the surface to 15-feet below ground surface at five-foot intervals (total of four samples per location). At a minimum, the 25-foot by 25-foot grid shall encompass all portions of the OD Unit that have hosted or may have hosted a pit or crater used for the treatment of hazardous waste. Any areas at the OD Unit used for training shall be considered a part of the OD Unit for purposes of establishing the sampling grid.

The samples shall be analyzed for the parameters listed in Tables H-2, H-3, and H-4, which include the general types of hazardous wastes managed at the OD Unit.

Surface soil samples (zero to six inches depth) shall be collected with a wooden or Teflon™ trowel or scoop. To collect deeper samples, a Veihmeyer soil sampler, auger drill, direct push technology, or other appropriate method shall be used. Only discrete grab samples shall be collected; no samples shall be composited.

Clean sampling equipment shall be used to collect each sample. Unused, disposable sampling equipment may be presumed clean if still in a factory-sealed wrapper prior to use. Reusable sampling equipment shall be decontaminated after each use by scraping to remove any loose material, washing with a detergent and water solution, rinsing several times with tap water, rinsing with deionized water, and drained of excess water, and air-dried or wiped dry.

1.4.2. Liquid Sampling

A Coliwasa sampler or similar device shall be used to sample liquids (for example, rinse water). As an alternative to the Coliwasa, glass tubes or similar devices may be used to sample liquids.

1.4.3. Sample Containers and Preservatives

Samples shall be placed in clean containers compatible with the intended analysis and shall be properly prepared, preserved, documented, labeled, handled, and secured to maintain sample integrity (see Tables H-5 and H-6).

1.4.4. Sample Handling and Documentation

Each sample shall be labeled, sealed, and accompanied by a chain-of-custody form and a request-for-analysis form. A chain-of-custody form shall be used to track samples from collection through analysis to ensure that the integrity of the samples is protected. The sample handling and documentation procedures shall be equivalent to those in the most current version of *SW-846*.

A chain-of-custody form shall be prepared for all samples collected for laboratory analyses. The form shall include at a minimum:

1. Sample identification number.
2. Name and signature of sample collector.
3. Date and time of sample collection.
4. Location at which sample was collected.
5. Type of sample (e.g., soil, liquid).

6. Signatures of persons who have had the samples in their possession.
7. Dates and times of possession.

The form shall be completed upon receipt at the laboratory and the original returned to the Permittee for inclusion in the Operating Record. The request-for-analysis form shall list all analyses to be performed for the samples and all special instructions relating to sample management or analysis. Any potential hazards posed by the samples shall be listed on the request-for-analysis form.

Sample containers shall be sealed with gummed paper seals attached to the containers in such a way that the seals must be broken in order to open the containers. Seals and sample labels shall be completed with a waterproof pen or marker. Sample labels are necessary to prevent misidentification of samples and shall include at minimum the following information:

1. A unique sample identification number.
2. Name or initials of sample collector.
3. Sample collection date and time.
4. Sample location.
5. Sample type, depth, and description.

A field logbook shall be kept and shall contain information pertinent to field surveys and sampling. Sufficient information shall be recorded so that a person can reasonably reconstruct what occurred at a sampling event without relying on a collector's memory. Entries in the logbook for a given sampling event shall, at a minimum, include:

1. Purpose of sampling.
2. Sample locations.
3. Name and business address of person making log entry.
4. Numbers, types, and volumes of samples, including field QC samples.
5. Description of sampling method and equipment used.
6. Date and time of sample collection.
7. Sample destination and transporter's name (for example, name of laboratory, United Parcel Service).
8. Map or photograph of the sampling site.
9. Field observations (for example, ambient temperature, sky conditions, past 24-hour precipitation).
10. Listing of sample identification number(s).
11. Signature of person responsible for the log entry.

1.4.5. Sample Shipping

Samples shall be packaged and shipped to the laboratory in accordance with DOT shipping requirements and in a manner to ensure that the integrity of the samples is protected. The sample containers shall be cushioned to protect against breakage or puncture.

1.4.6. Sample Analysis

Samples shall be analyzed at an EPA-certified commercial laboratory. Test methods for analysis of all samples shall be performed according to procedures documented in *SW-846* or other methods approved by the Department. Constituents in the hazardous wastes treated at the OD Unit are to be included in these analyses. Analytical methods and detection limits are listed in Tables H-2 through H-4.

Calibration, operation, QC (bias, precision, blank and matrix effects), and requirements for laboratory analyses shall be performed as listed in the individual analytical methods of *SW-846*. All laboratory analyst notebooks, log-sheets, instrument printouts, charts, and calculations relevant to analyses of these samples shall be identified and remain accessible. This information may be requested by the Department for independent review and validation. If requested by the Department, the information shall be provided by the Permittee to the Department.

The analytical laboratory shall have procedures for minimizing cross-contamination of samples and securing sample custody within the laboratory.

1.4.7. Quality Assurance (QA)/Quality Control (QC)

Because decisions about closure activities shall be based, in part, on analyses of samples, a program to ensure data are of high quality is mandatory. The Permittee shall ensure the high quality of data by documenting sample collection and management. The Permittee shall accomplish this also by following a QA/QC program that mandates documentation of the precision and accuracy of all laboratory analyses, as well as data completeness, representativeness, and comparability.

Sampling activities shall include the collection of field QC samples and their documentation. QC samples to be collected include equipment blanks, trip blanks, field blanks, and duplicate samples. Table H-7 of this Permit Attachment (H) summarizes the field QC sample requirements.

Blanks and duplicate samples shall be prepared or collected to monitor the performance of the data collection and analysis process, beginning with sampling and continuing through transportation, storage, and analysis. To document adequate decontamination of sampling equipment, equipment blanks (consisting of deionized water rinsate captured from decontaminated sampling equipment) shall be prepared and analyzed if reusable sampling equipment is employed.

In the case of samples to be analyzed for volatile organic compounds, in order to document cross-contamination attributable to shipping and handling procedures, trip blanks (consisting of deionized water) shall be prepared, taken to the sampling site, and then shipped to the laboratory along with the other samples to be analyzed for VOCs.

In the case of samples to be analyzed for volatile organic compounds, field blanks shall also be prepared to document cross-contamination attributable to field conditions. Field blanks (consisting of deionized water) shall be prepared, taken to the sampling site, their containers opened during the sampling of environmental media, and then shipped to the laboratory along with the samples to be analyzed for volatile organic compounds.

Equipment blanks shall be collected at a frequency of one per sampling day per media type. Duplicate samples shall be collected at a frequency of at least one per every twenty environmental samples per media type. Field and trip blanks shall be collected at a frequency of at least one each per sampling day. Acceptance criteria for QA/QC sample analyses shall be consistent with those for environmental samples as specified in Permit Attachment D, Section 1.3.

The Permittee shall require that the analytical laboratory operate under a QA Program Plan (QAPP) that meets the requirements of *SW-846*. QC procedures at the analytical laboratory are to be guided by the laboratory's QAPP. Laboratory QC samples are required to evaluate the accuracy and precision of analytical data. The laboratory must analyze and report to the Permittee the results of the following types of laboratory quality control samples: method blanks, duplicates, spikes, matrix spikes and matrix spike duplicates.

The Permittee shall also validate the data following the procedures in Permit Section 6.5.18.3.

1.5. MANAGEMENT OF WASTE FROM CLOSURE ACTIVITIES

Wastes that will be generated during closure activities at the OD Unit include decommissioned structures and equipment, excess soil from sampling, decontamination water, PPE, and possibly contaminated soil and debris and treatment residues.

1.5.1. Waste Management

Wastes associated with closure activities at the OD Unit shall also be managed as follows:

1. Wastes shall be stored in appropriate containers that are compatible with the wastes and that are in good condition.
2. If hazardous or potentially hazardous, the containers shall be labeled as hazardous waste or shall be labeled with the contents of the container. If potentially hazardous waste is determined not to be hazardous waste, the container label shall be changed to indicate that the waste is not hazardous waste.
3. Hazardous waste shall be managed in accordance with all applicable regulations in 40 C.F.R. 261-268.
4. Waste containers shall remain under the control of the personnel generating the waste.
5. Waste containers shall be segregated according to compatibility and chemical waste type.
6. Wastes shall be stored in containers that remain closed, except when adding or removing wastes.
7. Waste containers bearing free liquid shall be provided with secondary containment of sufficient volume to prevent spilled liquids from being released onto the ground.
8. Waste containers shall be managed in such a way as to prevent ruptures and leaks.

9. Waste containers shall be labeled appropriately, pending receipt of analytical results. Labels shall be marked using a permanent marker or pen. In addition to that required by item #2 of this Section, label information shall include waste source, depth (if appropriate), the date on which accumulation began, and the name and contact information of the generator.

1.5.2. Waste Characterization

Characterization of waste generated during closure activities shall be based upon the results of sampling and analysis.

1.5.3. Waste Disposal

All wastes from closure activities determined to be hazardous shall be managed in accordance with the Hazardous Waste Management Regulations (HWMR) from the time of generation. Hazardous waste shall be shipped off-site for treatment and disposal at a permitted RCRA Subtitle C facility. Wastes characterized as non-hazardous shall also be managed and disposed of in accordance with applicable law.

1.6. GROUNDWATER MONITORING WELLS

Groundwater monitoring wells shall be properly plugged and abandoned in accordance with all regulations and Department guidance, provided groundwater contamination has not occurred. If groundwater contamination has occurred, monitoring wells shall be maintained for the purpose of implementing corrective action. If corrective action is required by the Department, the Permittee shall immediately implement corrective action pursuant to Part 6 of this Permit.

REFERENCES

U.S. Environmental Protection Agency (EPA), 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; 3rd edition, update 3, SW-846, Office of Solid waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1980. Samplers and Sampling Procedures for Hazardous Waste Streams; Municipal and Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio, EPA-600/2-80-018, January 1980.

"U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work for Inorganic and Organic Analysis" (EPA, 1990).

TABLE H-1
Closure Schedule

Activity	Time Required
Advertise for proposals.	-90 Days
Notify the Department of receiving final volume of hazardous waste.	-45 Days
Receive proposals.	-30 Days
Select contractor and award contract.	-10 Days
Begin closure activities—field investigation.	Day 0
OD Unit structure and equipment removal.	Day 10
Conduct soil sampling.	Day 50
Obtain analysis of soil samples.	Day 80
Soil excavation (if necessary) and verification sampling.	Day 100
Final decontamination activities and soil removal (if necessary).	Day 130
Submit final report and Closure Certification to the Department.	180 days after receiving final volume of hazardous waste

Note: The schedule above indicates calendar days from the beginning of closure activities by which the listed activities shall be completed. Some activities may be conducted simultaneously.

TABLE H-2
Maximum Detection Limits and Analytical Methods for Analysis of Metals

Analyte	Maximum Detection Limit		EPA *SW-846*[c] Analytical Method[d]
	Water (ug/L)[a]	Soil (mg/kg)[b]	
Arsenic	1.0	1.0	6010C, 7000B, 7061A
Antimony	2.0	6.0	6010C, 7000B
Barium	2.0	20.0	6010C, 7000B
Beryllium	0.20	0.50	6010C, 7000B
Cadmium	0.10	0.5	6010C, 7000B
Chromium	1.0	1.0	6010C, 7000B, 7195, 7196A, 7197
Cobalt	1.0	5.0	6010C, 7000B
Copper	2.0	2.5	6010C, 7470A, 7471B
Lead	1.0	1.0	6010C, 7000B
Mercury	0.2	0.1	7000B, 7470A, 7471B
Nickel	1.0	4.0	6010C, 7000B
Selenium	2.0	3.5	6010C, 7000B, 7741B, 7742
Silver	0.20	1.0	6010C, 7000B
Thallium	1.0	2.5	6010C, 7000B
Tin	5.0	5.0	6010C, 7000B
Vanadium	1.0	5.0	6010C, 7000B
Zinc	2.0	5.0	6010C, 7000B

a ug/L = micrograms per liter;

b mg/kg = milligrams per kilogram (non-aqueous detection limit);

c U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, *SW-846"*.

d Another applicable or newer method may be used with prior NMED approval.

TABLE H-3
Maximum Detection Limits and Analytical Methods
for Analysis of VOCs and SVOCs

Analyte	Media (Maximum Detection Limit)	
	Water (ug/L)[1]	Soil (ug/kg)[2]
Volatile Organic Compounds (VOCs)		
Method SW-846-8260B		
Acetone	5.0	10
Benzene	0.50	5.0
Bromochloromethane	0.50	5.0
Bromodichloromethane	0.50	5.0
Bromoform	0.50	5.0
Bromomethane	0.50	5.0
Carbon disulfide	0.50	5.0
Carbon tetrachloride	0.50	5.0
Chlorobenzene	0.50	5.0
Chloroethane	0.50	5.0
Chloroform	0.50	5.0
Chloromethane	0.50	5.0
cis-1,2-Dichloroethene	0.50	5.0
cis-1,3-Dichloropropene	0.50	5.0
Cyclohexane	0.50	5.0
Dibromochloromethane	0.50	5.0
Dichlorodifluoromethane	0.50	5.0
Ethylbenzene	0.50	5.0
Isopropylbenzene	0.50	5.0
Methyl acetate	0.50	5.0
Methylcyclohexane	0.50	5.0
Methylene chloride	0.50	5.0
Methyl tert-butyl ether (MTBE)	0.50	5.0
4-Methyl-2-pentanone	5.0	10
Styrene	0.50	5.0
Toluene	0.50	5.0
trans-1,2-Dichloroethene	0.50	5.0
trans-1,3-Dichloropropene	0.50	5.0
Trichloroethene (TCE)	0.50	5.0
Trichlorofluoromethane	0.50	5.0
Tetrachloroethene	0.50	5.0
m,p-Xylene	0.50	5.0
o-Xylene	0.50	5.0
Vinyl chloride	0.50	5.0
1,2-Dibromo-3-chloropropane	0.50	5.0
1,2-Dichlorobenzene	0.50	5.0
1,3-Dichlorobenzene	0.50	5.0
1,4-Dichlorobenzene	0.50	5.0
1,1-Dichloroethane	0.50	5.0

Table H-3 (Continued)		
Analyte	**Media**	
	Water (ug/L)	**Soil (ug/kg)**
1,2-Dibromoethane	0.50	5.0
1,2-Dichloroethane	0.50	5.0
1,1-Dichloroethene	0.50	5.0
1,2-Dichloropropane	0.50	5.0
1,4-Dioxane	1.0	100
1,1,2,2-Tetrachloroethane	0.50	5.0
1,2,3-Trichlorobenzene	0.50	5.0
1,2,4-Trichlorobenzene		5.0
1,1,1-Trichloroethane	0.50	5.0
1,1,2-Trichloroethane	0.50	5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	0.50	5.0
1,2,3-Trichloropropane	na	10.0
1,2,4-Trimethylbenzene	na	na
1,3,5-Trimethylbenzene	na	na
2-Butanone	5.0	10
2-Hexanone	5.0	10
Method SW-846-8011		
Ethylene dibromide	0.02	na
1,2-dibromo-3-chloropropane	0.02	na
Semi-Volatile Organic Compounds (SVOCs)		
Method SW-846-8270C		
Benzaldehyde	5.0	170
Phenol	5.0	170
Bis(2-chloroethyl) ether	5.0	170
2-Chlorophenol	5.0	170
2-Methylphenol	5.0	170
2,2'-Oxybis(1-choloropropane)	5.0	170
Acetophenone	5.0	170
4-Methylphenol	5.0	170
N-Nitroso-di-n propylamine	5.0	170
Hexachloroethane	5.0	170
Nitrobenzene	5.0	170
Isophorone	5.0	170
2-Nitrophenol	5.0	170
2,4-Dimethylphenol	5.0	170
Bis(2-chloroethoxy) methane	5.0	170
2,4-Dichlorophenol	5.0	170
Naphthalene	5.0	170
4-Chloroaniline	5.0	170
Hexachlorobutadiene	5.0	170
Caprolactam	5.0	170
4-Chloro-3-methylphenol	5.0	170
2-Methylnaphthalene	5.0	170
Hexachlorocyclopentadiene	5.0	170
2,4,6-Trichlorophenol	5.0	170
2,4,5-Trichlorophenol	5.0	170
1,1'-Biphenyl	5.0	170
2-Chloronaphthalene	5.0	170

Table H-3
(Continued)

Analyte	Media	
	Water (ug/L)	**Soil (ug/kg)**
2-Nitroaniline	10	330
Dimethylphthalate	5.0	170
2,6-Dinitrotoluene	5.0	170
Acenaphthylene	5.0	170
3-Nitroaniline	10	330
Acenaphthene	5.0	170
2,4-Dinitrophenol	10	330
4-Nitrophenol	10	330
Dibenzofuran	5.0	170
2,4-Dinitrotoluene	5.0	170
Diethyl phthalate	5.0	170
Fluorene	5.0	170
4-Chlorophenyl-phenyl ether	5.0	170
4-Nitroaniline	10	330
4,6-Dinitro-2-methylphenol	10	330
N-Nitrosodiphenylamine	5.0	170
1,2,4,5-Tetrachlorobenzene	5.0	170
4-Bromophenyl-phenylether	5.0	170
Hexachlorobenzene	5.0	170
Atrazine	5.0	170
Pentachlorophenol	5.0	330
Phenanthrene	5.0	170
Anthracene	5.0	170
Carbazole	5.0	170
Di-n-butyl phthalate	5.0	170
Fluoranthene	5.0	170
Pyrene	5.0	170
Butyl benzyl phthalate	5.0	170
3,3'-dicholorobenzidine	5.0	170
Benzo(a)anthracene	5.0	170
Chrysene	5.0	170
Bis(2-ethylhexyl) phthalate	5.0	170
Di-n-octyl phthalate	5.0	170
Benzo(b) fluoranthene	5.0	170
Benzo(k) fluoranthene	5.0	170
Benzo(a) pyrene	5.0	170
Indeno(1,2,3,-cd) pyrene	5.0	170
Dibenzo(a,h) anthracene	5.0	170
Benzo(g,h,i)perylene	5.0	170

1. Micrograms per liter = parts per billion
2. Micrograms per kilogram = parts per billion
3. not applicable

TABLE H-4
Maximum Detection Limits and Analytical Methods for Analysis of High Explosives and Other Compounds

Analyte (Group)	Maximum Detection Limits[a]		Analytical Method EPA *SW-846*[b]
	Soil (mg/kg)	Water (ug/L)	
1,3,5-Trinitrobenzene	0.25	7.3	8330B
1,3-Dinitrobenzene	0.25	4.0	"
2,4,6-Trinitrotoluene (TNT)	0.25	6.9	"
2,4-Dinitrotoluene	0.25	5.7	"
2,6-Dinitrotoluene	0.26	9.4	"
2-Amino-4,6-Dinitrotoluene	0.25	--	"
4-Amino-2,6-Dinitrotoluene	0.25	--	"
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.22	13.0	"
2-Nitrotoluene	0.25	12.0	"
Nitrobenzene	0.26	6.4	"
3-Nitrotoluene	0.25	7.9	"
4-Nitrotoluene	0.25	8.5	"
Tetryl	0.65	4.0	"
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	1.0	14.0	"
Nitroglycerin (NG)	6.1	3.65	"
Perchlorate	0.010	0.53	6850
White phosphorus	0.43	0.008	7580
Dioxins and Furans	0.50	0.005	8280B or 8290A

a. mg/kg = milligrams per kilogram; ug/L = micrograms per liter.

b. U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, *SW-846"*.

TABLE H-5
Sample Containers, Preservation Methods, and Holding Times for Soil Samples

Analyte Group	Container Type[a]	Preservation Method	Holding Time[b]
Metals[c] (except mercury and hexavalent chromium)	4 oz glass jar with PTFE[d] cap	Cool to 4 degrees Celsius (°C)	180 days
Mercury	4 oz glass jar with PTFE cap	Cool to 4°C	28 days
Hexavalent chromium	4 oz glass jar with PTFE cap	Cool to 4°C	28 days
Volatile organic compounds[c]	4 oz glass jar with PTFE cap	Cool to 4°C	14 days
Semivolatile organic compounds[c]	4 oz glass jar with PTFE cap	Cool to 4°C	14 days
High explosives[c]	4 oz glass jar with PTFE cap	Cool to 4°C	14 days
Perchlorate	4 oz glass jar with PTFE cap	Cool to 4°C	28 days
White Phosphorus	4 oz glass jar with PTFE cap	Cool to 4°C	Indefinite (if preserved at or below 4°C, kept in the dark, and tightly sealed)
Dioxins and Furans	250 mL wide mouth amber glass jar with PTFE lid	Cool to 4°C	30 days

a. Other container types may be used depending upon the laboratory or the method used and with prior NMED approval.

b. Holding time information from U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*.

c. Volatile and semivolatile organic compounds, metals, and high explosives are listed by respective test method numbers in U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*.

d. Polytetrafluoroethylene (Teflon™)

TABLE H-6
Sample Containers, Preservation Methods and Holding Times for Liquid Samples

Analyte Group	Container Type[a]	Preservation Method	Holding Time[b]
Metals[c] (except mercury and hexavalent chromium)	1-liter Polyethylene bottle with PTFE[d] lined cap	HNO_3[e] to pH <2 and cool to 4 degrees Celsius (°C)	180 days
Mercury	1-liter Polyethylene or Glass bottle with PTFE-lined lid	HNO_3 to pH <2	28 days
Hexavalent chromium	1-liter Amber Glass jar with PTFE lined cap	Cool to 4°C	24 hours
Volatile organic compounds[c]	3 x 40 mL Glass vials with PTFE-lined septum caps	HCl[f] Cool to 4°C	14 days
Semivolatile organic compounds[c]1 Liter	2 x 1-liter Amber Glass with PTFE-lined lid	Cool to 4°C	7 days
High explosives[c]	1-liter Amber Glass with PTFE-lined lid	Cool to 4°C	7 days
Perchlorate	125-mL Polyethylene bottle with PTFE-lined lid	Cool to 4°C	28 days
White Phosphorus	500-mL Polyethylene bottle with PTFE-lined lid	Cool to 4°C, kept in dark storage	5 days
Dioxins and Furans	4 x 1-liter Amber Glass with PTFE-lined lid	Cool to 4°C	30 days

a. Other container types may be used depending upon the laboratory or the method used and with prior NMED approval.

b. Holding time information from U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846.*

c. Volatile and semivolatile organic compounds, metals, and high explosives are listed by respective test method numbers in U.S. Environmental Protection Agency, 1986 and all approved updates, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," *SW-846*.

d. Polytetrafluoroethylene (Teflon™)

e. HNO_3 = Nitric acid

f HCl = Hydrochloric acid

TABLE H-7
Field Quality Control Samples

Quality Control Sample Type	Sample Matrix	Applicable Analyses	Frequency	Purpose
Trip blank	Water/Soil	VOCs[a]	One per day	Document any contamination attributable to shipping and field handling procedures
Field blank	Soil/Water	VOCs	One per day	Document any contamination attributable to field conditions
Field duplicate	Soil/Water	VOCs, SVOCs[b], metals, HE[c] Dioxins and Furans White Phosphorus Perchlorate	Minimum of one per 20 environmental samples per media type	Document precision of the sampling/analysis process
Equipment blank	Water	VOCs, SVOCs, metals, HE Dioxins and Furans White Phosphorus Perchlorate	One sample per day per media type	Document whether decontamination of sampling equipment was adequate

a VOCs = volatile organic compounds.

b SVOCs = semivolatile organic compounds.

c. HE = High Explosives

PERMIT ATTACHMENT I: COMPLIANCE SCHEDULES

1.0 INTRODUCTION

The Permittee shall meet the due dates in the compliance schedules of Tables I-1 through I-3 of this Permit Attachment (I), as well as any other due dates specified in this Permit that are not included in the tables of Permit Attachment I. Table I-1 contains a list of general submittals and their due dates. Table I-2 lists various submittals related to corrective action and their due dates, whereas, Table I-3 lists submittals for corrective action related to specific SWMUs and AOCs and their associated due dates.

Table I-1
General Submittals[a]

Facility Submission Requirements	Due Date
Biennial Report (Permit Section 2.16)	March 1 of every even-numbered year
Waste Minimization Program Certified Report (Permit Section 2.8)	Annually, by December 1
Annual Sampling and Analysis Report for Air (Permit Section 3.3)	Annually by March 31
Permit renewal (Permit Section 1.14)	180 days before Permit expiration
Non-Compliance Oral Report (Permit Section 1.27, item 1)	Within 24 hours of non-compliance activity
Non-Compliance Written Report (Permit Section 1.27, item 2)	Within five days of non-compliance activity
Certification of Construction or Modification (Permit Section 1.26)	Prior to treatment or storage of hazardous waste in the modified portion of the permitted unit
Revised Closure Plan (Permit Sections 4.1 and 4.2)	Within 60 days after discovering that a revised Closure Plan is required in accordance with this Permit, or within 60 days after receiving written notification by the Department whichever is earlier
Notification of Closure (Permit Section 4.3)	45 days prior to closure
Final Closure Report and written Closure Certification (Permit Section 4.7)	Within 60 calendar days from the date of completion of closure of the OD Unit.
Human Risk Screening: Exceedances of SSLs (Permit Attachment D, Section 1.6)	Within 15 days of exceedance
Annual Soil Sampling Report (Permit Attachment D, Section 1.7)	Within 90 days of completion of each sampling event
Monitoring Well Installation Plan (Permit Section 3.5.1)	Within 90 days of the effective date of this Permit
Well Completion Report (Permit Section 3.5.1)	Within 30 days of completing well installation
Groundwater Sampling and Analysis Plan (Permit Section 3.5.2)	Within 90 days of the effective date of this Permit

a. Not necessarily all-inclusive listing of required submittals under this Permit

TABLE I-2 Submittal Requirements for Corrective Action	
TYPE OF SUBMITTAL	**DUE DATE**
ANNUAL REPORTS	
Annual Report: Outdoor Testing and Training Activities (Permit Section 6.1.7)	90 days from effective date of this Permit and annually thereafter by March 31 of each year
Quarterly Reports	
Quarterly Progress Reports (Permit Section 6.1.6)	January 31, April 30, July 31, and October 31 of each calendar year
Quarterly Perchlorate Screening Reports (Permit Section 6.4.1.4)	January 31, April 30, July 31, and October 31 of each year for at least 8 consecutive quarters
Other Reports/Submittals	
Offsite Access (Permit Section 6.1.1)	Immediately upon discovery
Field Sampling/Activities (Permit Section 6.1.2)	At least 15 days prior to field sampling or activity
Verbal notification of newly-discovered releases, SWMUs or AOCs (Permit Section 6.1.8)	Within 24 hours after release discovery
Written notification of newly-discovered releases, SWMUs or AOCs (Permit Section 6.1.8)	Within 15 days after release discovery
SWMU Assessment Report (SAR) (Permit Section 6.1.8)	Within 90 days after submitting written notification of a newly-discovered SWMU/AOC
Notification of Land Transfer (Permit Section 6.1.12)	Within 90 days of transfer of the property
Investigation Work Plan (Permit Section 6.2.2.1.1)	Date specified in Table I-3
Investigation Report (Permit Section 6.2.2.1.2)	Schedule provided in Table I-3
Corrective Measures Evaluation (CME) Work Plan (Permit Section 6.2.2.2.2)	Within 90 days of notification by the Department
Corrective Measures Evaluation (CME) Report (Permit Section 6.2.2.2.3)	Within 90 days of completion of CME
Risk Assessment Report (Permit Section 6.2.4.5)	Appended to or in combination with a CME or Investigation Report, or as otherwise specified in a work plan or by the Department in writing
CMI Work Plan (Permit Section 6.2.2.2.7)	Within ninety (90) days after the Department's selection of a final remedy, or as otherwise specified by the Department in writing
CMI Work Plan Progress Report (Permit Section 6.2.2.2.9)	In accordance with the schedule approved in the CMI Work Plan
CMI Report (Permit Section 6.2.2.2.10)	Within 90 days of completion of remedy or ACM
Accelerated Corrective Measures (ACM) Work Plan (Permit Section 6.2.2.2.11.2)	Prior to ACM initiation
ACM CMI Report (Permit Section 6.2.2.2.11.3)	Within ninety (90) days of completion of ACM

Table I-2 (continued)	
Interim Measures Work Plan (Permit Section 6.2.2.2.12.2)	Within 60 days after receiving notification from the Department that interim measures are required, or such other period as stated in the notification
Emergency Interim Measures (Permit Section 6.2.2.2.12.4)	Within three (3) days of discovery that Emergency IM are required
Interim Measures Report (Permit Section 6.2.2.2.12.5)	60 days after completion of Interim Measure or as otherwise specified in the Interim Measures Work Plan
Periodic Monitoring Reports (Permit Section 6.5.17.7	Within 90 days of completion of monitoring fieldwork or in accordance with work plan schedules
General Facility Information (Permit Section 6.2.1.1)	Within 90 days from effective date of this Permit and annually thereafter by March 31 if update needed
Report on Potential Receptors (Permit Section 6.2.1.2)	Within 90 days from effective date of this Permit and no later than March 31 of subsequent years if an update is needed
Surface Water Contamination Assessment Report (Permit Section 6.2.1.3)	Within 90 days after effective date of Permit
Corrective Measures Evaluation (CME) Work Plan: Landfills with contents not removed (Permit Section 6.4.1.1**)**	Within 180 days after effective date of this Permit
CME Report: Landfills with contents not removed (Permit Section 6.2.2.2.3)	Within 90 days of completion of CME
Military Range Assessment Report (Permit Section 6.4.1.2)	Within 90 days after effective date of Permit

TABLE I-3
Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)
Requiring Corrective Action

SWMU/ AOC	IRP SITE	DESCRIPTION	REQUIRED SUBMITTAL	
			TYPE	DUE DATE
6-1	LF-001	Landfill #1	Long Term Monitoring and Maintenance Plan	submitted
6-2	LF-002	Landfill #2	Corrective Measures Implementation Report for Cover Construction	submitted
			Corrective Measures Implementation Work Plan for Sewer Line Removal or Abandonment	180 days after effective date of Permit
			Long Term Monitoring and Maintenance Plan	submitted
6-4	LF-008	Landfills #4, 5 and 6	Investigation Work Plan (groundwater selenium)	3/31/11
			Long Term Monitoring and Maintenance Plan	submitted
6-19	OT-029	Open Burn Pit on EOD Range	Investigation Report	12/28/11
6-24	WP-016	Manzano Sewage Treatment Facility	Investigation Report (groundwater)	submitted
MBG	MBG	Manzano Base Groundwater	Investigation Work Plan	3/31/11
6-30	RW-006	Radioactive Burial 11	Investigation Report	submitted
10-2-A	ST-325	Corrosion Control Shop Storm Drain Bldg. 482	Investigation Report	12/28/10
10-2-B	ST-220	Paint Shop, Storm Drain	Investigation Report	12/28/10
10-2-C	ST-220	Plating & Anodizing Bldg. 1001	Investigation Report	submitted
10-2-D	ST-329	Propulsion Branch Floor Drain Bldg. 336	Investigation Report	submitted
10-2-F	ST-325	H-3/H-53 Phase Dock Bldg. 1000 Floor Drains	Investigation Report	12/28/10
10-2-G	ST-331	C-130 Maintenance Shop Bldg. 1009 Storm Sewer	Investigation Report	12/28/10
10-2-H	ST-285	West Storm Sewer System	Investigation Report	12/28/12
10-2-I	ST-286	East Storm Sewer System	Investigation Report	12/28/12
10-7-V	ST-267	Oil/Water Separator Bldg. 57007	Investigation Report	submitted
10-21-B	ST-288	Septic System Bldg. 614	Investigation Report	12/31/12
	ST-289	Septic System Bldg. 617 & 620	Investigation Report	12/31/12
	ST-291	Septic System Bldg. 617	Investigation Report	12/31/12
10-21-C	ST-294	Septic System Bldg. 633	Investigation Report	12/31/12
	ST-298	Septic System Bldg. 730 &734	Investigation Report	12/31/12
	ST-299	Septic System Bldg. 751	Investigation Report	12/31/12

Table I-3
(continued)

SWMU/ AOC	IRP SITE	DESCRIPTION	REQUIRED SUBMITTAL	
			TYPE	DUE DATE
10-21-M	ST-309	Septic System Bldg. 37504	Investigation Report	12/31/12
10-21-N	ST-310	Septic System Bldgs. 37507, 37508 & 37513	Investigation Report	12/31/12
	ST-322	Septic System Bldgs. 37507, 37508 & 37513	Investigation Report	12/31/12
10-21-O	ST-311	Septic System Plant 1 & Bldg. 37501	Investigation Report	12/31/12
10-21-P	ST-312	Septic System Plant 2 & Bldg. 37503	Investigation Report	12/31/12
10-21-Q	ST-313	Septic System Bldgs. 37529 & 37530	Investigation Report	12/31/12
10-21-R	ST-293	Septic System Bldg. 37570	Investigation Report	12/31/12
10-21-S	ST-314	Septic System Bldgs. 48056 & 48059	Investigation Report	12/31/12
10-21-T	ST-316	Septic System CERF Bldgs. 57003 & 57012	Investigation Report	12/31/12
	ST-340	Septic System CERF Bldgs. 57001 & 57002	Investigation Report	submitted
10-21-U	ST-318	Septic System Bldg. 37200	Investigation Report	6/30/13
10-21-V	ST-319	Septic System Bldg. 37541	Investigation Report	6/30/13
10-21-Z	ST-330	Septic System Bldg. 1032	Investigation Report	6/30/13
10-21-AA	ST-333	Septic System SOR Bldg. 66001	Investigation Report	6/30/13
	ST-343	Septic System SOR Bldgs. 66000 & 66008	Investigation Report	6/30/13
	ST-344	Septic System SOR Bldgs. 66042	Investigation Report	6/30/13
ST-70-A	ST-202 & 203	Oil/Water Separator & Sediment Trap Bldgs. 333/334	Investigation Report	submitted
ST-70-B	ST-210	Oil/Water Separator Tank & Drying Rack Bldg. 377	Investigation Report	submitted
ST-70-C	ST-211	Oil/Water Separator Bldg. 381	Investigation Report	submitted
ST-70-D	ST-215 & 216	Oil/Water Separators (2) Bldg. 471	Investigation Report	submitted
ST-70-E	ST-219	Oil/Water Separator Bldgs. 481/482	Investigation Report	submitted
ST-70-F	ST-247	Oil/Water Separator Bldg. 2637	Investigation Report	submitted
ST-70-G	ST-248	Oil/Water Separator Bldg. 20205	Investigation Report	submitted
ST-70-H	ST-258	Oil/Water Separator Bldg. 20375	Investigation Report	submitted
ST-70-I	ST-260	Oil/Water Separator Bldg. 20442	Investigation Report	submitted

Table I-3
(continued)

SWMU/ AOC	IRP SITE	DESCRIPTION	REQUIRED SUBMITTAL	
			TYPE	DUE DATE
ST-73	ST-073	CERF Drain	Investigation Report	submitted
ST-106 and SS-111	ST-106 and SS-111	Bulk Fuels Facility Spill	CME Report	180 days after NMED approves site characterization
DP-067	DP-067	Three Mine Shafts	Investigation Report	6/16/11
DP-088	DP-088	Trestle Site Disposal Area	Investigation Report	6/16/11
WP-026	WP-026	Sewage Lagoons and Golf Course Pond	Investigation Report	submitted
SS-102	SS-102	ARES Test Facility	Investigation Report	6/30/11
RW-68	RW-68	Radium Dump/Slag Pile and Cratering Area	Investigation Report	submitted
TAG	TAG	Tijeras Arroyo Groundwater Area	Investigation Report	submitted
Monitoring Well WYO-4 Area	WYO-4 Well Ground-water Area	TCE contaminated groundwater	Investigation Work Plan	3/31/11
EOD Hill	EOD Hill	Perchlorate contaminated groundwater	Investigation Work Plan	submitted
McCormick Ranch	McCor-mick Ranch	Nitrate contaminated groundwater	Investigation Work Plan	3/31/11

PERMIT ATTACHMENT J: LIST OF HAZARDOUS WASTE MANAGEMENT UNITS

1.0 INTRODUCTION

Table J-1 lists the operating and closed hazardous waste management units at the Facility.

TABLE J-1
Hazardous Waste Management Units

Operating Hazardous Waste Management Units
Open Burn (OB) Treatment Unit (pending closure)
Open Detonation (OD) Treatment Unit
Closed Hazardous Waste Management Units
Hazardous Waste Container Storage Unit (CSU) / Defense Reutilization and Marketing Office Building 1024

PERMIT ATTACHMENT K: LIST OF SWMUS AND AOCS FOR WHICH CORRECTIVE ACTION IS COMPLETE

1.0 INTRODUCTION

Table K-1 lists SWMUs and AOCs for which corrective action is complete without controls.

TABLE K-1
Solid Waste Management Units (SWMUS) and Areas of Concern (AOCS) for which Corrective Action is Complete Without Controls
(Granted No Further Action Status)

SWMUs/AOCs			
SWMU/AOC	**IRP SITE**	**DESCRIPTION**	**DATE OF APPROVAL**
6-7	LF-018	Landfill A	8/28/03
6-10	LF-009	Abandoned Landfill	8/28/03
6-15	LF-045	Unnamed Dump	8/28/03
6-16	FT-013	Kirtland Fire Training Area	8/28/03
8-53	ST-335	Paint Shop Floor Drain, Bldg. 20681	8/28/03
8-58	ST-321	Battery Storage Area, Bldg. 57007	8/28/03
10-3	ST-249	Waste Oil Storage Tank, Bldg. 20205	8/28/03
ST-66	ST-066	Trestle Facility Oil Water Separator and Pit	8/28/03
SS-76	SS-076	Fuel Tank Burn Area	8/28/03
SS-83	SS-083	Skeet Range and Landfill Road	8/28/03
ST-326	ST-326	Waste Oil Storage Tank, Bldg. 20375	8/28/03
ST-328	ST-328	Blast Overpressure Site Cesspools	8/28/03
6-A1	RW-021	Radioactive Burial 7	8/03/05
8-49	SS-061	Fuel Shop Waste Battery Storage, Bldg. 20667	8/03/05
LF-56	LF-056	Landfill D	8/03/05
OT-086	OT-086	Former Small Arms Range	8/03/05
RW-085	RW-085	Manzano Maintenance Building	8/03/05
SS-65	SS-065	Horizontal Dipole Drum Rack	8/03/05
SS-082	SS-082	ALECS Facility	8/03/05
SS-103	SS-103	Jet Engine Test Fuel Line	8/03/05
ST-59	ST-059	ART Drum	8/03/05
ST-60	ST-060	ART Pit	8/03/05
6-A2-A	RW-004	Radioactive Holding Tank 4	9/21/05
6-A2-B	RW-005	Radioactive Holding Tank 5	9/21/05
6-A2-C	RW-017	Radioactive Holding Tank 6	9/21/05
6-A2-D	RW-019	Radioactive Holding Tank 8	9/21/05
6-A2-E	RW-023	Radioactive Holding Tank 9	9/21/05

TABLE K-1
(Continued)

SWMU/AOC	IRP SITE	DESCRIPTION	DATE OF APPROVAL
6-8	LF-015	Landfill B	9/21/05
6-29	LF-020	Manzano Landfill	9/21/05
8-13	ST-071	Bldg. 1000/1001 Oil/Water Separator	9/21/05
9-14	ST-270	Buried Caustic Drain Line Bldg. 617	9/21/05
9-15	ST-271	Neutralization Pit Bldg. 617	9/21/05
9-16	ST-272	Evaporation/Infiltration Pond Bldg. 617	9/21/05
10-21-S	ST-353	Bldg. 48057 Septic Tank	9/21/05
	ST-354	Sheep Grooming Septic Tank	9/21/05
SS-69	SS-069	Drum Storage Area	9/21/05
ST-100	ST-100	Coyote Springs Cesspool	9/21/05
ST-341	ST-341	Condensate Tank Bldg. 1033	9/21/05
WP-58	WP-058	East Laundry Bldg. 20451	9/21/05
10-21-OO	ST-355	Riding Stables Residence [Domestic Sewage]	9/21/05
OT-010	OT-010	Radiation Training Sites 5-8	9/21/05
RW-075	RW-075	South Tijeras Radiation Trench	9/21/05
10-7-A	ST-204	Sediment Trap Bldg. 333	11/29/05
	ST-205	Oil/Water Separator Bldg. 333	11/29/05
10-7-B	ST-206	Oil/Water Separator Bldg. 336	11/29/05
	ST-207	Oil/Water Separator Bldg. 336	11/29/05
	ST-208	Oil/Water Separator Bldg. 336	11/29/05
	ST-209	Catch Basin Bldg. 336	11/29/05
10-7-C	ST-212	Oil/Water Separator Bldg. 381	11/29/05
	ST-213	Area Drain Bldg. 381	11/29/05
10-7-D	ST-217	Oil/Water Separator Bldg. 481	11/29/05
10-7-E	ST-218	Oil/Water Separator Bldg. 482	11/29/05
10-7-F	ST-222	Oil/Water Separator Bldg. 1031	11/29/05
	ST-223	Sewage Ejector Unit Bldg. 1031	11/29/05
	ST-224	Area Drain Bldg. 1031	11/29/05
	ST-225	Holding Tank Bldg. 1031	11/29/05
10-7-G	ST-226	Oil/Water Separator Bldg. 1037	11/29/05
	ST-227	Holding Tank Building 1037	11/29/05
10-7-H	ST-228	Area Drain Bldg. 1040	11/29/05
10-7-I	ST-229	Sewage Ejector Unit Bldg. 1043	11/29/05
10-7-J	ST-230	Oil/Water Separator Bldg. 1046	11/29/05
	ST-231	Holding Tank Bldg. 1046	11/29/05
	ST-232	Sewage Ejector Unit Bldg. 1046	11/29/05
	ST-233	Area Drain Bldg. 1046	11/29/05

TABLE K-1
(Continued)

SWMU/AOC	IRP SITE	DESCRIPTION	DATE OF APPROVAL
10-7-K	ST-234	Oil/Water Separator Bldg. 1051	11/29/05
	ST-235	Oil/Water Separator Bldg. 1051	11/29/05
	ST-236	Oil/Water Separator Bldg. 1051	11/29/05
	ST-237	Area Drain Bldg. 1051	11/29/05
10-7-L	ST-238	Oil/Water Separator Bldg. 1056	11/29/05
	ST-239	Oil/Water Separator Bldg. 1056	11/29/05
10-7-M	ST-240	Holding Tank Bldg. 1058	11/29/05
10-7-N	ST-241	Oil/Water Separator Bldg. 1061	11/29/05
10-7-O	ST-244	Oil/Water Separator Bldg. 1064	11/29/05
	ST-245	Holding Tank Bldg. 1064	11/29/05
10-7-P	ST-246	Oil/Water Separator Bldg. 1070	11/29/05
10-7-Q	ST-254	Oil/Water Separator Bldg. 20365	11/29/05
10-7-R	ST-255	Oil/Water Separator Bldg. 20375	11/29/05
	ST-256	Oil/Water Separator Bldg. 20375	11/29/05
	ST-257	Oil/Water Separator Bldg. 20375	11/29/05
10-7-S	ST-259	Oil/Water Separator Bldg. 20422	11/29/05
10-7-T	ST-263	Oil/Water Separator Bldg. 23226	11/29/05
10-7-U	ST-264	Oil/Water Separator Bldg. 30142	11/29/05
6-14	ST-051	Sewage Effluent Line	2/27/06
8-5	ST-201	Oil/Water Separator Bldg. 255	2/27/06
8-6	WP-047	Silver Recovery Unit	2/27/06
8-26	ST-242	Oil/Water Separator Bldg. 1063	2/27/06
	ST-243	Oil/Water Separator Bldg. 1063	2/27/06
8-28	ST-250	Oil/Water Separator Bldg. 20338	2/27/06
8-29	ST-251	Oil/Water Separator Bldg. 20344	2/27/06
8-31-A	ST-252	Oil/Water Separator Bldg. 20348	2/27/06
8-31-B	ST-253	Oil/Water Separator Bldg. 20348	2/27/06
8-41	ST-274	Waste Battery Storage Area Bldg. 20423	2/27/06
8-47	ST-261	Oil/Water Separator (OW/S) Bldg. 20423	2/27/06
8-55	ST-262	Oil/Water Separator CE Bldg. 20698	2/27/06
10-1-A	ST-278	Sanitary Sewer System A	2/27/06
10-1-B	ST-279	Sanitary Sewer System B	2/27/06
10-1-C	ST-280	Sanitary Sewer System C	2/27/06
10-1-D	ST-281	Sanitary Sewer System D	2/27/06
10-1-E	ST-282	Sanitary Sewer System E	2/27/06
10-1-F	ST-283	Sanitary Sewer System F	2/27/06
10-1-G	ST-284	Sanitary Sewer System G	2/27/06
10-1-H	ST-327	Manzano Sanitary Sewer System	2/27/06

TABLE K-1
(Continued)

SWMU/AOC	IRP SITE	DESCRIPTION	DATE OF APPROVAL
6-31	OT-028	McCormick Ranch Range	6/02/06
9-4	ST-276	Waste Accumulation Area Bldg. 617	6/02/06
9-20	SS-062	Waste Accumulation Area Bldg. 909	6/02/06
10-21-B	ST-273	Septic System Bldg. 618	6/02/06
	ST-351	Building 635 Septic Tank	6/02/06
	ST-352	Building 613/614 Septic Tank	6/02/06
DP-099	DP-099	Disposal Pit Bldg. 29015	6/02/06
DP-101	DP-101	Old EOD Disposal Pits	6/02/06
FT-015	FT-015	NMERI Fire Suppression Test Area	6/02/06
LF-268	LF-268	Active Landfill	6/02/06
OT-74	OT-074	Pistol Range Sites	6/02/06
OT-091	OT-091	South Coyote Firing Site	6/02/06
RW-084	RW-084	Manzano Burial Site	6/02/06
SD-090	SD-090	JATO Rocket Motor Disposal Site	6/02/06
SS-078	SS-078	Water Tower Soils	6/02/06
SS-079	SS-079	Building 381 Spill Site	6/02/06
SS-081	SS-081	Detention Pond and Yard Bldg. 907	6/02/06
SS-089	SS-089	Transportation Yard	6/02/06
ST-72	ST-072	MWSA Security Garage Oil/Water Separator, Bldg. 30146	6/02/06
ST-080	ST-080	Auto Hobby Shop Bldg. 30124	6/02/06
ST-347	ST-347	Building 29015 Cesspool	6/02/06
WP-087	WP-087	Grab Site Waste Pile	6/02/06
WP-339	WP-339	Contractor Yard West of Bldg. 20423	6/02/06
6-11	LF-044	Fill Area Southeast of Old Sewage Lagoons (Former LF-044)	7/17/07
ST-064	ST-064	Corps of Engineers (COE) Vehicle Maintenance Yard, (Former ST-337)	7/17/07
ST-108	ST-108	Abandoned JP-4 Fuel Line (ST-108)	7/17/07
SS-77	SS-77	Abandoned Railroad Spur	7/17/07
6-32	FT-014	Manzano Fire Training Area (Former FT-14)	7/17/07
8-35	ST-214	Waste Oil Storage Tank, Building 471 (Former ST-214)	7/17/07
10-21-B	ST-348	Site ST-348, Building 610 Septic Tank	7/17/07
10-21-B	ST-349	Site ST-349, Building 626 Septic Tank	7/17/07
10-2-E	SS-063	Jet Engine Test Cell (Former ST-336)	7/17/07
6-22	OT-046	Lake Christian	7/17/07
LF-107	ST-107	Veterans Administration Demolition Debris Landfill (LF-107)	7/17/07
SS-78-B	SS-078	Water Tower Soils (WT-21871)	7/17/07

TABLE K-1
(Continued)

SWMU/AOC	IRP SITE	DESCRIPTION	DATE OF APPROVAL
SS-78-C	SS-078	Water Tower Soils (WT-2474)	7/17/07
SS-78-D	SS-078	Water Tower Soils (ITRI WTs)	7/17/07
10-21-A	ST-287	Building 525 Septic System	4/29/08
10-21-B	ST-290	Building 619 Septic System	4/29/08
10-21-B	ST-292	Building 622 Septic System	4/29/08
10-21-C	ST-295	Building 638 Septic System	4/29/08
10-21-D	ST-296	Building 702 Septic System	4/29/08
10-21-D	ST-297	Building 707 Septic System	4/29/08
10-21-E	ST-300	Building 20199 Septic System	4/29/08
10-21-F	ST-301	Building 20560 Septic System	4/29/08
10-21-G	ST-302	Building 20599 Septic System	4/29/08
10-21-H	ST-303	Building 20749 Septic System	4/29/08
10-21-I	ST-304	Building 20797 Septic System	4/29/08
10-21-J	ST-305	Building 28054 Septic System	4/29/08
10-21-J	ST-306	Building 28050 Septic System	4/29/08
10-21-K	ST-307	Building 30101 Septic System	4/29/08
10-21-L	ST-308	Building 37511 Septic System	4/29/08
10-21-K	ST-315	Building 30102 Septic System	4/29/08
10-21-T	ST-317	Building 57011 Septic System	4/29/08
10-21-W	ST-320	Building 20149 Septic System	4/29/08
10-21-X	ST-323	Building 29042 Septic System	4/29/08
10-21-Y	ST-324	Building 29051 Septic System	4/29/08
10-21-AA	ST-342	SOR Building 66029 Septic System	4/29/08
10-21-AA	ST-345	SOR Building 66006 Septic System	4/29/08
10-21-BB	ST-346	Trestle Site Septic System	4/29/08
6-3	LF-007	Landfill 3	4/29/08
ST-356	ST-356	Skeet Range Septic Tank [Domestic Sewage]	4/29/08
10-21-X	ST-350	600 Area Field Office Septic Tank [Domestic Sewage]	4/29/08

PERMIT ATTACHMENT L (RESERVED)

(Reserved for Groundwater Sampling and Analysis Plan)

NEW MEXICO
ENVIRONMENT DEPARTMENT

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BUTCH TONGATE
Cabinet Secretary Designate

J. C. BORREGO
Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

December 12, 2016

Colonel Eric. H. Froelich
Base Commander
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5606

Mr. John Pike
Director, Environmental Management Services
377 MSG
2050 Wyoming Blvd SE, Suite 116
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RE: OPERATIONS AND MAINTENANCE PLAN, GROUNDWATER TREATMENT SYSTEM, BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE
EPA ID# NM9570024423, HWB-KAFB-13-MISC

Dear Colonel Froelich and Mr. Pike:

The New Mexico Environment Department (NMED) received the Kirtland Air Force Base (KAFB) (the Permittee) *Operations and Maintenance Plan, Groundwater Treatment System,* dated August 18, 2016. The Operations and Maintenance Plan (O&M Plan) is a reference document for site personnel and includes:

- Equipment information (e.g., manufacturer-supplied O&M Plans and cut sheets);
- Operational procedures;
- Inspections and maintenance;
- Repairs;
- Recordkeeping; and
- Waste management.

The NMED has reviewed the O&M Plan and approves the document with the following modifications.

General Comments:

1. The document shall be revised to reference NMED Ground Water Quality Bureau (GWQB), where applicable, or simply reference NMED. Issues related to failures of the treatment system to treat water to appropriate standards and issues associated with discharges of inappropriate water will be of concern to both the GWQB and Hazardous Waste Bureau (HWB).
2. The document must be revised to include a reference to Discharge Permit (DP) 1839 as finalized, where appropriate, particularly in association with the Contingency Plan and the Sampling and Analysis Plan.
3. Condition 3 of DP 1839 states, "The Permittee shall ensure that the most recent versions of the O&M Plan and the Work Plan for Dissolve-Phase Treatment System design are consistent with the requirements of [the] Discharge Permit." The Permittee shall revise the O&M Plan accordingly.
4. The O&M Plan does not identify the contaminants of concern for the Groundwater Treatment System (GWTS) and incorrectly references the Hazardous Waste Treatment Facility (HWTF) Permit in multiple locations. The document must be revised to include the list of COCs (listed below) and reference the appropriate regulatory document throughout:

    Ethylene dibromide (EDB) – 0.05 micrograms per liter (µg/L)
    Benzene – 5 µg/L
    Ethylbenzene – 700 µg/L
    Toluene – 750 µg/L
    Total xylenes – 620 µg/L
    Iron (Dissolved) – 1 milligram per liter (mg/L)
    Manganese (Dissolved) – 0.2 mg/L.

Specific Comments:

1. **Section 1, Introduction**

    The Introduction needs to be revised to reference all associated regulatory requirements, including the KAFB HWTF Permit and DP 1839.

2. **Section 1.3 Discharge Requirements**

    Permittee's Statement: "The treated groundwater discharged from the GWTS must meet the human health standard for contaminants that are listed in Section 20.6.2.3103 of the New Mexico Administrative Code (NMAC), other requirements of the NMED Ground and Surface Water Protection regulations (NMAC 20.6.2) and must comply with any additional approved federal, state, or local permits."

NMED's Comment: The O&M Plan must be revised to reference the specific standards in the HWTF Permit. The HWTF Permit, Section 6.2.3.1, *Cleanup Levels for Contaminants in Groundwater (other than Perchlorate)*, states: "The cleanup levels for groundwater shall be the New Mexico Water Quality Control Commission (WQCC) water quality standards (20.6.2.3103 and 20.6.2.4103 NMAC) and the drinking water maximum contaminant levels (MCLs) adopted by EPA under the Federal Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26). If both a WQCC standard and a Maximum Contaminant Level (MCL) have been established for a contaminant, then the most stringent of the two levels shall be the cleanup level for that contaminant."

3. **Section 2.1 Operational Approach**

Permittee's Statement: "The flow rate of groundwater from each of the three extraction wells will be dynamic. As the groundwater elevations rise in the aquifer or EDB concentrations change, adjustments to the extraction well flow rates will be made to ensure plume capture."

NMED's Comment: It is not clear what data will be utilized to evaluate and confirm ethylene dibromide (EDB) plume capture or how the Permittee is defining plume capture in the context of adjustment to extraction rates. The Permittee shall revise the O&M Plan to provide additional detail to clearly explain how plume capture will be determined and how adjustments will be made to the extraction rates. Additionally, NMED must be notified of the planned adjustments, with supporting documentation, a minimum of 2-weeks prior to such changes being implemented.

4. **Section 4, Process Monitoring**

Permittee's Statement: "Analytical results will be reported to the NMED Hazardous Waste Bureau as required in any approved permit."

NMED's Comment: Both the NMED HWB and GWQB will need to receive the analytical results for review. The Permittee shall revise the document to reference NMED or specify both HWB and GWQB.

5. **Section 4.1, Extraction Wells**

NMED's Comment: In addition to monitoring the water level in the well casing, the pump status, and the groundwater flow rate, the Permittee should also monitor the height of the filter pack at each of the extraction wells, at least annually.

6. **Section 5.1, Reporting**

NMED's Comment: The first paragraph in Section 5.1 addresses quarterly and annual reports to NMED and lists the information to be included. These reports must include the

effluent discharge volumes to each discharge location. The O&M Plan must be revised accordingly.

The fourth paragraph in the section addresses the evaluation of the system performance associated with the extraction and injection systems. The evaluation and reporting must also address the discharge (i.e., injection of the treated water); the Underground Injection Control (UIC) well performance parameters; flow rates; any observed changes in groundwater chemistry; groundwater mounding; and any changes in groundwater flow direction. The O&M Plan must be revised accordingly.

7. **Section 6.2, Monitoring Well Purge Water**

Permittee's Statement: "Groundwater generated during either well development or routine groundwater monitoring events … that is non-hazardous water … will be discharged to the GWTS through the sump in the building floor."

NMED's Comment: The Permittee's application for discharge via UIC injection well(s) makes the commitment to treating and discharging groundwater from the EDB-only portion of the contaminant plume (See Part I, Subsection 6). Additionally, this limitation is a requirement in the finalized DP 1839 (See Permit Condition #8). The O&M Plan must be revised to include the same limitation in the waste management of monitoring well purge water.

8. **Section 6.3, Backwash Water**

NMED's Comment: This Section addresses the backwashing of various components of the GWTS and after settling and pre-filtration, putting the water back into the GWTS. Backwash water may contain a significant amount of undissolved manganese and iron that could, after settling and pre-filtration, result in elevated dissolved concentrations of these metals. This Section of the O&M Plan must be revised to include the sampling and analysis of filtered backwash water for dissolved phase manganese and iron, prior to adding the water into the GWTS for treatment.

9. **Section 6.4, Depleted Granulated Activated Carbon (GAC)**

Permittee's Statement: "Depleted GAC will be removed from the GAC tanks and regenerated or disposed of off-site in accordance with the NMED RCRA permit."

NMED's Comment: As stated in Section 6.5.7, *Collection and Management of Investigation Derived Waste* of the HWTF Permit, "The Permittee shall include a description of the anticipated IDW waste management process as part of any work plan submitted to the Department for approval." The amount of information provided in Section 6.4 for waste management of depleted GAC is insufficient for NMED approval. The O&M Plan must be revised to include details on the management of depleted GAC,

specifically for off-site disposal of if the GAC is not regenerated. The O&M Plan must be revised accordingly.

10. Section 6.5., GAC Adjustment Solutions

Permittee Statement: "Spent or unused agents used to condition the GAC will be characterized and handled/packaged as hazardous waste in accordance with the Kirtland AFB RCRA Permit."

NMED 's Comment: As stated in Section 6.5.7, *Collection and Management of Investigation Derived Waste* of the HWTF Permit, "The Permittee shall include a description of the anticipated IDW waste management process as part of any work plan submitted to the Department for approval." The amount of information provided in Section 6.4 for management of the GAC adjustment solutions is insufficient for NMED approval. The O&M Plan must be revised to include details on the management of the adjustment solution waste stream.

11. Appendix D, Description of GWTS, Section D.5, Treated Water Discharge

NMED 's Comment: Appendix D addresses the leak detection associated with the conveyance system between the extraction wells and the GWTS. Section D.5 in Appendix D must be revised to include the Permittee's procedures for demonstrating the structural integrity of the effluent conveyance system (Conditions 11 and 16 in DP 1839).

12. Appendix K, Contingency Plan, Section K.2, Notification Procedures

Permittee Statement: "As soon as Kirtland AFB has knowledge that effluent water quality exceeds the discharge criteria for one or more of the contaminants listed in approved permits, the NMED HWB must be notified in writing within 24 hours of discovery in accordance with Section 1.27 of the RCRA Permit."

NMED 's Comment: Issues associated with failures of the treatment system to treat water to appropriate standards and issues associated with discharges of inappropriate water will be of concern to both the GWQB and the HWB. Please revise the document to reference both GWQB and HWB or simply reference NMED.

13. Appendix K, Contingency Plan, Section K.6, Spills and Notification Procedures

Permittee Statement: "If the release or leak results in a release to the environment (outside the secondary containment area), the system will be immediately shutdown, and NMED will be notified. Notification procedures and corrective actions in accordance with Section 1.27 and 1.28 of the RCRA Permit are summarized below."

NMED 's Comment: Reference to Section 1.28 of the HWTF Permit is not appropriate in this instance. HWTF Permit Section 1.28 references Permit Attachment F, Contingency

Plan, which states, "This Contingency Plan has been prepared for the Open Detonation (OD) Unit located at the Explosive Ordnance Detonation Disposal (EOD) Range at the Kirtland Air Force Base (KAFB) Facility in compliance with 40 C.F.R. Part 264, Subpart D, as applicable" The O&M Plan must be revised to remove reference to Section 1.28 of the HWTF Permit as Attachment F is not applicable to the BFF project site.

Permittee Statement: "In the event that a release or unauthorized discharge occurs, the Kirtland AFB Compliance Coordinator will complete the following notifications:

1. NMED will be verbally notified via the Environmental Emergencies hot line (505-827-9329) within 24 hours of discovery with the following information: a. Information concerning release of any hazardous waste or constituents that may cause an endangerment to public drinking water supplies."

NMED 's Comment: The Permittee must revise the O&M Plan to state that the NMED will be notified of a release or unauthorized discharge as soon as possible after learning of a discharge but no more than 24 hours thereafter.

Reference to the hot line should be clarified that the number is only to be used during non-business hours and on weekends and holidays. The hot line contacts the New Mexico State Police Dispatch Center, which will in turn call an NMED employee tasked with responding to an after-hours phone. During business hours, the Permittee should contact an employee of either the HWB or GWQB, depending on the nature of the emergency. For spills associated with DP 1839, contact should be made with the permit reviewer directly or the GWQB can be contacted directly at 505-827-2900. The Permittee shall revise the O&M Plan accordingly.

Finally, reference to "hazardous waste or constituents" is not sufficient. The O&M Plan must be revised to include the constituents associated with the standards referenced in HWTF Permit Section 6.2.3.1 as well as those contaminants listed in Table A-1 and the toxic pollutants defined in Subsection WW of 20.6.2.7 NMAC.

14. Appendix L, Sampling and Analysis Plan, Section L.1, Discharge Requirements

Permittee Statement: "Treated groundwater discharged from the GWTS must meet the human health standard for contaminants that are listed in Section 20.6.2.3103 of the New Mexico Administrative Code (NMAC), requirements of the New Mexico Environment Department (NMED) Ground and Surface Water Protection regulations (NMAC 20.6.2), and must comply with any additional approved federal, state, or local permits. Effluent discharged from the GWTS must not exceed the following criteria as currently stipulated in permits from the aforementioned regulations:

Ethylene dibromide (EDB) – 0.05 micrograms per liter (µg/L)
Benzene – 5 µg/L
Ethylbenzene – 700 µg/L
Toluene – 750 µg/L
Total xylenes – 620 µg/L

Iron (Dissolved) – 1 milligram per liter (mg/L)
Manganese (Dissolved) – 0.2 mg/L."

NMED 's Comment: In addition to referencing the standards in NMAC 20.6.2.3103, the quoted paragraph must be revised to reference the Federal MCLs, as referenced in HWTF Permit Section 6.2.3.1, *Cleanup Levels for Contaminants in Groundwater (other than Perchlorate).*

15. Appendix L, Sampling and Analysis Plan, Section L.2.3, Effluent Monitoring

Permittee Statement: "Additional effluent monitoring following any significant change to the treatment train (e.g. addition of a new extraction well) will consist of samples taken from the outlet of the post-filters. During the first month of operation, the samples will be collected daily for 7 days and then weekly until the end of the month."

NMED 's Comment: The Permittee must revise this section to reflect the sampling requirements of the finalized DP 1839.

16. Appendix L, Sampling and Analysis Plan, Table L-1, Groundwater Treatment System Monitoring Requirements

NMED 's Comment: The Permittee must revise this table to include the annual and five-year monitoring requirements in the finalized DP 1839.

NMED understands that this is a dynamic document that will be revised at least annually to reflect actual operations and maintenance at the GWTS for the dissolve-phase EDB plume collapse. The modifications in this letter must be incorporated into the next version of the O&M Plan for submittal to the NMED. NMED requires that a revised O&M Plan be submitted within 120-days of significant changes to the GWTS, including addition of pre-treatment, new extraction well(s), new injection well(s), and expansion of the treatment capacity.

Should you have any questions, please contact Ms. Diane Agnew of my staff at 505-222-9555 or via email at diane.agnew@state.nm.us.

Sincerely,

Kathryn Roberts
Director
Resource Protection Division

cc: Col M. Harner, KAFB
K. Lynnes, KAFB
A. Bodour, KAFB-AFCEC
T. Simpler, USACE
M.L. Leonard, AEHD
F. Shean, ABCWUA
L. King, EPA-Region 6 (6PD-N)
K. Kieling, NMED-HWB
D. McQuillan, NMED
D. Agnew, NMED-HWB
M. Hunter, NMED-GWQB
S. Pullen, NMED-GWQB

File: KAFB 2016 Bulk Fuels Facility Spill

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

May 31, 2017

Colonel Eric. H. Froehlich
Base Commander
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5606

Lieutenant Colonel Wayne J. Acosta
Civil Engineer Office
377 Civil Engineering Division
2050 Wyoming Blvd SE, Suite 116
Kirtland AFB, NM 87117-5270

RE: BULK FUELS FACILITY EXPANSION OF THE DISSOLVED-PHASE PLUME GROUNDWATER TREATMENT SYSTEM DESIGN, REVISION 2
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE
EPA ID# NM9570024423, HWB-KAFB-13-MISC

Dear Colonel Froelich and Lt. Colonel Acosta:

The New Mexico Environment Department ("NMED") received the Kirtland Air Force Base ("KAFB" or "the Permittee") *Work Plan for Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design Revision 2* ("Work Plan"), dated January 31, 2017. The revisions to the Work Plan address the conditions in the NMED conditional approval letter dated November 16, 2016, as well as additional site activities to be performed at the Bulk Fuels Facility ("BFF") site, including:

- Design and installation of pre-treatment sand filters at the groundwater treatment system ("GWTS");
- Equipment changes to new pump skids;
- Change to passive diffusion sampling at select groundwater monitoring wells; and
- Rehabilitation and re-development of KAFB-106233.

NMED is also in receipt of the KAFB *Technical Memorandum Maximum Concentration Limits for Kirtland BFF Groundwater Treatment System* ("Memo"), dated May 10, 2017. This Memo documents modeling completed by KAFB's contractor to determine maximum loading criteria for operations and maintenance of the groundwater treatment system, using a 6-month lead change out for the granulated activated carbon lead tank. The Memo also includes maximum concentrations of iron and manganese for the sand filter pre-treatment to be installed in Summer 2017. It is NMED's understanding that the influent criteria presented in the Memo will be part of the Operations and Maintenance Plan revisions anticipated to be formally submitted by December 31, 2017.

NMED understands that the intention of the Air Force is to make this a programmatic document and to submit revisions to add new or revised tasks. NMED's review of the current Work Plan, conducted with the Air Force, highlighted problems in making continuous revisions to an "original" document, including increased review times, inconsistencies, and a general lack of transparency. Consequently, and as discussed with the Air Force on several occasions, NMED will no longer accept revisions to the original document. Additional tasks will need to be submitted as new, stand-alone work plan documents or appendices. Changes to this Work Plan, including appendices and other Work Plan documents, made or added in response to the conditions in this letter, must be done as tracked changes and limited to the relevant text and sections.

The Work Plan, as revised, extends beyond the original scope approved in Section 1.2. Additionally, revisions to the Work Plan contain unnecessary documentation of work that has been completed which is not appropriate for a planning document such as this Work Plan. Work completed should be removed from this Work Plan and documented in the appropriate and applicable submittal document (e.g., quarterly and/or annual report, work plan, etc.).

The Work Plan tasks, procedures, and quality control are hereby approved with the following conditions:

1. The revisions to Section 3.1.5 delete what was originally proposed and approved for the groundwater monitoring well nests. Additionally, it is not clear what will be done for future groundwater monitoring wells and instead, the revised language in the Work Plan appears to document what was done for the already completed wells; the added text references specific depths and design details. This section of the Work Plan must be revised to keep the original well design language as well as details on what design will be used relative to the water table. Well completion discussion and detail should be included in the applicable and appropriate well completion report, quarterly and or annual report.

2. In Section 3.2.15.2, the Work Plan revisions indicate a deviation from KAFB Standard Operating Procedures ("SOPs") and previously approved metrics for well development specific to turbidity. The Permittee states turbidity stabilization at less than 100 NTUs is acceptable and that since "these wells were decided for passive sampling, the 0.010 slot size should minimize formation fines in these wells." There is no referenced technical justification for these statements. The Permittee must provide technical justification to

change the NTU goal for the development of groundwater monitoring well nests, particularly with respect to analysis of metals in groundwater samples using the passive sampling technique.

3. The change to the use of passive diffusion bags and dual membrane samplers is approved for the following groundwater monitoring wells located north of Ridgecrest Drive in residential areas:

KAFB-106015	KAFB-106070	KAFB-106212
KAFB-106021	KAFB-106071	KAFB-106213
KAFB-106022	KAFB-106072	KAFB-106214
KAFB-106023	KAFB-106085	KAFB-106215
KAFB-106025	KAFB-106086	KAFB-106216
KAFB-106026	KAFB-106087	KAFB-106217
KAFB-106029	KAFB-106088	KAFB-106218
KAFB-106030	KAFB-106089	KAFB-106219
KAFB-106031	KAFB-106090	KAFB-106220
KAFB-106032	KAFB-106091	KAFB-106221
KAFB-106033	KAFB-106092	KAFB-106222
KAFB-106034	KAFB-106093	KAFB-106223
KAFB-106035	KAFB-106103	KAFB-106224
KAFB-106036	KAFB-106104	KAFB-106225
KAFB-106037	KAFB-106105	KAFB-106226
KAFB-106042	KAFB-106106	KAFB-106227
KAFB-106043	KAFB-106107	KAFB-106230
KAFB-106049	KAFB-106201	KAFB-106231
KAFB-106050	KAFB-106202	KAFB-106232
KAFB-106051	KAFB-106203	KAFB-106235-463
KAFB-106052	KAFB-106204	KAFB-106235-492
KAFB-106053	KAFB-106205	KAFB-106235-521
KAFB-106054	KAFB-106206	KAFB-106236-461
KAFB-106055	KAFB-106207	KAFB-106236-490
KAFB-106057	KAFB-106208	KAFB-106236-519
KAFB-106058	KAFB-106209	

4. Appendix F appears to have been revised to include the actual well construction diagrams for completed groundwater monitoring well nests KAFB-106235 and KAFB-106236. These diagrams should be included in the applicable report(s). The Work Plan should only include the proposed well design for groundwater monitoring wells, as described in Section 3.1.5.

5. Appendix J includes an unidentified geophysical log. It is unclear if this is meant as an example of what may be generated by the proposed geophysical logging tools or if it is an

actual log from the BFF site. If the log is from the BFF site, it should be removed from this Work Plan and included in the applicable report. If the log is an example, the Permittee must revise Appendix J to clarify.

6. Appendix K, Section 2.5 details well inspection and equipment reinstallation at extraction well KAFB-106233 following completion of well rehabilitation and re-development. There is no indication on the planned sampling of influent at the GWTS following resumed operation of this extraction well. The Fourth Quarter 2016 Annual Report groundwater data shows a low-level detection of benzene (0.7 J µg/L) at groundwater monitoring well KAFB-106225, located approximately 1,500 feet northeast of extraction well KAFB-106233. Additionally, toluene was detected at a concentration of 2 µg/L in groundwater monitoring well KAFB-106025, located roughly 500 feet due north of the extraction well. These recent detections of benzene and toluene, combined with the existence of EPS in the rehabilitated extraction well, indicates a potential hydrocarbon source near the extraction well and therefore potentially changing groundwater concentrations for hydrocarbon constituents. The Permittee must therefore follow the sampling frequency for newly installed extraction wells which specifies daily sampling for 7 days, then weekly until the end of the first month, and monthly thereafter.

The following sections of the Work Plan are not approved:

1. Section 3.1.2 states that the Quality Assurance Project Plan ("QAPjP") has been updated to be a programmatic document, capturing "all activities performed by EA on the Kirtland BFF project under multiple contracts." The original QAPjP, as submitted and approved, was specific to "Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design" and in Section 2.3 of the approved QAPjP the scope of the document is stated to be:

   "The QAPjP addresses all the quality aspects of the following tasks: installation of groundwater extraction, observation, and monitoring wells in the area north of KAFB; installation of conveyance lines from extraction wellhead vaults to the GWTS building located on KAFB; expansion of the treatment train in the GWTS Building; and installation of regional injection wells and associated conveyance lines for discharge of the treated effluent on KAFB, as well as operation and maintenance of the GWTS and groundwater monitoring."

   NMED sent an email, dated December 8, 2016, to the Air Force stating that vadose zone activities must be submitted under a separate work plan, which includes the QAPjP. Expansion of the QAPjP to a programmatic scale to include vadose zone activities is not approved.

2. Bullet 2 in Section 3.1.7 on Page 3-11 under Treatment Train #2 testing reads:

   "Operational status of the Treatment Train #2 will be confirmed with weekly samples for one month, followed by monthly sampling specified in the O&M Plan (USACE, 2016a)."

This change is not approved. The Permittee must follow the sampling frequency for a new treatment train, as approved in Section L.2.2 of the Sampling and Analysis Plan (Appendix L of the O&M Plan [USACE, 2016]), which is daily sampling for 7 consecutive days, then sampling will occur once weekly until the end of the first month, and finally, sampling will occur once monthly thereafter.

3. Section 3.2.22 states that the Permittee will reduce data validation to 10 percent for all groundwater monitoring samples except for "newly installed wells," which will undergo 100 percent Stage 3 data validation for four quarters, and drinking water data which will maintain 100 percent Stage 3 data validation. This reduction of data validation is not approved.

If you have any questions regarding this letter, please contact Diane Agnew at (505) 222-9555.

Sincerely,

Juan Carlos Borrego
Deputy Secretary
Environment Department

cc: Col. M. Harner, KAFB
K. Lynnes, KAFB
A. Bodour, KAFB-AFCEC
T. Simpler, USACE
M.L. Leonard, AEHD
F. Shean, ABCWUA
L. King, EPA-Region 6 (6PD-N)
J. Kieling, NMED-HWB
D. Agnew, NMED-GWQB
S. Pullen, NMED-GWQB
M. Hunter, NMED-GWQB

File: KAFB 2017 Bulk Fuels Facility Spill

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Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

February 20, 2018

Colonel Richard W. Gibbs
Base Commander
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5606

Mr. Chris Segura
Chief, Installation Support Section
AFCEC/CZOW
2050 Wyoming Blvd SE, Suite 124
Kirtland AFB, NM 87117-5270

RE: EXTRACTION WELL KAFB-106239 STARTUP, AUTHORIZATION FOR INJECTION OF TREATED WATER INTO WELL KAFB-7
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE
EPA ID# NM9570024423, HWB-KAFB-13-MISC

Dear Colonel Gibbs and Mr. Segura:

The New Mexico Environment Department ("NMED") is in receipt of the Kirtland Air Force Base ("KAFB") ("Permittee") test results for the first two of seven daily samples collected from the extraction well KAFB-106239, and samples from groundwater treatment system influent, mid-point, and effluent in both treatment trains associated with extraction wells KAFB-106228, 106233, 106234, and 106239. Effluent samples collected on February 5 and 6, 2018 contained no detectable ethylene dibromide ("EDB") or petroleum hydrocarbons, and metals concentrations were either not detectable or within effluent standards. Test results are as follows:

Test Results for Extraction Well KAFB-106239 Startup (first two of seven daily samples).

	5-Feb-18	6-Feb-18
KAFB-106239	1 µg/L toluene	0.9 J µg/L toluene 0.018 J µg/L EDB
Train 1 Influent	0.029 µg/L EDB	0.028 µg/L EDB
Train 1 Mid-Point	All Non Detect	All Non Detect
Train 1 Effluent	All Non Detect	All Non Detect
Train 2 Influent	0.026 J µg/L EDB 0.0149 mg/L Mn	0.023 J µg/L EDB 0.0024 J mg/L Mn
Train 2 Mid-Point	0.0034 J mg/L Mn	All Non Detect
Train 2 Effluent	0.100 J mg/L Fe 0.0029 J mg/L Mn	0.0019 J mg/L Mn

DP-1839 Effluent Limits:
EDB < 0.050 µg/L
Toluene < 750 µg/L
Fe < 1.0 mg/L
Mn < 0.2 mg/L
J value quantifier means estimated concentration (greater than method detection limit, but less than limit of quantitation)

Contaminants were not detected in the trip blank, and data for matrix spikes and surrogate recoveries were within acceptable ranges. Based on the submitted test results, the Permittee is authorized to discharge treated water into injection well KAFB-7 in compliance with all conditions and monitoring requirements of the Permittee's Hazardous Waste Permit and Groundwater Discharge Permit, DP-1839.

If you have any questions regarding this letter, please contact NMED Chief Scientist, Dennis McQuillan at (505) 827-2140.

Sincerely,

JCB

Juan Carlos Borrego
Deputy Secretary
Environment Department

cc: Col. M. Harner, KAFB
K. Lynnes, KAFB
B. Renaghan, AFCEC
H. O'Grady, KAFB-AFCEC
T. Simpler, USACE
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J. Kieling, NMED-HWB
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P. Longmire, NMED-GWQB
M. Hunter, NMED-GWQB
D. McQuillan, NMED-OOTS

File: KAFB 2018 Bulk Fuels Facility Spill

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Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

August 6, 2018

Colonel Dawn A. Nickell
Vice Commander
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland AFB NM 87117

RE: Conditional Approval of Standard Operating Procedure for Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells, DP-1839

Dear Colonel Nickell:

On April 2, 2018, the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) received the *Standard Operating Procedure for Disinfection of the Groundwater Treatment System Remediation Wells and Groundwater Monitoring Wells* at the Kirtland Air Force Base (KAFB) groundwater treatment system (GWTS). This *Standard Operating Procedure* delineates protocols for performing well disinfection at the KAFB GWTS and associated monitoring wells without dedicated pump systems.

As explained in the *Standard Operating Procedure*, the pumping efficiency of a well and/or the flow through the filter pack may decline due to bacterial growth and biofouling. Routine disinfection (every few months) will assist in maintaining well efficiency. A remediation well (extraction or injection) with permanent equipment installed will be disinfected by providing the casing, screening, and surrounding filter pack around the well with a free chlorine residual of at least 50 milligrams per liter (mg/L), adequate mixing, and then removal from the well (American Water Works Association [AWWA], 2013). For injection wells, downhole equipment will require removal prior to disinfection to pump the well and remove the residual chlorine. The same standard

describes the chlorination of existing gravel pack in wells not installed with equipment (monitoring wells) at a concentration not less than 100 mg/L free chlorine residual (AWWA, 2013).

NMED requires KAFB ensure that all wells treated with sodium hypochlorite do not impair the aquifer with bromate, chlorite and perchlorate. To demonstrate this, NMED requires KAFB analyze all wells prior to and immediately after being treated with sodium hypochlorite for bromate, perchlorate, and chlorite to determine the presence of these compounds in groundwater.

Bromate, chlorite, and perchlorate, are known to occur in sodium hypochlorite (Greiner et al., 2008, and Asami et al., 2009). For example, Asami et al. (2009) report that concentrations of perchlorate range from 0.17 mg/L to 33 mg/L in hypochlorite solutions. The same solutions are proposed for well rehabilitation at KAFB, therefore, the potential for perchlorate added to groundwater is substantial. Analysis of chlorite and perchlorate shall be by liquid chromatography electrospray ionization mass spectrometry (EPA Method 331 or 332). Bromate shall be analyzed using inductively coupled plasma - mass spectrometry (EPA Method 321.8).

Should any of the above referenced constituents be detected above Safe Drinking Water Act maximum contaminant levels, or if perchlorate is detected above 13.8 ug/L, the KAFB shall notify NMED immediately.

This approval is contingent on the Permittee performing the procedure as described in the *Standard Operating Procedure*. A final report listing the injections and reporting the analytical results shall be submitted to NMED in the subsequent Quarterly Report.

Approval of this *Standard Operating Procedure* does not relieve the Permittee of the responsibility to comply with any other applicable federal, state, and/or local laws and regulations. This approval does not relieve the Permittee of liability should operations associated with this *Standard Operating Procedure* result in actual pollution of ground or surface waters.

If you have any questions regarding this letter, please contact Andrew Romero at (505) 827-0076. Thank you for your cooperation.

Sincerely,

Michelle Hunter
Chief, Ground Water Quality Bureau
New Mexico Environment Department

cc (e-copies):

J. Kieling, NMED-HWB
D. McQuillan, NMED-OOTS
M. Hunter, NMED-GWQB
S. Pullen, NMED-GWQB
A. Romero, NMED-GWQB
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S. Clark, AFCEC
K. Lynnes, SAF-IEE
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T. Simpler, ASACE

References

Asami, M., Kosaka, K. and Kunikane, S., 2009, Bromate, chlorate, chlorite and perchlorate in sodium hypochlorite solution used in water supply, 2009, Journal of Water Supply: Research and Technology – AQUA-58.2 pp. 107-115.

Greiner, P., McLellan, C, Bennett, D., and Ewing, A., 2008, Occurrence of perchlorate in sodium hypochlorite, American Water Works Association, November 2008, Journal AWWA-100.11 pp. 68-74.

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CERTIFIED MAIL – RETURN RECEIPT REQUESTED

April 4, 2016

Mr. L. Wayne Bitner
Chief, Environmental Restoration
2050 Wyoming Blvd SE
Kirtland AFB, New Mexico 87117-5600

RE: DP-1770 Modification Application and Termination

Dear Mr. Bitner:

On December 4, 2015, the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) received Kirtland Air Force Base's (KAFB) application (Application) to modify Discharge Permit 1770 (DP-1770). The Application requested authorization to apply treated groundwater as an irrigation source to the KAFB Tijeras Arroyo Golf Course (Golf Course), to utilize the treated groundwater for dust suppression, and to infiltrate a portion of the water. The source of this discharge is groundwater contaminated with ethylene dibromide (EDB) extracted from wells KAFB-106228R, KAFB-106233 and KAFB-106234, which is then treated using granular activated carbon (GAC) for EDB removal to below the constituent's 0.05 µg/L Maximum Contaminant Level prior to discharge. KAFB has established a treatment goal for the GAC system of non-detectable EDB. The proposed discharge is on or near the northwest edge of the Golf Course, Kirtland Air Force Base, Albuquerque in Section 9, Township 9N, Range 4E, Bernalillo County, New Mexico.

In addition to the land application procedures addressed in the Application, KAFB has requested authorization to utilize underground injection wells as a means to dispose of the treated groundwater in a separate discharge permit application (DP-1839). The groundwater that is the subject of DP-1770 is undergoing remediation, *i.e.*, extracted and treated, pursuant to KAFB's Hazardous Waste Treatment Facility Operating Permit, EPA ID No. NM9570024423, and meets Federal Drinking Water Standards. The GWQB also notes that KAFB has been irrigating the Golf Course with water of similar chemistry and quality for over fifteen years, with no adverse effects to public health or the environment.

KAFB is abating water pollution under Resource Conservation and Recovery Act (RCRA) authority delegated to NMED, pursuant to a hazardous waste permit and the Hazardous Waste Management Regulations, 20.4.1 NMAC. Therefore, KAFB is exempt from abatement plan requirements for this activity pursuant to 20.6.2.4105.A(2) and (3) NMAC. As would be the case if the abatement was occurring strictly under an abatement plan approved pursuant to the Ground and Surface Water Protection Regulations, 20.6.2 NMAC, a discharge permit for land application of treated effluent is not required. Therefore, the GWQB hereby terminates DP-1770 as it is not required for the activity of irrigating the Golf Course with treated effluent regulated pursuant to Hazardous Waste Permit No. NM9570024423.

Should any of these circumstances change, please contact NMED immediately so that we may re-evaluate the regulatory status of this activity. DP-1839 is not impacted by this determination.

If you have any questions, please contact Steve Pullen of the Ground Water Quality Bureau's Pollution Prevention Section at (505) 827-2962.

Sincerely,

Trais Kliphuis, Director
Water Protection Division

Cc: (via e-mail)
Kathryn Roberts, NMED Resource Protection Division
Dennis McQuillan, NMED Chief Scientist
Michelle Hunter, NMED Ground Water Quality Bureau
John Kieling, NMED Hazardous Waste Bureau
Steve Huddleson, NMED Ground Water Quality Bureau
Steve Pullen, NMED Ground Water Quality Bureau
Jennifer Hower, NMED Office of General Counsel
John Verheul, NMED Office of General Counsel

NEW MEXICO
ENVIRONMENT DEPARTMENT

Ground Water Quality Bureau
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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

BUTCH TONGATE
Cabinet Secretary

J.C. BORREGO
Deputy Secretary

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

April 28, 2017

Colonel Eric H. Froelich, Commander
337 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5606

RE: Discharge Permit Issuance, DP-1839, Kirtland Air Force Base

Dear Col. Froelich:

The New Mexico Environment Department (NMED) issues the enclosed Discharge Permit, DP-1839, to Kirtland Air Force Base (Permittee) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§74-6-1 through 74-6-17, and the New Mexico Ground and Surface Water Protection Regulations, 20.6.2 NMAC, under the authority of the New Mexico Water Quality Control Commission (WQCC).

The Discharge Permit contains terms and conditions that shall be complied with by the Permittee and are enforceable by NMED pursuant to Section 20.6.2.3104 NMAC, WQA, NMSA 1978 §74-6-5 and §74-6-10. Please be aware that this Discharge Permit may contain conditions that require the Permittee to implement operational, monitoring or closure actions by a specified deadline. Such conditions are listed at the beginning of the operational, monitoring and closure plans of this Discharge Permit.

Issuance of this Discharge Permit does not relieve the Permittee of the responsibility to comply with the WQA, WQCC Regulations, and any other applicable federal, state, and/or local laws, regulations, zoning requirements, and nuisance ordinances.

Pursuant to Paragraph (4) of 20.6.2.3109.H NMAC, the term of the Discharge Permit shall be five years from the effective date. The term of this Discharge Permit will end on April 28, 2022.

NMED requests that the Permittee submit an application for renewal (or renewal and modification) at least 180 days prior to the date the Discharge Permit term ends.

An invoice for the Discharge Permit Fee of $1,600.00 is being sent under separate cover. Payment of the Discharge Permit Fee must be received by NMED within 30 days of the date the Discharge Permit is issued.

If you have any questions, please contact Steve Pullen at (505) 827-2962. Thank you for your cooperation during this Discharge Permit review.

Sincerely,

Michelle Hunter, Chief
Ground Water Quality Bureau

MH:sdp

Encs: Discharge Permit, DP-1839

cc (electronic w/enclosure):
J. Kieling, NMED-HWB
D. Agnew, NMED-GWQB
S. Pullen, NMED-GWQB
L. King, EPA-Region 6 (6PD-N)
S. Clark, AFCEC-CZOW
K. Lynnes, KAFB
A. Bodour, KAFB-AFCEC
T. Simpler, USACE

file:
Read File
DP1839 File

GROUND WATER DISCHARGE PERMIT
Kirtland Air Force Base
Underground Injection Control Wells
DP-1839

I. INTRODUCTION

The New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) issues this Discharge Permit (DP-1839) for discharges via Class V underground injection control (UIC) well(s) to Kirtland Air Force Base (KAFB or Permittee) pursuant to the New Mexico Water Quality Act (WQA), New Mexico Statutes Annotated (NMSA) 1978 §§74-6-1 through 74-6-17, and the New Mexico Water Quality Control Commission (WQCC) Regulations, 20.6.2 New Mexico Administrative Code (NMAC).

The discharge that is covered by this Discharge Permit is limited to groundwater associated with the KAFB's Bulk Fuel Facility (BFF) corrective action. The groundwater is specifically the dissolved-phase portion of the contaminant plume within the regional aquifer that is elevated above the standards of 20.6.2.3103 NMAC and investigation derived waste (IDW) that meets the design parameters of the treatment system. This groundwater is being treated as an interim measure implemented pursuant to the corrective action provisions in Part 6 of KAFB's Hazardous Waste Treatment Facility Operating Permit (HWTF Permit No. NM9570024423 – "RCRA Permit").

The NMED GWQB's purpose in issuing this Discharge Permit, and in imposing the requirements and conditions specified herein, is to control the discharge of water contaminants so as to protect groundwater for present and potential future use as domestic and agricultural water supply and other uses and to protect public health. In issuing this Discharge Permit, NMED has determined that the requirements of Subsection C of 20.6.2.3109 NMAC have been or will be met. Pursuant with Section 20.6.2.3104 NMAC, it is the responsibility of the Permittee to comply with the terms and conditions of this Discharge Permit; failure to do so may result in an enforcement action(s) by NMED (20.6.2.1220 NMAC).

The NMED's Hazardous Waste Bureau (HWB) and GWQB both provide regulatory oversight at the BFF project site. The HWB regulates the evaluation and remediation of the KAFB BFF dissolved-phase plume and the associated groundwater treatment system (GWTS). The GWQB regulates the procedures that ensure treated groundwater discharged from the GWTS to UIC well(s) meet Discharge Permit requirements. This Discharge Permit is not intended to conflict or supersede the remedial actions selected for the BFF under the Resource Conservation and Recovery Act (RCRA), any implementing agreements, or the corrective action provisions of the RCRA Permit.

In the event that an associated comprehensive Work Plan or report is submitted to the NMED, NMED's HWB and GWQB will coordinate review of the comprehensive documents to ensure there is no conflict with any agency response. Associated documents will be submitted to the apparent lead bureau, copied to the other bureau, and NMED will determine which bureau will respond.

The activities which produce the discharge, the location of the discharge, and the quantity, quality, and flow characteristics of the discharge are described as follows.

The constituents of concern (CoC) within the dissolved-phase portion of the contaminant plume have been extensively investigated at the KAFB BFF under the RCRA Permit and have been narrowed to seven CoCs based on groundwater monitoring of the dissolved-phase portion of the contaminant plume within the regional aquifer. These seven CoCs have been identified as being present in untreated groundwater at concentrations potentially exceeding their respective regulatory action levels, and include ethylene dibromide (EDB), benzene, toluene, ethylbenzene, total xylenes, dissolved iron, and dissolved manganese. The CoCs and their respective effluent standards are listed in Table 2. The term "effluent standard" is used in this Discharge Permit to refer to the New Mexico Water Quality Control Commission (WQCC) groundwater standard or the federal Environmental Protection Agency (EPA) maximum contaminant level (MCL); whichever is more stringent.

Under the RCRA interim measure, contaminated groundwater is pumped from extraction wells and distributed through a piping system to a GWTS. Contaminated groundwater may also originate from groundwater monitoring or newly installed extraction wells within the dissolved-phase portion of the contaminant plume undergoing development, testing, or sampling. This liquid IDW will be transported by truck to the GWTS and added to the influent stream for treatment. This work is being completed in accordance with Work Plans approved by the NMED HWB.

The GWTS consists of a series of lead-lag granulated activated carbon (GAC) treatment vessels designed to adsorb the groundwater organic CoCs, thus reducing contaminant concentrations to at or below the effluent standards cited in Permit Condition #6 and identified in Permit Table #2. Adherence to the numeric standards will be assured by sampling the associated fluids at numerous stages of plume delineation, extraction, and treatment. Sampling associated with treatment is conducted at the influent to the GWTS, between the lead-lag GAC tanks, and at the effluent port prior to discharge to the UIC well(s). Samples collected between the lead-lag GAC tanks will notify operators when breakthrough is beginning to occur and replacement of the lead GAC tank is needed. The treatment capacity of the GWTS will be doubled in 2017 by adding a second treatment train to support the increased volume (not to exceed the permitted volume) that will be produced as additional extraction wells are installed and begin operation. Additional design changes are also planned to add additional pre-treatment and to optimize operations. This expansion/optimization of the treatment system will include two additional lead-lag GAC tanks, sand filters, and/or equipment and piping upgrades to the GWTS.

Treated effluent will be conveyed to UIC wells as defined by 20.6.2.5002.B(5)(d)(i) NMAC, including the well identified as KAFB-7 and up to four additional wells, for injection into the regional aquifer within the KAFB facility boundary. This Discharge Permit authorizes the discharge of a maximum of 1,440,000 gallons per day (gpd) via the NMED approved UIC well(s). Treated effluent is pumped from the GWTS through single-walled piping and distributed to the UIC well(s). Appendix A includes the specifics of a typical UIC well design. Final design plans will be submitted for NMED approval prior to mobilization for drilling and installation of new UIC well(s). Total discharge volume will be metered at the GWTS effluent port and at the UIC

well(s). The combined treated effluent rate of discharge employed by the Permittee will not exceed 1,000 gallons per minute (gpm), which is the maximum design treatment rate of the GWTS.

Monitoring of the extraction, treatment, and injection systems will be performed to ensure proper system operation using an automated monitoring system with a centrally located programmable logic controller (PLC) or an equivalent system. The PLC allows the operator to evaluate and control operations to maintain GWTS efficiency and effectiveness in treating the CoCs, and ensure proper discharge to the UIC well(s). Incoming data includes flowrates, pressures (*i.e.*, hydraulic head), liquid levels, groundwater levels, pump status, and alarms from the system sites. The treated effluent pumped to the UIC well(s) will be controlled via monitoring devices (*i.e.*, water level transducers and pressure head gauges) to prevent overfilling of the UIC well(s), to keep the down-hole discharge injection pipe(s) filled, and to prevent cascading of the effluent water into the UIC well(s). Effluent water will enter the UIC well casing and gravity flow through the well screen into the formation. The PLC will be programmed to alarm the operator in the event that the water level within the UIC well casing reaches the high-level set point.

The discharge, including all activities associated with the extraction and treatment of contaminated groundwater, and all associated procedures to maintain regulatory compliance with the RCRA Permit, are described in the Permittee's *Operation and Maintenance Plan* (O&M Plan). The O&M Plan is a HWB approved document that provides the procedures for management of the contaminated groundwater extraction and conveyance systems, the GWTS, and the sampling and quality assurance requirements. The O&M Plan also complies with the requirements in this Discharge Permit.

A Contingency Plan, which describes the actions that the Permittee will take in the event of a failure of the system that generates and discharges the treated effluent to a UIC well(s), is attached to this Discharge Permit at Appendix C.

KAFB is located southeast of Albuquerque in Bernalillo County. The discharge authorized by this Discharge Permit is located within the Designated UIC Area in Section 01 of T9N R3E, Sections 05, 06, 07, 08, and 09 of T9N R4E, and Section 31 of T10N R4E in the southern portion of the facility proximal to the groundwater monitoring wells associated with the existing nitrate plume (SWMU ST-105). Permit Appendix B identifies the Designated UIC Area and the current footprint of the 10 milligrams per liter (mg/L) nitrate plume within the regional aquifer. Additional UIC wells and associated infrastructure installed within the Designated UIC Area are subject to the conditions of this Discharge Permit and would not require a permit modification in accordance with 20.6.2.7(P) NMAC.

The nitrate plume is being remediated under the *Site ST-105 Stage 2 Abatement Plan for Nitrate Contaminated Water* (Abatement Plan) dated October 2007, which was approved by the GWQB Remediation Oversight Section in correspondence dated September 26, 2008. The most current version of the approved Abatement Plan may be viewed at the GWQB's web site at https://www.env.nm.gov/gwb/RemediationOversight.htm.

The regional groundwater beneath the SWMU ST-105 where KAFB-7 and the proposed UIC well(s) are located ranges from a depth of 202 to 709 feet (ft) below ground surface (bgs) with an average of 434 ft bgs and has a total dissolved solids (TDS) concentration ranging from 160 to 1200 mg/L with an average of 345 mg/L.

The application consists of the *Discharge Permit Application* (Application) submitted by the Permittee on December 4, 2015, a revised Application submitted by the Permittee on September 28, 2016, and additional information submitted as requested by NMED. The discharge shall be managed in accordance with all conditions and requirements of this Discharge Permit.

Pursuant to Section 20.6.2.3109 NMAC, NMED reserves the right to require a discharge permit modification in the event NMED determines that the requirements of 20.6.2 NMAC are being or may be violated or the standards of Section 20.6.2.3103 NMAC are being or may be violated. This may include a determination that structural controls and/or management practices approved under this Discharge Permit are not protective of groundwater quality and that more stringent requirements to protect groundwater quality may be required by NMED. Though conformance with this Discharge Permit and the RCRA Permit would result in a very low probability of there being a discharge causing groundwater contamination above applicable standards, NMED reserves the right to require remediation of such a discharge.

Issuance of this Discharge Permit does not relieve the Permittee of the responsibility to comply with the WQA, WQCC Regulations, and any other applicable federal, state, and/or local laws, regulations, zoning requirements, and nuisance ordinances.

The following acronyms and abbreviations may be used in this Discharge Permit:

Abbreviation	Explanation	Abbreviation	Explanation
bgs	below ground surface	MCL	maximum contaminant level
BFF	Bulk Fuels Facility	mg/L	milligrams per liter
CFR	Code of Federal Regulations	mL	milliliters
CoCs	constituents of concern	NMAC	New Mexico Administrative Code
DP	Discharge Permit	NMED	New Mexico Environment Department
EDB	ethylene dibromide	NMSA	New Mexico Statutes Annotated
EPA	United States Environmental Protection Agency	NO_3-N	nitrate-nitrogen
GAC	granulated activated carbon	O&M Plan	Operation and Maintenance Plan
gpd	gallons per day	PLC	programmable logic controller
gpm	gallons per minute	RCRA	Resource Conservation and Recovery Act
GWTS	groundwater treatment system	SWMU	solid waste management unit
GWQB	Ground Water Quality Bureau	TDS	total dissolved solids
ft	feet	total nitrogen	= TKN + NO_3-N
HWB	Hazardous Waste Bureau	UIC	underground injection control
HWTF	Hazardous Waste Treatment Facility	VOC	volatile organic carbon
IDW	investigation derived waste	WQA	New Mexico Water Quality Act
KAFB	Kirtland Air Force Base	WQCC	Water Quality Control Commission

II. FINDINGS

In issuing this Discharge Permit, NMED finds the following:

1. The Permittee is discharging effluent treated to at or below regulatory standards from the facility so that such effluent may move directly or indirectly into groundwater within the meaning of Section 20.6.2.3104 NMAC.

2. The Permittee is discharging effluent from the facility so that such effluent may move into groundwater of the State of New Mexico which has an existing concentration of 10,000 mg/L or less of TDS within the meaning of 20.6.2.3101(A) NMAC.

3. The discharge from the facility is not subject to any of the exemptions of Section 20.6.2.3105 NMAC.

4. The Permittee is operating UIC recharge well(s) within the meaning of 20.6.2.5002(A)(1) and 20.6.2.5002(B)(5)(d)(i) NMAC which is subject to the prohibitions listed under 20.6.2.5004(A)(4) NMAC.

III. AUTHORIZATION TO DISCHARGE

Pursuant to 20.6.2.3104 NMAC, it is the responsibility of the Permittee to ensure that discharges authorized by this Discharge Permit are consistent with the terms and conditions herein.

The Permittee is authorized to discharge up to 1,440,000 gpd of treated effluent via a maximum of five UIC wells to the groundwater aquifer within the Designated UIC Area in Section 01 of T9N R3E (KAFB-7), Sections 05, 06, 07, 08, and 09 of T9N R4E, and Section 31 of T10N R4E, Bernalillo County, NM. The Designated UIC Area is identified in Appendix B. UIC wells currently authorized by this Discharge Permit are identified in Table 1. Up to four additional UIC wells may be proposed pursuant to Permit Condition #11 of this Discharge Permit.

[20.6.2.3104 NMAC, 20.6.2.3106(C) NMAC, 20.6.2.3109(C) NMAC]

IV. CONDITIONS

The following conditions shall be complied with by the Permittee and are enforceable by NMED. Any reference in this Discharge Permit to communication with NMED shall be inferred to mean communication with the Bureau Chiefs of the GWQB and the HWB. The Permittee is authorized to discharge treated effluent subject to the following conditions.

A. OPERATIONAL PLAN

#	**Terms and Conditions**
1.	The Permittee shall implement the following operational plan to ensure compliance with Title 20, Chapter 6, Parts 2 and 4 NMAC. [20.6.2.3109.C NMAC]
2.	The Permittee shall operate in a manner such that standards and requirements of Sections 20.6.2.3101 and 20.6.2.3103 NMAC are not violated. [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]
3.	The Permittee shall ensure that the most recent versions of all Work Plans associated with the GWTS, the effluent conveyance pipeline, and the UIC well(s) are consistent with the requirements of this Discharge Permit. [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]
4.	The Permittee shall ensure all discharges associated with this Discharge Permit are located within the Designated UIC Area within Section 01 of T9N R3E, Sections 05, 06, 07, 08, and 09 of T9N R4E, and Section 31 of T10N R4E (See Appendix B). [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]
5.	The Permittee shall ensure that proposed UIC well locations (see Appendix B) and associated discharges are consistent with the most recent approved Stage 2 Abatement Plan for SWMU ST-105. [20.6.2.3101 NMAC, 20.6.2.3103 NMAC, 20.6.2.3109(C) NMAC]
6.	The Permittee shall ensure that discharged groundwater effluent is less than or equal to the effluent standards for all constituents referenced in 20.6.2.3103 NMAC. The term "effluent standard" is used in this Discharge Permit to refer to the New Mexico Water Quality Control Commission (WQCC) groundwater standard or the federal Environmental Protection Agency (EPA) maximum contaminant level (MCL); whichever is more stringent.

#	**Terms and Conditions**
	[20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]
7.	The Permittee shall ensure that GWTS influent chemistry is consistent with the design basis of the GWTS. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]
8.	The Permittee is authorized to install and operate not more than five UIC wells. Authorized UIC wells are listed in Table 1. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]
9.	The Permittee shall ensure that the total discharge from the facility via UIC wells does not exceed 1,440,000 gpd. [20.6.2.3109(C) NMAC, 20.7.10.100 NMAC]
10.	Prior to the installation of a new UIC well, the Permittee shall submit a Work Plan for NMED approval that satisfies the requirements of this Discharge Permit and the corrective action provisions at Part 6 of the RCRA Permit. This Work Plan shall, at a minimum, include the following information unless the Permittee can demonstrate to NMED that an item is not applicable or appropriate under the proposed activity or if an item has been provided separately under another submission: a. A statement of purpose and need for the additional UIC well(s); b. A list of groundwater monitoring wells which may be added to the monitoring program to effectively monitor performance of the new UIC well(s); c. A map showing the location of the proposed UIC well(s) and the location of all associated monitoring well(s); d. The geographic coordinates of the location of the UIC well(s) including township/range and section; e. A map showing the location of the nearest production well; f. A proposal of how the structural integrity of the treated effluent conveyance system between the GWTS and the new well will be demonstrated; g. Existing data showing the depth to water and general groundwater quality at the proposed new UIC well discharge location; h. A detailed description of groundwater flow modeling (numeric or analytical) predicting the effect of injection on the groundwater flow direction at the discharge location; i. A detailed description of geochemical modeling (numeric or analytical) evaluating the interaction between the treated effluent and receiving groundwater. Prior to any such geochemical modeling the treated effluent and receiving groundwater shall be

#	**Terms and Conditions**
	tested for the analytes listed in Table 5 unless the Permittee can demonstrate that testing for a particular analyte is unnecessary; j. A detailed description of the impact that the proposed injection will have on any known groundwater contaminant plumes, e.g., the nitrate plume(s) addressed in the Site ST-105 Stage 2 Abatement Plan for Nitrate Contaminated Water; k. Maximum estimated monthly discharge volume to the UIC well(s); l. Project schedule, including the date the discharge is to commence and the anticipated duration; and m. Necessary changes to this Discharge Permit's language should the proposal be approved, *e.g.*, the listing of authorized injection wells and associated monitoring wells in Table 1. These Work Plans shall be submitted for NMED approval at least 90 days prior to the scheduled installation of any UIC well. Proposed changes to this Discharge Permit constituting a "permit modification" as defined at 20.6.2.7.P NMAC shall not be submitted as a Work Plan, but shall instead be submitted as a discharge permit modification request as specified at 20.6.2.3109.G NMAC. A proposal to locate a discharge at a location outside the areas specified in Permit Condition #4 shall be considered a permit modification. A proposal to locate a UIC well at a location within the Designated UIC Area shall not be considered a permit modification unless the discharge quality or quantity is modified from that permitted herein. The Permittee shall post the approved Work Plan to the appropriate web site, *i.e.*, KAFB/Environment/Kirtland AFB Fuel Plume Project Documents. [20.6.2.7(P) NMAC, 20.6.2.3107(A) NMAC, 20.6.2.3109(G) NMAC, 20.6.2.5003 NMAC]
11.	Prior to discharging to a newly installed UIC well, the Permittee shall submit written notification to NMED stating the date that the discharge is to commence. [20.6.2.3107(A) NMAC]
12.	The Permittee shall ensure that the GWTS is secured to control access by the general public. [20.6.2.3109(B) and(C) NMAC, NMSA 1978, §74-6-5(D)]
13.	The Permittee shall maintain signs in English and Spanish (unless otherwise prohibited by KAFB policy) at appropriate locations indicating that the GWTS effluent is non-potable. Signs shall be posted at the UIC wellheads, at the GWTS, and any associated UIC well-related infrastructure.

#	**Terms and Conditions**
	[20.6.2.3109(B) and(C) NMAC, NMSA 1978, § 74-6-5(D)]
14.	The Permittee shall ensure that the UIC well(s) include monitoring devices, *i.e.,* water level and pressure head transducers, to prevent overfilling of the well. The Permittee shall measure the volume of treated effluent discharged to each UIC well and maintain a record of these volumes. [20.6.2.3107 and 20.6.2.3109(C)(3)(c)(i) NMAC]
15.	The Permittee shall ensure the treated effluent conveyance system, *i.e.*, piping, between the GWTS and the UIC well(s) does not leak and shall report any such leakage to the NMED GWQB in accordance with 20.6.2.1203(A) NMAC and copy the NMED HWB. Within one year of the effective date of this Discharge Permit, the Permittee shall demonstrate the structural integrity of the treated effluent conveyance system between the GWTS and KAFB-7. Prior to testing, the Permittee shall propose for NMED approval the test method to be used. The results of the mechanical integrity testing shall be submitted to NMED within 60 days of test completion. The Permittee shall integrity test the treated effluent conveyance system between GWTS and the UIC well(s) prior to submitting a permit renewal application. [20.6.2.3106(C) NMAC, 20.6.2.3107(A) NMAC]
16.	Prior to an initial discharge from the GWTS of treated effluent associated with a new extraction well, the Permittee shall submit documentation to NMED demonstrating that the treated effluent is at or below the effluent standards specified for the CoCs listed in Table 2. [20.6.2.1202(A) and (C) NMAC, 20.6.2.3109(C) NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]

B. MONITORING, REPORTING, AND OTHER REQUIREMENTS

#	**Terms and Conditions**
17.	The Permittee shall conduct the monitoring, operations, and reporting listed below. Unless otherwise specified, all periodic monitoring results or general information obtained shall be reported in the forthcoming quarterly report. [20.6.2.3107 NMAC]

#	**Terms and Conditions**
18.	Unless otherwise approved by NMED, the Permittee shall conduct sampling in accordance with standard industry practice. Sampling in accordance with the most current version of the GWTS Sampling and Analysis Plan (Appendix L of the O&M Plan), which includes sampling locations, procedures, field measurements, quality control samples, handling and custody, analytical methods, quality control, analytical validation, and reporting requirements, satisfies this Condition. [20.6.2.3107(B) NMAC]
19.	The Permittee shall submit quarterly and annual reports to NMED pursuant to the most recent NMED HWB approved Work Plans. The Permittee shall identify the portions of these reports pertaining to this Discharge Permit with a table in the reports that identifies those portions. Quarterly reports shall be submitted as specified below unless otherwise authorized by NMED: • January 1st through March 31st – due by June 30th • April 1st through June 30th – due by September 30th • July 1st through September 30th – due by December 31st • October 1st through December 31st – due by March 31st Annual reporting requirements for the previous year, i.e., January 1st through December 31st, shall be reported in the March 31st quarterly report. [20.6.2.3107(A) NMAC]
20.	The Permittee shall monitor the concentration of all CoCs listed on Table 2 in GWTS treated effluent. Associated sampling and analysis shall be performed monthly at a minimum. When groundwater from a new extraction well is first introduced to the GWTS, CoC monitoring of the GWTS treated effluent shall occur daily for the first week of treatment, weekly for the first month of treatment, and monthly thereafter. If alterations to, or conditions at, the GWTS result in a potential impact to effluent quality, the Permittee will repeat this sampling sequence as directed by NMED. A representative sample of GWTS influent and effluent shall be analyzed annually for the constituents identified in Table 3. A representative sample of GWTS influent and effluent shall be analyzed every five years for the constituents identified in Table 4. The first analysis of the five-year constituent list shall occur in July 2017. Any newly identified constituents detected during the five-years sampling events will be added to the annual sampling constituent list in Table 3.

#	**Terms and Conditions**
	All analysis of GWTS influent and effluent shall utilize analytical methods with detection limits that are sufficiently low to allow comparison to the standards included in the above referenced state and federal regulations. All sampling, analysis, and reporting shall comply with the most recent approved Work Plans. [20.6.2.3107(A) NMAC and 20.6.2.3107(B) NMAC]
21.	The Permittee shall report the volume of treated GWTS effluent discharged to each UIC well each quarter. This report shall include the following: a. Monthly average, maximum, and minimum values for flow rate and volume of treated effluent transferred to each UIC well; b. The totalized monthly volume of treated effluent transferred to all UIC wells; and c. Monthly average, maximum, and minimum head values of injection water for each UIC well. The Permittee shall monitor the GWTS effluent volume utilizing an effluent flow meter installed on the effluent pump skid after the GAC units. Each UIC well shall have a dedicated flow meter. Flow meters shall be inspected and calibrated in accordance with the associated manufacturer's recommendations. [20.6.2.3107 NMAC]
22.	The Permittee shall include the following results and general information in quarterly reports to NMED: a. Any mechanical integrity conducted on either the GWTS or a UIC well; b. Any replacement of GAC media and the associated data that initiated the decision to replace the media; c. Any UIC well rehabilitation conducted; d. Any malfunction, repair, or replacement of a flow meter; and e. Any additional operational changes with the potential to affect the discharge. [20.6.2.3107 NMAC]
23.	The Permittee shall monitor the groundwater wells in the vicinity of KAFB-7 and in the vicinity of any newly installed UIC well(s) to determine any change to aquifer chemistry that may be the result of injection. This monitoring shall be performed annually, shall conform to the procedures of the most current approved Work Plan, and shall measure the CoCs listed in Table 2. This chemistry will be reported in the Annual Report for BFF. ST-105 Annual Report includes elevation contour mapping and analytical parameters identified in the Stage 2 Abatement Plan.

#	Terms and Conditions
	The Permittee shall develop a groundwater elevation contour map depicting the groundwater flow direction in the vicinity of each UIC well and report it in the ST-105 Annual Report. If the chemical quality of the treated groundwater being injected changes over time, NMED may require the Permittee to repeat geochemical modeling (numeric or analytical) to predict the interaction between the treated effluent and receiving groundwater. [20.6.2.3107 NMAC]
24.	The Permittee shall post all reports required by this Discharge Permit on KAFB's most current web site (e.g., https://kirtlandafb.tlisolutions.com/main.aspx.) [20.6.2.3107(A) NMAC]

C. CONTINGENCY PLAN

#	Terms and Conditions
25.	If the automated monitoring system records a system alarm indicating a threat condition to a UIC well, and that threat condition is confirmed, at a minimum the affected UIC well will be taken off-line. If the alarm condition is confirmed during the response investigation, the UIC well(s) will be taken off-line and the discharge to the UIC well(s) will not be resumed until the problem is identified and corrected. [20.6.2.3107(A) NMAC]
26.	In accordance with this Discharge Permit, if the discharge to a UIC well exceeds effluent standards, the Permittee shall enact the Contingency Plan (Appendix C). The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. [20.6.2.3107(A) NMAC, 20.6.2.3109(E) NMAC, 20.6.2.4105(A)(2) and (3) NMAC]
27.	In the event that a release or a spill occurs that is not authorized under this Discharge Permit, the Permittee shall notify the NMED GWQB in accordance with 20.6.2.1203(A) NMAC, shall include any additional reporting requirements specified at RCRA Permit Section 1.27, and shall copy the NMED HWB. The Permittee shall also take measures to mitigate damage from the unauthorized discharge and initiate corrective actions specified in the Contingency Plan (Appendix C). The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC.

#	**Terms and Conditions**
	Nothing in this condition shall be construed as relieving the Permittee of the obligation to comply with all requirements of Section 20.6.2.1203 NMAC. [20.6.2.1203 NMAC, 20.6.2.4105(A)(2) and (3) NMAC]
28.	In the event that information indicates that a UIC well referenced at Table 1 is not constructed in a manner consistent with its intended use or is not completed in a manner that is protective of groundwater quality, the Permittee shall submit a Work Plan to the NMED with a proposal for well rehabilitation, abandonment only, or abandonment and replacement. This Work Plan shall include a project schedule and shall be submitted for NMED approval within 120 days following confirmation of the above referenced problems. The Permittee may propose an alternate use for the well. The UIC well requiring replacement shall be properly plugged and abandoned in accordance with Part 6.5.17.10.9 of the RCRA permit. [20.6.2.3107(A) NMAC, 20.6.2.5005 NMAC]
29.	In the event that NMED or the Permittee identifies any failures of the Application or this Discharge Permit not specifically noted herein, NMED may require the Permittee to submit a corrective action plan and a schedule for completion of corrective actions to address the failures. Additionally, NMED may require a modification to this Discharge Permit to achieve compliance with 20.6.2 NMAC. [20.6.2.3107(A) NMAC, 20.6.2.3109(E) NMAC]

D. CLOSURE PLAN

#	**Terms and Conditions**
30.	Upon permanent cessation of discharge to a UIC well(s), the Permittee shall perform the following closure measures upon NMED approval, unless UIC well(s) and/or conveyance pipelines are needed for another use: a) Cap, plug, or remove all conveyance pipelines to prevent the discharge of GWTS treated effluent to all UIC well(s); b) Abandon UIC well(s) in accordance with Part 6.5.17.10.9 of the RCRA permit, which reference OSE regulation 19.27.4.30 and 31 NMAC and associated well abandonment guidance; and c) Appropriately dispose of any wastes associated with UIC well plugging and abandonment. The Permittee may, instead of abandoning a UIC well, propose an alternate use for the well.

	Upon cessation of the closure measures, the Permittee shall perform the following post-closure measures: a) Continue monitoring CoCs in groundwater for at least two years, or as appropriate and in concurrence with NMED; and b) Enact the release notification requirements of the Contingency Plan if groundwater standards are exceeded. The Permittee may be required to remediate water pollution in accordance with the corrective action provisions in Part 6 of the RCRA Permit except as provided in 20.6.2.4105(B) NMAC. When all post-closure requirements have been met, the Permittee may request to terminate the Discharge Permit. [20.6.2.3107 (A)11 NMAC]

E. GENERAL TERMS AND CONDITIONS

#	Terms and Conditions
31.	The Permittee shall maintain a written record of the following information: a) Information and data used to complete the Application for this Discharge Permit; b) Records of any releases or spills not authorized under this Discharge Permit and reports submitted pursuant to 20.6.2.1203 NMAC; c) Records of the operation, maintenance, and repair of all facilities/equipment used to treat, store, or inject the treated groundwater; d) Facility record drawings (plans and specifications) showing the actual construction of the facility and that the construction complies with all applicable statutes, regulations, and codes including applicable Department of Defense Engineering Standards; e) Copies of quarterly reports completed and/or submitted to NMED pursuant to this Discharge Permit; f) The volume of treated water discharged pursuant to this Discharge Permit; g) Groundwater quality and injected water quality data collected pursuant to this Discharge Permit; h) Copies of construction records and well logs for all groundwater monitoring wells required to be sampled pursuant to this Discharge Permit; i) Records of the maintenance, repair, replacement, or calibration of any monitoring equipment or flow measurement devices required by this Discharge Permit; and j) Data and information related to field measurements, sampling, and analysis conducted pursuant to this Discharge Permit. The following information shall be recorded and made available to NMED upon request: i) The dates, location, and times of sampling or field measurements; ii) The sample analysis date of each sample; iii) The name and address of the laboratory, and the name of the signatory authority for the laboratory analysis;

#	**Terms and Conditions**
	iv) The analytical technique or method used to analyze each sample or collect each field measurement; v) The results of each analysis or field measurement; vi) The results of any split, spiked, duplicate or repeat sample; and vii) A copy of the laboratory analysis chain-of-custody as well as a description of the quality assurance and quality control procedures used. The written record shall be maintained by the Permittee so that it is accessible within a reasonable time period during or following a facility inspection by NMED through the post-closure period and shall be made available to NMED upon request. [20.6.2.3107(A) and (C) NMAC]
32.	The Permittee shall allow NMED representatives to inspect the facility and its operations which are subject to this Discharge Permit and the WQCC regulations. NMED representatives may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which any records are located regarding this discharge permit or related discharges required to be maintained by regulations of the federal government or the WQCC. The Permittee shall allow NMED representatives to have access to any copy of the records, and to perform assessments, sampling, or monitoring during an inspection for the purpose of evaluating compliance with this Discharge Permit and the WQCC regulations. Nothing in this Discharge Permit shall be construed as limiting in any way the inspection and entry authority of NMED under the WQA, the WQCC Regulations, or any other local, state, or federal regulations. [20.6.2.3107(D) NMAC, NMSA 1978, §§ 74-6-9(B) and 74-6-9(E)]
33.	The Permittee shall, upon NMED's request, allow for NMED's duplication of records required by this Discharge Permit and/or furnish to NMED electronic copies of such records. [20.6.2.3107(D) NMAC]
34.	In the event the Permittee proposes a change to the facility or the facility's discharge that would result in a change in the volume discharged; the location of the discharge; or in the amount or character of water contaminants received, treated, or discharged by the facility that differs from the terms and conditions in this Discharge Permit, the Permittee shall notify NMED prior to implementing such changes. The Permittee shall obtain approval (which may require modification of this Discharge Permit) by NMED prior to implementing such changes.

#	**Terms and Conditions**
	[20.6.2.7(P) NMAC, 20.6.2.3107(C) NMAC, 20.6.2.3109(E) and (G) NMAC]
35.	In the event the Permittee proposes to construct or change an existing system such that the quantity or quality of the discharge will change substantially from that authorized by this Discharge Permit, the Permittee shall submit construction plans and specifications to NMED for the proposed system or process unit prior to the commencement of construction. In the event the Permittee implements changes to an existing system authorized by this Discharge Permit which will result in only a minor effect on the quality of the discharge, the Permittee shall report such changes (including the submission of record drawings, where applicable) in the next quarterly report to NMED. [20.6.2.1202(A) and (C) NMAC, NMSA 1978, §§ 61-23-1 through 61-23-32]
36.	Any violation of the requirements and conditions of this Discharge Permit, including any failure to allow properly credentialed NMED staff to enter and inspect records or facilities, or any refusal or failure to provide NMED with records or information required to be maintained by this Discharge Permit or related regulation may subject the Permittee to a civil enforcement action. Pursuant to WQA 74-6-10(A) and (B), such action may include a compliance order requiring compliance immediately or in a specified time, assessing a civil penalty, modifying or terminating the Discharge Permit, or any combination of the foregoing; or an action in district court seeking injunctive relief, civil penalties, or both. Pursuant to WQA 74-6-10(C) and 74-6-10.1, civil penalties of up to $15,000 per day of noncompliance may be assessed for each violation of the WQA 74-6-5, the WQCC Regulations, or this Discharge Permit, and civil penalties of up to $10,000 per day of noncompliance may be assessed for each violation of any other provision of the WQA, or any regulation, standard, or order adopted pursuant to such other provision. In any action to enforce this Discharge Permit, the Permittee waives any objection to the admissibility as evidence of any data generated pursuant to this Discharge Permit. [20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10 and 74-6-10.1]
37.	No person shall: 1) make any false material statement, representation, certification, or omission of material fact in an application, record, report, plan, or other document filed, submitted, or required to be maintained under the WQA; 2) falsify, tamper with, or render inaccurate any monitoring device, method, or record required to be maintained under the WQA; or 3) fail to monitor, sample, or report as required by a permit issued pursuant to a state or federal law or regulation.

#	**Terms and Conditions**
	Any person who knowingly violates or knowingly causes or allows another person to violate the requirements of this condition is guilty of a fourth degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who is convicted of a second or subsequent violation of the requirements of this condition is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition or knowingly causes another person to violate the requirements of this condition and thereby causes a substantial adverse environmental impact is guilty of a third degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. Any person who knowingly violates the requirements of this condition and knows at the time of the violation that he is creating a substantial danger of death or serious bodily injury to any other person is guilty of a second degree felony and shall be sentenced in accordance with the provisions of NMSA 1978, § 31-18-15. [20.6.2.1220 NMAC, NMSA 1978, §§ 74-6-10.2(A) through 74-6-10.2.F]
38.	Nothing in this Discharge Permit shall be construed in any way as relieving the Permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits, or orders. [NMSA 1978, § 74-6-5.L]
39.	The Permittee may file a petition for review before the WQCC on this Discharge Permit. Such petition shall be in writing to the WQCC within thirty days of the receipt of postal notice of this Discharge Permit and shall include a statement of the issues to be raised and the relief sought. Unless a timely petition for review is made, the decision of NMED shall be final and not subject to judicial review. [20.6.2.3112 NMAC, NMSA 1978, § 74-6-5.O]
40.	Prior to the transfer of any ownership, control, or possession of this facility or any portion thereof, the Permittee shall: 1) notify the proposed transferee in writing of the existence of this Discharge Permit; 2) include a copy of this Discharge Permit with the notice; and 3) Deliver or send by certified mail to NMED a copy of the notification and proof that such notification has been received by the proposed transferee. Until both ownership and possession of the facility have been transferred to the transferee, the Permittee shall continue to be responsible for any discharge from the facility. [20.6.2.3111 NMAC]

#	**Terms and Conditions**
41.	Payment of permit fees is due at the time of Discharge Permit approval. Permit fees shall be paid in a single payment or shall be paid in equal installments on a yearly basis over the term of the Discharge Permit. Single payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date. Initial installment payments shall be remitted to NMED no later than 30 days after the Discharge Permit effective date; subsequent installment payments shall be remitted to NMED no later than the anniversary of the Discharge Permit effective date. Permit fees are associated with issuance of this Discharge Permit. Nothing in this Discharge Permit shall be construed as relieving the Permittee of the obligation to pay all permit fees assessed by NMED. A Permittee that ceases discharging or does not commence discharging from the facility during the term of the Discharge Permit shall pay all permit fees assessed by NMED. An approved discharge permit shall be suspended or terminated if the facility fails to remit an installment payment by its due date. [20.6.2.3114(F) NMAC, NMSA 1978, § 74-6-5(K)]

TABLE 1 - Authorized Underground Injection Control Wells

Well Identifier	Well Location	Associated Monitoring Wells
KAFB-7	Latitude 35° 02' 31.41" N Longitude 106° 34' 10.79" W Section 01 of T9N R3E	KAFB-0505, KAFB-0507, KAFB-0508

TABLE 2 - Constituents of Concern (CoCs)

(Constituents measured in the dissolved-phase portion of BFF plume at concentrations exceeding effluent standards.)

Constituent	Effluent Standards
Ethylene dibromide (EDB)	0.05 µg/L
Benzene	5.0 µg/L
Ethylbenzene	700 µg/L
Toluene	750 µg/L
Total xylenes	620 µg/L
Iron	1,000 µg/L
Manganese	200 µg/L

TABLE 3 - Annual Monitoring Constituent List

(Constituents having 20.6.2.3103 NMAC Human Health Standards and Federal Drinking Water Primary Maximum Contaminant Levels (MCLs) that have ever been detected within KAFB BFF site wells. Permittee may petition NMED to change a constituent monitoring frequency from annual to once every five years, i.e., move to Table 4, if after eight consecutive quarters of monitoring the constituent is not detected in any BFF site wells.)

Category	Constituent
Anions	
	chloride
	nitrogen (nitrate-nitrite)
	sulfate
Organic compounds	
	1,1,2,2-tetrachloroethane
	1,1,2,2-tetrachloroethylene (PCE)
	1,1,2-trichloroethane
	1,1,2-trichloroethylene (TCE)
	1,2-dichloroethane (EDC)
	1,1-dichloroethane
	1,2-dibromomethane
	bis(2-ethylhexyl) phthalate
	Chloroform
	cis-1,2-dichloroethylene
	Dibromochloromethane
	Methylene chloride
	Naphthalenes
	Phenols
	Pyrene

TABLE 4 – Five-year Monitoring Constituent List

(Constituents with 20.6.2.3103 NMAC action levels and Federal Drinking Water maximum contaminant levels (MCLs) – this list is not meant to be redundant with Table 3)

Category	Constituent
Anion	
	Fluoride
Metals	
	Aluminum
	Antimony
	Arsenic
	Barium
	Beryllium
	Cadmium
	Chromium
	Copper
	Cyanide (as free Cyanide)
	Lead
	Manganese
	Mercury (total)
	Selenium
	Silver
	Thallium
	Uranium
	Zinc
Organic compounds	
	Dichloromethane
	Methyl tertiary butyl ether (MTBE)

TABLE 5 – Geochemical Modeling Analyte List

Analyte
Calcium
Magnesium
Sodium
Potassium
Chloride
Sulfate
Total Carbonate Alkalinity
Silica
Iron
Manganese
Dissolved Organic Carbon
Aluminum
Arsenic
Barium
Nitrate-Nitrite(N)
Strontium
Temperature (°C)
pH
ORP (mV), Eh (mV)
DO
Charge Balance (%)

PERMIT TERM & SIGNATURE

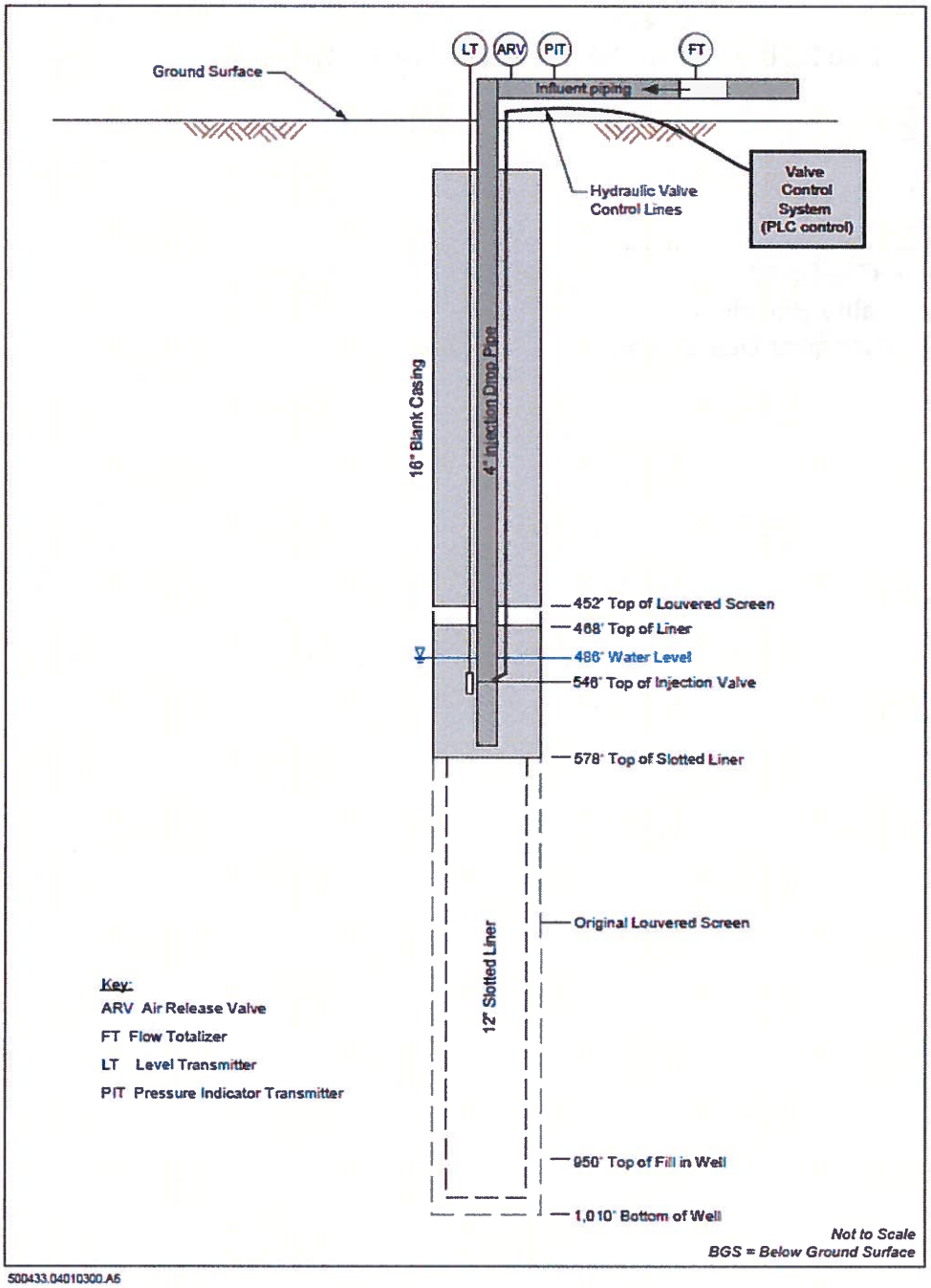
EFFECTIVE DATE: April 28, 2017
EXPIRATION DATE: April 28, 2022

[Subsection H of 20.6.2.3109 NMAC, NMSA 1978, § 74-6-5.I]

Michelle Hunter, Chief
Ground Water Quality Bureau
New Mexico Environment Department

Appendix A

Injection Well Configuration (KAFB-7)



Appendix B

Designated UIC Area and Nitrate Plume

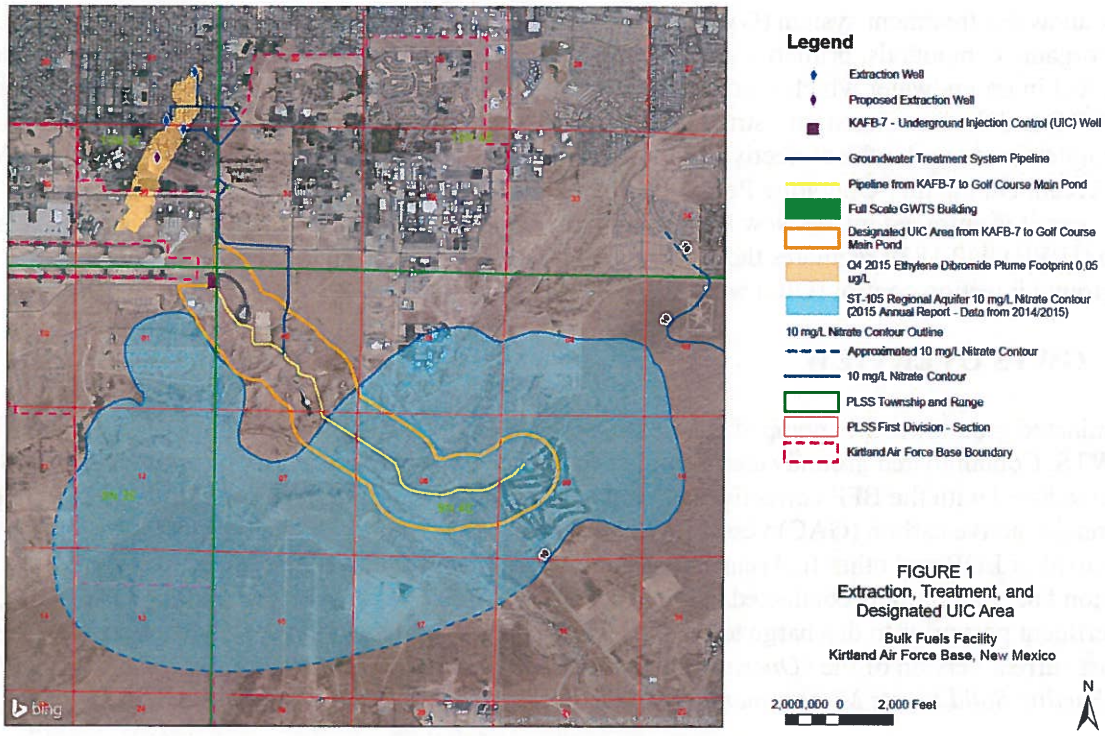


FIGURE 1
Extraction, Treatment, and Designated UIC Area
Bulk Fuels Facility
Kirtland Air Force Base, New Mexico

Appendix C

Contingency Plan

This Contingency Plan (Plan) has been developed for DP-1839 pursuant to 20.6.2.3107(A)(10) NMAC to cope with a failure of the Discharge Permit or system. This Plan describes the actions that Kirtland Air Force Base (AFB) will take in the event of a failure of Discharge Permit 1839 (DP-1839) or the systems that generates and discharges the treated effluent that is the subject of DP-1839. The provisions of this Plan will be carried out immediately whenever there is a release which could threaten human health or the environment.

1.0 BACKGROUND

The groundwater treatment system (GWTS) treats groundwater that contains low concentrations of fuel-related organic compounds, primarily ethylene dibromide (EDB), from a historic leak of aviation gasoline and jet fuel in groundwater which is conveyed to the GWTS from the extraction well network off-base. The GWTS and the associated infrastructure are part of an interim measure pump and treat system that is being implemented under the corrective action provisions in Part 6.2.2.2.12 of Kirtland AFB's Hazardous Waste Treatment Facility Operating Permit (HWTF Permit No. NM9570024423 –"RCRA Permit"). The RCRA permit is enforced by the New Mexico Environment Department's (NMED's) Hazardous Waste Bureau (HWB). DP-1839 regulates the discharge of treated effluent from the GWTS to one or more underground injection control (UIC) wells.

2.0 GWTS OVERVIEW

Contaminated groundwater is pumped from extraction wells and distributed through a piping system to the GWTS. Contaminated groundwater may also originate from groundwater monitoring or extraction wells associated with the BFF corrective action that are undergoing development, testing, or sampling. The granular active carbon (GAC) vessels are arranged in series to provide the contact time required for the removal of EDB and other fuel related organic compounds to achieve the effluent standards in Condition #6. Sampling is conducted at the influent to the GWTS, between the lead-lag GAC tanks, and at the effluent port prior to discharge to the UIC well(s) in accordance with the frequencies established in the most current version of the "*Operations and Maintenance Plan Groundwater Treatment System Bulk Fuels Facility Solid Waste Management Unit ST-106/SS-111*" that has been approved by the NMED HWB.

To ensure that the treated effluent meets all applicable effluent standards in DP-1839, Kirtland AFB has conservatively defined breakthrough as contaminant removal of equal to 90% of the applicable effluent standard as measured between the GAC vessels. If contaminant breakthrough occurs in the lead GAC vessel, the vessels are switched in the lead-lag position and GAC change-out is scheduled. Sampling frequency is increased for any GWTS system change (i.e., new extraction wells added to system).

Samples are collected from the GTWS effluent pipe on a monthly basis. Sampling frequency is increased for any GWTS system change (i.e., new extraction wells added to system). In the unlikely event that the GWTS cannot achieve all applicable effluent standards, the affected treatment train will be shut-down until system modifications can be approved and implemented.

The GWTS is designed and instrumented to efficiently operate 24-hours per day with minimal operator attention. A control system and operator interface panel is installed to allow remote control of the GWTS

and the extraction and injection well network. The control system includes telemetry and web access to alert operators of off-hour alarm conditions. Subcontractor staff are scheduled for on-call responses on weekends and after hours for any emergency response if alarm conditions warrant.

3.0 CONTINGENCY PLAN OVERVIEW

In the event of a spill, leak or unplanned release to the environment associated with the treated effluent from the GWTS or the treated effluent conveyance system, Kirtland AFB will assess possible hazards to human health and/or the environment and will implement this Plan. Possible failures of DP-1839 or the treatment system include the following:

- Treated effluent exceeds one of more of the effluent standards in Condition # 6.
- A leak from the treated effluent conveyance system.
- UIC well is not constructed in a manner consistent with its intended use or completed in a manner that is protective of groundwater.
- The automated monitoring system records a system alarm that indicates a possible threat to a UIC well.

The Permittee's planned response to each of these possible contingencies is described below.

3.1 Treated effluent exceeds one or more effluent standards

As discussed above, the GWTS is operated very conservatively to ensure that effluent standards are never exceeded between the two lead-lag GAC vessels. This is done to ensure that there will be no effluent standard exceedances at the effluent discharge point. In the unlikely event that treated effluent that exceeds one or more effluent standards is discharged to a permitted UIC well, the Permittee will submit a "Notification of Discharge-Removal" to the NMED Groundwater Quality Bureau (GWQB) pursuant to 20.6.2.1203(A) NMAC as required in Condition # 27. The Permittee will copy the NMED HWB on the initial and all subsequent release reports.

In the event of such an exceedance, one or both treatment trains at the GWTS will be promptly shut-down as necessary until system modifications can be approved by the NMED HWB and implemented. If the exceedance is related to concentrations of one or more contaminants in the influent, the Permittees will submit a work plan to the NMED HWB to sample one or more extraction wells. If necessary, an extraction well with an exceedance will be taken off line until the problem is addressed and the NMED HWB authorizes the well to begin pumping again. If plant adjustments are necessary, the Permittee will make the necessary changes. If the required corrective actions are considered to be outside the scope of work for plant operations, one or both treatment trains at the GWTS will be shut down and Kirtland AFB will submit a corrective action plan to the NMED HWB and copy the GWQB. One or both treatment trains at the GWTS will remain shut down pending the approval of the corrective action plan from the NMED HWB.

Following the necessary changes, the effluent groundwater will be re-tested, and the GWTS monitoring frequency will be increased as required in Discharge Permit (i.e., daily for the first week and weekly for three additional weeks). After 4 consecutive weeks of analytical results below the applicable effluent standards, monitoring will return to a monthly frequency.

If necessary, Kirtland AFB will sample groundwater associated with the affected UIC well(s) for all relevant constituents and will provide the data to the NMED HWB and GWQB. Any groundwater

corrective actions will be implemented pursuant to Part 6.2.2 of the RCRA Permit. The Permittee will copy the NMED GWQB on all documents related to the corrective action required in Condition # 26.

3.2 Leak from treated effluent conveyance system

As discussed above, the treated effluent meets all applicable effluent standards in Condition #6. In the event there is a leak from the treated effluent conveyance system that transports the treated effluent to a UIC well, the Permittee will conservatively submit a "Notification of Discharge-Removal" to the NMED GWQB pursuant to 20.6.2.1203(A) NMAC, which includes an estimate of the volumes released, the location of the release and the likely cause of the failure. The Permittee will copy the NMED HWB on the initial and all subsequent release reports.

If necessary, corrective actions will be implemented pursuant to Part 6.2.2 of the RCRA Permit. The Permittee will copy the NMED GWQB on all documents related to the corrective action as required in Condition # 27.

3.3 UIC well is not constructed in a manner consistent with its intended use or not completed in a manner that is protective of groundwater

The design of any new UIC well installed under DP-1839 is subject to approval in accordance with Condition #10. In the unlikely event that a well is not constructed or completed to meet the approved specifications and a design change has not been approved by NMED, the Permittee will submit a work plan to NMED with a proposal for well rehabilitation, abandonment only or abandonment and replacement as detailed in Condition #28.

3.4 The automated monitoring system records a system alarm that indicates a possible threat to a UIC well

Alarms may be activated in the UIC well either due to pressure reading in the discharge pipe or a fluid level in the well casing outside of the operating parameters. Both alarms automatically shut-down the GWTS. Operators will be notified immediately by email of the alarm condition, and proceed to investigate the alarms through the human machine interface (HMI) at the site or remote access after-hours to determine if the alarm represents actual field conditions. Corrective action and subsequent reporting will depend on the condition causing the alarm condition.

4.0 RELEASE NOTIFICATION REQUIREMENTS

4.1 External Notification Procedures

In the event of a spill, leak or unplanned release to the environment associated with the treated effluent from the GWTS or the treated effluent conveyance system, Kirtland AFB will follow the release reporting requirements in 20.6.2.1203(A) NMAC. These requirements are fundamentally equivalent to the "Twenty-Four Hour and Subsequent Reporting" requirements in Part 1.27 of the RCRA Permit. The NMED HWB will be copied on all notifications and any subsequent reports.

4.2 Internal Notification Procedures

GWTS Operators/Contractor staff notify the Chief of Environmental Restoration Program at Kirtland AFB by telephone and by email immediately following any accidental releases of untreated/treated water

at the GWTS, immediately upon having knowledge of a non-compliance event (i.e., sampling results), or if the GWTS operation has to be shut down continuously for more than 24 hours (may include normal maintenance, equipment repairs, or alarm investigations).

STATE OF NEW MEXICO OFFICE OF THE STATE ENGINEER PERMITS

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

DISTRICT 1

TOM BLAINE, P.E.
NEW MEXICO STATE ENGINEER

5550 San Antonio Drive, N.E.
Albuquerque, NM 87109 (505) 383-4000

December 10, 2015

File No.: RG-1587

Kirtland Air Force Base
Attn: Wayne Bitner, Chief, Environmental Restoration
AFCEC/Kirtland AFB IST; Bldg 20685
2050 Wyoming Blvd, SE
Kirtland AFB, NM 87117-5270

RE: Permit No. RG-1587

Greetings,

Your copy of the above numbered permit, which has been approved subject to the conditions set forth on the approval page, is enclosed.

Please review the Conditions of Approval for any required submittals. If submittals are not made by the date(s) indicated in the conditions, your rights under this permit are subject to expiration unless a request for an Extension of Time is received in the District Office of the State Engineer by that date, and that Extension of Time is subsequently approved.

Appropriate forms can be downloaded from the OSE website at www.ose.state.nm.us/WR/forms.php or will be mailed to you upon request.

Sincerely,

Christopher Burrus
Water Resource Specialist
Albuquerque, OSE, District 1

C: CB/cb

HCI-54235
$50

File No. RG-1587

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO CHANGE AN EXISTING WATER RIGHT

(Non 72-12-1)

(check applicable boxes):

For fees, see State Engineer website: http://www.ose.state.nm.us/

☒ Change Purpose of Use ☒ Groundwater ☐ Surface Water ☐ Change Place of Use ☐ Groundwater ☐ Surface Water	☐ Change Point of Diversion (POD): From: ☐ Groundwater ☐ Surface Water To: ☐ Groundwater ☐ Surface Water	☐ Additional Groundwater Point of Diversion (POD) ☐ Additional Surface Water Point of Diversion (POD)
☐ Temporary Change, NMSA 1978, § 72-12-7(B) Requested Start Date: (Not to Exceed 3 ac-ft in One Year)		Requested End Date:
☐ Water Use Lease, NMSA 1978, §§ 72-6-1 to-7 Requested Start Date:		Requested End Date:

1. APPLICANT(S) (Required) Note: water-right owner must be listed as an applicant.

Name: **Kirtland Air Force Base**	Name: **N/A**
Contact or Agent: check here if Agent ☒ **Wayne Bitner**	Contact or Agent: check here if Agent ☐ **N/A**
Mailing Address: **Chief Environmental Restoration 2050 Wyoming Blvd SE**	Mailing Address: **N/A**
City: **Albuquerque**	City:
State: **NM** Zip Code: **87117-5270**	State: Zip Code:
Phone: **N/A** ☐ Home ☐ Cell Phone (Work): **505-853-3484**	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): **Ludie.Bitner@us.af.mil**	E-mail (optional):

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2. CURRENT OSE FILE INFORMATION (Required)

OSE File No(s):	Priority Date (if known):	Subfile/Cause No. (if applicable):

3. CURRENT PURPOSE OF USE AND AMOUNT OF WATER (Required)

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): _____ Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): **extraction/production well**	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: **See comments** Consumptive Use: **See comments** Other (include units): **see comments**

FOR OSE INTERNAL USE

Application for Permit, Form wr-06, Rev 9/26/12

File No.: RG-1587	Trn. No.:	Receipt No.: 1-54235 $50
Trans Description (optional):		Sub-Basin:
PCW/LOG Due Date:	PBU Due Date:	

4. COUNTY WHERE WATER RIGHT IS CURRENTLY USED (Required)

Bernalillo

5. ADDITIONAL STATEMENTS CONCERNING THE CURRENT WATER RIGHT

RG-1587 (KAFB-7) is an existing well included in Kirtland AFB's water right as described in District Court order: United States District Court, District of New Mexico, State of New Mexico State Engineer vs. Kirtland Air Force, dated November 27, 1973. See court order included as Attachment 1. The Kirtland AFB water rights allow for diversion and consumptive use of up to 4,500 acre feet per anum. The well is currently used as an extraction well for nitrate abatement at SWMU ST-105. This application does not seek to increase the allowable groundwater diversion described for RG-1587, but seeks to change the purpose of use to pollution control, recovery, and irrigation, including both injection and extraction of groundwater

6. CURRENT or MOVE-FROM POINT(S) OF DIVERSION (POD) (Required)

☐ Surface POD OR ☒ Ground Water POD (Well)

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☐ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☐ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☒ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
RG-1587	106 34 6.06	35 2 23.68	NW 1/4, NW 1/4, Sec 6, T 9N, R 4E

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NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional point of diversion descriptions are attached: ☐ Yes ☐ No If yes, how many____

Point of Diversion is on Land Owned by:

Other description relating point of diversion to common landmarks, streets, or other:

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG -1587 | Trn Number:

7. CURRENT or MOVE-FROM PLACE(S) OF USE (Required)

The land is legally described by (check all that apply):

☒ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
RG-1587--NW 1/4, NW 1/4,	**S6**	**T9N**	**R3E**		
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other: **RG 1587 (KAFB-7) is an existing well included Kirtland AFB's water right as descibed in Attachment 1. This application seeks to change the purpose of use to pollution control, recovery, and irrigation, including both injection and extraction**

Place of use is on land owned by (required):

Are there other sources of water for these lands? No ☒ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

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8. MOVE-TO PURPOSE OF USE AND AMOUNT OF WATER (Complete this section ONLY if the purpose of use is changing)

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): **Pollution Control and Recovery** Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): **Injection and Extraction of groundwater**	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: _____ Consumptive Use: _____ Other (include units): **see comments**

9. MOVE-TO POINT(S) OF DIVERSION (POD) (Complete this section ONLY if adding or replacing a POD)

☐ **Surface POD** **OR** ☒ **Ground Water POD (Well)**

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-7 (RG-1587)	1544679.14	1470794.81	NW 1/4, NW 1/4, Sec 6, T 9N, R 4E

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NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional POD descriptions are attached: ☐ **Yes** ☒ **No** **If yes, how many** _____

Other description relating point(s) of diversion to common landmarks, streets, or other: **KAFB-7 is located on Kirtland AFB just south of Kirtland Road between Ammo Road and Ordnance Street.**

Point of Diversion is on Land Owned by: **Kirtland Afb**

Note: The following information is for wells only. If more than one (1) well needs to be described, provide attachment.

Approximate depth of well (feet): **1,000.00** | Outside diameter of well casing (inches): **16.00**

Driller Name: **NA** | Driller License Number: **NA**

FOR OSE INTERNAL USE — Application for Permit, Form wr-06

File Number: RG.1587 | Trn Number:

If replacing the current well, is the current well to be plugged? ☐ Yes ☐ No ☒ Not Applicable
If No, state for what use it is retained:

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STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

10. MOVE-TO PLACE(S) OF USE (Complete this section ONLY if adding or changing a place of use)
List each individually

The land is legally described by (check all that apply):

☐ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other:

Place of use is on land owned by (required):

Are there other sources of water for these lands? No ☐ Yes ☐ describe by OSE file number:

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Note: If on Federal or State Land, please provide copy of lease.

11. ADDITIONAL STATEMENTS OR EXPLANATIONS

RG-1587 (KAFB-7) is an existing well included in Kirtland AFB's water right as described in District Court order: United States District Court, District of New Mexico, State of New Mexico State Engineer vs. Kirtland Air Force, dated November 27, 1973. See court order included as Attachment 1. The Kirtland AFB water rights allow for diversion and consumptive use of up to 4,500 acre feet per anum. The well is currently used as an extraction well for nitrate abatement at SWMU ST-105. This application does not seek to increase the allowable groundwater diversion described for RG-1587, but seeks to change the purpose of use to pollution control, recovery, and irrigation, including both injection and extraction of groundwater

ACKNOWLEDGEMENT

I, We (name of applicant(s)), **Eric H. Froehlich**
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

2015 SEP 17 PM 4:17

Witness my hand and seal this 10th day of December 2015, for the State Engineer,

Tom Blaine, P.E.
State Engineer
, State Engineer

By: Jeffrey L. Peterson
Signature Print

Title: Water Resource Supervisor
Print

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG-1587	Trn Number:

CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee:	Kirtland Air Force Base
Permit No:	RG-1587
Application File Date:	September 17, 2015
Notice for Publication Issued:	October 13, 2015
Affidavit of Publication Filed:	November 4, 2015, The Albuquerque Journal published on October 16, 23, and 30, 2015
Priority:	March 1, 1949
Source:	Groundwater
Point of Diversion:	
RG-1587:	Located at a point where X=1,544,731.13 feet and Y=1,470,756.22 feet, NMSPCS, Central Zone, NAD 83, on land owned by the Kirtland Air Force Base, Bernalillo County, New Mexico.
Purpose of Use:	Extraction/Production, Injection, and Irrigation
Place of Use:	NE ¼ NE ¼, Section 1, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection wells on land owned by the Kirtland Air Force Base.

2. The total diversion of water from well RG-1587 under this permit shall not exceed 4,500 acre-feet per annum.

3. The total injection of water from well RG-1587 under this permit shall not exceed 2,000 acre-feet per annum.

4. Well RG-1587 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped and injected shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of January, April, July and October of each year. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.

5. The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

6. This Permit will expire on December 1, 2025.

Witness my hand and seal this 10th day of December, A.D., 2015

Tom Blaine, P.E.
NEW MEXICO STATE ENGINEER

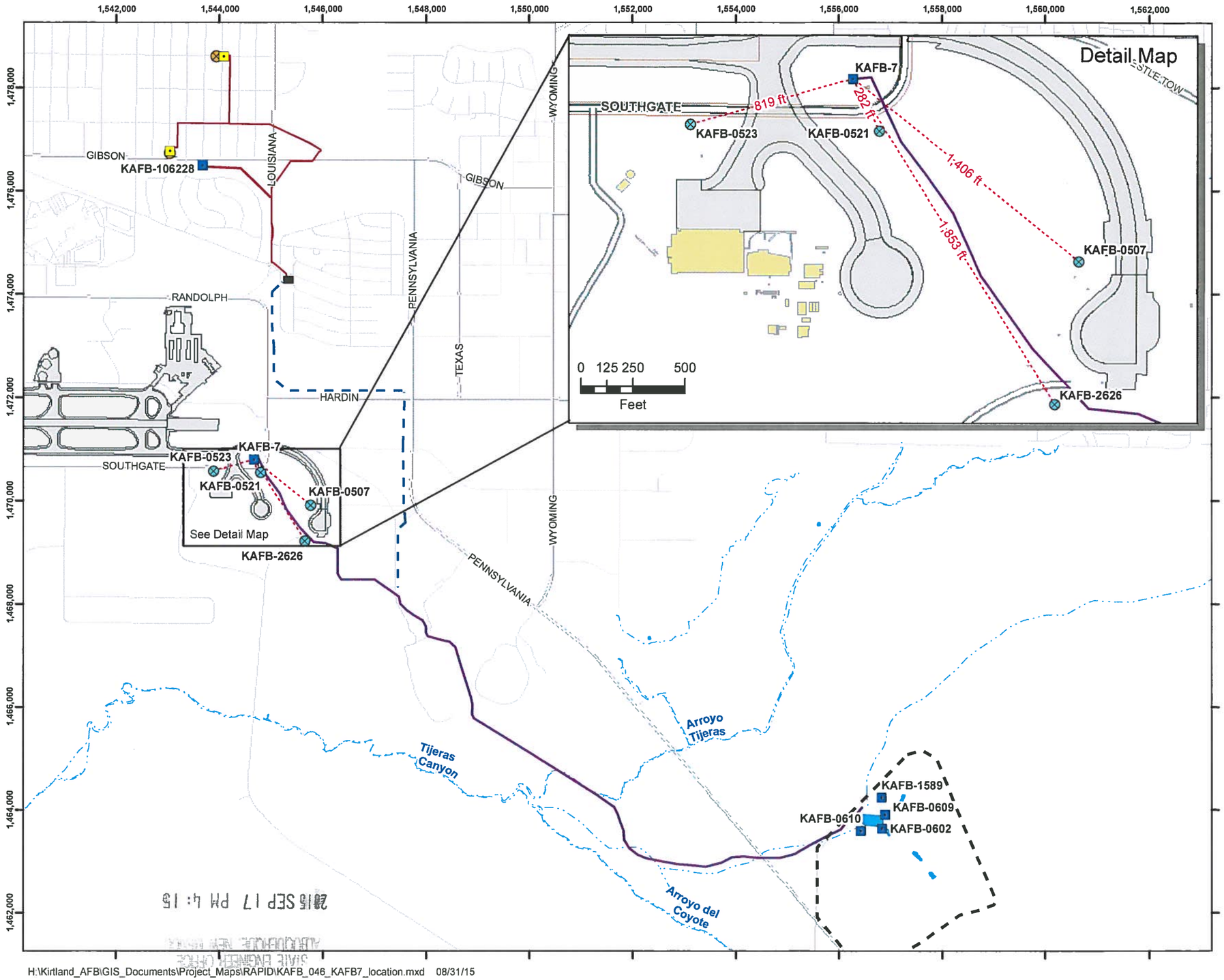
By: _____
Jeffrey L. Peterson
Water Resource Supervisor
District I

CB:cb
cc: WRAB

FIGURE 1

KAFB-7 LOCATION

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 SEP 17 PM 4:15



Legend

- Monitoring Well
- Proposed Monitoring Well
- Existing Extraction Well
- Proposed Extraction Well
- Distance Line from KAFB-7
- Influent Pipeline
- Permanent Effluent Pipeline
- Pipe from KAFB-7
- Ephemeral Stream
- Permanent Groundwater Treatment System
- Tijeras Arroyo Golf Course
- Pond



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Revision Date: 08/31/15

N

0 1,000 2,000 4,000

Feet

1 inch = 2,000 feet

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

RAPID RESPONSE
OSE PERMIT APPLICATION
BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

KAFB-7 LOCATION

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

CERTIFIED RETURN-RECEIPT REQUESTED

2015 SEP 17 PM 4:14
STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

Colonel Eric H. Froehlich
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5600

Office of the State Engineer
c/o Jeffrey L. Peterson, Water Rights Division
5550 San Antonio Blvd. NE
Albuquerque, New Mexico 87109

Dear Mr. Peterson

Kirtland Air Force Base (KAFB) is submitting herein one "Application for Permit to Change an Existing Water Right" with supporting documents to add an additional purpose of use for existing well RG-1587 (KAFB-7). This application seeks to change the purpose of use of RG-1587 to pollution control, recovery, and irrigation, which will include extraction and injection of groundwater. This application does not seek to increase the allowable groundwater diversion described for RG-1587, but it does seek to credit any injected water towards KAFB's consumptive water use. RG-1587 is an existing well included in the KAFB water right as described in District Court order: United States District Court, District of New Mexico, State of New Mexico State Engineer vs. Kirtland Air Force, dated November 27, 1973 (Attachment 1). The KAFB water right allows for diversion and consumptive use of up to 4,500 acre feet per annum. The well is currently used as an extraction well for nitrate abatement at Solid Waste Management Unit (SWMU) ST-105.

To prevent spreading of contaminated groundwater into the Albuquerque municipal water supply and expedite the collapse of the downgradient portion of the SWMU SS-111 dissolved-phase ethylene dibromide (EDB) plume, KAFB plans to install up to eight extraction wells. One well, KAFB-106228 (RG-1579 POD 292) is currently installed and actively extracting water from the aquifer. Two additional extraction wells, KAFB-106233 and KAFB-106234 (RG-1579 POD 309 and 310) are currently being installed and will be operational by winter 2015. Up to five more extraction wells may be installed in subsequent years to extract up to 1,200 gallons per minute (gpm) total (approximately 2,000 acre feet per year) when the well network is completed, and will be will be supplemental to the wells described in KAFB file No. RG-1579 through RG-1589. Extracted water is treated using a granular activated carbon groundwater treatment system (GWTS), and is discharged to the KAFB Golf Course Pond (GCMP) in accordance with the temporary permission to discharge approved by the New Mexico Environment Department (NMED) Groundwater Quality Bureau (GWQB) in a letter dated June 1, 2015.

During winter months the KAFB GCMP will not have the capacity to accept the entirety of the water extracted from the existing and proposed extraction wells. As a result, this application seeks to change the purpose of use for RG-1587 to include injection of treated water, and to credit any injected water up to the entire extracted amount of 2000 acre feet per year towards KAFB's consumptive use. The GWTS could operate for up to ten years; however, it is possible that the GWTS could be operational for a longer or shorter period of time. Construction details for KAFB-7 are included as Attachment 2 to this application. Existing downhole apparatus for KAFB-7 will be replaced or upgraded as necessary to allow for injection of treated groundwater.

The specific requirements for pollution control and recovery will apply to RG-1587 and are as follows:

- The need for the pollution control or recovery operation:
  - SWMU SS-111 is groundwater impacted by jet fuel. The New Mexico Environment Department has directed KAFB to implement Interim Measures to address the groundwater contamination. Existing and proposed extraction wells will extract contaminated water and treat it to concentrations below applicable Environmental Protection Agency maximum contaminant levels and New Mexico Water Quality Control Commission standards. Treated water will be injected back into the aquifer via RG-1587.

- The estimated maximum period of time for completion of the operation:
  - 10 years.

- The annual diversion amount for each well:
  - This application does not seek to increase the allowable diversion amount of 4,500 acre feet per annum included under the KAFB water right.

- The annual consumptive use for each well:
  - This application does not seek to increase the allowable consumptive use of 4,500 acre feet per annum included under the KAFB water right.

- The maximum amount of water to be diverted for the duration of the operation:
  - This application does not seek to increase the allowable diversion amount of 4,500 acre feet per annum included under the KAFB water right.
  - Up to 2,000 acre feet per annum will be injected into the aquifer via existing well RG1587 (KAFB-7) and will be credited to KAFB's consumptive use.

- The method and place of discharge
  - Water extracted from SWMU SS-111 will be discharged to the GCMP, or infiltration galleries. In addition, this application seeks to permit RG-1587 for pollution control, recovery, and irrigation, which will include injection of treated groundwater.

- The method of measurement of water produced and discharged:
  - Water will be metered as it is extracted from the individual extraction wells and treated by the GWTS.

- The source of water to be injected:
  - Injected water will be extracted from existing and proposed extraction wells installed to expedite the collapse of the downgradient portion of the SWMU SS-111 dissolved-phase EDB plume. The extracted water will be treated through a granular-activated carbon system prior to injection.

- The method of measurement of water injected:
  - Treated water will be metered as it is discharged to RG-1587.

- The characteristics of the aquifer:
  - The aquifer is primarily comprised of unconsolidated sand and gravel, with an average hydraulic conductivity of 63 feet/day.

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STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

- The method of determining the resulting annual consumptive use of water and depletion from any related stream system:
  - The groundwater from KAFB-106233 and KAFB-106234 are projected to be extracted at a rate of up to 200 gpm (323 acre-feet per year per well) and groundwater from KAFB-106228 is currently permitted to extracted at a rate of 250 gpm (403 acre-feet per year). Once the five additional extraction wells are added to the treatment network, the eight extraction wells are estimated to extract up to 1,200 gpm total (approximately 2,000 acre feet per year). The groundwater will be metered from each extraction well as it is extracted from the aquifer and pumped to the KAFB GWTS. Treated water will be metered as the groundwater is discharged to the GCMP and infiltration galleries. These metered locations will be used to determine the annual consumptive use.
  - Treated water will also be discharged via injection to RG-1587. A flow meter will be installed at RG-1587 to measure the volume of treated water injected into the aquifer. Treated water will be injected into RG-1587 during periods in which the GCMP and infiltration galleries are non-operational, so the volume removed from the extraction wells will essentially equal the amount discharged to the aquifer. Injected water will be created to KAFB's consumptive use.

- Proof of any permit required from the NMED:
  - KAFB is working with the NMED – Hazardous Waste Bureau and GWQB to identify necessary permits. These include the following:
    a. Discharge Permit
    b. Temporary Discharge Permit
  - A Modification to Discharge Permit DP-1770 has been submitted to the NMED GWQB and the first Public Notice has been issued. Additional information regarding the KAFB-7 injection well will be submitted to the NMED GWQB to include in the permit modification.
  - Temporary permission to discharge treated groundwater to the GCMP was issued by the NMED in a letter dated June 1, 2015.

- An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located:
  - KAFB is the owner of the land on which RG-1587 is located.

In addition to the application, this packet contains figure illustrating the location of KAFB-7 (RG-1587), the Kirtland AFB water rights file, and well construction details for KAFB-7. Please contact Mr. L. Wayne Bitner at 505.853.3484 or at ludie.bitner@us.af.mil or Ms. Victoria R. Branson at 505.846.6362 or at victoria.branson@us.af.mil if you have any questions.

Sincerely

ERIC H. FROEHLICH, Colonel, USAF
Commander

Attachment: WR06 Application for Permit to Change an Existing Water Right

cc:
AFCEC-CZRX (Bodour)
USACE-Omaha District Office (Ellender)
USACE-ABQ District Office (Simpler, Phaneuf)
Public Info Repository, AR/IR, and File

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STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

ATTACHMENT 1

KIRTLAND WATER RIGHT

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 SEP 17 PM 4:15

73 DEC 3 A 8:26
ALBUQUERQUE, N. MEX.
ORIGINAL
FILED IN MY OFFICE
NOV 27 1973
L. C. KANALY
CLERK

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, ex rel, S. E. REYNOLDS, State Engineer.

Plaintiff

vs.

JOHN McLUCAS, Secretary of the Air Force, THOMAS W. MORGAN, Commander, Air Force Special Weapons Center, and JAMES B. MYERS, Base Commander, Kirtland Air Force Base

Defendants.

JUDGMENT AND ORDER

THIS MATTER coming on to be heard upon the Stipulation of the parties, and the Court having considered the same and being otherwise fully advised in the premises, finds that the Court has jurisdiction of the parties and the subject matter and that the said Stipulation should be approved and incorporated in the final judgment of this Court.

IT IS THEREFORE ORDERED, ADJUDGED AND DECREED that the Stipulation of the parties is hereby approved and incorporated in this judgment as if set out in full herein.

IT IS FURTHER ORDERED that the defendants, their employees, agents, assigns and successors in interest be and they are hereby permanently enjoined and restrained from any diversion and/or use of water from the Rio Grande Underground Water BAsin in and for Kirtland Air Force BAse except in strict conformity with this final judgment.

HOWARD BRATTON

JUDGE OF THE U. S. DISTRICT COURT

2015 SEP 17 PM 4:15
STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

I agree;
FLS
J Grant

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, ex rel, S. E. REYNOLDS, State Engineer.	)
Plaintiff	)
vs.	)
JOHN McLUCAS, Secretary of the Air Force, THOMAS W. MORGAN, Commander, Air Force Special Weapons Center, and JAMES B. MYERS, Base Commander, Kirtland Air Force Base	)
Defendants.	)

73 DEC 3 A 8:
ALBUQUERQUE, N.M.
ORIGINAL FILED IN MY OFFICE
NOV 27 1973
L. G. KANALY
CLERK

STIPULATION

COME NOW the Plaintiff and Defendants herein, by and through their attorneys, and hereby mutually stipulate and agree that final judgment may enter in this cause in the following terms:

1. The United States of America, acting through and by means of the United States Air Force, owns and operates that certain complex of military facilities known as Kirtland Air Force Base within Bernalillo County, New Mexico, which Base includes the former Sandia Base, a Military installation heretofore operated by the United States Army. That area heretofore known as Sandia Base shall be designated in this stipulation as Kirtland East and that area known as Kirtland Air Force Base prior to the merger of the two installations shall be designated as Kirtland West.

2. On November 29, 1956, the Plaintiff, S. E. Reynolds, State Engineer, duly and lawfully declared the Rio Grande Underground Water Basin, an underground reservoir of public waters of the State of New Mexico having reasonably ascertainable boundaries.

3. All of Kirtland East and Kirtland West were, on November 29, 1956, and have continued to the present time to be within the exterior boundaries of the said Rio Grande Underground Water Basin.

4. On November 29, 1956, the United States of America owned within Kirtland East a water supply system consisting of 9 completed and operating wells, together with associated water storage and delivery works, and had prior to that date diverted and used underground waters of the Rio Grande Underground Water Basin by means of each and every of the said 9 wells for the lawful purposes of the said military installation.

5. The said nine wells in the Kirtland East water supply system were duly declared by an authorized representative of the United States of America in the office of the Plaintiff on the 4th day of October, 1957, and have been since that date designated in the files of the State Engineer as wells No. RG-1581 through RG-1589. The respective locations and priorities of the said 9 wells, as declared by the United States of America, are as follows:

RG-1581 NW1/4SE1/4, Sec. 31 T. 10 N., R. 4 E. March 1, 1949

RG-1582 NW1/4NW1/4, Sec. 1 T. 9 N., R. 3 E. August, 1949

RG-1583 NW1/4SW1/4, Sec. 30, T. 10 N., R. 4 E. August, 1949

RG-1584 NE1/4SW1/4, Sec. 6, T. 9 N., R. 4 E. August, 1949

RG-1585 NE1/4SW1/4, Sec. 29, T. 10 N., R. 4 E. July, 1952

RG-1586 SW1/4SE1/4, Sec. 32, T. 10 N., R. 4 E. July, 1952

RG-1587 NW1/4NW1/4, Sec. 6, T. 9 N., R. 4 E. Feb., 1955

RG-1588 SW1/4SW1/4, Sec. 5, T. 9 N., R. 4 E. Feb., 1955

RG-1589 SW1/4SW1/4, Sec. 15, T. 9 N., R. 4 E. Feb., 1949

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SANTA FE, N. MEX.

6. Between November 1, 1958, and May 27, 1959, the United States of America drilled or caused to be drilled, in the NW1/4NE1/4 of Sec. 20, T. 9 N., R. 4 E., an additional water well which was thereafter made a part of the water supply system of Kirtland East. This well is designated in the files of the State Engineer as RG-1581 through RG-1589-S. By means of the said well, the United States of America has thereafter continually diverted and beneficially used public underground waters of the Rio Grande Underground Water Basin, as a supplemental point of diversion in and for Kirtland East.

7. In 1972, the United States of America drilled or caused to be drilled an additional water well within Kirtland East in the NW1/4NE1/4 of Sec. 4, T. 9 N., R. 4 E., which well has been completed except for the installation of a pump and has not yet been put to beneficial use, and which is hereby designated RG-1581 through RG-1589-S-2. The said well was drilled for the purpose of serving as a supplemental well for the water supply system of Kirtland East

8. The United States of America owns, under the Constitution and laws of the State of New Mexico, the right to divert the public underground waters of the Rio Grande Underground Water Basin, through and by means of the said eleven wells set forth in paragraphs 5, 6 and 7, in an amount not to exceed an annual quantity of four thousand five hundred (4,500) acre-feet, and to apply the same to beneficial use for the purposes of Kirtland Air Force Base. The priorities of the said eleven wells composing the water supply system of Kirtland East are as set forth

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above in paragraphs 5, 6 and 7. The defendants stipulate that the United States Air Force has no right to divert any of the underground waters of the Rio Grande Underground Water Basin, by means of the said 11 wells or otherwise, for the purposes of Kirtland Air Force Base, except as set forth in this Stipulation, provided, however, that the United States shall enjoy the same right as any other appropriator in the State of New Mexico to make application hereafter to the Plaintiff, State Engineer, for permit to drill supplemental well(s) (i.e., make partial or total change in point of diversion or place or purpose of use) or to effect the transfer of valid and existing water rights for the purposes of Kirtland Air Force Base.

9. On November 29, 1956, the United States of America owned a water supply system in and for Kirtland West consisting of two water wells whose respective locations and priorities were declared in the Office of the State Engineer, by a duly authorized representative of the United States on the 4th day of October, 1957, to be as follows:
RG-1579 NW1/4NW1/4, Sec. 35, T. 10 N., R. 3 E., Oct. 9, 1952
RG-1580 SE1/4NW1/4, Sec. 34, T. 10 N., R. 3 E., Mar. 6, 1956

10. In 1969, the United States of America drilled or caused to be drilled an additional well in and for the Kirtland West water supply system, designated in the records of the State Engineer as RG-1579 and RG-1580 Combined-S, which well was thereafter made a part of the Kirtland West water supply system as a supplemental well.

11. The United States of America owns, under the Constitution and laws of the State of New Mexico, the right to divert

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the public underground waters of the Rio Grande Underground Water Basin by means of the three wells set out in paragraphs 9 and 10 above in an amount not to exceed an annual quantity of 1,898 acre-feet for the purposes of Kirtland Air Force Base. The defendants stipulate that the United States Air Force has no right to divert or use the underground waters of the Rio Grande Underground Water Basin for the purposes of Kirtland Air Force Base, except as set forth in this Stipulation, by means of the said three wells or otherwise, provided, however, that the United States of America shall enjoy the same right as any other appropriator of public water in the State of New Mexico to make application to the Plaintiff, State Engineer, hereafter for permit to drill and use supplemental well(s) (i.e., make partial or total change in point of diversion or place or purpose of use) or to effect the transfer of existing valid water rights for the purposes of Kirtland Air Force Base.

12. The United States of America also owns the right under the Constitution and laws of the State of New Mexico to divert public underground waters of the Rio Grande Underground Water Basin in an amount not to exceed three acre-feet per year by and from each of the following three domestic wells located and existing within, and for the purposes of Kirtland Air Force Base:

Location	Priorities
RG-1578 SE1/4NW1/4, Sec. 35, T. 9 N., R. 4 E.	1945
RG-1590 SE1/4NW1/4, Sec. 35, T. 9 N., R. 4 E.	1945
RG-1591 NE1/4SE1/4, Sec. 24, T. 9 N., R. 4 E.	1948

13. The defendants stipulate that the United States Air Force will not after the entry of final judgment herein drill

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or cause or allow to be drilled any water well(s) within the boundaries of the Rio Grande Underground Water Basin, within and/or for the purposes of Kirtland Air Force Base (including Kirtland East and Kirtland West), except when and to the extent that it will have fully complied with the laws of the State of New Mexico and the Rules and Regulations of the State Engineer in respect to obtaining from the State Engineer permit(s) to drill water wells and/or produce public waters therefrom for any purpose.

14. The defendants stipulate that they will make on behalf of the United States accurate monthly reports to the Plaintiff, State Engineer, of the total metered quantities of underground water diverted by means of any and all of the wells composing the Kirtland East and Kirtland West water supply systems, provided, however, that the United States of America shall not be required to make application for, or obtain permit authorizing the physical combination of the two water supply systems so long as the total annual metered diversion from each system is within the respective limit established in paragraphs 8 and 11. The defendants further agree that they will, within 60 days of the date of entry of final judgment herein, file in the Office of the Plaintiff, State Engineer, on forms to be supplied by the Plaintiff, applications on behalf of the United States seeking the right to divert and use public underground waters of the Rio Grande Underground Water Basin by means of those two certain wells RG-1581 through RG-1589-S-2 and RG-1579 and RG-1580 Combined-S, within the respective limits set forth in paragraphs 8 and 11 above. The State of New Mexico agrees that together

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with the terms of judgment entered in this cause pursuant to this Stipulation, the said applications shall be administratively recognized as evidencing the right of the United States to use the said two wells within the terms of this Stipulation and the Order of the Court entered pursuant thereto, without any further requirement for advertisement or hearing.

PAUL L. BLOOM
Special Assistant Attorney General
State of New Mexico

s/ Victor Ortega
United States Attorney

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ATTACHMENT 2

KAFB-7 WELL CONSTRUCTION INFORMATION

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DATA WELL NO. 7 KIRTLAND EAST

ELEVATION (FT)	LOCATION	DATE CONSTR ENDED
5349.0	NE¼-NE¼-NE¼=SEC 1-T9N-R3E	February 1955

WELL

TYPE		
Rotary Drilled, Gravel Packed, 3/4" Gravel		
DEPTH: 1010'	DIAMETER: 28" Hole, 16" Casing	PUMPSETTING DEPTH: 475'
ORIGINAL STATIC LEVEL: 395'	DRAWDOWN: 22'	RECOVERY TIME:

TEST DATA		AIR LINE AND GAGES					SPECIFIC CAPACITY (GAL) PER (FT)
WELL CAPACITY	PUMPING LEVEL	YES	X	NO		LENGTH	GPM / DRAWDOWN = 64 GPM/FT
1400GPM	417'		X			475'	

WELL PUMPING EQUIPMENT

PUMP

TYPE AND MAKE			CAPACITY
Submersible, Byron-Jackson			1150 GPM
SUCTION (FT): N/A	SIZE AND LENGTH: N/A	COLUMN: 10" w/check valve at water level	

HEAD			NUMBER BOWLS	SIZE AND TYPE	NO. STAGES
ABOVE GRD	BELOW GRD	TOTAL			
161'	425'	586'		12" 3CK	7

MOTOR

SERIAL NO.	TYPE	MAKE	HP	RPM	FRAME	PHASE	CYCLES	VOLTAGE
	14" H Submersible	B&J	200	1750		3	60	440

STAND BY POWER	MAKE	SIZE
440 volt	Cummins Installed 1970	300KW

HP	RPM	DESCRIPTION
	1800	Diesel powered generator

CASING AND WELL SCREENING MATERIAL USED	SETTING DEPTH	LENGTH EACH
16" O.D. Blank Casing	448	448
16" O.D. ⅛" Shutter Screen casing	856	408
16" O.D. Blank Casing	880	24
16" O.D. ⅛" Shutter screen casing	976	96
16" O.D Blank Casing	1,010	34

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FORMATIONS ENCOUNTERED DURING DRILLING #7(KE)	DEPTH (FT)	STRATUM
Top soil, sand and gravel	35	35
Sand, gravel and clay	95	60
Course sand and gravel	125	30
Sandy clay and gravel	190	65
Sand and gravel	240	50
Coarse sand and gravel	275	35
Sand, gravel and streaks of clay	315	40
Sand, gravel and boulders	465	250
Sand, gravel and streaks of clay	525	60
Sand, gravel and boulders	740	215
Coarse sand and boulders	855	115
Sandy clay	945	90
Coarse sandy clay and boulders	1,000	55

CHANGES MADE FROM ORIGINAL DATA

1961: Motor failed,equipment removed. Well bailed and surged and added 40 CY of gravel (3/4") and removed 30 CY of 1/4" gravel. Installed new pump and motor identical to original. Static level 418 feet.

1967: Pump failed to operate, equipment removed. Well bailed, surged and caged. 80 CY of 1/4 inch gravel removed and 100 CY of 3/4 inch gravel added. Installed new identical equipment. Static level 420 feet.

1970: Equipment failed, removed. Installed Johnson pump and 250 HP GE submersible motor, 1400 GPM @ 615' head. Static level 425 feet.

1973: Equipment failed, removed. Installed 7-stage Fairbanks-Morse lineshaft pump w/250 HP Westinghouse hollowshaft motor, 1400 GPM @ 560' head. Static level 425 feet.

1976: Motor burned out, replaced w/250 HP GE hollowshaft. (Jan-Apr) $6,171.03
Sand sampler installed

1976: July, replaced water meter and installed drawdown recorder. $4,500.00
September, replaced seal and bearings in motor. $1,800.00

1977: March, Motor Overhauled (Shops). $1,500.00

DRILLING COMPANY	LOCATION
LOSCOE MOSS CO	LOS ANGELES CALIFORNIA

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

DISTRICT I

JOHN R. D'ANTONIO, JR., P.E.
STATE ENGINEER

5550 San Antonio Drive NE
Albuquerque, NM 87109-4127
(505) 383-4000

January 9, 2020

Kirtland Airforce Base
C/o EA Engineering
Attn: Bernard Bockisch
320 Gold Avenue SW, Suite 1300
Albuquerque, NM 87102

Permit No.: RG-1579 POD 376-379

Greetings:

The Office of the State Engineer has approved the above-referenced permit subject to the attached Conditions of Approval. Also attached are the well tags for all wells, which must be attached to each well using a metal band.

Pursuant to Section 72-2-16, NMSA 1978, if you are aggrieved by this decision you may submit a request to this office asking for a hearing to be held. The request must be in writing and must be submitted no later than 30 days after receipt of this letter. Failure to request a hearing by such time will waive your right to request a hearing on this decision.

In accordance with Subsection B of 19.25.2.10 NMAC, you will be required to pay a hearing fee when the hearing is announced by the OSE Hearings Unit.

Aggrieval of the permit or any of the conditions of approval suspends the permit. **No water may be diverted** under an aggrieved permit until final resolution of the aggrieval with the Office of the State Engineer. Any water diverted while the aggrieval is pending will have to be repaid.

You may also submit additional evidence in support of your application for this Office to reconsider your application. This office will give full consideration to any additional evidence.

Requesting a hearing does not preclude you from submitting additional evidence at any time before or after such request. However, please note that any submissions of additional evidence do not alter the thirty-day deadline to request a hearing, and if an application is deemed final, no further evidence will be considered.

If you have any questions or comments, please contact this office.

Sincerely,

Jeffrey Falance
Water Resources Professional I, District 1

Enclosures

HC 1-59372
$100

File No.

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO CHANGE AN EXISTING WATER RIGHT

(Non 72-12-1)

(check applicable boxes):

For fees, see State Engineer website: http://www.ose.state.nm.us/

☒ Change Purpose of Use ☒ Groundwater ☐ Surface Water ☐ Change Place of Use ☐ Groundwater ☐ Surface Water	☐ Change Point of Diversion (POD): From: ☐ Groundwater ☐ Surface Water To: ☐ Groundwater ☐ Surface Water	☒ Additional Groundwater Point of Diversion (POD) ☐ Additional Surface Water Point of Diversion (POD)

☐ Temporary Change, NMSA 1978, § 72-12-7(B) Requested Start Date: Requested End Date:
(Not to Exceed 3 ac-ft in One Year)

☐ Water Use Lease, NMSA 1978, §§ 72-6-1 to-7 Requested Start Date: Requested End Date:

☐ Temporary Change (other) Requested Start Date: Requested End Date:

1. APPLICANT(S) (Required) Note: water-right owner must be listed as an applicant.

Name: Kirtland Air Force Base	Name: N/A
Contact or Agent: check here if Agent ☐ Mr. Scott Clark	Contact or Agent: check here if Agent ☐ N/A
Mailing Address: Bldg 20685; 2050 Wyoming Blvd. SE	Mailing Address:
City: Kirtland Airforce Base	City:
State: Zip Code: New Mexico 87117-5270	State: Zip Code:
Phone: ☐ Home ☐ Cell Phone (Work): (505) 846-9017	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): scott.clark@us.af.mil	E-mail (optional):

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2. CURRENT OSE FILE INFORMATION (Required)

OSE File No(s): RG-1579 Through RG-1589	Priority Date (if known): March 1, 1949	Subfile/Cause No. (if applicable):

3. CURRENT PURPOSE OF USE AND AMOUNT OF WATER (Required)

☐ Domestic ☐ Livestock ☐ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): Kirtland AFB Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): Remediation of groundwater and reinjection.	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: See Table 1 Consumptive Use: See Table 1 Other (include units): See Table 1

FOR OSE INTERNAL USE

Application for Permit, Form wr-06, Rev 4/04/17

File No.:	Trn. No.:	Receipt No.:
Trans Description (optional):		Sub-Basin:
Well Tag ID No. (if applicable):	PCW/LOG Due Date:	PBU Due Date:

4. COUNTY WHERE WATER RIGHT IS CURRENTLY USED (Required)

Bernalillo

5. ADDITIONAL STATEMENTS CONCERNING THE CURRENT WATER RIGHT

The Kirtland AFB water rights allow for diversion and consumptive use of up to 4,500 acre feet per annum. The proposed injection wells will be used for the reinjection of groundwater treated through the Groundwater Treatment System (GWTS) to meet the standards of 20.6.2.3103 NMAC. Treated water is either sent to the Golf Course main pond (summer months) or injection well KAFB-7 (winter months and GCMP upset conditions, OSE file number RG-1587). KAFB-7 is a retrofitted groundwater production well and has experienced biofouling and current screen conditions limit rehabilitation. The new injection wells will provide an additional option for the conservation of treated groundwater. A location map for KAFB-106IN2 is present as Figure 1. The proposed construction detail of the injection wells is provided in Figure 2. The remaining wells will be located as shown below on page 4. A Pollution Control and/or Recovery Plan Summary is presented as Table 1. A Well Construction Plan is included as Attachment 1. NMED DP-1839 is included as Attachment 2.

6. CURRENT or MOVE-FROM POINT(S) OF DIVERSION (POD) (Required)

☐ **Surface POD** **OR** ■ **Ground Water POD (Well)**

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

■ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
■ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
RG-1579 through RG-1589	-	-	See District Court Order Dated Nov. 27, 1973 (attachment 3)

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional point of diversion descriptions are attached: ☐ **Yes** ■ **No** **If yes, how many**_____

Point of Diversion is on Land Owned by: Kirtland Air Force Base (KAFB-7) and City of Albuquerque (KAFB-106228, 233, 234, and 239).

Other description relating point of diversion to common landmarks, streets, or other:
KAFB-7 is currently being used for injection of groundwater from the GWTS. Water may be diverted from this location to the proposed injection wells (KAFB-106IN2 thru 5). KAFB-106228, 233, 234, and 239 are currently being used for extraction of impacted groundwater.

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7. CURRENT or MOVE-FROM PLACE(S) OF USE (Required)

The land is legally described by (check all that apply):

☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

■ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
Kirtland Air Force Base					
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other:

Place of use is on land owned by (required):
Kirtland Air Force Base

Are there other sources of water for these lands? No ■ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

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8. MOVE-TO PURPOSE OF USE AND AMOUNT OF WATER (Complete this section ONLY if the purpose of use is changing)

Check all that apply:	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section.
☐ Domestic ☐ Livestock ☐ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ■ Other Use (specify): Pollution Control and Recovery Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): Remediation of groundwater and reinjection.	Diversion: See Comments Consumptive Use: See Comments Other (include units): See Comments

9. MOVE-TO POINT(S) OF DIVERSION (POD) (Complete this section ONLY if adding or replacing a POD)

☐ **Surface POD OR** ■ **Ground Water POD (Well)**

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

■ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
■ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106IN2 (No POD No.)	1547415	1470053	NE1/4, NW1/4, Section 6, Township 9N, Range 4E
KAFB-106IN3 (no POD No.)	TBD	TBD	To be installed within UIC area. See Fig 1 of attached DP-1839
KAFB-106IN4 (no POD No.)	TBD	TBD	To be installed within UIC area. See Fig 1 of attached DP-1839
KAFB-106IN5 (no POD No.)	TBD	TBD	To be installed within UIC area. See Fig 1 of attached DP-1839

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional POD descriptions are attached: ☐ **Yes** ☑ **No** **If yes, how many**_____

Other description relating point(s) of diversion to common landmarks, streets, or other:

Point of Diversion is on Land Owned by: Kirtland Air Force Base

Note: The following information is for wells only. If more than one (1) well needs to be described, provide attachment.

Approximate depth of well (feet): 905 ft bgs | Outside diameter of well casing (inches): Up to 14.5-inch

Driller Name: To be determined. | Driller License Number: To be provided prior to drilling.

If replacing the current well, is the current well to be plugged? ☐ Yes ■ No ☐ Not Applicable
If No, state for what use it is retained: KAFB-7 will be retained as a backup well in the event that the new wells are not available.

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10. MOVE-TO PLACE(S) OF USE (Complete this section ONLY if adding or changing a place of use)
List each individually

The land is legally described by (check all that apply):

- ☐ Hydrographic Survey Report or Map
- ☐ Subdivision
- ☐ Grant
- ■ Public Land Survey System (PLSS) (quarters, section, township, range)
- ☐ Irrigation or Conservation District Map

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
NE1/4, NW1/4	6	9N	4E		
Proposed Injection wells to be installed within					
the UIC area shown on Figure 1 in the attached					
Discharge Permit - DP-1839					
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other:

Place of use is on land owned by (required): Kirtland Air Force Base

Are there other sources of water for these lands? No ■ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

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11. ACEQUIA OR COMMUNITY DITCH REQUIREMENTS

☒ A. The water right is not within a Community Ditch or Acequia

☐ B. The water right is within a Community Ditch or Acequia. **If you checked box B you must:**

1) Attach documentary evidence provided by commissioners of the Community Ditch or Acequia confirming applicant's compliance with any applicable requirement for the change adopted by the Community Ditch or Acequia **or**

2) Attach an affidavit from the commissioners of the Community Ditch or Acequia stating that no such requirement has been adopted by the relevant association bylaws.

This documentation is required pursuant to NMSA 1978 § 72-5-24.1.

12. ADDITIONAL STATEMENTS OR EXPLANATIONS

A location map for KAFB-106IN2 is present as Figure 1 and a well construction summary is provided as Attachment 1. The Remaining Proposed Injection Wells (KAFB-106IN3 through KAFB-106IN5) will be installed within the UIC area depicted on Figure 1 in Attachment 2, NMED discharge permit (DP-1839). The proposed injection well construction detail is provided in Figure 2.

STATE ENGINEERS OFFICE
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ACKNOWLEDGEMENT

I, We (name of applicant(s)), David S. Miller, Colonel, USAF Commander
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 8 day of January 20 20, for

JOHN R. D'ANTONIO, JR. P.E.
STATE ENGINEER

, New Mexico State Engineer

By: Jeffrey Falance
Signature Print

Title: Water Resources Professional I
Print

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
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☒ Check here if a new well is to be drilled under this permit.

FOR OSE INTERNAL USE

Well Tag ID Issued? ☐ Yes ☐ No

Application for Permit, Form wr-06

File No.:	Trn No.:	Well ID Tag No.:

NEW MEXICO OFFICE OF THE STATE ENGINEER
CONDITIONS OF APPROVAL

1. This Application is approved as follows:

Permittee: Kirtland Air Force Base
Bldg 20685
2050 Wyoming Blvd. SE
Kirtland Air Force Base, NM 87117-5270

Permit Number: RG-1579 PODS 376-379

Application File Date: August 26, 2019

Notice for Publication Issued: September 30, 2019

Affidavit of Publication Filed: December 6, 2019 The Albuquerque Journal published on October 4, 11, and 18, 2019

Priority: March 1, 1949

Source: Groundwater

Purpose of Use: Pollution Control and Recovery/Remediation

Additional Points of Diversion (PODs):

OSE POD No.	Other Well ID No.	Locations (NM Central Zone, NAD83)
RG-1579 POD376	KAFB-106IN2	X: 1547415 feet Y: 1470053 feet, also described at NE1/4, NW1/4, Section 6, Township 9 North, Range 4 East, NMPM

OSE POD No.	Other Well ID No.	Locations (PLSS)
RG-1579 POD377	KAFB-106IN3	To be installed within the Underground Injection Control area. Township 9 North, Range 4 East, or Township 9 North, Range 3 East, or Township 10 North Range 4 East, NMPM
RG-1579 POD378	KAFB-106IN4	
RG-1579 POD379	KAFB-106IN5	

To be installed on land owned by Kirtland Air Force Base within the Underground Injection Control (UIC) area, KAFB, Bernalillo County, New Mexico. All wells to be supplemental to permitted wells under permits RG-1579 through RG-1589 et al.

Place of Use: UIC area associated with the Ground Water Treatment System (GWTS), for the remediation of the historic jet fuel spill at KAFB, further described as being located within Township 9 North, Range 4 East, Township 9 North, Range 3 East, and

NEW MEXICO OFFICE OF THE STATE ENGINEER
CONDITIONS OF APPROVAL

Township 10 North Range4 East, Bernalillo County, New Mexico.

2. The total diversion of water from all wells combined, under this permit and previous permits shall not exceed 4,500 acre-feet per annum.

3. The wells shall be drilled by a driller licensed in the State of New Mexico in accordance with Section 72-12-12 NMSA and the wells shall be constructed in accordance with 19.27.4 NMAC.

4. All wells shall be equipped with a totalizing meter, or meters, of a type and at a location(s) approved by and installed in a manner acceptable to the State Engineer. Records of the total amount of water diverted from all wells shall be submitted to the District 1 Office via mail, e-mail, or facsimile on or before the 10th day of January, April, July and October for the preceding three calendar months, i.e. *quarterly*. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.

5. The State Engineer shall supply well identification tags for the well driller to firmly affix to the well casing or cap with a steel band upon completion in accordance with Subsection M of 19.27.4.29 NMAC. The permit holder is responsible for maintaining the well identification tag. Well tag ID Numbers associated with this permit: POD 376-105F0, POD 377-105F2, POD 378-105F3, and POD 378-105F4.

6. Upon completion of permitted use, wells shall be plugged under State Engineer-approved Plugging Plans, and Plugging Records shall be filed with the State Engineer within thirty (30) days after the wells are plugged in accordance with Subsection C of 19.27.4.30 NMAC.

7. Pursuant to Section 72-8-1 NMSA, the permittee shall allow the State Engineer and his representatives entry upon private property for the performance of their respective duties, including but not limited to field checks for permit compliance and access to the well(s) for meter reading and water level measurement.

8. The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

9. The State Engineer retains jurisdiction to cancel this permit if the Conditions of Approval are not met or if the actions of the permittee(s) are not in accordance with this permit.

Witness my hand and seal this 8 day of January, 2020.

John R. D'Antonio, Jr., P.E., State Engineer

By: _____ Jeffrey Falance, Water Resource Professional I

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

DISTRICT I

JOHN R. D'ANTONIO, JR., P.E.
STATE ENGINEER

5550 San Antonio Dr. NE
Albuquerque, NM 87109-4127
(505) 383-4000

July 3, 2019

Permit No: RG-1579 POD 376

Kirtland Air Force Base
C/o Bernard Bockisch, PMP
320 Gold Avenue SW, Suite 1300
Albuquerque, NM 87102

Greetings:

Your copy of Permit to Drill an Exploratory Well, which has been approved in accordance with the attached Conditions of Approval, is enclosed. If you have any questions, please don't hesitate to contact me.

Sincerely,

Jeffrey Falance
Water Resource Professional I

Enclosures

WR-07 Application for Permit to Drill A Well With No Water Right

HC1-59128 $5.00

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2019 JUN 26 PM 2:34

File No. RG-01579

NEW MEXICO OFFICE OF THE STATE ENGINEER

WR-07 APPLICATION FOR PERMIT TO DRILL

A WELL WITH NO WATER RIGHT

(check applicable box):

HC1-59128
$5.00

For fees, see State Engineer website: http://www.ose.state.nm.us/

Purpose:	☒ Pollution Control And/Or Recovery	☐ Ground Source Heat Pump
☒ Exploratory Well (Pump test)	☐ Construction Site/Public Works Dewatering	☐ Other(Describe):
☐ Monitoring Well	☐ Mine Dewatering	

A separate permit will be required to apply water to beneficial use regardless if use is consumptive or nonconsumptive.

☐ Temporary Request - Requested Start Date: Requested End Date:

Plugging Plan of Operations Submitted? ☐ Yes ☒ No

1. APPLICANT(S)

Name: Kirtland Air Force Base	Name: N/A
Contact or Agent: check here if Agent ☐ Scott Clark, Chief Env. Restoration	Contact or Agent: check here if Agent ☐ N/A
Mailing Address: AFCEC/CZO, Kirtland IST, 2050 Wyoming Blvd. SE	Mailing Address: N/A
City: Albuquerque	City: N/A
State: NM Zip Code: 87117-5270	State: N/A Zip Code: N/A
Phone: N/A ☐ Home ☐ Cell Phone (Work): 505.846.9017	Phone: N/A ☐ Home ☐ Cell Phone (Work):
E-mail (optional): scott.clark@us.af.mil	E-mail (optional):

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2019 JAN 25 PM 2:34

FOR OSE INTERNAL USE Application for Permit, Form WR-07, Rev 11/17/16

File No.: RG-1579	Trn. No.:	Receipt No.:
Trans Description (optional): POD ~~376~~ JF 376		
Sub-Basin:	PCW/LOG Due Date:	

2. **WELL(S)** Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106IN2	1547415 (approx.)	1470053 (approx.)	NE1/4,NW1/4, Section 6, Township 9N, Range 4E

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ☐ **Yes** ☒ **No** **If yes, how many**_____

Other description relating well to common landmarks, streets, or other:

See attached Figure 1, Exploratory Well Location Map (Final well location survey data will be provided to NMOSE upon completion).

Well is on land owned by: Kirtland Air Force Base

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. Attached? ☐ **Yes** ☒ **No**
If yes, how many_____

Approximate depth of well (feet): up to 920 ft bgs	Outside diameter of well casing (inches): up to 14.5-inch
Driller Name: To be determined.	Driller License Number: To be determined

STATE ENGINEER'S OFFICE
ALBUQUERQUE, NEW MEXICO
2019 JUN 26 PM 2:34

3. ADDITIONAL STATEMENTS OR EXPLANATIONS

The purpose of this well is to test aquifer conditions for suitability for clean water injection. The exploratory well may be used in the future as an injection well for the conservation of groundwater treated at the Kirtland AFB Bulk Fuels Facility (BFF) Groundwater Treatment System (GWTS). The GWTS treats groundwater extracted from an area historically impacted by releases from the BFF. The proposed exploratory well location is provided as Figure 1. The final well location will be located within the designated section. The proposed construction of the exploratory well is provided in Figure 2. A Pollution Control and/or Recovery Plan Summary is presented as Table 1. A Well Construction Plan is included as Attachment 1. Final well construction specifications are subject to pending regulatory approval.

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application:

Exploratory:	**Pollution Control and/or Recovery:**	**Construction Dewatering:**	**Mine De-Watering:**
■ Include a description of any proposed pump test, if applicable.	■ Include a plan for pollution control/recovery, that includes the following: ■ A description of the need for the pollution control or recovery operation. ■ The estimated maximum period of time for completion of the operation. ■ The annual diversion amount. ■ The annual consumptive use amount. ■ The maximum amount of water to be diverted and injected for the duration of the operation. ■ The method and place of discharge.	☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐ The geohydrologic characteristics of the aquifer(s). ☐ The maximum amount of water to be diverted per annum. ☐ The maximum amount of water to be diverted for the duration of the operation. ☐ The quality of the water. ☐ The method of measurement of water diverted. ☐ The recharge of water to the aquifer. ☐ Description of the estimated area of hydrologic effect of the project. ☐ The method and place of discharge. ☐ An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐ A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐ Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.
Monitoring: ☐ Include the reason for the monitoring well, and, ☐ The duration of the planned monitoring.	■ The method of measurement of water produced and discharged. ■ The source of water to be injected. ■ The method of measurement of water injected. ■ The characteristics of the aquifer. ■ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ■ Proof of any permit required from the New Mexico Environment Department. ☐ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Ground Source Heat Pump:** ☐ Include a description of the geothermal heat exchange project, ☐ The number of boreholes for the completed project and required depths. ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	

ACKNOWLEDGEMENT

I, We (name of applicant(s)), RICHARD W. GIBBS, COLONEL, USAF, 377 ABW COMMANDER
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Richard W. Gibbs
Applicant Signature

Applicant Signature

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2019 JUN 26 PM 2:34

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 3rd day of July 20 19, for the State Engineer,

JOHN R. D'ANTONIO, JR. P.E.
STATE ENGINEER
, State Engineer

By: Jeff Fal
Signature

Jeffrey Falance
Print

Title: Water Resource Professional I
Print

FOR OSE INTERNAL USE

Application for Permit, Form WR-07

File No.:	Trn No.:

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT TO DRILL EXPLORATORY AND
POLLUTION CONTROL AND/OR RECOVERY WELL
CONDITIONS OF APPROVAL

This Application is approved provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the following conditions of approval:

Permittee: Kirtland Air Force Base
AFCEC/CZO, Kirtland IST, 2050 Wyoming Blvd, SE
Albuquerque, NM 87117-5270

Permit Number: RG-1579 POD 376

Exploratory Well/Point of Diversion (POD):

OSE POD No.	Other Well ID No.	NAD 83 State Plane Central Zone (feet)
RG-1579 POD376	KAFB-106IN2	X: 1547415 (approx.) Y: 1470053 (approx.)

1. No water shall be appropriated and beneficially used under this permit.

2. Water shall be used from well RG-1579 POD376 for exploratory and pollution control and/or recovery purposes only, unless and until a permit for a specific use has been issued by the State Engineer.

3. The well shall be drilled by a driller licensed in the State of New Mexico in accordance with Section 72-12-12 NMSA and the well shall be constructed in accordance with 19.27.4 NMAC.

4. No water shall be diverted from the well except for testing purposes which shall not exceed ten (10) cumulative days, and the well shall be plugged or capped in accordance with Subsection C of 19.27.4.30 NMAC, unless a permit to use water from the well is acquired from the Office of the State Engineer.

5. Test data shall be filed not later than twenty (20) days after completion of the aquifer/pump test(s).

6. If artesian water is encountered, the Permittee and driller shall comply with Subsection C of 19.27.4.31 NMAC, and an artesian plan of operations shall be submitted to the State Engineer.

7. The well shall be drilled and completed within one year of issuance of this permit. A Well Record shall be filed no later than thirty (30) days after completion of well in accordance with Subsection N of 19.27.4.29 NMAC (i.e. due by August 3, 2020).

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT TO DRILL EXPLORATORY AND
POLLUTION CONTROL AND/OR RECOVERY WELL
CONDITIONS OF APPROVAL

8. Pursuant to Section 72-8-1 NMSA, the permittee shall allow the State Engineer and his representatives entry upon private property for the performance of their respective duties.

9. The State Engineer retains jurisdiction over this permit.

Witness my hand and seal this 3rd day of July 2019.

John R. D'Antonio, Jr., P.E., State Engineer

By: _____ Jeffrey Falance, Water Resource Professional I

HCl- 53067
#25

File No. RG-1573 POD 292

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO CHANGE AN EXISTING WATER RIGHT
(Non 72-12-1)
(check applicable boxes):

For fees, see State Engineer website: http://www.ose.state.nm.us/

☒ Change Purpose of Use ☒ Groundwater ☐ Surface Water X Change Place of Use X Groundwater ☐ Surface Water	☐ Change Point of Diversion (POD): From: ☐ Groundwater ☐ Surface Water To: ☐ Groundwater ☐ Surface Water	X Additional Groundwater Point of Diversion (POD) ☐ Additional Surface Water Point of Diversion (POD)
☐ Temporary Change, NMSA 1978, § 72-12-7(B) Requested Start Date: (Not to Exceed 3 ac-ft in One Year)		Requested End Date:
☐ Water Use Lease, NMSA 1978, §§ 72-6-1 to-7 Requested Start Date:		Requested End Date:

1.APPLICANT(S) **(Required) Note: water-right owner must be listed as an applicant.**

Name: **Kirtland Air Force Base**	Name: **N/A**
Contact or Agent: **Wayne Bitner** check here if Agent	Contact or Agent: **N/A** check here if Agent
Mailing Address: **Chief Environmental Restoration AFCEC/CZO, Kirtland IST 2050 Wyoming Blvd SE**	Mailing Address: **N/A**
City: **Albuquerque**	City:
State: **NM** Zip Code: **87117-5270**	State: Zip Code:
Phone: **N/A** ☐ Home Cell Phone (Work): **505-853-3484**	Phone: ☐ Home Cell Phone (Work):
E-mail (optional): **ludie.bitner@us.af.mil**	E-mail (optional):

2. CURRENT OSE FILE INFORMATION **(Required)**

OSE File No(s): **RG-1579 through RG-1589**	Priority Date (if known):	Subfile/Cause No. (if applicable):

3. CURRENT PURPOSE OF USE AND AMOUNT OF WATER **(Required)**

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): **Pollution Control and Recovery** Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): **Extraction of groundwater for remediation**	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: **up to 403** Consumptive Use: **up to 403** Other (include units): **see comments**

FOR OSE INTERNAL USE — Application for Permit, Form wr-06, Rev 9/26/12

File No.: RG-1579 POD 292	Trn. No.:	Receipt No.: HCl- 53067

4. COUNTY WHERE WATER RIGHT IS CURRENTLY USED (Required)

Bernalillo

5. ADDITIONAL STATEMENTS CONCERNING THE CURRENT WATER RIGHT

Extraction well KAFB-106228 will be supplimental to the wells described in Kirtland AFB file No. RG 1579 through RG-1589. The application does not request to increase the allowable groundwater diversion described in RG-1579 through 1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add a place of use not currently described in RG-1579 through RG-1589.

6. CURRENT or MOVE-FROM POINT(S) OF DIVERSION (POD) (Required)

☐ Surface POD OR ☒ Ground Water POD (Well)

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106228	1543617	1476456	

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional point of diversion descriptions are attached: ☐ Yes ☒ No If yes, how many

Point of Diversion is on Land Owned by: The Albuquerque Christ United Methodist Church

Other description relating point of diversion to common landmarks, streets, or other: South of Gibson Blvd. SE, west of Louisiana Blvd., east of Dakota St. SE, and north of Mitchell St. SE. See attached Figure 1.

2011 NOV 13 PM 3:16

FOR OSE INTERNAL USE | Application for Permit, Form wr-06

File Number: RG-1579 POD252 | Trn Number:

7. CURRENT or MOVE-FROM PLACE(S) OF USE (Required)

The land is legally described by (check all that apply):

☒ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
RG-1579	**36**	**10 N**	**3 E**		
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other: **Kirtland AFB as described in District Court order: United States District Court, District of New Mexico, State of New Mexico State Engineer vs. Kirtland Air Force, dated November 27, 1973. See court order attached.**

Place of use is on land owned by (required): **Kirtland Air Force Base**

Are there other sources of water for these lands? No ☒ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

8. MOVE-TO PURPOSE OF USE AND AMOUNT OF WATER (Complete this section ONLY if the purpose of use is changing)

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): **Pollution Control and Recovery** Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): **Extraction of groundwater for remediation**	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: **up to 403** Consumptive Use: **up to 403** Other (include units): **see comments**

9. MOVE-TO POINT(S) OF DIVERSION (POD) (Complete this section ONLY if adding or replacing a POD)

☐ **Surface POD** **OR** ☒ **Ground Water POD (Well)**

Name of ditch, acequia, or spring:

Stream or water course:	Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106228	1543617	1476456	

2015 FEB -5 PM 1:39

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional POD descriptions are attached: ☐ **Yes** ☒ **No** **If yes, how many**_____

Other description relating point(s) of diversion to common landmarks, streets, or other: **South of Gibson Blvd. SE, west of Louisiana Blvd., east of Dakota St. SE, and north of Mitchell St. SE. See attached Figure 1.**

Point of Diversion is on Land Owned by: **Albuquerque Christ United Methodist Church**

Note: The following information is for wells only. If more than one (1) well needs to be described, provide attachment.

Approximate depth of well (feet): 530 to 600, not to exceed 700 ft Outside diameter of well casing (inches): 8 -12, not to exceed 12

Driller Name: **NA**	Driller License Number: **NA**

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG-1579 POD292	Trn Number:

If replacing the current well, is the current well to be plugged? ☐ Yes ☐ No ☒ Not Applicable

If No, state for what use it is retained:

10. MOVE-TO PLACE(S) OF USE (Complete this section ONLY if adding or changing a place of use)
List each individually

The land is legally described by (check all that apply):

☒ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
NE1/4 NE1/4	**36**	**10 N**	**3 E**		

Total Acres:

Other description relating place of use to common landmarks, streets, or other: **South of Gibson Blvd. SE, west of Louisiana Blvd., east Dakota St. SE, and north of Mitchell St. SE. See attached Figure 1.**

Place of use is on land owned by (required): **Albuquerque Christ United Methodist Church**

Are there other sources of water for these lands? No ☒ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

11. ADDITIONAL STATEMENTS OR EXPLANATIONS

This application seeks to use well KAFB-106228 for a groundwater extraction pilot implementation plan suplemental to the Kirtland AFB water rights (RG-1579 through 1589). The applicaton does not request to increase the allowable groundwater diversion described in RG-1579 through RG-1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add a place of use not currently described in RG-1579 through RG1589. The well will extract groundwater up to 403 acre feet per year (250 gallons per minute) for 10 years. The extracted groundwater will be treated and discharged at Kirtland AFB's infiltration gallery and a reclaimed wastewater system.

ACKNOWLEDGEMENT

I, We (name of applicant(s)), **Tom D. Miller, Colonel USAF**
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Tom D. Miller SEP 2 9 2014
Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

2015 JUN 30 PM 1:51

Witness my hand and seal this 17th day of June 2015, for the State Engineer,

Tom Blaine, P.E.
State Engineer, State Engineer

By: Wayne Canon
Signature

Wayne G. Canon
Print

Title: Water Resource Supervisor
Print

FOR OSE INTERNAL USE — Application for Permit, Form wr-06

File Number: RG 1579 POD 292	Trn Number:

CONDITIONS OF APPROVAL

Permit No.: RG-1579 POD 292
Permittee: Kirtland Air Force Base

1. This application is approved as follows:

Permittee:	Kirtland Air Force Base
Permit Number:	RG-1579 POD 292
Application File Date:	November 13, 2014
Notice for Publication:	February 10, 2015
Affidavit of Publication:	May 1, 2015 from the *Albuquerque Journal*
Priority:	March 1, 1949
Source:	Groundwater
Points of Diversion:	RG-1581 POD 292, located at a point where X=1,543,677 feet and Y=1,476,476 feet, NMSPCS, Central Zone, NAD 83, within the NE ¼ NE ¼ of Section 36, Township 10 North, Range 3 East, NMPM, Bernalillo County New Mexico.
Purpose of Use:	Pollution control and recovery, specifically extraction of groundwater for remediation
Place of Use:	Land within Kirtland Air Force Base, and land within Section 36, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico.
Amount of Water:	403 acre-feet per annum

2. The total diversion of groundwater from well RG-1579 POD 292 shall be limited to 403 acre-feet per annum, measured at the well, a portion of the 6,398 acre-feet per annum which includes the water right of 4,500 acre-feet per annum from well No.s RG-1581 through RG-1589 (Kirtland East), and 1,898 acre-feet per annum from No.s RG-1579, RG-1580 and RG-1579 and RG-1580 Combined-S (Kirtland West).

3. The total amount of water pumped from well RG-1579 POD 292 shall be measured by a totalizing meter of a type, at a location, and installed in a manner acceptable to the State Engineer. The Permittee shall provide the make, model, serial number, initial reading, units, multiplier, data of installation, and dates of recalibration to the State Engineer prior to any diversion of water under this permit.

CONDITIONS OF APPROVAL

Permit No.: RG-1579 POD 292
Permittee: Kirtland Air Force Base

4. Records of the quantity of water diverted from well RG-1579 POD 292 shall be submitted to the District 1 Office via mail, e-mail, or facsimile on or before the 10th day of the months of January, April, July and October for the preceding three calendar months, i.e. quarterly.

6. The Permittee shall utilize the highest and best technology available to assure conservation of water to the maximum extent practical.

7. This permit shall automatically expire on June 15, 2025 or upon completion of the intended purpose of use. If the intended purpose of use is completed prior to June 15, 2025, the permittee shall notify the State Engineer by certified letter.

8. Proof of Completion of Well shall be filed on or before June 15, 2017.

Witness my hand and seal this 17th day of June, A.D. 2015.

TOM BLAINE, P.E.
NEW MEXICO STATE ENGINEER

By: _____
Wayne G. Canon
Water Resource Supervisor, District 1

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

DISTRICT 1

TOM BLAINE, P.E.
NEW MEXICO STATE ENGINEER

5550 San Antonio Drive, N.E.
Albuquerque, NM 87109 (505) 383-4000

October 29, 2015

File No.: RG-1579

Kirtland Air Force Base
Attn: Wayne Bitner, Chief, Environmental Restoration
AFCEC/Kirtland AFB IST; Bldg 20685
2050 Wyoming Blvd, SE
Kirtland AFB, NM 87117-5270

RE: Permit No. RG-1579 POD309 and 310

Greetings,

Your copy of the above numbered permit, which has been approved subject to the conditions set forth on the approval page, is enclosed.

Please review the Conditions of Approval for any required submittals. If submittals are not made by the date(s) indicated in the conditions, your rights under this permit are subject to expiration unless a request for an Extension of Time is received in the District Office of the State Engineer by that date, and that Extension of Time is subsequently approved.

Appropriate forms can be downloaded from the OSE website at www.ose.state.nm.us/WR/forms.php or will be mailed to you upon request.

Sincerely,

Christopher Burrus
Water Resource Specialist
Albuquerque, OSE, District 1

C: CB/cb

HCI-53980
$130.00

File No. RG 1579

POD 309 - 310

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO CHANGE AN EXISTING WATER RIGHT

(Non 72-12-1)

(check applicable boxes):

For fees, see State Engineer website: http://www.ose.state.nm.us/

☒ Change Purpose of Use ☒ Groundwater ☐ Surface Water ☒ Change Place of Use ☒ Groundwater ☐ Surface Water	☐ Change Point of Diversion (POD): From: ☐ Groundwater ☐ Surface Water To: ☐ Groundwater ☐ Surface Water	☒ Additional Groundwater Point of Diversion (POD) ☐ Additional Surface Water Point of Diversion (POD)
☐ Temporary Change, NMSA 1978, § 72-12-7(B) Requested Start Date: (Not to Exceed 3 ac-ft in One Year)		Requested End Date:
☐ Water Use Lease, NMSA 1978, §§ 72-6-1 to-7 Requested Start Date:		Requested End Date:

1. APPLICANT(S) (Required) Note: water-right owner must be listed as an applicant.

Name: **Kirtland Air Force Base**	Name: **N/A**
Contact or Agent: check here if Agent ☒ **Wayne Bitner, Chief, Environmental Restoration**	Contact or Agent: check here if Agent ☐ **N/A** Mailing Address: **N/A**
Mailing Address: **AFCEC/Kirtland AFB IST; Bldg 20685; 2050 Wyoming Blvd SE**	
City: Kirtland AFB	City:
State: **NM** Zip Code: **87117-5270**	State: Zip Code:
Phone: **N/A** ☐ Home ☐ Cell Phone (Work): **505-853-3484**	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): **Ludie.Bitner@us..af.mil**	E-mail (optional):

2. CURRENT OSE FILE INFORMATION (Required)

OSE File No(s): **RG-1579 THROUGH RG-1589**	Priority Date (if known):	Subfile/Cause No. (if applicable):

3. CURRENT PURPOSE OF USE AND AMOUNT OF WATER (Required)

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): **Pollution Control and Recovery** Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): **Extraction of groundwater for remediation**	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: **up to 646** Consumptive Use: **up to 646** Other (include units): **see comments**

STATE ENGINEER OFFICE ALBUQUERQUE, NM
2015 JUL 1 PM 3 02

FOR OSE INTERNAL USE — Application for Permit, Form wr-06, Rev 9/26/12

File No.: RG-1579	Trn. No.:	Receipt No.: 1-53980 9/130
Trans Description (optional): POD 309 + 310		Sub-Basin:
PCW/LOG Due Date:	PBU Due Date:	

4. COUNTY WHERE WATER RIGHT IS CURRENTLY USED (Required)

Bernalillo

5. ADDITIONAL STATEMENTS CONCERNING THE CURRENT WATER RIGHT

Extraction wells KAFB-106233 and KAFB-106234 will be supplimental to the wells described in Kirtland AFB file No. RG 1579 through RG-1589. The application does not request to increase the allowable groundwater diversion described in RG-1579 through 1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add a place of use not currently described in RG-1579 through RG-1589.

6. CURRENT or MOVE-FROM POINT(S) OF DIVERSION (POD) (Required)

☐ **Surface POD** **OR** ☒ **Ground Water POD (Well)**

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106233 POD 309	1543061	1476824	
KAFB-106234 POD 310	1544083	1478577	

2015 JUL 10 PM 3:0

STATE ENGINEER OFFICE ALBUQUERQUE, NEW MEXICO

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional point of diversion descriptions are attached: ☐ **Yes** ☒ **No** **If yes, how many**

Point of Diversion is on Land Owned by: **City Of Albuquerque**

Other description relating point of diversion to common landmarks, streets, or other: **Extraction Well KAFB-106233 will be located near Gibson Blvd SE and California St SE. Extraction Well KAFB-106234 will be located near the intersection of Anderson Ave and Georgia St SE**

FOR OSE INTERNAL USE — Application for Permit, Form wr-06

File Number: RG 1579 POD 309-310 | Trn Number:

7. CURRENT or MOVE-FROM PLACE(S) OF USE (Required)

The land is legally described by (check all that apply):

☒ Public Land Survey System (PLSS) (quarters, section, township, range)

☐ Irrigation or Conservation District Map

☐ Hydrographic Survey Report or Map

☐ Subdivision

☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
RG-1579	**36**	**10 N**	**3 E**		
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other: **Kirtland AFB as described in District Court order: United States District Court, District of New Mexico, State of New Mexico State Engineer vs. Kirtland Air Force, dated November 27, 1973. See court order attached.**

Place of use is on land owned by (required): **Kirtland Air Force Base**

Are there other sources of water for these lands? No ☒ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 01

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG-1579 POD 309+310 | Trn Number:

8. MOVE-TO PURPOSE OF USE AND AMOUNT OF WATER (Complete this section ONLY if the purpose of use is changing)

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): **Pollution Control and Recovery** Describe a specific use if applicable (i.e. sand & gravel washing, dairy etc): **Extraction of groundwater for remediation**	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: **up to 646** Consumptive Use: **up to 646** Other (include units): **see comments**

9. MOVE-TO POINT(S) OF DIVERSION (POD) (Complete this section ONLY if adding or replacing a POD)

☐ **Surface POD** **OR** ☒ **Ground Water POD (Well)**

Name of ditch, acequia, or spring:

Stream or water course: | Tributary of:

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
- ☐ NM West Zone
- ☐ NM East Zone
- ☒ NM Central Zone

☐ UTM (NAD83) (Meters)
- ☐ Zone 12N
- ☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) *(Quarters or Halves , Section, Township, Range)* OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106233	1543061	1476824	
KAFB-106234	1544083	1478577	

2015 JUL 10 PM 3:01

STATE ENGINEER OFFICE ALBUQUERQUE, NEW MEXICO

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional POD descriptions are attached: ☐ **Yes** ☒ **No** **If yes, how many**

Other description relating point(s) of diversion to common landmarks, streets, or other: **KAFB-106233 will be located near Gibson Blvd SE and California St SE. KAFB-106234 will be located near the intersection of Anderson Ave and Georgia St SE**

Point of Diversion is on Land Owned by: **City Of Albuquerque**

Note: The following information is for wells only. If more than one (1) well needs to be described, provide attachment.

Approximate depth of well (feet): **~535.00**	Outside diameter of well casing (inches): **8.00**
Driller Name: **NA**	Driller License Number: **NA**

If replacing the current well, is the current well to be plugged? ☐ Yes ☐ No ☒ Not Applicable
If No, state for what use it is retained:

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:01

10. MOVE-TO PLACE(S) OF USE (Complete this section ONLY if adding or changing a place of use)
List each individually

The land is legally described by (check all that apply):

☒ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
SE 1/4 SE 1/4	**25**	**10 N**	**3 E**		
NE 1/4 SE 1/4	**25**	**10 N**	**3 E**		
			Total Acres:		

2015 JUL 10 PM 3:01

Other description relating place of use to common landmarks, streets, or other: **KAFB-106233 will be located near Gibson Blvd SE and California St SE. KAFB-106234 will be located near the intersection of Anderson Ave and Georgia St SE**

Place of use is on land owned by (required): **City of Albuquerque**

Are there other sources of water for these lands? No ☒ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

11. ADDITIONAL STATEMENTS OR EXPLANATIONS

This application seeks to use wells KAFB-106233 and KAFB-106234 for a groundwater extraction and treatment system supplemental to the Kirtland AFB water rights (RG-1579 through 1589). The application does not request to increase the allowable groundwater diversion described in RG-1579 through RG-1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add places of use not currently described in RG-1579 through RG1589. The wells will extract groundwater up to 323 acre feet per year (200 gallons per minute) per well (646 acre feet per year total), for 10 years. The extracted groundwater will be treated and discharged to the Golf Course Main Pond and Infiltration Galleries on Kirtland AFB

ACKNOWLEDGEMENT

I, We (name of applicant(s)), ERIC H. FROELICH, Colonel, USAF Commander
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☐ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

STATE ENGINEER OFFICE
ALBUQUERQUE
2015 JUL 10 P 3:01

Witness my hand and seal this _____ day of _____ 20 _____ , for the State Engineer,

_____, State Engineer

By: _____
Signature

_____
Print

Title: _____
Print

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG 1579 POD 309+310	Trn Number:

11. ADDITIONAL STATEMENTS OR EXPLANATIONS

This application seeks to use wells KAFB-106233 and KAFB-106234 for a groundwater extraction and treatment system supplemental to the Kirtland AFB water rights (RG-1579 through 1589). The application does not request to increase the allowable groundwater diversion described in RG-1579 through RG-1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add places of use not currently described In RG-1579 through RG1589. The wells will extract groundwater up to 323 acre feet per year (200 gallons per minute) per well (646 acre feet per year total), for 10 years. The extracted groundwater will be treated and discharged to the Golf Course Main Pond and Infiltration Galleries on Kirtland AFB

ACKNOWLEDGEMEN

T I, We (name of applicant(s)), ERIC H. FROEHLICH, Colonel, USAF
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☒ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:02

Witness my hand and seal this 28th day of October 2015, for the State Engineer,

Tom Blaine, P.E.
State Engineer, State Engineer

By: _____
Signature

Jeffrey L. Peterson
Print

Title: Water Resource Supervisor
Print

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG-1579 POD 309 + 310

Trn Number:

CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee:	Kirtland Air Force Base
Permit No:	RG-1579 POD 309 and POD 310
Application File Date:	July 10, 2015
Notice for Publication Issued:	August 25, 2015
Affidavit of Publication Filed:	September 14, 2015, The Albuquerque Journal published on August 28, September 5, and September 11, 2015
Priority:	March 1, 1949
Source:	Groundwater
Point of Diversion:	
RG-1579 POD 309:	Located at a point where X=1,543,061 feet and Y=1,476,824 feet, NMSPCS, Central Zone, NAD 83, on land owned by the City of Albuquerque, Bernalillo County, New Mexico.
RG-1579 POD 310:	Located at a point where X=1,544,083 feet and Y=1,478,577 feet, NMSPCS, Central Zone, NAD 83, on land owned by the City of Albuquerque, Bernalillo County, New Mexico.
Purpose of Use:	Pollution Control and Recovery, and Irrigation

Place of Use:
SE ¼ SE ¼, Section 25, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection wells on land owned by the Kirtland Air Force Base.

2. The total diversion of water from wells RG-1579 POD309 and RG-1579 POD310 under this permit shall not exceed 636 acre-feet per annum.

3. Wells RG-1579 POD309 and RG-1579 POD310 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of January, April, July and October of each year. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.

4. The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

5. This Permit will expire on November 1, 2025.

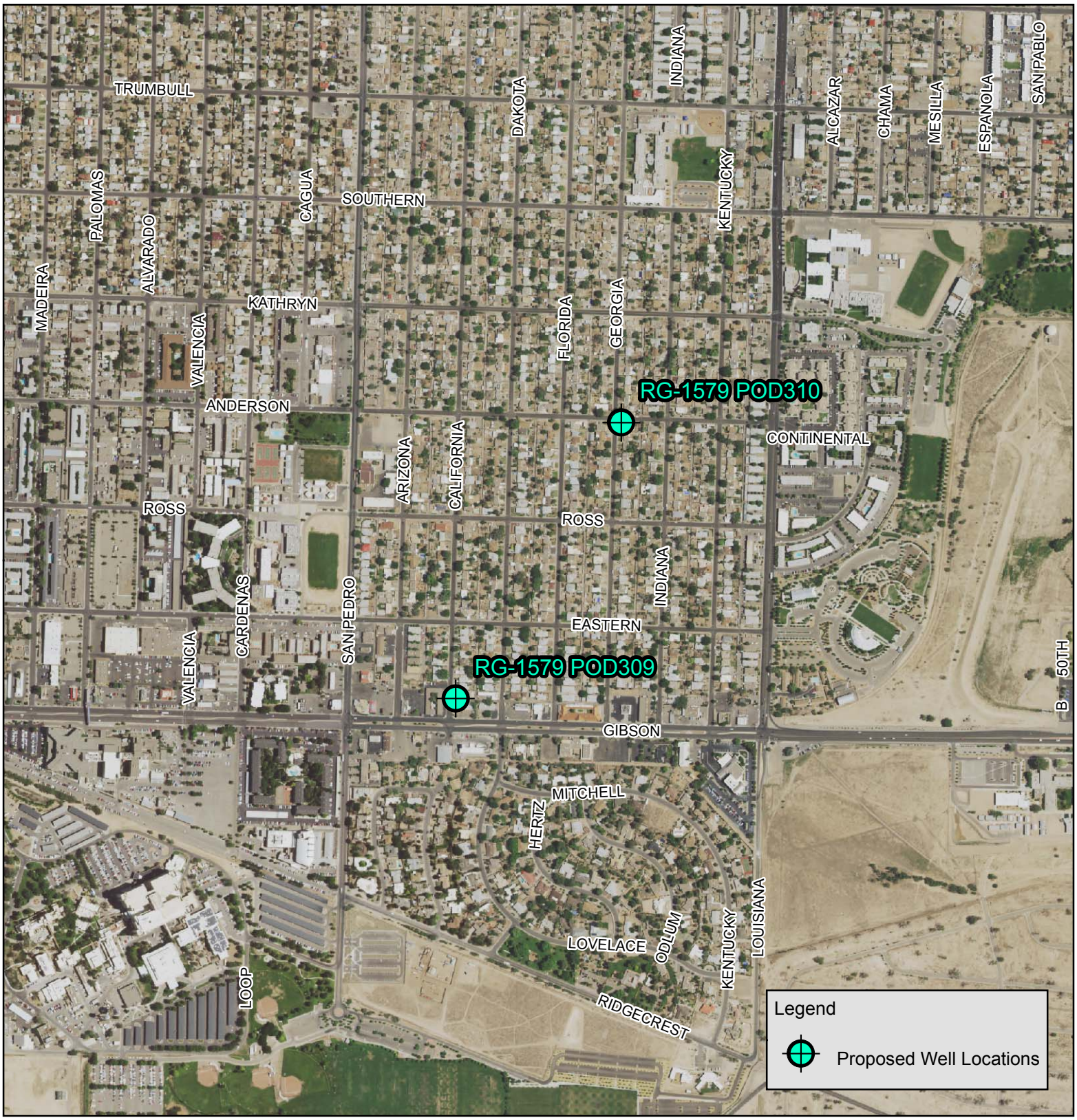
Witness my hand and seal this 29th day of October, A.D., 2015

Tom Blaine, P.E.
NEW MEXICO STATE ENGINEER

By: _____
Jeffery L. Peterson
Water Resource Supervisor
District I

CB:cb
cc: WRAB

File No.: RG-1579



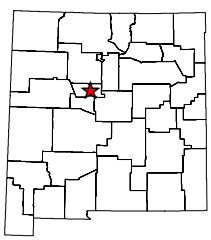
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Absolute Scale 1:10,000

Coordinate System:
NAD 1983 UTM Meters

0 500 1,000 Feet

0 100 200 Meters



RG-1579
POD309 and POD310

Location

Conditions of Approval

State of New Mexico
Office of the State Engineer
District 1
5550 San Antonio Dr NE
Albuquerque, NM 87109

Tom Blaine, P.E. State Engineer

Created by C.Burrus

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

CERTIFIED RETURN-RECEIPT REQUESTED

Colonel Eric H. Froehlich
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5600

JUL 0 9 2015

Office of the State Engineer
c/o Jeffrey L. Peterson, Water Rights Division
5550 San Antonio Blvd. NE
Albuquerque, New Mexico 87109

Dear Mr. Peterson

Kirtland Air Force Base (AFB) is submitting herein one "Application for Permit to Change an Existing Water Right" with supporting documents for extraction wells. This application seeks to permit the exploratory wells KAFB-106233 and KAFB-106234 as supplemental wells to Kirtland AFB water rights RG-1579 through RG-1589 by changing the purpose of use to pollution control, recovery, and irrigation and by adding places of use not currently described in water rights RG-1579 through RG-1589. The extraction wells (KAFB-106233 and KAFB-106234) are to be advanced into the water table and screened to extract water from the Shallow, Intermediate, and Deep aquifer zones to aid in the treatment of contaminated groundwater as part of the existing ethylene dibromide (EDB) pump and treat system at Kirtland AFB Bulk Fuels Facility SWMUs ST-106 and SS-111. These wells are proposed to be advanced on City of Albuquerque property.

To prevent spreading of contaminated groundwater into the Albuquerque municipal water supply and expedite the collapse of the downgradient portion of the dissolved-phase EDB plume, Kirtland AFB plans to install extraction wells KAFB-106233 and KAFB-106234. Groundwater from the two extraction wells will be pumped through high-density polyethylene pipelines to the groundwater treatment system (GWTS) located just east of Louisiana Boulevard on Kirtland AFB property. The GWTS will remediate dissolved phase EDB and petroleum-related contaminants of concern to concentrations below the Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) and New Mexico Water Quality Control standards.

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STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

Treated water will be discharged to two locations on Kirtland AFB: the Golf Course Main Pond (GCMP) to irrigate the Tijeras Arroyo Golf Course, and infiltration galleries to be located adjacent to the Golf Course. Treated groundwater will be discharged to the unlined infiltration galleries located adjacent to the Tijeras Arroyo Golf Course during winter months, or if the discharge volume exceeds GCMP capacity. The infiltration galleries will be designed to provide sufficient surface area for the treated water to percolate into the vadose zone soil. KAFB-106233 and KAFB-106234 will extract groundwater up to 323 acre feet per year (200 gallons per minute) for each well. Initially, all treated water will be discharged to the GCMP until the

- The source of water to be injected:
  - No water will be injected into the water table during this operation.

- The method of measurement of water injected:
  - No water will be injected into the water table during this operation.

- The characteristics of the aquifer:
  - The aquifer is primarily comprised of unconsolidated sand and gravel, with an average hydraulic conductivity of 63 feet/day.

- The method of determining the resulting annual consumptive use of water and depletion from any related stream system:
  - The groundwater from KAFB-106233 and KAFB-106234 are projected to be extracted at a rate of up to 200 gallons per minute equivalent to 323 acre-feet per year per well. The groundwater will be metered as it is extracted from the aquifer and pumped to the Kirtland AFB water treatment system and will be metered as the groundwater is discharged to the GCMP and infiltration galleries. These metered locations will be used to determine the annual consumptive use.

- Proof of any permit required from the New Mexico Environment Department:
  - Kirtland AFB is working with the New Mexico Environment Department – Hazardous Waste Bureau and Groundwater Quality Bureau to identify necessary permits. These include any of the following:
    a. Discharge Permit
    b. Temporary Discharge Permit

  - KAFB-106233 and KAFB-106234 will be included under the modification to discharge permit (DP)-1770. In the meantime, temporary permission to discharge to the GCMP has been granted for 120 days.

- An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located:
  - Kirtland AFB is currently updating existing access agreements for KAFB-106233 and KAFB-106234. Once updated, Kirtland AFB will submit the access agreements to the Office of the State Engineer.

In addition to the application, this packet contains a summary of the well construction KAFB-106233 and KAFB-106234, and one figure showing the well locations. The well construction details may be subject to change depending on the EDB vertical extent that will be characterized by observations wells to be installed prior to the installation of extraction wells.

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ALBUQUERQUE, NEW MEXICO
2015 JUL 10 P

number and location of the infiltration galleries are determined. The extracted, treated, and injected groundwater will have no additional diversion to Kirtland AFB's water rights. The GWTS could operate for up to ten years; however, it is possible that the GWTS could be operational for a longer or shorter period of time.

Extraction wells KAFB-106233 and KAFB-106234 will be supplemental to the wells described in Kirtland AFB file No. RG-1579 through RG-1589. The application does not request to increase the allowable groundwater diversion described in RG-1579 through RG-1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add a place of use not currently described in RG-1579 through RG-1589. The current places of use for wells KAFB-106233 and KAFB-106234 are on the City of Albuquerque property; this application seeks to add Kirtland AFB as a place of use to the water rights RG-1579 through RG-1589.

The specific requirements for pollution control and recovery will apply to the exploratory wells KAFB-106233 and KAFB-106234, and are as follows:

- The need for the pollution control or recovery operation:
  - The KAFB-106233 and KAFB-106234 wells are currently categorized as exploratory wells at SWMU SS-111, which is groundwater impacted by jet fuel. The New Mexico Environment Department has directed Kirtland AFB to implement Interim Measures to address the groundwater contamination.KAFB-106233 and KAFB-106234 will expand the current treatment system, which is extracted water from KAFB-106228

- The estimated maximum period of time for completion of the operation:
  - 10 years.

- The annual diversion amount for each well:
  - Up to 323 acre-feet per year.

- The annual consumptive use for each well:
  - Up to 323 acre-feet per year.

- The maximum amount of water to be diverted for the duration of the operation:
  - Up to 3,230 acre-feet.
  - No water will be injected in the water table during this operation.

- The method and place of discharge
  - The groundwater from wells KAFB-106233 and KAFB-106234 will be discharged at the GCMP at Tijeras Arroyo Golf Course, or at infiltration galleries.

- The method of measurement of water produced and discharged:
  - Any extracted water will be metered as it is extracted from the aquifer and as it is discharged from the GWTS.

2015 JUL 10 PM 3:01
STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

Please contact Mr. L. Wayne Bitner at 505.853.3484 or at ludie.bitner@us.af.mil or Ms. Victoria R. Branson at 505.846.6362 or at victoria.branson@us.af.mil if you have any questions.

Sincerely

ERIC H. FROEHLICH, Colonel, USAF
Commander

Attachment: WR06 Application for Permit to Change an Existing Water Right

cc:
AFCEC-CZRX (Bodour)
USACE-Omaha District Office (Ellender)
USACE-ABQ District Office (Simpler, Phaneuf)
Public Info Repository, AR/IR, and File

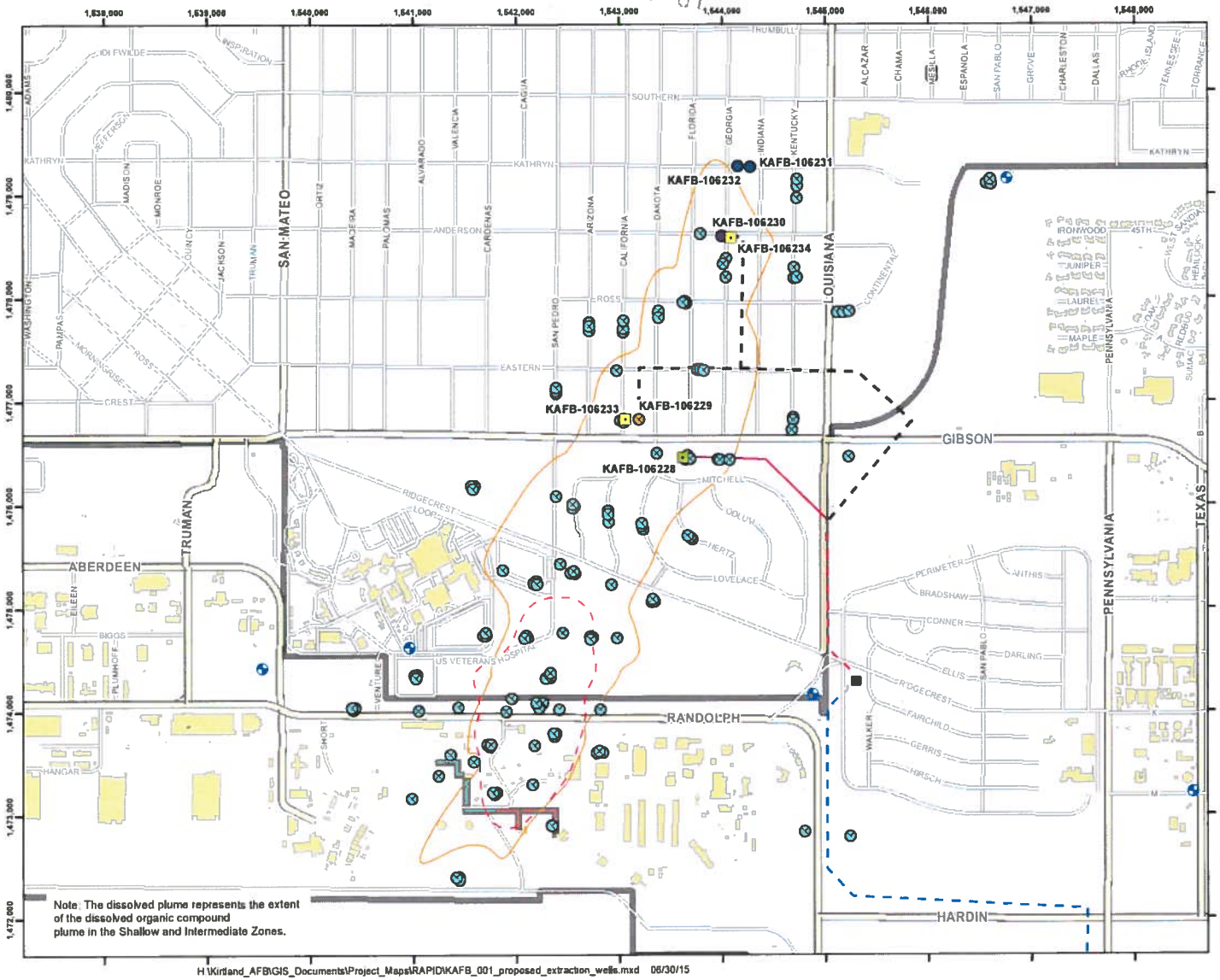
STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:01

FIGURE 1

PROPOSED WELL LOCATIONS

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:01

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:01



H:\Kirtland_AFB\GIS_Documents\Project_Maps\RAPID\KAFB_001_proposed_extraction_wells.mxd 06/30/15

Legend

- Proposed Extraction Well
- Existing Extraction Well
- Proposed Observation Monitoring Well
- Proposed Data Gap and Observation Monitoring Well
- Proposed Data Gap Monitoring Well
- Existing Monitor Well
- Water Supply Well
- Proposed Influent Piping
- Influent Piping
- Permanent Underground Discharge Piping
- Permanent Underground Influent Piping
- Dissolved Plume January 2015
- New Groundwater Treatment System Building
- Historical Area of Observed LNAPL (July 2009)



SITE LOCATION

Revision Date: 06/30/15

N

0 500 1,000 2,000

Feet
1 inch = 1,000 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

PERMIT APPLICATION
OFFICE OF THE STATE ENGINEER
BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

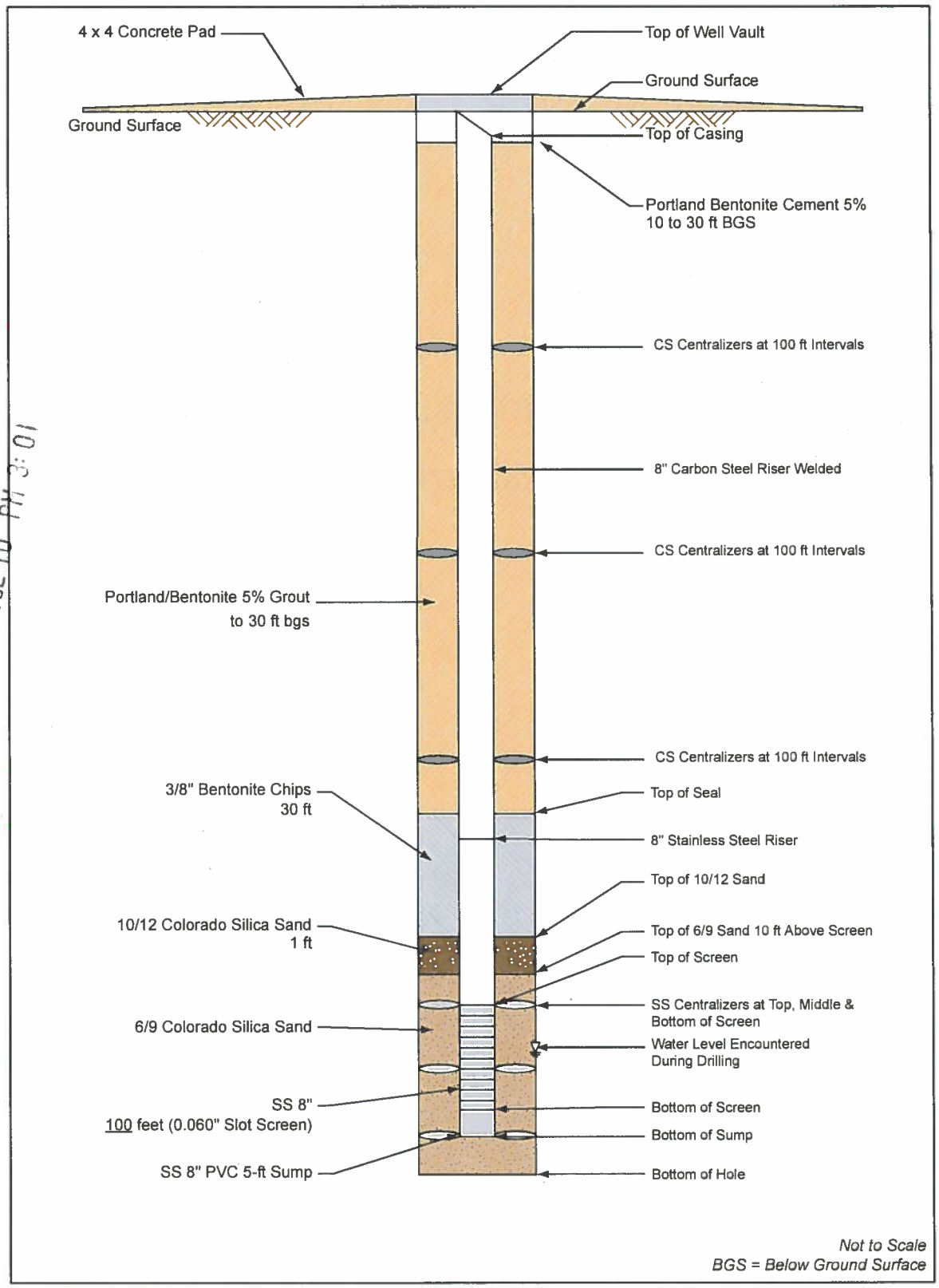
EXTRACTION WELL LOCATIONS

FIGURE 2

EXTRACTION WELL CONSTRUCTION DIAGRAM

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ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:01

Extraction Well Construction Diagram



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ALBUQUERQUE, NEW MEXICO
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ATTACHMENT 1

WELL SUMMARY

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ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:01

KIRTLAND AIR FORCE BASE
BULK FUELS FACILITY SPILL
WELL SUMMARY

Extraction Well

Extraction wells KAFB-106233 and 106234 will be screened to extract water from the top 80 feet of the aquifer. The final well design will be based on model results and lithologic data from nearby groundwater monitoring wells to capture the maximum radius of influence and have at least 70 percent efficiency. Extraction wells will be installed in accordance with the *Rapid Response Action, Additional Data Gap Groundwater Monitoring Wells and Expansion of Groundwater Extraction Work Plan* (USACE, 2015a) and additional correspondence between Kirtland AFB and NMED pertaining to extraction well installation (USACE, 2015b; 2015c).

The extraction wells will be drilled using mud rotary drilling technology. The wells will be constructed using 8-inch diameter casing, screened at an interval extending from 80-feet below current groundwater, upwards to a level at the site of 20-feet above groundwater level, or approximately 100-feet total screened interval. A moderately aggressive filter pack and 50 to 60 slot screen size will be used. The well string will be composed of nominal 8-inch steel pipe from ground surface to 20 feet above the water table encountered during drilling bgs, followed by stainless steel wire wrap screen to a depth of 80 feet below the water table encountered during drilling, and finally stainless pipe and cap extending to 5 feet below the screen. Following placement of the well screen and riser pipe, filter pack (sand) will be placed adjacent to the well screen followed by a fine sand seal and bentonite chip seal. A cement/bentonite grout will extend from the bentonite chip seal to near ground surface. The bentonite chip seal will be hydrated in lifts using a "clean" water source.

- The appropriate depth of the boring will be determined in the field and is dependent on the occurrence of significant water. If significant groundwater is encountered during drilling, drilling will cease, and the hole will be allowed to equilibrate for approximately 1 hour to determine the water table elevation.

- If the boring is over drilled beyond the bottom of the proposed sump elevation by more than 10 feet, the borehole will be backfilled with filter pack material to an elevation approximately 5 feet below the proposed bottom of sump elevation.

- The well will be constructed within the borehole using a 5-foot stainless-steel sump; 304 Stainless steel wire wrap with a 50 to 60 slotted screen size; and 8-inch steel casing. The sump will extend 5 feet below the bottom of the screened interval.

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- While slowly removing the drill casing from the borehole, the borehole annular space will be backfilled with a filter pack. The filter pack will be placed using a tremie pipe to avoid bridging and ensure a continuous filter pack throughout the screened interval of the well. The well may be gently surged to breakup bridging and ensure complete placement of the filter pack around the well screen. A gravel tube will be installed within the annulus between the well string and the borehole from 10 feet above the top of screen extending upward to the surface, and will be welded to the steel riser pipe. The gravel tube will be 2 ½ inches inner diameter, and will be composed of the same materials as the adjacent riser pipe. The gravel tube will be installed free of sand.

- A 30 to 40-foot hydrated bentonite seal will be emplaced above the sand filter pack, incrementally hydrated with potable water in 1-foot lifts for the first 10 feet.

- A high solids (20 wt%) bentonite grout will be emplaced by tremie pipe to within 30 feet of the surface, and a cement/bentonite grout will be emplaced to the ground surface.

- To the surface, a cement/bentonite grout mixture will be installed over the high-solids bentonite grout using a tremie pipe. The mixture will consist of 94 pounds of Portland cement to 7 gallons of approved water and 3 percent by weight of sodium bentonite powder.

- A three-foot square by four-inch thick concrete surface pad shall be installed around the well immediately after the protective casing is installed. The surface pad shall be sloped so that drainage will be off the pad and away from the protective casing. In addition, a minimum of one inch of the finished pad shall be below grade or ground elevation to prevent washing and undermining by soil erosion.

- Protective casing with a locking cover shall be installed around the well casing (flush to the street) to prevent damage or unauthorized entry. The protective casing shall be anchored in the concrete surface pad below the frost line.

Final well design details will be determined based on installation of surrounding monitoring wells and during drilling of the borehole at this location.

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References

USACE. 2015a. *Rapid Response Action, Additional Data Gap Groundwater Monitoring Wells and Expansion of Groundwater Extraction Work Plan, Bulk Fuels Facility, Kirtland Air Force Base, New Mexico.* Prepared by CB&I Federal Services, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10- D-0014, Delivery Order 0002. June.

USACE. 2015b.*Groundwater Extraction Pilot Implementation and Additional Plume Characterization Letter Work Plan Addendum #3 Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by CB&I Federal Services, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. March.

USACE. 2015c.*Groundwater Extraction Pilot Implementation and Additional Plume Characterization Letter Work Plan Addendum #4 Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by CB&I Federal Services, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002.May.

ATTACHMENT 2

KIRTLAND WATER RIGHT

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2015 JUL 10 PM 3:02

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ALBUQUERQUE, N. MEX.

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, ex rel, S. E. REYNOLDS, State Engineer.

Plaintiff

vs.

JOHN McLUCAS, Secretary of the Air Force, THOMAS W. MORGAN, Commander, Air Force Special Weapons Center, and JAMES B. MYERS, Base Commander, Kirtland Air Force Base

Defendants.

ORIGINAL
FILED IN MY OFFICE
NOV 27 1973
L. C. KANALY
CLERK

JUDGMENT AND ORDER

THIS MATTER coming on to be heard upon the Stipulation of the parties, and the Court having considered the same and being otherwise fully advised in the premises, finds that the Court has jurisdiction of the parties and the subject matter and that the said Stipulation should be approved and incorporated in the final judgment of this Court.

IT IS THEREFORE ORDERED, ADJUDGED AND DECREED that the Stipulation of the parties is hereby approved and incorporated in this judgment as if set out in full herein.

IT IS FURTHER ORDERED that the defendants, their employees, agents, assigns and successors in interest be and they are hereby permanently enjoined and restrained from any diversion and/or use of water from the Rio Grande Underground Water BAsin in and for Kirtland Air Force BAse except in strict conformity with this final judgment.

HOWARD BRATTON

JUDGE OF THE U. S. DISTRICT COURT

2015 JUL 10 PM 3:02
STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO

1 general
FLS
J Black

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, ex rel, S. E. REYNOLDS, State Engineer.

Plaintiff

vs.

JOHN McLUCAS, Secretary of the Air Force, THOMAS W. MORGAN, Commander, Air Force Special Weapons Center, and JAMES B. MYERS, Base Commander, Kirtland Air Force Base

Defendants.

73 DEC 3 A 8:
ALBUQUERQUE, N.M.
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NOV 27 1973
L. G. KANALY
CLERK

STATE ENGINEER OFFICE
ALBUQUERQUE NEW MEXICO
2015 JUL 10 PM 3:02

STIPULATION

COME NOW the Plaintiff and Defendants herein, by and through their attorneys, and hereby mutually stipulate and agree that final judgment may enter in this cause in the following terms:

1. The United States of America, acting through and by means of the United States Air Force, owns and operates that certain complex of military facilities known as Kirtland Air Force Base within Bernalillo County, New Mexico, which Base includes the former Sandia Base, a Military installation heretofore operated by the United States Army. That area heretofore known as Sandia Base shall be designated in this stipulation as Kirtland East and that area known as Kirtland Air Force Base prior to the merger of the two installations shall be designated as Kirtland West.

2. On November 29, 1956, the Plaintiff, S. E. Reynolds, State Engineer, duly and lawfully declared the Rio Grande Underground Water Basin, an underground reservoir of public waters of the State of New Mexico having reasonably ascertainable boundaries.

3. All of Kirtland East and Kirtland West were, on November 29, 1956, and have continued to the present time to be within the exterior boundaries of the said Rio Grande Underground Water Basin.

4. On November 29, 1956, the United States of America owned within Kirtland East a water supply system consisting of 9 completed and operating wells, together with associated water storage and delivery works, and had prior to that date diverted and used underground waters of the Rio Grande Underground Water Basin by means of each and every of the said 9 wells for the lawful purposes of the said military installation.

5. The said nine wells in the Kirtland East water supply system were duly declared by an authorized representative of the United States of America in the office of the Plaintiff on the 4th day of October, 1957, and have been since that date designated in the files of the State Engineer as wells No. RG-1581 through RG-1589. The respective locations and priorities of the said 9 wells, as declared by the United States of America, are as follows:

RG-1581 NW1/4SE1/4, Sec. 31 T. 10 N., R. 4 E. March 1, 1949

RG-1582 NW1/4NW1/4, Sec. 1 T. 9 N., R. 3 E. August, 1949

RG-1583 NW1/4SW1/4, Sec. 30, T. 10 N., R. 4 E. August, 1949

RG-1584 NE1/4SW1/4, Sec. 6, T. 9 N., R. 4 E. August, 1949

RG-1585 NE1/4SW1/4, Sec. 29, T. 10 N., R. 4 E. July, 1952

RG-1586 SW1/4SE1/4, Sec. 32, T. 10 N., R. 4 E. July, 1952

RG-1587 NW1/4NW1/4, Sec. 6, T. 9 N., R. 4 E. Feb., 1955

RG-1588 SW1/4SW1/4, Sec. 5, T. 9 N., R. 4 E. Feb., 1955

RG-1589 SW1/4SW1/4, Sec. 15, T. 9 N., R. 4 E. Feb., 1949

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6. Between November 1, 1958, and May 27, 1959, the United States of America drilled or caused to be drilled, in the NW1/4NE1/4 of Sec. 20, T. 9 N., R. 4 E., an additional water well which was thereafter made a part of the water supply system of Kirtland East. This well is designated in the files of the State Engineer as RG-1581 through RG-1589-S. By means of the said well, the United States of America has thereafter continually diverted and beneficially used public underground waters of the Rio Grande Underground Water Basin, as a supplemental point of diversion in and for Kirtland East.

7. In 1972, the United States of America drilled or caused to be drilled an additional water well within Kirtland East in the NW1/4NE1/4 of Sec. 4, T. 9 N., R. 4 E., which well has been completed except for the installation of a pump and has not yet been put to beneficial use, and which is hereby designated RG-1581 through RG-1589-S-2. The said well was drilled for the purpose of serving as a supplemental well for the water supply system of Kirtland East

8. The United States of America owns, under the Constitution and laws of the State of New Mexico, the right to divert the public underground waters of the Rio Grande Underground Water Basin, through and by means of the said eleven wells set forth in paragraphs 5, 6 and 7, in an amount not to exceed an annual quantity of four thousand five hundred (4,500) acre-feet, and to apply the same to beneficial use for the purposes of Kirtland Air Force Base. The priorities of the said eleven wells composing the water supply system of Kirtland East are as set forth

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ALBUQUERQUE, NEW MEXICO
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above in paragraphs 5, 6 and 7. The defendants stipulate that the United States Air Force has no right to divert any of the underground waters of the Rio Grande Underground Water Basin, by means of the said 11 wells or otherwise, for the purposes of Kirtland Air Force Base, except as set forth in this Stipulation, provided, however, that the United States shall enjoy the same right as any other appropriator in the State of New Mexico to make application hereafter to the Plaintiff, State Engineer, for permit to drill supplemental well(s) (i.e., make partial or total change in point of diversion or place or purpose of use) or to effect the transfer of valid and existing water rights for the purposes of Kirtland Air Force Base.

9. On November 29, 1956, the United States of America owned a water supply system in and for Kirtland West consisting of two water wells whose respective locations and priorities were declared in the Office of the State Engineer, by a duly authorized representative of the United States on the 4th day of October, 1957, to be as follows:
RG-1579 NW1/4NW1/4, Sec. 35, T. 10 N., R. 3 E., Oct. 9, 1952
RG-1580 SE1/4NW1/4, Sec. 34, T. 10 N., R. 3 E., Mar. 6, 1956

10. In 1969, the United States of America drilled or caused to be drilled an additional well in and for the Kirtland West water supply system, designated in the records of the State Engineer as RG-1579 and RG-1580 Combined-S, which well was thereafter made a part of the Kirtland West water supply system as a supplemental well.

11. The United States of America owns, under the Constitution and laws of the State of New Mexico, the right to divert

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the public underground waters of the Rio Grande Underground Water Basin by means of the three wells set out in paragraphs 9 and 10 above in an amount not to exceed an annual quantity of 1,898 acre-feet for the purposes of Kirtland Air Force Base. The defendants stipulate that the United States Air Force has no right to divert or use the underground waters of the Rio Grande Underground Water Basin for the purposes of Kirtland Air Force Base, except as set forth in this Stipulation, by means of the said three wells or otherwise, provided, however, that the United States of America shall enjoy the same right as any other appropriator of public water in the State of New Mexico to make application to the Plaintiff, State Engineer, hereafter for permit to drill and use supplemental well(s) (i.e., make partial or total change in point of diversion or place or purpose of use) or to effect the transfer of existing valid water rights for the purposes of Kirtland Air Force Base.

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12. The United States of America also owns the right under the Constitution and laws of the State of New Mexico to divert public underground waters of the Rio Grande Underground Water Basin in an amount not to exceed three acre-feet per year by and from each of the following three domestic wells located and existing within, and for the purposes of Kirtland Air Force Base:

Location	Priorities
RG-1578 SE1/4NW1/4, Sec. 35, T. 9 N., R. 4 E.	1945
RG-1590 SE1/4NW1/4, Sec. 35, T. 9 N., R. 4 E.	1945
RG-1591 NE1/4SE1/4, Sec. 24, T. 9 N., R. 4 E.	1948

13. The defendants stipulate that the United States Air Force will not after the entry of final judgment herein drill

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or cause or allow to be drilled any water well(s) within the boundaries of the Rio Grande Underground Water Basin, within and/or for the purposes of Kirtland Air Force Base (including Kirtland East and Kirtland West), except when and to the extent that it will have fully complied with the laws of the State of New Mexico and the Rules and Regulations of the State Engineer in respect to obtaining from the State Engineer permit(s) to drill water wells and/or produce public waters therefrom for any purpose.

14. The defendants stipulate that they will make on behalf of the United States accurate monthly reports to the Plaintiff, State Engineer, of the total metered quantities of underground water diverted by means of any and all of the wells composing the Kirtland East and Kirtland West water supply systems, provided, however, that the United States of America shall not be required to make application for, or obtain permit authorizing the physical combination of the two water supply systems so long as the total annual metered diversion from each system is within the respective limit established in paragraphs 8 and 11. The defendants further agree that they will, within 60 days of the date of entry of final judgment herein, file in the Office of the Plaintiff, State Engineer, on forms to be supplied by the Plaintiff, applications on behalf of the United States seeking the right to divert and use public underground waters of the Rio Grande Underground Water Basin by means of those two certain wells RG-1581 through RG-1589-S-2 and RG-1579 and RG-1580 Combined-S, within the respective limits set forth in paragraphs 8 and 11 above. The State of New Mexico agrees that together

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STATE ENGINEER OFFICE
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NEW MEXICO

with the terms of judgment entered in this cause pursuant to this Stipulation, the said applications shall be administratively recognized as evidencing the right of the United States to use the said two wells within the terms of this Stipulation and the Order of the Court entered pursuant thereto, without any further requirement for advertisement or hearing.

PAUL L. BLOOM
Special Assistant Attorney General
State of New Mexico

s/ Victor Ortega
United States Attorney

STATE ENGINEER OFFICE
ALBUQUERQUE, NEW MEXICO
2015 JUL 10 PM 3:03

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STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

DISTRICT 1

TOM BLAINE, P.E.
NEW MEXICO STATE ENGINEER

5550 San Antonio Drive, N.E.
Albuquerque, NM 87109 (505) 383-4000

December 7, 2016

File No.: RG-1579

Kirtland Air Force Base
Attn: Wayne Bitner, Chief, Environmental Restoration
AFCEC/Kirtland AFB IST; Bldg 20685
2050 Wyoming Blvd, SE
Kirtland AFB, NM 87117-5270

RE: Permit No. RG-1579 POD319

Greetings,

Your copy of the above numbered permit, which has been approved subject to the conditions set forth on the approval page, is enclosed.

Please review the Conditions of Approval for any required submittals. If submittals are not made by the date(s) indicated in the conditions, your rights under this permit are subject to expiration unless a request for an Extension of Time is received in the District Office of the State Engineer by that date, and that Extension of Time is subsequently approved.

Appropriate forms can be downloaded from the OSE website at www.ose.state.nm.us/WR/forms.php or will be mailed to you upon request.

Sincerely,

Christopher Burrus
Water Resource Specialist
Albuquerque, OSE, District 1

C: CB/cb

1-55404
$50

File No. RG-1579 POD 3 19

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO CHANGE AN EXISTING WATER RIGHT

(Non 72-12-1)

(check applicable boxes):

For fees, see State Engineer website: http://www.ose.state.nm.us/

☒ Change Purpose of Use ☒ Groundwater ☐ Surface Water ☒ Change Place of Use ☒ Groundwater ☐ Surface Water	☐ Change Point of Diversion (POD): From: ☐ Groundwater ☐ Surface Water To: ☐ Groundwater ☐ Surface Water	☒ Additional Groundwater Point of Diversion (POD) ☐ Additional Surface Water Point of Diversion (POD)
☐ Temporary Change, NMSA 1978, § 72-12-7(B) Requested Start Date: (Not to Exceed 3 ac-ft in One Year)		Requested End Date:
☐ Water Use Lease, NMSA 1978, §§ 72-6-1 to-7 Requested Start Date:		Requested End Date:

1. APPLICANT(S) (Required) Note: water-right owner must be listed as an applicant.

Name: Kirtland Air Force Base	Name: N/A
Contact or Agent: check here if Agent ☒ Wayne Bitner, Chief, Environmental Restoration	Contact or Agent: check here if Agent ☐ N/A
Mailing Address: AFCEC/Kirtland AFB IST; Bldg 20685; 2050 Wyoming Blvd SE	Mailing Address:
City: Kirtland AFB	City:
State: NM Zip Code: 87117-5270	State: Zip Code:
Phone: N/A ☐ Home ☐ Cell Phone (Work): 505-853-3484	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): ludie.bitner@us.af.mil	E-mail (optional):

STATE ENGINEERS OFFICE ALBUQUERQUE, NEW MEXICO 2016 AUG 25 PM 3:55

2. CURRENT OSE FILE INFORMATION (Required)

OSE File No(s): RG-1579 through RG-1589	Priority Date (if known): March 1, 1949	Subfile/Cause No. (if applicable):

3. CURRENT PURPOSE OF USE AND AMOUNT OF WATER (Required)

☒ Domestic ☐ Livestock ☒ Irrigation ☒ Municipal ☒ Industrial ☐ Commercial ☒ Other Use (specify): Kirtland Air Force Base Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): _____	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: 323 (partial) Consumptive Use: up to 323 Other (include units): _____

FOR OSE INTERNAL USE

Application for Permit, Form wr-06, Rev 3/07/16

File No.: RG 1579	Trn. No.:	Receipt No.:
Trans Description (optional): POD 3 19		Sub-Basin:
PCW/LOG Due Date:	PBU Due Date:	

4. COUNTY WHERE WATER RIGHT IS CURRENTLY USED (Required)

Bernalillo

5. ADDITIONAL STATEMENTS CONCERNING THE CURRENT WATER RIGHT

Extraction well KAFB-106239 will be supplemental to existing wells described in OSE file No. RG-1579 through RG-1589. The application will not increase the allowable groundwater diversion described in RG-1579 through 1589, but seeks to make a change to the purpose of use to include pollution control, recovery, and irrigation and a change in point of diversion to include a location that is not currently described in RG-1579 through RG-1589.

6. CURRENT or MOVE-FROM POINT(S) OF DIVERSION (POD) (Required)

☐ **Surface POD** OR ■ **Ground Water POD (Well)**

Name of ditch, acequia, or spring: N/A

Stream or water course: N/A | Tributary of: N/A

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

■ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
■ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
RG-1579 through RG-1589	–	–	See District Court Order dated Nov. 27, 1973 (attached)

STATE ENGINEERS OFFICE
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NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional point of diversion descriptions are attached: ■ Yes ☐ No **If yes, how many** 11

Point of Diversion is on Land Owned by: Kirtland Air Force Base

Other description relating point of diversion to common landmarks, streets, or other: See attached District Court Order dated November 27, 1973.

FOR OSE INTERNAL USE — Application for Permit, Form wr-06

File Number: RG-1579 POD319 | Trn Number:

7. CURRENT or MOVE-FROM PLACE(S) OF USE (Required)

The land is legally described by (check all that apply):

☐ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
Kirtland Air Force Base					
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other:

Place of use is on land owned by (required):
Kirtland Air Force Base

Are there other sources of water for these lands? No ■ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

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ALBUQUERQUE, NEW MEXICO
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FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG-1579 POD 319

Trn Number:

8. MOVE-TO PURPOSE OF USE AND AMOUNT OF WATER (Complete this section ONLY if the purpose of use is changing)

☐ Domestic ☐ Livestock ☒ Irrigation ☐ Municipal ☐ Industrial ☐ Commercial ☒ Other Use (specify): Pollution Control/Recovery Describe a specific use If applicable (i.e. sand & gravel washing, dairy etc): Groundwater remediation	Amount of Water (acre-feet per annum): If more details are needed, type "See Comments" in "Other" field below, and explain in Additional Statements Section. Diversion: 323 Consumptive Use: Up to 323 Other (include units):

9. MOVE-TO POINT(S) OF DIVERSION (POD) (Complete this section ONLY if adding or replacing a POD)

☐ Surface POD OR ☒ Ground Water POD (Well)

Name of ditch, acequia, or spring: N/A

Stream or water course: N/A | Tributary of: N/A

If application proposes a new point of diversion involving a diversion dam, storage dam, main canal, and/or pipeline, complete Attachment 2. ☐ Check here if Attachment 2 is included in this application packet.

POD Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) & District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

POD Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range*) OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
KAFB-106239	1542707.9	1475412.0	

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2016 AUG 25 PM 3:55

NOTE: If more PODS need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional POD descriptions are attached: ☐ Yes ☒ No **If yes, how many**

Other description relating point(s) of diversion to common landmarks, streets, or other: East of San Pedro Dr. along southside of Ridgecrest Dr.

Point of Diversion is on Land Owned by: City of Albuquerque

Note: The following information is for wells only. If more than one (1) well needs to be described, provide attachment.

Approximate depth of well (feet): 575 | Outside diameter of well casing (inches): 8

Driller Name: To be determined | Driller License Number: To be determined

If replacing the current well, is the current well to be plugged? ☐ Yes ☐ No ☒ Not Applicable
If No, state for what use it is retained:

FOR OSE INTERNAL USE — Application for Permit, Form wr-06

File Number: RG-1579 POD3 19 | Trn Number:

10. MOVE-TO PLACE(S) OF USE (Complete this section ONLY if adding or changing a place of use)
List each individually

The land is legally described by (check all that apply):

☐ Public Land Survey System (PLSS) (quarters, section, township, range)
☐ Irrigation or Conservation District Map
☐ Hydrographic Survey Report or Map
☐ Subdivision
☐ Grant

Complete the blocks below for all tracts of land (more than one description can be provided for a tract if available):

PLSS Quarters or Halves, **and/or** Name of Hydrographic Survey, **and/or** Name of Irrigation or Conservation District, **and/or** Name and County of Subdivision **and/or** Grant	PLSS Section **and/or** Map No. **and/or** Lot No.	PLSS Township **and/or** Tract No. (Please list each tract individually) **and/or** Block No.	PLSS Range	Acres	Priority
No changes to place of use.					
			Total Acres:		

Other description relating place of use to common landmarks, streets, or other:

Place of use is on land owned by (required):
Kirtland Air Force Base

Are there other sources of water for these lands? No ■ Yes ☐ describe by OSE file number:

Note: If on Federal or State Land, please provide copy of lease.

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FOR OSE INTERNAL USE — Application for Permit, Form wr-06

File Number: RG-1579 POD 3/9 | Trn Number:

11. ACEQUIA OR COMMUNITY DITCH REQUIREMENTS

☒ A. The water right is not within a Community Ditch or Acequia.

☐ B. The water right is within a Community Ditch or Acequia. **If you checked box B you must:**

1) Attach documentary evidence provided by commissioners of the Community Ditch or Acequia confirming applicant's compliance with any applicable requirement for the change adopted by the Community Ditch or Acequia **or**

2) Attach an affidavit from the commissioners of the Community Ditch or Acequia stating that no such requirement has been adopted by the relevant association bylaws.

This documentation is required pursuant to NMSA 1978 § 72-5-24.1.

12. ADDITIONAL STATEMENTS OR EXPLANATIONS

This application seeks to add a new point of diversion (KAFB-106239) for groundwater extraction supplemental to the Kirtland AFB water rights (OSE file no. RG-1579 through 1589). The application does not request to increase the allowable groundwater diversion described in RG-1579 through RG-1589, but seeks to change the purpose of use to pollution control, recovery, and irrigation and to add a new point of diversion that is not currently described in RG-1579 through RG1589.

KAFB-106239 will extract groundwater up to 323 acre feet per year (200 gallons per minute), for approximately 10 years. The extracted groundwater will be treated and discharged to the Golf Course Main Pond and Infiltration Galleries on Kirtland AFB, and/or injected back into the aquifer through KAFB-7 (OSE file no. RG-1587).

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ACKNOWLEDGEMENT

I, We (name of applicant(s)), Eric H. Froehlich, COLONEL, USAF, 377 ABW COMMANDER
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☑ approved ☐ ~~partially approved~~ ☐ ~~denied~~

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this 7 day of December 20 16, for the State Engineer,

Tom Blaine, P.E.
State Engineer, State Engineer

By: Signature CHRISTOPHER BURRUS Print

Title: Water Resource Specialist Print

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2016 AUG 25 PM 3:55

FOR OSE INTERNAL USE

Application for Permit, Form wr-06

File Number: RG-1579 POD3/9	Trn Number:

CONDITIONS OF APPROVAL

1. This application is approved as follows:

Permittee:	Kirtland Air Force Base
Permit No:	RG-1579 POD319
Application File Date:	August 25, 2016
Notice for Publication Issued:	September 14, 2016
Affidavit of Publication Filed:	October 6, 2016, The Albuquerque Journal published on September 18, 25, and October 2, 2016
Priority:	March 1, 1949 through March 6, 1956
Source:	Groundwater
Point of Diversion:	
RG-1579 POD319:	(KAFB-106239) Located at a point where X=1,542,707.9 feet and Y=1,475,412 feet, NAD 83, SPCS, Central Zone, on land owned by the City of Albuquerque, Bernalillo County, New Mexico.
Purpose of Use:	Pollution Control and Recovery
Place of Use:	SE ¼ SE ¼, Section 25, Township 10 North, Range 3 East, NMPM, Bernalillo County, New Mexico, and under permits RG-1579 through RG-1589 the applicant will discharge treated groundwater into the Tijeras Arroyo Golf Course main pond, infiltration galleries located adjacent to the golf course, and injection well, RG-1587, on land owned by Kirtland Air Force Base.

2. The total diversion of water from well RG-1579 POD319 under this permit shall not exceed 323 acre-feet per annum consumptive use.

3. The new well shall be drilled by a well driller licensed in the State of New Mexico, and a well record for new well RG-1579 POD319 shall be filed with the Office of the State Engineer within twenty (20) days of drilling the well.

4. Well RG-1579 POD319 shall be equipped with a totalizing meter of a type, at location(s) approved by, and installed in a manner acceptable to the State Engineer. Records of the amount of water pumped shall be submitted, in writing, to the District 1 Office of the State Engineer on or before the 10th day of each month. No water shall be diverted from any well unless equipped with a functional totalizing meter. The Permittee shall provide in writing the make, model, serial number, date of installation, initial reading, units, and dates of recalibration of each meter and any replacement meter.

5. The Permittee shall utilize the highest and best technology to ensure conservation of water to the maximum extent practical.

6. This Permit will expire on December 1, 2025.

7. The State Engineer retains jurisdiction over this permit.

8. Pursuant to Section 72-8-1 NMSA, the permittee shall allow the state engineer and his representative's entry upon private property for the performance of their respective duties, including access to the wells for meter readings and water level measurements.

Witness my hand and seal this 7 day of December, A.D., 2016

Tom Blaine, P.E.
NEW MEXICO STATE ENGINEER

By: _____

Christopher Burrus
Water Resource Specialist
District I
CB:cb
cc: WRAB

Application for Permit to Change an Existing Water Right

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2016 AUG 25 PM 3:54

DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

Colonel Eric H. Froehlich
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB NM 87117-5000

AUG 2 4 2016

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2016 AUG 25 PM 3:54

Office of the State Engineer
c/o Jeffery L. Peterson, Water Rights Division
5550 San Antonio Blvd NE
Albuquerque New Mexico 87109

Dear Mr. Peterson

Kirtland Air Force Base (AFB) is submitting herein one "Application for Permit to Change an Existing Water Right" with supporting documents for a proposed extraction well (KAFB-106239) to be located on City of Albuquerque property near the intersection of San Pedro Drive and Ridgecrest Drive. This application seeks to permit KAFB-106239 under existing Kirtland AFB water rights described under OSE file number RG-1579 through RG-1589. The application requests a change in purpose to include pollution control, recovery, and irrigation and addition of the supplemental point of diversion currently not described within OSE file number RG-1579 through RG-1589.

KAFB-106239 will be used for the extraction and treatment of contaminated groundwater at the Kirtland AFB Bulk Fuels Facility SWMUs ST-106 and SS-111. The extraction well will be constructed from 8-inch diameter galvanized and stainless steel. A 100-foot stainless steel wire-wrap screen will extend below the water table so that contaminated groundwater can be extracted from the shallow aquifer. Stainless steel centralizers shall be placed at the top, center, and bottom of the screen, and at 100 foot intervals along the casing. All casing sections will be joined with weld rings. The borehole annulus will be filled with a silica sand filter pack (#10-20), followed by bentonite and portland cement seals to near ground surface.

Extraction well KAFB-106239 will divert groundwater up to 323 acre feet per year for treatment and use. The extracted groundwater will be pumped through high-density polyethylene pipelines to the groundwater treatment system located just east of Louisiana Boulevard on Kirtland AFB property. The system will remediate dissolved phase ethylene dibromide and petroleum-related contaminants of concern to concentrations below the Environmental Protection Agency maximum contaminant levels and New Mexico Water Quality Control standards.

Treated water will be discharged to multiple locations on Kirtland AFB: The Golf Course Main Pond to irrigate the Tijeras Arroyo Golf Course or direct injection at KAFB-7 (OSE file number RG-1587).

Attached to the application are the pollution control and/or recovery plan summary, figures showing the proposed extraction well location and construction plan details, a narrative summary of the proposed well construction plan, and Kirtland AFB water right summary.

If you have any question or concerns, please contact Mr. Wayne Bitner at (505) 853-3484 or at ludie.bitner@us.af.mil.

Sincerely

ERIC H. FROEHLICH, Colonel, USAF
Commander

Attachment:
WR-06 Application for Permit to Change an Existing Water Right

cc:
NMED-EHD (Roberts, McQuillan)
NMED-HWB (Agnew)
NMED-GWQB (Hunter, Pullen)
EPA Region 6 (King, Ellinger)
AFCEC/CZ (Bodour, Bitner, Clark)
USACE-ABQ District Office (Simpler, Phaneuf, Dreeland; Sanchez; Salazar)
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File

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TABLE 1

POLLUTION CONTROL AND/OR RECOVERY PLAN SUMMARY, KAFB-106239

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Table 1. Pollution Control and/or Recovery Plan Summary, Extraction Well KAFB-106239

Item	Comments
Description of need	The New Mexico Environment Department has directed Kirtland AFB to implement Interim Measures to address the groundwater contamination. Extraction well KAFB-106239 will aid in the remediation of the contaminated groundwater.
Estimated maximum time for completion of operation	10 years
Annual diversion amount	Instantaneous flow rate of 200 gallons per minute equates to maximum diversion of 323 acre-feet per year
Annual consumptive use amount	Up to 323 acre-feet per year
Maximum amount of water to be diverted and injected for duration of operation	Maximum diversion is 323 acre-feet per year. No injection is planned for this location.
Method and place of discharge	Extracted groundwater will be treated and discharged to the Golf Course Main Pond or KAFB-7 (OSE-File number RG-1587).
Method of measurement of water produced and discharged	Extracted water will be metered at the point of diversion and at the point of discharge.
Source of water to be injected	Not applicable
Method of measurement of water injected	Not applicable
Characteristics of aquifer	Unconsolidated sand and gravel sediments of the Middle Rio Grande Basin aquifer. An average hydraulic conductivity value for the area is 63 feet/day.
Method of determining resulting annual consumptive use of water and depletion from any related steam system.	Not applicable.
Proof of any permit required from the New Mexico Environment Department.	Kirtland AFB is working with the New Mexico Environment Department Hazardous Waste Bureau and Groundwater Quality Bureau to identify necessary permits. Extraction well KAFB-106239 will be included under Discharge Permit (DP)-1839 when discharging to KAFB-7. NMED determined that there is no DP required for discharge to the Golf Course Main Pond.
An access agreement if the applicant is not owner of the land on which the pollution plume control or recovery well is to be located.	Kirtland AFB is currently updating the existing access agreements with the City of Albuquerque for KAFB-106239. Once updated, Kirtland AFB will submit the access agreements to the Office of the State Engineer.

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FIGURE 1

LOCATION FOR EXTRACTION WELL KAFB-106239

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Legend

- Proposed Extraction Well

N

0 50 100 200 300 400 Feet

1 in = 200 ft

KIRTLAND AIR FORCE BASE BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

PROPOSED EXTRACTION WELL

P:\gis\Projects\Kirtland\Figures\NMOSE\Fig1_NMOSE07Mar2016.mxd 3/7/2016 EA ASpiller

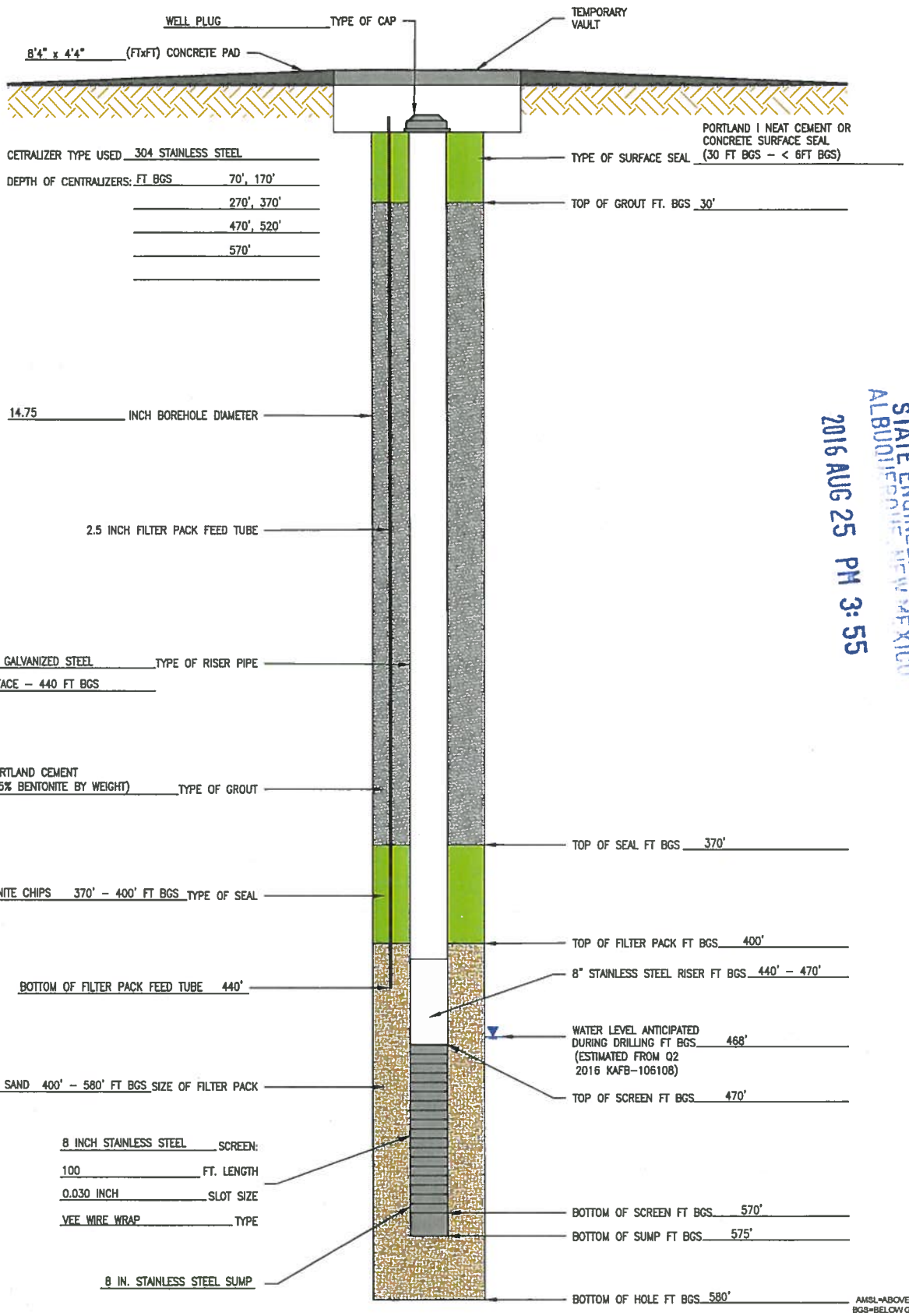
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FIGURE 2

EXTRACTION WELL CONSTRUCTION DIAGRAM

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PROPOSED EXTRACTION WELL CONSTRUCTION - KAFB-106239



NOT TO SCALE
AMSL=ABOVE MEAN SEA LEVEL
BGS=BELOW GROUND SURFACE
FT=FEET

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2016 AUG 25 PM 3:55

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC
320 Gold Avenue, SW Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013
Fax: (505) 224-9016

KIRTLAND AIR FORCE BASE		INSTALLATION START DATE/TIME:	INSTALLATION END DATE/TIME:
PROJECT NO.: 62599DM01	WELL ID: KAFB-106239 (EXTRACTION)	GEOLOGIST:	DRILLER:

FILE PATH: F:\FEDERAL\DOD\AFCEC\PROJECTS\62599DM01 - KIRTLAND BFT\CADD\FIGURES\EXTRACTION WELLS-NM\APRIL 2016\EXTRACTION WELL COMPLETION DIAGRAM-KAFB-106239.DWG [EXTRACTION WELL] MATHER, JASON 7/25/2016 10:29 AM

ATTACHMENT 1

WELL CONSTRUCTION PLAN

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2016 AUG 25 PM 3:55

KIRTLAND AIR FORCE BASE BULK FUELS FACILITY SPILL

WELL CONSTRUCTION PLAN FOR KAFB-106239

Extraction well KAFB-106239 will be installed and developed in accordance with the NMED-approved *Work Plan for the Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design, Solid Waste Management Unit St-106/SS-111* (USACE 2016) with completion details provided in the attached Technical Memorandum dated 3 May 2016.

A 14.75-inch borehole will be advanced using mud rotary drilling methods to approximately 580 feet below ground surface (ft bgs) for construction of the extraction well. The 8-inch steel casing string will be composed of galvanized steel from ground surface to 440 ft bgs, then 304 Stainless steel from 440 to 470 ft bgs, followed by 304 Stainless steel wire wrap screen from 470 to 570 ft bgs, and finally 304 Stainless steel from 560 to 565 ft bgs.

Following placement of the well screen and riser pipe, the filter pack (silica sand) will be placed adjacent to the well screen. A bentonite chip and cement/bentonite grout will extend from the filter pack to near ground surface. Additional construction details are provided below.

- If the boring is over drilled beyond the bottom of the proposed sump elevation by more than 10 feet, the borehole will be backfilled with filter pack material to an elevation approximately 5 feet below the proposed bottom of sump elevation.
- The filter pack will be placed using a tremie pipe to avoid bridging and ensure a continuous filter pack throughout the screened interval of the well. The well may be gently surged to breakup bridging and ensure complete placement of the filter pack around the well screen.
- A 30 to 40-foot hydrated bentonite seal will be emplaced above the sand filter pack, incrementally hydrated with potable water.
- A high-solids bentonite grout will be emplaced by tremie pipe to within 30 feet of the surface, and a cement/bentonite grout will be emplaced to the ground surface.
- To the surface, a cement/bentonite grout mixture will be installed over the high-solids bentonite grout using a tremie pipe. The mixture will consist of 94 pounds of Portland cement to 7 gallons of approved water and 3 percent by weight of sodium bentonite powder.
- An approximate eight-foot by 4-foot by four-inch thick concrete surface pad shall be installed around the well immediately after the protective casing is installed. The surface pad shall be sloped so that drainage will be off the pad and away from the protective casing. In addition, a minimum of one inch of the finished pad shall be below grade or ground elevation to prevent washing and undermining by soil erosion.

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Final well construction details will be determined in the field based on observed conditions at this location.

References

USACE. 2016. *Work Plan for the Bulk Fuels Facility Expansion of the Dissolved-Phase Plume Groundwater Treatment System Design, Solid Waste Management Unit ST-106/SS-111.* Prepared by EA Engineering, Science, and Technology, Inc., PBC for USACE–Albuquerque District. 21 January.

EA Engineering, Science, & Technology, Inc., PBC
320 Gold Avenue SW, Suite 1300
Albuquerque, New Mexico 87102
Phone: (505) 224-9013

3 May 2016

Mr. Trent Simpler, PE
USACE Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, NM 87109

STATE ENGINEERS OFFICE
ALBUQUERQUE, NEW MEXICO
2016 AUG 25 PM 3:55

RE: Design Memorandum for Filter Pack and Screen Extraction Well KAFB-106239
Bulk Fuels Facility Project, Albuquerque, New Mexico

Dear Mr. Simpler,

The proposed extraction well KAFB-106239 has been designed to meet the current and future needs of the Kirtland Bulk Fuels Facility (BFF) Pump and Treat (P&T) system. This Design Memorandum provides basis and specification of filter pack and slot size for KAFB-106239 to meet the performance objectives of the remedial design.

PROJECT OVERVIEW

Three groundwater extraction wells are currently pumping and providing system performance data at the BFF P&T system. A fourth well location has been determined by groundwater flow modeling to be necessary for plume containment and collapse. Current models of the Kirtland BFF Pump and Treat system indicate the process may take up to a decade to completely collapse the ethylene dibromide (EDB) plume. The proposed location of the extraction well KAFB-106239 has been selected by the BFF Project Modeling Working Group comprised of stakeholders from government and private industry. Changes in EDB concentration within the plume over time, or a change in pump and treat strategy may require a larger extraction volume than presently considered. This Design Memorandum provides basis and specification of filter pack and slot size for KAFB-106239 that allows a wide range of pumping rates to facilitate varying system operation to meet current and future project goals.

DESIGN CRITERIA

The filter pack and slot size for KAFB-106239 has been designed with the following goals:

- Provide a wide range of well yield based on formation capacity and well hydraulics to allow variation in pumping stresses and account for loss of well efficiency due to fouling between well maintenance;
- Provide low groundwater entrance velocity through the screen for efficient performance;
- Minimize or eliminate sediment pumping via proper filter sizing and low entrance velocities.

REFERENCES

Colorado Sand - Typical Specifications and Properties, retrieved from www.premiersilica.com on April 22, 2016.

Driscoll, F.G.. (1986). Groundwater and Wells 2nd Edition. St. Paul, Minnesota: Johnson Filtration Systems Inc. pg. 441-443, 451, 951.

Stainless Steel Well Screens and Accessories, Johnson Screens, pg. 8, retrieved from www.groundwatersupply.net on April 22, 2016.

The Engineering ToolBox. Sieve Size and Mesh Designation. Located retrieved from http://www.engineeringtoolbox.com/sieve-numbers-openings-d_1645.html on May 2, 2016.

FILTER PACK AND SCREEN DESIGN

Filter Pack Sizing

The filter pack was designed using the method described by Driscoll 1986. Grain size distribution curves from wells KAFB-106212 and KAFB-106229 were used to determine representative aquifer matrix grain size distribution. The grain-size distribution curves for the finest grained sediments in each borehole were utilized to determine the appropriate range of filter packs. Following Driscoll, the 70% retained (d_{70}) grain size (0.35 mm) was multiplied by a factor of 5 which is appropriate for uniform aquifers with a 40% retained sediment size 0.010 inches or less, which our formation grain sizes satisfy. For each grain size distribution curve, a parallel coarser filter pack curve representing a uniformity coefficient of approximately 2.5 was constructed through the d_{70} grain size multiplied by the factor of 5. The resultant filter pack d_{70} values are 1.85 and 1.75 mm, respectively, for the fine fraction in KAFB-106212 and KAFB-106229.

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The uniformity coefficient is the ratio of the 60% finer by weight grain size to the 10% finer by weight grain sizes. The uniformity coefficient (CU):

$$CU = \frac{D60}{D10} \quad \text{Equation 1}$$

A line with CU approximately equal to 2.5 was constructed through the d_{70} values of 1.85 and 1.75 mm (Attachment 1). These curves represent the range of grain sizes in an ideal filter pack for the fine portion of aquifer. Based on the design filter pack curves in Attachment 1, the filter pack should be composed of grain sizes between 3.0 and 0.5 mm (equivalent to #7 to #32 sieve sizes [Attachment 2]). Using this criterion for filter pack, a range of screen slot sizes can be selected, including 10, 20, 30 and 40 slot.

Selecting Slot Screen Size

For design purposes, the extraction well KAFB-106239 will be constructed with 8 inch pipe size stainless steel vee-wire continuous wrap screen. The Johnson Screens "Free-Flow" 304 stainless steel screens technical information (Attachment 3) was used to estimate the transmitting capacity of a range of slot screen sizes. Casing strength of 1,000 foot maximum depth with a hanging weight of 20,800 pounds was used to resist collapse. The transmitting capacities for various slot sizes were calculated from the respective intake areas from Attachment 3 to determine the maximum production rate of the well. Transmitting Capacity was calculated as follows (Attachment 3):

$$\text{Transmitting Capacity}\left[\frac{gpm}{ft\ screen}\right] = \text{Intake Area } (IN^2/\text{Ft screen}) * 0.31 \left[\frac{gpm}{ft\ screen}\right] \quad \text{Equation 2}$$

The transmitting capacity for 80 feet of submerged 20, 30, and 40 slot screen were considered as shown in Table 1 The total screen length will be 100 feet with 10 feet unsubmerged and approximately 10 feet of drawdown in the well. Therefore, 80 feet of effective screen length was used in the design.

Table 1. Analysis of Well Yield for Various Slot Sizes

Slot Size	Open Area (in^2/ft)	Transmitting Capacity (gpm/ft)	Total Discharge (gpm)
20 (0.020 in)	39	12.1	968
30 (0.030 in)	55	17.0	1,360
40 (0.040 in)	70	21.7	1,736

Theoretical Maximum Well Yield

EA anticipates the operational well yield to be around 100 gpm; however, to accommodate future flow modification, a design flow rate of up to 300 gpm is considered appropriate. Moreover, the theoretical well yield in areas of high permeability (e.g., 200 ft/day) is much higher, on order of 94 gpm per foot of drawdown:

$$Specific\ Capacity = \frac{Q}{\Delta S} \approx T = K * b = 200\frac{ft}{day} * 90\,ft * 7.48\frac{gallons}{ft^3} * \frac{day}{1{,}440\,min} = 94\frac{gpm}{ft} \quad \text{Equation 3}$$

Q = well yield (ft^3/sec)
ΔS = drawdown in well (ft)
T = Transmissivity (ft^2/day and gpm/ft)
K = hydraulic conductivity (ft/day)
b = aquifer thickness (estimated as submerged screen length – 90 ft)

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The empirical relationship between specific capacity and transmissivity is provided in Driscoll 1986:

$$T \cong 1500\,\frac{Q}{\Delta S} \quad \text{Equation 4}$$

In equation 4, Q is in gpm and T gallons per day per foot (gpd/ft) versus gpm/ft, but the relationship between T, Q and drawdown is demonstrated. Based on transmissivity and considerations discussed above, a 30-slot screen will meet all the design criteria and objectives listed above.

Entrance Velocity

The entrance velocity of the water flowing into the well was considered. It is customary to design wells with an entrance velocity of 0.1 feet per second or less (Attachment 3). Wells with entrance velocities greater than 0.1 feet per second have a greater tendency to entrain sediment, lower well efficiency, and attendant higher lifting costs. The entrance velocity ($V_{entrance}$) was calculated as:

$$V_{entrance} = \frac{Q\left(\frac{ft^3}{sec}\right)}{A\,(ft^2)} = \frac{300\ gpm}{(7.48\ \frac{gpm}{ft^3} * 60\ \frac{sec}{min})} * \frac{1}{\left(\frac{55}{144}\ \frac{ft^2}{ft} * 80\,ft\right)} = 0.022\ \frac{ft}{sec} \quad \text{Equation 4}$$

The 30 slot screen size will yield the maximum anticipated discharge of 300 gpm at 22 percent (0.022/0.1) of the Johnson Screen design entrance velocity of 0.1 ft/sec. The low entrance velocity will provide an efficient well and will further protect against sediment entrainment.

Selected Filter Pack

A 30 slot screen size has an opening size of 0.030 inches. The # 20 sieve has an opening of 0.0331 inches and the # 25 sieve size has an opening of 0.0278 inches. Using the Colorado Sand typical specifications and properties chart (Attachment 4), EA selected a filter pack with a retention rate greater than 90%. EA estimates than approximately half of all material passed by a #20 sieve but retained by a #25 sieve would pass through the screen. Therefore, the 10/20 mesh filter pack is expected to retain 97 to 98 percent of the filter pack.

Summary

In summary, a continuous vee-wire stainless steel 30 slot screen is selected with a 10/20 mesh filter pack. This design will achieve a wide range of flow rates at low to moderate entrance velocities, provide an efficient design, and mitigate or eliminate altogether sediment pumping.

If you have any questions or would need additional information, please do not hesitate to call me at (505) 400-7125.

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ALBUQUERQUE NEW MEXICO
2016 AUG 25 PM 3:55

Sincerely,

Jay T. Snyder, PG, CHg, EI
Senior Hydrogeologist

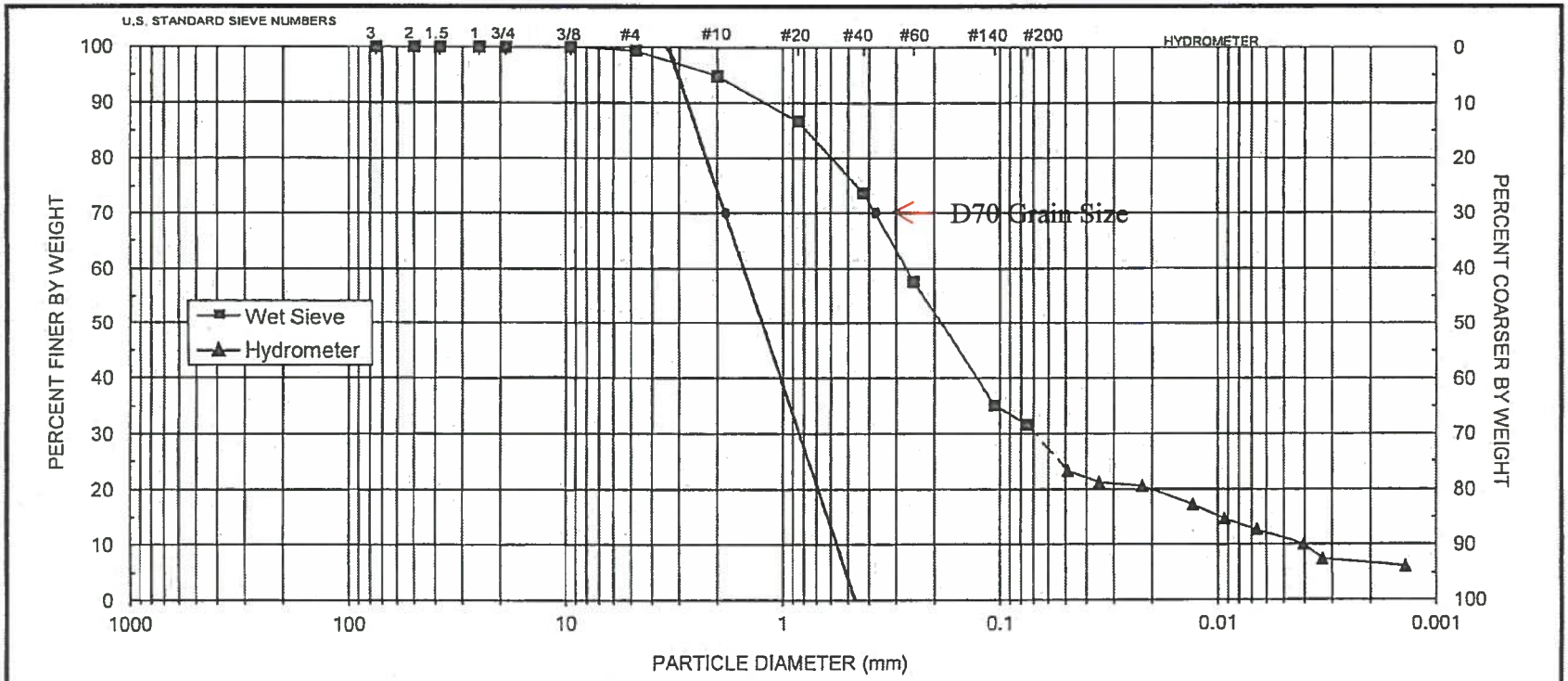
CC: Devon Jercinovic, PMP. PG, Project Manager
Lee Becker P.E., Project Engineer

Attachments:
1 Filter Design
2 Sieve and Mesh Dimensions
3 Stainless Steel Well Screens and Accessories
4 Colorado Sand - Typical Specifications & Properties

ATTACHMENT 1

FILTER DESIGN

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UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY				
		Coarse	Fine	Coarse	Medium	Fine					
USDA	COBBLES	GRAVEL		SAND				SILT	CLAY		
				Very coarse	Coarse	Medium	Fine	Very fine			

d_{10} = 0.0040	d_{30} = 0.069	d_{50} = 0.19	d_{60} = 0.27	C_u = 68	C_c = 4.4

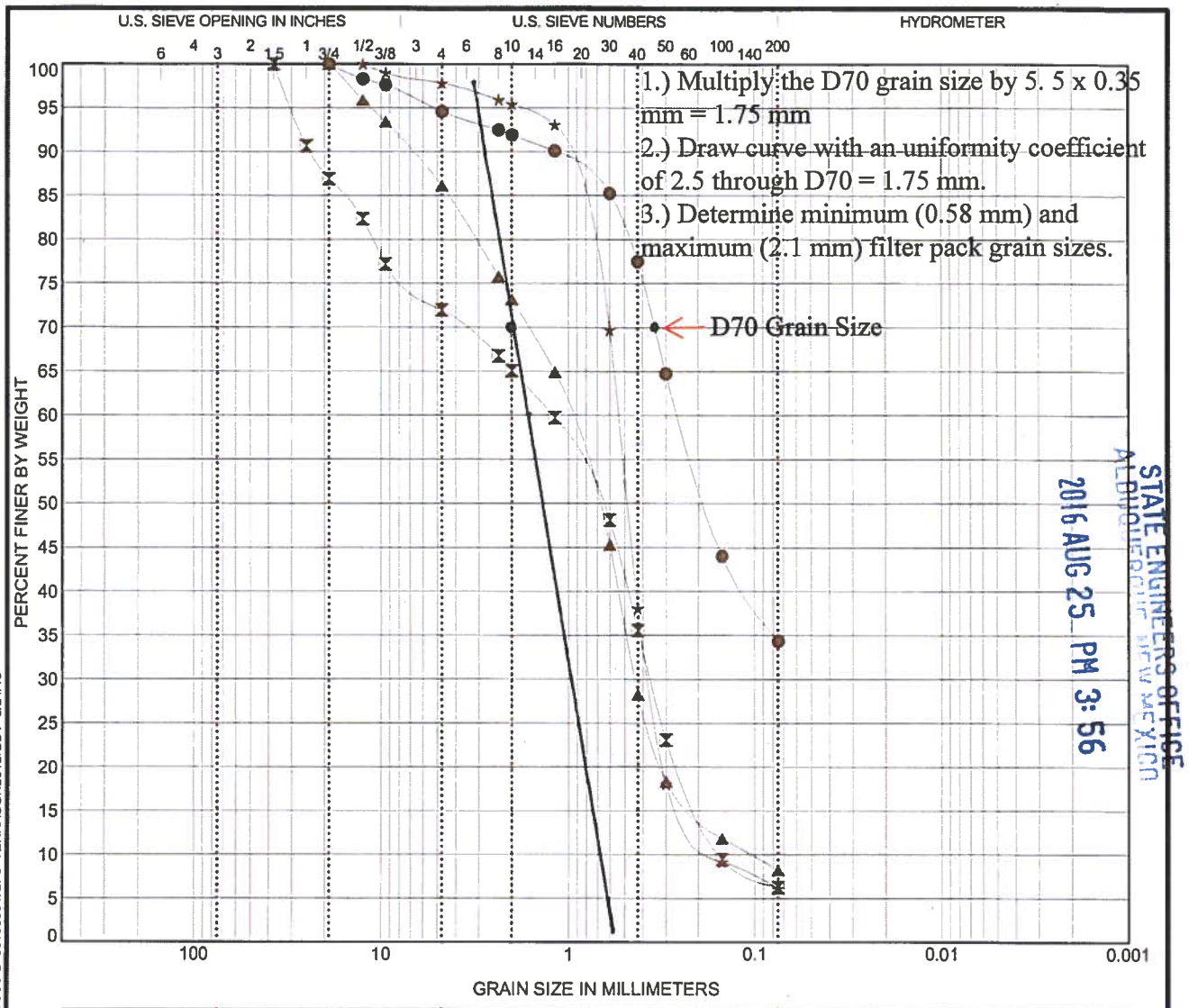
SAMPLE NUMBER	CLIENT SAMPLE ID	ASTM CLASSIFICATION	USDA CLASSIFICATION
1502313-001B	KAFB106212-GEO-001	Classification by ASTM 2487 requires Atterberg test	Sandy Loam

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ALBUQUERQUE, NEW MEXICO

1.) Multiply the D70 grain size by 5. 5 x 0.37 mm = 1.85 mm
2.) Draw curve with an uniformity coefficient of 2.5 through D70 = 1.85 mm.
3.) Determine minimum (0.46 mm) and maximum (3.1 mm) filter pack grain sizes.

GRAIN SIZE DISTRIBUTION

ASTM D422



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2016 AUG 25 PM 3:56

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	LL	PL	PI	Cc	Cu
●	106229 - 452 to 454	0	SILTY SAND(SM)	NP	NP	NP		
⧗	106229 - 465 to 470	0	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)	NP	NP	NP	0.71	7.84
▲	106229 - 490 to 495	0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP	1.85	9.46
★	106229 - 517 to 525	0	POORLY GRADED SAND with SILT(SP-SM)	NP	NP	NP	1.58	3.38

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Fines
●	106229 - 452 to 454	0	19	0.256			5.4	60.2	34.4
⧗	106229 - 465 to 470	0	37.5	1.209	0.364	0.154	28.0	65.7	6.3
▲	106229 - 490 to 495	0	19	0.995	0.44	0.105	13.9	77.9	8.2
★	106229 - 517 to 525	0	12.5	0.54	0.369	0.16	2.2	91.7	6.2

PROJECT: KAFB Nov Response -Geotech Lab Testing

SITE: KAFB
Albuquerque, NM

Terracon
4905 Hawkins, NE
Albuquerque, New Mexico

PROJECT NUMBER: 66155064

CLIENT: CB&I Federal Services
Albuquerque, NM

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 66155064.GPJ TERRACON2012.GDT 8/24/15

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ATTACHMENT 2

SIEVE AND MESH DIMENSIONS

Attachment 2. Sieve and Mesh Dimensions from The Engneering ToolBox

Commonly used US Standard commercial sieve and mesh dimensions:

Sieve size	Opening		Standard Mesh
(mm)	*(in)*	*(10^{-6} m)*	*US*
11.2	0.438	11200	7/16"
6.35	0.250	6350	1/4"
5.6	0.223		3.5
4.75	0.187		4
4.0	0.157		5
3.35	0.132		6
2.80	0.110		7
2.36	0.0937		8
2.0	0.0787		10
1.7	0.0661		12
1.4	0.0555		14
1.18	0.0469		16
1.0	0.0394		18
0.841	0.0331	841	20
0.71	0.0278		25
0.595	0.0232	595	30
0.50	0.0197		35
0.400	0.0165	400	40
0.355	0.0139		45
0.30	0.0117		50
0.250	0.0098	250	60
0.210	0.0083	210	70
0.177	0.0070	177	80
0.149	0.0059	149	100
0.125	0.0049	125	120
0.105	0.0041	105	140
0.088	0.0035	88	170
0.074	0.0029	74	200
0.063	0.0024	63	230
0.053	0.0021	53	270
0.044	0.0017	44	325
0.037	0.0015	37	400
0.025	0.0010		500
0.020	0.0008		632

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ATTACHMENT 3

STAINLESS STEEL WELL SCREENS AND ACCESSORIES

TECHNICAL INFORMATION: JOHNSON SCREENS® FREE-FLOW® 304 STAINLESS STEEL SCREENS



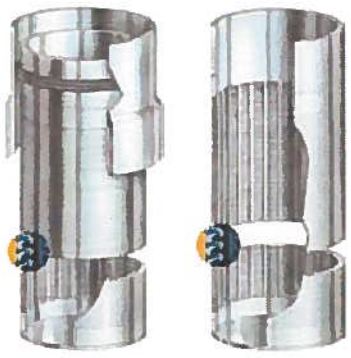
JOHNSON SCREENS LARGE DIAMETER *FREE-FLOW* SCREENS: SIZES 6P - 16T

Size In.	Max Depth: ft	OD: In.	ID: In.	Weight[1]: lbs/ft	Recom. Hang Weight[2]: lbs	Collapse Strength[1]: PSI	Intake Area[3] - In²/ft of Screen							
							Screen Slot Size in Thousandths of an Inch							
							10	20	30	40	50	60	80	100
6" P	100	6.5	6.0	4.4	4,300	87	35	61	82	98	111	123	140	153
	250	6.6	6.0	4.8	4,300	194	20	37	51	64	75	85	102	115
	600	6.7	5.9	6.0	8,800	185	20	37	52	65	76	86	103	117
	1,000	6.8	5.9	7.6	8,800	677	16	30	43	54	64	73	89	103
8" T	250	7.6	6.7	7.0	11,000	127	23	42	59	73	86	98	117	133
	1,000	7.7	6.7	8.9	11,000	468	18	34	48	61	73	83	101	116
8" P	250	8.7	7.9	7.9	12,100	85	26	48	67	84	99	112	134	152
	1,000	8.8	7.9	10.1	20,800	314	21	39	55	70	83	95	115	133
10" T	250	9.5	8.6	8.3	12,100	65	28	53	74	92	108	122	146	166
	1,000	9.6	8.6	10.7	12,100	242	23	43	60	76	90	103	126	145
10" P	600	10.8	9.8	12.6	15,400	170	25	48	68	86	102	116	142	163
	1,000	10.8	9.8	17.8	15,400	226	25	48	68	86	102	116	142	163
12" T	600	11.4	10.4	13.6	17,600	145	27	51	72	90	107	123	149	173
	1,000	11.4	10.4	19.0	17,600	192	27	51	72	90	107	123	149	173
12" P	250	12.8	11.8	14.8	17,600	103	30	57	80	102	121	138	168	193
	600	12.8	11.8	20.9	17,600	136	30	57	80	102	121	138	168	193
	1,000	12.9	11.8	25.2	17,600	193	29	55	78	98	117	134	163	188
14" T	250	12.6	11.6	13.6	14,300	108	30	56	79	100	119	136	165	190
	600	12.6	11.6	19.6	14,300	143	30	56	79	100	119	136	165	190
	1,000	12.6	11.6	24.0	14,300	207	28	53	76	96	114	131	160	184
14" P / 16" T	250	14.1	13.1	15.5	17,100	77	33	63	89	112	133	152	185	213
	600	14.1	13.1	22.2	17,100	102	33	63	89	112	133	152	185	213
	1,000	14.1	13.1	27.2	17,100	148	32	60	85	107	128	146	179	206

NOTES:

- Screens are available in up to 40 foot lengths of continuously wrapped screen with no mid-weld
- 316 stainless steel screen technical information is available upon request
- P - pipe size, T - telescope

1. Based on 0.030 In. slot size (collapse values contain no safety factor)
2. Recommended hang weight is 50 percent of the calculated tensile strength
3. Transmitting capacity in gpm/ft of screen = open area x 0.31



Telescope size screens (left) install through the casing and usually have a Figure K packer as upper fitting. Pipe size screens (right) usually have weld rings at each end and attach directly to the casing.

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ATTACHMENT 4

COLORADO SAND - TYPICAL SPECIFICATIONS & PROPERTIES

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Attachment 4. Grain Size Distribution for Various Colorado Silica Sand products

Colorado Sand - Typical Specifications & Properties

	Sieves																					
Products	5	6	7	8	10	12	14	16	18	20	25	30	35	40	45	50	60	70	100	140	200	Pan
6/9	0-5	0-5	10-20	49-59	10-25	0-3																0-1
8/12		0-1		0-5	20-40	32-42	0-10	0-1														0-1
8/16				0-5	15-30	30-50	15-30	5-15	0-5													0-1
10/16				0-1	0-5	25-50	15-50	10-20	0-1													0-1
10/20				0-1	0-5	3-18	30-40	30-45	10-25	0-5	0-1											0-1
12/20					0-1	5-15	30-50	20-40	10-20	0-5	0-1											0-1
16/30							0-1	0-5	25-45	23-33	15-20	5-15	0-5									0-1
20/40								0-1		0-1	0-10	28-57	30-40	15-27	5-10							0-1
30/70											0-1	0-5		5-20		40-70	10-30	5-10	0-10			0-1
100 Mesh														15-40		5-15	10-20	5-10	10-20	0-10	0-5	0-1
Traction Sand												50-70		0-40		0-30	5-20	5-15	5-10			0-1

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ATTACHMENT 2

KAFB WATER RIGHTS

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, ex rel, S. E. REYNOLDS, State Engineer.	)
Plaintiff	)
vs.	)
JOHN McLUCAS, Secretary of the Air Force, THOMAS W. MORGAN, Commander, Air Force Special Weapons Center, and JAMES B. MYERS, Base Commander, Kirtland Air Force Base	)
Defendants.	)

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JUDGMENT AND ORDER

THIS MATTER coming on to be heard upon the Stipulation of the parties, and the Court having considered the same and being otherwise fully advised in the premises, finds that the Court has jurisdiction of the parties and the subject matter and that the said Stipulation should be approved and incorporated in the final judgment of this Court.

IT IS THEREFORE ORDERED, ADJUDGED AND DECREED that the Stipulation of the parties is hereby approved and incorporated in this judgment as if set out in full herein.

IT IS FURTHER ORDERED that the defendants, their employees, agents, assigns and successors in interest be and they are hereby permanently enjoined and restrained from any diversion and/or use of water from the Rio Grande Underground Water BAsin in and for Kirtland Air Force BAse except in strict conformity with this final judgment.

HOWARD BRATTON

JUDGE OF THE U. S. DISTRICT COURT

J. general;
FLS
J Baird

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF NEW MEXICO

STATE OF NEW MEXICO, ex rel, S. E. REYNOLDS, State Engineer,

Plaintiff

vs.

JOHN McLUCAS, Secretary of the Air Force, THOMAS W. MORGAN, Commander, Air Force Special Weapons Center, and JAMES B. MYERS, Base Commander, Kirtland Air Force Base

Defendants.

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CLERK

STIPULATION

COME NOW the Plaintiff and Defendants herein, by and through their attorneys, and hereby mutually stipulate and agree that final judgment may enter in this cause in the following terms:

1. The United States of America, acting through and by means of the United States Air Force, owns and operates that certain complex of military facilities known as Kirtland Air Force Base within Bernalillo County, New Mexico, which Base includes the former Sandia Base, a Military installation heretofore operated by the United States Army. That area heretofore known as Sandia Base shall be designated in this stipulation as Kirtland East and that area known as Kirtland Air Force Base prior to the merger of the two installations shall be designated as Kirtland West.

2. On November 29, 1956, the Plaintiff, S. E. Reynolds, State Engineer, duly and lawfully declared the Rio Grande Underground Water Basin, an underground reservoir of public waters of the State of New Mexico having reasonably ascertainable boundaries.

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3. All of Kirtland East and Kirtland West were, on November 29, 1956, and have continued to the present time to be within the exterior boundaries of the said Rio Grande Underground Water Basin.

4. On November 29, 1956, the United States of America owned within Kirtland East a water supply system consisting of 9 completed and operating wells, together with associated water storage and delivery works, and had prior to that date diverted and used underground waters of the Rio Grande Underground Water Basin by means of each and every of the said 9 wells for the lawful purposes of the said military installation.

5. The said nine wells in the Kirtland East water supply system were duly declared by an authorized representative of the United States of America in the office of the Plaintiff on the 4th day of October, 1957, and have been since that date designated in the files of the State Engineer as wells No. RG-1581 through RG-1589. The respective locations and priorities of the said 9 wells, as declared by the United States of America, are as follows:

RG-1581 NW1/4SE1/4, Sec. 31 T. 10 N., R. 4 E. March 1, 1949

RG-1582 NW1/4NW1/4, Sec. 1 T. 9 N., R. 3 E. August, 1949

RG-1583 NW1/4SW1/4, Sec. 30, T. 10 N., R. 4 E. August, 1949

RG-1584 NE1/4SW1/4, Sec. 6, T. 9 N., R. 4 E. August, 1949

RG-1585 NE1/4SW1/4, Sec. 29, T. 10 N., R. 4 E. July, 1952

RG-1586 SW1/4SE1/4, Sec. 32, T. 10 N., R. 4 E. July, 1952

RG-1587 NW1/4NW1/4, Sec. 6, T. 9 N., R. 4 E. Feb., 1955

RG-1588 SW1/4SW1/4, Sec. 5, T. 9 N., R. 4 E. Feb., 1955

RG-1589 SW1/4SW1/4, Sec. 15, T. 9 N., R. 4 E. Feb., 1949

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6. Between November 1, 1958, and May 27, 1959, the United States of America drilled or caused to be drilled, in the NW1/4NE1/4 of Sec. 20, T. 9 N., R. 4 E., an additional water well which was thereafter made a part of the water supply system of Kirtland East. This well is designated in the files of the State Engineer as RG-1581 through RG-1589-S. By means of the said well, the United States of America has thereafter continually diverted and beneficially used public underground waters of the Rio Grande Underground Water Basin, as a supplemental point of diversion in and for Kirtland East.

7. In 1972, the United States of America drilled or caused to be drilled an additional water well within Kirtland East in the NW1/4NE1/4 of Sec. 4, T. 9 N., R. 4 E., which well has been completed except for the installation of a pump and has not yet been put to beneficial use, and which is hereby designated RG-1581 through RG-1589-S-2. The said well was drilled for the purpose of serving as a supplemental well for the water supply system of Kirtland East

8. The United States of America owns, under the Constitution and laws of the State of New Mexico, the right to divert the public underground waters of the Rio Grande Underground Water Basin, through and by means of the said eleven wells set forth in paragraphs 5, 6 and 7, in an amount not to exceed an annual quantity of four thousand five hundred (4,500) acre-feet, and to apply the same to beneficial use for the purposes of Kirtland Air Force Base. The priorities of the said eleven wells composing the water supply system of Kirtland East are as set forth

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above in paragraphs 5, 6 and 7. The defendants stipulate that the United States Air Force has no right to divert any of the underground waters of the Rio Grande Underground Water Basin, by means of the said 11 wells or otherwise, for the purposes of Kirtland Air Force Base, except as set forth in this Stipulation, provided, however, that the United States shall enjoy the same right as any other appropriator in the State of New Mexico to make application hereafter to the Plaintiff, State Engineer, for permit to drill supplemental well(s) (i.e., make partial or total change in point of diversion or place or purpose of use) or to effect the transfer of valid and existing water rights for the purposes of Kirtland Air Force Base.

9. On November 29, 1956, the United States of America owned a water supply system in and for Kirtland West consisting of two water wells whose respective locations and priorities were declared in the Office of the State Engineer, by a duly authorized representative of the United States on the 4th day of October, 1957, to be as follows:

RG-1579 NW1/4NW1/4, Sec. 35, T. 10 N., R. 3 E., Oct. 9, 1952

RG-1580 SE1/4NW1/4, Sec. 34, T. 10 N., R. 3 E., Mar. 6, 1956

10. In 1969, the United States of America drilled or caused to be drilled an additional well in and for the Kirtland West water supply system, designated in the records of the State Engineer as RG-1579 and RG-1580 Combined-S, which well was thereafter made a part of the Kirtland West water supply system as a supplemental well.

11. The United States of America owns, under the Constitution and laws of the State of New Mexico, the right to divert

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the public underground waters of the Rio Grande Underground Water Basin by means of the three wells set out in paragraphs 9 and 10 above in an amount not to exceed an annual quantity of 1,898 acre-feet for the purposes of Kirtland Air Force Base. The defendants stipulate that the United States Air Force has no right to divert or use the underground waters of the Rio Grande Underground Water Basin for the purposes of Kirtland Air Force Base, except as set forth in this Stipulation, by means of the said three wells or otherwise, provided, however, that the United States of America shall enjoy the same right as any other appropriator of public water in the State of New Mexico to make application to the Plaintiff, State Engineer, hereafter for permit to drill and use supplemental well(s) (i.e., make partial or total change in point of diversion or place or purpose of use) or to effect the transfer of existing valid water rights for the purposes of Kirtland Air Force Base.

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12. The United States of America also owns the right under the Constitution and laws of the State of New Mexico to divert public underground waters of the Rio Grande Underground Water Basin in an amount not to exceed three acre-feet per year by and from each of the following three domestic wells located and existing within, and for the purposes of Kirtland Air Force Base:

Location	Priorities
RG-1578 SE1/4NW1/4, Sec. 35, T. 9 N., R. 4 E.	1945
RG-1590 SE1/4NW1/4, Sec. 35, T. 9 N., R. 4 E.	1945
RG-1591 NE1/4SE1/4, Sec. 24, T. 9 N., R. 4 E.	1948

13. The defendants stipulate that the United States Air Force will not after the entry of final judgment herein drill

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or cause or allow to be drilled any water well(s) within the boundaries of the Rio Grande Underground Water Basin, within and/or for the purposes of Kirtland Air Force Base (including Kirtland East and Kirtland West), except when and to the extent that it will have fully complied with the laws of the State of New Mexico and the Rules and Regulations of the State Engineer in respect to obtaining from the State Engineer permit(s) to drill water wells and/or produce public waters therefrom for any purpose.

14. The defendants stipulate that they will make on behalf of the United States accurate monthly reports to the Plaintiff, State Engineer, of the total metered quantities of underground water diverted by means of any and all of the wells composing the Kirtland East and Kirtland West water supply systems, provided, however, that the United States of America shall not be required to make application for, or obtain permit authorizing the physical combination of the two water supply systems so long as the total annual metered diversion from each system is within the respective limit established in paragraphs 8 and 11. The defendants further agree that they will, within 60 days of the date of entry of final judgment herein, file in the Office of the Plaintiff, State Engineer, on forms to be supplied by the Plaintiff, applications on behalf of the United States seeking the right to divert and use public underground waters of the Rio Grande Underground Water Basin by means of those two certain wells RG-1581 through RG-1589-S-2 and RG-1579 and RG-1580 Combined-S, within the respective limits set forth in paragraphs 8 and 11 above. The State of New Mexico agrees that together

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with the terms of judgment entered in this cause pursuant to this Stipulation, the said applications shall be administratively recognized as evidencing the right of the United States to use the said two wells within the terms of this Stipulation and the Order of the Court entered pursuant thereto, without any further requirement for advertisement or hearing.

PAUL L. BLOOM
Special Assistant Attorney General
State of New Mexico

s/ Victor Ortega
United States Attorney

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APPENDIX A-2

Access Agreements

RIGHT OF ENTRY AGREEMENTS

CHRIST UNITED METHODIST CHURCH

LICENSE

TO

KIRTLAND AIR FORCE BASE

CHRIST UNITED METHODIST CHURCH, INC., a New Mexico nonprofit corporation, hereinafter referred to as the "LICENSOR," as owner of the property located at 6200 Gibson Boulevard, S.E., Albuquerque, NM 87108, hereby grants to the Secretary of the Air Force, by and through the Installation Commander, Kirtland Air Force Base (AFB), Albuquerque, New Mexico, hereinafter referred to as the 'LICENSEE," or his authorized representative, a License upon the following terms and conditions:

1. The LICENSOR hereby grants unto the LICENSEE a no-rent license to enter upon the LICENSOR's real property located at 6200 Gibson Boulevard, S.E., Albuquerque, Bernalillo County, New Mexico, which real property is also known as :

> Tract C, as shown on the Replat of Tracts B, C, D and E, Siesta Hills No. 2, recorded November 25, 1980 in Book B18, Page 84, records of Bernalillo County, New Mexico,

as more specifically identified on the general location map, attached hereto and incorporated herein as Attachment A, for the express purpose of:

> 1) constructing, drilling, installing, operating, maintaining and removing one (1) bulk fuels facility (BFF) interim fuel remediation extraction well, extraction well pipeline and associated electrical power lines, pole, transformer and junction boxes; 2) depending upon the depth of the ethylene-di-bromide plume, constructing, drilling, installing, operating, maintaining and removing no more than two (2) BFF regional deep monitoring wells; and 3) parking well drilling and construction equipment, to include a fork lift, water truck, other miscellaneous work pickups, hopper, lined waste roll-off bin and daily construction supplies, to include well casing; and 4) collecting ground water monitoring samples from the regional deep monitoring well and extracting and pumping ethylene-di-bromide contaminated groundwater through the extraction well pipeline to Kirtland AFB for treatment during the term of the Kirtland AFB BFF fuel release remediation; in that area of the LICENSOR's west parking lot located immediately adjacent to the city alley right-of-way at the south boundary of the parking lot, as shown on the aerial photograph attached hereto and incorporated herein as Attachment B.

2. The term of this license is five (5) years, beginning on January 9, 2015 and ending January 8, 2020.

3. The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns, shall use the area described above, and as shown in Attachments A and B, for the purposes described above and not for any other purpose without first obtaining the written consent of the LICENSOR. The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns shall comply with the following additional LICENSOR use restrictions:

3.1. LICENSEE shall conduct no activities on LICENSOR's property on any Saturday or Sunday during the term of this License;

3.2. LICENSEE shall remove the basketball board standard from the west parking lot and reinstall it at a location on the parcel to be specified by the LICENSOR;

3.3. LICENSEE shall provide for city waste disposal truck access to the LICENSOR's trash dumpster located at the SE corner of the west parking lot to facilitate waste collection and disposal;

3.4 LICENSEE shall provide access to the west door of the Church through the west parking lot for Food Band truck deliveries on the first Tuesday of each month;

3.5. LICENSEE shall provide access to the west door of the Church through the west parking lot to LICENSOR's contractor(s) for the construction and installation of an ADA compliant wheelchair ramp; and

3.6. LICENSEE shall provide day and night access to the west door through the west parking lot for groups, including church members, using church facilities.

4. All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the LICENSOR's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within seven (7) days after the installation of the extraction and/or ground water monitoring wells or the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.

5. Liability and Insurance.

5.1 Liability

5.1.1 As between the PARTIES, the LICENSEE, its agents, representatives, contractors and/or sub-contractors assume all risk of loss or damage to property and injury or death to persons,

whether to its officers, employees, contractors of any tier, agents, invitees or others, by reason of or incident to LICENSEE's use of the licensed area, and its activities conducted under this LICENSE. The LICENSEE agrees to hold harmless the LICENSOR, and its officials, agents and employees from any claims, actions, suits or other proceedings arising from or out of the acts or omissions of the LICENSEE, its agents, representatives, contractors or sub-contractors or arising from the failure of the LICENSEE, its agents, representatives, contractors or sub-contractors to perform any act or duty required of the LICENSEE herein. To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies.

5.1.2. The LICENSEE hereby undertakes a contractual obligation to repair all actual damages to LICENSOR's property and improvements caused by LICENSEE's operation(s). Upon completion of the repairs, LICENSEE shall repave the west parking lot ensuring said paving is on-grade with the LICENSEE installed well casings and/or vaults. In lieu of performing such repair, LICENSEE may, at its discretion, pay for said repairs and parking lot repaving. To the extent provided by law, the Licensee's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR may have to make a claim for damages under applicable laws.

5.1.3. Claims for damages, personal injury or death arising from negligent or wrongful act of LICENSEE, its officers, employees, contractors of any tier, agents or invitees (but specifically excluding contractual claims arising under paragraph 6.1.2 above) shall be subject to the provisions of the Federal Tort Claims Act (28 USC §§ 2671 et seq.).

5.2 Insurance Requirement. LICENSEE shall require its agents, representatives, contractors or sub-contractors to obtain insurance coverage for the specific protection and benefit of the LICENSOR, including but not necessarily limited to, the following coverage:

5.2.1. Comprehensive General Liability Insurance. Comprehensive general liability insurance with liability limits in an initial amount not less than $1,000,000 aggregate limit of liability for bodily injury, including death, and property damage in any one occurrence.

5.2.2. Automobile Liability Insurance. An automobile liability policy with liability limits in amounts not less than $1,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. Said policy of insurance must include coverage for the use of all owned, non-owned, hired

automobiles, vehicles and other equipment both on and off work and is in addition to the Comprehensive General Liability Coverage.

5.2.3. Proof of Insurance: During the term of this Agreement, not less than once each year, on or before 9 January 2015 and 9 January of each succeeding year, LICENSEE shall cause its primary contractor to provide to the LICENSOR without demand, or more frequently upon demand, proof of all required insurance coverage. Prior to expiration or exchange of any policy, LICENSEE shall cause its primary contractor to furnish the LICENSOR evidence satisfactory to the LICENSOR that the policy has been renewed or replaced or is no longer required by this Agreement. All policies required hereunder shall provide that the LICENSOR shall be given thirty (30) days prior written notice of cancellation, non-renewal or material alteration of coverage. Provisions that the insurance company shall "endeavor to give the LICENSOR notice" shall not be allowed.

6. The LICENSEE shall be solely responsible for maintaining the premises upon which LICENSEE's equipment is being stored in a safe condition during the term of this License.

7. The LICENSEE will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and incorporated herein as Attachment C, and an Environmental Baseline Survey (EBS), which is attached hereto and incorporated herein as Attachment D. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments C and D, the LICENSOR's land will be returned in the same environmental condition as received, but without the contamination conditions for which the LICENSEE is performing the remediation, which shall be documented in a final closeout EBS, a copy of which shall be provided to the LICENSOR.

8. In connection with its use of or any other activity on the property, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.

9. The LICENSEE, its officers, employees, agents, representatives, contractors, and assigns shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.

10. For purposes of giving formal written notice, the points of contact are as follows:

LICENSOR: CHRIST UNITED METHODIST CHURCH
Attn: Ms. Vicki Chronister
6200 Gibson Blvd., SE
Albuquerque, NM 87108

LICENSEE: Installation Commander
2000 Wyoming Blvd, SE
Kirtland AFB, NM 87117

11. Claims.

11.1 Point of Contact. The Permittee point of contact for all damages, whether to real or personal property, will be submitted to:

AFNWC/JA
2000 Wyoming Blvd., SE
Building 20604, Room B-36
Kirtland AFB, NM 87117
(505) 846-4217

11.2 Claims Process:

To file a claim for damage and/or injury due to LICENSEE''s operations, the claimant, or his/her authorized agent, must file a properly signed SF-95, *Claim for Damage, Injury or Death*, setting forth a sum certain for damage to or loss of property, personal injury or death, to the POC identified in 11.1 above, within two (2) years of the incident causing the damage or injury. The claim form is available at the website www.claims.jag.af.mil.

12. This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.

13. This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.

14. If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.

15. Index of Attachments

Attachment A – Description of Licensed Premises

Attachment B – Map

Attachment C – AF-813

Attachment D – Environmental Baseline Survey (EBS)

SIGNATURES ON FOLLOWING PAGES

CHRIST UNITED METHODIST CHURCH, INC.,
a New Mexico nonprofit corporation

By Vickie Chronister
VICKIE CHRONISTER, President and
Chair of Board of Trustees

STATE OF NEW MEXICO
COUNTY OF BERNALILLO

The foregoing instrument was acknowledged before me this 9th day of January, 2015, by Vickie Chronister, as President and Chair of Board of Trustees, Christ United Methodist Church, Inc., a New Mexico nonprofit corporation.

Julie A. Walker
Notary Public

My Commission Expires:
04/22/2018

OFFICIAL SEAL
Julie A. Walker
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 04/22/2018

FOR THE UNITED STATES OF AMERICA

Tom D. Miller

TOM D. MILLER, Colonel, USAF
Commander

STATE OF NEW MEXICO
COUNTY OF BERNALILLO

The foregoing instrument was acknowledged before me this 9th day of January, 2015, by Tom D. Miller, Colonel, USAF, the Commander, 377 ABW, duly authorized to sign on behalf of the United States of America.

Julie A. Walker

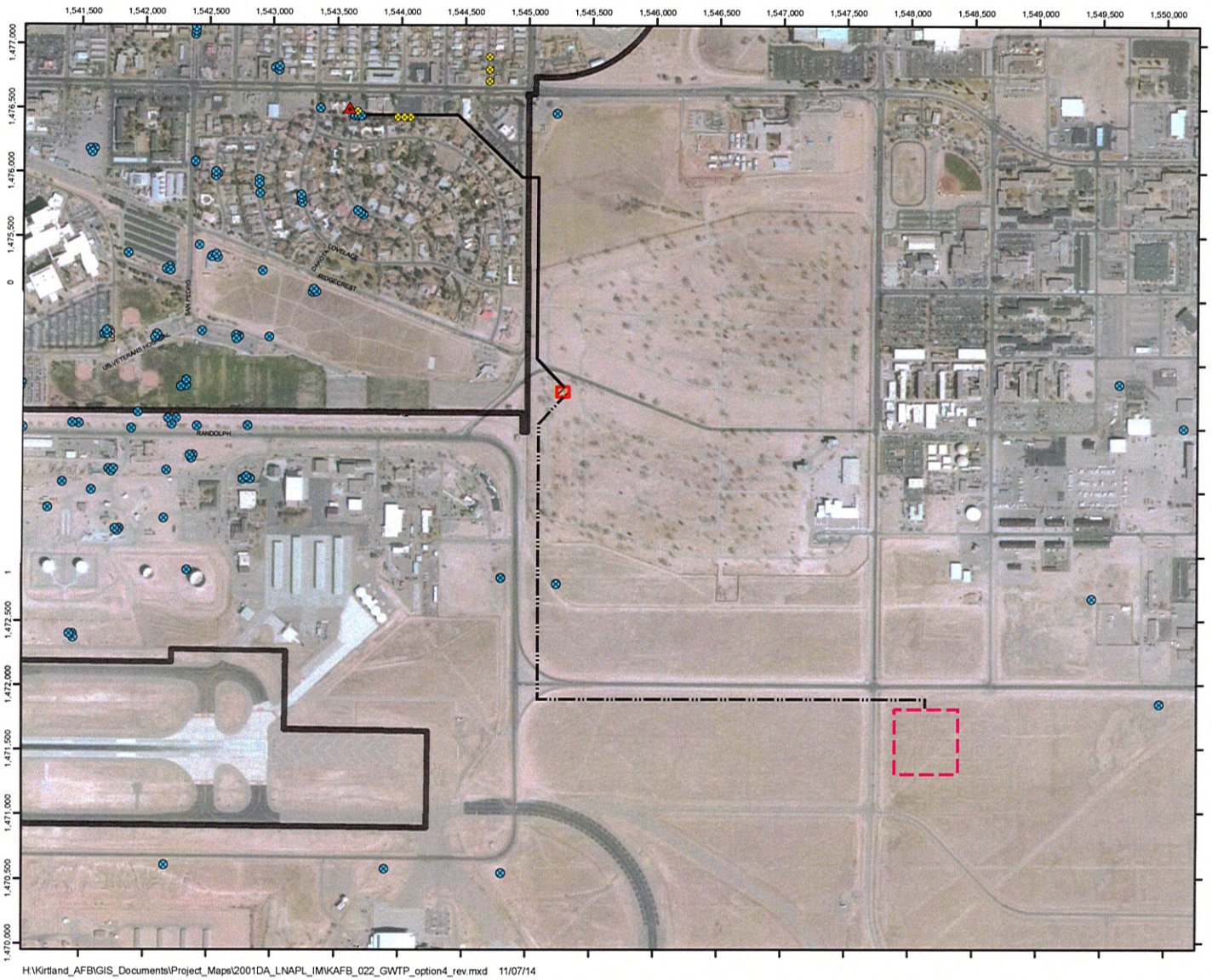
Notary Public

My Commission Expires:
04/22/2018

OFFICIAL SEAL
Julie A. Walker
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 04/22/2018


N
Attachment A
115 ft
N - 35° 03' 28.2"
W - 106° 34' 23.9"
72 ft
57 ft
KAFB-106212
9 ft
26 ft
28 ft
KAFB-106228
KAFB-106035
KAFB-106036
KAFB-106037
0
10
20
40
Feet

Attachment B



Legend

- Proposed Monitor Well
- Proposed Extraction Well Location
- Monitor Well
- New Underground Influent Piping
- New Underground Discharge Piping
- New Groundwater Treatment Plant
- New Infiltration Gallery
- Installation Boundary



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community VA parking lot area from Google Maps

Revision Date: 11/07/14

N

0 400 800 1,600

Feet

1 inch = 800 feet

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

DISSOLVED PHASE EDB
INTERIM MEASURE WORK PLAN
BULK FUELS FACILITY
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2

PIPING LAYOUT

PERMIT AMENDMENT NO. 2

THIS PERMIT AMENDMENT NO. 2 to the New Mexico Veterans Administration Health Care System ("NMVAHCS") Permit dated from 9/12/2008 to 8/31/2013 (the "Permit") is entered into this 11 day of July, 2016 between the Director, NMVAHCS, hereinafter referred to as the "PERMITTOR," and the Secretary of the Air Force, acting by and through the Installation Commander, Kirtland Air Force Base (KAFB), hereinafter referred to as the "PERMITTEE." The PERMITTOR and the PERMITTEE, when referred to together herein, shall also be known as the "PARTIES."

RECITALS

WHEREAS, the PERMITTOR granted the Permit to the PERMITTEE on 12 September 2008 for a term of five (5) years beginning 12 September 2008 and ending 31 August 2013, but revocable at will by the PERMITTOR, to conduct environmental services and remediation on NMVAHCS property, to include drilling and monitoring test wells to explore the quality of the groundwater at the well sites on the NMVAHCS and the use of remediation equipment; and

WHEREAS, the regulatory oversight of the PERMITTEE's remediation activity for the KAFB bulk fuels release has been assumed by the New Mexico Environment Department's Hazardous Waste Bureau ("NMED-HWB"), resulting in changes to the PERMITTEE's bulk fuels release remediation efforts; and

WHEREAS, the PERMITTEE's contractor shall investigate the KAFB bulk fuels release and implement interim and/or final remediation activities;

WHEREAS, the PARTIES signed Permit Amendment 1 granting the PERMITTEE a continuing right-of-entry to investigate and remediate the PERMITTEE's bulk fuel release during the term 28 January 2011 through 27 January 2016; and

WHERAS, it has been determined that the PERMITTEE has a continuing need for the continued use of the PERMIT and Grant of Right of Entry to investigate and remediate the PERMITTEE's bulk fuel release,

AGREEMENT

NOW THEREFORE, the PARTIES hereto do mutually agree as follows:

1. The Permit shall be amended to extend the permit term for a five (5) year term beginning on 28 January 2016 and ending on 27 January 2021.

2. All Permit references to "PERMITTEE's contractor" shall refer to any of the PERMITTEE's contractors/subcontractors conducting environmental services for the KAFB bulk fuels release investigation and remediation.

3. Permit § 8(8), *Effective Date*, shall be amended to read as follows:

   "This Agreement is effective for the period 28 January 2016 through 27 January 2021."

4. All other terms and conditions of the NMVAHCS Permit shall be and remain the same.

(Signatures on Following Pages)

IN WITNESS WHEREOF, I have hereunto set my hand as Director, New Mexico Veterans Administration Health Care System this 28 day of June, 2016.

FOR THE NEW MEXICO VETERANS
ADMINISTRATION HEALTH CARE SYSTEM

ANDREW WELCH, MHA, FACHE
Director
New Mexico VA Health Care System

IN WITNESS WHEREOF, I have hereunto set my hand by authority of the Secretary of the Air Force this 11 day of July, 2016.

FOR THE SECRETARY OF THE AIR FORCE

ERIC H. FROEHLICH, Colonel, USAF
Commander

Department of Veterans Affairs

PERMIT FOR USE OF REAL PROPERTY BY FEDERAL AGENCY

1. PERMIT NO.

Permission, revocable at the will of the Department of Veterans Affairs, is hereby granted the permittee hereinafter named to use the property described below for the purpose designated. subject to the conditions, special and general, herein prescribed.

2. NAME OF PERMITTEE AGENCY

U.S. Air Force
Kirtland AFB, NM 87117

3A. NAME AND ADDRESS OF LOCAL PERMITTEE REPRESENTATIVE

Mark Holmes, Project Manager
Natural Resource Management Restoration Section
Kirtland AFB, NM 87117-5522

3B. TELEPHONE NUMBER

(505) 846-9005

4. NAME AND ADDRESS OF INSTALLATION

New Mexico VA Health Care System (NMVAHCS)
1501 San Pedro S.E.
Albuquerque, NM 87108

5. MAXIMUM PERIOD COVERED

FROM *(MM/DD/YYYY)*	TO *(MM/DD/YYYY)*
9/12/2008	8/31/2013

6A. DESCRIPTION OF PROPERTY AFFECTED

Described herein in the terms of this Permit

6B. EXHIBIT(S) ATTACHED

None

7. PURPOSE OF PERMIT

To grant permission for Kirtland AFB to use a contractor/subcontractor to conduct environmental services and remediation on NMVAHCS property. Environmental services include the drilling and monitoring of test wells to explore the quality of the groundwater at the well sites on the NMVAHCS and the use of remediation equipment.

By the acceptance of this permit, the permittee agrees to abide by and be bound by the following conditions:

8. SPECIAL CONDITIONS

VA grants this Permit to Kirtland Air Force Base under the following conditions, which Kirtland Air Force Base accepts.

1. PURPOSE:

This Permit outlines the grant of right of entry and agreement between the New Mexico VA Health Care System (NMVAHCS) and Kirtland Air Force Base (KAFB) for disclosure of results of environmental services on NMVAHCS property. NMVAHCS has granted permission for KAFB to use a contractor to conduct environmental services and remediation on NMVAHCS property. The contractor selected by KAFB to conduct environmental services and remediation is CH2MHill. KAFB agrees to allow NMVAHCS direct access to any information and outcomes regarding environmental services and remediation performed on NMVAHCS property by CH2MHill.

2. BACKGROUND:

In 2001, KAFB completed delineation of contaminated soil and groundwater discovered in 1999 as part of the Stage 1 Abatement Plan. In February 2007, KAFB discovered fuel product on the groundwater at another location near the Bulk Fuels Facility, which is being investigated as part of a Modification to the Stage 2 Abatement Plan. KAFB has delineated the contaminated areas on its property in the first and second stages of their abatement plan. The proposed next step in the Stage 2 Abatement Plan Modification is to investigate the land both within and outside of the KAFB boundaries, to determine if, and to what extent the fuel product has migrated outside of KAFB boundaries.

(CONTINUED ON PAGES 1 THROUGH 4 ATTACHED TO THIS VA FORM 10-6215)

Item 8. SPECIAL CONDITIONS, Paragraph 2, continued:

Subsequent to the investigation, KAFB may be required to install remediation systems to remove the fuel product. As part of these efforts, KAFB has retained the services of an environmental contractor, CH2MHill, to perform environmental services on land both inside and outside of the KAFB boundary.

The land proposed to be tested includes an 11.5 acre plot of land on VA property or other areas identified and agreed upon that are owned by NMVAHCS. KAFB is required by the New Mexico Environment Department to define the extent of the fuel product on and off of KAFB. KAFB may therefore be required to install groundwater monitor wells on other VA property, specifically within the parking lots south and east of the VA Hospital to complete the investigation. This has been presented to the VA Engineering Staff in previous meetings. These 11.5 acres of VA-owned land are currently vacant, but the NMVAHCS has future plans to develop this land under the Federal Enhanced Use Lease (EUL) authority. The NMVAHCS needs assurance that any environmental contamination on its 11.5 acre property has been addressed, and will be remediated before proceeding further with its EUL project plans. Thus, the NMVAHCS has granted permission to KAFB to conduct environmental services on the property proposed for use in the EUL or other areas identified and agreed upon that are owned by NMVAHCS. This testing is projected to include the drilling and testing of monitoring wells, in order to explore the quality of the groundwater beneath the 11.5 acre parcel, to determine whether the leaked fuel product has migrated to affect the 11.5 acre parcel or other VA property. The NMVAHCS needs to have unrestricted access to any and all results of the testing, conducted by CH2MHill, on its 11.5 acre parcel of land and on all other VA property.

3. RESPONSIBILITIES:

a. Kirtland Air Force Base:

1) Allows NMVAHCS full, unrestricted access to any and all results of environmental services performed on NMVAHCS (VA) property.

2) Coordinates communication between NMVAHCS and KAFB to ensure that NMVAHCS is provided full access to all environmental services results derived from activities on NMVAHCS property.

3) Agrees to provide a written copy of any final environmental assessment reports produced by CH2MHill, once all testing on NMVAHCS property is complete.

4) Agrees to maintain open communication with the Engineering Staff of the NMVAHCS regarding environmental services performed on NMVAHCS property, and promptly informs them of any proposed changes to the initial testing protocols and schedules.

b. New Mexico VA Health Care System:

1) Grants KAFB or its contractor/subcontractor permission to conduct environmental services on NMVAHCS property, to include drilling monitoring wells on NMVAHCS property to determine the quality of the groundwater at the well sites located on NMVAHCS property.

2) Grants KAFB or its contractor/subcontractor permission to temporarily install and use remediation equipment such as soil vapor extraction systems currently installed on KAFB, to remove any leaked fuel product. When remediation equipment is used by KAFB or its subcontractor, KAFB agrees to adhere to the following:

a. Remediation equipment will be secured using a secured chain-link fencing system.

b. Remediation equipment located in residential areas will be soundproofed.

c. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the remediation equipment is deployed.

d. KAFB will be responsible for meeting any and all applicable air emission standards for the remediation equipment.

e. KAFB agrees to comply with any and all applicable city, state or federal laws and regulations regarding EPA permitting.

f. All tools, equipment, and other property taken upon, placed upon, or installed on VA property by KAFB, or its contractor/subcontractor, excluding the installed monitoring wells, shall remain the property of KAFB, or its contractor/subcontractor, and may be removed by KAFB, or its contractor/subcontractor, at any time within a reasonable period after the expiration of this right-of-entry.

g. Monitoring wells drilled and installed on VA property will remain in place until groundwater remediation activities are completed consistent with the terms of Paragraph 6, Terms of Agreement, contained herein, at which time NMVAHCS will determine which monitoring wells will be removed and/or abandoned in place. All monitoring well removal and/or abandonment activities will comply with the provisions of Title 19, Chapter 27 and Title 20, Chapter 6 of the New Mexico Administrative Code (NMAC).

3) Grants KAFB permission to erect a temporary equipment staging area on VA property in an area within the 11.5 acre plot of land, not to exceed 50 feet by 100 feet for the purpose of housing supplies needed for the environmental services effort. When a temporary equipment staging area has been established by KAFB, KAFB agrees to adhere to the following:

a. The temporary storage area located on VA property within the 11.5 acre plot of land will be secured using a secured chain-link fencing system.

b. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the remediation equipment is deployed.

c. KAFB agrees to maintain oversight of and responsibility for all items placed in the designated temporary storage area.

d. KAFB will be responsible for and will address issues of physical equipment security, public safety and public perception at the time the temporary storage area is deployed.

e. All tools, equipment, and other property taken upon the land and housed or placed on VA property within the temporary equipment staging area by KAFB, or its contractor/subcontractor, shall remain the property of KAFB, or its contractor/subcontractor, and may be removed by KAFB, or its contractor/subcontractor, at any time within a reasonable period after the expiration of this right-of-entry.

4) Receives copies of all environmental services performed by CH2MHill, reviews them, and promptly provides comment back to KAFB regarding any concerns, questions, or issues involving the environmental services so that if changes need to be made to the environmental services schedule and/or protocols, this information can be communicated to KAFB and CH2MHill.

5) Maintains open communication with the KAFB Natural Resource Management Restoration Section concerning the environmental services on NMVAHCS property.

6) Informs KAFB of any access and/or scheduling issues with the environmental services performed by CH2MHill.

7) Grants KAFB, via VA Form 10-6215, "Permit for Use of Real Property by Federal Agency," a five (5) year "Right of Entry" for the installation of and collection of data from groundwater monitoring wells designed to both delineate and remediate any leaked groundwater fuel product.

4. PROCEDURES:

Standard procedures and timelines for receiving regular updates on the progress of environmental services, as well as periodic written reports and the final written report produced by CH2MHill will be developed and adhered to.

5. PAYMENT / REIMBURSEMENT:

No payment or reimbursement will be made or exchanged between NMVAHCS and KAFB for environmental services conducted, or copies of testing results shared between the two organizations in accordance with this Permit.

6. TERMS OF AGREEMENT:

This five (5) year agreement may be modified or revised by written amendment, provided such revision or modification is mutually agreed upon and signed by the authorized representative of Kirtland Air Force Base and the New Mexico VA Health Care System. This agreement will remain in effect during the period stated unless terminated at the request of either party after thirty (30) days notice in writing. The parties involved shall review this agreement annually. No later than twelve (12) months prior to the expiration of this Permit, NMVAHCS and KAFB officials will review the status of groundwater monitoring and remediation efforts and determine whether the Permit and Right of Entry shall both expire or be renewed for an additional term not to exceed five (5) years.

7. PROTECTION OF RESOURCES

a. GRANTEE will use all reasonable means available to protect the environment and natural resources from damage arising from this Right of Entry or activities incident to it. Where damage nonetheless occurs, GRANTEE shall be liable to restore the damaged resources. Upon termination of this Right of Entry, the land shall be returned to GRANTOR in the same environmental condition as received, as documented in the Request for Environmental Impact Analysis (AF Form 813) and Environmental Baseline Survey (EBS) Waiver for Right of Entry attached hereto and made a part hereof as Exhibit B and C respectively.

b. To the extent provided by law and subject to the availability of funds, KAFB agrees to use its appropriations and resources, as required, to repair damages to said parcel and pay any awards, claims, settlements or judgments rising out of its use of said parcel, or routes of ingress or egress therefrom, including reimbursement of the Judgment Fund, 31 USC § 1304; provided however, that NMVAHCS or another agency of the Government may, as a matter of its internal policy, assume responsibility for certain claims of that agency's personnel while assigned or detailed to the KAFB, or otherwise present on the said parcel.

8. EFFECTIVE DATE:

This agreement is effective for the period 09/12/2008 through 08/31/2013.

for Michael S. Duvall, Col, USAF
Commander, 377th Air Base Wing
Kirtland Air Force Base

16 Sep 08
Date

per George Marnell
Director
New Mexico VA Health Care System

Sept. 12, 2008
Date

RENEWAL DATE: 09/01/2013

Attachments:

A. Aerial Map of Proposed Locations for Additional Groundwater Monitoring Points
B. Request for Environmental Impact Analysis (AF Form 813)
C. Waiver for Right of Entry (ROE) on NMVAHCS Property

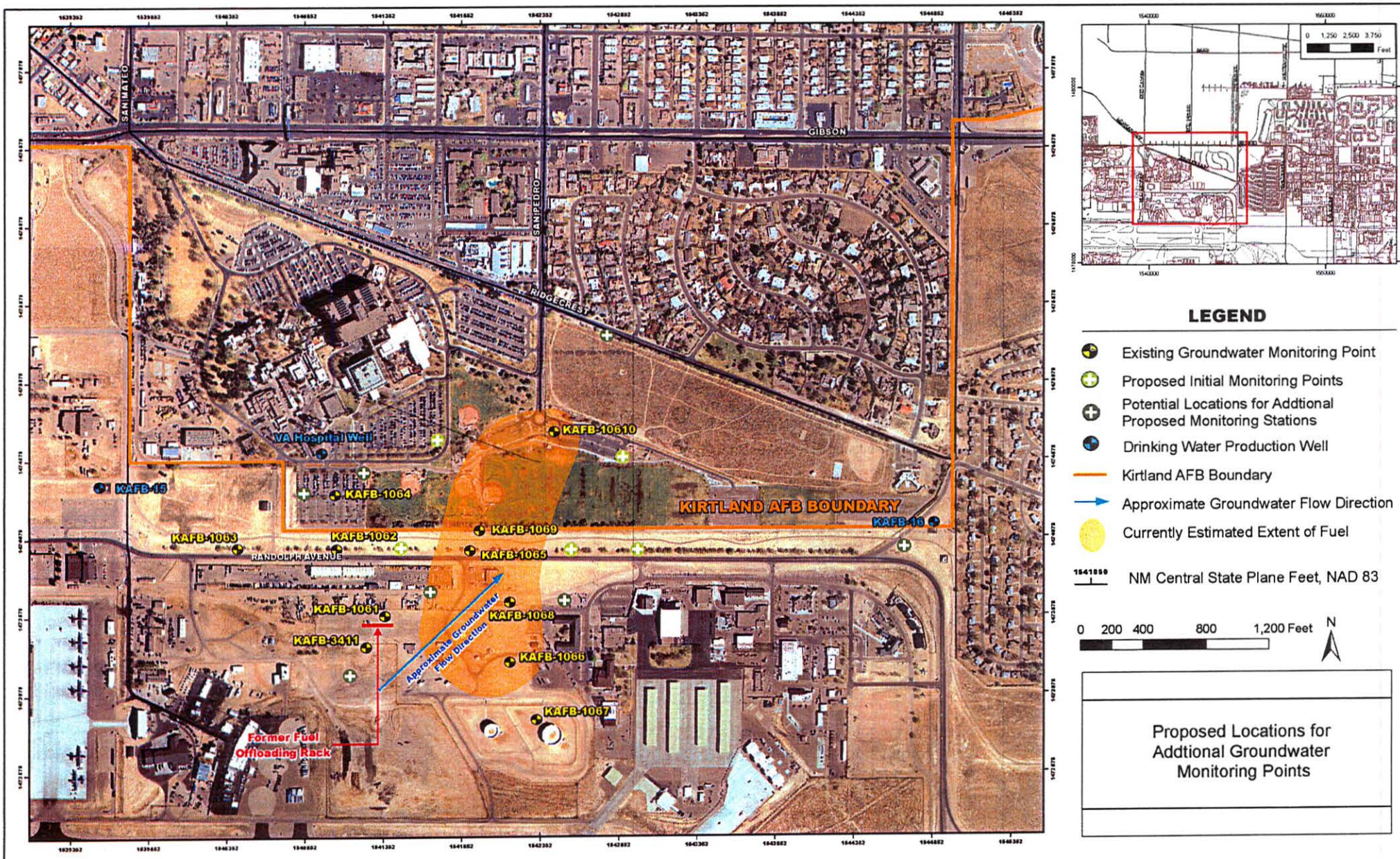

SAN MATEO
GIBSON
SAN PEDRO
RIDGECREST
VA Hospital Well
KAFB-10610
KAFB-15
KAFB-1064
KIRTLAND AFB BOUNDARY
KAFB-16
KAFB-1063
KAFB-1062
KAFB-1069
RANDOLPH AVENUE
KAFB-1065
KAFB-1061
KAFB-1068
KAFB-3411
Approximate Groundwater Flow Direction
KAFB-1066
KAFB-1067
Former Fuel Offloading Rack
0 1,250 2,500 3,750 Feet
LEGEND
Existing Groundwater Monitoring Point
Proposed Initial Monitoring Points
Potential Locations for Addtional Proposed Monitoring Stations
Drinking Water Production Well
Kirtland AFB Boundary
Approximate Groundwater Flow Direction
Currently Estimated Extent of Fuel
1641850
NM Central State Plane Feet, NAD 83
0 200 400 800 1,200 Feet
N
Proposed Locations for Addtional Groundwater Monitoring Points

Exhibit A

REQUEST FOR ENVIRONMENTAL IMPACT ANALYSIS

Report Control Symbol RCS: 35-09- 610

INSTRUCTIONS: *Section I to be completed by Proponent; Sections II and III to be completed by Environmental Planning Function. Continue on separate sheets as Necessary, Reference appropriate item numbers.*

SECTION I - PROPONENT INFORMATION

1. TO *(Environmental Planning Function)*	2. FROM *(Proponent organization and functional address symbol)*	2a. Telephone
Department of the Air Force HQ 377th Air Base Wing ATTN: 377 MSG/CEANQ	Mark Holmes 377 MSG/CEANR	6-9005

3. TITLE OF PROPOSED ACTION
Environmental services on NM Veterans Affairs Health Care System (NMVAHCS)

4. PURPOSE AND NEED FOR ACTION *(Identify decision to be made and need date)*
To grant permission for Kirtland AFB to use a subcontractor (CH2MHill) to conduct environmental services and remediation on NMVAHCS property. KAFB is required by the New Mexico Environment Department to define the extent of the fuel product contaminating groundwater on and off of KAFB.

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES (DOPAA) *(Provide sufficient details for evaluation of the total section.)*
KAFB proposes to conduct environmental services and remediation on NM VA HCS property. Environmental services include both the drilling and monitoring of monitor wells to explore the quality of the groundwater to determine if the fuel product has migrated to and affected the NMVAHCS property and the use of remediation equipment on the NMVAHCS property. (Cont.)

6. PROPONENT APPROVAL *(Name and Grade)*	6a. SIGNATURE	6b. DATE
MARK HOLMES YD-02	Mark Holmes	4 SEP 08

SECTION II PRELIMINARY ENVIRONMENTAL SURVEY. *(Check appropriate box and describe potential environmental effects including cumulative effects.) (+ = positive effect; O = no effect; - = adverse effect; U = unknown effect)*	+	O	-	U
7. AIR INSTALLATION COMPATIBLE USE ZONE/LAND USE *(Noise, accident potential encroachment, etc.)*				
8. AIR QUALITY *(Emission, attainment status, state implementation plan, etc.)*				
9. WATER RESOURCES *(Quality, quantity, source, etc.)*				
10. SAFETY AND OCCUPATIONAL HEALTH *(Asbestos/radiation/chemical exposure, explosives safety quantity-distance, etc.)*				
11. HAZARDOUS MATERIALS/WASTE *(Use/storage/generation, solid waste, etc.)*				
12. BIOLOGICAL RESOURCES *(Wetlands/floodplains, flora, fauna, etc.*				
13. CULTURAL RESOURCES *(Native American burial sites, archeological, historical, etc.)*				
14. GEOLOGY AND SOILS *(Topography, minerals, geothermal, Installation Restoration Program, seismicity, etc.)*				
15. SOCIOECONOMIC *(Employment/population projections, school and local fiscal impacts, etc.)*				
16. OTHER *(Potential impacts not addressed above.)*				

SECTION III - ENVIRONMENTAL ANALYSIS DETERMINATION

17. ☐ PROPOSED ACTION QUALIFIES FOR CATEGORICAL EXCLUSION (CATEX) # _____ OR

☐ PROPOSED ACTION DOES NOT QUALIFY FOR A CATEX. FURTHER ENVIRONMENTAL ANALYSIS IS REQUIRED

18. REMARKS

19. ENVIRONMENTAL PLANNING FUNCTION CERTIFICATION *(Name and Grade)*	19a. SIGNATURE	19b. DATE
Evelyn C. Watkins, YD-02 *NEPA Program Manager*	Evelyn C Watkins	8 Sep 08

Exhibit B

Comments on AF 813

4. Purpose and Need for Action (continued)

5. Description of Proposed Action (continued)

The investigation will begin as soon as a right-of-entry has been properly secured.

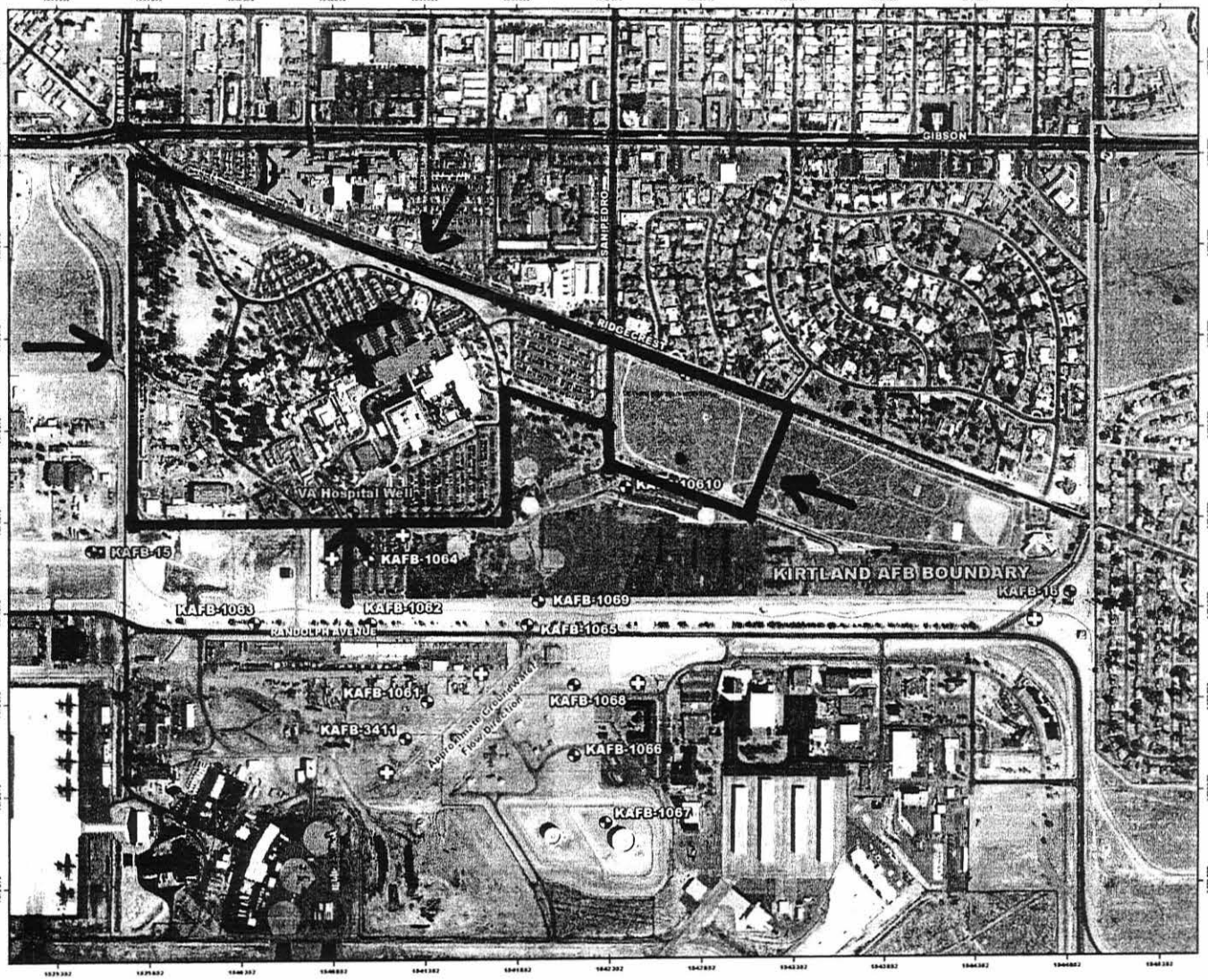
Although the proposed project may require access to NMVAHCS property in general, specific NMVAHCS property identified as areas of probable locations of monitor well and remediation equipment include an 11.5 acre tract of vacant land located along Ridgecrest Drive adjacent to the City of Albuquerque Bullhead Park, and two parking lots located directly north and west of the BullHead park. NMVAHCS has future plans to develop the 11.5 acre tract of vacant land under the Federal Enhanced Use Lease (EUL) authority. The NMVAHCS needs assurance that any environmental contamination on its 11.5 acre property has been addressed, and will be remediated before proceeding further with its EUL project plans. Thus, the NMVAHCS has granted permission to KAFB to conduct environmental services on the property proposed for use in the EUL. The NMVAHCS needs to be able to have unrestricted access to any and all results of the testing, conducted by CH2MHill, on its 11.5 acre parcel of land.

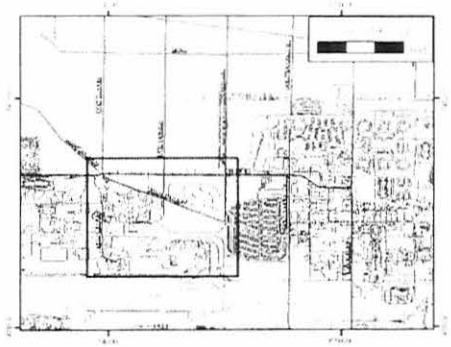
BACKGROUND:

In 2001, KAFB completed delineation of contaminated soil and groundwater discovered in 1999 as part of the Stage 1 Abatement Plan. In February 2007, KAFB discovered fuel product on the groundwater at another location near the Bulk Fuels Facility, which is being investigated as part of a Modification to the Stage 2 Abatement Plan. KAFB has delineated the contaminated areas on its property in the first and second stages of their abatement plan. The proposed next step in the Stage 2 Abatement Plan Modification is to investigate the land both within and outside of the KAFB boundaries, to determine if, and to what extent the fuel product has migrated outside of KAFB boundaries.

[redacted]

VA PROPERTY





LEGEND

- Existing Groundwater Monitoring Point
- Proposed Initial Monitoring Points
- Potential Locations for Addtional Proposed Monitoring Points
- Drinking Water Production Well
- Kirtland AFB Boundary
- Approximate Groundwater Flow Direction
- Currently Estimated Extent of Fuel

1541850 NM Central State Plane Feet, NAD 83

0 200 400 800 1,200 Feet N

Proposed Locations for Additional Groundwater Monitoring Points

DEPARTMENT OF THE AIR FORCE
377th Civil Engineer Division (AFMC)

SEP 1 1 2008

MEMORANDUM FOR 377 MSG/CEPR

FROM: 377 MSG/CE

SUBJECT: Environmental Baseline Survey (EBS) Waiver for Right of Entry (ROE) to Collect Water Monitoring Samples on New Mexico Veterans Affairs Health Care Systems Property

1. This EBS waiver is accomplished in accordance with (IAW) AFI 32-7066, *Environmental Baseline Surveys in Real Estate Transactions*, to meet real estate transaction requirements. The proposed transaction is to attain a ROE on New Mexico Veterans Affairs Health Care Systems property in order to conduct environmental services and remediation.

2. This ROE would allow Kirtland Air Force Base (AFB) to enter and drill and monitor wells to explore the quality of the groundwater to determine if contaminants from the Kirtland AFB Bulk Fuel Facility release have migrated to and/or have contaminated the groundwater at the subject location. The property includes approximately 11.5 acres of vacant land located adjacent to Kirtland AFB and the City of Albuquerque Bullhead Park.

3. This waiver is being granted in accordance with AFI 32-7066, Section 1.5.3, Issuing entry rights for surveys, inspections, and tests where there will be no introduction of hazardous materials or petroleum products on the property.

4. 377 MSG/CE is signing in accordance with a Delegation of Authority Letter dated 8 April 08 from 377 ABW/CC.

5. If you have any questions or require further information, please contact Dr. Evelyn Watkins, NEPA Program Manager, at 505-846-4377.

D. BRENT WILSON, PE
Base Civil Engineer

Exhibit C

GIBSON MEDICAL CENTER
LICENSE
TO
KIRTLAND AIR FORCE BASE

GIBSON MEDICAL CENTER, hereinafter referred to as the "LICENSOR," as owner of the property located at 5400 Gibson Blvd SE, Albuquerque, NM 87108, hereby grants to the Secretary of the Air Force, by and through the Installation Commander, Kirtland Air Force Base, Albuquerque, New Mexico, hereinafter referred to as the 'LICENSEE," or his authorized representative, a LICENSE upon the following terms and conditions:

1. The LICENSOR hereby grants unto the LICENSEE a license to enter upon the LICENSOR's real property located at 5400 Gibson Blvd SE, Albuquerque, Bernalillo County, New Mexico, which real property is also known as:

SWIFT ADDITION, LOT 1, BERNALILLO COUNTY
&
LOVELACE HOSPITAL, LOT A1 A, BERNALILLO COUNTY

and more specifically identified on the attached general location map, which is attached hereto and incorporated herein as Attachment A, for the express purpose of:

constructing, installing, operating, maintaining, modifying, repairing, replacing and/or removing soil vapor and ground water monitoring wells for the collection of soil and groundwater samples; and collecting quarterly well samples as more fully identified in Attachments B and C, attached hereto and incorporated herein.

2. The LICENSEE shall use the area described above, and as shown in Attachments A and B, for the purposes described above and not for any other purpose without first obtaining the written consent of the LICENSOR and shall adhere to the following use conditions:

a. LICENSEE shall obtain a City of Albuquerque Well Permit for each well by making application to the Development and Building Services Division. One permit may be used for multiple wells, grouped by type of well, by installation priority, by cluster or by location.

b. Ensure that the LICENSEE's Contractor complies with the terms of the well permit Division.

c. Ensure that the LICENSEE's Contractor complies with permitting and environmental health protections requirements of the city of Albuquerque Environmental Health Department, including but not limited to air quality and noise remediation;

d. Restore all well heads to pre-existing grades and restore any surface disturbance created by the well installation process;

e. At each successive License renewal, or upon request, provide the LICENSOR a well status update as set forth in the annual monitoring reports submitted to the New Mexico Environment Department Hazardous Waste Bureau

f. Provide the LICENSOR a 48 hour notice, as set forth in Condition 11 herein, before the Contractor enters the property to conduct sampling.

3. This License shall remain in effect for a period of five (5) years beginning on the date of execution by the PARTIES, with multiple options to renew thereafter, corresponding with, but not to exceed, the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) remediation timetable, which timetable will be attached and incorporated herein as Attachment D when approved by the NMED-HWB, unless revoked as provided herein, or extended by the mutual written consent of both parties.

4. Either Party may revoke this License upon providing written notice to the other party thirty (30) days prior to such revocation.

5. All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the LICENSOR's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within thirty (30) days after the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.

6. Damages and Indemnity. The LICENSEE shall repair or pay for all actual damages done to LICENSOR's property and improvements caused by LICENSEE's operation(s), to include damage caused by vibration during well drilling and installation. All claims for damage to LICENSOR's property and improvements shall be subject to the provisions of the Federal

Tort Claims Act (28 USC §§ 2671 et seq.). To the extent provided by law, the Licensee's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR may have to make a claim for damages under applicable laws.

7. The LICENSEE shall be solely responsible for maintaining the premises upon which the Improvements are being constructed in a safe condition during construction and subsequent well monitoring events.

8. The Licensee will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and incorporated herein as Attachment E, and two Environmental Baseline Surveys (EBS), which are attached hereto and incorporated herein as Attachments F and G. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments E, F and G, the LICENSOR's land will be returned in the same environmental condition as received but without the contamination conditions for which the LICENSEE is performing the remediation.

9. In connection with its use of or any other activity on the property, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.

10. The LICENSEE and its contractors shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.

11. For purposes of giving formal written notice, the points of contact are as follows:

LICENSOR: GIBSON MEDICAL CENTER
2009 EUBANK NE
Albuquerque, NM 87112

LICENSEE: Installation Commander
2000 Wyoming Blvd, SE
Kirtland AFB, NM 87117

12. Claims.
    a. Point of Contact. The Permittee point of contact for all damages, whether to real or personal property, will be submitted to:

    377 ABW/JA
    Attention: Claims Division
    2000 Wyoming Blvd., SE
    Kirtland AFB, NM 87117-5000
    (505) 846-4217
    http://www.kirtland.af. mil/Organizations/StaffJudge/index.htm

    b. Claims Process:
    To file a claim for damage and/or injury due to Permittee's operations, the claimant, or his/her authorized agent, must file a properly signed SF-9S, *Claim for Damage, Injury or Death,* setting forth a sum certain for damage to or loss of property, personal injury or death, to the POC identified in Condition 13(a) above, within two (2) years of the incident causing the damage or injury. The claim form is available at the website provided herein in paragraph a.

13. This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.

14. This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.

15. If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.

16. Index of Attachments

Attachment A - General Location Map
Attachment B - Well Permits as Developed
Attachment C - Sampling Schedule
Attachment D - NMED-HWB Remediation Plan and Timetable
Attachment E - Request for Environmental Impact Analysis (AF Form 813)
Attachment F - Initial Environmental Baseline Survey (EBS)
Attachment G - Final EBS

(SIGNATURES ON FOLLOWING PAGES)

FOR THE GIBSON MEDICAL CENTER

Nadine Martinez-Dasklalos

Nadine Martinez, MBA
Gibson Medical
Property Manager

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

The foregoing instrument was acknowledged before me this 15th day of July, 2016, by Nadine Martinez, Gibson Medical Center Property Manager.

Notary Public

My Commission Expires:
10-19-2019

FOR THE UNITED STATES OF AMERICA

ERIC H. FROEHLICH, Colonel, USAF
Commander

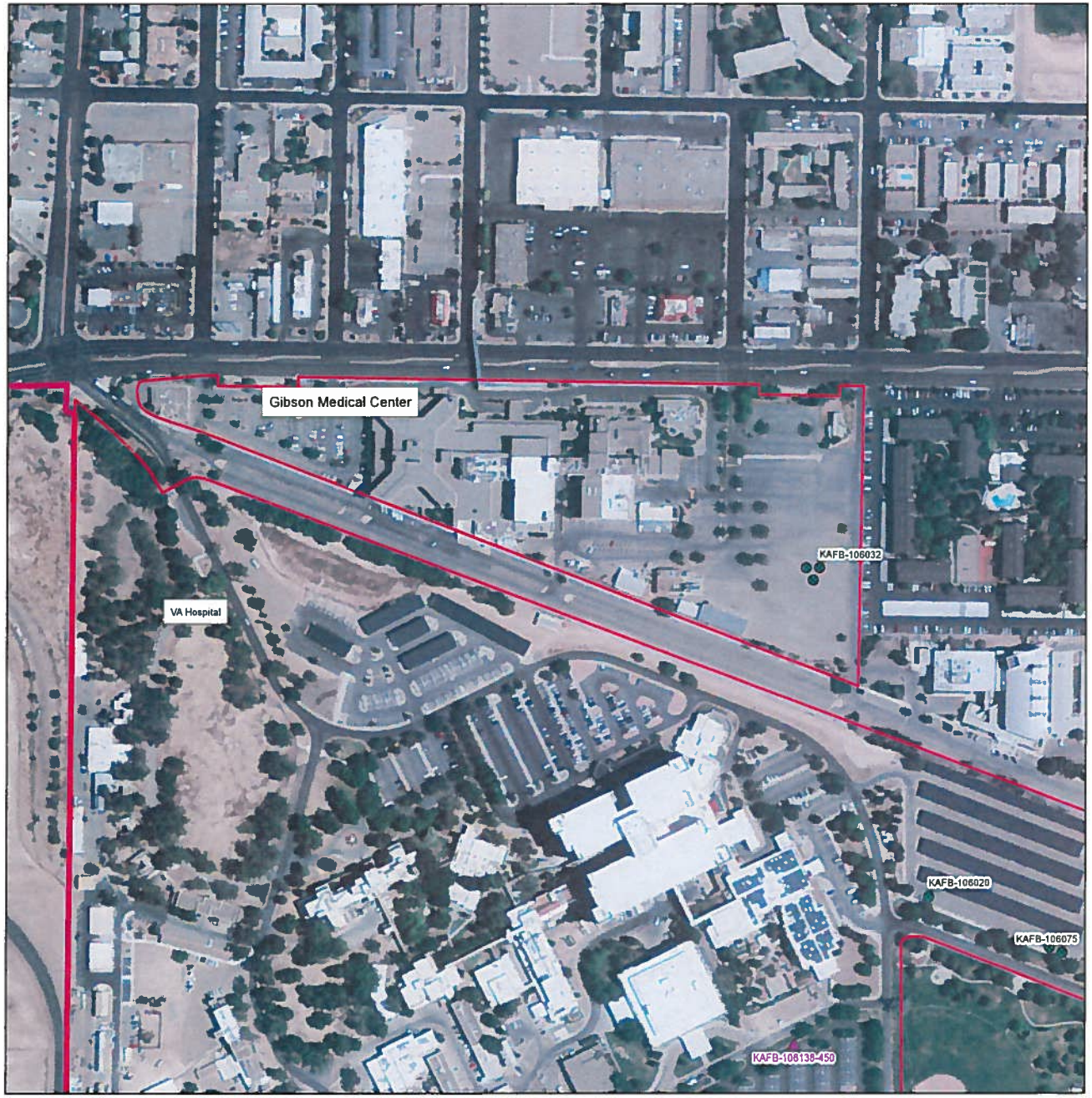
OFFICIAL SEAL
Lori A. Orona
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 2/21/2019

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

The foregoing instrument was acknowledged before me this 17 day of June, 2016, by Eric H. Froehlich, Colonel, USAF, the Commander, 377 ABW, duly authorized to sign on behalf of the United States of America.

Notary Public

My Commission Expires:
2 February 2019



Legend

- Groundwater Monitoring Wells (Off-Base)
- Soil Vapor Monitoring Point (Off-Base)
- KAFB-106211
- USGS Sentinel Well
- Extraction Well
- KAFB-106157 (to be abandoned)
- Parcel Boundaries
- KAFB Base Boundary

Note: Due to the density of wells, not all well labels appear on this figure. Please use with corresponding table for full list of wells.

Off-Base Well Location Map

Bulk Fuels Facility
Kirtland Air Force Base, New Mexico

500 250 0 Attachment A 500 Feet

N

Attachment B

Well Permits as Developed

(To be Attached Upon Approval and Signature by the City of Albuquerque)

Sampling Schedule

Sampling Event	Date of Event*			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Gauging of 3 GMC wells	January	April	July	October
Sampling of 3 GMC wells	January	April	July	October

*Note #1: Teams entering the property will provide a 48 hour notice.
Note #2: Subject to change based on conditions (ie: access schedules, sampling pump deficiencies, water quality, etc).

Attachment D

New Mexico Environmental Department (NMED) - HWB Remediation Plan and Timetable

(To be Attached Upon Completion by NMED)

REQUEST FOR ENVIRONMENTAL IMPACT ANALYSIS

Report Control Symbol RCS: 35- 09-846

INSTRUCTIONS: *Section I to be completed by Proponent; Sections II and III to be completed by Environmental Planning Function. Continue on separate sheets as Necessary, Reference appropriate item numbers.*

SECTION I - PROPONENT INFORMATION

1. TO *(Environmental Planning Function)*	2. FROM *(Proponent organization and functional address symbol)*	2a. Telephone
Department of the Air Force HQ 377th Air Base Wing ATTN: 377 MSG/CEIE	Victoria Branson AFCEC/CZO	505-846-6362

3. TITLE OF PROPOSED ACTION

Bulk Fuels Facility (BFF) restoration project - Renewal License (File 9A-3m, LIC/I-KI-11-0002) to enter Real Property with the Gibson Medical Center, LLC for access to current and future wells to comply with New Mexico Environment Department (NMED) approved Resource Conservation and Recovery Act (RCRA) permit No. NM9570024423 requirements.

4. PURPOSE AND NEED FOR ACTION *(Identify decision to be made and need date)*

See Page 2

5. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES (DOPAA) *(Provide sufficient details for evaluation of the total section.)*

See Page 2

6. PROPONENT APPROVAL *(Name and Grade)*	6a. SIGNATURE	6b. DATE
VICTORIA L BRANSON	Victoria L Branson	2/11/2016

SECTION II PRELIMINARY ENVIRONMENTAL SURVEY. *(Check appropriate box and describe potential environmental effects including cumulative effects.) (+ = positive effect; O = no effect; - = adverse effect; U = unknown effect)*	+	O	-	U
7. AIR INSTALLATION COMPATIBLE USE ZONE/LAND USE *(Noise, accident potential encroachment, etc.)*		X		
8. AIR QUALITY *(Emission, attainment status, state implementation plan, etc.)*		X		
9. WATER RESOURCES *(Quality, quantity, source, etc.)*		X		
10. SAFETY AND OCCUPATIONAL HEALTH *(Asbestos/radiation/chemical exposure, explosives safety quantity-distance, etc.)*		X		
11. HAZARDOUS MATERIALS/WASTE *(Use/storage/generation, solid waste, etc.)*		X		
12. BIOLOGICAL RESOURCES *(Wetlands/floodplains, flora, fauna, etc.*		X		
13. CULTURAL RESOURCES *(Native American burial sites, archeological, historical, etc.)*		X		
14. GEOLOGY AND SOILS *(Topography, minerals, geothermal, Installation Restoration Program, seismicity, etc.)*		X		
15. SOCIOECONOMIC *(Employment/population projections, school and local fiscal impacts, etc.)*		X		
16. OTHER *(Potential impacts not addressed above.)*				

SECTION III - ENVIRONMENTAL ANALYSIS DETERMINATION

17. [X] PROPOSED ACTION QUALIFIES FOR CATEGORICAL EXCLUSION (CATEX) # A2.3.19 ; OR

[ ] PROPOSED ACTION DOES NOT QUALIFY FOR A CATEX, FURTHER ENVIRONMENTAL ANALYSIS IS REQUIRED

18. REMARKS

EBS Wavier Letter required. Visual Site Inspection for EBS Waiver Letter was conducted on 19 Feburary 2016 by Ms. Victoria Branson & Ms. Martha Garcia.

The proposed action will occur in a Carbon Monoxide (CO) maintenance area. However, the Regulatory Authority has approved a CO Limited Maintenance Plan eliminating the need for a General Conformity analyses.

19. ENVIRONMENTAL PLANNING FUNCTION CERTIFICATION *(Name and Grade)*	19a. SIGNATURE	19b. DATE
John S. Pike, GS-14 377 MSG/CEI		20160224

Comments on AF 813

4. Purpose and Need for Action (continued)

In support of the Bulk Fuels Facility remediation project, the 377th Air Base Wing Enviromental Restoration is requesting a Renewal License (File 9A-3m, LIC/I-KI-11-0002) to enter Real Property with the Gibson Medical Center, LLC for access to the area bounded by Gibson Blvd SE, Ridgecrest Dr. SE, and San Pedro Dr. SE to the north, southwest, and east, respectively (see attached Figure 1), to facilitate access to current and future wells. The area requested by Environmental Restoration is for access to perform the requirements dictated by the New Mexico Environment Department (NMED) approved RCRA permit No. NM9570024423.

5. Description of Proposed Action (continued)

The 377th Air Base Wing Enviromental Restoration is requesting a renewal License (File 9A-3m, LIC/I-KI-11-0002) to enter Real Property with the Gibson Medical Center, LLC for access to current wells and the future installation and use of wells associated with the NMED approved RCRA permit No. NM9570024423. The area to be accessed is bounded by Gibson Blvd SE, Ridgecrest Dr. SE, and San Pedro Dr. SE to the north, southwest, and east, respectively (see attached Figure 1). The wells will be secured by locked protective covers or vault lids, and the area will be used during normal business hours.

The DOPAA (alternative) would require the 377th Air Base Wing Enviromental Restoration to not have access to existing and future wells and remediation systems associated with the NMED approved RCRA permit No. NM9570024423. This lack of access would delay the project and limit the extent to which the project could be completed.

Reference Document:

File 9A-3m - LIC/I-KI-11-0002 Gibson Medical Center.

8.1 RECERTIFICATION

I have conducted this Environmental Baseline Survey on behalf of the Air Force. I have reviewed all appropriate records made available, and conducted visual site inspections of the selected facilities following an analysis of information during the record search. The information contained within the survey report is based on records made available and, to the best of my knowledge, is correct and current as of 19 January 2016.

Recertified by: Martha E. Garcia
MARTHA E. GARCIA
NEPA Program Manager

Date: 20 January 2016

Approved by:
GREGORY S. CAPRA, P.E., LEED AP
Base Civil Engineer

Date: 7 Feb 16

Attachment G

Final EBS

(Will be Completed Upon Site Close Out)

LICENSE AGREEMENT
BETWEEN
THE CITY OF ALBUQUERQUE
AND
KIRTLAND AIR FORCE BASE

THIS REVOCABLE LICENSE, made and entered into this ___21nd___day of _September,__ 2016 by and between the City of Albuquerque, New Mexico, a municipal corporation (hereinafter referred to as the "CITY" or "LICENSOR") as LICENSOR and the Secretary of the Air Force, represented by the Installation Commander, Kirtland Air Force Base, located at 2000 Wyoming Boulevard SE, Kirtland Air Force Base, Albuquerque, NM 87117-5663, (hereinafter referred to as "KIRTLAND AFB" or "LICENSEE") as LICENSEE.

WITNESSETH, that in consideration of the mutual obligations and covenants herein, the parties hereto do mutually agree as follows:

1. Subject to the terms and conditions of this License, and as set forth in the Vadose Zone Investigation Work Plan Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 – March 2011 and Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 – March 2011, which are attached hereto and incorporated herein as Attachments A and B, respectively, the final revised plans will be attached and incorporated herein upon approval and signature by New Mexico Environmental Department (NMED), the LICENSOR grants to LICENSEE this License to:

a. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon soil vapor and ground water monitoring wells for the collection of groundwater samples and conducting aquifer tests. Wells are identified as shallow (groundwater surface), intermediate (45 to 60 feet below groundwater surface) and deep (85 to 100 feet below groundwater surface). Existing and currently proposed monitoring wells subject to the terms of this permit are:

Kirtland Bulk Fuels Facility Off-Base Groundwater Monitoring Well Locations[1]

WELL ID	LATITUDE	LONGITUDE	AQUIFER ZONE
KAFB-106004	35° 3' 6.950" N	106° 34' 55.396" W	Shallow
KAFB-106010	35° 3' 10.983" N	106° 34' 38.422" W	Shallow
KAFB-106021	35° 3' 24.053" N	106° 34' 39.241" W	Shallow
KAFB-106022	35° 3' 28.203" N	106° 34' 27.493" W	Shallow
KAFB-106023	35° 3' 20.015" N	106° 34' 23.331" W	Shallow
KAFB-106025	35° 3' 36.107" N	106° 34' 32.215" W	Shallow
KAFB-106026	35° 3' 49.160" N	106° 34' 22.522" W	Shallow
KAFB-106028-510	35° 3' 6.723" N	106° 34' 39.866" W	Shallow
KAFB-106029	35° 3' 33.861" N	106° 34' 39.293" W	Shallow
KAFB-106030	35° 3' 34.151" N	106° 34' 39.277" W	Intermediate
KAFB-106031	35° 3' 34.435" N	106° 34' 39.272" W	Deep
KAFB-106035	35° 3' 27.632" N	106° 34' 24.235" W	Shallow
KAFB-106036	35° 3' 27.638" N	106° 34' 23.943" W	Intermediate
KAFB-106037	35° 3' 27.635" N	106° 34' 23.638" W	Deep
KAFB-106042	35° 3' 42.716" N	106° 34' 24.318" W	Shallow
KAFB-106043	35° 3' 42.581" N	106° 34' 24.532" W	Deep
KAFB-106049	35° 3' 39.887" N	106° 34' 35.451" W	Shallow
KAFB-106050	35° 3' 40.670" N	106° 34' 35.443" W	Intermediate
KAFB-106051	35° 3' 40.327" N	106° 34' 35.445" W	Deep
KAFB-106052	35° 3' 39.769" N	106° 34' 31.480" W	Shallow
KAFB-106053	35° 3' 40.078" N	106° 34' 31.474" W	Intermediate
KAFB-106054	35° 3' 40.851" N	106° 34' 31.460" W	Deep
KAFB-106055	35° 3' 36.160" N	106° 34' 22.812" W	Shallow
KAFB-106057	35° 3' 36.151" N	106° 34' 22.460" W	Intermediate
KAFB-106058	35° 3' 36.059" N	106° 34' 22.073" W	Deep

[1] This list of wells does not include wells drilled on Federal and/or private parcels granted under separate license and/or permit.

KAFB-106065	35° 3' 6.659" N	106° 34' 40.370" W	Intermediate
KAFB-106066	35° 3' 7.162" N	106° 34' 39.872" W	Deep
KAFB-106067	35° 3' 10.559" N	106° 34' 34.926" W	Shallow
KAFB-106068	35° 3' 10.653" N	106° 34' 35.215" W	Deep
KAFB-106069	35° 3' 10.388" N	106° 34' 35.186" W	Intermediate
KAFB-106070	35° 3' 22.682" N	106° 34' 33.181" W	Shallow
KAFB-106071	35° 3' 21.610" N	106° 34' 33.116" W	Deep
KAFB-106072	35° 3' 22.349" N	106° 34' 33.177" W	Intermediate
KAFB-106085	35° 3' 23.072" N	106° 34' 37.108" W	Shallow
KAFB-106086	35° 3' 22.937" N	106° 34' 37.257" W	Intermediate
KAFB-106087	35° 3' 23.262" N	106° 34' 37.266" W	Deep
KAFB-106088	35° 3' 20.928" N	106° 34' 29.104" W	Shallow
KAFB-106089	35° 3' 21.239" N	106° 34' 29.194" W	Intermediate
KAFB-106090	35° 3' 21.515" N	106° 34' 29.258" W	Deep
KAFB-106091	35° 3' 31.328" N	106° 34' 31.769" W	Shallow
KAFB-106092	35° 3' 31.149" N	106° 34' 31.393" W	Intermediate
KAFB-106093	35° 3' 31.447" N	106° 34' 31.390" W	Deep
KAFB-106094	35° 3' 10.477" N	106° 34' 42.518" W	Shallow
KAFB-106095	35° 3' 10.718" N	106° 34' 42.698" W	Intermediate
KAFB-106096	35° 3' 10.449" N	106° 34' 42.876" W	Deep
KAFB-106099	35° 3' 6.888" N	106° 34' 55.682" W	Intermediate
KAFB-106100	35° 3' 6.636" N	106° 34' 55.522" W	Deep
KAFB-106103	35° 3' 20.166" N	106° 34' 23.609" W	Intermediate
KAFB-106104	35° 3' 20.340" N	106° 34' 23.887" W	Deep
KAFB-106105	35° 3' 41.551" N	106° 34' 27.374" W	Intermediate
KAFB-106106	35° 3' 41.797" N	106° 34' 27.352" W	Shallow
KAFB-106107	35° 3' 41.163" N	106° 34' 27.382" W	Deep
KAFB-106204	35° 3' 52.598" N	106° 34' 11.292" W	Shallow
KAFB-106205	35° 3' 53.771" N	106° 34' 11.270" W	Intermediate
KAFB-106206	35° 3' 54.416" N	106° 34' 11.254" W	Deep
KAFB-106207	35° 4' 4.140" N	106° 33' 55.532" W	Shallow

KAFB-106208	35° 4' 4.481" N	106° 33' 55.526" W	Intermediate
KAFB-106209	35° 4' 4.943" N	106° 33' 55.527" W	Deep
KAFB-106213	35° 3' 27.578" N	106° 34' 20.372" W	Shallow
KAFB-106214	35° 3' 27.570" N	106° 34' 20.119" W	Intermediate
KAFB-106215	35° 3' 27.569" N	106° 34' 19.707" W	Deep
KAFB-106216	35° 3' 31.620" N	106° 34' 11.594" W	Shallow
KAFB-106217	35° 3' 31.353" N	106° 34' 11.606" W	Intermediate
KAFB-106218	35° 3' 30.980" N	106° 34' 11.611" W	Deep
KAFB-106219	35° 3' 41.994" N	106° 34' 4.794" W	Shallow
KAFB-106220	35° 3' 41.906" N	106° 34' 5.057" W	Intermediate
KAFB-106221	35° 3' 41.808" N	106° 34' 5.457" W	Deep
KAFB-106222	35° 3' 45.955" N	106° 34' 11.564" W	Shallow
KAFB-106223	35° 3' 44.965" N	106° 34' 11.580" W	Intermediate
KAFB-106224	35° 3' 43.181" N	106° 34' 11.608" W	Deep
KAFB-106225	35° 3' 46.803" N	106° 34' 19.493" W	Shallow
KAFB-106226	35° 3' 45.032" N	106° 34' 19.516" W	Intermediate
KAFB-106227	35° 3' 43.402" N	106° 34' 19.546" W	Deep
KAFB-106230	35° 3' 49.027" N	106° 34' 20.588" W	Intermediate
KAFB-106231	35° 3' 55.595" N	106° 34' 16.057" W	Shallow
KAFB-106232	35° 3' 55.601" N	106° 34' 16.383" W	Intermediate
KAFB-106235	Anderson Ave between Georgia St. and Florida St. (new installation-2016)		Deep
KAFB-106236	California St. South of Anderson Ave (new installation-2016)		Shallow
KAFB-106237	California St. South of Anderson Ave (new installation-2016)		Intermediate
KAFB-106238	California St. South of Anderson Ave (new installation -2016)		Deep
KAFB-106TBD	Pending NMED Requirement		TBD
KAFB-106TBD	Pending NMED Requirement		TBD
KAFB-106TBD	Pending NMED Requirement		TBD

Kirtland Bulk Fuels Facility Off-Base Soil Vapor Monitoring Well Locations[2]

WELL ID	LATITUDE	LONGITUDE	AQUIFER ZONE (depth horizon)
KAFB-106028-150	35° 3' 6.716" N	106° 34' 39.868" W	Vadose (150 ft bgs)
KAFB-106028-250	35° 3' 6.718" N	106° 34' 39.868" W	Vadose (250 ft bgs)
KAFB-106028-350	35° 3' 6.719" N	106° 34' 39.864" W	Vadose (350 ft bgs)
KAFB-106028-450	35° 3' 6.720" N	106° 34' 39.863" W	Vadose (450 ft bgs)

USGS Monitoring Well Locations3[3]

WELL ID	LATITUDE	LONGITUDE	AQUIFER ZONE
Cesar Chavez Shallow Sentinel (1)	35° 03' 59.53" N	106° 33' 51.79" W	Shallow
Cesar Chavez Deep Sentinel (3)	35° 03' 59.48" N	106° 33' 51.79" W	Deep
Cesar Chavez Observation (Temp) (3)	35° 03' 59.27" N	106° 33' 52.22" W	Deep
Cesar Chavez Flow-Logger Well (temp) (1)	35° 03' 59.66" N	106° 33' 52.22" W	Deep
Southern Shallow Sentinel Well (1)	35° 03' 59.58" N	106° 33' 39.23" W	Shallow
Southern Deep Sentinel Wells (3)	35° 03' 59.65" N	106° 33' 39.24" W	Deep
Southern Flow-Logger Well (temp) (3)	35° 03' 59.62" N	106° 33' 40.01" W	Deep
Southern Observation Wells (temp)(1)	35° 03' 58.83" N	106° 33' 40.00" W	Deep

b. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon groundwater extraction wells, and their associated pipeline and infrastructure, to include underground power lines, for the extraction and transport of influent (LNAPL, and/or its various constituents, to include ethylene-di-bromide (EDB)), to the Kirtland AFB groundwater treatment facility for treatment. Existing and currently proposed extraction wells and extraction well pipelines subject to the terms of this permit are:

[2] This list of wells does not include wells drilled on Federal and/or private parcels granted under separate license and/or permit.

[3] This list of USGS wells does not include USGS wells drilled on Federal and/or private parcels by separate license and/or permit.

Extraction Well Locations

WELL ID	LATITUDE	LONGITUDE	AQUIFER ZONE
KAFB-106233	35° 3' 30.906" N	106° 34' 31.391" W	Deep
KAFB-106234	35° 3' 48.991" N	106° 34' 18.709" W	Deep
KAFB - 106239	Ridgecrest Drive east of San Pedro (new installation – 2016)		Deep
KAFB-106240	Georgia St. and Eastern Ave if data suggests it is required (new installation – 2016)		Deep
KAFB-106TBD	Pending NMED Requirement		Deep
KAFB-106TBD	Pending NMED Requirement		Deep

Extraction Pipeline Locations

Extraction Pipeline	Location
Two (2) seventeen hundred foot (1700') long influent extraction pipelines consisting of one (1) seventeen hundred foot (1700') long four inch by eight inch (4"x8") dual containment pipeline and one (1) seventeen hundred foot (1700') long eight inch by twelve inch (8"x12") dual containment pipeline	From extraction well KAFB-106228 east in the City alley to Kirtland AFB
two (2) forty nine hundred foot (4900')long influent extraction pipelines consisting of one (1) forty nine hundred foot (4900') long four inch by eight inch (4x8") dual containment pipeline and one (1) forty nine hundred foot (4900') long eight inch by twelve inch (8"x12") dual containment pipeline.	As depicted in Attachments F and K
Two (2) twenty two hundred foot (2200') long influent extraction pipelines consisting of one (1) twenty two hundred foot (2200') long four inch by eight inch (4"x8") dual containment pipeline and one (1) twenty two hundred foot long (2200') eight inch by twelve inch (8"x12") dual containment pipeline.	(final location selection pending NMED's final selection of two extraction well locations)

c. Respond to and conduct emergency response activities at all current and future monitoring and extraction well locations and extraction well pipeline locations identified herein.

d. Construct, install, operate, maintain, modify, repair, replace, remove, and plug and abandon additional groundwater extraction wells, and their associated pipeline and infrastructure, to include underground power lines additional groundwater monitoring wells, influent extraction wells, and/or influent extraction pipelines required by NMED/HWB to complete the Bulk Fuels Facility fuel plume remediation. All such activity shall occur within the area of investigation described in Condition 1 herein and as more fully depicted in Attachment D herein, such construction and installation being subject to the terms and conditions herein, or as otherwise agreed to by the PARTIES by written agreement and submission of well permits and other drawings, plans and schematics as determined necessary by the City and the City manuals.

e. Coordinate all LICENSOR well location deviation requests with the NMED/HWB.

f. Construct, install, operate, maintain, modify, repair, replace, remove, plug and abandon a core drilling borehole, as more fully depicted in Attachment G herein, for the collection of a continuous core sample extending from a borehole depth of three hundred fifty feet (350') to five hundred feet (500') below ground level. The final core depth will depend upon observed LNAPL concentrations. A second alternate core drilling borehole may be necessary, if the first borehole LNAPL is observed in the first core sample. Specific borehole latitude/longitude location coordinates will be provided upon determination of the final borehole location and engineering specifications will be submitted prior to drilling. If the location of boreholes is within the confines of Bullhead park, the borehole location, core drilling time of year and other logistic considerations must be discussed with Park personnel well in advance of any activity planned for the Park and written approval by the Parks and Recreation Director must be obtained.

Core Drilling Borehole Locations

WELL ID	LATITUDE	LONGITUDE	AQUIFER ZONE
Core Borehole 1	TBD	TBD	Deep
Core Borehole 2 (if needed)	TBD	TBD	Deep

g. Conduct all remediation activities set forth in Clauses 1(a) through 1(f) herein on City property, including rights of ways, within the following general area within the municipal boundaries of the City of Albuquerque and City-owned property in the County of Bernalillo, excluding all City-owned parks except Bullhead Park, Phil Chacon Park and the Veterans Memorial:

Beginning at starting point #100 located at coordinates E1539764.97 N1474552.887, which point is located 610.56 feet S 57-56-34 E of the USGS Monument Hanger at coordinates 1539727.504 1474552.886; thence N 0-30-7 E 2011.624 feet to a point #101; thence N 68-28-49 W 22.557 feet to a point #102; thence N 1-7-56 E 65.504 feet to a point #103; thence N 1-47-38 E 102.451 feet to a point #104; thence N 0-51-35 E 2602.194 feet to a point #105; thence N 1-29-12 W 990.385 feet to a point #106; thence N 1-18-22 E 932.223 feet to a point #107; thence N 0-27-50 E749.859 feet to a point #108; thence S 88-55-28 E5316.566 feet to a point #109; thence N 89-23-49 E 3136.126 feet to a point #110; thence S 89-37-0 E 2356.942 feet to a point #111; thence S 0-49-9 W 1848.795 feet to a point #112; thence S 90-0-0 W 10.337 feet to a point #113; thence S 0-57-13 W 153.937 feet to a point #114; thence N 89-32-15 W 31.865 feet to a point #115; thence S 0-57-40 W 460.914 feet to a point #116; thence S 89-48-22 W 149.943 feet to a point #117; thence S 0-59-55 W 199.934 feet to a point #118; thence S 89-47-15 W 199.934 feet to a point #119; curve R 767.288 feet D 29-56-13 C S 20-12-45 W L to a point #120; thence S 5-44-26 W 1316.071 feet to a point #121; curve R 908.641 feet D 84-40-10 C S 47-27-1 W R to a point #122; thence N 89-6-23 W 133.287 feet to a point #123; thence S 0-59-11 W 131.748 feet to a point #124; thence S 89-57-53 W 61.472 feet to a point #125; thence S 0-3-57 E 19.993 feet to a point #126; thence N 89-55-56 E 9.996 feet to a point #127; thence S 0-4-7 E 2619.911 feet to a point #128; thence S 89-55-53 W 39.985 feet to a point #129; thence N 0-4-6 W 149.662 feet to a point #130; thence N 89-45-44 W 4239.031 feet to a point #131; thence N 0-16-36 E 406.187 feet to a point #132, thence N 89-44-15 W 1003.504 feet to starting point #100;

and as more fully identified in Attachments D and E attached hereto and incorporated herein. Final locations of each well described and shown in the attachments, any changes in location and any future wells determined to be necessary to the investigation and remediation of the fuel plume shall be approved by the LICENSOR, as follows: new or additional sampling wells determined to be necessary during the term of this license that are located within the license agreement area in city right-of-ways need prior approval of the City Environmental Health Department, Environmental Services Division. All wells and construction need to be addressed by amending this License and approval by the City of Albuquerque Chief Administrative Officer. Additionally, all wells must be processed through the Well Permit approval process prior to LICENSEE commencing construction. Final locations of all pipelines described and shown in the attachments, any changes in location and any future wells, extraction pipelines or other infrastructure determined to be necessary to the investigation and remediation of the fuel plume shall be approved by the LICENSOR prior to LICENSEE commencing construction.

2. The LICENSEE shall use the area described in Clause 1(g) herein and as shown in Attachments D and E for the purposes described in Clause 1 herein and not for any other purpose without first obtaining the written consent of the LICENSOR and shall adhere to the following use conditions:

a. As to the underground extraction pipeline, LICENSEE shall:

i. Obtain written preconstruction approval of the location of the pipeline, which written approval will be documented on the underground influent pipeline map attached hereto and incorporated herein as Attachment F;

a. Future Underground Influent Extraction Pipeline Locations:

Reserved.

ii. Conduct all construction, installation, maintenance, operation modification, repair, replacement, removal and abandonment activities to minimize impacts to the LICENSOR's property and minimize construction related noise and dust;

iii. Backfill the pipeline trench immediately and in such a manner as to retard soil subsidence;

iv. Inspect and repair any subsequent subsidence occurring along the length of the pipeline;

v. Coordinate with the City Engineering Department when initiating horizontal drilling under city streets, particularly Louisiana Avenue, for pipeline installation to minimize traffic flow interruptions and damage to the surface of any city street;

vi. Repair immediately all damage to city streets and/or alleys along the entire length of the pipeline;

vii. Provide an as-built schematic to the LICENSOR to eliminate potential damage to the influent extraction pipeline system during any LICENSOR maintenance and/or construction activities, or any other LICENSOR subsurface activities, which schematic shall be attached hereto and incorporated herein as part of Attachment K when construction is completed;

b. Future As Builts Schematic and Cross Sections of Wells and Extraction Pipeline

Reserved

viii. Coordinate all extraction pipeline deviations with the LICENSOR;

ix. Register the influent extraction pipeline with New Mexico One Call to eliminate inadvertent line ruptures or breaks during LICENSOR and/or third party digging or excavation activities; and

x. Remove said influent extraction pipeline upon New Mexico Environment Department's approved closure of the LICENSEE's bulk fuel release remediation.

c. As to the monitoring and extraction well locations, LICENSEE shall:

i. Obtain a City of Albuquerque Well Permit for each well by making application to the Development and Building Services Division. One permit may be used for multiple wells, grouped by type of well, by installation priority, by cluster or by location;

a. Future Well Permits:
Reserved.

ii. Ensure that the LICENSEE's Contractor complies with the terms of all issued well permits and coordinates field activities with the Development and Building Services Division;

iii. Ensure that the LICENSEE's Contractor complies with permitting and traffic/safety control requirements of the City's Department of Municipal Development (DMD), including but not limited to obtaining an excavation and barricade permit at each cluster;

iv. Ensure that the LICENSEE's Contractor complies with permitting and environmental Health protections requirements of the City of Albuquerque Environmental Health Department, including but not limited to air quality and noise remediation;

v. Restore all well heads to pre-existing grades in compliance with City ordinances, codes and guidelines and according to the approved work plans;

vi. Coordinate all well installations within City Parks with the City's Department of Parks and Recreation (Parks) to implement adequate safety control measures prior to and during well drilling and construction activities and to minimize disruption to activities and uses scheduled by Parks;

vii. Revegetate the soil surface immediately consistent with the landscaping specifications contained in the City's Standard Specifications for Public Works Construction, Section 1000 – Landscaping and coordinate all surface restoration with Parks to allow on-site pre-construction field inspections by Parks with the KAFB contractor and a post-construction field inspection by Parks following the restoration activities; and

viii. Ensure LICENSEE's Contractor contacts the Bullhead Park Superintendent and/or park personnel to coordinate all sampling at wells 106028, 106065 and 106066 within Bullhead Park prior to traversing the park with vehicles to conduct the sampling.

ix. Coordinate all monitoring and sampling activity affecting the Cesar Chavez Community Center facility with the facility's site manager to implement adequate safety control measures prior to and during well monitoring and sampling activities to minimize disruption to activities and uses scheduled by Family and Community Services.

x. Restore any surface disturbance created by monitoring and sampling activities at the Cesar Chavez Community Center to its pre-disturbance condition.

xi. Repair or replace any curbing or other vehicular access facility infrastructure affected by monitoring and sampling activities at the Cesar Chavez Community Center to restore it to its pre-disturbance condition.

d. Miscellaneous locations: all ingress, egress and miscellaneous sites disturbed by the LICENSEE during the construction, installation, maintenance, operation, repair and/or removal of wells and underground pipeline shall be returned to pre-construction condition or as mutually agreed by the Parties.

e. Before commencing or resuming any construction and repairs in USS Bullhead Park and/or the Veterans Memorial, LICENSEE shall coordinate with the Director of Parks and Recreation Department to schedule LICENSEE's activities so as to not interfere with activities and uses scheduled by Parks. The decision of the Director of Parks and Recreation as to when LICENSEE's construction and repairs may occur shall be final.

f. In addition to the foregoing, LICENSEE shall, during and after the installation of its remediation infrastructure, ensure that the City property continues to be usable for its intended uses reasonably to the same extent as before the installation of the remediation infrastructure.

3. This License shall remain in effect for a period of ten (10) years beginning on the date of execution by the LICENSEE, with multiple options to renew in five-year increments thereafter, corresponding with, but not to exceed, the New Mexico Environment Department Hazardous Waste Bureau remediation timetable, as set forth in Attachments A through D incorporated above in Clause 1, unless revoked as provided herein, or extended by the mutual written consent of both parties.

4. Either Party may revoke this License upon providing written notice to the other party thirty (30) days prior to such revocation.

5. All tools, equipment, and other property (the "Personal Property") taken upon or placed upon the City's land by the LICENSEE shall remain the property of the LICENSEE and shall be removed within thirty (30) days after the expiration or revocation of this License. In the event that the LICENSEE fails to timely remove the Personal Property the LICENSOR may, at the LICENSOR's election, remove and have stored the Personal Property at the LICENSEE's expense or may elect to retain the Personal Property as LICENSOR's property.

6. Damages.

a. If any action of the LICENSEE's officers, employees, or authorized representatives including contractors and subcontractors) in the exercise of this license results in damage to the Property, or any other property of the LICENSOR or LCENSOR's tenants, including but not limited to water lines, sanitary and storm sewers, and other utilities and services, caused by LICENSEE's Operation(s), to include but not limited to damage caused by vibration during well and pipeline drilling and installation, the LICENSEE will either repair such damage or make an appropriate settlement with the LICENSOR. Upon completion, expiration or termination of this license, LICENSEE shall make all reasonable efforts to restore the Property to its original condition in accordance with section 9. The LICENSEE's liability under this clause may not exceed appropriations available for such payment and nothing contained in this license may be considered as implying that Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this paragraph are without prejudice to any rights the LICENSOR may have to make a claim under applicable laws for any other damages than provided herein.

b. The LICENSEE shall respond to claims repair or pay for all actual damages done to City Property and improvements, or to the improvements of the City's tenants. All claims for damage to adjacent properties caused by LICENSEE's Operations, to include damage caused by vibration during well and pipeline drilling and installation, brought by third parties shall be subject to the claims process set forth in Condition 13 herein and as limited by the provisions of the Federal Tort Claims Act (28 USC §§ 2671 et seq.). To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained

in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this clause are without prejudice to any rights the LICENSOR or any third party may have to make a claim for damages under applicable laws.

7. The LICENSEE shall be solely responsible for maintaining in a safe condition the premises upon which the LICENSEE's remediation operations, to include but not limited to construction of improvements, subsequent well monitoring events effluent pipeline transport from well sites to the LICENSEE groundwater treatment facility, are being conducted and the property of the LICENSOR or LICENSOR's tenants within the premises, including but not limited to water lines, sanitary and storm sewer and other utilities and services. To the extent provided by law, the LICENSEE's liability under this clause is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. Nothing herein is intended to impair any right or immunity under the laws of the State of New Mexico.

8. The hold harmless provisions contained herein shall not apply to any liability, claims, damages, losses or expenses, including reasonable attorney's fees, arising out of bodily injury to persons or damage to property caused by or resulting from, in whole or in part, the negligent act or omission of the City, or the agents or employees of the City. Furthermore, LICENSEE shall require its agents, representatives, contractors or sub-contractors to obtain insurance for the specific protection and benefit of the City, including but not necessarily limited to, the following coverage:

a. Comprehensive General Liability Insurance. Comprehensive general liability insurance with liability limits in an initial amount not less than $1,000,000 aggregate limit of liability for bodily injury, including death, and property damage in any one occurrence.

b. Automobile Liability Insurance. An automobile liability policy with liability limits in amounts not less than $1,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. Said policy of insurance must include coverage for the use of all owned, non-owned, hired automobiles, vehicles and other equipment both on and off work and is in addition to the Comprehensive General Liability Coverage.

c. Workers' Compensation Insurance. Workers' Compensation Insurance for its employees in accordance with the provisions of the Workers' Compensation Act of the State of New Mexico.

d. Owner's Protective Public Liability Insurance. During any period of construction or major renovation, an owner's protective public liability insurance policy with liability limits in an amount not less than $1,000,000 combined single limit of liability for bodily injury, including death and property damage in any one occurrence.

e. Builder's Risk and Property Insurance. During any period of construction or major renovation, until completion of the construction, builder's risk, vandalism and malicious mischief insurance for the value of the property. Alternatively, Contractor shall procure and maintain insurance against loss or damage to the Project by fire, lightning, vandalism, and malicious mischief with the uniform extended coverage endorsement limited only as may be provided in the standard form or extended coverage endorsement at the time in use by the State of New Mexico to provide for not less than 90% recovery of the market value of the buildings and other improvements.

f. Increased Limits. The City may require the LICENSEE's Contractor to reasonably increase the maximum limits of any insurance required herein and LICENSEE's Contractor shall promptly comply.

g. No Subrogation. LICENSEE's Contractor and its surety shall and hereby do waive any right of subrogation they may acquire against the City, its officers, agents and employees by reason of any payment made on account of injury, including death, sustained by any employee of the insured arising out of performance of this Agreement. Neither the LICENSEE's Contractor nor its employees are considered to be employees of the City of Albuquerque for any purpose whatsoever.

h. The LICENSEE's Contractor shall be and is an independent contractor at all times in the performance of this Agreement. Neither the LICENSEE's Contractor nor its employees are entitled to any benefits from the City under the provisions of the Worker's Compensation Act of the State of New Mexico, nor to any of the benefits granted to employees of the City under the provisions of the Merit System Ordinance or any other law or provision, as now enacted or hereafter amended.

i. Proof of Insurance: During the term of this Agreement, not less than once each year, on or before May 31, LICENSEE's Contractor shall provide to the City without demand, or more frequently upon demand, proof of all required insurance coverage. Prior to expiration or exchange of any policy, LICENSEE's Contractor shall furnish the City evidence satisfactory to the City that the policy has been renewed or replaced or is no longer required by this Agreement. All policies required hereunder shall provide that the City shall be given thirty (30) days prior written notice of cancellation, non-renewal or material alteration of coverage. Provisions that the insurance company shall "endeavor to give the City notice" shall not be allowed.

j. Application of Net Proceeds of Insurance. The Net Proceeds of builder's risk insurance and of fire and other hazard and casualty insurance, carried pursuant to the provisions of this Agreement hereof, shall be applied first to the payment of the interests of the City as it may be from time to time, and only after such payment, to the interests of Contractor and others, and otherwise as provided in this Agreement and the Net Proceeds of liability insurance carried pursuant to the provisions of this Agreement hereof shall be applied toward extinguishment or satisfaction of the liability with respect to which such insurance proceeds have been paid.

k. Additional Provisions Respecting Insurance. All insurance required of Contractor pursuant to this Agreement shall be obtained by Contractor from and maintained in generally recognized responsible insurance authorized to do business in the State of New Mexico. All applicable policies evidencing such insurance shall name both the City and Contractor as named insured and the City shall be named as loss payee as to the City's Mortgage under the builder's risk and property insurance required by this Agreement.

9. The LICENSEE will use all reasonable means available to protect the environment and natural resources from damage arising from this License or activities incident to it, to include the removal and disposal of all municipal and hazardous waste generated at all well and infrastructure construction and operation sites in accordance with City of Albuquerque, State and Federal law. Where damage occurs, the Licensee shall be liable and shall restore the damaged resources to the condition existing prior to the implementation of the remediation and monitoring, as documented in the Request for Environmental Impact Analysis (AF Form 813), which is attached hereto and made a part of this License as Attachment H, and two Environmental Baseline Survey (EBS), which are to be attached hereto and made a part of

this License as Attachments I and J when completed. Upon revocation or termination of this License, with the exception of pre-existing conditions identified in Attachments H, I and J herein, the LICENSOR's land will be returned in the same environmental condition as received but without the contamination conditions for which the LICENSEE is performing the remediation.

a. Final EBS

Reserved

10. In connection with its use of or any other activity at the Location, the LICENSEE, its officers, employees, agents, representatives, contractors, and assigns will at all times and in all respects comply with all federal, state and local laws, ordinances and regulations, relating to the protection of the environment, including but not limited to protection of surface water and groundwater; industrial hygiene; the use, handling and disposal of any hazardous or toxic substances; the Clean Air Act, 42 U.S.C. 7401 et seq. applicable state and air quality local laws, and policies and procedures of the City's Environmental Health Air Quality Division.

11. The LICENSEE and its agents, representatives, contractors or sub-contractors shall comply with all other applicable federal, state and local laws, statutes, ordinances and regulations and will not discriminate illegally against any person.

12. For purposes of giving formal written notice, the points of contact are as follows:

For the City: Chief Administrative Officer, City of Albuquerque
City-County Government Center, #1 Civic Plaza
P.O. Box 1293
Albuquerque, NM 87103

For Kirtland: Installation Commander
2000 Wyoming Blvd, SE
Kirtland AFB, NM 87117

13. Claims.

a. Point of Contact. The LICENSEE's point of contact for all damages, whether to real or

personal property, will be submitted to:

377 ABW/JA
Attention: Claims Division
2000 Wyoming Blvd., SE
Building 20604, Room B-36

Kirtland AFB, NM 87117-5000
(505) 846-4217
http://www.claims.jag.af.mil

b. Claims Process. As set forth in License #LIC/I-KI-11-0001 Condition 6, *Damages*, a claim for damage and/or injury due to LICENSEE's operations, a claimant, or his/her authorized agent, must file a properly signed SF-95, *Claim for Damage, Injury, or Death,* setting forth a sum certain for damage to or loss of property, personal injury or death, to the point of contact identified in Condition 7(a) above. The claim form is available at the website provided herein in Condition 7(a) above. To the extent provided by law, the LICENSEE's liability under this Condition 13 is subject to the availability of funds, as set forth in 31 USC § 1341 (Anti-Deficiency Act) and nothing contained in this License may be considered as implying Congress will at a later date appropriate funds sufficient to meet deficiencies. The provisions of this Condition 13 are without prejudice to any rights the LICENSOR or any third party may have to make a claim for damages under applicable laws.

14. Index of Attachments referred to in License, copies of which are on file with LICENSOR

Attachment A – Vadose Zone Investigation Work Plan - Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 – March 2011

Attachment B – Groundwater Investigation Work Plan, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111 – March 2011

Attachment C – Well Permits for wells identified under clauses 1(a) and 1(b) on file with LICENSOR'S City Engineer

Attachment D – General Location Map of License Area

Attachment E – Off Installation Well Location Map 2015

Attachment F – City of Albuquerque Well Locations with LNAPL Containment System

Attachment G – Coring Borehole location map

Attachment H – Requests for Environmental Impact Analysis (AF Form 813) dated 2/17/09 and 3/18/10 (Attachments H-1 and H-2, respectively)

Attachment I – Initial Environmental Baseline Survey (EBS) dated 2/22/11, 3/2/10, 3/3/10, and 2/4/09 (Attachments I-1, I-2, I-3, and I-4, respectively)

Attachment J – Final Environmental Baseline Survey February 2012

Attachment K – As built schematics and cross sections of wells and extraction pipeline (to be attached and incorporated herein when completed)

15. This License contains the entire agreement of the parties. Changes to this License are not binding unless made in writing and signed by both parties.

16. This License is governed by and construed and enforced in accordance with federal law and the laws of New Mexico.

17. If any part of this License is held to be invalid or unenforceable, the remainder of this License will remain valid and enforceable if the remainder of the License is reasonably capable of completion.

SIGNATURES ON FOLLOWING PAGES

CITY OF ALBUQUERQUE
A New Mexico municipal corporation

Robert Perry
Chief Administrative Officer

STATE OF NEW MEXICO)
)ss.
COUNTY OF BERNALILLO)

The foregoing instrument was acknowledged before me this 21 day of Sept, 2016, by Robert Perry, Chief Administrative Officer of the City of Albuquerque, New Mexico, a New Mexico municipal corporation, on behalf of said corporation.

Notary Public

My Commission Expires:
4-4-2017

OFFICIAL SEAL
Giselle M. Alvarez
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 4-4-2017

FOR THE UNITED STATES OF AMERICA

ROBERT E. MORIARTY, P.E.
Director
Installations Directorate

STATE OF TEXAS)
)ss.
COUNTY OF BEXAR)

The foregoing instrument was acknowledged before me this 3rd day of August 2016, by Robert E. Moriarty, P.E., Director, Installations Directorate, Air Force Civil Engineer Center, USAF, duly authorized to sign on behalf of the United States of America.

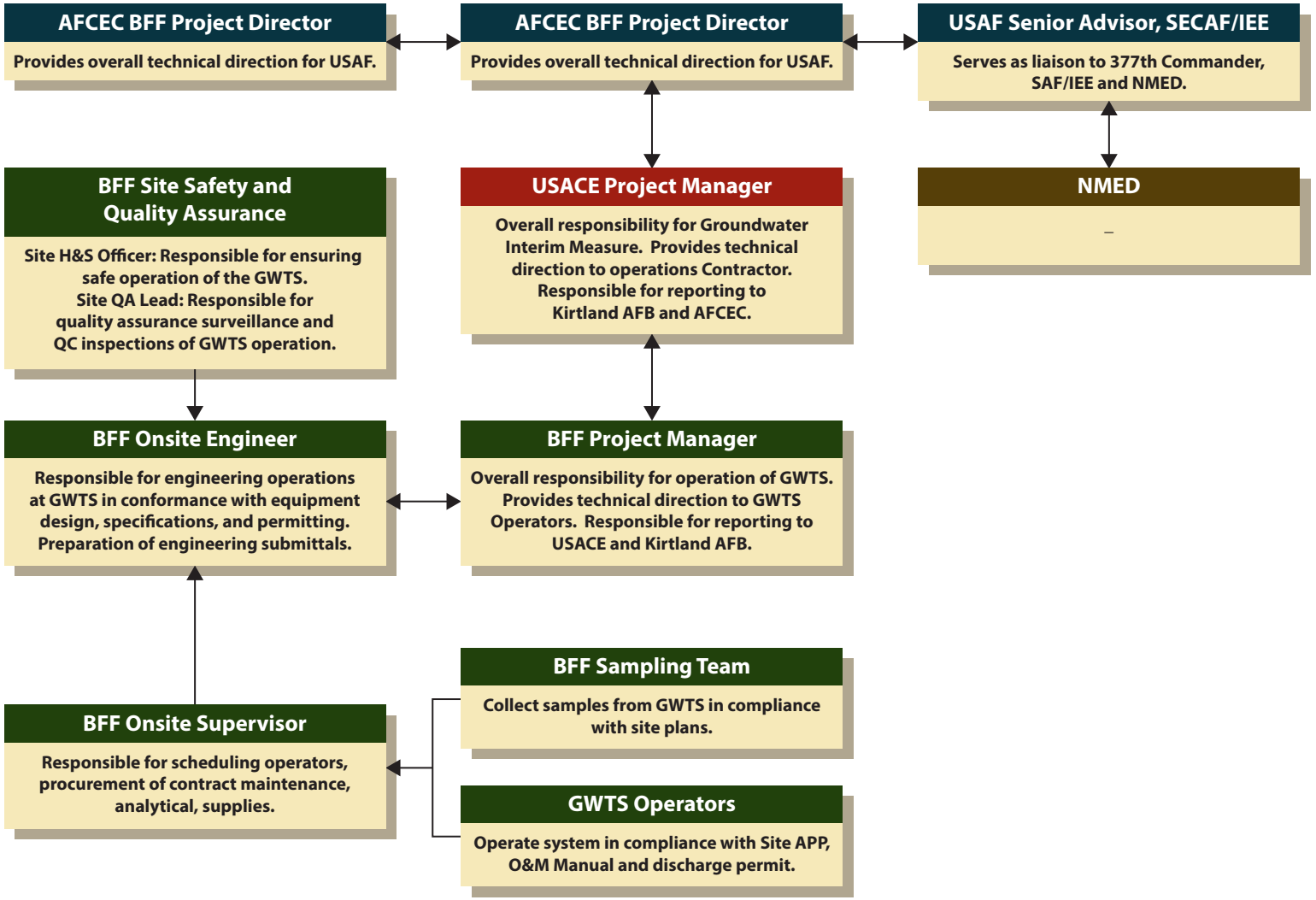
AGUSTIN PERALES
Notary Public, State of Texas
My Commission Expires
February 22, 2019

Notary Public

My Commission Expires:
2/22/2019

APPENDIX B

ORGANIZATION AND RESPONSIBILITIES



P:\Projects\Kirtland\Figures\O&M\AI_FILES\C-1 Groundwater Treatment System Organization Responsibilities.ai

APPENDIX C

DESCRIPTION OF GROUNDWATER TREATMENT SYSTEM EQUIPMENT AND FACILITIES

DESCRIPTION OF GROUNDWATER TREATMENT SYSTEM EQUIPMENT AND FACILITIES

The purpose of this appendix is to familiarize users with basic information regarding the groundwater treatment system (GWTS). Pertinent vendor catalog information and manuals from equipment manufacturers are provided in the equipment binders that will be kept at the GWTS building. The text of this appendix is intended to provide an overview without being overly redundant with the manufacturer's information. A flow diagram and piping and instrumentation diagrams for the GWTS are provided in Appendix D of the Operations and Maintenance Plan.

C.1 Groundwater Extraction Wells, Pumps, and Conveyance Lines

The extraction system consists of four extraction wells (KAFB-106228, KAFB-106233, KAFB-106234, and KAFB-106239), one well control house (WCH), and approximately 3 miles of double-wall piping to convey the extracted groundwater to the GWTS. As shown on the flow sheet in Appendix D, the well pumps are P-101, P-102, P-103, and P-104 for the four wells.

The wellhead for each well is enclosed in a below grade, reinforced concrete well vault. The vaults house the piping that connects the well pump outlet to the double-wall pipelines that carry the contaminated groundwater to the GWTS. The conveyance lines are fitted with leak-monitoring devices (conductivity switches) in the annular space between the inner and outer walls of the double-wall pipe. Water sensors are also located in each well vault.

C.1.1 KAFB-106228

KAFB-106228 is located in the parking lot of Christ United Methodist Church at 6200 Gibson Boulevard Southeast. The extraction well is 8 inches in diameter and screened from 440 to 540 feet below ground surface (bgs). The well is equipped with a well pump (P-101), which is a 30-horsepower (Hp), 16-stage submersible centrifugal pump (480-volt, three-phase) capable of pumping a nominal flow rate up to 180 gallons per minute (gpm). Flow rate is controlled by manually adjusting the inline valve at the wellhead. P-101 is set 52.51 feet above the bottom of the well screen.

Electrical power for KAFB-106228 is supplied by a nearby Public Service Company of New Mexico pole-top three-phase transformer that feeds 480-volt, three-phase power routed a short distance overhead to an above grade rack. The rack is located on Christ United Methodist Church property and is installed in an enclosed shed. The rack secures a 200-ampere line disconnect switch, service meter (provided by Public Service Company of New Mexico), and service entrance disconnect. The shed and panels are always locked. Power from the service disconnect breaker feeds the well pump motor starter and a small power center for 120-volt devices. The well pump and flow control valve are automated by the main control panel in the GWTS building. Control wiring for the well pump and other well instrumentation is installed in a conduit alongside the pipeline from the wellhead to the treatment plant. All controls are fed to the main control panel in the GWTS building.

For KAFB-106228, the groundwater flowmeter and a motor-actuated control valve are installed in the well vault for KAFB-106228. These instruments can be used to regulate the groundwater extraction rate. The low profile, lockable well vault is concrete-constructed with an H-20 traffic-rated cover and flush-mounted with the existing grade.

The conveyance line from this well is a 4-inch inner × 8-inch outer diameter double-wall, high density polyethylene (HDPE) pipe. The inner wall is DR-11, while the outer wall is DR-17. The pipeline runs

from the well vault under an unnamed alley that runs parallel to and just south of Gibson Boulevard. It crosses underneath Louisiana Boulevard onto Kirtland Air Force Base property and turns south to the valve vault. The valve vault is similar to the well vault and was installed initially to provide a connection to the former temporary treatment system. The conveyance line then runs south and southeast to the GWTS building. Air/vacuum relief valves and leak detection are installed in both the wellhead vault and valve vault. Leak detection switches are installed in the annular space between the inner and outer walls of the double-wall pipe. These switches are installed in a flange on the end of the pipeline that is located in the wellhead vault.

C.1.2 KAFB-106233 and KAFB-106234

KAFB-106233 is located at the end of California Street Southeast near its intersection with Gibson Boulevard. The extraction well is 8 inches in diameter and is screened from 430 to 532 feet bgs. The well is equipped with a well pump (P-102), which is a 40-Hp, 22-stage submersible centrifugal pump (480-volt, three-phase) that is designed to pump up to 180 gpm of groundwater. Flow rate is controlled by manually adjusting the inline valve at the WCH. P-102 is set 15 feet above the bottom of the well screen.

KAFB-106234 is located at the southeast corner of the intersection of Anderson Avenue and Georgia Avenue. The extraction well is 8 inches in diameter and screened from 439.6 to 539.6 feet bgs. The well is equipped with a well pump (P-103), which is a 40-Hp, 22-stage submersible centrifugal pump (480-volt, three-phase) that is designed to pump up to 180 gpm of groundwater. Flow rate is controlled by manually adjusting the inline valve at the WCH. P-103 intake is set at 46 feet bgs above the bottom of the well screen.

Electrical power for KAFB-106233 and KAFB-106234 is supplied from the WCH through a 480-volt power cable installed in conduit buried alongside the groundwater pipeline from the wellhead to the GWTS. Signal wiring for the well level and leak detection is installed in a parallel conduit. All signals are connected to a panel in the WCH and transmitted by telemetry to the main control panel in the GWTS building.

The conveyance lines for wells KAFB-106233 and KAFB-106234 to the WCH are double-wall 4- × 8-inch HDPE pipe as was used for well KAFB-106228. Each pipe is sloped toward the well vault to ensure that any internal leaks will activate the leak detection sensor in the secondary containment pipe. The conveyance line for KAFB-106233 runs from the well vault north under California Street, east under an alley, and turns north under the alley that runs between California Street and Dakota Street. The conveyance line turns east under Eastern Avenue, crosses under Louisiana Boulevard to the New Mexico Veterans Memorial, where it turns southeast toward the WCH and onto Kirtland Air Force Base property. The conveyance for KAFB-106234 runs from the well vault east under Anderson Avenue and turns south under the alley that runs between Georgia Street and Indiana Street to Eastern Avenue. From there, it runs parallel to the line for well KAFB-106233.

The conveyance lines from KAFB-106233 and KAFB-106234 both go through a valve vault that is located under Eastern Avenue, where it intersects the alley between Georgia Street and Indiana Street. Air/vacuum relief valves are installed on both pipelines in this vault. Leak detection switches are also installed in this vault. Air/vacuum relief valves and a pressure relief valve are also installed in the wellhead vault for both pipelines.

C.1.3 KAFB-106239

KAFB-106239 is located at the southeast corner of the intersection of Ridgecrest Drive and San Pedro Drive. This extraction well is 8 inches in diameter and screened from 470 to 527.7 feet bgs. The well is equipped with a 25-Hp pump (P-104) submersible centrifugal pump (480-volt, three-phase) that is designed to pump 75 gpm of groundwater. Flow rate is controlled by a variable frequency drive housed at the nearby electrical rack. P-104 is set 81.32 feet above the bottom of the well screen.

Electrical power for KAFB-106239 is supplied from on-Base through a 480-volt power cable installed in a concrete encased conduit buried alongside the groundwater pipeline from the Base to the electrical rack in the Veterans Affairs parking lot then to the well head. A 12-strand fiber optic cable is installed in a parallel conduit. All signal and electrical wires coming from the wellhead are connected to the control panel on the electrical rack in the Veterans Affairs parking lot.

The conveyance line for KAFB-106239 runs from the well vault to a junction vault on-Base with the KAFB-106228 existing conveyance line; the entirety of the conveyance line is composed of double-wall 4- × 8-inch HDPE pipe. This section of pipe is equipped with continuous leak detection within an annular space of the dual wall conveyance line running from the well vault to the junction vault. The conveyance line runs from the well vault east along the southern edge of Ridgecrest Drive. The conveyance line crosses Ridgecrest Drive just east (approximately 150 feet) of the intersection of Kentucky Street and Ridgecrest Drive. The conveyance line then proceeds along the north side of Ridgecrest Drive under Kentucky Street and Louisiana Boulevard and onto the Base where it ties into the existing KAFB-106228 conveyance line just northeast of the intersection of Ridgecrest Drive and Perimeter Circle. The conveyance line junction is contained in a junction vault equipped with a leak detection sensor.

C.2 Well Control House for KAFB-106233 and KAFB-106234

The WCH is located on Kirtland Air Force Base as Building 19160. This insulated steel-stud building with a stucco exterior is located at the closest point from Kirtland Air Force Base property to the extraction wells. The building is heated and cooled to protect equipment within. The building has a concrete slab floor with a curb for leak containment. The pipelines from KAFB-106233 and KAFB-106234 terminate into a piping manifold in the WCH that includes the sample points, flowmeters, and control valves for both wells. The piping manifold then combines the groundwater flow from the two wells and connects to an 8- × 12-inch diameter double-wall HDPE pipeline that runs from the WCH to the GWTS building. Leak detection switches for the containment annulus are located in the WCH. Additional pressure gauges are installed on the outer wall of the influent pipes from KAFB-106233 and KAFB-106234. While the well pumps are running, these gauges will show if there has been a breach in the inner wall pipe. Power to the WCH is supplied from a nearby underground 12,740-volt power service connected to a pad-mounted transformer that supplies 480-volt power to an electrical service rack that includes the reduced voltage (soft-start) motor starters for the well pumps and feeds the power cable that runs out to the pumps. The signal cables from the well and valve vaults terminate at a control panel in the WCH that communicates with the GWTS main control system by radio telemetry.

C.3 Groundwater Treatment System Building

The GWTS building is a single-story, free-standing 4,160-square foot (52 × 80 feet), non-sprinkler equipped structure. The building has a covered (16 × 80 feet) truck-loading/unloading bay and a control room (12 × 12 feet) attached to the side of the main structure. The main control programmable logic controller (PLC) for the GWTS is installed in this control room. The PLC integrates all controls for the

four operating extraction wells, the GWTS, and discharge to the Tijeras Arroyo golf course main pond (GCMP) and injection well KAFB-7.

The building is constructed of conventional reinforced concrete masonry block walls supporting a steel bar joist roof. The floor slab is constructed as a reinforced concrete slab-on-grade with isolated spread footings provided as necessary to support the carbon beds and water tanks. The slab is designed to accommodate vehicle and/or fork-truck traffic/loading as well as loading from miscellaneous totes and equipment. A curb integral to the wall of the building is sealed to act as secondary containment. The containment is able to hold the liquid volume of the largest vessel in the facility if a pipe/tank should rupture. Stormwater runoff from the building, and surrounding drive and parking area, is diverted to a small run-off swale that, during heavy rain events, overflows to the street. The building includes an attached open-air truck-loading/unloading bay that is covered with a roof structure. The truck bay includes a concrete apron that slopes to a containment trench designed to capture approximately 5,000 gallons of water.

The building is heated to 50 degrees Fahrenheit and ventilated with exhaust fans. The heating system will prevent freezing of pipelines, and the location of control/electrical equipment is acceptable for proper electrical component operation. Additional utilities include a 6-inch-diameter non-potable water connection from the Kirtland Air Force Base water distribution system. This line supplies a 2-inch line inside the building that is used for general washdown and carbon changeout operations. A hose bib (hydrant-style connector) is installed outside the building in the truck bay, which allows for ease of slurrying granular activated carbon during changeout.

A 480-volt, three-phase service is supplied by tapping into the existing 12,470-volt service line at Pennsylvania Avenue and Ridgecrest Street. An underground service line from a sectionalizer at Walker Street feeds a 500-kilovolt-ampere transformer located east of the GWTS building. Underground cable connects the transformer to the main disconnect panel in the GWTS building. The electrical service panel in the building contains distribution equipment for the building and for both trains of the GWTS. The control room also contains the main GWTS PLC and supervisory control and data acquisition (SCADA) system.

The GWTS is designed and instrumented to efficiently operate 24 hours per day with minimal Operator attention needed. The system is monitored and controlled by a PLC-based system that includes radio telemetry and web access to alert operators to off-hour upset conditions and allow them to monitor the system. The GWTS includes two parallel treatment trains. The process flow diagram and piping and instrumentation diagrams for the GWTS are provided in Appendix D. The components of the GWTS are described in the following sections.

C.4 Pre-Treatment

The GWTS feed tanks (TK-110 and TK-210) are 6,000-gallon storage tanks that currently receive untreated water from the three well pumps. They are flat-bottomed tanks constructed of epoxy-coated carbon steel, 10 feet in diameter × 11 feet tall. The treated water storage tanks (TK-116 and TK-216) are identical to the feed tanks. All tanks are fitted with level switches and level indication instruments. All tanks are vented into the GWTS building through screened vent caps. Additional details on the tanks are provided in Appendix I.

Immediately upstream of the feed tanks, injectors are tapped into the influent lines. These injectors are linked to dosing pumps that are used to provide sodium hypochlorite into the influent water (3 gallons per day resulting in a chlorine residual of 0.3 parts per million). The sodium hypochlorite is a reagent used

by the sand filters to removed dissolved metals (explained later in this section). The units provide a storage capacity of 15 gallons (5-day capacity).

The sodium hypochlorite used in this process is generated with a MIOX H Vault 25. The cabinet is 64 inches tall × 36 inches wide × 17.13 inches deep. Operations are controlled through a PLC on the front face. Sodium hypochlorite is generated within the cabinet through a 30-volt direct current electrolytic cell that converts dilute brine solution into a <1 percent sodium hypochlorite solution. The sodium hypochlorite solution is pumped from the MIOX cabinet and stored in a 90-gallon linear low-density polyethylene (LLDPE) tank that sits on a secondary containment pallet. Solution from this tank is pumped by the dosing pumps and through the injectors. The brine solution used in the electrolytic conversion is generated in a 200-gallon polyethylene tank where food grade salt is dissolved with softened water and is pumped from the tank into the MIOX cabinet.

The feed pumps (P-112 A/B and P212 A/B) are identical centrifugal pumps sized to process 200 gpm per pump when operated in tandem. Two feed pumps are required per train and supply influent water to the sand filters, pre-treatment bag filters, and carbon beds. Having two smaller pumps provides a backup for when the system is operating at less than 200 gpm capacity (per train). The pumps are horizontal, American National Standards Institute style pumps (Goulds 3196 MTI 2x3-6) with stainless steel wetted parts and mechanical seals. The pumps have 15-Hp motors and are rated for 100 feet of total discharge head. The feed pumps and the pre-treatment bag filters were supplied by Fliteway as a pre-piped, skid-mounted system that includes flowmeters and other instruments. The flow from each pump is controlled by a separate variable frequency drive controlling the pump speed. The flowmeter on the skid (FIT-3102) is a magnetic flow metering device.

Sand filters are installed on both treatment trains to remove suspended solids, biological materials, and dissolved metals from the influent water. The sand filter skid consists of two sand filter housings per influent skid. Each filter skid is installed with a bypass line, backwash line, controller, and copper piping to the GWTS air compressor to perform a manually initiated 4-minute backwashing cycle when sand filter differential pressure exceeds 10 pounds per square inch from clean filter operational pressure differential. The sand filters are designed to be backwashed at 239 gpm. Water is pumped to the prefilters for the granular activated carbon following pre-treatment.

The sand filter backwash water is discharged to a 40-yard roll-off clarifier located outside of the GWTS above the truck bay sump. This clarifier is designed to contain a maximum of 8,000 gallons (approximately 8 backwash cycles). The clarifier is fitted with a high-level sensor that alarms the Operator that the clarifier requires draining. A drain line installed at the clarifier's last chamber automatically drains the clarifier into the internal sump of the GWTS. If the clarifier requires manual draining, a pump and hose assembly is inserted into the clarifier and drained to the GWTS internal sump. If needed, the tube media may be removed and solids vacuumed from the clarifier via a vacuum truck once the clarifier has been drained. Any removed solids will be properly characterized and disposed of at a permitted facility.

The pre-filters for the carbon beds (F-112 A/B) are two bag-filter housings piped in parallel. Each housing holds six, 30- × 6-inch diameter filter bags rated at nominal 10-micron filtration. The filter housings are epoxy-coated carbon steel with stainless steel baskets. A davit support for the filter housing lid is provided for supporting the lid during filter bag changeout. The post-filters have an identical setup. Additional information on the pump-filter skids is included in the Fliteway Operations and Maintenance Manual.

C.5 Carbon Filtration

The two carbon vessels (V-114 A/B) are 10 feet in diameter, and each can be loaded with 20,000 pounds of activated carbon. They are constructed of epoxy-lined carbon steel and fitted with a common valve manifold that allows either bed to operate in the lead/lag position. The valve manifold also allows for backwashing of the carbon beds and allows operation of only one bed online, if desired. The valves on the manifold are gear-driven 8-inch butterfly valves. The valve position (open/closed) for different operating modes is provided in the TIGG Operations and Maintenance Manual and are also shown in Appendix I. Since the GWTS may be operated at less than its design capacity, the groundwater flow distributors on the carbon beds are designed to minimize channeling at low flow rates. Flow distributors and other internals in the carbon vessels are constructed of stainless steel. The carbon vessels are American Society of Mechanical Engineers-code vessels rated for 125 pounds per square inch gauge. Additional information on the carbon adsorbers is included in the TIGG Operations and Maintenance Manual provided in Appendix I. Each vessel is loaded with 20,000 pounds of TIGG 5DC 12-40 NSF-grade carbon. The size range for the carbon is 12-40 mesh.

The discharge pumps (P-118) are each rated for 400 gpm. These pumps are horizontal American National Standards Institute-style centrifugal type pumps (Goulds 3196 MTI 3x4-10H) with stainless steel wetted parts and a mechanical seal. The pumps have 20-Hp motors and are rated for 400 gpm at 80 feet of total discharge head. The discharge pump skids have similar instrumentation as the feed pump skids. A skid-mounted variable frequency drive controls the pump speed and thereby the discharge flowrate. The flowmeters on the skids (FIT-3108, FIT-3208) are magnetic flow metering devices. The post-filters (F-118 A/B, F-218 A/B) are identical to the pre-filters. Additional information on the pump-filter skids is included in the Fliteway Operations and Maintenance Manual.

C.6 Treated Water Discharge

Treated water from the GWTS is pumped through almost 2 miles of below grade, 12-inch single-wall HDPE discharge line to a tee connection installed on an existing base pipeline that connects well KAFB-7 to the GCMP. Five valve vaults are installed at roughly 2,000-foot intervals along the discharge line that house air/vacuum relief valves. The existing KAFB-7-to-GCMP pipeline includes both 14-inch polyvinyl chloride pipe and 12-inch HDPE pipe. The section where the tee connects the treated water pipeline to the KAFB-7 line is 12-inch HDPE. As shown on the piping and instrumentation diagrams, there are two manual, post-indicator valves, one each on either side of the tee, that have been installed on the GCMP/KAFB-7 line. These valves allow the operators to direct the treated water to either the GCMP or to KAFB-7 by opening one valve and closing the other. Additional injection wells are planned for the system to provide additional options for water discharge. Currently one injection well, KAFB-106-IN2 (see Figure 1-1 in the report for the proposed location) is planned to be added in 2020. Treated water will also be diverted to proposed underground injection control well KAFB-106IN2 once it is brought on-line.

C.6.1 Tijeras Arroyo Golf Course Main Pond

Discharge to the GCMP does not require a New Mexico Environment Department (NMED) discharge permit (NMED, 2016), but must meet the requirements of Hazardous Waste Treatment Facility Permit Number NM9570024423 (NMED, 2010). Directing effluent to the GCMP is a manual operation at the post-indicator valves. The GWTS staff will manually drive to switch the position of the pipeline valves as necessary (GCMP valve open, KAFB-7 valve shut). GCMP level is reported on the SCADA system and a high-level switch at the pond will shut down the GWTS to prevent overfilling of the pond. The signal from the high-level switch is transmitted to the GWTS control system by radio telemetry.

C.6.2 KAFB-7

KAFB-7 is located within the bounds of Section 6 of T9N, R4E and was originally used as a drinking water well but was taken out of this service and adapted for use as an extraction well due to high nitrates in the groundwater at this location. During its operation as an extraction well, KAFB-7 discharged water to the GCMP that was used to irrigate the golf course. KAFB-7 has since been converted to a Class V injection well for discharge of the treated groundwater, and the discharge to the well is governed by Underground Injection Control permit DP-1839 (NMED, 2017). The line-shaft well pump was removed from the well, and a 4-inch-diameter drop pipe was installed in its place. After the downhole control valve (V-smart valve) was determined to be malfunctioning due to a hydraulic line failure, the control valve and all components associated with the valve, including the 4-inch drop pipe, were removed, and were replaced with 6-inch Schedule 50 low-carbon black steel, installed to approximately 539 feet bgs. The drop pipe was retained for future re-use and is stored at the KAFB-7 site. A replacement flow control valve will be installed in a future phase of work (ORCOM, 2019). A level transducer in the well sends water level in the well to the GWTS PLC. A control panel in the KAFB-7 WCH communicates with the PLC by radio telemetry.

C.6.3 KAFB-106IN2

The Class V UIC well will be connected to the 12-in. inner diameter high-density polyethylene GWTS effluent pipeline via 6-in. inner diameter carbon steel or high-density polyethylene pipe once it is in operation. Figure 1-1 of the report provides an approximate location of the GWTS tie-in line. A 12-in. tee connected to a 12- × 6-in. reducer will be placed within the GWTS effluent pipeline. One gate valve will be placed a minimum of 10 ft upstream of the tee. The gate valve will meet American Water Works Association standard C509 or C515.

The 6-in. pipeline to the UIC well will be placed approximately 4 ft bgs. The pipeline will surface near the UIC well and extend to approximately 3 ft above ground surface to accommodate additional valves, equipment, and instrumentation. The equipment will include air relief valves, sample port, magnetic totalizing flowmeter, pressure transmitters, and ball valve with electronic actuator. Aboveground piping and equipment will be protected from freezing weather conditions with heat tape and insulation.

C.6.4 Dust Suppression

On the treated water discharge line, between the post-treatment bag filters and the underground effluent pipeline leaving the building, there are two actuated valves that can be used to deliver water to the truck bay via a 2-inch steel pipe. The pipe is equipped with a mechanical totalizing flowmeter and the valves are controlled by the GWTS PLC to divert water to the external line hookup for dust suppression. At this time, dust-suppression valve operation has been locked out to access.

A GEI Works Express 500-gallon water trailer was purchased, and is held in the GWTS yard, to carry out dust suppression. As a Government-owned property, proper documentation for acquisition and maintenance must be reported to the Government in accordance with contract requirements.

References

New Mexico Environment Department (NMED). 2010. Hazardous Waste Treatment Facility Operating Permit, EPA ID Number NM9570024423, issued to U.S. Air Force for the Open Detonation Unit

Located at Kirtland Air Force Base, Bernalillo County, New Mexico, by the New Mexico Environment Department Hazardous Waste Bureau. July.

NMED. 2016. DP-1770 Modification Application and Termination, New Mexico Environment Department, Ground Water Quality Bureau. April.

NMED. 2017. Discharge Permit Issuance DP-1839, Kirtland Air Force Base, Bernalillo County, New Mexico, New Mexico Environment Department, Ground Water Quality Bureau. April.

ORCOM. 2019. KAFB-7 Injection System Repair and Improvement, Bulk Fuels Facility Report, Kirtland Air Force Base, New Mexico. May.

APPENDIX D

Process Drawings and Groundwater Treatment System Equipment/Instrument Location Pictures

P&IDs

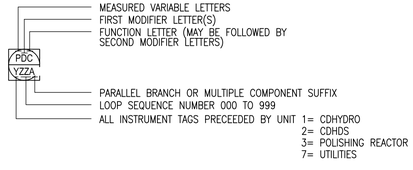
IDENTIFICATION LETTERS

	FIRST–LETTER		SUCCEEDING–LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE			CONTROL	CLOSE, CLOSED
D	USER'S CHOICE	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO, FRACTION			
G	USER'S CHOICE		GLASS, VIEWING DEVICE, GAUGE		
H	HAND	HAND			HIGH
I	CURRENT (ELECTRICAL)		INDICATE (ANALOG)		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT, STATUS		LOW, LIGHT, STATUS
M	USER'S CHOICE	MOMENTARY			MIDDLE,INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY, HEAT	INTEGRATE, TOTALIZE			
R	RADIATION, RESTRICTION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	MULTIFUNCTION
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT, SOLENOID	
Z	POSITION, DIMENSION	Z AXIS, POSITION, DIMENSION	POSITION, DIMENSION	DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

SPECIAL ABBREVIATIONS

APC – ADVANCED PROCESS CONTROL
ATM – ATMOSPHERE
CEMS – CONTINUOUS EMISSION MONITORING SYSTEMS
CO – CARBON MONOXIDE
D/P – DIFFERENTIAL PRESSURE
PCS – PROCESS CONTROL SYSTEM
DEEN – DEENERGIZE
DISP – DISPLACEMENT
EN – ENERGIZE
FF – FOUNDATION FIELD BUS
FG – SIGHT GLASS
FGPLC – FIRE AND GAS DETECTION PLC
FO – FLOW ORIFICE
GC – GAS CHROMATOGRAPH
GWR – GUIDED WAVE RADAR
H2 – HYDROGEN
H2S – HYDROGEN SULFIDE
HOA – HAND SELECTOR SWITCH (HAND–OFF–AUTO)
HSL – SWITCH(ES) AND LIGHT(S)
INT – INTERFACE
MAG – MAGNETIC
MMS – MACHINERY MONITORING SYSTEM
NOX – NITROUS OXIDE
O2 – OXYGEN GAS
PLC – PROGRAMMABLE LOGIC CONTROLLER
PP – PRESSURE SENSING POINT
PSE – RUPTURE DISK
PSV – PRESSURE OR VACUUM SAFETY RELIEF VALVE
PVSV – PRESSURE–VACUUM SAFETY RELIEF VALVE
RO – RESTRICTION ORIFICE
RTD – RESISTANCE TEMPERATURE DETECTOR
SIS – SAFETY INSTRUMENTED SYSTEM
TJI – MULTIPOINT TEMPERATURE INDICATOR (NON DCS)
TJR – MULTIPOINT TEMPERATURE RECORDER (NON DCS)
TJT – MULTIPOINT TEMPERATURE TRANSMITTER
TW – THERMOWELL OR TEST WELL
UK – PANEL, CONSOLE, OR RACK
XE – FLAME ARRESTOR
XV – SPECIAL VALVES NOT PART OF A MEASURED VARIABLE LOOP–eg ON–OFF VALVES, MOTOR OPERATED VALVES, IN–LINE SOLENOID VALVES, EXCESS FLOW VALVES

TYPICAL TAG NUMBER FORMAT



DCS SUB–FUNCTION



* SYMBOLS FOR DCS SUB–FUNCTIONS
D – DEVIATION ALARM
HH – HIGH–HIGH ALARM
H – HIGH ALARM
L – LOW ALARM
LL – LOW–LOW ALARM
Mo3 – MIDDLE OF THREE

SIGNAL TYPES

OP – OUTPUT
PV – PROCESS VARIABLE
SP – SETPOINT

INSTRUMENT LINE DESIGNATIONS

INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
PNEUMATIC SIGNAL
ELECTRIC SIGNAL
HYDRAULIC SIGNAL
IA INSTRUMENT AIR
CAPILLARY TUBE
ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
INTERNAL SYSTEM LINK
MECHANICAL LINK
INSTRUMENT PURGE (**) PURGE MEDIUM (SERVICE ABBREVIATION) SEE "INSTRUMENT PURGE DETAIL"

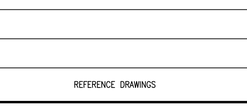
INSTRUMENT SYMBOL IDENTIFICATION & REPRESENTATION

LOCAL INSTRUMENT OR FUNCTION ONLY
INSTRUMENT ON PANEL OR HARD CONSOLE IN CONTROL ROOM
INSTRUMENT ON RACK OR REAR OF PANEL IN CONTROL ROOM
INSTRUMENT ON LOCAL PANEL
INSTRUMENT ON REAR LOCAL PANEL
SIS UCXX — SIS INTERLOCK
XX= INTERLOCK NUMBER
FGS UCXX — FGS MONITORING
XX= INTERLOCK/LOGIC NUMBER
DISPLAY PROCESS CONTROL SYSTEM (PCS) FUNCTION IN CONTROL ROOM
DISPLAY PROCESS CONTROL SYSTEM (PCS) FUNCTION NON–DISPLAY
DISCRETE HARDWARE INTERLOCK
130 — SYSTEM FOR LOGIC FUNCTION(S) OR COMPLEX ADVANCED CONTROL SYSTEMS
Y= SYSTEM/PACKAGED EQUIPMENT CONTROL NUMBER
PLCX UCXX — PLC LOGIC
XX= INTERLOCK/LOGIC NUMBER
PCS UCXX — PCS LOGIC
XX= INTERLOCK/LOGIC NUMBER

COMPUTER FUNCTION AND LOGIC SYSTEMS

FIELD MOUNTED COMPUTER FUNCTION
PANEL OR HARD CONSOLE COMPUTER FUNCTION
LOCAL PANEL COMPUTER FUNCTION
BATCH OR SEQUENTIAL LOGIC PROGRAMMABLE FUNCTION IN CONTROL ROOM
PROGRAMMABLE LOGIC CONTROL FUNCTION LOCAL
PROGRAMMABLE LOGIC CONTROL FUNCTION WHEN PART OF PCS
PROGRAMMABLE LOGIC CONTROL FUNCTION NON–DISPLAY
PROGRAMMABLE LOGIC CONTROL FUNCTION ON LOCAL PANEL

INSTRUMENT PURGE DETAIL



MATH FUNCTIONS

* SYMBOLS FOR MATH FUNCTION
Σ SUM
Δ DIFFERENCE
X MULTIPLY
— DIVIDE
> HIGH SELECT
< LOW SELECT
√ EXTRACT SQUARE ROOT
REV REVERSE
± BIAS
Σ/n AVERAGE
⌃ HIGH LIMIT
⌄ LOW LIMIT
SW SWITCH
K PROPORTIONAL
f(x) UNSPECIFIED FUNCTION
∫ INTEGRATION
X^n EXPONENTIAL
d/dt DERIVATIVE
x^{-k} INVERSE
f(t) TIME FUNCTION

CONTROL VALVE TYPE

GENERAL CONTROL VALVE GLOBE
BALL OR PLUG (OPTIONAL)
DIAPHRAGM (OPTIONAL)
BUTTERFLY (OPTIONAL)
THREE WAY GLOBE NOTE 6
FOUR WAY GLOBE NOTE 6

CONVERTERS

(OPTIONAL)

/ SYMBOLS FOR CONVERTERS (INPUT/OUTPUT)
A – ANALOG
D – DIGITAL
E – VOLTAGE
H – HYDRAULIC
I – CURRENT
P – PNEUMATIC

CONTROL ACTUATORS

NOTE 6

SPRING AND DIAPHRAGM
* SYMBOL INDICATES TYPE
M – ELECTRIC MOTOR
S – SOLENOID
E – ELECTRIC–HYDRAULIC
H – HYDRAULIC
PISTON TYPE – SINGLE ACTING
PISTON TYPE – DOUBLE ACTING

COMPUTER FUNCTIONS

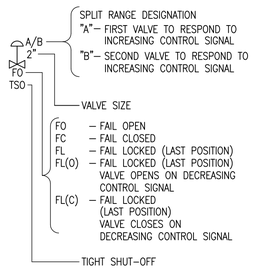
(OPTIONAL)

* SYMBOLS FOR COMPUTER FUNCTIONS
DDC – DIRECT DIGITAL CONTROL
SPC – SUPERVISORY SETPOINT CONTROL
DI – DIGITAL INPUT
DO – DIGITAL OUTPUT
AI – ANALOG INPUT
AO – ANALOG OUTPUT

MANUAL OPERATORS

CONTROL VALVE WITH HANDWHEEL
SOLENOID VALVE WITH MANUAL RESET
SOLENOID VALVE WITH REMOTE RESET

ADDITIONAL INFORMATION



INLINE FLOW INSTRUMENTS

ORIFICE PLATE OR FLOW ORIFICE
ORIFICE PLATE IN QUICK CHANGE FITTINGS
VENTURI FLOW TUBE
FLOW NOZZLE
WEIR
FLOW STRAIGHTENING VANES
FLUME
FI — ROTAMETER
WEDGE
C — CORIOLIS MASS FLOW METER
TARGET TYPE SENSOR
AVERAGING PITOT TUBE OR ANNUBAR
INLINE SIGHT GLASS
TURBINE / PROPELLER METER
POSITIVE DISPLACEMENT FLOW TOTALIZING INDICATOR
VORTEX SENSOR
SONIC FLOW METER
M — MAGNETIC FLOW METER
TH — THERMAL DISPERSION FLOW METER
DIAPHRAGM SEALS
FLUSH MOUNTED
WITH PIPE ROOT VALVE

SELF ACTUATED DEVICES

PSE — PRESSURE RELIEF RUPTURE DISK
PSE — VACUUM RELIEF RUPTURE DISK
L — INTERNAL FLOAT TYPE LEVEL INSTRUMENT
TCV — TEMPERATURE REGULATOR
PCV — UPSTREAM CONN. FOR BACK PRESSURE DOWNSTREAM CONN. FOR PRESSURE REDUCING PRESSURE REGULATOR WITH EXTERNAL PRESSURE TAP
PCV — UPSTREAM CONN. FOR BACK PRESSURE DOWNSTREAM CONN. FOR PRESSURE REDUCING PRESSURE REGULATOR SELF–CONTAINED
PDCV — REGULATOR WITH INTERNAL AND DIFFERENTIAL PRESSURE REDUCING EXTERNAL PRESSURE TAPS
PSV (SIZE) (PRESSURE) NOTE 9 — SAFETY RELIEF VALVE
PSV (SIZE) (PRESSURE) NOTE 9 — VACUUM RELIEF VALVE
PVSV (SIZE) (PRESSURE) — PRESSURE AND VACUUM SAFETY RELIEF VALVE (CONSERVATION VENT)
PSV — INDICATE INTERNAL OR EXTERNAL TAPPING
PILOT OPERATED SAFETY RELIEF VALVE (PRESSURE TAP CONNECTED TO VALVE BODY OR LINE/VESSEL AS REQUIRED.)
RELIEVING MANHOLE COVER
* INDICATED TYPE
PSV – PRESSURE OR VACUUM RELIEF
PVSV – PRESSURE–VACUUM RELIEF
LI — FLOAT AND TAPE TYPE LEVEL INDICATOR OR TRANSMITTER FOR STORAGE TANKS
ARV — AIR/VACUUM RELIEF VALVE

GENERAL NOTES

1. THE INSTRUMENTATION REPRESENTATION ON P&ID'S, AS PER ABBREVIATED ISA SYMBOLOGY. COMPLEX OR UNUSUAL LOOPS ARE DEPICTED WITH INDIVIDUAL COMPONENT BALLOONS AS REQUIRED FOR CLARITY.
2. SAFE OPERATION OF ANY SYSTEM WITH BLOCK VALVES ON THE INLET OR OUTLET LINES OF RELIEVING DEVICES REQUIRE ADMINISTRATIVE CONTROLS WHICH ARE TOTALLY UNDER THE CONTROL AND RESPONSIBILITY OF THE OWNER.

MISCELLANEOUS

INDICATING LIGHT
DUPLEX TEMPERATURE ELEMENT
SKIN — SKIN TYPE TEMPERATURE ELEMENT
TT TE TW — ACTUAL DEPICTION TE, TW NOT SHOWN ON P&ID.
SOLENOID OPERATED VALVE ARROW INDICATES DE–ENERGIZED POSITION NOTE 5
IA PILOT CABINET — PILOT OPERATED OR ASSISTED RELIEF VALVE WITH PILOT CABINET

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PROCESS LEAD SHEET
INST. SYMBOLS, LEGENDS & ABBREVIATIONS
PHASE IV MID–PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 140705 | DWG NO: 140705–001–PR–03–400011 | REV: 1

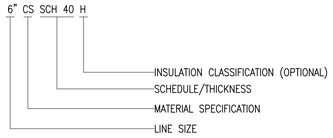
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Plot Date/Time: Mar 21, 2016 – 2:20pm
Plotted By: charles.bentley

Form: CMS–830–00–FM–02104 CBI ANSI D.dwg

MISCELLANEOUS ABBREVIATIONS

AG	ABOVE GROUND
ATM	ATMOSPHERE
BFW	BOILER FEED WATER
BL	BATTERY LIMIT
BV	BY VENDOR
CO	CLEAN OUT
CSC	CAR SEALED CLOSE
CSO	CAR SEALED OPEN
D	DRAIN
DEC	DETAILED ENGINEERING CONTRACTOR (COMPANY)
DMDS	DIMETHYL DISULFIDE
EPC	ENGINEERING PROCUREMENT AND CONSTRUCTION
FP	FULL PORT
GO	GEAR OPERATED
HC	HOSE CONNECTION
HCN	HEAVY CAT NAPHTHA
HH	HANDHOLE
ISBL	INSIDE BATTERY LIMIT
LC	LOCKED CLOSED
LCN	LIGHT CAT NAPHTHA
LO	LOCKED OPEN
LP	LOW PRESSURE
MAX	MAXIMUM
MIN	MINIMUM
MP	MEDIUM PRESSURE
MW	MANWAY
MH	MANHOLE
NC	NORMALLY CLOSED
NNF	NORMALLY NO FLOW
NO	NORMALLY OPEN
OSBL	OUTSIDE BATTERY LIMIT
RO	ROD OUT
RSP	REMOVABLE SPOOL PIECE
S	SAMPLE CONNECTION
SC	SAMPLE CONN WITH COOLER
SO	STEAM OUT
SP	SPECIALTY ITEM
TL	TANGENT LINE
TL/TL	TANGENT TO TANGENT
TP	TIE-IN POINT
TS	TEMPORARY STRAINER
TYP	TYPICAL
UC	UTILITY CONNECTION
UG	UNDERGROUND
V	VENT

PIPELINE IDENTIFICATION



INSULATION CLASSIFICATION

A	ACOUSTICAL INSULATION (NOTE 5)	N	NO INSULATION
C	ANTICONDENSATION	P	PERSONNEL PROTECTION
E	ELECTRICAL TRACING	R	CONTRATRACE
F	COLD INSULATION	S	STEAM TRACING
H	HEAT CONSERVATION	T	HOT OIL TRACING
I	WINTERIZING/ANTIFREEZING	V	UNINSULATED TRACER
J	JACKETING	Z	PAINTING

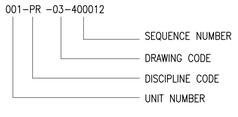
TRACING LEGEND

EP	ELECTRICAL TRACING FOR PROCESS REASONS
EW	ELECTRICAL TRACING FOR WINTERIZATION
TL	TRACING WITH LP STEAM (STABILIZATION)
TM	TRACING WITH MP STEAM
TS	SPACER TRACING WITH LP STEAM
TW	TRACING WITH HOT WATER OR OIL (WINTERIZATION)

MATERIAL SPECIFICATION

CS	CARBON STEEL ASTM53
HDPE	HIGH DENSITY POLYETHYLENE, PE 3408
CU	COPPER
PVC	POLYVINYL CHLORIDE

DRAWING NUMBER IDENTIFICATION



PIPING LINES

PIPELINE TO/FROM DRAWING OF ANOTHER UNIT

UNDERGROUND PIPING (BURIED LINE)

TRACING
REFER TO TRACING LEGEND FOR XX VALUES

JACKETED LINE

VENDOR PACKAGE BOUNDARY

BATTERY LIMIT

(UG) SPEC | (AG) SPEC

GATE/GENERAL VALVE

VALVE WITH PLUG

VALVE WITH BLIND FLANGE

BUTTERFLY VALVE

DIAPHRAGM VALVE

GLOBE VALVE

NEEDLE VALVE

PLUG VALVE

BALL VALVE

CHECK VALVE

STOP CHECK VALVE (BOILER NON-RETURN VALVE)

THREE WAY VALVE

ANGLE VALVE

RAM TYPE VALVE (SPECIALTY ITEM)

MECH. LINK — INTERLOCKED VALVES (MECHANICAL LINK)

SPRING LOADED QUICK OPENING OR CLOSING VALVE

SLIDE VALVE

SLOPE — SLOPE INDICATION

FREE DRAINING — FREE DRAINING

PIPING SYMBOLS

OUTSIDE BATTERY LIMIT

DWG.NO. — CONTINUITY ARROW

BLIND FLANGE

PIPE CAP (WELDED)

ECCENTRIC REDUCER

CONCENTRIC REDUCER

SP / XYZZ — STRAINER

TS — TEMPORARY STRAINER

CONE TYPE STRAINER

T-TYPE STRAINER

Y-TYPE STRAINER

REMOVABLE SPOOL

B — BLINDING POINT

SPACER FOR BLIND

LINE BLIND (SPADE)

REVERSIBLE BLIND (OPEN) (FIGURE EIGHT)

REVERSIBLE BLIND (CLOSED) (FIGURE EIGHT)

SPEC BREAK
XXX | XXX — XXX – PIPING SPEC

MIN — MINIMUM DISTANCE

DUCT OR STACK DAMPER

XX — OPEN SERVICE DRAIN
XX – SERVICE SYMBOL

XX — CLOSED SERVICE DRAIN
XX – SERVICE SYMBOL

ATMOSPHERIC VENT

SAFETY AND FIRE WATER PROTECTION

SAFETY SHOWER

EYE WASH

GATE VALVE WITH POST INDICATOR

HH — HOSE CONNECTION

HR — HOSE REEL

FIRE HYDRANT

FIRE MONITOR

FLANGED CONNECTION

HOSE CONNECTION

FLEXIBLE HOSE

EXPANSION JOINT

INLINE MIXER

EXHAUST HEAD

T — STEAM TRAP/DRAIN TRAP (NON PROCESS)

SP / XYZZ / T — CONTINUOUS DRAINER

EDUCTOR OR EJECTOR

PIPING SPECIALTY ITEM
SP / XYZZ
ZZ- SEQUENCE NUMBER
Y- AREA NUMBER (1=100, 2=200,...7=700)
X- UNIT NUMBER

SAMPLE CONN OR (WITH COOLER)
SC / XYZZ
ZZ- SEQUENCE NUMBER
Y- AREA NUMBER (1=100, 2=200,...7=700)
X- UNIT NUMBER

DISCIPLINE INDEX CODE (P1, P2)
IP-INDEX-XXX-YYY-ZZZZ
SEQUENCE NUMBER
INTERCONNECTING UNIT
ORIGINATING ISBL UNIT NUMBER

D — DRAIN PORT WITH VALVE

S — SAMPLE PORT WITH VALVE

AIR FILTER WITH HOOD

FLAME ARRESTOR

GRADE

FUNNEL

VENT

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PROCESS LEAD SHEETS
INST. SYMBOLS, LEGENDS & ABBREVIATIONS
PHASE IV MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 140705 | DWG NO: 140705-001-PR-03-400012 | REV: 1

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg

File: 140705-001-PR-03-400012.DWG.dwg
Plot Date/Time: Mar 21, 2016 - 2:22pm
Plotted By: charles.bentley

PUMPS/AGITATORS

CENTRIFUGAL/INLINE PUMP (MOTOR DRIVEN)

CENTRIFUGAL/INLINE PUMP (TURBINE DRIVEN)

BLOWER

SUMP PUMP

SUBMERSIBLE PUMP

CAN PUMP

DIAPHRAGM PUMP

ROTARY PUMP

METERING PUMP

SCREW/PROGRESSIVE CAVITY PUMP

AGITATOR

DRIVERS

ELECTRIC MOTOR

DIESEL DRIVE – D
AIR MOTOR – A
HYDRAULIC MOTOR – H

STEAM TURBINE

PROCESS EQUIPMENT

VERTICAL SHELL AND TUBE EXCHANGER AS PER TEMA

SHELL AND TUBE EXCHANGER AS PER TEMA

SHELL AND TUBE EXCHANGER AS PER TEMA

SHELL AND TUBE EXCHANGER AS PER TEMA

SHELL AND TUBE EXCHANGER AS PER TEMA

SHELL AND TUBE EXCHANGER AS PER TEMA

KETTLE EXCHANGER AS PER TEMA

KETTLE EXCHANGER AS PER TEMA

DOUBLE PIPE HEAT EXCHANGER

SPIRAL HEAT EXCHANGER

PLATE & FRAME EXCHANGER

STORAGE TANK WITH CONE ROOF

STORAGE TANK WITH DISH ROOF

STORAGE TANK WITH INTERNAL FLOATING ROOF

TRAYED TOWER TRAY NUMBERING AS DEPICTED

VORTEX BREAKER

TL

DIM. TO GRADE

TOWER/VESSEL WITH PROCESS PACKING

TOWER/VESSEL WITH DEMISTER PAD

AIR COOLER

AIR COOLER W/LOUVER

SINGLE FILTER

DUPLEX FILTER

CENTRIFUGAL COMPRESSOR

SCREW TYPE COMPRESSOR

RECIPROCATING COMPRESSOR

CORE (DOUBLE PLATE) EXCHANGER

CORE & KETTLE EXCHANGER

MH

HH

EQUIPMENT CLASS

F	FIRED HEATERS
T	TOWERS – SHELLS
R	REACTORS AND COKE DRUMS
E	HEAT EXCHANGERS – SHELL AND TUBE
AC	HEAT EXCHANGE EQUIPMENT SPECIAL (AIR COOLERS)
STR	STRAINERS AND COALESCERS
FG	LINE FILTERS AND SILENCERS
P	PUMPS AND DRIVES
C	COMPRESSORS AND BLOWERS
M	STEAM SPECIALTIES – DESUPERHEATERS LINE SEPARATORS
PA	PACKAGE UNITS AND SPECIAL EQUIPMENT
TK	TANK
AD	SUMP
J	EDUCTOR
EH	ELECTRIC HEATER

GENERAL NOTES

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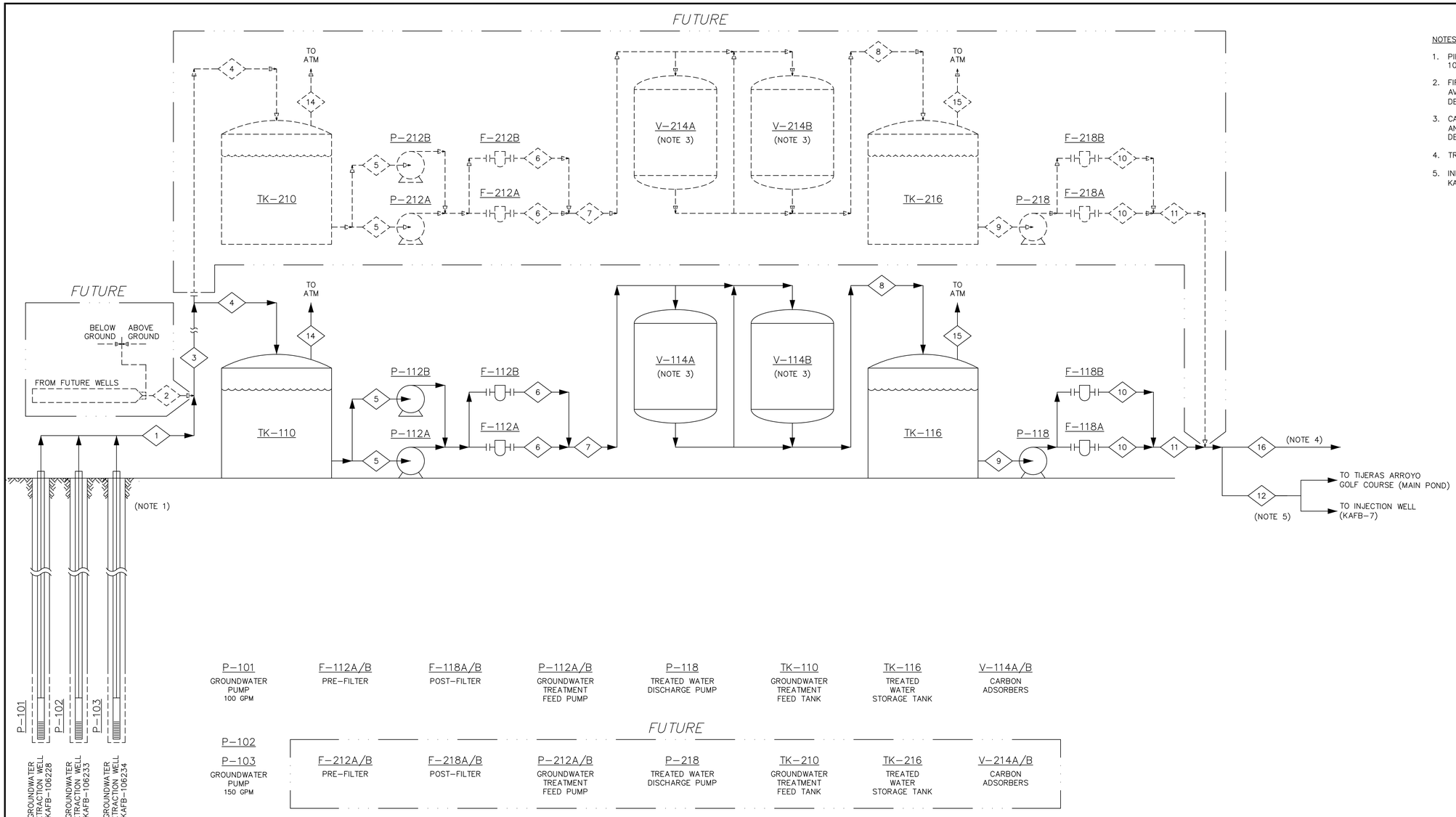
PROCESS LEAD SHEET
INST. SYMBOLS, LEGENDS & ABBREVIATIONS
PHASE IV MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 140705 | DWG NO: 140705-001-PR-03-400013 | REV: 1

File: 140705-001-PR-03-400013.dwg
Plot Date/Time: Mar 21, 2016 - 2:24pm
Plotted By: charles.bentley

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg



NOTES:

1. PIPELINE FROM GROUNDWATER WELL KAFB-106228, KAFB-106233 AND KAFB 106234 IS DOUBLE-WALLED HDPE PIPE.
2. FIRST 3 WELLS ARE EXPECTED TO PRODUCE 400 GPM OF GROUND WATER. AVERAGE EDB CONCENTRATION IS EXPECTED TO BE BETWEEN 0.05 AND 0.5 UG/L. DESIGN INLET EDB TO CARBON BEDS IS 2.0 UG/L.
3. CARBON VESSELS ARE RUN IN SERIES WITH OPTIONAL VALVING FOR PARALLEL AND LEAD/LAG CONFIGURATION. SEE DRAWING PR-03-400003 FOR VALVING DETAIL.
4. TREATED WATER CONNECTION FOR DUST CONTROL. (INTERMITTENT)
5. INITIALLY TREATED GW (UP TO 400 GPM) WILL GO TO GOLF COURSE AND/OR THE KAFB-7, (INJECTION WELL).

P-101	F-112A/B — PRE-FILTER
GROUNDWATER PUMP 100 GPM	F-118A/B — POST-FILTER
P-102	P-112A/B — GROUNDWATER TREATMENT FEED PUMP
P-103 GROUNDWATER PUMP 150 GPM	P-118 — TREATED WATER DISCHARGE PUMP
	TK-110 — GROUNDWATER TREATMENT FEED TANK
	TK-116 — TREATED WATER STORAGE TANK
	V-114A/B — CARBON ADSORBERS

FUTURE

P-212A/B — PRE-FILTER	F-218A/B — POST-FILTER
P-212A/B — GROUNDWATER TREATMENT FEED PUMP	P-218 — TREATED WATER DISCHARGE PUMP
TK-210 — GROUNDWATER TREATMENT FEED TANK	TK-216 — TREATED WATER STORAGE TANK
V-214A/B — CARBON ADSORBERS	

COMPONENT \ STREAM NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
	WELLS TO GWTS	FUTURE WELLS TO GWTS	WELL FIELD TO GWTS	INFLUENT TO FEED TANK	GWTS FEED PUMPS	PRE-FILTER	CARBON ABSORPTION INLET	TREATED WATER	DISCHARGE PUMP	POST-FILTER	TREATED DISCHARGE	TREATED DISCHARGE	INFILTRATION GALLERY	GROUNDWATER TREATMENT FEED TANK VENT	TREATED WATER STORAGE TANK VENT	TREATED WATER TO DUST CONTROL CONNECTION		
LIQUID FLOW (DESIGN) gpm	400	400	800	400	200	200	400	400	400	200	400	400				100 (NOTE 4)		
LIQUID FLOW (average) gpm	400 (NOTE 2)																	
AIR FLOW acfm (scfm)																		
ETHYLENE DIBROMIDE (EDB) ug/L	2	2	2	2	2	2	2	0.03	0.03	0.03	0.03	0.03						
PRESSURE psig (psia)	25	25	25	25	5	25	25	25	5	25	25	25		(12.05)	(12.05)			
TEMPERATURE °F	58	58	58	58	58	58	58	58	58	58	58	58		68	68			
DENSITY (AT 70°F) lb/ft³	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4		0.061	0.061			

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DRAWN: EGA | CK'D: SES | APPD: BAH | DATE: 03/30/15 | SCALE: NONE

PROCESS FLOW DIAGRAM
MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

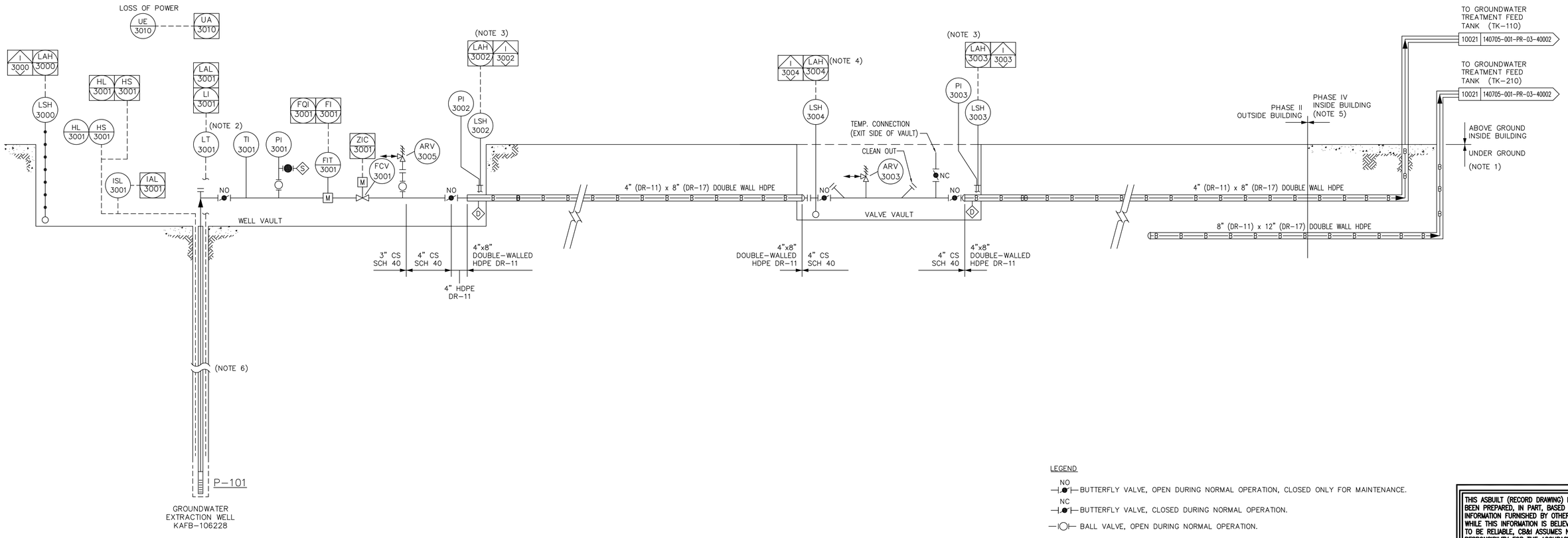
PROJECT NO: 140705 | DWG NO: 140705-001-PR-01-400001 | REV: 1

File: 140705-001-PR-01-400001.dwg
Plot Date/Time: Mar 23, 2016 - 8:56am
Plotted By: charles.bentley

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg

NOTES:

1. DOUBLE-WALLED PIPE WILL PENETRATE BUILDING FLOOR.
2. LEVEL TRANSDUCER TO MONITOR WATER LEVEL.
3. INTERSTITIAL LEAK DETECTION.
4. VAULT LEAK DETECTION.
5. INSTALLED AND CAPPED BELOW GRADE DURING PHASE IV FOR RAPID WELLS.
6. TWO CHECK VALVES INSTALLED ON 3" DIA. DROP PIPE TO PUMP. CHECK VALVES ARE LOCATED AT PUMP DISCHARGE AND 250 FEET ABOVE DISCHARGE.



P-101
WELL PUMP
30 HP
100 GPM
600 FT TDH

LEGEND

- NO — BUTTERFLY VALVE, OPEN DURING NORMAL OPERATION, CLOSED ONLY FOR MAINTENANCE.
- NC — BUTTERFLY VALVE, CLOSED DURING NORMAL OPERATION.
- BALL VALVE, OPEN DURING NORMAL OPERATION.
- BALL VALVE, CLOSED DURING NORMAL OPERATION.

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CLIENT DWG NO:

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REFERENCE DRAWINGS	NO.	REVISION	DRAWN	CK'D	APPD	DATE
	1	RECORD DRAWING	CFB	SES	BAH	03/25/16
	0	ISSUED FOR CONSTRUCTION	EGA	SES	BAH	03/30/15

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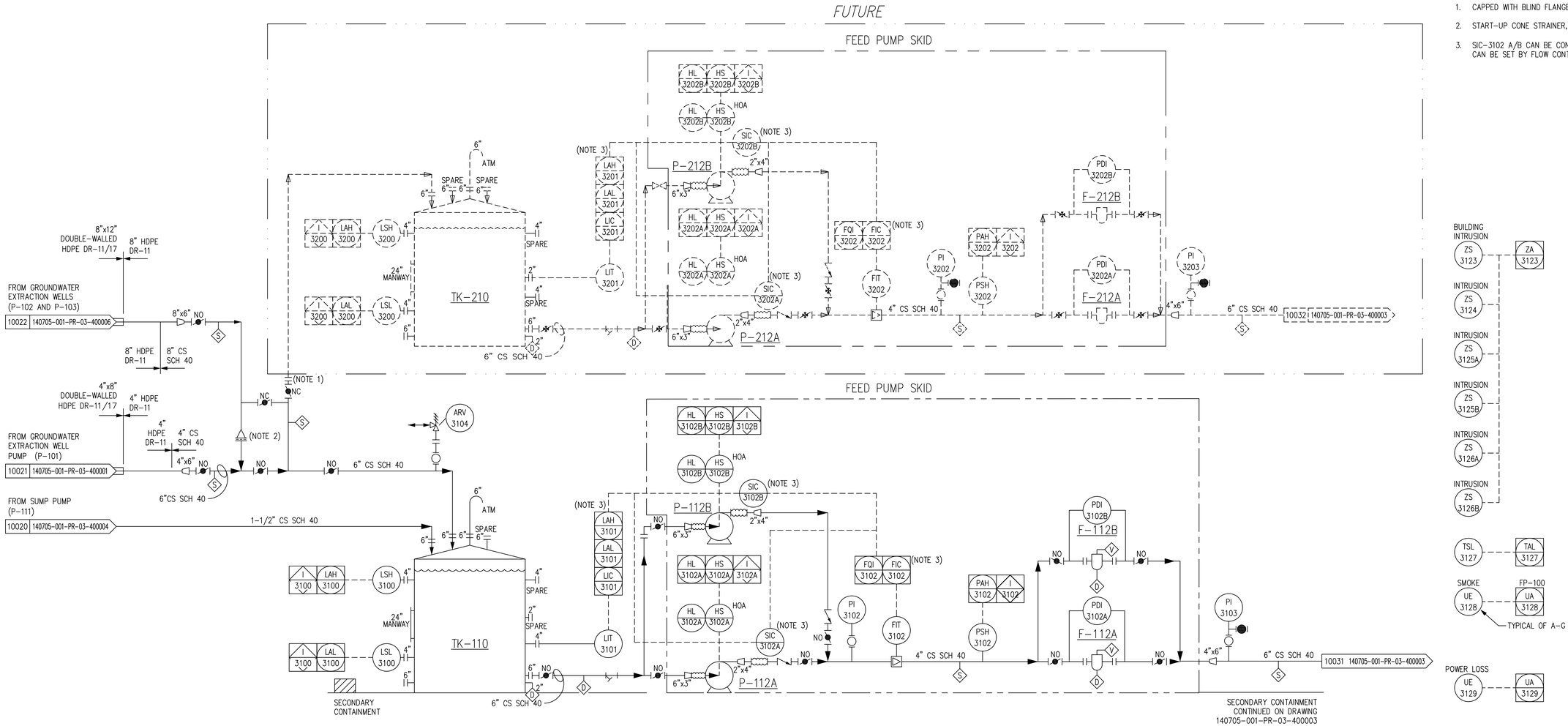
PIPING & INSTRUMENTATION DIAGRAM
EXTRACTION WELL KAFB-106228
MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 140705 | DWG NO: 140705-001-PR-03-400001 | REV: 1

File: 140705-001-PR-03-400001.dwg
Plot Date/Time: Mar 23, 2016 - 9:08am
Plotted By: charles.bentley

Form: CM5-830-00-FM-02104 CB ANSI D.dwg



NOTES:

1. CAPPED WITH BLIND FLANGE FOR FUTURE USE.
2. START-UP CONE STRAINER, SEE MECHANICAL DRAWINGS FOR DETAILS.
3. SIC-3102 A/B CAN BE CONTROLLED BY LEVEL IN TK-110 (LIC-3101) OR CAN BE SET BY FLOW CONTROL SET POINT ON FIC - 3102

LEGEND

- NO — BUTTERFLY VALVE, OPEN DURING NORMAL OPERATION, CLOSED ONLY FOR MAINTENANCE.
- NC — BUTTERFLY VALVE, CLOSED DURING NORMAL OPERATION.
- BALL VALVE, OPEN DURING NORMAL OPERATION.
- BALL VALVE, CLOSED DURING NORMAL OPERATION.
- V — VENT
- D — DRAIN

FUTURE

F-112A/B
PRE-FILTER

P-112A/B
GROUNDWATER TREATMENT FEED PUMP
15 HP
200 GPM
100 FT TDH

TK-110
GROUNDWATER TREATMENT FEED TANK
10' DIA. 12' H.
6,000 GALLONS

F-212A/B
PRE-FILTER

P-212A/B
GROUNDWATER TREATMENT FEED PUMP
15 HP
200 GPM
100 FT TDH

TK-210
GROUNDWATER TREATMENT FEED TANK
10' DIA. 12' H.
6,000 GALLONS

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NO.	REVISION	DRAWN	CK'D	APPD	DATE
1	RECORD DRAWING	RJT	SES	BAH	03/25/16
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DRAWN: EGA | CK'D: SES | APPD: BAH | DATE: 03/30/15 | SCALE:

PIPING & INSTRUMENT DIAGRAM
GROUNDWATER TREATMENT SYSTEM
MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 140705 | DWG NO: 140705-001-PR-03-400002 | REV: 1

File: 140705-001-PR-03-400002.dwg
Plot Date/Time: Mar 23, 2016 - 9:06am
Plotted By: charles.bentley

Form: CMS-830-00-FM-02104 CB! ANSI D.dwg

NOTES:

1. WALL MOUNTED UTILITY STATION.
2. VALVE INCLUDES INTEGRAL BACK FLOW PREVENTION CAPABILITY
3. VALVE POSITIONS SET ACCORDING TO TABLES

FUTURE

FROM GROUNDWATER TREATMENT FEED PUMP (P-212A/B)
10032 | 140705-001-PR-03-400002

6" CS SCH 40

1-1/2 CU, TYPE K

TAP ON EXISTING WATER LINE

6"x1-1/2"

6" C900 PVC

FI/FQI 3130

BURIED OUTSIDE BUILDING

ABOVE GROUND INSIDE BUILDING

PRV 3130

(NOTE 2)

1 1/2" CU

1 1/2" C.S. GALV.

(NOTE 1)

(NOTE 1)

HL 3120

HS 3120

HS 3120

(NOTE 1)

1" CS SCH 40

VENDOR SUPPLIED PACKAGE UNIT

AIR COMPRESSOR AND FILTERS

C-120

SECONDARY CONTAINMENT CONTINUED FROM DRAWING 140705-001-PR-03-400002

ARV 3206

BACK WASH EFFLUENT

CARBON SKID

½" AIR RELIEF BLOW-OFF

2" MANUAL VENT LINE

TO FLOOR

V-214A

V-214B

PI 3205

PAH 3205

PSH 3205

PI 3204A

PI 3204B

8"x¾"

8"x2"

¼"

2"x¾"

4"x¾"

4"x2"

PRESSURE RELIEF FOR FILLING

CARBON FILL

CARBON DISCHARGE

BACK WASH INFLUENT

FUTURE

ARV 3106

6" CS SCH 40

TO TREATED WATER STORAGE TANK (TK-216)

10042 | 140705-001-PR-03-400004

ARV 3106

BACK WASH EFFLUENT

CARBON SKID

½" AIR RELIEF BLOW-OFF

2" MANUAL VENT LINE

TO FLOOR

V-114B

V-114A

V-1 V-2 V-3 V-4 V-5 V-6 V-7 V-8 V-9 V-10 V-11 V-12 V-13 V-14 V-15 V-16

(NOTE 3)

PI 3105

PAH 3105

PSH 3105

PI 3104B

PI 3104A

8"x¾"

8"x2"

¼"

2"x¾"

4"x¾"

4"x2"

PRESSURE RELIEF FOR FILLING

CARBON FILL

CARBON DISCHARGE

BACK WASH INFLUENT

FROM GROUNDWATER TREATMENT FEED PUMP (P-112A/B)

10031 | 140705-001-PR-03-400002

6" CS SCH 40

ARV 3107

TO TREATED WATER STORAGE TANK (TK-116)

10041 | 140705-001-PR-03-400004

6" CS SCH 40

SECONDARY CONTAINMENT CONTINUED ON DRAWING 140705-001-PR-03-400004

LENGEND

NO — BUTTERFLY VALVE, OPEN DURING NORMAL OPERATION, CLOSED ONLY FOR MAINTENANCE.

NC — BUTTERFLY VALVE, CLOSED DURING NORMAL OPERATION.

BALL VALVE, OPEN DURING NORMAL OPERATION.

BALL VALVE, CLOSED DURING NORMAL OPERATION.

DRAIN

SAMPLE

C-120
PACKAGE AIR COMPRESSOR SYSTEM
107 SCFM
115 PSIG

V-114A/B
CARBON ADSORBERS
40,000 LBS.

V-214A/B
CARBON ADSORBERS
40,000 LBS.

FUTURE

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1	RECORD DRAWING	RJT	SES	BAH	03/25/16
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DRAWN: EGA | CK'D: SES | APPD: BAH | DATE: 03/30/15 | SCALE: NONE

PIPING & INSTRUMENTATION DIAGRAM
GROUNDWATER TREATMENT SYSTEM
MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

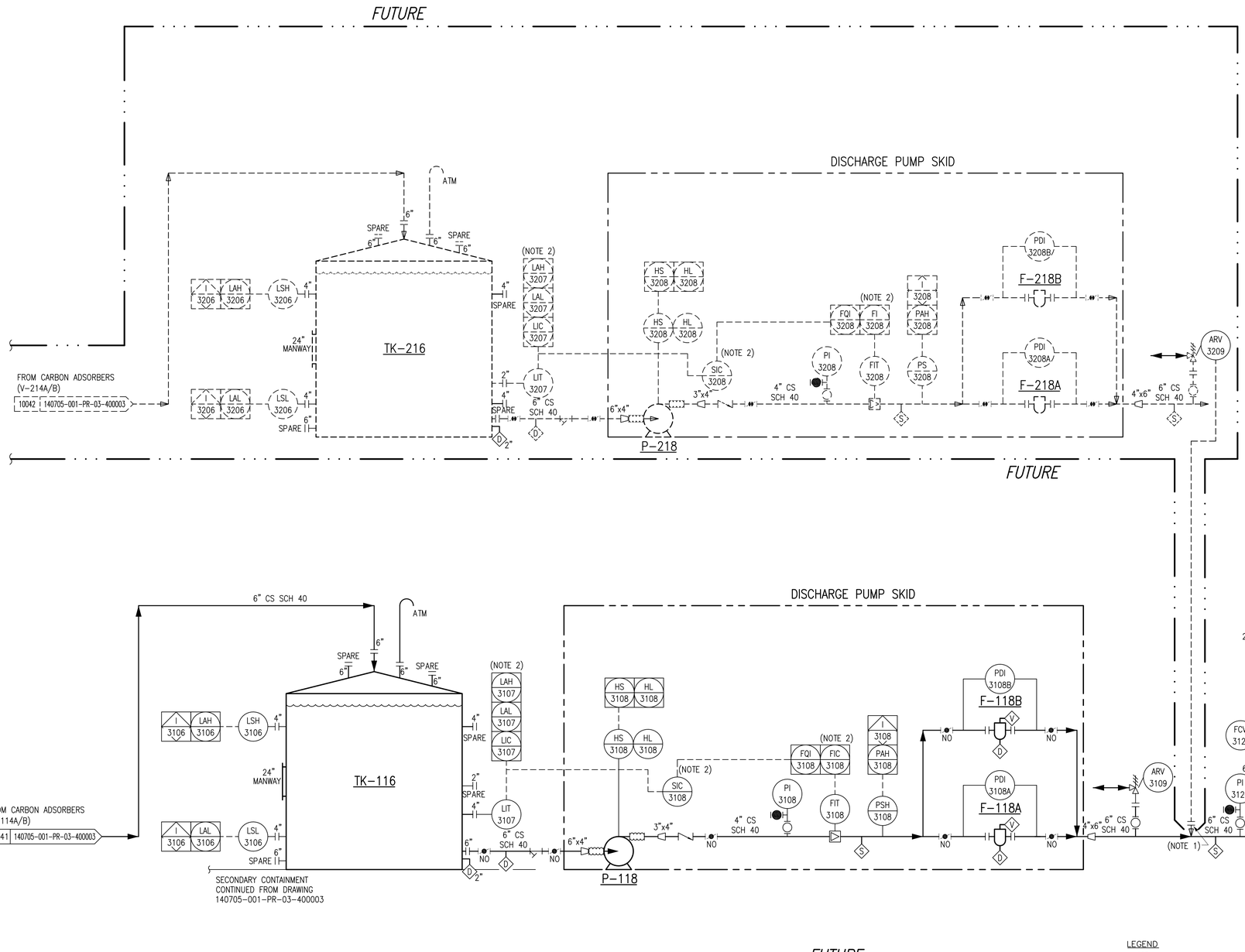
PROJECT NO: 140705 | DWG NO: 140705-001-PR-03-400003 | REV: 1

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg

File: 140705-001-PR-03-400003.dwg
Plot Date/Time: Mar 21, 2016 - 3:18pm
Plotted By: charles.bentley

NOTES:

1. CAPPED WITH BLIND FLANGE FOR FUTURE USE.
2. SIC-3108 CAN BE CONTROLLED BY LEVEL IN TK-116 OR CAN BE SET BY FLOW CONTROL SET POINT ON FIC-3108.



LEGEND

NO
- BUTTERFLY VALVE, OPEN DURING NORMAL OPERATION, CLOSED ONLY FOR MAINTENANCE.

NC
- BUTTERFLY VALVE, CLOSED DURING NORMAL OPERATION.
- BALL VALVE, OPEN DURING NORMAL OPERATION.
- BALL VALVE, CLOSED DURING NORMAL OPERATION.
- GATE VALVE, NORMALLY OPEN.

F-118A/B
POST-FILTER

P-118
TREATED WATER DISCHARGE PUMP
40 HP
400 GPM
180 FT TDH

P-111
SUMP PUMP
1/3 HP
5 GPM
20 FT TDH

TK-116
TREATED WATER STORAGE
10' DIA. 12' H
6,000 GALLONS

FUTURE

F-218A/B
POST-FILTER

P-218
TREATED WATER DISCHARGE PUMP
40 HP
400 GPM
180 FT TDH

TK-216
TREATED WATER STORAGE
10' DIA.
12' H
6,000 GALLONS

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CLIENT DWG NO:

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1	RECORD DRAWING	RJT	SES	BAH	03/25/16
0	ISSUED FOR CONSTRUCTION	EGA	SES	BAH	03/30/15

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DRAWN: EGA | CK'D: SES | APPD: BAH | DATE: 03/30/15 | SCALE: NONE

PIPING & INSTRUMENTATION DIAGRAM
GROUNDWATER TREATMENT SYSTEM
MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

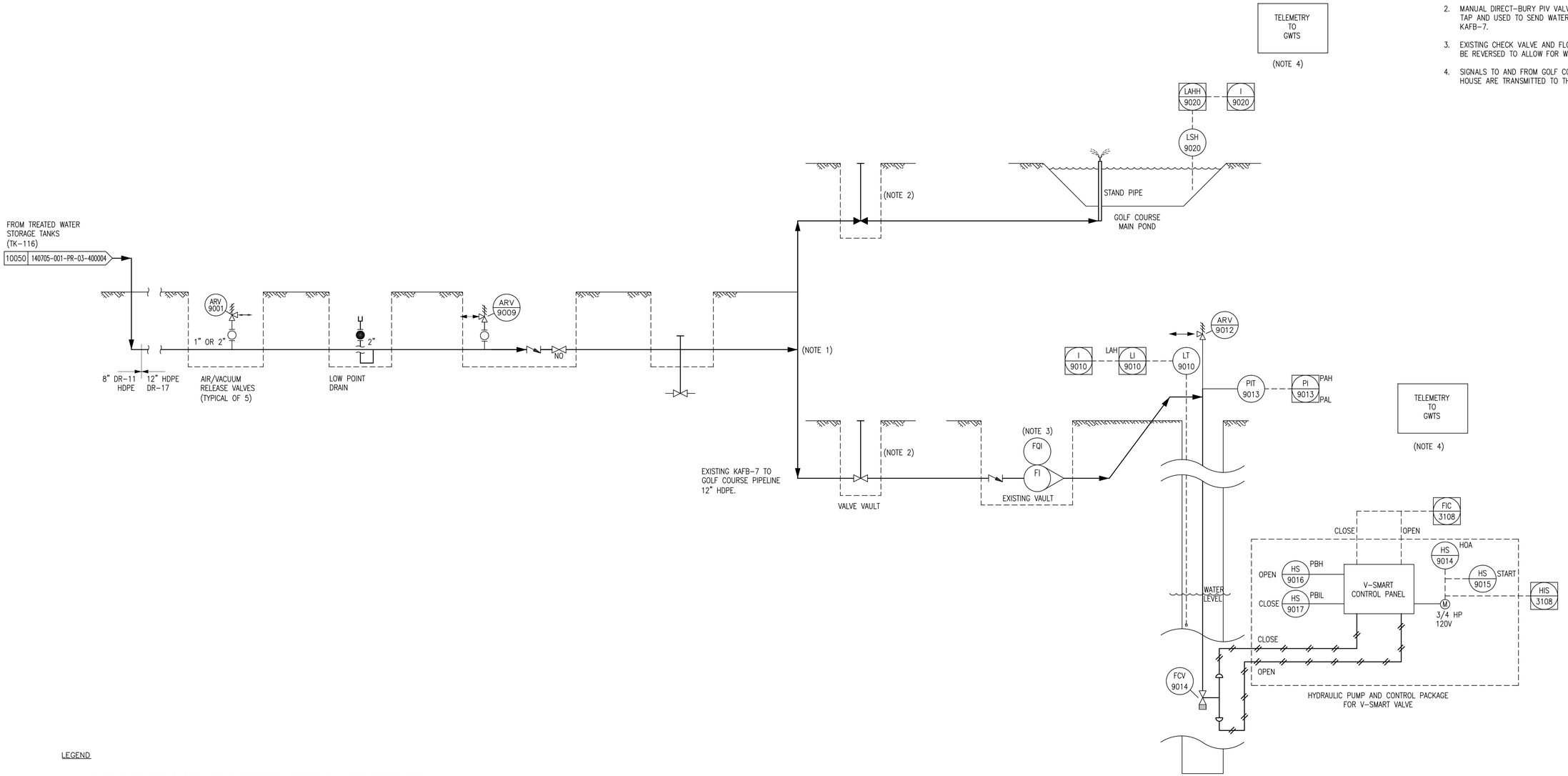
PROJECT NO: 140705 | DWG NO: 140705-001-PR-03-400004 | REV: 1

File: 140705-001-PR-03-400004.dwg
Plot Date/Time: Mar 23, 2016 - 9:41am
Plotted By: charles.bentley

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg

NOTES:

1. NEW 12" HDPE TREATED WATER PIPELINE FROM GWTS WILL CONNECT TO EXISTING KAFB-7 TO GOLF COURSE PIPELINE. CONNECTION WILL UTILIZE EXISTING TAP INSTALLED FOR TTS.
2. MANUAL DIRECT-BURY PIV VALVES WILL BE INSTALLED ON EITHER SIDE OF TAP AND USED TO SEND WATER TO EITHER GOLF COURSE MAIN POND OR KAFB-7.
3. EXISTING CHECK VALVE AND FLOW METER IN KAFB-7 VALVE VAULT WILL BE REVERSED TO ALLOW FOR WATER INJECTION.
4. SIGNALS TO AND FROM GOLF COURSE MAIN POND AND KAFB-7 CONTROL HOUSE ARE TRANSMITTED TO THE GWTS BUILDING BY TELEMETRY.



KAFB-7
INJECTION WELL

LEGEND

- GATE VALVE, OPEN DURING NORMAL OPERATION, CLOSED ONLY FOR MAINTENANCE.
- GATE VALVE, CLOSED DURING NORMAL OPERATION.
- BALL VALVE, OPEN DURING NORMAL OPERATION.
- BALL VALVE, CLOSED DURING NORMAL OPERATION.

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CLIENT DWG NO:

NOTES							
		0	ISSUED FOR O&M MANUAL	RJT	SES	SES	03/31/16
	REFERENCE DRAWINGS	NO.	REVISION	DRAWN	CK'D	APPD	DATE

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DRAWN: RJT | CK'D: SES | APPD: SES | DATE: 03/31/16 | SCALE: NONE

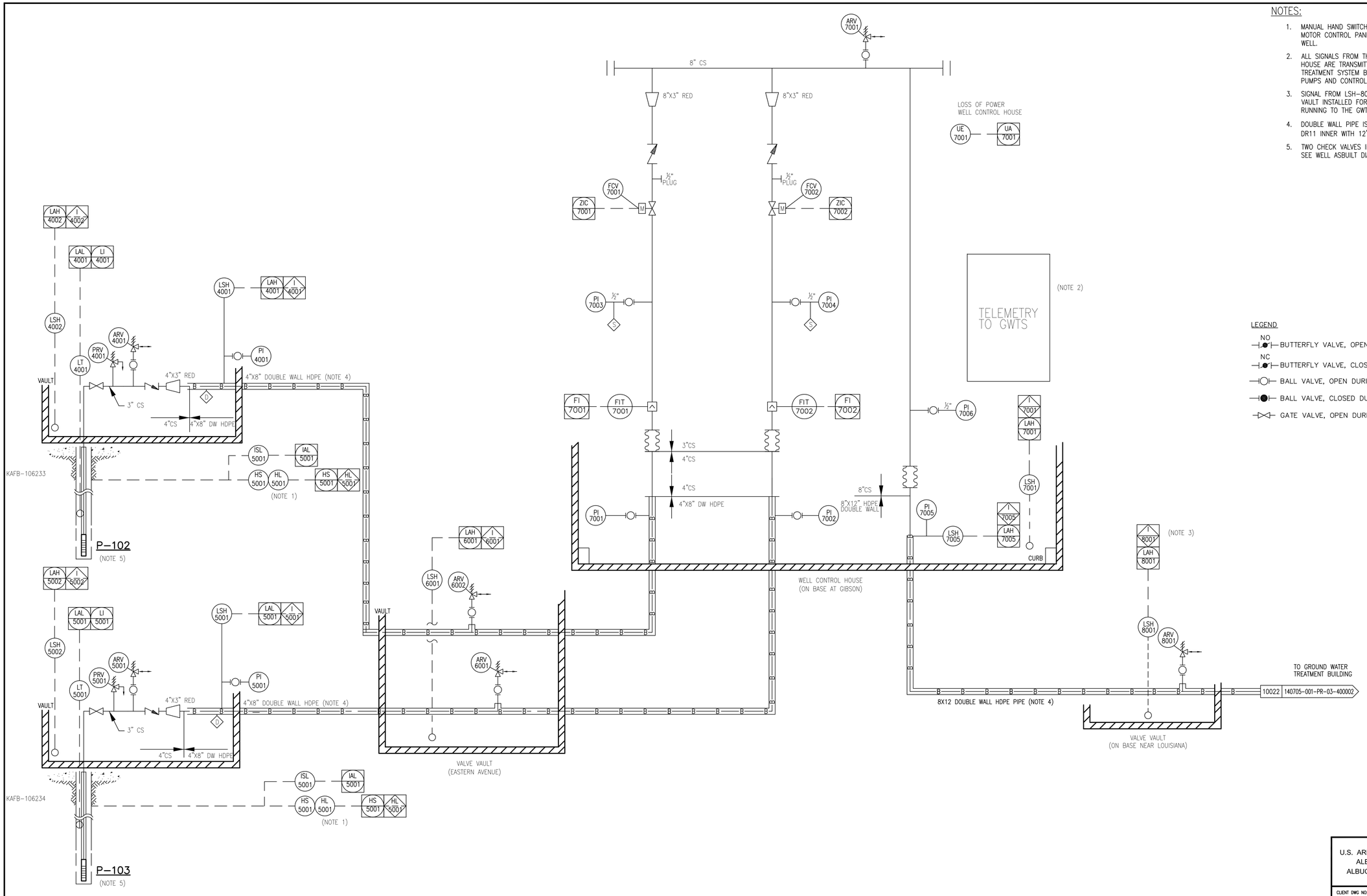
PIPING & INSTRUMENTATION DIAGRAM
GOLF COURSE AND KAFB-7 INJECTION
MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 500433 | DWG NO: 500433-001-PR-03-400005 | REV: 0

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg

File: 500433-001-PR-03-400005.dwg
Plot Date/Time: Mar 31, 2016 - 10:22am
Plotted By: charles.bentley



NOTES:

1. MANUAL HAND SWITCHES FOR KAFB-106233 AND 106234 ARE INSTALLED ON MOTOR CONTROL PANEL IN THE WELL CONTROL HOUSE. NO SWITCHES AT THE WELL.
2. ALL SIGNALS FROM THE INSTRUMENTS IN THE WELL VAULTS AND WELL CONTROL HOUSE ARE TRANSMITTED TO THE MAIN CONTROL PANEL IN THE GROUNDWATER TREATMENT SYSTEM BUILDING BY A TELEMETRY SYSTEM. CONTROL SIGNALS TO PUMPS AND CONTROL VALVES ALSO TRANSMITTED BY TELEMETRY.
3. SIGNAL FROM LSH-8001 IS HARD WIRED TO THE JUNCTION BOX IN THE VALVE VAULT INSTALLED FOR KAFB-106228 AND CONNECTED TO EXISTING CABLE RUNNING TO THE GWTS CONTROL PANEL.
4. DOUBLE WALL PIPE IS 4"-DR11 INNER PIPE WITH 8"-DR17 OUTER PIPE OR 8" DR11 INNER WITH 12" DR17 OUTER.
5. TWO CHECK VALVES INSTALLED ON DROP PIPE BETWEEN PUMP AND SURFACE. SEE WELL ASBUILT DIAGRAM FOR DROP PIPE DETAILS.

LEGEND

- NO — BUTTERFLY VALVE, OPEN DURING NORMAL OPERATION.
- NC — BUTTERFLY VALVE, CLOSED DURING NORMAL OPERATION.
- BALL VALVE, OPEN DURING NORMAL OPERATION.
- BALL VALVE, CLOSED DURING NORMAL OPERATION.
- GATE VALVE, OPEN DURING NORMAL OPERATION.

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DRAWN: RJT | CK'D: SES | APPD: SES | DATE: 03/29/16 | SCALE: NONE

PIPING AND INSTRUMENTATION DIAGRAM
RAPID EXTRACTION WELLS
MID-PLUME PUMP & TREAT SYSTEM

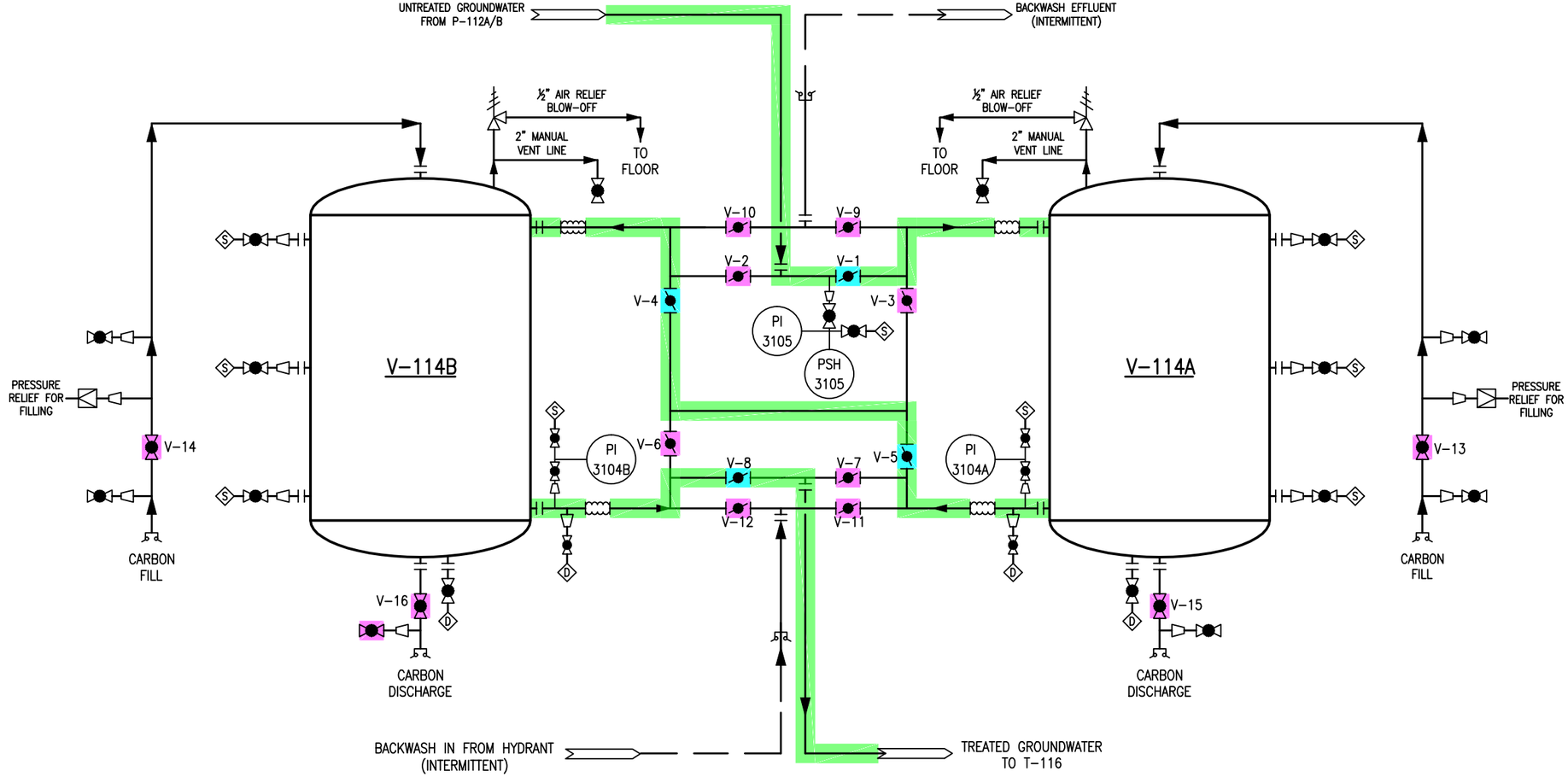
FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 500433 | DWG NO: 500433-001-PR-03-400006 | REV: 0

File: 500433-001-PR-03-400006.dwg
Plot Date/Time: Mar 29, 2016 - 3:39pm
Plotted By: charles.bentley

Form: CMS-830-00-FM-02104 CBI ANSI D.dwg

TRAIN 1 VALVE POSITIONS



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN: | CK'D: | APPD: | DATE: | SCALE:

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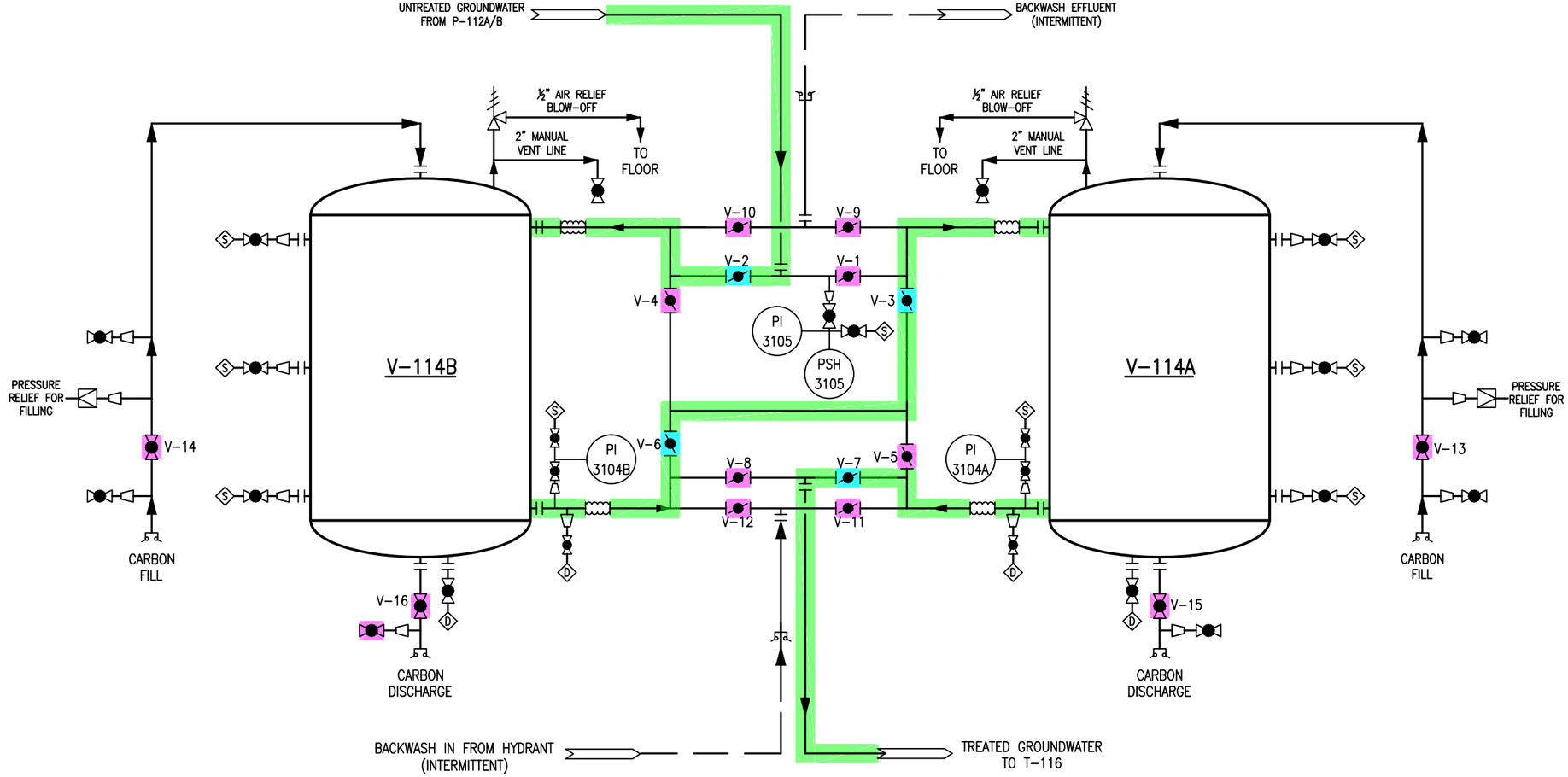
CARBON BED VALVE POSITIONS

SERIES OPERATION

A LEAD - B LAG

FOR:

PROJ NO:140705 | DWG NO: FIGURE E-1 | REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN: | CK'D: | APPD: | DATE: | SCALE:

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ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

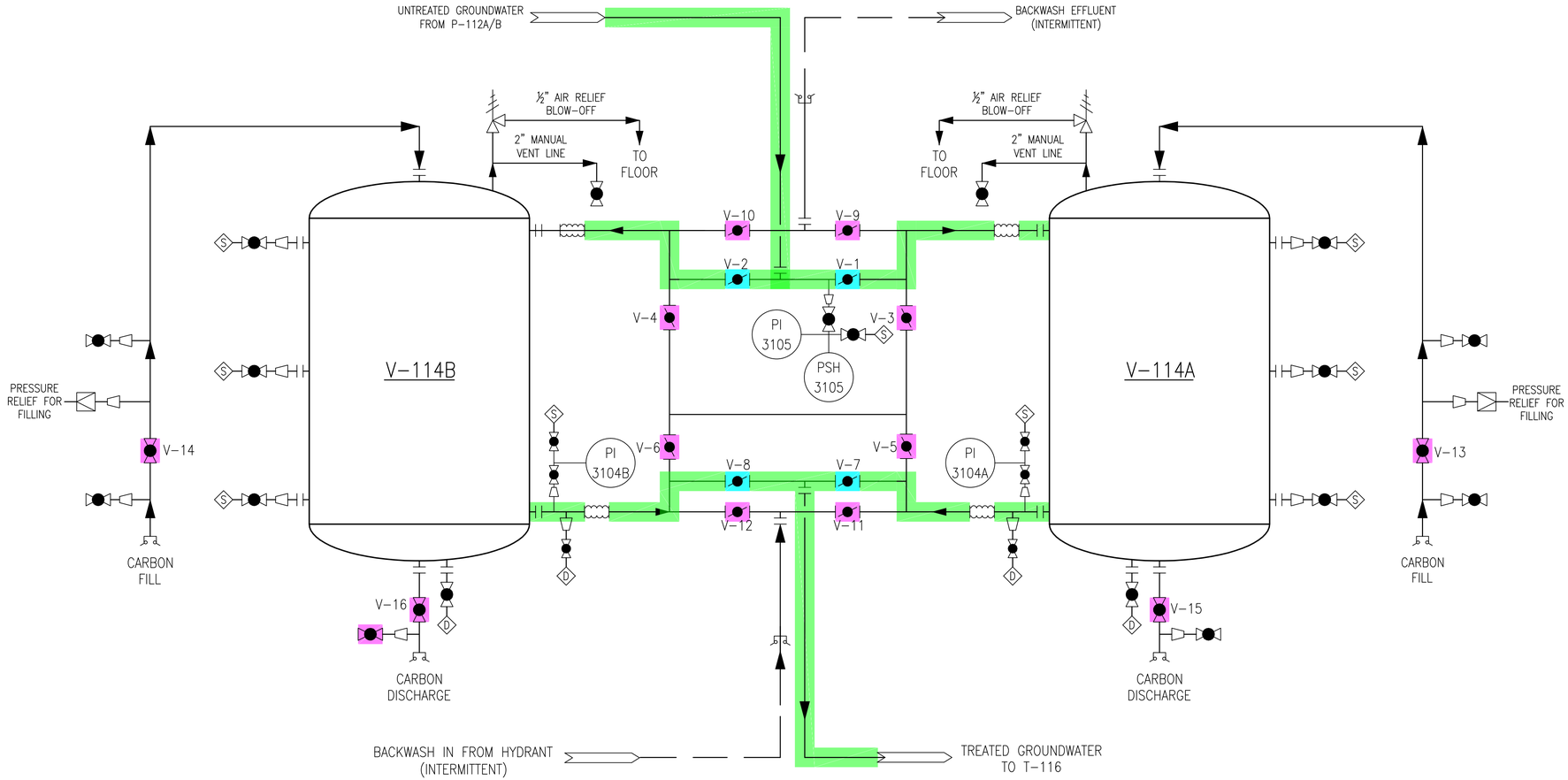
CARBON BED VALVE POSITIONS

SERIES OPERATION

B LEAD - A LAG

FOR:

PROJ NO: | DWG NO: FIGURE E-2 | REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

CARBON BED VALVE POSITIONS

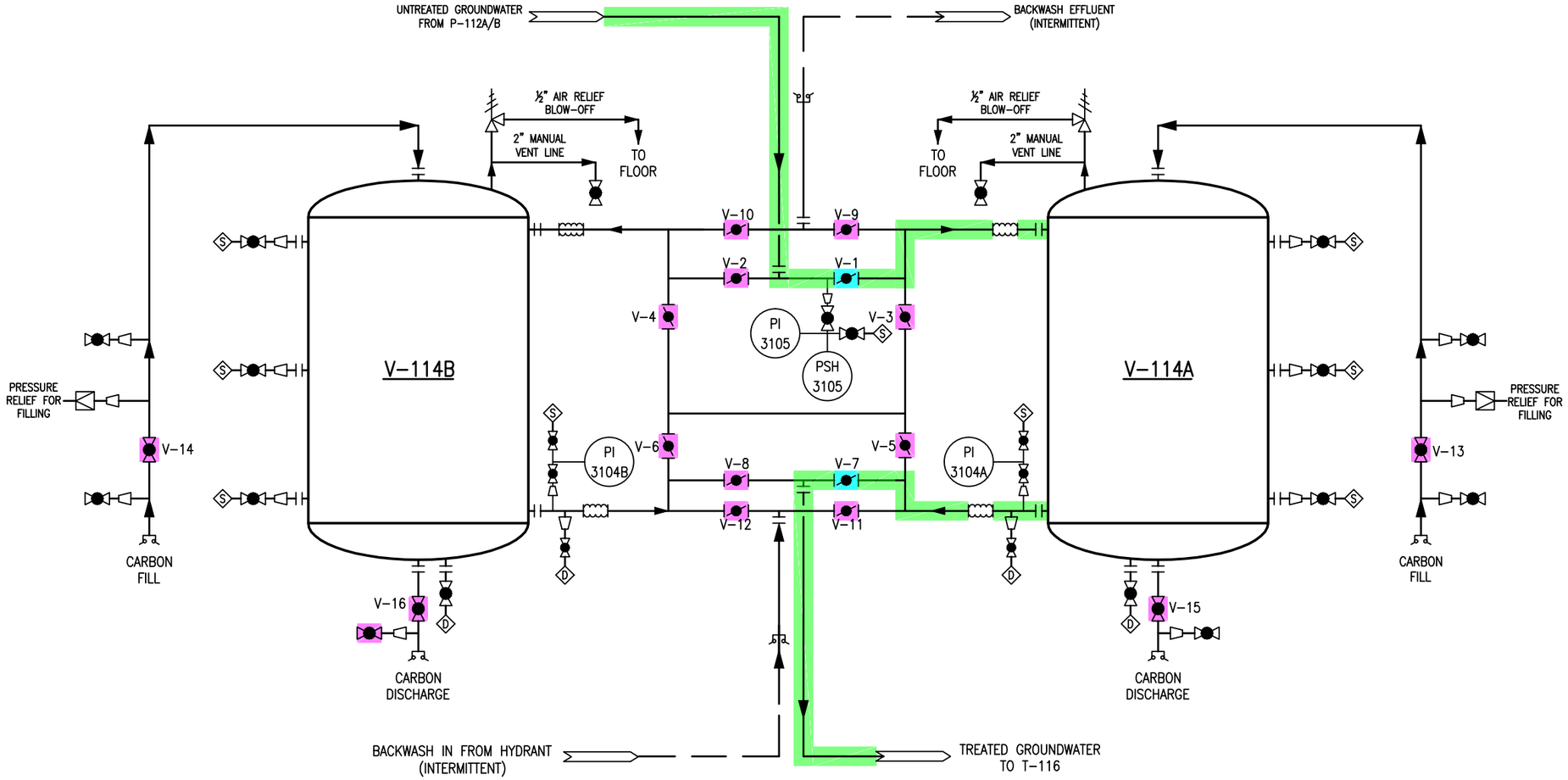
PARALLEL FLOW

A AND B BOTH ONLINE

FOR:

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:	PROJ NO:	DWG NO: FIGURE E-3	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN: | CK'D: | APPD: | DATE: | SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

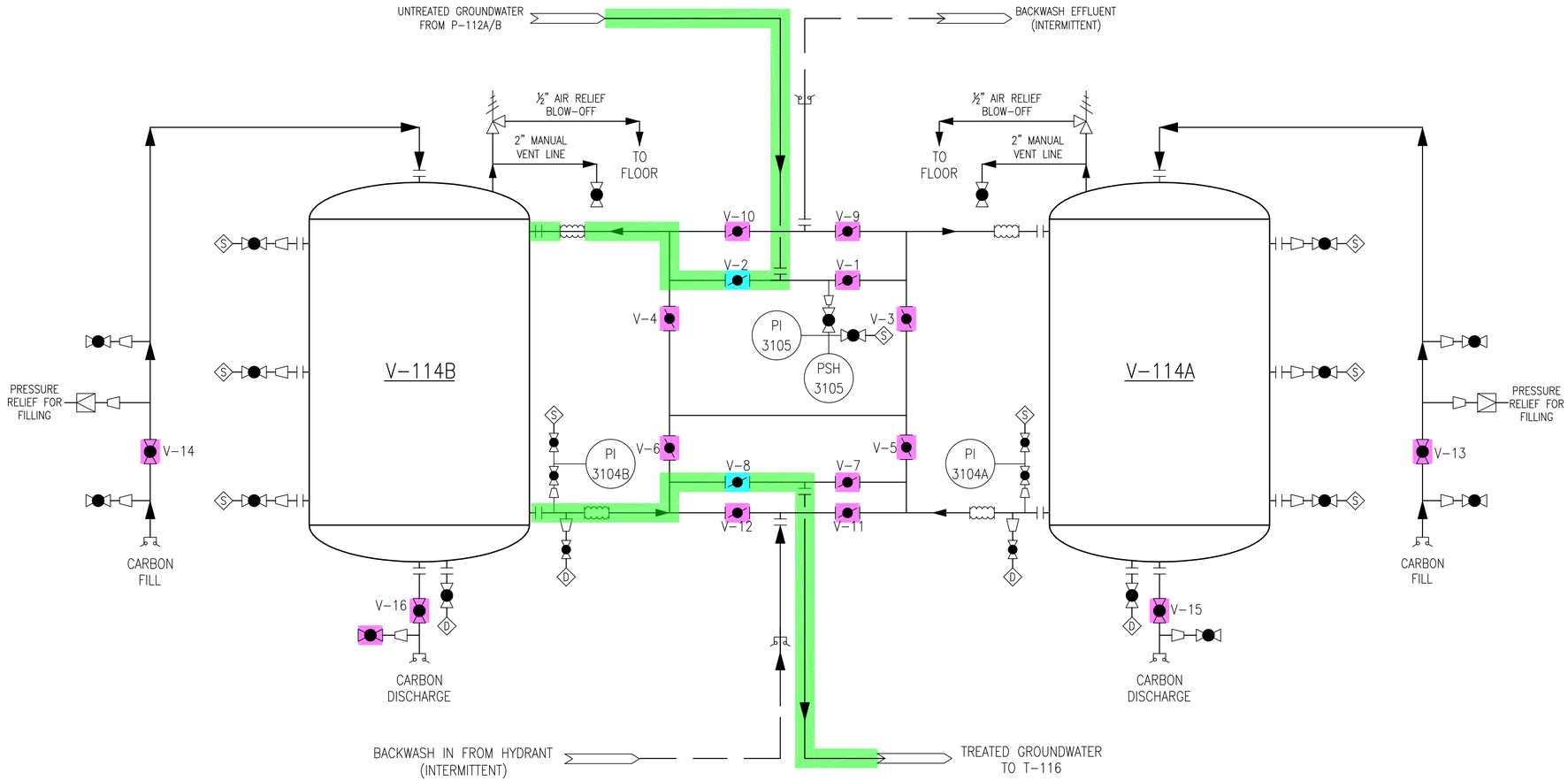
CARBON BED VALVE POSITIONS

SINGLE BED

A ONLINE B OFFLINE

FOR:

PROJ NO: | DWG NO: FIGURE E-4 | REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

CARBON BED VALVE POSITIONS

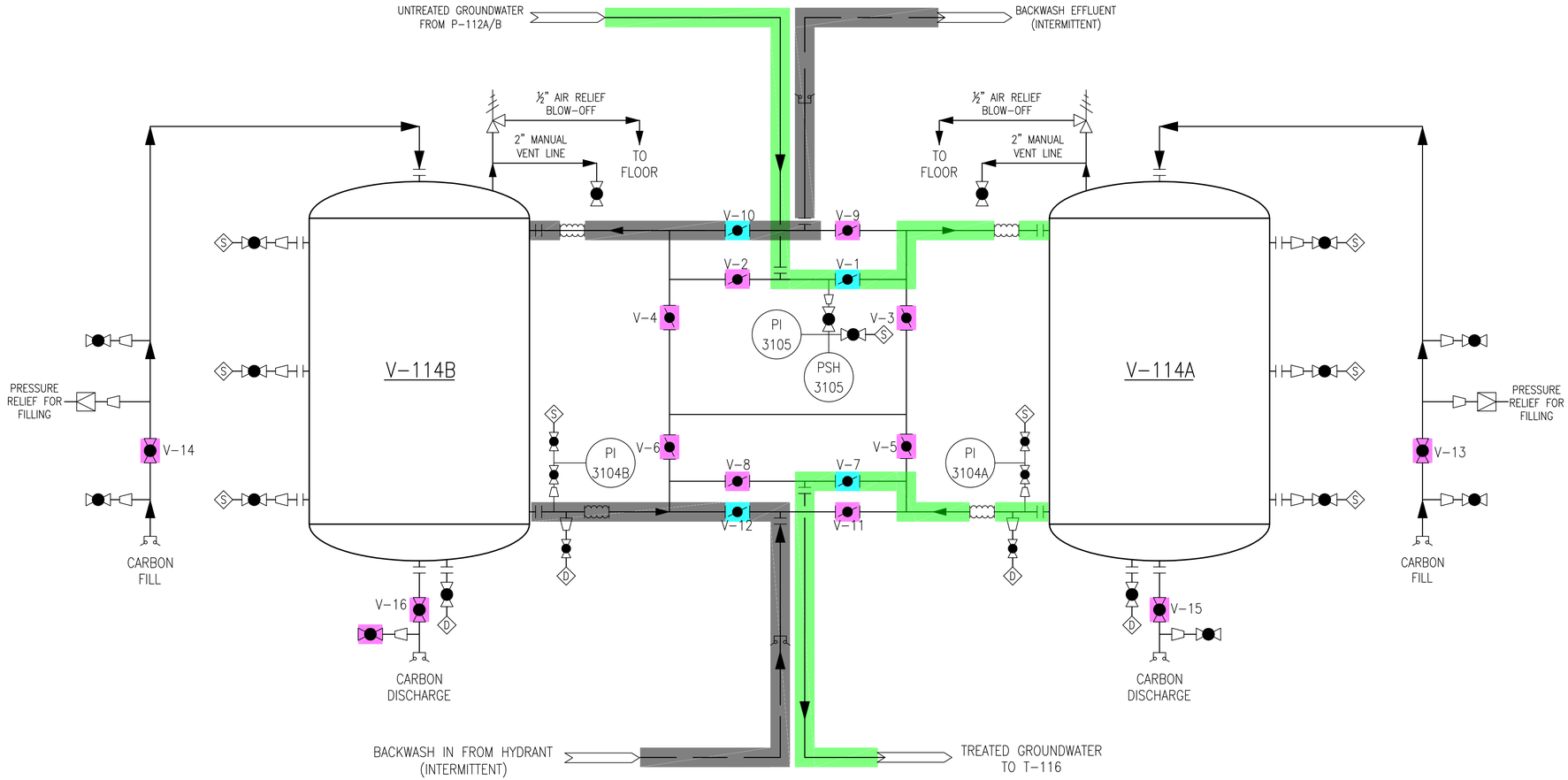
SINGLE BED

B ONLINE A OFFLINE

FOR:

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:	PROJ NO:	DWG NO: FIGURE E-5	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW
- BACKWASH FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

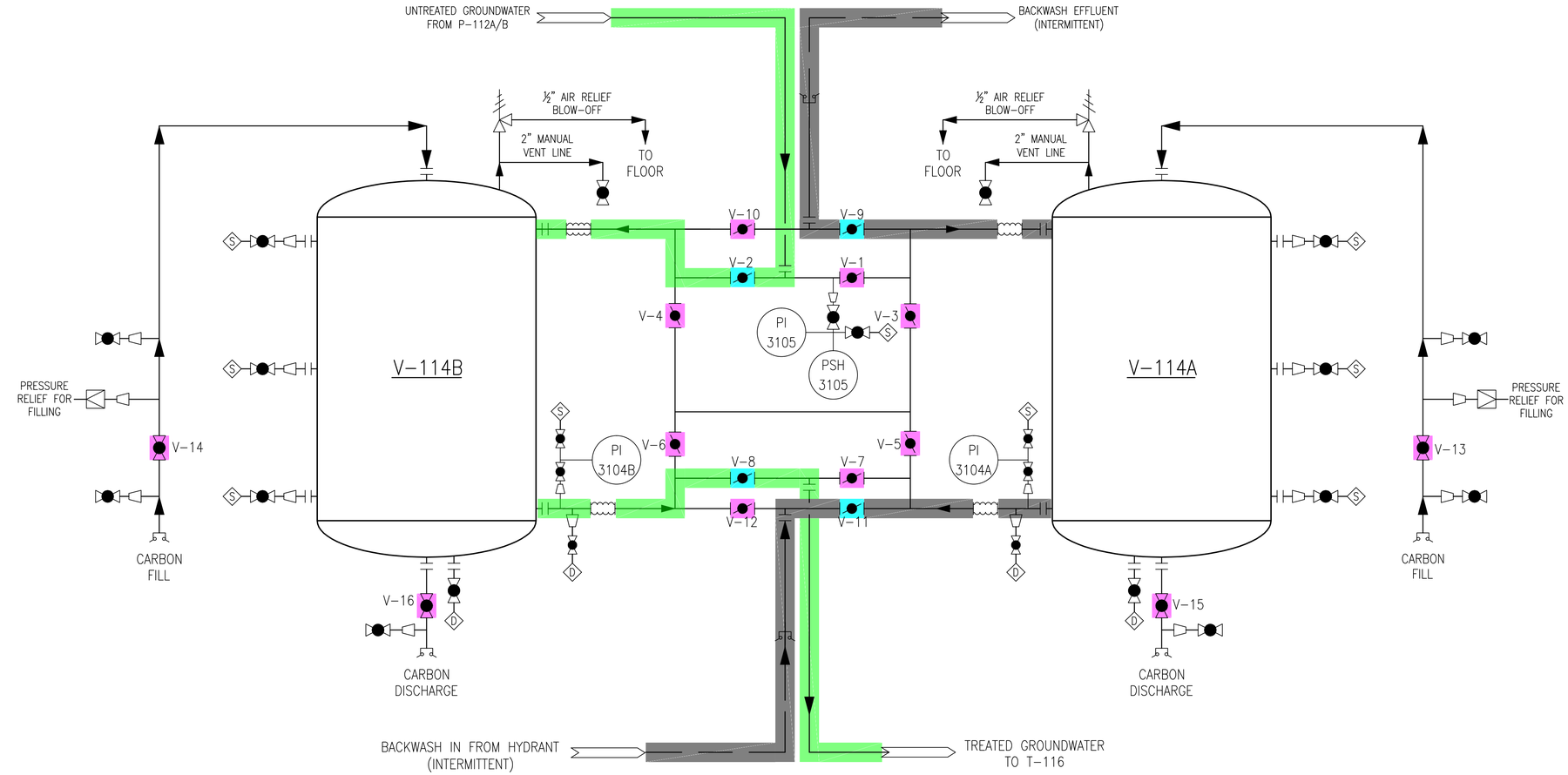
CARBON BED VALVE POSITIONS

ONLINE AND BACKWASH

A ONLINE B BACKWASH

FOR:

PROJ NO:	DWG NO: FIGURE E-6	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW
- BACKWASH FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

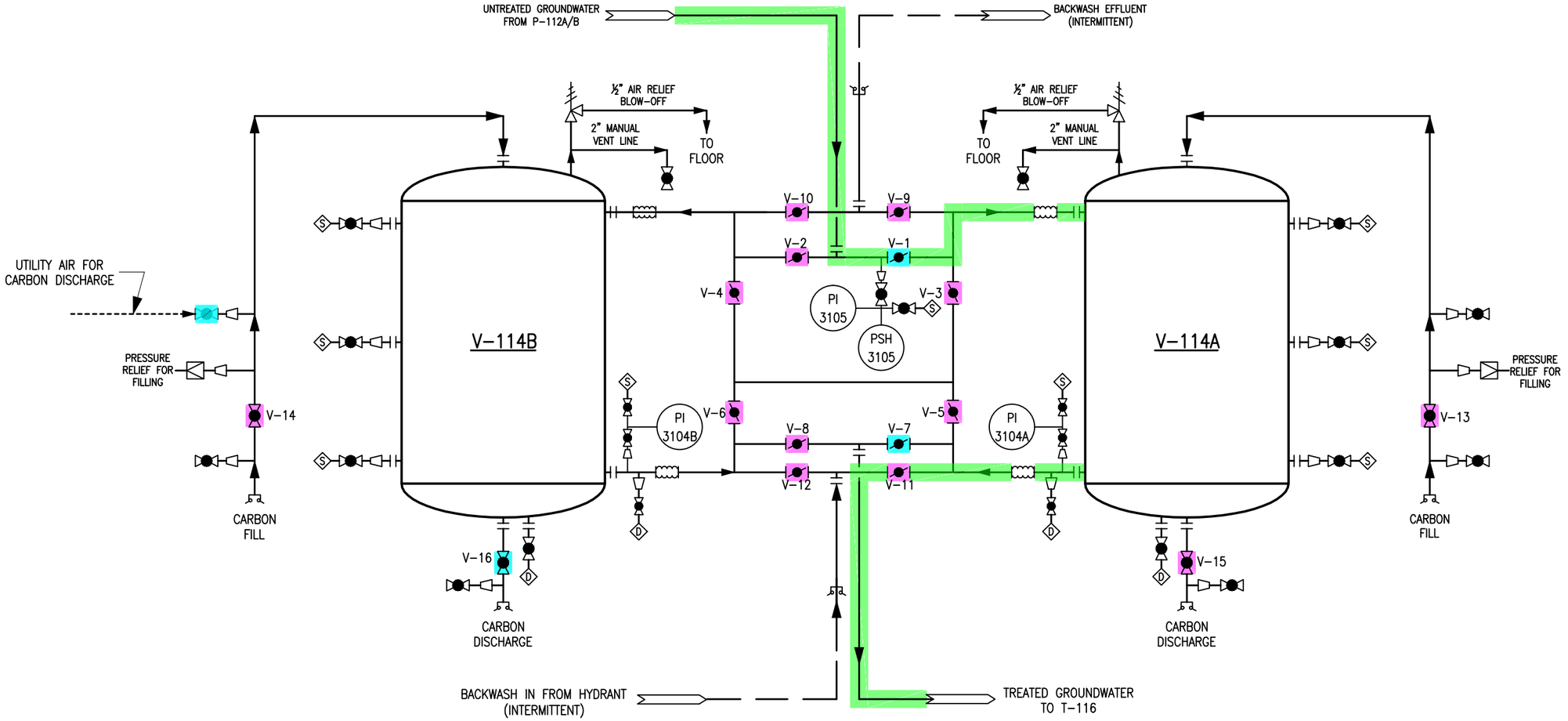
CARBON BED VALVE POSITIONS

ONLINE AND BACKWASH

B ONLINE A BACKWASH

FOR:

PROJ NO:	DWG NO: FIGURE E-7	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW
- BACKWASH FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

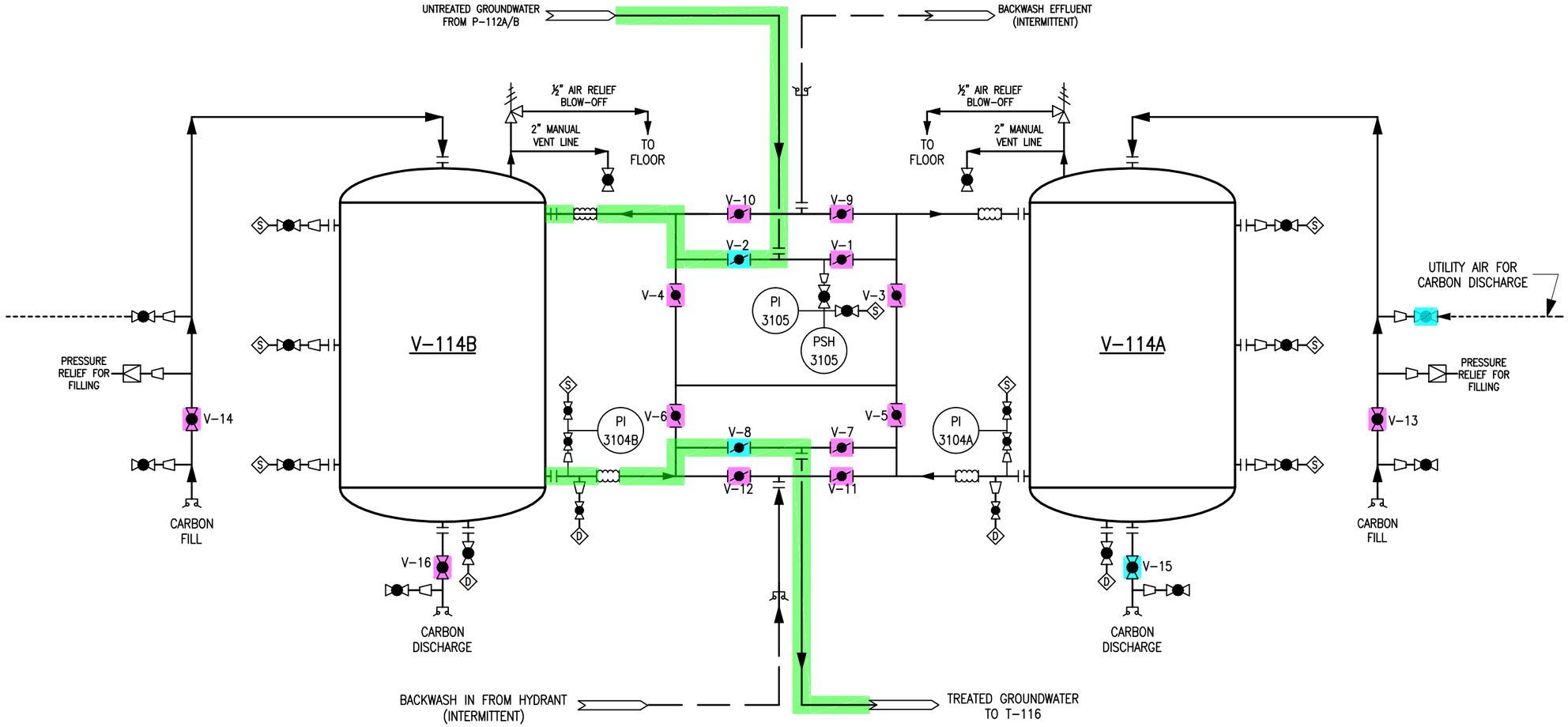
CARBON BED VALVE POSITIONS

ONLINE AND UNLOADING CARBON

A ONLINE B UNLOADING CARBON

FOR:

PROJ NO:	DWG NO: FIGURE E-8	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW
- BACKWASH FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

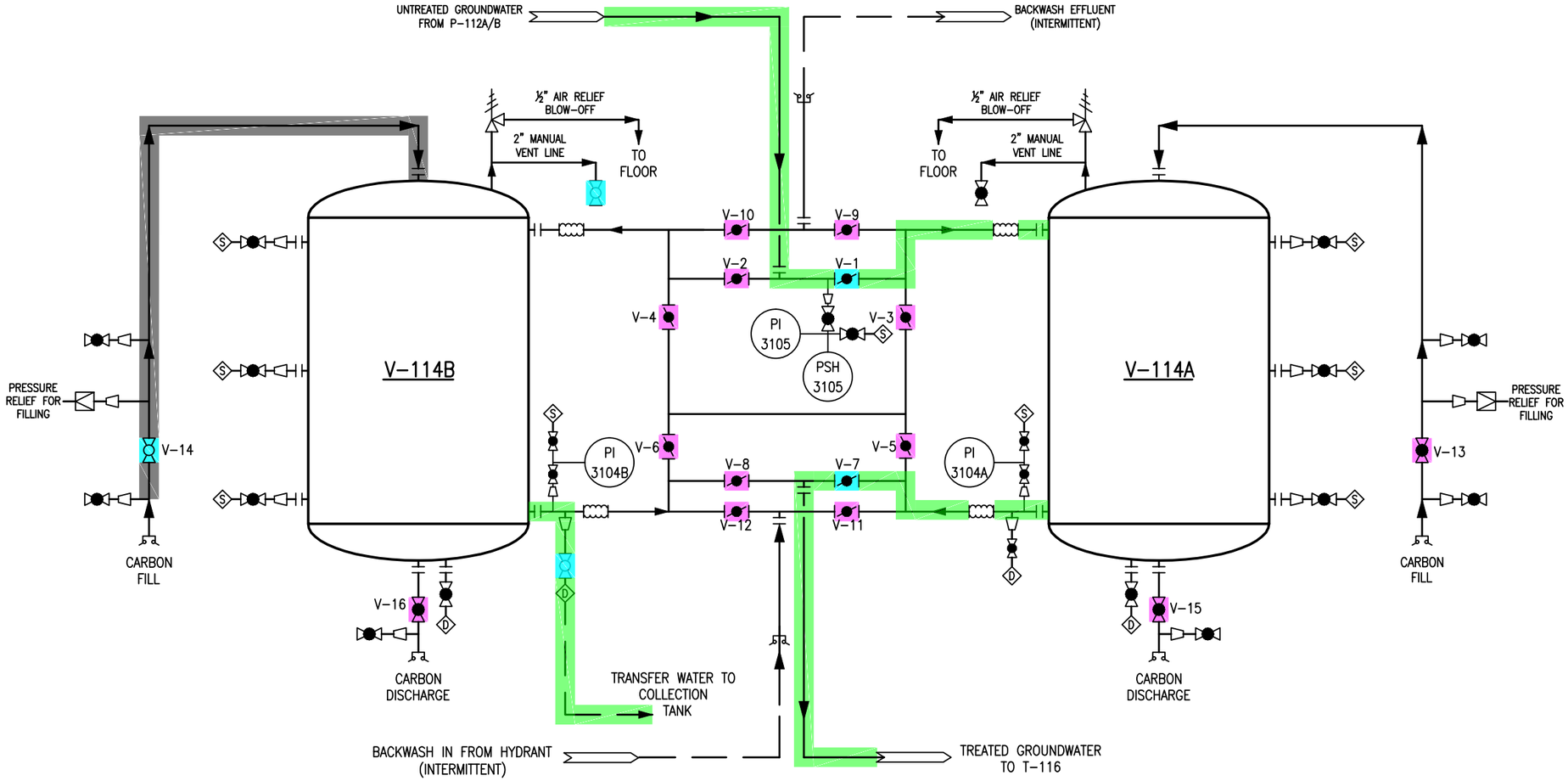
CARBON BED VALVE POSITIONS

ONLINE AND UNLOADING CARBON

B ONLINE A UNLOADING CARBON

FOR:

PROJ NO:	DWG NO: FIGURE E-9	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW
- CARBON SLURRY FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN:	CK'D:	APPD:	DATE:	SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

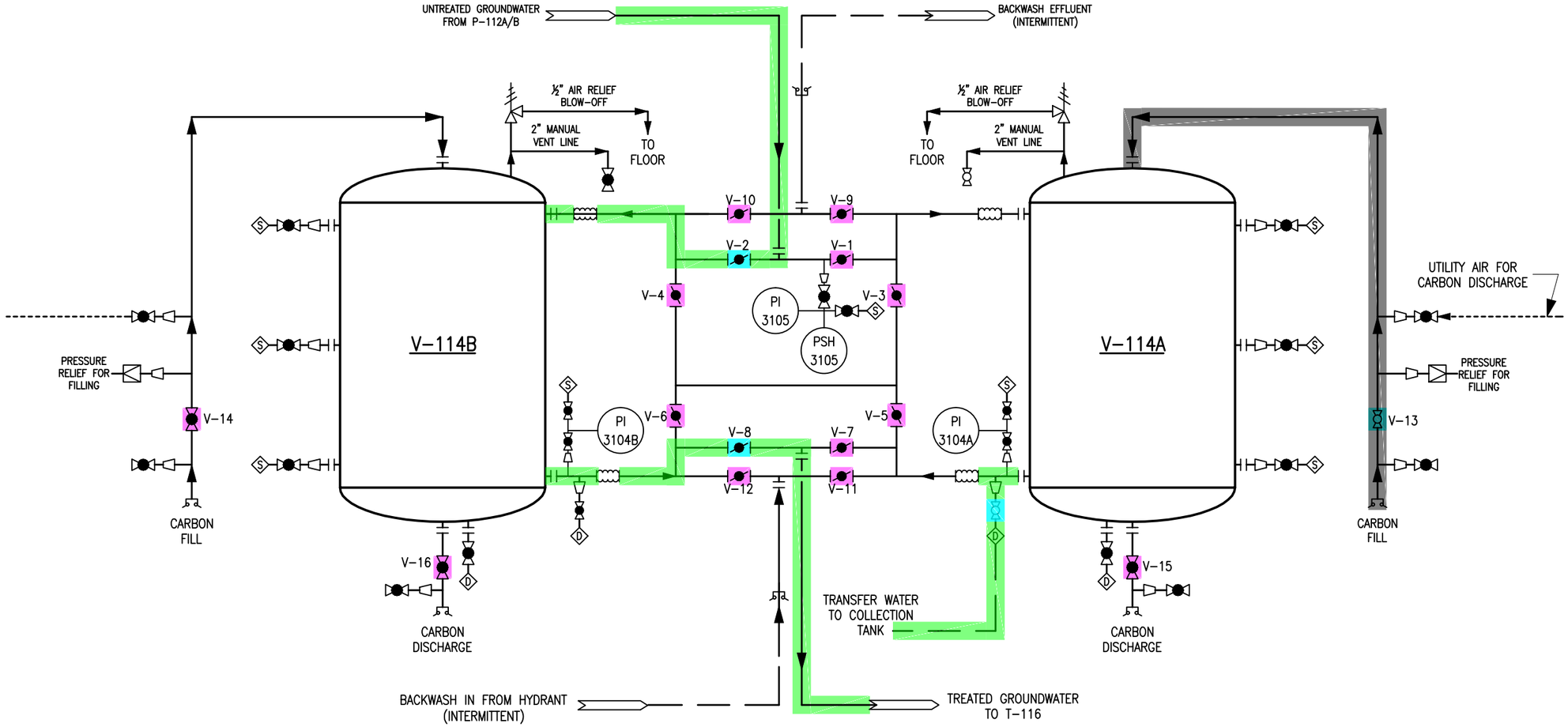
CARBON BED VALVE POSITIONS

ONLINE AND LOADING CARBON

A ONLINE B LOADING CARBON

FOR:

PROJ NO:	DWG NO: FIGURE E-10	REV:



LEGEND

- EXPANSION JOINT
- BALL VALVE
- PRESSURE SWITCH
- REDUCER
- PRESSURE GUAGE
- RUPTURE DISK
- MANUALLY OPERATED BUTTTERFLY VALVE
- QUICK CONNECT CAM LOCK FITTING
- AIR RELIEF VALVE
- S — SAMPLE PORT
- FC — FLUSH CONNECTION
- D — DRAIN CONNECTION

- CLOSED VALVE
- OPEN VALVE
- GROUND WATER FLOW
- CARBON SLURRY FLOW

NO.	REVISION	DRAWN	CK'D	APPD	DATE

DRAWN: | CK'D: | APPD: | DATE: | SCALE:

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
ALBUQUERQUE, NEW MEXICO

CLIENT DWG NO:

CARBON VALVE POSITIONS
ONLINE AND LOADING CARBON
B ONLINE A LOADING CARBON

FOR:

PROJ NO: | DWG NO: FIGURE E-11 | REV:

TRAIN 2 VALVE POSITIONS

SECTION 8

OPERATING INFORMATION

FIGURE 1 VESSEL V-214A TO V-214B SERIES FLOW

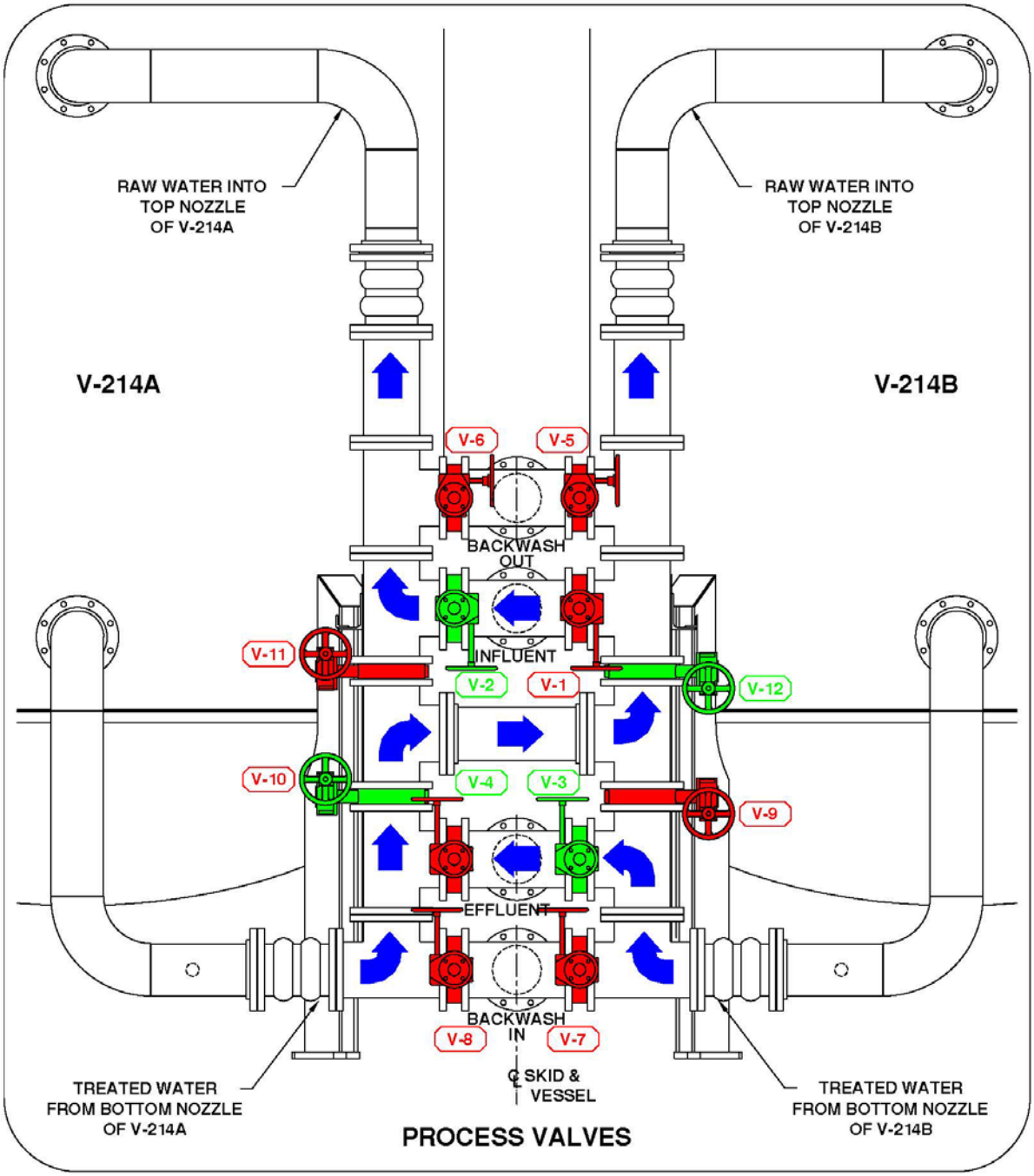


FIGURE 2 VESSEL V-214B ON-LINE VESSEL V-214A CARBON TRANSFER

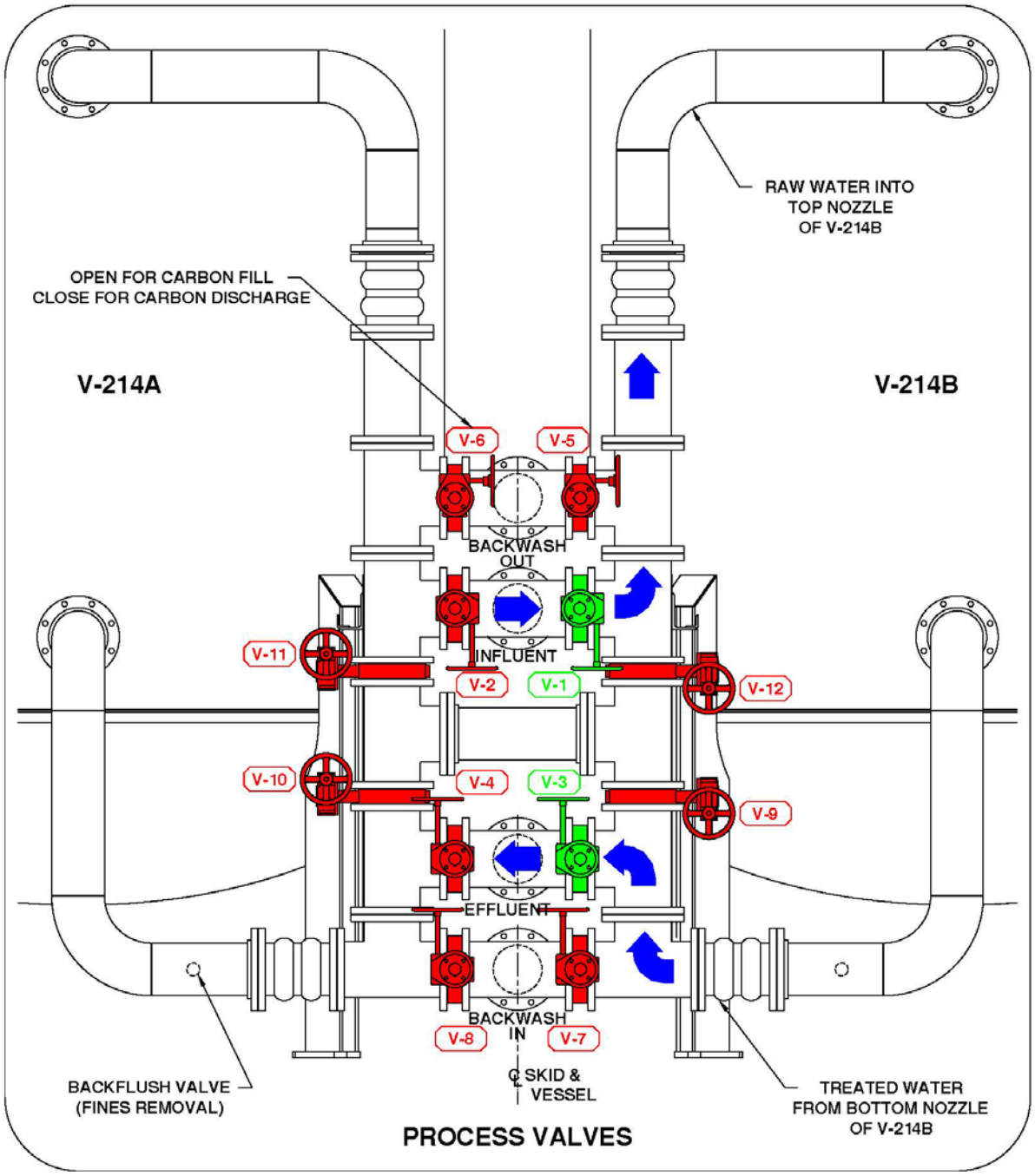


FIGURE 3 SERIES FLOW VESSEL V-214B TO V-214A

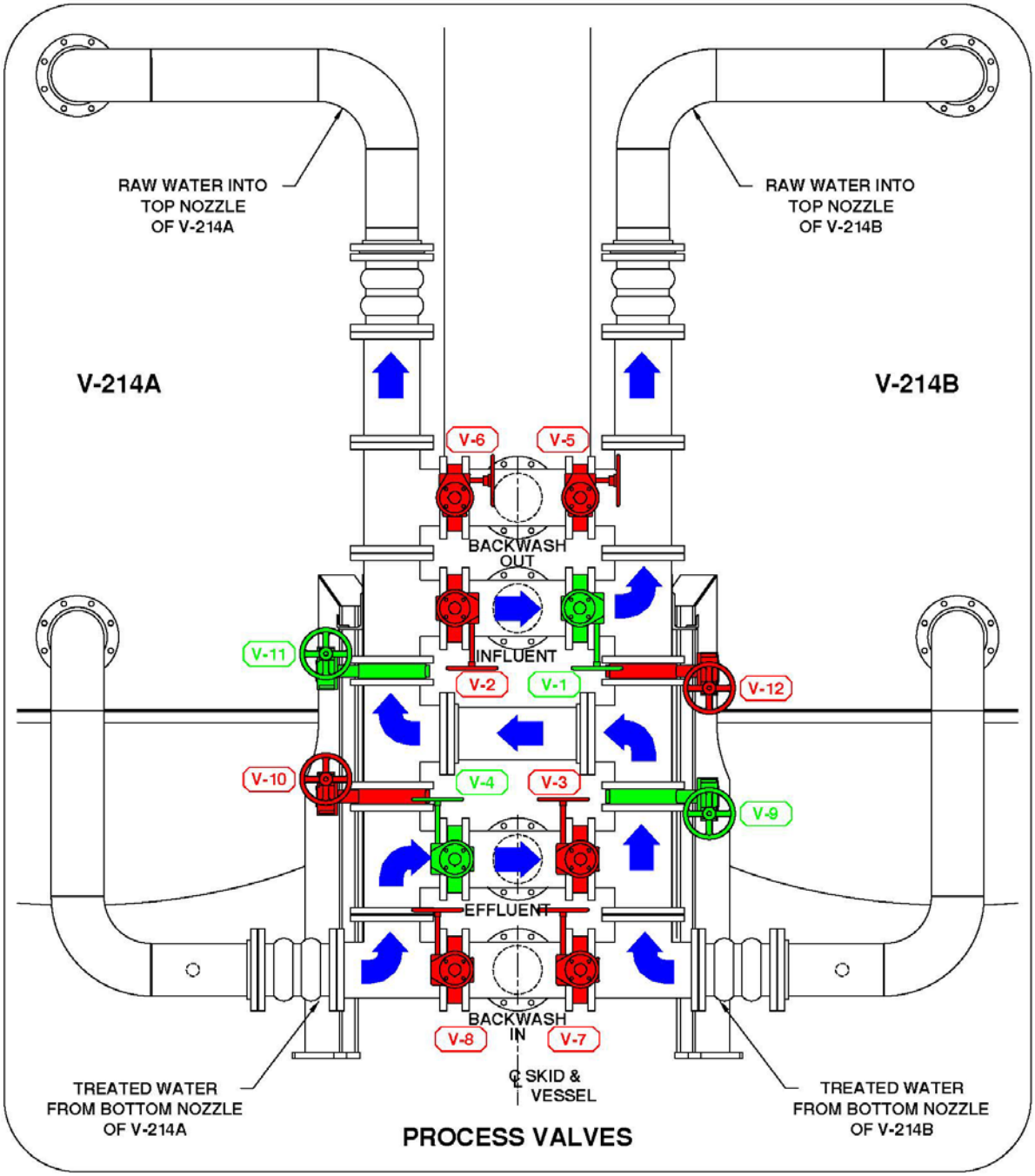


FIGURE 4 VESSEL V-214A ON-LINE VESSEL V-214B CARBON TRANSFER

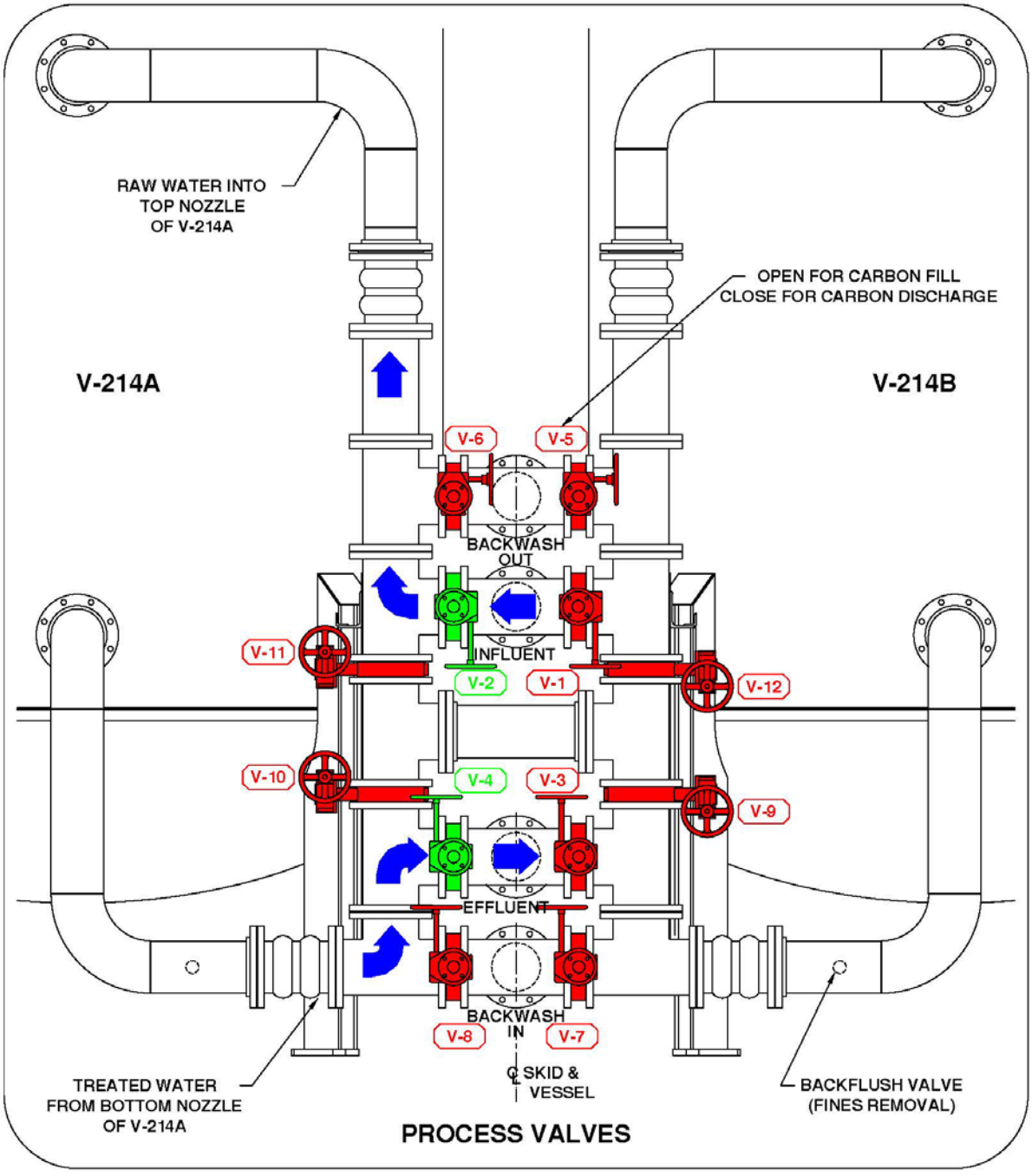


FIGURE 5 PARALLEL FLOW VESSEL V-214A AND V-214B

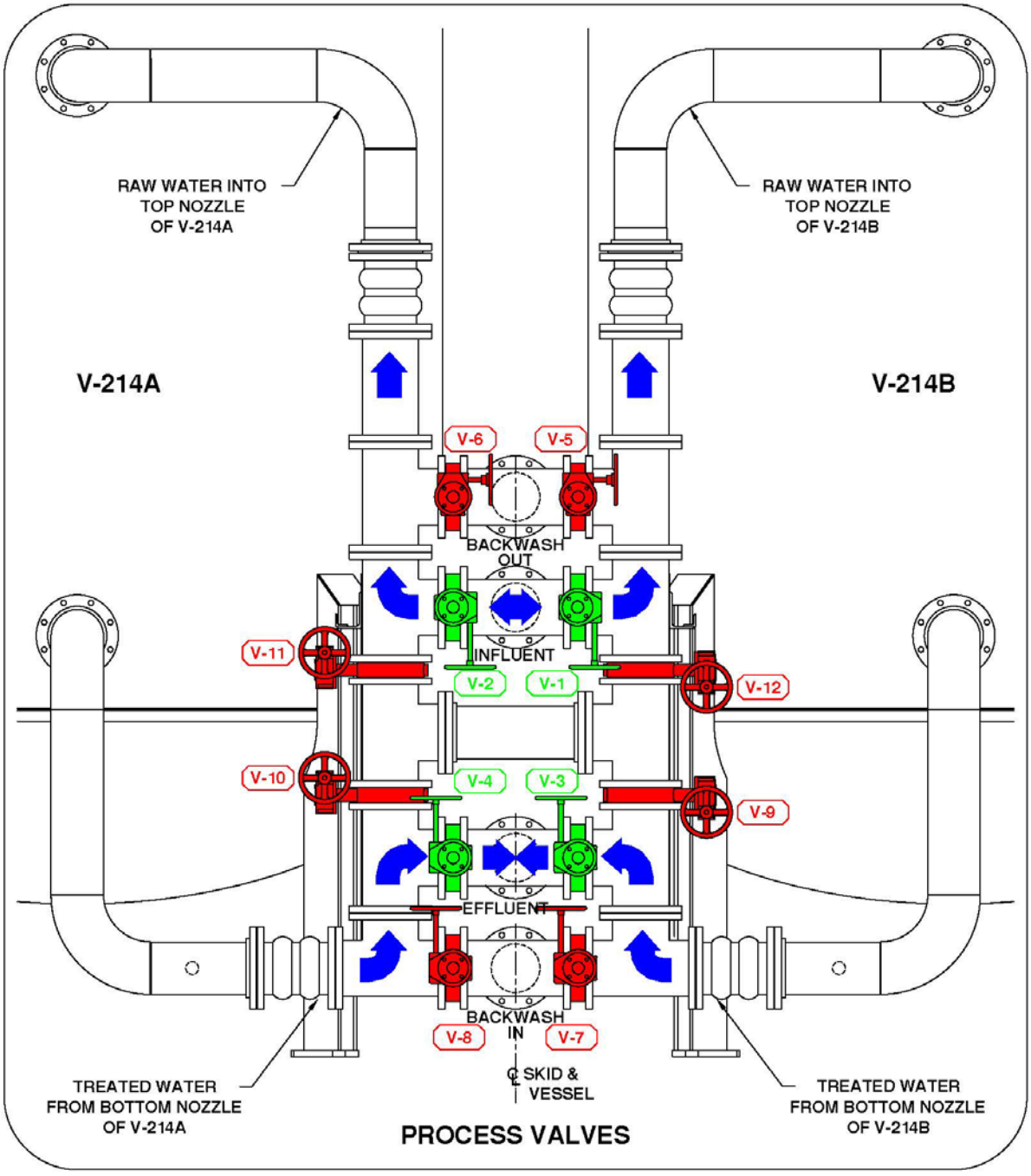


FIGURE 6 VESSEL V-214B ON-LINE VESSEL V-214A BACKWASHING

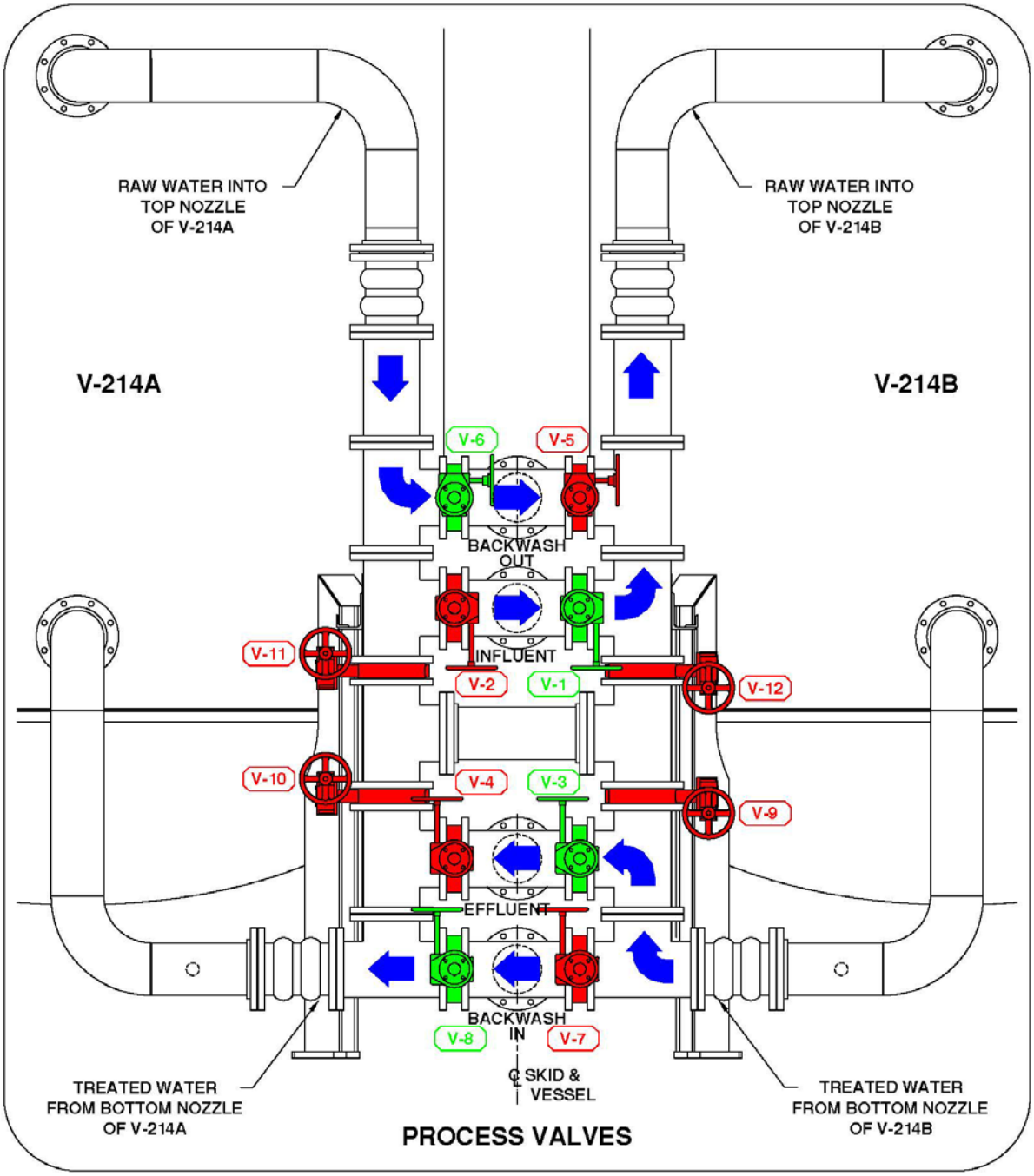
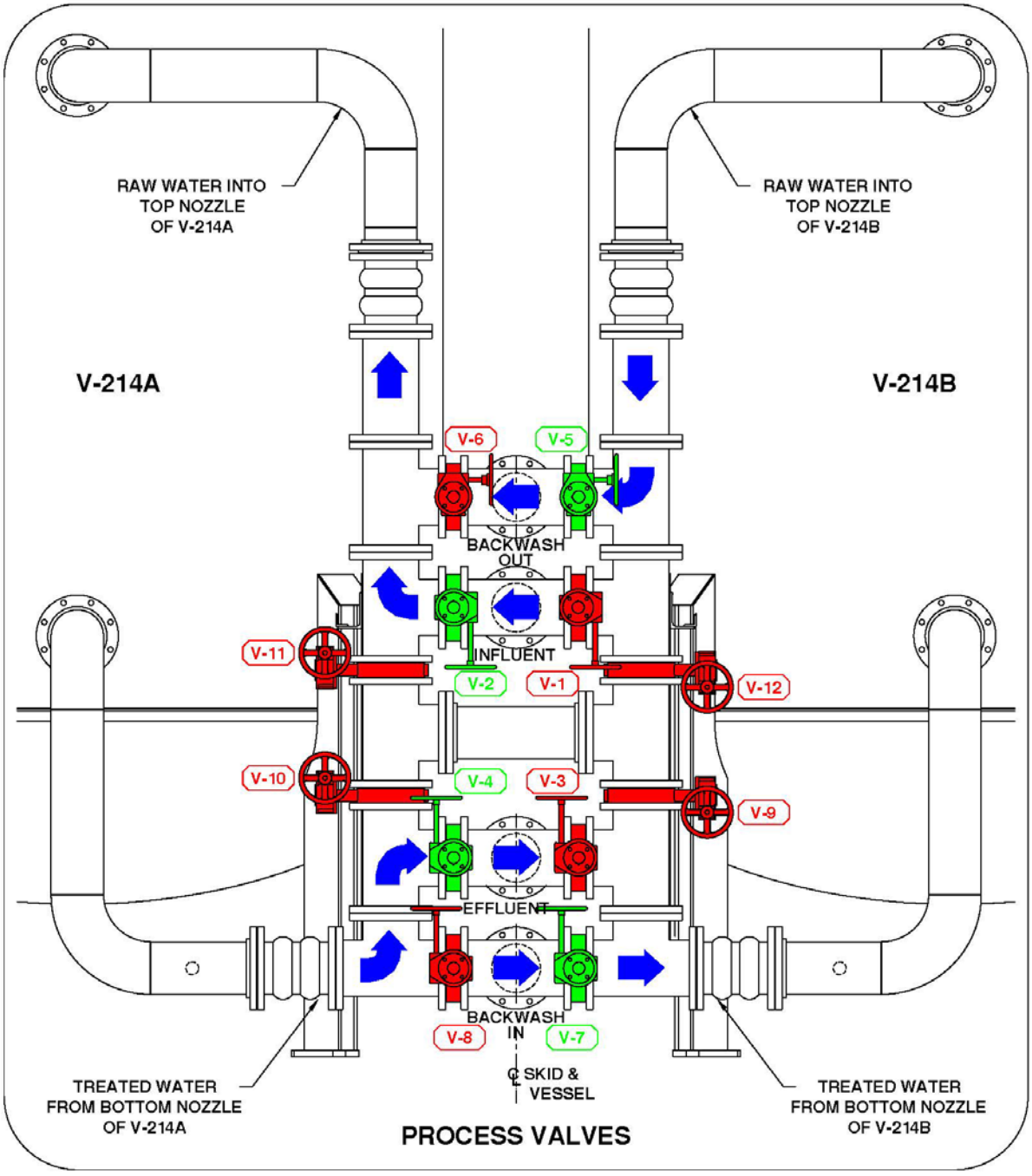


FIGURE 7 VESSEL V-214A ON-LINE VESSEL V-214B BACKWASHING



GWTS EQUIPMENT PHOTOGRAPHS


KAFB-106239 Vault

KAFB-106239 Wellhead

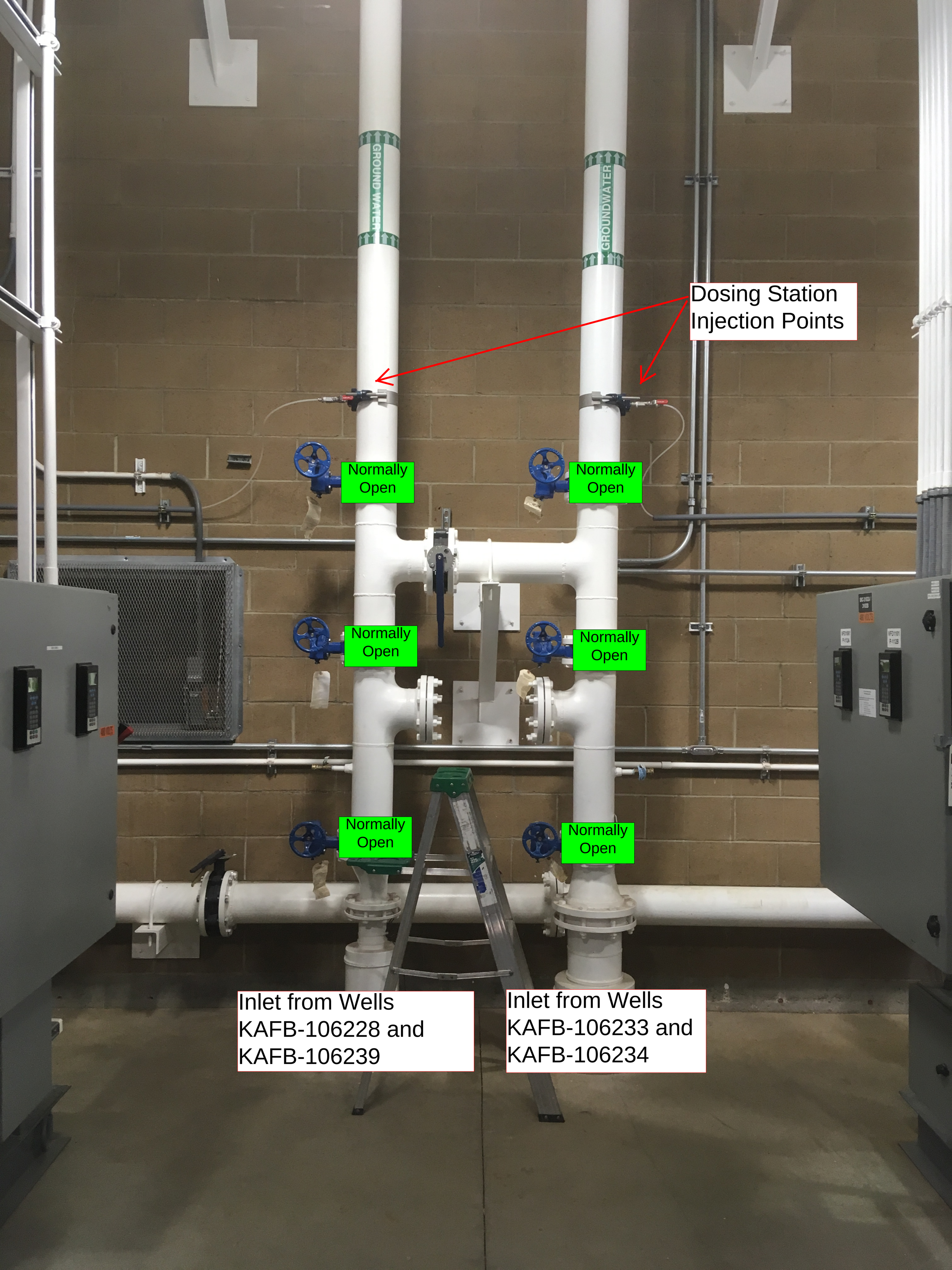




KAFB-106239
Electrical Pad

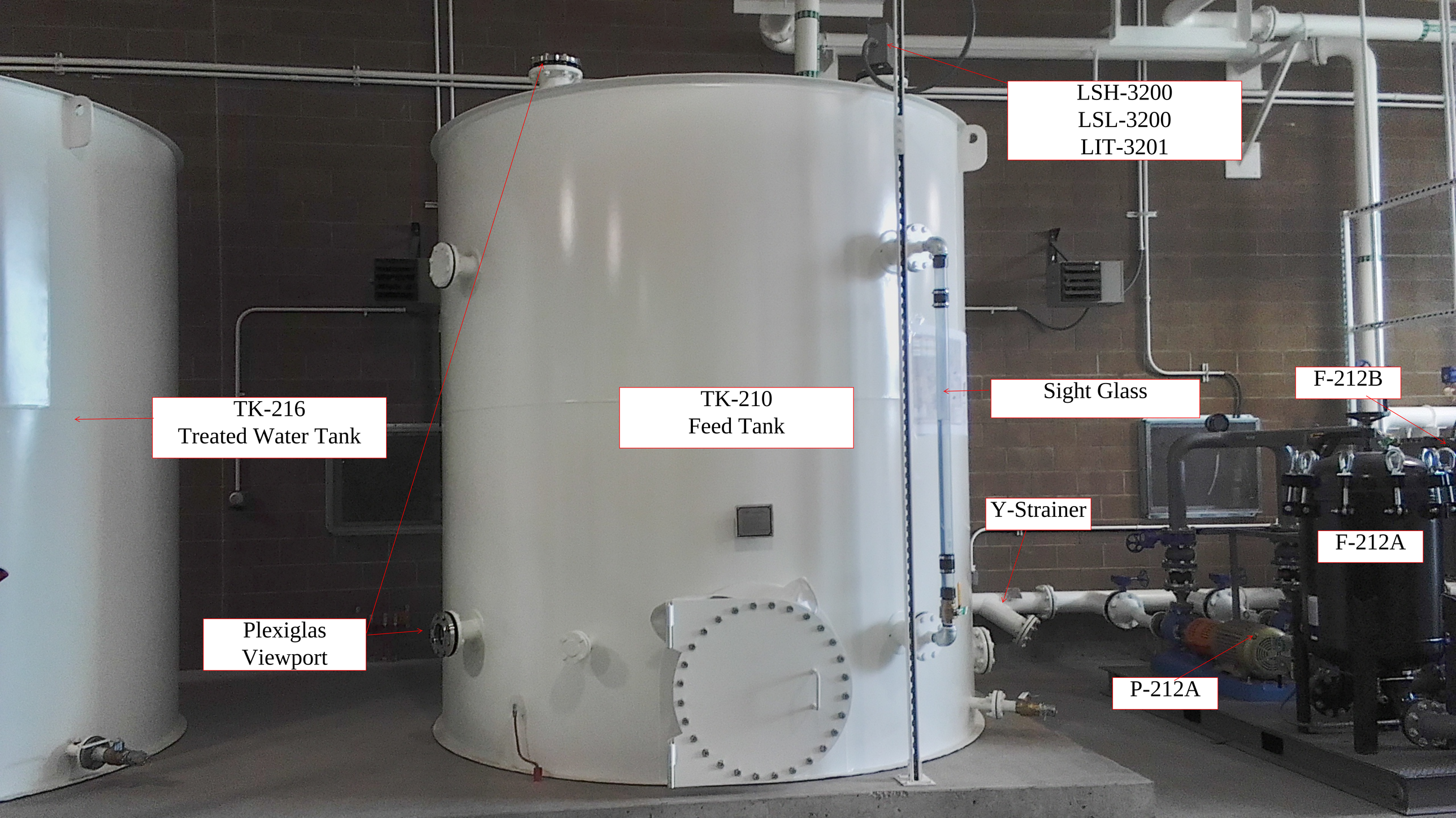
Junction Vault


Junction Vault


GROUND WATER
GROUNDWATER
Dosing Station Injection Points
Normally Open
Normally Open
Normally Open
Normally Open
Normally Open
Normally Open
Inlet from Wells KAFB-106228 and KAFB-106239
Inlet from Wells KAFB-106233 and KAFB-106234


Bypass lines


LSH-3100
LSL-3100
LIT-3101
Magnetic Flow Meter
(FIT-3102)
TK-110
Feed Tank
Vent
Sight Glass
F-112A
Plexiglas
Viewport

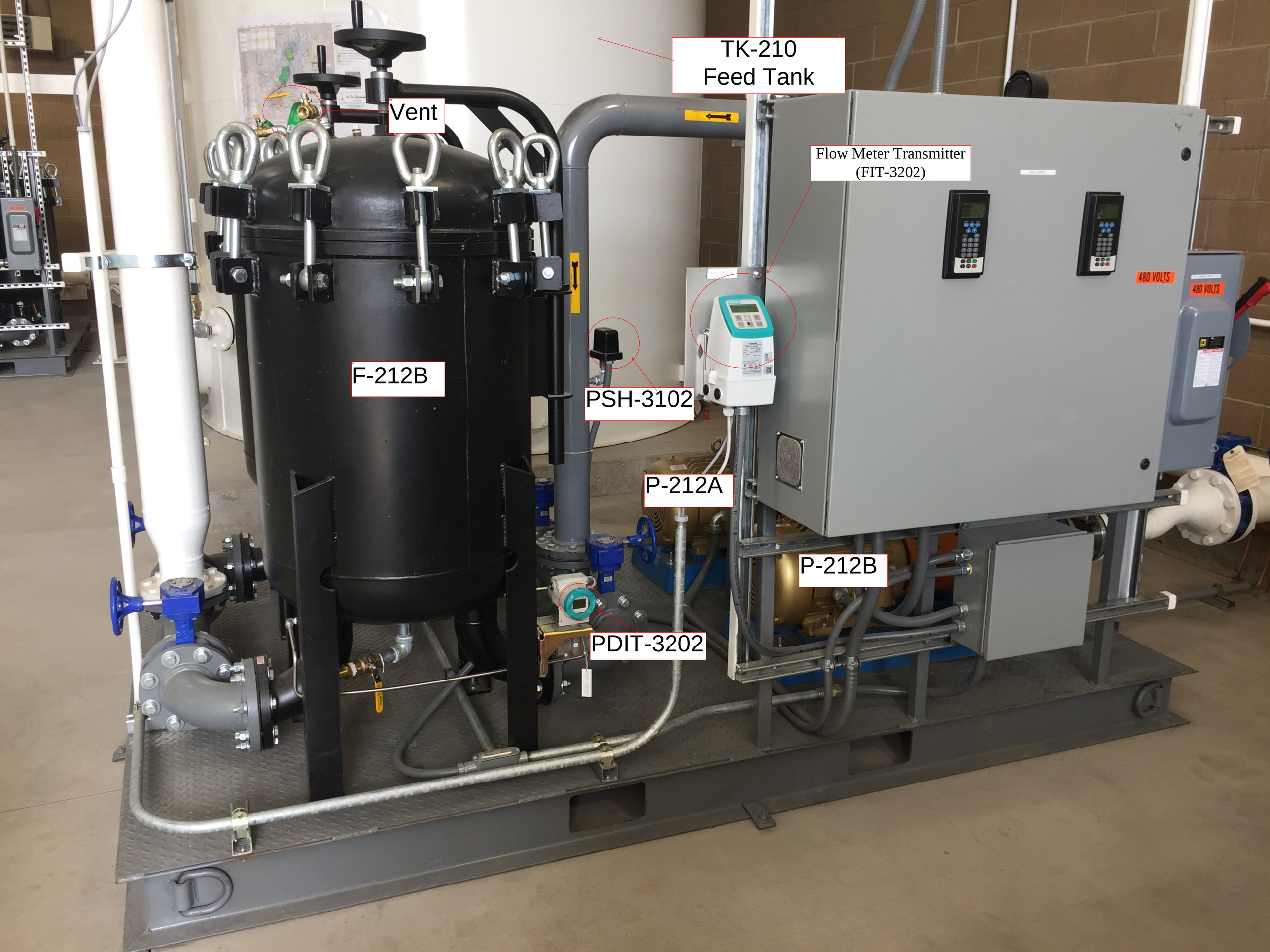

LSH-3200
LSL-3200
LIT-3201
TK-216
Treated Water Tank
TK-210
Feed Tank
Sight Glass
F-212B
Y-Strainer
F-212A
Plexiglas
Viewport
P-212A


Normally Open
F-112B Vent
PI-3103
F-112A Vent
Normally Open
F-112B
F-112A
GROUNDWATER
Normally Open


TK-110
Feed Tank
Flow Meter Transmitter
(FIT-3102)
Sample Port
Vent
PSH-3102
F-112B
F-112A
P-112A
P-112B
PDIT-3103
SIC-3102A /
3102B
480 VOLTS
VFD1061
P-112A
VFD1101
P-112B
DANGER
DRAIN
PENTAIR


PI-3102
Normally Open
F-112A
F-112B
Normally Open


TK-210
Feed Tank
P-212A
Normally
Open
Normally
Open


TK-210
Feed Tank
Vent
Flow Meter Transmitter
(FIT-3202)
F-212B
PSH-3102
P-212A
P-212B
PDIT-3202
480 VOLTS
480 VOLTS

PI-3202

Magnetic Flow Meter
(FIT-3202)

F-212B

F-212A

Normally
Open

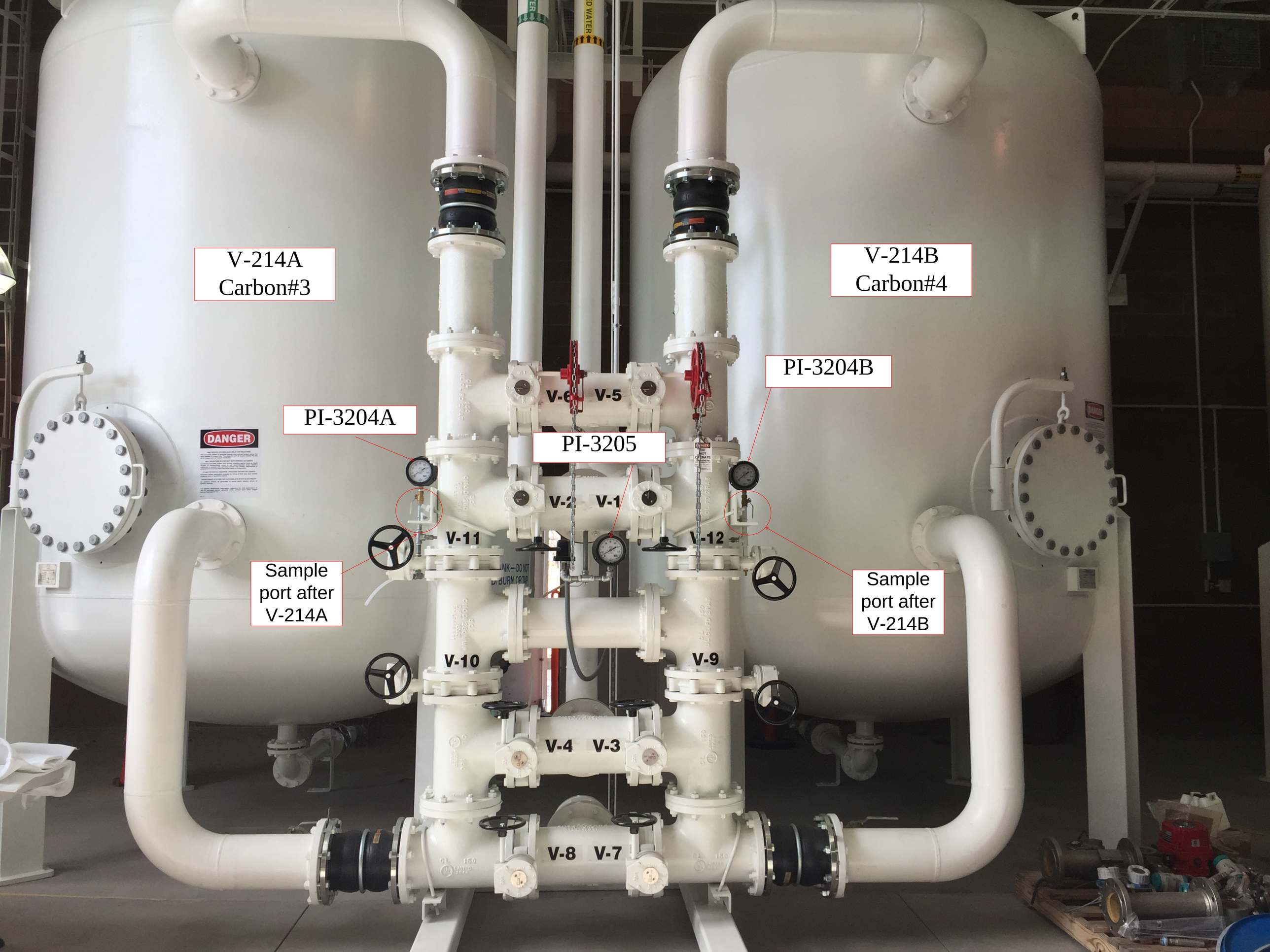
Normally
Open

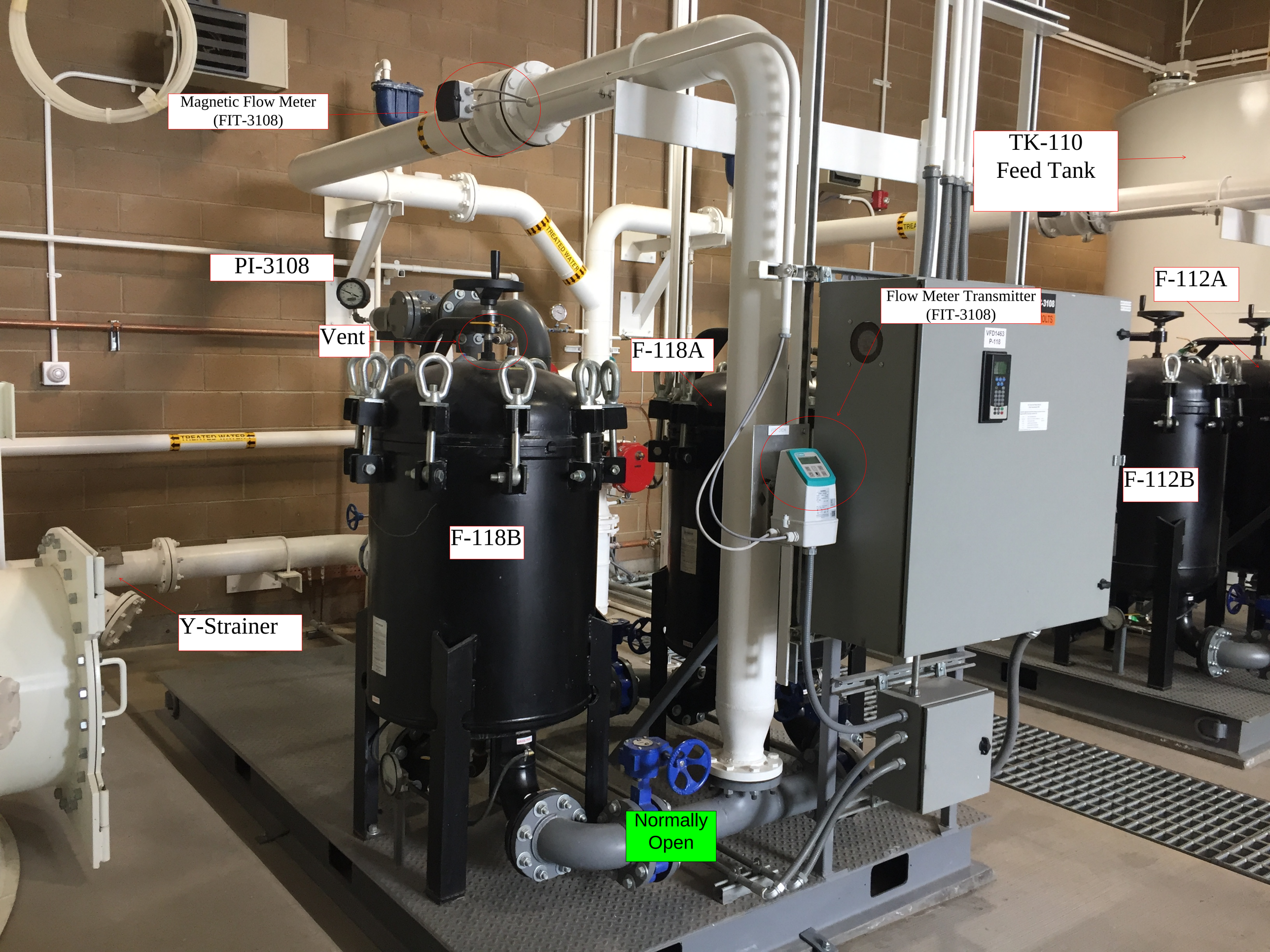
Normally
Open

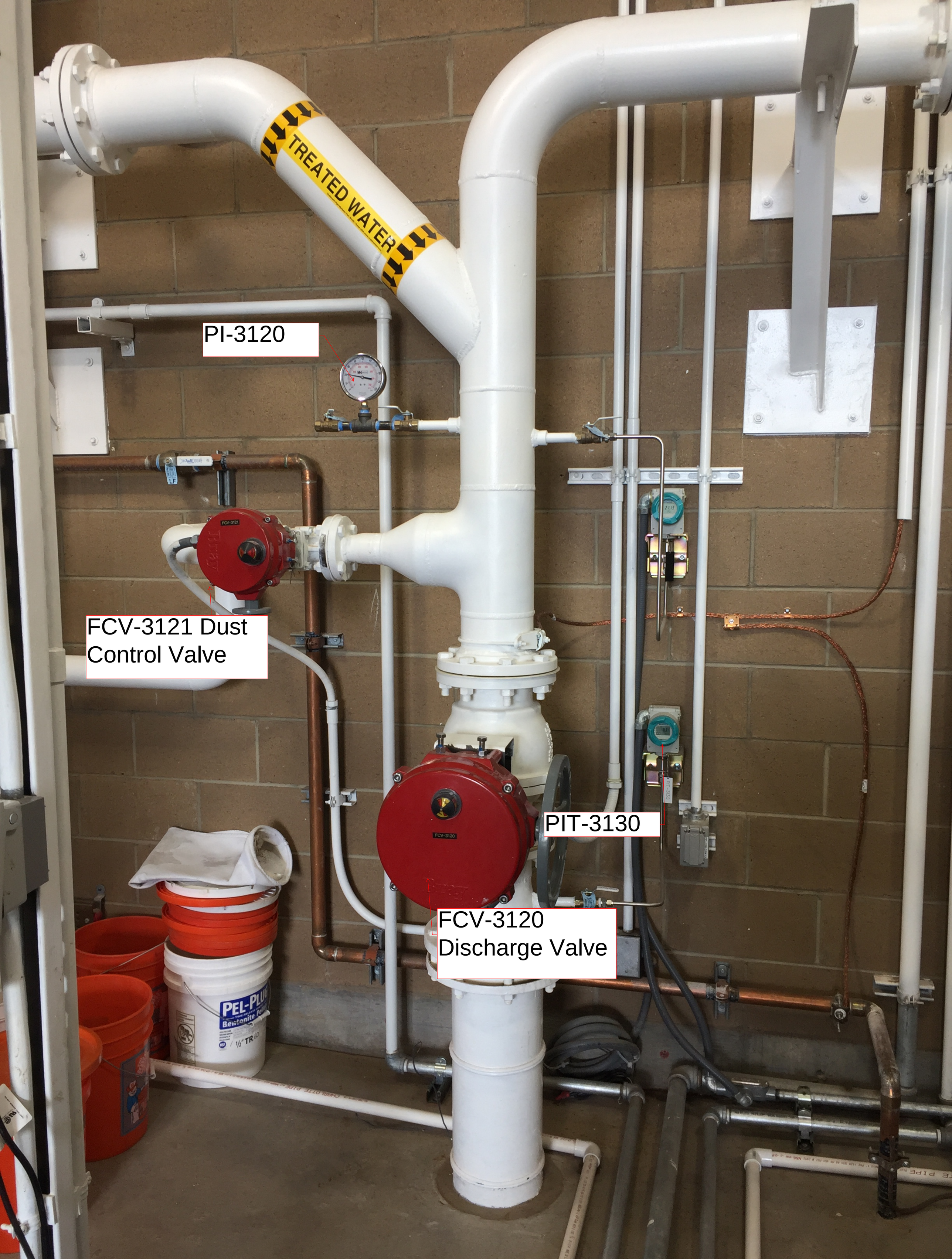
P-212B

P-212A


V-114B
Carbon#1
V-114A
Carbon#2
PI-3105
PI-3104B
PI-3104A
Sample Port
after V-114B
Sample Port
after V-114A


V-214A
Carbon#3
V-214B
Carbon#4
PI-3204A
PI-3205
PI-3204B
Sample
port after
V-214A
Sample
port after
V-214B
V-6
V-5
V-2
V-1
V-11
V-12
V-10
V-9
V-4
V-3
V-8
V-7
DANGER


Magnetic Flow Meter
(FIT-3108)
TK-110
Feed Tank
PI-3108
Vent
F-118A
Flow Meter Transmitter
(FIT-3108)
F-112A
F-112B
F-118B
Y-Strainer
Normally
Open


TREATED WATER
PI-3120
FCV-3121 Dust Control Valve
PIT-3130
FCV-3120 Discharge Valve

Sight Glass

TK-116
Treated Water Tank

Y-Strainer

Normally
Open



Basket strainer
(replaced original Y-strainer)


Magnetic Flow Meter
(FIT-3208)
PI-3208
F-218B Vent
F-218A Vent
Flow Meter Transmitter
(FIT-3208)
Normally
Open
F-218A
F-218B
P-218
PI-3203


TK-116
Treated Water Tank
Vent
F-218A
F-218B
F-118A
F-118B
P-118
Normally Open
PI-3102
Normally Open
P-218

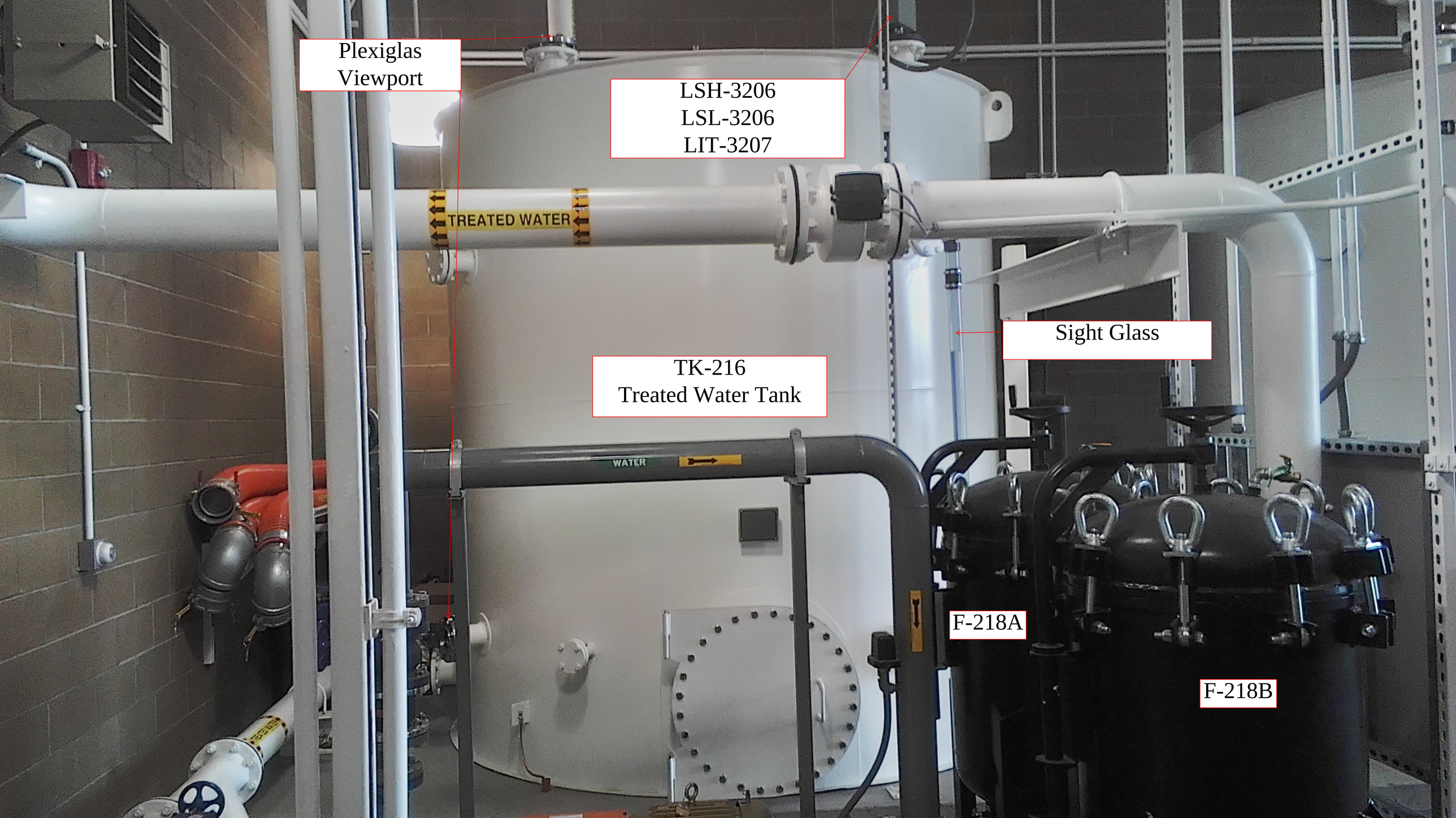
Normally Open

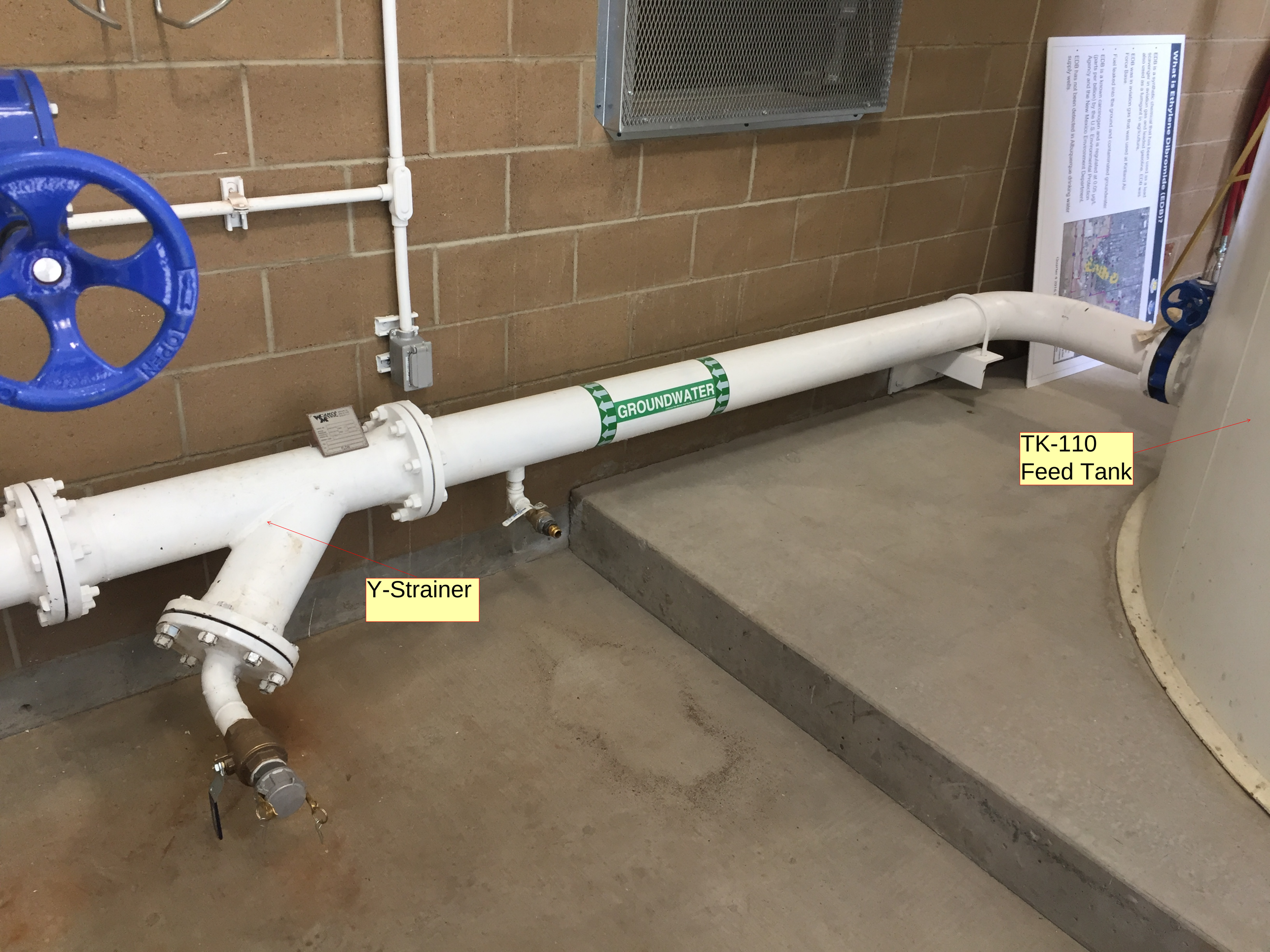
Normally Open

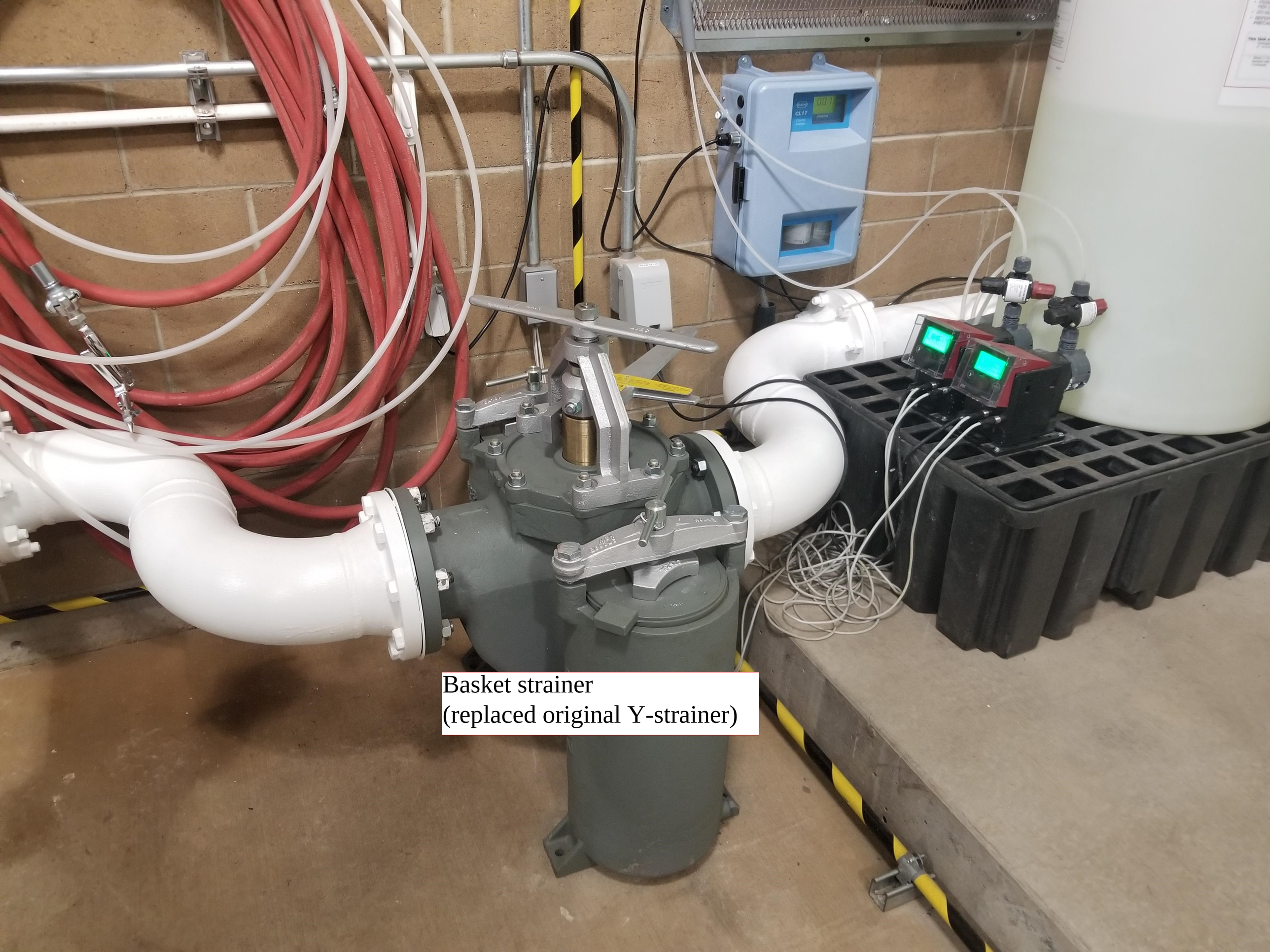
Normally Open


WATER
Normally Open
F-218A
F-218B
PSH-3208
P-218
Normally Open

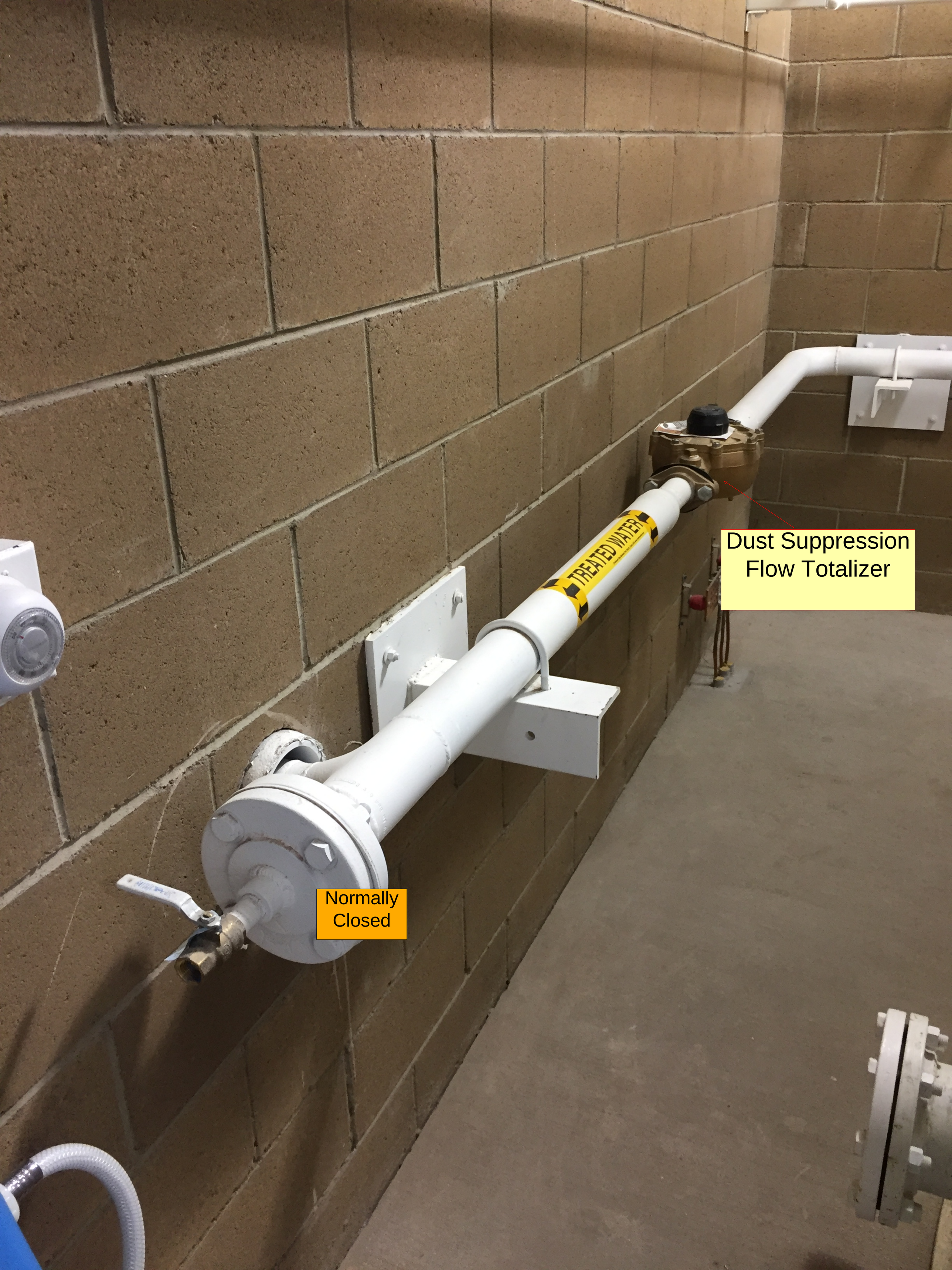

Tank Vent
TK-116
Treated Water Tank
Sight Glass
F-118B

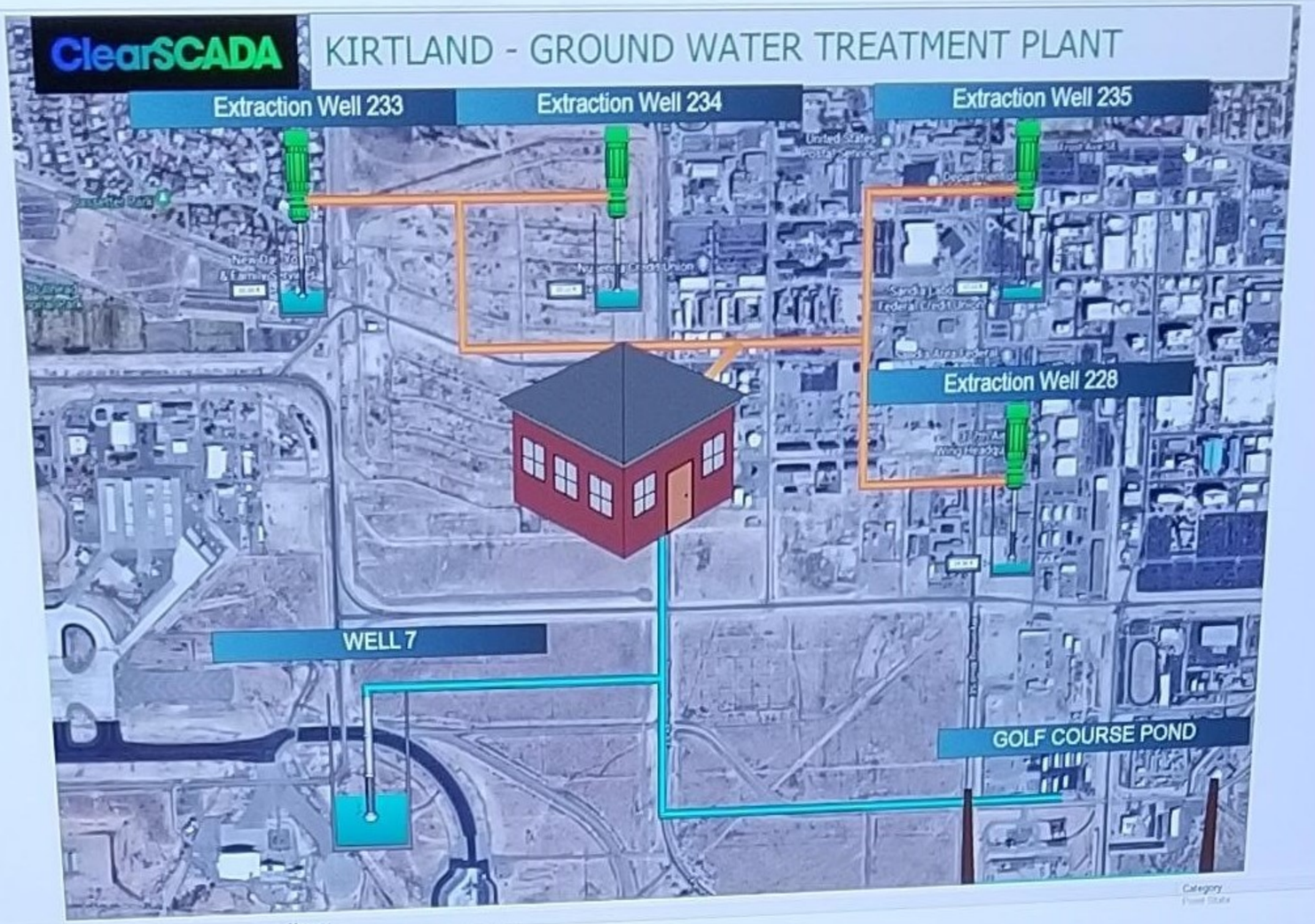

Plexiglas
Viewport
LSH-3206
LSL-3206
LIT-3207
TREATED WATER
Sight Glass
TK-216
Treated Water Tank
WATER
F-218A
F-218B


What is Ethylene Dibromide (EDB)?
GROUNDWATER
TK-110
Feed Tank
Y-Strainer



Basket strainer
(replaced original Y-strainer)


TREATED WATER
Dust Suppression
Flow Totalizer
Normally
Closed



SCADA Screen



CP-100
HMI Screen

NOTICE

IN CASE OF EMERGENCY, CONTACT

EA Engineering, Science, and Technology, Inc., PBC

KEVIN McKEAGE (316) 765-1486

TYLER CURLEY (719) 688-9558

DEVON JERCINOVIC (505) 401-1181

BASE EMERGENCY NUMBER (505) 853-9111



EMERGENCY
STOP
BUTTON


Post Indicator
Valve to Golf
Course Main Pond
Post Indicator
Valve to KAFB-7


KAFB-7 Wellhead
Pressure Transmitter
KAFB-7 Flow Meter
KAFB-7 PLC Cabinet
Hydraulic Unit Cabinet


GROUNDWATER
GROUND WATER
GROUNDWATER
yardney
WATER FILTRATION SYSTEMS
YARDNEY WATER MANAGEMENT SYSTEMS, INC. | RIVERSIDE, CA | U.S.A.
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Train 2 Effluent Check Valve

APPENDIX E

PROCESS CONTROL DESCRIPTION

PROCESS CONTROL DESCRIPTION

SUMMARY

This appendix includes process control operations, interlocks, and control methodology for programming of the programmable logic controller (PLC) and supervisory control and data acquisition (SCADA) system.

Main System Sections:

1. Process System Overview
2. Extraction Well KAFB-106228 Control Description
3. Main Treatment Plant Control Description
4. KAFB-106233 and KAFB-106234 Control Description
5. KAFB-106239 Control Description
6. Injection Well and Pond Level Control Description
7. Sand Filter, Sodium Hypochlorite Generator, Dosing Pumps, and Clarifier Control
8. Communications System
9. Historical Data and User Interface Screens
10. Internet-Based Monitoring
11. Identification
12. Field Quality Control.

DEFINITIONS

The following definitions are relevant to this document

- ***GWTS***—Groundwater Treatment System.
- ***HIM***—Human Interface Module.
- ***P&ID***—Piping and Instrumentation Diagram.
- ***PID***—Proportional, Integral, Derivative.
- ***PLC***—Programmable Logic Controller.
- ***SCADA***—Supervisory Control and Data Acquisition.
- ***VFD***—Variable Frequency Drive.

1. Process System Overview

The following is a description of each of the component systematic parts for the system.

1.1 Main Treatment Plant

Contaminated groundwater from the four extraction wells is piped to a treatment facility located on Kirtland Air Force Base property. The GWTS includes two parallel treatment trains, each with the capacity to treat 400 gallons per minute of groundwater. Each treatment train begins with a 6,000-gallon influent equalization tank with level feedback to the PLC. The two carbon adsorbers in each train are 10 feet in diameter and designed for optimal ethylene dibromide removal at flow rates between 120 and 400 gallons per minute. The carbon beds operate in lead-lag configuration. A 6,000-gallon holding tank holds the treated water before discharge. A portion of the discharge water can be diverted to a hose connection to a truck sump located immediately outside of the treatment plant. Treated groundwater is

then routed through the effluent pipeline to gravity fed injection well KAFB-7 or the main pond at the on-Base Tijeras Arroyo Golf Course.

2. Extraction Well KAFB-106228 Control Description

The following control description for the Extraction Well and Wellhead Vault is for the KAFB-106228 extraction well and wellhead vault. Control for wells KAFB-106233 and KAFB-106234 is described in Section 1.6 of the Operations and Maintenance Plan.

2.1 Wellhead Vault and Valve Vault Interlocks and Alarms

Level Switch LSH-3000—The leak detection switch is located in the wellhead vault and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the well vault activates the LSH-3000 interlock and disables the well KAFB-106228 pumps, initiates a remote alarm, and notifies the Operators of a leak in the wellhead vault. Operator intervention is required to restart the extraction well pumps.

Level Switch LSH-3002—This leak detection switch is located in the pipeline secondary containment in the wellhead vault and provides a contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the containment activates the LSH-3002 interlock and disables the well KAFB-106228 pump, initiates a remote alarm, and notifies the Operators of a leak in the containment. Operator intervention is required to restart the extraction well pumps.

Level Switch LSH-3003—This leak detection switch is located in the pipeline secondary containment, in the Louisiana vault, and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the containment activates the LSH-3003 interlock and disables the well KAFB-106228 pump, initiates a remote alarm, and notifies the Operators of a leak in the containment. Operator intervention is required to restart the extraction well pumps.

Level Switch LSH-3004—The leak detection switch is located in the Louisiana vault and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the well vault activates the LSH-3000 interlock and disables the well KAFB-106228 pump, initiates a remote alarm, and notifies the Operators of a leak in the valve vault. Operator intervention is required to restart the extraction well pumps.

Loss of Power UEL-3010—On loss of power to the extraction well pump (P-101), the power supply in the extraction well control panel provides an alarm contact to the PLC and the power failure is displayed on the SCADA screen. Power failure initiates a remote alarm to notify the Operators.

2.2 Extraction Well KAFB-106228 Controls and Interlocks

The following control description applies to extraction well KAFB-106228 with Well Pump P-101, Flow Control Valve FCV-3001, and Flow Transmitter FIT-3001.

2.2.1 Remote Controls and Indications

The Treatment Plant Main Control Panel (CP-100) SCADA display is programmed to show all extraction well system indications and controls including pump running status, flow measurement, flow total, wellhead pressure, downhole water elevation, control interlocks, and alarms. Well Pump SCADA

controls include OFF/ON/SEQ selection. For normal operation, the local HAND/OFF/AUTO switch HS-3001 in the wellhead control panel indicates to the SCADA that Well Pump P-101 is in AUTO mode. The well pump will not start through the SCADA unless the local switch is in AUTO. After power loss and power up, the Well Pump P-101 is automatically restarted if it is in AUTO mode.

Remote Modes Available:

- Remote SEQ Mode
- Remote ON Mode.

Remote SEQ Mode

Pump starting and stopping are controlled by the PLC at the Treatment Plant Control Panel (CP-100). The Operator uses ZIC-3001 to adjust the position signal to the control valve FCV-3001 at the SCADA to obtain the target groundwater extraction rate as measured by FIT-3001.

There is a low-level alarm set point (>10 feet above pump intake) on the level transducer in the well that shuts down P-101. The pump alarm is reset when the level in the well recovers to a preset elevation and when the reset button is pushed on the SCADA. Also, to protect the pump from running dry, a low current switch (ISL-3001) turns the pump off to prevent damage to motor. The Operator may restart the pump after low current shutdown. In the event of either failure, Operator intervention is required to restart the extraction well pumps.

Remote ON Mode

The ON button allows the Operator to run Well Pump P-101 through the PLC so long as the ON mode is selected on the screen.

2.2.2 Local Controls and Indications

Controls

Controls include the HAND/OFF/AUTO HS-3001 selection switch on the wellhead motor starter panel MS-101.

Indications

Indicator lights include a green running light and a red stop light HL-3001 on the motor starter panel MS-101.

Flow indicator FIT-3001 displays instantaneous groundwater flow rate for Well KAFB-106228. FQI-3001 displays total integrated groundwater flow.

PI-3001 shows pressure in the groundwater pipeline at the top of the wellhead.

TI-3001 shows the temperature of the groundwater at the top of the wellhead.

2.2.3 Interlocks

Well Pump P-101 is interlocked to shut down on Groundwater Treatment Feed Tank high-high level alarm at the Main Treatment Plant. The pump will be disabled and placed in OFF mode and require user intervention to restart.

Well Pump P-101 is interlocked to shut down on any containment area leak detection alarm. The pump will be disabled and placed in a faulted state and require user intervention to restart.

All well pumps are interlocked to shut down on any pipeline containment leak detection alarm. The pump will be disabled and placed in a faulted state and require user intervention to restart.

Well Pump P-101 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LIT-3001. The pump will be disabled and placed in a faulted state and require user intervention to restart.

Well Pump P-101 is interlocked to shut down on treatment plant shutdown.

When Well Pump P-101 Low Current from ISL-3001 is received, the pump will be disabled and placed in a faulted state and require user intervention to restart.

Overload protection OL-3001 will shut the pump down. The pump will be disabled and placed in a faulted state and require user intervention to restart.

3. Main Treatment Plant Control Description

The following is a description of the control system in the Treatment Plant.

3.1 Treatment Plant General Interlocks and Alarms

Leak Detection Interlock LSH-3121—Level Switch LSH-3121 is located in the groundwater system building containment sump and provides dry contacts back to the PLC. Normal and alarm status is displayed on the SCADA screen. A leak detection alarm will disable all three extraction well pumps (P-101, P-102, and P-103), the influent pumps (P-112 A/B, P-212 A/B), and the effluent pumps (P-118 and P-218). A leak will also initiate a remote alarm and notify the Operators of a leak at the Treatment Plant. Operator intervention shall be required to restart the pumps.

Leak Detection Interlock LSH-3122—Level Switch LSH-3122 is located in the truck bay sump and provides contacts back to the PLC. Normal and alarm status is displayed on the SCADA screen. An activation alarm will disable the Treated Water Discharge Pump P-118. An activated switch will also initiate a remote alarm and notify the Operators of a leak at the Treatment Plant. Operator intervention shall be required to restart the pump.

Intrusion Detection Switches ZS-3123, ZS-3124, ZS-3125A/B, and ZS-3126A/B—These switches are located on each of the entry doors and provide a common signal back to the PLC and are displayed on the SCADA screen as an alarm when active. Opening and closing of the door are logged events. Opening a door will also initiate a remote alarm to notify the Operators.

Low Temperature Switch TSL-3127—TSL-3127 provides a low temperature alarm contact back to the PLC and is displayed on the SCADA screen. The switch will be set to alarm at 35 degrees Fahrenheit. Low temperature will initiate a remote alarm, TAL-3127, to notify the Operators.

Smoke Detector Alarm UA-3128—UA-3128 provides a contact back to the PLC and is displayed on the SCADA screen. A smoke alarm will initiate a remote alarm (UA-3128) to notify the Operators and the Kirtland Air Force Base fire department.

Loss of Power Alarm UA-3129—On loss of power to the Treatment Plant, the uninterruptible power supply in the control panel provides an alarm contact to the PLC and displays the power failure on the SCADA screen. Power failure triggers the system to turn off including all upstream and downstream processes (i.e., extraction well pumping). Power failure will initiate a remote alarm (UA-3129) to notify the Operators.

An Ethernet connection is provided at the main treatment plant control panel CP-100 to allow the Operator to attach a laptop control station for programming purposes. In addition, all information and control functions are available to the Operator via the computer touch screen mounted on the front of CP-100.

3.2 Groundwater Treatment Feed Pumps and Their Associated Equipment and Instrumentation

3.2.1 Remote Controls and Indications

The Treatment Plant main control panel (CP-100) SCADA display is programmed to show Groundwater Treatment Feed Pump indications and controls including running status, running speed, flow measurement, flow total, and alarms that affect the pump.

SCADA Controls for the Groundwater Treatment Feed Pumps (P-112 A/B, P-212 A/B) include Remote OFF, ON, and SEQ selections. The Groundwater Treatment Feed Pumps will not start through the SCADA unless the local HIM for the VFD is in AUTO.

SEQ Mode (Automatic Flow Control)

Pump starting, speed, and stopping are controlled by the PLC at the Treatment Plant control panel (CP-100). The system is set to vary the flow rate by a user settable flow rate. The flow will be varied by modulating the speed of the pump(s) by responding to the programmed PID. Both the A and B pumps have sequence numbers that directly affect how the pumps respond to automated control by the SCADA. When the pumps are in series, the pump in position 1 will operate solely and the pump in position 2 will activate only in the event of a failure of the pump in position 1 (applicable when flow rates are less than 200 gallons per minute). When pumps are operated in parallel, both pumps are set as the same position (applicable when flow rates exceed 200 gallons per minute). When the level in the influent tank reaches 6 feet, the train influent pump(s) activates and proceeds to pump the tank level to 4 feet, which causes the pump(s) to cycle off.

Remote ON Mode

The ON button allows the Operator to run Groundwater Treatment Feed Pump P-112A/B through the PLC so long as the ON button is selected.

Indications

When the Groundwater Treatment Feed Tank level as measured by LIT-3101 drops to 24 inches, a low-level alarm will be activated and whichever train's influent pump(s) operating will shut down. Pump(s) will be disabled and require user intervention to restart.

When the Treated Water Storage Tank level as measured by LIT-3107 reaches 120 inches, a high-level alarm will be activated and whichever train's influent pump(s) is operating will shut down. Pump(s) will be disabled and require user intervention to restart.

3.2.2 Local Controls and Indications

Controls

The HIM of the VFD allows manual drive operation, including a manual drive and fixed speed operation.

Indications

VFD Controller indications are all contained within the HIM of the VFD Controller.

The influent skid flow indicator will display the instantaneous, combined flow rate for both Groundwater Treatment Feed Pumps on a skid.

3.2.3 Interlocks

Each interlock is train specific; train tanks, pumps, and vessels are independent in their effect on their associated train (Train 1 failures do not affect Train 2 operation, etc.)

Groundwater Treatment Feed Pumps are interlocked to shut down on treatment plant shutdown or low level in the influent tank. The pump(s) will be disabled and require user intervention to restart.

Groundwater Treatment Feed Pumps are interlocked to shut down on high level in the effluent feed tank. Pump(s) will be disabled and require user intervention to restart.

Groundwater Treatment Feed Pumps are interlocked to shut down on high pump outlet pressure on the influent skid pressure switch set at 45 pounds per square inch gauge. The pump(s) will be disabled and require user intervention to restart.

Groundwater Treatment Feed Pumps are interlocked to shut down on high carbon vessel pressure set at 45 pounds per square inch gauge. Pump(s) will be disabled and require user intervention to restart.

Groundwater Treatment Feed Pumps are interlocked to shut down on a containment area leak detection alarm. Pump(s) will be disabled and require user intervention to restart.

VFD Motor Protective Functions will shut down the associated pump. The Operator will be required to reset and restart Groundwater Treatment Feed Pump manually at the VFD Controller after a VFD Controller protection shutdown.

3.3 Treated Water Discharge Pump

The following is a description of the control of Pump P-118, P-218, and their associated equipment and instrumentation. Control of these pumps is similar to the control of the influent pumps.

3.3.1 Remote Controls and Indications

The Treatment Plant main control panel (CP-100) SCADA display will be programmed to show Treated Water Discharge Pump indications and controls including running status, running speed, flow measurement, flow total, and alarms that affect the pump. The pump will not start through the SCADA unless the local HIM for the VFD is in AUTO.

AUT Mode (Groundwater Flow Control)

Pump starting, speed, and stopping are controlled by the PLC at the Treatment Plant control panel (CP-100). The system is set to vary the flow rate by a user settable flow rate. The flow will be varied by modulating the speed of the pump by responding to the programmed PID. When the level in the effluent tank reaches 6 feet, the effluent pump activates and proceeds to pump the tank level to 4 feet, which causes the pump to cycle off.

Remote ON Mode

The ON button allows the Operator to run the effluent pump through the PLC so long as the ON button is selected.

3.3.2 Local Controls and Indications

Controls

The HIM of the VFD allows manual drive operation, including a manual drive and fixed speed operation.

Indications

VFD Controller indications are all contained within the HIM of the VFD Controller.

Flow indicator FIT-3108 will display the instantaneous flow rate for the Treated Water Discharge Pump.

3.3.3 Interlocks

Treated Water Discharge Pumps are interlocked to shut down on treatment plant shutdown or low-low level in their respective effluent tank. The pumps will be disabled and require user intervention to restart.

Treated Water Discharge Pumps are interlocked to shut down on high level in the golf course pond LAH-9020. The pumps will be disabled and placed in Remote MANUAL Mode and require user intervention to restart.

Treated Water Discharge Pumps are interlocked to shut down on high pump outlet pressure set at 40 pounds per square inch gauge. The pumps will be disabled and require user intervention to restart.

Treated Water Discharge Pumps are interlocked to shut down on high pressure at the injection wellhead PAH-9013 (when in Well 7 Mode). The pumps will be disabled and require user intervention to restart.

Treated Water Discharge Pumps are interlocked to shut down on high level in the injection well LAH-9010 (when in Well 7 Mode). The pumps will be disabled and placed in Remote MANUAL Mode and require user intervention to restart.

Treated Water Discharge Pumps are interlocked to shut down on a containment area leak detection alarms. The pumps will be disabled and require user intervention to restart.

VFD Motor Protective Functions will shut down the Treated Water Discharge Pump affected. The Operator will be required to reset and restart the pump manually at the VFD Controller after a VFD Controller protection shutdown.

3.4 Air Compressor (C-120)

C-120 is a manually operated compressor that is used during carbon changeouts. The air compressor is controlled by hand switch HS-3120 for on/off operation during carbon transfers.

3.5 Sump Pump (P-111)

Pump P-111 is a self-contained float-operated sump pump that is used to pump water from the treatment building containment into the Groundwater Treatment Feed Tank or into drums for disposal. The sump pump is controlled by a float switch attached to the pump. When the level of water in the building containment is high enough to trip the float switch, the pump turns on and moves water to the desired location. The pump can also be operated manually to pump down the sump for maintenance or to remove any standing water from the sump.

3.6 Dust Control (FCV-3120)

FCV-3120 and FCV-3121 are two motor-operated flow control valves that are used to divert water to a hose-bib on the exterior of the building. This function is needed to wet the new carbon prior to carbon changeout.

3.6.1 Remote Controls and Indications

The valves are operable from a keypad outside of the building, HS-3120. The Operator will require a code to initiate flow diversion from the effluent location to the hose-bib. Once the code is properly entered, the PLC will initiate the commands needed to fully open FCV-3121 and close FCV-3120. This will divert the treated water to the hose-bib at the combined rates of the effluent pumps.

Once initiated, the system starts a timer for 30 minutes of operation. After 30 minutes of operation, FCV-3122 will close and FCV-3120 will open and direct flow back to the discharge location. At any point during the process, the Operator may restart the timer at the keypad. Also, at any point during the process, the Operator may end the flow to the hose-bib at the keypad.

3.6.2 Local Controls and Indications

The valve has the capability of being manually operated if desired by plant Operators by way of the valve handle. When the valve handle is pulled toward the Operator, the remote actuation is disabled, allowing the Operator to open or close the valve manually.

3.6.3 Interlocks

A high level in the truck bay sump (LAH-3121) will shut down the entire system requiring Operator assistance in order to restart the system.

4. KAFB-106233 and KAFB-106234 Control Description

The following is a control description for the two extraction wells (KAFB-106233 and KAFB-106234) and the associated equipment and instrumentation.

4.1 Wellhead Vault, Air Release Vault, and Well Control House Interlocks and Alarms

Level Switch LSH-4001—This leak detection switch is located in the pipeline secondary containment in the wellhead vault for KAFB-106233 and provides a contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the interstitial space will activate LSH-4001 interlock and will disable all well pumps, initiate a remote alarm, and notify the Operators of a leak in the containment. Operator intervention shall be required to restart the well pumps.

Well Pump P-102 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LIT-4001. The pump will be disabled and placed in a faulted state and require user intervention to restart.

Level Switch LSH-4002—The leak detection switch is located in the wellhead vault for KAFB-106233 and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the wellhead vault will activate LSH-4002 interlock and will disable the well's pump, initiate a remote alarm, and notify the Operators of a leak in the wellhead vault. Operator intervention shall be required to restart the pump.

Level Switch LSH-5001—This leak detection switch is located in the pipeline secondary containment in the wellhead vault for KAFB-106234 and provides a contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the interstitial space will activate LSH-5001 interlock and will disable the three well pumps, initiate a remote alarm, and notify the Operators of a leak in the containment. Operator intervention shall be required to restart the well pumps.

Well Pump P-103 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LIT-5001. The pump will be disabled and placed in faulted Mode and require user intervention to restart.

Level Switch LSH-5002—The leak detection switch is located in the wellhead vault for KAFB-106234 and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the wellhead vault will activate LSH-5002 interlock and will disable the well's pump, initiate a remote alarm, and notify the Operators of a leak in the wellhead vault. Operator intervention shall be required to restart the well pump.

Level Switch LSH-6001—The leak detection switch is located in the air release vault on Eastern Avenue and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the air release vault will activate LSH-6001 interlock and disable the pumps at KAFB-106233 and

KAFB-106234, initiate a remote alarm, and notify the Operators of a leak in the system at the air release vault. Operator intervention shall be required to restart the well pumps.

Level Switch LSH-7001—The leak detection switch is located in the well control house and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the well control house will activate LSH-7001 interlock and will disable the pumps at KAFB-106233 and KAFB-106234, initiate a remote alarm, and notify the Operators of a leak in the system at the well control house. Operator intervention shall be required to restart the well pumps.

Level Switch LSH-7005—This leak detection switch is located in the pipeline secondary containment in the well control house and provides a contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the interstitial space will activate LSH-7005 interlock and will disable all well pumps, initiate a remote alarm, and notify the Operators of a leak in the containment at the well control house. Operator intervention shall be required to restart the well pumps.

Level Switch LSH-8001—The leak detection switch is located in the air release valve vault at the Louisiana Boulevard vault and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the well control house will activate LSH-7001 interlock and will disable the pumps at KAFB-106233 and KAFB-106234, initiate a remote alarm, and notify the Operators of a leak in the Louisiana Boulevard vault. Operator intervention shall be required to restart the well pumps.

4.2 KAFB-106233 and KAFB-106234 Controls and Interlocks

The following control description applies to Extraction Wells (KAFB-106233 and KAFB-106234) with Well Pumps P-102 and P-103, respectively; Flow Control Valves FCV-7001 and FCV-7002, respectively; and Flow Transmitters FIT-7001 and FIT-7002, respectively.

4.2.1 Remote Controls and Indications

The Treatment Plant Main Control Panel (CP-100) SCADA display is programmed to show extraction well system indications and controls including pump running status, flow measurement, flow total, and alarms. Well Pump SCADA controls include OFF, ON, and SEQ selection. For normal operation, the local HAND/OFF/AUTO switches HS-4001 and HS-5001 at the well control house panel will indicate to the SCADA that Well Pumps P-102 and P-103, respectively, are in AUTO mode. The well pump will not start through the SCADA unless the local switch is in AUTO.

Modes Available:

- Remote SEQ Mode
- Remote ON Mode.

Remote SEQ Mode

Pump starting and stopping are controlled by the PLC at the Treatment Plant Control Panel (CP-100). On initial startup, the pumps are turned on from the PLC and set to the desired groundwater extraction rate by manually adjusting the position of control valves located in the well vaults. The Operator will monitor groundwater flow as measured by FI-7001 and FI-7002 and adjust the control valves to obtain the target groundwater extraction rates for the two wells.

The PLC will monitor the groundwater level in the extraction wells (LI-4001 and LI-5001). There are low level alarm setpoints in wells KAFB-106233 and KAFB-106234. The alarm is set to 5 feet above the

transducer (>10 feet above pump intake), but is Operator settable should conditions determine that a different value should be used. These low-level alarms will shut down groundwater pumps P-102 and P-103 and require Operator interaction to restart.

Remote ON Mode

An ON button allows the Operator to run Well Pumps P-102 and P-103 through the PLC so long as the button ON mode is selected on the screen.

4.2.2 Local Controls and Indications

Controls

Controls include HAND/OFF/AUTO HS-4001 and HS-5001 selection switch on the wellhead motor starter panels MS-102 and MS-103, respectively. If the user toggles HAND, the pump starts and runs. The pump continues to run as long as the switch is in HAND mode.

Indications

Indicator lights include a green running light and a red stop light HL-4001 and HL-5001 on motor starter panels MS-102 and MS-103, respectively.

Flow indicator FIT-4001 will display instantaneous groundwater flow rate for Well KAFB-106233. Flow indicator FIT-5001 will display instantaneous groundwater flow rate for Well KAFB-106234.

PI-4001 will show pressure in the groundwater pipeline at the top of the wellhead for KAFB-106233. PI-5001 will show pressure in the groundwater pipeline at the top of the wellhead for KAFB-106234.

PI-7001 will show pressure in the interstitial space between the inner and outer pipe of the double-wall pipeline at well control house for output from KAFB-106233. An increase in this pressure indicates that there may be a leak in the inner pipe. PI-7002 will show pressure in the interstitial space between the inner and outer pipe of the double-wall groundwater pipeline at the well control house for output from KAFB-106234.

PI-7003 will show pressure in the groundwater pipeline at the well control house for output from KAFB-106233. PI-7004 will show pressure in the groundwater pipeline at the well control house for output from KAFB-106234.

PI-7005 will show pressure in the groundwater pipeline at the well control house for the combined output from KAFB-106233 and KAFB-106234.

4.2.3 Interlocks

Well Pump P-102 is interlocked to shut down on Groundwater Treatment Feed Tank high-high level alarm at the Main Treatment Plant. The pump will be disabled and placed in OFF Mode and require user intervention to restart.

Well Pump P-102 is interlocked to shut down on a containment area leak associated with any of the three extraction wells. The pumps are interlocked to shut down during a leak detection alarm in the well and valve vaults associated with that well. Conveyance line leak alarms are associated with interstitial pipe

leaks that cause a shutdown of all well pumps. Pumps will be disabled and placed in a faulted state and require user intervention to restart.

Well Pump P-102 is interlocked to shut down on treatment plant shutdown.

Well Pump P-102 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LIT-4001. The pump will be disabled and placed in a faulted state and requires user intervention to restart.

Overload protection OL-4001 will shut the pump down. The Operator will be required to reset OL-4001 manually at starter MS-102 to restart Well Pump P-102 after an overload protection shutdown.

Well Pump P-103 is interlocked to shut down on Groundwater Treatment Feed Tank high-high level alarm at the Main Treatment Plant. The pump will be disabled and placed in a faulted Mode and require user intervention to restart.

Well Pump P-103 is interlocked to shut down on a containment area leak associated with any of the three extraction wells. This includes leak detection alarms in the well and valve vaults and the containment on the double wall pipelines. Conveyance line leak alarms are associated with interstitial pipe leaks that cause a shutdown of all well pumps. Pumps will be disabled and placed in faulted state and require user intervention to restart.

Well Pump P-103 is interlocked to shut down on treatment plant shutdown.

Well Pump P-103 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LIT-5001. Pump will be disabled and placed in faulted state and require user intervention to restart.

Overload protection OL-5001 will shut the pump down. The Operator will be required to reset OL-5001 manually at starter MS-103 to restart Well Pump P-103 after an overload protection shutdown.

5. KAFB-106239 Control Description

The following is a control description for extraction well KAFB-106239 and associated equipment and instrumentation.

5.1 Wellhead Vault and Junction Vault Interlocks and Alarms

Level Switch LD-301—This continuous leak detection conductor is located in the pipeline secondary containment from the wellhead vault for KAFB-106239 to the junction vault and provides a contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the interstitial space will activate the LD-301 interlock and will disable all well pumps, initiate a remote alarm, and notify the Operators of a leak in the containment piping. Operator intervention shall be required to restart the well pumps.

Well Pump P-301 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LT-301. Pump will be disabled and placed in OFF Mode and require user intervention to restart.

Level Switch LSH-301—The leak detection switch is located in the wellhead vault for KAFB-106239 and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the wellhead vault will activate LSH-301 interlock and will disable the well's pump, initiate a remote alarm, and notify the Operators of a leak in the wellhead vault. Operator intervention shall be required to restart the pump.

Level Switch LSH-302—The leak detection switch is located in the junction vault and provides a dry contact back to the PLC. Alarm status is displayed on the SCADA screen. A high level in the junction vault will activate the LSH-302 interlock and will disable the pumps at KAFB-106228 and KAFB-106239, initiate a remote alarm, and notify the Operators of a leak in the junction vault. Operator intervention shall be required to restart the well pumps.

5.2 KAFB-106239 Controls and Interlocks

The following control description applies to Extraction Well KAFB-106239 with Well Pump P-301, Flow Control Valve FCV-301, and Flow Transmitter FIT-301.

5.2.1 Remote Controls and Indications

The Treatment Plant Main Control Panel (CP-100) SCADA display is programmed to show extraction well system indications and controls including pump running status, flow measurement, flow total, and alarms. Well Pump SCADA controls include OFF, ON, and SEQ selection. For normal operation, the local HAND/OFF/AUTO switch HS-301 at the wellhead electrical panel will indicate to the SCADA that Well Pump P-301 is in AUTO mode. The well pump will not start through the SCADA unless the local switch is in AUTO.

Modes Available:

- Remote SEQ Mode
- Remote ON Mode.

Remote SEQ Mode

Pump starting and stopping are controlled by the PLC at the Treatment Plant Control Panel (CP-100). On initial startup, the pumps are turned on from the PLC and set to the desired groundwater extraction rate by manually adjusting the frequency percentage of the VFD. The Operator will monitor groundwater flow as measured by FIT-301 and adjust the frequency percentage to obtain the target groundwater extraction rate for the well.

The PLC will monitor the groundwater level in the extraction well (LIT-301). There is a low-level alarm set point in well KAFB-106239. The alarm is set to 5 feet above the transducer (>10 feet above pump intake), but is Operator settable should conditions determine that a different value should be used. These low-level alarms will shut down the groundwater pump (P-301) and require Operator interaction to restart.

Remote ON Mode

An ON button allows the Operator to run Well Pump P-301 through the PLC so long as the button ON mode is selected on the screen.

5.2.2 Local Controls and Indications

Controls

Controls include HAND/OFF/AUTO HS-301 selection switch on the wellhead VFD panel VFD-301. If the user toggles HAND, the pump can be operated using the enclosed VFD interface.

Indications

Indicator lights include a green running light and a red stop light HL-301 on the VFD panel VFD-301.

Flow indicator FIT-301 will display instantaneous groundwater flow rate for Well KAFB-106239.

PI-301 will show pressure in the groundwater pipeline at the top of the wellhead for KAFB-106239.

PI-302 will show pressure in the interstitial space between the inner and outer pipe of the double-wall pipeline at the wellhead vault of KAFB-106239. An increase in this pressure indicates that there may be a leak in the inner pipe.

5.2.3 Interlocks

Well Pump P-301 is interlocked to shut down on Groundwater Treatment Feed Tank high-high level alarm at the Main Treatment Plant. The pump will be disabled and placed in a faulted state and require user intervention to restart.

Well Pump P-301 is interlocked to shut down on a containment area leak associated with any of the four extraction wells. The pumps are interlocked to shut down during a leak detection alarm in the well and valve vaults associated with that well. Conveyance line leak alarms are associated with interstitial pipe leaks that cause a shutdown of all well pumps. Pumps will be disabled and placed in a faulted state and require user intervention to restart.

Well Pump P-301 is interlocked to shut down on treatment plant shutdown.

Well Pump P-301 is interlocked to shut down on a low well water level alarm generated by the PLC via the signal from LIT-301. Pump will be disabled and placed in a faulted state and require user intervention to restart.

Overload protection OL-301 will shut the pump down. The Operator will be required to reset OL-301 manually at VFD-301 to restart Well Pump P-301 after an overload protection shutdown.

6. Injection Well and Pond Level Control Description

The following is a description of the control system for the Injection Well and Pond Level.

6.1 Injection Well and Pond Level Interlocks and Alarms

The interlocks and alarms associated with the Injection Well and Pond Level affect the operation of the GWTS.

Injection Well Water Level is monitored by LIT-9010. If the level rises to above normal operating levels (4,909 feet above mean sea level; the top of the louvered screen), LAH-9010 will trigger and the treatment system will shut down. This level setpoint is Operator settable on the SCADA.

Injection Well Head Pressure is monitored by PIT-9013. If the pressure at the wellhead rises above 50 pounds per square inch gauge, an alarm will trigger and the treatment system will shut down.

Main Pond Water Level is monitored by LIT-9020. If the level rises to 1 foot below the maximum level as defined by Tijeras Arroyo golf course personnel (set at 5.5 feet in the SCADA, 3.5 on the pond stadia rod), an alarm will trigger and the treatment system will shut down. This level setpoint is Operator settable on the SCADA.

7. Sand Filter, Sodium Hypochlorite Generator, Dosing Pumps, and Clarifier Control

The following is a description of the control system for the sand filters, dosing pumps, and clarifier.

7.1 Sand Filter Interlocks and Alarms

The sand filters are not equipped with any interlocks but do alarm when the units enter a backwash cycle based on differential pressure.

7.2 Sand Filter Control Description

The sand filters are not equipped with any PLC or SCADA related controls. The sand filters are equipped with a self-contained control panel that can be used to schedule recurring backwashing events if desired. The control panel also automatically manages the function of electronic actuators that open and close the pneumatic valves used for backwashing. The sand filters are currently set to operate in an as needed fashion, meaning that they only backwash when a certain differential pressure is obtained and held for approximately 30 seconds. The differential pressure resulting in the initiation of a backwash is manually set on the underside of the sand filter control panel.

7.3 Sodium Hypochlorite Generator Interlocks and Alarms

The sodium hypochlorite generator is not equipped with any interlocks or alarms.

7.4 Sodium Hypochlorite Generator Control Description

The sodium hypochlorite generator is not equipped with any controls tied externally to the GWTS SCADA. The generator is equipped with a self-contained PLC that maintains all operations relating to the generator which can shut off the unit. If the oxidant storage tank is full (activates the high-level switch), the system shuts down, and will return to normal function without manual intervention when the tank level decreases (high-level switch is deactivated). There are several hard faults that require manual intervention if the conditions are met. Details on these hard faults are provided in Appendix I. The brine tank is equipped with a level float and valve assembly to control the amount of brine solution in the tank.

7.5 Dosing Pump Interlocks and Alarms

The dosing pumps are equipped with a level sensor that causes the dosing pump screen to change color from green to yellow when the stored oxidant quantity falls below approximately 3 gallons, and then red when the level falls below the pump intake. Once the level falls below the intake of the pump, the dosing station faults and must be refilled and reset on the SCADA prior to restarting the pump.

7.6 Dosing Pump Control Description

The dosing pump can be activated on the SCADA in two modes, manual and auto. Manual mode operates the dosing station without any direction from the PLC. Auto mode operates the dosing station only when the associated train is in operation. Dosing rate is manually adjusted on the pump using the pump control dial.

7.7 Clarifier Interlocks and Alarms

The clarifier is equipped with a high level switch that engages interlocks and alarms. In the event that the level switch activates, the entire GWTS experiences a shutdown and sends an alarm to the GWTS Operator. The clarifier must be manually drained in order to disengage the clarifier high level switch and restart the GWTS.

7.8 Clarifier Control Description

The clarifier is not equipped with any electronic controls.

8. Communications System

The main PLC at the Treatment Plant communicates with offsite personnel via a licensed wireless cellular data system. Alarms to notify the Operator are sent by email or text message through control system internet connection. Remote Alarms are provided in Table F-1.

9. Historical Data and User Interface Screens

9.1 Historical Data

The following data are stored in non-volatile data storage utilizing a CompactFlash card installed in the PLC. All data are stored indefinitely on the SCADA. Operators are able to download data via data extraction within the SCADA software.

Data (unit)	Period
Flow Transmitters	
Flow (gallons per minute)	1 minute
Well Level Transmitters	
Level (feet above mean sea level)	1 minute
Tank Level Transmitters	
Level (feet)	1 minute
Effluent and KAFB-7 Pressure Transmitters	
Pressure (pounds per square inch)	1 minute

Data (unit)	Period
Golf Course Main Pond Level	
Level (feet)	1 minute
Logs	
Event Log (Stored on Non-Volatile Data Storage)	Not applicable
Alarm Log (Stored on Non-Volatile Data Storage)	Not applicable

9.2 Operator Interface Screens

Screens are provided in Appendix F.

10. Internet-Based Monitoring

Software—ViewX Programming Software.

Security—Uses password-based security to allow viewing. Up to 5 users may be logged on at any one time.

Scope—All process variables, process states, alarms, and historical trending are viewable through the Explorer screens.

Control—Full Remote Control of the system is possible after proper login has occurred. Only one remote controller is allowed at a given time.

Alarming—Any alarm notifications to remote Operators are performed over a cellular network and transmitted via email. Provide for at least six email recipients. Provide capability to add and remove recipients.

11. Identification

SCADA equipment and instrumentation tags are based on the instrument and equipment tags on the P&IDs.

12. Field Quality Control

Every 5 years, the system should be tested for stability, including the following tests:

- Loop Check
- Status Indication Function Check
- Alarm Limit Check
- Alarm Logging and Acknowledging Check
- Trending and Visualization Check
- Remote Alarm Notification Check.

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TABLES

Table E-1
Groundwater Treatment System Remote Alarms and Interlocks

Alarm Signal From	Remote Alarm Message	System Interlock Response
P-101	EXTRACTION WELL PUMP 101 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106228 Pump Shutdown
P-102	EXTRACTION WELL PUMP 102 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106233 Pump Shutdown
P-103	EXTRACTION WELL PUMP 103 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106234 Pump Shutdown
P-112A	GROUND WATER FEED PUMP 112A FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Pump A Shutdown
P-112B	GROUND WATER FEED PUMP 112B FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Pump B Shutdown
P-212A	GROUND WATER FEED PUMP 212A FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Pump A Shutdown
P-212B	GROUND WATER FEED PUMP 212B FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Pump B Shutdown
LSH-3100	GROUND WATER TANK 110 LEVEL SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Extraction Wells Shutdown
LSL-3100	GROUND WATER TANK 110 LEVEL SW LO <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Skid Pumps Shutdown
LSH-3200	GROUND WATER TANK 210 LEVEL SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Extraction Wells Shutdown
LSL-3200	GROUND WATER TANK 210 LEVEL SW LO <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Skid Pumps Shutdown
PSH-3105	CARBON ABSORBER V114AB PRESS SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Skid Pumps Shutdown
PSH-3102	TRAIN 1 FEED DISCHARGE PRESS SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Skid Pumps Shutdown
PSH-3205	CARBON ABSORBER V214AB PRESS SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Skid Pumps Shutdown
PSH-3202	TRAIN 2 FEED DISCHARGE PRESS SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Skid Pumps Shutdown
P-9014	INJECTION WELL 7 HYDRAULIC PUMP FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Effluent Skid Pumps Shutdown
P-118	TREATED WATER DIST PUMP 118 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Effluent Skid Pump Shutdown
P-218	TREATED WATER DIST PUMP 218 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Effluent Skid Pump Shutdown
LSH-3106	TREATED WATER TANK 116 LEVEL SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Skid Pumps Shutdown
LSL-3106	TREATED WATER TANK 116 LEVEL SW LO <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Effluent Skid Pump Shutdown
LSH-3206	TREATED WATER TANK 216 LEVEL SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Skid Pumps Shutdown
LSL-3206	TREATED WATER TANK 216 LEVEL SW LO <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Effluent Skid Pump Shutdown
PSH-3108	TRAIN 1 DIST PRESS SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Effluent Skid Pump Shutdown
PSH-3208	TRAIN 2 DIST PRESS SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Effluent Skid Pump Shutdown
LSH-3002	WELL 228 CONVEYANCE LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-3004	WELL 228 LOUISIANA VAULT LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106228 Pump Shutdown
LSH-3003	WELL 228 LOUISIANA CONVEYANC LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-3000	WELL 228 VAULT LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106228 Pump Shutdown
LSH-4001	WELL 233 CONVEYANCE LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-6001	EASTERN AVE VAULT LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106233 and KAFB-106234 Pumps Shutdown
LSH-4002	WELL 233 VAULT LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106233 Pump Shutdown
LSH-5001	WELL 234 CONVEYANCE LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-5002	WELL 234 VAULT LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106234 Pump Shutdown
CP-100	GW FEED PMP 112B COMM FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Skid Pumps Shutdown
CP-100	GW FEED PMP 112A COMM FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Influent Skid Pumps Shutdown
CP-100	GW FEED PMP 212A COMM FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Skid Pumps Shutdown
CP-100	GW FEED PMP 212B COMM FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Influent Skid Pumps Shutdown
CP-100	TW DIST PMP 118 COMM FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Effluent Skid Pump Shutdown

Table E-1
Groundwater Treatment System Remote Alarms and Interlocks

Alarm Signal From	Remote Alarm Message	System Interlock Response
CP-100	TW DIST PMP 218 COMM FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Effluent Skid Pump Shutdown
ZS-3123 ZS-3124 ZS-3125A/B ZS-3126A/B	PLANT INTRUSION ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
CP-100	PLANT EMO ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-3121	PLANT SUMP LEAK DETECT ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-3122	TRUCK SUMP LEAK DETECT ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
PIT-3130	SYS DISCH DOWNSTREAM PRESS ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Effluent Skid Pumps Shutdown
PDI-3102A	GW TRAIN 1 FEED DIFF PRESS A ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
PDI-3102B	GW TRAIN 1 FEED DIFF PRESS B ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
LIT-9010	WELL 7 HIGH LEVEL ELEVATION ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Effluent Skid Pumps Shutdown
LIT-4001	WELL 233 DRAWDOWN LEVEL ELEVATION ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106233 Pump Shutdown
LIT-5001	WELL 234 DRAWDOWN LEVEL ELEVATION ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106234 Pump Shutdown
PDI-3202A	GW TRAIN 2 FEED DIFF PRESS A ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
PDI-3202B	GW TRAIN 2 FEED DIFF PRESS B ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
LIT-3001	WELL 228 DRAWDOWN LEVEL ELEVATION ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106228 Pump Shutdown
LSH-8001	233/234 LOUISIANA VAULT LEAK ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106233 and KAFB-106234 Pumps Shutdown
LSH-7001	WELL HOUSE FLOOR LEAK ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106233 and KAFB-106234 Pumps Shutdown
LSH-7005	WELL HOUSE CONVEYANCE LEAK ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
CP-102	WELL HOUSE EMO ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LIT-9020	GOLF COURSE POND LEVEL HIGH SHUTDOWN <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Effluent Skid Pumps Shutdown
CP-100	TRAIN 1 NOT IN PROCESS MODE <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Train 1 Influent and Effluent Pump Shutdown
CP-100	TRAIN 2 NOT IN PROCESS MODE <!<mm/dd/yy>!> <!<24H:MM:SS>!>	All Train 2 Influent and Effluent Pump Shutdown
SF-101	SAND FILTER 1 IN BACKWASH <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
SF-201	SAND FILTER 2 IN BACKWASH <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None
LSH-4000	BACKWASH TANK LEVEL SW HI <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
CI-101	CHEMICAL PUMP 1 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 1 Dosing Pump Shutdown
CI-201	CHEMICAL PUMP 2 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	Train 2 Dosing Pump Shutdown
P-301	EXTRACTION WELL PUMP 105 FAILED <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106239 Pump Shutdown
LD-301	WELL 239 CONVEYANCE LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	Entire System Shutdown
LSH-301	WELL 239 VAULT LEAK DETECTED<!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106239 Pump Shutdown
LIT-301	WELL 239 DRAWDOWN LEVEL ELEVATION ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106239 Pump Shutdown
ZA-301A/B	WELL 239 VAULT HATCH DOOR OPEN <!<mm/dd/yy>!> <!<24H:MM:SS>!>	None

Table E-1
Groundwater Treatment System Remote Alarms and Interlocks

Alarm Signal From	Remote Alarm Message	System Interlock Response
LSH-302	WALKER STREET VAULT LEAK ALARM <!<mm/dd/yy>!> <!<24H:MM:SS>!>	KAFB-106228 and KAFB-106239 Pumps Shutdown
TAL-3127	"Low Temperature Alarm Main Plant"	None
BAH-3128	"Smoke Alarm"	Notifies Base Fire Department
UA-3129	"Loss of Power"	None

A system interlock response of "None" indicates that a remote alarm message is sent to the Operator, but does not initiate a preprogrammed programmable logic controller system response.
KAFB = Kirtland Air Force Base.

APPENDIX F

SUPERVISORY CONTROL AND DATA ACQUISITION AND HUMAN MACHINE INTERFACE SCREENS

Supervisory Control and Data Acquisition Screens

ViewX

Guest

File | Home | Edit | View

Log On | Log Off | Security

Home | Back | Forward | Alarms | Alarm Banner | Events | Operate

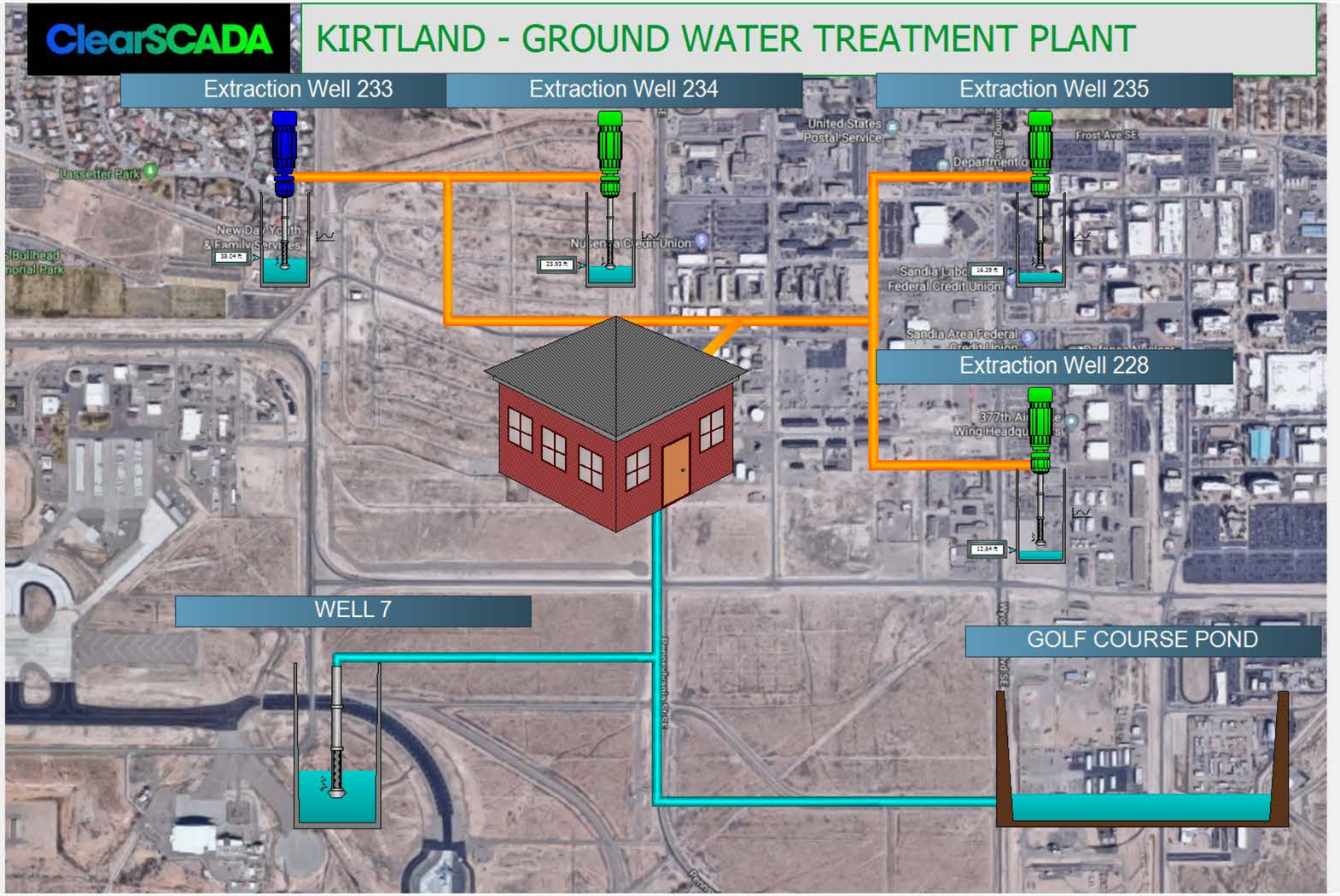
Navigation

Status | System

Database

Local (DESKTOP-8342GJ4)

SCADA Layout



Database | OPC Data

Severity	Time	Source	Message	Category	Suppressed Alarm Count
High	11/20/2019 7:27:35.830 AM	Kirtland GWTP.Plant.Intrusion	State changed from Normal to Alarm, value is 1 (Current data)	Point State	0

1

1

Kirtland GWTP.Plant.Intrusion, Alarm "11/20/2019 7:27:35.830 AM State changed from Normal to Alarm, value is 1 (Current data)" re... 07:53:11

ClearSCADA

KIRTLAND - GROUND WATER TREATMENT PLANT

Site Overview

Extraction Well 228

ON	OFF	SEQ
Running		
HS AUTO		
RESET		
Seq Number : 1		

Extraction Well 233

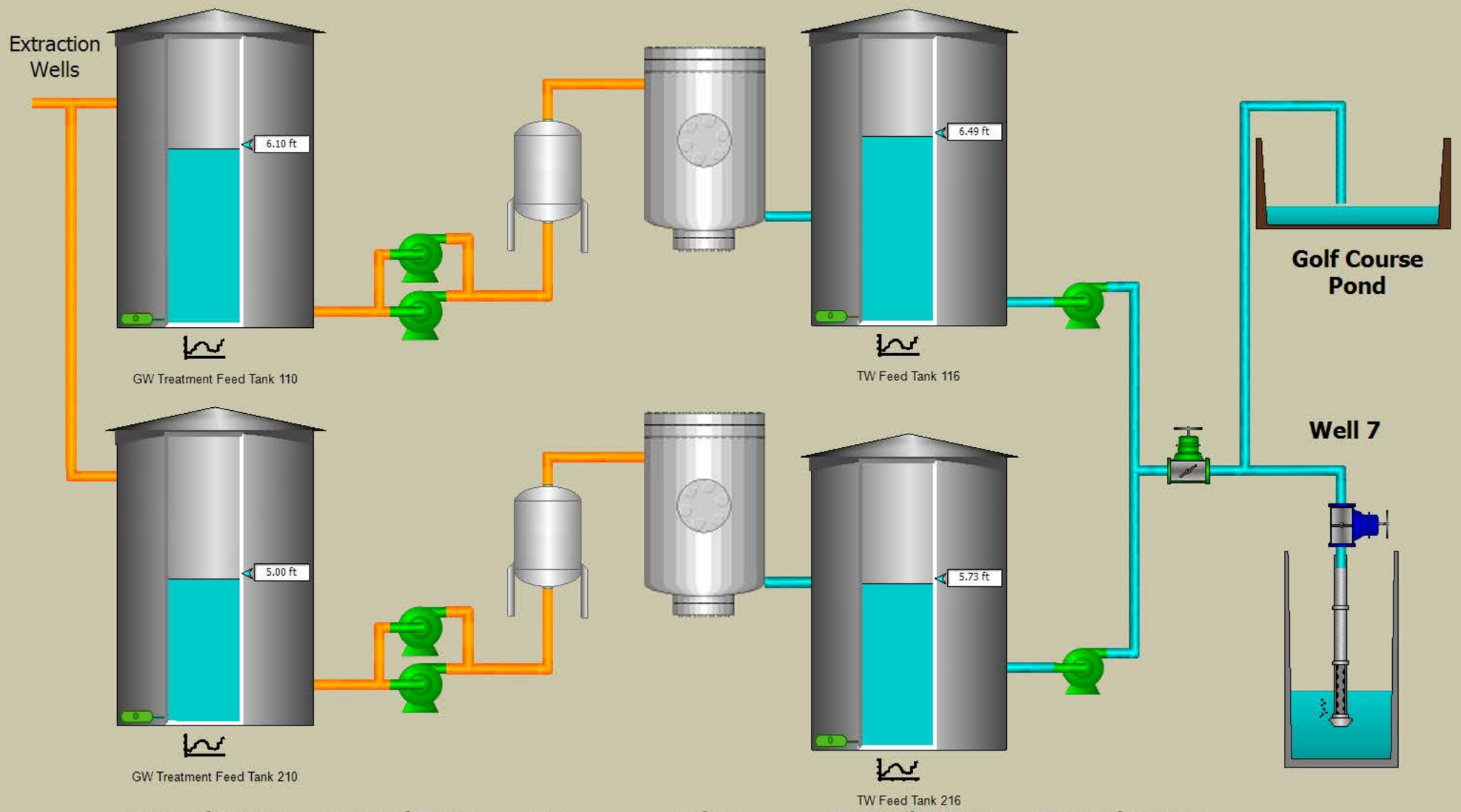
ON	OFF	SEQ
Stopped		
HS AUTO		
RESET		
Seq Number : 2		

Extraction Well 234

ON	OFF	SEQ
Running		
HS AUTO		
RESET		
Seq Number : 3		

Extraction Well 235

ON	OFF	SEQ
Running		
HS AUTO		
RESET		
Seq Number : 4		



ClearSCADA

TRAIN 1 - GROUND WATER FEED PUMPS

Extraction Well 228
ON | OFF | SEQ
Running
HS AUTO
RESET
Seq Number : 1

Extraction Well 233
ON | OFF | SEQ
Stopped
HS AUTO
RESET
Seq Number : 2

Extraction Well 234
ON | OFF | SEQ
Running
HS AUTO
RESET
Seq Number : 3

Extraction Well 235
ON | OFF | SEQ
Running
HS AUTO
RESET
Seq Number : 4

Extraction Wells

6.10 ft

0

GW Treatment Feed Tank 110

GW Feed Pump 112A
ON | OFF | SEQ
HS AUTO
CONTINUOUS
RESET
Seq Number : 1

Min:28.0 % | Max:100.0 %

70 %

17192 Hrs

GW Feed Pump 112B
ON | OFF | SEQ
HS AUTO
CONTINUOUS
RESET
Seq Number : 1

Min:28.0 % | Max:100.0 %

17773 Hrs

70 %

Train 1 Feed Pumps Seq

Start PID CO : 80.0 % | Start Delay : 1 sec

Stop PID CO : 70.0 % | Stop Delay : 5 sec

AUTO

Flow Summary

210 gpm

Sand & PreFilter F-112A

0.25 psid

Sand & PreFilter F-112B

0.25 psid

Carbon Absorber V-114A

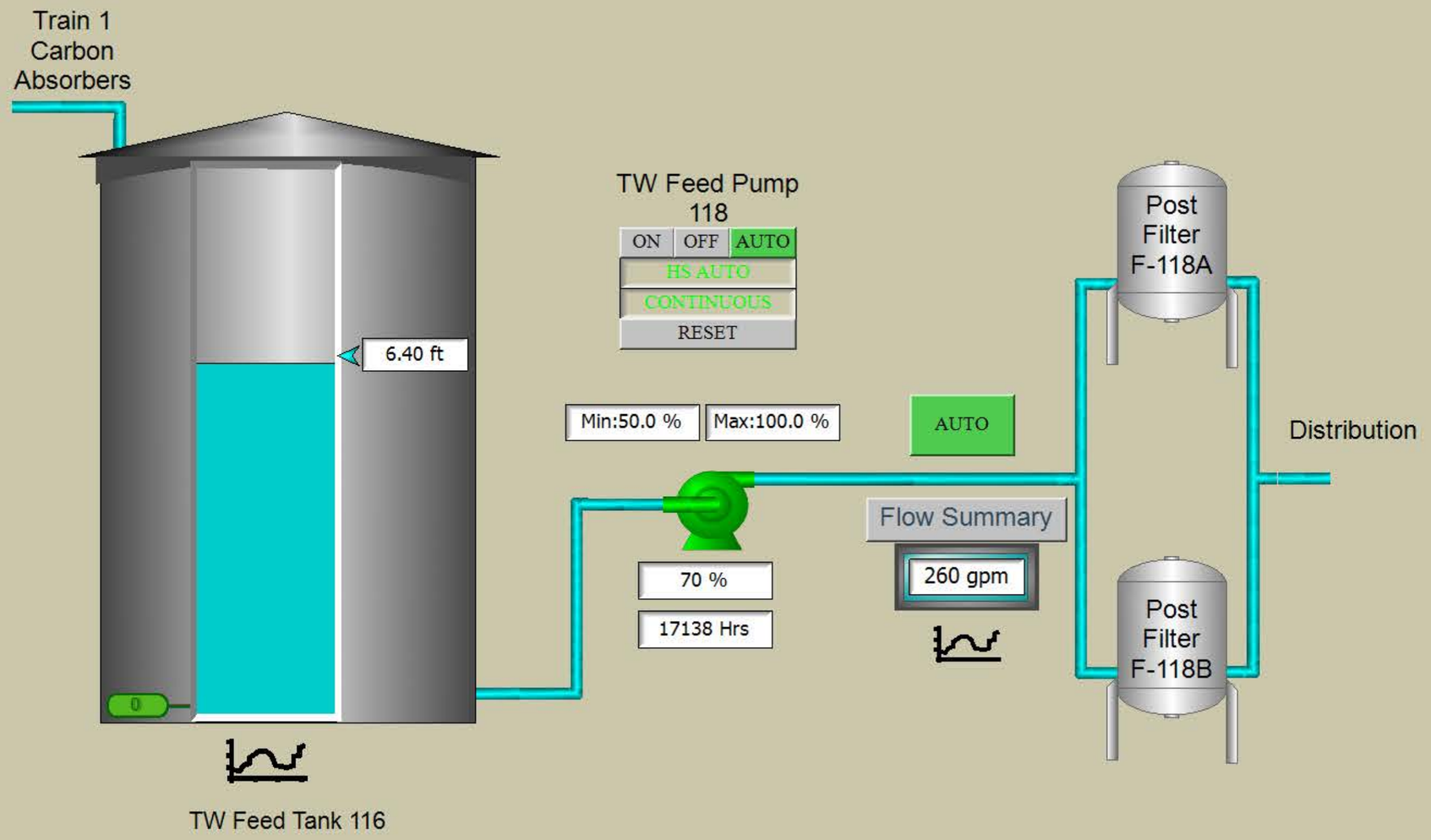
Carbon Absorber V-114B

Treated Water Storage Tank T-116

Train Overview | Train Control

ClearSCADA

TRAIN 1 - TREATED WATER STORAGE TANK AND PUMP

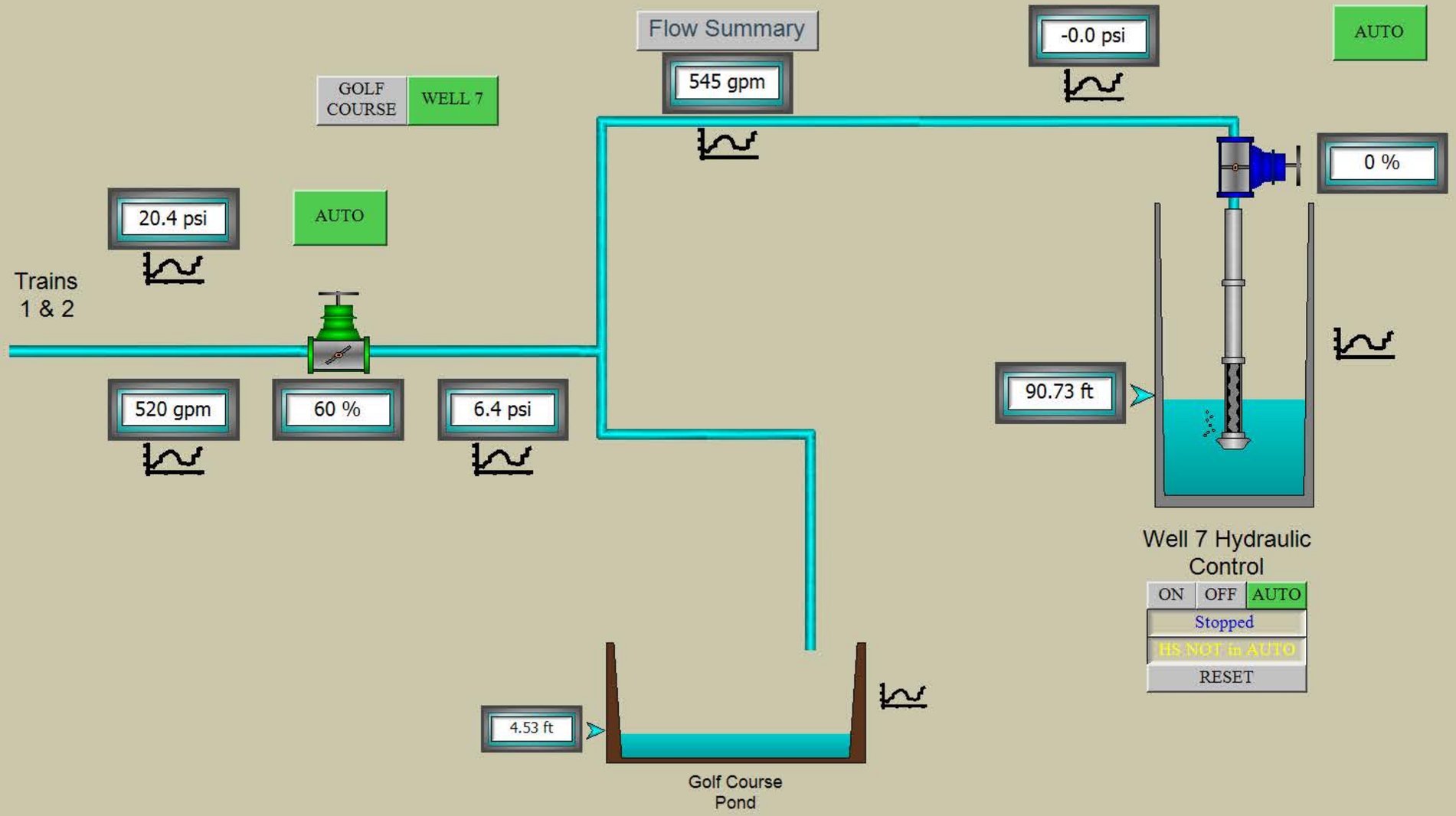


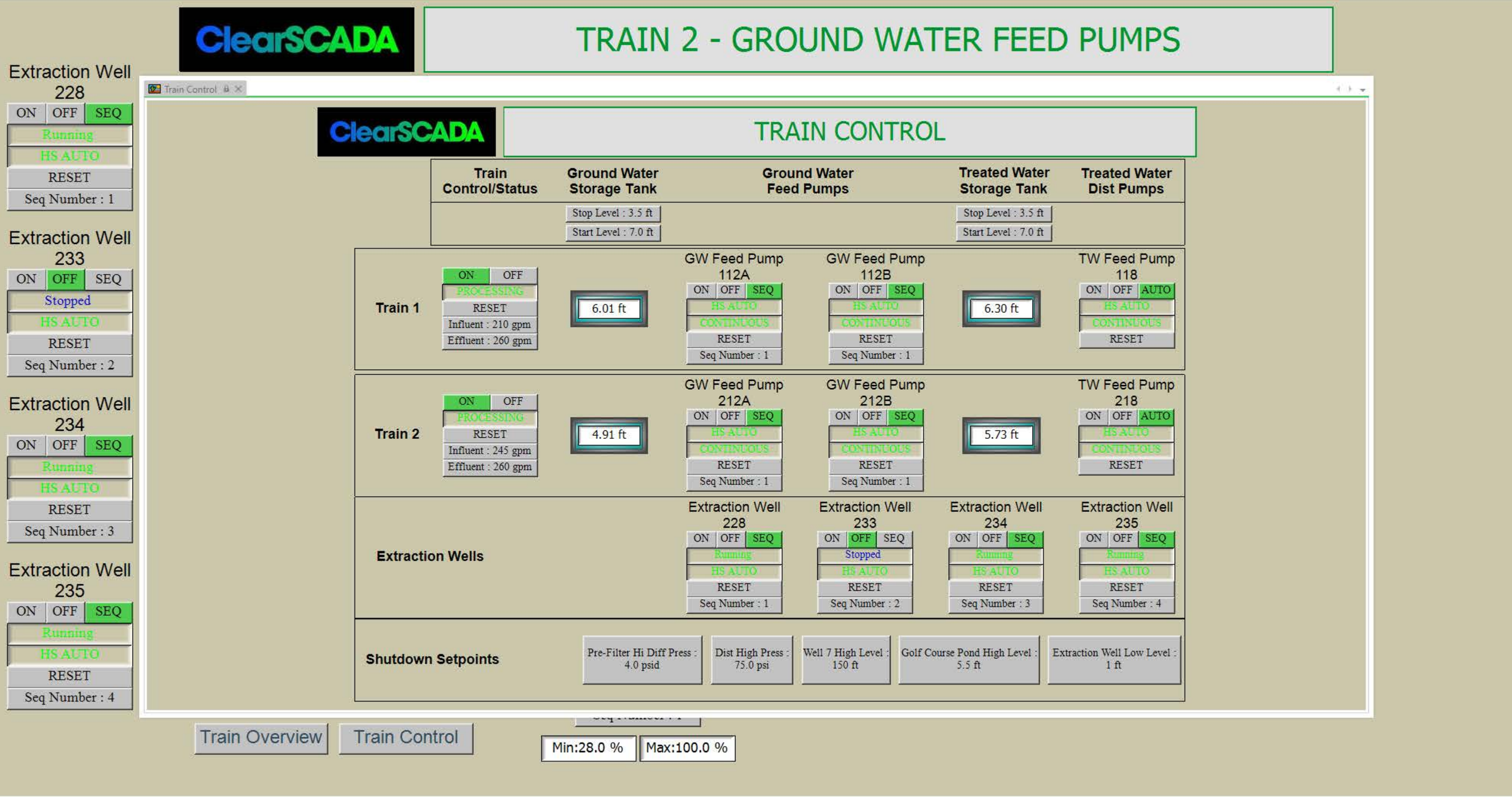
Train Overview | Train Control

ClearSCADA

TREATMENT DISTRIBUTION SYSTEM

Site Overview




ClearSCADA
TRAIN 2 - GROUND WATER FEED PUMPS
Extraction Well 228
ON OFF SEQ
Running
HS AUTO
RESET
Seq Number : 1
Extraction Well 233
ON OFF SEQ
Stopped
HS AUTO
RESET
Seq Number : 2
Extraction Well 234
ON OFF SEQ
Running
HS AUTO
RESET
Seq Number : 3
Extraction Well 235
ON OFF SEQ
Running
HS AUTO
RESET
Seq Number : 4
Train Control
ClearSCADA
TRAIN CONTROL
Train Control/Status
Ground Water Storage Tank
Stop Level : 3.5 ft
Start Level : 7.0 ft
Ground Water Feed Pumps
Treated Water Storage Tank
Stop Level : 3.5 ft
Start Level : 7.0 ft
Treated Water Dist Pumps
Train 1
ON OFF
PROCESSING
RESET
Influent : 210 gpm
Effluent : 260 gpm
6.01 ft
GW Feed Pump 112A
ON OFF SEQ
HS AUTO
CONTINUOUS
RESET
Seq Number : 1
GW Feed Pump 112B
ON OFF SEQ
HS AUTO
CONTINUOUS
RESET
Seq Number : 1
6.30 ft
TW Feed Pump 118
ON OFF AUTO
HS AUTO
CONTINUOUS
RESET
Train 2
ON OFF
PROCESSING
RESET
Influent : 245 gpm
Effluent : 260 gpm
4.91 ft
GW Feed Pump 212A
ON OFF SEQ
HS AUTO
CONTINUOUS
RESET
Seq Number : 1
GW Feed Pump 212B
ON OFF SEQ
HS AUTO
CONTINUOUS
RESET
Seq Number : 1
5.73 ft
TW Feed Pump 218
ON OFF AUTO
HS AUTO
CONTINUOUS
RESET
Extraction Wells
Extraction Well 228
ON OFF SEQ
Running
HS AUTO
RESET
Seq Number : 1
Extraction Well 233
ON OFF SEQ
Stopped
HS AUTO
RESET
Seq Number : 2
Extraction Well 234
ON OFF SEQ
Running
HS AUTO
RESET
Seq Number : 3
Extraction Well 235
ON OFF SEQ
Running
HS AUTO
RESET
Seq Number : 4
Shutdown Setpoints
Pre-Filter Hi Diff Press : 4.0 psid
Dist High Press : 75.0 psi
Well 7 High Level : 150 ft
Golf Course Pond High Level : 5.5 ft
Extraction Well Low Level : 1 ft
Train Overview
Train Control
Min:28.0 %
Max:100.0 %

ClearSCADA

EXTRACTION WELL 234

Site Overview

Extraction Well 234

ON | OFF | SEQ

Running

HS AUTO

RESET

Seq Number : 3

5099 Hrs

Extraction Wells Seq Parameters

Start PID CO : 65.0 %

Start Delay : 10 sec

Stop PID CO : 50.0 %

Stop Delay : 10 sec

Include in Avg

NO | YES

100 %

AUTO

18.5 psi

Flow Summary

175 gpm

Average Level

5.48 ft

6.01 ft

Train 1

GW Treatment Feed Tank 110

25.93 ft

Chemical Pump1

ON | OFF | AUTO

Running

RESET

Chemical Pump2

ON | OFF | AUTO

Running

RESET

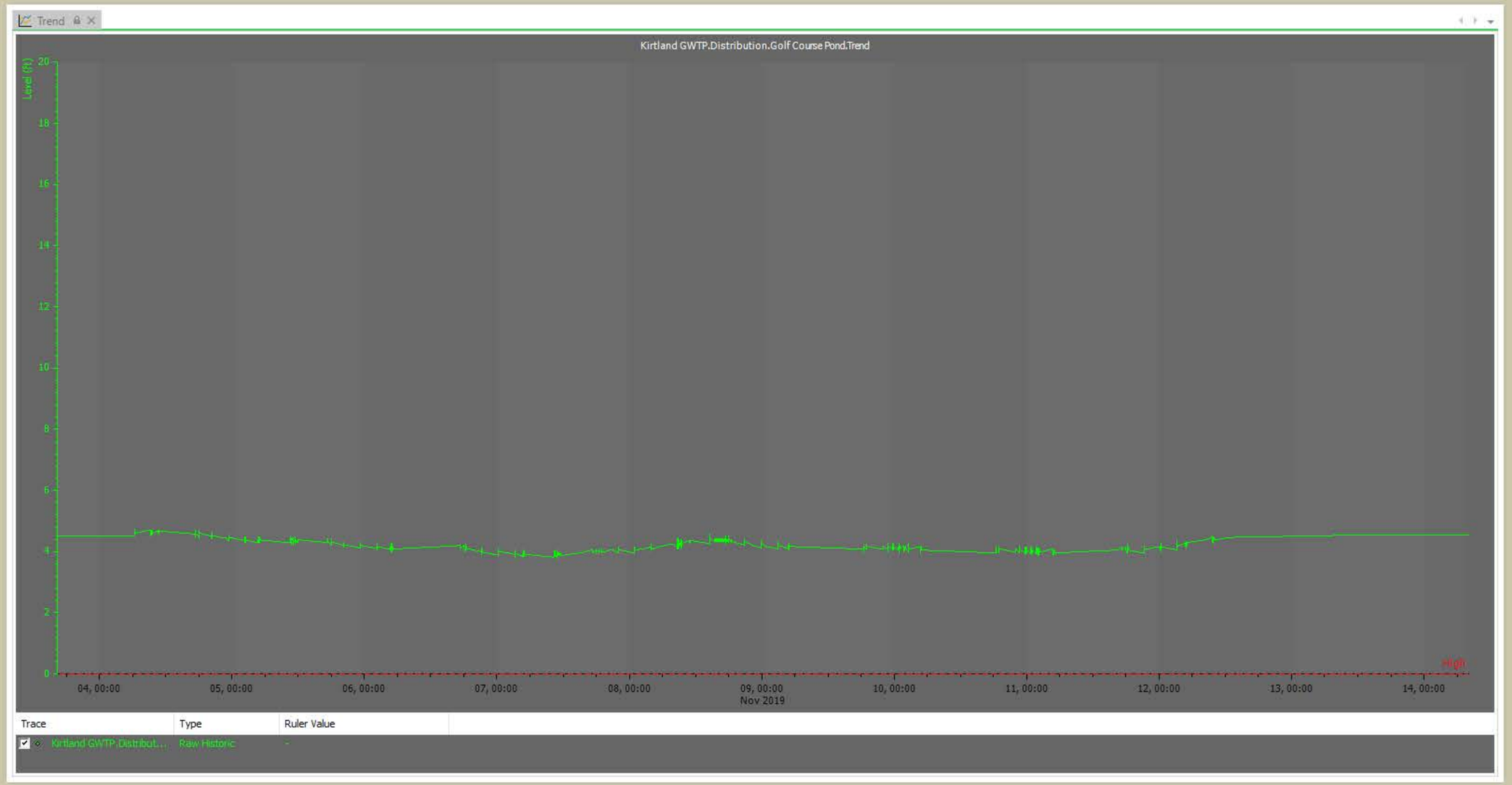
Include in Avg

NO | YES

4.91 ft

Train 2

GW Treatment Feed Tank 210


Trend
Kirtland GWTP.Distribution.Golf Course Pond.Trend
Level (ft)
20
18
16
14
12
10
8
6
4
2
0
High
04, 00:00
05, 00:00
06, 00:00
07, 00:00
08, 00:00
09, 00:00
Nov 2019
10, 00:00
11, 00:00
12, 00:00
13, 00:00
14, 00:00
Trace
Type
Ruler Value
Kirtland GWTP.Distribut...
Raw Historic
-

Distribution | Alarms

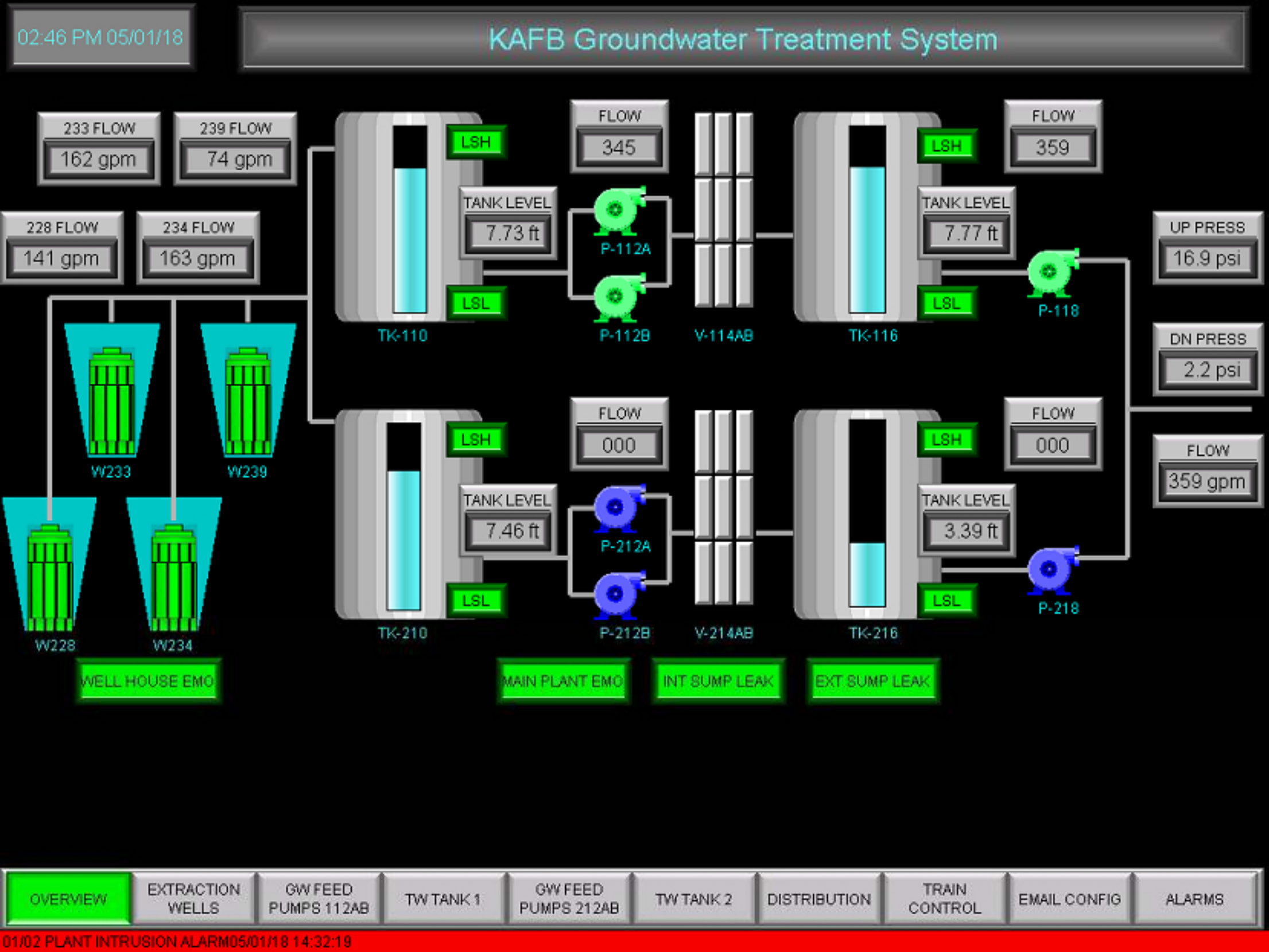
Viewing Alarms on 'Local'

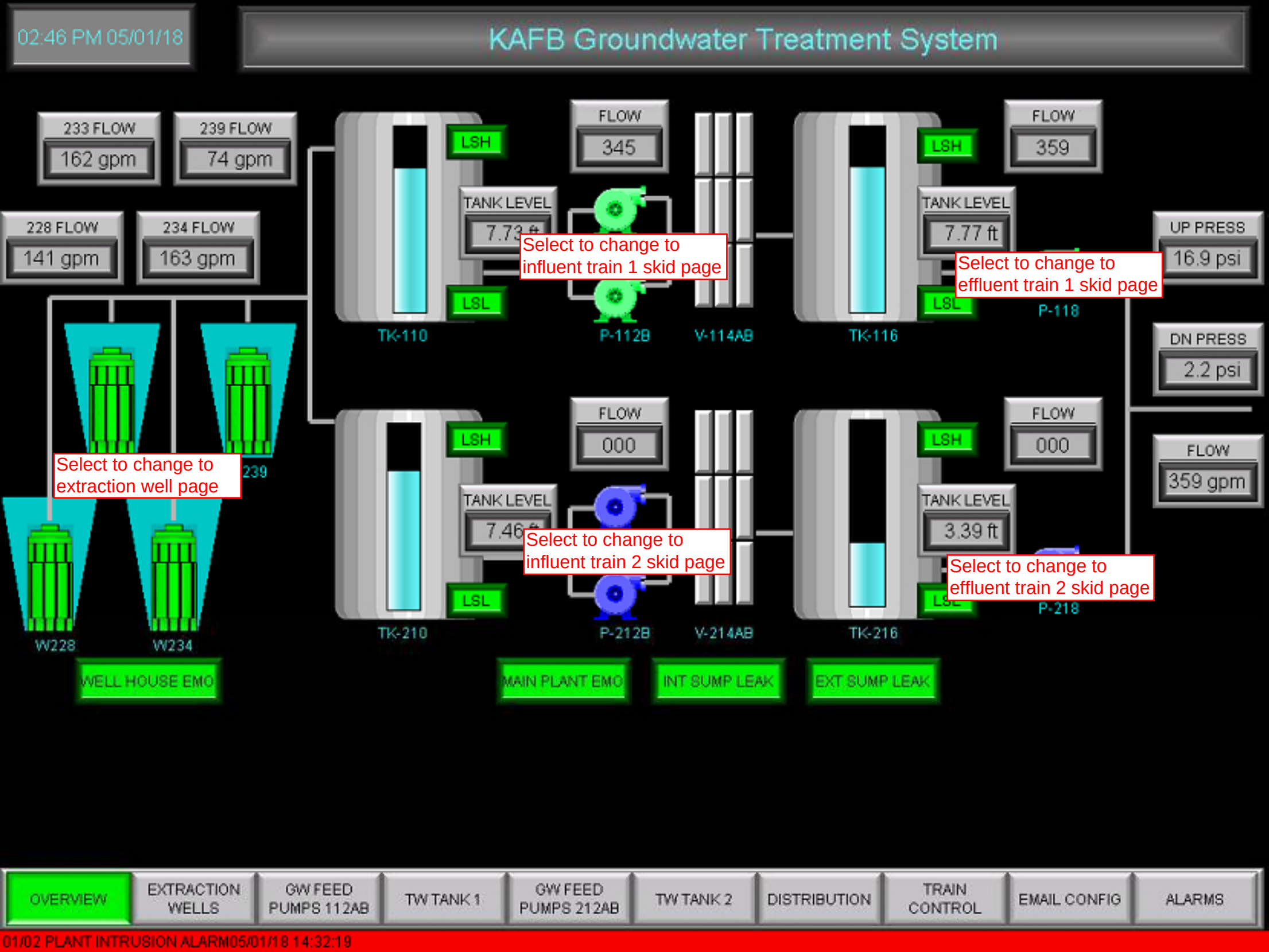
Severity	Time	Source	Message	Category	Suppressed Alarm Count
High	11/20/2019 7:27:35.830 AM	Kirtland GWTP.Plant.Intrusion	State changed from Normal to Alarm, value is 1 (Current data)	Point State	0

SCADA Layout | Events

Severity	Time	Source	Message	User	Category
Low	11/20/2019 7:27:35.831 AM	Kirtland GWTP.Plant.Intrusion	Alarm "11/20/2019 7:27:35.830 AM State changed from Normal to Alarm, value is 1 (Current data)" redirected to "SMS Action"	System	Alarm Redirection
High	11/20/2019 7:27:35.830 AM	Kirtland GWTP.Plant.Intrusion	State changed from Normal to Alarm, value is 1 (Current data) - Alarm raised	System	Point State
High	11/19/2019 4:55:33.088 PM	Kirtland GWTP.Plant.Intrusion	State changed from Alarm to Normal, value is 0 (Current data) - Alarm cleared	System	Point State
Low	11/19/2019 4:24:22.746 PM	Kirtland GWTP.Plant.Intrusion	Alarm "11/19/2019 4:24:22.745 PM State changed from Normal to Alarm, value is 1 (Current data)" redirected to "SMS Action"	System	Alarm Redirection
High	11/19/2019 4:24:22.745 PM	Kirtland GWTP.Plant.Intrusion	State changed from Normal to Alarm, value is 1 (Current data) - Alarm raised	System	Point State
High	11/19/2019 3:30:14.154 PM	Kirtland GWTP.Plant.Intrusion	State changed from Alarm to Normal, value is 0 (Current data) - Alarm cleared	System	Point State
Low	11/19/2019 3:26:36.119 PM	Kirtland GWTP.Plant.Intrusion	Alarm "11/19/2019 3:26:36.116 PM State changed from Normal to Alarm, value is 1 (Current data)" redirected to "SMS Action"	System	Alarm Redirection
High	11/19/2019 3:26:36.116 PM	Kirtland GWTP.Plant.Intrusion	State changed from Normal to Alarm, value is 1 (Current data) - Alarm raised	System	Point State
High	11/19/2019 12:48:36.475 PM	Kirtland GWTP.Plant.Intrusion	State changed from Alarm to Normal, value is 0 (Current data) - Alarm cleared	System	Point State
Low	11/19/2019 12:42:38.689 PM	Kirtland GWTP.0 Config.Users.PFERRARI	Logged off	PFERRARI	Security
Low	11/19/2019 12:42:28.785 PM	Kirtland GWTP.Plant.Intrusion	Alarm "11/19/2019 12:35:44.341 PM State changed from Normal to Alarm, value is 1 (Current data)" acknowledged	PFERRARI	Action
Low	11/19/2019 12:42:28.785 PM	Kirtland GWTP.Distribution.Golf Course Pond.Comm	Alarm "11/18/2019 10:07:05.419 PM State changed from COMM NORMAL to COMM FAILED, value is 0 (Current data)" acknowledged	PFERRARI	Action
Low	11/19/2019 12:42:28.785 PM	Kirtland GWTP.Extraction Well 235.Vault Leak 2	Alarm "11/19/2019 8:53:23.582 AM State changed from Normal to Conveyance Leak, value is 0 (Current data)" acknowledged	PFERRARI	Action
Low	11/19/2019 12:42:28.785 PM	Kirtland GWTP.Extraction Well 235.Failed	Alarm "11/19/2019 8:53:23.582 AM State changed from Normal to Failed to Run, value is 0 (Current data)" acknowledged	PFERRARI	Action
Low	11/19/2019 12:42:05.782 PM	Kirtland GWTP.0 Config.Users.PFERRARI	Logged on	PFERRARI	Security
Low	11/19/2019 12:35:44.342 PM	Kirtland GWTP.Plant.Intrusion	Alarm "11/19/2019 12:35:44.341 PM State changed from Normal to Alarm, value is 1 (Current data)" redirected to "SMS Action"	System	Alarm Redirection
High	11/19/2019 12:35:44.341 PM	Kirtland GWTP.Plant.Intrusion	State changed from Normal to Alarm, value is 1 (Current data) - Alarm raised	System	Point State
High	11/19/2019 8:57:08.594 AM	Kirtland GWTP.Extraction Well 235.Failed	State changed from Failed to Run to Normal, value is 1 (Current data) - Alarm cleared	System	Point State
High	11/19/2019 8:54:28.585 AM	Kirtland GWTP.Extraction Well 235.Vault Leak 2	State changed from Conveyance Leak to Normal, value is 1 (Current data) - Alarm cleared	System	Point State
Low	11/19/2019 8:53:47.630 AM	Kirtland GWTP.Extraction Well 235.Vault Leak 2	Alarm "11/19/2019 8:53:23.582 AM State changed from Normal to Conveyance Leak, value is 0 (Current data)" redirected to "SMS Action"	System	Alarm Redirection
Low	11/19/2019 8:53:23.583 AM	Kirtland GWTP.Extraction Well 235.Failed	Alarm "11/19/2019 8:53:23.582 AM State changed from Normal to Failed to Run, value is 0 (Current data)" redirected to "SMS Action"	System	Alarm Redirection
High	11/19/2019 8:53:23.582 AM	Kirtland GWTP.Extraction Well 235.Vault Leak 2	State changed from Normal to Conveyance Leak, value is 0 (Current data) - Alarm raised	System	Point State
High	11/19/2019 8:53:23.582 AM	Kirtland GWTP.Extraction Well 235.Failed	State changed from Normal to Failed to Run, value is 0 (Current data) - Alarm raised	System	Point State
High	11/19/2019 8:03:41.478 AM	Kirtland GWTP.Plant.Intrusion	State changed from Alarm to Normal, value is 0 (Current data) - Alarm cleared	System	Point State

Human Machine Interface Screens


02:46 PM 05/01/18
KAFB Groundwater Treatment System
233 FLOW
162 gpm
239 FLOW
74 gpm
228 FLOW
141 gpm
234 FLOW
163 gpm
W233
W239
W228
W234
LSH
LSL
TANK LEVEL
7.73 ft
TK-110
FLOW
345
P-112A
P-112B
V-114AB
TANK LEVEL
7.77 ft
TK-116
FLOW
359
P-118
UP PRESS
16.9 psi
DN PRESS
2.2 psi
FLOW
359 gpm
TANK LEVEL
7.46 ft
TK-210
FLOW
000
P-212A
P-212B
V-214AB
TANK LEVEL
3.39 ft
TK-216
FLOW
000
P-218
WELL HOUSE EMO
MAIN PLANT EMO
INT SUMP LEAK
EXT SUMP LEAK
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:46 PM 05/01/18
KAFB Groundwater Treatment System
233 FLOW
162 gpm
239 FLOW
74 gpm
228 FLOW
141 gpm
234 FLOW
163 gpm
LSH
LSL
TANK LEVEL
7.73 ft
FLOW
345
TK-110
P-112B
V-114AB
TK-116
7.77 ft
359
P-118
UP PRESS
16.9 psi
DN PRESS
2.2 psi
FLOW
359 gpm
Select to change to influent train 1 skid page
Select to change to effluent train 1 skid page
Select to change to extraction well page
239
TK-210
7.46 ft
000
P-212B
V-214AB
TK-216
3.39 ft
P-218
Select to change to influent train 2 skid page
Select to change to effluent train 2 skid page
W228
W234
WELL HOUSE EMO
MAIN PLANT EMO
INT SUMP LEAK
EXT SUMP LEAK
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:47 PM 05/01/18

KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

P102 - CONTROL
OFF ON SEQ
RUNNING

P103 - CONTROL
OFF ON SEQ
RUNNING

P105 - CONTROL
OFF ON SEQ
RUNNING

P3100

P3200

TANK LEVEL
7.72 ft

TK 1 IN AVG
NO YES

TANK LEVEL
7.51 ft

TK 2 IN AVG
NO YES

AUTO
W228

AUTO
W233

AUTO
W234

AUTO
W239

W228	W233	W234	W239
Flow 141 gpm	Flow 162 gpm	Flow 163 gpm	Flow 75 gpm
PRESS 63 psi	PRESS 23 psi	PRESS 23 psi	PRESS 43 psi
LEVEL 17.51 ft	LEVEL 32.19 ft	LEVEL 20.72 ft	LEVEL 28.89 ft
			SPEED 85 %

AVG TANK
7.62 ft

LEVEL PID
100 %

START PID CO
65 %

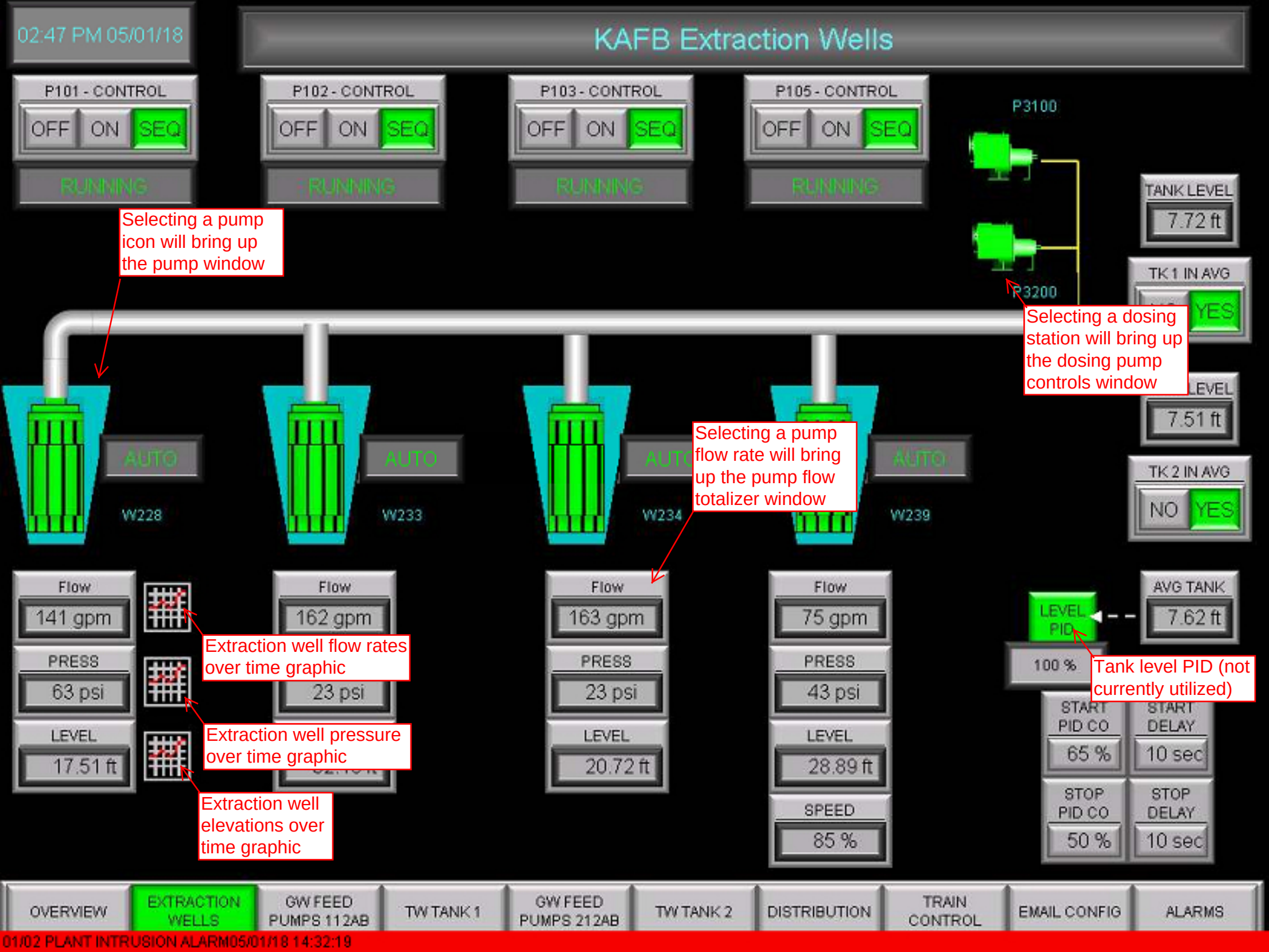
START DELAY
10 sec

STOP PID CO
50 %

STOP DELAY
10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:47 PM 05/01/18
KAFB Extraction Wells
P101 - CONTROL
OFF ON SEQ
RUNNING
P102 - CONTROL
OFF ON SEQ
RUNNING
P103 - CONTROL
OFF ON SEQ
RUNNING
P105 - CONTROL
OFF ON SEQ
RUNNING
P3100
P3200
TANK LEVEL
7.72 ft
TK 1 IN AVG
YES
LEVEL
7.51 ft
TK 2 IN AVG
NO YES
Selecting a pump icon will bring up the pump window
Selecting a dosing station will bring up the dosing pump controls window
Selecting a pump flow rate will bring up the pump flow totalizer window
AUTO
W228
AUTO
W233
AUTO
W234
AUTO
W239
Flow
141 gpm
PRESS
63 psi
LEVEL
17.51 ft
Flow
162 gpm
PRESS
23 psi
Flow
163 gpm
PRESS
23 psi
LEVEL
20.72 ft
Flow
75 gpm
PRESS
43 psi
LEVEL
28.89 ft
SPEED
85 %
AVG TANK
7.62 ft
LEVEL PID
100 %
START PID CO
65 %
START DELAY
10 sec
STOP PID CO
50 %
STOP DELAY
10 sec
Extraction well flow rates over time graphic
Extraction well pressure over time graphic
Extraction well elevations over time graphic
Tank level PID (not currently utilized)
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:47 PM 05/01/18

KAFB Extraction Wells

PUMP 101

SEQ NUMBER: 1

RUNTIME: 7,856 hrs

CLOSE

P102 - CONTROL: OFF ON SEQ — RUNNING

P103 - CONTROL: OFF ON SEQ — RUNNING

P105 - CONTROL: OFF ON SEQ — RUNNING

P3100

P3200

TANK LEVEL: 7.73 ft

TK 1 IN AVG: NO YES

TANK LEVEL: 7.56 ft

TK 2 IN AVG: NO YES

W228	W233	W234	W239
AUTO	AUTO	AUTO	AUTO
Flow: 141 gpm	Flow: 161 gpm	Flow: 163 gpm	Flow: 74 gpm
PRESS: 63 psi	PRESS: 23 psi	PRESS: 23 psi	PRESS: 43 psi
LEVEL: 17.51 ft	LEVEL: 32.19 ft	LEVEL: 20.74 ft	LEVEL: 28.85 ft
			SPEED: 85 %

LEVEL PID: 100 %

AVG TANK: 7.64 ft

START PID CO: 65 %

START DELAY: 10 sec

STOP PID CO: 50 %

STOP DELAY: 10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:47 PM 05/01/18

KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

PUMP 102
SEQ NUMBER
3
RUNTIME
7,119 hrs
CLOSE

P103 - CONTROL
OFF ON SEQ
RUNNING

P105 - CONTROL
OFF ON SEQ
RUNNING

P3100
P3200

TANK LEVEL
7.73 ft

TK 1 IN AVG
NO YES

TANK LEVEL
7.60 ft

TK 2 IN AVG
NO YES

AUTO
W228

AUTO
W233

AUTO
W234

AUTO
W239

Flow	PRESS	LEVEL
141 gpm	63 psi	17.51 ft
162 gpm	23 psi	32.19 ft
164 gpm	23 psi	20.74 ft
74 gpm	43 psi	28.89 ft

SPEED
85 %

AVG TANK
7.66 ft

LEVEL PID
100 %

START PID CO
65 %

START DELAY
10 sec

STOP PID CO
50 %

STOP DELAY
10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:47 PM 05/01/18

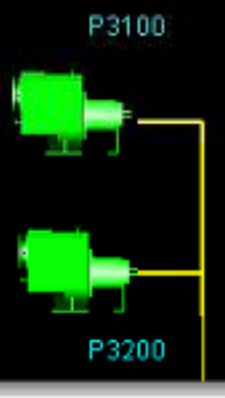
KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

P102 - CONTROL
OFF ON SEQ
RUNNING

PUMP 103
SEQ NUMBER
4
RUNTIME
8,729 hrs
CLOSE

P105 - CONTROL
OFF ON SEQ
RUNNING

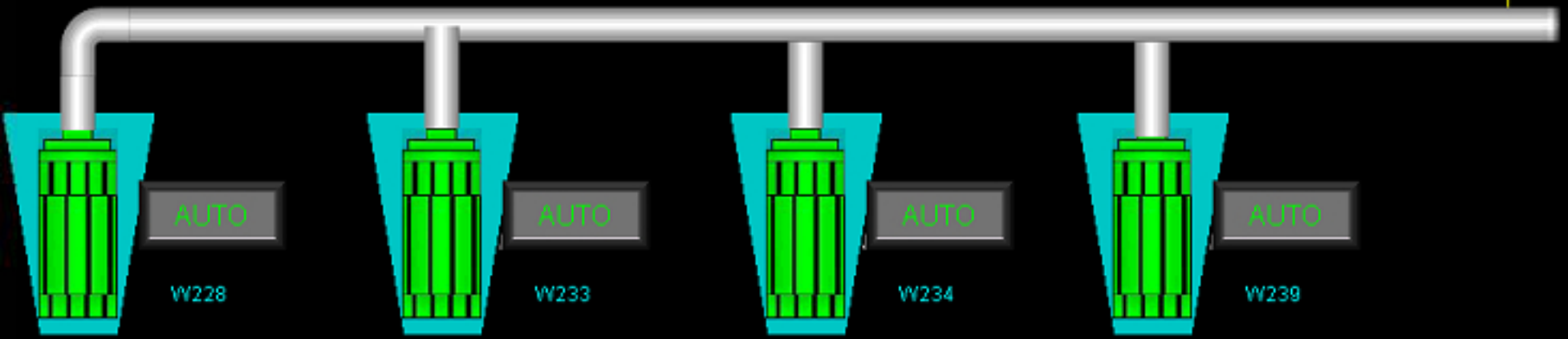


TANK LEVEL
7.71 ft

TK 1 IN AVG
NO YES

TANK LEVEL
7.64 ft

TK 2 IN AVG
NO YES



W228	W233	W234	W239
Flow 141 gpm	Flow 162 gpm	Flow 164 gpm	Flow 75 gpm
PRESS 63 psi	PRESS 23 psi	PRESS 23 psi	PRESS 43 psi
LEVEL 17.51 ft	LEVEL 32.14 ft	LEVEL 20.71 ft	LEVEL 28.85 ft
			SPEED 85 %

AVG TANK
7.69 ft

LEVEL PID
100 %

START PID CO
65 %

START DELAY
10 sec

STOP PID CO
50 %

STOP DELAY
10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:47 PM 05/01/18

KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

P102 - CONTROL
OFF ON SEQ
RUNNING

P103 - CONTROL
OFF ON SEQ
RUNNING

PUMP 105

MIN SPEED	MAX SPEED	SEQ NUMBER
50.0 %	85.0 %	2

RUNTIME
1,078 hrs

CLOSE

P3100

P3200

TANK LEVEL
7.72 ft

TK 1 IN AVG
NO YES

TANK LEVEL
7.68 ft

TK 2 IN AVG
NO YES

AUTO W228

AUTO W233

AUTO W234

AUTO W239

	W228	W233	W234	W239
Flow	141 gpm	161 gpm	164 gpm	75 gpm
PRESS	63 psi	23 psi	23 psi	43 psi
LEVEL	17.51 ft	32.19 ft	20.71 ft	28.89 ft
SPEED				85 %

LEVEL PID
100 %

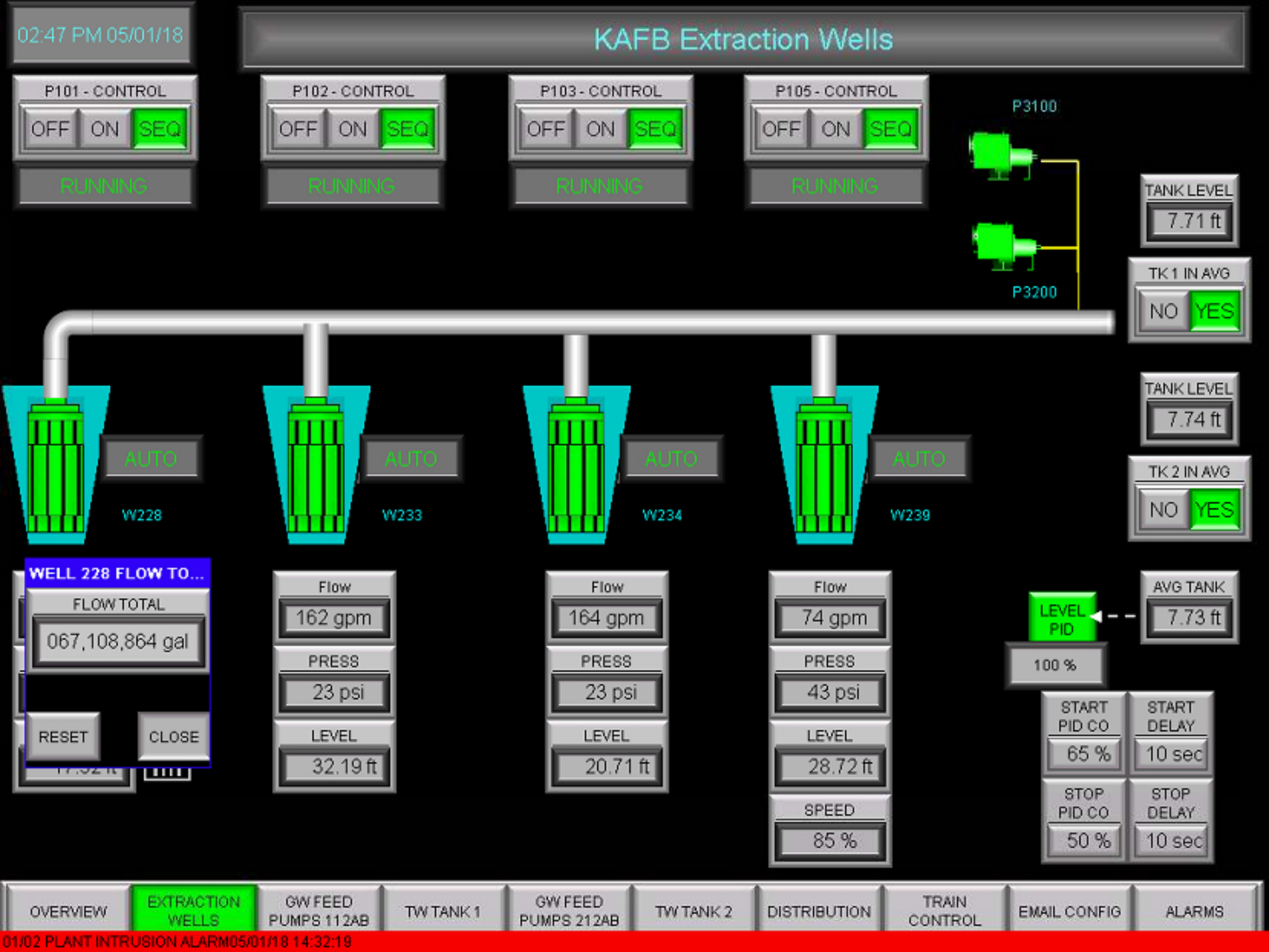
AVG TANK
7.70 ft

START PID CO	START DELAY
65 %	10 sec

STOP PID CO	STOP DELAY
50 %	10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:47 PM 05/01/18
KAFB Extraction Wells
P101 - CONTROL
OFF ON SEQ
RUNNING
P102 - CONTROL
OFF ON SEQ
RUNNING
P103 - CONTROL
OFF ON SEQ
RUNNING
P105 - CONTROL
OFF ON SEQ
RUNNING
P3100
P3200
TANK LEVEL
7.71 ft
TK 1 IN AVG
NO YES
TANK LEVEL
7.74 ft
TK 2 IN AVG
NO YES
AUTO
W228
AUTO
W233
AUTO
W234
AUTO
W239
WELL 228 FLOW TO...
FLOW TOTAL
067,108,864 gal
RESET
CLOSE
Flow
162 gpm
PRESS
23 psi
LEVEL
32.19 ft
Flow
164 gpm
PRESS
23 psi
LEVEL
20.71 ft
Flow
74 gpm
PRESS
43 psi
LEVEL
28.72 ft
SPEED
85 %
AVG TANK
7.73 ft
LEVEL PID
100 %
START PID CO
65 %
START DELAY
10 sec
STOP PID CO
50 %
STOP DELAY
10 sec
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:47 PM 05/01/18

KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

P102 - CONTROL
OFF ON SEQ
RUNNING

P103 - CONTROL
OFF ON SEQ
RUNNING

P105 - CONTROL
OFF ON SEQ
RUNNING

P3100

P3200

TANK LEVEL
7.71 ft

TK 1 IN AVG
NO YES

TANK LEVEL
7.80 ft

TK 2 IN AVG
NO YES

AUTO
W228

AUTO
W233

AUTO
W234

AUTO
W239

Flow
141 gpm

PRESS
63 psi

LEVEL
17.52 ft

WELL 233 FLOW TO...
FLOW TOTAL
067,108,864 gal
RESET
CLOSE

Flow
163 gpm

PRESS
23 psi

LEVEL
20.72 ft

Flow
75 gpm

PRESS
43 psi

LEVEL
28.77 ft

SPEED
85 %

AVG TANK
7.75 ft

LEVEL PID
100 %

START PID CO
65 %

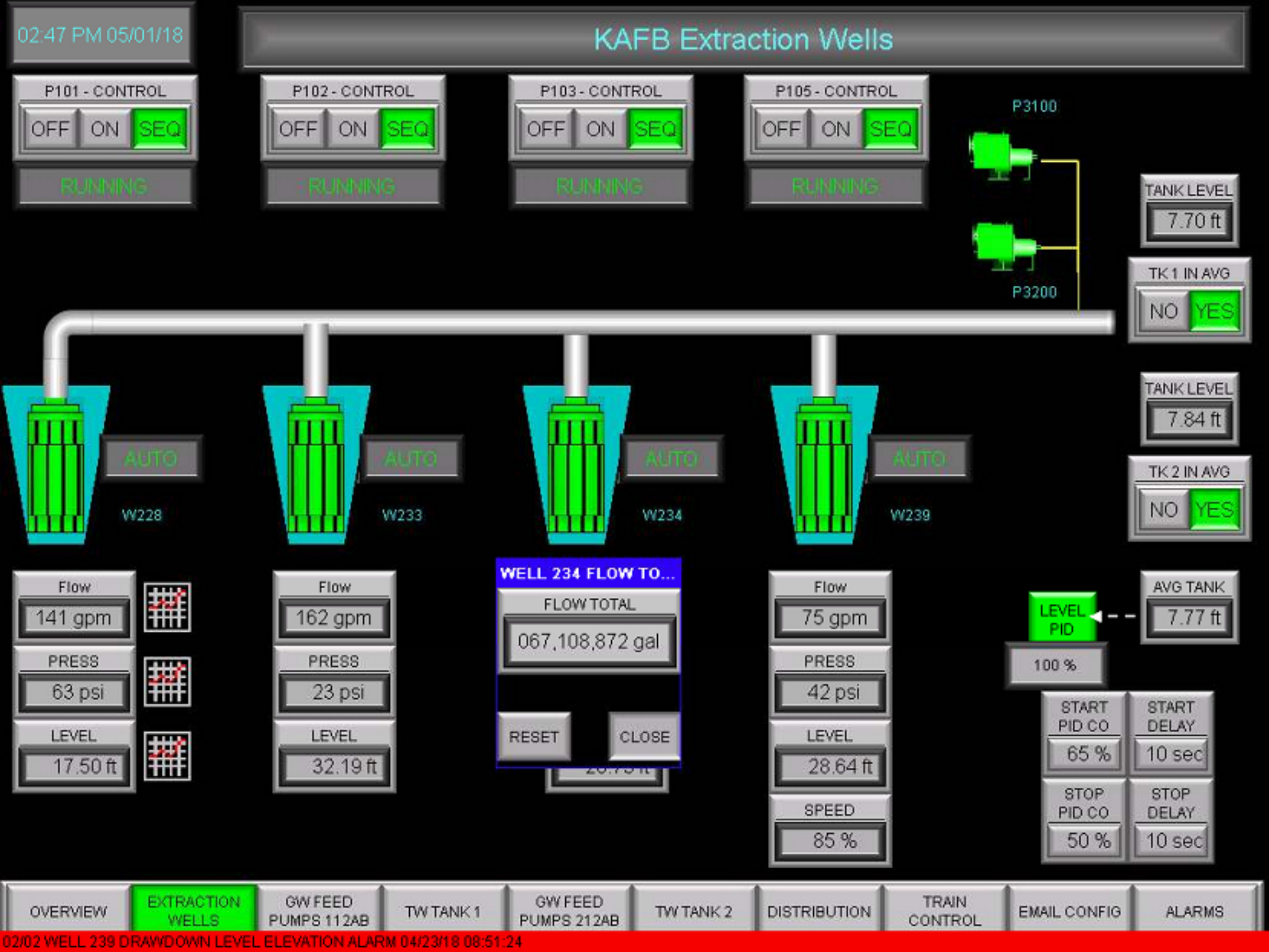
START DELAY
10 sec

STOP PID CO
50 %

STOP DELAY
10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:47 PM 05/01/18
KAFB Extraction Wells
P101 - CONTROL
OFF ON SEQ
RUNNING
P102 - CONTROL
OFF ON SEQ
RUNNING
P103 - CONTROL
OFF ON SEQ
RUNNING
P105 - CONTROL
OFF ON SEQ
RUNNING
P3100
P3200
TANK LEVEL
7.70 ft
TK 1 IN AVG
NO YES
TANK LEVEL
7.84 ft
TK 2 IN AVG
NO YES
AUTO
W228
AUTO
W233
AUTO
W234
AUTO
W239
Flow
141 gpm
PRESS
63 psi
LEVEL
17.50 ft
Flow
162 gpm
PRESS
23 psi
LEVEL
32.19 ft
WELL 234 FLOW TO...
FLOW TOTAL
067,108,872 gal
RESET
CLOSE
Flow
75 gpm
PRESS
42 psi
LEVEL
28.64 ft
SPEED
85 %
AVG TANK
7.77 ft
LEVEL PID
100 %
START PID CO
65 %
START DELAY
10 sec
STOP PID CO
50 %
STOP DELAY
10 sec
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:48 PM 05/01/18

KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

P102 - CONTROL
OFF ON SEQ
RUNNING

P103 - CONTROL
OFF ON SEQ
RUNNING

P105 - CONTROL
OFF ON SEQ
RUNNING

P3100

P3200

TANK LEVEL
7.69 ft

TK 1 IN AVG
NO YES

TANK LEVEL
7.88 ft

TK 2 IN AVG
NO YES

AUTO
W228

AUTO
W233

AUTO
W234

AUTO
W239

Flow
141 gpm
PRESS
63 psi
LEVEL
17.51 ft

Flow
162 gpm
PRESS
23 psi
LEVEL
32.19 ft

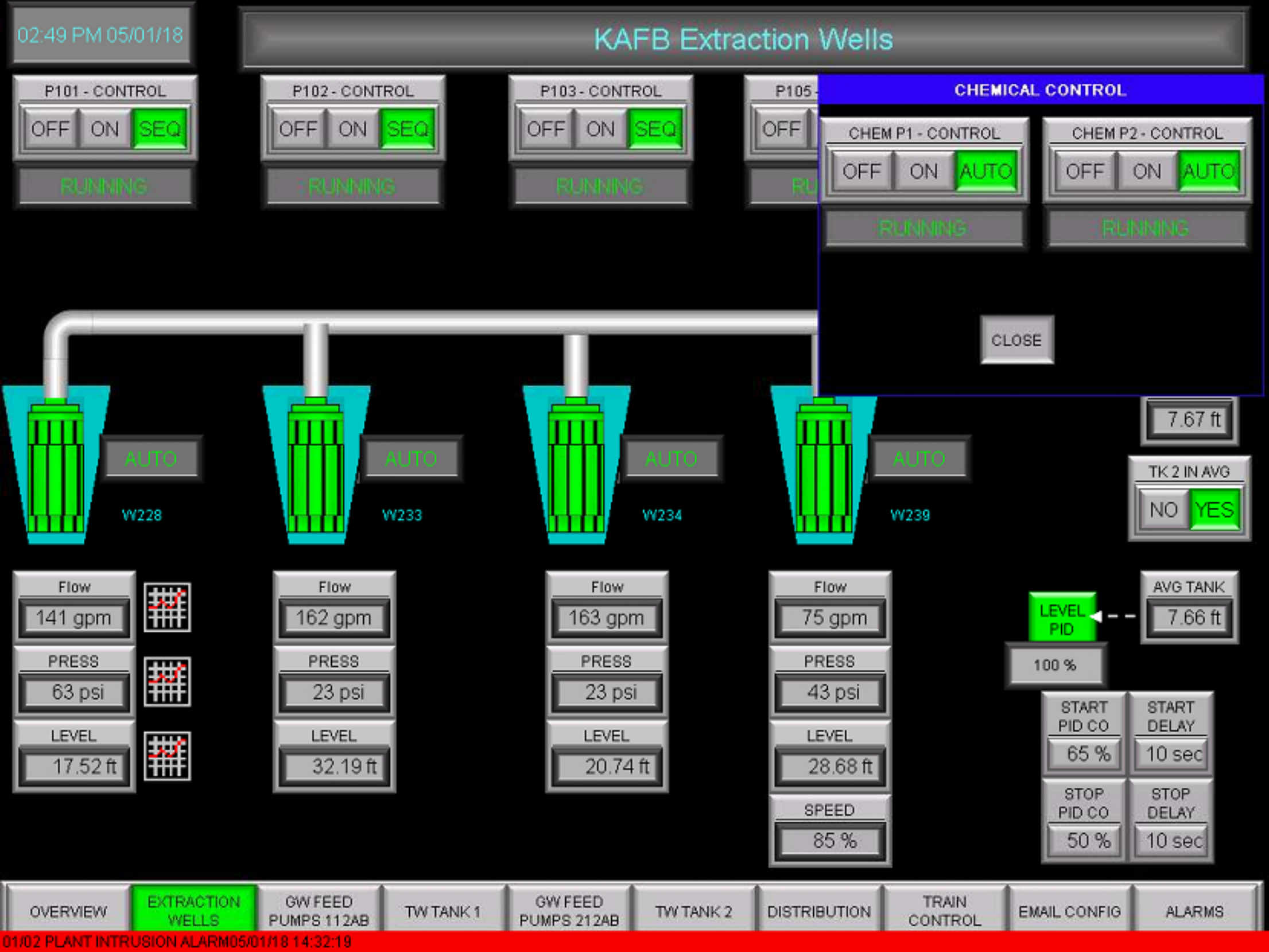
Flow
164 gpm
PRESS
23 psi
LEVEL
20.72 ft

WELL 235 FLOW TO...
FLOW TOTAL
003,876,928 gal
RESET
CLOSE
SPEED
85 %

AVG TANK
7.79 ft
LEVEL PID
100 %
START PID CO
65 %
START DELAY
10 sec
STOP PID CO
50 %
STOP DELAY
10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


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KAFB Extraction Wells
P101 - CONTROL
OFF ON SEQ
RUNNING
P102 - CONTROL
OFF ON SEQ
RUNNING
P103 - CONTROL
OFF ON SEQ
RUNNING
P105 -
OFF
RU
CHEMICAL CONTROL
CHEM P1 - CONTROL
OFF ON AUTO
RUNNING
CHEM P2 - CONTROL
OFF ON AUTO
RUNNING
CLOSE
AUTO
W228
AUTO
W233
AUTO
W234
AUTO
W239
7.67 ft
TK 2 IN AVG
NO YES
Flow
141 gpm
PRESS
63 psi
LEVEL
17.52 ft
Flow
162 gpm
PRESS
23 psi
LEVEL
32.19 ft
Flow
163 gpm
PRESS
23 psi
LEVEL
20.74 ft
Flow
75 gpm
PRESS
43 psi
LEVEL
28.68 ft
SPEED
85 %
LEVEL PID
100 %
AVG TANK
7.66 ft
START PID CO
65 %
START DELAY
10 sec
STOP PID CO
50 %
STOP DELAY
10 sec
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

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KAFB Extraction Wells

P101 - CONTROL
OFF ON SEQ
RUNNING

P102 - CONTROL
OFF ON SEQ
RUNNING

P103 - CONTROL
OFF ON SEQ
RUNNING

P105 - CONTROL
OFF ON SEQ
RUNNING

P3100

P3200

TANK LEVEL
7.65 ft

TK 1 IN AVG
NO YES

AUTO
W228

AUTO
W233

AUTO
W234

W228	W233	W234
Flow 141 gpm	Flow 161 gpm	Flow 164 gpm
PRESS 63 psi	PRESS 23 psi	PRESS 23 psi
LEVEL 17.52 ft	LEVEL 32.19 ft	LEVEL 20.71 ft

GW Feed Tanks Avg - Level Ctrl

CLR STOP

SETPOINT
9.5 ft

AUTO

10.00
7.50
5.00
2.50
0.00
89 91.5 94 96.5 99
OUTPUT 100%
AUTO

KP 1.75
KI 0.020
KD 0.00

CLOSE

LEVEL
28.85 ft

SPEED
85 %

65 %
10 sec

STOP PID CO
50 %

STOP DELAY
10 sec

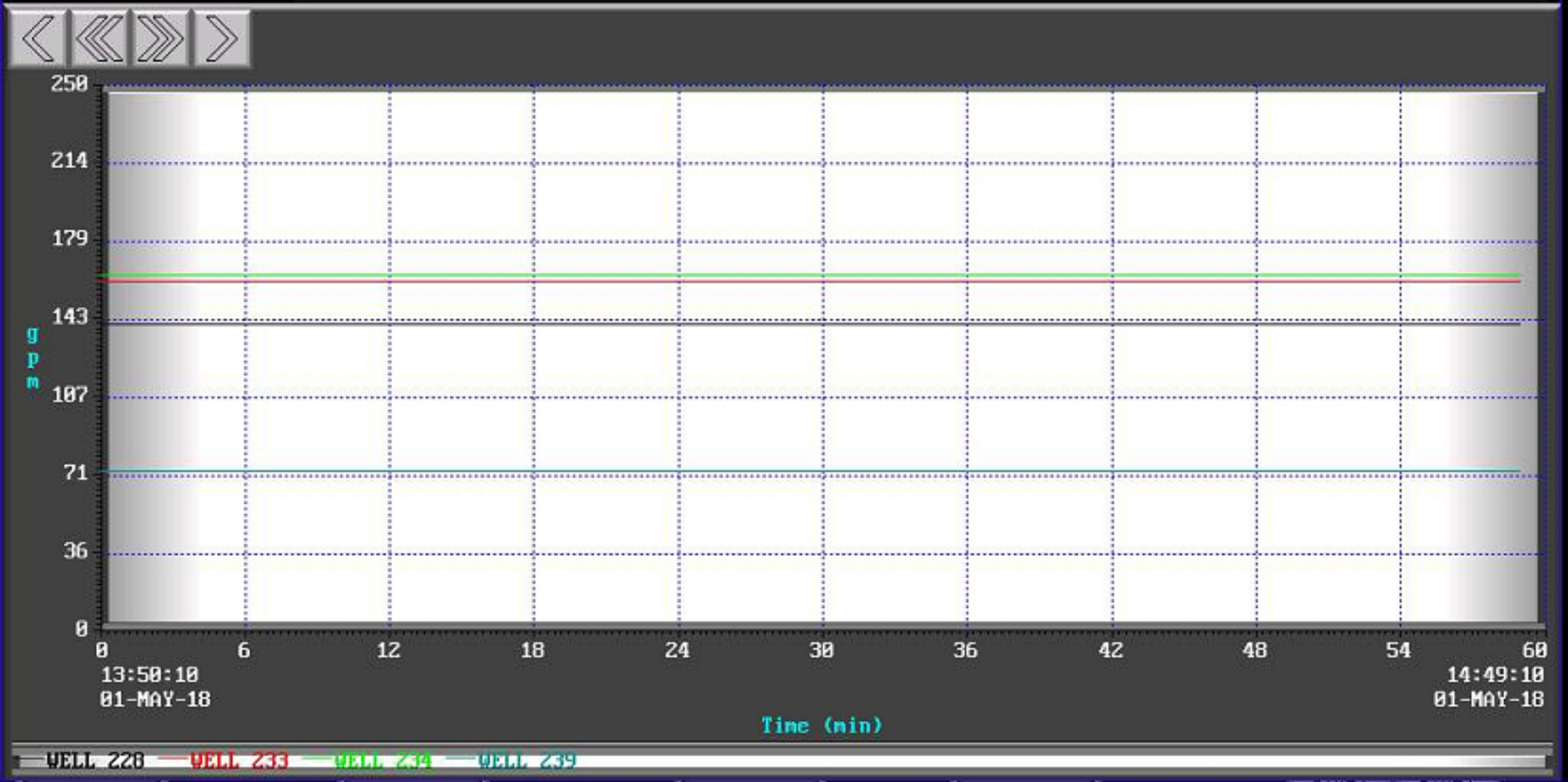
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

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EXTRACTION WELLS DISCHARGE FLOW

CLOSE



LEVEL 17.52 ft

LEVEL 32.23 ft

LEVEL 20.71 ft

LEVEL 28.85 ft

SPEED 85 %

START PID CO 65 %

START DELAY 10 sec

STOP PID CO 50 %

STOP DELAY 10 sec

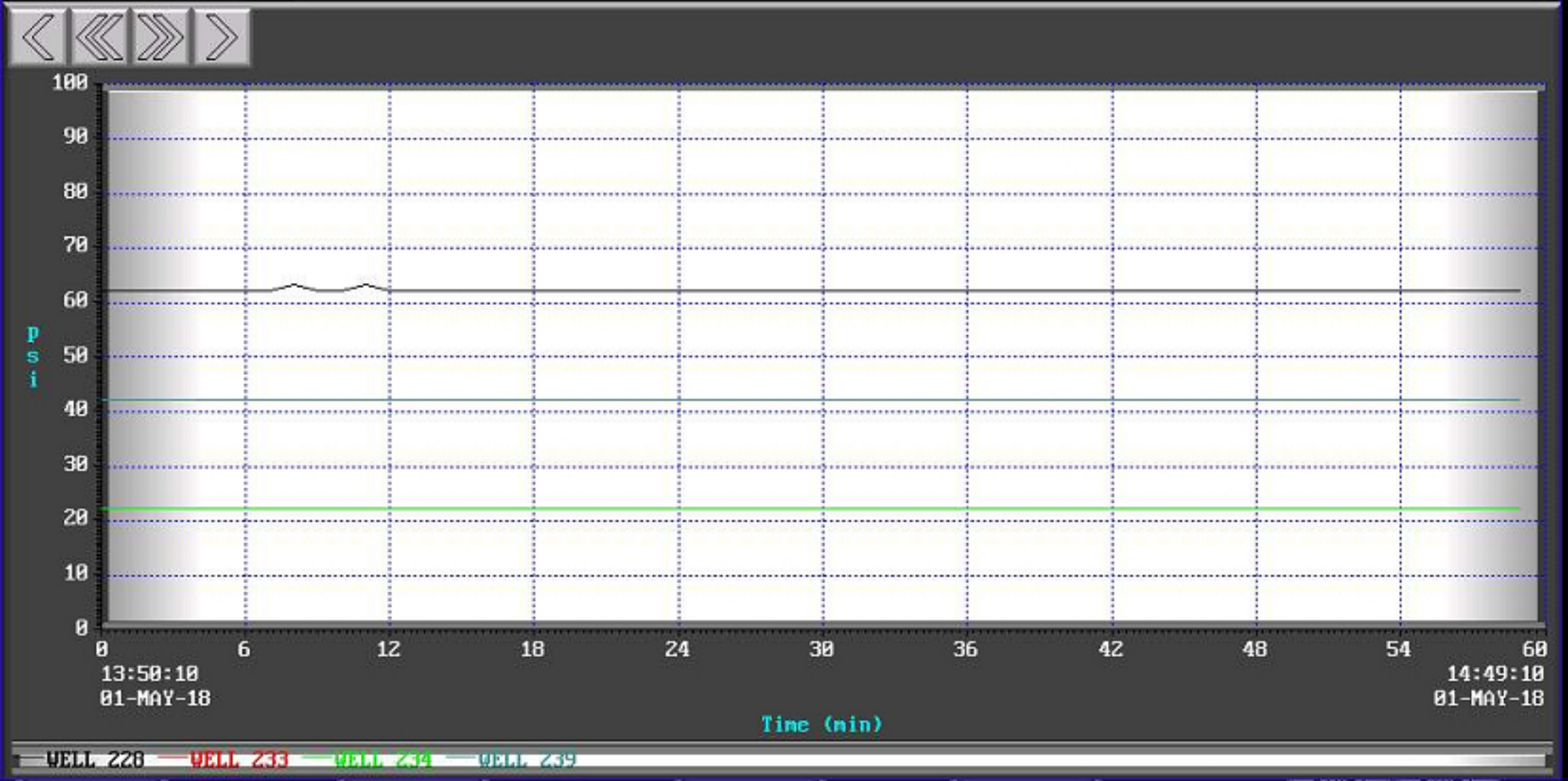
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

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EXTRACTION WELL PRESSURES

CLOSE



LEVEL
17.51 ft

LEVEL
32.23 ft

LEVEL
20.74 ft

LEVEL
28.89 ft

SPEED
85 %

START PID CO
65 %

START DELAY
10 sec

STOP PID CO
50 %

STOP DELAY
10 sec

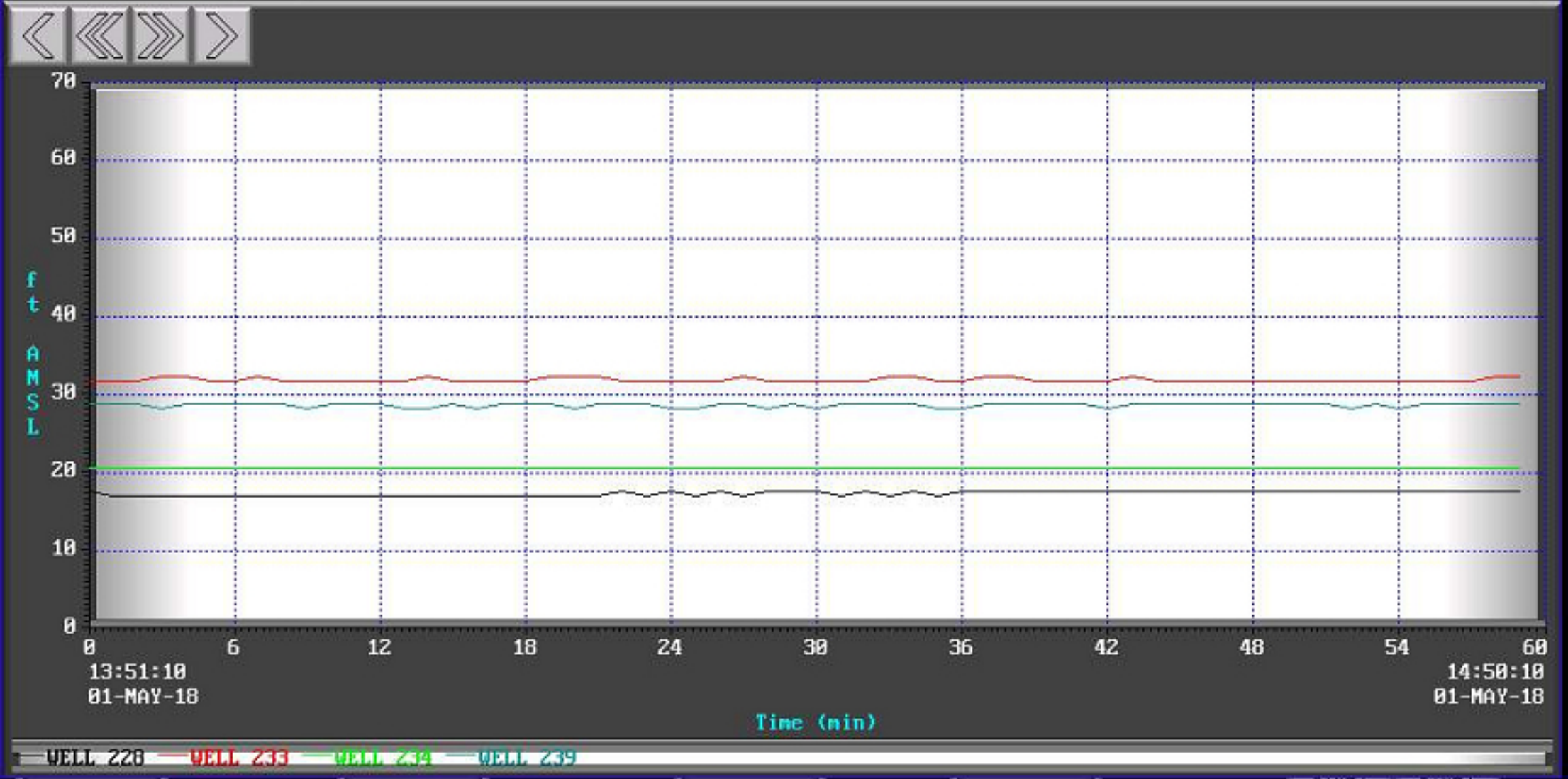
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

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EXTRACTION WELLS DRAWDOWN LEVEL

CLOSE



LEVEL
17.51 ft

LEVEL
32.23 ft

LEVEL
20.73 ft

LEVEL
29.06 ft

SPEED
85 %

START PID CO
65 %

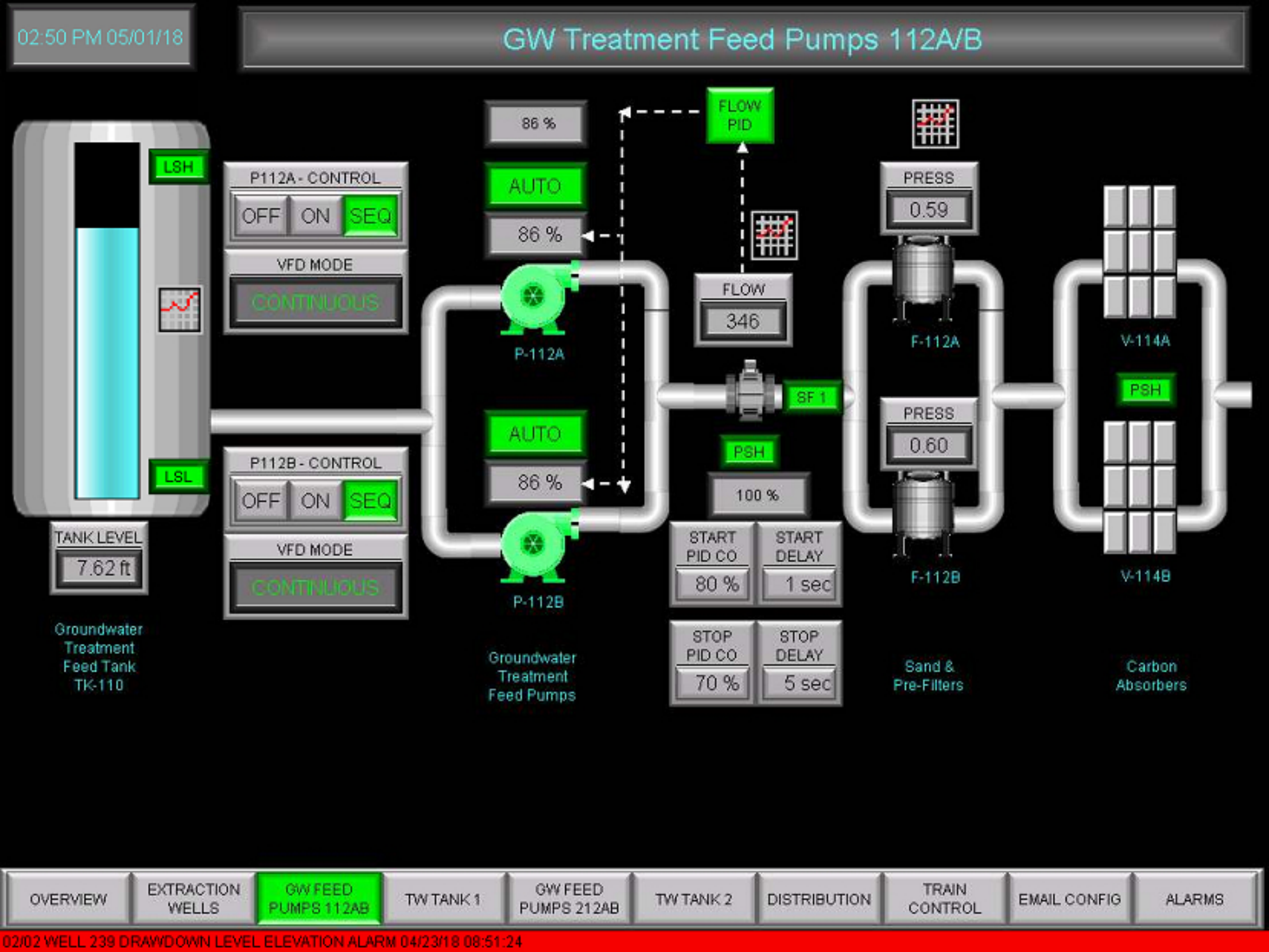
START DELAY
10 sec

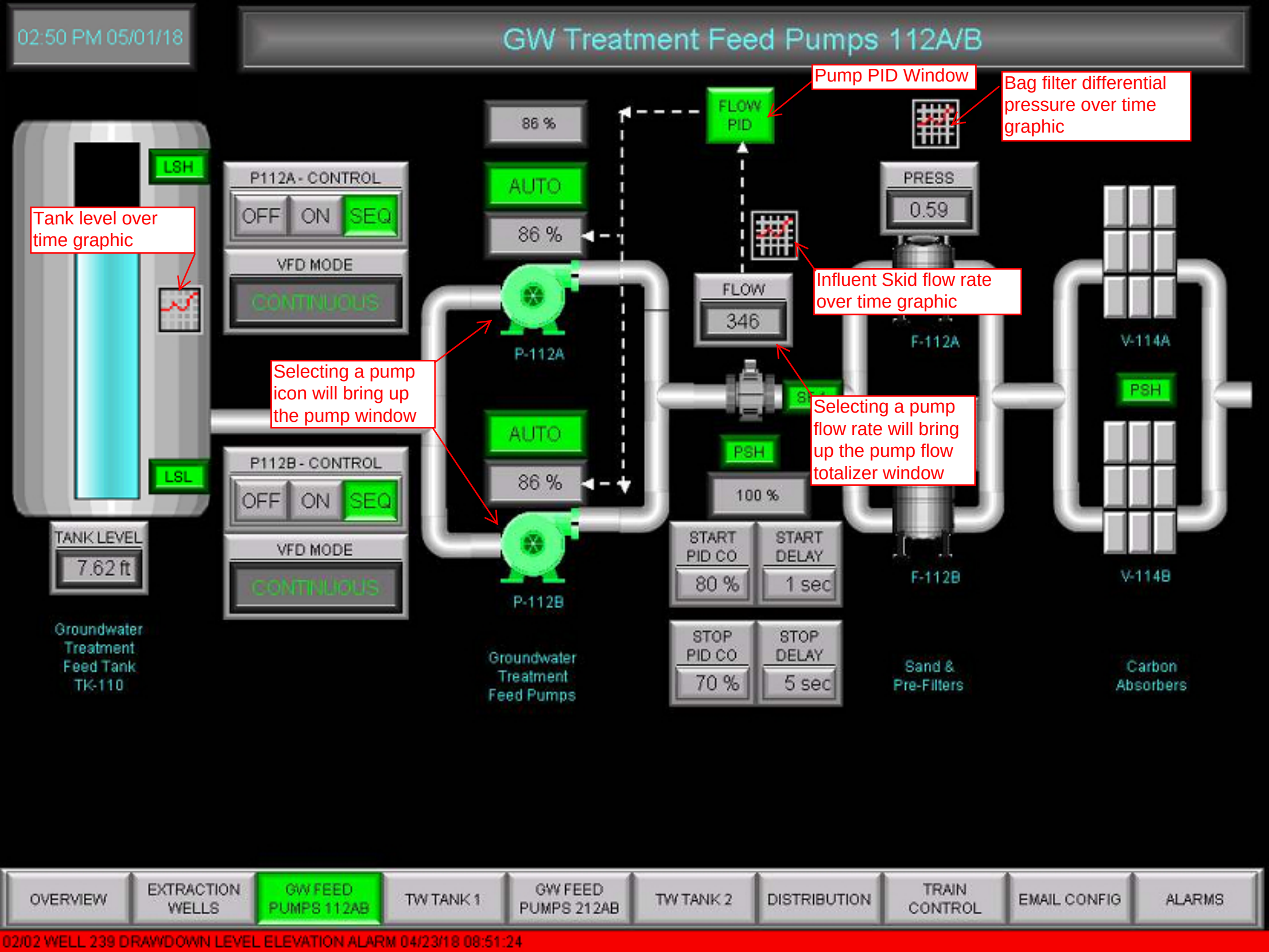
STOP PID CO
50 %

STOP DELAY
10 sec

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

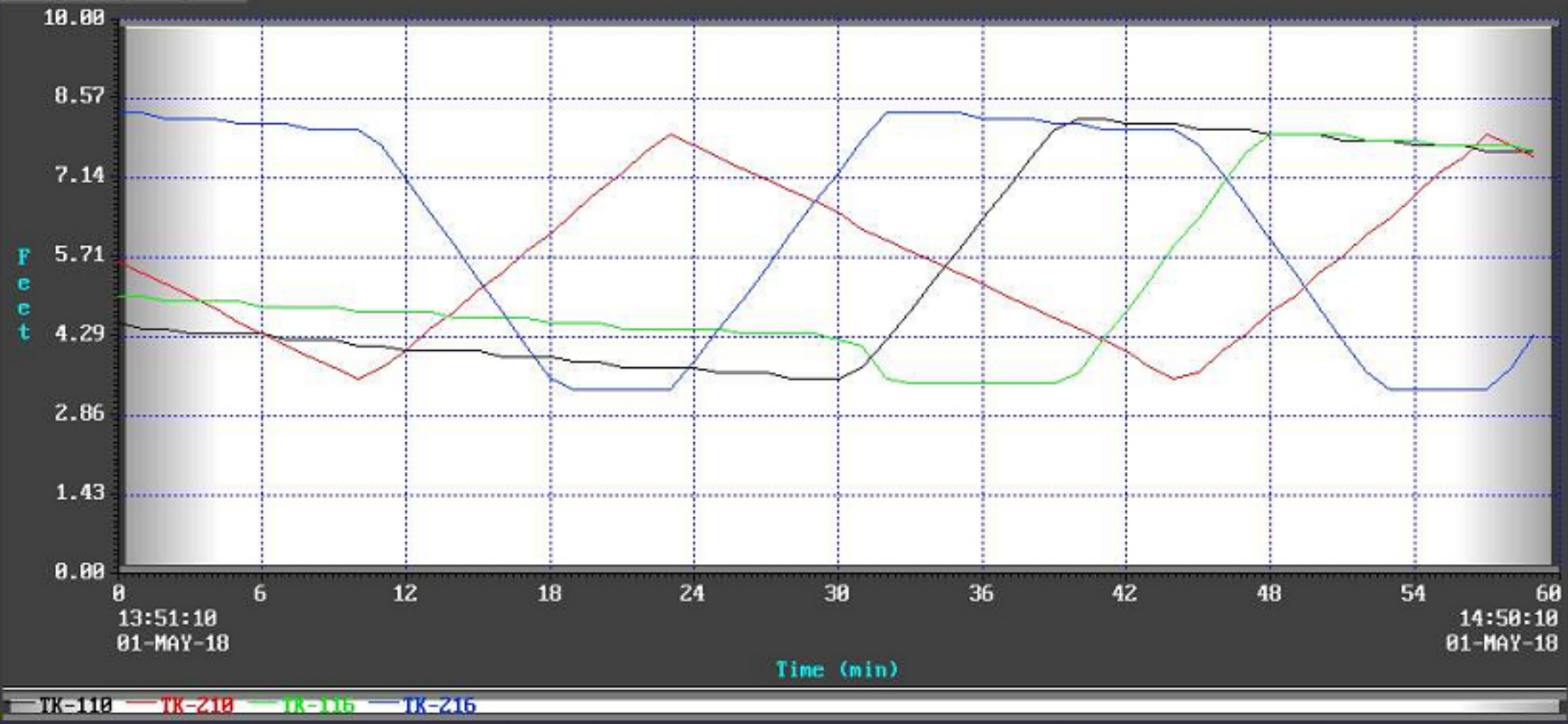

02:50 PM 05/01/18
GW Treatment Feed Pumps 112A/B
LSH
LSL
TANK LEVEL
7.62 ft
Groundwater Treatment Feed Tank TK-110
P112A - CONTROL
OFF
ON
SEQ
VFD MODE
CONTINUOUS
P112B - CONTROL
OFF
ON
SEQ
VFD MODE
CONTINUOUS
86 %
AUTO
86 %
P-112A
AUTO
86 %
P-112B
Groundwater Treatment Feed Pumps
FLOW PID
FLOW
346
SF 1
PSH
100 %
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.59
F-112A
PRESS
0.60
F-112B
Sand & Pre-Filters
V-114A
PSH
V-114B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:50 PM 05/01/18
GW Treatment Feed Pumps 112A/B
Pump PID Window
Bag filter differential pressure over time graphic
Tank level over time graphic
Influent Skid flow rate over time graphic
Selecting a pump icon will bring up the pump window
Selecting a pump flow rate will bring up the pump flow totalizer window
LSH
LSL
TANK LEVEL
7.62 ft
Groundwater Treatment Feed Tank TK-110
P112A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P112B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
86 %
AUTO
86 %
P-112A
AUTO
86 %
P-112B
Groundwater Treatment Feed Pumps
FLOW PID
FLOW
346
PSH
100 %
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.59
F-112A
F-112B
Sand & Pre-Filters
V-114A
PSH
V-114B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:50 PM 05/01/18

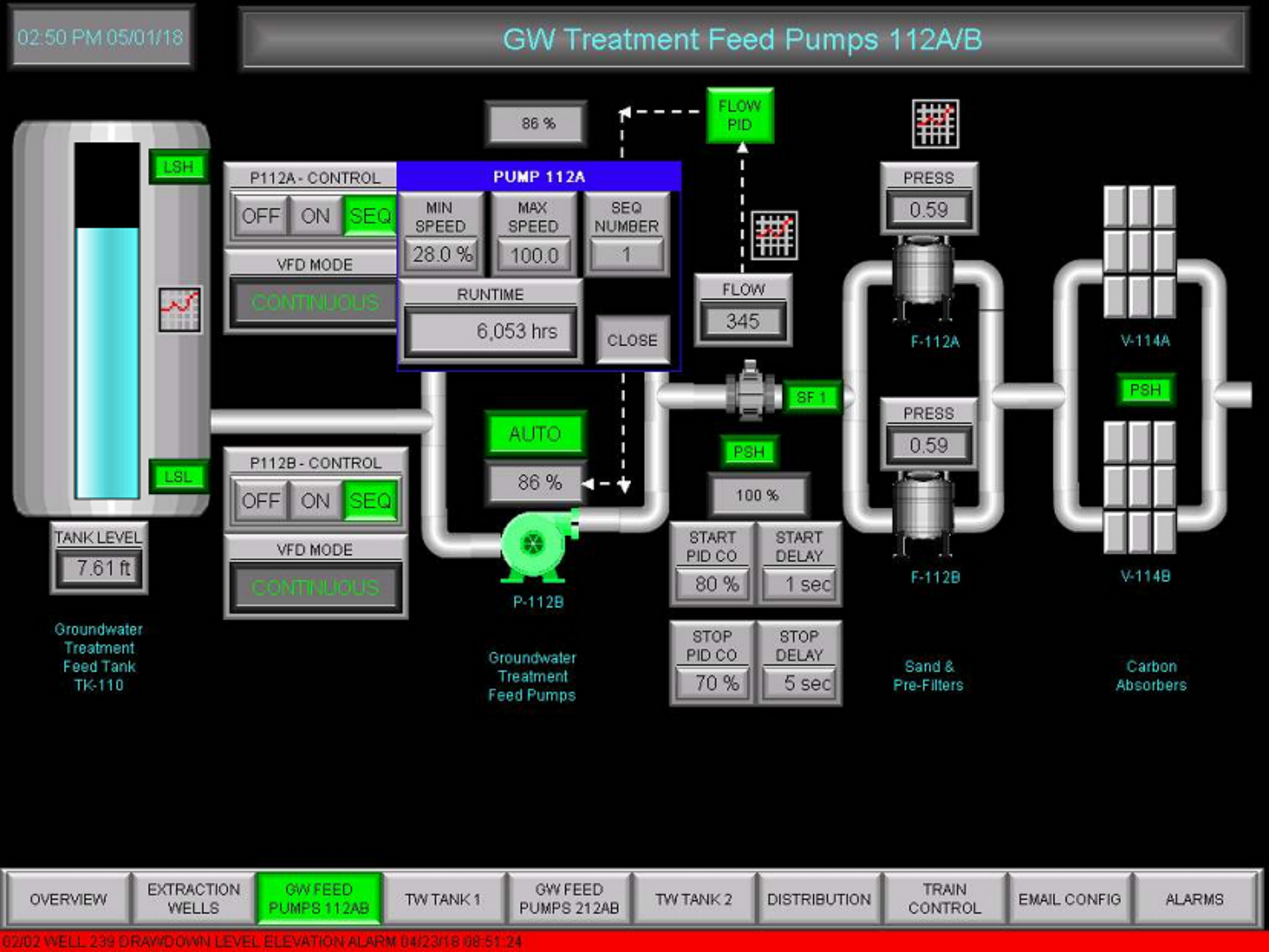
TANK LEVELS

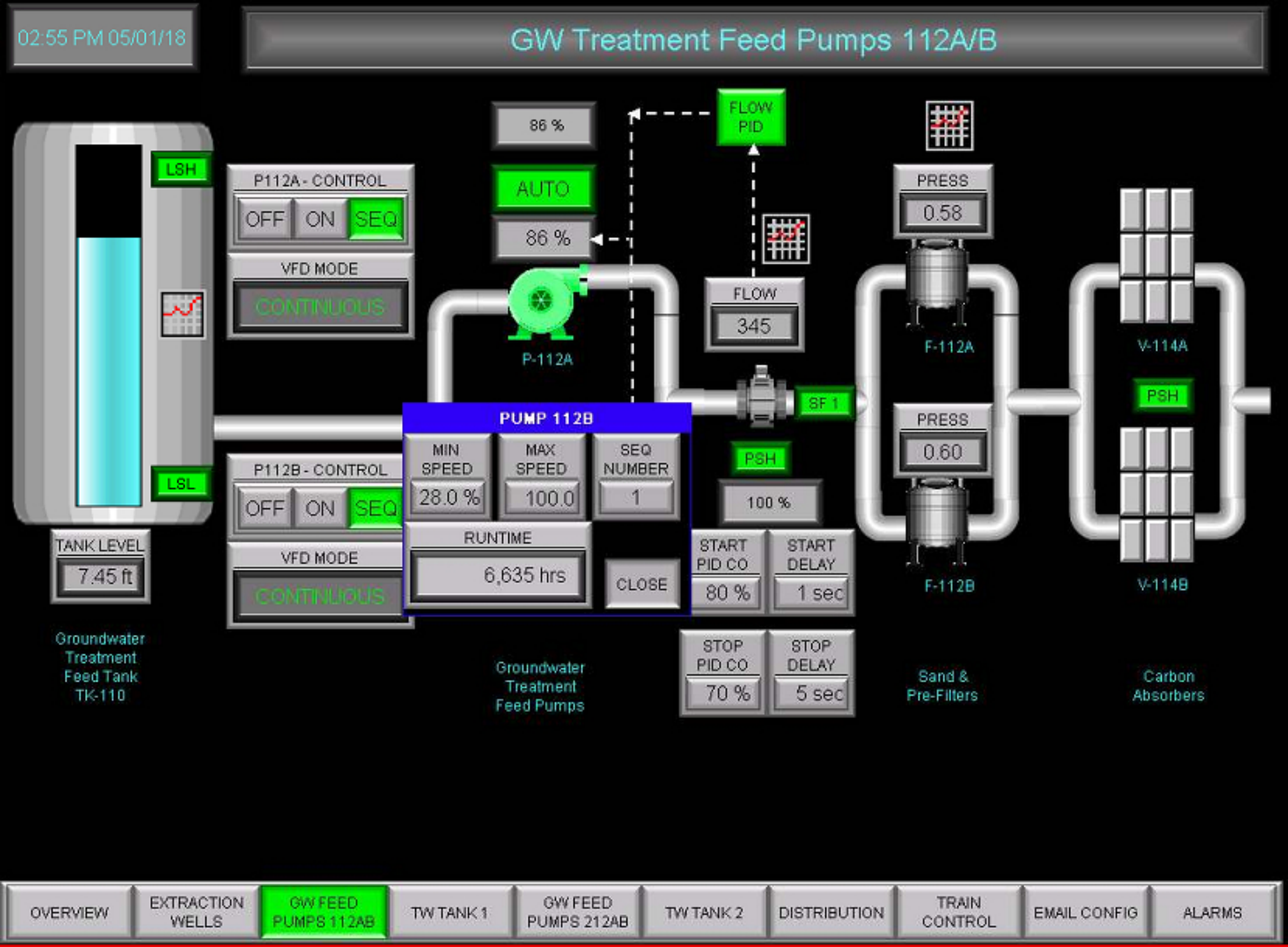
CLOSE

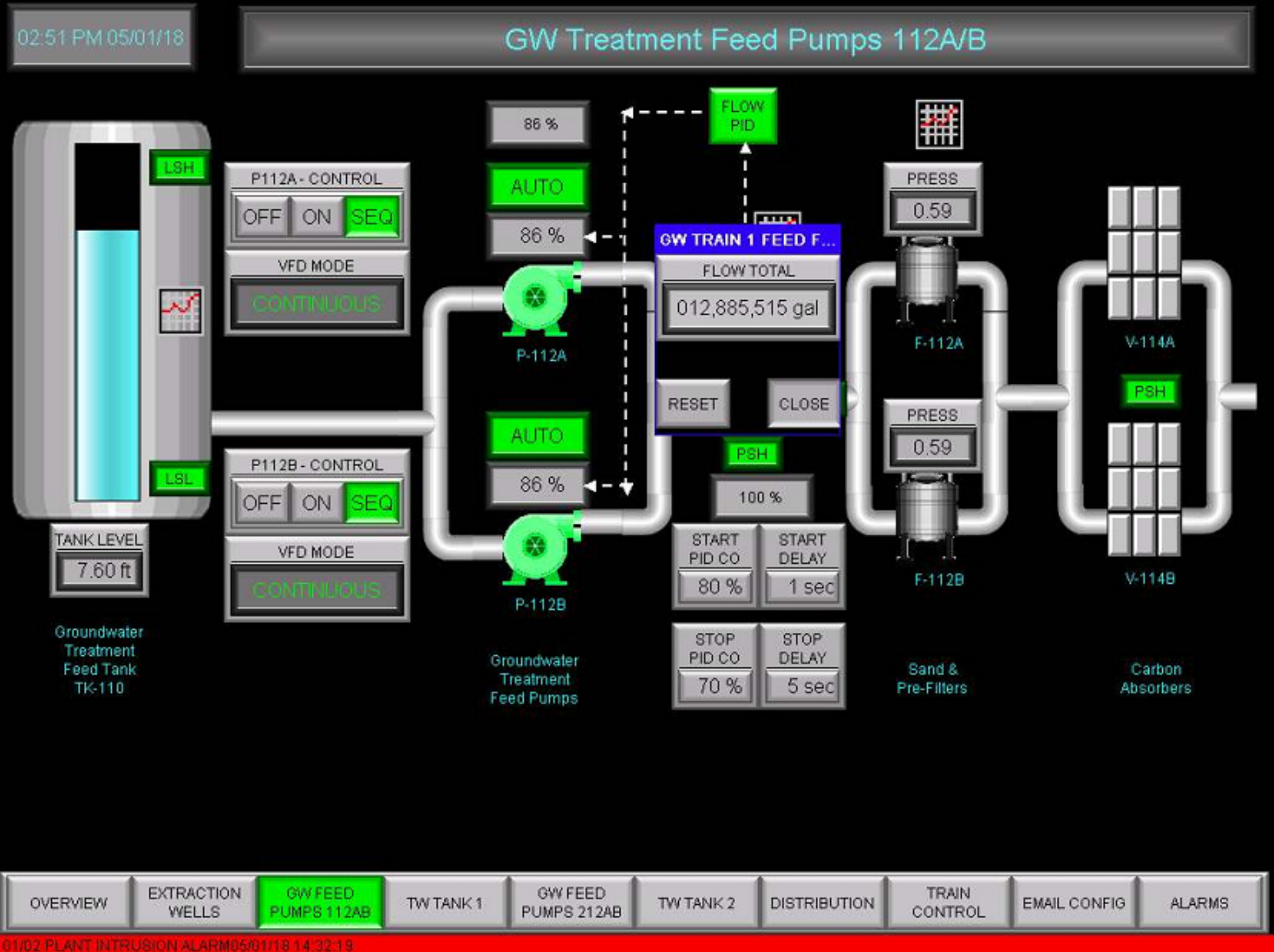


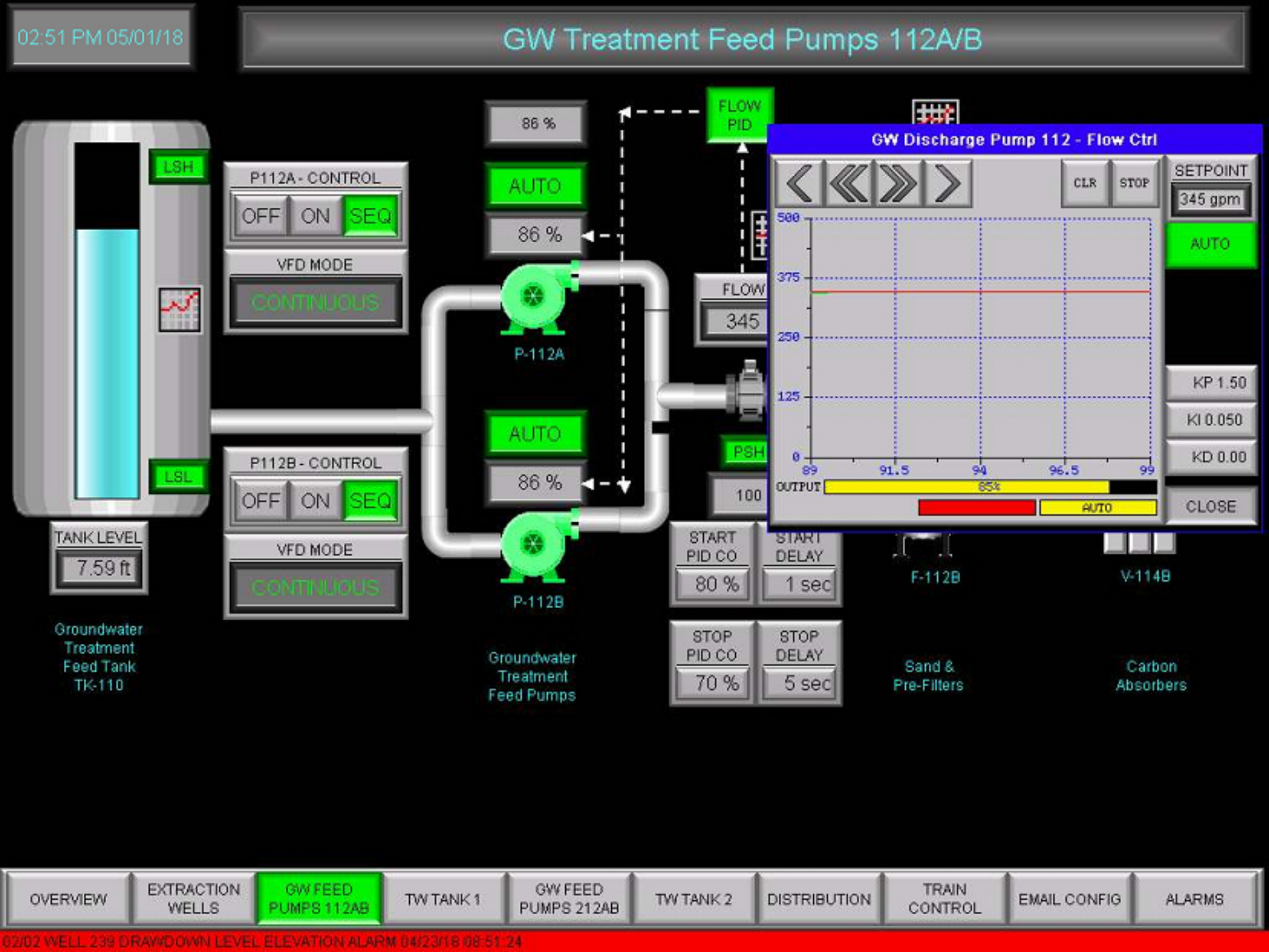
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:50 PM 05/01/18
GW Treatment Feed Pumps 112A/B
86 %
FLOW PID
LSH
LSL
P112A - CONTROL
OFF
ON
SEQ
VFD MODE
CONTINUOUS
PUMP 112A
MIN SPEED
28.0 %
MAX SPEED
100.0
SEQ NUMBER
1
RUNTIME
6,053 hrs
CLOSE
FLOW
345
PRESS
0.59
F-112A
V-114A
PSH
SF 1
PRESS
0.59
F-112B
V-114B
AUTO
86 %
PSH
100 %
P112B - CONTROL
OFF
ON
SEQ
VFD MODE
CONTINUOUS
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
TANK LEVEL
7.61 ft
P-112B
Groundwater Treatment Feed Tank TK-110
Groundwater Treatment Feed Pumps
Sand & Pre-Filters
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:55 PM 05/01/18
GW Treatment Feed Pumps 112A/B
LSH
LSL
TANK LEVEL
7.45 ft
Groundwater Treatment Feed Tank TK-110
P112A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P112B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
86 %
AUTO
86 %
FLOW PID
P-112A
FLOW
345
PUMP 112B
MIN SPEED
28.0 %
MAX SPEED
100.0
SEQ NUMBER
1
RUNTIME
6,635 hrs
CLOSE
Groundwater Treatment Feed Pumps
SF 1
PSH
100 %
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.58
F-112A
PRESS
0.60
F-112B
Sand & Pre-Filters
V-114A
PSH
V-114B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
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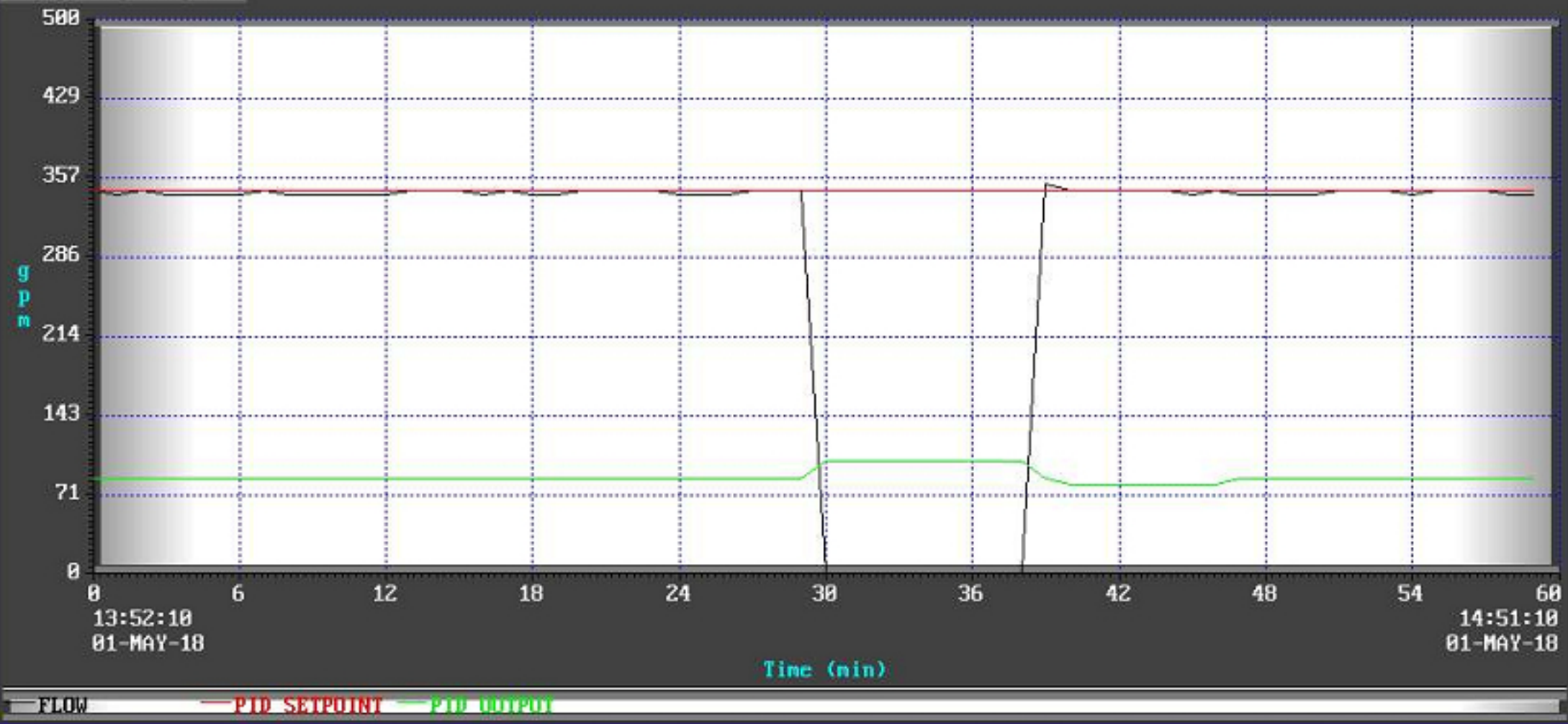

02:51 PM 05/01/18
GW Treatment Feed Pumps 112A/B
LSH
LSL
TANK LEVEL
7.60 ft
Groundwater Treatment Feed Tank TK-110
P112A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P112B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
86 %
AUTO
86 %
P-112A
AUTO
86 %
P-112B
Groundwater Treatment Feed Pumps
FLOW PID
GW TRAIN 1 FEED F...
FLOW TOTAL
012,885,515 gal
RESET
CLOSE
PSH
100 %
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.59
F-112A
PRESS
0.59
F-112B
Sand & Pre-Filters
V-114A
PSH
V-114B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:51 PM 05/01/18
GW Treatment Feed Pumps 112A/B
LSH
LSL
TANK LEVEL
7.59 ft
Groundwater Treatment Feed Tank TK-110
P112A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P112B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
86 %
AUTO
86 %
P-112A
AUTO
86 %
P-112B
Groundwater Treatment Feed Pumps
FLOW PID
FLOW
345
PSH
100
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
F-112B
Sand & Pre-Filters
V-114B
Carbon Absorbers
GW Discharge Pump 112 - Flow Ctrl
CLR
STOP
SETPOINT
345 gpm
AUTO
500
375
250
125
0
89
91.5
94
96.5
99
OUTPUT
65%
AUTO
KP 1.50
KI 0.050
KD 0.00
CLOSE
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
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GROUNDWATER TRAIN 1 FEED FLOW

CLOSE



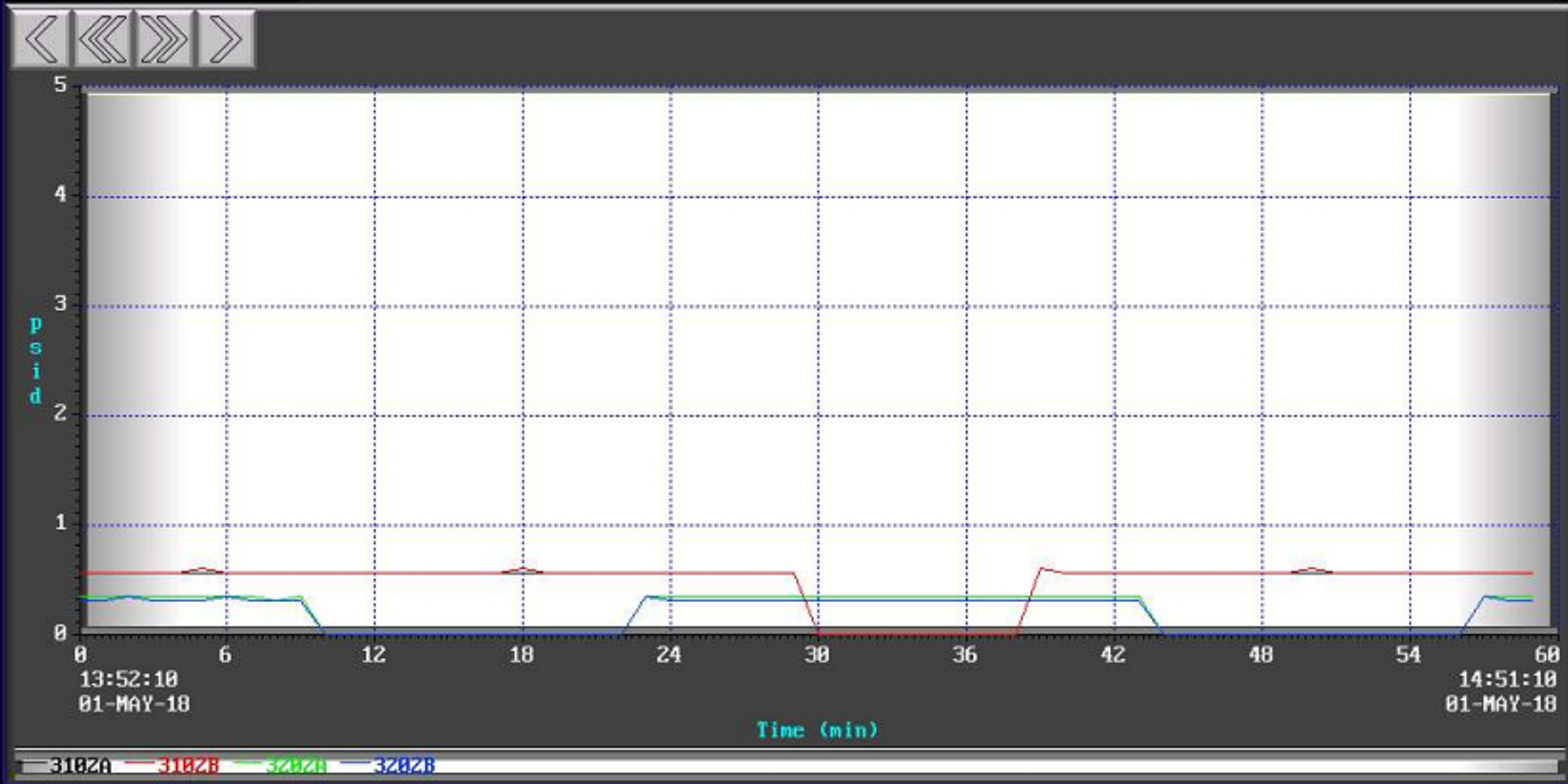
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

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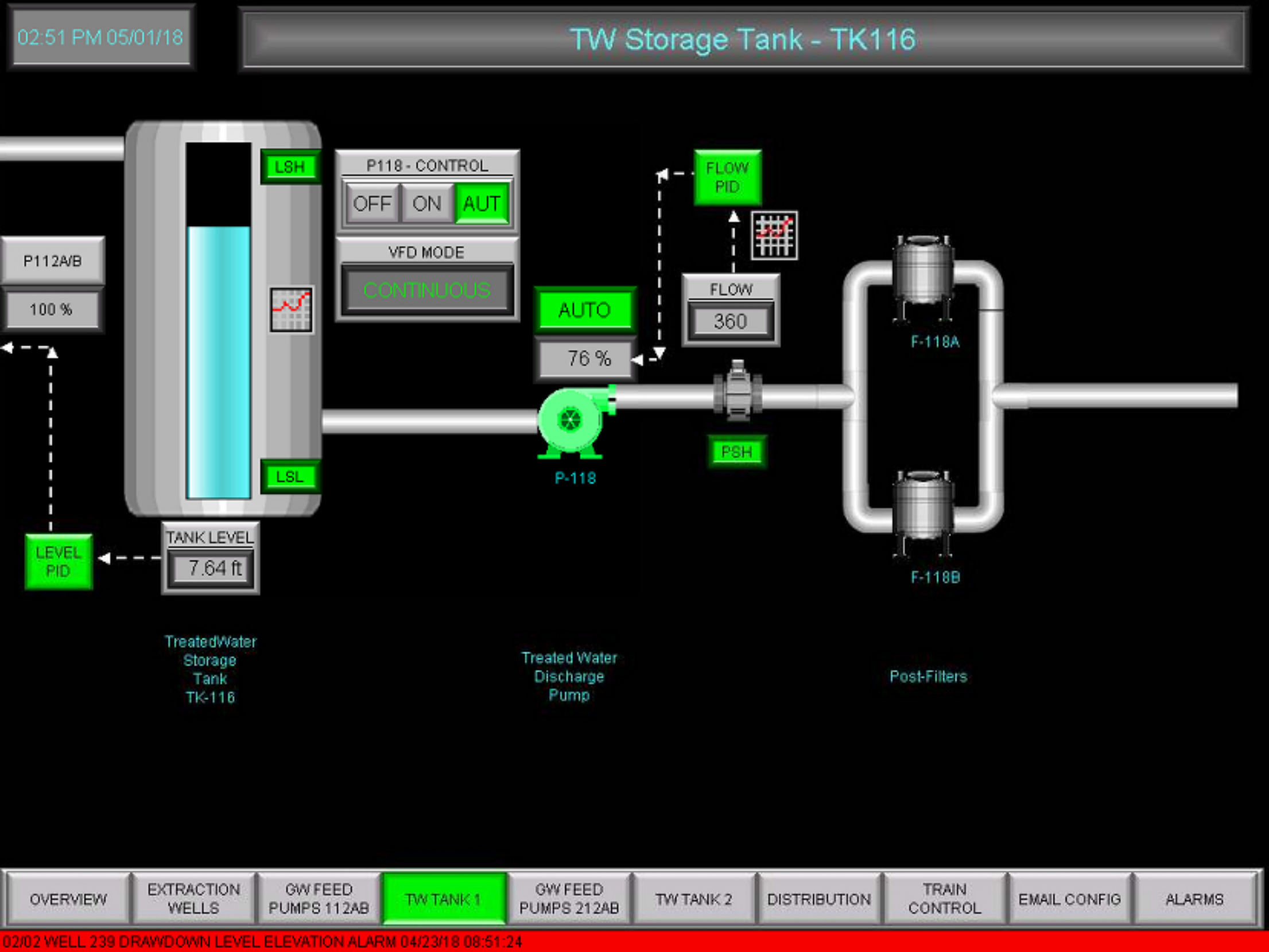
BAG FILTER DIFFERENTIAL PRESSURES

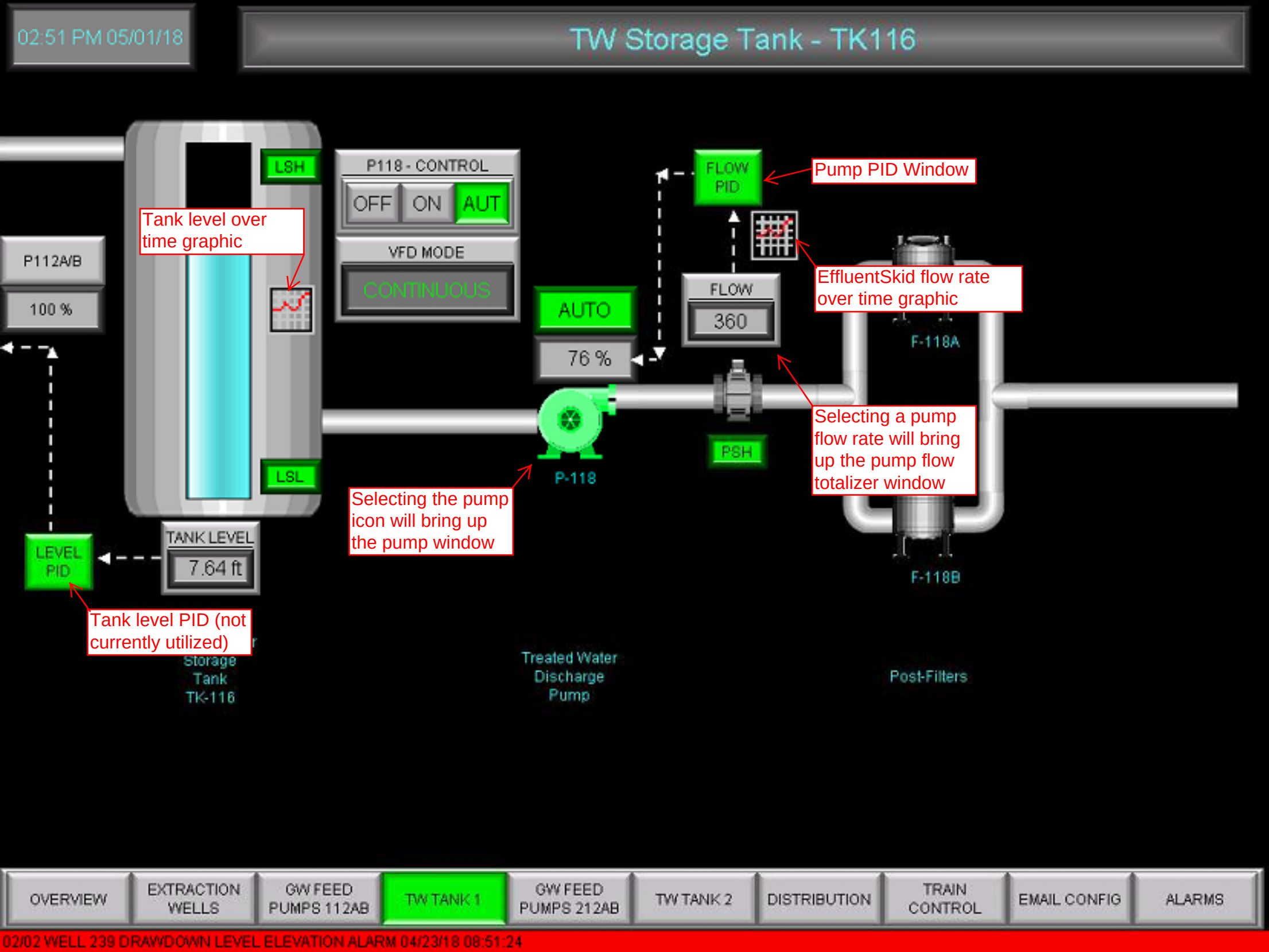
CLOSE

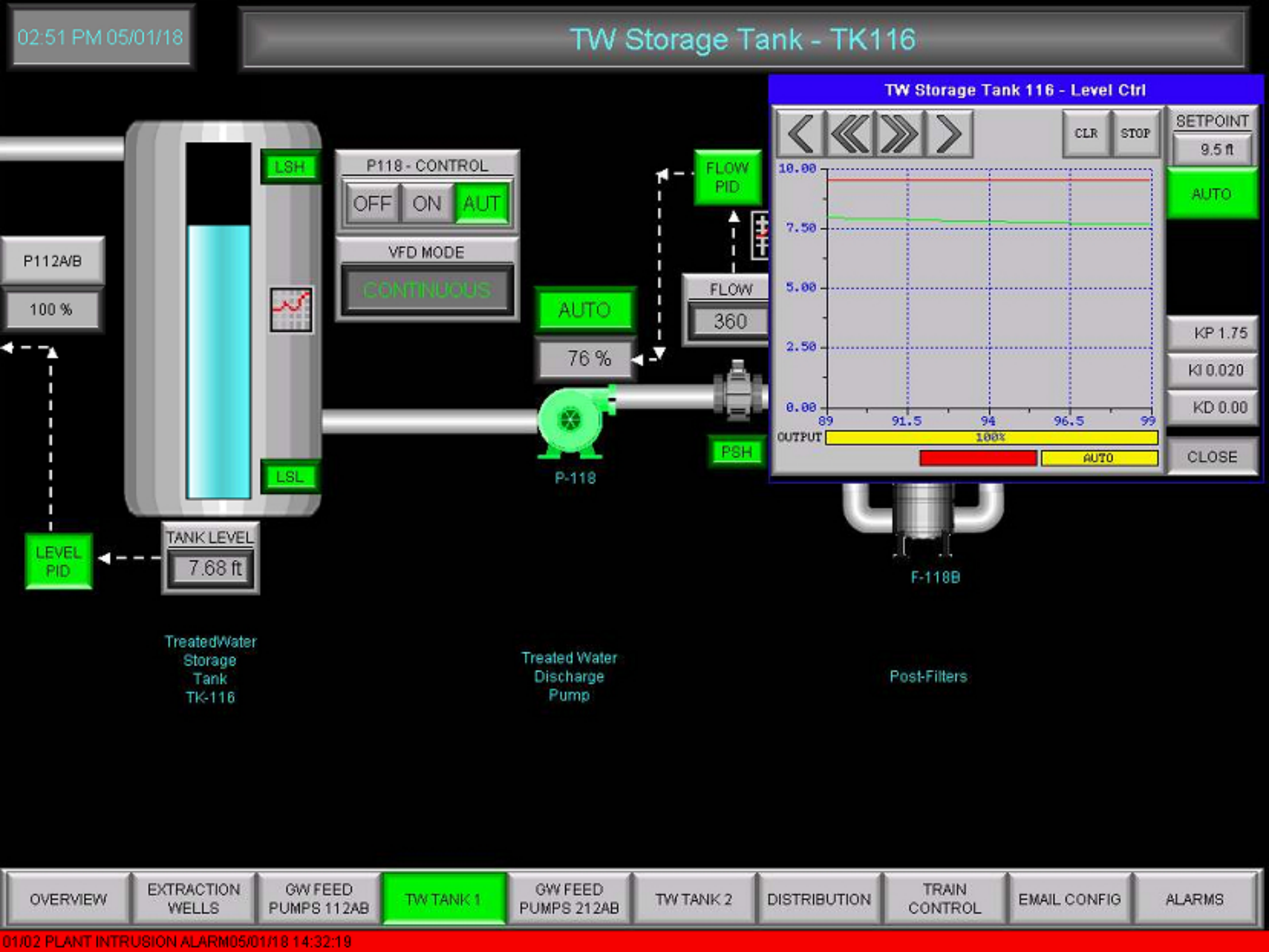


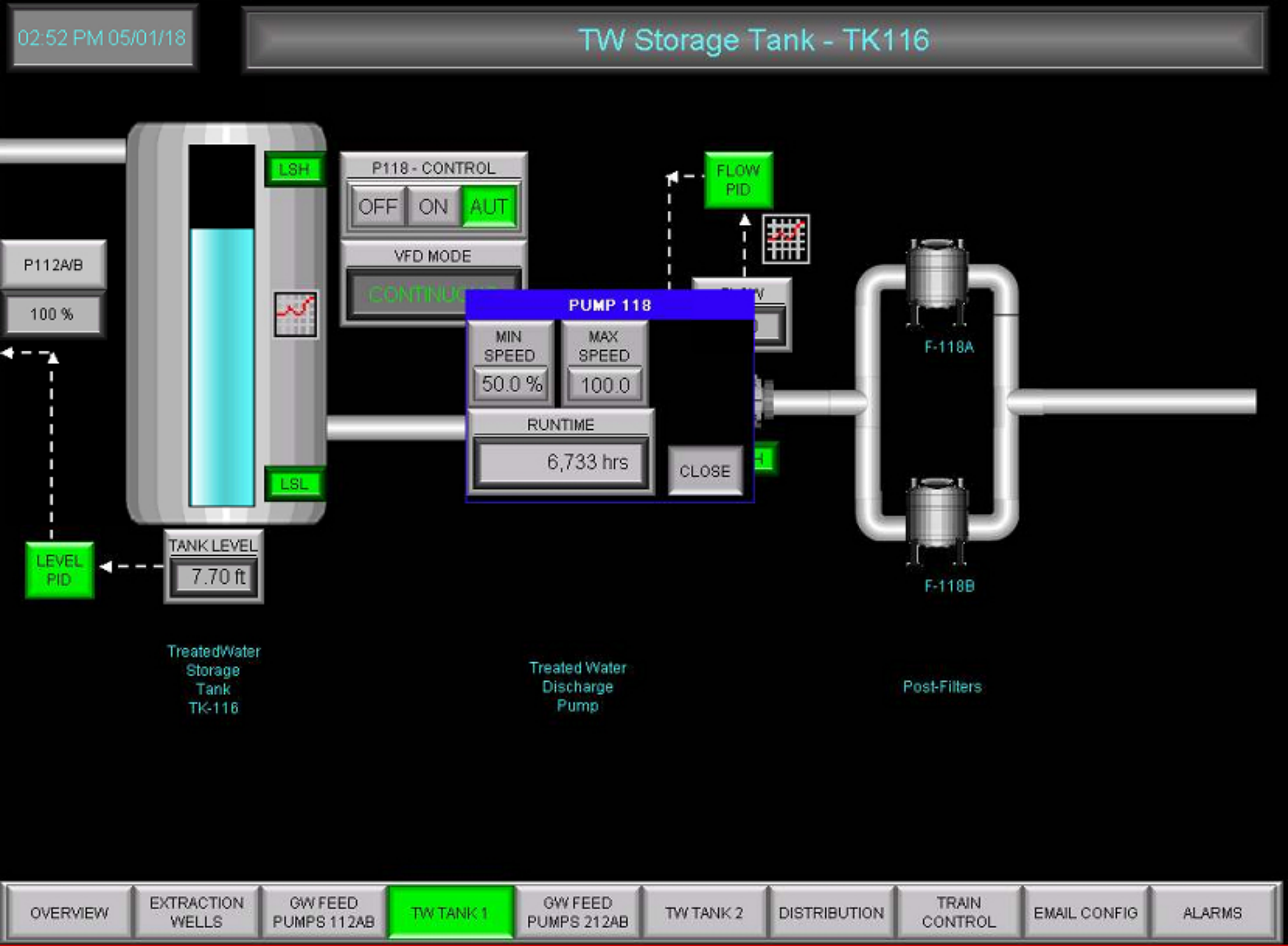
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

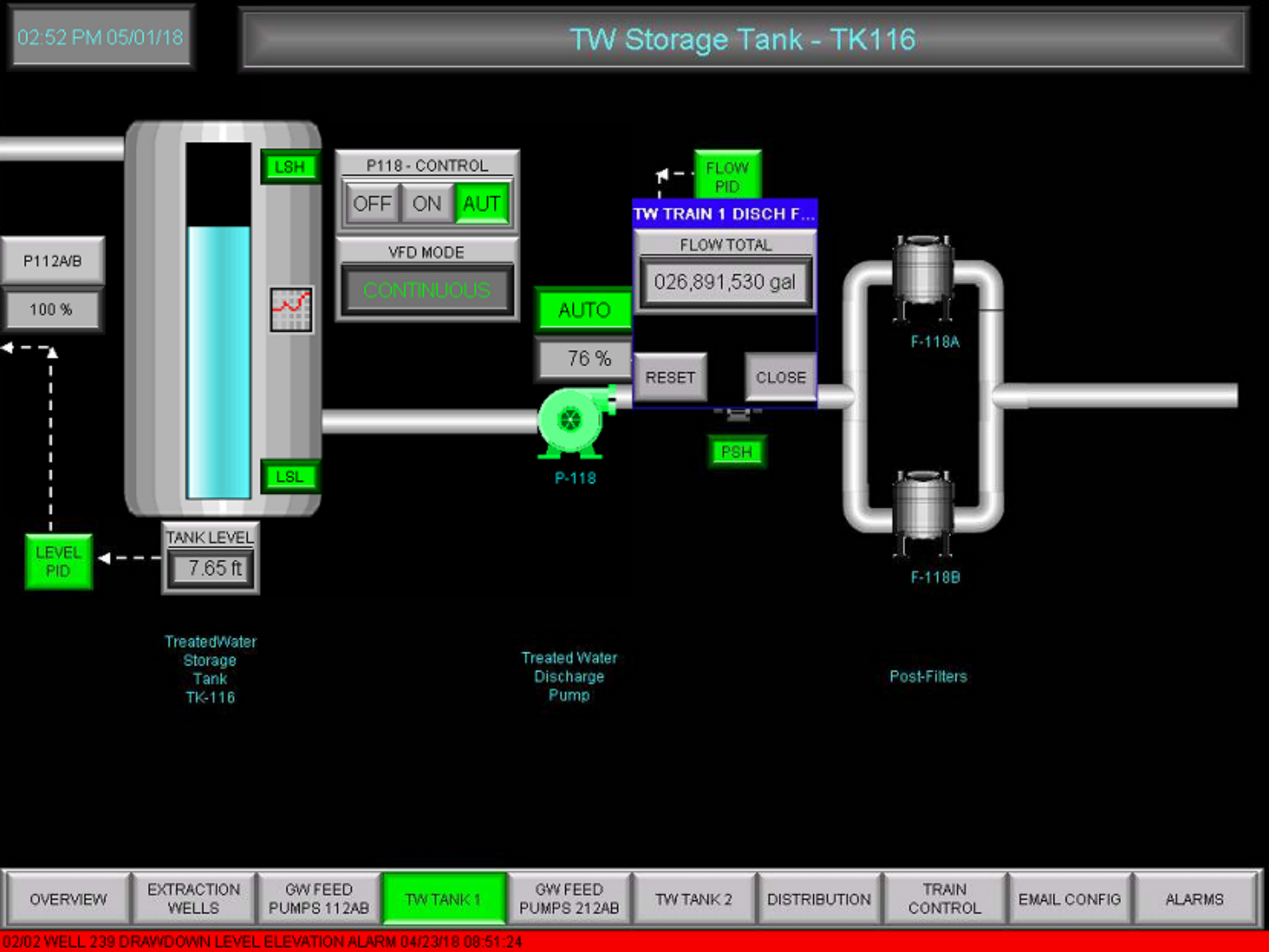
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

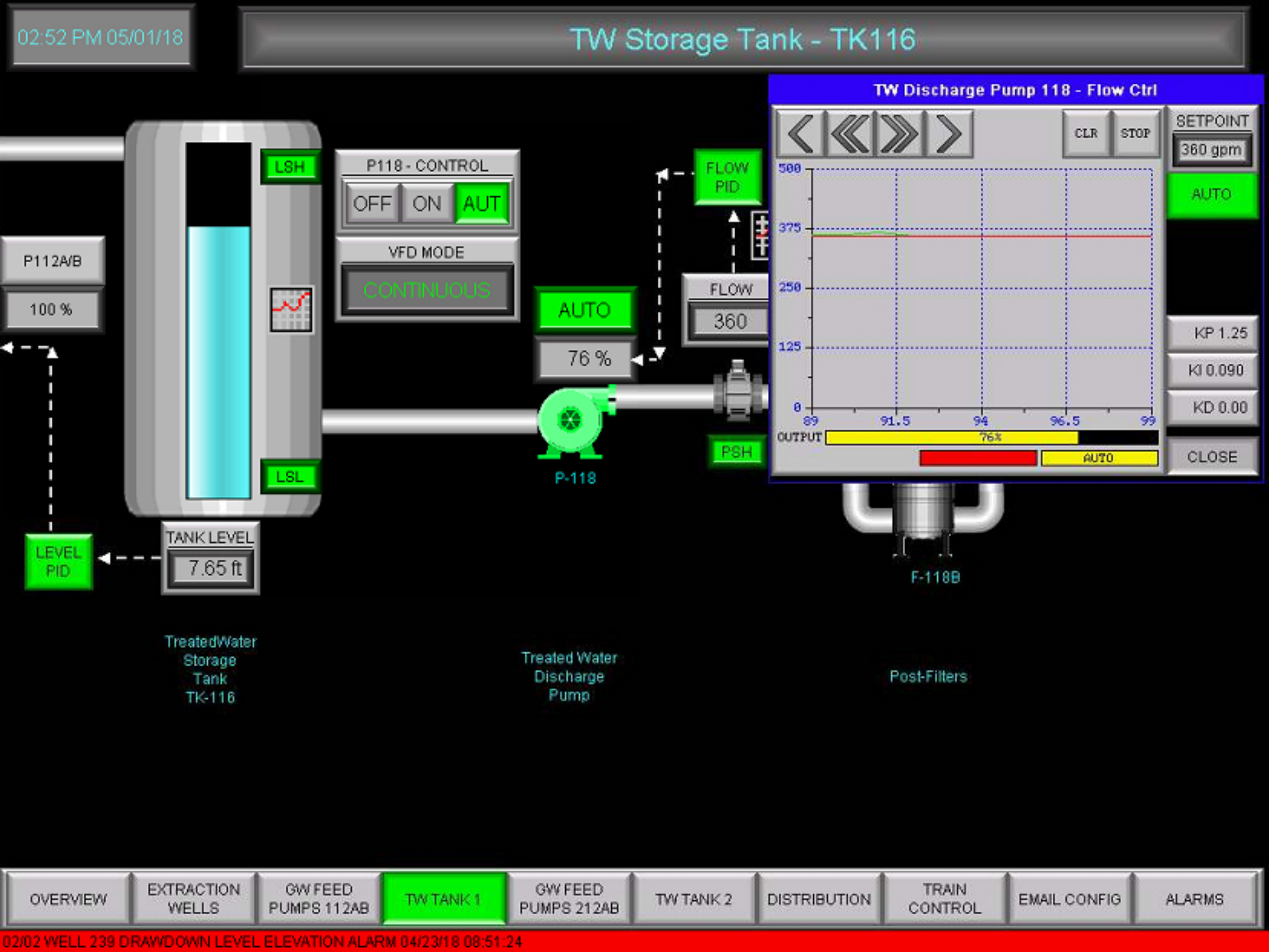

02:51 PM 05/01/18
TW Storage Tank - TK116
LSH
P118 - CONTROL
OFF
ON
AUT
VFD MODE
CONTINUOUS
FLOW PID
FLOW
360
AUTO
76 %
P112A/B
100 %
LSL
P-118
PSH
F-118A
F-118B
LEVEL PID
TANK LEVEL
7.64 ft
TreatedWater Storage Tank TK-116
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:51 PM 05/01/18
TW Storage Tank - TK116
LSH
LSL
P118 - CONTROL
OFF
ON
AUT
VFD MODE
CONTINUOUS
P112A/B
100 %
AUTO
76 %
FLOW PID
FLOW
360
PSH
P-118
F-118A
F-118B
TANK LEVEL
7.64 ft
LEVEL PID
Tank level over time graphic
Pump PID Window
EffluentSkid flow rate over time graphic
Selecting a pump flow rate will bring up the pump flow totalizer window
Selecting the pump icon will bring up the pump window
Tank level PID (not currently utilized)
Storage Tank TK-116
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:51 PM 05/01/18
TW Storage Tank - TK116
TW Storage Tank 116 - Level Ctrl
LSH
LSL
P118 - CONTROL
OFF
ON
AUT
VFD MODE
CONTINUOUS
P112A/B
100 %
FLOW PID
FLOW
360
AUTO
76 %
P-118
PSH
F-118B
CLR
STOP
SETPOINT
9.5 ft
AUTO
KP 1.75
KI 0.020
KD 0.00
CLOSE
10.00
7.50
5.00
2.50
0.00
89
91.5
94
96.5
99
OUTPUT
100%
AUTO
LEVEL PID
TANK LEVEL
7.68 ft
TreatedWater Storage Tank TK-116
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:52 PM 05/01/18
TW Storage Tank - TK116
LSH
LSL
P118 - CONTROL
OFF
ON
AUT
VFD MODE
CONTINUOUS
FLOW PID
PUMP 118
MIN SPEED
50.0 %
MAX SPEED
100.0
RUNTIME
6,733 hrs
CLOSE
P112A/B
100 %
LEVEL PID
TANK LEVEL
7.70 ft
F-118A
F-118B
TreatedWater Storage Tank TK-116
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

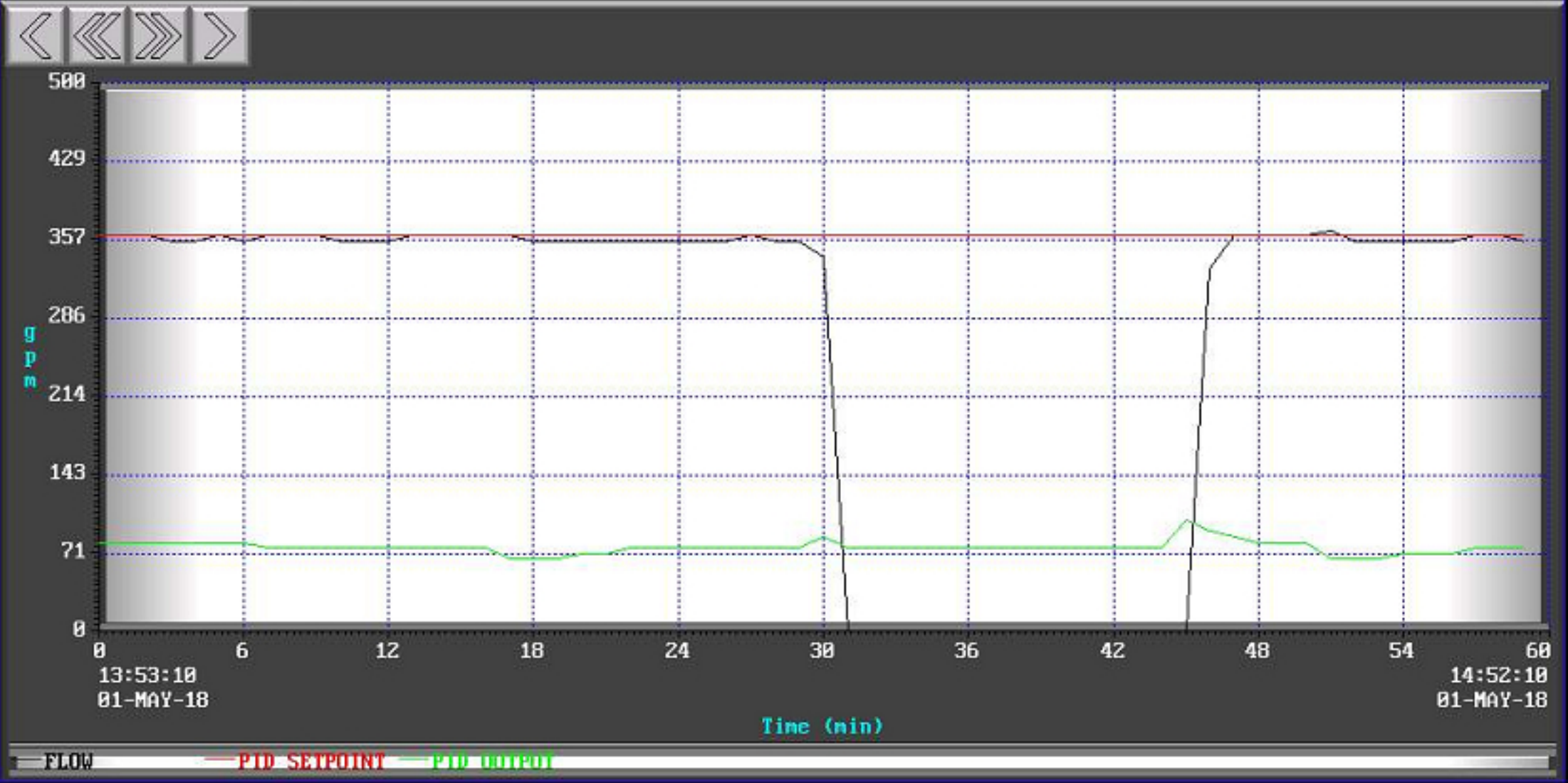

02:52 PM 05/01/18
TW Storage Tank - TK116
LSH
LSL
P118 - CONTROL
OFF
ON
AUT
VFD MODE
CONTINUOUS
FLOW PID
TW TRAIN 1 DISCH F...
FLOW TOTAL
026,891,530 gal
AUTO
76 %
RESET
CLOSE
PSH
P-118
P112A/B
100 %
LEVEL PID
TANK LEVEL
7.65 ft
F-118A
F-118B
TreatedWater Storage Tank TK-116
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:52 PM 05/01/18
TW Storage Tank - TK116
TW Discharge Pump 118 - Flow Ctrl
LSH
LSL
P118 - CONTROL
OFF
ON
AUT
VFD MODE
CONTINUOUS
P112A/B
100 %
LEVEL PID
TANK LEVEL
7.65 ft
AUTO
76 %
P-118
FLOW PID
FLOW
360
PSH
CLR
STOP
SETPOINT
360 gpm
AUTO
KP 1.25
KI 0.090
KD 0.00
CLOSE
500
375
250
125
0
89
91.5
94
96.5
99
OUTPUT
76%
AUTO
F-118B
TreatedWater Storage Tank TK-116
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:52 PM 05/01/18

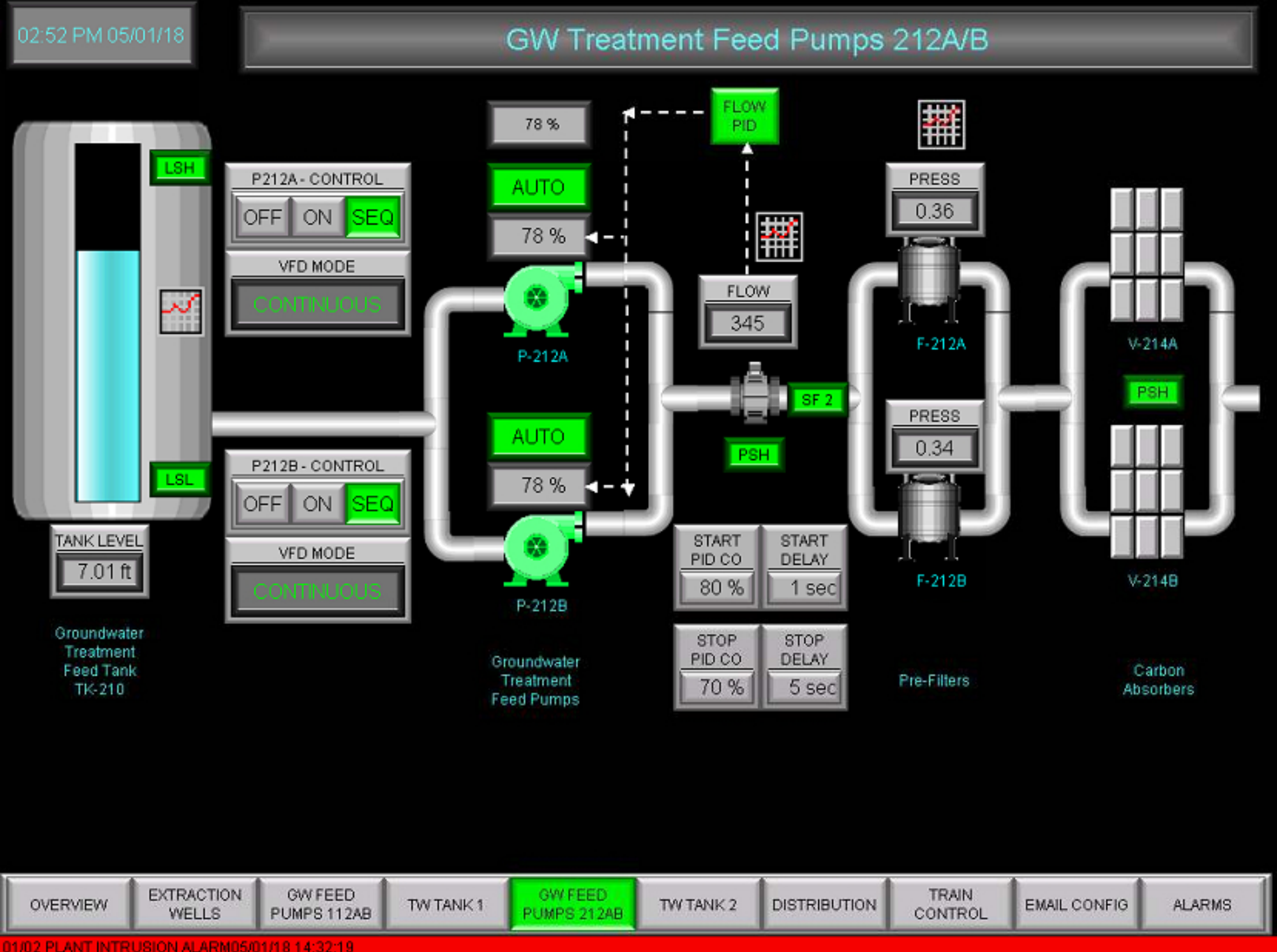
TREATEDWATER TRAIN 1 DISCHARGE FLOW

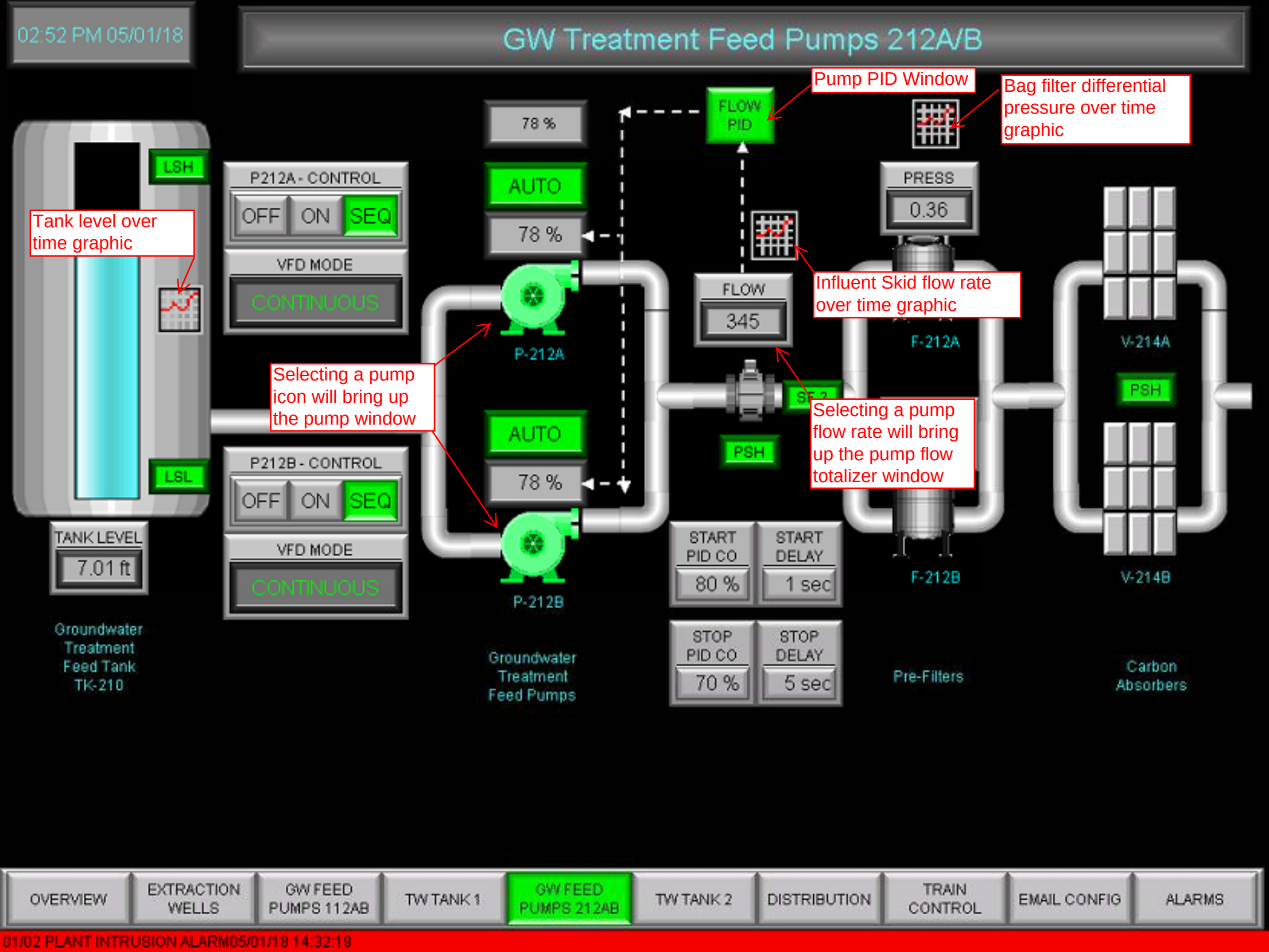
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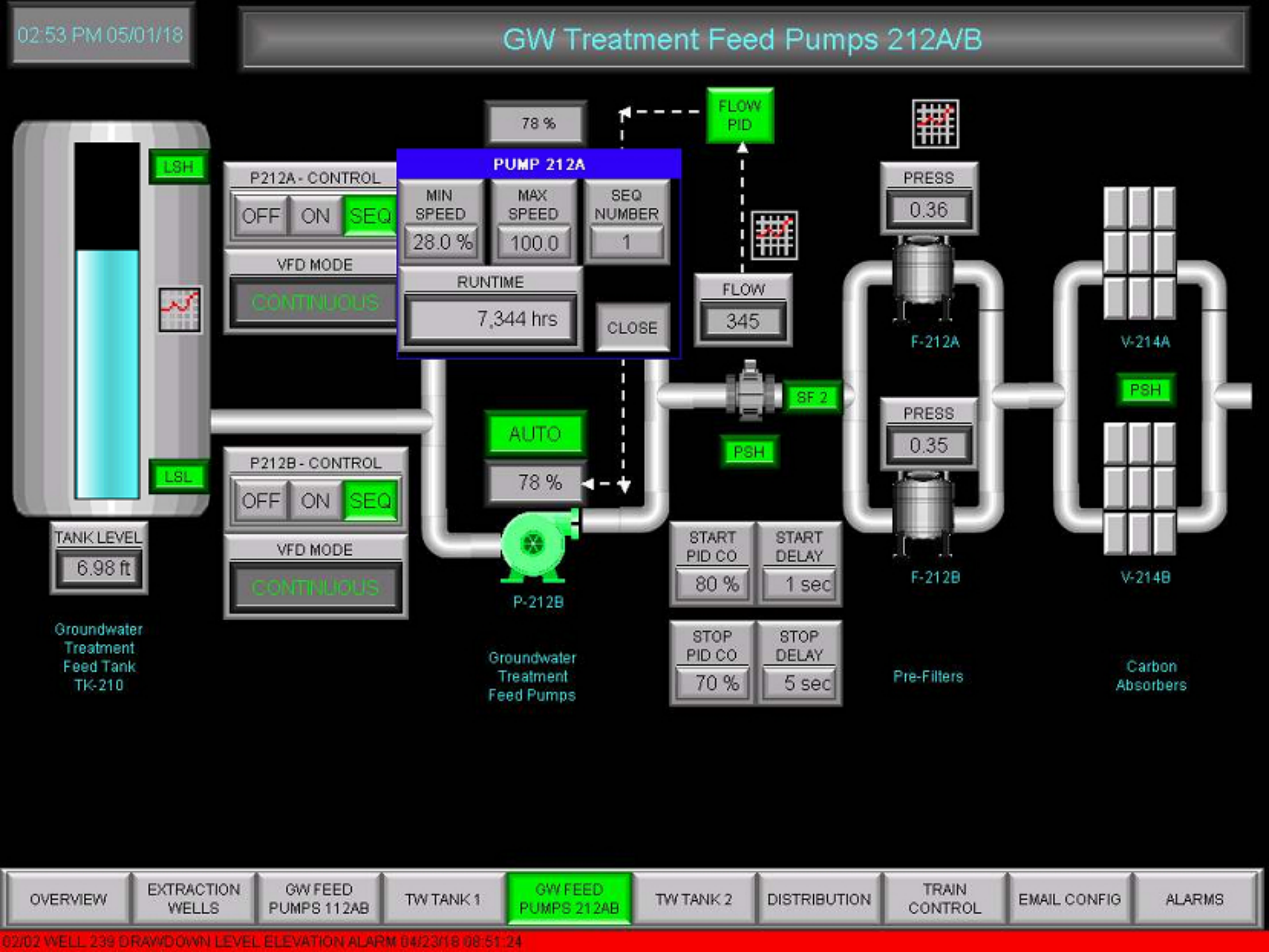


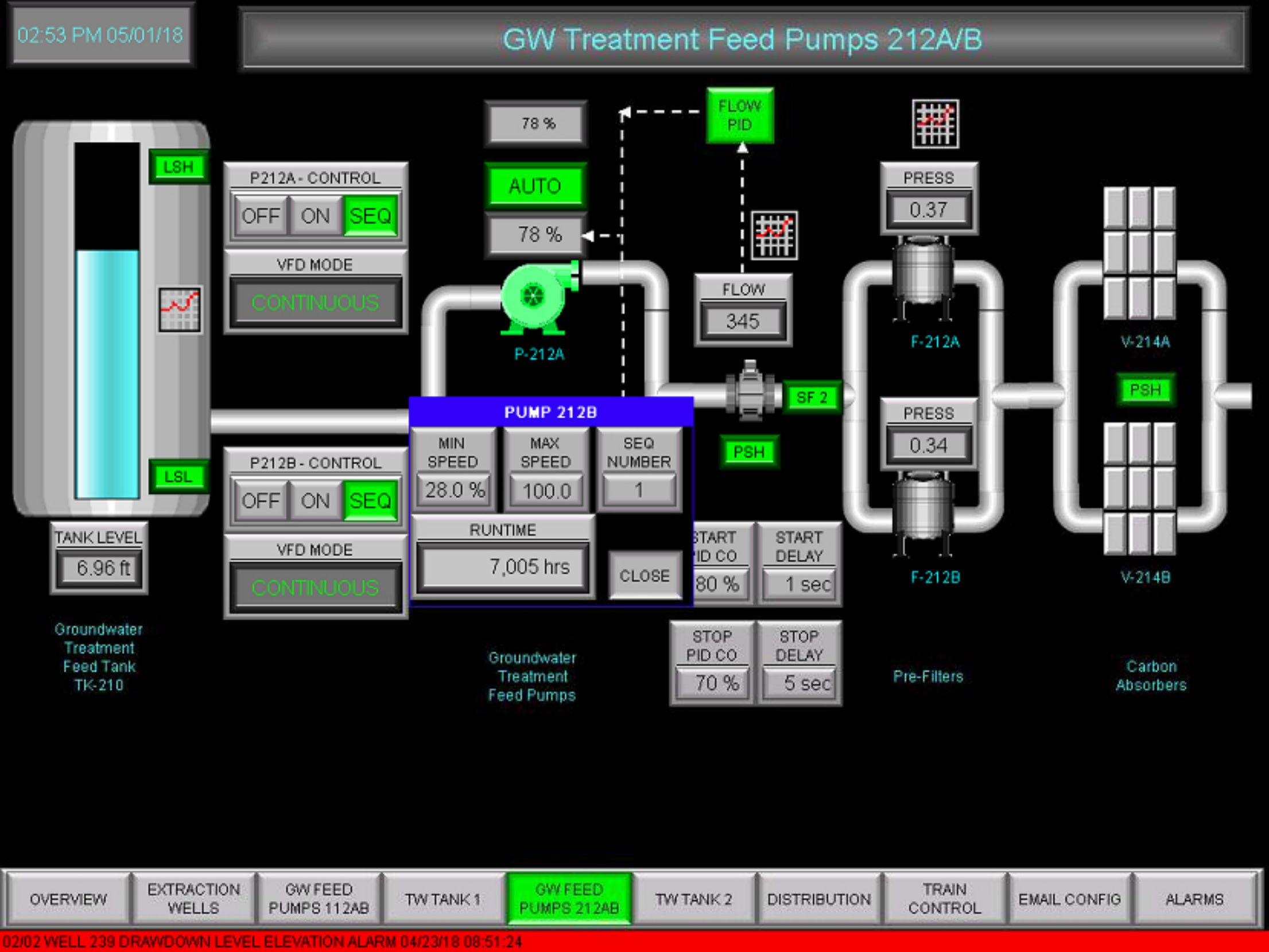
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

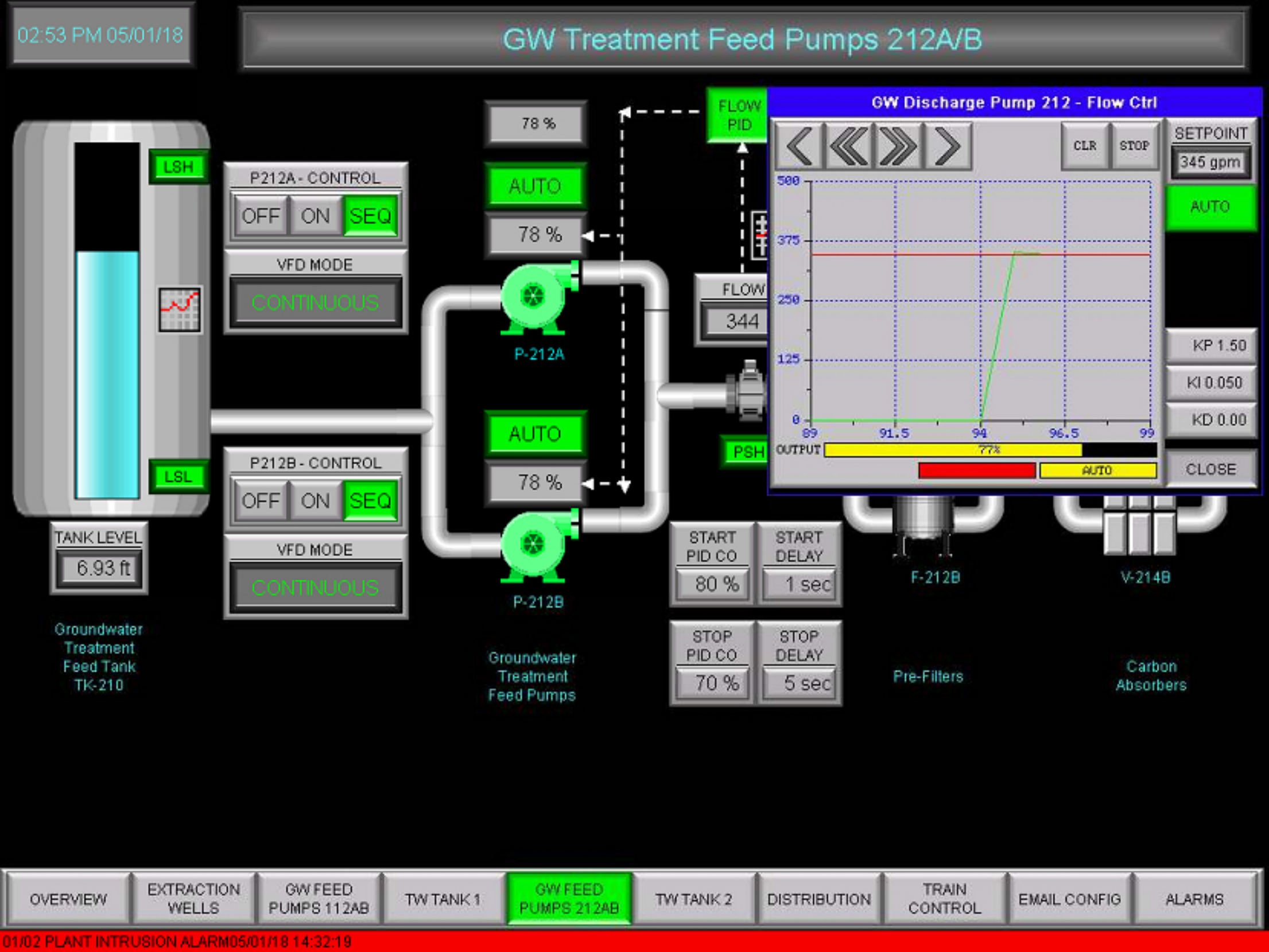
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

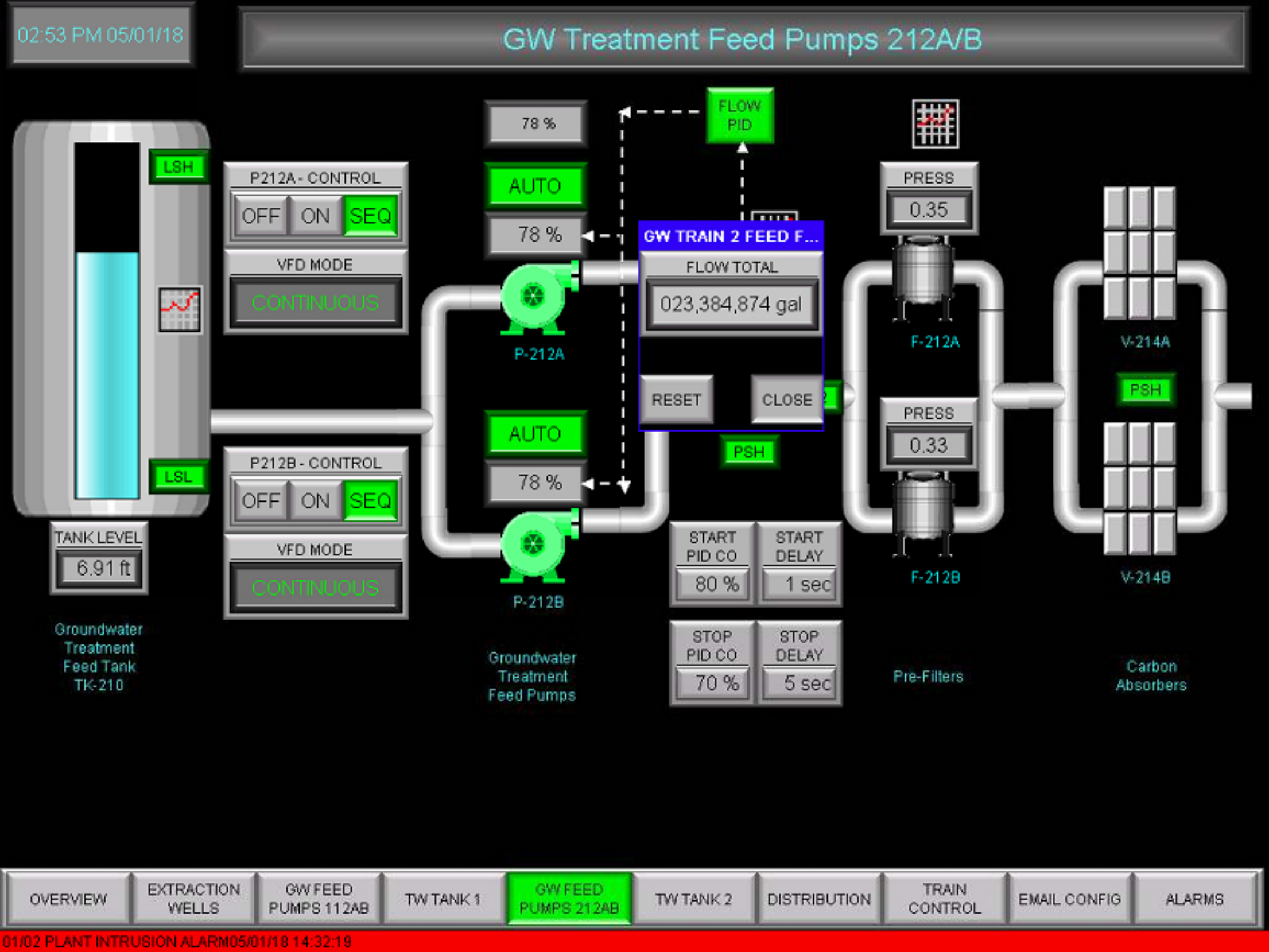

02:52 PM 05/01/18
GW Treatment Feed Pumps 212A/B
LSH
LSL
TANK LEVEL
7.01 ft
Groundwater Treatment Feed Tank TK-210
P212A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P212B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
78 %
AUTO
78 %
P-212A
AUTO
78 %
P-212B
Groundwater Treatment Feed Pumps
FLOW PID
FLOW
345
SF 2
PSH
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.36
F-212A
PRESS
0.34
F-212B
Pre-Filters
V-214A
PSH
V-214B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
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02:52 PM 05/01/18
GW Treatment Feed Pumps 212A/B
Pump PID Window
Bag filter differential pressure over time graphic
Tank level over time graphic
Influent Skid flow rate over time graphic
Selecting a pump icon will bring up the pump window
Selecting a pump flow rate will bring up the pump flow totalizer window
LSH
LSL
TANK LEVEL
7.01 ft
Groundwater Treatment Feed Tank TK-210
P212A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P212B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
78 %
AUTO
78 %
P-212A
AUTO
78 %
P-212B
Groundwater Treatment Feed Pumps
FLOW PID
FLOW
345
PSH
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.36
F-212A
F-212B
Pre-Filters
V-214A
PSH
V-214B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:53 PM 05/01/18
GW Treatment Feed Pumps 212A/B
78 %
FLOW PID
PUMP 212A
MIN SPEED
28.0 %
MAX SPEED
100.0
SEQ NUMBER
1
RUNTIME
7,344 hrs
CLOSE
P212A - CONTROL
OFF
ON
SEQ
VFD MODE
CONTINUOUS
LSH
LSL
TANK LEVEL
6.98 ft
Groundwater Treatment Feed Tank TK-210
P212B - CONTROL
OFF
ON
SEQ
VFD MODE
CONTINUOUS
AUTO
78 %
P-212B
Groundwater Treatment Feed Pumps
FLOW
345
SF 2
PSH
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.36
F-212A
PRESS
0.35
F-212B
Pre-Filters
V-214A
PSH
V-214B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:53 PM 05/01/18
GW Treatment Feed Pumps 212A/B
78 %
FLOW PID
AUTO
78 %
LSH
LSL
P212A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P-212A
FLOW
345
PRESS
0.37
F-212A
V-214A
PSH
SF 2
PSH
PRESS
0.34
F-212B
V-214B
PUMP 212B
MIN SPEED
28.0 %
MAX SPEED
100.0
SEQ NUMBER
1
RUNTIME
7,005 hrs
CLOSE
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
P212B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
TANK LEVEL
6.96 ft
Groundwater Treatment Feed Tank TK-210
Groundwater Treatment Feed Pumps
Pre-Filters
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

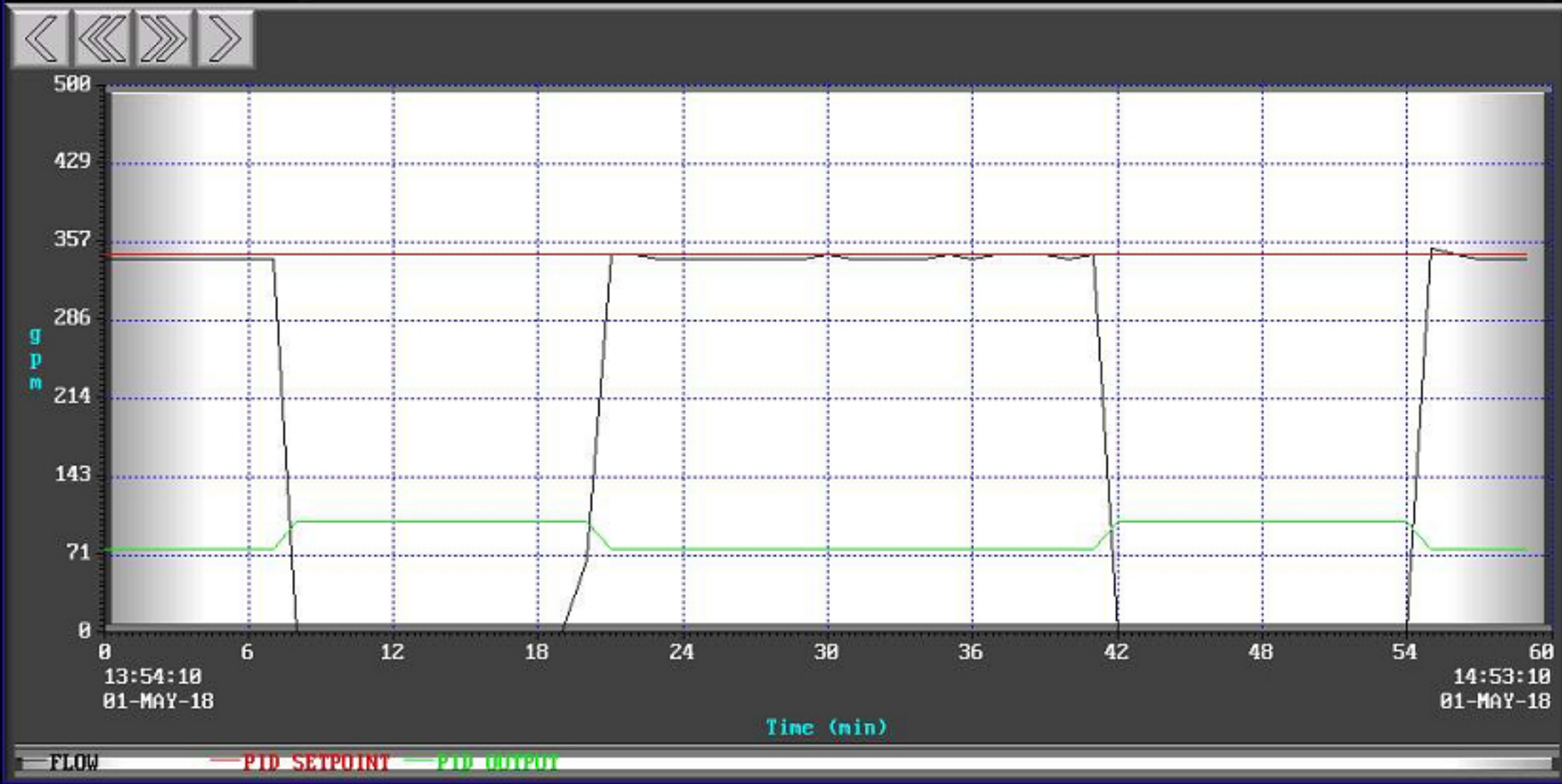

02:53 PM 05/01/18
GW Treatment Feed Pumps 212A/B
LSH
LSL
TANK LEVEL
6.93 ft
Groundwater Treatment Feed Tank TK-210
P212A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P212B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
78 %
AUTO
78 %
P-212A
AUTO
78 %
P-212B
Groundwater Treatment Feed Pumps
FLOW PID
FLOW
344
PSH
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
Pre-Filters
F-212B
V-214B
Carbon Absorbers
GW Discharge Pump 212 - Flow Ctrl
CLR
STOP
SETPOINT
345 gpm
AUTO
500
375
250
125
0
89
91.5
94
96.5
99
OUTPUT
77%
AUTO
KP 1.50
KI 0.050
KD 0.00
CLOSE
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
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02:53 PM 05/01/18
GW Treatment Feed Pumps 212A/B
LSH
LSL
TANK LEVEL
6.91 ft
Groundwater Treatment Feed Tank TK-210
P212A - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
P212B - CONTROL
OFF ON SEQ
VFD MODE
CONTINUOUS
78 %
AUTO
78 %
P-212A
AUTO
78 %
P-212B
Groundwater Treatment Feed Pumps
FLOW PID
GW TRAIN 2 FEED F...
FLOW TOTAL
023,384,874 gal
RESET
CLOSE
PSH
START PID CO
80 %
START DELAY
1 sec
STOP PID CO
70 %
STOP DELAY
5 sec
PRESS
0.35
F-212A
PRESS
0.33
F-212B
Pre-Filters
V-214A
PSH
V-214B
Carbon Absorbers
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
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02:53 PM 05/01/18

GROUNDWATER TRAIN 2 FEED FLOW

CLOSE



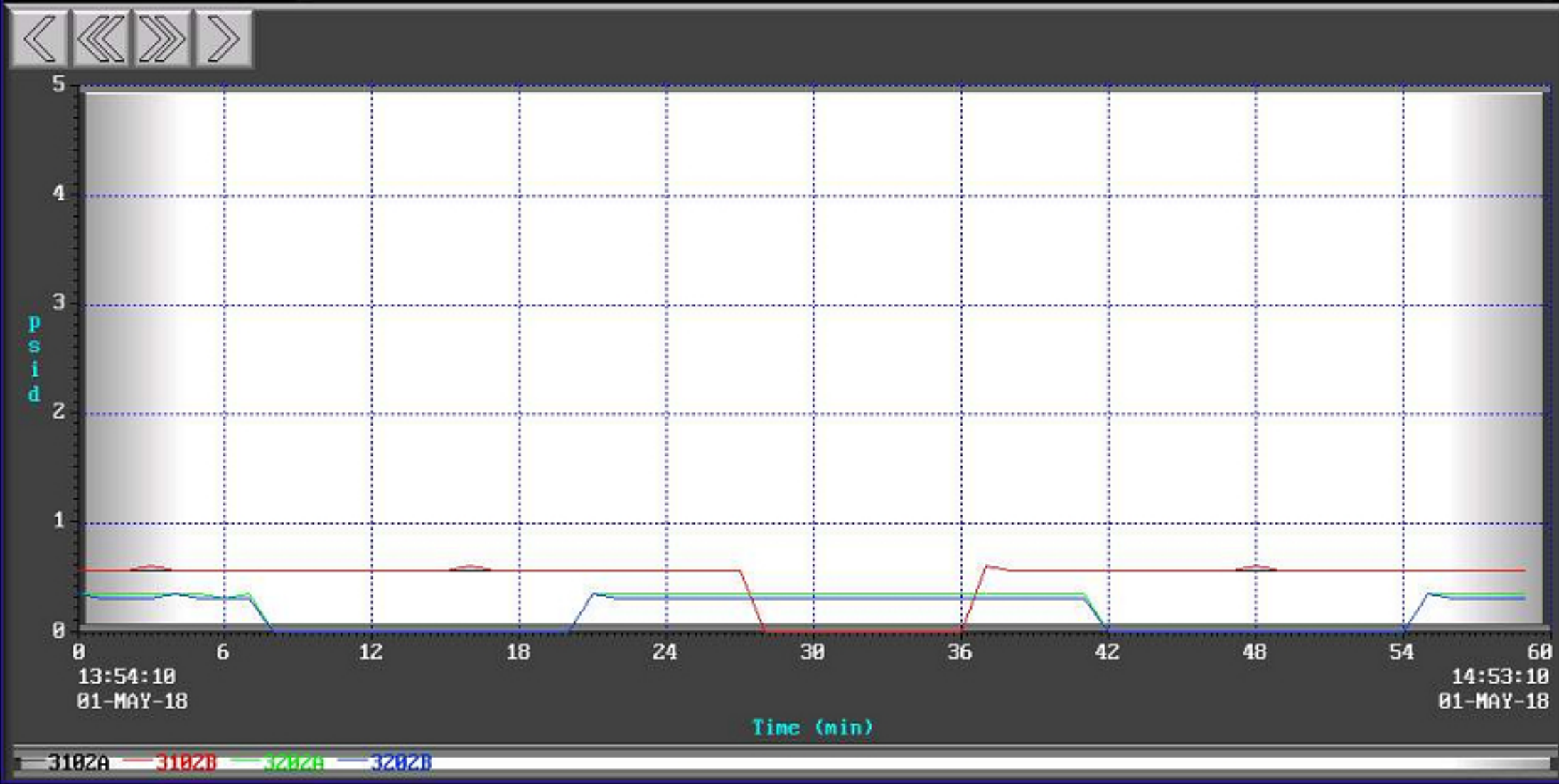
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:53 PM 05/01/18

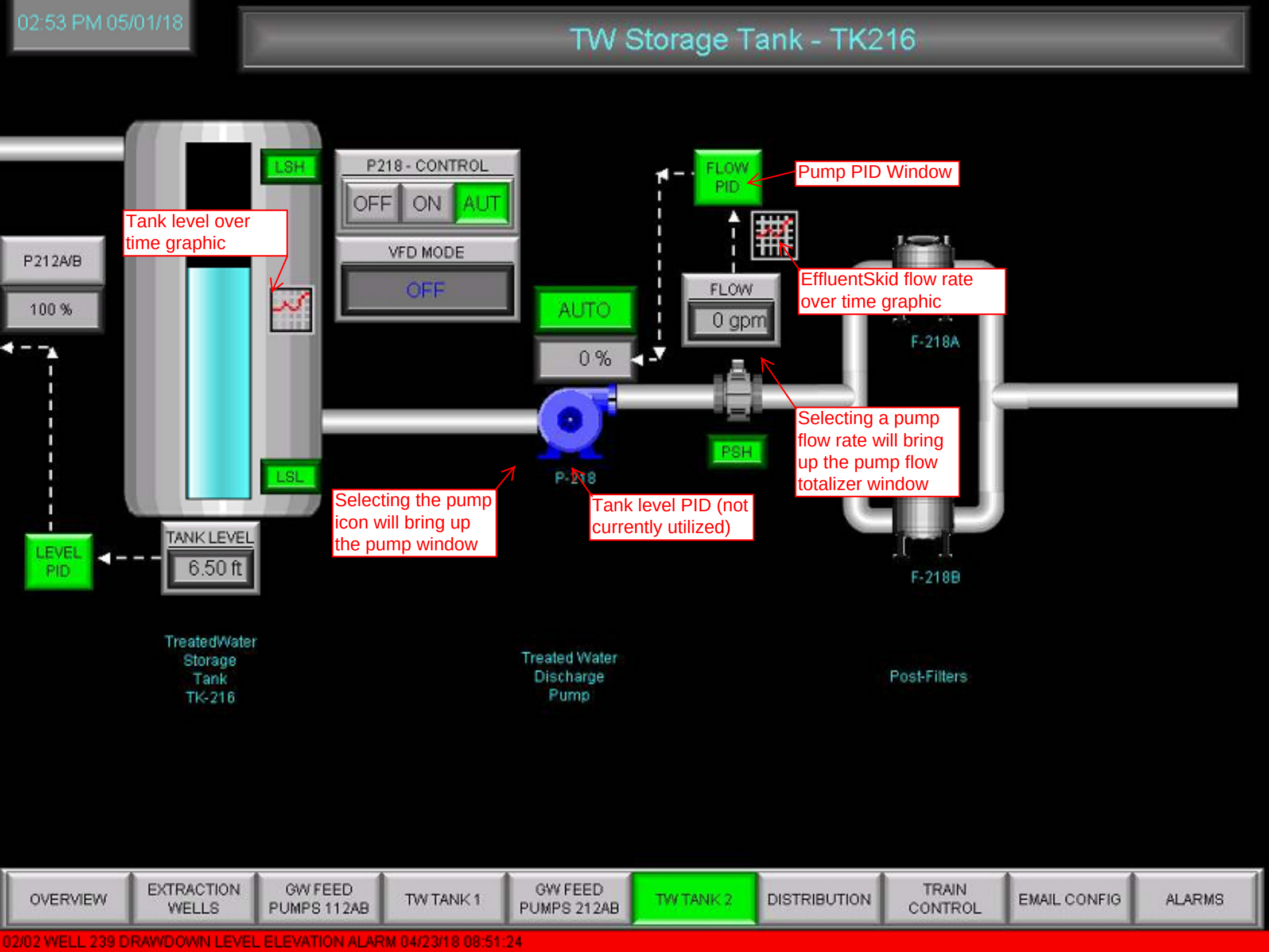
BAG FILTER DIFFERENTIAL PRESSURES

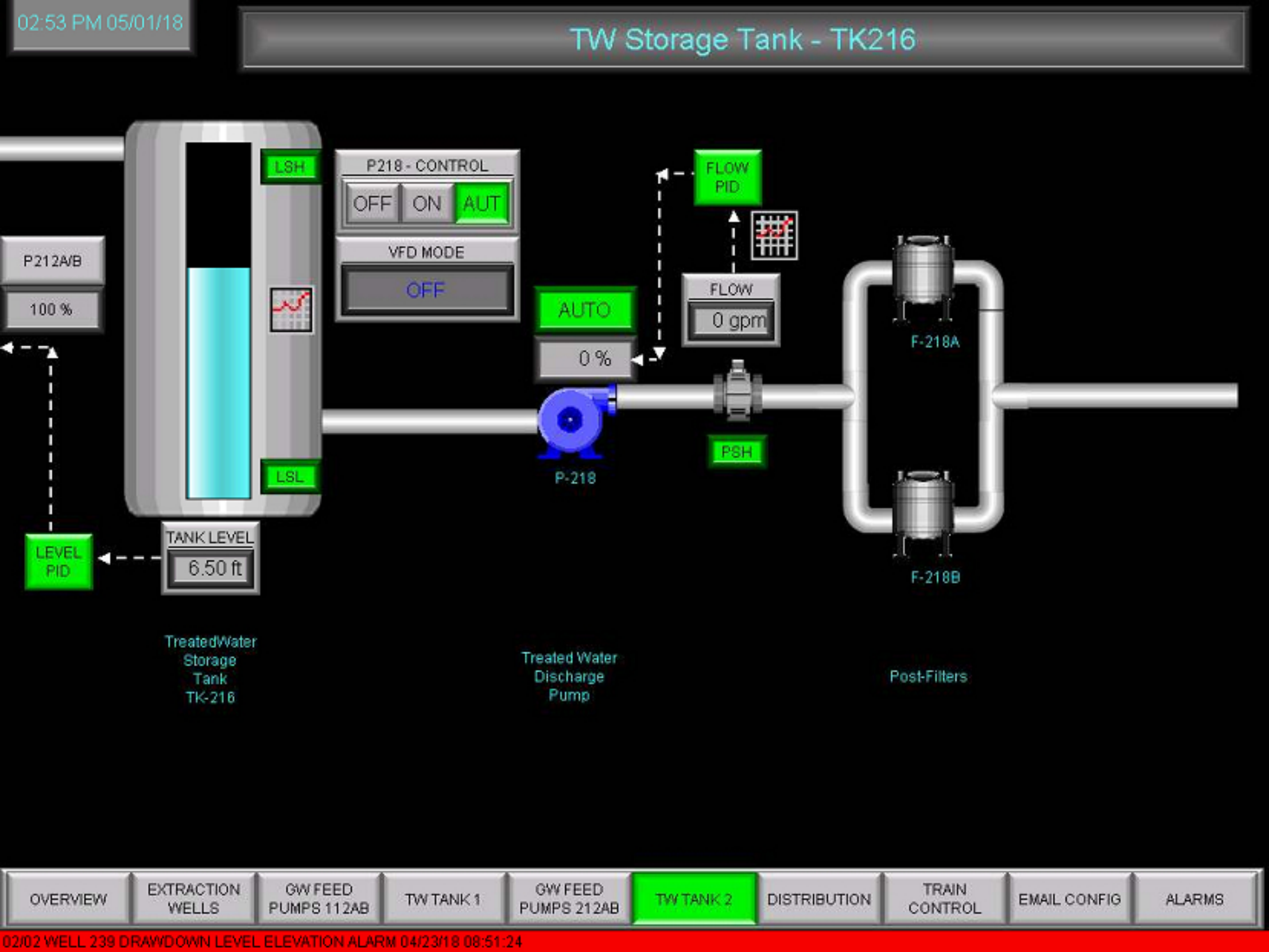
CLOSE

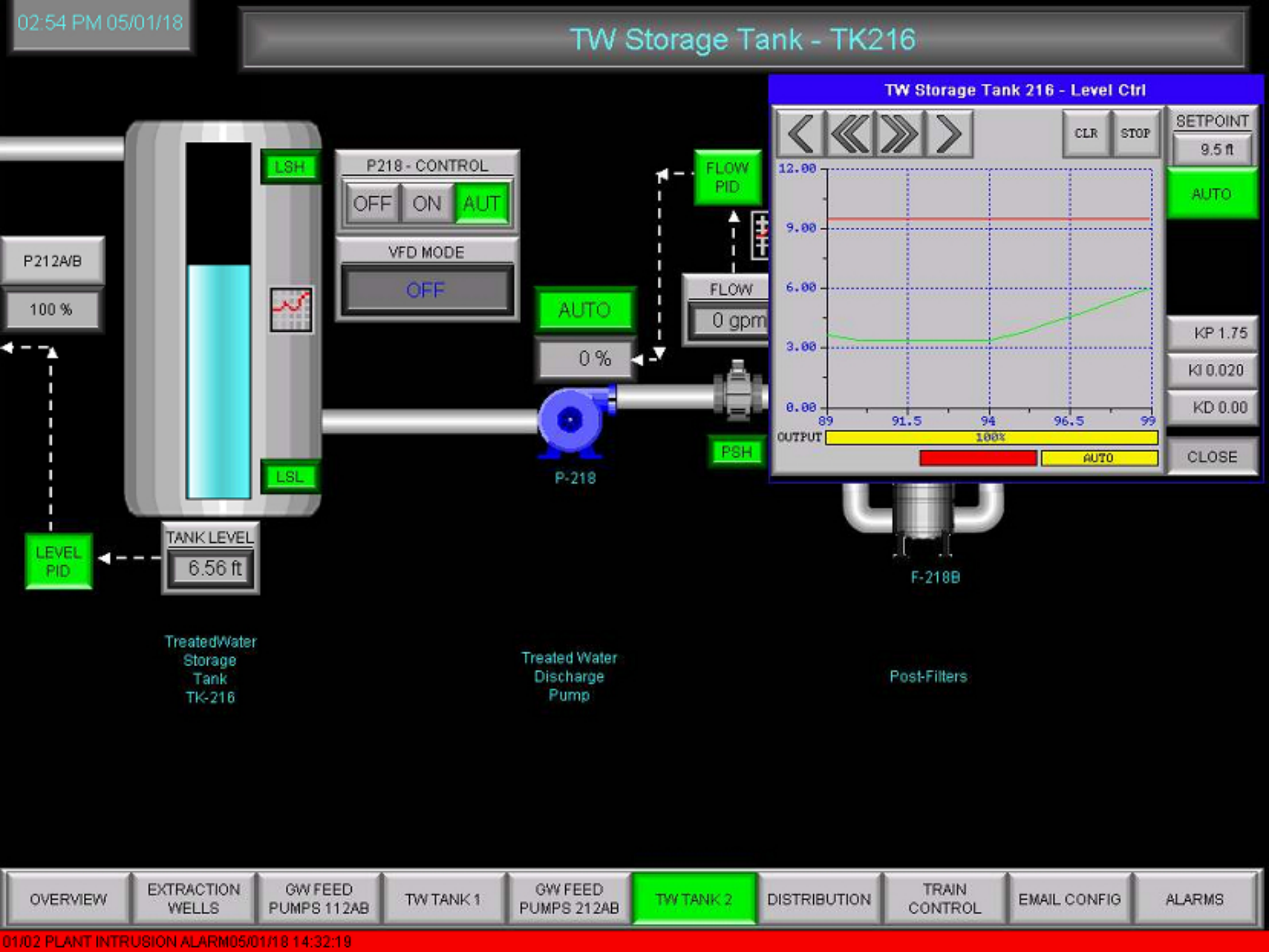


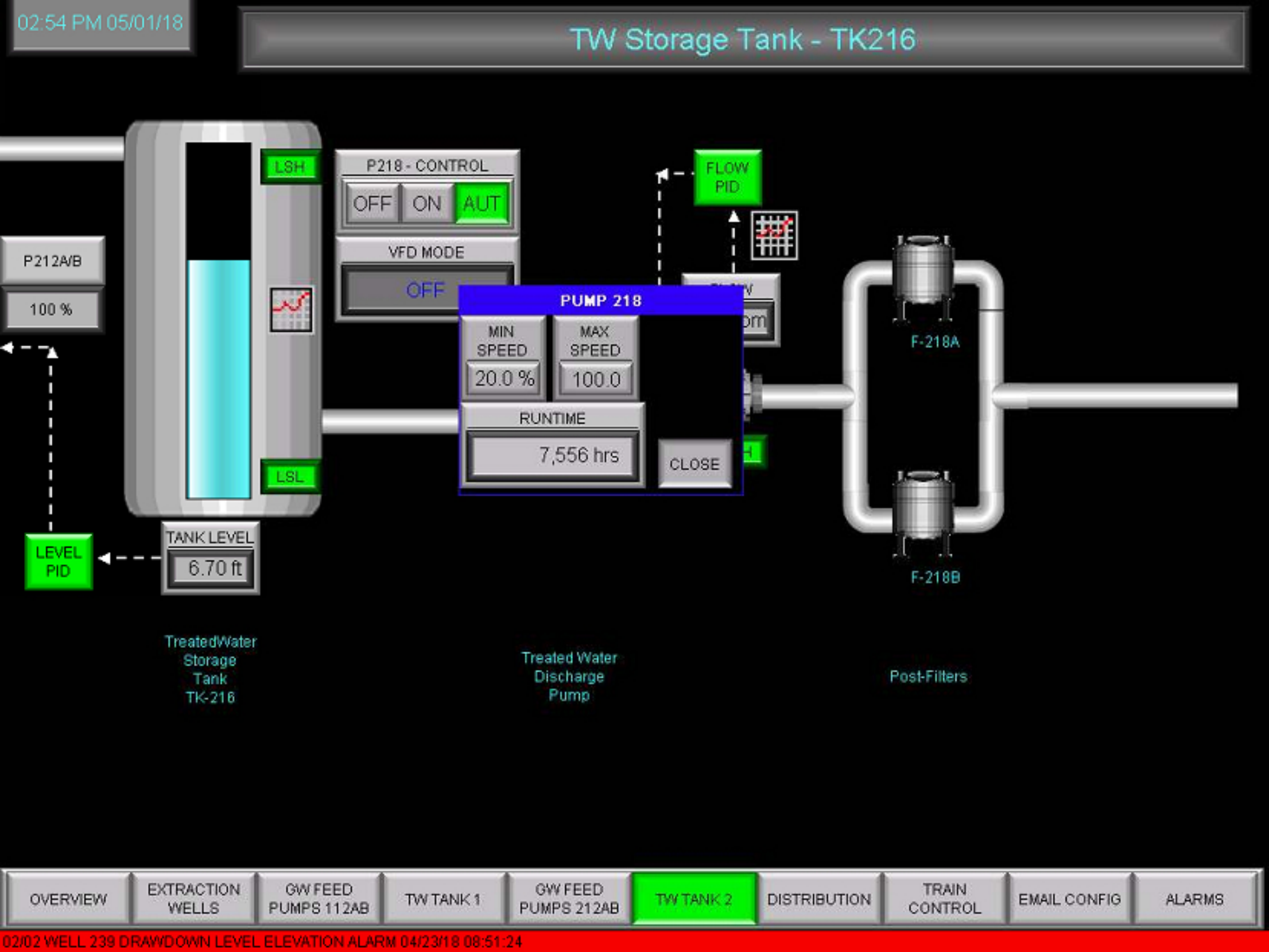
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

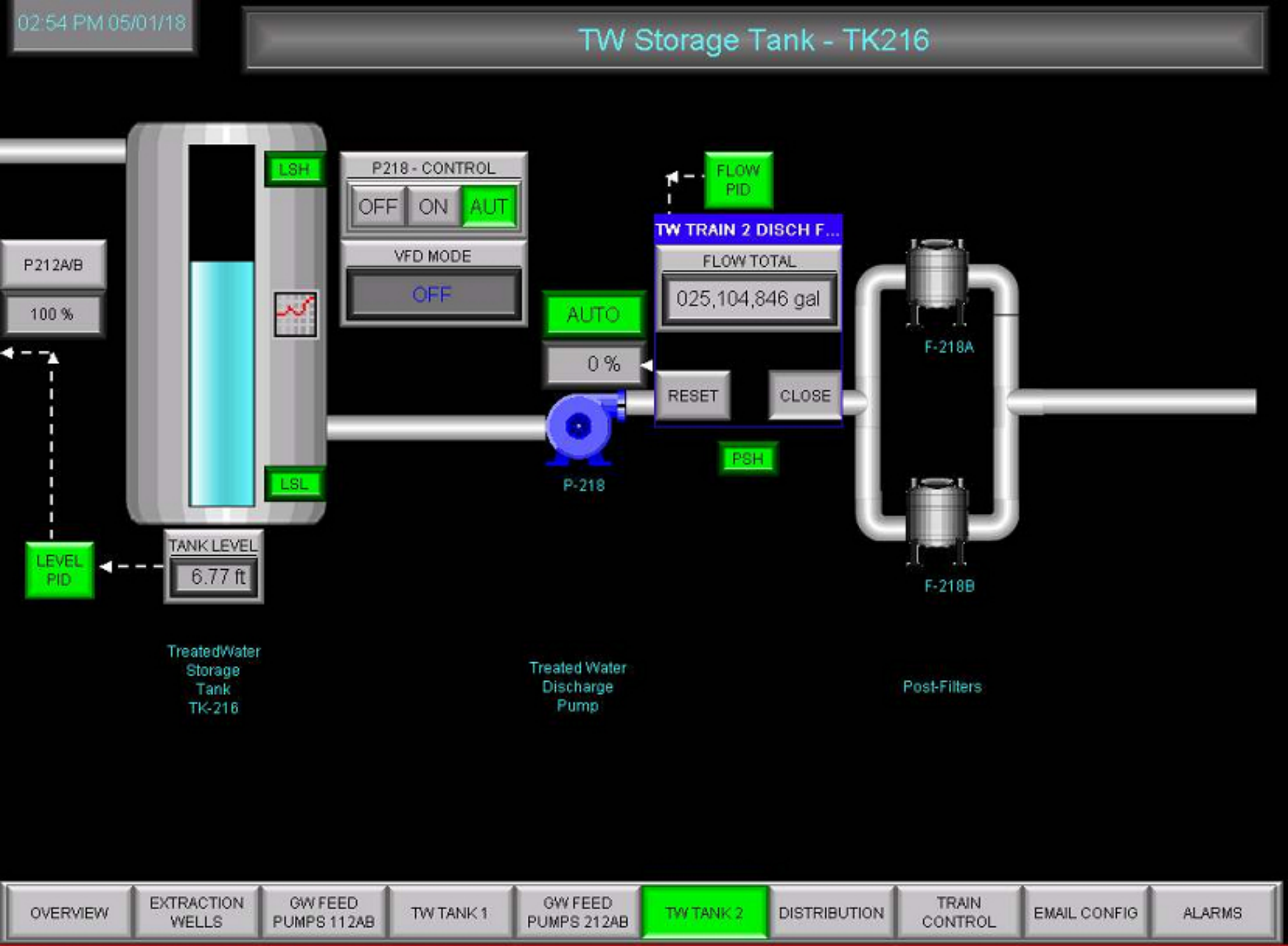
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

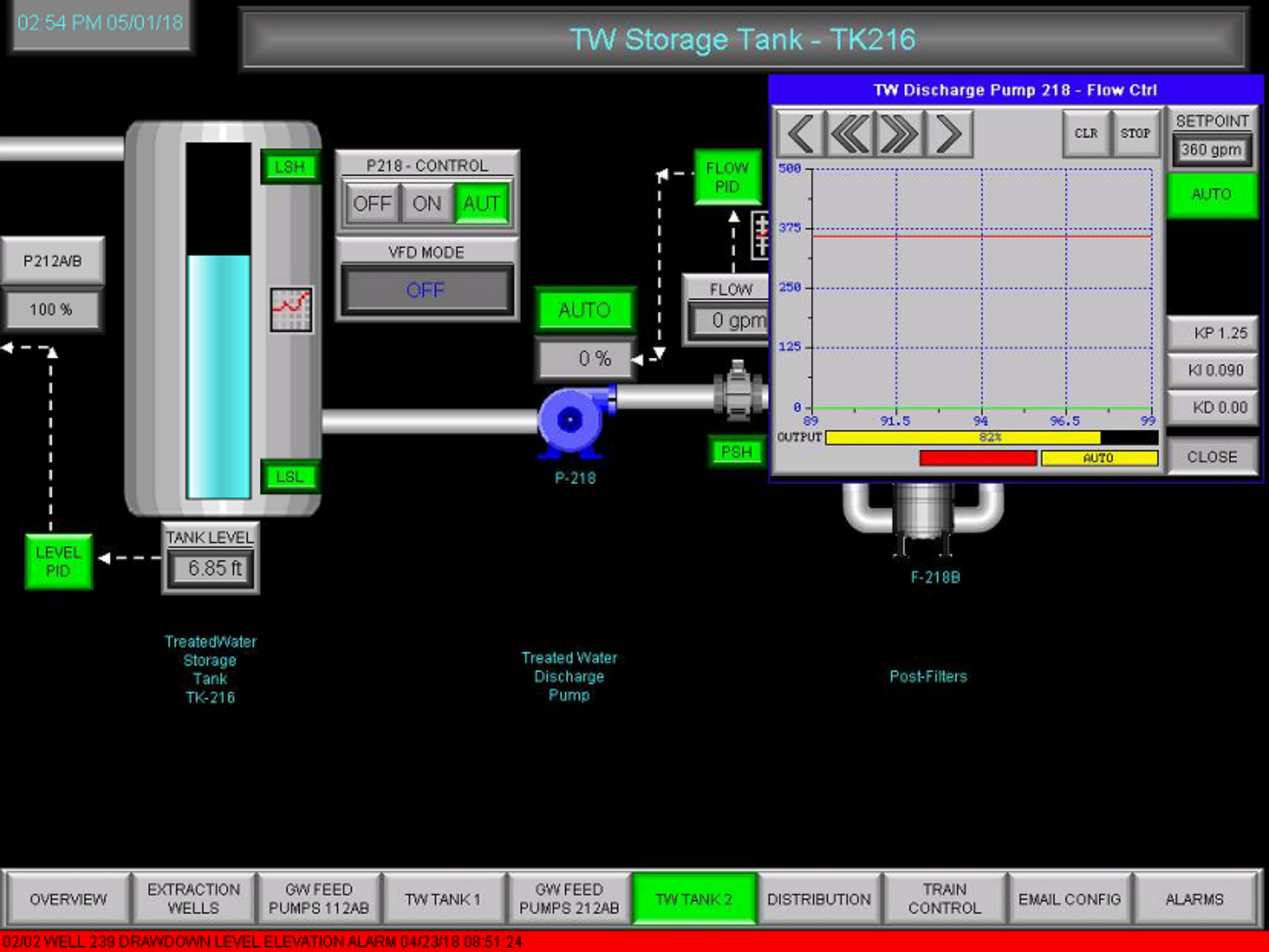

02:53 PM 05/01/18
TW Storage Tank - TK216
LSH
LSL
P218 - CONTROL
OFF
ON
AUT
VFD MODE
OFF
P212A/B
100 %
AUTO
0 %
FLOW PID
FLOW
0 gpm
PSH
F-218A
F-218B
P-218
LEVEL PID
TANK LEVEL
6.50 ft
Tank level over time graphic
Pump PID Window
EffluentSkid flow rate over time graphic
Selecting a pump flow rate will bring up the pump flow totalizer window
Selecting the pump icon will bring up the pump window
Tank level PID (not currently utilized)
TreatedWater Storage Tank TK-216
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:53 PM 05/01/18
TW Storage Tank - TK216
LSH
P218 - CONTROL
OFF
ON
AUT
VFD MODE
OFF
FLOW PID
FLOW
0 gpm
P212A/B
100 %
AUTO
0 %
LSL
P-218
PSH
F-218A
F-218B
LEVEL PID
TANK LEVEL
6.50 ft
TreatedWater Storage Tank TK-216
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:54 PM 05/01/18
TW Storage Tank - TK216
TW Storage Tank 216 - Level Ctrl
LSH
LSL
P218 - CONTROL
OFF
ON
AUT
VFD MODE
OFF
P212A/B
100 %
FLOW PID
FLOW
0 gpm
AUTO
0 %
PSH
P-218
CLR
STOP
SETPOINT
9.5 ft
AUTO
12.00
9.00
6.00
3.00
0.00
89
91.5
94
96.5
99
OUTPUT
100%
AUTO
KP 1.75
KI 0.020
KD 0.00
CLOSE
LEVEL PID
TANK LEVEL
6.56 ft
F-218B
TreatedWater Storage Tank TK-216
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:54 PM 05/01/18
TW Storage Tank - TK216
LSH
LSL
P218 - CONTROL
OFF
ON
AUT
VFD MODE
OFF
PUMP 218
MIN SPEED
20.0 %
MAX SPEED
100.0
RUNTIME
7,556 hrs
CLOSE
FLOW PID
P212A/B
100 %
LEVEL PID
TANK LEVEL
6.70 ft
F-218A
F-218B
TreatedWater Storage Tank TK-216
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

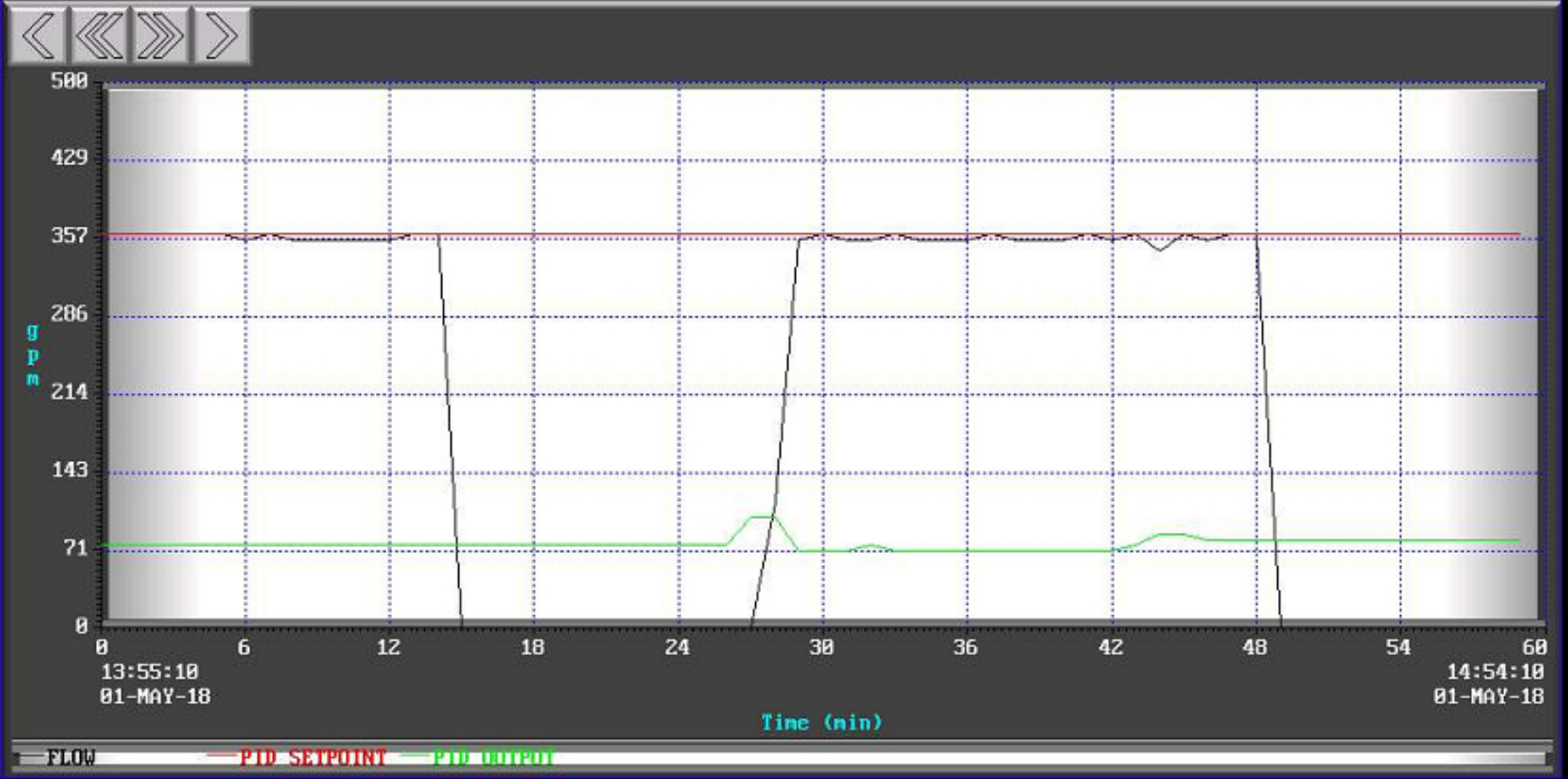

02:54 PM 05/01/18
TW Storage Tank - TK216
LSH
P218 - CONTROL
OFF
ON
AUT
VFD MODE
OFF
FLOW PID
TW TRAIN 2 DISCH F...
FLOW TOTAL
025,104,846 gal
P212A/B
100 %
AUTO
0 %
RESET
CLOSE
PSH
P-218
F-218A
F-218B
LSL
LEVEL PID
TANK LEVEL
6.77 ft
TreatedWater Storage Tank TK-216
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


02:54 PM 05/01/18
TW Storage Tank - TK216
TW Discharge Pump 218 - Flow Ctrl
LSH
LSL
P218 - CONTROL
OFF
ON
AUT
VFD MODE
OFF
P212A/B
100 %
AUTO
0 %
FLOW PID
FLOW
0 gpm
PSH
P-218
SETPOINT
360 gpm
AUTO
CLR
STOP
500
375
250
125
0
89
91.5
94
96.5
99
OUTPUT
82%
AUTO
KP 1.25
KI 0.090
KD 0.00
CLOSE
LEVEL PID
TANK LEVEL
6.85 ft
F-218B
TreatedWater Storage Tank TK-216
Treated Water Discharge Pump
Post-Filters
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:54 PM 05/01/18

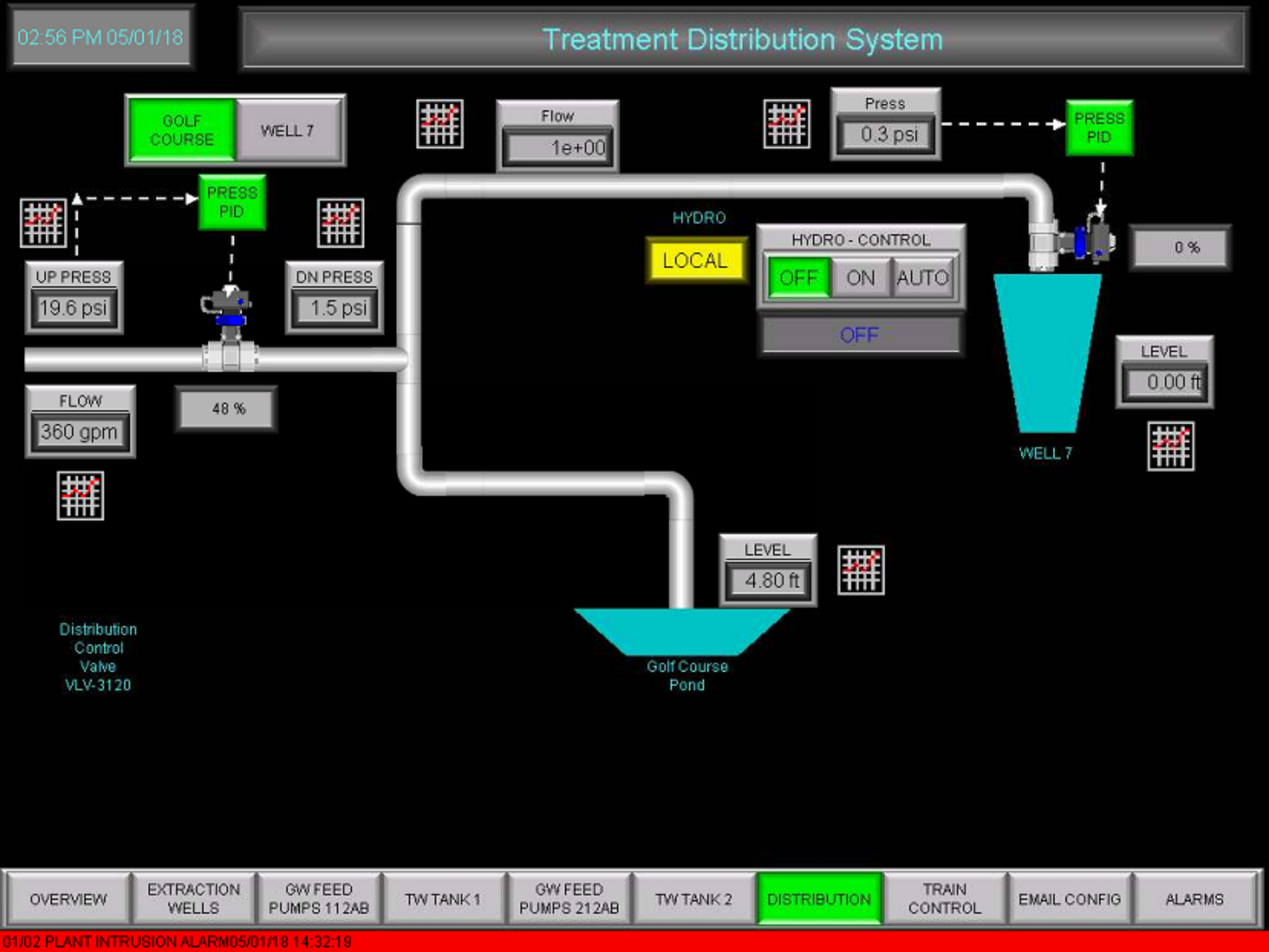
TREATEDWATER TRAIN 2 DISCHARGE FLOW

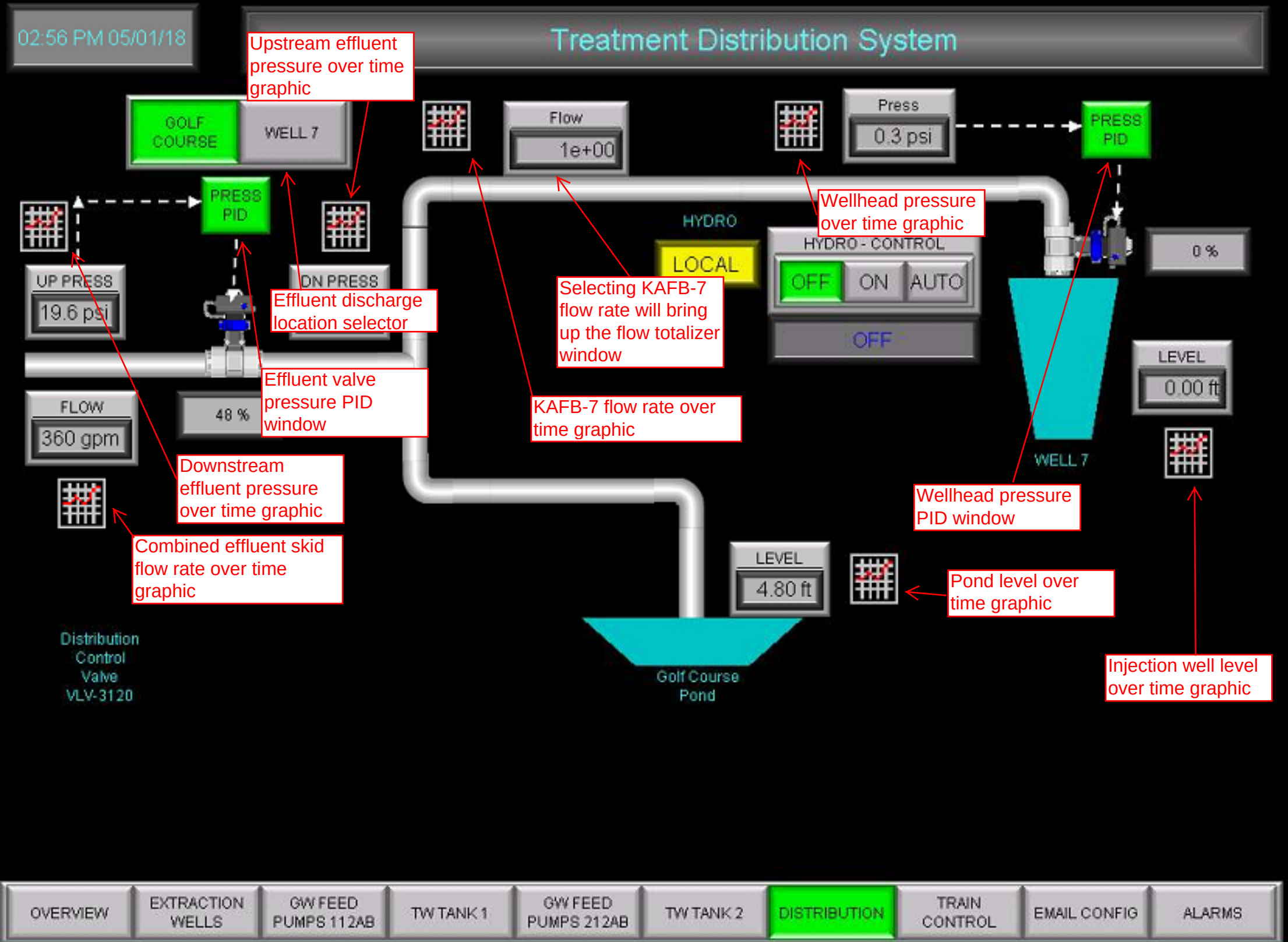
CLOSE



OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:56 PM 05/01/18
Treatment Distribution System
GOLF COURSE
WELL 7
Flow
1e+00
Press
0.3 psi
PRESS PID
PRESS PID
HYDRO
LOCAL
HYDRO - CONTROL
OFF
ON
AUTO
OFF
0 %
UP PRESS
19.6 psi
DN PRESS
1.5 psi
LEVEL
0.00 ft
FLOW
360 gpm
48 %
WELL 7
LEVEL
4.80 ft
Distribution Control Valve VLV-3120
Golf Course Pond
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:56 PM 05/01/18
Treatment Distribution System
Upstream effluent pressure over time graphic
GOLF COURSE
WELL 7
Flow
1e+00
Press
0.3 psi
PRESS PID
PRESS PID
HYDRO
LOCAL
HYDRO - CONTROL
OFF
ON
AUTO
OFF
0 %
Wellhead pressure over time graphic
UP PRESS
19.6 psi
DN PRESS
Effluent discharge location selector
Selecting KAFB-7 flow rate will bring up the flow totalizer window
Effluent valve pressure PID window
KAFB-7 flow rate over time graphic
FLOW
360 gpm
48 %
LEVEL
0.00 ft
WELL 7
Downstream effluent pressure over time graphic
Wellhead pressure PID window
Combined effluent skid flow rate over time graphic
LEVEL
4.80 ft
Pond level over time graphic
Distribution Control Valve VLV-3120
Golf Course Pond
Injection well level over time graphic
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:56 PM 05/01/18

TREATEDWATER UPSTREAM PRESSURE

CLOSE



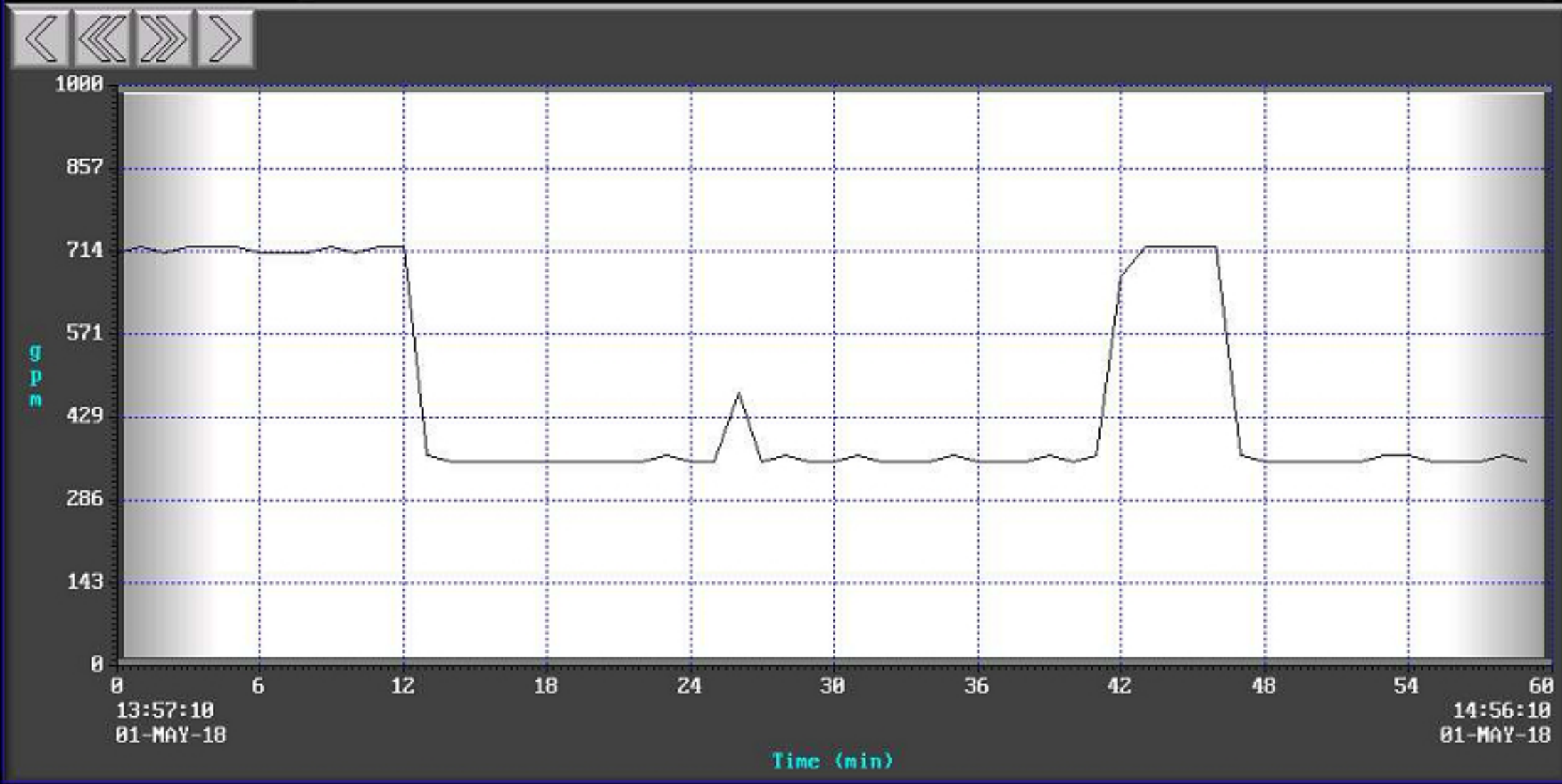
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01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:56 PM 05/01/18

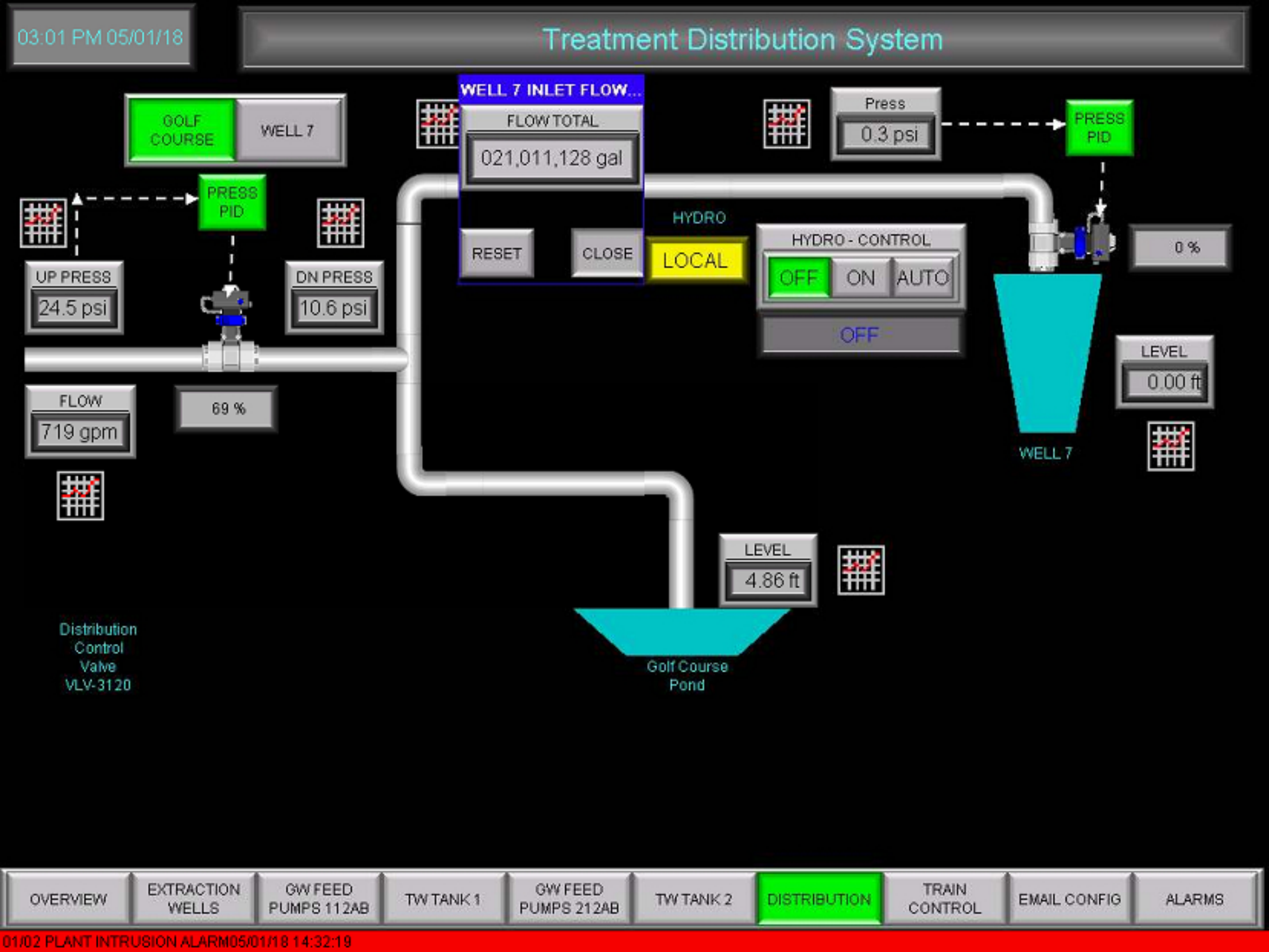
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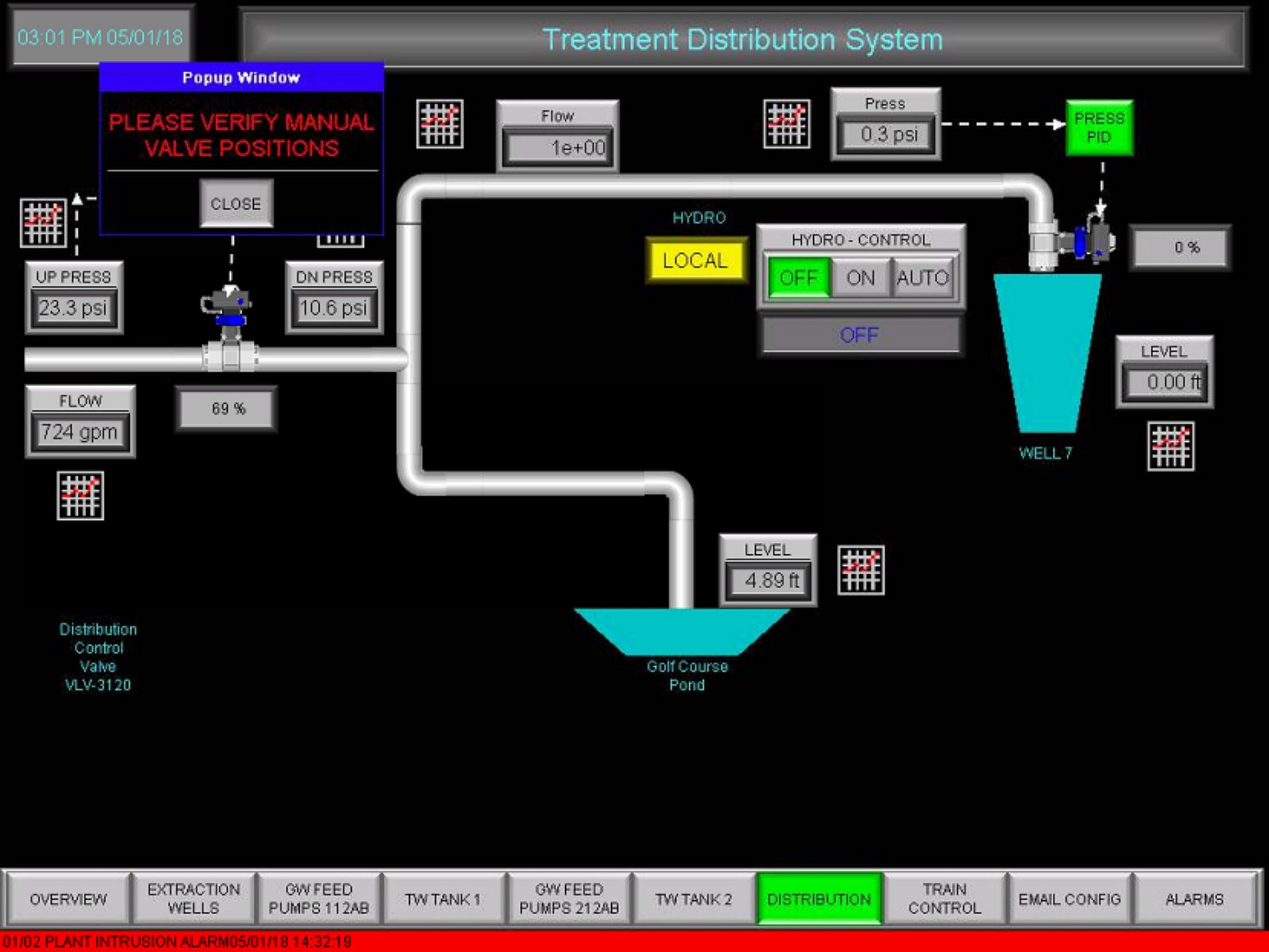
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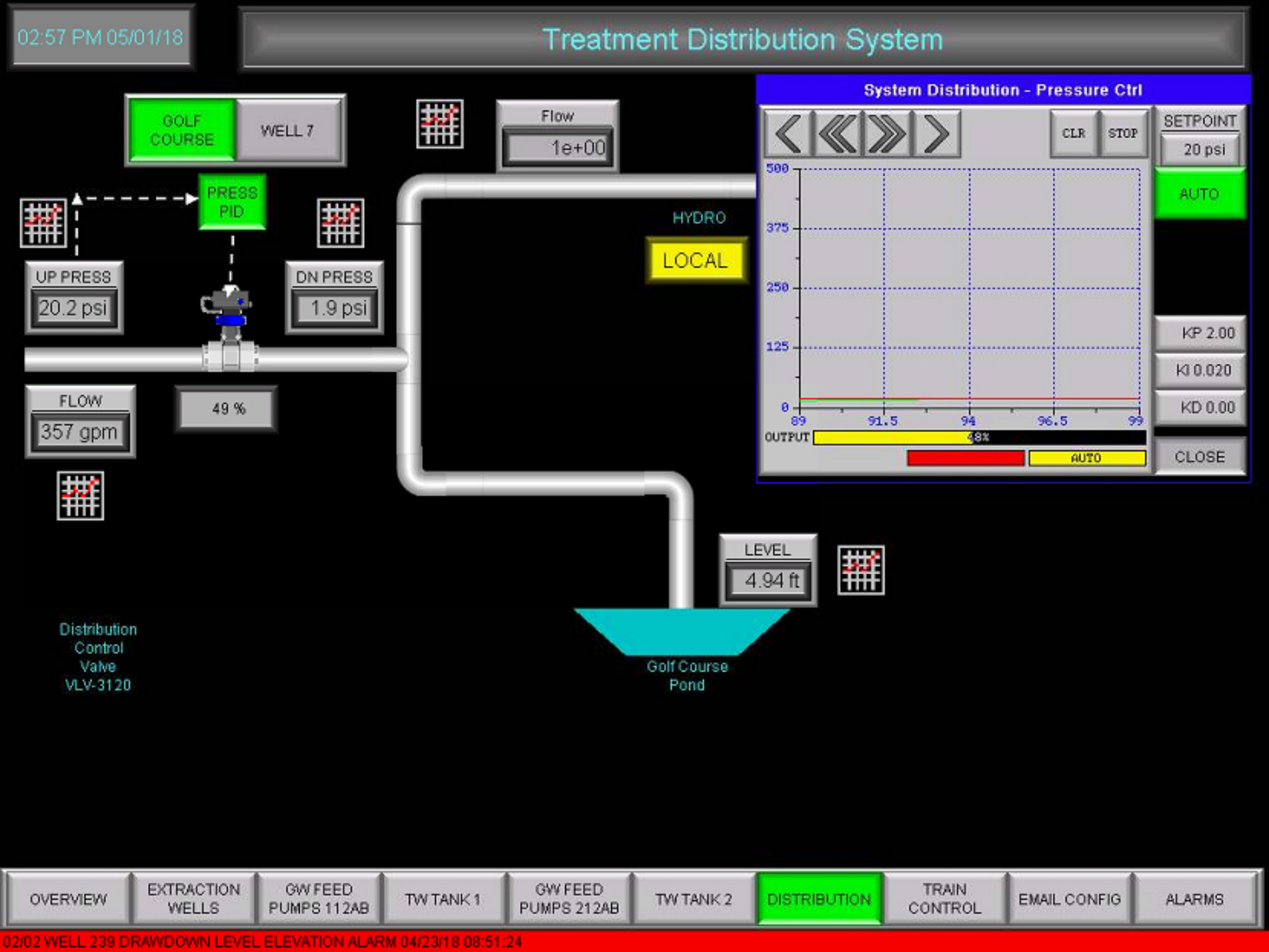


OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24


03:01 PM 05/01/18
Treatment Distribution System
GOLF COURSE
WELL 7
WELL 7 INLET FLOW...
FLOW TOTAL
021,011,128 gal
RESET
CLOSE
HYDRO
LOCAL
HYDRO - CONTROL
OFF
ON
AUTO
OFF
Press
0.3 psi
PRESS PID
PRESS PID
UP PRESS
24.5 psi
DN PRESS
10.6 psi
FLOW
719 gpm
69 %
0 %
LEVEL
0.00 ft
WELL 7
LEVEL
4.86 ft
Distribution Control Valve VLV-3120
Golf Course Pond
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

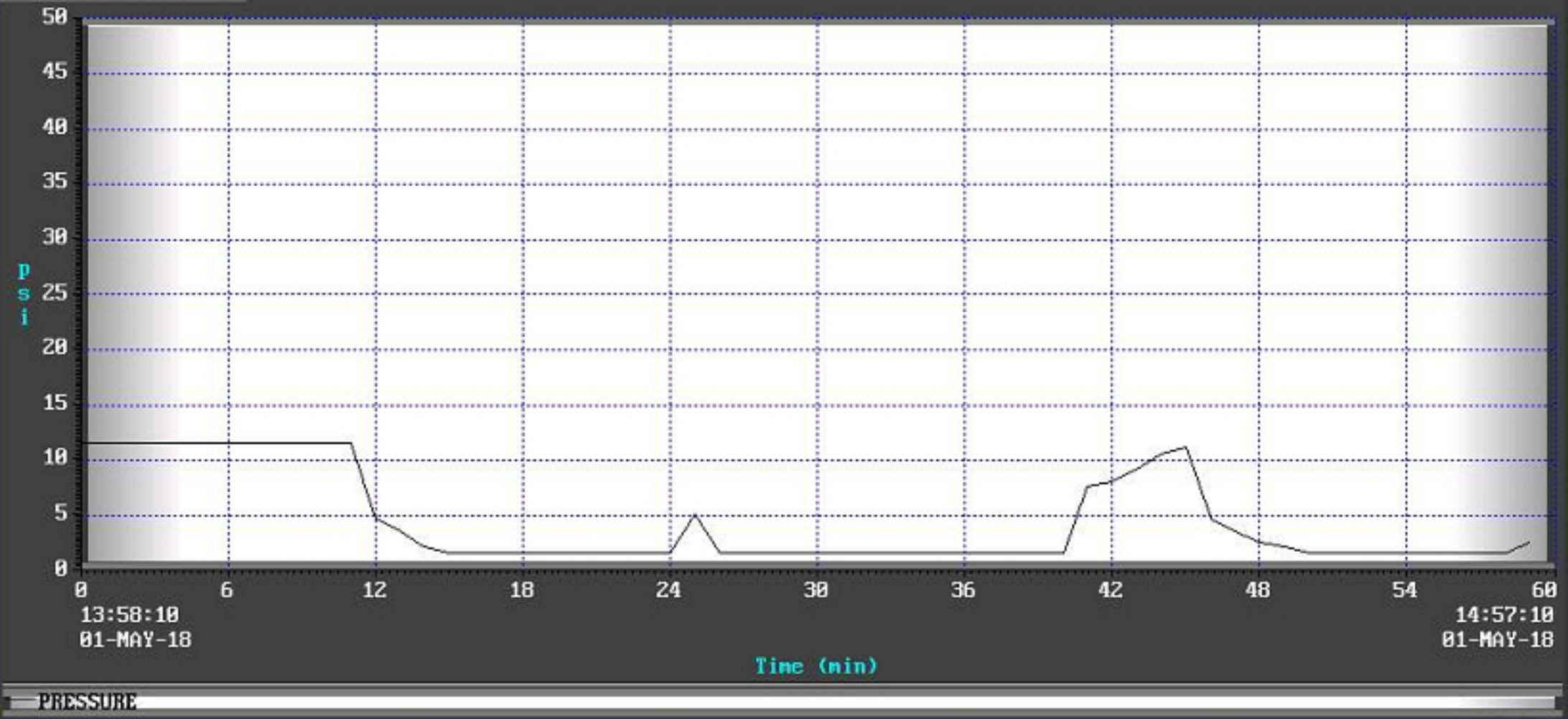

03:01 PM 05/01/18
Treatment Distribution System
Popup Window
PLEASE VERIFY MANUAL VALVE POSITIONS
CLOSE
Flow
1e+00
Press
0.3 psi
PRESS PID
HYDRO
LOCAL
HYDRO - CONTROL
OFF
ON
AUTO
OFF
0 %
UP PRESS
23.3 psi
DN PRESS
10.6 psi
FLOW
724 gpm
69 %
LEVEL
0.00 ft
WELL 7
LEVEL
4.89 ft
Distribution Control Valve VLV-3120
Golf Course Pond
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
01/02 PLANT INTRUSION ALARM05/01/18 14:32:19


02:57 PM 05/01/18
Treatment Distribution System
GOLF COURSE
WELL 7
Flow
1e+00
PRESS PID
HYDRO
LOCAL
UP PRESS
20.2 psi
DN PRESS
1.9 psi
FLOW
357 gpm
49 %
LEVEL
4.94 ft
Distribution Control Valve VLV-3120
Golf Course Pond
System Distribution - Pressure Ctrl
CLR
STOP
SETPOINT
20 psi
AUTO
500
375
250
125
0
89
91.5
94
96.5
99
OUTPUT
48%
AUTO
KP 2.00
KI 0.020
KD 0.00
CLOSE
OVERVIEW
EXTRACTION WELLS
GW FEED PUMPS 112AB
TW TANK 1
GW FEED PUMPS 212AB
TW TANK 2
DISTRIBUTION
TRAIN CONTROL
EMAIL CONFIG
ALARMS
02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:57 PM 05/01/18

TREATEDWATER DOWNSTREAM PRESSURE

CLOSE



PRESSURE

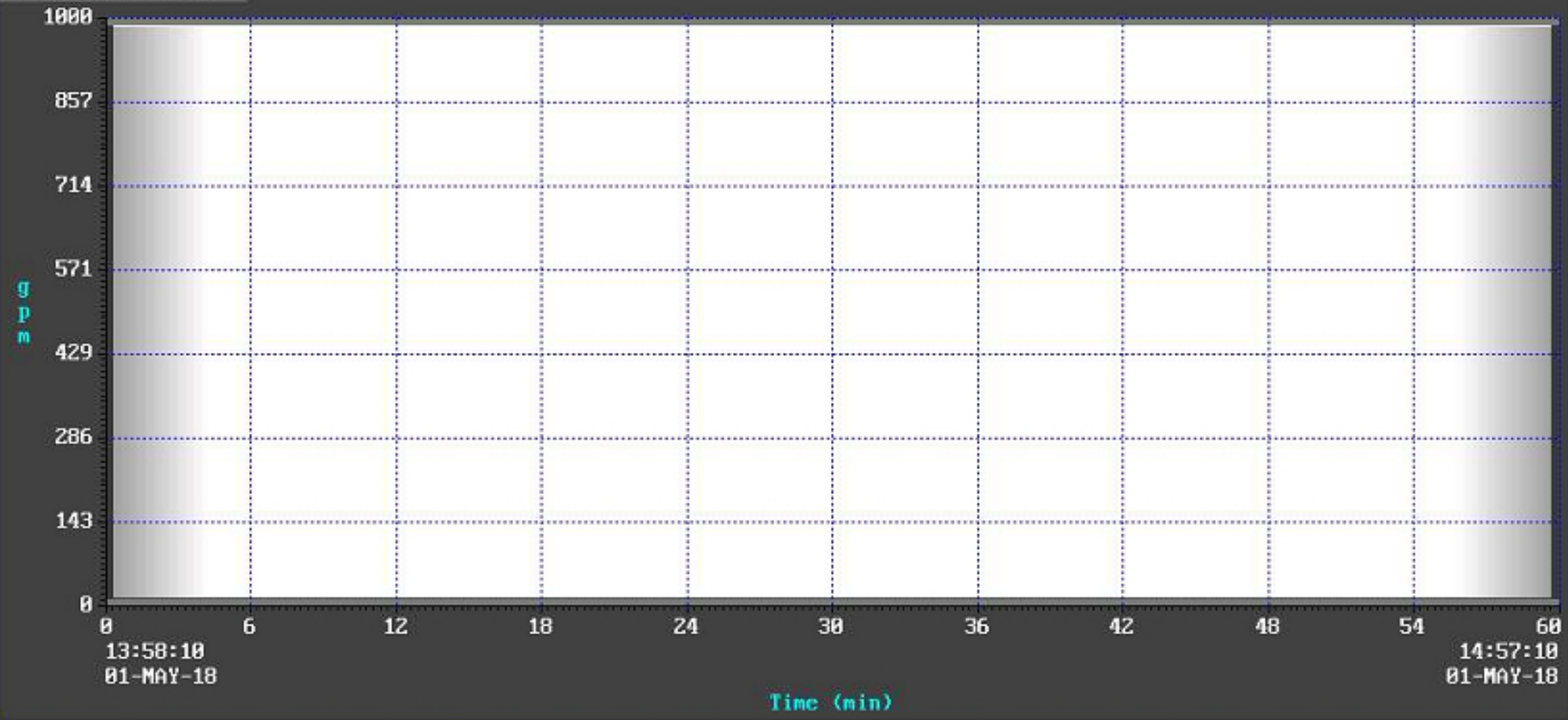
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:57 PM 05/01/18

WELL 7 INLET FLOW

CLOSE



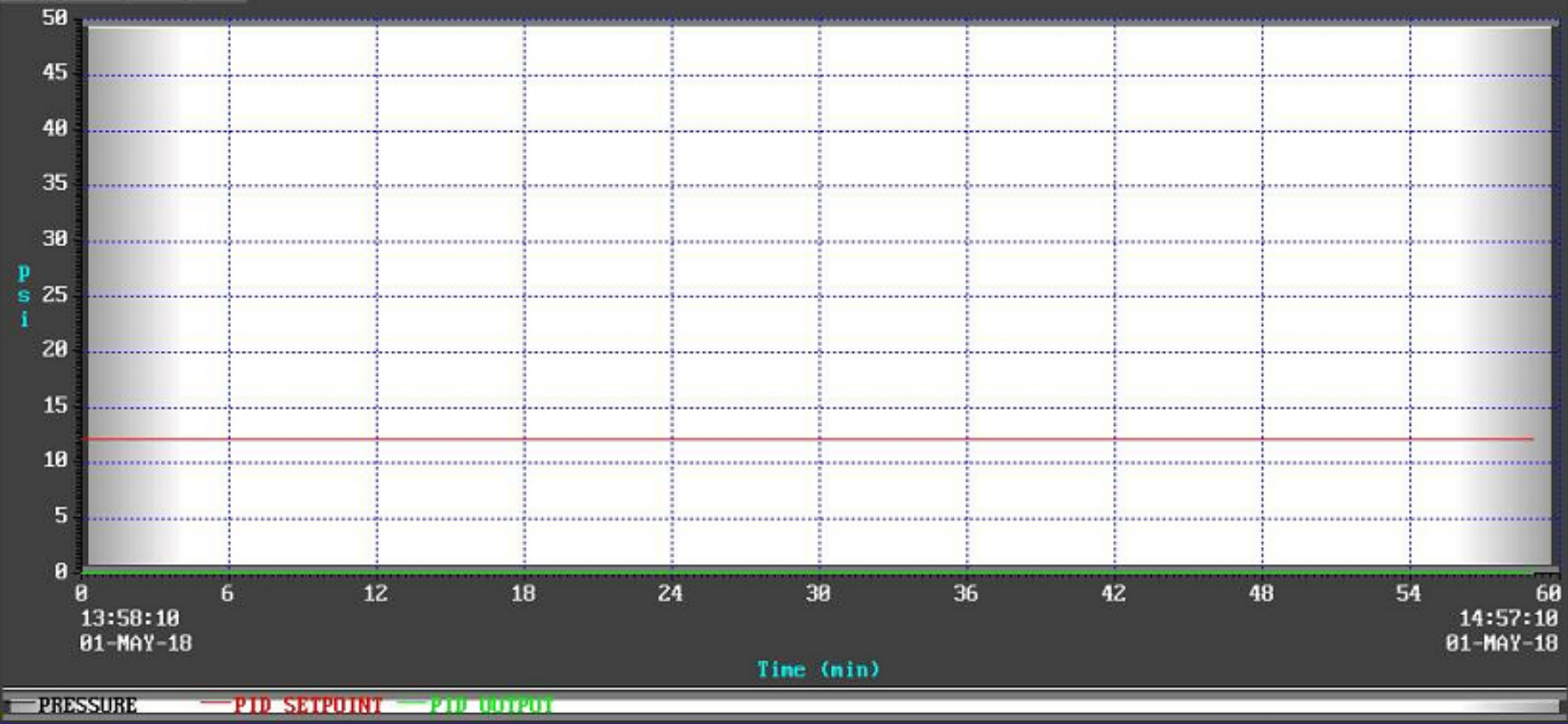
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:57 PM 05/01/18

WELL 7 INLET PRESSURE

CLOSE



OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:57 PM 05/01/18

Treatment Distribution System

GOLF COURSE | WELL 7

Flow
1e+00

PRESS PID

HYDRO
LOCAL

UP PRESS
30.9 psi

DN PRESS
7.5 psi

FLOW
652 gpm

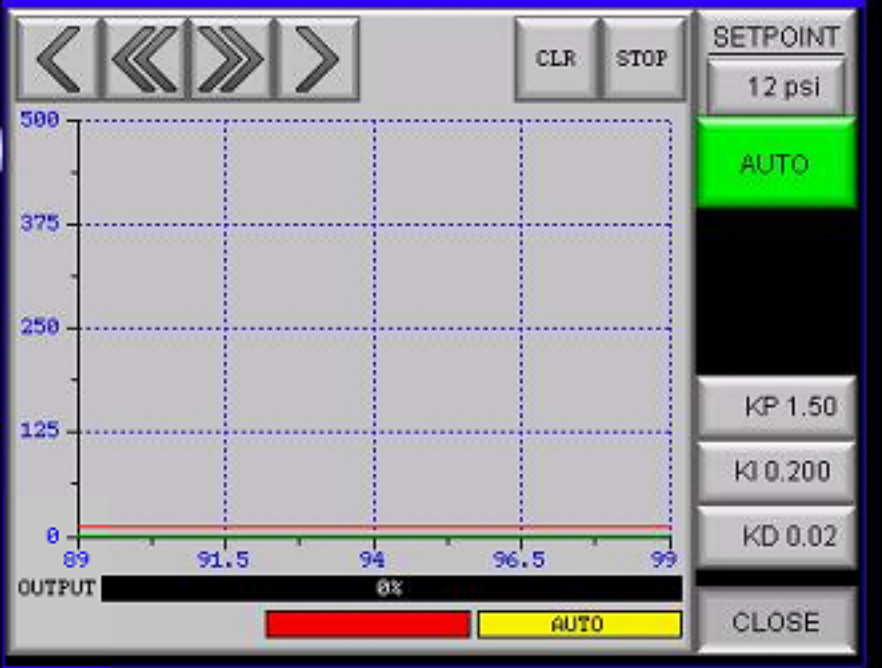
62 %

LEVEL
4.89 ft

Distribution Control Valve VLV-3120

Golf Course Pond

Well 7 Injection - Pressure Ctrl



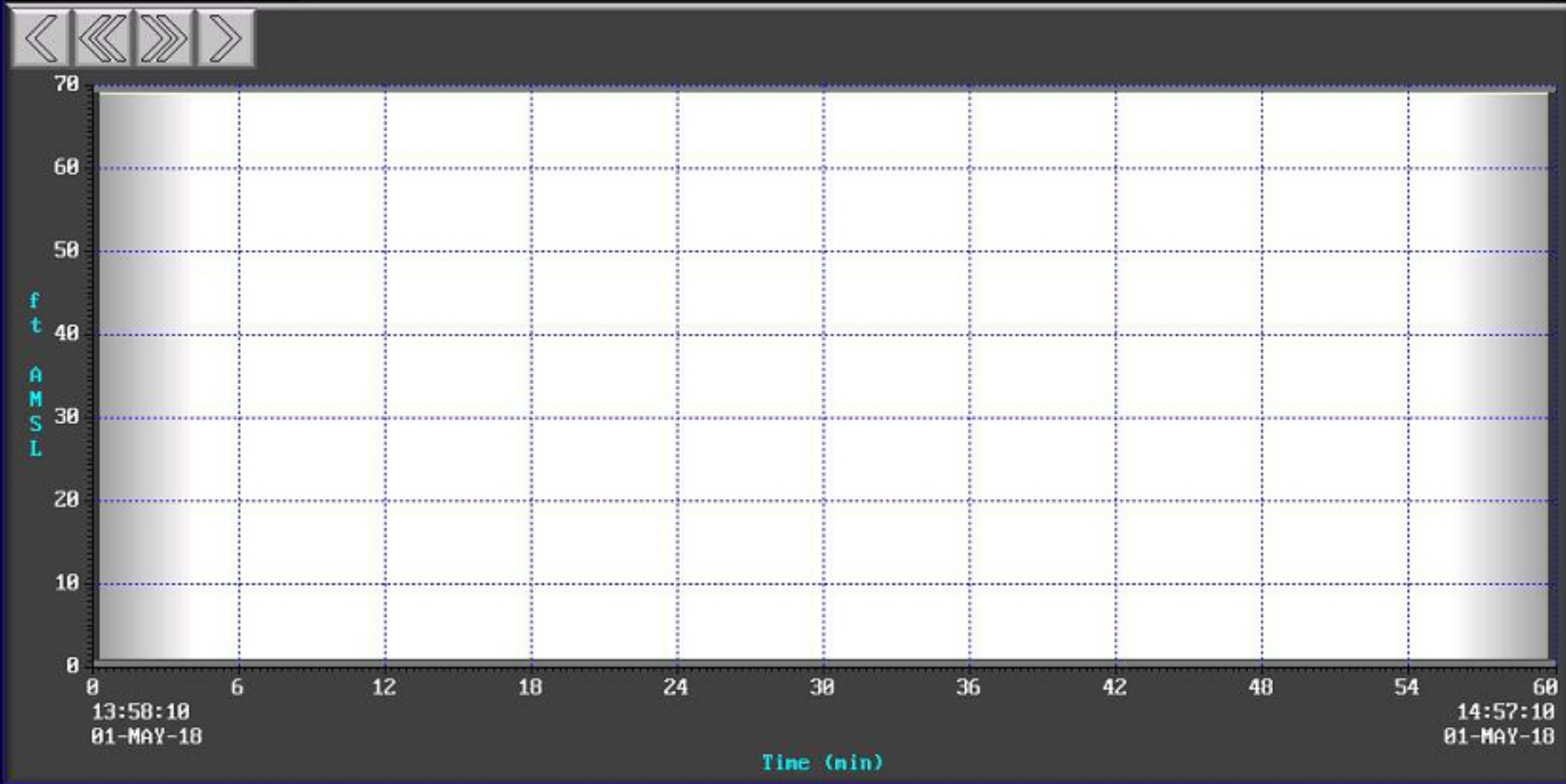
OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:57 PM 05/01/18

WELL 7 LEVEL

CLOSE

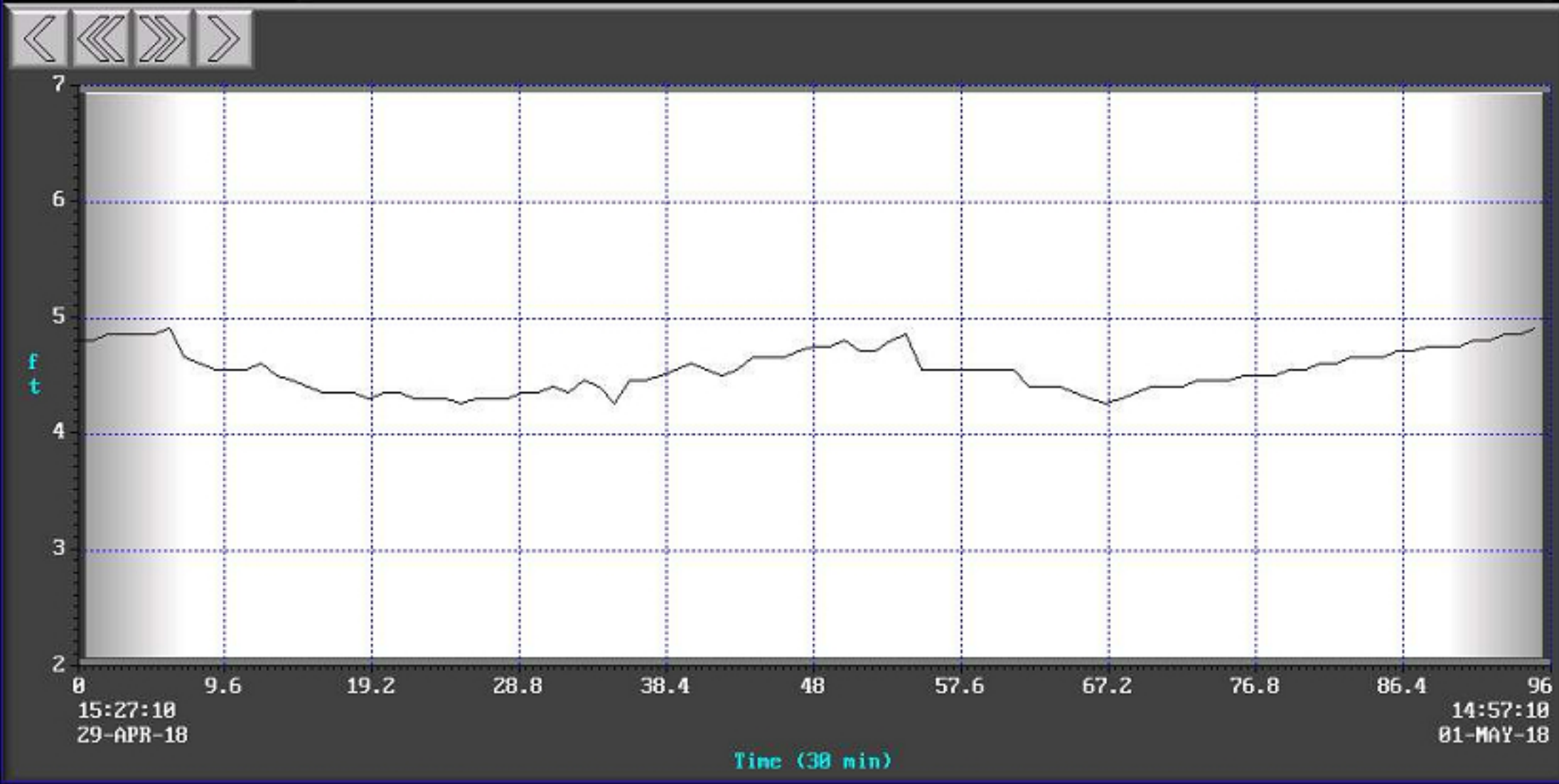


02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:58 PM 05/01/18

GOLF COURSE POND LEVEL

CLOSE



OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:58 PM 05/01/18

Train Control

	Train 1			Train 2		
Groundwater Tank	7.4 ft			5.9 ft		
GW Feed Pump A	CONTINUOUS	1	OFF ON SEQ	CONTINUOUS	1	OFF ON SEQ
GW Feed Pump B	CONTINUOUS	1	OFF ON SEQ	CONTINUOUS	1	OFF ON SEQ
Treatedwater Tank	7.5 ft			8.5 ft		
Distribution Pump	CONTINUOUS		OFF ON SEQ	CONTINUOUS		OFF ON SEQ
Train Status	PROCESSING			PROCESSING		
Control	OFF ON		RESET	OFF ON		RESET
Inf / Eff Flow SP's	345 gpm	360 gpm		345 gpm	360 gpm	

	Status	Sequence #	Sequence Ctrl		Level Stop	Level Start
Extraction Well 228	RUNNING	1	OFF ON SEQ	GW Pumps	3.5 ft	7.5 ft
Extraction Well 233	RUNNING	3	OFF ON SEQ	TW Pumps	3.5 ft	7.5 ft
Extraction Well 234	RUNNING	4	OFF ON SEQ			
Extraction Well 239	RUNNING	2	OFF ON SEQ			

Shutdowns

- Pre-Filter Hi Diff Press: 4.0 psid
- Distribution Hi Press: 45.0 psid
- Well 7 Hi Level: 500 ft
- Golf Course Level Shutdown: 5.5 ft
- Extraction Well Drawdown Lo: 5 ft

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

02:58 PM 05/01/18

KAFB Groundwater Treatment System

Email Address

1	BFFGWTS@EAEST.COM
2	
3	
4	
5	
6	

TEST EMAIL

02/02 WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24

02:58 PM 05/01/18

KAFB Groundwater Treatment System Alarms

Alarm Summary — Total of 64 Alarms

Message	Confirm	Activated	Confirmed	Deactivated
PLANT INTRUSION ALARM05/01/18 14:32:19	Required	18/05/01 14:32:19		
PLANT INTRUSION ALARM05/01/18 13:43:46	Required	18/05/01 13:43:46		18/05/01 14:07:17
PLANT INTRUSION ALARM05/01/18 06:02:35	Required	18/05/01 06:02:35		18/05/01 06:06:08
PLANT INTRUSION ALARM04/30/18 10:04:39	Required	18/04/30 10:04:39		18/04/30 13:50:30
PLANT INTRUSION ALARM04/30/18 09:48:21	Required	18/04/30 09:48:21		18/04/30 09:48:29
PLANT INTRUSION ALARM04/30/18 07:28:03	Required	18/04/30 07:28:03		18/04/30 07:31:58
WELL 239 VAULT HATCH DOOR OPEN 04/30/18 07:14:25	Required	18/04/30 07:14:25		18/04/30 07:16:38
PLANT INTRUSION ALARM04/30/18 06:10:31		18/04/30 06:10:31	18/04/30 06:13:01	18/04/30 06:50:09
PLANT INTRUSION ALARM04/27/18 12:40:29		18/04/27 12:40:29	18/04/30 06:13:01	18/04/27 12:40:36
PLANT INTRUSION ALARM04/27/18 09:35:18		18/04/27 09:35:18	18/04/30 06:13:01	18/04/27 12:40:23
TRAIN 2 NOT IN PROCESS MODE 04/27/18 06:48:03		18/04/27 06:48:03	18/04/27 07:54:06	18/04/27 07:27:48
TRAIN 1 NOT IN PROCESS MODE 04/27/18 06:47:58		18/04/27 06:47:58	18/04/27 07:54:06	18/04/27 07:27:48
PLANT INTRUSION ALARM04/27/18 06:27:15		18/04/27 06:27:15	18/04/27 07:54:06	18/04/27 08:14:10
SAND FILTER 2 IN BACKWASH 04/27/18 03:56:25		18/04/27 03:56:25	18/04/27 07:54:06	18/04/27 04:04:24
PLANT INTRUSION ALARM04/26/18 13:13:32		18/04/26 13:13:32	18/04/27 07:54:06	18/04/26 14:02:31
PLANT INTRUSION ALARM04/26/18 13:07:03		18/04/26 13:07:03	18/04/27 07:54:06	18/04/26 13:08:14
WELL 239 VAULT HATCH DOOR OPEN 04/26/18 12:42:53		18/04/26 12:42:53	18/04/27 07:54:06	18/04/26 12:48:55
EXTRACTION WELL PUMP 105 FAILED 04/26/18 10:40:23		18/04/26 10:40:23	18/04/27 07:54:06	18/04/26 10:41:03
WELL 239 VAULT HATCH DOOR OPEN 04/26/18 09:45:59		18/04/26 09:45:59	18/04/27 07:54:06	18/04/26 10:10:13
PLANT INTRUSION ALARM04/26/18 06:28:28		18/04/26 06:28:28	18/04/27 07:54:06	18/04/26 08:13:30
PLANT INTRUSION ALARM04/25/18 13:52:55		18/04/25 13:52:55	18/04/27 07:54:06	18/04/25 13:53:56
PLANT INTRUSION ALARM04/25/18 09:15:47		18/04/25 09:15:47	18/04/27 07:54:06	18/04/25 09:36:57
PLANT INTRUSION ALARM04/25/18 06:39:52		18/04/25 06:39:52	18/04/27 07:54:06	18/04/25 08:20:46
PLANT INTRUSION ALARM04/24/18 09:15:13		18/04/24 09:15:13	18/04/27 07:54:06	18/04/24 09:16:26
PLANT INTRUSION ALARM04/24/18 06:09:17		18/04/24 06:09:17	18/04/27 07:54:06	18/04/24 06:56:33
PLANT INTRUSION ALARM04/23/18 14:20:32		18/04/23 14:20:32	18/04/27 07:54:06	18/04/23 14:43:27
WELL 239 VAULT HATCH DOOR OPEN 04/23/18 13:41:12		18/04/23 13:41:12	18/04/27 07:54:06	18/04/23 14:11:15
PLANT INTRUSION ALARM04/23/18 13:29:12		18/04/23 13:29:12	18/04/27 07:54:06	18/04/23 13:30:20
WELL 239 VAULT HATCH DOOR OPEN 04/23/18 08:54:17		18/04/23 08:54:17	18/04/27 07:54:06	18/04/23 09:51:03
WELL 239 DRAWDOWN LEVEL ELEVATION ALARM 04/23/18 08:51:24		18/04/23 08:51:24	18/04/27 07:54:06	

Page Up | Page Down | Line Up | Line Down | Detail | Clear All | Confirm | Confirm All

OVERVIEW | EXTRACTION WELLS | GW FEED PUMPS 112AB | TW TANK 1 | GW FEED PUMPS 212AB | TW TANK 2 | DISTRIBUTION | TRAIN CONTROL | EMAIL CONFIG | ALARMS

01/02 PLANT INTRUSION ALARM05/01/18 14:32:19

APPENDIX G

DESIGN CALCULATIONS FOR CARBON VESSEL MEDIA BEDS

TIGG CARBON LIFE ANALYSES

From: John Mickler
To: Jim Kearns; Jercinovic, Devon
Cc: Nicholas Kelly
Subject: RE: Kirtland BFF - GAC Lifetime Analysis w/ Update Concentrations
Date: Friday, April 14, 2017 6:06:26 AM

Devon, EA is granted permission to provide this information to NMED in support of the TIGG equipment and carbons for this application.

Let us know if you need any other help.

John M. Mickler P.E., PMP
Vice President and General Manager

TIGG, LLC
1 Willow Avenue
Oakdale, PA 15071
Office: 724-703-3020 x106
Mobile: 412-370-5833
jmickler@tigg.com



1 Willow Avenue
Oakdale, PA 15071
p. 724-703-3020
f. 724-703-3026

Title: Kirtland AFB 4/13/17

Report Basis

Flow Rate	400 GPM
Water pH	7
Water Temperature	65 °F

Component	Inlet Concentration
ethylene dibromide	20.000 ppb
benzene	450.000 ppb
ethyl benzene	102.000 ppb
toluene	212.000 ppb
xylene	110.000 ppb

Report: 114.31 lbs. activated carbon per day saturated at conditions

Average Loading at Saturation 4.024 lbs./100 lbs. Carbon

Note: Contact TIGG Corporation if comments are needed on preferential adsorption of contaminants above.

PROPRIETARY AND CONFIDENTIAL

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1 Willow Avenue
Oakdale, PA 15071
p. 724-703-3020
f. 724-703-3026

Title: Kirtland AFB 4/13/17

Report Basis

Flow Rate	400 GPM
Water pH	7
Water Temperature	65 °F

Component	Inlet Concentration
ethylene dibromide	10.000 ppb
benzene	225.000 ppb
ethyl benzene	51.000 ppb
toluene	106.000 ppb
xylene	55.000 ppb

Report: 43.64 lbs. activated carbon per day saturated at conditions

Average Loading at Saturation 3.245 lbs./100 lbs. Carbon

Note: Contact TIGG Corporation if comments are needed on preferential adsorption of contaminants above.

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CARBON ADSORBER DESIGN CALCULATION

Project Title:	**Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico**	**Document Number:**	**140705-001-PR-CL-40002**
Owner:	**Process Engineering**	**Revision:**	**0**

CARBON ADSORBER DESIGN CALCULATION

Rev	Status/Changes	Performed		Checked		Approved	
		Initial	Date	Initial	Date	Initial	Date
0	100% Design	SES	3/09/15	DWB	3/10/15	BACH	3/11/15

CARBON ADSORBER DESIGN CALCULATION

Project Title:	Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico	Document Number:	140705-001-PR-CL-40002
Owner:	Process Engineering	Revision:	0

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1.1 Background 3

1.2 Objectives 3

2.0 Inputs and assumptions 3

2.1 Calculation Methodology 3

2.2 Inputs 4

2.3 Assumptions 4

3.0 Results and Conclusions 5

3.1 Results 5

3.2 Conclusions 5

4.0 References 5

List of Attachments

Attachment A: Process flow diagram for groundwater treatment system
Attachment B: Groundwater data for monitoring wells
Attachment C: Design recommendations for activated carbon
Attachment D: Tigg submittals on activated carbon and carbon adsorbers
Attachment E: Spreadsheet - carbon adsorber calculations

CARBON ADSORBER DESIGN CALCULATION

Project Title:	Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico	Document Number:	140705-001-PR-CL-40002
Owner:	Process Engineering	Revision:	0

1.0 INTRODUCTION

The mid-plume pump and treat system is part of an interim remedial measure for the Bulk Fuels Facility (BFF) groundwater plume at Kirtland AFB. The mid-plume groundwater is currently contaminated with ethylene dibromide (EDB) at concentrations above the maximum contaminant level (MCL) of 0.05 µg/L. The mid-plume pump and treat system will eventually consist of several extraction wells that are expected to produce up to 800 gpm of groundwater. Current scope of work is to design and install one groundwater extraction well and a groundwater treatment (GWT) system designed for 400 gpm of groundwater.

1.1 Background

Attachment A is a flow diagram for the mid-plume groundwater treatment system. Groundwater from the extraction well is pumped from the well through a buried pipeline into the GWT system feed tank. The groundwater is then pumped from the feed tank through pre-filters and activated carbon adsorbers which remove the EDB. The treated water from the carbon adsorbers is collected in a discharge tank and then pumped into an infiltration gallery for disposal. The design flow rate for the first extraction well is 100 gpm. Eventually additional wells and a second 400 gpm treatment system will be installed.

The carbon adsorber system is a standard two-bed unit with a piping manifold. The two carbon beds will be run in lead-lag configuration. The lead bed removes almost all of the EDB while the lag or polishing bed is on line to remove any remaining EDB from the lead bed effluent. The piping manifold for the carbon adsorbers allows either bed to serve as the lead or lag bed and allows either bed to be taken offline for carbon replacement while the other bed is in service.

1.2 Objectives

The objectives for this calculation are to determine the amount of carbon needed for EDB removal, the diameter of the carbon adsorbers and to estimate the carbon consumption. The carbon adsorbers will be sized for a maximum groundwater flow rate of 400 gpm and a minimum flow rate of 100 gpm.

2.0 INPUTS AND ASSUMPTIONS

2.1 Calculation Methodology

The amount of carbon needed in the carbon adsorbers is set by the residence time needed to remove the EDB from the groundwater. This design criteria based on the empty bed contact time which is the volume of the carbon divided by the groundwater flow rate. The required contact time depends on the characteristics of the organic, its concentration in the groundwater and the degree of removal required. Unless pilot test data is available, design contact time is based on the recommendations of the carbon vendors. EDB has a higher solubility in water and is less readily adsorbed by activated carbon than many

organics, especially hydrocarbons. In addition the drinking water standard for EDB is very low (0.05 µg/L). Because of these factors and past operating experience with EDB and similar compounds, vendors recommend a contact time of at least 8 to 10 minutes in the each of the two carbon beds operating in series. During the aquifer test on KAFB 106157, carbon treatment with a contact time of 10 to 11 minutes successfully removed EDB from the groundwater. For this calculation, the design contact time will be a more conservative 12 minutes. The additional contact time and carbon volume will be needed if dissolved gasoline range organics (GRO) from the downgradient plume are pulled into the extraction well.

Once the amount of carbon is calculated, based on the required contact time and groundwater flow rate, the diameter of the carbon bed can be determined. The diameter of the carbon bed has to be large enough so that the pressure drop through the bed is reasonable but not so large that the groundwater flow is too low. Groundwater flow rate, or hydraulic loading (calculated as gpm/square foot of carbon bed cross sectional area), must be high enough to provide good distribution of the groundwater over the carbon in the adsorber. This minimum hydraulic loading is a function of the size of the carbon, design of the carbon adsorber inlet and outlet manifolds and is obtained from the equipment vendor. Typically minimum flow is between 1 and 2 gpm per square foot (gpm/ft2). Maximum loading can be as high as 9 gpm/ft2, but 5 is a more typical design value.

Unless test data is available, carbon usage for removal of any organic, including EDB, is typically calculated from isotherm adsorption data provided by the carbon vendor. The isotherm data is a curve showing the predicted loading capacity for the organic on the carbon (grams of organic adsorbed per gram of carbon) plotted against the organic concentration in groundwater. Carbon loading for an adsorber is generally taken to be 60% to 75% of the isotherm loading. This accounts for imperfect mass transfer in the carbon bed. Once the loading is estimated, carbon usage can be calculated based on the mass of organic removed divided by the loading of the organic on the carbon.

2.2 Inputs

Inputs include:

- The groundwater design (maximum) feed rate is 400 gpm. Minimum flow to the carbon adsorbers will be 100 gpm. The carbon adsorber feed pumps will be shut down if flow drops below 100 gpm.
- Design groundwater EDB concentration is 2.0 µg/L. Actual concentration, based on recent monitoring well analysis, shown as Attachment B, should be between 0.14 and 1.4 µg/L
- Groundwater inlet temperature from the extraction well will be between 55 to 60°F.

2.3 Assumptions

1) Although Tigg and other vendors report that a contact time of 8 to 10 minutes can give acceptable removal for EDB, the carbon beds will be designed to provide 12 minutes contact time. This provides extra contact time and carbon if GRO compounds are pulled into the extraction well.
2) Carbon density is 30 pounds per cubic foot.
3) Extracted groundwater will be no higher in EDB than 2.0 µg/L. Attachment B shows recent analytical results for the three monitoring wells that are closest to the new proposed extraction well, KAFB-106228. This data shows that the EDB in the groundwater from these monitoring wells ranges from 0.16 to 1.4 µg/L. The design value of 2.0 should be conservative.
4) Based on Tigg's recommendation, minimum groundwater flow for the adsorbers will be 1 gpm per square foot of adsorber cross section.
5) Estimated EDB loading on the carbon at 2.0 µg/L inlet will be 0.0062 gram of EDB per gram of carbon.

3.0 RESULTS AND CONCLUSIONS

3.1 Results

At the design flow rate of 400 gpm of groundwater and a design contact time of 12 minutes, 20,000 pounds of carbon is required. Standard 20,000 pound carbon beds are 10 foot diameter.

With 10 foot diameter carbon bed and a minimum groundwater flow of 100 gpm. The hydraulic loading is 1.27 gpm per square foot which is above the minimum value of 1.0. At 400 gpm the hydraulic loading is 5.1 gpm/ft2 and vendor pressure drop curves shows less than 2 psi pressure drop over the system.

At a design EDB concentration of 2.0 µg/L of EDB in the groundwater and a groundwater flow of 400 gpm, carbon usage is estimated to be 567 pounds per year. Based on this usage the 20,000 pound carbon adsorber should last 20 years. It is likely that the bed life will be limited by fouling due to mineral scale, fine soil particles or biological deposits. A yearly evaluation of pressure drop through the carbon beds and EDB removal trends is recommended. It is not uncommon to change carbon on a yearly or biannual basis in this type of service.

3.2 Conclusions

The carbon adsorption system design of two 10 foot diameter beds, each containing 20,000 pounds of carbon, meets all design criteria.

4.0 REFERENCES

Table 5-1 in Kirtland BFF Quarterly reports contains the analytical data on the groundwater monitoring wells. Monitoring wells KAFB-106035, KAFB-106036 and KAFB-106037 are close to the location of the first extraction well, KAFB-106228. The data shown in Attachment B is extracted from this table in the quarterly reports.

The letter report on the KAFB 106157 aquifer test is:

USACE, 2014, "Fourth Quarter CY2013 Aquifer Test Results", January 27, 2014, Bulk Fuels Facility Spill, Solid Waste Management Units ST-106 and SS-111. Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 002. October.

The work plan which describes the carbon adsorption system is:

USACE, 2013a, *Groundwater Extraction Well KAFB-106157 Aquifer Testing Work Plan, Bulk Fuels Facility, Spill, Solid Waste Management Units ST-106 and SS-111*. Prepared by Shaw Environmental & Infrastructure, Inc. for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 002. October.

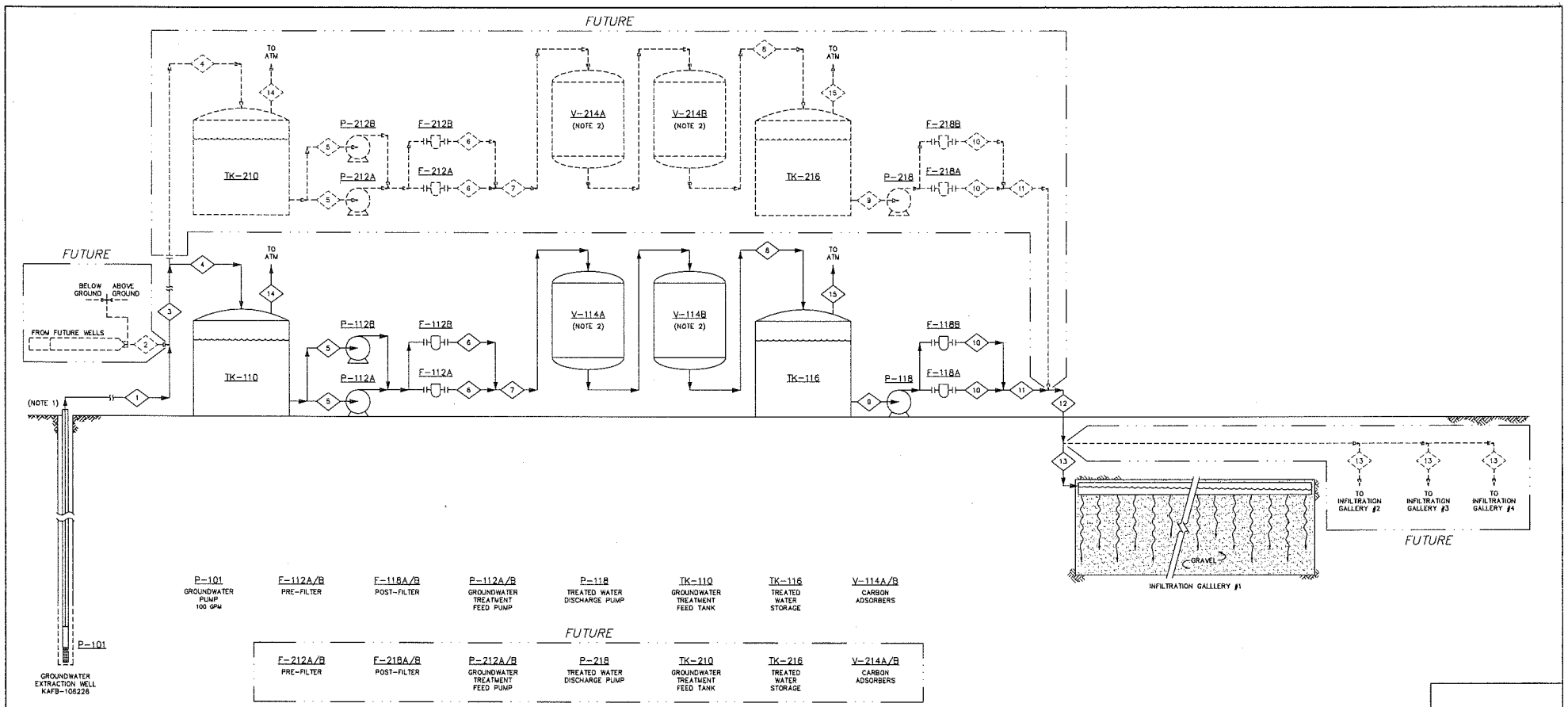
CARBON ADSORBER DESIGN CALCULATION

Project Title:	**Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico**	**Document Number:**	**140705-001-PR-CL-40002**
Owner:	**Process Engineering**	**Revision:**	**0**

Attachment A:

Process flow diagram for groundwater

treatment system



STREAM NO. / COMPONENT		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
		KAFB-106228 TO GWTS	FUTURE WELLS TO GWTS	WELL FIELD TO GWTS	INFLUENT TO FEED TANK	GWTS FEED PUMPS	PRE-FILTER	CARBON ABSORPTION INLET	TREATED WATER	DISCHARGE PUMP	POST-FILTER	TREATED DISCHARGE	TREATED DISCHARGE	INFILTRATION GALLERY	TREATED WATER STORAGE TANK VENT	TREATED WATER STORAGE TANK VENT			
LIQUID FLOW (maximum)	gpm		700	800	400	200	400	400	400	400	400	400	800	200					
LIQUID FLOW (average)	gpm	100																	
AIR FLOW	acfm (scfm)																		
INFILTRATION RATE	gal/day/ft^2													TBD		ATM			
ETHYLENE DIBROMIDE (EDB)	µg/L	2	2	2	2	2	2	2	0.03	0.03	0.03	0.03	0.03	0.03					
PRESSURE	psig	25	25	25	25	19	25	25	25	19	25	25	25	1	(12.05)	(12.05)			
TEMPERATURE	°F	58	58	58	58	58	58	58	58	58	58	58	58	58	68	68			
DENSITY (AT 70°F)	lb/ft^3	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	0.061	0.061			

NOTES

1. PIPELINE FROM GROUNDWATER WELL KAFB-106226 IS DOUBLE-WALLED HDPE PIPE.
2. CARBON VESSELS ARE RUN IN SERIES WITH OPTIONAL VALVING FOR PARALLEL AND LEAD/LAG CONFIGURATION. SEE DRAWING 03-000003 FOR VALVING DETAIL.

REFERENCE DRAWINGS

NO.	REVISION	DRAWN	CK'D	APP'D	DATE
A	30% INTERNAL REVIEW	EGA	ACS	SES	1/9/15

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CLIENT DWG NO.

PROCESS FLOW DIAGRAM (PFD)
PHASE IV MID-PLUME PUMP & TREAT SYSTEM

FOR: BULK FUELS FACILITY, KIRTLAND AFB, NM

PROJECT NO: 140705 | DWG NO: 140705-001-PR-01-000001 | REV: A

File: 140705-001-PR-01-000001.dwg
Plot Date/Time: Jan 09, 2015 - 10:34am
Plotted By: Edward Anderson

CARBON ADSORBER DESIGN CALCULATION

Project Title:	**Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico**	**Document Number:**	**140705-001-PR-CL-40002**
Owner:	**Process Engineering**	**Revision:**	**0**

Attachment B:

Groundwater data for monitoring wells

Attachment B-Groundwater Analyses
(for well cluster near proposed new extraction well)

LOCATION_CODE		KAFB-106035 – 0 - 22ft below water level											
SAMPLE_NO		GW1320			GW1454			GW1586			GW1751		
SAMPLE_DATE		16-Oct-13			27-Jan-14			9-Apr-14			15-Jul-14		
PURP		REG			REG			REG			REG		
Test Group	Units	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD
1,2-DIBROMOETHANE	ug/L	0.667		0.0188	1.42	D	0.0932	1.35	D	0.0942	0.514		0.0188
Water Chemistry													
OXIDATION-REDUCTION POTENTIAL	MV	31			-54			125					
SPECIFIC CONDUCTIVITY	US/CM	430.9			473.2			441.1					
PH	PH UNITS	7.64			9.12			7.69					
TEMPERATURE	DEG C	18.64			18.85			19.04					
TURBIDITY, NTU	NTU	1.23			1.53			0.35					
DISSOLVED OXYGEN	MG/L	5.18			3.81			4.51					
ALKALINITY, TOTAL	MG/L	140			140			148					
BROMIDE	mg/L	0.372		0.125	0.418		0.125	0.421	MJ	0.125	0.372		0.125
CHLORIDE	mg/L	31.7	M	0.33	37.6		0.33	38.6		0.33	39.2		0.33
SULFATE	mg/L	46.8	M	1	46.1		1	46.7		1	46.9		1
NITROGEN, NITRATE-NITRITE	mg/L	0.428	J	0.75	0.326	J	0.75	0.311	J	0.75	0.453	JN	0.75
ALKALINITY, BICARBONATE (AS CACO3)	mg/L	115		1	120		1	123		1	131		1
ALKALINITY, CARBONATE (AS CACO3)	mg/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
AMMONIA (AS N)	mg/L	ND	U	0.15	ND	U	0.15	ND	U	0.15	0.157	J	0.15
SULFIDE, TOTAL	mg/L	ND	U	1.69	ND	U	1.82	ND	U	1.82	0.863	J	1.96
Metals													
CALCIUM	mg/L	50.7		2	54.1		2	51.8		2	55.7		2
LEAD	mg/L	0.00215	J	0.003	ND	U	0.003	ND	U	0.003	ND	U	0.003
MAGNESIUM	mg/L	6.67		3	7.17	N	3	7.53		3	7.94		3
POTASSIUM	mg/L	2.37	J	3	2.42	NJ	3	2.44	J	3	2.57	J	3
SODIUM	mg/L	27.5		3	29.1		3	28.7		3	30.7		3
IRON, DISSOLVED	mg/L	ND	U	0.06	ND	U	0.06	ND	U	0.06	ND	U	0.06
MANGANESE, DISSOLVED	mg/L	ND	U	0.006	ND	U	0.006	ND	U	0.006	ND	U	0.006
Hydrocarbons													
DIESEL RANGE ORGANICS	mg/L	ND	U	0.198	ND	U	0.2	ND	XU	0.2	ND	U	0.204
GASOLINE RANGE ORGANICS	mg/L	ND	U	0.1	ND	U	0.1	ND	U	0.1	ND	U	0.1
VOCs													
1,1,1,2-TETRACHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
1,1,1-TRICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1,2,2-TETRACHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1,2-TRICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,3-TRICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,3-TRICHLOROPROPANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2,4-TRICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,4-TRIMETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DIBROMO-3-CHLOROPROPANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE	ug/L	0.77	J	0.5	1.32		0.5	1.18		0.5	0.658	J	0.5
1,2-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3,5-TRIMETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,4-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
2,2-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	XU	0.5	ND	U	0.5	ND	U	0.5
2-BUTANONE	ug/L	ND	U	5	ND	U	5	ND	U	5	ND	U	5
2-CHLOROTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
2-HEXANONE	ug/L	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	2.5
4-CHLOROTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
4-METHYL-2-PENTANONE	ug/L	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	2.5
ACETONE	ug/L	ND	U	5	ND	XU	5	ND	U	5	2.76	XJ	5
BENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOCHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5

Attachment B-Groundwater Analyses
(for well cluster near proposed new extraction well)

LOCATION_CODE		KAFB-106035 – 0 - 22ft below water level											
SAMPLE_NO		GW1320			GW1454			GW1586			GW1751		
SAMPLE_DATE		16-Oct-13			27-Jan-14			9-Apr-14			15-Jul-14		
PURP		REG			REG			REG			REG		
Test Group	Units	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD
BROMODICHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOFORM	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
BROMOMETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	XU	1
CARBON DISULFIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CARBON TETRACHLORIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
CHLOROFORM	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CIS-1,2-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CIS-1,3-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DIBROMOCHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DIBROMOMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DICHLORODIFLUOROMETHANE	ug/L	ND	U	1	ND	XU	1	ND	U	1	ND	U	1
ETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
HEXACHLOROBUTADIENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
ISOPROPYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
METHYL TERT-BUTYL ETHER	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
METHYLENE CHLORIDE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
NAPHTHALENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
N-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
N-PROPYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
P-ISOPROPYLTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
SEC-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
STYRENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
TERT-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TETRACHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
TOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRANS-1,2-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRANS-1,3-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRICHLOROFLUOROMETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
VINYL CHLORIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
XYLENES	ug/L	ND	U	1.5	ND	U	1.5	ND	U	1.5	ND	U	1.5

Attachment B-Groundwater Analyses
(for well cluster near proposed new extraction well)

LOCATION_CODE		KAFB-106036 -- 22 - 37 ft below water level											
SAMPLE_NO		GW1321			GW1455			GW1587			GW1752		
SAMPLE_DATE		16-Oct-13			27-Jan-14			9-Apr-14			10-Jul-14		
PURP		REG			REG			REG			REG		
Test Group	Units	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD
1,2-DIBROMOETHANE	ug/L	0.481		0.0188	0.58		0.0187	0.601		0.0189	0.493		0.0189
Water Chemistry													
OXIDATION-REDUCTION POTENTIAL	MV	76			127			217					
SPECIFIC CONDUCTIVITY	US/CM	520.6			501			485.7					
PH	PH UNITS	7.63			7.73			7.66					
TEMPERATURE	DEG C	18.86			17.79			19.24					
TURBIDITY, NTU	NTU	0.97			2.11			0.47					
DISSOLVED OXYGEN	MG/L	3.96			2.93			2.98					
ALKALINITY, TOTAL	MG/L	136			120			132					
BROMIDE	mg/L	0.538		0.125	0.5		0.125	0.458	MJ	0.125	0.473		0.125
CHLORIDE	mg/L	44.5	M	0.33	44.4		0.33	41.7		0.33	44.1		0.33
SULFATE	mg/L	64.3	M	1	59.6		1	55.6		1	58.7		1
NITROGEN, NITRATE-NITRITE	mg/L	0.798	J	0.75	0.66	J	0.75	0.55	J	0.75	0.573	NJ	0.75
ALKALINITY, BICARBONATE (AS CACO3)	mg/L	120		1	122		1	128		1	134		1
ALKALINITY, CARBONATE (AS CACO3)	mg/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
AMMONIA (AS N)	mg/L	ND	U	0.15	ND	U	0.15	ND	U	0.15	0.159	J	0.15
SULFIDE, TOTAL	mg/L	ND	U	1.69	ND	U	1.79	ND	U	1.82	ND	U	2
Metals													
CALCIUM	mg/L	63.2		2	61.1		2	58.5		2	63.2		2
LEAD	mg/L	0.00155	J	0.003	ND	U	0.003	ND	U	0.003	ND	U	0.003
MAGNESIUM	mg/L	8.3		3	8.16	N	3	8.51		3	8.87		3
POTASSIUM	mg/L	2.66	J	3	2.57	NJ	3	2.73	J	3	2.76	J	3
SODIUM	mg/L	29.6		3	29.6		3	29.8		3	32		3
IRON, DISSOLVED	mg/L	ND	U	0.06	ND	U	0.06	0.0332	J	0.06	ND	U	0.06
MANGANESE, DISSOLVED	mg/L	ND	U	0.006	ND	U	0.006	ND	U	0.006	ND	U	0.006
Hydrocarbons													
DIESEL RANGE ORGANICS	mg/L	ND	U	0.198	ND	U	0.222	ND	XU	0.196	ND	U	0.192
GASOLINE RANGE ORGANICS	mg/L	ND	U	0.1	ND	U	0.1	ND	U	0.1	ND	U	0.1
VOCs													
1,1,1,2-TETRACHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
1,1,1-TRICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	QU	0.5
1,1,2,2-TETRACHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1,2-TRICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,3-TRICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,3-TRICHLOROPROPANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2,4-TRICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,4-TRIMETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DIBROMO-3-CHLOROPROPANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE	ug/L	0.57	J	0.5	0.51	J	0.5	0.529	J	0.5	0.482	J	0.5
1,2-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3,5-TRIMETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,4-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
2,2-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	XU	0.5	ND	U	0.5	ND	U	0.5
2-BUTANONE	ug/L	ND	U	5	ND	U	5	ND	U	5	ND	U	5
2-CHLOROTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
2-HEXANONE	ug/L	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	2.5
4-CHLOROTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
4-METHYL-2-PENTANONE	ug/L	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	2.5
ACETONE	ug/L	ND	U	5	ND	XU	5	ND	U	5	ND	J	5
BENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOCHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5

Attachment B-Groundwater Analyses
(for well cluster near proposed new extraction well)

LOCATION_CODE		KAFB-106036 -- 22 - 37 ft below water level											
SAMPLE_NO		GW1321			GW1455			GW1587			GW1752		
SAMPLE_DATE		16-Oct-13			27-Jan-14			9-Apr-14			10-Jul-14		
PURP		REG			REG			REG			REG		
Test Group	Units	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD
BROMODICHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOFORM	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	QU	0.5
BROMOMETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
CARBON DISULFIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CARBON TETRACHLORIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	QU	0.5
CHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
CHLOROFORM	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CIS-1,2-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CIS-1,3-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DIBROMOCHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DIBROMOMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DICHLORODIFLUOROMETHANE	ug/L	ND	U	1	ND	XU	1	ND	U	1	ND	QU	1
ETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
HEXACHLOROBUTADIENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
ISOPROPYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
METHYL TERT-BUTYL ETHER	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
METHYLENE CHLORIDE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
NAPHTHALENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
N-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
N-PROPYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
P-ISOPROPYLTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
SEC-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
STYRENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
TERT-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TETRACHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
TOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRANS-1,2-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRANS-1,3-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRICHLOROFLUOROMETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	QU	1
VINYL CHLORIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	QU	0.5
XYLENES	ug/L	ND	U	1.5	ND	U	1.5	ND	U	1.5	ND	U	1.5

Attachment B-Groundwater Analyses
(for well cluster near proposed new extraction well)

LOCATION_CODE		KAFB-106037 – 47 to 62 ft below water level											
SAMPLE_NO		GW1322			GW1456			GW1588			GW1753		
SAMPLE_DATE		16-Oct-13			27-Jan-14			9-Apr-14			10-Jul-14		
PURP		REG			REG			REG			REG		
Test Group	Units	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD
1,2-DIBROMOETHANE	ug/L	0.23		0.0188	0.171		0.0188	0.157		0.0188	0.182		0.0184
Water Chemistry													
OXIDATION-REDUCTION POTENTIAL	MV	167			169			210					
SPECIFIC CONDUCTIVITY	US/CM	339			317.2			312.6					
PH	PH UNITS	7.65			7.75			7.7					
TEMPERATURE	DEG C	18.5			17.47			19.01					
TURBIDITY, NTU	NTU	2.34			1.66			0.46					
DISSOLVED OXYGEN	MG/L	7.05			6.6			7.83					
ALKALINITY, TOTAL	MG/L	132			128			124					
BROMIDE	mg/L	0.121		0.125	ND	U	0.125	ND	MU	0.125	0.047	J	0.125
CHLORIDE	mg/L	11.4	M	0.33	10.4		0.33	10.2		0.33	10.3		0.33
SULFATE	mg/L	36.9	M	1	33.4		1	33.1		1	33.7		1
NITROGEN, NITRATE-NITRITE	mg/L	0.306	J	0.75	ND	U	0.75	ND	U	0.75	ND	UN	0.75
ALKALINITY, BICARBONATE (AS CACO3)	mg/L	106		1	107		1	112		1	116		1
ALKALINITY, CARBONATE (AS CACO3)	mg/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
AMMONIA (AS N)	mg/L	ND	U	0.15	ND	U	0.15	ND	U	0.15	ND	U	0.15
SULFIDE, TOTAL	mg/L	ND	U	1.69	ND	U	1.79	ND	U	1.75	ND	U	2
Metals													
CALCIUM	mg/L	38.5		2	35.7		2	35.6		2	37.2		2
LEAD	mg/L	0.00157	J	0.003	ND	U	0.003	ND	U	0.003	ND	U	0.003
MAGNESIUM	mg/L	5.08		3	4.9	NJ	3	5.28		3	5.37		3
POTASSIUM	mg/L	2.12	J	3	1.97	NJ	3	2.12	J	3	2.17	J	3
SODIUM	mg/L	22.8		3	22.3		3	23.2		3	24.7		3
IRON, DISSOLVED	mg/L	ND	U	0.06	ND	U	0.06	ND	U	0.06	ND	U	0.06
MANGANESE, DISSOLVED	mg/L	ND	U	0.006	ND	U	0.006	ND	U	0.006	ND	U	0.006
Hydrocarbons													
DIESEL RANGE ORGANICS	mg/L	ND	U	0.2	ND	U	0.2	ND	XU	0.2	ND	U	0.196
GASOLINE RANGE ORGANICS	mg/L	ND	U	0.1	ND	U	0.1	ND	U	0.1	ND	U	0.1
VOCs													
1,1,1,2-TETRACHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
1,1,1-TRICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	QU	0.5
1,1,2,2-TETRACHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1,2-TRICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,1-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,3-TRICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,3-TRICHLOROPROPANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2,4-TRICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2,4-TRIMETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DIBROMO-3-CHLOROPROPANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,2-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3,5-TRIMETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,3-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
1,4-DICHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
2,2-DICHLOROPROPANE	ug/L	ND	U	0.5	ND	XU	0.5	ND	U	0.5	ND	U	0.5
2-BUTANONE	ug/L	ND	U	5	ND	U	5	ND	U	5	ND	U	5
2-CHLOROTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
2-HEXANONE	ug/L	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	2.5
4-CHLOROTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
4-METHYL-2-PENTANONE	ug/L	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	2.5
ACETONE	ug/L	ND	U	5	ND	XU	5	ND	U	5	ND	U	5
BENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOCHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5

Attachment B-Groundwater Analyses
(for well cluster near proposed new extraction well)

LOCATION_CODE		KAFB-106037 – 47 to 62 ft below water level											
SAMPLE_NO		GW1322			GW1456			GW1588			GW1753		
SAMPLE_DATE		16-Oct-13			27-Jan-14			9-Apr-14			10-Jul-14		
PURP		REG			REG			REG			REG		
Test Group	Units	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD	Result	Qual	LOD
BROMODICHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
BROMOFORM	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	QU	0.5
BROMOMETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
CARBON DISULFIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CARBON TETRACHLORIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	QU	0.5
CHLOROBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
CHLOROFORM	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CIS-1,2-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
CIS-1,3-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DIBROMOCHLOROMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DIBROMOMETHANE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
DICHLORODIFLUOROMETHANE	ug/L	ND	U	1	ND	XU	1	ND	U	1	ND	QU	1
ETHYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
HEXACHLOROBUTADIENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
ISOPROPYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
METHYL TERT-BUTYL ETHER	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
METHYLENE CHLORIDE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	U	1
NAPHTHALENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
N-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
N-PROPYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
P-ISOPROPYLTOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
SEC-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
STYRENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
TERT-BUTYLBENZENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TETRACHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	XU	0.5	ND	U	0.5
TOLUENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRANS-1,2-DICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRANS-1,3-DICHLOROPROPENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRICHLOROETHENE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
TRICHLOROFLUOROMETHANE	ug/L	ND	U	1	ND	U	1	ND	U	1	ND	QU	1
VINYL CHLORIDE	ug/L	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	QU	0.5
XYLENES	ug/L	ND	U	1.5	ND	U	1.5	ND	U	1.5	ND	U	1.5

CARBON ADSORBER DESIGN CALCULATION

Project Title:	**Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico**	**Document Number:**	**140705-001-PR-CL-40002**
Owner:	**Process Engineering**	**Revision:**	**0**

Attachment C:

Design recommendations for activated carbon

SIEMENS

"Rules of Thumb"

The following general observations offer guidelines for applying activated carbon for the adsorption of organic compounds in both liquid phase and gas phase applications. These "Rules of Thumb" should only be used as guidelines as situations that lie outside of the suggested boundary conditions may be acceptable, safe and economic under a specific set of conditions.

Gas Phase Adsorption Applications

➢Influent gas temperatures to a carbon bed should not exceed 120°F

- Higher temperatures will significantly reduce the carbon's adsorption capacity
- May cause damage to PVC internals
- May make bed hot spots and bed fires more likely

➢The total influent VOC concentration should not exceed 25% of the L.E.L. (lower explosive limit) for the compounds being adsorbed

- If influent concentrations exceed these levels, dilution air should be used

➢A good design superficial velocity for a gas phase adsorber should be between 40 – 60 fpm

- Depending on operating conditions and concentrations, a range of superficial velocities from 20 to 80 would be acceptable

➢When the influent VOC concentration exceeds 5,000 ppmv, superficial velocities <20 fpm should be avoided

➢For up flow operation, a superficial velocity of >80 fpm should be avoided to prevent bed expansion, carbon particle movement and bed "burping"

➢If ketones and similarly reactive organics are being adsorbed, intermittent and low flow conditions should be avoided

➢The use of impregnated carbons where low flow and intermittent flow conditions exist should be avoided

➢When ketones are being adsorbed and a bed hot spot develops, oxidation of the ketones on the carbon surface will take place before the carbon itself begins to burn and will result in the formation of thousands of ppms of carbon monoxide (CO)

- This formation of carbon monoxide allows a CO monitor to be used as a sensitive indicator of a bed hot spot problem

➢If high VOC concentrations are being adsorbed under low flow rate conditions, 15 to 25% water (based on carbon weight) should be added to the bed to prevent an excessive temperature rise within the carbon's principle mass transfer zone

➢When adsorbing low to moderate VOC concentrations, the relative humidity of the influent gas should be controlled so that it is less than 50%

➢The GAC loading capacities of organic compounds that have large Henry's Constants are more adversely affected by high relative humidity than are organic compounds that have small values for their Henry's Constant

- As an example, in going from a relative humidity of 50% to 95% at 10 ppmv and 90 ^{o}F, the GAC loading capacity for benzene (Henry's Constant ~ 400 atm) decreases by a factor of 2.5 while the GAC loading for hexane (Henry's Constant ~ 48,000 atm) decreases by a factor of 5.

➢In general an adsorber operating at 95% RH will require the use of 2 – 3 times more carbon when compared to an adsorber seeing the same influent VOC concentrations but operating at 40% RH

➢A reduction in the relative humidity of an air stream from >95% to <40% can be achieved by heating the air by 25 – 30 ^{o}F

➢Operating two adsorbers in a series configuration (lead/lag operation) can result in a reduction in GAC usage rates of 20 – 40% when compared to using a single adsorber

Liquid Phase Adsorption Applications

➢In order to minimize channeling, up flow operation should be used when the influent water flow rate is less than 10% of a vessel's design flow rate

- In low flow situations where there is not a significant bed pressure drop, up flow will give the best distribution of water and will significantly reduce the chances of channeling

➢Conditions for channeling and premature breakthrough during the operation of a liquid phase adsorber increase rapidly as the pressure drop across the carbon bed approaches zero

- Hydraulic loadings of <1 gpm/ft^2 do not result in a significant pressure drops across beds of 8x30 or 12x40 mesh carbons, making them susceptible to channeling

➢At ambient temperatures, a minimum soak time for a carbon bed during startup of 24 hours is required to assure >90% of a carbon's surface area is available for adsorption

➢During startup, a GAC bed that is not backwashed or back flushed after initial soaking is likely to show flow abnormalities and premature contaminant breakthrough when put into service

➢A single GAC adsorber should not be operated at an empty bed contact time (EBCT) that is less than 5 minutes

- Short contact times can lead to poor carbon utilization and early contaminant breakthrough

➢Shortening of the empty bed contact time (increasing the water flow rate) will increase the length of the mass transfer zone (MTZ) for the compounds of interest and can significantly increase GAC usage rates

➢The following are minimum suitable per vessel EBCTs for the adsorption of the listed compounds:

- BTEX - 5 to 8 minutes
- THMs - 8 to 10 minutes
- MTBE - 10 to 15 minutes – EDB not as bad as MTBE
- chlorine - 5 to 8 minutes
- chloramines - 10 to 15 minutes or longer (or until adsorped)

➢Suitable hydraulic loadings for liquid phase vessels can range from 1.5 to 9 gpm/ft^2

➢Hydraulic loadings of 3.5 to 5.0 are good design values with respect to minimizing GAC usage rates

➢Both hydraulic loading (HL) and empty bed contact time (EBCT) should be considered together when defining the operation of a liquid phase carbon adsorber

System Operation

➢For water flowing through a pipe, fluid velocities up to 5 – 6 feet/second are acceptable

- Fluid velocities of 7 to 10 feet/second are acceptable if pressure drop is not an issue

➢For sizing of ducts used in vapor phase applications, gas velocities of 3000 – 5000 fpm are acceptable

Shealy, Stuart

From: John Sherbondy <jsherbondy@tigg.com>
Sent: Monday, March 09, 2015 11:28 AM
To: Shealy, Stuart
Subject: RE: Design parameters for EDB removal

Stuart,

Responses in order:

8 to 10 min OK

1) This is fair, leaning higher as the usage rate increases, generally. We assume a mass transfer zone of about 6 minutes which leaves in this case 2-4 minutes worth of carbon for saturation.
2) We have run at 0.5 gpm/ft2 in our CP style vessels but prefer to be at 1 or higher. The only reason we go that low is the fact that we have an inlet distributor as well as a collector. If just using liquid head to distribute flow would not go below 1 gpm/ft2.

1 gpm/ft^2 OK

I am assuming this discussion is not for Kirtland as we are well above the contact time and flow velocity figures with our design.

John Sherbondy
Account Manager
Office: 800-925-0011 x102
Mobile: 412-720-4897

Learn How to Get the Most From Your Vessel's Activated Carbon Bed

www.TIGG.com

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From: Shealy, Stuart [mailto:Stuart.Shealy@CBIFederalServices.com]
Sent: Monday, March 09, 2015 11:19 AM
To: John Sherbondy
Subject: Design parameters for EDB removal

John

A couple of things I wanted to confirm.

1) I have typically used an empty bed contact time of 8 to 10 minutes to achieve 98 to 99% removal of EDB from groundwater. Does that fit with your expectation ?

2) Typically have tried to get minimum superficial velocity of 1.5 gpm/ft2 to ensure good water distribution through carbon bed. Can I go a little lower if I have to ?

Thanks

stuart

Stuart E. Shealy, PE
Senior Process Engineer 3
Technical Services
CB&I Federal Services
Tel: 865-694-7447
Cell: 865-661-7328
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CARBON ADSORBER DESIGN CALCULATION

Project Title:	**Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico**	**Document Number:**	**140705-001-PR-CL-40002**
Owner:	**Process Engineering**	**Revision:**	**0**

Attachment D:

Tigg submittals on activated carbon

and carbon adsorbers

TIGG corporation
www.TIGG.com

TIGG 5DC 1240

Virgin Liquid Phase Coconut Based Activated Carbon

DESCRIPTION

TIGG 5DC 1240 is a coconut-based activated carbon specially designed to remove low concentrations of weakly adsorbed organics from water. This activated carbon combines higher than usual microporosity with sufficient transport pores to permit superior loadings of highly soluble organics.

TYPICAL PROPERTIES	TIGG 5DC 1240
U.S Sieve, 90 wt% min	12 x 40
Iodine Number, mg/g, min	1050
Apparent Density, (dense packing)	
g/cc	0.47 - 0.52
lbs/ft^3	29 - 32
Abrasion No. - min	85

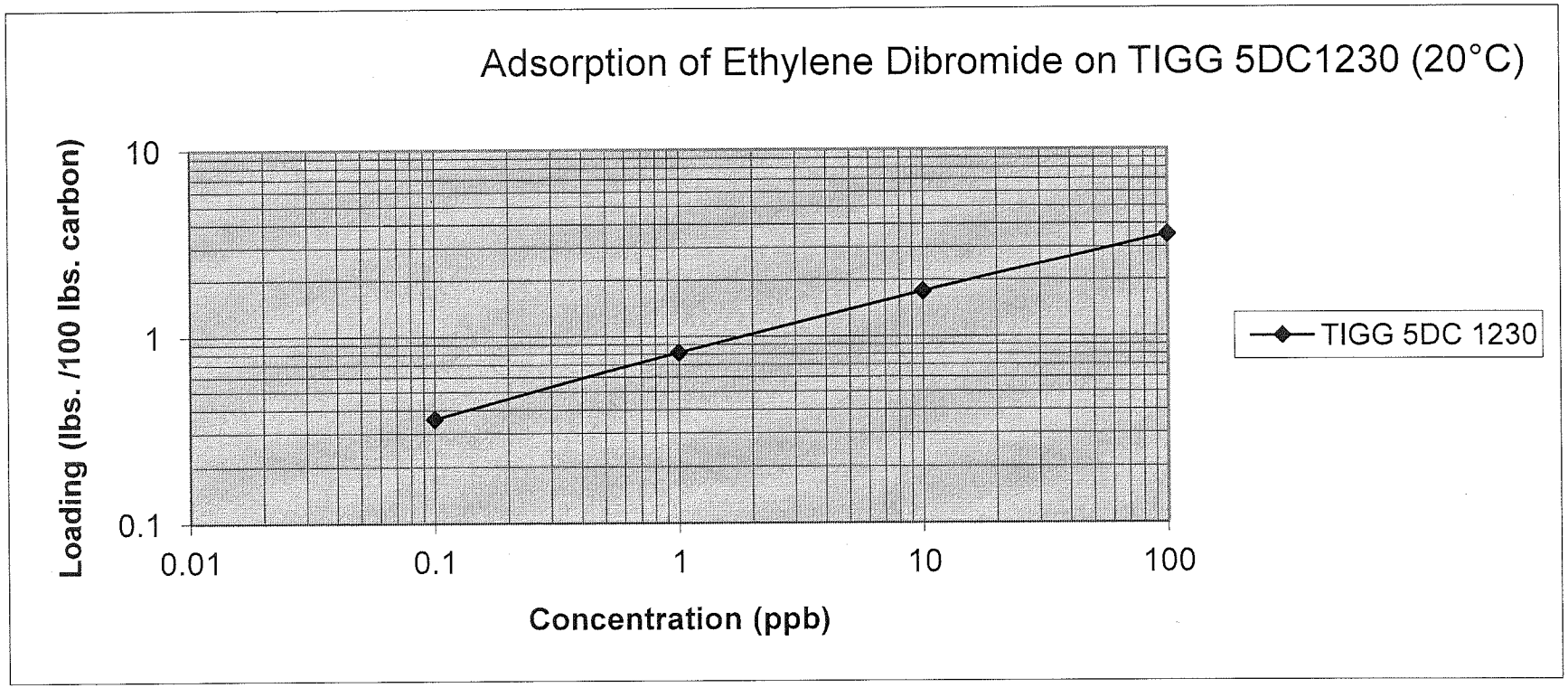
wsc 30

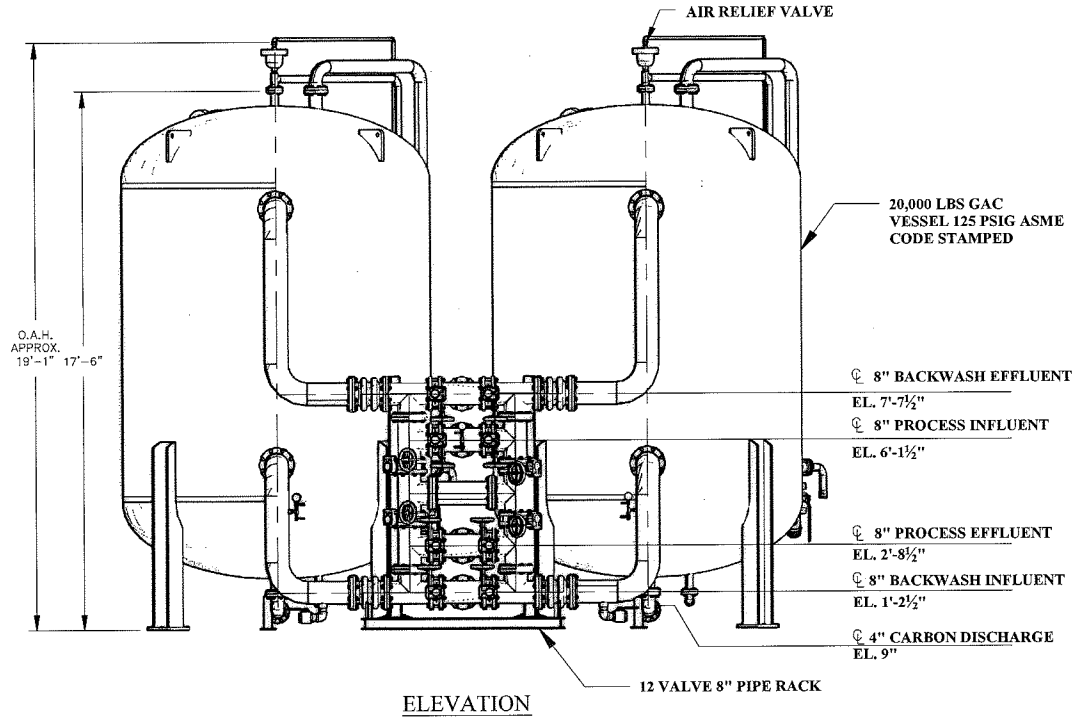
TYPICAL APPLICATIONS

This activated carbon is more cost effective than standard liquid phase carbons in removing highly soluble organics such as methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA) from water. This carbon is typically employed in an adsorber downstream of TIGG 5D 1240 or other TIGG liquid phase adsorbent which exhibits broad-spectrum purification ability.

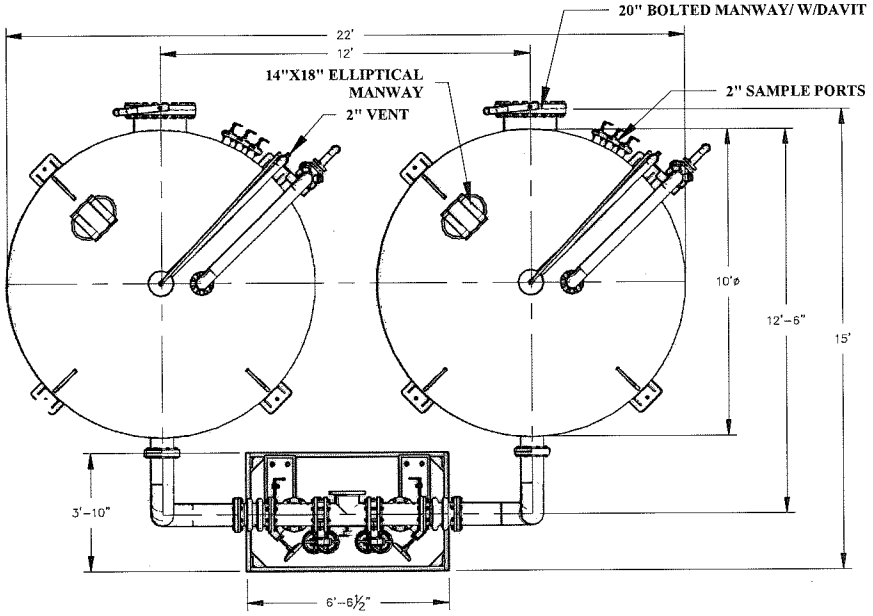
Standard packaging of the activated carbon is in 55 pound pags or 1100 pound supersaks.

Wet drained activated carbon adsorbs oxygen from the air. Therefore, when workers need to enter a vessel containing wet activated carbon, they should follow confined space/low oxygen level procedures. Activated carbon dust does not present an explosion hazard.

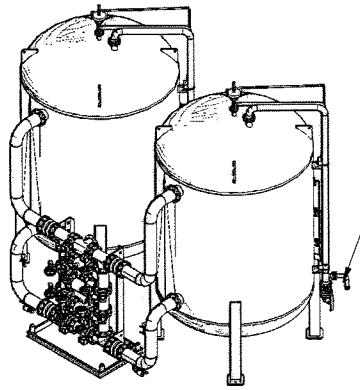

Adsorption of Ethylene Dibromide on TIGG 5DC1230 (20°C)
Loading (lbs. /100 lbs. carbon)
10
1
0.1
0.01
0.1
1
10
100
Concentration (ppb)
TIGG 5DC 1230



ELEVATION



PLAN



FOR REFERENCE ONLY

NO.	REVISION	BY	DATE
1	ADD SAMPLE PORTS TO VESSEL	RC	12/19/12

PROJECT
CP-20K-10
(SYSTEM)

PROJ. NO.	SALES
P.O. NO.	

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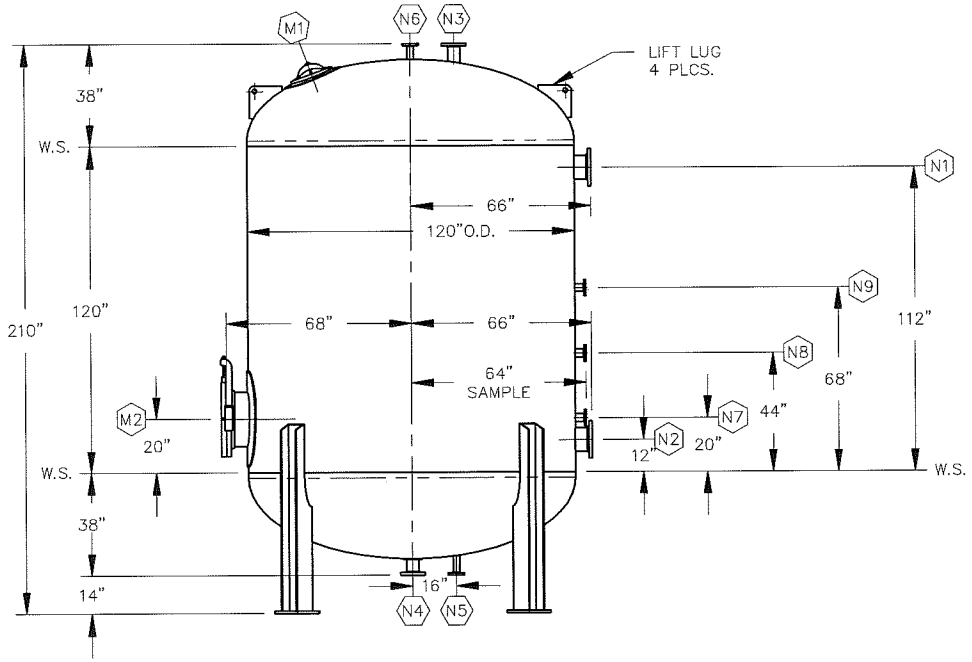
DRAWN BY	JB
DESIGN BY	JB
CHKD. BY	BB
DATE	2/9/10
SCALE	NTS

TIGG corporation

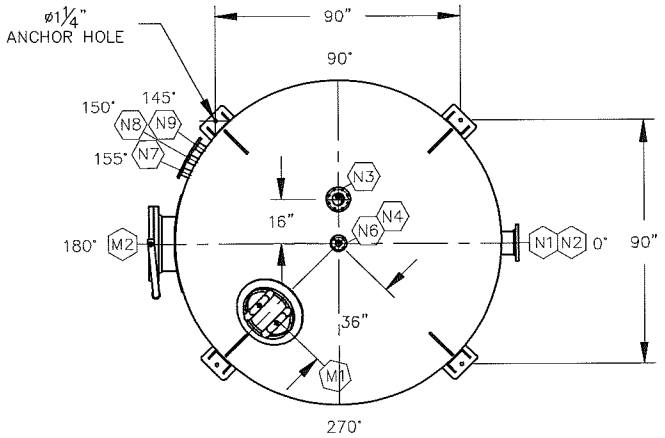
SYSTEM GENERAL ARRANGEMENT

DWG. NO. CP-20K-10-1003 REV. 1

MARK	SERVICE	DESCRIPTION	LOCATION
NOZZLE SCHEDULE			
N9	SAMPLE	2" 150# FFSO FLANGE	SHELL
N8	SAMPLE	2" 150# FFSO FLANGE	SHELL
N7	SAMPLE	2" 150# FFSO FLANGE	SHELL
N6	AIR RELIEF	2" 150# FFSO FLANGE	TOP HEAD
N5	DRAIN	2" 150# FFSO FLANGE	BOTTOM HEAD
N4	CARBON DISCHARGE	4" 150# FFSO FLANGE	BOTTOM HEAD
N3	CARBON FILL/PRES. RELIEF	4" 150# FFSO FLANGE	TOP HEAD
N2	OUTLET	8" 150# FFSO FLANGE	SHELL
N1	INLET	8" 150# FFSO FLANGE	SHELL
M2	MANWAY	20" 150# FFSO W/ DAVIT	SHELL
M1	MANWAY	14"x18" ELL. MANWAY	TOP HEAD



ELEVATION



PLAN

VESSEL STANDARDS

VESSEL MATERIALS : SA-516-70	VESSEL ACCESS : 20" BOLTED MANWAY W/ DAVIT
LINING : NSF APPROVED VINYL ESTER	LIQUID DRAIN ASSEMBLY : 2" 150# FFSO FLANGE
EXTERIOR PAINT : EPOXY BASE / URETHANE TOP COAT	TOTAL VOLUME : 1055 FT³
HEAD THICKNESS : ½" NOM.	SHIP WT. EMPTY : 11783 LBS
SHELL THICKNESS : ½" NOM.	MAX. OPERATING PRESSURE : 125 PSIG/-15 PSIG (VAC.)
INTERNALS : STAINLESS STEEL	MAX. OPERATING TEMPERATURE. : 150°F

NO.	REVISION	BY	DATE
3	UPDATE VESSEL STANDARDS	RC	5/1/13
2	ADD SAMPLE PORTS	RC	11/15/12
1	REVISE FLANGE TYPE & LINING	JB	7/5/11

PROJECT

CP-20K-10

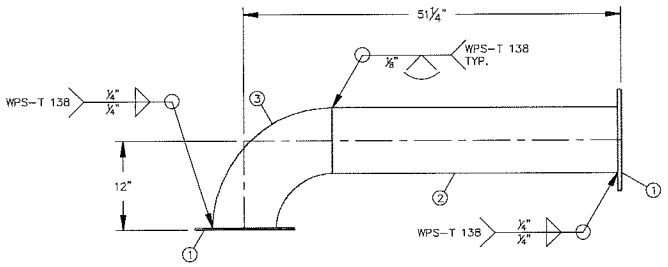
PROJ. NO.	SALES
P.O. NO.	
DRAWN BY	JB
DESIGN BY	BB
CHKD. BY	BB
DATE	2/28/11
SCALE	NTS

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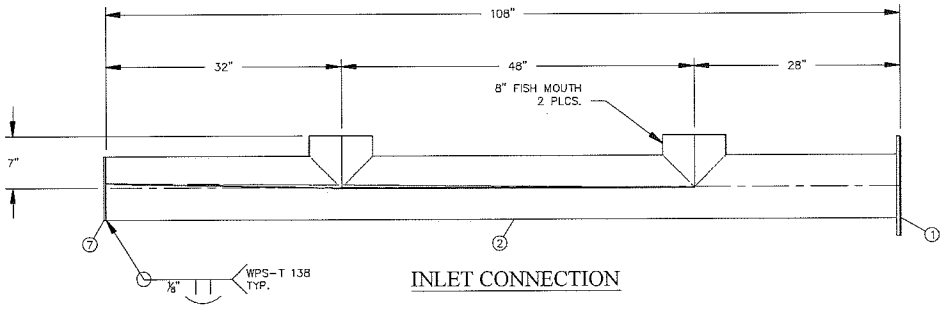
TIGG corporation

PLAN & ELEVATION

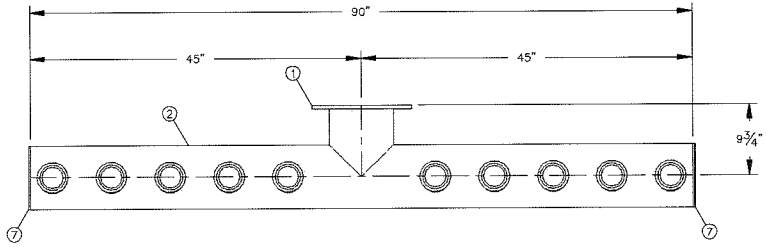
CP-20K-10-1001 REV. 3



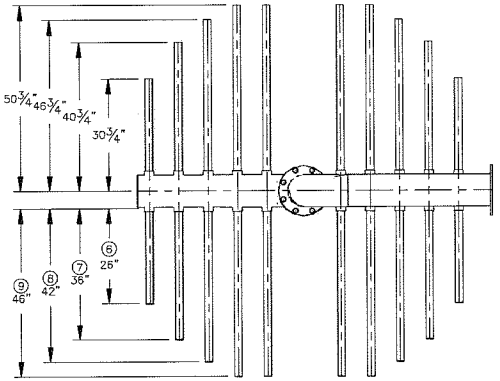
DISCHARGE FLANGE CONNECTION

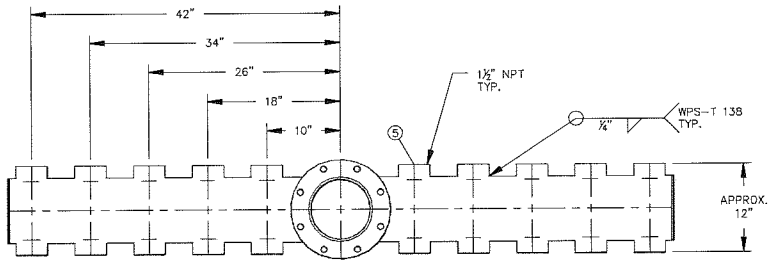


INLET CONNECTION

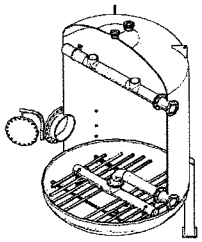


DISCHARGE LATERAL CONNECTION





DISCHARGE LATERAL CONNECTION



ITEM	QTY.	DESCRIPTION	MATERIAL
	1	8" U-BOLT	304SS
	20	1½" U-BOLT	304SS
	48	¾"ø WASHER	304SS
	24	¾"ø HEAVY HEX NUT	18-8 OR BETTER
	24	¾"ø x 2" BOLT	18-8 OR BETTER
	3	8" 150# FULL FACE GASKET	NEOPRENE
9	8	1½" WEDGE WIRE 0.010"SLOTTED PIPE 46" LONG	SA-182 304L
8	4	1½" WEDGE WIRE 0.010"SLOTTED PIPE 42" LONG	SA-182 304L
7	4	1½" WEDGE WIRE 0.010"SLOTTED PIPE 36" LONG	SA-182 304L
6	4	1½" WEDGE WIRE 0.010"SLOTTED PIPE 26" LONG	SA-182 304L
5	20	1½" NPT 3000# HALF COUPLING	SA-182 304L
4	3	8 5/16"ø x ½" END PLATE	SA-240 304L
3	1	8" SCH 10 90° LR ELBOW	SA-312 304L
2	22'	8" SCH 10 PIPE	SA-312 304L
1	4	8" 150# FABRICATED FLANGE ½" TK.	SA-240 304L

BILL OF MATERIALS

NO.	REVISION	BY	DATE

RELEASED FOR FABRICATION

PROJECT	CP-20K-10
PROJ. NO.	PLANT STANDARDS
P.O. NO.	
DRAWN BY	JB
DESIGN BY	BB
CHKD. BY	
DATE	3/11/11
SCALE	NTS

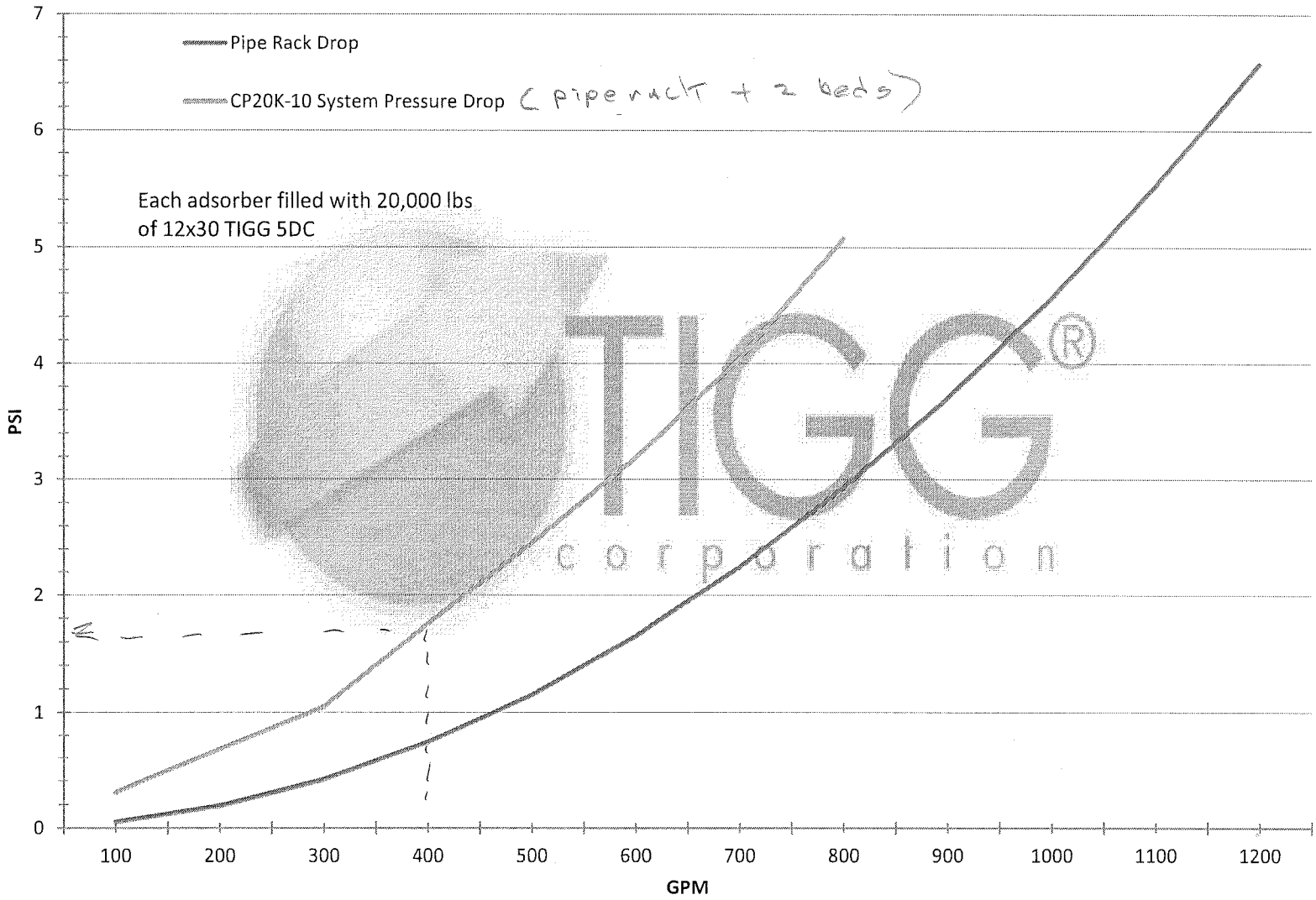
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TIGG corporation

VESSEL INTERNALS
(STAINLESS STEEL)

DWG. NO. CP-20K-10-2004(SS) REV. 0

CP20K-10 System Pressure Drop



CARBON ADSORBER DESIGN CALCULATION

Project Title:	**Mid-Plume Pump and Treat System, Kirtland Air Force Base, New Mexico**	**Document Number:**	**140705-001-PR-CL-40002**
Owner:	**Process Engineering**	**Revision:**	**0**

Attachment E:

Spreadsheet – carbon adsorber calculations

Carbon Treatment Calculations
Kirtland BFF Mid Plume Interim Measure

Calculate carbon volume needed to provide adequate contact time to remove EDB to low levels.

Flow rate, gpm	400	
Contact time, minutes	12	from assumptions
Carbon density, lb/ft3	30	
Carbon volume, ft3	642	
Carbon weight, lb	**19,251**	

Calculate bed velocity in Carbon bed

Based on needing 20,000 lbs of carbon, use a 10-ft diameter adsorber

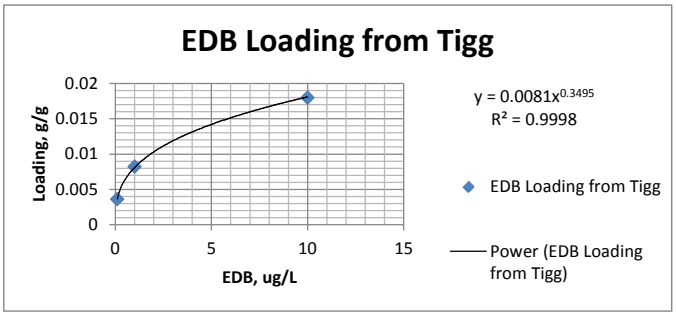
Flow rate, gpm	100	200	400
bed diameter, ft	10	10	10
Cross-sectional area, t2	78.54	78.54	78.54
hydraulic loading, gpm/ft2	1.27	2.55	5.09

loading exceeds minimum criteria of 1.0 gpm/ft2 at minimum groundwater flow of of 100 gpm.
At 400 gpm (max flow) loading is 5.1, which is good

Calculate estimated carbon consumption using loading data for EDB on carbon vs inlet concentration.

EDB Loading from Tigg

conc, ug/L	loading g EDB/g carbon
0.1	0.0036
1	0.0082
10	0.018



Carbon usage

EDB conc in GW, ug/L	2	1.5	1	0.5
loading from Tigg correllation, g EDB/g carbon	0.0103	0.0093	0.0081	0.0064
flow, gpm	400	400	400	400
EDB, lb/day	0.0096	0.0072	0.0048	0.0024
Isotherm loading correction factor	0.6	0.6	0.6	0.6
Estimated carbon loading g EDB/ g carbon	0.0062	0.0056	0.0049	0.0038
carbon, lb/day	1.6	1.3	1.0	0.6
carbon, lb/month	47	39	30	19
carbon, lb/year	567	470	361	230

APPENDIX H

GROUNDWATER TREATMENT SYSTEM OPERATIONS LOG SHEETS AND RECORD FORMS

DAILY INSPECTION FORM

Daily and Weekly Inspection Log for the Kirtland AFB GWTS

Location	Component	Item	Normal Range	Recordation Frequency	Monday __/__/__ Time:	Tuesday __/__/__	Wednesday __/__/__	Thursday __/__/__	Friday __/__/__	Saturday __/__/__	Sunday __/__/__
HMI	Well KAFB-106228	GW flow, FT-3001 (gpm)	0-200 gpm	Daily							
		Wellhead Pressure (psig)	< 150 psig	Daily							
		Water Level Above Transducer (ft)	---	Daily							
	Well KAFB-106233	GW flow, FT-7001 (gpm)	0-200 gpm	Daily							
		Wellhead Pressure (psig)	< 150 psig	Daily							
		Water Level Above Transducer (ft)	---	Daily							
	Well KAFB-106234	GW flow, FI-7002(gpm)	0-200 gpm	Daily							
		Wellhead Pressure (psig)	< 150 psig	Daily							
		Water Level Above Transducer (ft)	---	Daily							
	Well KAFB-106239	GW flow, FI-7002(gpm)	0-200 gpm	Daily							
		Wellhead Pressure (psig)	< 150 psig	Daily							
		Water Level Above Transducer (ft)	---	Daily							
	Influent Pump Skid (1)	GW flow (gpm)	0-400 gpm	Daily							
		Totalizer (1000 gal)	---	Daily							
		Bag filter differential pressure, F112A, PDI-3102A	<15 psid	Daily							
		Bag filter differential pressure, F112B, PDI-3102B	<15 psid	Daily							
	Influent Pump Skid (2)	GW flow (gpm)	0-400 gpm	Daily							
		Totalizer (1000 gal)	---	Daily							
		Bag filter differential pressure, F-212A, PDI-3202A	<15 psid	Daily							
		Bag filter differential pressure, F-212B, PDI-3202B	<15 psid	Daily							
	Eflluent Skid Pump (1)	GW flow (gpm)	0-400 gpm	Daily							
		Totalizer (1000 gal)	---	Daily							
	Eflluent Skid Pump (2)	GW flow (gpm)	0-400 gpm	Daily							
		Totalizer (1000 gal)	---	Daily							
	Injection Well 7	Pressure (psig)	0-120 psig	Daily							
		Water Level Above Transducer (ft)	10-30 ft	Daily							
	Golf Course Pond	Pond Level (ft)	0.7-3.5 ft	Daily							
HIMs	Influent Pump Skid (1)	Frequency (Hz, P112A | B)	>30 Hz	Daily	|	|	|	|	|	|	|
		Amperage (A, P112A | B)	>10 A	Daily	|	|	|	|	|	|	|
		Sand Filter Differential Pressure (psi)	>1 psi	Daily							
	Influent Pump Skid (2)	Frequency (Hz, P212A | B)	>30 Hz	Daily	|	|	|	|	|	|	|
		Amperage (A, P212A | B)	>10 A	Daily	|	|	|	|	|	|	|
		Sand Filter Differential Pressure (psi)	>1 psi	Daily							
	Effluent Pump Skid (1)	Frequency (Hz, P118)	>30 Hz	Daily							
		Amperage (A, P118)	>10 A	Daily							
	Effluent Pump Skid (2)	Frequency (Hz, P218)	>30 Hz	Daily							
		Amperage (A, P218)	>10 A	Daily							
Well Vault	KAFB-106228	Totalizer (Mgal)	---	Weekly							
		GW flow, FT-3001 (gpm)	0-200 gpm	Weekly							
Well Vault	KAFB-106239	Totalizer (Mgal)	---	Weekly							
		GW flow, FT-3001 (gpm)	0-200 gpm	Weekly							
Well Control House	KAFB-106233	Wellhead Pressure (psig)	< 150 psig	Weekly							
		GW flow, FT-7001 (gpm)	0-200 gpm	Weekly							
		Totalizer (Mgal)	---	Weekly							
	KAFB-106234	Wellhead Pressure (psig)	< 150 psig	Weekly							
		GW flow, FT-7002 (gpm)	0-200 gpm	Weekly							
		Totalizer (Mgal)	---	Weekly							
	Well Control House	Effluent Line Pressure, PI-7005	< 150 psig	Weekly							
Well Head	KAFB-7	*Totalizer (1000 gal)	---	Weekly							
		GW flow (gpm)	0-800 gpm	Weekly							

* The KAFB-7 Totalizer reading should be recorded weekly as well as on days when the effluent flow is changed between KAFB-7 and the Golf Course Main Pond.

Notes:

Daily and Weekly Inspection Log for the Kirtland AFB GWTS

Location	Component	Item	Normal Range	Recordation Frequency	Monday __/__/__ Time:	Tuesday __/__/__	Wednesday __/__/__	Thursday __/__/__	Friday __/__/__	Saturday __/__/__	Sunday __/__/__
GWTS	Influent Pump Skid (Train 1)	Inlet pressure pump skid, PI-3102 (psig)	< 60 psig	Daily							
		Bag filter differential pressure, F112A, PDI-3102A	<15 psid	Daily							
		Bag filter differential pressure, F112B, PDI-3102B	<15 psid	Daily							
		Sand filter differential pressure, SF-101 (1)	---	Daily							
		Sand filter differential pressure, SF-101 (2)	---	Daily							
		Outlet pressure pump skid, PI-3103 (psig)	< 60 psig	Daily							
		GW flow (gpm)	0-500 gpm	Daily							
		Totalizer (Mgal)	---	Daily							
		Bag filters changed?	yes/no	Daily							
	Influent Pump Skid (Train 2)	Inlet pressure pump skid, PI-3202 (psig)	< 60 psig	Daily							
		Bag filter differential pressure, F212A	<15 psid	Daily							
		Bag filter differential pressure, F212B	<15 psid	Daily							
		Sand filter differential pressure, SF-201 (1)	---	Daily							
		Sand filter differential pressure, SF-201 (2)	---	Daily							
		Outlet pressure pump skid,PI-3203, (psig)	< 60 psig	Daily							
		GW flow (gpm)	0-500 gpm	Daily							
		Totalizer (Mgal)	---	Daily							
		Bag filters changed?	yes/no	Daily							
	GAC (Train 1)	V-114A Pressure, PI-3104A (psig)	0-20 psig	Daily							
		Between Tanks, PI-3105 (psig)	0-20 psig	Daily							
		V-114B Pressure, PI-3104B (psig)	0-20 psig	Daily							
		Which Tank is Lead?	---	Daily							
		Which Tank is Lag?	---	Daily							
	GAC (Train 2)	V-214A Pressure (psig)	0-20 psig	Daily							
		Between Tanks (psig)	0-20 psig	Daily							
		V-214B Pressure (psig)	0-20 psig	Daily							
		Which Tank is Lead?	---	Daily							
		Which Tank is Lag?	---	Daily							
	Effluent Pump Skid (Train 1)	Inlet press. pump skid, PI-3108 (psig)	< 60 psig	Daily							
		Bag filter differential pressure, F-118A	<15 psid	Daily							
		Bag filter differential pressure, F-118B	<15 psid	Daily							
		Upstream outlet press. pump tree (psig)	< 60 psig	Daily							
		GW flow (gpm)	0-500 gpm	Daily							
		Totalizer (Mgal)	---	Daily							
	Effluent Pump Skid (Train 2)	Inlet press. pump skid, PI-3208 (psig)	< 60 psig	Daily							
		Bag filter differential pressure, F-218A	<15 psid	Daily							
		Bag filter differential pressure, F-218B	<15 psid	Daily							
		Upstream outlet press. pump tree (psig)	< 60 psig	Daily							
		GW flow (gpm)	0-500 gpm	Daily							
		Totalizer (Mgal)	---	Daily							
	Backwash System	Clarifier Level (ft)	---	Daily							
		Clarifier Discharged to Sump?	yes/no	Daily							
	Sodium Hypochlorite Generator	Upstream Filter Pressure (psi)	>30 psig	Daily							
		Downstream Filter Pressure (psi)	>30 psig	Daily							
		Brine Tank Filled with Salt?	yes/no	Daily							
		Generator Inlet Pressure (psi)	>30 psig	Daily							
		Generator Faulted?	yes/no	Daily							
		Oxidant Tank Level (ft)	>2 ft	Daily							
		Train 1 Dosing Pump Faulted?	yes/no	Daily							
		Train 2 Dosing Pump Faulted?	yes/no	Daily							
		Train 1 Free Chlorine (ppm)	0.1 - 0.3 ppm	Daily							
		Train 2 Free Chlorine (ppm)	0.1 - 0.3 ppm	Daily							

Notes:

WEEKLY INSPECTION FORM

KAFB BFF: Weekly Inspection Form for GWTS

Train: _____

Groundwater Feed (tank, feed pumps and pre-filter)	Condition	Inspector	Date/Time
Pipes, fittings and instruments free of leaks			
Feed pump seals free of leaks			
Pump vibration normal (i-ALERT®)			
Oil reservoir for feed pumps full			
Pump oil has been changed within last 90 days			
Filter housing gaskets free of leaks			
Filter differential pressure less than 15 psi			
Vent air from top of filter housings			
Notes:			

Carbon Adsorbers	Condition	Inspector	Date/Time
Pipes, fittings and instruments free of leaks			
Pressure drop less than 15 psig for each bed			
Vent air from top of carbon beds			
Notes:			

Treated Water Discharge (tank, feed pumps and post-filter)	Condition	Inspector	Date/Time
Pipes, fittings and instruments free of leaks			
Treated water discharge pump seal free of leaks			
Pump vibration normal (i-ALERT®)			
Oil reservoir for feed pump full			
Pump oil has been changed within last 90 days			
Filter housing gaskets free of leaks			
Filter differential pressure less than 15 psi			
Vent air from top of filter housings			
Notes:			

Calrifier and Backwashing Lines	Condition	Inspector	Date/Time
Pipes, fittings and instruments free of leaks			
Notes:			

MONTHLY INSPECTION FORM

Monthly Operation and Maintenance Inspections
Vaults

Wellhead Vault KAFB-106228	Condition	Inspected by	Date/Time
wellhead vault dry and free of debris			
Air relief valve (ARV-3005) outlet clear			
Pressure in double wall pipe interstitial space (PI-3002) is near zero after ventvalve is opened for 2 minutes and then closed			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables, vault cover and seals intact			
Locks on electrical shed and panels intact			

Valve Vault KAFB-106228 (Louisiana inside base fence)	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Air relief valve (ARV-3008) outlet clear			
Pressure in double wall pipe interstitial space (PI-3003) is near zero after ventvalve is opened for 2 minutes and then closed			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables, vault cover and seals intact			

Wellhead Vault KAFB-106233	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Air relief valve (ARV-4001) outlet clear			
Pressure in double wall pipe interstitial space (PI-4001) is near zero after ventvalve is opened for 2 minutes and then closed			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables, vault cover and seals intact			

Wellhead Vault KAFB-106234	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Air relief valve (ARV-5001) outlet clear			
Pressure in double wall pipe interstitial space (PI-5001) is near zero after ventvalve is opened for 2 minutes and then closed			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables, vault cover and seals intact			

Air Release Valve Vault - Eastern Avenue	Condition	Inspected by	Date/Time
wellhead vault dry and free of debris			
Air relief valve (ARV-6001 and ARV-6002) outlets clear			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables intact			
Vault cover and seals intact			

Wellhead Vault KAFB-106239	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Pressure in double wall pipe interstitial space (PI-?001) is near zero after ventvalve is opened for 2 minutes and then closed			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables, vault cover and seals intact			

Junction Vault KAFB-106239 (Ridgecrest inside base fence)	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables, vault cover and seals intact			

Well Control House (WCH) - Gibson Avenue (inside base fence)	Condition	Inspected by	Date/Time
WCH dry and free of debris			
Air relief valve (ARV-3008) outlet clear			
Pressure in double wall pipe interstitial spaces (PI-7001 and PI-7002) is near zeroafter space is vented at wellhead.			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables intact			

Monthly Operation and Maintenance Inspections
Vaults

Valve Vault WCH to GWTS (Louisiana inside base fence)	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Air relief valve (ARV-8001) outlet clear			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables intact			

Air Relief Valve Vaults on Discharge line (on base)	Condition	Inspected by	Date/Time
Vault dry and free of debris			
Air relief valve outlets clear			

KAFB Well 7 Wellhead	Condition	Inspected by	Date/Time
Well 7 flowmeter vault dry and free of debris			
Air relief valve (ARV-9012) outlet clear			
V-Smart valve hydraulic oil reservoir full			
Piping, valves and electrical boxes are free of leaks and external corrosion			
Electrical cables intact			
Filter pressure reading within green on dial			
Oil temperature between 90-110 degrees Farenheit			
Oil clear and without solids			

Golf Course Main Pond	Condition	Inspected by	Date/Time
GCMP water level consistent with HMI			
Discharge line clear of obstruction(s)			

Monthly Operation and Maintenance Inspections
Vaults

Date/Inspected by:	Flowmeters										
Flowmeter Inspection Items	**FIT- 3001**	**FIT- 7001**	**FIT- 7002**	**FIT-**	**FIT- 3102**	**FIT- 3108**	**FIT- 3202**	**FIT- 3208**	**FIT- 3120**	**FIT- 3120**	**KAFB-7**
Flow reading operational											
PLC totalizer functional											
No moisture in readout											
Free of mechanical damage											
Readings consistent with past operations											

FE/FIT- 3001, located in KAFB-106228 well vault. Magmeter (flow and totalizer) that measures well flow to the GWTS.
FE/FIT- 7001, located in well control house. Magmeter (flow and totalizer) that measures well flow to the GWTS.
FE/FIT- 7002, located in well control house. Magmeter (flow and totalizer) that measures well flow to the GWTS.
FE/FIT- , located in KAFB-106239 well vault. Magmeter (flow and totalizer) that measures well flow to the GWTS.
FE/FIT- 3102, located on the Train 1 feed pump skid in the treatment building. Magmeter (flow and totalizer) that measures flow from the feed tank to carbon beds.
FE/FIT- 3108, located on the Train 1 discharge pump skid in the treatment building. Magmeter (flow and totalizer) that measures flow from the treated water tank to discharge line.
FE/FIT- 3202, located on the Train 2 feed pump skid in the treatment building. Magmeter (flow and totalizer) that measures flow from the feed tank to carbon beds.
FE/FIT- 3208, located on the Train 2 discharge pump skid in the treatment building. Magmeter (flow and totalizer) that measures flow from the treated water tank to discharge line.
FI/FQI- 3120, located on the effluent bypass in the treatment building. Turbine meter (local) with analog flow rate and mechanical totalizer readout in increments of 100 gallons. Measures water volume discahrged to the truck bay.
FI/FQI-KAFB-7, located in existing vault near KAFB-7. Turbine meter with analog flow rate and mechanical totalizer readout in increments of 1,000 gallons. Measures injection volume into KAFB-7.

MISCELLANEOUS OPERATIONS AND MAINTENANCE FORM

Miscellaneous Operations and Maintenance Activities

FILTER PACK TAGGING FORM

Filter Pack Tagging						
Well		KAFB-106228	KAFB-106233	KAFB-106234	KAFB-106239	Notes
January	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
February	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
March	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
April	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
May	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
June	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
July	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
August	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
September	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
October	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
November	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					
December	Date/Time					
	WL Depth (ft)					
	Filter Pack Depth (ft)					

bgs = below ground surface
ft = feet
NM = not measured

Filter pack tagging tool reference points

Top black mark =	Top black mark =	432 ft
Red mark =	Red mark =	429.5 ft
Bottom black mark =	Bottom black mark =	428 ft

SHUTDOWN LOG

Kirtland AFB GWTS System Shutdown Log

Date of shutdown	Time of shutdown	Date of restart	Time of restart	Was system completely shut down?	If No, which equipment was shut down?	Reason for shutdown
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		
				YES □ NO □		

IDW DISPOSAL FORM

KAFB BFF: IDW Disposal Form

Sample Quarter	Collection Date	Well ID	Container Type	# of Containers	Estimated Volume	Disposal Date	Disposal Location	Initials	Notes

LOCKOUT TAGOUT FORM

KAFB BFF: GWTS Lockout/Tagout Form

Tagged by:	Date/Time Tagged	Equipment	Date/Time Removed:	Notes:

VFD PERFORMANCE LOG

Weekly VFD Performance and Temperature Log

Date:															
VFD	**Flowrate (gpm)**	**Hertz**	**Amps**	**Flowrate (gpm)**	**Hertz**	**Amps**	**Flowrate (gpm)**	**Hertz**	**Amps**	**Flowrate (gpm)**	**Hertz**	**Amps**	**Flowrate (gpm)**	**Hertz**	**Amps**
P-112A															
P-112B															
P-212A															
P-212B															
P-118															
P-218															
KAFB-106239															

Date:										
Location	**Max VFD Temp (°C)**	**Motor End Temp (°C)**	**Max VFD Temp (°C)**	**Motor End Temp (°C)**	**Max VFD Temp (°C)**	**Motor End Temp (°C)**	**Max VFD Temp (°C)**	**Motor End Temp (°C)**	**Max VFD Temp (°C)**	**Motor End Temp (°C)**
P-112A										
P-112B										
P-212A										
P-212B										
P-118										
P-218										
KAFB-106239		NA		NA		NA		NA		NA

temp = temperature

ANNUAL ALARM VERIFICATION

Annual Alarm Verification

Alarm Condition	System Effect	Alarm Reported to HMI and Remotely Notified	Pass/Fail	Date	Time	Operator	Notes
Extraction Wells							
Well KAFB-106228 Vault, Leak Detect							
Well KAFB-106228 Conveyance Line, Leak Detect							
Well KAFB-106228 Louisiana Vault, Leak Detect							
Well KAFB-106228 Louisiana Conveyance Line, Leak Detect							
Well KAFB-106223 Vault, Leak Detect							
Well KAFB-106223 Conveyance Line, Leak Detect							
Well KAFB-106234 Vault, Leak Detect							
Well KAFB-106234 Conveyance Line, Leak Detect							
Well KAFB-106233/4 Louisiana Vault, Leak Detect							
Eastern Avenue Vault, Leak Detect							
Well Control House Building, Leak Detect							
Well Control House Conveyance Line, Leak Detect							
Well KAFB-106239 Vault, Leak Detect							
Well KAFB-106239 Conveyance Line, Leak Detect							
Well KAFB-106239 Vault, Door Open							
Well KAFB-106239 Louisiana Vault, Leak Detect							
Extraction Well KAFB-106228 Pump Failure							
Extraction Well KAFB-106228 Level Low							
Extraction Well KAFB-106233 Pump Failure							
Extraction Well KAFB-106233 Level Low							
Extraction Well KAFB-106234 Pump Failure							
Extraction Well KAFB-106234 Level Low							
Extraction Well KAFB-106239 Pump Failure							
Extraction Well KAFB-106239 Level Low							

Annual Alarm Verification

Alarm Condition	System Effect	Alarm Reported to HMI and Remotely Notified	Pass/Fail	Date	Time	Operator	Notes
GWTS Train 1							
Influent Pump P-112A Failure							
Influent Pump P-112A Communication Failure							
Influent Pump P-112B Failure							
Influent Pump P-112B Communication Failure							
Influent Train 1 Bag Filter Differential Switch High							
Influent Train 1 Skid Pressure Switch High							
Train 1 Dosing Pump Level Switch Low							
Influent Tank TK-110 Level Switch High							
Influent Tank TK-110 Level Switch Low							
Train 1 Sand Filter Backwash							
Carbon Absorber V-114AB Pressure Switch High							
Effluent Train 1 Skid Press Switch High							
Effluent Pump P-118 Failure							
Effluent Pump P-118 Communication Failure							
Treated Water Tank TK-116 Level Switch High							
Treated Water Tank TK-116 Level Switch Low							
Train 1 Not in Process Mode							

Annual Alarm Verification							
Alarm Condition	System Effect	Alarm Reported to HMI and Remotely Notified	Pass/Fail	Date	Time	Operator	Notes
GWTS Train 2							
Influent Pump P-212A Failure							
Influent Pump P-212A Communication Failure							
Influent Pump P-212B Failure							
Influent Pump P-212B Communication Failure							
Influent Train 2 Bag Filter Differential Switch High							
Influent Train 2 Discharge Pressure Switch High							
Train 2 Dosing Pump Level Switch Low							
Influent Tank TK-210 Level Switch High							
Influent Tank TK-210 Level Switch Low							
Train 2 Sand Filter Backwash							
Carbon Absorber V-214AB Pressure Switch High							
Effluent Train 2 Skid Press Switch High							
Effluent Pump P-218 Failure							
Effluent Pump P-218 Communication Failure							
Effluent Tank TK-216 Level Switch High							
Effluent Tank TK-216 Level Switch Low							
Train 2 Not in Process Mode							

Annual Alarm Verification							
Alarm Condition	System Effect	Alarm Reported to HMI and Remotely Notified	Pass/Fail	Date	Time	Operator	Notes
Distribution							
Effluent Downstream Pressure High							
Golf Course Pond Level High							
KAFB-7 Level High							
KAFB-7 Hydraulic Pump Failure							

Annual Alarm Verification							
Alarm Condition	System Effect	Alarm Reported to HMI and Remotely Notified	Pass/Fail	Date	Time	Operator	Notes
GWTS Buildings							
Internal Sump							
External Sump							
Interior E-stop							
Exterior E-stop							
Well Control House E-stop							
Intrusion							

ANNUAL FLOW METER VERIFCATION

Flow Meter Calibration Verification									
Flow Meter	**Date**	**Start Time**	**Initial Tank Level**	**End Time**	**Final Tank Level**	**Calculated Flow Rate**	**Flow Meter Reading**	**Operator**	**Notes**
KAFB-106228									
KAFB-106233									
KAFB-106234									
KAFB-106239									
Train 1 Influent									
Train 1 Effluent									
Train 2 Influent									
Train 2 Effluent									
Dust Suppression									
KAFB-7									

APPENDIX J

SAMPLING AND ANALYSIS PLAN

Sampling and Analysis Plan

This Sampling and Analysis Plan describes sampling activities intended for monitoring the groundwater treatment system (GWTS) located at Kirtland Air Force Base (AFB), New Mexico. These activities are to occur whether the GWTS is discharging to irrigation, injection well(s), and/or other approved discharge locations.

J.1 Discharge Requirements

Treated groundwater discharged from the GWTS must comply with Section 6.2.3.1 (Cleanup Levels for Contaminated Groundwater [other than Perchlorate]) of the Kirtland AFB Hazardous Waste Treatment Facility Permit Number NM9570024423 (New Mexico Environment Department [NMED], 2010). These cleanup levels are equivalent to the New Mexico Water Quality Control Commission water quality standards (20.6.2.3103 and 20.6.2.4103 New Mexico Administrative Code) and the drinking water maximum contaminant levels adopted by U.S. Environmental Protection Agency (EPA) under the Federal Safe Drinking Water Act (42 U.S. Code §§ 300f to 300j-26). If both a New Mexico Water Quality Control Commission standard and maximum contaminant levels have been established for a contaminant, then the more stringent of the two cleanup levels shall be defined as the discharge limit for GWTS effluent.

Effluent discharged from the GWTS must not exceed the following criteria as currently stipulated in Discharge Permit DP-1839 (NMED, 2017) from which the aforementioned regulations are cited:

- Ethylene dibromide (EDB) – 0.05 micrograms per liter (µg/L)
- Benzene – 5 µg/L
- Ethylbenzene – 700 µg/L
- Toluene – 750 µg/L
- Total xylenes – 620 µg/L
- Iron (dissolved) – 1 milligram per liter (mg/L)
- Manganese (dissolved) – 0.2 mg/L.

J.2 Sample Locations and Sampling Interval

J.2.1 Extraction Wells

All four of the extraction wells are capable of being sampled individually. The sample will be collected from the sample valve in the wellhead vault and/or collected at the sample valves located in the well control house just downstream of the flowmeter for each well. When groundwater from a new extraction well is first introduced to the GWTS, monitoring of the GWTS treated effluent shall occur daily for the first week of treatment, weekly for the first month of treatment, and monthly thereafter for EDB; benzene, toluene, ethylbenzene, and total xylenes (BTEX); dissolved iron; and manganese (Section J.2.2). Prior to initial discharge of treated effluent from a newly installed well to KAFB-7 or other injection well, appropriate documentation will be submitted to NMED demonstrating that the treated effluent is at or below the effluent standards.

All extraction wells are sampled annually in the second quarter of the calendar year at a minimum. Sampling of individual extraction wells is also required when the combined influent concentrations increase more than 35 percent, the same range as a field duplicate, from the previous month's results for any of the monitored contaminants. This applies unless the samples are collected during an operational change condition that impacts influent concentrations, such as during partial operation of the extraction

well network, or if analyte concentrations are below the effluent discharge criteria concentrations provided in DP-1839 (NMED, 2017). In the event that the combined influent samples are collected during an operational change condition, sampling of individual extraction wells is required when the combined influent concentrations increase more than 35 percent from the maximum results for any of the monitored contaminants from either the combined influent or individual wells over the previous four quarters and exceed the effluent discharge criteria concentrations provided in DP-1839 (NMED, 2017).

J.2.2 Treatment System

Samples will be collected at a minimum of monthly at three locations from each treatment train in the GWTS to monitor the performance of the carbon treatment system (Table L-1). These monthly samples will be collected at the outlet of the influent pumps, prior to the pretreatment bag filters, at the outlet of the first or lead carbon vessel, and at the outlet of the effluent pumps prior to the post-treatment bag filters.

After a monthly sampling event has taken place, and the samples have been analyzed, if a sample taken between the granular activated carbon (GAC) vessels (outlet of the first carbon vessel) is shown to be detect of EDB, a special procedure will be followed that includes an additional sampling port during the next month's sampling event. This port shall be a vertical port on the lag GAC vessel of the train with the detected EDB. A flowchart describing this procedure is provided in Attachment L-1.

In addition to the monthly sampling, samples will be collected annually and once every 5 years for the analytes listed on Table L-1. The annual and 5-year samples are collected from both influent and effluent skids (4 sample locations) of the GWTS but not between the GAC vessels. Any analytes detected in the samples collected as part of the 5-year sampling event will be added to the annual sampling list. The most recent 5-year sampling event occurred in the third quarter of 2017. The next 5-year sampling event will need to take place in the third quarter of 2022.

In the event that equipment modifications are made to the GWTS, such as the beginning of operation of a new extraction well, treatment train, or changing out GAC, samples will be collected from the three locations from each treatment train daily for the first 7 days, then weekly until the end of the first month, and monthly thereafter. The same effluent sampling schedule will be implemented in the event that conditions at the GWTS are believed to be potentially impacting GWTS effluent water quality.

Prior to discharging treated water from a new extraction well to any permitted injection well, NMED will be supplied with adequate documentation showing that the treated effluent produced from this new extraction well meets the effluent discharge criteria provided in Section J.1.

J.2.3 Non-Extraction Well Influent Monitoring

Non-extraction well water (e.g., investigation-derived wastewater from drilling and sampling at Kirtland AFB Bulk Fuels Facility, GAC backwash water, etc.) from the groundwater monitoring network can be introduced as influent to the GWTS for treatment and discharged to an approved location. Appendix K of the Operations and Maintenance Plan contains operational models of the GWTS that determine, under specific flow conditions, acceptance criteria of non-extraction well water for treatment by the GWTS. In order to meet the acceptance criteria for treatment, the water must be characterized for EDB, BTEX, dissolved iron, and manganese. Water that has not been characterized or does not meet the requirements provided in Appendix K of the Operations and Maintenance Plan is not acceptable for treatment and disposal through the GWTS (as described in Section 6 of the Operations and Maintenance Plan).

J.3 Sampling Procedure

Samples will be collected from their respective sampling ports by opening the port and discharging process water into the sampling containers. The port will be opened in such a way that it does not readily cause entraining of air and subsequent off-gassing of the samples and will not cause loss of sample preservatives from sample containers. Waste containers will be placed under sampling ports prior to sampling to ensure capture of all process water. Excess water collected in the waste containers will be emptied into the GWTS building sump for treatment.

Field filtering for dissolved metals will be performed by affixing a clean piece of poly tubing onto the sampling port. The inline 0.45-micron field filter will be attached to the open end of the poly tubing. The port will then be opened so as to condition the poly tubing and filter with process water for approximately 30 seconds. Samples will then be collected from the process water flowing through the filter. All process water not collected in the sample container will be collected into an appropriate waste container and then discharged to the GWTS building sump for treatment.

J.4 Field Measurements

Field parameters including temperature, turbidity, specific conductance, and pH will be collected in the field using water quality and turbidity meters. See Table L-2 for field meter calibration requirements and associated corrective actions. Free chlorine concentration will be measured with an inline chlorine analyzer for influent measurements and a handheld colorimeter or chlorine test strips for mid-GAC, effluent, or extraction well measurements. See Table L-6 for field measurement frequency.

J.5 Field Quality Control Samples

Field quality control (QC) samples will be collected in association with the GWTS sampling to ensure field sample collection and analytical precision and representativeness. Field duplicate samples will be collected each month, year, and 5-year sampling event from an effluent sample and shipped to the laboratory for the same analyses as the associated parent sample. In addition, trip blank samples for EDB, BTEX, and volatile organic compounds will accompany each shipment of GWTS samples to the laboratory to monitor for volatile organics contamination during sampling, sample shipping, and storage of samples at the laboratory. Matrix spike/matrix spike duplicates will also be collected in conjunction with each sampling event. Field blank samples for volatile organic compounds will be collected as deemed necessary based on site conditions at the time of sample collection.

J.6 Sample Bottles, Preservation, and Shipping

Water samples collected from the GWTS will be collected and analyzed in accordance with EPA guidelines for analytical methods and parameters, sample containers, sample preservation, and sample preparation and analysis holding times presented on Table L-3.

Sample packaging and shipping requirements are designed to maintain sample integrity from the time a sample is collected until it is received at the analytical laboratory. All chain-of-custody forms, sample labels, custody seals, and other sample documents will be completed. Specific procedures for packaging and shipping of environmental samples are presented below:

- A sample label, completed with indelible ink, will be attached to the sample bottle.
- A cooler will be used as a shipping container.

- In preparation for shipping samples, the drain plug will be taped shut so that no fluids, such as melted ice, will drain out of the cooler during shipment. A large plastic bag may be used as a liner for the cooler. Ice will be placed at the bottom of the cooler.

- The containers will be placed in the lined cooler. Cardboard separators or bubble wrap may be placed between the containers at the discretion of the shipper.

- All samples for chemical analysis must be shipped cooled to ≤6 degrees Celsius with ice. All samples will require icing before shipment. A temperature blank will be included in each shipment of samples.

- The liner will be taped closed, if used, and sufficient packing material will be used to prevent sample containers from making contact or rolling around during shipment.

- A copy of the chain-of-custody form will be placed inside the cooler.

- The cooler will be closed and taped shut with clear packing tape.

- Custody seals will be placed on the cooler. Clear tape will be placed over the custody seals to help prevent them from being accidentally torn or ripped off.

- The cooler of samples will be shipped via an overnight carrier. A copy of the shipping bill will be retained for the field records and sent electronically to the project chemist.

J.7 Laboratory Analyses and Methods

Information regarding analytical methods, reporting limits, and project screening levels are listed in Table L-4.

J.8 Data Validation

All samples collected for permit compliance will be reviewed using established data validation procedures to perform EPA Stage 3 data review on 100 percent of data. The data review will be performed using the (QC) criteria specified in the following analytical method and data validation guidelines, or the most recent updates to these documents:

- Project-specific Quality Assurance Project Plan

- Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (2013)

- EPA Test Methods for Evaluating Solids Waste, Physical/Chemical Methods (SW 846, Third Edition and updates) (EPA, 2006)

- EPA Methods for Chemical Analysis of Water and Wastes (EPA, 1983 and Update)

- Standard Methods for Examination of Water and Wastewater, 22nd Edition (American Public Health Organization, 2005)

- EPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review (EPA, 2014a)

- EPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review (EPA 2014b).

The following QC elements will be included in the EPA Stage 3 data review:

- Sample extraction and analysis holding times
- Laboratory method blanks
- Surrogate spike recoveries
- Laboratory control sample/laboratory control sample duplicate recoveries
- Matrix spike/matrix spike duplicate recoveries
- Relative percent difference
- Initial calibrations
- Continuing calibrations
- Trip blank results
- Field duplicate sample precision.

Data will be validated and flagged with the data qualifiers found in Table L-5 as applicable:

As a result of the data validation process, EPA qualifiers will be generated and applied to the affected sample results that exceeded the established QC criteria. EPA Stage 3 data review findings will be summarized and documented with each quarterly monitoring report.

J.9 Data Analysis and Reporting Triggers

When BTEX and EDB analytical results from water samples collected between the GAC vessels reach 90 percent of any of the project screening levels (Section J.1), the flow will be switched between the lead and lag GAC vessels and the GAC in the former lead GAC will be scheduled for change-out. If dissolved iron and manganese concentrations reach 90 percent of the project screening levels (Section J.1) downstream of the sand filters, then the sand filter catalytic media will need to be replaced.

J.10 Reporting

J.10.1 Compliance

Compliance reporting will occur quarterly in the respective Quarterly Reports. The Quarterly Report is submitted 90 days after the conclusion of the quarter in which the quarterly groundwater sampling event occurred. These quarterly reports include quarterly and cumulative operational run-time; cumulative EDB removal; quarterly and cumulative treated investigation-derived waste purge water to irrigation, injection well(s), or other discharge location; groundwater treated; analytical sampling results of the GWTS (e.g., influent, between the GAC tanks, and treated effluent); major maintenance activities (e.g., GAC changes, pump changes, etc.); mechanical integrity test results of effluent conveyance line and injection wells; significant system alarms or shutdowns for more than 48 hours; and groundwater potentiometric elevation map(s).

J.10.2 Exceedance

As soon as Kirtland AFB has knowledge that effluent water quality exceeds the discharge criteria for one or more of the contaminants listed in approved permits, the NMED Hazardous Waste Bureau and Ground Water Quality Bureau must be notified. Any actions that can be taken to correct the problem and achieve the required effluent concentrations will be performed immediately. Following plant operational adjustments, the effluent groundwater will be re-tested, and the monitoring frequency will be increased to weekly. After 4 consecutive weeks where the analytical results are below the standards for the discharge permit analytes listed in Section J.1, monitoring will return to a monthly frequency.

If the required actions are considered to be outside the scope of work for plant operations, then the system will be shut down pending submittal of a corrective action plan to NMED.

REFERENCES

American Public Health Organization. 2005. *Standard Methods for the Examination of Water and Wastewater, 22nd Edition.*

Department of Defense (DoD). 2013. *Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0.* July.

(U.S.) Environmental Protection Agency (EPA). 1983. *Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.*

EPA. 2006. *Solid Waste SW-846 Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, Third Edition and Updates.*

EPA. 2014a. *EPA National Functional Guidelines for Superfund Organic Methods Data Review EPA-540-R-014-002.* Office of Superfund Remediation and Technology Innovation. August.

EPA. 2014b. *EPA National Functional Guidelines for Inorganic Superfund Data Review, EPA-540-R-013-001.* Office of Superfund Remediation and Technology Innovation. August.

New Mexico Environment Department (NMED). 2010. Hazardous Waste Treatment Facility Operating Permit, EPA ID Number NM9570024423, Issued to U.S. Air Force for the Open Detonation Unit Located at Kirtland Air Force Base, Bernalillo County, New Mexico, by the New Mexico Environment Department Hazardous Waste Bureau. July.

NMED. 2017. *Discharge Permit Issuance, DP-1839, Kirtland Air Force Base*. Ground Water Quality Bureau. April.

TABLES

Table J-1
Groundwater Treatment System Monitoring Requirements

Analysis	Analytes	Frequency[a]	Sample Location
EPA Method SW8011	EDB	Monthly	Influent, between tanks, and effluent
EPA Method SW8260C	Benzene, ethylbenzene, toluene, and xylenes	Monthly	
EPA Method SW6010C	Dissolved iron and dissolved manganese	Monthly	
EPA Method E300.0A	Chloride and sulfate	Annually[b]	Trains 1 and 2 – influent and effluent
	Chloride, sulfate, fluoride	5-year[c]	
EPA Method E353.2	Nitrogen (nitrate-nitrite)	Annually[b]	Trains 1 and 2 – influent and effluent
EPA Method SW8260C[(b)]		Annually[b]	Trains 1 and 2 – influent and effluent
EDB – Method SW8011		Annually[b]	Trains 1 and 2 – influent and effluent
SVOCs – Method SW8270D[(b)]		Annually[b]	Trains 1 and 2 – influent and effluent
Total phenol – E420.4		Annually[b]	Trains 1 and 2 – influent and effluent
Cyanide (free) – OIA-1677-09		Annually[b]	Trains 1 and 2 – influent and effluent
Total mercury – SW7470A		5-year[c]	Trains 1 and 2 – influent and effluent
Total and dissolved metals – SW6010C/SW6020A[(c)]		5-year[c]	Trains 1 and 2 – influent and effluent
Total and dissolved metals – SW6010C/SW6020A[(d)]		Geochemical modeling[d]	Trains 1 and 2 – influent and effluent
Total and dissolved silica – SM4500-SiO2 C-1997		Geochemical modeling[d]	Trains 1 and 2 – influent and effluent
Carbonate alkalinity – SM2320B		Geochemical modeling[d]	Trains 1 and 2 – influent and effluent
Dissolved organic carbon – SM5310 C-2000		Geochemical modeling[d]	Trains 1 and 2 – influent and effluent

a. Sampling frequency will be increased (daily, weekly, etc.) during shakedown testing of new components.
b. List of analytes per the Kirtland Air Force Base Discharge Permit DP-1839, Table 3, Annual Monitoring Constituent List.
c. List of analytes per the Kirtland Air Force Base Discharge Permit DP-1839, Table 4, Five-year Monitoring Constituent List. The next 5-year sampling event must take place in Q3 2022.
d. List of analytes per the Kirtland Air Force Base Discharge Permit DP-1839, Table 5, Geochemical Modeling Analyte List.

E = EPA Methods for Chemical Analysis of Water and Wastes, 1983 and Updates.
EDB = Ethylene dibromide.
EPA = U.S. Environmental Protection Agency.
OIA = EPA Office of International Affairs Method OIA-1677-09, 2010.
SM = American Public Health Organization Standard Methods for the Examination of Water and Wastewater, 22nd Edition.
SVOC = Semivolatile organic compound.
SW = EPA SW-846-Test Methods for Evaluating Solid Waste, 3rd Edition, 1986 and Updates.
VOC = Volatile organic compound.

Table J-2
Field Instrument Quality Control

Field Equipment	Calibration Verification Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference
YSI (or equivalent) water quality meter with flow cell	Check calibration against two of the following three traceable standards with nominal pH of 4.0, 7.0, and 10.0 Check calibration of outside of range -10–60 ºC (14–140 ºF)	Calibrate probe once per week and then verify once per day before first use	± 0.2 pH units	Recalibrate	Field personnel	Manufacturer's Operation Manual
	Check calibration against specific conductance standard Check calibration of outside of range -10–60 ºC (14–140 ºF)	Calibrate probe once per week and then verify once per day before first use	± 0.5 percent of standard value or 0.0001 millisiemens per centimeter, whichever is greater	Recalibrate	Field personnel	Manufacturer's Operation Manual
Turbidity Meter	Calibrate with primary standard of 10 nephelometric turbidity units	Calibrate every 3 months; verify once a week reading is within acceptable value	±10 percent	Recalibrate	Field personnel	Manufacturer's Operation Manual

°C = Degree Celsius.
°F= Degree Fahrenheit.

Table J-3
Analytical Parameter, Method, Sample Container, Preservation, and Holding Time Requirements

Parameter	Preparation/ Analysis Method	Bottle Type	Preservative	Preparation Holding Time	Analytical Holding Time
Volatile Organic Compounds and BTEX	SW5030B/8260C	3 x 40-ml glass VOA vials	HCl to pH <2; Cool ≤6°C	NA	14 days
Ethylene dibromide	SW8011	2 x 40-ml glass VOA vials	HCl to pH <2; Cool ≤6°C	NA	14 days
Semivolatile Organic Compounds	SW3510C/8270D	2 x 250-ml amber	Cool ≤6°C	7 days	40 days
Total and dissolved metals	SW3005A/6010C; SW3020A/6020A	1 x 250-ml HDPE	HNO3 to pH <2; Cool ≤6°C	NA	180 days
Total mercury	SW7470A	1 x 250-ml HDPE	HNO3 to pH <2; Cool ≤6°C	NA	28 days
Total and dissolved silica	SM4500-SiO2 C-1997	1 x 250-ml HDPE	Cool ≤6°C	NA	28 days
Anions (chloride, sulfate, fluoride	E300.0A	2 x 40-ml VOA vials	Cool ≤6°C	NA	28 days
Nitrate-nitrite nitrogen	E353.2	1 x 250-ml HDPE	H_2SO4 to pH<2; Cool to 6°C	NA	28 days
Total phenol	E420.4	1 x 250-ml glass	H2SO4 to pH<2; Cool to 6°C	NA	28 days
Cyanide (free)	OIA-1677-09	1 x 250-ml glass	NaOH to pH>12; Cool to 6°C	NA	14 days
Carbonate alkalinity	SM2320B	1 x 250-ml HDPE	Cool to 6°C	NA	14 days
Dissolved organic carbon	SM5310 C-2000	2 x 40-ml VOA vials	Cool to 6°C	NA	28 days

°C = Degree Celsius.
BTEX = Benzene, toluene, ethylbenzene, and xylenes.
E = EPA Methods for Chemical Analysis of Water and Wastes, 1983 and Updates.
H2SO4 = Sulfuric acid.
HCl = Hydrochloric acid.
HDPE = High density polyethylene.
HNO3 = Nitric acid.
ml = Milliliter.
NA = Not applicable.
NaOH = Sodium hydroxide.
OIA = EPA Office of International Affairs Method OIA-1677-09, 2010.
SM = American Public Health Organization Standard Methods for the Examination of Water and Wastewater, 22nd Edition.
SW = U.S. Environmental Protection Agency SW846 – Test Methods for Evaluating Solid Waste, Third Edition and Updates.
VOA = Volatile organics analysis.

TABLE J-4
Analytical Parameter, Analyte Reporting Limits, and Screening Criteria for Water

Analyte	Analytical Method	CASRN	Units	NMWQCC[1]	EPA MCL[2]	Project Screening Level[3]	Achievable Laboratory Limits[4]		
							LOQ	LOD	DL
Volatile Organic Compounds									
1,1,2,2-Tetrachloroethane	SW8260C	79-34-5	µg/L	10	NS	10	1.0	1.0	0.5
1,1,2-Trichloroethane	SW8260C	79-00-5	µg/L	10	5.0	5.0	1.0	1.0	0.5
1,1-Dichloroethane	SW8260C	75-34-3	µg/L	25	NS	25	1.0	1.0	0.5
1,2-Dibromoethane (EDB)	SW8011	106-93-4	µg/L	0.1	0.05	0.05	0.03	0.02	0.01
1,2-Dichloroethane	SW8260C	107-06-2	µg/L	10	5.0	5.0	1.0	1.0	0.5
Benzene	SW8260C	71-43-2	µg/L	10	5.0	5.0	1.0	1.0	0.5
Chloroform	SW8260C	67-66-3	µg/L	100	80	80	1.0	1.0	0.5
cis-1,2-Dichloroethene	SW8260C	156-59-2	µg/L	NS	70	70	1.0	1.0	0.5
Dibromochloromethane	SW8260C	124-48-1	µg/L	NS	80	80	1.0	1.0	0.5
Ethylbenzene	SW8260C	100-41-4	µg/L	750	700	700	1.0	1.0	0.5
Methyl tert-Butyl Ether (MTBE)	SW8260C	1634-04-4	µg/L	NS	NS	NS	1.0	1.0	0.5
Methylene Chloride	SW8260C	75-09-2	µg/L	100	5.0	5.0	4.0	4.0	2.0
Naphthalene[5]	SW8260C	91-20-3	µg/L	30	NS	30	5.0	2.0	1.0
Tetrachloroethene (PCE)	SW8260C	127-18-4	µg/L	20	5.0	5.0	1.0	1.0	0.5
Toluene	SW8260C	108-88-3	µg/L	750	1000	750	1.0	1.0	0.5
Trichloroethene (TCE)	SW8260C	79-01-6	µg/L	100	5.0	5.0	1.0	1.0	0.5
m,p-Xylene	SW8260C	179601-23-1	µg/L	NS	10,000	10,000	1.0	1.0	0.5
o-Xylene	SW8260C	95-47-6	µg/L	NS	10,000	10,000	1.0	1.0	0.5
Xylene (Total)	SW8260C	1330-20-7	µg/L	620	10,000	620	1.0	1.0	0.5
Semivolatile Organic Compounds									
bis(2-Ethylhexyl)phthalate	SW8270D	117-81-7	µg/L	NS	6	6	5	4	2
1-Methylnaphthalene[5]	SW8270D	90-12-0	µg/L	30	NS	30	0.5	0.2	0.1
2-Methylnaphthalene[5]	SW8270D	95-95-4	µg/L	30	NS	30	0.5	0.2	0.1
Naphthalene[5]	SW8270D	91-20-3	µg/L	30	NS	30	0.5	0.4	0.1
Pyrene	SW8270D	129-00-0	µg/L	NS	NS	120	0.5	0.4	0.1

TABLE J-4
Analytical Parameter, Analyte Reporting Limits, and Screening Criteria for Water

Analyte	Analytical Method	CASRN	Units	NMWQCC[1]	EPA MCL[2]	Project Screening Level[3]	Achievable Laboratory Limits[4]		
							LOQ	LOD	DL
Metals - Total and dissolved									
Aluminum	SW6010C	7429-90-5	mg/L	5.0	NS	5.0	0.400	0.400	0.0870
Antimony	SW6020A	7440-36-0	mg/L	NS	0.006	0.006	0.002	0.001	0.00033
Arsenic	SW6020A	7440-38-2	mg/L	0.1	0.01	0.01	0.004	0.002	0.00054
Barium	SW6010C	7440-49-3	mg/L	1.0	2.0	1.0	0.010	0.0063	0.0003
Beryllium	SW6020A	7440-41-7	mg/L	NS	0.004	0.004	0.001	0.00013	0.00007
Cadmium	SW6020A	7440-43-9	mg/L	0.01	0.005	0.005	0.001	0.005	0.00023
Calcium	SW6010C	7440-70-2	mg/L	NS	NS	NS	0.004	0.050	0.033
Chromium	SW6020A	7440-47-3	mg/L	0.05	0.1	0.05	0.004	0.002	0.0007
Copper	SW6010C	7440-50-8	mg/L	1.0	1.3	1.0	0.02	0.005	0.0025
Iron	SW6010C	7439-89-6	mg/L	1.0	NS	1.0	0.4	0.05	0.033
Lead	SW6020A	7439-92-1	mg/L	0.05	0.015	0.015	0.002	0.00025	0.00013
Magnesium	SW6010C	7439-95-4	mg/L	NS	NS	NS	0.2	0.05	0.017
Manganese	SW6010C	7439-96-5	mg/L	0.2	NS	0.2	0.01	0.0013	0.0008
Mercury (total)	SW7470A	7439-97-6	mg/L	0.002	0.002	0.002	0.0002	0.0001	0.00005
Potassium	SW6010C	7440-09-7	mg/L	NS	NS	NS	1.0	5.0	0.192
Selenium	SW6020A	7782-49-2	mg/L	0.05	0.05	0.05	0.004	0.001	0.0005
Silver	SW6020A	7440-22-4	mg/L	0.05	NS	0.05	0.001	0.00025	0.00011
Sodium	SW6010C	7440-23-5	mg/L	NS	NS	NS	2.0	0.5	0.167
Strontiuim	SW6020A	7440-24-6	mg/L	NS	NS	NS	0.002	0.002	0.000436
Thallium	SW6020A	7440-28-0	mg/L	NS	0.002	0.002	0.001	0.00025	0.00015
Uranium	SW6020A	NS	mg/L	0.03	0.03	0.03	0.0005	0.0002	0.0000618
Zinc	SW6010C	7440-66-6	mg/L	10	NS	10	0.04	0.01	0.0039
Miscellaneous									
Alkalinity, carbonate	SM2320B	NS	mg/L	NS	NS	NS	2	2	0.7
Chloride	E300.0A	16887-00-6	mg/L	250	NS	250	2.0	2.0	1.0
Cyanide (free)	OIA-1677-09	57-12-5	mg/L	0.2	0.2	0.2	0.006	0.006	0.002
Dissolved organic carbon	SM5310 C-2000	NS	mg/L	NS	NS	NS	1.0	1.0	0.5
Fluoride	E300.0A	16984-48-8	mg/L	1.6	NS	1.6	0.5	0.5	0.25
Nitrate-nitrite nitrogen[6]	E353.2	84145-82-4	mg/L	10	10	10	1.0	0.1	0.04
Silica	SM4500-SiO2 C-1997	7631-86-9	mg/L	NS	NS	NS	0.4	0.4	0.1
Sulfate	E300.0A	18785-72-3	mg/L	600	250	250	5.0	5.0	1.5
Total phenols	E420.4	108-95-2	mg/L	0.005	NS	0.04	0.04	0.04	0.015

TABLE J-4
Analytical Parameter, Analyte Reporting Limits, and Screening Criteria for Water

[1] NMWQCC standards per the New Mexico Administrative Code Title 20.6.2.3101A, Standards for Ground Water of 10,000 mg/L Total Dissolved Solids Concentration or Less (NMAC 2004). For metals, the NMWQCC standard applies to dissolved metals and total mercury.

[2] EPA National Primary Drinking Water Regulations, Maximum Contaminant Levels and Secondary Maximum Contaminant Levels, Title 40 Code of Federal Regulations Part 141, 143 (May 2009).

[3] The project screening level was selected to satisfy the requirements of the Kirtland Air Force Base Hazardous Waste Permit Number NM9570024423 as the lowest of (1) NMWQCC standard or (2) EPA MCL. If no MCL or NMWQCC standard exists for any analyte, then the project screening level will be the EPA Tapwater Regional Screening Level. Project screening levels below the LOD are highlighted and the screening level is set at the LOQ.

[4] Achievable laboratory limits are for Eurofins Lancaster Laboratories Environmental, LLC, Lancaster Pennsylvania.

[5] NMWQCC specifies a standard for the sum of naphthalene and mononaphthalenes (1-methylnaphthalene and 2-methylnaphthalene). Conservatively, this standard is shown for each of the three compounds.

[6] The MCL for nitrate is 10 mg/L.

µg/L = Microgram(s) per liter.

CASRN = Chemical Abstracts Service Registry Number.

DL = Detection limit.

E = EPA Methods for Chemical Analysis of Water and Wastes, 1983 and Updates.

EPA = U.S. Environmental Protection Agency.

LOD = Limit of detection.

LOQ = Limit of quantitation.

MCL = Maximum Contaminant Level.

mg/L = Milligram(s) per liter.

NMWQCC = New Mexico Water Quality Control Commission.

NS = Not specified.

SW = EPA SW846 - Test Methods for Evaluating Solid Waste, Third Edition and Updates.

Table J-5
Data Qualification Flags and Reason Codes

Qualifier	Definition
	No Qualifier indicates that the data are acceptable both qualitatively and quantitatively.
U	The analyte was analyzed for but was not detected above the reported limit of quantitation.
J	The analyte was analyzed for and was positively identified, but the reported numerical value may not be consistent with the amount actually present in the environmental sample. Results are estimated, although the data are considered usable and may be used as appropriate to meet project objectives. Results are qualitatively acceptable and quantitatively uncertain.
J-	The analyte was positively identified; the associated numerical value is its approximate concentration with a low bias in the sample.
J+	The analyte was positively identified; the associated numerical value is its approximate concentration with a high bias in the sample.
UJ	The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Re-sampling and re-analysis may be necessary to confirm or deny the presence of the analyte. Results are rejected, and data are unusable for any purposes.

Table J-6
Field Measurement Frequency

Field Equipment	Values Measured (Units)	Frequency	Sample Locations
YSI (or equivalent) water quality meter with flow cell	Temperature (°C) Saturated DO (%) DO (mg/L) Specific Conductance (µS/cm) pH ORP (mV)	Concurrently with monthly, annual, and 5-year GWTS samples; with annual extraction well samples; as needed	Influent, mid-GAC, effluent sampling ports; extraction well sampling ports; any location as needed.
Turbidity Meter	Turbidity (NTU)	Concurrently with monthly, annual, and 5-year GWTS samples; with annual extraction well samples; as needed	Influent, mid-GAC, effluent sampling ports; extraction well sampling ports; any location as needed
Handheld Colorimeter (0-2 mg/L)	Free chlorine (mg/L)	As needed	Influent, mid-GAC, effluent sampling ports; extraction well sampling ports; any location as needed
Chlorine Test Papers (0-200 mg/L)	Free chlorine (mg/L)	As needed	Influent, mid-GAC, effluent sampling ports; extraction well sampling ports; any location as needed
Inline Influent Chlorine Analyzer (0-5 mg/L)	Free chlorine (mg/L)	Continuous	Permanently inline with influent, pre-influent pump skid

°C = Degree Celsius
DO = dissolved oxygen
GAC = granular activated carbon
GWTS = groundwater treatment system
µS/cm=micro Siemens per centimeter
mg/L=milligrams per liter
mV=millivolts
NTU=Nephelometric Turbidity Units
ORP=oxidation-reduction potential

APPENDIX K

WASTE CHARACTERIZATION DOCUMENTATION

BAG FILTER DISPOSAL APPROVAL

From:	Simpler, Trent SPA
To:	Jercinovic, Devon; Phaneuf, Mark J SPA; Dreeland, Linda SPA; Sanchez, Amy E. SPA; Adria Bodour; BITNER, LUDIE W GS-13 USAF AFCEC/CZO; Vic Branson; Amdurer, Mike; Tarbert, Jason A
Subject:	Bag filters
Date:	Thursday, June 09, 2016 7:50:47 AM

Devon and Mike,

We spoke with Katrina and she is good with us throwing the bag filters away. There is no official reply.

Consider this your approval to put used bag filters in the dumpster.

Trent

Trent Simpler, P.E.
Project Manager BFF
Chair Wind Energy CX
Red Team LGL
US Army Corps of Engineers
Trent.Simpler@usace.army.mil
505-342-4823 (office)
505-301-6996 (Blackberry)

HAZARDOUS WASTE PROCESS DESCRIPTION

ORGANIZATION CODE & UEC NAME:

WASTE COLLECTION SITE ID (IAP#):

SHOP CODE:

BUILDING NUMBER/LOCATION: Building 19150 Bulk Fuels Facility Groundwater Treatment System (GWTS)

DATE: 4/27/16

D**ESCRIPTION OF PROCESS:**
Bag filters are located at both the inlet and outlet of the granular-activated carbon beds at the GWTS to remove suspended solids resulting from groundwater extraction, and fines released from the activated carbon beds. During normal operation of the GWTS, bag filters are replaced on an as-needed basis, or semiannually as required in the *Operation and Maintenance Manua*l, *Mid-Plume Pump and Treat System* (USACE, 2016).

WASTE DESCRIPTION:
Non-hazardous solid waste. See Attachment 1 for a description of how the waste was characterized, and Attachment 2 for the analytical data.

LIST MATERIALS AND NSNs SPECIFIC TO THIS PROCESS:
Used bag filters (10 micron size #2, 7-inch by 32-inch) stored in DOT-approved 55-gallon drums

IS THIS A NEW PROCESS? YES____X____ NO_____
DESCRIBE ANY CHANGES MADE TO PROCESS SINCE LAST EVALUATION
(If no change, a negative response is required)
N/A

PREPARER'S NAME, JOB TITLE, PHONE NUMBER, & SIGNATURE
(This person must be actively involved in the process)

I certify that to the best of my knowledge and belief, all of the process description information contained herein is accurate and complete. Caitlin Q. LaChance

Signature of Person Actively Involved in the Process
Caitlin LaChance, Scientist
505-262-8942

PLEASE include, if applicable:

- Any T. O. or other references related to the process;

- A diagram of the process; and
- Any comments relevant to process description not otherwise included.

****FOR HAZARDOUS WASTE PERSONNEL USE ONLY****

ASSIGNED WASTE PROFILE:_____

COMMENTS: _____

Attachment 1: Bag Filter Waste Characterization and Request for Disposal

Background

Kirtland Air Force Base (KAFB) is investigating and remediating a historical release of aviation gasoline and jet fuel from the Bulk Fuels Facility (BFF) pursuant to the Resource Conservation and Recovery Act (RCRA) corrective action provisions in Part 6 of KAFB's Hazardous Waste Treatment Facility Operating Permit (HWTF Permit No. NM9570024423). The HWTF Permit is enforced by the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB).

KAFB is currently implementing an ethylene dibromide (EDB) groundwater treatment interim measure (IM) in accordance with Part 6.2.2.2.12 of the HWTF Permit. The EDB plume IM consists of extraction wells and treatment with granulated activated carbon (GAC) at the Groundwater Treatment System (GWTS) facility. The groundwater treated at the GWTS is non-hazardous. The treated effluent from the system is non-detect for all fuel-related constituents.

Bag filters are located at both the inlet and outlet of the GAC beds at the GWTS to remove suspended solids resulting from groundwater extraction, and fines released from the GAC beds. During normal operation of the GWTS, bag filters are replaced on an as-needed basis, or semiannually as required in the *Operation and Maintenance Manua*l, *Mid-Plume Pump and Treat System* (USACE, 2016). The waste was accumulated from January 1, 2016 through April 12, 2016. Currently, the waste is being stored on-site in a 55-gallon drum and requires disposal.

Waste Characterization

A generator may use testing, acceptable knowledge (i.e.: process knowledge), or a combination of the two to satisfy its RCRA waste characterization responsibilities (40 CFR 262.11). Waste characterization requirements are detailed in Part 2.6 of the HWTF Permit. Part 2.6.2 states that "Acceptable knowledge may be used as the sole method to characterize waste only when the waste is from a process that is consistent and well-documented".

The influent and effluent from the GWTS meets this permit requirement for the use of acceptable knowledge as the sole method to characterize the inlet and outlet bag filters. As stated above, the influent to the treatment system that goes through the inlet bag filters is nonhazardous and contains no constituents other than EDB above applicable groundwater standards. The treated groundwater that goes through the outlet bag filters has no detectable fuel constituents and meets drinking water quality standards.

Analytical results from two extraction wells (KAFB-106233 and KAFB-106234) and GWTS influent and effluent samples were evaluated as part of the acceptable knowledge review for the inlet filters. The extraction well groundwater and GWTS samples were analyzed for EDB, benzene, toluene, ethylbenzene, total xylenes, dissolved manganese, and dissolved iron. Benzene is the only analyte in this analytical suite that has an established toxicity characteristic standard (500 micrograms per liter; Title 40 Code of Federal Regulations Part 264.24, Table 1). As shown in Attachment 2, benzene concentrations were non-detect for all samples taken for the treatment system, and therefore below the established toxicity characteristic standard.

Conclusion

The totality of the acceptable knowledge demonstrates that the inlet and outlet bag filters are not hazardous waste; therefore, the waste is considered to be non-hazardous. The used bag filters are also not considered to be special waste, as defined in 20.9.7.S(13) NMAC. If the concentrations of contaminants in the system increase to a level at or above the regulatory limits, this process will be reevaluated and revised to comply with disposal requirements.

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-INF		GWTS-GAC1		GWTS-EFF		GWTS-INF		GWTS-GAC1	
				SAMPLE NO	GWTS-INF-0001		GWTS-GAC1-0001		GWTS-EFF-0001		GWTS-INF-0002		GWTS-GAC1-0002	
				SAMPLE DATE	12/16/2015		12/16/2015		12/16/2015		12/18/2015		12/18/2015	
				SAMPLE TIME	16:00		16:00		16:00		14:15		14:25	
				SAMPLE DAY	Wednesday		Wednesday		Wednesday		Friday		Friday	
				DAY NUMBER	1		1		1		2		2	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	12/18/2015		12/18/2015		12/18/2015		12/20/2015		12/20/2015	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	0.194	0.03	ND	0.03	ND	0.03	0.18	0.0281	ND	0.0288
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	0.316J	1	ND	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1	ND	1	ND	1
	XYLENES	NE	620	10000	0.918J	3	ND	3	ND	3	2.89J	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	36.8J	100	ND	100	ND	100	239	100	ND	100
	MANGANESE, DISSOLVED	NE	200	NE	ND	15	5.02J	15	3.55J	15	15.5	15	5.46J	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-	-	-	-	-
Field Data														
	Temperature (Deg.C)	---	---	---	17.48		17.33		13.78		17		16.4	
	Spec. Conductivity (us/cm)	---	---	---	354.2		373.5		609		393		388	
	pH	---	---	---	8.1		9.1		8.5		7.82		8.86	
	ORP (mV)	---	---	---	214		225		231		79.9		117.4	
	DO (mg/L)	---	---	---	6.91		0.57		7.53		7.64		1.48	

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-EFF		GWTS-INF		GWTS-GAC1		GWTS-EFF		GWTS-INF	
				SAMPLE NO	GWTS-EFF-0002		GWTS-INF-0003		GWTS-GAC1-0003		GWTS-EFF-0003		GWTS-INF-0004	
				SAMPLE DATE	12/18/2015		21-Dec-15		21-Dec-15		21-Dec-15		22-Dec-15	
				SAMPLE TIME	14:35		12:15		12:30		12:40		15:20	
				SAMPLE DAY	Friday		Monday		Monday		Monday		Tuesday	
				DAY NUMBER	2		3		3		3		4	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	12/20/2015		12/23/2015		12/23/2015		12/23/2015		12/24/2015	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	ND	0.0284	0.195	0.0281	ND	0.0282	ND	0.028	0.182	0.0283
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	ND	1	ND	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1	ND	1	ND	1
	XYLENES	NE	620	10000	1.08J	3	ND	3	ND	3	ND	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	81.2J	100	37.3J	100	ND	100	30.4J	100	ND	100
	MANGANESE, DISSOLVED	NE	200	NE	4.3J	15	ND	15	5.56J	15	5.87J	15	ND	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-	-	-	-	-
Field Data														
	Temperature (Deg.C)	---	---	---	14.7		18.3		17.3		16.3		19.3	
	Spec. Conductivity (us/cm)	---	---	---	542		387		388		434		397	
	pH	---	---	---	8.02		7.64		8.7		8.17		8.2	
	ORP (mV)	---	---	---	175.5		181.3		177		154.1		265.5	
	DO (mg/L)	---	---	---	6.54		7.95		3.16		6.62		7.42	

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-GAC1		GWTS-EFF		GWTS-INF		GWTS-GAC1		GWTS-EFF	
				SAMPLE NO	GWTS-GAC1-0004		GWTS-EFF-0004		GWTS-INF-0005		GWTS-GAC1-0005		GWTS-EFF-0005	
				SAMPLE DATE	22-Dec-15		22-Dec-15		29-Dec-05		29-Dec-05		29-Dec-05	
				SAMPLE TIME	15:10		15:00		13:55		13:47		13:38	
				SAMPLE DAY	Tuesday		Tuesday		Tuesday		Tuesday		Tuesday	
				DAY NUMBER	4		4		5		5		5	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	12/24/2015		12/24/2015		12/31/2015		12/31/2015		12/31/2015	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	ND	0.0278	ND	0.0283	0.181	0.0289	ND	0.0288	ND	0.0287
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	ND	1	ND	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1	ND	1	ND	1
	XYLENES	NE	620	10000	ND	3	ND	3	ND	3	ND	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	ND	100	39.4J	100	ND	100	ND	100	63J	100
	MANGANESE, DISSOLVED	NE	200	NE	5.3J	15	18.5	15	ND	15	6.65J	15	9.47J	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-	-	-	-	-
Field Data														
	Temperature (Deg.C)	---	---	---	19		18.2		18.2		16.1		17.7	
	Spec. Conductivity (us/cm)	---	---	---	363		391		405		393		419	
	pH	---	---	---	8.91		8.36		8.05		8.81		7.38	
	ORP (mV)	---	---	---	266.1		268.2		114.5		115.3		113.8	
	DO (mg/L)	---	---	---	2.13		6.5		7.66		2.46		6.47	

Attachment 2

Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-INF		GWTS-GAC1		GWTS-EFF		GWTS-INF		GWTS-GAC1	
				SAMPLE NO	GWTS-INF-0006		GWTS-GAC1-0006		GWTS-EFF-0006		GWTS-INF-0007		GWTS-GAC1-0007	
				SAMPLE DATE	30-Dec-05		30-Dec-05		30-Dec-15		31-Dec-15		31-Dec-15	
				SAMPLE TIME	13:05		13:00		13:10		9:47		9:43	
				SAMPLE DAY	Wednesday		Wednesday		Wednesday		Thursday		Thursday	
				DAY NUMBER	6		6		6		7		7	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	1/4/2016		1/4/2016		1/4/2016		1/5/2016		1/5/2016	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	0.194	0.0284	ND	0.0284	ND	0.0282	0.183	0.0287	ND	0.0286
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	ND	1	ND	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1	ND	1	ND	1
	XYLENES	NE	620	10000	ND	3	ND	3	ND	3	ND	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	ND	100	ND	100	ND	100	38.3J	100	ND	100
	MANGANESE, DISSOLVED	NE	200	NE	ND	15	6.9J	15	6.21J	15	ND	15	8.22J	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-	-	-	-	-
Field Data														
	Temperature (Deg.C)	---	---	---	17		18.8		17.1		17.2		18.4	
	Spec. Conductivity (us/cm)	---	---	---	421		407		425		424		401	
	pH	---	---	---	8.1		8.75		8.02		8.05		8.54	
	ORP (mV)	---	---	---	172.3		171.2		142.5		186.8		182.4	
	DO (mg/L)	---	---	---	7.7		3.33		6.46		7.47		2.95	

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-EFF		GWTS-INF		GWTS-GAC1		GWTS-EFF		KAFB-106233	
				SAMPLE NO	GWTS-EFF-0007		GWTS-INF-0008		GWTS-GAC1-0008		GWTS-EFF-0008		GW2601	
				SAMPLE DATE	31-Dec-15		7-Jan-16		7-Jan-16		7-Jan-16		13-Jan-16	
				SAMPLE TIME	8:30		9:00		9:10		9:20		14:36	
				SAMPLE DAY	Thursday		Thursday		Thursday		Thursday		Wednesday	
				DAY NUMBER	7		Week 1		Week 1		Week 1		Initial Sample	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	1/5/2016		1/15/2016		1/15/2016		1/15/2016		1/21/2016	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	ND	0.0287	0.176	0.0283	ND	0.0286	ND	0.0284	0.00982J	0.0284
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	ND	1	0.26J	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1	ND	1	1.17	1
	XYLENES	NE	620	10000	ND	3	ND	3	ND	3	ND	3	1.54J	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	54.9J	100	ND	100	ND	100	ND	100	ND	25
	MANGANESE, DISSOLVED	NE	200	NE	7.8J	15	ND	15	7.05J	15	8.37J	15	69.3	3.75
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-	-	-	195	20
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-	-	-	ND	4
Field Data														
	Temperature (Deg.C)	---	---	---	17.9		18.4		17.1		16.4		18.8	
	Spec. Conductivity (us/cm)	---	---	---	416		424		418		430		387	
	pH	---	---	---	8.42		7.94		8.3		7.87		6.42	
	ORP (mV)	---	---	---	194.9		151		164.7		158.16		200.1	
	DO (mg/L)	---	---	---	6.28		7.76		2.8		6.68		8.16	

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	KAFB-106234		GWTS-INF		GWTS-GAC1		GWTS-EFF		GWTS-INF	
				SAMPLE NO	GW2602		GWTS-INF-0009		GWTS-GAC1-0009		GWTS-EFF-0009		GWTS-INF-0010	
				SAMPLE DATE	13-Jan-16		14-Jan-16		14-Jan-16		14-Jan-16		21-Jan-16	
				SAMPLE TIME	14:52		9:28		9:40		9:53		16:08	
				SAMPLE DAY	Wednesday		Thursday		Thursday		Thursday		Thursday	
				DAY NUMBER	Initial Sample		Week 2		Week 2		Week 2		Week 3 & Day 1	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	1/21/2016		1/22/2016		1/22/2016		1/22/2016		1/26/2016	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	0.112	0.0284	0.15	0.286	ND	0.0287	ND	0.0284	0.146	0.0284
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	ND	1	ND	1
	TOLUENE	NE	750	1000	0.278J	1	ND	1	ND	1	ND	1	0.661J	1
	XYLENES	NE	620	10000	0.921J	3	ND	3	ND	3	ND	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	ND	25	ND	100	ND	100	37.3J	100	ND	100
	MANGANESE, DISSOLVED	NE	200	NE	8.23	3.75	ND	15	ND	15	3.69J	15	5.55J	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	360	20	-	-	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	ND	4	-	-	-	-	-	-	-	-
Field Data														
	Temperature (Deg.C)	---	---	---	16.4		18.8		18.9		18.8		14.3	
	Spec. Conductivity (us/cm)	---	---	---	701		425		431		444		490	
	pH	---	---	---	7.86		7.62		7.83		7.47		7.35	
	ORP (mV)	---	---	---	219.9		202.8		221.9		188.3		188.9	
	DO (mg/L)	---	---	---	3.22		7.2		1.7		6.54		7.99	

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-GAC1		GWTS-EFF		GWTS-INF		GWTS-GAC1		GWTS-EFF	
				SAMPLE NO	GWTS-GAC1-0010		GWTS-EFF-0010		GWTS-INF-0020		GWTS-GAC1-0020		GWTS-EFF-0020	
				SAMPLE DATE	21-Jan-16		21-Jan-16		23-Feb-16		23-Feb-16		23-Feb-16	
				SAMPLE TIME	15:58		15:40		13:25		13:45		14:05	
				SAMPLE DAY	Thursday		Thursday		Tuesday		Tuesday		Tuesday	
				DAY NUMBER	Week 3 & Day 1		Week 3 & Day 1		Monthly		Monthly		Monthly	
				SAMPLE PURPOSE	REG		REG		REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical		Empirical		Empirical	
				LAB DATA DUE	1/26/2016		1/26/2016		3/2/2016		3/2/2016		3/2/2016	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data														
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	ND	0.0286	ND	0.0281	0.0842	0.0284	ND	0.0282	ND	0.0281
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1	ND	1	ND	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1	ND	1	ND	1
	XYLENES	NE	620	10000	ND	3	ND	3	ND	3	ND	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	ND	100	ND	100	ND	100	ND	100	ND	100
	MANGANESE, DISSOLVED	NE	200	NE	25.6	15	11.5J	15	ND	15	ND	15	ND	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-	-	-	-	-
Field Data														
	Temperature (Deg.C)	---	---	---	10.8		17.2		19.4		19.4		19.5	
	Spec. Conductivity (us/cm)	---	---	---	463		570		505		471		496	
	pH	---	---	---	7.42		7.34		7.38		7.49		7.41	
	ORP (mV)	---	---	---	191.6		195.4		153		179.2		192.6	
	DO (mg/L)	---	---	---	3		6.96		7.21		4.2		6.87	

Attachment 2

Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

				LOCATION CODE	GWTS-INF		GWTS-GAC1		GWTS-EFF	
				SAMPLE NO	GWTS-INF-0012		GWTS-GAC1-0012		GWTS-EFF-0012	
				SAMPLE DATE	22-Mar-16		22-Mar-16		22-Mar-16	
				SAMPLE TIME	13;40		13:20		13:00	
				SAMPLE DAY	Tuesday		Tuesday		Tuesday	
				DAY NUMBER	Monthly		Monthly		Monthly	
				SAMPLE PURPOSE	REG		REG		REG	
				LABORATORY	Empirical		Empirical		Empirical	
				LAB DATA DUE	3/30/2016		3/30/2016		3/30/2016	
Chemical Class & Analytical Method	Parameter	Toxicity Characteristics (40 CFR 264.24)	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)	EPA MCLs[a]	Result	LOQ	Result	LOQ	Result	LOQ
Draft Analytical Data										
EDB (ug/L)SW8011	1,2-DIBROMOETHANE	NE	0.1	0.05	0.0756	0.0283	ND	0.0286	ND	0.0282
VOC (ug/L)/ SW8260B	BENZENE	500	10	5	ND	1	ND	1	ND	1
	ETHYLBENZENE	NE	750	700	ND	1	ND	1	ND	1
	TOLUENE	NE	750	1000	ND	1	ND	1	ND	1
	XYLENES	NE	620	10000	ND	3	ND	3	ND	3
Metals (ug/L)/SW6010C	IRON, DISSOLVED	NE	1,000	NE	ND	100	ND	100	ND	100
	MANGANESE, DISSOLVED	NE	200	NE	ND	15	ND	15	ND	15
TDS (mg/L)/SM2540C	TDS	NA	1,000	NE	-	-	-	-	-	-
TSS (mg/L)/SM2540D	TSS	NA	NE	NE	-	-	-	-	-	-
Field Data										
	Temperature (Deg.C)	---	---	---	19.9		19.5		19.5	
	Spec. Conductivity (us/cm)	---	---	---	460		472		473	
	pH	---	---	---	7.57		7.46		7.42	
	ORP (mV)	---	---	---	92.6		74.7		59.2	
	DO (mg/L)	---	---	---	6.29		5.85		6.15	

Attachment 2
Groundwater Extraction Well and Groundwater Treatment System Analtyical Data

Notes:

Laboratory results greater than EPA MCLs or NMED Groundwater Protection Standards are highlighted in yellow.

a = EPA MCLs are from the EPA RSL Table, dated Nov. 2015.

ND = not detected

NE = not established

- = not required

LOQ = Limit of Quantitation

J = analyte was detected at a trace level below the LOQ

ug/L = micrograms per liter

mg/L = milligrams per liter

The concentrations of iron and manganese for day 7 samples (12/31/15 sample date) are reported as total, not dissolved. Samples were not filtered in the field and were collected nitric acid containers.

12/16/15 thru 1/14/16: influent samples were collected from KAFB-106228

Starting 1/21/16: influent samples were collected from KAFB-106228, 106233 and 106234

APPENDIX L

USER OPERATIONAL ADJUSTMENTS DOCUMENTATION

REPLACEMENT KUNKLE LIQUID RELIEF VALVE IN KAFB-106233

McKeage, Kevin

From: SANCHEZ, AMY ELIZABETH CIV USARMY CESPA (US) <Amy.E.Sanchez@usace.army.mil>
Sent: Tuesday, May 16, 2017 10:31 AM
To: Salazar, Carlos F CIV USARMY CESPA (US); Simpler, Trent W CIV USARMY CESPA (US); McKeage, Kevin; Phaneuf, Mark J CIV USARMY CESPA (US); Dreeland, Linda E CIV USARMY CESPA (US)
Cc: Jercinovic, Devon; Curley, Tyler; Becker, Lee
Subject: RE: Kirtland BFF - Operational Vault Changes

I also concur with proposed recommendations.

Thanks,
Amy

-----Original Message-----
From: Salazar, Carlos F CIV USARMY CESPA (US)
Sent: Tuesday, May 16, 2017 10:23 AM
To: Simpler, Trent W CIV USARMY CESPA (US) <Trent.Simpler@usace.army.mil>; McKeage, Kevin <kmckeage@eaest.com>; SANCHEZ, AMY ELIZABETH CIV USARMY CESPA (US) <Amy.E.Sanchez@usace.army.mil>; Phaneuf, Mark J CIV USARMY CESPA (US) <Mark.J.Phaneuf@usace.army.mil>; Dreeland, Linda E CIV USARMY CESPA (US) <Linda.E.Dreeland@usace.army.mil>
Cc: Jercinovic, Devon <djercinovic@eaest.com>; Curley, Tyler <tcurley@eaest.com>; Becker, Lee <lbecker@eaest.com>
Subject: RE: Kirtland BFF - Operational Vault Changes

I also concur.

Carlos

-----Original Message-----
From: Simpler, Trent W CIV USARMY CESPA (US)
Sent: Tuesday, May 16, 2017 10:20 AM
To: McKeage, Kevin <kmckeage@eaest.com>; SANCHEZ, AMY ELIZABETH CIV USARMY CESPA (US) <Amy.E.Sanchez@usace.army.mil>; Salazar, Carlos F CIV USARMY CESPA (US) <Carlos.F.Salazar@usace.army.mil>; Phaneuf, Mark J CIV USARMY CESPA (US) <Mark.J.Phaneuf@usace.army.mil>; Dreeland, Linda E CIV USARMY CESPA (US) <Linda.E.Dreeland@usace.army.mil>
Cc: Jercinovic, Devon <djercinovic@eaest.com>; Curley, Tyler <tcurley@eaest.com>; Becker, Lee <lbecker@eaest.com>
Subject: RE: Kirtland BFF - Operational Vault Changes

I concur with these recommendations. Amy? Carlos?

Thanks
Trent

Trent Simpler, P.E.
Project Manager BFF
Chair Wind Energy CX
Red Team LGL
US Army Corps of Engineers
Trent.Simpler@usace.army.mil
505-342-4823 (office)
505-301-6996 (mobile)

-----Original Message-----

From: McKeage, Kevin [mailto:kmckeage@eaest.com]
Sent: Tuesday, May 16, 2017 9:16 AM
To: Simpler, Trent W CIV USARMY CESPA (US) <Trent.Simpler@usace.army.mil>; SANCHEZ, AMY ELIZABETH CIV USARMY CESPA (US) <Amy.E.Sanchez@usace.army.mil>; Salazar, Carlos F CIV USARMY CESPA (US) <Carlos.F.Salazar@usace.army.mil>; Phaneuf, Mark J CIV USARMY CESPA (US) <Mark.J.Phaneuf@usace.army.mil>; Dreeland, Linda E CIV USARMY CESPA (US) <Linda.E.Dreeland@usace.army.mil>
Cc: Jercinovic, Devon <djercinovic@eaest.com>; Curley, Tyler <tcurley@eaest.com>; Becker, Lee <lbecker@eaest.com>
Subject: [Non-DoD Source] Kirtland BFF - Operational Vault Changes

USACE Team,

KAFB-106233 Liquid Relief Valve:

Currently, KAFB-106233 is equipped with a Kunkle Model 20-H01 liquid relief valve with a pressure set point of 200 psi which began leaking during pumping operations 12MAY17. EA recommends decreasing the pressure set point to provide a margin of safety between the liquid relief valve set point pressure and the maximum pressure rating of the HDPE dual wall conveyance line (200 psi rated). EA is proposing to replace the leaking liquid relief valve with the same model valve (20-H01) but with a lower set point of 150 psi.

Vault Leak Detection Elevation Increase:

Currently the wellhead vaults for KAFB-106233 and KAFB-106234 can contain a total volume of approximately 628 gallons (7'x3'x4', assuming negligible volume loss due to the presence of installed lines and equipment) and the leak detection sensors are placed approximately 4 inches off of the vault floor which is the equivalent of approximately 50 gallons of water in the vault (8% of the vault volume). With the current position of the leak detection sensors, rain events typically cause the vaults to collect enough surface water run-off to activate the sensors and result in erroneous well and/or system shutdowns. EA is proposing that the leak sensors be moved to approximately 12 inches above the vault floor which is approximately 157 gallons (25% of the vault volume). This height is equivalent to the top of the 3-inch steel pipe in the vault.

In the event that the line between the pitless adaptor and the check valve were to fail while the pump was not currently in operation, approximately 2.5 gallons of water would be leaked into the vault resulting in a depth of less than a quarter of an inch in the vault (not enough to be detected by the current leak detection sensor position). Additionally if the line failed during pumping, the current sensor position (4 inches) would alarm and shutdown the system within 17 seconds. If the leak detection sensors are adjusted to approximately 12 inches from the vault bottom, a line failure during pumping would be detected within 1 minute of the failure. Since the system currently responds to vault leak alarms nearly instantaneously, there is very little increase in risk imposed by this short delay in system shutdown. Additionally this would decrease the amount of unnecessary downtime for wells and/or the entire system during and after rain events.

Please let us know how you would like these field changes documented and if you have any questions or concerns.

Thank you,

Kevin McKeage, E.I.

Engineer

Cell: (316) 765-1486

Office: (505) 933-6417

kmckeage@eaest.com <mailto:kmckeage@eaest.com>

EA Engineering, Science, and Technology, Inc., PBC

320 Gold Ave, Suite. 1300

Albuquerque, NM 87102

Blockedwww.eaest.com <Blockedhttp://www.eaest.com>

-----Original Message-----

From: Simpler, Trent W CIV USARMY CESPA (US) [mailto:Trent.Simpler@usace.army.mil <mailto:Trent.Simpler@usace.army.mil>]

Sent: Monday, May 15, 2017 2:03 PM

To: Jercinovic, Devon <djercinovic@eaest.com <mailto:djercinovic@eaest.com> >; McKeage, Kevin <kmckeage@eaest.com <mailto:kmckeage@eaest.com> >

Cc: SANCHEZ, AMY ELIZABETH CIV USARMY CESPA (US) <Amy.E.Sanchez@usace.army.mil <mailto:Amy.E.Sanchez@usace.army.mil> >; Salazar, Carlos F CIV USARMY CESPA (US) <Carlos.F.Salazar@usace.army.mil <mailto:Carlos.F.Salazar@usace.army.mil> >; Dreeland, Linda E CIV USARMY CESPA (US) <Linda.E.Dreeland@usace.army.mil <mailto:Linda.E.Dreeland@usace.army.mil> >; Phaneuf, Mark J CIV USARMY CESPA (US) <Mark.J.Phaneuf@usace.army.mil <mailto:Mark.J.Phaneuf@usace.army.mil> >

Subject: Vault changes

Devon,

Your proposed changes to the pressure valve and moving the flood sensor (and other standard maintenance items) are considered user maintenance or safety changes and you only need to send us an email explaining what you want to change and why (short email) and we will approve.

Thanks

Trent

Trent Simpler, P.E.

Project Manager BFF

Chair Wind Energy CX

Red Team LGL

US Army Corps of Engineers

Trent.Simpler@usace.army.mil <mailto:Trent.Simpler@usace.army.mil>

505-342-4823 (office)

505-301-6996 (mobile)

KUNKLE

Non-code Bronze Liquid Relief Valves

Features

- Both inlet and outlet connections are cast integral with body to permit easy inspection and servicing without disconnecting piping.
- Beveled seats lapped for optimum performance.
- Stainless Steel (SS) spring for optimum corrosion resistance.
- Each Kunkle valve is tested and inspected for pressure setting and leakage.

Model Descriptions

Model 19: All bronze, equipped with handwheel for easy adjustment within spring ranges.

Model 19M: Same as model 19 except SS trim (seat and disc). Available 2 1/2" and 3" only. For higher pressure settings or severe applications.

Model 20: All bronze, with pressure-tight cap. Suitable for maximum back pressure of 50 psig.[1]

Model 20M: Same as model 20 except SS trim. Available in 2 1/2" and 3" only (seat and disc). For higher pressure settings or severe applications. Maximum back pressure of 50 psig.[1]

Model 20P: Same as model 20 except with packed lift lever. Suitable for maximum back pressure of 50 psig.[1]

Model 20MP: Same as model 20M except with packed lift lever. Maximum back pressure of 50 psig.[1]

Model 200A: Special non-chattering design. Recommended for light oils and continuous by-pass or pressure regulation. UL842 listed for light oil service. Available 3/4" to 1 1/2" sizes. Female NPT connections only.

Model 200H: Same as model 20. UL842 listed for use with fuel oils. Available 3/4" to 2" sizes.

Applications

- Non-code liquid relief.
- Overpressure relief and protection of pumps, tanks, lines and hydraulic systems.



Model 20

- Pressure regulation.
- Continuous by-pass relief.

Options

- Available with optional female NPT inlet or flanged inlet and outlet connections.
- **Model 19**
  Variation 10: 1 to 150 psig adjustable spring range
  Variation 11: 151 to 300 psig adjustable spring range
- **Model 20-D**
  Variation 05: 50 to 150 psig spring range
  Variation 06: 100 to 300 psig

Pressure and Temperature Limits

Models 19, 20, 20P:
1 to 300 psig
-60° to 406°F

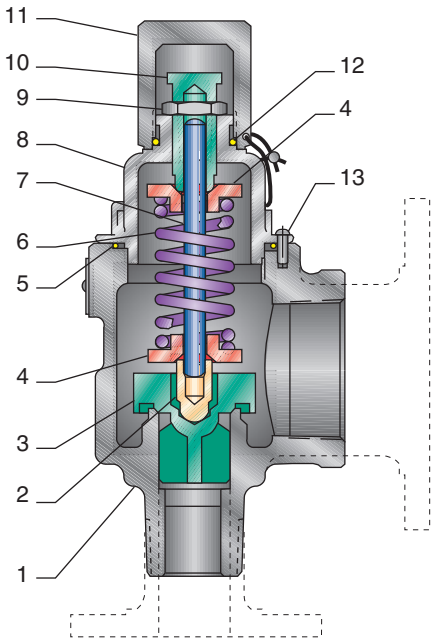
Models 19M, 20M, 20MP:
1 to 500 psig
-60° to 406°F

Models 200A, 200H:
1 to 200 psig
-60° to 406°F

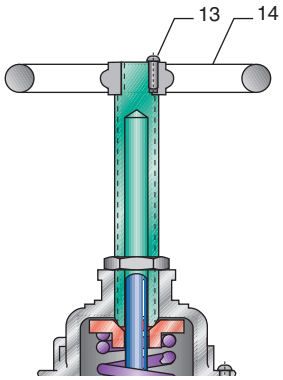
Note

1. Back pressure increases set pressure on a one to one basis, and reduces capacity. Back pressure in excess of 10% of set pressure is not recommended.

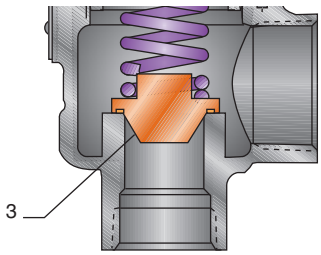
Parts and Materials



Models 20, 200H with Pressure Tight Cap



Model 19, 19M



Model 200A

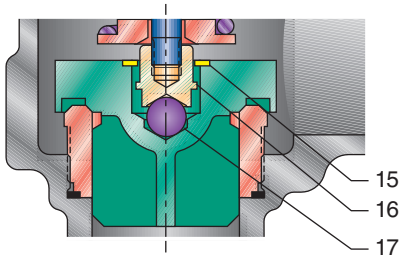
Parts and Materials

No.	Part Name	19, 19M	20, 20M, 20P, 20MP, 200A, 200H
1	Body[1]	Bronze B62	Bronze B62
2	Stem Retainer	Brass B16	Brass B16
3	Disc	Bronze B584 Alloy 84400[2,3]	Bronze B584 Alloy 84400[2,3]
4	Spring Step	Brass B16	Brass B16
5	O-ring	Teflon®	Teflon®
6	Spring	SS 316 or 17-7	SS 316 or 17-7
7	Stem	Brass B16	Brass B16
8	Bonnet	Bronze B584 Alloy 84400	Bronze B584 Alloy 84400
9	Jam Nut	Steel A108 Zinc Plated	Brass B16
10	Compression Screw	Brass B16	Brass B16
11	Cap	N/A	Brass B16
12	O-ring	N/A	BUNA-N
13	Drive Screw[6]	SS Commercial	SS Commercial
14	Handwheel	Iron A126 Zinc Plated[5]	N/A

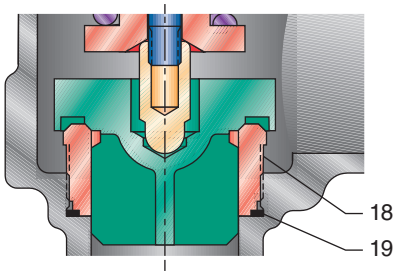
Notes

1. Flanged connections optional.
2. Models 19, 20, 20P, 200H are brass, B283, Alloy 485, for 1/2", 3/4", and 1".
3. Models 19M, 20M, and 20MP are SS A743-CF8.
4. Model 200A is brass B16.
5. Bronze B584 Alloy 84400 for 1/2", 3/4", 1 1/4".
6. Not used on bonnet for 2 1/2" and 3".

Parts and Materials



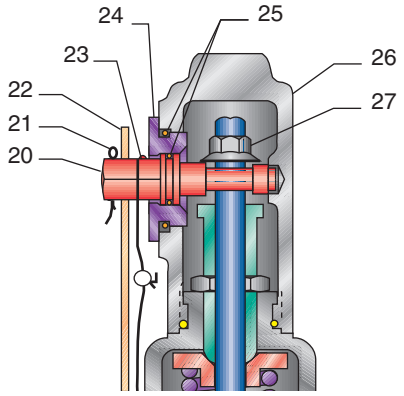
Models 19M, 20M and 20MP
2½" Seat Configuration



Models 19M, 20M and 20MP
3" Seat Configuration

Parts and Materials

No.	Part Name	Material
15	Retainer Washer	SS PH15-7MO
16	Stem End	SS A582-303
17	Ball	SS A756-440
18	Insert	SS A743 GR CF8
19	O-ring	Teflon®



Models 20MP and 20P With Lever

Parts and Materials

No.	Part Name	20P, 20MP
20	Lift Cam	SS A743-316
21	Cotter Pin	Steel
22	Lever	Steel A108 Zinc Plated
23	Drive Screw	SS Commercial
24	Retainer Cam	Brass B16
25	O-ring	BUNA-N
26	Cap	Bronze B584 Alloy 84400
27	Lift Nut	Steel A108

Liquid Relief Valves

Specifications

Size Inlet/Outlet NPT, (in)	Min/Max Set Pressure, (psig[1]) 19, 20, 20P	200A, 200H	19M, 20M, 20MP	Min/Max Temp. (°F)	Approximate Wt., (lb)
1/2[2]	1/300	—	—	-60/406	2 1/4
3/4	1/300	1/200	—	-60/406	2 1/4
1	1/300	1/200	—	-60/406	3 1/2
1 1/4	1/300	1/200	—	-60/406	5
1 1/2	1/300	1/200	—	-60/406	6 1/4
2	1/300	1/200	—	-60/406	11
2 1/2	1/300	—	1/500	-60/406	16
3	1/300	—	1/500	-60/406	25

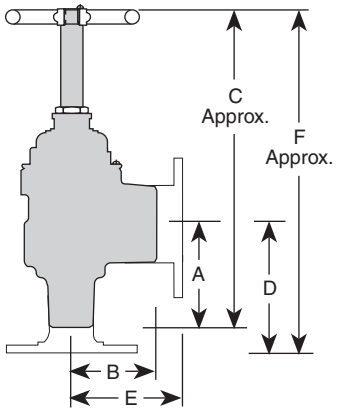
Dimensions

Valve Model	Threaded A	B	C	150/300 Flange D	E	F
1/2" Size						
19	2	1 5/8	6 1/8	3 5/16	3 5/16	7 3/8
20	2	1 5/8	5 7/8	3 5/16	3 5/16	7 1/4
20P	2	1 5/8	7 3/8	—	—	—
3/4" Size						
19	2	1 5/8	6 1/8	3 5/16	3 5/16	7 3/8
20	2	1 5/8	5 7/8	3 5/16	3 5/16	7 1/4
20P	2	1 5/8	7 3/8	3 5/16	3 5/16	8 3/4
200A	2	1 5/8	5 7/8	—	—	—
200H	1 15/16	1 5/8	5 7/8	3 5/16	3 5/16	7 3/8
1" Size						
19	2 1/4	1 7/8	7 1/8	3 7/16	3 7/16	8 1/4
20	2 1/4	1 7/8	6 3/4	3 7/16	3 7/16	7 7/8
20P	2 1/4	1 7/8	8 3/4	3 7/16	3 7/16	9 1/2
200A	2 1/4	1 7/8	6 3/4	—	—	—
200H	2 1/4	1 7/8	6 11/16	3 7/16	3 7/16	8

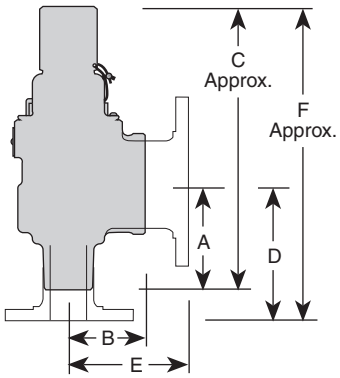
Dimensions are for reference only.

Notes

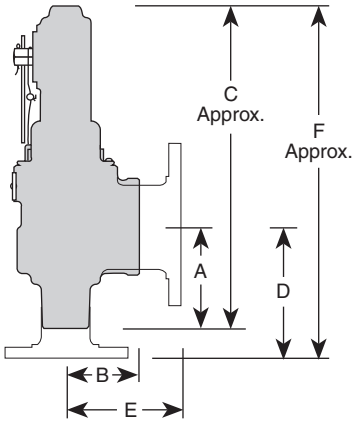
1. All flanges rated per ANSI B16.24.
2. Standard with 3/4" outlet - 1/2" outlet optional.



Models 19, 19M

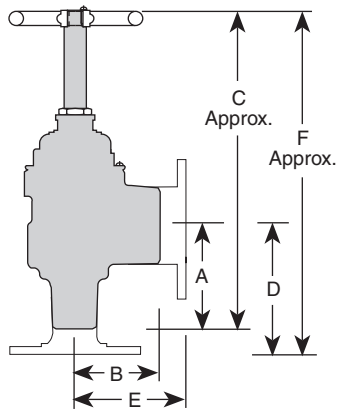


Models 20, 20M, 200A, 200H

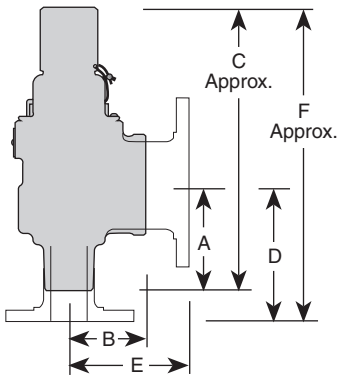


Models 20P, 20MP

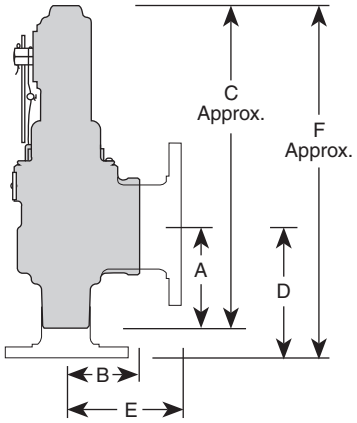
Liquid Relief Valves



Models 19, 19M



Models 20, 20M, 200A, 200H



Models 20P, 20MP

Dimensions, inches

Valve Model	Threaded			150/300 Flange		
	A	B	C	D	E	F
1¼" Size						
19	2 5/8	2 1/16	8 1/8	3 11/16	3 11/16	9 1/8
20	2 5/8	2 1/16	8 1/8	3 11/16	3 11/16	8 3/8
20P	2 5/8	2 1/16	9	3 11/16	3 11/16	10
200A	2 5/8	2 1/16	7 3/8	—	—	—
200H	2 5/8	2 1/16	7 3/8	3 11/16	3 11/16	8 5/8
1½" Size						
19	2 11/16	2 1/8	8 5/8	4 1/8	4 1/8	10 1/8
20	2 11/16	2 1/8	8 5/8	4 1/8	4 1/8	9 1/4
20P	2 11/16	2 1/8	9 1/4	4 1/8	4 1/8	10 3/4
200A	2 11/16	2 1/8	7 7/8	—	—	—
200H	2 11/16	2 1/8	7 7/8	4 1/8	4 1/8	9 1/2
2" Size						
19	3 1/2	2 11/16	10 5/8	4 1/4	4 1/4	11 1/4
20	3 1/2	2 11/16	10 5/8	4 1/4	4 1/4	10 5/8
20P	3 1/2	2 11/16	12 1/2	4 1/4	4 1/4	13 1/8
200H	3 1/2	2 11/16	9 15/16	4 1/2	4 1/4	10 15/16
2½" Size						
19	3 7/8	3	11 1/8	4 3/4	4 3/4	12
19M	3 7/8	3	11 1/8	4 3/4	4 3/4	12 1/4
20	3 7/8	3	10	4 3/4	4 3/4	13 5/16
20M	3 7/8	3	10	4 3/4	4 3/4	13 9/16
20P	3 7/8	3	12 1/2	4 3/4	4 3/4	15 3/4
20MP	3 7/8	3	12 1/2	54 3/4	4 3/4	16 1/16
3" Size						
19	4 5/8	3 7/8	12 1/4	5	5	12 5/8
19M	4 5/8	3 7/8	12 1/4	5	5	13 1/8
20	4 5/8	3 7/8	12 1/4	5	5	14 3/4
20M	4 5/8	3 7/8	12 1/4	5	5	15 1/8
20P	4 5/8	3 7/8	14 3/8	5	5	16 7/8
20MP	4 5/8	3 7/8	14 3/8	5	5	17 1/4

Dimensions are for reference only.

Models 19, 19M, 20, 20M, 20MP, 20P and 200H Capacities Liquid Relief Valves

Non-code Liquid Capacity - 25% Accumulation (GPM)

Set Pressure (psig)	Valve Inlet and Outlet Size							
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"
1	1	2	4	6	10	19	31	45
5	2	5	8	14	22	42	68	100
10	3	7	11	20	31	59	97	141
20	4	9	16	28	43	84	137	200
30	5	11	20	34	53	102	168	244
40	6	13	23	39	61	118	193	282
50	7	15	25	44	68	132	216	315
60	7	16	28	48	75	145	237	346
70	8	17	30	52	81	156	256	373
80	8	19	32	55	87	167	274	399
90	9	20	34	59	92	177	290	423
100	9	21	36	62	97	187	306	446
110	10	22	37	65	102	196	321	468
120	10	23	39	68	106	205	335	489
130	11	24	41	71	110	213	349	509
140	11	25	42	73	115	221	362	528
150	11	25	44	76	119	229	375	546
160	12	26	45	78	123	236	387	564
170	12	27	47	81	126	244	399	582
180	13	28	48	83	130	251	410	599
190	13	29	49	86	134	258	422	615
200	13	29	50	88	137	264	433	631
210	14	30	52	90	140	271	443	646
220	14	31	53	92	144	277	454	662
230	14	32	54	94	147	284	464	677
240	14	32	55	96	150	290	474	691

Note

1. Liquid Overpressure Factors

   To determine capacities at other than 25% overpressure/accumulation, multiply capacity shown by:

   10% Acc. = 0.6
   15% Acc. = 0.8
   20% Acc. = 0.9

Models 19, 19M, 20, 20M, 20MP, 20P and 200H Capacities Liquid Relief Valves

Non-code Liquid Capacity - 25% Accumulation (GPM)

Set Pressure (psig)	Valve Inlet and Outlet Size							
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"
250	15	33	56	98	153	296	484	705
260	15	34	58	100	156	301	493	719
270	15	34	59	102	159	307	503	733
280	16	35	60	104	162	313	512	746
290	16	35	61	106	165	318	521	760
300	16	36	62	107	168	323	530	773
310	—	—	—	—	—	—	539	785
320	—	—	—	—	—	—	547	798
330	—	—	—	—	—	—	556	810
340	—	—	—	—	—	—	564	823
350	—	—	—	—	—	—	572	835
360	—	—	—	—	—	—	580	846
370	—	—	—	—	—	—	588	858
380	—	—	—	—	—	—	596	870
390	—	—	—	—	—	—	604	881
400	—	—	—	—	—	—	612	892
410	—	—	—	—	—	—	619	903
420	—	—	—	—	—	—	627	914
430	—	—	—	—	—	—	634	925
440	—	—	—	—	—	—	642	936
450	—	—	—	—	—	—	649	946
460	—	—	—	—	—	—	656	957
470	—	—	—	—	—	—	663	967
480	—	—	—	—	—	—	670	977
490	—	—	—	—	—	—	677	987
500	—	—	—	—	—	—	684	998

Note

1. Liquid Overpressure Factors

   To determine capacities at other than 25% overpressure/accumulation, multiply capacity shown by:

   10% Acc. = 0.6
   15% Acc. = 0.8
   20% Acc. = 0.9

200A Capacities at 25%, 50%, 75% and 100% Accumulation (GPM)

Model 200A "D" - 3/4"

	Overpressure			
psi	25%	50%	75%	100%
5	1.2	1.9	2.7	3.7
10	1.2	2.0	2.8	4.4
15	1.3	2.0	2.9	4.7
20	1.5	2.2	3.0	5.2
25	1.5	2.2	3.0	6.0
30	1.5	2.2	3.1	6.5
35	1.5	2.5	3.3	7.4
40	1.7	2.6	3.5	8.5
45	1.9	2.8	3.6	9.6
50	2.0	3.0	3.8	11.0
55	2.2	3.2	4.0	12.2
60	2.3	3.4	4.2	13.5
65	2.4	3.5	4.4	14.8
70	2.5	3.7	4.5	16.0
75	2.6	4.0	4.7	17.1
80	2.8	4.2	5.0	18.2
85	2.9	4.4	5.1	19.3
90	3.0	4.6	5.4	20.2
95	3.1	4.7	5.5	21.0
100	3.1	4.8	5.7	21.4
105	3.3	5.0	6.0	21.5
110	3.4	5.1	6.1	21.4
115	3.4	5.3	6.2	21.0
120	3.5	5.5	6.4	20.5
125	3.5	5.6	6.5	20.2
130	3.5	5.8	6.7	19.8
135	3.7	6.0	6.9	20.0
140	3.7	6.1	7.0	20.2
145	3.8	6.2	7.0	20.8
150	3.8	6.3	7.2	21.5
155	4.0	6.5	7.4	22.0
160	4.0	6.5	7.5	22.9
165	4.0	6.5	7.6	23.7
170	4.0	6.6	7.8	24.6
175	4.1	6.8	8.2	25.5
180	4.2	6.9	8.5	26.8
185	4.3	6.9	9.0	28.5
190	4.4	7.0	10.0	30.5
195	4.4	7.0	11.5	33.5
200	4.5	7.0	12.9	36.2

Model 200A "E" - 1"

	Overpressure			
psi	25%	50%	75%	100%
5	0.7	1.0	1.3	2.5
10	1.1	1.5	2.0	4.2
15	1.5	2.0	2.7	5.9
20	1.7	2.5	3.5	7.5
25	2.0	2.9	4.1	9.5
30	2.2	3.2	4.6	11.0
35	2.5	3.6	5.0	12.9
40	2.6	4.0	5.5	14.5
45	2.8	4.2	5.8	16.5
50	2.9	4.5	6.0	18.4
55	3.0	4.8	6.4	20.1
60	3.2	5.0	6.6	22.0
65	3.4	5.2	6.8	24.0
70	3.5	5.5	7.1	26.0
75	3.5	5.7	7.3	27.8
80	3.6	6.1	7.5	29.5
85	3.8	6.4	7.7	31.0
90	3.9	6.7	8.1	32.7
95	4.0	6.9	8.2	34.2
100	4.1	7.0	8.5	35.5
105	4.3	7.2	8.7	37.0
110	4.4	7.4	9.0	38.0
115	4.5	7.5	9.1	39.0
120	4.5	7.6	9.2	39.8
125	4.7	7.7	9.5	40.2
130	4.8	7.8	9.6	40.5
135	4.8	8.0	9.7	40.5
140	4.9	8.0	9.8	40.1
145	5.0	8.4	10.0	39.5
150	5.0	8.5	10.0	38.3
155	5.0	8.5	10.2	37.2
160	5.1	8.7	10.4	36.0
165	5.2	9.0	10.5	34.8
170	5.4	9.2	10.8	33.7
175	5.5	9.4	10.9	33.0
180	5.5	9.5	11.0	33.0
185	5.5	9.5	11.2	34.2
190	5.4	9.5	11.3	37.5
195	5.2	9.5	11.5	43.5
200	5.0	9.5	11.6	48.8

200A Capacities at 25%, 50%, 75% and 100% Accumulation (GPM)

Model 200A "F" - 1 1/4"

	Overpressure			
psi	25%	50%	75%	100%
5	1.0	4.0	5.0	7.0
10	2.5	7.0	7.0	13.5
15	4.0	10.0	12.5	20.0
20	5.0	14.0	16.5	27.5
25	7.5	18.0	21.5	35.0
30	8.0	20.2	25.0	41.5
35	9.5	25.5	29.5	48.5
40	10.0	27.0	33.5	54.5
45	11.0	28.2	38.0	60.0
50	11.8	30.0	42.5	66.5
55	12.5	31.5	47.5	73.0
60	13.0	33.0	52.0	79.0
65	14.0	34.5	56.5	85.5
70	14.8	36.0	61.0	92.0
75	15.5	37.7	65.5	97.5
80	16.2	39.0	69.5	102.7
85	17.0	40.0	73.0	108.0
90	18.0	41.0	76.0	112.0
95	18.5	42.0	78.0	115.5
100	17.5	42.0	78.5	116.7
105	16.5	41.0	77.5	115.7
110	15.5	39.5	74.5	113.0
115	14.5	37.5	70.5	108.5
120	13.5	35.0	66.0	103.5
125	12.5	33.7	62.7	99.8
130	11.5	33.0	60.0	98.0
135	10.5	33.5	60.5	99.0
140	11.8	35.0	63.0	103.0
145	13.0	37.5	66.5	109.0
150	14.5	40.0	71.0	116.0
155	16.0	43.5	76.0	123.7
160	17.2	47.0	81.5	132.0
165	18.8	50.5	87.0	140.0
170	20.0	54.0	92.5	148.0
175	21.5	57.8	97.5	155.5
180	23.0	61.0	102.0	160.5
185	24.0	63.5	105.0	163.0
190	25.0	65.5	106.0	160.0
195	26.2	67.5	106.5	153.5
200	27.5	69.0	106.8	147.5

Model 200A "G" - 1 1/2"

	Overpressure			
psi	25%	50%	75%	100%
5	1.5	2.2	4.5	8.5
10	2.0	3.2	8.7	18.0
15	2.8	4.3	13.0	27.9
20	3.4	5.3	17.0	37.0
25	3.8	6.2	20.8	44.5
30	4.0	6.8	24.0	51.8
35	4.5	7.5	27.0	57.7
40	5.0	8.0	30.0	62.5
45	5.0	8.3	32.5	67.5
50	5.5	8.5	35.0	72.0
55	5.7	8.9	37.7	76.5
60	6.0	9.5	40.0	80.5
65	6.5	9.5	42.5	84.5
70	6.5	9.7	45.0	88.3
75	6.7	9.8	47.0	91.7
80	6.7	10.0	49.0	94.7
85	6.8	10.0	51.0	97.5
90	7.0	10.3	53.0	99.5
95	7.2	10.5	54.0	100.6
100	7.2	11.0	55.0	100.3
105	7.5	11.0	54.0	97.5
110	7.5	11.3	53.0	93.0
115	7.5	11.7	51.0	87.0
120	7.5	11.8	49.0	80.5
125	7.7	12.0	47.5	75.5
130	7.9	12.0	46.8	73.0
135	8.0	12.2	47.2	73.5
140	8.0	12.2	48.7	77.0
145	8.0	12.4	50.7	83.0
150	8.0	12.4	53.0	90.0
155	8.0	12.4	56.0	98.0
160	8.0	12.4	59.0	106.5
165	8.0	12.5	62.3	115.7
170	8.0	12.7	65.5	124.5
175	8.0	13.0	69.0	133.5
180	8.5	14.0	73.0	140.5
185	9.0	15.8	77.0	146.0
190	10.0	19.0	82.5	150.0
195	11.8	23.5	89.0	152.2
200	13.5	27.7	95.5	154.7

Model Number/Order Guide

Model Number Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	0	0	1	9	—	F	0	1	—	M	G	0	0	7	5

Model

0019	019M
0020	020M
020P	20MP
200A	200H

Inlet Size

C - 1/2"	G - 1 1/2"
D - 3/4"	H - 2"
E - 1"	J - 2 1/2"
F - 1 1/4"	K - 3"

Variation

See chart page 11

Design Revision

Indicates non-interchangeable revision. Dash (-) if original design.

Spring Material

G - 316 SS
H - 304 SS (only for Model 19M-K 300 psig or greater)

Set Pressure

0005 - 5 psig
0025 - 25 psig
0400 - 400 psig

		Variation														
		1/2" Male x 3/4" Female	1/2" Male x 1/2" Female	1/2" Female x 3/4" Female	Male x Female with Gag	1/2" Female x 1/2" Female	1/2" 150 Flg x 1/2" 150 Flg	1/2" 300 Flg x 1/2" 150 Flg	Male x Female	Female x Female (200A)	Female x Female	150 Flg x 150 Flg	300 Flg x 150 Flg (200H)	300 Flg x 150 Flg	150 Flg x 150 Flg (200H)	3/4" 300 Flg x 3/4" 150 Flg (020P-D)
Model - Inlet Size	**Inlet x Outlet**	**01**	**02**	**03**	**03**	**04**	**05**	**06[1]**	**01**	**01**	**02**	**03**	**03**	**04**	**04**	**05**
19-C, 20-C, 20P-C	1/2" x 1/2" (3/4")	X	X	X		X	X	X								
19-D, 20-D	3/4" x 3/4"								X		X	X		X		
200A-D	3/4" x 3/4"									X						
200H-D	3/4" x 3/4"								X		X		X		X	
19-E, 20-E, 20P-E[2]	1" x 1"								X		X	X		X		
200A-E	1" x 1"									X	X					
200H-E	1" x 1"								X		X		X		X	
19-F, 20-F, 20P-F[2]	1 1/4" x 1 1/4"								X		X	X		X		
200A-F	1 1/4" x 1 1/4"									X						
200H-F	1 1/4" x 1 1/4"								X		X		X		X	
19-G, 20-G, 20P-G[2]	1 1/2" x 1 1/2"								X		X	X		X		
200A-G	1 1/2" x 1 1/2"									X						
200H-G	1 1/2" x 1 1/2"								X		X		X		X	
19-H, 20-H, 20P-H[2]	2" x 2"								X		X	X		X		
200H-H	2" x 2"								X		X		X		X	
19-J, 19M-J, 20J, 20P-J, 20M-J, 20MP-J	2 1/2" x 2 1/2"								X		X	X		X		
19-K, 19M-K, 20-K, 20P-K, 20M-K, 20MP-K	3" x 3"								X		X	X		X		
20P-D	3/4" x 3/4"				X				X		X				X	X

Notes

1. Not available for 20P-C
2. Variation 04 not available for 20P-E, 20P-F, 20P-G, and 20P-H

SUMP PUMP REPLACEMENT MODEL

Liberty Pumps®

280-Series



Available with Vertical Float

Cast Iron Submersible Effluent/Sump Pumps

1/2 hp
1-1/2" Discharge
3/4" Solids Handling

Features:

- Liberty's unique, one-piece "Uni-Body" casting
- Quick-disconnect 10' standard power cord allows replacement of cord in seconds without breaking seals to motor (other lengths available)
- Permanently lubricated upper and lower bearings
- Oil-filled, hermetically sealed motors with thermal overload protection
- Stainless steel, removable bottom screen
- Stainless steel rotor shaft
- Stainless steel fasteners

115 V. Models:

280 Manual

281 Wide-Angle Float with Quick Disconnect

283 Wide-Angle Float, Series Plug

287 VMF, vertical magnetic float for heavy-duty sump pump applications

208-230 V. Models:

280HV Manual

281HV Wide-Angle Float with Quick Disconnect

283HV Wide-Angle Float, Series Plug

287HV Vertical Magnetic Float (VMF) Switch

Wide-Angle Floats are mercury-free, mechanically activated.

innovate. evolve.

280-SERIES
1/2 hp Submersible Effluent/Sump Pumps

The Liberty 280-Series provides a cost effective "mid-range" pump for on-site waste water systems, liquid waste transfer and commercial heavy-duty sump pump applications that require higher head or more flow. Designed around Liberty's unique "Uni-Body" casting, the 280-Series will provide years of reliable performance.

All Models Feature:

- Vortex style impeller permitting passage of solids up to ¾"
- 416 stainless steel rotor shaft
- Permanently lubricated upper and lower ball bearing
- Epoxy powder coat finish
- All fasteners – corrosion-resistant stainless steel
- 1½" Discharge
- Stainless steel bottom screen – easily removable
- Maximum fluid temperature: 140˚ F.
- **280-Series Cord Lengths**

Model	10'	25'(-2)	35'(-3)	50'(-5)
280	Standard	Optional	Optional	Optional
281	Standard	Optional	Optional	Optional
283	Standard	Optional	Optional	N/A
287	Standard	Optional	N/A	N/A

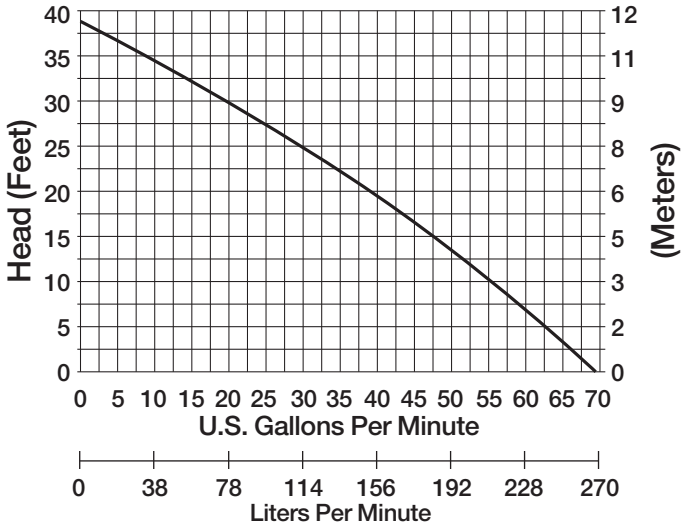
10' cord length standard on all models. For optional lengths, add "-2, -3 or -5" suffix to model number.
Example: for model 280 with 35' cord, order 280-3

Motor Specifications

½ hp 60 Hz 3450 RPM
Oil filled, thermally protected

8.0 amps (115V)
4.0 amps (208/230V)

Performance Curve: 280-Series



Dimensional Data:

Weight: 29 lbs.
Height: 13"
Major Width: 10" (model 287)

Minimum Sump Diameters:

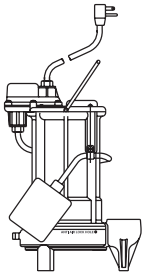
Model 281, 283…14"
Model 287 VMF…10"

Factory switch settings	Model 281, 283	Model 287 VMF
Turn on level	13"	9.5"
Turn off level	7"	4.0"

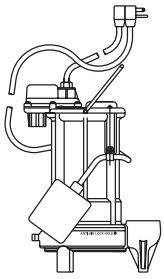
The Model 283 features a fully adjustable wide-angle float. Differential adjustments can be made easily by tethering the float to the discharge pipe or other mounting point. Vertical float model 287 is not adjustable.



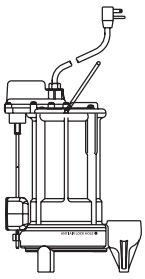
Model 280
Manual, no switch



Model 281
Wide angle float switch with quick-disconnect



Model 283
Wide angle float switch with series (piggy-back) plug



Model 287 VMF-Series
Vertical magnetic float for smaller pits – will operate in a 10" diameter sump

SSPMA CERTIFIED

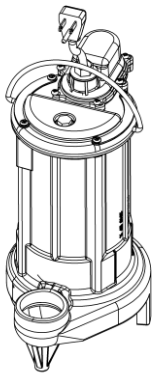
c CSA us Certified

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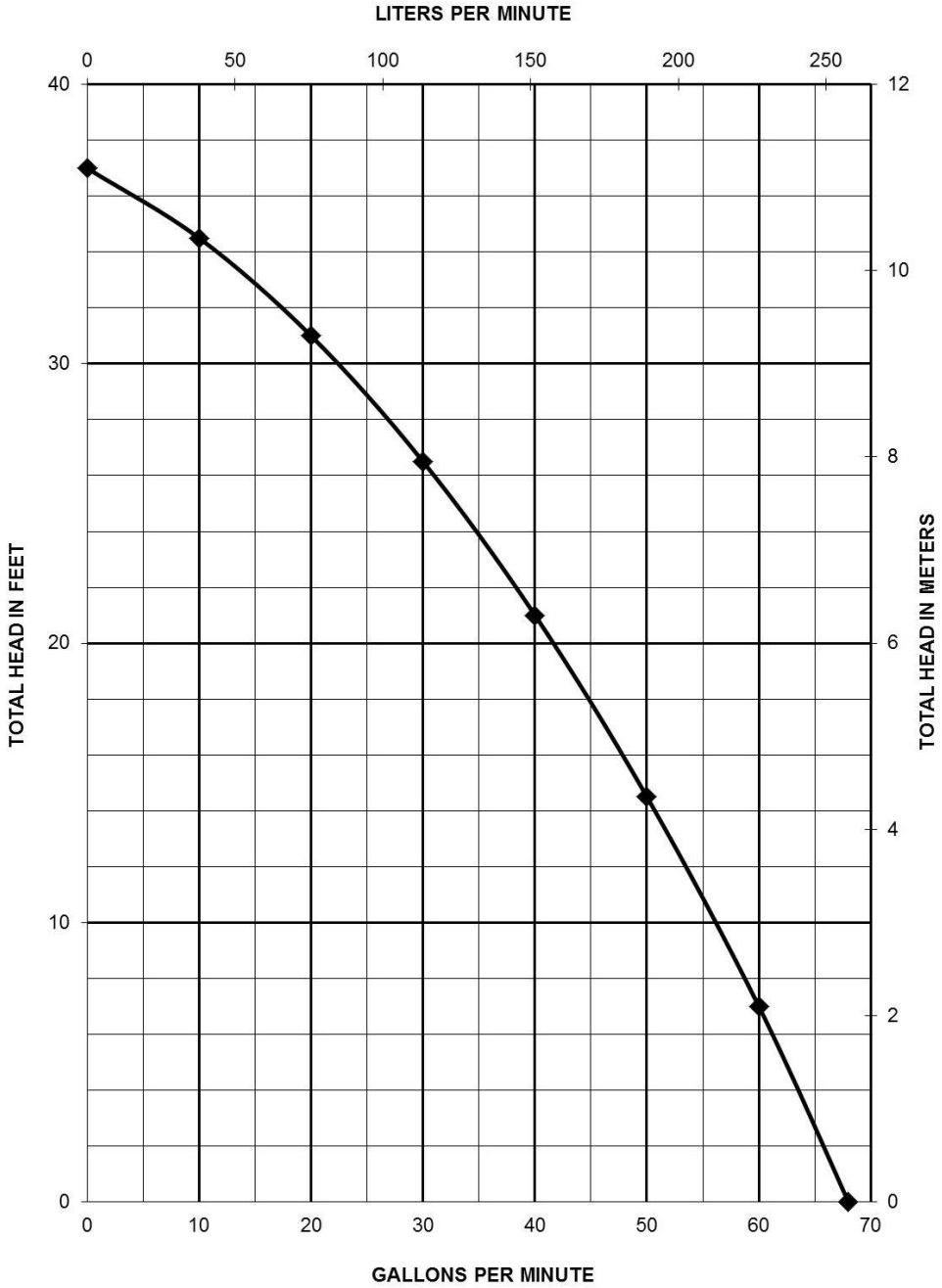
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Liberty Pumps®



Pump Specifications

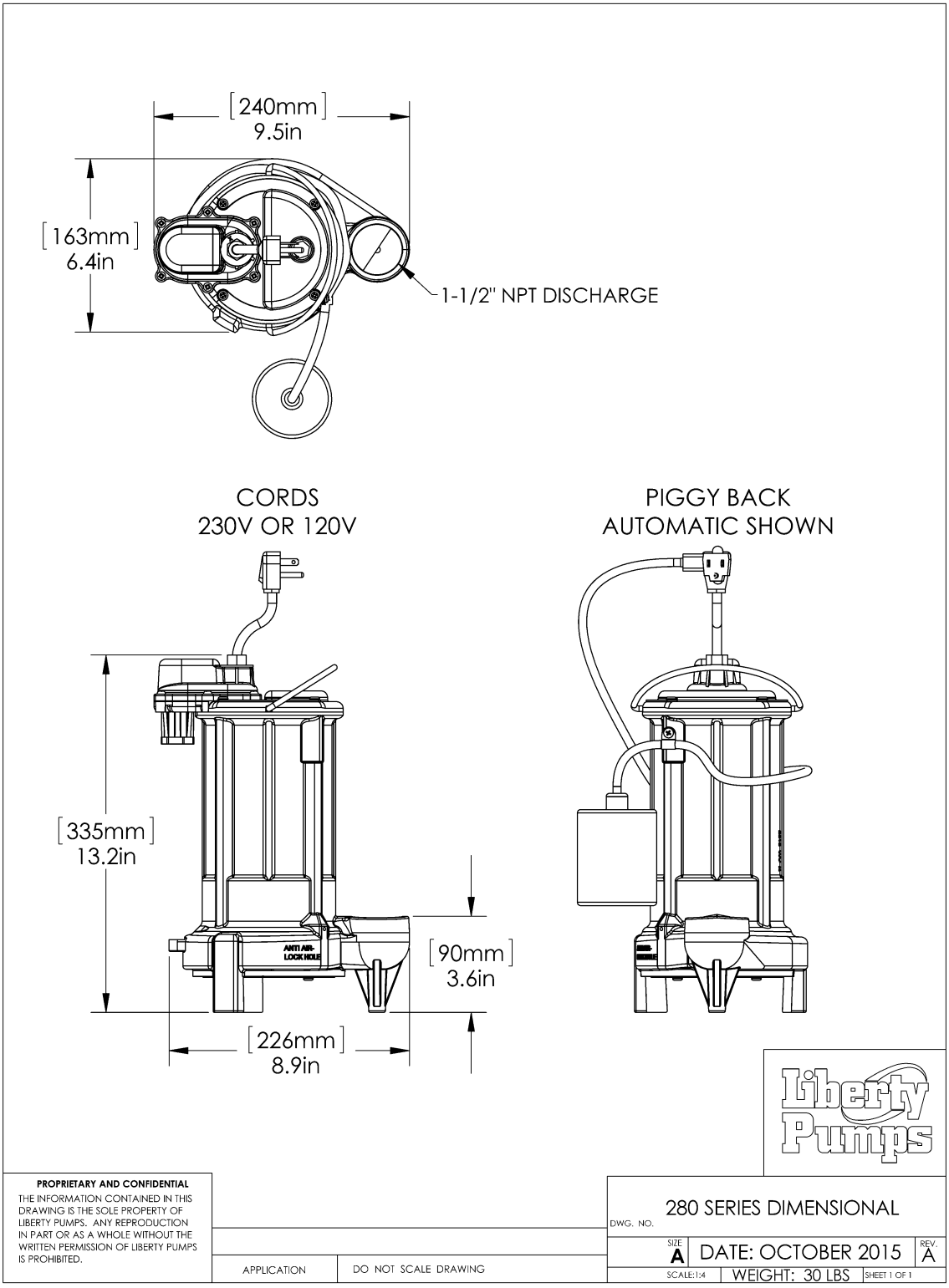
280 Series 1/2 hp Submersible Effluent Pump



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Liberty Pumps®

280-Series Dimensional Data



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280-Series Electrical Data

MODEL	HP	VOLTAGE	PHASE	FULL LOAD AMPS	LOCKED ROTOR AMPS	THERMAL OVERLOAD TEMP	STATOR WINDING CLASS	CORD LENGTH FT	DISCHARGE	AUTOMATIC
280	1/2	115	1	8.0	23	105˚C / 221°F	B	10	1 1/2	NO MANUAL
281	1/2	115	1	8.0	23	105˚C / 221°F	B	10	1 1/2	YES INTEGRAL FLOAT
283	1/2	115	1	8.0	23	105˚C / 221°F	B	10	1 1/2	YES PIGGY BACK FLOAT
287	1/2	115	1	8.0	23	105˚C / 221°F	B	10	1 1/2	YES INTEGRAL VERTICLE FLOAT
280HV	1/2	208-230	1	4.0	12.5	105˚C / 221°F	B	10	1 1/2	NO MANUAL
281HV	1/2	208-230	1	4.0	12.5	105˚C / 221°F	B	10	1 1/2	YES INTEGRAL FLOAT
283HV	1/2	208-230	1	4.0	12.5	105˚C / 221°F	B	10	1 1/2	YES PIGGY BACK FLOAT
287HV	1/2	208-230	1	4.0	12.5	105˚C / 221°F	B	10	1 1/2	YES INTEGRAL VERTICLE FLOAT

280-Series Cord Length Options*

Model	10'	25'(-2)	35'(-3)	50'(-5)
280	Standard	Optional	Optional	Optional
281	Standard	Optional	Optional	Optional
283	Standard	Optional	Optional	N/A
287	Standard	Optional	N/A	N/A

10' cord length standard on all models. For optional lengths, add “-2, -3 or -5” suffix to model number.
Example: for model 280 with 35' cord. Order 280-3

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**WARNING: ***Always use a replacement power cord assembly of the same length and type as originally installed on the Liberty product. Using a cord of improper gauge or length may lead to exceeding the electrical rating of the cord and could result in death, injury, fire or other significant failure.

280-Series Technical Data

IMPELLER	VORTEX ENGINEERED POLYMER
SOLIDS HANDLING SIZE	¾"
PAINT	POWDER COAT
MAX LIQUID TEMP	60˚C/ 140˚F
MAX STATOR TEMP	CLASS B 130˚C/ 266˚F
THERMAL OVERLOAD	105˚C / 221°F
POWER CORD TYPE	SJTW (10ft & 25ft models) SJTOOW (35ft & 50ft models)
MOTOR HOUSING/ VOLUTE	CLASS 25 CAST IRON
SHAFT	STAINLESS
HARDWARE	STAINLESS
ORINGS	BUNA N
MECHANICAL SEAL	UNITIZED CERAMIC CARBON
WEIGHT	30 LBS

280-Series Specifications

1.01 GENERAL:

The contractor shall provide labor, material, equipment, and incidentals required to provide_____(QTY) centrifugal pumps as specified herein. The pump models covered in this specification are Series 280 single phase pumps. The pump furnished for this application shall be model _____as manufactured by Liberty pumps.

2.01 OPERATING CONDITIONS:

Each submersible pump shall be rated at 1/2 hp_____volts, single phase, 60 Hz.,. 3450 RPM. The unit shall produce_____G.P.M. at _____ feet of total dynamic head.

The submersible pump shall be capable of handling effluent with 3/4" solid handling capability. The submersible pump shall have a shut-off head of 37 feet and a maximum flow of 62 GPM @ 5 feet of total dynamic head.

The pump shall be controlled with:

_____A piggy back style on/off float switch.

_____An integrally wired on/off float switch.

_____A Vertical Mechanical Float (VMF) type on/off switch.

_____A NEMA 4X outdoor simplex control panel with three float switches and a high water alarm.

_____A NEMA 1 indoor simplex control panel with three float switches and a high water alarm.

_____A NEMA 4X outdoor simplex control panel with four float switches and a high water alarm.

_____A NEMA 1 indoor simplex control panel with four float switches and a high water alarm.

_____A NEMA 4X outdoor duplex control panel with three float switches and a high water alarm.

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_____A NEMA 1 indoor duplex control panel with three float switches and a high water alarm.
_____A NEMA 4X outdoor duplex control panel with four float switches and a high water alarm.
_____A NEMA 1 indoor duplex control panel with four float switches and a high water alarm.

3.01 CONSTRUCTION:

Each submersible pump shall be equal to the C US certified Series 280 SERIES pumps as manufactured by Liberty Pumps, Bergen NY. The castings shall be constructed of class 25 cast iron. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor. All mating parts shall be machined and sealed with a Buna-N o-ring. All fasteners exposed to the liquid shall be stainless steel. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring. The pump shall be furnished with stainless steel handle.

4.01 ELECTRICAL POWER CORD

The submersible pump shall be supplied with 10, 25, 35, or 50 feet of multiconductor power cord. It shall be cord type SJTW, or SJTOOW capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a water tight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

5.01 MOTORS

Single phase motors shall be oil filled, permanent split capacitor, class B insulated NEMA B design, rated for continuous duty. At maximum load the winding temperature shall not exceed 130 degrees C unsubmerged. Since air filled motors are not capable of dissipating heat they shall not be considered equal. The pump motor shall have an integral thermal overload switch in the windings for protecting the motor. The capacitor circuit shall be mounted internally in the pump.

6.01 BEARINGS AND SHAFT

An upper and lower ball bearing shall be required. The ball bearing shall be a single ball / race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 or 400 series stainless steel and have a minimum diameter of .311”

7.01 SEALS

The pump shall have a unitized carbon / ceramic seal with stainless steel housings and spring equal to Crane Type 6A. The motor plate / housing interface shall be sealed with a Buna-N o-ring.

8.01 IMPELLER

The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.

9.01 CONTROLS

All pumps can be supplied with a CSA and UL approved VMF type switch, an integrally wired wide angle tilt float switch, or piggy back type wide angle tilt float switches. The piggy back style switches are equipped with a plug that allows the pump to be operated manually without the removal of the pump in the event that a switch becomes inoperable. Manual pumps are operable by means of a pump control panel.

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10.01 PAINT

The exterior of the casting shall be protected with powder coat paint.

11.01 SUPPORT

The pump shall have cast iron support legs, enabling it to be a free standing unit. The legs will be high enough to allow 3/4" solids to enter the volute.

12.01 SERVICEABILTY

Components required for the repair of the pump shall be shipped within a period of 24 hours.

13.01 FACTORY ASSEMBLED TANK SYSTEMS WITH GUIDE RAIL AND QUICK DISCONNECT DISCHARGE

_____Guide factory mounted rail system with pump suspended by means of bolt on quick disconnect which is sealed by means of nitrile grommets or o-rings. The Discharge piping shall be schedule 80 PVC and furnished with a PVC check valve and shut-off ball valve. The Tank shall be wound fiberglass or roto-molded plastic. An inlet hub shall be provided with the fiberglass systems.

_____Stainless steel Guide Rail
_____Zinc plated steel Guide Rail
_____"diameter of basin size
_____"height of basin size
_____"distance from top of tank to discharge pipe outlet
_____Fiberglass cover
_____Structural foam polymer cover
_____Steel cover
_____Simplex System with Outdoor panel and alarm
_____Duplex System with Outdoor panel and alarm
_____Separate Outdoor Alarm
_____Remote Outdoor Alarm

14.01 TESTING

The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage and current monitored, and the tester checks for noise or other malfunction.

15.01 QUALITY CONTROL

The pump shall be manufactured in an ISO 9001 certified Facility.

16.01 WARRANTY

Standard limited warranty shall be 3 years.

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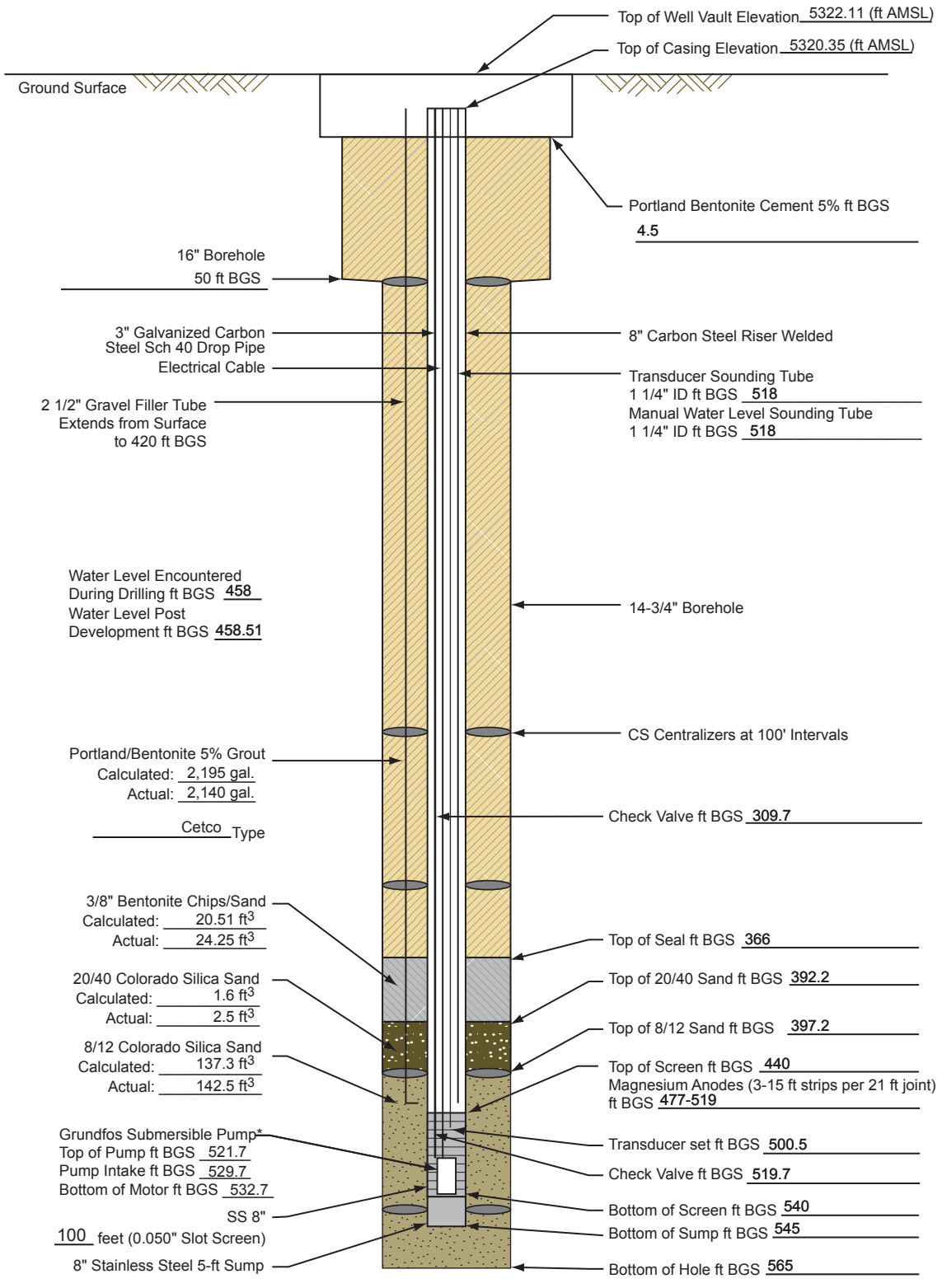
APPENDIX M

WELL CONSTRUCTION DIAGRAMS AND BOREHOLE LOGS

EXTRACTION WELL CONSTRUCTION DIAGRAMS

Extraction Well Construction Diagram KAFB-106228

Installation Start Date/Time: 5/18/2015
Installation End Date/Time: 6/2/2015
Magnesium Anodes and Sounding Tubes added: 7/6/2016

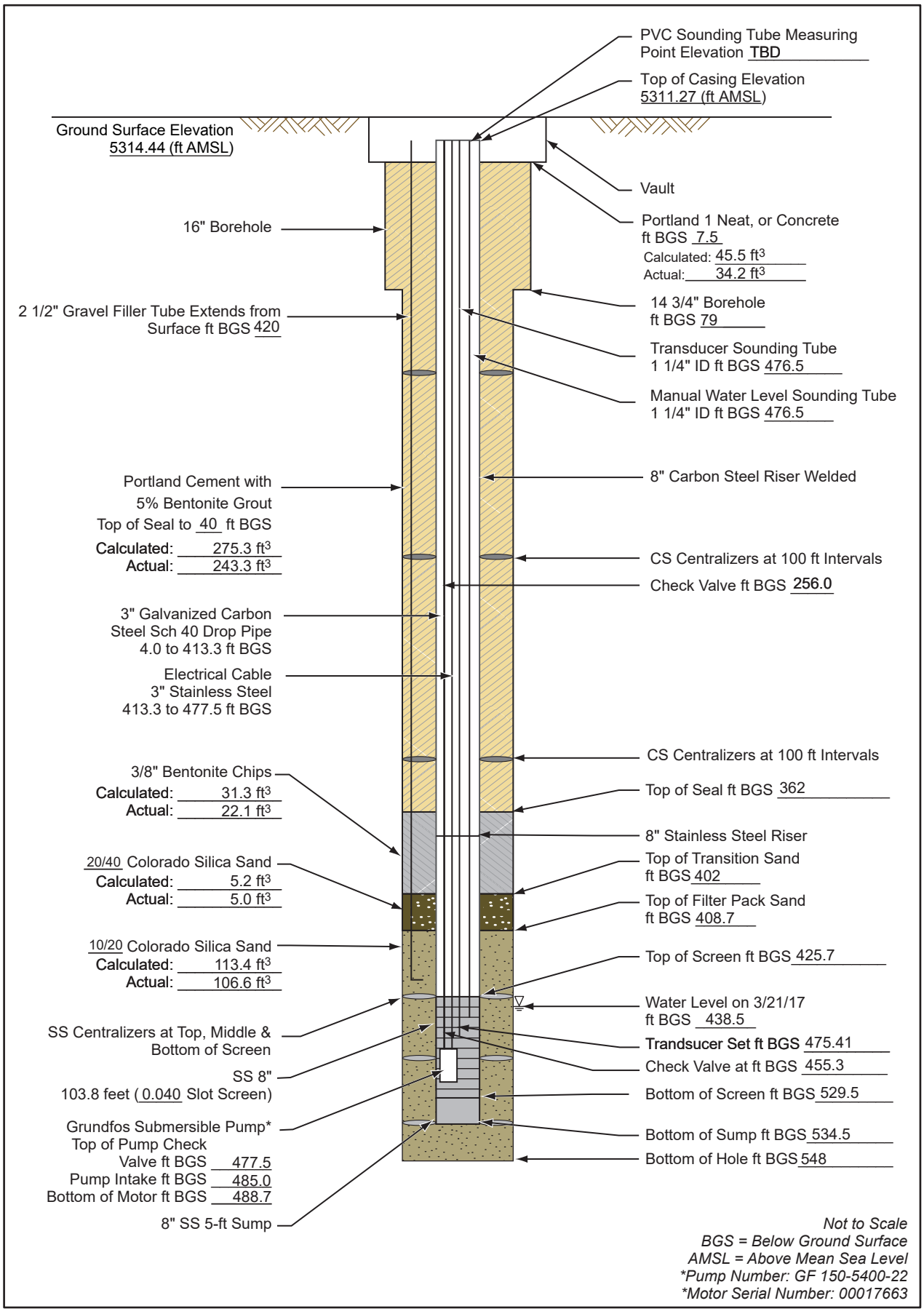


Elevations are NAVD 88 Datum values based on NGS Control Station "Hanger", Elevation = 5,343.43 ft. GPS/RTK methods and GEO1D99 model were used to determine elevations of all surveyed points.

Not to Scale
BGS = Below Ground Surface
AMSL = Above Mean Sea Level
**Pump Serial Number: 7656-13P21328*
**Motor Serial Number: 7656-13P21328*

140705.CB020403.A19

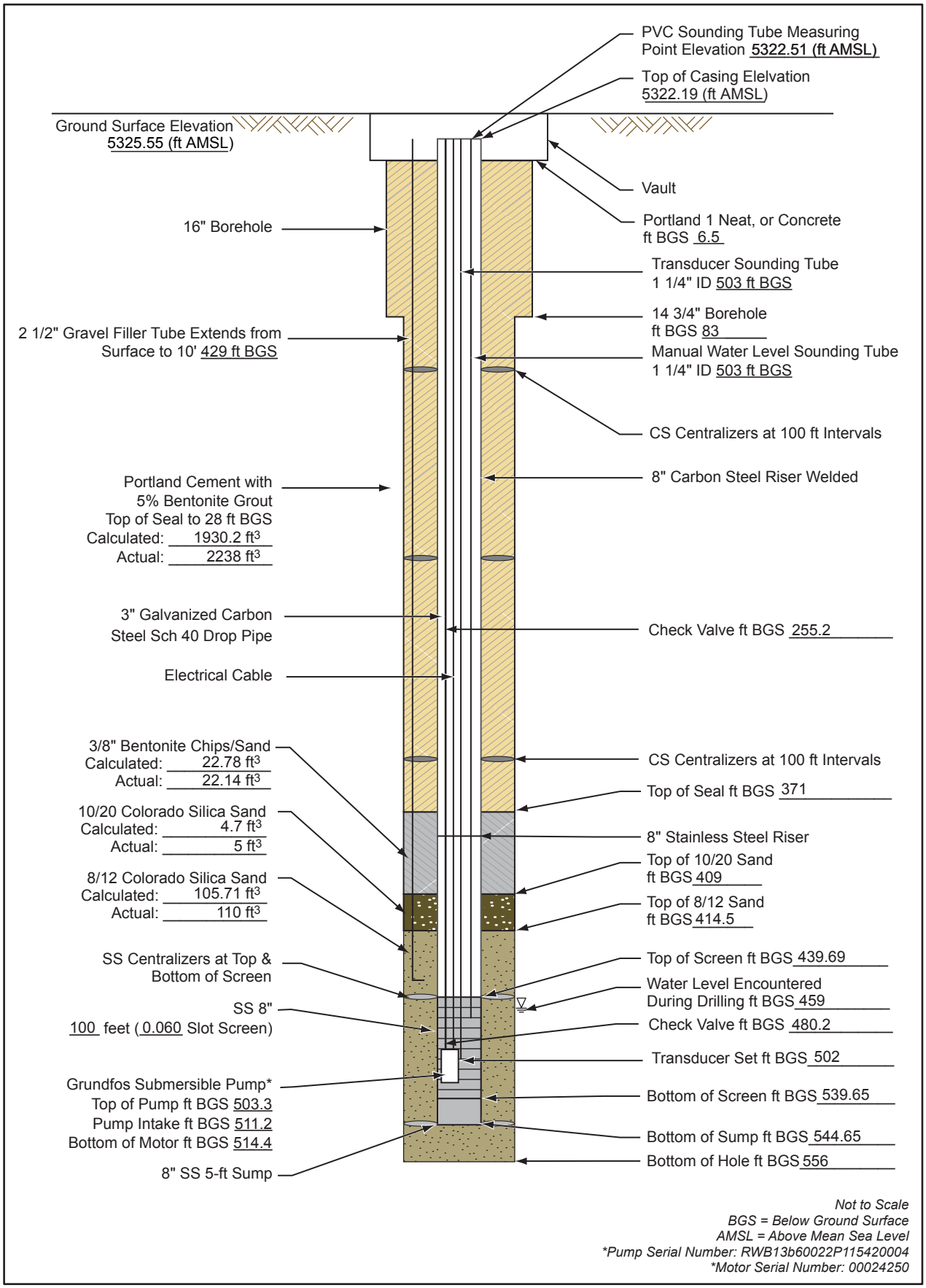
Extraction Well Construction Diagram KAFB-106233



500433.04010300.A4

Extraction Well Construction Diagram KAFB-106234

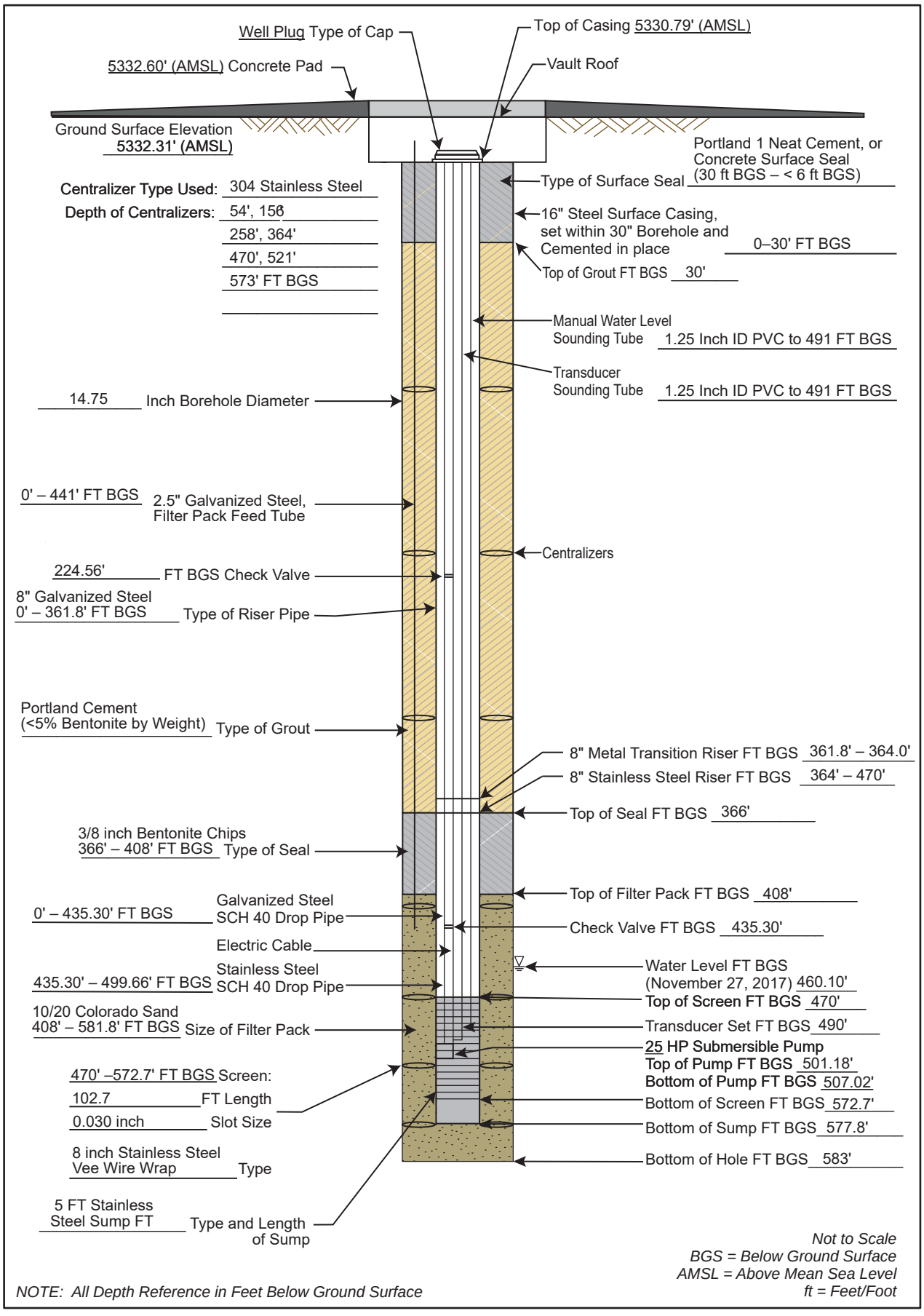
Installation Start Date/Time: 10/2/2015
Installation End Date/Time: 10/9/2015



Not to Scale
BGS = Below Ground Surface
AMSL = Above Mean Sea Level
**Pump Serial Number: RWB13b60022P115420004*
**Motor Serial Number: 00024250*

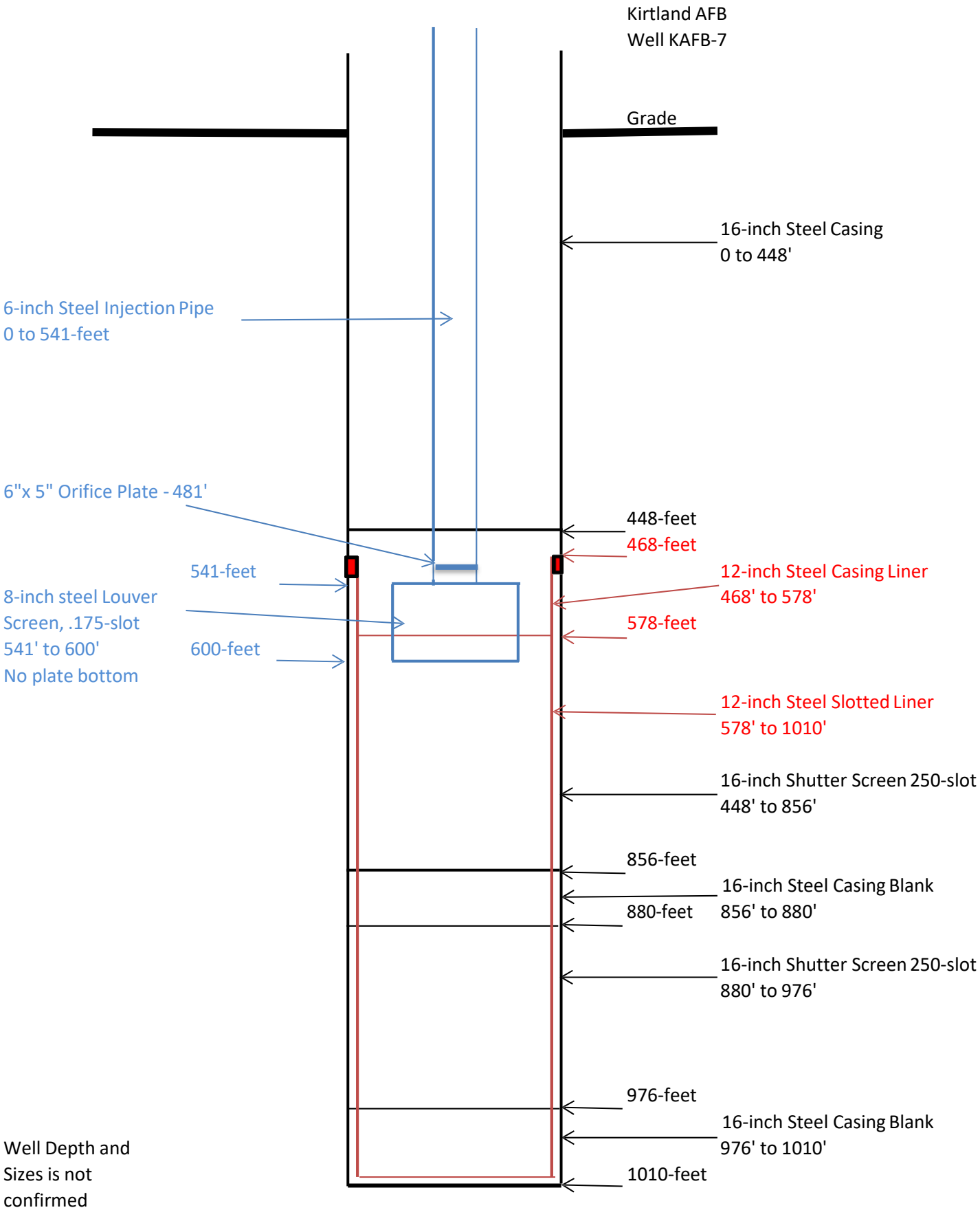
500433.04010300.A5

Extraction Well Construction - KAFB-106239



62599DM01

INJECTION WELL SCHEMATIC


Kirtland AFB
Well KAFB-7
Grade
16-inch Steel Casing
0 to 448'
6-inch Steel Injection Pipe
0 to 541-feet
6"x 5" Orifice Plate - 481'
448-feet
468-feet
541-feet
12-inch Steel Casing Liner
468' to 578'
8-inch steel Louver
Screen, .175-slot
541' to 600'
No plate bottom
600-feet
578-feet
12-inch Steel Slotted Liner
578' to 1010'
16-inch Shutter Screen 250-slot
448' to 856'
856-feet
16-inch Steel Casing Blank
856' to 880'
880-feet
16-inch Shutter Screen 250-slot
880' to 976'
976-feet
16-inch Steel Casing Blank
976' to 1010'
1010-feet
Well Depth and
Sizes is not
confirmed

EXTRACTION WELL BOREHOLE LOGS

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

LICENSED PROFESSIONAL GEOLOGIST
VIRGINIA BRACHT
8881903-2250
STATE OF UTAH

7/13/15

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					ASPHALT			
					Water jetted to 9', lithology disturbed.			Begin advancing 16" casing @ 1507 on 5/18/15.
5							- Top of Casing/ Top of Bentonite Cement	
10					Well-graded GRAVEL with Sand (GW); strong brown (7.5YR 5/6); 60% fine to coarse gravel to 2"; angular to subangular; gravel is mafics and quartzite; 35% fine to coarse sand; angular to subrounded; sand is quartz and quartzite; 5% silt.	GW		
15					Same as above (9 ft).		- Portland Bentonite Cement	Kelly down @ 1517, resume drilling @ 1700.
20					Poorly graded SAND with Silt (SP-SM); yellowish brown (10YR 5/8); 90% medium sand; trace fine and coarse sand; subangular to subrounded; sand is quartz; 10% silt.	SP-SM		
25					Silty GRAVEL with Sand (GM); yellowish brown (10YR 5/8); 55% fine to coarse gravel to 1 1/2"; subangular; gravel is mafics; 25% fine to coarse sand; subangular to subrounded; sand is quartz; 20% silt.	GM		
30								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
35					Silty GRAVEL with Sand (GM); yellowish brown (10YR 5/8); 55% fine to coarse gravel to 1 1/2"; subangular; gravel is mafics; 25% fine to coarse sand; subangular to subrounded; sand is quartz; 20% silt.	GM		Cuttings moist after driller added water.
40					Silty SAND (SM); yellowish brown (10YR 5/8); 85% fine to coarse sand; subangular to subrounded; sand is quartz and mafics; 15% silt.	SM		Kelly down @ 1800, resume drilling @ 1810.
45					Same as above (35 ft); 75% fine to medium sand; trace coarse sand; 25% silt.		- Portland Bentonite Cement	End day @ 47' @ 1820. on 5/18/15.
50					Same as above (35 ft); 75% fine to medium sand; trace coarse sand; 25% silt.			Push 16" casing to 50' @ 0935 on 5/19/15. @ 1648 begin mud rotary. Begin drilling with 2 collars and 7' of lot/sub/pound.
55					Lean CLAY with Sand (CL); reddish yellow (7.5YR 6/6); 75% clay; 25% coarse sand; trace medium and fine sand; angular to subangular; trace silt.	CL		
60					Same as above (50 ft).			

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Lean CLAY with Sand (CL); reddish yellow (7.5YR 6/6); 75% clay; 25% coarse sand; trace medium and fine sand; coarse sand is quartz and granite; angular to subangular; trace silt.			Add 3rd collar @ 60' @ 1800.
65					Same as above (60 ft).			
70					Lean CLAY (CL); reddish yellow (7.5YR 6/8); medium plasticity; 90% clay; 10% medium to coarse sand; sand is quartz and granite; trace silt.			
75					Same as above (70 ft).	CL	Portland Bentonite Cement	Stop drilling @ 75' on 5/19/15. Resume drilling @ 0840 on 5/21/15.
80					Same as above (70 ft).			Add 4th collar @ 80' @ 0857. Total of 77' of collar.
85					Same as above (70 ft).			
90								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Sandy lean CLAY (CL); strong brown (7.5YR 5/8); medium plasticity; 60% clay; 40% coarse sand; subangular; sand is quartz, mafics, and quartzite.			
95					Lean CLAY (CL); yellowish red (5YR 5/8); medium plasticity; 90% clay; 10% medium to coarse sand; subangualr; sand is granite, mafics, and quartzite.			
100					Same as above (95 ft).			
105					Same as above (95 ft).	CL	Portland Bentonite Cement	Kelly down @ 0940, resume drilling @ 1240.
110					Same as above (95 ft); 95% clay; 5% medium to coarse sand; trace fine gravel.			
115					Same as above (95 ft); 95% clay; 5% medium to coarse sand; trace fine gravel.			
120								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Sandy lean CLAY (CL); strong brown (7.5YR 5/8); low plasticity; 60% clay; 40% fine sand.	CL		
125					Same as above (120 ft).			Kelly down @ 1313, resume drilling @ 1330.
130					Same as above (120 ft).			
135					Clayey SAND (SC); strong brown (7.5YR 5/8); 60% fine to medium sand; subangular; sand is quartz; 40% clay.	SC	Portland Bentonite Cement	
140					Same as above (135 ft); clay is firmer.			
145					Clayey SAND with Gravel (SC); strong brown (7.5YR 5/6); 40% fine to medium sand; subangular; 20% fine gravel to 3/4"; subangular; 40% clay; medium plasticity; sand is quartz; gravel is mafics.			Kelly down @ 1352, resume drilling.
150								

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Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
155					Gravelly lean CLAY (CL); strong brown (7.5YR 5/6); medium plasticity; 70% clay; 30% fine gravel to 1/2"; angular; gravel is black.	CL		
160					Clayey SAND with Gravel (SC); strong brown (7.5YR 5/6); 50% fine to coarse sand; subangular; 30% fine gravel to 3/4"; angular to subangular; 20% clay; sand is quartz; gravel is mafics. Same as above (155 ft).	SC		
165								
170					Gravelly lean CLAY (CL); strong brown (7.5YR 5/6); medium plasticity; 60% clay; 30% fine gravel to 1/2"; angular to subangular; 10% medium to coarse sand; subangular; gravel is mafics.	CL	- Portland Bentonite Cement	Kelly down @ 1438, resume drilling @ 1503.
175					Clayey GRAVEL (GC); strong brown (7.5YR 5/6); 80% fine gravel to 1/2"; angular to subangular; 20% clay; gravel is mafics.	GC		
180					Poorly graded GRAVEL with Silt and Sand (GP-GM); strong brown (7.5YR 5/6); 60% fine gravel to 1/2"; angular to subangular; 30% fine sand; trace medium and coarse sand; subangular; 10% silt; gravel is mafics and granite; sand is quartz, mafics, and granite.	GP-GM		

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded GRAVEL with Silt and Sand (GP-GM); strong brown (7.5YR 5/6); 60% fine gravel to 1/2"; angular to subangular; 30% fine sand; trace medium and coarse sand; subangular; 10% silt; gravel is mafics and granite; sand is quartz, mafics, and granite.	GP-GM		
185					Silty GRAVEL with Sand (GM); reddish yellow (7.5YR 6/6); 70% fine gravel; subangular; 15% fine to coarse sand; subangular; 15% silt; gravel is mafics, granite, and quartzite; sand is mafics.			End day on 5-21-15 @ 183'. Kelly down @ 1542. 1500 gallons mud used on 5/21/15. Resume drilling on 5/22/15 @ 0830.
190					Same as above (185 ft).			
195					Same as above (185 ft).		- Portland Bentonite Cement	
200					Silty GRAVEL (GM); reddish yellow (7.5YR 6/6); 70% fine gravel; subangular; 10% fine to coarse sand; subangular to subrounded; 20% silt; gravel is mafics and granite; sand is quartz.	GM		Kelly down @ 0905, resume drilling @ 0940.
205					Same as above (200 ft); 60% fine gravel; 10% coarse sand; subrounded; 30% silt.			
210								

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Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Poorly graded GRAVEL with Silt and Sand (GP-GM); reddish yellow (7.5YR 6/8); 70% fine gravel to 3/8"; subangular to subrounded; 20% fine to coarse sand; 10% silt; gravel is mafics and quartz; sand is quartz and mafics.	GP-GM		
215					Poorly graded SAND (SP); reddish yellow (7.5YR 6/8); 90% coarse sand; trace fine and medium sand; subrounded; 5% fine gravel to 3/8"; 5% silt; sand is mafics, quartzite, and granite; gravel is mafics.	SP		
220					Same as above (215 ft).			
225					Silty GRAVEL with Sand (GM); reddish yellow (7.5YR 6/8); 70% coarse gravel; trace fine gravel; subangular to subrounded; 15% fine sand; 15% silt; gravel is mafics and granite; sand is mafics.	GM	Portland Bentonite Cement	Kelly down @ 1002, resume drilling @ 1023.
230					Same as above (225 ft).			Hard drilling @ 227', possibly cemented formation.
235					Same as above (225 ft).			
240								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Silty SAND (SM); reddish yellow (7.5YR 6/6); 70% fine to coarse sand; subangular to subrounded; 10% fine gravel to 3/8"; 20% silt; sand is mafics and granite; gravel is feldspar.	SM		Kelly down @ 1150, resume drilling @ 1258.
245					Same as above (240 ft).			
250					Well-graded SAND with Silt and Gravel (SW-SM); reddish yellow (7.5YR 6/6); 60% fine to coarse sand; subangular to subrounded; 30% fine gravel to 3/8"; angular to subrounded; 10% silt; sand is mafics and granite; gravel is mafics, granite, and quartz.	SW-SM	Portland Bentonite Cement	Gravel clasts are generally flat.
255					Same as above (250 ft).			
260					Silty SAND (SM); yellowish brown (10YR 5/6); 80% coarse sand; trace fine and medium sand; angular to subrounded; 20% silt; sand is mafics and granite.	SM		Kelly down @ 1410, resume drilling @ 1420.
265					Same as above (260 ft); 70% coarse sand; trace fine and medium sand; 30% silt.			
270								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Silty SAND (SM); yellowish brown (10YR 5/6); 70% coarse sand; trace fine and medium sand; angular to subrounded; 30% silt; sand is mafics and granite.			Some color change due to mud added.
275					Same as above (270 ft).	SM		
280					Same as above (270 ft).			
285								Kelly down @ 1455, resume drilling @ 1515.
290					Silty GRAVEL with Sand (GM); light yellowish brown (10YR 6/4); 60% fine gravel; angular to subangular; 15% fine sand; trace medium and coarse sand; 25% silt; gravel is granite and quartzite; sand is quartz. Same as above (285 ft)	GM	Portland Bentonite Cement	
295					Silty GRAVEL (GM); light brown (7.5YR 6/4); 80% fine gravel; angular to subangular; 20% silt; gravel is mafics and granite.			Coarse mafic gravel observed @ 294' likely causing pipe to bounce.
300								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded GRAVEL (GP); light brown (7.5YR 6/4); 90% fine gravel to 3/8"; angular to subangular; 5% coarse sand; subangular; 5% silt; gravel is mafics, granite, and quartzite; sand is mafics.			Kelly down @ 1550. Lost circulation @ 1600. Resume drilling @ 1605 with circulation.
305					Same as above (300 ft).			Drilling bit binding up at 305 to 310' likely due to coarse gravel.
310					Poorly graded GRAVEL with Sand (GP); light brown (7.5YR 6/4); 80% fine gravel to 3/8"; angular to subangular; 15% medium to coarse sand; subangular; 5% silt; gravel is mafics, granite, and quartzite; sand is quartz and mafics.			Stop drilling @ 310' @ 1620 on 5/22/15. 1500 gallons mud used on 5/22/15. Resume drilling @ 0842 on 5/26/15, redrill 3' due to fill in bottom of hole.
315					Same as above (310 ft).	GP	Portland Bentonite Cement	
320					Poorly graded GRAVEL (GP); light brown (7.5YR 6/4); 85% fine gravel to 3/8"; angular to subangular; 10% fine sand; subangular; 5% silt; gravel is mafics and quartzite; sand is quartz.			
325					Poorly graded GRAVEL with Sand (GP); light brown (7.5YR 6/4); 80% fine gravel to 3/8"; angular to subangular; 15% fine sand; subangular; 5% silt; gravel is granite and quartz; sand is quartz.			Drill bit bouncing likely due to coarse gravel. Kelly down @ 0902, resume drilling @ 0936.
330								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Poorly graded GRAVEL with Sand (GP); light brown (7.5YR 6/4); 80% fine gravel to 3/8"; angular to subangular; 15% fine sand; subangular; 5% silt; gravel is granite and quartz; sand is quartz.	GP		
335					Silty GRAVEL with Sand (GM); light brown (7.5YR 6/4); 70% fine gravel to 3/8"; angular to subangular; 15% fine sand; subangular; 15% silt; gravel is mafics and granite; sand is quartz.	GM		
340					Same as above (335 ft).			
345					Silty SAND (SM); brown (7.5YR 5/4); 80% fine sand; trace medium sand; subangular to subrounded; 20% silt; sand is quartz.	SM	Portland Bentonite Cement	Kelly down @ 1103, resume drilling @ 1125.
350					Same as above (345 ft).			
355					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 5/4) 75% fine gravel to 3/8"; angular to subangular; 20% fine to coarse sand; 5% silt; gravel is mafics, granite, and quartzite; sand is quartz and mafics.	GP		Rig bouncing slightly.
360								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360								
					Silty SAND (SM); brown (7.5YR 5/4); 80% fine to coarse sand; angular to subangular; 20% silt; trace crushed coarse gravel; sand is quartz, mica, and quartzite.	SM		Slow drilling, bit bouncing at 358 to 363 ft. Kelly down @ 1436, resume drilling @ 1438.
365							Portland Bentonite Cement	
					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 60% fine to coarse sand; angular to subangular; 35% fine gravel to 3/8"; angular to subangular; 5% silt; sand is mafics and quartz; gravel is mafics and granite.	SW	Top of Bentonite Seal	
370					Same as above (365 ft).			Drill bit bouncing.
375					Same as above (365 ft).			
380							Bentonite Seal	
					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/4); 80% fine to coarse sand; angular to subangular; 10% fine gravel to 3/8"; 10% silt; sand is quartz and mafics; gravel is mafics and quartz.	SW-SM		Kelly down @ 1710, resume drilling @ 1715. Used 1500 gallons mud on 5/26/15.
385								
					Silty SAND (SM); brown (7.5YR 5/3); 80% fine to coarse sand; angular to subangular; 20% silt; sand is quartz and mafics.	SM		Bit bouncing @ 1804.
390								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Silty SAND (SM); brown (7.5YR 5/3); 80% fine to coarse sand; angular to subangular; 20% silt; sand is quartz and mafics.	SM	- Top of 20/40 Sand	Stop drilling @ 392.5' @ 1843 on 5/26/15. Used 1600 gallons mud on 5/26/15. Resume drilling @ 0805 on 5/27/15.
395					Well-graded SAND with Silt (SW-SM); gray (7.5YR 6/1); 80% fine to coarse sand; subangular to subrounded; 10% fine gravel to 3/8"; subangular to subrounded; 10% silt; sand and gravel are quartz and mafics.	SW-SM	- Top of 10/20 Sand	
400					Fat CLAY with Sand (CH); strong brown (7.5YR 5/6); medium plasticity; 80% clay; 20% fine sand; trace medium and coarse sand.	CH		
405					Same as above (399 ft).			
410					Same as above (399 ft); sand is more coarse.			Stop drilling @ 1145. Trip out and replace drill bit, dump mud in shaker, and repair sand pump. Resume drilling @ 1738.
415					Clayey SAND (SC); strong brown (7.5YR 5/6); 70% fine to coarse sand; subangular to subrounded; 30% clay; sand is mafics, quartz, and granite.	SC		
420								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND with Silt (SP-SM); pinkish gray (7.5YR 6/2); 90% coarse sand; trace fine and medium sand; subangular to subrounded; 10% silt; sand is mafics, granite, quartz, and quartzite.	SP-SM		
425					Same as above (420 ft).			Pipe bouncing.
430					Same as above (420 ft).			Pipe bouncing.
435					Same as above (420 ft).			
440					Same as above (420 ft).		- Top of 8" Stainless Steel 0.050 Slot Screen	Stop drilling @ 443' @ 1846 on 5/27/15. Used 1600 gallons mud on 5/27/15. Resume drilling @ 0816 on 5/28/15.
445					Poorly graded SAND (SP); brown (7.5YR 5/4); 95% coarse sand; trace fine and medium sand; subangular to subrounded; 5% silt; sand is mafics, quartz, quartzite, and granite.	SP		Fine sand coming off the shaker.
450								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Poorly graded SAND (SP); brown (7.5YR 5/4); 95% coarse sand; trace fine and medium sand; subangular to subrounded; 5% silt; sand is mafics, quartz, quartzite, and granite.	SP		Fine sand coming off the shaker.
455					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% coarse sand; trace fine and medium sand; angular to subrounded; 10% silt; sand is quartz, mafics, and granite.			
460					Same as above (455 ft); 90% fine sand; trace medium and coarse sand; subangular; sand is quartz.			
465					Same as above (455 ft); 90% fine sand; trace medium and coarse sand; subangular; sand is quartz.	SP-SM	8" Stainless Steel 0.050 Slot Screen	
470					Same as above (455 ft); 90% fine sand; trace medium and coarse sand; subangular; sand is quartz.			
475					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/4); 90% fine to coarse sand; subangular to subrounded; 10% silt; fine sand is quartz and mafics; coarse sand is quartz, granite, and mafics.	SW-SM		Bit bouncing @ 478'.
480								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 458.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/4); 90% fine to coarse sand; subangular to subrounded; 10% silt; fine sand is quartz and mafics; coarse sand is quartz, granite, and mafics.	SW-SM		
485					Same as above (480 ft); fine sand is quartz; medium and coarse sand is quartz, mafics, and quartzite.			
490					Same as above (480 ft); fine sand is quartz; medium and coarse sand is quartz, mafics, and quartzite.			
495					Silty SAND (SM); brown (7.5YR 5/4); 85% fine to coarse sand; subangular to subrounded; 15% silt; fine sand is quartz; medium and coarse sand is granite, quartzite, and mafics.		8" Stainless Steel 0.050 Slot Screen	A little bouncing.
500					Same as above (495 ft).	SM		A little bouncing.
505					Well-graded SAND (SW); brown (7.5YR 5/4); 95% fine to coarse sand; angular to subrounded; 5% silt; sand is quartz, mafics, and granite.	SW		
510								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510								
515					Well-graded SAND (SW); brown (7.5YR 5/4); 95% fine to coarse sand; angular to subrounded; 5% silt; sand is quartz, mafics, and granite.	SW		
520					Poorly graded SAND (SP); brown (7.5YR 5/4); 95% coarse sand; trace fine sand; subangular to subrounded; 5% silt; sand is quartz, mica, and granite.	SP		Bit bouncing.
525					Same as above (515 ft).		8" Stainless Steel 0.050 Slot Screen	Bit bouncing.
530					Same as above (515 ft).			Bit bouncing.
535					Same as above (515 ft).			Bit bouncing.
540					Well-graded SAND (SW); brown (7.5YR 5/4); 95% fine to coarse sand; subangular to subrounded; 5% silt; sand is quartz, granite, and mica.	SW		

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Borehole ID: KAFB-106228

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB BFF SWMU ST-106 and SS-111
Project Number: 140705

Date Started: 5/18/2015
Date TD Reached: 5/29/15
Date Completed: 6/2/2015

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 458.00
At End of Drilling: Not Recorded
After Drilling: 458.51

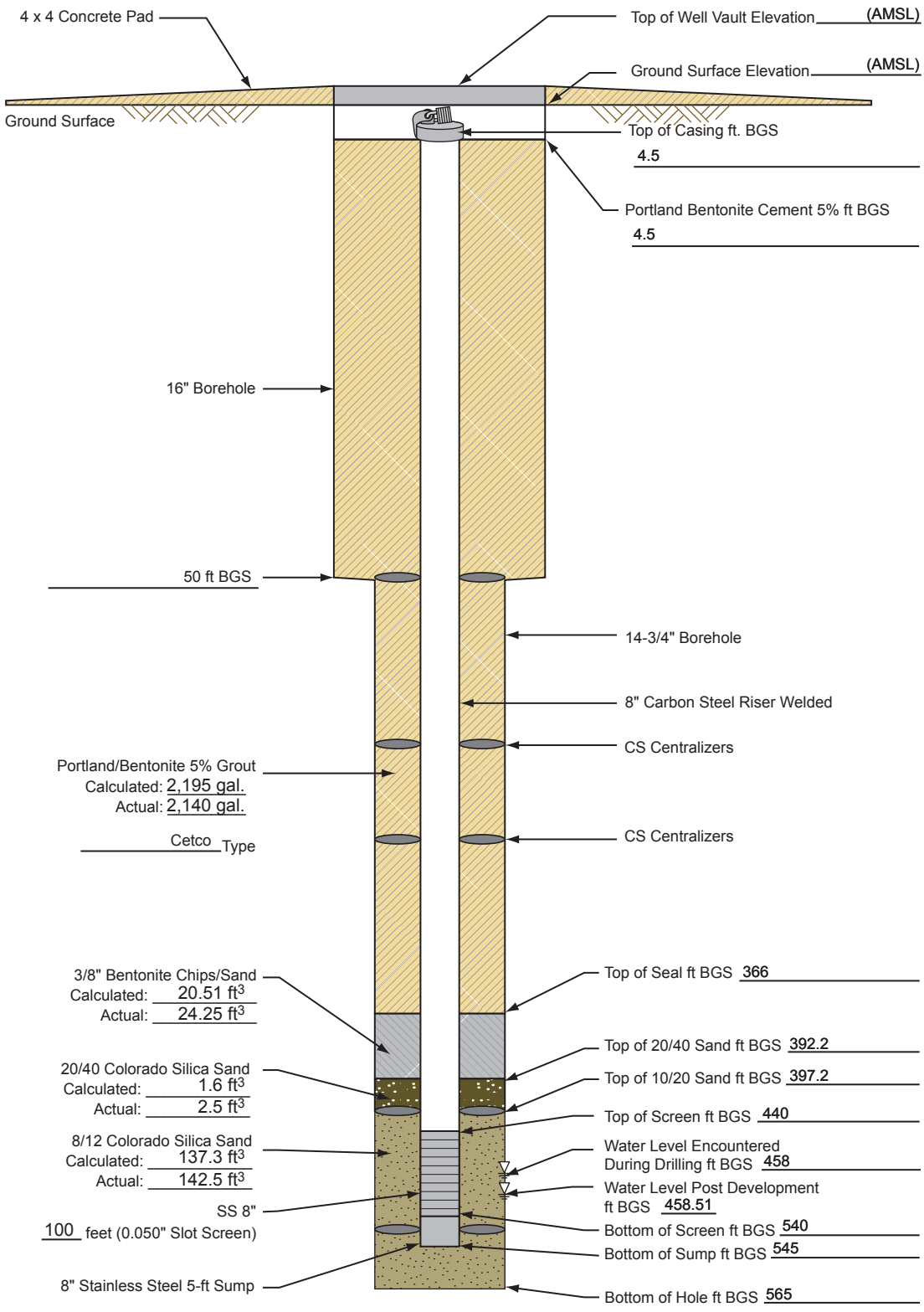
Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					Well-graded SAND (SW); brown (7.5YR 5/4); 95% fine to coarse sand; subangular to subrounded; 5% silt; sand is quartz, granite, and mica.		Botton of Screen	Bit bouncing.
							Sump	
545					Same as above (540 ft).	SW	Bottom of Sump	
550					Poorly graded SAND (SP); brown (7.5YR 5/4); 95% coarse sand; trace fine and medium sand; angular to subrounded; 5% silt; sand is quartz, mica, and granite.			Stop drilling @ 1845 on 5/28/15. Used 2,300 gallons of mud on 5/28/15. Resume drilling @ 0803 on 5/29/15.
555					Same as above (550 ft).			
560					Same as above (550 ft).	SP		
565							Bottom of Filter Pack	Total depth = 565 ft. Reached total depth @ 0847 on 5/29/15. Used 600 gallons of mud on 5/29/15. Used a total of 9,100 gallons mud on the entire boring.
570								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 7/13/15 13:12 - Z:\KAFB BFF\GINT\KAFB_PROJECT\KAFB_BFF.GPJ

Extraction Well Completion Diagram KAFB-106228

Installation Start Date/Time: 5/18/2015
Installation End Date/Time: 6/2/2015



(4,816.90) = *Elevations are NAVD 88 Datum values based on NGS Control Station "Hanger", Elevation = 5,343.43 ft. GPS/RTK methods and GEO1D99 model were used to determine elevations of all surveyed points.*

Not to Scale
BGS = Below Ground Surface

140705.CB020403.A19

Groundwater Extraction Well Development

Project Name: KAFB BFF
Location: Gibson
Personnel: VB, RW, EP
Start Date: 6/4/2015
End Date: 6/16/2015

Well No.: KAFB-106228
Date Installed: 6/2/2015
Casing Diameter (I.D.): 8-inch
Total Depth (ft. BGS): 545

Method of Development:

[X] Surging [X] Bailing [X] Pumping [X] Jetting

[X] Original Development [ ] Redevelopment [ ] Other

Depth to Water Before Developing Well (ft. BGS): NR
Screened Interval (ft. BGS): 440 - 540
Weather: Varied

Equipment Numbers: **pH:** NR **Conductivity:** NR
Turbidity: NR

Equipment Decontaminated Prior to Development? [X] Yes [ ] No
Describe:

Collected Sample of Water Added to Well? [ ] Yes [X] No
Describe:

Comments:

Summary of development procedure, including key decision-points, calculations, and observations (described in detail in the following pages):

Well development consisted of bailing, surging, pumping, and jetting. The first step of development removed mud and cuttings from the well casing and filter pack, which were generated during the drilling process, by surging and bailing. The second step entailed physical well development using surging, bailing, and pumping to assess development progress. These actions included taking measurements of sediment content in the water using the Imhoff cone technique, and applying 30 minutes of sustained pumping, measuring, and plotting drawdown to estimate development effectiveness. The third step used jetting with simultaneous pumping.

Groundwater Extraction Well Development

Bailing				
Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
6/4/2015	1157	15	25	Bailer was full of dark mud.
6/4/2015	1215	120	5	Wait until 993 gallons to begin purging well.
6/4/2015	1530	1,000	30	Water/mud is dark brown.
6/5/2015	1243	1,015	25	Continue bailing. Water/mud is dark brown.
6/5/2015	1323	1,300	10	Water/mud is dark brown.
6/5/2015	1356	1,375	10	Water/mud is dark brown.
6/5/2015	1428	1,600	15	Lighter brown in color.
6/6/2015	1018	1,765	10	Lighter brown in color.
6/6/2015	1032	1,840	3	Lighter brown in color. Sand to 1 mm.
6/8/2015	1157	2,935	0.7	Water is light brown.
6/8/2015	1207	2,980	3.0	Water is light brown.
6/8/2015	1220	2,995	0.5	Water is light brown.
6/8/2015	1226	3,040	0.9	Water is light brown.

L = liter

mL = milliliter

Groundwater Extraction Well Development

Surging				
Interval (feet below ground surface)	Date	Start Time	End Time	Comments
540-535	6/5/2015	1746	1750	Begin purging.
535-530	6/5/2015	1752	1756	
530-525	6/5/2015	1757	1801	
525-520	6/5/2015	1802	1806	
520-515	6/5/2015	1807	1811	
515-510	6/5/2015	1812	1816	
510-505	6/5/2015	1816	1820	
505-500	6/5/2015	1821	1825	
500-495	6/5/2015	1826	1830	
495-490	6/5/2015	1834	1838	
490-485	6/5/2015	1838	1642	Stop purging for 6/5/2015.
485-480	6/6/2015	0844	0848	
480-475	6/6/2015	0850	0854	
475-470	6/6/2015	0855	0859	
470-465	6/6/2015	0900	0904	
465-460	6/6/2015	0905	0909	
460-455	6/6/2015	0910	0914	
455-450	6/6/2015	0915	0919	
450-445	6/6/2015	0921	0925	
445-440	6/6/2015	0926	0930	
540-440	6/6/2015	0940	0950	Four strokes.
540-535	6/8/2015	0910	0914	
535-530	6/8/2015	0916	0920	
530-525	6/8/2015	0921	0925	
525-520	6/8/2015	0926	0930	
520-515	6/8/2015	0932	0936	
515-510	6/8/2015	0937	0941	
510-505	6/8/2015	0943	0947	
505-500	6/8/2015	0951	0955	
500-495	6/8/2015	0957	1001	
495-490	6/8/2015	1002	1006	
490-485	6/8/2015	1008	1012	
485-480	6/8/2015	1014	1018	
480-475	6/8/2015	1022	1026	
475-470	6/8/2015	1029	1034	
470-465	6/8/2015	1035	1039	
465-460	6/8/2015	1040	1045	
460-455	6/8/2015	1046	1050	Out of saturated screen
540-455	6/8/2015	1056	1130	Six strokes.

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
6/6/2015	1325	4.55	NR	1,930	23.02	8.38	1.270	>1,000	NR	Water level meter malfunction prior to pumping
6/6/2015	1345	4.5	NR	2,020	25.24	8.71	1.104	>1,000	NR	
6/6/2015	1400	4.5	NR	2,100	23.48	8.78	1.090	>1,000	NR	Imoff = 1.5 mL
6/6/2015	1415	4.5	NR	2,170	23.66	8.79	0.986	>1,000	NR	Imoff =0.25 mL
6/6/2015	1430	4.5	NR	2,240	23.29	8.61	0.835	>1,000	NR	Imoff = 0.5 mL
6/6/2015	1445	4.5	NR	2,310	23.70	8.53	0.699	>1,000	NR	Imoff = 0.25 mL
6/6/2015	1500	4.0	NR	2,380	23.97	8.31	0.622	>1,000	NR	Imoff = 0.25 mL
6/6/2015	1515	4.0	NR	2,440	22.91	7.83	0.562	>1,000	NR	Imoff = 0.4 mL
6/6/2015	1530	4.0	NR	2,500	22.66	7.89	0.548	>1,000	NR	Imoff = 0.3 mL
6/6/2015	1545	4.0	NR	2,560	23.11	7.87	0.540	>1,000	NR	Imoff = 0.2 mL
6/6/2015	1600	4.0	NR	2,620	22.85	7.88	0.533	>1,000	NR	Imoff = 0.2 mL
6/6/2015	1615	4.0	479.00	2,680	22.49	7.78	0.534	>1,000	NR	Imoff = 0.4 mL
6/6/2015	1630	4.0	479.80	2,740	22.70	7.81	0.529	>1,000	NR	Imoff = 0.3 mL
6/6/2015	1645	4.0	NR	2,800	22.50	7.91	0.535	>1,000	NR	Imoff = 0.1 mL
6/6/2015	1700	4.0	NR	2,860	22.27	7.69	0.544	>1,000	NR	Imoff = 0.3 mL
6/6/2015	1715	4.0	NR	2,920	22.44	7.72	0.522	>1,000	NR	Imoff = 0.2 mL
6/9/2015	0720	11.0	467.15	3,722	21.19	8.42	0.529	>1,000	NR	Imoff = 0.1 mL; Pump at 532 feet bgs
6/9/2015	0740	11.0	467.80	3,940	21.16	8.32	0.508	781	NR	Imoff = < 0.1 mL
6/9/2015	0750	11.0	470.65	4,050	21.16	8.22	0.499	313	NR	Imoff = < 0.1 mL
6/9/2015	0800	11.0	471.10	4,160	21.16	8.21	0.503	278	NR	Imoff = < 0.1 mL
6/9/2015	0810	11.0	471.50	4,270	21.16	8.21	0.497	207	0.6	Imoff = < 0.1 mL
6/9/2015	0820	18.0	478.1	4,380	21.10	8.21	0.488	165	NR	Imoff = < 0.1 mL
6/9/2015	0830	19.0	482.80	4,560	20.85	8.21	0.522	196	NR	Imoff = < 0.1 mL
6/9/2015	0840	18.0	486.20	4,750	20.87	8.25	0.514	429	NR	Imoff = < 0.1 mL
6/9/2015	0850	18.5	487.00	4,930	20.88	8.26	0.507	452	NR	Imoff = < 0.1 mL
6/9/2015	0900	19	486.00	5,125	20.80	8.20	0.491	351	NR	Imoff = 0.1 mL
6/9/2015	0910	18	485.20	5,315	20.75	8.17	0.496	262	NR	Imoff = < 0.1 mL
6/9/2015	0920	18	485.10	5,495	20.75	8.16	0.493	230	NR	Imoff = < 0.1 mL
6/9/2015	0930	18	484.50	5,670	20.77	8.16	0.487	184	NR	Imoff = 0.1 mL
6/9/2015	0940	18	484.00	6,850	20.63	8.14	0.491	176	0.64	Imoff = 0.1 mL
6/9/2015	1025	21	471.20	6,930	21.41	8.19	0.910	146	NR	Imoff = 0.1 mL; Pump at 511 feet bgs

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U.)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
6/9/2015	1035	20	476.95	7,130	20.86	7.99	0.503	75.4	NR	Imoff = 0.1 mL
6/9/2015	1045	20	480.50	7,330	20.85	8.11	0.487	11.5	NR	Imoff = < 0.1 mL
6/9/2015	1055	20	481.75	7,530	20.94	8.15	0.478	143	NR	Imoff = < 0.1 mL
6/9/2015	1055	20	482.35	7,730	20.87	8.15	0.480	147	0.79	Imoff = < 0.1 mL
6/9/2015	1135	21	468.00	7,830	22.84	8.24	0.478	136	NR	Imoff = < 0.1 mL Pump at 490 feet bgs
6/9/2015	1145	22	480.00	8,050	20.66	7.96	0.490	96.4	NR	Imoff = < 0.1 mL
6/9/2015	1155	20	479.00	8,270	20.71	8.05	0.456	88.2	NR	Imoff = < 0.1 mL
6/9/2015	1205	20	479.50	8,470	20.72	8.08	0.454	96.5	NR	Imoff = < 0.1 mL
6/9/2015	1215	20	479.50	8,670	20.66	8.08	0.468	89.0	NR	Imoff = < 0.1 mL
6/9/2015	1225	20	479.50	8,870	20.64	8.08	0.461	76.6	NR	Imoff = < 0.1 mL
6/9/2015	1235	20	479.50	9,070	20.63	8.08	0.460	73.5	0.89	Imoff = < 0.1 mL
6/9/2015	1245	20	479.50	9,270	20.66	8.09	0.450	73.7	0.89	Imoff = < 0.1 mL
6/9/2015	1255	20	479.50	9,470	20.71	8.10	0.458	72.1	0.89	Imoff = < 0.1 mL
6/9/2015	1305	20	479.50	9,670	20.73	8.10	0.455	79.8	0.89	Imoff = < 0.1 mL
6/9/2015	1320	20	479.00	9,970	20.71	8.08	0.452	68.8	0.90	Imoff = < 0.1 mL
6/9/2015	1415	20	465.00	10,010	21.02	8.24	0.458	125	2.5	Imoff = < 0.1 mL; Pump at 506 feet bgs
6/9/2015	1425	21	474.00	10,220	20.61	7.85	0.444	50.2	2.4	Imoff = < 0.1 mL
6/9/2015	1435	21	477.15	10,420	20.66	7.99	0.452	82.4	1.05	Imoff = < 0.1 mL
6/9/2015	1445	21	477.00	10,630	20.68	8.00	0.494	80.0	1.05	Imoff = < 0.1 mL
6/9/2015	1455	21	477.00	10,840	20.65	8.01	0.452	73.7	1.05	Imoff = < 0.1 mL; Pump at 501 feet bgs
6/9/2015	1505	21	476.50	11,050	20.74	8.02	0.458	72.4	1.08	Imoff = < 0.1 mL; Pump at 496 feet bgs
6/9/2015	1515	21	476.50	11,260	20.64	8.03	0.449	68.8	1.08	Imoff = < 0.1 mL
6/9/2015	1540	22	467.30	11,360	20.68	7.47	0.406	155	2.14	Imoff = < 0.1 mL; Pump at 527 feet bgs
6/9/2015	1550	22	477.50	11,580	20.59	7.89	0.432	45.2	1.07	Imoff = < 0.1 mL; Pump at 527 feet bgs
6/9/2015	1600	22	477.90	11,800	20.65	7.95	0.442	74.1	1.05	Imoff = < 0.1 mL
6/9/2015	1610	22	477.69	12,020	20.60	7.99	0.446	67.0	1.06	Imoff = < 0.1 mL; Pump at 522 feet bgs

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U.)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
6/9/2015	1620	22	477.40	12,240	20.62	8.02	0.441	59.9	1.08	Imoff = < 0.1 mL
6/9/2015	1630	21	477.50	12,450	20.69	8.00	0.500	49.3	1.02	Imoff = < 0.1 mL; Pump at 502 feet bgs
6/9/2015	1640	21	477.39	12,660	20.69	8.03	0.446	48.7	1.03	Imoff = < 0.1 mL
6/9/2015	1650	45	496.30	13,110	20.51	8.00	0.474	87.0	1.15	Imoff = < 0.1 mL; Pump at 532 feet bgs
6/9/2015	1700	43	507.90	13,540	20.31	8.04	0.476	92.0	0.84	Imoff = 1.0 mL
6/10/2015	1700	45	471.90	15,810	22.82	8.69	0.448	143	3.02	Imoff = < 0.1 mL; Pump at 513 feet bgs
6/10/2015	1710	45	474.00	16,260	21.25	7.97	0.443	70.9	2.65	Imoff = < 0.1 mL
6/10/2015	1720	45	474.90	16,710	21.02	7.96	0.429	59.9	2.15	Imoff = < 0.1 mL
6/11/2015	0810	46	466.00	17,537	21.59	7.20	0.459	17.6	5.11	Imoff = 0 mL; Pump at 481.5 feet bgs
6/11/2015	0820	45.5	470.60	17,442	20.33	7.19	0.458	49.7	3.31	Imoff = 0 mL
6/11/2015	0830	45.5	471.70	18,447	20.46	7.31	0.444	62.3	3.10	Imoff = 0 mL
6/11/2015	0840	45.5	472.30	18,902	19.91	7.37	0.440	45.9	2.97	Imoff = 0 mL
6/12/2015	1435	45	460.50	20,098	26.45	6.79	0.527	15.2	12.16	Imoff = 0 mL; Pump at 533 feet bgs
6/12/2015	1445	45	461.31	20,548	25.42	7.31	0.526	5.79	9.20	Imoff = 0 mL
6/12/2015	1455	45	461.64	20,998	22.71	7.57	0.443	2.55	9.20	Imoff = 0 mL
6/12/2015	1505	45	461.89	20,448	21.57	7.64	0.428	1.90	8.84	Imoff = 0 mL
6/12/2015	1515	45	462.02	20,898	20.98	7.61	0.426	1.72	8.65	Imoff = 0 mL
6/13/2015	2031	45	460.00	38,341	25.52	8.63	0.511	13.7	15	Imoff = < 0.1 mL; Pump at 533 feet bgs
6/13/2015	2041	45	460.66	38,791	20.98	8.19	0.364	8.58	12.30	Imoff = 0 mL
6/13/2015	2051	45	460.77	39,241	20.76	8.12	0.380	9.79	11.94	Imoff = 0 mL
6/13/2015	2101	45.5	460.91	39,691	20.65	8.10	0.380	6.95	11.64	Imoff = 0 mL
6/13/2015	2111	45	460.99	40,141	20.56	8.10	0.379	4.96	11.28	Imoff = 0 mL
6/13/2015	2121	45	461.05	40,591	20.51	8.10	0.378	4.64	11.11	Imoff = 0 mL
6/13/2015	2131	45	461.10	41,041	20.48	8.11	0.378	4.32	10.98	Imoff = 0 mL
6/13/2015	2141	45	461.10	41,491	20.49	8.12	0.377	5.48	10.98	Imoff = 0 mL
6/15/2015	2120	45	452.05	53,048	27.21	7.87	0.500	14.3	NR	Imoff = < 0.1 mL
6/15/2015	2130	45	460.62	53,498	25.03	7.88	0.481	31.0	12.61	Imoff = < 0.1 mL
6/15/2015	2140	45	460.77	53,948	23.53	7.91	0.429	16.3	12.01	Imoff = < 0.1 mL
6/15/2015	2150	45	460.82	54,398	22.80	7.93	0.399	8.86	11.94	Imoff = < 0.1 mL

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U.)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
6/15/2015	2200	45	460.90	54,848	22.28	7.96	0.391	5.14	11.69	Imoff = < 0.1 mL
6/15/2015	2208	NR	NR	55,208	--	--	--	--	--	Shut off pump.
6/16/2015	1900	56	462.75	56,273	21.79	8.31	0.423	109	12.97	Imoff = < 0.1 mL
6/16/2015	1910	55	462.76	56,823	21.05	8.27	0.401	58.6	12.97	Imoff = < 0.1 mL
6/16/2015	1920	55	462.84	57,373	20.88	8.30	0.396	27.7	12.70	Imoff = < 0.1 mL
6/16/2015	1930	55	462.87	57,923	20.76	8.30	0.396	21.3	12.61	Imoff = < 0.1 mL
6/16/2015	1940	55	462.91	58,473	20.68	8.30	0.392	17.1	12.5	Imoff = < 0.1 mL
6/16/2015	1950	55	462.94	59,023	20.63	8.31	0.391	12.6	12.42	Imoff = < 0.1 mL
6/16/2015	2000	55	462.97	59,573	20.57	8.31	0.391	12.6	12.33	Imoff = < 0.1 mL
6/16/2015	2020	55	463.01	60,673	20.50	8.32	0.390	7.90	12.22	Imoff = < 0.1 mL
6/16/2015	2040	55	461.66	61,773	20.43	8.33	0.389	7.64	12.14	Imoff = < 0.1 mL
6/16/2015	2130	55	461.75	63,523	20.37	8.32	0.388	4.46	11.90	Imoff = < 0.1 mL

°C = degrees Celsius
EC = Electric Conductivity
ft bgs = feet below ground surface
gpm = gallons per minute
gpm/ft = gallons per minute per foot
mL = milliliter
mS/cm = millisiemen per centimeter
NR = not recorded
NTU = Nephelometric Turbidity Unit
S.U. = Standard Unit

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
6/9/2015	1715	484.5	29	45.5	0.2	Jet = 130 psi
6/9/2015	1721	481.5	29	45.5	0.7	Jet = 130 psi
6/9/2015	1724	478.5	29.5	45	0.5	Jet = 129 psi
6/9/2015	1736	475.5	29	--	--	Shut pump off @ 1734
6/9/2015	1740	472.5	29	--	--	Jet = 130 psi
6/9/2015	1744	469.5	29.5	--	--	Jet = 130 psi
6/9/2015	1748	466.5	29	--	--	Jet = 129 psi
6/9/2015	1751	463.5	29	--	--	Jet = 129 psi
6/9/2015	1755	460.5	29.5	--	--	Jet = 129 psi
6/10/2015	1450	531.5	22	44	< 0.1	Jet = 72 psi
6/10/2015	1505	536.5	24	45	0.3	Jet = 118 psi
6/10/2015	1514	533.5	24	45	0.1	Jet = 118 psi
6/10/2015	1518	530.5	24	45	0.2	Jet = 118 psi
6/10/2015	1524	527.5	24	46	0.5	Jet = 118 psi
6/10/2015	1529	524.5	24	46	0.1	Jet = 118 psi
6/10/2015	1534	521.5	24	45.5	0.1	Jet = 118 psi; Pumped 2,300 gallons
6/10/2015	1632	517.5	25	46	< 0.1	Jet = 117 psi
6/10/2015	1636	514.5	25	45	0.3	Jet = 117 psi
6/10/2015	1640	511.5	25	45.5	2.0	Jet = 117 psi
6/10/2015	1644	508.5	25	45.5	0.5	Jet = 117 psi
6/10/2015	1802	505.5	28	46	0.1	Jet = 117 psi
6/10/2015	1806	502.5	28	46	0.1	Jet = 116 psi
6/10/2015	1812	499.5	28.5	45.5	0.1	Jet = 116 psi
6/10/2015	1816	496.5	29	45	0.1	Jet = 117 psi
6/10/2015	1819	493.5	28	45	0.1	Jet = 117 psi
6/10/2015	1824	490.5	28	44	0.2	Jet = 117 psi
6/10/2015	1830	487.5	28	44.5	0.1	Jet = 117 psi; Stop jetting.
Jetted a total of 2,585 gallons and pumped out 6,490 gallons on 6/10/2015						
6/12/2015	0756	536.5	27	46	< 0.1	Jet = 129 psi
6/12/2015	0802	533.5	27	46	0.4	Jet = 129 psi
6/12/2015	0808	530.5	27	46	0.3	Jet = 128 psi
6/12/2015	0814	527.5	26	46	0.5	Jet = 128 psi
6/12/2015	0820	524.5	29	46	0.3	Jet = 129 psi
6/12/2015	0826	521.5	30	46	< 0.1	Jet = 128 psi
6/12/2015	0832	518.5	30	46	< 0.1	Jet = 128 psi
6/12/2015	0838	--	--	--	--	Breaking Connection.
6/12/2015	0934	515.5	26	45.5	< 0.1	Jet = 130 psi
6/12/2015	0940	512.5	26	46	0.1	Jet = 129 psi

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
6/12/2015	0946	509.5	26.5	46	< 0.1	Jet = 130 psi
6/12/2015	0952	--	--	--	--	Breaking Connection.
6/12/2015	1032	506.5	27.5	45	< 0.1	Jet = 132 psi
6/12/2015	1038	503.5	28	45	< 0.1	Jet = 131 psi
6/12/2015	1044	500.5	28	45	< 0.1	Jet = 131 psi
6/12/2015	1050	497.5	28	45	< 0.1	Jet = 132 psi
6/12/2015	1056	494.5	28	45	< 0.1	Jet = 131 psi
6/12/2015	1102	491.5	28	46	< 0.1	Jet = 131 psi
6/12/2015	1108	--	--	--	--	Breaking Connection.
6/12/2015	1234	488.5	16	44	< 0.1	Jet = 130 psi
6/12/2015	1248	485.5	16	45	< 0.1	Jet = 132 psi
6/12/2015	1254	482.5	16	45	< 0.1	Jet = 132 psi; Stop pumping
6/12/2015	1300	479.5	16	--	--	Jet = 132 psi
6/12/2015	1306	476.5	16	--	--	Jet = 132 psi
6/12/2015	1312	473.5	16	--	--	Jet = 132 psi
6/12/2015	1318	470.5	16	--	--	Jet = 132 psi
6/12/2015	1324	467.5	16	--	--	Jet = 132 psi
6/12/2015	1330	464.5	15.5	--	--	Jet = 132 psi
6/12/2015	1336	--	--	--	--	Stop Jetting; Drop pump to bottom.
6/12/2015	1544	536.5	12	45	< 0.1	Jet = 132 psi; DTW = 460.20
6/12/2015	1551	533.5	11	45	< 0.1	Jet = 132 psi; DTW = 460.50
6/12/2015	1557	530.5	11	45	0.1	Jet = 132 psi
6/12/2015	1605	527.5	11	45	< 0.1	Jet = 132 psi
6/12/2015	1612	524.5	10	45	< 0.1	Jet = 132 psi
6/12/2015	1618	521.5	11	45	< 0.1	Jet = 132 psi; DTW = 461.50
6/12/2015	1620	--	--	--	--	Stop Jetting for repairs.
6/13/2015	1340	536.5	42	45	< 0.1	Jet = 120 psi
6/13/2015	1348	533.5	42	45	0.2	Jet = 120 psi
6/13/2015	1356	530.5	42	45	0.1	Jet = 120 psi
6/13/2015	1402	527.5	42	45	0.1	Jet = 120 psi
6/13/2015	1409	524.5	42	45	0.3	Jet = 120 psi
6/13/2015	1415	521.5	41	45.5	< 0.1	Jet = 120 psi
6/13/2015	1639	518.5	42	45	0.1	Jet = 122 psi
6/13/2015	1646	515.5	42	45.5	0.2	Jet = 121 psi
6/13/2015	1652	512.5	42	45.5	0.1	Jet = 121 psi
6/13/2015	1659	509.5	42	45	0.1	Jet = 121 psi
6/13/2015	1730	506.5	42	45	< 0.1	Jet = 122 psi

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
6/13/2015	1736	503.5	42	45	0.1	Jet = 122 psi
6/13/2015	1811	500.5	42	45	< 0.1	Jet = 122 psi
6/13/2015	1818	497.5	42	45	< 0.1	Jet = 122 psi
6/13/2015	1825	494.5	42	45	< 0.1	Jet = 122 psi
6/13/2015	1831	491.5	42	45	0.1	Jet = 122 psi
6/13/2015	1837	488.5	42	45	0.2	Jet = 122 psi
6/13/2015	1924	485.5	42	45	0.1	Jet = 121 psi
6/13/2015	1931	482.5	42	45.5	0.1	Jet = 121 psi
6/13/2015	1937	479.5	42	45.5	< 0.1	Jet = 121 psi
6/13/2015	1941	--	--	--	--	Stop Jetting; Out of water
6/15/2015	0723	536.5	42	45.5	0.7	Jet = 124 psi
6/15/2015	0729	533.5	42	45.5	0.1	Jet = 124 psi
6/15/2015	0735	530.5	42	45.5	< 0.1	Jet = 124 psi
6/15/2015	0741	527.5	42	45	< 0.1	Jet = 124 psi
6/15/2015	0746	524.5	42	45.5	< 0.1	Jet = 123 psi
6/15/2015	0752	521.5	42	46	< 0.1	Jet = 123 psi
6/15/2015	0758	518.5	--	46	--	Stop Jetting; Out of water
6/15/2015	0906	518.5	18	45	< 0.1	Jet = 50 psi
6/15/2015	0912	515.5	42	45	< 0.1	Jet = 120 psi
6/15/2015	0918	512.5	42	45	< 0.1	Jet = 122 psi
6/15/2015	0924	509.5	42	45.5	< 0.1	Jet = 122 psi
6/15/2015	0930	--	--	--	--	Remove stick
6/15/2015	1013	506.5	41	45	< 0.1	Jet = 119 psi
6/15/2015	1019	503.5	42	45	< 0.1	Jet = 120 psi; Out of water
6/15/2015	1100	500.5	42	46	< 0.1	Jet = 120 psi
6/15/2015	1106	497.5	41	46	< 0.1	Jet = 120 psi
6/15/2015	1112	494.5	41	46	< 0.1	Jet = 120 psi
6/15/2015	1118	491.5	40.5	46	< 0.1	Jet = 120 psi
6/15/2015	1124	488.5	40.5	46	< 0.1	Jet = 120 psi
6/15/2015	1201	485.5	41	45	0.1	Jet = 120 psi
6/15/2015	1207	482.5	41	45	< 0.1	Jet = 120 psi; Out of water
6/15/2015	1303	479.5	41	45	< 0.1	Jet = 117 psi; DTW = 457.7
6/15/2015	1309	476.5	41	45	< 0.1	Jet = 117 psi
6/15/2015	1315	473.5	41	46	< 0.1	Jet = 117 psi
6/15/2015	1321	470.5	41	46	< 0.1	Jet = 117 psi
6/15/2015	1327	467.5	41	--	--	Jet = 117 psi; Pump off
6/15/2015	1333	464.5	41	--	--	Jet = 117 psi
6/15/2015	1339	461.5	41	--	--	Jet = 117 psi
6/15/2015	1447	461.5	41	--	--	Jet = 117 psi

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
6/15/2015	1451	--	--	--	--	Stop jetting due to lightning
6/15/2015	1602	461.5	41	--	--	Jet = 122 psi; Finish section
6/15/2015	1604	464.5	41	--	--	Jet = 122 psi
6/15/2015	1610	467.5	41	--	--	Jet = 122 psi
6/15/2015	1616	470.5	41	45	< 0.1	Jet = 121 psi; Start pumping
6/15/2015	1622	473.5	41	46	< 0.1	Jet = 121 psi
6/15/2015	1628	476.5	41	46	< 0.1	Jet = 121 psi
6/15/2015	1634	479.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1640	482.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1646	--	--	--	--	Out of water; Add 20 feet of pipe
6/15/2015	1741	485.5	41	44	0.1	Jet = 121 psi
6/15/2015	1747	488.5	41	45	0.1	Jet = 121 psi
6/15/2015	1753	491.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1759	494.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1805	497.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1811	500.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1817	--	--	--	--	Add pipe
6/15/2015	1841	503.5	41	45	< 0.1	Jet = 121.5 psi
6/15/2015	1847	506.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1853	--	--	--	--	Out of water
6/15/2015	1931	509.5	42	45	< 0.1	Jet = 121 psi
6/15/2015	1937	512.5	41	46	< 0.1	Jet = 121 psi
6/15/2015	1945	515.5	41	45	< 0.1	Jet = 121 psi
6/15/2015	1950	518.5	42	45.5	< 0.1	Jet = 121 psi
6/15/2015	1956	521.5	42	45	< 0.1	Jet = 121 psi
6/15/2015	2002	521.5	--	--	--	Add pipe
6/15/2015	2030	524.5	42	46	< 0.1	Jet = 121 psi
6/15/2015	2036	527.5	42	46	< 0.1	Jet = 121 psi
6/15/2015	2042	530.5	42	46	< 0.1	Jet = 121 psi
6/15/2015	2048	533.5	42	46	< 0.1	Jet = 121 psi
6/15/2015	2054	--	--	--	--	Turn off jet pump

ft bgs = feet below ground surface

gpm = gallons per minute

L = liter

mL = millliliter

psi = pounds per square inch

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

LICENSED PROFESSIONAL GEOLOGIST
VIRGINIA BRACHT
8881903-2250
STATE OF UTAH

12/9/15

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No lithologic description.		- Top of Casing/Top of Portland Bentonite Cement - Portland Bentonite Cement	Borehole was potholed from 0 - 12'.
15					Sandy SILT (ML); pinkish white (7.5YR 8/2); dry; soft; 60% silt; 40% fine to coarse sand; angular to subangular. Note: sand is quartz and mafics.	ML		Begin advancing 16" casing @ 1140 on 9/8/15.
20					Poorly graded GRAVEL with Silt and Sand (GP-GM); reddish yellow (7.5YR 7/6); 60% fine gravel to 3/4"; angualr to subangular; 30% fine to coarse sand; subangular to subrounded; 10% silt. Note: gravel is mafics and granite. Sand is mafics, quartzite, and quartz.	GP-GM		Kelly down @ 1201, new 10' connection. Resume drilling @ 1400.
25					Poorly graded SAND with Silt and Gravel (SP-SM); brown (7.5YR 5/3); 70% coarse sand; trace fine and medium sand; subangular to subrounded; 20% fine gravel to 1/2"; subangular; 10% silt. Note: sand is quartz, mafics, and quartzite. Gravel is mafics.	SP-SM		Kelly down @ 1506, new connection. Resume drilling @ 1528.
30								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30								
					Poorly graded SAND with Silt and Gravel (SP-SM); brown (7.5YR 5/3); 70% coarse sand; trace fine and medium sand; subangular to subrounded; 20% fine gravel to 1/2"; subangular; 10% silt. Note: sand is quartz, mafics, and quartzite. Gravel is mafics.	SP-SM		
35								
					Gravelly SILT with Sand (ML); light brown (7.5YR 6/4); low plasticity; 60% silt; 25% fine gravel to 1/2"; angular to subangular; 15% medium to coarse sand.			Cuttings come out of cyclone as mush.
40								
					Sandy SILT (ML); light brown (7.5YR 6/4); low plasticity; 50% silt; 40% coarse sand; angular to subangular; 10% fine gravel to 1/2"; angular to subangular. Note: gravel is mafics.			Kelly down @ 1615, new connection. Resume drilling @ 1735.
45						ML		
					Same as above (40 ft).		Portland Bentonite Cement	
					Same as above (40 ft); trace clay.			Kelly down @ 1820. End of 9/8/15. Resume drilling with 16" casing @ 0812 on 9/9/15. Used approximately 500 gallons of water.
50								
					Same as above (40 ft).			
55								
					Silty SAND (SM); brown (7.5YR 4/4); 85% very fine to fine sand; trace gravel; 15% silt.			
					Same as above (53 ft); 80% fine to coarse sand; 20% silt. Note: sand is quartz and mafics.	SM		Kelly down @ 0902, new 10' connection. Resume drilling @ 1011.
60					Same as above (53 ft); 80% fine to coarse sand; 20% silt; trace clay. Note: sand is quartz and mafics.			

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
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Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Sandy SILT (ML); strong brown (7.5YR 4/6); low plasticity; 50% silt; 40% fine sand; trace medium sand; 10% fine gravel to 3/8".			PID = 0.0 ppm @ mud pit.
65					SILT (ML); yellowish red (5YR 5/6); 90% silt; 10% coarse sand; angular.			PID = 0.0 ppm @ mud pit. Driller added water to clean out hose and cyclone. Kelly down @ 1107, new 10' connection. Resume drilling @ 1123.
70					Same as above (65 ft); yellowish red (5YR 5/8); trace clay.	ML		
75					Same as above (65 ft); yellowish red (5YR 5/8); trace clay.		Portland Bentonite Cement	PID = 0.0 ppm @ mud pit. Kelly down @ 1212 @ 77'.
80					Lean CLAY with Sand (CL); light greenish gray (Gley1 8/1); soft; low plasticity; 80% clay; 20% fine sand; trace coarse sand.	CL		Reach total depth with 16" casing @ 1246. End of 9/9/15. Resume drilling with mud rotary @ 1010 on 9/10/15. Used a total of 1,100 gallons of water to date.
85					SILT with Sand (ML); brown (7.5YR 5/4); low plasticity; 75% silt; 25% very fine to fine sand.	ML		PID = 0.0 ppm @ mud pit.
90								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					SILT with Sand (ML); brown (7.5YR 5/4); low plasticity; 75% silt; 25% very fine to fine sand.	ML		PID = 0.0 ppm @ mud pit.
95					Lean CLAY with Sand (CL); yellowish red (5YR 5/8); soft; low plasticity; 70% clay; 10% silt; 20% fine to medium sand.			
100					Same as above (95 ft); 20% coarse sand; angular.			Kelly down @ 1152, new 20' connection. Resume drilling @ 1247.
105					Same as above (95 ft); 30% fine to coarse sand; no silt.	CL	Portland Bentonite Cement	
110					Lean CLAY (CL); yellowish red (5YR 5/8); soft; low plasticity; 90% clay; 10% meduim to coarse sand.			PID = 0.0 ppm @ mud pit.
115					Same as above (110 ft).			
120								PID = 0.0 ppm @ mud pit.

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120								
125					Sandy SILT (ML); brown (7.5YR 5/4); low plasticity; 70% silt; 30% fine sand.	ML		Kelly down @ 1305, new 20' connection. Resume drilling @ 1315.
130					Silty SAND (SM); light brown (7.5YR 6/4); loose; 75% very fine sand; 25% silt.	SM		PID = 0.0 ppm @ mud pit.
135					Sandy SILT (ML); strong brown (7.5YR 5/6); 60% silt; 40% fine to coarse sand. Note: sand is mafics.	ML		
140					Poorly graded SAND with Silt (SP-SM); strong brown (7.5YR 5/6); 90% coarse sand; angular to subangular; 10% silt. Note: sand is quartz, granite, and mafics.	SP-SM	Portland Bentonite Cement	PID = 0.0 ppm @ mud pit.
145					Silty SAND (SM); strong brown (7.5YR 5/6); 70% fine to coarse sand; angular to subangular; 30% silt. Note: sand is mafics.	SM		Kelly down @ 1330, new 20' connection. Resume drilling @ 1352.
150					Well-graded SAND with Silt (SW-SM); strong brown (7.5YR 5/6); 90% fine to coarse sand; angular to subrounded; 10% silt. Note: sand is mafics, quartz, and granite.	SW-SM		

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150								
155					Well-graded SAND with Silt (SW-SM); strong brown (7.5YR 5/6); 90% fine to coarse sand; angular to subrounded; 10% silt. Note: sand is mafics, quartz, and granite.	SW-SM		PID = 0.0 ppm @ mud pit.
160					Silty SAND (SM); brown (7.5YR 5/4); 75% fine to coarse sand; angular to subrounded; 25% silt. Note: sand is quartz and mafics.	SM		
165					Poorly graded SAND with Silt (SP-SM); strong brown (7.5YR 5/6); 90% coarse sand; trace fine and medium sand; angular to subangular; 10% silt. Note: sand is mafics and quartz.	SP-SM	- Portland Bentonite Cement	Kelly down @ 1410, new 20' connection. Resume drilling @ 1428.
170					Same as above (160 ft).			PID = 0.0 ppm @ mud pit.
175					Poorly graded SAND (SP); strong brown (7.5YR 5/6); 95% coarse sand; trace fine and medium sand; angular to subangular; 5% silt. Note: sand is mafics, quartz, and quartzite.	SP		
180					Same as above (170 ft).			PID = 0.0 ppm @ mud pit.

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well-graded SAND (SW); strong brown (7.5YR 5/6); 95% fine to coarse sand; angular to subrounded; 5% silt. Note: sand is quartz and mafics.			Kelly down @ 1445, new 20' connection. Resume drilling @ 1500.
185					Same as above (180 ft).			PID = 0.0 ppm @ mud pit.
190					Same as above (180 ft).	SW		
195					Same as above (180 ft).		Portland Bentonite Cement	
200					Silty SAND (SM); brown (10YR 5/3); 85% fine to coarse sand; angular to subangular; 15% silt. Note: sand is quartz with mafics and quartzite.			Kelly down @ 1527, new 20' connection. Resume drilling @ 1547.
205					Same as above (200 ft); 80% fine to coarse sand; 20% silt.	SM		PID = 0.0 ppm @ mud pit.
210								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Silty SAND (SM); brown (10YR 5/3); 80% fine to coarse sand; angular to subangular; 20% silt. Note: sand is quartz with mafics and quartzite.	SM		
215					Poorly graded SAND (SP); strong brown (7.5YR 5/6); 95% coarse sand; trace medium sand; angular to subangular; 5% silt. Note: sand is quartz with mafics and quartzite.	SP		PID = 0.0 ppm @ mud pit.
220					Well-graded SAND (SW); strong brown (7.5YR 5/6); 95% fine to coarse sand; angular to subangular; 5% silt. Note: sand is quartz, mafics, and quartzite.	SW		Kelly down @ 1612, new 20' connection. Resume drilling @ 1636.
225					Same as above (220 ft); 95% medium to coarse sand.		Portland Bentonite Cement	
230					Same as above (220 ft); 95% medium to coarse sand.			
235					Silty SAND (SM); brown (7.5YR 4/2); 60% fine sand; trace medium sand; subangular to subrounded; 40% silt. Note: sand is quartz with mafics.	SM		PID = 0.0 ppm @ mud pit.
240								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
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Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Silty SAND (SM); brown (7.5YR 4/2); 70% fine sand; trace medium sand; subangular to subrounded; 30% silt. Note: sand is quartz with mafics.			Kelly down @ 1705, new 20' connection. Resume drilling @ 1713.
245					Same as above (240 ft); 60% fine sand; 40% silt.			
250					Same as above (240 ft); 80% fine sand; 20% silt.	SM		
255					Same as above (240 ft); 80% fine sand; 20% silt.		- Portland Bentonite Cement	PID = 0.0 ppm @ mud pit.
260					Same as above (240 ft); brown (7.5YR 5/3); 75% very fine to fine sand; trace medium and coarse sand; 25% silt.			Kelly down @ 1728, new 20' connection. Resume drilling @ 1745.
265					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine to medium sand; trace coarse sand; angular to subrounded; 10% silt. Note: sand is quartz, mafics, and quartzite.	SP-SM		
270								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
275					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine to medium sand; trace coarse sand; angular to subrounded; 10% silt. Note: sand is quartz, mafics, and quartzite.	SP-SM		Rig chatter @ 273'. PID = 0.0 ppm @ mud pit.
280					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/3); 90% fine to coarse sand; angular to subangular; 10% silt. Note: sand is quartz, mafics, and quartzite.	SW-SM		
285					Poorly graded GRAVEL (GP); brown (7.5YR 5/3); 85% fine gravel to 3/8"; angular to subrounded; 10% coarse sand; 5% silt. Note: gravel and sand are mafics, quartz, and felspar.	GP	- Portland Bentonite Cement	Kelly down @ 1800. End of 9/10/15. Resume drilling @ 1003 on 9/11/15. Used 2,400 gallons of water on 9/10/15.
290					Same as above (280 ft).			
295					Poorly graded GRAVEL with Silt and Sand (GP-GM); brown (7.5YR 5/3); 50% fine gravel to 3/8"; angular to subrounded; 40% fine sand; 10% silt. Note: gravel is mafics, quartz, and feldspar. Sand is quartz.	GP-GM		
300					Same as above (290 ft); 70% fine gravel to 3/8"; 20% fine sand.			

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

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Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Silty GRAVEL with Sand (GM); light brown (7.5YR 6/4); 55% fine gravel to 3/8"; angular to subangular; 30% fine sand; 15% silt. Note: gravel is mafics and feldspar. Sand is quartz.	GM		Kelly down @ 1020, new 20' connection. Resume drilling @ 1028.
305					Same as above (300 ft); 70% fine gravel to 3/8"; 15% fine sand; subangular to subrounded. Note: gravel is mafics and quartz.			PID = 0.0 ppm @ mud pit.
310					Silty SAND with Gravel (SM); light brown (7.5YR 6/4); 70% fine to coarse sand; angular to subrounded; 15% fine gravel to 3/8"; 15% silt. Note: sand and gravel are mafics, granite, quartzite, and quartz.	SM		
315					Poorly graded GRAVEL with Sand (GP); light brown (7.5YR 6/4); 60% fine gravel to 3/8"; angular to subrounded; 35% fine to coarse sand; 5% silt. Note: gravel is mafics, feldspar, and quartz. Sand is quartz.	GP	Portland Bentonite Cement	PID = 0.0 ppm @ mud pit.
320					Well-graded SAND with Silt and Gravel (SW-SM); light brown (7.5YR 6/4); 65% fine to coarse sand; angular to subrounded; 25% fine gravel to 3/8"; 10% silt. Note: sand and gravel are mafics, quartzite, felspar, and quartz.	SW-SM		Kelly down @ 1058, new 20' connection. Resume drilling @ 1112.
325					Same as above (320 ft). Note: greater fine sand fraction.			
330								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Silty SAND (SM); light brown (7.5YR 6/4); 80% fine to coarse sand; angular to subrounded; 5% fine gravel to 3/8"; 15% silt. Note: sand and gravel are mafics, quartz, and feldspar.			
335					Same as above (330 ft).	SM		
340					Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/4); 90% coarse sand; trace fine and medium sand; angular to subangular; 10% silt. Note: sand is quartz, mafics, and granite.			Kelly down @ 1127, new 20' connection. Resume drilling @ 1140.
345					Same as above (340 ft).	SP-SM	Portland Bentonite Cement	
350					Silty SAND with Gravel (SM); light brown (7.5YR 6/4); 65% fine to coarse sand; angular to subangular; 20% fine gravel to 3/8"; 15% silt. Note: sand and gravel are quartz, mafics, quartzite, and granite.			
355					Same as above (350 ft).	SM		
360								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360								
365					Silty SAND (SM); light brown (7.5YR 6/3); 80% very fine to fine sand; trace medium and coarse sand; subangular to subrounded; 20% silt. Note: sand is quartz with some mafics.	SM	- Top of 3/8" Bentonite Chip Seal	Kelly down @ 1155, new 20' connection. Resume drilling.
370					Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/3); 90% coarse sand; trace fine and medium sand; subangular to subrounded; 10% silt. Note: sand is mafics, quartz, feldspar, and granite.	SP-SM		
375					Silty SAND with Gravel (SM); light brown (7.5YR 6/3); 50% fine to coarse sand; angular to subrounded; 40% fine gravel to 3/8"; 15% silt. Note: sand and gravel are mafics, quartz, feldspar, and granite.	SM		
380					Poorly graded GRAVEL (GP); light brown (7.5YR 6/3); 85% fine gravel to 1/2"; angular to subrounded; 10% fine sand; 5% silt. Note: gravel and sand are mafics, feldspar, quartz, and granite.	GP	- 3/8" Bentonite Chip Seal	PID = 0.0 ppm @ mud pit.
385					Poorly graded GRAVEL with Silt and Sand (GP-GM); light brown (7.5YR 6/3); 75% fine gravel to 1/2"; subangular to subrounded; 15% fine sand; 10% silt. Note: gravel and sand are mafics, feldspar, quartz, and granite. Same as above (380 ft).	GP-GM		Kelly down @ 1324, new 20' connection. Resume drilling @ 1335.
390								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Silty GRAVEL with Sand (GM); light brown (7.5YR 6/3); 70% fine gravel to 1/2"; angular to subangular; 15% fine sand; 15% silt. Note: gravel and sand are mafics, quartz, feldspar, and granite.			
395					Silty GRAVEL (GM); light brown (7.5YR 6/3); 70% fine gravel to 1/2"; angular to subrounded; 10% fine sand; 20% silt. Note: gravel and sand are mafics, quartz, feldspar, and granite.	GM	- 3/8" Bentonite Chip Seal	
400					Silty SAND with Gravel (SM); light brown (7.5YR 6/3); 50% fine to coarse sand; subangular to subrounded; 20% fine gravel to 3/8"; 30% silt. Note: sand and gravel are mafics, quartz, and granite.	SM	- Top of 20/40 Sand	Kelly down @ 1459, new 20' connection. Resume drilling @ 1508.
405					Clayey SAND with Gravel (SC); reddish brown (5YR 5/4); low plasticity; 50% fine to coarse sand; subangular to subrounded; 25% fine gravel to 3/8"; 25% clay. Note: sand and gravel are quartz, mafics, feldspar, and granite.	SC	- Top of 10/20 Sand	
410					Silty SAND with Gravel (SM); light brown (7.5YR 6/3); 50% fine to coarse sand; subangular to subrounded; 25% fine gravel to 3/8"; 25% silt. Note: sand and gravel are quartz, mafics, and granite.			PID = 0.0 ppm @ mud pit.
415					Same as above (410 ft); 55% fine to coarse sand; 30% fine gravel to 3/8"; 15% silt. Note: sand and gravel are quartz, mafics, granite, and feldspar.	SM		
420								

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Borehole ID: KAFB-106233

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/8/2015
Date TD Reached: 9/18/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
425					Silty SAND with Gravel (SM); light brown (7.5YR 6/3); 55% fine to coarse sand; subangular to subrounded; 30% fine gravel to 3/8"; 15% silt. Note: sand and gravel are quartz, mafics, granite, and feldspar.	SM		Kelly down @ 1437. End of mud rotary drilling @ 425' @ 1450 on 9/11/15.
430								
435								
440								
445								
450					▽			

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:33 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420								
					Silty SAND with Gravel (SM); light brown (7.5YR 6/3); 55% fine to coarse sand; subangular to subrounded; 30% fine gravel to 3/8"; 15% silt. Note: sand and gravel are quartz, mafics, granite, and feldspar.	SM		Drill with mud rotary to 425'.
425								
					Poor recovery.			Begin sonic coring @ 1650 on 9/14/15 for test run. @ 425 - 430 ft, geologist noted loose, coarse gravel with trace fine gravel; subangular to subrounded.
430								
					@ 430 ft. Fat CLAY (CH); red (10R 5/8); hard; high plasticity; 100% clay.		- Top of 8" Stainless Steel 0.050 Slot Screen	@ 430 ft occasional black specs, streaks, and gray material interfilling cracks of the clay. End of 9/14/15. Resumed drilling on 9/15/15.
					@ 432.1 ft. Fat CLAY with Sand (CH); greenish gray (Gley 1 6/1); hard; high plasticity; 80% clay; 20% fine sand.	CH		@ 431.7 - 435 ft sand is quartz with occasional biotite.
435								

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Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
435					@ 434.8 ft. Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/4); 90% fine sand; subangular; 10% silt.	SP-SM		@ 435 - 435.7 ft drilled instead of cored due to possible obstruction.
					@435 ft. No recovery.			
					@ 435.7 ft. Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/4); 90% fine sand; trace medium sand; subangular to subrounded; 10% silt.			@ 435 - 445.9 ft sand is quartz with biotite and occasional microcline.
440					Same as above (435.7 ft).	SP-SM	8" Stainless Steel 0.050 Slot Screen	@ 440 ft occasional layers of slightly higher silt.
445					@ 443.7 ft. Same as above (435.7 ft); light brown (7.5YR 6/3); 90% fine to medium sand; trace coarse sand.			
					@ 445.9 ft. No recovery.			Driller reported that it felt like coring through a gravel interval.
450					▽			

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					@ 450 ft. Well-graded SAND (SW); light brown (7.5YR 6/3); 95% fine to coarse sand; subangular to subrounded; 5% silt.	SW		@ 450 - 454 ft sand is quartz and biotite with occasional microcline. Gravel is mafics and occasional quartzite. @ 450.8 - 451.1 ft trace fine gravel to 3/8".
					@ 451.8 ft. Poorly graded SAND with Silt and Gravel (SP-SM); light brown (7.5YR 6/3); 75% fine sand; trace medium sand; subangular to subrounded; 15% coarse gravel to 2-1/2"; 10% silt.	SP-SM		
					@ 452.8 ft. No lithologic description. Core removed for testing.	SP-SM		
					@ 453.6 ft. Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/3); 90% fine to medium sand; subangular to subrounded; 10% silt.	CL		
455					@ 453.8 ft. Lean CLAY with Gravel (CL); strong brown (7.5YR 5/6); low plasticity; 75% clay; 25% fine gravel to 1/2"; subrounded.	SM		@ 455 - 457.1 ft sand is quartz with occasional biotite. Gravel is mafics, quartz, and quartzite. @ 455.6 - 455.7 ft cored rock.
					@ 454 ft. No recovery.	GW-GM		
					@ 455 ft. Silty SAND (SM); brown (10YR 5/3); 70% very fine sand; 30% silt.	SP-SM	8" Stainless Steel 0.050 Slot Screen	
					@ 455.7 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); strong brown (7.5YR 5/6); 50% fine to coarse gravel to 2"; subrounded; 40% fine to coarse sand; subangular to subrounded; 10% silt.			
460					@ 456.3 ft. Poorly graded SAND with Silt (SP-SM); strong brown (7.5YR 5/6); 90% fine sand; subangular to subrounded; 10% silt.	SP-SM		@ 460 - 462.8 ft sand is quartz with biotite and occasional microcline. Gravel is mafics with occasional sandstone and quartzite.
					@ 457.1 ft. No recovery.	GW-GM		
					@ 460 ft. Poorly graded SAND with Silt and Gravel (SP-SM); brown (7.5YR 5/4); 70% fine to medium sand; subangular to subrounded; 20% fine gravel to 1/2"; subangular to subrounded; 10% silt.	SM		@ 462.7 ft, silt is very hard, possibly cemented.
					@ 460.8 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 5/4); 60% fine to coarse gravel to 1"; subrounded; 30% fine to coarse sand; subangular to subrounded; 10% silt.			
465								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Material Description	U.S.C.S.	Well Diagram	Remarks
465	@ 462.7 ft. Silty SAND (SM); light brownish gray (10YR 6/2); 75% fine to coarse sand; subangular to subrounded; 25% silt.	SP-SM		@ 465 - 466.6 ft sand is quartz and biotite with occasional microcline. Gravel is mafics.
	@ 462.8 ft. No recovery.	GW-GC		
	@ 465 ft. Poorly graded SAND with Silt (SP-SM); light brownish gray (10YR 6/2); 90% fine to medium sand; subangular to subrounded; 10% silt.	SP		@ 467.5 ft 2-1/2" clay lense; light red (2.5YR 6/8). @ 467.5 - 468.4 ft sand is quartz.
	@ 466 ft. Well-graded GRAVEL with Clay and Sand (GW-GC); brown (7.5YR 5/3); 60% fine to coarse gravel to 2"; subangular; 30% fine to coarse sand; subangular to subrounded; 10% clay.			@ 468.3 ft coarse gravel to 1"; subrounded, mafics.
470	@ 466.6 ft. No recovery.			
	@ 467.5 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; trace medium sand; subangular to subrounded; 5% silt.	GW-GM		@ 470 - 471.4 ft sand is quartz with biotite and quartzite. Gravel is mafics, feldspar, and quartzite.
	@ 468.4 ft. No recovery.			
	@ 470 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); strong brown (7.5YR 4/6); 60% fine to coarse gravel to 2"; angular to subangular; 30% fine to coarse sand; 10% silt.		8" Stainless Steel 0.050 Slot Screen	@ 471.4 ft. 2" piece of gravel in shoe of core barrel with multiple rock fragments.
	@ 471.4 ft. No recovery.			End of 9/15/15 @ 472.5 ft. Used approximately 500 gallons of water to date. Resume coring on 9/16/15 @ 0750.
475	@ 475 ft. No lithologic description. Core removed for testing.			
	@ 476 ft. Poorly graded SAND (SP); strong brown (7.5YR 4/6); 95% fine sand; subangular to subrounded; 5% silt.	SP		@ 475 - 476.3 ft sand is quartz with biotite.
	@ 476.3 ft. No recovery.			
	@ 477.5 ft. Poorly graded SAND with Silt (SP-SM); strong brown (7.5YR 4/6); 90% fine sand; trace medium sand; subangular to subrounded; 10% silt.	SP-SM		@ 477.5 - 478.2 ft sand is quartz with some biotite.
	@ 478.2 ft. No recovery.			
480				

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					@ 480 ft. Poorly graded SAND (SP); light brown (7.5YR 6/4); 95% fine sand; trace coarse sand; subangular to subrounded; 5% silt.	SP		@ 480 - 481.2 ft sand is quartz with some biotite.
					@ 481.2 ft. No recovery.			
					@ 482.5 ft. Poorly graded SAND (SP); light brown (7.5YR 6/4); 95% fine sand; trace medium sand; subangular to subrounded; 5% silt.	SP		@ 482.5 - 483.4 ft sand is quartz with some biotite. @ 483.1 ft conglomerate rock fragment jamming shoe in core barrel.
					@ 483.4 ft. No recovery.			
485								@ 485 - 486 ft drilled without coring due to rock fragments in shoe of the core barrel.
					@ 487.5 ft. Poorly graded SAND (SP); light brown (7.5YR 6/3); 95% fine to medium sand; trace coarse sand; subangular to subrounded; trace fine gravel to 1/2"; subrounded; 5% silt.	SP	8" Stainless Steel 0.050 Slot Screen	@ 487.5 - 490.5 ft sand is quartz with biotite and occasional microcline. Gravel is mafics.
					@ 488.6 ft. Silty SAND (SM); light brown (7.5YR 6/3); 80% fine to coarse sand; subangular to subrounded; 20% silt.	SM		
490					@ 490 ft. Well-graded SAND with Silt (SW-SM); light brown (7.5YR 6/3); 90% fine to coarse sand; subangular to subrounded; 10% silt.	SW-SM		@ 490.4 ft cemented sandstone, fine to coarse grained.
					@ 490.5 ft. No recovery.			
					@ 492.5 ft. Well-graded SAND with Gravel (SW); light brown (7.5YR 6/3); 75% fine to coarse sand; subangular to subrounded; 20% fine to coarse gravel to 1-1/2"; subrounded; 5% silt.	SW		@ 492.5 ft coarse gravel is cemented sandstone. @ 492.5 - 495 ft sand is quartz, biotite, and microcline. Gravel is mafics.
495								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					@ 495 ft. Well-graded SAND (SW); brown (7.5YR 5/3); 95% fine to coarse sand; subangular to subrounded; 5% silt.	SW		@ 495 - 497.2 ft, sand is quartz, biotite, microcline, and occasional quartz.
					@ 495.8 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine to medium sand; subangular to subrounded; 5% silt.	SP		
					@ 497.2 ft. No recovery.			
					@ 497.5 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 90% fine to medium sand; subangular to subrounded; 5% fine gravel to 3/4"; subrounded; trace coarse gravel; 5% silt.	SP		@ 497.5 - 499 ft sand is quartz with biotite. Gravel is mafics. Occasional coarse gravel in shoe.
					@ 499 ft. No recovery.			
500					@ 500 ft. Poorly graded SAND (SP); brown (10YR 4/3); 90% fine to medium sand; trace coarse sand; subangular to subrounded; 5% fine gravel to 3/4"; subrounded; 5% silt.	SP		@ 500 - 501.1 ft sand is quartz, biotite, and microcline. Gravel is mafics.
					@ 501.1 ft. No recovery.			
					@ 502.5 ft. Well-graded SAND (SW); brown (10YR 4/3); 90% fine to coarse sand; angular to subrounded; 5% fine gravel to 1/2"; subrounded; 5% silt.	SW	8" Stainless Steel 0.050 Slot Screen	@ 502.5 - 504.5 ft sand is quartz, biotite, and microcline. Gravel is mafics.
					@ 504.5 ft. No recovery.			
505					@ 505 ft. Poorly graded GRAVEL (GP); yellowish red (5YR 5/8); 85% coarse gravel to 2"; trace fine gravel to 1/2"; subangular; 10% fine to medium sand; 5% clay.	GP		@ 505 - 505.4 ft sand is quartz. Gravel is mafics.
					@ 505.4 ft. No recovery.			
					@ 507.5 ft. Well-graded SAND (SW); brown (10YR 4/3); 95% fine to coarse sand; subangular to subrounded; 5% silt.	SW		@ 507.5 - 509.5 ft sand is quartz with occasional biotite and microcline. Gravel is mafics.
					@ 508.3 ft. Poorly graded SAND (SP); brown (10YR 4/3); 95% fine to medium sand; 5% silt.	SP SM		
510					@ 509 ft. Silty SAND with Gravel (SM);	SW		

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Material Description	U.S.C.S.	Well Diagram	Remarks
510	brown (10YR 4/3); 50% fine sand; 35% coarse gravel to 1-1/4"; subrounded; 15% silt.	SW-SM		@ 510 - 510.8 ft sand is quartz with biotite, microcline, and quartzite. Gravel is mafics.
	@ 509.3 ft. Well-graded SAND (SW); brown (10YR 4/3); 95% fine to coarse sand; subangular to subrounded; 5% silt.			
	@ 509.5 ft. No recovery.			
	@ 510 ft. Well-graded SAND with Silt (SW-SM); brown (10YR 4/3); 80% fine to coarse sand; subangular to subrounded; 10% fine gravel to 1/2"; subrounded; 10% silt.	SW		@ 512.5 - 514.5 ft sand is quartz with biotite and occasional microline. Gravel is mafics.
	@ 510.8 ft. No recovery.	SP		
515	@ 512.5 ft. Well-graded SAND (SW); brown (10YR 4/3); 85% fine to coarse sand; subangular to subrounded; 10% fine to coarse gravel; 5% silt.			Interval 515 - 515.5 ft was not opened to obtain a minimally disturbed sample.
	@ 514 ft. Poorly graded SAND (SP); brown (10YR 4/3); 95% fine to medium sand; subangular to subrounded; 5% silt.	SW / SP-SM		@ 515.5 - 516.2 ft sand is quartz with biotite and occasional microcline. Gravel is mafics.
	@ 514.5 ft. No recovery.			
	@ 515 ft. No lithologic description. Core removed for testing.	GW	8" Stainless Steel 0.050 Slot Screen	@ 517.5 - 518.9 ft sand is quartz and microcline, with occasional mafics, biotite, and quartzite. Gravel is mafics and quartzite.
	@ 515.5 ft. Well-graded SAND (SW); light brown (7.5YR 6/4); 90% fine to coarse sand; subangular to subrounded; 5% fine gravel to 1/2"; subrounded; 5% silt.	SP		
520	@ 516 ft. Poorly graded SAND with Silt (SP-SM); light brown (7.5YR 6/4); 90% fine sand; 10% silt.			@ 520 - 521.8 ft sand is quartz, biotite, and microcline.
	@ 516.2 ft. No recovery.			
	@ 517.5 ft. Well-graded GRAVEL with Sand (GW); light brown (7.5YR 6/4); 60% fine to coarse gravel to 1-1/4"; angular to subrounded; 35% fine to coarse sand; subangular to subrounded; 5% silt.	SP		
	@ 517.9 ft. Poorly graded SAND (SP); light brown (7.5YR 6/4); 95% fine to medium sand; subangular to subrounded; 5% silt.	SP-SM		End of 9/16/15 @ 522.5 ft. Used approximately 300 gallons of water. Resume coring on 9/17/15. @ 522.5 - 523.1 ft sand is quartz with trace biotite.
	@ 518.9 ft. No recovery.			
525	@ 520 ft. Poorly graded SAND (SP);			

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Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 450.00
At End of Drilling: Not Recorded
After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Material Description	U.S.C.S.	Well Diagram	Remarks
525	brown (7.5YR 4/4); 95% fine to medium sand; subangular to subrounded; 5% silt.	SP		@ 525 - 527.2 ft sand is quartz with occasional biotite.
	@ 521.8 ft. No recovery.	ML		
	@ 522.5 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/4); 90% fine to medium sand; trace coarse sand; subangular to subrounded; 10% silt.	SP		
	@ 523.1 ft. No recovery.	GC		@ 526.8 ft clay is firm with high plasticity.
	@ 525 ft. Poorly graded SAND (SP); brown (7.5YR 5/4); 95% fine to medium sand; subangular to subrounded; 5% silt.	CH		@ 527.9 - 529 ft sand is quartz with biotite.
	@ 525.3 ft. SILT with Sand (ML); brown (7.5YR 5/4); firm; low plasticity; 85% silt; 15% fine sand.	SP	8" Stainless Steel 0.050 Slot Screen	
530	@ 525.6 ft. Poorly graded SAND (SP); brown (7.5YR 5/4); 95% fine to medium sand; subangular to subrounded; trace fine gravel; rounded; 5% silt.			End of continuous coring @ 530 ft on 9/17/15. Resumed drilling on 9/18/15 with mud rotary.
	@ 526.8 ft. Clayey GRAVEL (GC); reddish yellow (7.5YR 6/6); 80% coarse gravel to 2-1/2"; subangular; 20% clay.			
	@ 527.2 ft. No recovery.		Bottom of Screen	
	@ 527.5 ft. Fat CLAY (CH); light reddish brown (5YR 6/4); dry; hard; high plasticity; 100% clay.			
	@ 527.9 ft. Poorly graded SAND (SP); brown (7.5YR 5/4); 95% fine to medium sand; subangular to subrounded; 5% silt.			
	@ 529.7 ft. No recovery.			
535	@ 530 ft. Poorly graded GRAVEL with Silt and Sand (GP-GM); light brown (7.5YR 6/3); 50% fine gravel to 3/8"; subangular to subrounded; 40% fine to coarse sand; subangular to subrounded; 10% silt. Note: Gravel is mafics, quartz, and granite. Sand is quartz, mafics, and microcline.	GP-GM		
			Bottom of Sump	
540				

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106233-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/14/2015
Date TD Reached: 9/24/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

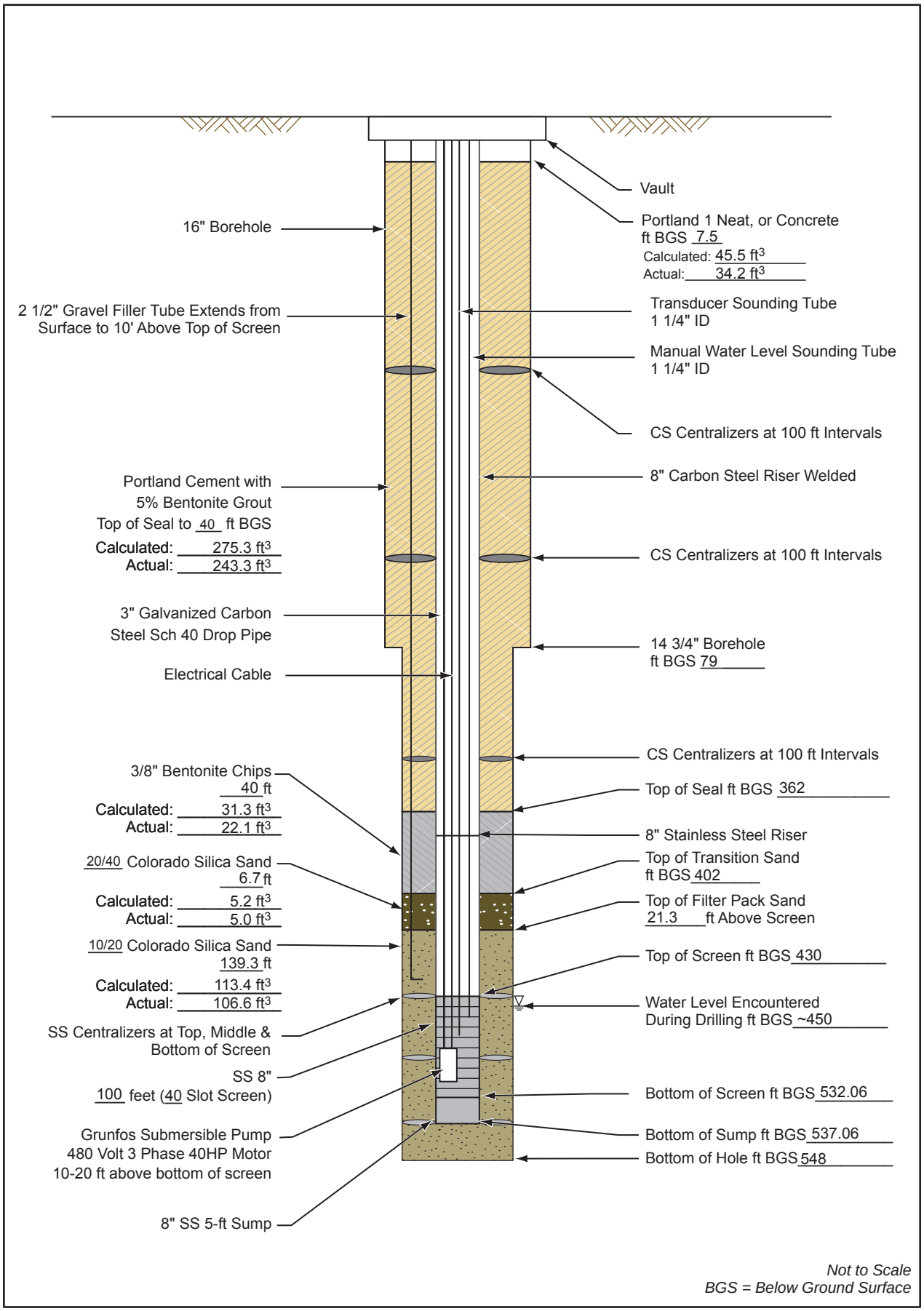
Groundwater Levels BGS (ft):
▽ At Time of Drilling: 450.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 459.60

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: M. Giles

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 540 ft. Poorly graded GRAVEL with Silt and Sand (GP-GM); light brown (7.5YR 6/3); 50% fine gravel to 3/8"; subangular to subrounded; 40% fine to coarse sand; subangular to subrounded; 10% silt. Note: Gravel is mafics, quartz, and granite. Sand is quartz, mafics, and microcline.			12" reaming stopped @ 543 ft on 9/18/15 @ 1155. Resume drilling @ 1020 on 9/24/15.
545					Same as above (540 ft); 60% fine gravel to 3/8"; angular to subrounded; 30% medium to coarse sand; subangular to subrounded. Note: gravel is mafics and quartz. Sand is quartz with some mafics and granite.	GP-GM		
550					Same as above (540 ft); 60% fine gravel to 3/8"; angular to subrounded; 30% medium to coarse sand; subangular to subrounded. Note: gravel is mafics and quartz. Sand is quartz with some mafics and granite.		Bottom of Filter Pack/Bottom of Hole Native Backfill Bottom of Rat Hole	Total depth = 552 ft bgs. Reached total depth on 9/24/15 @ 1055.
555								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/9/15 13:24 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Extraction Well Construction Diagram KAFB-106233



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Groundwater Extraction Well Development

Project Name: KAFB BFF
Location: Gibson and California
Personnel:
Start Date: 10/1/2015
End Date: /2015

Well No.: KAFB-106233
Date Installed: 9/30/2015
Casing Diameter (I.D.): 8-inch
Total Depth (ft. BGS): 537.06

Method of Development:

[X] Surging [X] Bailing [X] Pumping [X] Jetting

[X] Original Development [ ] Redevelopment [ ] Other

Depth to Water Before Developing Well (ft. BGS): NR
Screened Interval (ft. BGS): 430 – 532.06
Weather: Varied

Equipment Numbers: **pH:** NR **Conductivity:** NR
Turbidity: NR

Equipment Decontaminated Prior to Development? [X] Yes [ ] No
Describe:

Collected Sample of Water Added to Well? [ ] Yes [X] No
Describe:

Comments:

Summary of development procedure, including key decision-points, calculations, and observations (described in detail in the following pages):

Well development consisted of bailing, surging, pumping, and jetting. The first step of development removed mud and cuttings from the well casing and filter pack, which were generated during the drilling process, by surging and bailing. The second step entailed physical well development using surging, bailing, and pumping to assess development progress. These actions included taking measurements of sediment content in the water using the Imhoff cone technique, and applying 30 minutes of sustained pumping, measuring, and plotting drawdown to estimate development effectiveness. The third step used jetting with simultaneous pumping.

Groundwater Extraction Well Development

Bailing				
Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
10/1/2015	1638	0	--	Begin bailing
10/1/2015	1815	480	--	Stop bailing
10/2/2015	1038	480	--	Resume bailing on 10/2/15
10/2/2015	1044	495	0.2	First reading; thick mud; solids still suspended after 5 minutes
10/2/2015	1103	540	8.0	Diluted 250 mL mud with 750 mL of clean water; readings multiplied by 4.
10/2/2015	1113	600	10.0	Same as above
10/2/2015	1125	705	11.3	Same as above
10/2/2015	1147	825	6.0	Same as above
10/2/2015	1205	930	6.0	Same as above
10/2/2015	1330	1005	4.0	Same as above
10/2/2015	1348	1080	6.5	Same as above
10/2/2015	1407	1155	4.0	Same as above
10/2/2015	1418	1230	4.0	Same as above
10/2/2015	1423	1305	3.0	Same as above
10/2/2015	1517	1395	2.6	Same as above
10/2/2015	1530	1420	10.0	Same as above
10/2/2015	1609	1620	3.0	Same as above
10/2/2015	1617	1680	3.0	Same as above
10/3/2015	0900	1785	0.3	Getting 1,000 mL of well water
10/3/2015	0910	1840	1.0	Getting 1,000 mL of well water
10/3/2015	0923	1915	1.0	Getting 1,000 mL of well water
10/3/2015	0938	1990	1.0	Getting 1,000 mL of well water
10/6/2015	1408	4046	1.5	Begin bailing
10/6/2015	1425	4121	1.5	
10/6/2015	1436	4196	1.5	
10/6/2015	1446	4271	0.6	
10/6/2015	1458	4346	1.0	
10/6/2015	1508	4421	0.5	
10/6/2015	1519	4481	0.4	
10/7/2015	1036	4496	1.3	Begin bailing
10/7/2015	1051	4571	2.0	
10/7/2015	1105	4646	1.5	
10/7/2015	1130	4721	1.1	
10/7/2015	1142	4796	1.0	

Groundwater Extraction Well Development

Bailing				
Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
10/7/2015	1205	4931	0.7	
10/7/2015	1249	4946	0.1	
10/7/2015	1256	4991	0.5	
10/18/2015	1103	68922	--	Bailer full of sand; use suction to get sand off of bottom
10/18/2015	1630	69147	--	Still sandy with some water; 225 gallons bailed, 45 gallons of which was sand.

L = liter

mL = milliliter

Groundwater Extraction Well Development

Surging				
Interval (feet below ground surface)	Date	Start Time	End Time	Comments
532-527	10/6/2015	0905	0915	
527-522	10/6/2015	0915	0926	
522-517	10/6/2015	0927	0937	
517-512	10/6/2015	0938	0948	
512-507	10/6/2015	0948	0958	
507-502	10/6/2015	1009	1019	
502-497	10/6/2015	1020	1030	
497-492	10/6/2015	1030	1040	
492-487	10/6/2015	1040	1050	
487-482	10/6/2015	1050	1100	
482-477	10/6/2015	1116	1126	
477-472	10/6/2015	1127	1137	
472-467	10/6/2015	1137	1147	
467-462	10/6/2015	1147	1157	
462-457	10/6/2015	1157	1207	
457-452	10/6/2015	1255	1305	
452-447	10/6/2015	1302	1315	
532-448	10/6/2015	1315	1326	
532-527	10/6/2015	1629	1640	
527-522	10/6/2015	1641	1651	
522-517	10/6/2015	1651	1701	
517-512	10/6/2015	1701	1702	
512-507	10/6/2015	1720	1730	
507-502	10/6/2015	1730	1740	
402-497	10/6/2015	1740	1750	
497-492	10/6/2015	1750	1800	
492-487	10/7/2015	0808	0819	
487-482	10/7/2015	0827	0837	
482-477	10/7/2015	0837	0847	
477-472	10/7/2015	0847	0857	
472-467	10/7/2015	0857	0907	
467-462	10/7/2015	0907	0917	
462-457	10/7/2015	0923	0933	
457-452	10/7/2015	0934	0944	
452-447	10/7/2015	0944	0954	
532-449	10/7/2015	0954	1009	

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Depth of pump (Feet)
10/3/2015	1707	8	474.00	1995	20.7	8.23	0.689	>1,000	0.31	0.3	491.3
10/3/2015	1715	5	474.00	1075	21.3	8.17	0.745	>1,000	0.31	0.1	491.3
10/3/2015	1725	6.5	471.00	2125	21.5	8.11	0.813	>1,000	0.22	0.2	491.3
10/3/2015	1735	6.5	473.65	2190	21.8	7.96	0.808	>1,000	0.25	0.1	491.3
10/3/2015	1745	6	476.80	2255	21.5	7.95	0.721	>1,000	0.21	0.1	491.3
10/3/2015	1755	6	475.50	2310	21.5	7.91	0.707	>1,000	0.22	0.1	491.3
10/3/2015	1805	6	475.80	2370	21.4	7.89	0.665	>1,000	0.21	<0.1	491.3
10/3/2015	1815	6	476.00	2430	21.3	7.89	0.645	>1,000	0.21	<0.1	491.3
10/3/2015	1825	6	476.30	2490	21.3	7.89	0.633	>1,000	0.21	<0.1	491.3
10/3/2015	1835	6	476.55	2550	21.3	7.90	0.626	>1,000	0.21	<0.1	491.3
10/5/2015	0908	--	448.9	2557	--	--	--	--	--	--	491.3
10/5/2015	0910	8.5	452.1	2557	14.7	6.89	0.608	185	2.66	<0.1	491.3
10/5/2015	0920	8.5	463.2	2642	20.7	7.34	0.614	>1,000	0.59	<0.1	491.3
10/5/2015	0930	8.0	470.45	2727	20.2	7.30	0.599	125	0.37	<0.1	491.3
10/5/2015	0940	8.0	474.05	2807	20.7	7.83	0.592	123	0.32	<0.1	491.3
10/5/2015	0950	7.5	477.35	2887	20.8	7.90	0.604	217	0.28	<0.1	491.3
10/5/2015	1000	7.5	479.00	2962	20.8	7.87	0.585	334	0.25	<0.1	491.3
10/5/2015	1010	7.5	479.75	3037	20.8	7.63	0.611	>1,000	0.24	<0.1	491.3
10/5/2015	1108	--	449.41	3037	--	--	--	--	--	--	530.7
10/5/2015	1110	8	451.20	3037	21.6	7.85	0.607	>1,000	3.5	<0.1	530.7
10/5/2015	1120	8	459.53	3117	21.1	7.84	0.586	810	0.75	<0.1	530.7
10/5/2015	1130	7.5	463.95	3197	20.5	7.96	0.631	>1,000	0.53	<0.1	530.7-525.7
10/5/2015	1140	7.5	467.20	3172	20.8	7.92	0.606	666	0.41	<0.1	530.7-525.7
10/5/2015	1150	7.5	469.40	3247	20.7	7.80	0.535	238	0.37	<0.1	525.7-520.7
10/5/2015	1200	7.5	471.45	3322	20.7	7.78	0.514	264	0.33	<0.1	525.7-520.7
10/5/2015	1240	7.5	452.80	3322	22.0	7.74	0.516	302	1.92	<0.1	520.7-515.7
10/5/2015	1250	7.5	461.65	3397	21.0	7.76	0.514	149	0.59	<0.1	520.7-515.7
10/5/2015	1300	7.5	467.98	3472	20.9	7.74	0.525	109	0.38	<0.1	515.7-510.7
10/5/2015	1322	8	452.40	3472	21.9	7.74	0.512	79.1	2.28	<0.1	510.7-505.7

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Depth of pump (Feet)
10/5/2015	1342	7.5	471.50	3632	20.8	7.77	0.498	165	0.33	<0.1	505.7-500.7
10/5/2015	1352	7.5	476.23	3707	21.0	7.77	0.509	326	0.27	<0.1	500.7-495.7
10/5/2015	1402	8	474.90	3782	21.1	7.77	0.526	455	0.31	<0.1	495.7-490.7
10/5/2015	1427	8	453.90	3782	23.3	7.74	0.528	414	1.6	<0.1	490.7-485.7
10/5/2015	1437	8	464.20	3862	21.1	7.75	0.514	373	0.52	<0.1	490.7-485.7
10/5/2015	1448	7.5	471.35	3942	20.7	7.75	0.487	183	0.33	<0.1	480.7-485.7
10/7/2015	1518	--	448.35	4991	--	--	--	--	--	--	512.3
10/7/2015	1525	9	450.4	4991	24.7	7.00	0.561	>1,000	6.42	0.2	512.3
10/7/2015	1535	9	450.35	5081	20.2	7.84	0.570	>1,000	6.67	<0.1	512.3
10/7/2015	1545	9	450.35	5171	20.5	7.87	0.547	>1,000	6.67	<0.1	512.3
10/7/2015	1552	30	453.90	5171	19.4	7.77	0.509	555	6.12	<0.1	512.3
10/7/2015	1602	29	453.80	5471	19.0	7.74	0.511	572	6.04	<0.1	512.3
10/7/2015	1612	29.5	453.95	5771	18.9	7.71	0.496	392	5.96	<0.1	512.3
10/7/2015	1622	29	454.15	6071	18.8	7.68	0.479	222	5.63	<0.1	512.3
10/7/2015	1632	29	454.30	6371	18.8	7.67	0.472	138	5.47	<0.1	512.3
10/7/2015	1648	28.5	453.65	6371	19.6	7.75	0.465	139	6.13	<0.1	530.4-525.4
10/7/2015	1658	28	454.18	6656	18.8	7.69	0.463	137	5.40	<0.1	530.4-525.4
10/7/2015	1708	28	454.45	6936	18.8	7.68	0.461	95.2	5.14	<0.1	530.4-525.4
10/7/2015	1718	28	454.49	7216	18.7	7.68	0.442	110	5.10	<0.1	525.4-520.4
10/7/2015	1728	28	454.52	7496	18.7	7.67	0.447	43.2	5.07	<0.1	520.4-515.4
10/7/2015	1738	28	454.60	7776	18.7	7.68	0.441	111	5.00	<0.1	515.4-510.4
10/7/2015	1815	30	453.80	7776	18.0	7.80	0.466	81.7	6.25	<0.1	510.4-505.4
10/7/2015	1825	30	454.80	8076	18.5	7.70	0.445	101	5.17	<0.1	510.4-505.4
10/8/2015	0824	30	453.37	8568	11.7	7.17	0.458	38	7.48	<0.1	505.4-500.4

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Depth of pump (Feet)
10/8/2015	0834	30	454.70	8868	12.2	7.32	0.458	40.9	5.62	<0.1	505.4-500.4
10/8/2015	0844	30	454.70	9168	12.9	7.44	0.460	13.6	5.62	<0.1	500.4-495.4
10/8/2015	0854	30	454.70	9468	14.0	7.56	0.460	8.1	5.62	<0.1	500.4-495.4
10/8/2015	0904	30	455.20	9768	14.1	7.57	0.459	5.83	5.17	<0.1	495.4-490.4
10/8/2015	0931	30	453.30	9768	19.1	7.64	0.466	15.9	7.61	<0.1	490.4-485.4
10/8/2015	0941	31	454.90	10068	18.6	7.71	0.462	10.8	5.60	<0.1	490.4-485.4
10/8/2015	0951	31	455.22	10378	18.6	7.71	0.444	24.2	5.29	<0.1	480.4-475.4
10/8/2015	1001	31	455.41	10688	18.6	7.70	0.447	20.0	5.12	<0.1	480.4-475.4
10/8/2015	1011	31	455.37	10998	18.6	7.70	0.453	13.5	5.16	<0.1	475.4-470.4
10/8/2015	1054	31	453.25	10998	19.3	7.68	0.450	9.98	7.97	<0.1	470.4-465.4
10/8/2015	1104	31	453.90	11308	18.6	7.71	0.435	4.22	6.82	<0.1	470.4-465.4
10/8/2015	1114	31	455.25	11618	18.6	7.69	0.435	9.63	5.26	<0.1	470.4
10/8/2015	1124	31	455.25	11928	18.6	7.69	0.443	6.41	5.26	<0.1	470.4
10/8/2015	1134	31	455.44	12238	18.6	7.69	0.442	5.21	5.09	<0.1	470.4
10/8/2015	1144	31	455.55	12548	18.6	7.68	0.443	3.5	5.00	<0.1	470.4
10/8/2015	1154	31	455.30	12858	18.6	7.68	0.445	59.4	5.21	<0.1	470.4
10/8/2015	1204	31	455.60	13168	18.6	7.69	0.445	76.0	4.96	<0.1	470.4
10/8/2015	1347	31	455.08	13168	18.9	7.68	0.492	34.5	5.42	<0.1	470.4
10/8/2015	1358	31	453.80	13478	18.7	7.73	0.444	9.0	6.98	<0.1	470.4
10/8/2015	1408	31	455.50	13788	18.6	7.71	0.444	8.29	5.04	<0.1	470.4
10/8/2015	1418	31	--	--	--	--	--	--	--	--	--
10/15/2015	1400	40	450.36	--	22.5	7.62	0.508	142	36.04	<0.1	529
10/15/2015	1412	39.5	451.20	--	19.8	7.72	0.461	97.8	20.26	<0.1	529
10/15/2015	1422	39.5	451.26	--	19.2	7.69	0.465	24.8	19.65	<0.1	529
10/16/2015	0932	42.5	451.25	42809	18.9	7.29	0.484	545	24.29	0.2	488
10/16/2015	0942	42	451.34	43123	18.8	7.61	0.458	51.1	22.8	0.15	488
10/16/2015	0952	42	451.39	43165	18.6	7.72	0.463	15.3	23.22	<0.1	488

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Depth of pump (Feet)
10/16/2015	1002	42	451.42	43207	18.5	7.73	0.464	10.0	21.88	<0.1	488
10/16/2015	1022	42	451.44	43209	18.4	7.72	0.465	5.76	21.65	<0.1	488
10/16/2015	1042	42	451.47	43375	18.3	7.72	0.463	4.08	21.32	<0.1	488
10/16/2015	1102	42	451.49	43459	18.3	7.72	0.464	4.14	21.11	<0.1	488
10/16/2015	1122	42	451.49	43543	18.3	7.71	0.462	2.11	21.11	<0.1	488
10/16/2015	1142	42	451.49	43627	18.2	7.71	0.460	2.23	21.11	<0.1	488
10/16/2015	1202	42	449.65	43711	20.0	7.86	0.515	198	--	<0.1	488
10/16/2015	1222	42	451.40	43795	18.4	7.74	0.462	4.58	22.11	<0.1	488
10/16/2015	1312	42	451.30	44005	19.8	7.80	0.466	96.8	23.33	<0.1	488
10/16/2015	1318	42	451.37	44306	18.5	7.74	0.455	30.2	22.46	<0.1	488
10/16/2015	1625	42	451.15	--	19.8	7.76	0.507	>1,000	25.45	6.0	468
10/16/2015	1635	43.5	451.66	--	20.6	7.82	0.523	748	20.14	0.2	468
10/16/2015	1645	44	451.70	--	19.6	7.79	0.498	227	20.00	0.2	468
10/16/2015	1655	44	451.74	--	18.9	7.77	0.473	114	--	--	468
10/20/2015	1528	63.78	452.07	--	18.1	7.65	0.463	78.7	22.34	<0.1	509.4
10/20/2015	1538	63.90	452.11	--	18.0	7.64	0.488	10.4	21.59	<0.1	509.4
10/20/2015	1548	63.08	452.15	--	18.0	7.63	0.486	3.88	21.46	<0.1	509.4
10/20/2015	1621	63.08	452.43	--	--	--	--	--	19.59	--	--

°C = degrees Celsius
EC = Electric Conductivity
ft bgs = feet below ground surface
gpm = gallons per minute
gpm/ft = gallons per minute per foot
mL = milliliter
mS/cm = millisiemen per centimeter
NR = not recorded
NTU = Nephelometric Turbidity Unit
S.U. = Standard Unit

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Depth to Water (feet bgs)	Comments
10/12/2015	1820	520.0	--	--	--	--	Pump on
10/12/2015	1823	520.0	--	46.5	<0.1	458.0	
10/12/2015	1828	520.0	37.44	46.5	0.2	454.2	
10/12/2015	1834	525-520	36.12	46.0	0.2	452.0	
10/13/2015	0914	520-515	--	47.0	0.2	451.0	Pump on
10/13/2015	0928	520-515	26.0	47.0	2.0	454.2	Turn on jet
10/13/2015	0958	520-515	26.0	44.0	1.5	454.0	
10/13/2015	1011	520-515	--	44.0	0.3	454.1	
10/13/2015	1123	515-510	43.9	46.0	0.3	453.1	
10/13/2015	1137	510-505	30.0	44.0	0.7	452.3	
10/13/2015	1144	520-515	30.0	43.0	1.0	453.0	
10/13/2015	1149	525-505	30.0	43.0	0.5	453.0	Turn off jet/pump
10/13/2015	1240	505-500	32.0	47.0	0.9	453.9	Turn on jet/pump
10/13/2015	1247	500-495	30.0	46.0	0.5	451.6	
10/13/2015	1257	495-490	32.0	45.0	0.6	452.5	Turn off jet/pump
10/13/2015	1408	495-490	30.0	44.0	1.5	451.1	Turn on jet/pump
10/13/2015	1418	490-485	30.0	44.0	2.0	451.3	Turn off jet/pump
10/13/2015	1513	485-480	32.0	46.0	0.3	451.5	Turn on jet/pump
10/13/2015	1520	480-475	32.0	45.0	2.5	451.2	Turn off jet/pump
10/13/2015	1630	475-470	24.0	45.0	0.4	451.1	Turn on jet/pump
10/13/2015	1635	470-465	22.0	45.0	0.7	451.8	Turn off jet/pump
10/13/2015	1726	465-460	35.0	46.0	1.5	451.5	Turn on jet/pump
10/13/2015	1732	460-455	24.0	45.0	2.5	451.8	
10/13/2015	1739	455-450	23.0	43.0	3.0	451.0	Turn off jet/pump
10/14/2015	0830	465-460	26	46.5	2.5	451.3	Turn on jet/pump
10/14/2015	0835	460-455	25	44	7.5	451.5	
10/14/2015	0840	455-450	24	44	10.0	451.5	
10/15/2015	0906	465-460	39	46	7.0	450.0	
10/15/2015	0913	460-455	37	44	4.0	450.0	
10/15/2015	0920	455-450	36	43	7.0	449.9	
10/15/2015	1028	470-465	36	44	18.0	451.1	
10/15/2015	1034	475-470	36	43	10.0	449.7	
10/15/2015	1041	480-475	39	42	6.0	449.7	
10/15/2015	1045	485-480	38	40	5.0	449.7	
10/15/2015	1150	490-485	37	44	6.5	449.6	
10/15/2015	1155	495-490	37	40	4.5	449.7	
10/15/2015	1202	450-495	37	41	1.5	449.6	
10/15/2015	1208	505-500	38	40	3.0	449.6	

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Depth to Water (feet bgs)	Comments
10/15/2015	1339	510-505	36	42	1.1	449.6	
10/15/2015	1345	515-510	36	40	1.5	449.5	
10/15/2015	1350	520-515	36	40	2.5	449.5	
10/15/2015	1356	525-520	36	40	0.8	449.5	
10/15/2015	1432	525-520	35	39	0.6	449.2	
10/15/2015	1438	520-515	36	38	2.5	449.5	
10/15/2015	1444	515-510	36	37	1.9	449.4	
10/15/2015	1450	510-505	35	38	5.0	449.6	
10/15/2015	1530	505-500	34	41	1.6	449.8	
10/15/2015	1535	500-495	36	40	3.5	449.6	
10/15/2015	1548	495-490	32	38	2.5	449.8	
10/15/2015	1554	490-485	35	38	4.0	499.6	
10/15/2015	1654	485-480	35	42	4.5	449.4	
10/15/2015	1659	480-475	35	39.5	7.5	449.6	
10/15/2015	1705	475-470	34	39	8.0	449.8	
10/15/2015	1710	470-465	34	39	7.0	450.0	
10/16/2015	0637	465-460	35	44	10.0	450.2	
10/16/2015	1458	430-445	34	--	--	--	In unsaturated zone
10/16/2015	1618	445-440	34	--	--	--	In unsaturated zone
10/16/2015	1706	465-460	27	44	2.3	450.8	
10/16/2015	1711	460-455	24	43	9.8	450.6	
10/16/2015	1718	455-450	24	43	7.0	450.5	
10/16/2015	1738	465-460	35	40	3.5	450.6	
10/16/2015	1743	460-455	35	40	8.0	450.5	
10/16/2015	1749	455-450	24	40	5.0	450.3	
10/17/2015	0826	465-460	24	13	5.5	449.5	
10/17/2015	0831	460-455	24	42	7.5	450.3	
10/17/2015	0837	455-450	24	41	5.5	450.3	
10/17/2015	0842	455-450	25	40	7.5	450.4	
10/17/2015	0847	460-455	24	39	8.0	450.4	
10/17/2015	0852	465-460	24	38	6.0	450.3	
10/17/2015	0857	465-460	25	38	4.5	450.3	
10/17/2015	0902	460-455	24	38	5.5	450.4	
10/17/2015	0908	455-450	25	38	3.5	450.3	
10/17/2015	1010	480-475	35	39	1.2	450.0	
10/17/2015	1016	475-470	33	39	3.0	449.8	
10/17/2015	1026	470-465	24	38	4.75	450.4	

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Depth to Water (feet bgs)	Comments
10/17/2015	1031	470-465	23	38	4.0	450.4	
10/17/2015	1036	475-470	23	38	4.5	450.2	
10/17/2015	1041	480-475	27	38	3.75	450.0	
10/17/2015	1047	480-475	27	38	3.0	450.0	
10/17/2015	1053	475-470	27	38	2.0	450.3	
10/17/2015	1058	470-465	25	38	2.0	450.2	
10/17/2015	1249	465-460	23	40	4.0	449.9	
10/17/2015	1254	460-455	22	39	3.5	450.0	
10/17/2015	1259	455-450	22	38	11.0	450.2	
10/17/2015	1304	455-450	21	38	3.0	450.0	
10/17/2015	1310	460-455	22	38	6.5	450.4	
10/17/2015	1315	465-460	23	38	4.0	450.4	
10/17/2015	1321	465-460	24	38	2.5	450.3	
10/17/2015	1326	460-455	24	38	7.0	450.3	
10/17/2015	1331	455-450	23	38	6.5	450.1	
10/17/2015	1336	455-450	23	38	6.0	450.2	
10/17/2015	1341	460-455	24	38	7.0	450.1	
10/17/2015	1347	455-450	23	38	9.0	450.5	
10/17/2015	1354	460-455	23	34	10.0	450.3	
10/17/2015	1413	460	--	33	1.5	451.1	
10/17/2015	1418	455	--	33	0.7	451.1	
10/17/2015	1423	455	--	33	0.3	451.1	
10/17/2015	1427	465	--	33	0.3	451.1	
10/17/2015	1435	465	--	33	0.1	451.1	
10/17/2015	1445	465	--	34	0.1	451.3	
10/17/2015	1500	465	--	35	0.1	451.4	

ft bgs = feet below ground surface

gpm = gallons per minute

L = liter

mL = millliliter

psi = pounds per square inch

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
- At Time of Drilling: 459.00
- At End of Drilling: Not Recorded
- After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

LICENSED PROFESSIONAL GEOLOGIST
VIRGINIA BRACHT
8881903-2250
STATE OF UTAH
12/3/15

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					ASPHALT			
					No lithologic description.			Borehole was air knifed from 0.5 - 8.7 ft for utility clearance on 8/31/15. Sand, silt, and gravel observed.
5							- Top of Casing/Cement Seal	
10					SILT (ML); brown (10YR 4/3); hard; 100% silt. SILT with Sand (ML); reddish brown (5YR 5/4); 80% silt; 20% fine sand.	ML		Begin ARCH drilling with 3/4" O.D. bit @ 1715 on 9/2/15. PID = 0.0 ppm @ breathing zone. Resume drilling @ 0835 on 9/3/15 @ 12 ft. PID = 0.0 ppm @ cyclone and breathing zone.
15					Same as above (10 ft).		- Cement Seal	
					Silty SAND (SM); dark reddish brown (5YR 3/3); 70% fine to medium sand; subangular to subrounded; 30% silt. Note: sand is biotite.	SM		Injected water to control dust.
20					@ 17 ft. Same as above (16 ft); trace gravel.			Depth of stabilization. Begin drilling with mud @ 1705.
					Well-graded SAND with Gravel (SW); reddish brown (5YR 4/3); dry; 75% fine to coarse sand; subangular to rounded; 20% gravel; angular to rounded; 5% silt. Note: sand is quartz, feldspars, and mafics.	SW		PID = 0.0 ppm @ breathing zone.
25					Same as above (18 ft); sand is subrounded to rounded.			Rig bouncing and chattering.
								Color cannot be determined.
30							Top of Portland Bentonite Cement	

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Well-graded SAND with Gravel (SW); 75% fine to coarse sand; subrounded to rounded; 20% gravel; 5% silt. Note: sand is quartz, feldspar, and mafics.			Occasional chatter from drill stem. End of 9/3/15 @ 34 ft. Resume drilling @ 0905 on 9/4/15. PID = 0.0 ppm @ breathing zone. Gravel layer observed from 35 - 37 ft.
35					Same as above (30 ft).			
40					Same as above (30 ft); dark reddish brown (5YR 3/3); 55% fine to very coarse sand; 40% coarse gravel; angular.			Significant drill chatter.
45					Same as above (30 ft); dark reddish brown (5YR 3/3); 55% fine to very coarse sand; 40% coarse gravel; angular.	SW	Portland Bentonite Cement	Hard drilling. Add 150 gallons of water.
50					Same as above (30 ft); dark reddish brown (5YR 3/3); 55% fine to very coarse sand; 40% coarse gravel; angular.			PID = 0.0 ppm @ breathing zone. Added stabilizing collar @ 1140. Hole sloughted approximately 8 ft @ 1230.
55					Same as above (30 ft); dark reddish brown (5YR 3/3); dense; 55% fine to very coarse sand; 40% coarse gravel; angular; 5% silt.			Continuous chatter from 55 - 58 ft.
60								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Poorly graded SAND with Gravel (SP); dark reddish brown (5YR 3/3); 60% fine to medium sand; subrounded to rounded; 35% fine gravel; subangular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.			Collection of very coarse gravel in sieve from mud tub.
65					Same as above (60 ft).			
70					Same as above (60 ft); Note: percentage of mafics in gravel increases.	SP		Stopped drilling due to low circulation.
75					Same as above (60 ft).		- Portland Bentonite Cement	Borehole collapsed due to inability to remove fine gravel. Backfill borehole with 8/12-grade sand from 61.7 - 18.1 ft. Added third 20' collar @ 75 ft. Resume drilling with ARCH @ 1430 on 9/12/15. Very hard drilling from 76 - 84.6 ft. Drill stem bouncing and chattering. PID = 0.0 ppm @ breathing zone. Continue advancing casing using ARCH to 83 ft on 9/14/15. Could not advance any further.
80					Same as above (60 ft); gravel to 1"; angular.			
85								
90					Well-graded SAND with Gravel (SW); dark reddish brown (5YR 3/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine gravel; subangular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Well-graded SAND with Gravel (SW); dark reddish brown (5YR 3/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine gravel; subangular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		Begin drilling using mud @ 0835 on 9/15/15.
95					Same as above (90 ft); 50% very fine to coarse sand; 45% coarse gravel to 3 cm; angular. Note: sand is quartz, mafics, and feldspar.			PID = 0.0 ppm @ breathing zone.
100					Well-graded GRAVEL with Sand (GW); dark reddish brown (5YR 3/3); 60% fine to coarse gravel; angular to rounded; 35% very fine to medium sand; subrounded to rounded; 5% silt. Note: gravel is quartz and feldspar. Sand is quartz.	GW		
105					Same as above (97 ft).		Portland Bentonite Cement	
110					Clayey GRAVEL with Sand (GC); dark reddish brown (5YR 3/4); 50% fine to coarse gravel; angular to rounded; 30% very fine sand; rounded; 20% clay. Note: gravel is quartz and feldspar.	GC		
115					Same as above (107 ft); 50% very fine to coarse gravel; 20% very fine sand; 30% clay.			
120					Clayey GRAVEL (GC); strong brown (7.5YR 5/6); 50% gravel; angular to rounded; 10% very fine sand; rounded;			

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Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					40% clay. Note: gravel is quartz and feldspar.	GC		
					Clayey GRAVEL (GC); strong brown (7.5YR 5/6); 50% gravel; angular to rounded; 10% very fine sand; rounded; 40% clay. Note: gravel is quartz and feldspar.			PID = 0.0 ppm @ breathing zone.
125					Gravelly fat CLAY with Sand (CH); strong brown (7.5YR 5/6); 50% clay; 30% fine to coarse gravel; subrounded; 20% very fine sand.	CH		
130					Fat CLAY with Gravel (CH); brown (7.5YR 4/3); 70% clay; 20% fine to coarse gravel; angular to subrounded; 10% very fine sand. Note: sand is quartz.			
135					Fat CLAY (CH); brown (7.5YR 4/3); 90% clay; 10% very fine sand; subrounded to rounded.		- Portland Bentonite Cement	
140					Clayey SAND (SC); brown (7.5YR 5/4); 60% very fine sand; subrounded; 40% clay.	SC		
					Same as above (135 ft).			Kelly down, new 20' connection.
145					Sandy fat CLAY (CH); brown (7.5YR 5/3); 60% clay; 40% very fine sand.	CH		PID = 0.0 ppm @ breathing zone.
150								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Sandy fat CLAY (CH); brown (7.5YR 5/3); 60% clay; 40% very fine sand.			
155					Same as above (150 ft).	CH		
160					Same as above (150 ft).			Kelly down @ 1345, new 20' connection. Difficult drilling and chatter.
165					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; 35% fine to coarse gravel; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.			
170					Same as above (161 ft).		Portland Bentonite Cement	
175					Same as above (161 ft).	SW		PID = 0.0 ppm @ breathing zone.
180					Same as above (161 ft); 35% coarse gravel.			Kelly down @ 1447, new

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Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; 35% coarse gravel; angular to rounded; 5% silt. Note: gravel is feldspar and mafics.	SW		20' connection. Bit chatter.
185					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/3); 55% very fine sand; 40% fine gravel; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	SP		PID = 0.0 ppm @ breathing zone.
190					Same as above (184 ft); 65% very fine sand; 30% fine gravel.			
195					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel; subrounded to rounded; 35% very fine sand; rounded; 5% silt. Note: gravel is quartz, fedspar, and mafics.	GP	Portland Bentonite Cement	
200					Same as above (192 ft); 60% coarse gravel.			Kelly down @ 1540, new 20' connection.
205					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 60% very fine to coarse sand; 35% medium gravel; subrounded to rounded; 5% clay. Note: sand is quartz. Gravel is quartz and feldspar.	SW		
210								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 60% very fine to coarse sand; 35% medium gravel; subrounded to rounded; 5% clay. Note: sand is quartz. Gravel is quartz and feldspar.			
215					Same as above (210 ft); 70% very fine to coarse sand; 25% fine to medium gravel. Note: gravel is quartz, feldspar, and mafics.			
220					Same as above (215 ft).			Kelly down @ 1620, new 20' connection.
225					Same as above (215 ft).	SW	Portland Bentonite Cement	
230					Same as above (215 ft).			Hammer chatter.
235					Same as above (215 ft).			
240								Kelly down @ 1719, new

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Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% clay. Note: gravel is quartz, feldspar, and mafics.			20' connection.
245					Same as above (240 ft).			
250					Same as above (240 ft); 35% fine gravel.			
255					Same as above (240 ft); 35% fine gravel.	SW	Portland Bentonite Cement	Drill stem chattering.
260					Same as above (240 ft); 35% coarse gravel.			Kelly down, new 20' connection. End of 9/15/15 @ 1817. Resume drilling @ 0820 on 9/16/15.
265					Same as above (240 ft); 35% fine gravel.			PID = 0.0 ppm @ breathing zone.
270								

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Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270								
275					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 55% very fine to coarse sand; subrounded to rounded; 40% fine to coarse gravel; rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics. Same as above (270 ft).	SW		PID = 0.0 ppm @ breathing zone.
280					Silty SAND with Gravel (SM); brown (7.5YR 4/2); 50% very fine to coarse sand; subrounded to rounded; 20% fine to coarse gravel; angular to subrounded; 30% silt. Note: gravel is quartz, feldspar, and mafics.	SM		Kelly down @ 281 ft, new 20' connection.
285					Same as above (279 ft).		Portland Bentonite Cement	
290					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine to medium gravel; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	SW		
295					Same as above (287 ft).			Rig chatter.
300								

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Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		Kelly down @ 301 ft, new 20' connection.
305					Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% coarse gravel; subrounded to rounded; 35% very fine to coarse sand; subrounded to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	GP		Constant rig chatter.
310					Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/3); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% silt. Note: sand is quartz. Gravel is quartz, feldspar, and mafics.			PID = 0.0 ppm @ breathing zone.
315					Same as above (309 ft).		Portland Bentonite Cement	
320					Same as above (309 ft).	SW		Bit chatter.
325					Same as above (309 ft); 55% very fine to coarse sand; 40% fine gravel.			Kelly down @ 1045, new 20' connection.
330								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/4); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; angular to rounded; 5% silt. Note: sand and gravel are quartz, feldspar, and mafics.	SW	Portland Bentonite Cement	PID = 0.0 ppm @ breathing zone.
335					Same as above (330 ft); 35% coarse gravel.			Rig chatter.
340					Same as above (330 ft); 35% coarse gravel.			Kelly down @ 1334, new 20' connection.
345					Same as above (330 ft); 35% coarse gravel.			Rig chatter.
350					Same as above (330 ft); 35% coarse gravel.			Rig chatter; hard cuttings.
355					Same as above (330 ft); 35% coarse gravel.			
360								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/4); 60% very fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; angular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SW		Kelly down @ 1459, new 20' connection.
365					Same as above (360 ft); 35% coarse gravel.		Portland Bentonite Cement	
370					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/2); 60% fine sand; trace coarse sand; subrounded to rounded; 35% fine to coarse gravel; angular to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, mafics, and feldspar.		Top of 3/8" Bentonite Chip Seal	
375					Same as above (368 ft); trace medium to coarse sand.			
380					Poorly graded SAND (SP); brown (7.5YR 4/2); 85% very fine to fine sand; subrounded to rounded; 10% fine gravel; angular to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.	SP	3/8" Bentonite Chip Seal	End of 9/16/15 @ 379 ft. Begin drilling with 12 1/4" bit mud rotary on 9/17/15 @ 0901. Kelly down @ 381 ft, new 20' connection.
385					Same as above (380 ft).			PID = 0.0 ppm @ breathing zone.
390								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Poorly graded SAND (SP); brown (7.5YR 4/2); 85% very fine to fine sand; subrounded to rounded; 10% fine gravel; angular to rounded; 5% silt. Note: gravel is quartz, feldspar, and mafics.			Rig chatter.
395					@ 391 ft. Poorly graded SAND with Gravel (SP); brown (7.5YR 5/3); 70% fine sand; subrounded to rounded; 25% fine to coarse gravel; angular to subangular; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.		- 3/8" Bentonite Chip Seal	
400					Same as above (391 ft); 60% fine sand; 35% fine to coarse gravel.			Rig chatter; slowed drilling rate. PID = 0.0 ppm @ breathing zone. Kelly down @ 1002, new 20' connection.
405					Same as above (391 ft); brown (7.5YR 4/3); 60% fine sand; 35% fine to coarse gravel.	SP		
410					Same as above (391 ft); brown (7.5YR 4/3); 60% fine sand; trace medium to coarse sand; 35% fine to coarse gravel.		- Top of 10/20 Sand	
415					Same as above (391 ft); brown (7.5YR 4/3); 60% fine sand; trace medium to coarse sand; 35% fine to coarse gravel.		- Top of 8/12 Sand	
420								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/2/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Mud Rotary
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND with Gravel (SP); brown (7.5YR 4/2); 75% fine sand; subrounded to rounded; 20% fine gravel; subrounded to rounded; 5% silt. Note: sand is quartz and mafics. Gravel is quartz, mafics, and feldspar.	SP		
425					Well-graded SAND with Gravel (SW); brown (7.5YR 4/2); 65% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; angular to rounded; 5% silt. Note: sand is quartz and mafics.	SW	8/12 Sand	PID = 0.0 ppm @ breathing zone.
430					Silty SAND (SM); 60% fine sand; subrounded to rounded; 10% fine gravel; angular to subrounded; 30% silt. Note: sand is quartz and mafics. Gravel is quartz, feldspar, and mafics.	SM		
435								End of mud rotary drilling @ 435 ft on 9/17/15.
440								
445								
450								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:49 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
435					@ 435 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; subrounded to rounded; trace fine gravel; 5% silt.	SP		Begin sonic coring with mud on 9/18/15 with 6" O.D. bit. @ 435 - 449 ft sand is quartz with occasional mafics. @ 436.6 - 437 ft gravel is quartz, mafics, and feldspar.
					@ 435.5 ft. Fat CLAY (CH); reddish brown (5YR 5/4); high plasticity; 100% clay.	CH		
					@ 436.2 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% very fine to fine sand; subrounded to rounded; 10% silt.	SP-SM		
					@ 436.6 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 5/3); 60% fine to coarse sand; subrounded to rounded; 35% fine to coarse gravel; subrounded to rounded; 5% silt.	SW		
440					@ 437 ft. No recovery.		- Top of 8" Stainless Steel 0.050 Slot Screen	
					@ 440 ft. Poorly graded SAND (SP); brown (7.5YR 4/4); 95% fine sand; subrounded to rounded; 5% silt.	SP		@ 440 - 442.8 ft sediments are fining upwards and laminated. @ 440.52 ft cobble to 1-5/8"; subangular; sandstone.
					@ 442.8 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/4); 50% fine to coarse gravel; subrounded; 40% fine to coarse sand; angular to rounded; 10% silt.	GW-GM		@ 442.8 - 449 ft gravel is quartz, mafics, and feldspars with occasional granite and quartzite.
445					@ 443.1 ft. No recovery.			
					@ 445 ft. Silty GRAVEL (GM); brown (7.5YR 5/3); 60% fine to coarse gravel; subrounded; 10% fine to coarse sand; subrounded to rounded; 30% silt.	GM		@ 445 - 446.7 ft the percentage of silt decreases with depth.
					@ 446.7 ft. No recovery.			
					@ 447.5 ft. Poorly graded SAND with Gravel (SP); brown (7.5YR 5/3); 80% fine to medium sand; trace coarse sand; subrounded to rounded; 15% fine to coarse gravel; subrounded to rounded; 5% silt.	SP		
450					@ 449 ft. No recovery.			

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					@ 450 ft. Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 5/3); 70% fine to coarse sand; 20% coarse gravel; 10% silt.	SW-SM		End of 9/18/15 @ 450 ft. Resume coring @ 1030 on 9/23/15. @ 450 - 464.2 ft sand is quartz with occasional granite, mafics, and feldspar. Gravel is quartz with occasional mafics.
					@ 450.7 ft. Silty SAND with Gravel (SM); brown (7.5YR 5/4); 50% fine to coarse sand; subrounded to rounded; 20% gravel; 30% silt; trace clay. @ 451.7 ft. Same as above (450.7 ft); 20% very coarse gravel to 40 mm; subrounded to rounded. @ 452 ft. Same as above (450.7 ft); brown (7.5YR 4/4); 60% fine to coarse sand; 15% coarse gravel to 40 mm; 25% silt.	SM		
455					@ 453.9 ft. No recovery.			
					@ 455 ft. Silty SAND with Gravel (SM); brown (7.5YR 4/4); 70% fine to coarse sand; subrounded to rounded; 15% coarse gravel to 40 mm; 15% silt.	SM		
					@ 455.8 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine sand; subrounded to rounded; trace fine gravel; 10% silt. @ 456.5 ft. No recovery.	SP-SM	8" Stainless Steel 0.050 Slot Screen	@ 456.5 ft driller states that coring feels like gravel. Gravel was likely pushed aside instead of recovered, causing loss of core sample.
460					@ 461.4 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; trace medium sand; subrounded to rounded; 5% silt.	SP		
						GM		
					@ 461.9 ft. Silty GRAVEL with Sand (GM); brown (7.5YR 5/4); 50% fine to coarse gravel; subrounded to rounded; 35% fine to coarse sand; subrounded to rounded; 15% silt.	SP		
465					@ 462.5 ft. Poorly graded SAND (SP); dark brown (7.5YR 3/3); 95% fine sand;			

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
465					subrounded to rounded; trace gravel; rounded; 5% silt.	SP		@ 465 - 479.4 ft sand is quartz with occasional mafics. Gravel is quartz with occasional mafics.
					@ 464.2 ft. No recovery.			
					@ 465 ft. Poorly graded SAND (SP); brown (7.5YR 4/3); 95% medium sand; trace coarse sand; trace fine gravel; subrounded to rounded; 5% silt.	GW-GM		
					@ 466.2 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/3); 60% fine to coarse gravel; subrounded to rounded; 30% fine to coarse sand; 10% silt.	SW		
						GW-GM		
					@ 466.5 ft. No recovery.			@ 468.4 ft driller reported drilling in gravel, which likely caused loss of core.
470					@ 467.5 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 4/3); 80% fine to coarse sand; 15% fine to coarse gravel; 5% silt.			
					@ 468 ft. Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 4/3); 70% fine to coarse gravel to 40 mm; subrounded to rounded; 20% coarse sand; trace fine and medium sand; 10% silt.		8" Stainless Steel 0.050 Slot Screen	
					@ 468.4 ft. No recovery.			
					@ 472.5 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); 90% fine sand; subrounded; trace gravel; 10% silt.	SP-SM		
475					@ 474.7 ft. No recovery.			@ 474.6 - 474.7 ft clay lense.
					@ 475 ft. Silty SAND (SM); brown (7.5YR 4/3); 80% fine sand; subrounded to rounded; trace coarse gravel; 20% silt.	SM		End of 9/23/15 @ 475 ft. Resume drilling on 9/24/15.
					@ 476.6 ft. No recovery.			@ 476.1 ft silt lense, 7 mm thick.
					@ 477.5 ft. Silty SAND (SM); brown (7.5YR 4/3); 85% fine sand; subrounded to rounded; 15% silt.	SM		@ 476.5 ft silt lense, 5 mm thick. Two 5 mm clay nodules.
					@ 478.4 ft. Fat CLAY (CH); yellowish brown (10YR 5/4); hard; medium plasticity; 100% clay.	CH		
						CL		
						SM		
480					@ 478.7 ft. Lean CLAY (CL); reddish			

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					brown (2.5YR 4/3); low plasticity; 95% clay; 5% gravel.	SM		@ 480 - 494.8 ft sand is quartz with occasional mafics.
					@ 479 ft. Silty SAND (SM); brown (7.5YR 4/3); 80% fine sand; subrounded to rounded; 20% silt.	CL		
					@ 479.4 ft. No recovery.			
					@ 480 ft. Silty SAND (SM); brown (7.5YR 5/3); 80% fine to coarse sand; subrounded to rounded; 20% silt.			@ 483.5 - 484 ft sediment is laminated.
					@ 480.7 ft. Lean CLAY with Sand (CL); reddish brown (5YR 5/4); low plasticity; 80% clay; 20% very fine sand; rounded.	SP		
					@ 480.8 ft. No recovery.			
485					@ 482.5 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; subrounded to rounded; 5% silt.			
					@ 484.3 ft. No recovery.	SP		
					@ 485 ft. Poorly graded SAND (SP); brown (7.5YR 5/3); 95% fine sand; subrounded to rounded; 5% silt.			@ 485.65 - 485.7 ft laminations observed.
					@ 486.1 ft. No recovery.			@ 486 ft drilling through gravels; weathered sandstone; white (10YR 8/1).
					@ 487.6 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine sand; subrounded to rounded; 10% silt.	SP-SM	8" Stainless Steel 0.050 Slot Screen	@ 488 ft texture is blocky.
					@ 488 ft. Lean CLAY with Sand (CL); reddish brown (2.5YR 4/4); low plasticity; 80% clay; 20% fine sand; trace gravel to 30 mm.	CL		
490						SP-SM		
					@ 489.3 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); 90% fine sand; subrounded to rounded; 10% silt.	SM		@ 490 - 494.8 ft sediment is fining upward.
					@ 489.9 ft. No recovery.			
					@ 490 ft. Silty SAND with Gravel (SM); dark brown (7.5YR 3/3); 65% fine to coarse sand; subrounded to rounded; 15% fine to coarse gravel; rounded; 20% silt.			
					@ 491.8 ft. No recovery.			@ 492.6 ft cobble.
					@ 492.5 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/3); 90% fine to medium sand; trace coarse sand; subrounded to rounded; trace gravel to 45 mm; 10% silt.	SP-SM		
495								

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
495					@ 494.8 ft. No recovery.			
					@ 495 ft. Well-graded SAND with Silt (SW-SM); brown (7.5YR 4/2); 90% fine to coarse sand; subrounded to rounded; trace gravel; 10% silt.	SW-SM		@ 495 - 507.8 ft sand is quartz with occasional mafics.
					@ 496.2 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/2); 90% fine sand; subrounded to rounded; trace gravel; 10% silt.	SP-SM		@ 496.3 ft lost what appeared to be saturated sands.
					@ 496.3 ft. No recovery.	GW		@ 497.5 ft sand and silt likely washed out from core sample.
					@ 497.5 ft. Well-graded GRAVEL (GW); 100% fine to coarse gravel to 24 mm.			@ 497.7 ft drilling through gravels. All core lost during core rod and drill stem removal.
					@ 497.7 ft. No recovery.			
500								
					@ 502.5 ft. Well-graded GRAVEL (GW); 100% gravel; rounded.	GW	8" Stainless Steel 0.050 Slot Screen	End of 9/24/15 @ 502.5 ft. Resume drilling on 9/25/15. Silt and sand fraction washed away.
					@ 502.7 ft. SILT (ML); light reddish brown (2.5YR 6/3); hard; low plasticity; 85% silt; trace clay; 10% fine sand; rounded; 5% fine gravel; rounded.	ML		
					@ 503.1 ft. Well-graded SAND with Silt (SW-SM); 90% sand; trace gravel; 10% silt.	SW-SM		@ 504.1 ft gravel encountered.
505					@ 503.5 ft. Poorly graded SAND (SP); 95% sand; 5% silt.	SP		
					@ 504.1 ft. No recovery.	GP		
					@ 505 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel to 25 mm; subrounded; 35% fine to coarse sand; 5% silt.			@ 505.6 ft gravel encountered.
					@ 505.6 ft. No recovery.	GP		
					@ 507.5 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel to 25 mm; subrounded; 35% fine to coarse sand; 5% silt.			@ 507.8 ft gravel encountered.
510					@ 507.8 ft. No recovery.			

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					@ 510 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel; subrounded; 35% fine to coarse sand; 5% silt.	GP		@ 510.2 ft gravel encountered.
					@ 510.2 ft. No recovery.			
					@ 512.5 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/3); 60% fine gravel; subrounded; 35% fine to coarse sand; 5% silt.	GP		@ 512.8 ft very coarse pebble in shoe of core barrel.
					@ 512.8 ft. No recovery.			
515					@ 517.5 ft. Poorly graded GRAVEL (GP); brown (7.5YR 4/2); 95% fine gravel to 4 mm; subangular to subrounded; 5% silt.	GP	8" Stainless Steel 0.050 Slot Screen	End of 9/25/15 @ 517.5 ft. Resume coring on 9/26/15.
					@ 518.1 ft. Poorly graded SAND with Silt and Gravel (SP-SM); brown (7.5YR 4/2); 60% fine sand; rounded; 30% coarse gravel; 10% silt.	SP-SM		@ 518.1 - 520.6 ft sand is quartz.
520					@ 518.3 ft. No recovery.	ML		@ 520 ft gravel encountered.
					@ 520.1 ft. SILT (ML); brown (7.5YR 4/2); nonplastic; 90% silt; 10% very fine to fine sand.	SW		@ 520.6 ft loose, wet sand and gravel encountered.
					@ 520.2 ft. Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 65% fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel; subangular to subrounded; 5% silt.			@ 522.5 ft gravel within coring interval caused core barrel thread sheering.
					@ 520.6 ft. No recovery.			
525								

KAFB_BOREHOLE_LOG - SHAW_DRILLING.GDT - 12/2/15 15:54 - Z:\KAFB RAPID\GINT\KAFB_RAPID.GPJ

Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 459.00
At End of Drilling: Not Recorded
After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
525					@ 525 ft. Poorly graded GRAVEL with Silt and Sand (GP-GM); brown (7.5YR 4/2); 60% fine gravel to 8 mm; subangular to subrounded; 30% fine to coarse sand; 10% silt.	GP-GM		@ 525 - 537.2 ft gravel is quartz, mafics, and occasional granite.
					@ 525.6 ft. Poorly graded SAND with Silt (SP-SM); brown (7.5YR 4/2); dense; 90% fine sand; subangular to subrounded; 10% silt.	SP-SM		@ 525.6 - 537.2 ft sand is quartz and mafics.
					@ 525.9 ft. No recovery.			@ 525.9 ft gravel encountered.
					@ 527.5 ft. Poorly graded GRAVEL with Sand (GP); brown (7.5YR 4/2); loose; 70% fine gravel to 4 mm; subrounded to rounded; 25% fine to coarse sand; subrounded to rounded; 5% silt.	GP		@ 528.5 ft gravel encountered.
530					@ 528.5 ft. No recovery.	SW		@ 530 ft top section of sample shows little sand. Inferred that the sand washed out.
					@ 530 ft. Well-graded SAND with Gravel (SW); dark brown (7.5YR 3/3); 65% very fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel to 35 mm; subrounded; 5% silt.			@ 530.4 ft gravel encountered.
					@ 530.4 ft. No recovery.			
					@ 532.5 ft. Well-graded GRAVEL with Sand (GW); gray (7.5YR 6/1); 50% fine to coarse gravel; subrounded to rounded; 45% fine to coarse sand; subrounded to rounded; 5% silt.	GW	- 8" Stainless Steel 0.050 Slot Screen	End of 9/26/15 @ 532.5 ft. Resume drilling on 9/28/15. @ 532.5 ft portions of the gravel are cemented with calcium carbonate.
					@ 533.7 ft. No recovery.			@ 533.7 ft sand was washed away and gravel not recovered.
535					@ 535 ft. Well-graded GRAVEL with Sand (GW); gray (7.5YR 6/1); 50% fine to coarse gravel; subrounded to rounded; 45% fine to coarse sand; subrounded to rounded; 5% silt.	GW		@ 535 ft hard to very hard conglomerate rock; calcite-cemented.
					@ 535.2 ft. No recovery.	SW-SM		@ 536.5 - 536.55 ft silt lense; gray (7.5YR 5/1).
					@ 536.5 ft. Well-graded SAND with Silt and Gravel (SW-SM); dark brown (7.5YR 3/2); 60% very fine to coarse sand; subrounded to rounded; 30% fine to coarse gravel to 35 mm; subrounded; 10% silt.			@ 537.2 ft gravel obstructed sample collection.
					@ 537.2 ft. No recovery.			
540							- Bottom of	

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
Date TD Reached: 10/1/2015
Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					@ 540 ft. Poorly graded GRAVEL with Sand (GP); dark brown (7.5YR 3/2); 55% fine gravel; angular to subrounded; 40% very fine to coarse sand; angular to subrounded; 5% silt.	GP	Screen	End of continuous coring @ 540 ft on 9/28/15. @ 540 - 556 ft sand is quartz and mafics. Gravel is quartz, mafics, and granite.
545					@ 545 ft. Same as above (540 ft); 55% fine gravel to 6 mm; angular.		Bottom of Sump	Very hard drilling from 547 - 556 ft.
550					@ 550 ft. Same as above (540 ft) 80% fine gravel; angular; 20% very fine to coarse sand.			Reamed borehole using 12-1/4" bit from 435 - 550 ft on 9/26/15 through 9/28/15.
555								

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Borehole ID: KAFB-106234-Sonic

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106 and SS-111
Project Number: 500433

Date Started: 9/18/2015
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Date Completed:

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 16
Hole Diameter Lower (in.): 14-3/4
Surface Completion Type: Flush

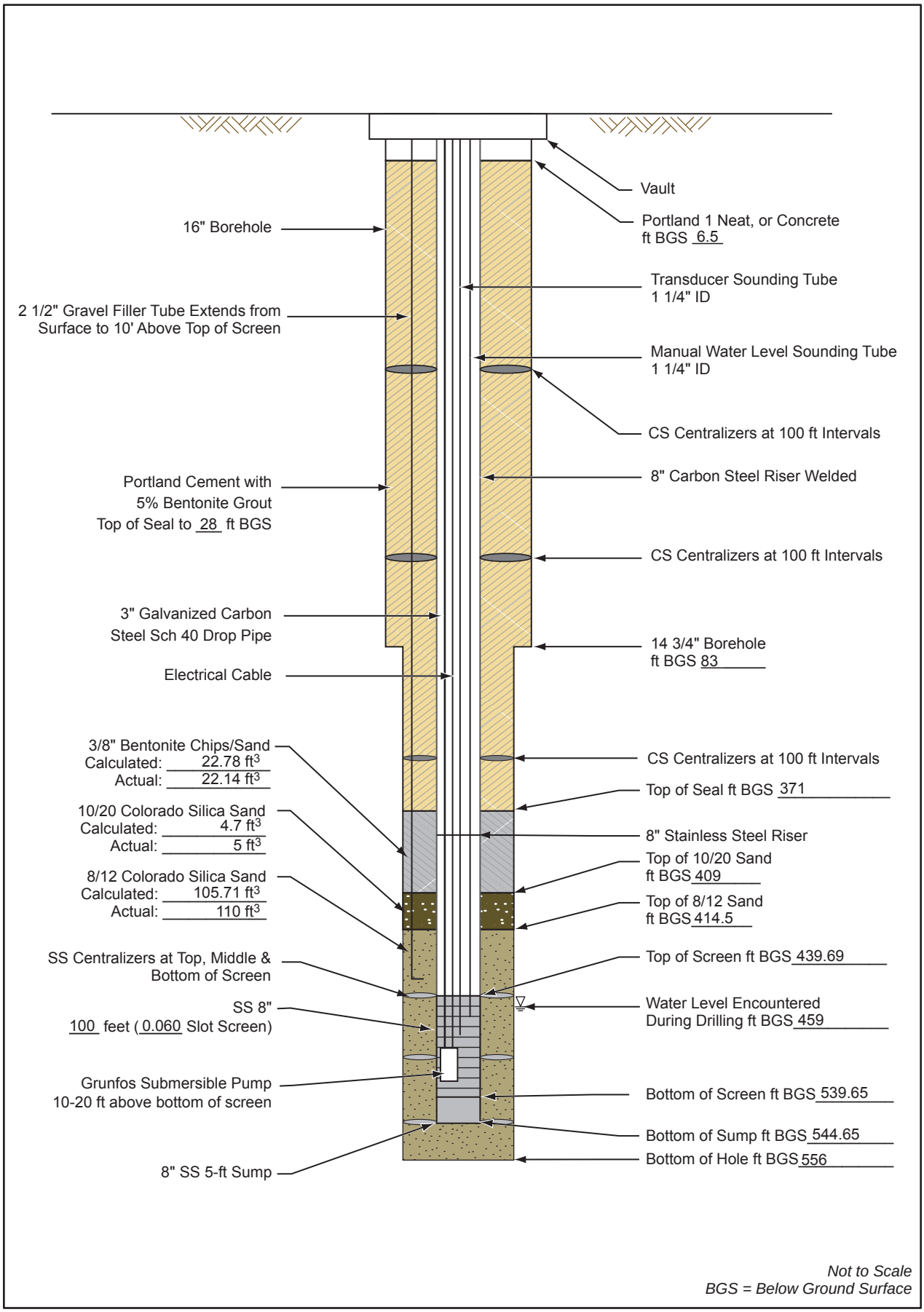
Groundwater Levels BGS (ft):
▽ At Time of Drilling: 459.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 458.90

Drillling Contractor: National Drilling
Drilling Method: Sonic Coring
Logged By: David Kessler

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
555					@ 555 ft. Poorly graded GRAVEL with Sand (GP); dark brown (7.5YR 3/2); 80% fine gravel; angular; 20% very fine to coarse sand; angular to subrounded.	GP	- Bottom of Filter Pack/Bottom of Hole	Total depth = 556 ft bgs. Reached total depth on 10/1/15. Reamed borehole using 14-3/4" bit from 83 - 556 ft on 9/30/15 through 10/1/15.
560								
565								
570								

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Extraction Well Construction Diagram KAFB-106234



Not to Scale
BGS = Below Ground Surface

500433.04010300.A5

Groundwater Extraction Well Development

Project Name:	KAFB BFF	**Well No.:**	KAFB-106234
Location:	Anderson and Georgia	**Date Installed:**	10/9/2015
Personnel:	MG	**Casing Diameter (I.D.):**	8-inch
Start Date:	10/1/2015	**Total Depth (ft. BGS):**	544.65
End Date:	11/3/2015		

Method of Development:

[X] Surging [X] Bailing [X] Pumping [X] Jetting

[X] Original Development [ ] Redevelopment [ ] Other

Depth to Water Before Developing Well (ft. BGS): NR

Screened Interval (ft. BGS): 439.69-539.65

Weather: Varied

Equipment Numbers: **pH:** NR **Conductivity:** NR

Turbidity: NR

Equipment Decontaminated Prior to Development? [X] Yes [ ] No

Describe:

Collected Sample of Water Added to Well? [ ] Yes [X] No

Describe:

Comments:

Summary of development procedure, including key decision-points, calculations, and observations (described in detail in the following pages):

Well development consisted of bailing, surging, pumping, and jetting. The first step of development removed mud and cuttings from the well casing and filter pack, which were generated during the drilling process, by surging and bailing. The second step entailed physical well development using surging, bailing, and pumping to assess development progress. These actions included taking measurements of sediment content in the water using the Imhoff cone technique, and applying 30 minutes of sustained pumping, measuring, and plotting drawdown to estimate development effectiveness. The third step used jetting with simultaneous pumping.

Groundwater Extraction Well Development

Bailing				
Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
10/12/2015	1800	135	--	Very muddy, 4 mL of coarse sand and more suspended at 100 gallons
10/13/2015	0910	150	117	Mostly coarse sand
10/13/2015	1005	300	20	Mostly coarse sand
10/13/2015	1055	450	200	Mostly coarse sand
10/13/2015	1100	465	750	All coarse sand
10/13/2015	1305	600	10	Collected from the middle of screen
10/13/2015	1340	750	12	Collected from the middle of screen
10/13/2015	1415	900	10	Collected from the middle of screen
10/13/2015	1440	1050	4	1 mL fine grained, 3 mL very fine grained
10/13/2015	1513	1200	0.8	0.5 mL fine grained, 0.3 mL very fine grained
10/13/2015	1536	1350	0.8	0.5 mL fine grained, 0.3 mL very fine grained
10/13/2015	1605	1500	--	Stop bailing, tag bottom at 544.1 bgs
10/16/2015	1033	--	0.7	Collected after 4 bailing runs, sediment is very fine to fine sand
10/16/2015	1056	--	0.5	Collected after 6 bailing runs, sediment is very fine to fine sand
10/16/2015	1355	--	0.5	Collected after 4 bailing runs, sediment is very fine to fine sand
10/16/2015	1408	--	0.5	Collected after 6 bailing runs, sediment is very fine to fine sand

L = liter

mL = milliliter

Groundwater Extraction Well Development

Surging				
Interval (feet below ground surface)	Date	Start Time	End Time	Comments
540-535	10/15/2015	1640	1645	
535-530	10/15/2015	1645	1650	
530-525	10/15/2015	1650	1655	
525-520	10/15/2015	1655	1700	
520-515	10/15/2015	1700	1705	
515-510	10/15/2015	1705	1710	
510-505	10/15/2015	1710	1715	
505-500	10/15/2015	1715	1720	
500-495	10/15/2015	1720	1725	
495-490	10/15/2015	1725	1730	
490-485	10/15/2015	1730	1735	
485-480	10/15/2015	1735	1740	
480-475	10/15/2015	1740	1745	
475-470	10/15/2015	1745	1750	
470-465	10/15/2015	1750	1755	
465-462.9	10/15/2015	1755	1800	
540-530	10/16/2015	0845	0850	
530-525	10/16/2015	0850	0855	
525-520	10/16/2015	0900	0905	
520-515	10/16/2015	0905	0910	
515-510	10/16/2015	0910	0915	
510-505	10/16/2015	0915	0920	
505-500	10/16/2015	0920	0925	
500-495	10/16/2015	0925	0930	
495-490	10/16/2015	0930	0935	
490-485	10/16/2015	0935	0940	
485-480	10/16/2015	0940	0945	
480-475	10/16/2015	0945	0950	
475-470	10/16/2015	0950	0955	
470-465	10/16/2015	0955	1000	
540-530	10/16/2015	1130	1135	
535-530	10/16/2015	1135	1140	
530-525	10/16/2015	1140	1145	
525-520	10/16/2015	1145	1150	
520-515	10/16/2015	1150	1155	
515-510	10/16/2015	1155	1200	
510-505	10/16/2015	1200	1205	
505-500	10/16/2015	1205	1210	

Groundwater Extraction Well Development

Surging				
Interval (feet below ground surface)	Date	Start Time	End Time	Comments
500-495	10/16/2015	1210	1215	
495-490	10/16/2015	1215	1220	
490-485	10/16/2015	1220	1225	
485-480	10/16/2015	1225	1230	
480-475	10/16/2015	1320	1325	
475-470	10/16/2015	1330	1335	

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Pump Intake (Feet bgs)
10/14/2015	1114	0	462.7	--	--	--	--	--	--	--	490.5
10/14/2015	1312	0	464.5	--	--	--	--	--	--	--	511.5
10/14/2015	1340	16.5	502	259	21.78	5.99	1.029	1502	--	--	511.5
10/14/2015	1359	16.5	500	481.6	21.55	7.23	0.971	506	--	--	511.5
10/14/2015	1423	16.5	500	748.5	21.46	7.64	0.900	208	--	0.5	511.5
10/14/2015	1455	16.5	495	923	21.24	7.69	0.878	117.5	--	0.0	521.5
10/14/2015	1515	16.5	505	1238	21.32	7.91	08.35	214.3	--	Trace	521.5
10/14/2015	1530	25	514	1862	20.94	7.86	0.766	988.1	--	0.2	521.5
10/14/2015	1633	40	522	2675	20.77	8.19	0.788	620.1	--	0.5	532.5
10/14/2015	1647	37	525	3187	20.93	7.92	0.793	375.5	--	0.3	532.5
10/14/2015	1745	24.5	475	3812	--	--	--	--	1.84	--	532.5
10/15/2015	1005	20.6	--	4722	20.21	8.67	0.720	13.3	2.98	0.0	527.5
10/15/2015	1016	21.04	--	5149	20.45	8.26	0.398	10.6	--	0.0	527.5
10/15/2015	1026	20.72	--	5157	20.63	8.19	0.632	9.3	--	0.0	517.5
10/15/2015	1036	20.88	--	5359	20.77	8.18	0.757	9.6	--	0.0	512.5
10/15/2015	1103	20.88	--	5586	21.13	8.15	0.757	9.9	--	0.0	506.5
10/15/2015	1113	15.21	--	5745	21.21	8.11	0.755	9.3	--	0.0	501.5
10/15/2015	1123	15.38	--	5886	21.20	8.08	0.752	10.1	--	0.0	496.5
10/15/2015	1133	15.21	--	6037	21.31	8.08	0.750	10.5	--	0.0	491.5
10/15/2015	1305	14.25	--	6212	21.47	8.07	0.754	14.7	--	0.0	485.5
10/15/2015	1315	14.24	--	6338	21.52	8.07	0.759	11.0	--	0.0	480.5
10/15/2015	1325	14.24	--	6504	21.53	8.08	0.754	11.9	--	0.0	475.5
10/16/2015	1720	36.14	428.25	7365	19.92	8.47	0.705	259	6.4	<0.1	521.5
10/16/2015	1735	36.30	428.25	8630	19.82	8.13	0.692	140.8	--	--	521.5
10/17/2015	0820	--	--	9116.18	19.46	8.61	0.692	31.4	--	Trace	521.5
10/17/2015	0832	42.98	--	9781.18	20.25	8.35	0.695	72.0	--	Trace	521.5
10/17/2015	0855	4298	--	10831.18	19.70	8.06	0.692	30.7	--	Trace	521.5
10/17/2015	1100	40.3	467.4	13972.18	20.19	8.21	0.695	41.0	--	Trace	521.5

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U.)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Depth of pump (Feet bgs)
10/30/2015	1250	66.76	465.92	15013.18	17.7	7.66	0.811	10.4	25.98	<0.1	513.6
10/30/2015	1254	66.76	465.92	16424.18	17.7	7.59	0.817	6.30	25.98	<0.1	513.6
10/30/2015	1317	66.64	465.85	18302.18	18.0	7.57	0.806	44.7	26.65	<0.1	513.6
10/30/2015	1325	66.40	465.88	20642.18	17.7	7.59	0.805	12.7	26.25	<0.1	513.6
10/30/2015	1347	66.04	465.82	23453.18	17.8	7.58	0.807	21.4	26.74	<0.1	513.6
10/30/2015	1355	65.80	465.82	26667.18	17.7	7.60	0.808	7.15	26.64	<0.1	513.6
10/30/2015	1406	66.76	465.81	30240.18	17.9	7.65	0.807	17.1	27.13	<0.1	513.6
10/30/2015	1411	66.52	465.84	34162.18	17.8	7.60	0.807	5.21	26.71	<0.1	513.6
10/30/2015	1424	66.28	465.82	38502.18	17.6	7.65	0.807	13.4	26.83	<0.1	513.6
10/30/2015	1428	66.16	465.84	43312.18	17.6	7.59	0.808	4.41	26.57	<0.1	513.6
10/30/2015	1441	66.16	465.78	48447.18	17.4	7.60	0.805	11.0	27.23	<0.1	513.6
10/30/2015	1447	65.80	465.83	53972.18	17.6	7.59	0.806	3.93	26.56	<0.1	513.6
10/30/2015	1458	66.16	465.79	59863.18	17.5	7.65	0.806	8.59	27.11	<0.1	513.6
10/30/2015	1504	65.92	465.84	66147.18	17.6	7.59	0.807	2.84	26.47	<0.1	513.6
10/30/2015	1522	65.80	465.81	72957.18	17.9	7.56	0.810	4.32	26.75	<0.1	513.6
10/30/2015	1526	65.8	465.72	80041.18	17.6	7.54	0.786	O.R	--	1	513.6
10/30/2015	1545	65.8	465.73	88350.18	17.6	7.54	0.804	144	--	0.4	513.6
10/30/2015	1604	65.68	465.87	97725.18	17.9	7.55	0.808	35.5	--	<0.1	513.6
10/30/2015	1615	65.68	--	107823.18	17.7	7.57	0.790	557	--	0.5	513.6
10/30/2015	1622	65.68	--	118380.18	--	--	--	54.2	--	0.1	513.6
10/30/2015	1635	65.68	465.87	129331.18	18.1	7.55	0.802	51.1	26.59	0.1	513.6
10/30/2015	1648	65.44	465.81	140282.18	18.1	7.56	0.812	35.3	26.60	<0.1	513.6
10/30/2015	1712	66.04	465.74	152415.18	18.0	7.58	0.909	10.5	27.07	<0.1	513.6
10/30/2015	1729	65.80	4685.77	165009.18	17.8	7.59	0.806	7.11	27.19	<0.1	513.6

Groundwater Extraction Well Development

Pumping

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH (S.U.)	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Imhoff Cone (mL sediment per L water)	Depth of pump (Feet bgs)
11/02/2015	1330	208.5	471.6	168389.18	17.7	7.52	0.791	6.86	25.18	0.1	512.5
11/02/2015	1340	205.68	471.82	173279.18	17.6	7.49	0.784	1.91	24.19	<0.1	512.5
11/02/2015	1350	205.32	471.91	179959.18	17.7	7.50	0.784	2.21	23.90	<0.1	512.5
11/02/2015	1400	205.32	471.95	188499.18	17.7	7.51	0.783	1.17	23.79	<0.1	512.5
11/02/2015	1405	205.32	471.97	198499.18	--	--	--	--	23.74	--	512.5
11/02/2015	1420	150	469.02	208999.18	17.9	7.59	0.782	21.7	26.74	<0.1	512.5
11/02/2015	1430	152.41	469.45	220074.18	17.8	7.56	0.787	3.04	25.36	<0.1	512.5
11/02/2015	1503	153.46	469.20	231849.18	18.0	7.63	0.781	31.2	--	<0.1	512.5
11/02/2015	1510	152.64	469.35	244409.18	17.7	7.59	0.788	2.24	--	<0.1	512.5
11/02/2015	1530	154.20	469.25	257529.18	17.7	7.62	0.780	22.3	--	<0.1	512.5
11/02/2015	1538	152.64	--	271535.18	--	--	--	3.13	--	<0.1	512.5
11/03/2015	0940	150.04	469.32	273535.18	17.8	7.08	0.854	1.67	24.88	<0.1	512
11/03/2015	0950	150.16	469.36	276635.18	17.9	7.41	0.854	1.90	24.74	<0.1	512
11/03/2015	1000	150.16	469.43	281235.18	17.9	7.51	0.855	0.50	24.45	<0.1	512
11/03/2015	1010	150.40	469.46	287335.18	17.9	7.53	0.854	0.80	24.38	<0.1	512
11/03/2015	1020	150.28	469.51	294935.18	17.9	7.54	0.854	1.81	24.16	<0.1	512
11/03/2015	1030	150.4	469.52	304035.18	17.9	7.54	0.838	2.03	24.14	<0.1	512
11/03/2015	1050	150.04	464.53	316135.18	17.9	7.55	0.837	1.42	24.04	<0.1	512
11/03/2015	1110	150.16	469.55	331235.18	18.1	7.55	0.839	1.28	23.99	<0.1	512
11/03/2015	1130	150.16	469.57	349335.18	19.2	7.55	0.838	3.37	23.90	<0.1	512
11/03/2015	1150	150.16	469.58	370435.18	18.0	7.55	0.837	0.38	23.87	<0.1	512
11/03/2015	1210	150.16	469.59	394535.18	18.2	7.55	0.837	0.86	23.83	<0.1	512

°C = degrees Celsius
EC = Electric Conductivity
ft bgs = feet below ground surface
gpm = gallons per minute
gpm/ft = gallons per minute per foot
mL = milliliter
mS/cm = millisiemen per centimeter
NR = not recorded
NTU = Nephelometric Turbidity Unit
S.U. = Standard Unit

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Depth to Water (feet bgs)	Comments
10/24/2015	1255	532-537	37.44	55	9/9/9.8/4.5	--	
10/24/2015	1305	527-532	37.2	80 /45	4/1.2/1.3	--	Had to change flow meter
10/24/2015	1317	522-527	36.4	45	9/7.5/5/9	--	
10/24/2015	1327	517-522	35.9	--	3.5/4/4.5	--	
10/24/2015	1340	--	--	--	--	--	Moved jetting tool back to the bottom of the screen
10/24/2015	1343	537	0	85	3/0.35/0.4/0.75/0.1	--	
10/24/2015	1507	511-516	36.35	55	1.9/4/5/2.5/2.9	--	
10/24/2015	1524	506-511	36.23	62	3/5/3.5/2/4.5	--	
10/24/2015	1538	501-506	36.11	68/65/55	2.5/4/5/2.5	--	
10/24/2015	1634	496-501	37	--	--	--	
10/24/2015	1644	496-501	--	--	--	--	At 1644, determine flow meter is not functioning correctly. Calculate flow rate using bucket and stopwatch for remainder of 10/24
10/24/2015	1705	491-496	37	42	9.5/1.3/1.5/6/11	--	
10/24/2015	1720	--	--	--	--	--	Stop jetting at 1720
10/24/2015	1730	501	0	42	9.5	--	Jett off, pumping only
10/24/2015	1735	501	0	42	0.1	--	
10/24/2015	1740	501	0	42	--	--	Trace of fines
10/26/2015	0951	485-490	36	45 / 39.5	4.5/3.7	464.1	Stop jetting at 0955
10/26/2015	1007	485-490	--	44 / 40.5	--	466.4	Resume jetting at 1005
10/26/2015	1014	485-490	25	40.5 / 37	6.0/12/23	464.4	
10/26/2015	1021	480-485	24.91	40	12.7/13/10/2.5	464.3	
10/26/2015	1026	475-480	24.30	40	1.5/8/11	463.7/464.3	
10/26/2015	1037	470-475	23.86	40	30/11	464.0	

Groundwater Extraction Well Development

Jetting

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Depth to Water (feet bgs)	Comments
10/26/2015	1045	485	0	40	7/2.5/0.6		Jett off, pumping only
10/26/2015	1210	479	0	40	0.1/trace	466.2	
10/26/2015	1327	485	0	43.7	2.5/0.2/<0.1	466.27	
10/26/2015	1348	470-475	31.69	46.0	16/7/5	463/464.2	
10/26/2015	1354	465-470	31.69	44	10/5.5/1.78	464/464.7	
10/26/2015	1420	--	--	--	--	--	Set jet at 524 ft bgs
10/26/2015	1534	519-524	0	48.23	4/0.2/0.1	465.19/ 465.3	Jett off pumping only
10/26/2015	1554	519-524	33.72	47.34	10/12.5/5	463.37	
10/26/2015	1600	524-519	32.66	46.15	8/3.0/3.25	463.4/ 463.6	
10/26/2015	1606	519-514	32.54	44.1	4.5/4/5	463.8	
10/26/2015	1611	514-509	32.54	44.1	7.5/6.5/1.5	463.5	
10/26/2015	1653	509-504	0	50	0.3	464.4	Jet off pumping only
10/26/2015	1704	509-504	31.57	47.85	3.0/2.75/2.75	463.6	
10/26/2015	1710	504-499	31.69	46.30	8.0/13/5.25	463.64	
10/26/2015	1717	499-494	31.45	48.23	15.5/7.5/10.0	463.75	
10/26/2015	1722	494-489	31.22	46.15	19/24	464.1	Jet turned off in middle of the time interval
10/26/2015	1736	494-489	32.66	46.00	25/49	463.9	
10/27/2015	0919	489-484	0	50	0.1	464.95	Jett off, pumping only
10/27/2015	0926	489-484	34.80	45.39	12/10/3.5	463.6	
10/27/2015	0934	484-479	33.84	45	24/18/32	463.75	
10/27/2015	0939	479-474	33.60	45	3.5/6/17/5	463.62	
10/27/2015	0945	474-469	33.60	45	7/8.5/10/5	464.10	
10/27/2015	1003	469-464	33.60	47.03	4/10/33/8	463.40	
10/27/2015	1115	519-524	0	48.91	--	463.08	Jett off, pumping only
10/27/2015	1118	519-524	0	48.91	--	465.95	
10/27/2015	1126	519-524	33.02	48.91	6/20/7.5/2.0	463.52	
10/27/2015	1133	514-519	29.42	47.18	7/4.5/3/3.5	463.7	
10/27/2015	1141	509-514	29.3-31.45	43.21	5/4.5/4/4.5	463.5	
10/27/2015	1152	524	0	42	< 1	463.6	Jet off, pumping only

Groundwater Extraction Well Development

Jetting							
Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Depth to Water (feet bgs)	Comments
10/27/2015	1302	504-509	0	49.71	--	462.98	
10/27/2015	1306	504-509	29.9-31.45	49.71	5/11/2.5/2.8	463.63	
10/27/2015	1313	499-504	32.78	47.12	18/16/18/15	463.20	
10/27/2015	1320	494-499	30.26	46.97	19/25/20/19	463.5	
10/27/2015	1329	489-494	30.14	44	27/25/45	463.82	
10/27/2015	1336	509	--	44	--	--	Jett off, pumping only. Stop pump at 1343
10/27/2015	1428	484-489	0	48.9	--	462.95	Jett off, pumping only
10/27/2015	1432	484-489	0	48.9	--	464.9	
10/27/2015	1434	484-489	31.6	48.9	11/41/29/26	463.58	
10/27/2015	1442	479-484	32.66	47.1	26/30/41/25	463.30	
10/27/2015	1448	474-479	32.52	43.74	29/75/20	464.15	
10/27/2015	1455	469-474	32.42	43.69	49/44/22/21	464.05	
10/27/2015	1503	464-469	32.42	42.1	21/26/23	464.25	
10/27/2015	1512	489	0	421	--	463.95	Jet off, pumping only. Sop pump at 1518

ft bgs = feet below ground surface

gpm = gallons per minute

L = liter

mL = millliliter

psi = pounds per square inch

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
0–5		SP		Poorly graded sand: 5 YR 6/4, light reddish brown, very loose, dry, fine grained sand, subrounded grains, >70% quartz	Portland Cement 0-30 ft bgs 8" Galvanized Carbon Steel Riser 0.5-364 ft bgs
5–30		SP		Poorly graded sand: 5 YR 5/4, reddish brown, very loose, dry, fine grained sand, subrounded grains, >70% quartz	
30–35		SM		Silty sand: 5 YR 6/4, light reddish brown, >15% fines, fine to coarse grained sand (65% fine; 20% coarse [2-4 millimeters in diameter]), subangular to subrounded grains, sand composed of quartz, feldspar, and dark minerals	Bentonite Grout 30-366 ft bgs
35–50		SW		Well graded sand: 5 YR 6/4, light reddish brown, 10% fines, fine to coarse grained sand (30% fine to medium; 60% coarse), subangular to subrounded grains, sand composed of 95% quartz/feldspar, 5% dark minerals. Driller notes increased fines starting at 45 feet below ground surface.	

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

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Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
50–55		SM		Silty sand: 5 YR 6/3, light reddish brown, >20% fines, fine to coarse grained sand (40% fine; 40% medium to coarse), subangular to subrounded grains, coarse grained sand composed of 95% quartz/feldspar, 5% dark minerals	
55–60		SW		Well graded sand: 5 YR 6/2, pinkish grey, <10% fines, fine to coarse grained sand (30% fine to medium; 60% coarse [1-4 millimeters in diameter]), subangular to subrounded grains, coarse grained sand composed of 95% quartz/feldspar, 5% dark minerals	
60–70		SM		Silty sand: 5 YR 6/4, light reddish brown, >25% fines, fine to coarse grained sand (60% fine; 15% coarse [1-4 millimeters in diameter]), subangular to subrounded grains, coarse grained sand composed of 95% light quartz/feldspar, 5% dark minerals	
70–80		SM		Silty sand: 5 YR 6/3, light reddish brown, >30% fines, 55% fine to coarse grained sand (>40% fine to medium; 15% coarse), 3% fine gravel (up to 8 millimeters in diameter), subangular to subrounded sand and gravel, sand and gravel composed of primarily feldspar, minor chert and limestone, 3-5% dark minerals, lithics (angular)	
80–100		SM		Silty sand: 5 YR 6/4, light reddish brown, 30% silt, fine to coarse grained sand (60% fine; 10% coarse), 1-2% lithic fragments (up to 8 millimeters in diameter), subangular to subrounded coarse sand grains, 95% quartz/feldspar, 5% lithics/basalt	

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
100		SM		Silty sand: 5 YR 6/4, light reddish brown, >15% fines, fine to coarse grained sand (50% fine; 25% coarse), 1-2% lithic fragments (up to 10 millimeters in diameter), subangular to subrounded sand and gravel, sand composed of 30% quartz, 60% feldspar, 5% basalt	
105					
110		ML		Silt: 5 YR 6/4, light reddish brown, nonplastic to slightly plastic, >60% fines, 30% very fine grained sand, 2% lithic fragments (up to 3 millimeters in diameter)	
115					
120		ML		Silt with sand: 5 YR 6/3, light reddish brown, slightly plastic, 75% silt, 25% very fine to fine grained sand	
125					
130		SW		Well graded sand: 5 YR 5/3, reddish brown, <5% fines, fine to coarse grained sand (>20% fine to medium; 60% coarse), 15% gravel, lithic fragments (up to 12 millimeters in diameter), subangular gravel, 30% quartz (subrounded), 30% feldspar, 40% dark minerals/basalt (subangular)	
135					
140		ML		Sandy silt: 5 YR 6/4, light reddish brown, slightly plastic, 70% silt, >30% very fine grained sand	
145					
150					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
150		SM		Silty sand: 5 YR 6/4, light reddish brown, nonplastic, 30% fines, fine to coarse grained sand (50% fine; 10% coarse), 10% fine gravel (up to 10 millimeters in diameter), subangular gravel, 25% quartz, 25% feldspar, 50% dark minerals	
160		SM		Silty sand: 5 YR 6/4, light reddish brown, 30% fines, very fine to fine grained sand, 10% fine gravel, 10% coarse gravel, angular to subangular gravel (up to 19 millimeters in diameter), 20% feldspar, 50% basalt, 10% tuff	
170		ML		Sandy silt: 5 YR 6/4, light reddish brown, 40% very fine to fine grained sand, <10% coarse grained sand to fine gravel (up to 6 millimeters in diameter), angular to subangular gravel, gravel composed of >50% basalt	
180		SW		Well graded sand with gravel: 5 YR 5/3, reddish brown, <5% fines, coarse grained sand, 25% fine gravel (up to 10 millimeters in diameter), subangular gravel, sand composed of quartz and feldspar, gravel composed of basalt and tuff	
190		SP		Poorly graded sand with gravel: 5 YR 4/2, dark reddish brown, <5% fines, coarse grained sand, 20% fine gravel (up to 6 millimeters in diameter), subangular to subrounded gravel, sand composed of 30% quartz, 30% feldspar, 30% basalt, gravel composed of basalt	
200					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
200		ML		Silt with sand: 5 YR 6/3, light reddish brown, nonplastic, 15-29% very fine grained sand	
205					
210		SP		Poorly graded sand with gravel: 5 YR 5/3, reddish brown, <5% fines, coarse grained sand, 15% fine gravel (up to 6 millimeters in diameter), subangular gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
215					
220		GP		Poorly graded gravel with sand: 5 YR 4/3, reddish brown, <5% fines, 20% coarse grained sand, fine gravel (up to 6 millimeters in diameter), gravel subangular to subrounded, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
225					
230		SM		Silty sand: 5 YR 4/3, reddish brown, >15% fines, very fine to coarse grained sand (30% very fine; >15% fine; 30% coarse), 5% fine gravel (up to 9 millimeters in diameter), subangular gravel, sand and gravel composed of 25% quartz, 25% feldspar, 40% basalt	
235					
240		SM		Silty sand with gravel: 5 YR 5/3, reddish brown, >15% silt, very fine to coarse grained sand (30% very fine; 30% coarse), 15% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 25% quartz, 25% feldspar, 50% basalt	
245					
250					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
250		SM		Silty sand with gravel: 5 YR 5/3, reddish brown, >15% silt, very fine to coarse grained sand (30% very fine; 30% coarse), 15% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 25% quartz, 35% feldspar, 50% basalt	
255					
260		ML		Sandy and clayey silt with gravel: 5 YR 7/4, pink, 75% fines, very fine to coarse grained sand (80% very fine; 10% coarse), gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand composed of 20% quartz, 50% feldspar, 30% basalt, gravel composed of 20% quartz, 30% feldspar, 50% basalt	
265					
270		ML		Sandy and clayey silt with gravel: 5 YR 7/4, pink, 75% fines, very fine to coarse grained sand (80% very fine; 10% coarse), gravel (up to 8 millimeters in diameter), angular shards, subangular to subrounded gravel, sand and gravel composed of 20% quartz, 20% feldspar, 60% basalt	
275					
280		SM		Silty sand with gravel: 5 YR 7/3, pink, >15% fines, fine to coarse grained sand (30% fine; 30% coarse), 20% fine gravel (up to 6 millimeters in diameter), angular to subrounded gravel, sand and gravel composed of 25% quartz, 25% feldspar, 50% basalt	
285					
290					
295					
300					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
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Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
300					
305		SW		Well graded gravelly sand: 5 YR 5/2, reddish gray, <15% fines, fine to coarse grained sand (30% fine; 30% coarse), gravel (up to 12 millimeters in diameter), angular to subrounded gravel, sand and gravel composed of 35% quartz, 30% feldspar, 35% basalt	
310					
315		SW		Well graded gravelly sand: 5 YR 5/2, reddish gray, <15% fines, fine to coarse grained sand (40% fine; 30% coarse), gravel (up to 8 millimeters in diameter), angular to subrounded gravel, sand and gravel composed of 30% quartz, 40% feldspar, 30% basalt	
320					
325		SW		Well graded sand: 5 YR 4/2, dark reddish gray, <5% fines, fine to coarse grained sand (20% fine to medium; 50% coarse), <15% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand composed of 30% quartz, 30% feldspar, 30% basalt	
330					
335		SP		Poorly graded sand: 5 YR 5/3, reddish brown, <5% fines, fine to coarse grained sand (20% fine to medium; 60% coarse), 10% fine gravel (up to 6 millimeters in diameter), subangular gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
340					
345		SM		Silty sand with gravel: 5 YR 5/3, reddish brown, 20% fines, fine to coarse grained sand (20% fine to medium; 40% coarse), 15% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
350					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
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Geologist: **Bob Marley**
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Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
350					
355		SM		Silty sand with gravel: 5 YR 5/3, reddish brown, 30% fines, fine to coarse grained sand (10% fine to medium; 40% coarse), 15% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
360					
365		SM		Silty sand: 5 YR 5/3, reddish brown, 30% fines, fine to coarse grained sand (20% fine to medium; 40% coarse), <5% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	8" Stainless Steel Riser 364-470 ft bgs
370					3/8" Bentonite Chip Seal 366-408 ft bgs
375		SW		Well graded sand: 5 YR 5/3, reddish brown, <5% fines, fine to coarse grained sand (40% fine to medium; 50% coarse), <5% fine gravel (up to 8 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
380					
385		SW		Well graded sand with gravel: 5 YR 5/2, reddish gray, <5% fines, fine to coarse grained sand (25% fine to medium; 50% coarse), 20% fine gravel (up to 8 millimeters in diameter), angular shards, subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
390					
395		SW		Well graded sand: 5 YR 5/2, reddish gray, <5% fines, fine to coarse grained sand (25% fine to medium; 60% coarse), <15% fine gravel (up to 6 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt	
400					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

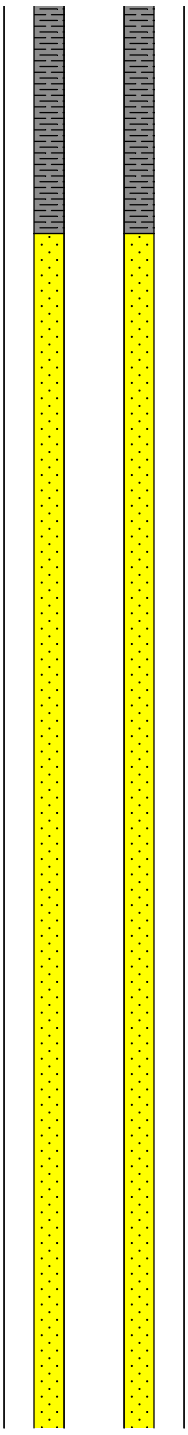
Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description
400				
405		SW		Well graded sand: 5 YR 5/2, reddish gray, <5% fines, fine to coarse grained sand (25% fine to medium; 60% coarse), <15% fine gravel (up to 6 millimeters in diameter), subangular gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt
410	0.9	SM		Silty sand: 5 YR 5/2, reddish gray, 25% fines, fine to coarse grained sand (25% fine to medium; 40% coarse), <10% fine gravel (up to 6 millimeters in diameter), subangular to subrounded gravel, sand and gravel composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert
415				
420		SM		Silty sand: 5 YR 6/2, pinkish gray, 30% fines, fine to coarse grained sand (20% fine to medium; 40% coarse), <10% fine gravel (up to 10 millimeters in diameter), fractured shards, subangular to subrounded gravel, sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert, gravel composed of 30% quartz, 30% feldspar, 30% basalt
425				
430	0.8	SM		Silty sand: 5 YR 6/2, pinkish gray, 30% fines, fine to coarse grained sand (40% fine; 20% medium to coarse), trace fine gravel (up to 6 millimeters in diameter), shards (primarily basalt), subangular to subrounded gravel, sand composed of 35% quartz, 20% feldspar, 30% basalt, 5% chert, gravel composed of 30% quartz, 30% feldspar, 30% basalt
435				
440	0.8	SM		Silty sand: 5 YR 6/2, pinkish gray, 30% fines, fine to coarse grained sand (35% fine; 30% medium to coarse), shards (primarily basalt), subrounded grains (minor subangular), sand composed of 35% quartz, 20% feldspar, 30% basalt, 5% chert
445				
450				



10/20 Silica Sand
408-581.8 ft bgs

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

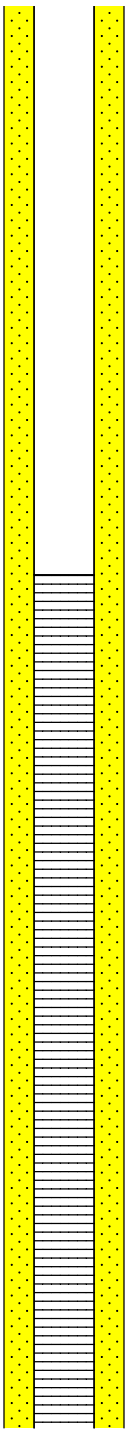
Well ID: **KAFB-106239**
Page: **10 of 12**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description
450	10.0	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (35% fine; 35% medium to coarse), subangular to subrounded grains, sand composed of 30% quartz, 20% feldspar, 35% basalt, 10% chert
455				
460	0.5	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (50% fine; 20% medium to coarse), trace fine gravel (up to 6 millimeters in diameter), subangular to subrounded grains and gravel, sand composed of 35% quartz, 35% feldspar, 20% basalt, 5% chert
465				
470	1.0	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (50% fine; 20% medium to coarse), subrounded grains, sand composed of 35% quartz, 35% feldspar, 20% basalt, 5% chert
475				
480	0.5	SW-SM		Well graded sand with silt: 5 YR 6/2, pinkish gray, <15% fines, fine to coarse grained sand (50% fine; 30% medium to coarse), <5% fine gravel (up to 6 millimeters in diameter), subangular to subrounded grains and gravel, subangular fragments of volcanic origin (basalt), sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert
485				
490	1.1	SW-SM		Well graded sand with silt: 5 YR 6/2, pinkish gray, <10% fines, fine to coarse grained sand (50% fine; 40% medium to coarse), trace fine gravel, subrounded grains and gravel, sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert
495				
500				



Completion Details
8" Stainless Steel Vee Wire Wrap Screen 0.030" Slot 470-572.7 ft bgs

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

Well ID: **KAFB-106239**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
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Geologist: **Bob Marley**
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Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
500	1.2	SW-SM		Well graded sand with silt: 5 YR 6/2, pinkish gray, <10% fines, fine to coarse grained sand (50% fine; 40% medium to coarse), trace fine gravel, subangular to subrounded grains and gravel (quartz subrounded; feldspar/basalt subangular), sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert	
505					
510	1.0	SW-SM		Well graded sand with silt: 5 YR 6/2, pinkish gray, <10% fines, fine to coarse grained sand (50% fine; 40% medium to coarse), subangular to subrounded grains (quartz subrounded; feldspar/basalt subangular), sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert	
515					
520	1.0	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (60% fine; 20% medium to coarse), subrounded grains, sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert	
525					
530	0.5	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (40% fine; 40% medium to coarse), subrounded grains, sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert	
535					
540	0.3	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (50% fine; 25% medium to coarse), subrounded grains, sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert	
545					
550					

Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

EA Engineering, Science, and Technology, Inc., PBC

Project: **62599DM01.1028**
Location: **Kirtland AFB, New Mexico**
Start Date: **11/3/2016**
Completion Date: **12/9/2016**

WELL LOG

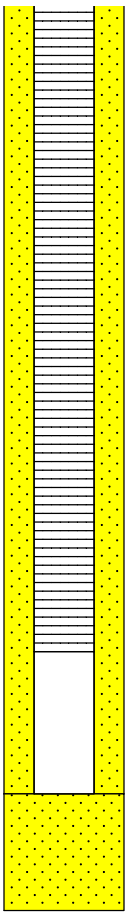
Well ID: **KAFB-106239**
Page: **12 of 12**

Drilling Company: **Yellow Jacket Drilling**
Drilling Method: **Direct Mud Rotary**
Drill Bit: **Tricone**
Driller: **Quentin Stevens**

Geologist: **Bob Marley**
Boring Depth (ft): **583**
Boring Diameter (in): **14.75**
Well Diameter: **8**

DTW During Drilling (ft): **Unknown**
Top of Casing Elev. (ft): **5332.32**
Northing: **1475415.85**
Easting: **1542702.31**

Depth (ft)	PID (ppmv)	USCS	Lithology	Sample Description	Completion Details
550	0.1	SM		Silty sand: 5 YR 6/2, pinkish gray, 20% fines, fine to coarse grained sand (50% fine; 25% medium to coarse), subrounded grains, sand composed of 30% quartz, 30% feldspar, 30% basalt, 5% chert	8" Stainless Steel Sump 572.7-577.8 ft bgs
555					
560	1.2				TD (well) = -577.8'
565					
570	1.5				
575					
580	1.1				



Notes: Survey performed 1/16/2017.

▽ = Depth to water measured 12/17/2016.

KAFB-7

DATA WELL NO. 7 KIRTLAND EAST

ELEVATION (FT)	LOCATION	DATE CONSTR ENDED
5349.0	NW¼-NW¼-NW¼=SEC 6-T10N-R4E	February 1955

WELL

TYPE: Rotary Drilled, Gravel Packed, 3/4" Gravel

DEPTH	DIAMETER	PUMPSETTING DEPTH
1010'	28" Hole 16" Casing	475'
ORIGINAL STATIC LEVEL	**DRAWDOWN**	**RECOVERY TIME**
395'	22'	

TEST DATA		AIR LINE AND GAGES					SPECIFIC CAPACITY (GAL) PER (FT)
WELL CAPACITY	PUMPING LEVEL	YES	X	NO		LENGTH	$\frac{\text{GPM}}{\text{DRAWDOWN}}$ = 64 GPM/FT
1400GPM	417'					475'	

WELL PUMPING EQUIPMENT

PUMP

TYPE AND MAKE: Submersible, Byron-Jackson — CAPACITY: 1150 GPM

SUCTION (FT)	SIZE AND LENGTH	COLUMN
N/A'	N/A	10" w/check valve at water level

HEAD			NUMBER BOWLS	SIZE AND TYPE	NO. STAGES
ABOVE GRD	BELOW GRD	TOTAL			
161'	425'	586'		12" 3CK	7

MOTOR

SERIAL NO.	TYPE	MAKE	HP	RPM	FRAME	PHASE	CYCLES	VOLTAGE
	14" H Submersible	B&J	200	1750		3	60	440

STAND BY POWER	MAKE	SIZE
440 volt	Cummins Installed 1970	300KW

HP	RPM	DESCRIPTION
	1800	Diesel powered generator

CASING AND WELL SCREENING MATERIAL USED	SETTING DEPTH	LENGTH EACH
16" O.D. Blank Casing	448	448
16" O.D. ¼" Shutter Screen casing	856	408
16" O.D. Blank Casing	880	24
16" O.D. ¼" Shutter screen casing	976	96
16" O.D Blank Casing	1,010	34

AF FORM 996

KAFB-7

FORMATIONS ENCOUNTERED DURING DRILLING #7(KE)	DEPTH (FT)	STRATUM
Top soil, sand and gravel	35	35
Sand, gravel and clay	95	60
Course sand and gravel	125	30
Sandy clay and gravel	190	65
Sand and gravel	240	50
Coarse sand and gravel	275	35
Sand, gravel and streaks of clay	315	40
Sand, gravel and boulders	465	250
Sand, gravel and streaks of clay	525	60
Sand, gravel and boulders	740	215
Coarse sand and boulders	855	115
Sandy clay	945	90
Coarse sandy clay and boulders	1,000	55

CHANGES MADE FROM ORIGINAL DATA

1961: Motor failed,equipment removed. Well bailed and surged and added 40 CY of gravel (3/4") and removed 30 CY of 1/4" gravel. Installed new pump and motor identical to original. Static level 418 feet.

1967: Pump failed to operate, equipment removed. Well bailed, surged and caged. 80 CY of 1/4 inch gravel removed and 100 CY of 3/4 inch gravel added. Installed new identical equipment. Static level 420 feet.

1970: Equipment failed, removed. Installed Johnson pump and 250 HP GE submersible motor, 1400 GPM @ 615' head. Static level 425 feet.

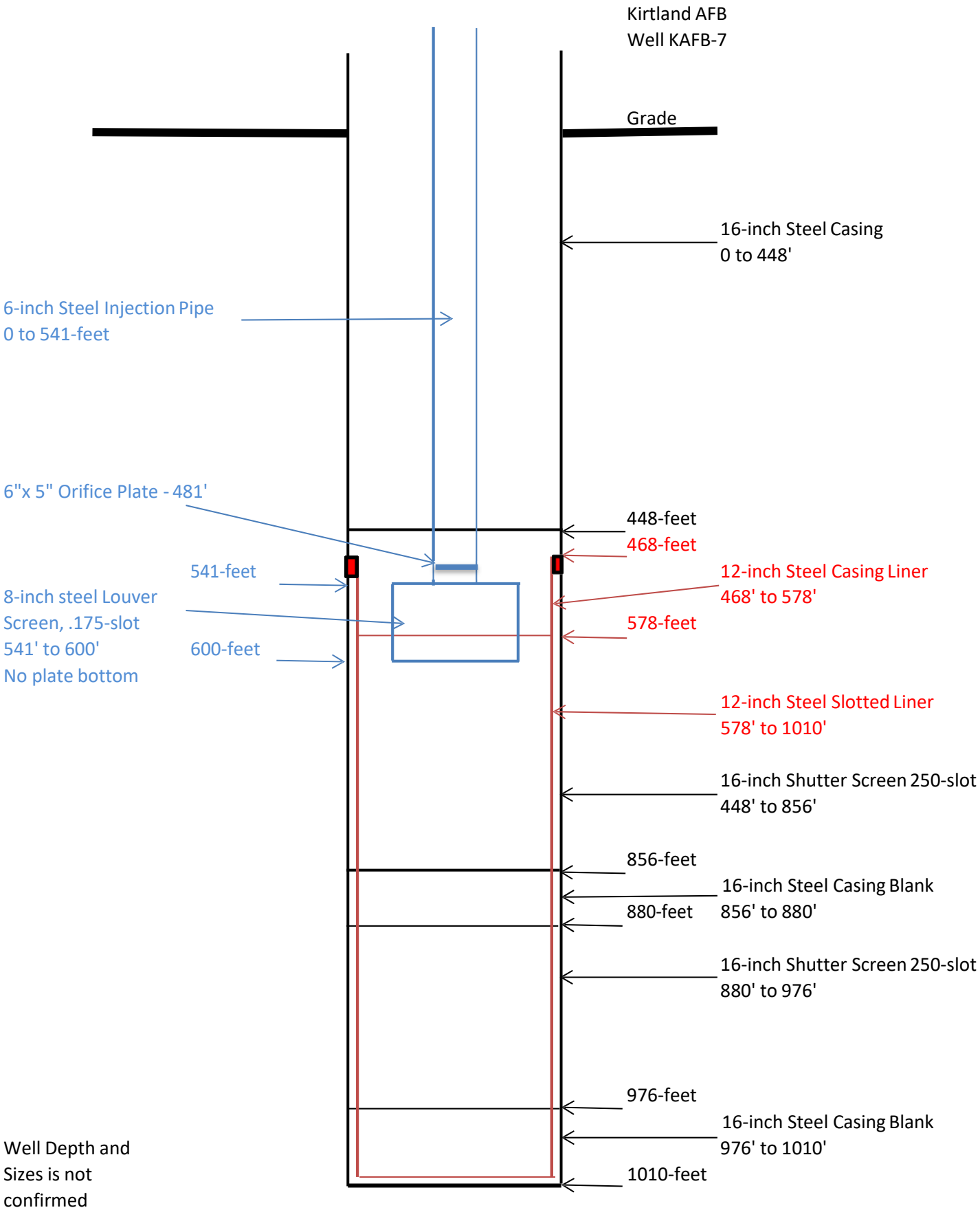
1973: Equipment failed, removed. Installed 7 stage Fairbanks-Morse lineshaft pump w/250 HP Westinghouse hollowshaft motor, 1400 GPM @ 560' head. Static level 425 feet.

1975: Motor burned out, replaced w/250 HP GE hollowshaft. (Jan-Apr) $6,171.03
Sand sampler installed.

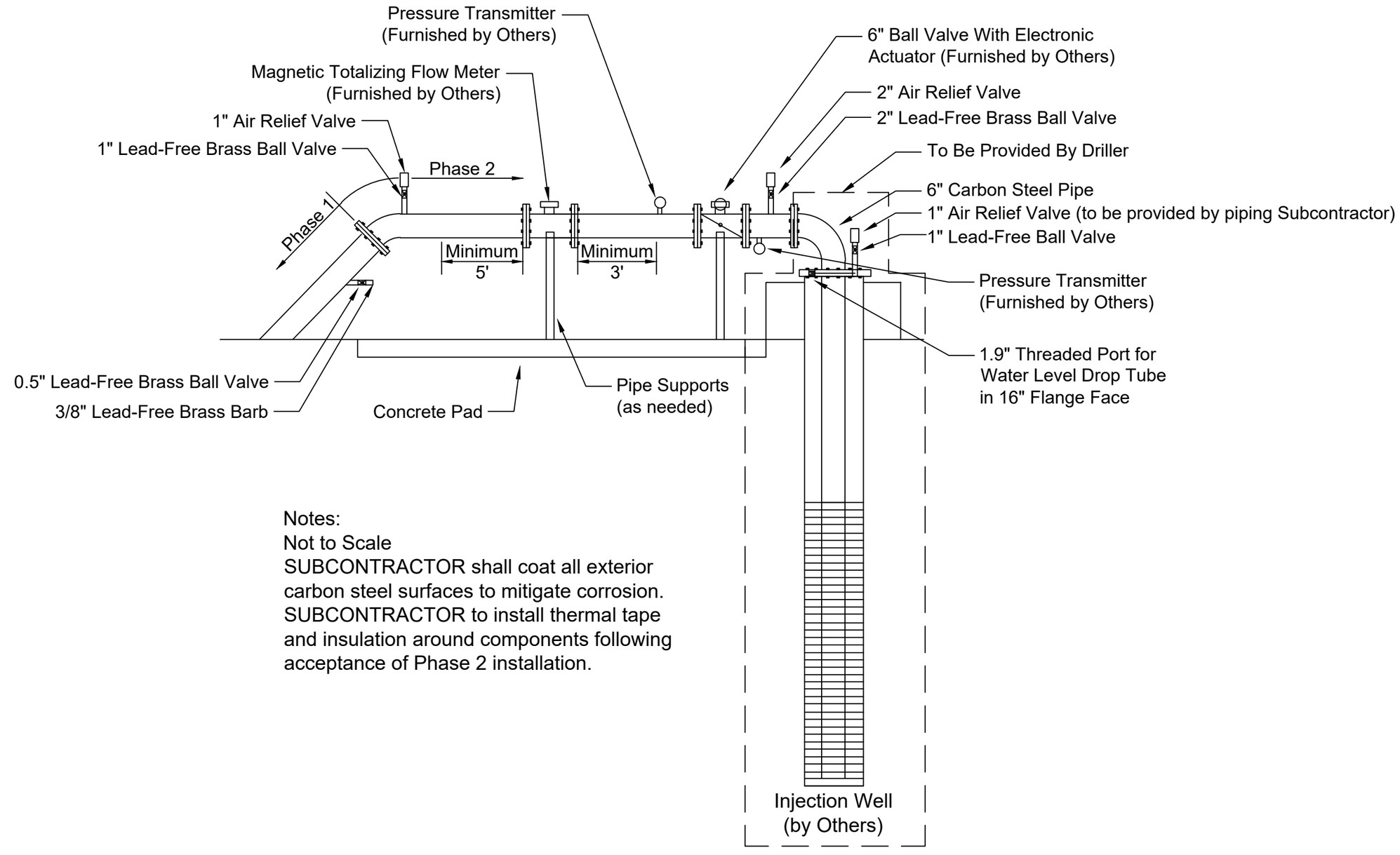
1976: July, replaced water meter and installed drawdown recorder. $4,500.00
September, replaced seal and bearings in motor. $1,800.00

1977: March, Motor Overhauled (Shops). $1,500.00

DRILLING COMPANY	LOCATION
ROSCOE MOSS CO	LOS ANGELES, CALIFORNIA


Kirtland AFB
Well KAFB-7
Grade
16-inch Steel Casing
0 to 448'
6-inch Steel Injection Pipe
0 to 541-feet
6"x 5" Orifice Plate - 481'
448-feet
468-feet
541-feet
12-inch Steel Casing Liner
468' to 578'
8-inch steel Louver
Screen, .175-slot
541' to 600'
No plate bottom
600-feet
578-feet
12-inch Steel Slotted Liner
578' to 1010'
16-inch Shutter Screen 250-slot
448' to 856'
856-feet
16-inch Steel Casing Blank
856' to 880'
880-feet
16-inch Shutter Screen 250-slot
880' to 976'
976-feet
16-inch Steel Casing Blank
976' to 1010'
1010-feet
Well Depth and
Sizes is not
confirmed

Underground Injection Control Well KAFB-106IN2
Conceptual Design Schematic



Notes:
Not to Scale
SUBCONTRACTOR shall coat all exterior carbon steel surfaces to mitigate corrosion.
SUBCONTRACTOR to install thermal tape and insulation around components following acceptance of Phase 2 installation.

DRAWN BY: KM
DESIGNED BY: KM
PROJECT MANAGER: DJ
PROJECT NO: 62735DM02

KIRTLAND AIR FORCE BASE

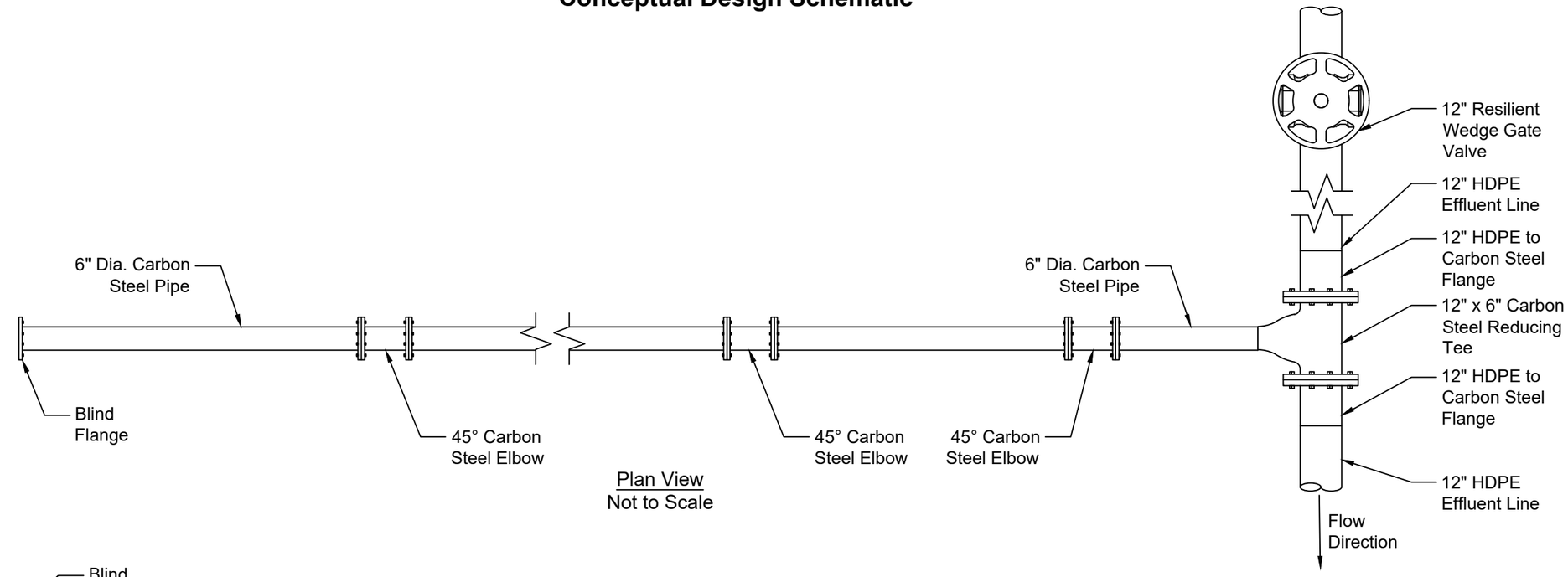
Phase 2 Conceptual Design - Injection Wellhead Piping and Instrumentation

320 Gold Avenue, SW Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013

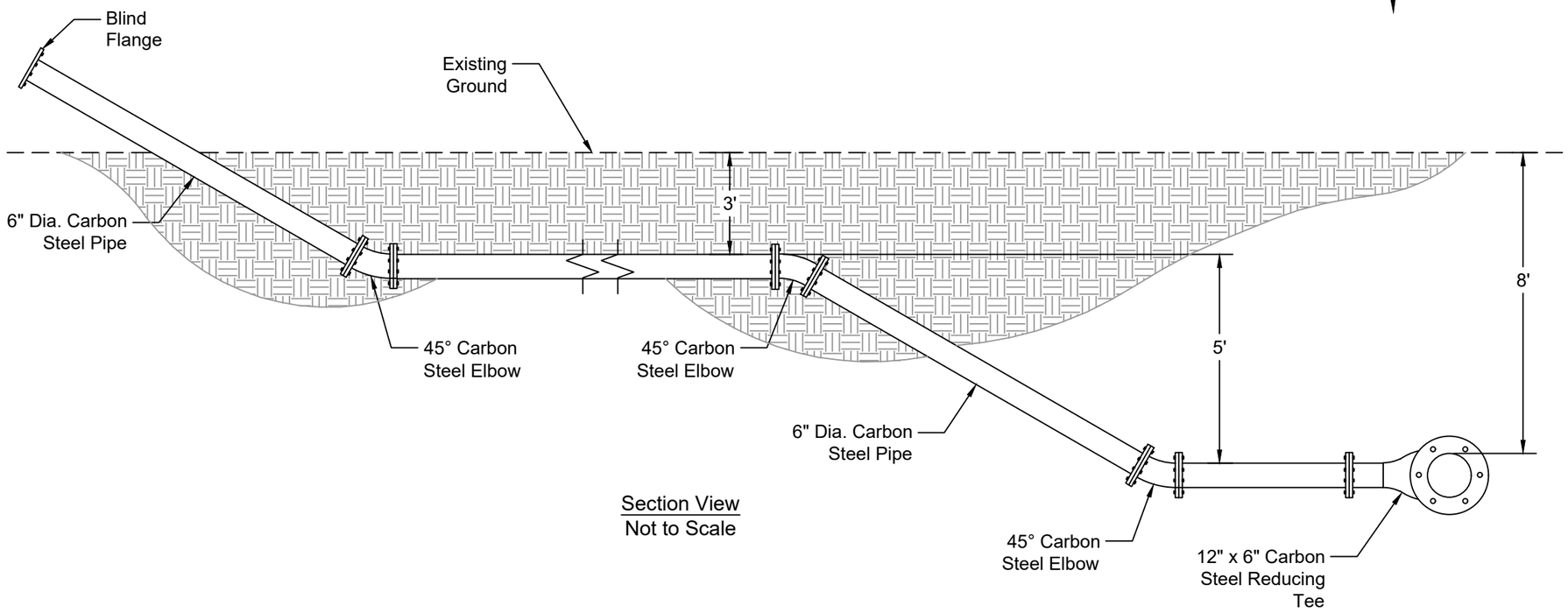
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC

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Underground Injection Control Well KAFB-106IN2
Conceptual Design Schematic



Plan View
Not to Scale



Section View
Not to Scale

DRAWN BY: CNS
DESIGNED BY: TC
PROJECT MANAGER: DJ
PROJECT NO: 62735DM02

KIRTLAND AIR FORCE BASE
KAFB Injection Well Piping Detail

320 Gold Avenue, SW Suite 1300
Albuquerque, NM 87102
Phone: (505) 224-9013
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC., PBC

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APPENDIX N

EXAMPLE REPORTS

Example Reports

- **Weekly Update Report**
- **GWTS Monthly Summary Report**
- **NMOSE Monthly Reporting for GWTS**
- **Report Recipients (Update Recipients Upon Request)**

WEEKLY UPDATE REPORT

Kirtland BFF Project - Site Monitoring Status

- Soil Vapor Monitoring – Q2 2019 sampling complete.
- Drinking Water Supply Wells – Next sampling event scheduled for 04JUN19.
- Groundwater Monitoring – Q2 2019 sampling and gauging complete.

GWTS Operation		Groundwater Treatment Totals (including Temporary Treatment System)
System Operational Dates	-	**6/4/15 - present**
Weekly Groundwater Treated (Gallons)(1)	06-Apr-19 to 13-May-19	4,860,000
Train 1 Weekly Groundwater Treated (Gallons)(1)	06-Apr-19 to 13-May-19	2,727,300
Train 2 Weekly Groundwater Treated (Gallons)	06-Apr-19 to 13-May-19	2,132,700
Cumulative Groundwater Treated (Gallons)	04-Jun-15 to present	637,007,400
Train 1 Cumulative Groundwater Treated (Gallons)	04-Jun-15 to present	405,106,900
Train 2 Cumulative Groundwater Treated (Gallons)	30-Jan-17 to present	231,900,500
Weekly Discharge Volume to Golf Course Main Pond (GCMP) (Gallons)(1)	06-Apr-19 to 13-May-19	2,180,900
Cumulative Discharge Volume to GCMP (Gallons)	01-Jan-16 to present	427,452,765
Weekly Discharge Volume to Injection Well KAFB-7 (Gallons)(1)	06-Apr-19 to 13-May-19	2,679,100
Cumulative Discharge Volume to Injection Well KAFB-7 (Gallons)	01-Jan-16 to present	209,554,635
Influent EDB Concentration (µg/L)(2)	1-May-19	0.022 J
Weekly Operational Run-time %(3)	06-Apr-19 to 13-May-19	99%
Cumulative EDB Removal (Grams)(4)	04-Jun-15 to present	115.54
Weekly Average Flow Rate (gpm)(5)	06-Apr-19 to 13-May-19	482
Weekly IDW Purge Water to GWTS-Golf Course (Gallons)	06-Apr-19 to 13-May-19	0
Cumulative IDW Purge Water to GWTS-Golf Course (Gallons)	24-Apr-16 to present	275,217
Weekly IDW Purge Water to GWTS-KAFB-7 (Gallons)	28-Apr-17 to present	0
Cumulative IDW Purge Water to GWTS-KAFB-7 (Gallons)	28-Apr-17 to present	0

(1) Volume totals for GCMP and KAFB-7 were calculated using the GWTS effluent totalizers.

(2) The 01MAY19 influent sample concentration for Train 1 and Train 2 were used to calculate EDB removal.

(3) All four extraction wells were in operation with effluent flow being directed approximately 55% to KAFB-7, and 45% to the GCMP to maintain the GCMP level. The entire system was shut down for 21 minutes on 08MAY19 due to one changeover in discharge between GCMP and KAFB-7, 63 minutes on 10MAY19 due to two changeovers in discharge between GCMP and KAFB-7 and to clean the Wye strainers, and 6 minutes on 12MAY19 due to one changeover in discharge between GCMP and KAFB-7.

(4) EDB mass removal is adjusted retroactively for the month based upon influent concentration from 01MAY19 for both Train 1 and Train 2.

(5) Average flow is total gallons treated divided by total treatment minutes available.

Current GWTS Discharge Destination GCMP

CURRENT GWTS EFFLUENT ANALYSES			Train 1		Train 2	
			Sample Date:	5/1/2019	Sample Date:	5/1/2019
Chemical Class & Analytical Method	Parameter	Project Screening Levels[a]	Result	LOD	Result	LOD
Draft Analytical Data						
EDB (µg/L) SW8011	ETHYLENE DIBROMIDE	0.05	ND	0.019	ND	0.019
VOC (µg/L) SW8260B	BENZENE	5	ND	0.5	ND	0.5
	ETHYLBENZENE	700	ND	0.8	ND	0.8
	TOLUENE	750	ND	0.5	ND	0.5
	XYLENES	620	ND	2	ND	2
Metals (µg/L) SW6010C	IRON, DISSOLVED	1,000	ND	100	ND	100
	MANGANESE, DISSOLVED	200	ND	2.5	ND	2.5

Notes
Laboratory results greater than EPA MCLs or NMED Groundwater Protection Standards are highlighted in yellow.

[a] Project Screening Levels are the lowest of either the EPA MCL (from the EPA RSL Table, dated June 2017) or the NMED Groundwater Protection Standards (NMAC 20.6.2.3103).

J = estimated value.
LOD = Limit of Detection.
ND = not detected.
µg/L = micrograms per liter.

Well 106228
Operational Flow Rate: 140 gpm
Operational Runtime: 99.1%; 0.9% offline for routine maintenance.

Well 106233
Operational Flow Rate: 161 gpm
Operational Runtime: 66.1%; 33.9% offline for routine maintenance, and to facilitate GCMP level management.

Well 106234
Operational Flow Rate: 159 gpm
Operational Runtime: 99.1%; 0.9% offline for routine maintenance.

Well 106239
Operational Flow Rate: 73 gpm
Operational Runtime: 99.1%; 0.9% offline for routine maintenance.

Well Control House (106233 and 106234)
No issues.

KAFB-7
KAFB-7 is currently operational and effluent injection is ongoing, with priority to GCMP discharge.

GWTS MONTHLY WATER SUMMARY REPORT

GWTS Operation	Total Groundwater Extracted (gallons)[a]	Treated Groundwater Injected to Injection Well KAFB-7 (gallons)	Treated Groundwater Discharged to the Golf Course Main Pond (gallons)[b]	Treated Groundwater Discharged for Dust Suppression (gallons)
Dec-15	17,664,900	0	17,664,900	0
2015 Total	17,664,900	0	17,664,900	0
Jan-16	1,777,200	0	1,777,200	0
Feb-16	881,000	181,300	699,700	0
Mar-16	22,168,080	1,231,350	20,936,730	0
Apr-16	12,649,920	582,570	12,067,350	0
May-16	12,090,000	0	12,090,000	0
Jun-16	8,850,000	0	8,850,000	0
Jul-16	9,940,000	0	9,940,000	0
Aug-16	9,400,000	0	9,400,000	0
Sep-16	12,980,000	0	12,980,000	0
Oct-16	8,300,000	0	8,300,000	0
Nov-16	7,200,000	2,970,000	4,230,000	0
Dec-16	14,570,100	14,501,190	68,910	0
2016 Total	120,806,300	19,466,410	101,339,890	0
Jan-17	6,177,000	5,877,600	299,400	0
Feb-17	3,994,500	2,216,600	1,777,900	0
Mar-17	11,256,600	5,172,800	6,083,800	0
Apr-17	13,981,700	2,248,062	11,733,638	0
May-17	18,688,600	4,722,563	13,966,037	0
Jun-17	18,761,200	1,592,700	17,168,500	0
Jul-17	24,136,000	3,023,500	21,112,500	0
Aug-17	18,460,700	4,847,500	13,613,200	0
Sep-17	18,962,100	6,752,400	12,209,700	0
Oct-17	21,626,600	14,775,800	6,850,800	0
Nov-17	12,513,400	3,734,900	8,778,500	0
Dec-17	13,304,300	10,724,700	2,579,600	0
2017 Total	181,862,700	65,689,125	116,173,575	0
Jan-18	15,362,700	13,887,700	1,475,000	0
Feb-18	17,571,400	13,765,300	3,806,100	0
Mar-18	18,098,900	9,235,300	8,863,600	0
Apr-18	13,268,900	0	13,268,900	0
May-18	19,300,000	0	19,300,000	0
Jun-18	24,933,200	0	24,933,200	0
Jul-18	19,939,600	0	19,939,600	0
Aug-18	24,557,000	0	24,557,000	0
Sep-18	17,026,500	0	17,026,500	0
Oct-18	8,861,100	0	8,861,100	0
Nov-18	12,471,200	7,517,100	4,954,100	0
Dec-18	25,803,600	23,080,800	2,722,800	0
2018 Total	217,194,100	67,486,200	149,707,900	0
Jan-19	21,536,900	19,494,500	2,042,400	0
Feb-19	21,265,100	13,624,600	7,640,500	0
Mar-19	26,516,500	13,435,900	13,080,600	0
Apr-19	21,201,900	7,170,800	14,031,100	0
2019 Total	90,520,400	53,725,800	36,794,600	0
Total	628,048,400	206,367,535	421,680,865	0

[a]Corrected volumes to include temporary treatment system in 2015.

[b]Corrected volumes from HMI datasets.

NMOSE MONTHLY REPORTING FOR GWTS

Injection and Extraction Well Volume Summary Table
January-August 2016

Month	Date Range[a]	Effluent Totalizer Reading (gallons)[c]	Well ID	KAFB-106228	KAFB-106233	KAFB-106234	KAFB-106239	KAFB-7[b]
			Well Type	Extraction Well	Extraction Well	Extraction Well	Extraction Well	Injection Well
			RG #	RG-1579	RG-1579	RG-1579	RG-1579	RG-1587
			POD	POD 292	POD 309	POD 310	POD 319	-
Jun-15	6/4/2015	0	Average Monthly Flow Rate (gpm)	3.82	0	0		
	6/30/2015	143,200	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)	143,200		143,200	0	0		0
Jul-15	6/30/2015	143,200	Average Monthly Flow Rate (gpm)	28.26	0	0		
	7/31/2015	1,404,800	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)	1,261,600		1,261,600	0	0		0
Aug-15	7/31/2015	1,404,800	Average Monthly Flow Rate (gpm)	93.21	0	0		
	8/31/2015	5,565,900	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)	4,161,100		4,161,100	0	0		0
Sep-15	8/31/2015	5,565,900	Average Monthly Flow Rate (gpm)	97.54	0	0		
	9/30/2015	9,779,800	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)	4,213,900		4,213,900	0	0		0
Oct-15	9/30/2015	9,779,800	Average Monthly Flow Rate (gpm)	118.02	0	0		
	10/30/2015	14,878,100	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)	5,098,300		5,098,300	0	0		0
Nov-15	10/30/2015	14,878,100	Average Monthly Flow Rate (gpm)	31.76	0	0		
	11/30/2015	16,295,700	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)	1,417,600		1,417,600	0	0		0
Dec-15	11/30/2015	16,295,700	Average Monthly Flow Rate (gpm)	27.82	0	0		
	12/31/2015	17,373,622	Percentage of Monthly Extraction Volume	100%	0%	0%		
	Monthly Total (gallons)[c]	1,241,722		1,241,722	0	0		0
Jan-16	12/31/2015	163,800	Average Monthly Flow Rate (gpm)	23.84	2.70	2.47		
	1/27/2016	1,941,000	Percentage of Monthly Extraction Volume	82.18%	9.31%	8.51%		
	Monthly Total (gallons)[c]	1,904,678		1,565,299	177,381	161,998		0
Feb-16	1/27/2016	1,941,000	Average Monthly Flow Rate (gpm)	55.44	57.89	37.75		
	3/1/2016	6,358,500	Percentage of Monthly Extraction Volume	36.70%	38.32%	24.99%		
	Monthly Total (gallons)	4,417,500		1,621,066	1,692,566	1,103,868		-181,300
Mar-16	3/1/2016	6,358,500	Average Monthly Flow Rate (gpm)	85.00	143.35	142.58		
	3/31/2016	24,990,080	Percentage of Monthly Extraction Volume	22.91%	38.65%	38.44%		
	Monthly Total (gallons)	18,631,580		4,269,361	7,200,347	7,161,872		-1,231,350
Apr-16	3/31/2016	24,990,080	Average Monthly Flow Rate (gpm)	52.25	155.50	152.49		
	5/2/2016	40,710,000	Percentage of Monthly Extraction Volume	14.50%	43.17%	42.33%		
	Monthly Total (gallons)	15,719,920		2,279,918	6,785,746	6,654,256		-582,570
May-16	5/2/2016	40,710,000	Average Monthly Flow Rate (gpm)	0.00	107.14	124.88		
	5/31/2016	49,730,000	Percentage of Monthly Extraction Volume	0.00%	46.18%	53.82%		
	Monthly Total (gallons)	15,719,920		0	7,259,100	8,460,820		0
Jun-16	5/31/2016	49,730,000	Average Monthly Flow Rate (gpm)	0.00	57.86	167.08		
	6/27/2016	58,580,000	Percentage of Monthly Extraction Volume	0.00%	25.72%	74.28%		
	Monthly Total (gallons)	8,850,000		0	2,276,436	6,573,564		0
Jul-16	6/27/2016	58,580,000	Average Monthly Flow Rate (gpm)	79.63	0.00	126.51		
	8/1/2016	68,520,000	Percentage of Monthly Extraction Volume	38.63%	0.00%	61.37%		
	Monthly Total (gallons)	9,940,000		3,839,825	0	6,100,175		0
Aug-16	8/1/2016	68,520,000	Average Monthly Flow Rate (gpm)	116.93	0.00	114.67		
	8/29/2016	77,920,000	Percentage of Monthly Extraction Volume	50.49%	0.00%	49.51%		
	Monthly Total (gallons)	9,400,000		4,745,722	0	4,654,278		0
Sep-16	8/29/2016	77,920,000	Average Monthly Flow Rate (gpm)	146.17	0.00	134.37		
	10/3/2016	90,900,000	Percentage of Monthly Extraction Volume	52.10%	0.00%	47.90%		
	Monthly Total (gallons)	12,980,000		6,762,886	0	6,217,114	NA	0
Oct-16	10/3/2016	90,900,000	Average Monthly Flow Rate (gpm)	99.28	0.00	104.84		
	10/31/2016	99,200,000	Percentage of Monthly Extraction Volume	48.64%	0.00%	51.36%		
	Monthly Total (gallons)	8,300,000		4,037,000	0	4,263,000		0
Nov-16	10/31/2016	99,200,000	Average Monthly Flow Rate (gpm)	90.31	0.00	95.87		
	11/28/2016	106,400,000	Percentage of Monthly Extraction Volume	48.51%	0.00%	51.49%		
	Monthly Total (gallons)	7,200,000		3,492,528	0	3,707,472		-2,970,000
Dec-16	11/28/2016	106,400,000	Average Monthly Flow Rate (gpm)	144.78	0.00	155.00		
	1/3/2017	120,970,100	Percentage of Monthly Extraction Volume	48.30%	0.00%	51.70%		
	Monthly Total (gallons)	14,570,100		7,036,722	0	7,533,378		-14,501,190
Jan-17[d]	1/3/2017	120,970,100	Average Monthly Flow Rate (gpm)	144.92	0.00	154.75		
	1/30/2017	127,059,800	Percentage of Monthly Extraction Volume	48.36%	0.00%	51.64%		
	Monthly Total (gallons)	6,089,700		2,944,976	0	3,144,724		-5,877,600
Feb-17[d]	1/30/2017	127,059,800	Average Monthly Flow Rate (gpm)	145.14	0.00	155.25		
	2/27/2017	131,141,600	Percentage of Monthly Extraction Volume	48.32%	0.00%	51.68%		
	Monthly Total (gallons)	4,081,800		1,972,238	0	2,109,562		-2,216,600
Mar-17[d]	2/27/2017	131,141,600	Average Monthly Flow Rate (gpm)	145.32	0.00	157.07		
	3/27/2017	142,398,200	Percentage of Monthly Extraction Volume	48.06%	0.00%	51.94%		
	Monthly Total (gallons)	11,256,600		5,409,542	0	5,847,058		-5,172,800
Apr-17[d]	3/27/2017	142,398,200	Average Monthly Flow Rate (gpm)	145.23	0.00	130.93		
	4/24/2017	152,005,300	Percentage of Monthly Extraction Volume	52.59%	0.00%	47.41%		
	Monthly Total (gallons)	9,607,100		5,052,356	0	4,554,744		-2,248,062
May-17[d]	4/24/2017	152,005,300	Average Monthly Flow Rate (gpm)	145.08	177.18	171.73		
	5/30/2017	175,068,500	Percentage of Monthly Extraction Volume	29.37%	35.87%	34.76%		
	Monthly Total (gallons)	23,063,200		6,773,382	8,272,246	8,017,572		-4,722,563
Jun-17[d]	5/30/2017	175,068,500	Average Monthly Flow Rate (gpm)	144.34	175.86	164.39		
	6/26/2017	193,829,700	Percentage of Monthly Extraction Volume	29.79%	36.29%	33.92%		
	Monthly Total (gallons)	18,761,200		5,588,212	6,808,528	6,364,460		-1,592,700
Jul-17[d]	6/26/2017	193,829,700	Average Monthly Flow Rate (gpm)	143.73	171.77	160.63		
	7/31/2017	217,965,700	Percentage of Monthly Extraction Volume	30.19%	36.08%	33.74%		
		24,136,000		7,286,046	8,707,321	8,142,633		-3,023,500
Aug-17[d]	7/31/2017	217,965,700	Average Monthly Flow Rate (gpm)	136.63	165.44	151.92		
	8/28/2017	236,426,400	Percentage of Monthly Extraction Volume	30.10%	36.44%	33.46%		
		18,460,700		5,555,799	6,727,324	6,177,577		-4,847,500
Sept-17[e]	8/28/2017	236,426,400	Average Monthly Flow Rate (gpm)	142.99	164.45	162.43		
	9/25/2017	255,388,500	Percentage of Monthly Extraction Volume	30.43%	35.00%	34.57%		
		18,962,100		5,769,400	6,636,200	6,555,000		-6,752,400
Oct-17[e]	9/25/2017	255,388,500	Average Monthly Flow Rate (gpm)	143.70	167.22	163.98		
	10/30/2017	277,015,100	Percentage of Monthly Extraction Volume	32.83%	29.38%	37.79%		
		21,626,600		7,084,200	6,340,100	8,155,300		-14,775,800
Nov-17[e]	10/30/2017	277,015,100	Average Monthly Flow Rate (gpm)	144.68	166.80	164.97		
	11/27/2017	289,528,500	Percentage of Monthly Extraction Volume	23.45%	24.98%	51.57%		
		12,513,400		2,934,200	3,126,300	6,452,900		-3,734,900
Dec-17[e]	11/27/2017	289,528,500	Average Monthly Flow Rate (gpm)	0.00	163.90	162.75		
	12/26/2017	302,832,800	Percentage of Monthly Extraction Volume	0.00%	50.18%	49.82%		
		13,304,300		0	6,685,500	6,638,400		-10,724,700
Jan-18[e]	12/26/2017	302,832,800	Average Monthly Flow Rate (gpm)	0.00	161.42	164.09		
	1/29/2018	318,195,500	Percentage of Monthly Extraction Volume	0.00%	49.59%	50.41%		
		15,362,700		0	7,609,000	7,734,900		-13,887,700
Feb-18[e]	1/29/2018	318,195,500	Average Monthly Flow Rate (gpm)	143.31	159.42	162.84	74.80	
	2/26/2018	335,766,900	Percentage of Monthly Extraction Volume	23.96%	34.61%	36.48%	4.95%	
		17,571,400		4,187,100	6,048,200	6,375,700	864,700	-13,765,300
Mar-18[e]	2/26/2018	335,766,900	Average Monthly Flow Rate (gpm)	143.61	159.08	164.64	75.75	
	4/2/2018	353,865,800	Percentage of Monthly Extraction Volume	26.18%	24.93%	35.99%	12.90%	
		18,098,900		4,733,100	4,507,500	6,507,200	2,332,500	-9,235,300
Apr-18[e]	4/2/2018	353,865,800	Average Monthly Flow Rate (gpm)	144.91	159.78	164.66	76.30	
	4/30/2018	367,134,700	Percentage of Monthly Extraction Volume	31.60%	7.01%	49.94%	11.45%	
		13,268,900		4,168,900	924,800	6,587,800	1,510,800	0
May-18[e]	4/30/2018	367,134,700	Average Monthly Flow Rate (gpm)	141.94	162.90	164.16	73.27	
	5/29/2018	386,434,700	Percentage of Monthly Extraction Volume	27.71%	24.53%	33.52%	14.24%	
		19,300,000		5,356,800	4,741,600	6,479,400	2,752,100	0
Jun-18[e]	5/29/2018	386,434,700	Average Monthly Flow Rate (gpm)	140.50	157.90	162.51	74.38	
	7/2/2018	411,367,900	Percentage of Monthly Extraction Volume	27.25%	27.36%	31.79%	13.59%	
		24,933,200		6,767,300	6,794,100	7,894,700	3,375,500	0
Jul-18[e]	7/2/2018	411,367,900	Average Monthly Flow Rate (gpm)	140.42	154.64	163.46	74.43	
	7/30/2018	431,307,500	Percentage of Monthly Extraction Volume	25.83%	28.43%	32.05%	13.69%	
		19,939,600		5,151,700	5,671,600	6,392,800	2,730,500	0
Aug-18[e]	7/30/2018	431,307,500	Average Monthly Flow Rate (gpm)	139.12	154.79	162.92	73.79	
	9/4/2018	455,864,500	Percentage of Monthly Extraction Volume	25.39%	28.24%	32.90%	13.47%	
		24,557,000		6,207,600	6,906,700	8,046,200	3,292,800	0
Sep-18[e]	9/4/2018	455,864,500	Average Monthly Flow Rate (gpm)	139.43	154.37	164.32	74.38	
	10/1/2018	472,891,000	Percentage of Monthly Extraction Volume	28.33%	19.55%	36.51%	15.61%	
		17,026,500		4,809,100	3,318,500	6,197,900	2,649,700	0
Oct-18[e]	10/1/2018	472,891,000	Average Monthly Flow Rate (gpm)	135.57	174.60	162.92	71.83	
	10/29/2018	481,752,100	Percentage of Monthly Extraction Volume	24.73%	0.62%	65.30%	9.35%	
		8,861,100		2,179,200	55,000	5,753,500	823,400	0
Nov-18[e]	10/29/2018	481,752,100	Average Monthly Flow Rate (gpm)	140.33	167.25	162.99	77.48	
	11/26/2018	494,223,300	Percentage of Monthly Extraction Volume	21.80%	19.83%	49.05%	9.32%	
		12,471,200		2,702,200	2,459,100	6,081,800	1,154,900	-7,517,100
Dec-18[e]	11/26/2018	494,223,300	Average Monthly Flow Rate (gpm)	140.91	165.95	160.61	75.49	
	12/31/2018	520,026,900	Percentage of Monthly Extraction Volume	25.47%	30.67%	29.52%	14.35%	
		25,803,600		6,560,241	7,901,436	7,603,886	3,696,058	-23,080,800
Jan-19[e]	12/31/2018	520,026,900	Average Monthly Flow Rate (gpm)	140.60	169.32	159.30	74.03	
	1/28/2019	541,563,800	Percentage of Monthly Extraction Volume	26.10%	31.27%	29.57%	13.06%	
		21,536,900		5,612,359	6,722,864	6,358,914	2,807,842	-19,494,500
Feb-19[e]	1/28/2019	541,563,800	Average Monthly Flow Rate (gpm)	140.86	169.59	157.88	74.53	
	2/25/2019	562,828,900	Percentage of Monthly Extraction Volume	25.99%	30.89%	29.36%	13.75%	
		21,265,100		5,532,600	6,575,400	6,249,900	2,927,200	-13,624,600
Mar-19[e]	2/25/2019	562,828,900	Average Monthly Flow Rate (gpm)	139.78	166.96	157.18	73.10	
	4/1/2019	589,345,400	Percentage of Monthly Extraction Volume	26.13%	31.22%	29.39%	13.25%	
		26,516,500		6,913,300	8,260,200	7,776,100	3,506,400	-13,435,900
Apr-19[e]	4/1/2019	589,345,400	Average Monthly Flow Rate (gpm)	140.00	162.98	157.42	74.23	
	4/29/2019	610,547,300	Percentage of Monthly Extraction Volume	25.98%	30.58%	29.54%	13.91%	
		21,201,900		5,494,700	6,468,700	6,247,900	2,941,900	-7,170,800
Total				183,021,000	155,399,595	235,264,225	33,859,900	-206,367,535

[a] Flow rate data for wells is not available prior to 15JAN2016. The average flowrate is based on available data.

[b] Negative volumes presented indicate water injected.

[c] Flow meter information presented is from both temporary and permanent ground water treatment systems. Both systems were used during December 2015 and January 2016 and values reflect the sum of each for these months. During December 2015 163,800 gallons were treated by the GWTS. During January 2016 127,478 gallons were treated by the temporary treatment system.

[d] Average Monthly Flow Rate is calculated only during times of pump operation.

[e] Beginning in September 2017 extraction well volumes utilize individual wellhead totalizer readings following the installation of more accurate flowmeters, and KAFB-7 continues to utilize the effluent totalizer data from the groundwater treatment system even following the wellhead totalizer replacement on February 27, 2018. Average Monthly Flow Rate calculated is only during times of pump operation. An additional 156,900 gallons of water was injected into the aquifer during September 2017 which was not previously accounted for as the weekly report and changeover between distribution point occurred on the same day.

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Daily/Weekly Operations Report Recipients: Attach PDF

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Subject : Kirtland BFF - GWTS Operational Status DDMON18

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Kirtland CE Monthly Water Summary Recipients (Gregory):

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USGS Monthly KAFB-7 Injection Report Recipients:

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APPENDIX O

TECHNICAL MEMORANDUM

IDW DISPOSAL TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

ESTABLISHING BASIS OF DESIGN MAXIMUM CONCENTRATION LIMITS FOR THE KIRTLAND BULK FUELS FACILITY GROUNDWATER TREATMENT SYSTEM

The groundwater treatment system (GWTS) has been designed to treat water from extraction wells as part of the Resource Conservation and Recovery Act groundwater interim measure at Solid Waste Management Unit ST-106/SS-111, the Bulk Fuels Facility (BFF) site, at Kirtland Air Force Base, New Mexico. This Technical Memorandum establishes maximum concentration limits for the sand filters and the lead granular activated carbon (GAC) vessel for inorganic and organic constituents at the GWTS to ensure treated effluent meets all applicable discharge limits. Influent to the GWTS consists of extracted contaminated groundwater and any non-hazardous investigation-derived waste (IDW) associated with Kirtland BFF remedial activities that include IDW water generated during well installation, well development and testing, well maintenance, and groundwater monitoring. Under no circumstances will hazardous IDW be accepted for treatment by the GWTS.

Tigg modeling was used to determine the organic criteria loading on the lead GAC based on operations and maintenance (O&M) not to exceed six month change out of the lead GAC. The six month lead GAC change out is a cost effective O&M approach for the GWTS based on a maximum process flow rate of 400 gallon per minute (gpm). To determine the organic concentration loading rates, the Tigg model used the worst case concentrations, which is the most conservative and not expected. It is important to note that the Tigg modeled continuous loading of these organic concentrations at the maximum process flow rate of 400 gpm to the lead GAC. This loading model results in breakthrough of the lead GAC in approximately 175 days (approximately 6 months) and subsequent GAC change out in the lead GAC vessel.

GROUNDWATER TREATMENT SYSTEM PROCESS

The treatment capabilities of the GWTS includes 1) removal of organic compounds by adsorption to GAC and 2) removal of dissolved metals and biologic materials in the sand filters containing catalytic media that are being installed as a pretreatment process. The GWTS process flow is shown in Figure 1 for one treatment train. Contaminated groundwater is extracted from the extraction wells and conveyed to the GWTS building. Once inside the building, the contaminated water is diverted into two influent tanks where hydraulic mixing achieves equalization. Following equalization, the contaminated water is pumped at 400 gpm per treatment train (i.e., Treatment Train #1 or Treatment Train #2) which consist of the following process units:

- Influent tank
- Influent pumps
- Sand filters with special media for biologic and metals pretreatment (installation pending)
    - Influent sampling port
- Bag filters
- Lead GAC vessel; 20,000 pounds of carbon
    - Post-lead GAC sampling port
- Lag GAC vessel; 20,000 pounds of carbon; redundant vessel for process safety factor
- Effluent tank
- Effluent pump
    - Effluent sampling port
- Bag filters

Following treatment, treated water is diverted into two effluent tanks for equalization, the treated water is pumped from treatment trains into a single conveyance line to either the Tijeras Arroyo Golf Course main pond or the gravity-fed underground injection control (UIC) well KAFB-7 or another UIC well. Additional discharge options are under evaluation and may be available in the future. Discharge to the Tijeras Arroyo Golf Course main pond does not require a discharge permit under New Mexico Administrative Code 20.6.2.3104 (2004) as long as the treated effluent meets the numerical standards of New Mexico Administrative Code 20.6.2.3103. Discharge to UIC well KAFB-7 and other UIC wells is performed under DP-1839, a Class V UIC permit issued on April 28, 2017 pursuant to New Mexico Administrative Code 20.6.2.3106.

SAND FILTER TREATMENT PROCESS AND MAXIMUM CONCENTRATION LIMITS

Sand filters are scheduled for installation in the GWTS as a pretreatment for the GAC vessels to assist in removal of biologic material and to treat dissolved iron (Fe) and manganese (Mn), which are not removed by the GAC treatment process. The sand filters, which contain a catalytic media, are designed to precipitate out the dissolved Fe and Mn by advanced oxidation processes and filter out suspended solids including biological materials. Once precipitated as iron and manganese oxides, the oxides and suspended solids are captured by the sand filter media and removed during backwashing to a storage tank for disposal. System backwashing is automatic and based on an increase in back pressure (typically set at 10-15 percent above the normal operating pressure). In order for the sand filter media to oxidize the Fe and Mn, an oxidant (sodium hypochlorite) is added to the water entering the treatment trains. Additionally, sodium hypochlorite acts as a disinfectant to mitigate biofilm formation on the sand filter media.

The Basis of Design for the GWTS sand filters (Attachment 1) provides a description of the advanced oxidation processes that catalyze the dissolved metals to metal oxides. The sand filters are designed to catalyze and remove up to 10 milligrams per liter (mg/L) of dissolved iron or manganese down to approximately 1 microgram per liter (µg/L) with a sodium hypochlorite concentration of 0.1-0.3 mg/L. The sand filters should minimize the amount of suspended solids and microorganisms that reach the lead GAC vessels, mitigating plugging and increased pressure drop along the lead GAC vessels.

For this Technical Memorandum, maximum sand filter concentration limits for Fe and Mn are established by manufacturer design. These maximum inorganic concentration limits are substantially higher than dissolved Fe and Mn concentrations at the BFF site. For example, the actual maximum dissolved Fe and Mn concentrations measured in Q4 2016 were 6,600 µg/L and 6,930 µg/L, respectively in KAFB-106006. KAFB-106006 is designated a hazardous IDW well due to benzene concentrations and would not be accepted to the GWTS; however, even these maximum concentrations of dissolved Fe and Mn are 60 percent below the maximum concentrations that the sand filters can treat.

MAXIMUM LEAD GAC CONCENTRATION LIMITS

Figure 1 shows the maximum organic concentration limits reaching the lead GAC vessel modeled by the GAC manufacturer (Attachment 2). The Tigg modeling assumed worst case concentrations as follows:

- Maximum EDB detected of all wells between Q1 2016 and Q3 2016 was 17 µg/L. **EDB was conservatively set at the modeled influent level to 20 µg/L**; however, the highest concentration within the GWTS capture zone is 0.7 µg/L as of Q4 2016.
- **Benzene worst case was set at 450 µg/L** which is 10% safety factor below the regulatory standard for D018 hazardous waste of 500 µg/L. The highest concentrations within the GWTS capture zone is 3 ug/L as of Q4 2016 results.

- Worst case concentrations of ethylbenzene, toluene, and total xylenes were extrapolated using linear regression between benzene and each ethylbenzene, toluene, and total xylenes for all wells containing detectable benzene concentrations between Q1 and Q3 2016. The interpolated concentrations for ethylbenzene, toluene, and total xylenes were calculated at a benzene concentration of 450 µg/L and then multiplied by safety factor of 2 (double the interpolated concentration). **Ethylbenzene, toluene, and total xylenes were set at 102 µg/L, 212 µg/L, and 110 µg/L, respectively**. As of Q4 2016, there are no concentrations of ethylbenzene, toluene, and total xylenes above the NMWQCC standards or EPA maximum contaminant levels within the GWTS capture zone.

At no time are the GWTS effluent limits exceeded because both Treatment Train #1 and Treatment Train #2 have a second, redundant 20,000 pound lag GAC vessel in series behind the lead GAC vessel. Treated groundwater samples are collected monthly between the two GAC vessels to monitor for breakthrough. Breakthrough is defined as a detectable concentration of a contaminant of concern (COC) and therefore, breakthrough concentrations will be much lower than the NMWQCC standards or EPA maximum contaminant levels for a COC. When breakthrough occurs in the lead GAC vessel, process flow is switched from the lead GAC vessel to the lag GAC vessel, and the former lead GAC vessel is scheduled for carbon change out.

REFERENCES

New Mexico Administrative Code. 2004. State of New Mexico, Title 20.6.2 Ground and Surface Water Protection.

Figures

1 GWTS Process Flow Diagram

Attachments

1 Basis of Design Groundwater Treatment System Sand Filters
2 TIGG Maximum Loading Concentrations at 400 Gallons per Minute

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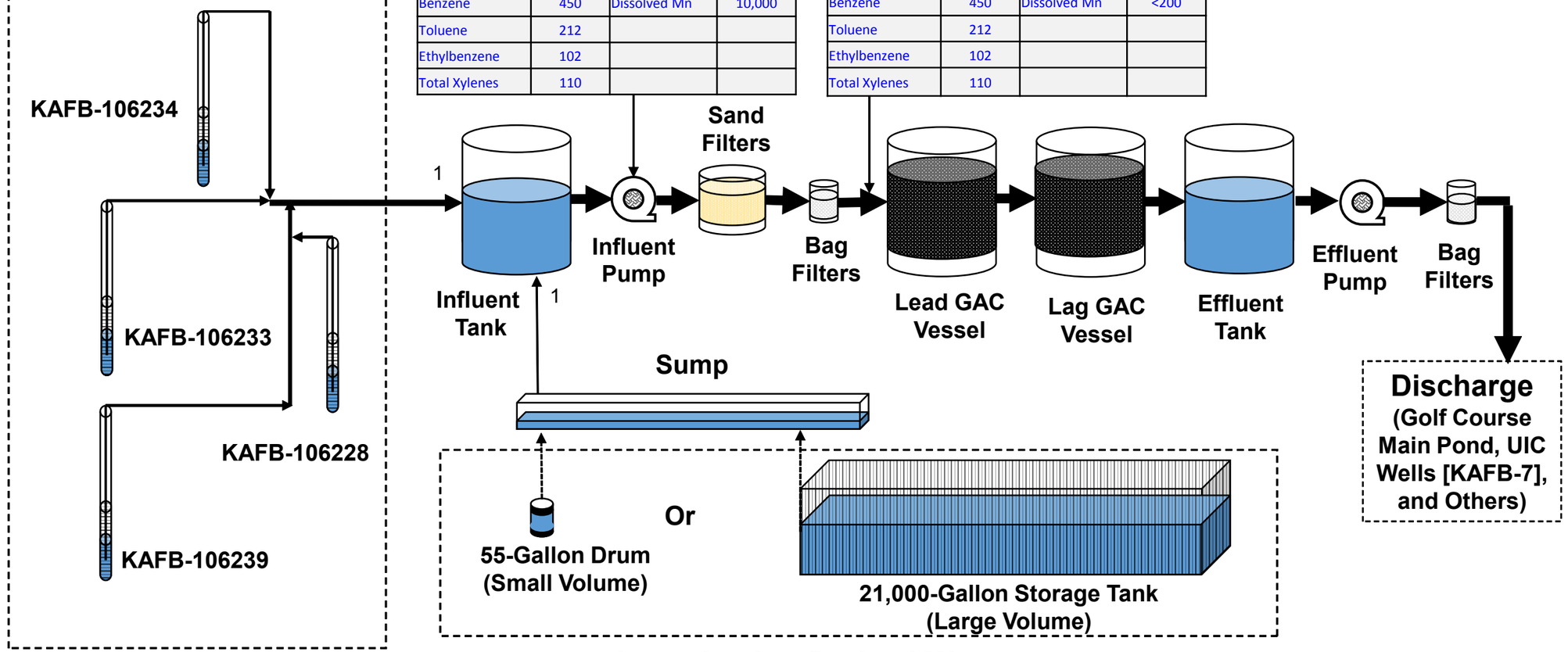
FIGURES

Sand Filter Concentration Limits

Organic	µg/L	Inorganic	µg/L
EDB	20	Dissolved Fe	10,000
Benzene	450	Dissolved Mn	10,000
Toluene	212		
Ethylbenzene	102		
Total Xylenes	110		

Lead GAC Concentration Limits

Organic	µg/L	Inorganic	µg/L
EDB	20	Dissolved Fe	<1,000
Benzene	450	Dissolved Mn	<200
Toluene	212		
Ethylbenzene	102		
Total Xylenes	110		



Note 1: Total process flow for each treatment train is 400 gpm.

Notes:
µg/L = Microgram(s) per liter
EDB - Ethylene dibromide
Fe = Iron
GAC = Granular activated carbon
gpm = Gallons per minute
Mn = Manganese
UIC = Underground injection control

TECHNICIAL MEMORANDUM ESTABLISHING
MAXIMUM INFLUENT LIMITS TO THE
GROUNDWATER TREATMENT SYSTEM
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

GWTS PROCESS FLOW DIAGRAM

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ATTACHMENT 1

BASIS OF DESIGN
GROUNDWATER TREATMENT SYSTEM SAND FILTERS

Sand Filter
Design Calculations

Kirtland Air Force Base Bulk Fuel Facility
Groundwater Treatment System

U.S. Army Corps of Engineers
Albuquerque District
Contract No. W912DR-12-D-0006

Prepared by

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Revision: 2

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ATTACHMENT 1 DESIGN CALCULATIONS FOR SAND FILTER SELECTION
ATTACHMENT 2 YARDNEY INDUSTRIAL SAND FILTER SPECIFICATIONS
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ATTACHMENT 6 PUMP SELECTION

1.0 INTRODUCTION

1.1 Background

The mid-plume pump and treat system is part of an interim remedial measure for the Bulk Fuels Facility (BFF) groundwater plume at Kirtland AFB. The mid-plume groundwater is currently contaminated with ethylene dibromide (EDB) at concentrations above the maximum contaminant level (MCL) of 0.05 µg/L. The mid-plume pump and treat system will eventually consist of several extraction wells that are expected to produce up to 800 gpm of groundwater. Currently three groundwater extraction wells and one groundwater treatment (GWT) system designed for 400 gpm of groundwater are in operations. A second GWT system also designed for 400 gallons per minute (gpm) of groundwater is currently under construction.

Groundwater from the extraction wells is pumped from the wells through buried pipelines into the GWT system feed tanks, one for each GWT system. Groundwater is then pumped from the feed tank through bag-filters for pretreatment, and activated carbon adsorbers which remove the EDB. The treated water from the carbon adsorbers is collected in a discharge tank and then pumped to either the golf course irrigation pond or an injection well for disposal.

Shortly after startup of the first GWT system downhole a corrosion and biofouling issue in the extraction network was identified. Subsequently the biofouling issue made its way to the bag-filters and lead GAC of the first treatment system. An additional pre-treatment system consisting of sand filters installed prior to the existing bag-filters has been proposed to address the biofouling issue.

In addition to addressing biofouling, removal of dissolved iron and manganese may be necessary in the future. Monitoring well results indicate that elevated concentrations of dissolved iron and manganese in the influent water delivered to the GWT system may be expected as additional extraction wells are brought on line.

The sand filters will be pre-fabricated skid mounted units installed with each GWT system. Each unit having flow capacity of 400 gpm will consist of two or more sand filters and include provisions for backwashing of the individual sand filter. Backwash water will be pumped to a Baker-type clarifier tank located outside of the GWT system building. Piping and valves for connection of the additional pre-treatment system to existing pumps and bag filters will be included in the design modifications. Piping and valves necessary to facilitate conveyance of backwash between the outside tanks and both GAC and sand filter units will also be included in the design modifications.

1.2 Objectives

The objectives for these calculations are to determine the appropriate sand filter, pipe sizing and to determine alterations of the existing feed pumps necessary to provide a maximum flow rate from the feed tank, pre-treatment (both sand filters and bag-filters) and GAC to the treated water tank of 400 gpm for each GWT system.

2.0 INPUTS AND ASSUMPTIONS

2.1 Calculation Methodology

Sand filters sizing is based on a loading rate expressed as gpm applied per square foot (ft^2) of filter surface area, i.e., gpm/ft^2. For high pressure rapid sand filters loading rates range from approximately 3 gpm/ ft^2 to 13 gpm/ft^2. The diameter of the sand filter bed has to be large enough so that the pressure drop through the bed is reasonable but not so large that the groundwater flow is too low. As a general practice lower loading rates are used to remove inorganic suspended solids. For the removal of organic material such as biofouling products higher loading rates are acceptable.

The feed pumps for the pre-filters and carbon beds of each GWT system are two identical centrifugal pumps sized for 200 gpm each. The flow from the pumps is controlled by a variable frequency drive (VFD) controlling the speed of the pumps. The system process piping for each GWT was designed by CB&I Federal Services LLC (CB&I) based on a flow rate of 400 gpm. Design Flow Solutions (DFS), a pipeline modeling software program (Reference 1), was used to calculate the frictional head loss within the process piping. The frictional head loss from the piping and components, equipment head loss, and elevation changes are summed to a resultant head loss for process system. This information was in turn used to size the pumps. This software program can be used to calculate the additional frictional head loss within the process piping with the addition of planned sand filter units. The resultant head loss can be used to determine modifications to the existing pumps to maintain the required flow rate for each GWT system.

2.2 Inputs

Inputs include:

- The groundwater design (maximum) feed rate is 400 gpm to each GWT system. Existing feed pumps consist of two pumps for each GWT system, 200 gpm each pump and operating at total head of 104 ft.
- Groundwater inlet temperature from the extraction wells will be between 55 and 60°F.
- Concentrations of dissolved metals, iron and manganese, are expected to increase.
- Monitor pressure and flow through sand filter units.
- Bed expansion of at least 20 percent at 239 gpm during backwash with duration of four minutes minimum for single media system.
- One sand filter at a time will be backwashed while continuing to process water until the entire unit is clean.
- Backwash water to be directed to Baker-type roll-off container located outside the GWT system building. Effluent from tank returned to sump in building and pumped to Feed Tank 110.

2.3 Assumptions

- Removal of organic biofouling products of primary importance. Removal of inorganic suspended solids of lessor importance with bag-filters following sand filter units. Based on manufacture's recommendation the sand filter units will be designed at maximum loading rate of 13 gpm/ft^2.
- Operation including backwash of each sand filter unit independent from the other.
- Controller PLC for the sand filters to be based on Allen Bradley logic and have Ethernet capability.
- Backwash can be initiated manually, via timer, or when observed pressure is ≤10 psi differential pressure from that of clean filter operation.
- Air activated valves switch operation filter to backwash mode. Air provided by small compressor mounted with each sand filter unit.
- Backwash will be initiated when observed pressure is 10 psi greater than from clean filter operation.
- Backwash rate based on manufacture's recommendations.
- Flow rate of feed pumps will be reduced to match backwash rate when backwash of sand filter units is required.
- Flow to GAC units suspended during backwash cycle.
- Provide oxidation and filtration for removal of dissolved iron and manganese

3.0 RESULTS AND CONCLUSIONS

3.1 Results

At the design flow rate of 400 gpm of groundwater and a design loading rate of 13 gpm/ft^2 filter surface area of 30.8 ft^2 is required (Attachment 1). Two 54-inch diameter filter vessels equal 31.8 ft^2 (Attachment 2). A 60-inch vertical side shell depth multi-media filter is recommended for removal of biofouling products as well as dissolved iron and manganese (Attachment 2).

High levels of dissolved iron and manganese greater than 10 mg/l can be treated by chemical oxidation, using an oxidizing chemical such as chlorine, followed by a sand trap filter to remove the precipitated material. DMI-65, a specialty media manufactured in Australia acts as an oxidation catalyst with immediate oxidation and filtration of the precipitates that has been certified to the US Standard of NSF/ANSI 61 for Drinking Water System Components. DMI-65 is an extremely powerful silica sand based catalytic action water filtration media that is designed for the removal of iron and manganese without the use of potassium permanganate through an Advanced Oxidation Process. The DMI-65 media has been shown to efficiently remove dissolved iron to the almost undetectable levels as low as 0.001 ppm and manganese to 0.001 ppm. Qualitative information about how this media works, its capabilities and limitations are included in Attachment 2. Yardney's IMA-65 Specialty Media is the United States equivalent of the DMI-65 media.

Continuous injection of sodium hypochlorite (liquid bleach) to maintain a 0.1 to 0.3 parts per million (ppm) residual level of chlorine (Attachment 2) promotes the oxidation process. Calculations supporting the design for the injection of sodium hypochlorite solution are included in Attachment 3. Based on these calculations injection of 3 gallons per day of household bleach would be required to maintain chlorine residual of 0.3 ppm.

Frequency of backwash is dependent on the production of biofouling products. At the backwash rate of 239 gpm for Yardney Model IL 5424-2A (Attachment 2) each backwash cycle will expand the filter bed 22 percent (Attachment1) and produce nearly 1,000 gallons of water during four minute backwash cycle. The same backwash rate applies to the Yardney Model IL 5460-2A (Attachment 2). One sand filter at a time will be backwashed while continuing to process water until the entire unit is clean (Attachment 3). Backwash effluent from each sand filter unit is conveyed by 4-inch diameter pipe and join with 6-inch diameter pipe to exit the building and discharge to Baker-style settling/clarifier (Attachment 4).

The 120V Allen Bradley Micrologix 1400 PLC Controller (Ethernet compatible) integrated with either Yardney model sand filter requires 120V/<1 A service. The Yardney IL 5424-2A and IL 5460-2A Filter Units each include a 1HP 3 gallon oil lube air compressor to control backwash valve operation and require 120V/15A service.

The groundwater treatment feed pump units for each GWT system will be required to pump 200 gpm each (400 gpm total). Based on modeling the hydraulic performance of the process piping system with dirty sand filters, dirty bag filters, and allowing for fouling/blinding across carbon vessels, a worst case condition, the required head is 120.59 ft wg. With a 20% design margin, per UFC 3-280-01A (Reference 2), the required head is 144.71 ft wg (Attachment 5). Currently each feed pump unit has two Gould model 3196 2x3-6 pumps with impeller diameter of 5.375 inches. The existing pumps will not achieve 200 gpm pumping at head of 144.71 ft wg.

Changing impeller diameter of this pump to 6.062 inches can achieve 200 gpm at total head of 148.9 ft wg. (Attachment 6).

3.2 Conclusions

Two 54 inch diameter sand filter units having 24 inch vertical sides meets the design criteria for removing biofouling products. Two 54 inch diameter multi-media sand filter units having 60 inch vertical sides with crushed gravel, garnet, and IMA-65 media meets the design criteria for removing biofouling products and dissolved iron and manganese. Small chorine injection units as used for residential purposes will provide the required sodium hypochlorite injection rates. Units selected should provide solution storage of at least 15 gallons (5 day capacity). Example systems are included in Attachment 3.

A 40 cubic yard roll-off settling/clarifier has capacity of 8,000 gallons, i.e., eight backwash cycles (Attachment 4).

Changing the impellers of the existing pumps to 6.062 inch diameter will exceed the 20% design margin criteria per UFC 3-280-01A.

4.0 REFERENCES

1. DF DesigNet® Version 4. Design Flow Solutions Software, ABZ, Incorporated
2. UFC 3-280-01A, Unified Facilities Criteria, Guidance for Ground Water/Fuel Extraction and Ground Water Injection Systems

Attachment 1

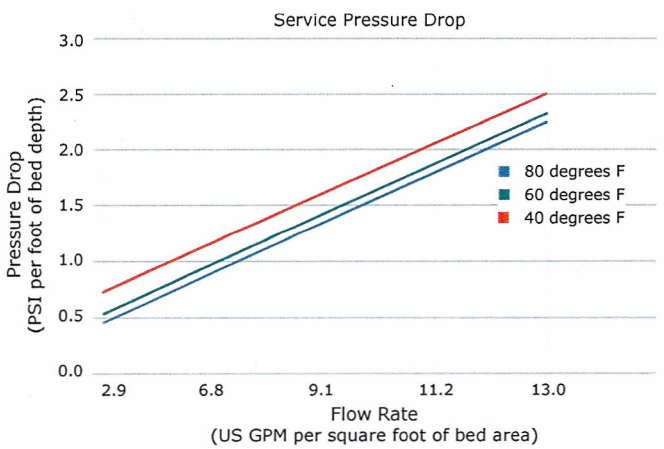
Design Calculations for Sand Filter Selection

Project KIRTLAND AFB BULK FUELS FACILITY Project No. 0912DK-12-D0006
Subject SAND FILTER DESIGN Sheet No. 1 of 2
Drawing No. 1033
Computed by H. Lee Beeka Date 10/24/2012 Checked by _____ Date _____

- LOADING RATE HIGH PRESSURE SAND FILTER 2.9-13 gpm/ft²
- SAND FILTERS FOLLOWED BY BAG FILTER → PARTICULATE REMOVAL NOT SIGNIFICANT REQUIREMENT AS THROUGH PUT
  USE UPPER LIMIT OF RECOMMENDED RANGE → 13 gpm/ft²
- FILTER AREA REQUIRED = $\frac{400 \text{ gpm}}{13 \text{ gpm/ft}^2} = 30.8 \text{ ft}^2$
- SPACE LIMITATIONS - 2 FILTER/UNIT

- YARDNEY SAND MEDIA FILTERS SPECIFICATION MODEL IL-5424-2A
  FILTRATION SURFACE AREA = 31.8 ft² > REQUIRED. OK

Engineering (Hydraulic) Data



MODEL IL-5424-2A BED DEPTH ⇒ 2.0 ft

SELECT PRESSURE DROP/ft @ $\frac{400 \text{ gpm}}{31.8 \text{ gpm/ft}^2} = 2.25 \text{ psi/ft}$

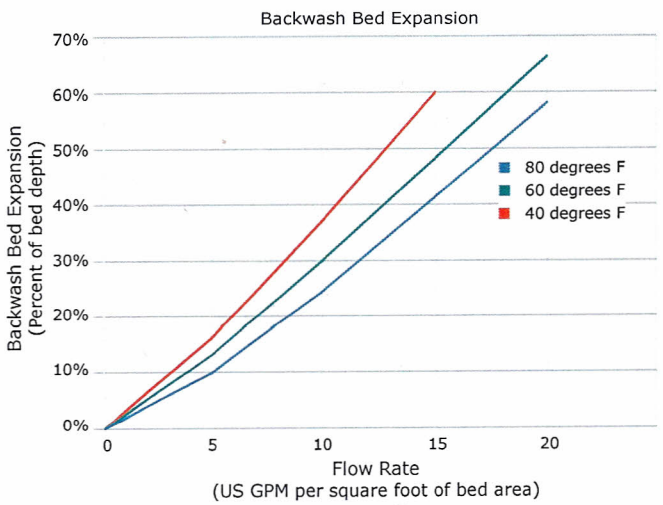
PRESSURE DROP = 2.25 psi/ft (2 ft) = 4.5 psi

Project KIRTLAND AFB BULK FUELS FACILITY Project No. W912DK-12-D-0006 1033
Subject SAND FILTER DESIGN Sheet No. 2 of 2
Drawing No.
Computed by H. Lee Berka Date 10/24/2016 Checked by Date

MODEL IL 5460-2A BED DEPTH ⇒ 5.0 ft

SERVICE PRESSURE DROP/ft @ $\frac{400 \text{ gpm}}{31.8 \text{ gpm/ft}} = 2.25 \text{ psi/ft}$

PRESSURE DROP = 2.25 psi/ft (5.0 ft) = 11.25 psi



BACKWASH BED EXPANSION

YARDNEY SAND FILTER SPECIFICATION BACKWASH RATE

MODEL IL 5424-2A ⇒ 239 gpm

$\text{gpm/ft}^2 = \frac{239}{31.8} = 7.5 \text{ gpm/ft}^2$

FROM GRAPH ABOVE @ 7.5 gpm/ft² BED EXPANSION % Bed Dp = 22%

MODEL IL 5460-2A BACKWASH RATE = 239 gpm

$\text{gpm/ft}^2 = \frac{239}{31.8} = 7.5 \text{ gpm/ft}^2$

FLOW GRAPH ABOVE @ gpm/ft² BED EXPANSION % Bed Dpt = 22%

Attachment 2

Yardney Industrial Sand Filter Specifications

yardney
WATER FILTRATION SYSTEMS

Sand Media Filters

Removal of Solids Down to 20 Microns

Yardney Sand Media filters are designed for the most challenging dirty water conditions with a high performance solution for water filtration down to 20 microns. These durable carbon steel filters utilize a 24" vertical side shell depth for removal of organic and inorganic suspended solids for filtering large volumes of water with very little pressure drop and a long-term value. All Yardney industrial media filters utilize our simple backwash system for ease of operation and consistent water quality. The Yardney automatically controlled filter systems operate for extended periods of time prior to a short backwash cycle.



Applications

- Removal of organic and/or inorganic suspended solids down to 20 microns
- Storm water runoff, industrial process water, incoming plant water, waste water clean-up, industrial water for plant reuse
- Pre-filtration in applications such as granular activated carbon, reverse osmosis, cartridge or bag filtration and deionized water
- 80 psi standard operating pressure (high pressure systems available)
- Flow ranges from 10 gpm and up

Advantages

- State of the art fabrication provides added strength under pressure and long system life
- ASME code shaped head construction for durability and safety
- Stainless steel wedgewire underdrain
  - ➤ Ensures structural integrity in the harshest conditions
  - ➤ Hydraulically balanced to increase effectiveness of backwash while reducing flush frequency and waste of water
  - ➤ High strength stainless steel wedgewire will withstand a collapse pressure in excess of 600 psi
- Standard carbon steel products - 3/16" thick material
- Backwash automatically initiated by elapsed time or pressure differential
- Yardney easy-entry lid closure with weld tabs for operator safety
- Available in welded carbon steel
- 3M Scotchkote® 134 fusion bonded epoxy coating on interior surfaces
- Made in USA

Sand Media Filters

Specifications

SPECIFICATIONS | INDUSTRIAL | SAND MEDIA FILTERS													
Model	Number of Tanks in System	Standard Flow Range				Filtration Surface Area (total sq ft)	Backwash Flow Rate (per tank)		Media Requirements (cubic feet)		Maximum Pressure	Inlet/ Outlet Pipe Size	Backwash Line Pipe Size
		Minimum		Maximum									
		gpm	m^3/hr	gpm	m^3/hr		gpm	m^3/hr	Gravel 1/2" - 3/4"	Media			
IL-1824-1A	1	18	4	26	6	1.75	26	6	1	3	100 psi	2"	2"
IL-2424-1A	1	32	7	47	11	3.15	47	11	2	5	100 psi	2"	2"
IL-1824-2A	2	35	8	53	12	3.50	26	6	2	5	100 psi	3"	2"
IL-3024-1A	1	49	11	74	17	4.91	74	17	3	7	100 psi	3"	3"
IL-1824-3A	3	53	12	79	18	5.25	26	6	3	8	100 psi	3"	2"
IL-2424-2A	2	63	14	95	22	6.30	47	11	3	9	100 psi	3"	2"
IL-3624-1A	1	71	16	107	24	7.10	107	24	4	10	100 psi	3"	3"
IL-2424-3A	3	95	22	142	32	9.45	47	11	5	14	100 psi	3"	2"
IL-3024-2A	2	98	22	147	33	9.82	74	17	5	14	100 psi	4"	2"
IL-4824-1A	1	126	29	189	43	12.60	189	43	7	21	80 psi	4"	4"
IL-3624-2A	2	142	32	213	48	14.20	107	24	8	20	100 psi	4"	4"
IL-3024-3A	3	147	33	221	50	14.73	74	17	8	21	100 psi	4"	2"
IL-5424-1A	1	159	36	238	54	15.90	239	54	10	23	80 psi	4"	4"
IL-3624-3A	3	213	48	320	73	21.30	107	24	12	30	100 psi	4"	4"
IL-4824-2A	2	252	57	378	86	25.20	189	43	14	42	80 psi	6"	4"
IL-5424-2A	2	318	72	476	108	31.80	239	54	19	46	80 psi	6"	4"
IL-4824-3A	3	378	86	567	129	37.80	189	43	21	63	80 psi	6"	4"
IL-5424-3A	3	477	108	714	162	47.70	239	54	29	69	80 psi	6"	4"
IL-4824-4A	4	504	115	756	172	50.40	189	43	28	84	80 psi	8"	4"
IL-4824-5A	5	630	143	945	215	63.00	189	43	35	105	80 psi	10"	4"
IL-4824-6A	6	756	172	1134	258	75.60	189	43	42	126	80 psi	10"	4"
IL-5424-4A	4	636	145	952	216	63.60	239	54	38	92	80 psi	8"	4"
IL-5424-5A	5	795	181	1190	270	79.50	239	54	48	115	80 psi	10"	4"
IL-5424-6A	6	954	217	1428	325	95.40	239	54	57	138	80 psi	10"	4"

Standard product includes:

- Completely assembled for easy installation
- Skid mounted tanks
- Yardney easy-entry lid closure with side manway
- Valves
- Inlet/outlet and backwash manifolds
- Controller, solenoids, electrical wire, tubing
- Removable underdrain
- 3M Scotchkote® 134 fusion bonded epoxy coating on interior surfaces

Available options:

- ASME code
- High pressure
- Solar package
- PLC controller
- Custom filter station layout piping
- Air scour

Made in USA

Phone: 951.656.6716
Toll-Free: 800.854.4788
Fax: 951.656.3867
info@yardneyfilters.com

yardney WATER FILTRATION SYSTEMS

www.yardneyfilters.com

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MULTIPLE TANK FILTRATION PROCESS | SAND MEDIA

Media filtration is the most effective method for removal of suspended organic and inorganic solids from water down to 20 microns. Yardney media filters operate on the same basic principle as nature's own ground water filtering process. Contaminated, unfiltered water enters the system through the inlet in the top of the filter and flows, with gravity and under pressure, through the media bed where solid particulates are entrapped. This occurs until the filtration system initiates an automatic backwash to expel all contaminates entrapped within the media bed. Yardney media filters are known for their capacity to extract and hold large amounts of water-borne particulate while continuing to deliver the rated flow of clean water.

FILTRATION PROCESS



- The contaminated water enters the tank through the inlet manifold, transitioning to the Yardney 3-way valve and into the top inlet of each tank
- The Yardney two-stage deflector creates a uniform distribution for laminar flow across the media bed while avoiding channeling of the media bed
- Particulate is trapped and retained within the media bed resulting in clean process water flowing out through the stainless steel wedgewire underdrain, to the outlet of each filter tank and to the outlet manifold for end use

In addition to the Yardney filter's ability to filter large volumes of water with very little pressure drop, one of the outstanding features is the simple backwash operation. This backwashing process is possible due to the highly efficient and hydraulically balanced underdrain systems utilized in Yardney media filters.

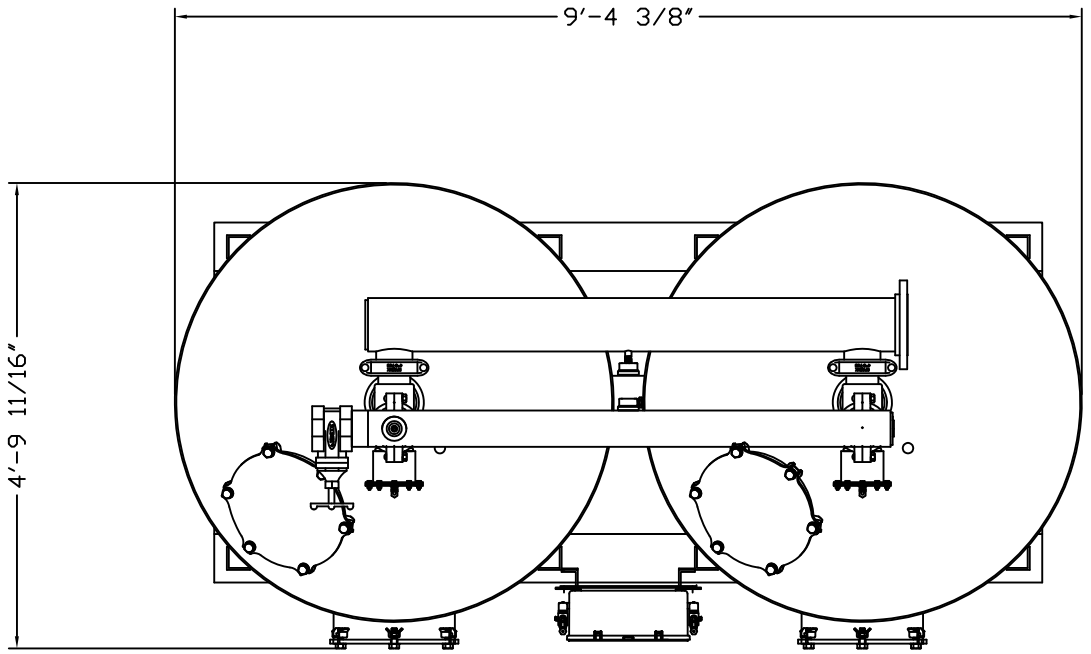
BACKWASH PROCESS



- Backwash sequence is initiated by either elapsed time of the Yardney controller or pressure differential between the inlet and outlet manifolds
- Water or air pressure opens the Yardney 3-way valve causing the reverse flow of a portion of filtered water up through the stainless steel underdrain to hydraulically and uniformly lift the media bed
- The use of a hydraulically balanced underdrain in conjunction with a gravel pack creates a proper and uniform lift of the media bed while avoiding a turbulent backwash
- Entrapped particulates are released during the backwash event, exhausted through the backwash manifold and routed to a convenient location
- One tank at a time is backwashed while continuing to process water for use until the entire system is clean
- Once completed with the backwash, filtration continues until the next backwash event is called for

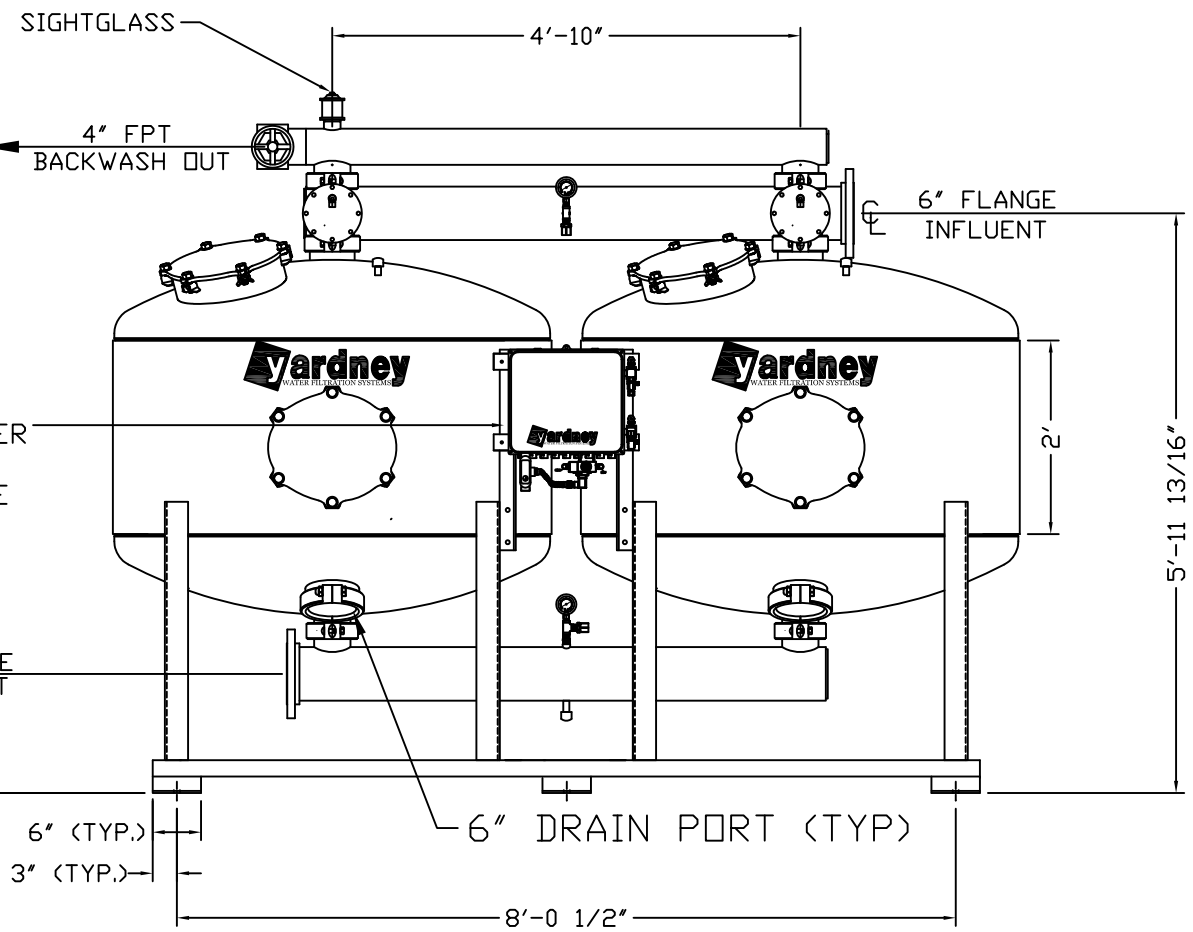
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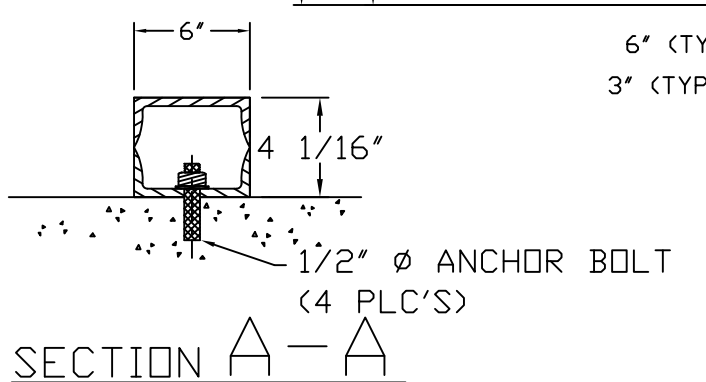
IL 5424-2A



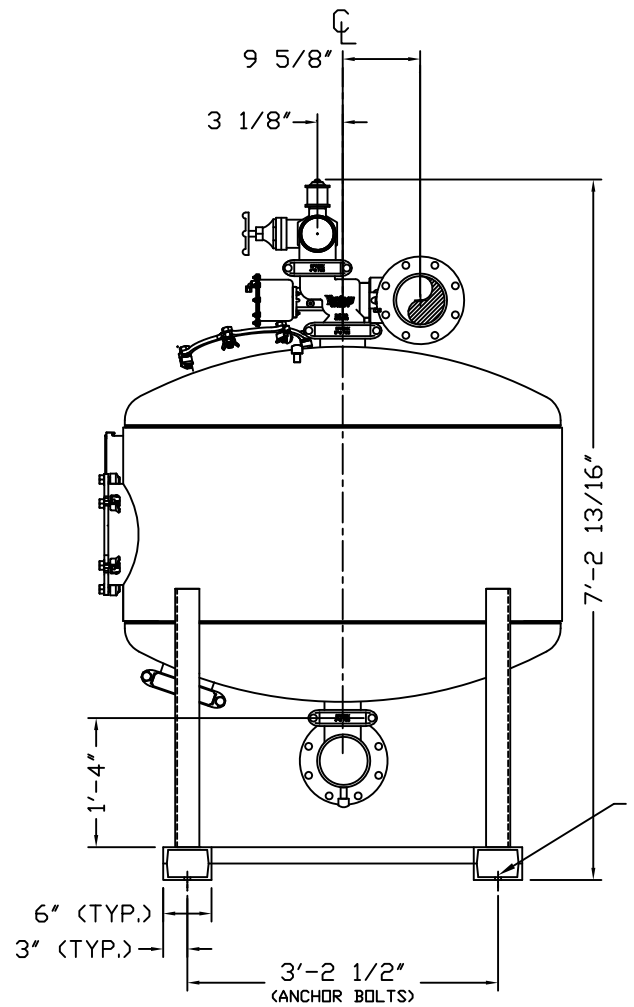
NOTES:

1. DESIGN FLOW RATE: 318-477 GPM.
   BACKWASH RATE: 15 GPM/FT^2.
2. MAXIMUM OPERATING PRESSURE: 80 PSI.
3. ELECTRICAL REQUIREMENTS:
   CONTROLLER 120V;
   SOLENOIDS 24VAC; FACTORY WIRED
4. AIR SUPPLY REQUIRED: 2 CFM @ 70 PSIG (MIN.).
5. MEDIA REQUIREMENT PER TANK:
   A. 1/2"x3/4" CRUSHED ROCK: 9.5 CU. FT. .
   B. 0.47mm CRUSHED SILICA SAND: 23.0 CU. FT. .
6. WEIGHT: (APPROX.)
   A. SHIPPING: 3,630 LBS (WITH MEDIA)
   B. OPERATING: 9,560 LBS
7. EXTERIOR PAINT COLOR: STANDARD BLUE, RAL 5010.





SECTION A—A



3/4" DIA. HOLE CENTERED ON BOTTOM PAD, 4 PLCS. (FOR 1/2" ANCHOR BOLTS)

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SYM	REVISIONS	BY	DATE	APP
F	REPLACE HEAD 104018954 w/104018955	DTC	8-16	APP
E	4" DRAIN PORT CHANGED TO 6"	DTC	5-15	APP
D	UPDATED YARDNEY LOGO	DTC	1-13	APP
C	WELD TABS ON MANWAY RINGS	DTC	11-12	APP
B	ADDED 4" DRAIN PORT	DTC	11-09	APP
A	DESIGNED WITH NEMA 4 ENCLOSURE	DTC	9-06	APP

yardney WATER FILTRATION SYSTEMS
RIVERSIDE, CALIFORNIA

APPROVALS	DATE
DRAWN BY: DTC	1/22/06
CHECKED BY:	
APPROVED BY:	
ARCHITECTURAL SCALE:	
USED ON:	

IL 5424-2A
FILTER SYSTEM

SIZE	DRAWING NO:	REV:
D	9500542402	F

SCALE: | ACAD #: SYSTEMS\IL | SHEET 1 OF 1

yardney
WATER FILTRATION SYSTEMS

Multi-Media Filters

Removal of Solids Down to 5 Microns

Yardney Multi-Media filters are designed for enhanced water quality filtration for the removal of organic and inorganic suspended solids down to 5 microns. Multi-Media filters may be used as a stand-alone system or in conjunction with or as a pretreatment for other filtration technologies. The Multi-Media Filtration Systems utilize a vertical side shell depth of 60" with accompanied reverse stacked medias for progressive filtration through the filtration system. All Yardney industrial media filters utilize our simple backwash system for ease of operation and consistent water quality.

Applications

- Removal of organic and/or inorganic suspended solids down to 5 microns with enhanced solids capacity vs. single media sand filtration
- Storm water runoff, industrial process water, incoming plant water, waste water clean-up, industrial water for plant reuse
- Pre-filtration in applications such as granular activated carbon, reverse osmosis, cartridge or bag filtration and deionized water
- 80 psi standard operating pressure (high pressure systems available)
- Flow ranges from 10 gpm



Advantages

- State of the art fabrication provides added strength under pressure and long system life
- ASME code shaped head construction for durability and safety
- Stainless steel wedgewire underdrain
  - ➤ Ensures structural integrity in the harshest conditions
  - ➤ Hydraulically balanced to increase effectiveness of backwash while reducing flush frequency and waste of water
  - ➤ High strength stainless steel wedgewire will withstand a collapse pressure in excess of 600 psi
- Standard carbon steel products, 3/16" thick material
- Backwash automatically initiated by elapsed time or pressure differential
- Yardney easy-entry lid closure with weld tabs for operator safety
- Available in welded carbon steel or stainless steel
- 3M Scotchkote® 134 fusion bonded epoxy coating on interior surfaces
- Made in USA

Multi-Media Filters

Specifications

SPECIFICATIONS | INDUSTRIAL | MULTI-MEDIA FILTERS															
Model	Number of Tanks in System	Standard Flow Range				Filtration Surface Area (total sq ft)	Backwash Flow Rate (per tank)		Media Requirements (cubic feet per tank)				Maximum Pressure	Inlet/ Outlet Pipe Size	Backwash Line Pipe Size
		Minimum		Maximum											
		gpm	m^3/hr	gpm	m^3/hr		gpm	m^3/hr	Gravel 1/2" - 3/4"	Garnet 1.45 mm	Garnet 0.35 mm	Anthracite 0.75 mm			
MM-1860-1A	1	9	2	26	6	1.77	27	6	1	1	2.5	2.5	100 psi	2"	2"
MM-2460-1A	1	16	4	47	11	3.15	47	11	2	2	5	5	100 psi	2"	2"
MM-1860-2A	2	18	4	53	12	3.54	27	6	1	1	2.5	2.5	100 psi	2"	2"
MM-3060-1A	1	25	6	74	17	4.91	74	17	3	3	8	8	100 psi	3"	3"
MM-1860-3A	3	27	6	79	18	5.31	27	6	1	1	2.5	2.5	100 psi	3"	2"
MM-2460-2A	2	32	7	95	22	6.30	47	11	2	2	5	5	100 psi	3"	2"
MM-3660-1A	1	35	8	107	24	7.10	107	24	4	4	11	11	100 psi	3"	3"
MM-2460-3A	3	48	11	142	32	9.45	47	11	2	2	5	5	100 psi	3"	2"
MM-3060-2A	2	50	11	147	33	9.82	74	17	3	3	8	8	100 psi	4"	2"
MM-4860-1A	1	63	14	189	43	12.60	189	43	7	7	19	19	80 psi	4"	4"
MM-3660-2A	2	70	16	213	48	14.20	107	24	4	4	11	11	100 psi	4"	4"
MM-3060-3A	3	75	17	221	50	14.73	74	17	3	3	8	8	100 psi	4"	2"
MM-5460-1A	1	80	18	239	54	15.91	239	54	10	8	24	24	80 psi	4"	4"
MM-3660-3A	3	105	24	320	73	21.30	107	24	4	4	11	11	100 psi	4"	4"
MM-4860-2A	2	126	29	378	86	25.20	189	43	7	7	19	19	80 psi	6"	4"
MM-5460-2A	2	160	36	477	108	31.82	239	54	10	8	24	24	80 psi	6"	4"
MM-4860-3A	3	189	43	567	129	37.80	189	43	7	7	19	19	80 psi	6"	4"
MM-5460-3A	3	240	55	716	163	47.73	239	54	10	8	24	24	80 psi	6"	4"
MM-4860-4A	4	252	57	756	172	50.40	189	43	7	7	19	19	80 psi	8"	4"
MM-4860-5A	5	315	72	945	215	63.00	189	43	7	7	19	19	80 psi	10"	4"
MM-5460-4A	4	320	73	955	217	63.64	239	54	10	8	24	24	80 psi	8"	4"
MM-4860-6A	6	378	86	1134	258	75.60	189	43	7	7	19	19	80 psi	10"	4"
MM-5460-5A	5	400	91	1193	271	79.55	239	54	10	8	24	24	80 psi	10"	4"
MM-5460-6A	6	480	109	1432	325	95.46	239	54	10	8	24	24	80 psi	10"	4"

Standard product includes:

- Completely assembled for easy installation
- Skid mounted tanks
- Yardney easy-entry lid closure with side manway
- Valves
- Inlet/outlet and backwash manifolds
- Controller, solenoids, electrical wire, tubing
- Removable underdrain
- 3M Scotchkote® 134 fusion bonded epoxy coating on interior surfaces

Available options:

- ASME code
- High pressure
- Solar package
- PLC controller
- Custom filter station layout piping
- Air scour
- Continuous flow
- Rinse to waste

Made in USA

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yardney WATER FILTRATION SYSTEMS

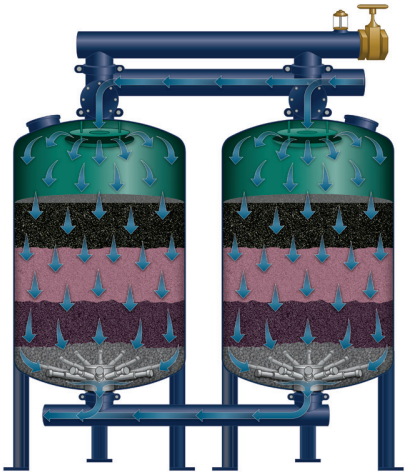
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MULTIPLE TANK FILTRATION PROCESS | MULTI-MEDIA

Multi-media filtration is a more effective method for removal of suspended organic and inorganic solids from water down to 5 microns. Yardney Multi-Media filters operate on a similar principle to the sand media but utilize multiple levels of coarse to fine media to achieve progressive filtration through the entire filter media bed. The coarse media within the top section of the tank filters the largest particulates while the finer media beds filter the fine particulates. This occurs until the filtration system initiates an automatic backwash to expel all contaminants entrapped within the media bed. Yardney Multi-Media filters are known for their capacity to extract and hold large amounts of water-borne particulate while continuing to deliver the rated flow of clean water.

FILTRATION PROCESS



- The contaminated water enters the tank through the inlet manifold, transitioning to the Yardney 3-way valve and into the top inlet of each tank
- The Yardney two-stage deflector creates a uniform distribution for laminar flow across the media bed while avoiding channeling of the media bed
- Particulate is trapped and retained within the media bed resulting in clean process water flowing out through the stainless steel wedgewire underdrain, to the outlet of each filter tank and to the outlet manifold for end use

In addition to the Yardney filter's ability to filter large volumes of water with very little pressure drop, one of the outstanding features is the simple backwash operation. This backwashing process is possible due to the highly efficient and hydraulically balanced underdrain systems utilized in Yardney Multi-Media filters. Yardney Multi-Media filters are hydraulically designed not to commingle the multiple levels of media during a backwash cycle due to the specific gravity of each media.

BACKWASH PROCESS



- Backwash sequence is initiated by either elapsed time of the Yardney controller or pressure differential between the inlet and outlet manifolds
- Water or air pressure opens the Yardney 3-way valve causing the reverse flow of a portion of filtered water up through the stainless steel underdrain to hydraulically and uniformly lift the media bed
- The use of a hydraulically balanced underdrain in conjunction with a gravel pack creates a proper and uniform lift of the media bed while avoiding a turbulent backwash
- Entrapped particulates are released during the backwash event, exhausted through the backwash manifold and routed to a convenient location
- One tank at a time is backwashed while continuing to process water for use until the entire system is clean
- Once completed with the backwash, filtration continues until the next backwash event is called for

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HOW DMI-65 WORKS

Introduction

The purpose of this paper is to provide users of DMI-65 catalytic water filtration media with qualitative information about how the material works, its capabilities and limitations and enable them to apply the material to water treatment processes in the appropriate manner and with confidence. The paper avoids the detailed complexity of solid surface electrochemical layers and colloidal science, quantitative physical and chemical processes and reactions. For readers having already significant knowledge in this area the paper brings more understanding of what DMI-65 is and its intended use. Newcomers to this area are provided with the bases, and perhaps motivation, for directing their more in depth studies as they might wish.

History

In the early days of water treating, naturally occurring zeolites (such as glauconite greensand) were used to soften and remove the iron and manganese from boiler make-up and process waters. As the demand for higher quality water increased (due in part to higher pressure class boilers) the water treating industry largely moved away from these products for softening to the newly developed synthetic ion exchange resins.

However, in the case of iron and manganese removal this move was much slower and the result was that the use of glauconite greensand (greensand) filtration media continues until the present time. Greensand was and is often used as a pretreatment step prior to ion exchange processes since the iron in a feed water can and does foul the cation resin. Other processes include aeration and oxidation-filtration with standard media filters or proprietary types of media and/or filters

While there have been other iron/manganese removal products and processes developed since greensand was introduced the use of greensand continued even though there were several issues that made it a less than ideal media. It required periodic regeneration with potassium permanganate, could not be used in lower pH waters (<6.2), had a relatively low operating temperature (80^{o}F), and tended to soften through time resulting in pressure drop issues at higher flow rates. Additionally, the supply could occasionally become restricted due to environmental concerns with the processing facilities along the Eastern coast of the United States.

Because of these issues in the 1970s water treating companies and end-users began to express an interest in “something else” to replace the greensand. In response to their requests, scientists and researchers in Japan began to look for ways to infuse oxidizing agents to different matrix materials. It was felt that a commercially produced product could be made more powerful, have better physical properties and be more subject to improvements and/or modifications than any naturally occurring media.

Decades of further research and development of the Japanese Infusion Technology have resulted in the uniquely Australian made product, DMI-65 a granular catalytic media used to boost the advanced reduction/oxidation (redox) processes in water. The media is part of a broad category of products deriving their physical and chemical action from the interaction of their metal oxide surface with the water molecules and ions in solution. This product is revolutionary due to proprietary infusion technology that penetrates the micro pours substrate of the matrix material, allowing for a greater catalytic surface area and of a tight particle size distribution. DMI-65 has low level of fines, a tolerance to wider pH range and chemically infused catalytic surface that won’t be consumed or diminished under normal operating conditions. Last 5 – 10 years of continuous use.

Background information

DMI-65 is an extremely powerful catalytic water filtration media that is designed for the removal of iron and manganese in aqueous solutions (water) without the need for potassium permanganate or chemical regeneration. The unique microporous structure of DMI-65 efficiently removes dissolve iron to the almost undetectable levels as low as 0.001 ppm and manganese to 0.001 ppm. DMI-65 acts as an oxidation catalyst with immediate oxidation and filtration of the insoluble precipitates derived from this oxidation reaction. DMI-65 can also remove Arsenic, Aluminium and other heavy metals and Hydrogen Sulfide under certain conditions.

The material is part of the broad category of products deriving their physical and chemical action from the interaction of their metal oxide surface with the water molecules and ions in solution.

Solid surface interaction with water distinguishes between adsorption as the weak van der Waal forces that hold a hydrophobic molecule in a rigid core media such as activated carbon and absorption as the weak van der Waal forces that hold a hydrophobic molecule in a swellable matrix (such as benzene) in a polymer of T-butyl styrene or absorption by liquid-liquid extraction. Ion exchange resins utilize absorption processes while interaction of DMI-65 with water molecules and ions in solution is initiated through adsorption.

Non catalytic type adsorbent materials retain target ions from water until either sites available for adsorption reach a maximum density and saturation or concentration of target ions in the treated water attain maximum acceptable concentration. At this point, the adsorbent material has to be regenerated to remove or replace the contaminant ions, or the used material is replaced with new material that is loaded in the treatment container. When the process works by swapping one type of ion for target ions from water the process is called ion exchange. This category of adsorbent and some partly absorbent materials remove the target ions from water. The larger the surface per volume of material the larger the amount of contaminant target ions which could be retained from the water.

Purely catalytic materials adsorb the reactant ions from solution bringing them in the proximity of chemical bonding. Then the reaction product moves away from the surface of catalyst. Strictly speaking catalysts facilitate chemical reactions; they do not implicitly remove anything. If the reaction product is a solid precipitate, often the product is retained in the catalytic bed, hence removed by filtration.

Many materials act in a mixed mode; with both ion exchange and catalytic action taking place. For those materials used primarily for their catalytic action, ion exchange resulting in dissolution of the catalytic layer leads to the need for periodic regeneration or reactivation to correct the matrix of ions at their active surface.

DMI-65 – Advanced Oxidation Catalytic Media

DMI-65 is a granular material of dark brown to black colour. This colour is produced by the manganese oxide in the outer layers of the granules. DMI-65 is a catalytic media in the true meaning of the word and facilitates oxidation – precipitation - filtration and does not get consumed in the reactions. Strictly speaking, the media facilitates chemical reactions and does not explicitly remove anything. Once oxidized, the depth filtration aspect of the media removes the solids that are then periodically backwashed out of the filter vessels.

The media does not need regeneration or reactivation and does not display a decaying capacity to do its catalytic work. Over 5 to 10 years period, through many backwashing operations of the bed to remove retained solids, the media is degraded by contact between particles and mechanical abrasion. Then the material has to be replaced.

BASIC OPERATION:

The processes that take place in a bed of DMI-65 involve reduction/oxidation (redox). Redox reactions involve a transfer of electrons between species. Reduction is the gain of electrons or a decrease in the oxidation state of a molecule, atom or ion. Oxidation is the loss of electrons or an increase in the oxidation state of a molecule, atom or ion. Redox reactions occur simultaneously whereby there cannot be a reduction reaction without an oxidation reaction. The media "helps" chemical reactions to occur by interacting with the reaction without being permanently altered. An in depth discussion about redox chemistry is outside the scope of this paper, it will only deal with how the redox process applies in the removal of iron and manganese using DMI-65. The individual redox equations will be covered in the following iron and manganese removal sections.

In order to begin the process of oxidation of the ions in solution and to ensure that the oxidative layer is not compromised the media is designed to operate in the presence of chlorine or other oxidant. In this process the oxidant removes electrons and is consumed in the process. The operator needs to ensure that there is a 0.1 – 0.3 ppm free chlorine residual in the effluent water.

Chlorine, fed as sodium hypochlorite (NaOCl) or bleach (12.5% NaOCl), is the preferred oxidant since it is relatively inexpensive, readily available around the world and it is effective. Other oxidants such as hydrogen peroxide (H_2O_2), chlorine oxide (ClO_2) or ozone can also be used so long as a residual can be measured and maintained.

Another function of the chlorine is that it keeps the media free from bacterial or slime growth. The manganese oxide catalytic surface has to remain clean so that the ions in the water can come in contact with it. At the same time, the chlorine is a source of oxygen more reactive than molecular oxygen. The following chart indicates safe levels for other water constituents that could interfere with the surface interaction.

Unlike ion exchange resins where higher regenerant dosages will increase the ion exchange capacity, chlorine residuals or concentrations higher than required to oxidize the Fe and Mn do not increase the oxidative properties of the media. Additionally, since the media is often used to pretreat waters prior to an Reverse Osmosis (RO) system a higher free chlorine residual would require more extensive post treatment to reduce the residual to protect the membranes from chlorine attack.

The DMI-65 must be activated prior to being placed into service for the first time. This activation requires a higher dosage of chlorine than used during normal operation but only has to be performed once during the initial start up. The dosage rate is 10 fluid ounces of 12.5% chlorine per cubic foot (ft^3) of the media. The activation only requires a soak of several hours but an overnight soak is preferred.

Once activated, the vessel(s) must be backwashed to remove the excess NaOCl and any fines. Since manganese oxide is one of the constituents used in the manufacture of the media an extended rinse is required at start up to remove any trace free manganese oxide residual left over from the

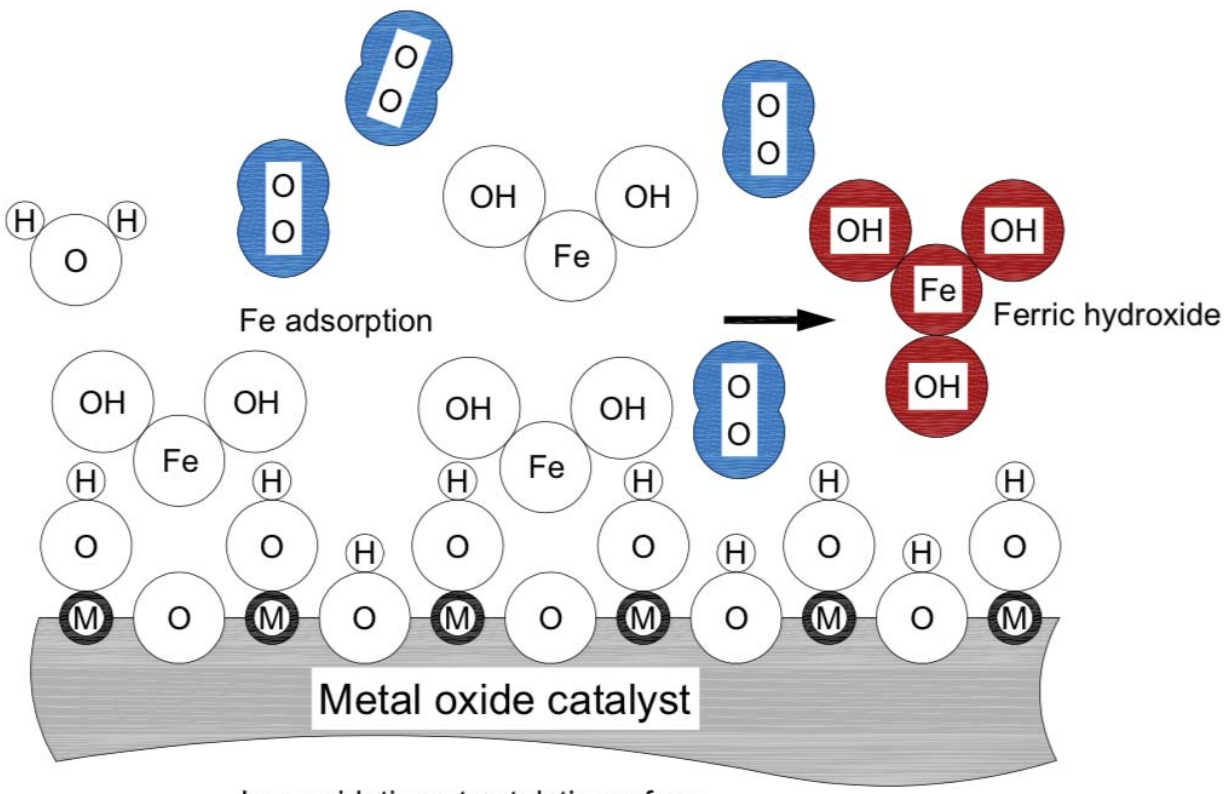
manufacturing process. Once the Mn level in the backwash water reaches values of 0.05 to 0.15 ppm and the free chlorine residual is set the filter is ready to be placed into service.

Media replacement due to the decreased physical filtration properties of the Media due to physical abrasion will occur before complete degradation of the catalytic layer takes place. Under normal operating conditions media life is estimated at 5 – 10 years.

Iron (Fe) precipitation and removal using DMI 65

Iron (Fe) is the fourth most common element found in the earth's crust and exists in a wide range of oxidation states from -2 to +6 although the most common states are ferrous (+2) and ferric (+3).

Ferrous salts are readily soluble. Before the ferrous iron, a dissolved solid commonly found as ferrous bicarbonate, can be removed by filtration it must be oxidized, become ferric hydroxide and in neutral pH waters precipitate out in the media bed. The catalytic surface of DMI-65 contains manganese oxide or exposes manganese and oxygen sites for adsorption of [Fe] ions that are in the water. The reaction of ferrous bicarbonate and NaOCl is almost instantaneous and the ferrous bicarbonate oxidizes (gives up an OH^-) to become the insoluble ferric hydroxide which is then removed through filtration in the catalytic surface of the media. The following redox reaction equation explains the process.



Iron oxidation at catalytic surface.

$$2Fe(HCO_3)_2 + NaOCl + H_2O \rightarrow 2Fe(OH)_2 + 2CO_2 + NaCl$$

In the above figure the catalytic surface is presented in a simplified smooth form. Letter "M" was used to represent a generic metal ion in the lattice of this surface. Letter "O", in the centre of circles, represents an oxygen atom. Various ion size and oxygen molecule (blue) are represented at true relative scale. Except the oxygen molecule, bonded irons are shown as tangent circles. The interpretation for letters and ions in the figure "Ion oxidation at catalytic surface" is:

M: generic metal ion in the catalytic surface lattice (Mn+); n = 1, 2…

O: oxygen atom or ion (O-)

Fe: iron atom or ion (Fe2+, Fe3+)

H: hydrogen atom or ion (H+)

OH: hydroxide, or hydroxyl anion (OH-)

H2O, water molecule shown as tangent circles

Fe (OH)2, ferrous hydroxide is shown as tangent circles

Fe (OH)3, ferric hydroxide, shown as tangent circles, brown colour

O2, oxygen molecule, atoms shown at covalent bonding distance, blue colour

Dissolved ferrous bicarbonate is attracted with the Fe end towards the lattice oxygen of the catalytic material. This brings the Fe in the proximity of covalent bonding with the hydroxide ion of a neighbouring site and the ferrous bicarbonate changes into insoluble ferric hydroxide which precipitates in crystalline form aggregates of size from 3 nanometre and larger. The aggregates coagulate in larger flocks and are retained in the catalytic bed.

As the ferrous bicarbonate is converted into ferric hydroxide, its concentration at the catalytic surface decreases. In the bulk of the water, away from the catalytic surface, the concentration of ferrous bicarbonate is higher resulting in it diffusing towards the lower concentration according to diffusion law. Diffusion flux is linearly dependent with concentration gradient over distance.

Dissolved oxygen contributes to production of hydroxide ions through direct oxidation of hydrogen in combination with Fe splitting the water molecule and by reacting with the hydrogen at the catalytic surface

It is important to note that although a source of oxygen is needed oxidation and precipitation of Fe is driven by the hydroxide ion. Even under relatively acidic conditions hydroxide ions (a very strong anion) are easier available for binding to Fe than oxygen. Thus, Fe is not very difficult to oxidise and precipitate around neutral pH condition. In addition, concentration of hydroxyl ions increases with pH value exponentially and so does the rate of oxidation and precipitation of Fe.

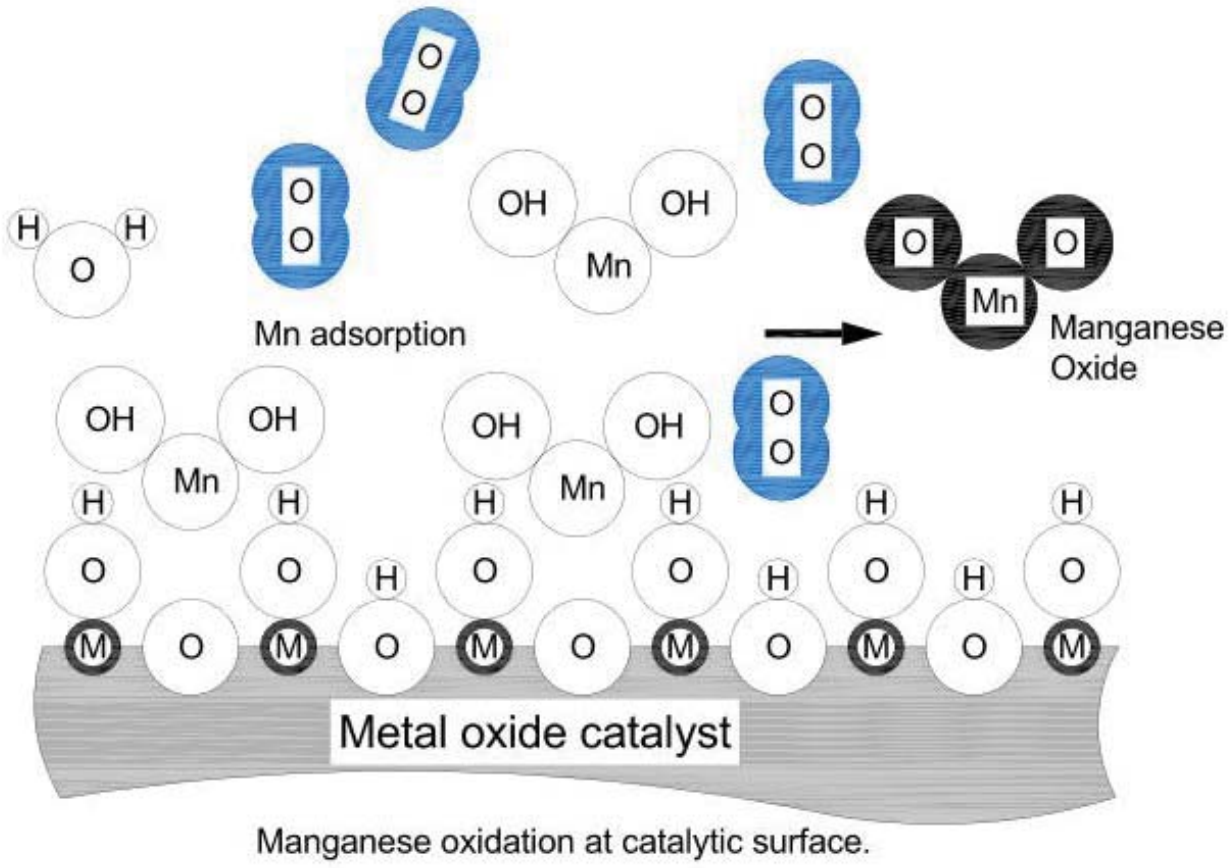
Chlorine (usually in the form of NaOCl) is a source of oxygen more reactive than molecular oxygen. The ideal residual to be maintained downstream of the catalytic filter is 0.2 mg/l (0.1 to 0.3) free chlorine. A higher residual of free chlorine and therefore higher sodium hypochlorite level in the catalytic filter does not always help. It could have an adverse effect due to venting of chlorine and an increase of competing sodium ions, Na+. The catalytic surface has to be clean so that ions in water could come in contact with it so the chlorine injected also prevents bacteria growth and blinding of the catalytic surface with slime.

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Manganese, Mn precipitation and removal using DMI 65

DMI-65 is a catalytic material specifically tailored to the oxidation and removal of manganese. The catalytic surface contains manganese oxide for brining into proximity of covalent bonding manganese and oxygen atoms from water. However, oxidation and removal of manganese (Mn) is vastly different from that of Fe. A major difference is caused by the solubility of manganese oxyhydroxide, $MnO(OH)_2$.

$$Mn(HCO_3)_2 + NaOCl \rightarrow MnO(OH)_2 + NaCl + 2CO_2$$



Manganese oxidation at catalytic surface.

Manganese does not precipitate as oxyhydroxide but as oxide, MnO_2 and higher valency oxides. Presence and concentration of hydroxide anions does not help much in the precipitation and removal of manganese. Manganese hydroxide will be attracted with the manganese end to the oxygen in catalytic lattice surface. An Oxygen molecule has to be available in the proximity for facilitating oxidation through the oxygen from lattice and swapping to the lattice with molecular oxygen. Conditions for this to happen are statistically less probable and reaction is of much slower rate than the oxidation of Fe via hydroxide.

While increases in pH to alkaline levels facilitates oxidation and removal of manganese, under these conditions the oxidised manganese could also dissolve back into the water. Consequently, regardless of the target contaminant to be removed, anoxic conditions have always to be avoided to protect the catalytic layer against leaching into water. When oxidising manganese the recommended pH is close to 8.

Manganese oxide has good autocatalytic effect. When backwashing it is better to stop the process before the water becomes very clear. Manganese oxide residue in the filter bed will enhance manganese oxidation.

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Key DMI-65 operating conditions

Treatment processes have to be conducted in such manner so that the catalytic surface of the material is kept clean and available to ion from water to contact.

Water with a large amount of suspended solids has to be clarified before passing it through the catalytic filter with DMI-65. Acceptable levels of suspended solids depends on their nature. A larger amount of mineral suspended solids than organic suspended solids could be handled.

Bacteria could grow and deposit slime on DMI-65. Thus disinfectant and oxidation conditions have to be maintained.

Water containing clays and large organic molecules may result in deposition of such material on the surface of DMI 65 and blinding of the catalytic surface. Treatment for removal of such contaminant before the catalytic filter is needed.

Polymer flocculent could also stick to the DMI-65 and blind catalytic surface.

Hard, unstable groundwater could cause scale deposition in the catalytic filter and blind the material in a solid mono bloc. In such case the DMI-65 material in the bed is lost and would have to be replaced. Treatment for stabilizing the water to prevent scale formation in the catalytic filter has to be carried out.

Both low acidic pH and anoxic conditions could cause dissolution of manganese from catalytic layer of DMI-65 and loss of its capacity. Excessively high pH means excessive concentration of hydroxyl ions (corrosive to metals) and could also cause dissolution of manganese from the catalytic layer.

Do not use demineralized water, distilled water or water known to be strongly corrosive to metals for initial soaking and activation of DMI-65.

yardney
WATER FILTRATION SYSTEMS

IMA-65 Specialty Media

Iron and Manganese Removal

IMA-65 Specialty Media is a revolutionary silica sand based filtration media designed for the removal of iron and manganese without the use of potassium permanganate. The unique micro porous structure of IMA-65 efficiently removes dissolved iron to as low as 0.005 ppm and manganese to 0.001 ppm. After initial activation, the IMA-65 acts as an oxidation catalyst with immediate oxidation and filtration of the insoluble precipitates. The media has been used extensively in a wide variety of applications in Japan for over 30 years. IMA-65 has been tested and certified by the Water Quality Association in accordance with NSF/ANSI 61.

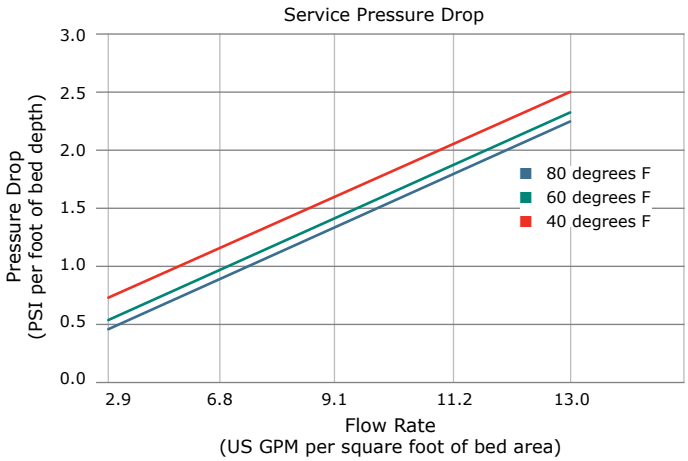


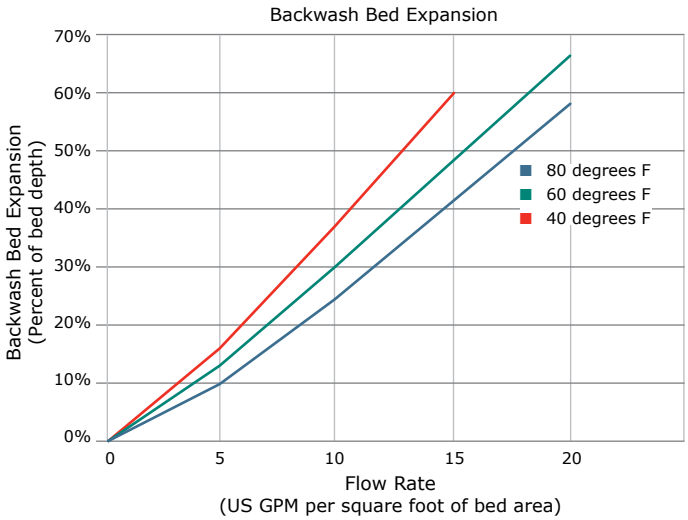
Advantages

- **Eliminates Potassium Permanganate.** Operates with continuous injection of sodium hypochlorite at low residual levels (0.1 to 0.3 ppm).
- **Wide pH range.** Stable and satisfactory performance at pH 5.8 to 8.6.
- **High Flow Rates.** IMA-65 can operate at linear filtration velocities up to twice that of conventional media with a corresponding reduction in capital equipment costs.
- **Higher Operating Temperatures.** Maximum operating temperature of 113 °F (45 °C).
- **Long Life.** IMA-65 is not consumed in the process, providing considerable advantages over other processes or media.
- **Regeneration Not Required.** After initial activation, only sodium hypochlorite feed is required.
- **System Compatibility.** Physical properties are similar to that of competitive media, allowing conversion to IMA-65 without major hardware modifications.
- **Arsenic Removal.** IMA-65 has been shown to be effective in the removal of arsenic associated with iron-containing influent. If necessary, ferric chloride can be introduced to treat waters with low influent iron levels or to enhance removal when treating waters with high levels of arsenic.

SPECIFICATIONS | IMA-65 SPECIALTY MEDIA			
Physical Properties		Operating Conditions	
Color	Brown to black	pH range	5.8 – 8.6
Bulk density	92.0 lbs./cu. ft.	Maximum water temp	113 °F (45 °C)
Specific gravity	2.7	Minimum bed depth	24 inches (600 mm)
Effective size	0.48	Freeboard	40% minimum
Uniformity coefficient	<1.8	Service flow rate	2 – 12 gpm per sq. ft.
Mesh size	20 – 45	Backwash flow rate	10 – 20 gpm per sq. ft.
Annual attrition	1-5%	Backwash expansion	15 – 50%

Engineering (Hydraulic) Data



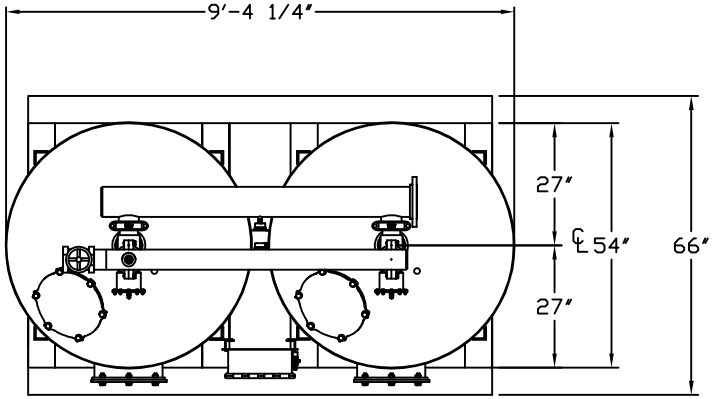


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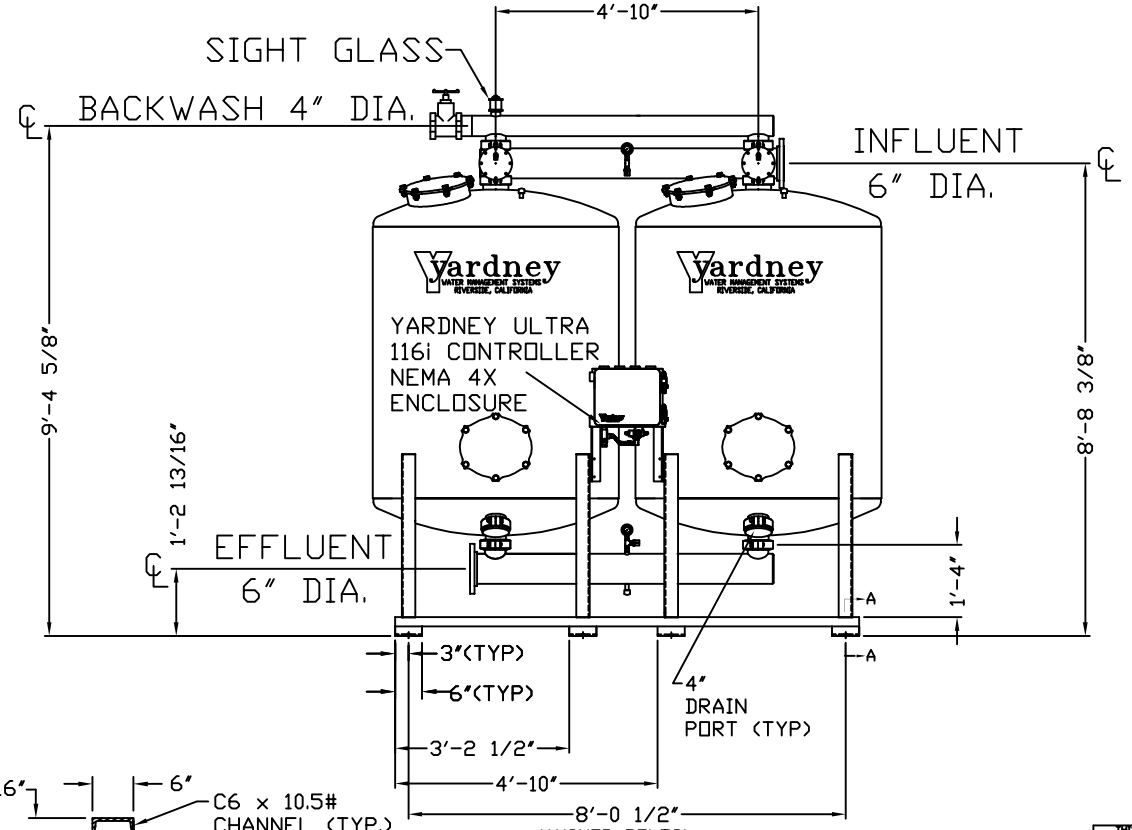
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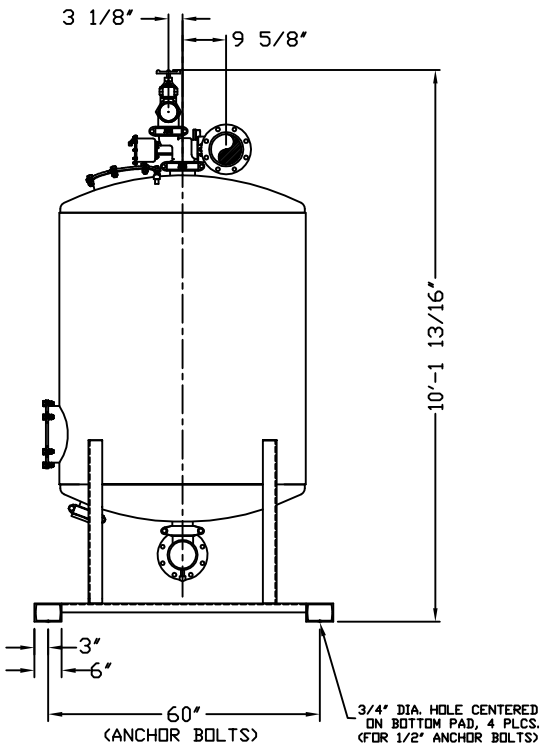
MODEL MM 5460-2A

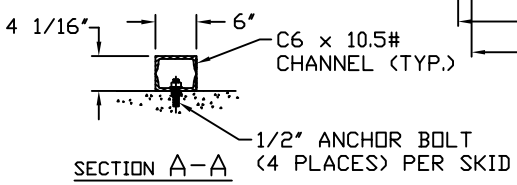


NOTES:

1. FLOW RATE DESIGN: 160-477 GPM; MAX TO 636 GPM
2. MAXIMUM WORKING PRESSURE: 80 PSI.
3. ELECTRICAL REQUIREMENTS:
   CONTROLLER 120V;
   SOLENOIDS 24VAC; FACTORY WIRED
4. AIR SUPPLY REQUIRED: 2 CFM @ 70 PSIG (MIN.).
5. MEDIA REQUIREMENT PER TANK:
   A. 1/2"x3/4" CRUSHED ROCK: 9.5 CU. FT. ,
   B. 1.45mm GARNET: 8.0 CU. FT. ,
   C. 0.35mm GARNET: 24.0 CU. FT. ,
   D. 0.75mm ANTHRACITE: 24.0 CU. FT. ,
6. WEIGHTS: (APPROX.)
   EQUIPMENT: 2,710 LBS (LESS MEDIA)
   MEDIA: 12,746 LBS
   OPERATION: 22,850 LBS







SECTION A-A

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Yardney WATER MANAGEMENT SYSTEMS RIVERSIDE, CALIFORNIA

SYM	REVISIONS	BY	DATE	APP
E	ADDED 4" DRAIN PORT	DTC	11-09	APP
D	ADDED SIGHTGLASS	DTC	8-07	APP
C	REVISED SKID TO STANDARD	DTC	11-06	APP
B	CORRECTED GPM FLOW RATES	DTC	10-05	APP
A	STANDARDIZED NOTES	DTC	9-05	APP

APPROVALS DATE
DRAWN BY K.A.T. 6/17/94
CHECKED BY
APPROVED BY
ARCHITECTURAL SCALE:
USED ON

MODEL MM 5460-2A

SIZE D | DRAWING NO: 9500546002 | REV: E

SCALE: | DWG SIZE SYSTEM\MM | SHEET 1 OF 1

Attachment 3

Design Calculations for Chlorine Injection











Configurable Dosing Tank Station

Storing and dosing liquid chemicals

General

Dosing is precision work and one of the main tasks in chemical and process engineering as well as water treatment. Thus dosing requires precise adjustment of the pump and its accessories to the process parameters of the respective application. DIGITAL DOSING™ pumps are delivering an optimal performance in these application fields.

As they are easy to install, DTS dosing tank stations are the first choice in the matter of economic efficiency when adding liquids such as coagulants, disinfectants or neutralising agents to a process in a precise and controlled way.

DTS dosing tank stations are intended for storing and dosing liquids. Many different configurations can be selected flexibly to fulfil various dosing tasks. Due to the use of high-quality materials, DTS dosing tank stations can be employed for diverse dosing liquids. The selection of materials can be adapted via the configuration.

Components and features

- Chemically resistant tank made of UV-stabilised, semitransparent or black polyethylene, in 6 sizes from 60 to 1000 litres, with embossed litre scale and PE screw cover
- PE collecting tray
- Handheld mixer or electric stirrer (230 V, 50 Hz) with level switch for dry-running protection
- Rigid suction lance or foot valve made of PE, with 2-step level switch for dry-running protection, suction line to the dosing pump
- PVC or PP injection unit with G 1/2 process connection
- PE or PVC discharge line (10 m)
- Drain valve
- Filling armature with ball valve (for all tank sizes) or dissolving hopper (from 200 l)
- Multi-function valve
- Prepared for the installation of a dosing pump DDA, DDC, DDE, DMX 221 or DDI 60-10 including necessary assembly material (connectors, click-plate and screws depending on pump type)

Note:
Dosing pumps are not comprised in a standard delivery. They have to be ordered separately.

Applications

- Dosing of biocides and inhibitors into cooling water
- Dosing of lyes and acids for pH regulation
- Dosing of coagulants, such as ferric(II)chloride or ferric(III) chloride, for waste water treatment
- Dosing of hypochlorite
- Dosing of cleaning agents and disinfectants (CIP, cleaning machines)

Type key

Example	DTS	100	T	1	0	3	4	RE	E	4	A	1	H

Product type
DTS Dosing Tank Station

Tank size
60 60 litres
100 100 litres
200 200 litres
300 300 litres
500 500 litres
1000 1000 litres

Tank colour
T Transparent
B Black

Collecting tray
0 Without
1 Collecting tray

Screw cover
0 Black screw cover without lock

Mixer or stirrer
0 Without
1 Handheld mixer, PE
2 Electric stirrer, stainless steel
3 Electric stirrer, PP, with sealing flange

Preparation for dosing pump
0 Without
1 Preparation for DMX 221 up to 50 l/h
3 Preparation for DDI 60-10
4 Preparation for SMART Digital DDA, DDC, DDE

Suction line
WO Without
RV Rigid suction lance PE/V
RE Rigid suction lance PE/E
RT Rigid suction lance PE/T
FV Foot valve with flexible suction line PE/V
FE Foot valve with flexible suction line PE/E
FT Foot valve with flexible suction line PE/T

Discharge line
A Without
B 10 m of PE hose 4/6 mm (up to 7.5 l/h)
C 10 m of braided PVC hose 6/12 mm (up to 30 l/h)
D 10 m of PE hose 9/12 mm (up to 60 l/h)
E 10 m of PE hose 6/9 mm (up to 30 l/h)

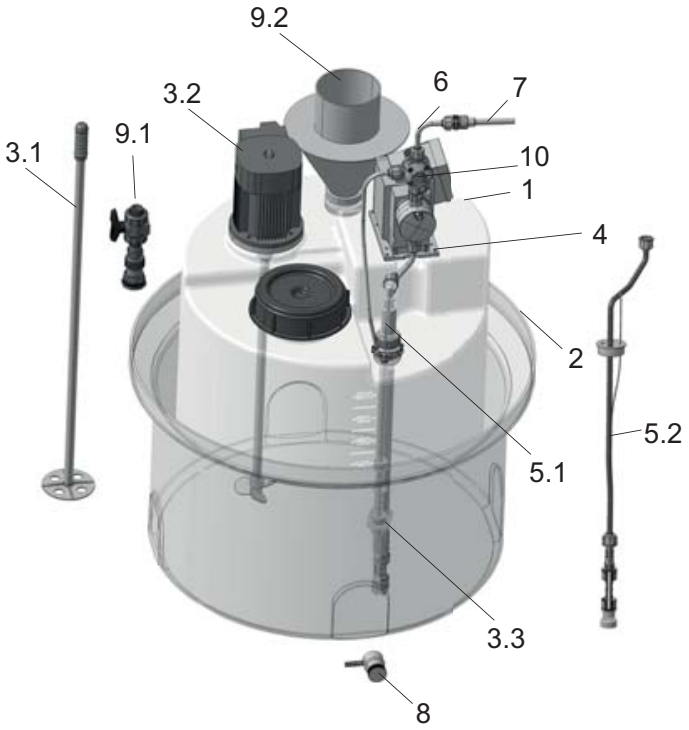
Injection unit (G 1/2 process connection)
0 Without
1 Injection unit PVC/V/C
2 Injection unit PP/V/C
3 Injection unit PVC/E/C
4 Injection unit PP/E/C
5 Injection unit PVC/T/C

Drain valve (not with collecting tray)
A Without
B Drain valve PVC/E

Filling device
0 Without
1 Filling armature PVC/E with ball valve
2 Dissolving hopper

Multi-function valve
A Without
G Multi-function valve PV/V
H Multi-function valve PV/E
I Multi-function valve PV/T

Components overview



1 Tank
2 Collecting tray
3.1 Handheld mixer
3.2 Electric stirrer
3.3 Level switch for electric stirrer
4 Installation material
5.1 Rigid suction lance with connection to the pump
5.2 Foot valve with flexible suction line
6 Discharge line
7 Injection unit
8 Drain valve
9.1 Filling armature with ball valve
9.2 Dissolving hopper
10 Multi-function valve

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GRUNDFOS



FROM THE INVENTOR OF DIGITAL DOSING™

SMART Digital
DDA – DDC – DDE
Modular. Simple. Intelligent.

be
think
innovate

GRUNDFOS

SMART Digital

Now it’s time to break the barriers of conventional dosing

A new era of dosing technology

Chemistry in water treatment, water and wastewater recycling and disinfection has experienced a huge development during the last years, and this poses a challenge for today’s dosing technology. More and more complex applications require intelligent dosing pumps with new drives or new control and adjustment mechanisms to simplify the operators’ job.

SMART Digital dosing pumps meet these challenges. They offer state-of-the-art drive technology, new dimensions of user-comfort and intelligent flow control. These features ensure extremely reliable, cost-effective and high-precision processes at an optimum price-performance ratio.

Reliable processes ✓
Unique user-friendliness ✓
Simple Plug’n’Play ✓

Designed to save costs and to protect the environment

In general, the investment for a dosing pump installation is low compared to its life cycle costs. Low operation costs and longer maintenance intervals combined with an extremely high dosing accuracy make SMART Digital the perfect partner for:

- Saving chemicals with high dosing accuracy and FlowControll
- Saving energy with latest drive technology and improved electronics
- Saving maintenance costs thanks to the universal chemical resistance of the full-PTFE diaphragm and Digital DosingTM
- Saving natural resources with new composite materials and sustainable production processes

Optimal cost control ✓
Environment-friendly ✓

Processes

SMART Digital can be used in a wide range of processes...

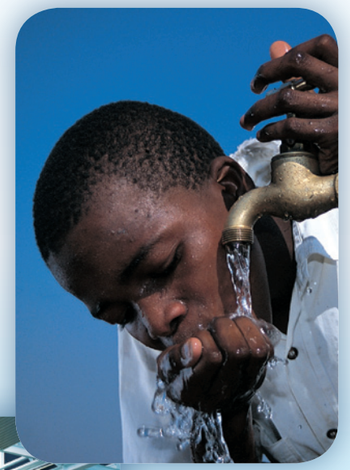
- Disinfection
- pH-adjustment
- Chemical dosing
- Cleaning-in-place
- Biocides
- Coagulation
- Precipitation/Flocculation
- Filtration
- Reverse osmosis

Application areas

... within a vast field of application areas:

- Ground water
- Surface water
- Drinking water
- Process water
- Recreational water
- Recycle & reuse

















SMART Digital
The perfect system

Simplicity

Precise and easy setup. Intuitive user interface. Simple handling and perfect overview and control even from the distance – it's always easy to handle our SMART Digital!

- Intuitive and self-explanatory menu
- Click wheel (turn-and-push knob)
- Big graphical LCD with four colour "traffic light" concept
- More than 25 languages



Intelligent and intuitive handling saves time and cost – ensuring a seamless integration in all workflows ✓

Modularity

Requirements change, demands grow, and capacities vary – **SMART Digital fits into every environment and situation!**

- Turn-down ratio up to 1:3000 with a dosing spectrum of 0.0025 – 30 l per hour
- Click-stop mounting plate for quick and variable installation
- Control cube can be positioned in three ways (left, right, front)
- Using switch-mode power supply, the SMART Digital model DDA is independent from regional voltages

Highest performance in all operating conditions and a flexible concept you can always rely on ✓





MODULARITY
SIMPLICITY
FLOW INTELLIGENCE

SMART Digital
High performance is our standard

Flow Intelligence

Full control under all conditions. Highest process reliability – at any time with SMART Digital!

- FlowControl with selective fault diagnosis
- Pressure monitoring
- Flow measurement
- AutoFlowAdapt

Groundbreaking flow intelligence guarantees highest process reliability ✓

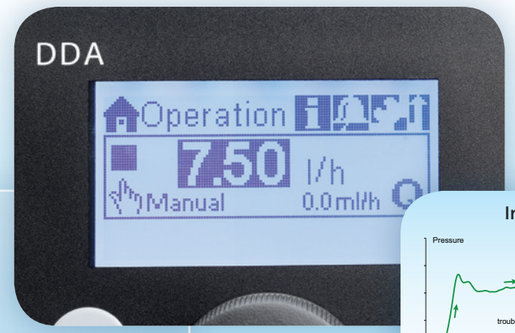
Digital Dosing™

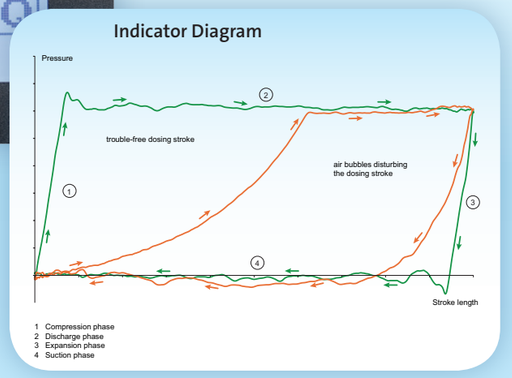
The SMART Digital generation DDA, DDC and DDE with powerful variable-speed stepper motors brings state-of-the-art technology to perfection.

Combined expert knowledge and the new patented solutions set future standards. Traditional technologies such as stroke length/stroke frequency adjustment with synchronous motor or solenoid drive become a thing of the past.

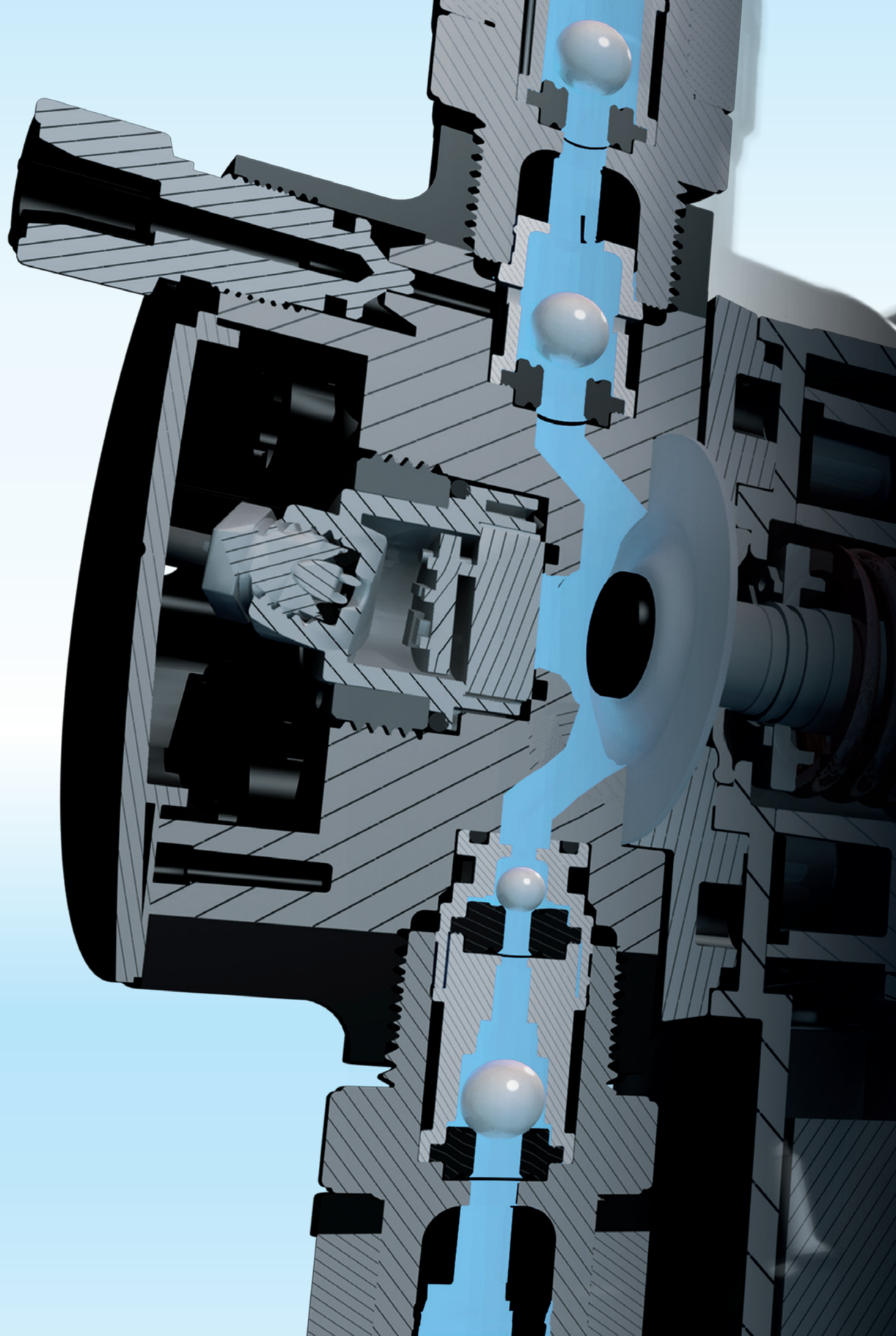
- Powerful variable-speed stepper motor
- Internal stroke speed control
- Turn-down ratio up to 1:3000
- Always full stroke length – even at small flow rates
- Smooth, continuous dosing
- Optimal for degassing liquids
- SlowMode function for high-viscosity liquids

New patented solutions set future standards ✓





MODULARITY
SIMPLICITY
FLOW INTELLIGENCE



SMART Digital DDA, DDC, DDE

Perfect solutions for vast market segments

DDA

This high-end DDA pump range is designed for complex and demanding applications. Whether degassing liquids, flow rates down to 2.5 ml/h or advanced process control are required, this pump offers the perfect solution:

- Max. 30 l/h and 16 bar
- Turn-down ratio 1:3000 (7.5-16) or 1:1000
- FlowControl with selective fault diagnosis
- Integrated flow measurement
- AutoFlowAdapt
- Auto deaeration also during pump standby
- Batch modes (timer- or pulse-based)
- Optional E-box for Profibus DP integration

Please see next page for further details.

DDC

The DDC pump range is the optimum solution for common applications. The easy-to-use interface with the click wheel makes the setup and operation as easy as your car radio system:

- Max. 15 l/h and 10 bar
- Turn-down ratio 1:1000
- Graphical LC display backlit in different colours
- More than 25 languages
- Standard operation modes, e.g. pulse and analog
- SlowMode for high viscosity liquids
- 2 integrated relay outputs

Please see next page for further details.

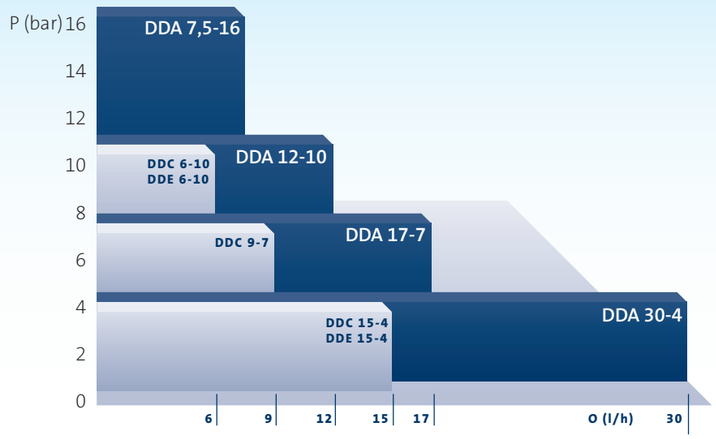
DDE

The DDE offers Digital Dosing with basic functions even for a low budget for easier applications. Now just 2 pump models cover a range where 12 or more were needed in the past:

- Max. 15 l/h and 10 bar
- Turn-down ratio 1:1000
- Smooth continuous dosing
- Always 100 % suction stroke
- Capacity setting 0.1-100 %
- Simple pulse operation mode
- External stop and empty tank alarm

Please see next page for further details.

Performance range



Overview of functions

Control variant:	DDA FCM	DDA FC	DDA AR	DDC AR	DDC A	DDE PR	DDE P	DDE B
General								
Digital Dosing: Internal stroke speed and frequency control	●	●	●	●	●	●	●	●
Mounting plate (basic / wall mounting)	●	●	●	●	●	●	●	●
Supply voltage 100-240 V, 50-60 Hz	●	●	●	●	●	●	●	●
Enclosure class IP 65, Nema 4X	●	●	●	●	●	●	●	●
Control panel								
Control cube mountable in three positions: front, left, right	●	●	●	●	●			
Control panel position: front-fitted						●	●	●
Transparent protective cover for control elements	●	●	●	●	●			
Capacity setting in millilitres, litres or US-gallons	●	●	●	●	●			
Graphical display with background light in four colours for status indication: white, green, yellow, red	●	●	●	●	●			
Plain-text menu in different languages	●	●	●	●	●			
Turn-and-push knob (click wheel) for easy navigation	●	●	●	●	●			
Capacity adjustment knob (0.1 - 100 %)						●	●	●
Start / Stop key	●	●	●	●	●			
100 % key (deaeration)	●	●	●	●	●	●	●	
Operation mode switch (manual / pulse)						●	●	
Operation modes								
Manual speed control	●	●	●	●	●	●	●	●
Pulse control in ml/pulse	●	●	●	●	●			
Pulse control (1:n)						●	●	
Analog control 0/4-20 mA	●	●	●	●				
Batch control (pulse-based)	●	●	●					
Dosing timer cycle	●	●	●					
Dosing timer week	●	●	●					
Fieldbus control	●	●	●					
Functions								
Auto deaeration also during pump standby	●	●	●					
FlowControl system with selective fault diagnosis	●	●						
Pressure monitoring (min / max)	●	●						
Flow measurement	●							
AutoFlowAdapt	●							
SlowMode (anti-cavitation)	●	●	●	●	●			
Calibration mode	●	●	●	●	●			
Scaling of analog input	●	●	●					
Service information display	●	●	●	●	●			
Relay setting: alarm, warning, stroke signal, pump dosing	●	●	●	●		●		
Relay setting (additionally): timer cycle, timer week	●	●	●					
Inputs/outputs								
Input for external stop	●	●	●	●	●	●	●	
Input for pulse control	●	●	●	●	●	●	●	
Input for analog 0/4-20 mA control	●	●	●	●				
Input for low-level signal	●	●	●	●	●	●	●	
Input for empty tank signal	●	●	●	●	●	●	●	
Output relay (2 relays)	●	●	●	●		●		
Output analog 0/4-20 mA	●	●	●					
Input / Output for GeniBus	●	●	●					
Input / Output for E-box (Profibus DP or additional alarm relays)	●	●	●					

SMART Digital
Accessories and Service

E-Box Profibus DP

With the additional E-Box module, the pump can be easily integrated in a Profibus DP network. This enables remote monitoring and setting via the fieldbus system. Just click the E-box in between the DDA pump and the mounting plate. With the plug and play solution, DDA pumps can also be easily retrofitted.

General pump accessories

A wide range of accessories is available for the SMART DIGITAL pump range, among others:

- Installation kit including foot valve, injection unit and hose
- Multi-function valve (PVDF)
- Rigid suction lance (PE, PVDF) with low level and empty tank signal
- Foot valve for flexible suction line (PE, PVDF, stainless steel)
- Injection unit (PP, PVC, PVDF, stainless steel) in different designs
- Hose in PVC, PE, ETFE in different sizes
- Signal cables for all inputs and outputs
- Dosing tanks in different sizes

All components have been especially designed for and adjusted to the new SMART Digital pumps.

Only original SMART accessories can guarantee optimum dosing results.

Service

The following service kits are obtainable (for PP, PVC, PVDF and stainless steel):

- Complete dosing head kit
- Valves and diaphragm kit
- Valve kit
- Diaphragm kit

Please see service catalogue for further service kits and details.

SMART Digital pumps have outstandingly long maintenance intervals.

Wear and tear parts which have been in contact with the media only have to be replaced after 8000 operating hours (or after two years at the latest).

Shorter intervals might be necessary for highly-abrasive media.





ALL THE INFORMATION YOU NEED IS ONLINE

Grundfos WebCAPS is an online product selection tool, but it offers much more than that. The site compiles all the product-related information you could ever need.

What you can find in WebCAPS

Catalogue – includes all products available in your region, complete with technical information, drawings, descriptions, performance curves, etc.

Literature – find everything from data booklets through installation & operating instructions to product brochures.

Service – the place to find service instructions (including video tutorials), service parts lists, assembly drawings, etc.

Sizing – enter your system requirements for instant recommendations. Includes Life Cycle Cost calculations.

Replacement – enter the make and model of your old pump for an instant replacement recommendation.

CAD drawings – download DXF and DWG files as required.

For offline use, WinCAPS is a CD-ROM version of WebCAPS. Contact Grundfos to order.

GRUNDFOS **WEBCAPS** GRUNDFOS **WINCAPS**



Our new SMART Digital pump family can be flexibly installed in various positions due to its modular construction. With its user-friendly display and menu-structure, the pump is easy to operate. The integrated flow intelligence assures safe and continuous processes, making it an absolutely reliable pump.

On top of that, you save TIME and MONEY when opting for SMART Digital.

You save TIME:

- Easy commissioning and service due to the click-stop mounting plate
- Self-explanatory user-interface, comparable to a car-radio system
- Plain-text display for failure indication: no need
- for time-consuming fault analysis
- Quick commissioning without reading the I/O
- Easy process control thanks to the intelligent flow management functions

You save MONEY:

- No additional installation parts needed due to the click-stop mounting plate
- High accuracy saves chemicals
- The required target flow is always achieved due to the AutoFlowAdapt, FlowControl and flow measurement functions; additional monitoring and control devices are made redundant
- Intelligent flow management prevents expensive process breakdowns

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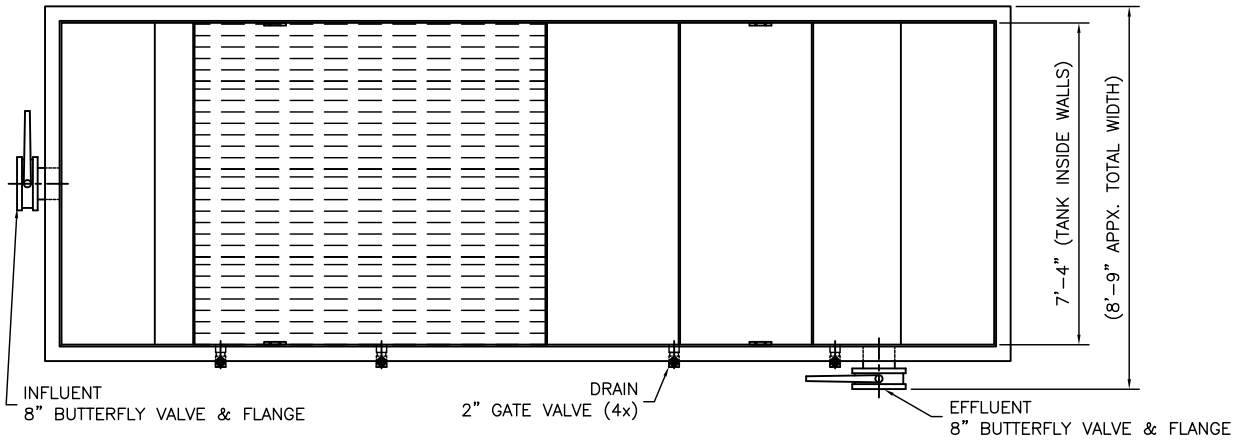
GRUNDFOS WATER TREATMENT GMBH
Reetzstr. 85
D-76327 Pfinztal
Tel: +49 7240 61 0
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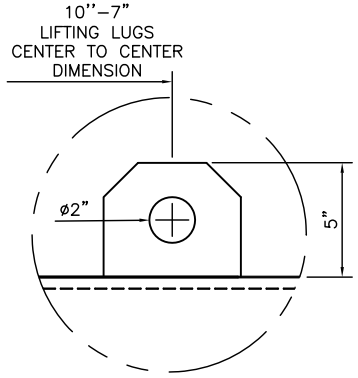
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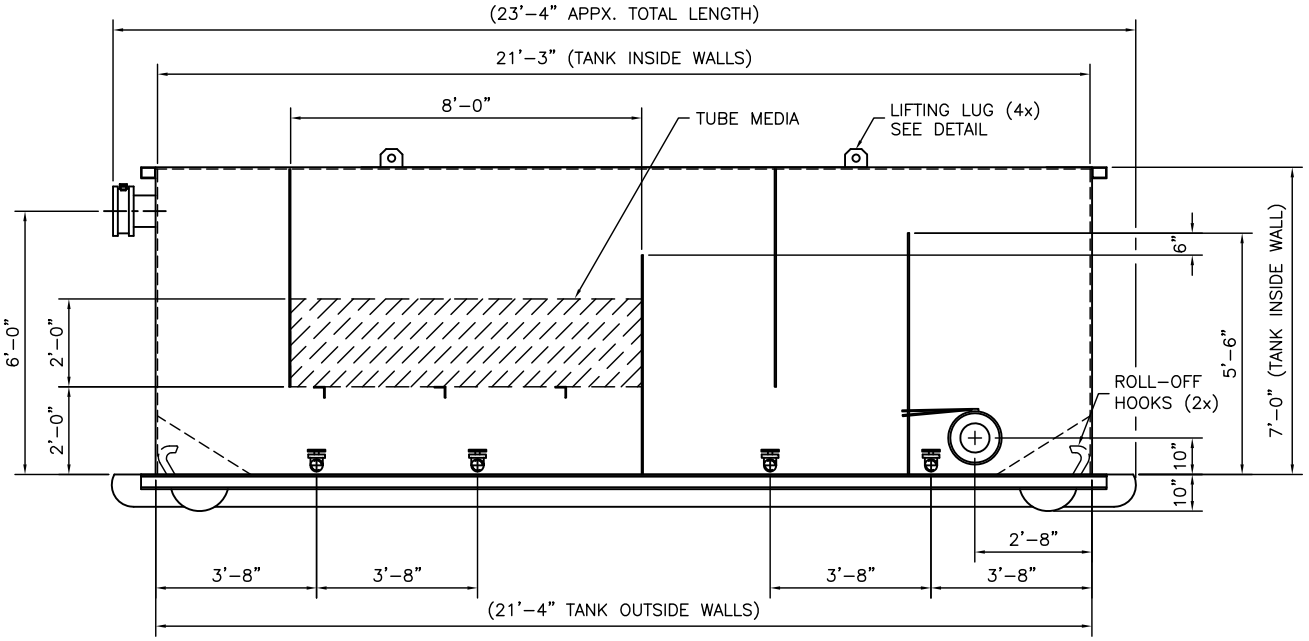
Attachment 4

Clarifier Equipment Specification





LIFTING LUG
DETAIL (TYP.)



40 YARD ROLL-OFF SETTLING TANK SPECIFICATIONS

– NOMINAL VOLUME:	8,000 GALLONS
– OPERATING VOLUME:	6,250 GALLONS
– DESIGN FLOW RATE:	300 GPM
– TANK CONSTRUCTION:	A-36 CARBON STEEL
– INLET CONNECTION:	8" FLANGE
– OUTLET CONNECTION:	8" FLANGE
– DRAINS (4x):	2" GATE VALVES
– APPX. TANK WEIGHT (EMPTY):	20,000 Lbs.
– APPX. TANK WEIGHT (OPERATING):	75,000 Lbs.
– TUBE SETTLERS:	ACCU-PAC IFR-6024

NO.	REVISIONS	DATE
A	TYPICAL	02/24/09

40 YARD ROLL-OFF SETTLING/CLARIFIER STANDARD EQUIPMENT SPECIFICATION

SCALE: NTS	APPROVED BY: JB	DRAWN BY: AAV	
DATE: 02/24/09			

GROUND/WATER TREATMENT & TECHNOLOGY
P.O. BOX 1174
DENVILLE, NJ 07834

THIS DRAWING IS THE PROPERTY OF
GROUND/WATER TREATMENT & TECHNOLOGY, INC

DWG SIZE: A	SHEET: 1 OF 1	DRAWING NUMBER: ST-0067-SPC	A

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Attachment 5

Hydraulic Analysis

Sand Filter Addition – Differential Pressure Model Outputs

The following is a presentation of a differential pressure model of the groundwater treatment system (GWTS) located at Kirtland Air Force Base, New Mexico. The model assumes a flow rate on 400 gallons per minute (gpm) on each individual treatment train. Each individual treatment train are modelled individually and are assumed to be of the same piping make up (lengths of pipe, number of valves, etc.). Table 1 shows the model outputs for an individual treatment train's head loss due to piping and equipment. Equipment refers to the flow meter, sand filter(s), bag filter(s), and granular activated carbon (GAC) vessels. The following is a list of important assumptions:

1. The model assumes that 200 gpm will pass through the parallel sand filters and bag filters uniformly.
2. All piping is assumed to be carrying 400 gpm and the separated sections of 200 gpm pipe are modeled as containing 400 gpm flow (yielding a more conservative estimate) except for the piping in the pump skid branch. The pump skid branch (branch 2) was modeled assuming a flowrate of 200 gpm as this branch does not contain large sections of 400 gpm piping but does contain reducers and enlargers that are largely influenced by flowrate. See Table 1 for the corresponding difference between the 400 and 200 gpm models.

Table 1. Head Loss Totals

	Piping Head Loss at 400 gpm from Influent to Effluent Tanks and 200 gpm from Influent to Clarifier[a] (psi)	Influent Skid Head Loss at 200 gpm from Influent to Effluent Tanks and 100 gpm from Influent to Clarifier[b] (psi)	Equipment Head Loss[c] (psi)	Total Head Loss[d] (psi)	Total Head Loss (ft)
Influent Tank to Effluent Tank	13.5	1.78	37	62.74	144.71
Influent Tank to Clarifier	4.7	0.45	20	30.18	69.61

[a] Piping head loss differs from the model calculations in that the model includes a 3" to 2" nominal reducer (accounting for 10.495 psid at 400 gpm) in branch 2 which is actually incorporated in the pump. Thus the reducer is included in the pump efficiency and has been removed from the piping head loss pressure shown above.
[b] Along the influent skid there is a section where the flow diverges into two separate flows of 200 gpm when the train is operating at a 400 gpm total and 100gpm at a 200 gpm total. The difference in headloss between the 400/200 and 200/100 gpm models are provided above and used to calculate total head loss.
[c] Assumes differential pressure at 400 gpm for the Sand Filter is 10 psi, Bag filter is 15 psi, flow meter is 2 psi, and GAC vessels are 10 psi (totaled for both vessels). When operating in sand filter backwash at 200 gpm, the sand filters account for a total of 20 psi (10 psi each).
[d] Total head loss includes additional 20% safety factor. " = inch(es)
% = percent ft = foot/feet
gpm = gallons per minute
psi = pounds per square inch

Attachment 6

Pump Selection

Model: 3196	Size: 2X3-6	Group: 3196STI	60Hz	RPM: 3500	Stages: 1

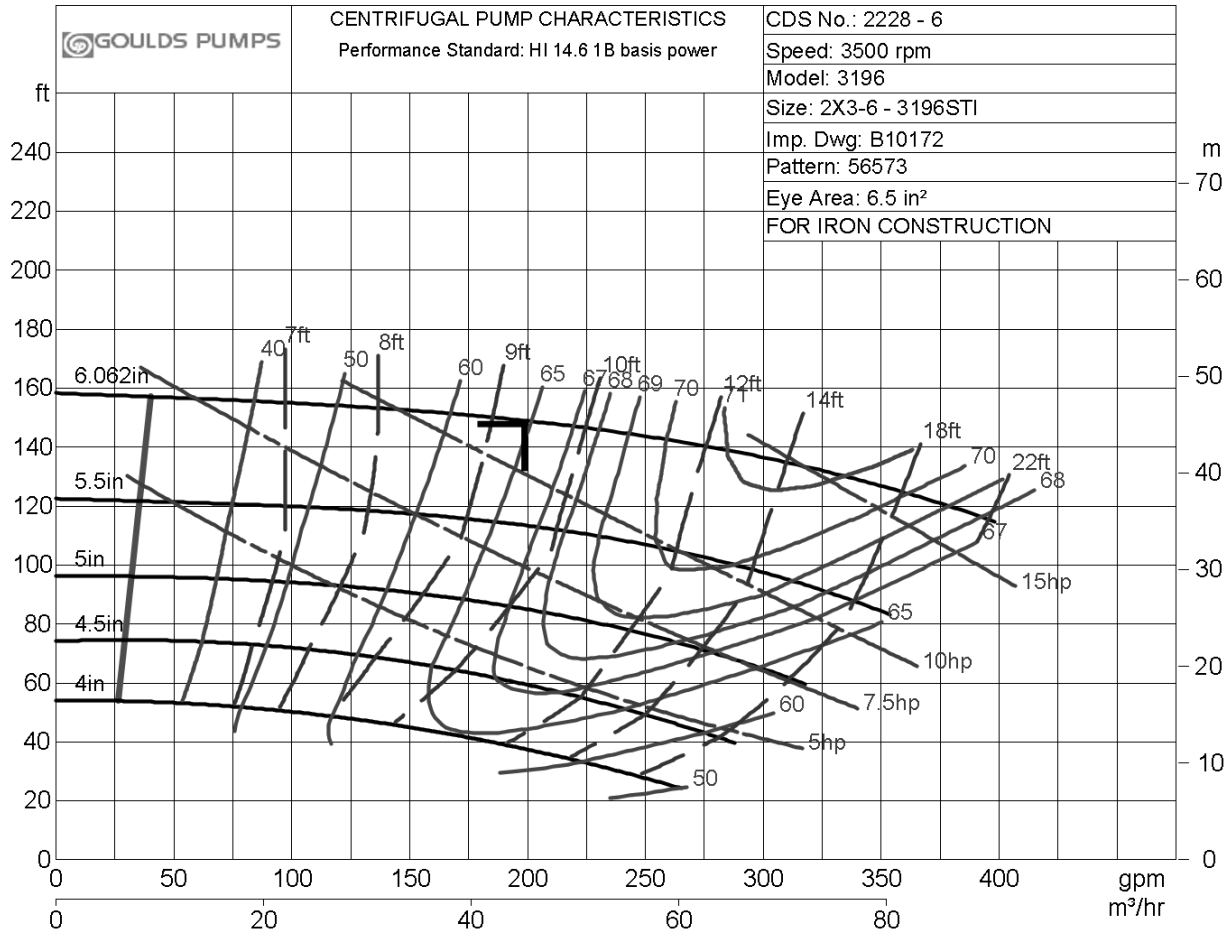
Job/Inq.No. :
Purchaser : Kirtland AFB BFF
End User:
Issued by :
Item/Equip.No. : ITEM 001
Quotation No. : FEED PUMPS W/SAND FILTER
Date : 10/29/2016
Service :
Order No. :
Rev. : 0

Operating Conditions

Liquid:	Water	Published Efficiency:	64.5 %	Suction Specific Speed:	8,473 gpm(US) ft
Temp.:	70.0 deg F	Rated Pump Efficiency:	64.5 %	Min. Hydraulic Flow:	40.0 gpm
S.G./Visc.:	1.000/1.000 cp	Rated Total Power:	11.7 hp	Min. Thermal Flow:	N/A
Flow:	200.0 gpm	Non-Overloading Power:	17.0 hp		
TDH:	135.0 ft	Imp. Dia. First 1 Stg(s):	6.0620 in		
NPSHa:		NPSHr:	9.5 ft		
Solid size:		Shut off Head:	158.3 ft		
% Susp. Solids (by wtg):		Vapor Press:		Max. Solids Size:	0.3750 in

Pump Performance

Notes: 1.The Mechanical seal increased drag effect on power and efficiency is not included, unless the correction is shown in the appropriate field above. 2. Magnetic drive eddy current and viscous effect on power and efficiency is not included. 3. Elevated temperature effects on performance are not included. 4. Non Overloading power does not reflect v-belt/gear losses.



ITT

Model: 3196	Size: 2X3-6	Group: 3196STI	60Hz	RPM: 3500	Stages: 1

Job/Inq.No. :
Purchaser : Kirtland AFB BFF
End User : Issued by : Rev. : 0
Item/Equip.No. : ITEM 001 Quotation No. : FEED PUMPS W/SAND FILTER Date : 10/29/2016
Service :
Order No. :

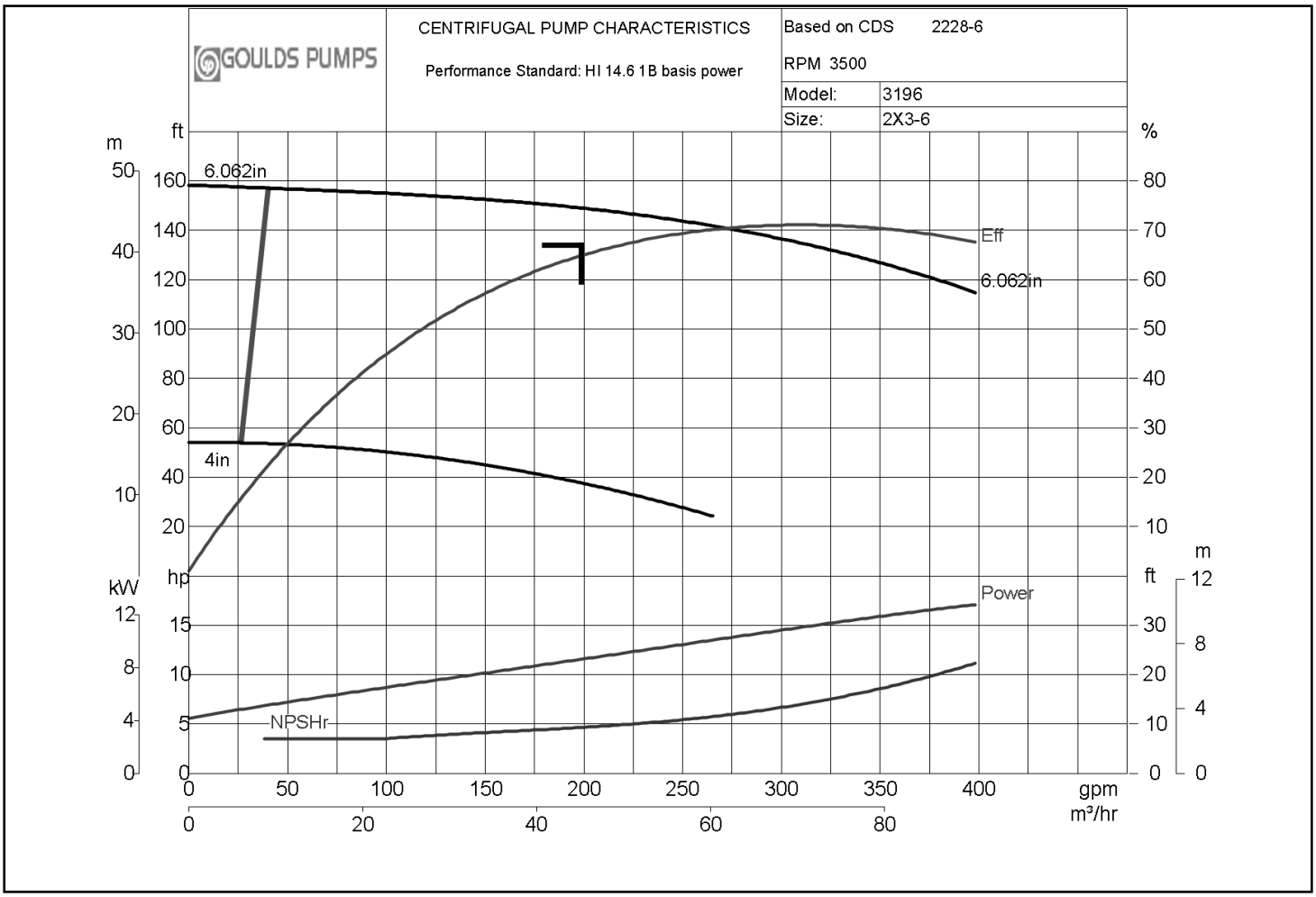
Operating Conditions

Liquid:	Water	Published Efficiency:	64.5 %	Suction Specific Speed:	8,473 gpm(US) ft
Temp.:	70.0 deg F	Rated Pump Efficiency:	64.5 %	Min. Hydraulic Flow:	40.0 gpm
S.G./Visc.:	1.000/1.000 cp	Rated Total Power:	11.7 hp	Min. Thermal Flow:	N/A
Flow:	200.0 gpm	Non-Overloading Power:	17.0 hp		
TDH:	135.0 ft	Imp. Dia. First 1 Stg(s):	6.0620 in		
NPSHa:		NPSHr:	9.5 ft	Shut off Head:	158.3 ft
Solid size:		Max. Solids Size:	0.3750 in	% Susp. Solids (by wtg):	

Pump Performance

Vapor Press:

Notes: 1. The Mechanical seal increased drag effect on power and efficiency is not included, unless the correction is shown in the appropriate field above. 2. Magnetic drive eddy current on power and efficiency is not included. 3. Elevated temperature effects on performance are not included. 4. Non Overloading power does not reflect v-belt/gear losses.



Viscosity corrections have been performed in accordance with HI 9.6.7-2015

Model: 3196	Size: 2X3-6	Group: 3196STI	60Hz	RPM Variable	Stages: 1

Job/Inq.No. :
Purchaser : Kirtland AFB BFF
End User :
Item/Equip.No. : ITEM 001
Service :
Order No. :

Issued by :
Quotation No. : FEED PUMPS W/SAND FILTER
Date : 10/29/2016
Rev. : 0

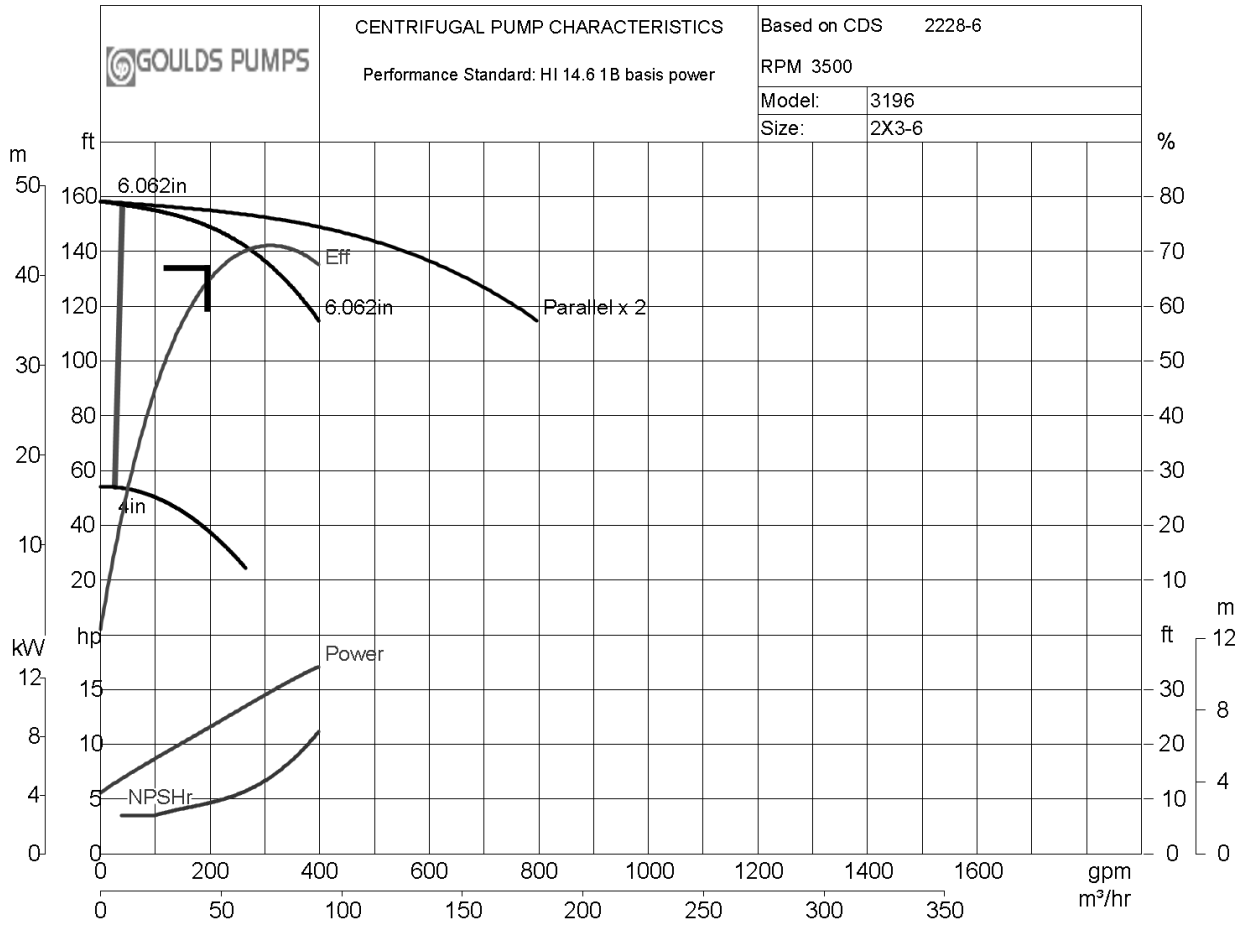
Operating Conditions

Liquid:	Water
Temp.:	70.0 deg F
S.G./Visc.:	1.000/1.000 cp
Flow:	200.0 gpm
TDH:	135.0 ft
NPSHa:	
Solid size:	
% Susp. Solids (by wtg):	
Max. Solids Size:	0.3750 in

Pump Performance @ 3500 RPM

Published Efficiency:	64.5 %	Suction Specific Speed:	8,473 gpm(US) ft
Rated Pump Efficiency:	64.5 %	Min. Hydraulic Flow:	40.0 gpm
Rated Total Power:	11.7 hp	Min. Thermal Flow:	N/A
Non-Overloading Power:	17.0 hp		
Imp. Dia. First 1 Stg(s):	6.0620 in		
NPSHr:	9.5 ft		
Shut off Head:	158.3 ft		
Vapor Press:			

Notes: 1. The Mechanical seal increased drag effect on power and efficiency is not included, unless the correction is shown in the appropriate field above. 2. Magnetic drive eddy current on power and efficiency is not included. 3. Elevated temperature effects on performance are not included. 4. Non Overloading power does not reflect v-belt/gear losses.



ITT

Model: 3196	Size: 2X3-6	Group: 3196STI	60Hz	RPM Variable	Stages: 1

Job/Inq.No. :
Purchaser : Kirtland AFB BFF
End User :
Item/Equip.No. : ITEM 001
Service :
Order No. :

Issued by :
Quotation No. : FEED PUMPS W/SAND FILTER
Date : 10/29/2016
Rev. : 0

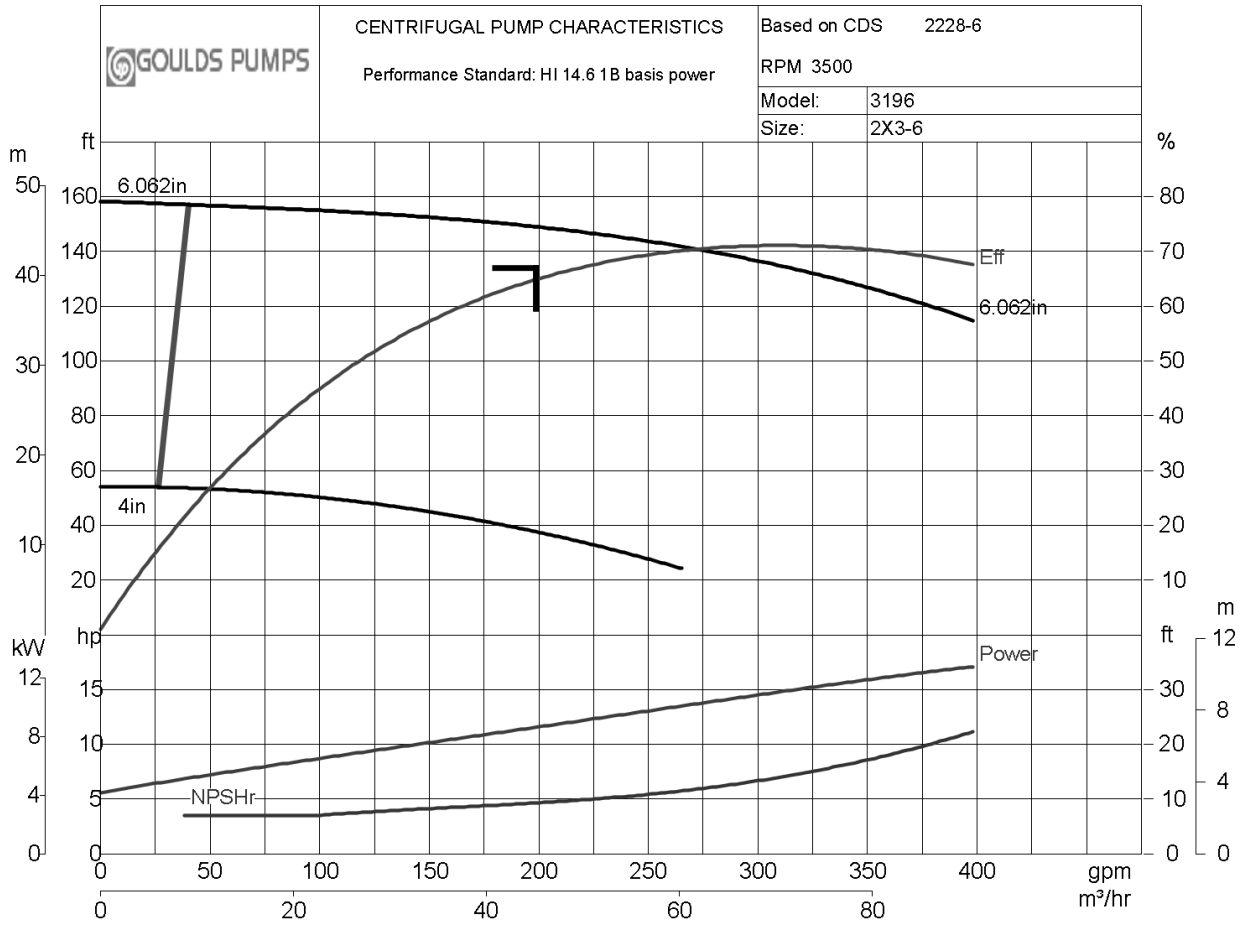
Operating Conditions

Liquid:	Water
Temp.:	70.0 deg F
S.G./Visc.:	1.000/1.000 cp
Flow:	200.0 gpm
TDH:	135.0 ft
NPSHa:	
Solid size:	
% Susp. Solids (by wtg):	
Max. Solids Size:	0.3750 in

Pump Performance @ 3500 RPM

Published Efficiency:	64.5 %	Suction Specific Speed:	8,473 gpm(US) ft
Rated Pump Efficiency:	64.5 %	Min. Hydraulic Flow:	40.0 gpm
Rated Total Power:	11.7 hp	Min. Thermal Flow:	N/A
Non-Overloading Power:	17.0 hp		
Imp. Dia. First 1 Stg(s):	6.0620 in		
NPSHr:	9.5 ft		
Shut off Head:	158.3 ft		
Vapor Press:			

Notes: 1. The Mechanical seal increased drag effect on power and efficiency is not included, unless the correction is shown in the appropriate field above. 2. Magnetic drive eddy current and viscous effect on power and efficiency is not included. 3. Elevated temperature effects on performance are not included. 4. Non Overloading power does not reflect v-belt/gear losses.



ITT

ATTACHMENT 2

TIGG MAXIMUM LOADING CONCENTRATIONS
AT 400 GALLONS PER MINUTE

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From: John Mickler
To: Jim Kearns; Jercinovic, Devon
Cc: Nicholas Kelly
Subject: RE: Kirtland BFF - GAC Lifetime Analysis w/ Update Concentrations
Date: Friday, April 14, 2017 6:06:26 AM

Devon, EA is granted permission to provide this information to NMED in support of the TIGG equipment and carbons for this application.

Let us know if you need any other help.

John M. Mickler P.E., PMP
Vice President and General Manager

TIGG, LLC
1 Willow Avenue
Oakdale, PA 15071
Office: 724-703-3020 x106
Mobile: 412-370-5833
jmickler@tigg.com



1 Willow Avenue
Oakdale, PA 15071
p. 724-703-3020
f. 724-703-3026

Title: Kirtland AFB 4/13/17

Report Basis

Flow Rate	400 GPM
Water pH	7
Water Temperature	65 °F

Component	Inlet Concentration
ethylene dibromide	20.000 ppb
benzene	450.000 ppb
ethyl benzene	102.000 ppb
toluene	212.000 ppb
xylene	110.000 ppb

Report: 114.31 lbs. activated carbon per day saturated at conditions

Average Loading at Saturation 4.024 lbs./100 lbs. Carbon

Note: Contact TIGG Corporation if comments are needed on preferential adsorption of contaminants above.

PROPRIETARY AND CONFIDENTIAL

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1 Willow Avenue
Oakdale, PA 15071
p. 724-703-3020
f. 724-703-3026

Title: Kirtland AFB 4/13/17

Report Basis

Flow Rate	400 GPM
Water pH	7
Water Temperature	65 °F

Component	Inlet Concentration
ethylene dibromide	10.000 ppb
benzene	225.000 ppb
ethyl benzene	51.000 ppb
toluene	106.000 ppb
xylene	55.000 ppb

Report: 43.64 lbs. activated carbon per day saturated at conditions

Average Loading at Saturation 3.245 lbs./100 lbs. Carbon

Note: Contact TIGG Corporation if comments are needed on preferential adsorption of contaminants above.

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IDW DISPOSAL MODEL

AQUASIM MODELING FOR IDW PROCESSING

This document describes the modeling performed to establish maximum IDW concentrations for processing by the GWTS. This modeling establishes concentration limits for discharges of either small volumes (55-gallon drum) or large volumes (21,000 gallon storage tank) of IDW water under minimum operating flow (120 gpm) and maximum operating flow (400 gpm) conditions. The GWTS is designed to treat non-hazardous IDW and to ensure that no hazardous IDW will be treated by the GWTS, the maximum concentration of benzene for IDW acceptable by the plant has been fixed at 450 µg/L.

DETERMINATION OF ACCEPTABLE IDW WATER PROCESSING CONCENTRATIONS

AQUASIM Version 2.1g (Reichert, 1994) was utilized as the software package to determine the concentration limits on IDW water to ensure that the influent limits on the lead GAC vessel would not be exceeded under normal operating conditions. AQUASIM is a free process flow modeling program available at the following URL: http://www.eawag.ch/en/department/siam/software/. This software is supplied with the basic formulas used to describe simple reactor configurations and process flows for simple systems. The model was used to evaluate disposal of non-hazardous IDW through the GWTS containing elevated concentrations of ethylene dibromide; benzene, toluene, ethylbenzene, and total xylenes (BTEX); dissolved iron; and dissolved manganese.

Within AQUASIM, the model was constructed by modeling the Treatment Train #1 influent tank as a continuously stirred tank reactor with continuous in and out flow and the in-floor sump as a plug flow reactor without diffusion with in and out flow. The two compartments were linked together with the sump flowing into the influent tank without diffusion through the link. The sand filter was incorporated into the model by modifying concentrations of dissolved iron and manganese between the influent tank and lead GAC vessel. Further description of how the sand filters remove dissolved iron and manganese is provided in Attachment 1. No additional processes were added to the model other than those above.

INPUT PARAMETERS AND REFERENCES

The water within the influent tank, flowing from the extraction wells and used to move the IDW water through the sump, was modeled as the average of concentrations measured from the influent samples collected on February 23, 2017 from both trains. The following is a list of the average concentrations of analytes collected on that date:

- Ethylene dibromide – 0.075 µg/L
- BTEX – 0 µg/L (all)
- Iron – 0 µg/L
- Magnesium – 0 µg/L.

The model was run using four different flow profiles of extraction well water and IDW water being discharged to the sump. Maximum IDW water concentrations discharged to the in-floor sump were iteratively calculated by the model to ensure concentrations reaching the lead GAC vessel did not exceed the limits. Limits for organic compounds were set to the manufacturer's modeled concentrations to ensure complete treatment of the influent water reaching the lead GAC vessel. Limits for dissolved iron and manganese were set to 10 mg/L with sand filters installed and to the lower of the New Mexico Water Quality Control Commission water quality standards and the drinking water maximum contaminant levels adopted by EPA under the Federal Safe Drinking Water Act. The GAC vessels can only be operated between a flow of 120 and 400 gpm to ensure complete treatment of the influent water.

IDW water discharged to the in-floor sump can be viewed as either a small and large volume input depending on the site activity that produced the IDW. Small volume IDW production occurs during activities such as groundwater monitoring and results in the creation of approximately a single 55-gallon drum (or less) of IDW water from each well. Large volume operations such as well installation can typically result in the creation of multiple 21,000-gallon containers of IDW.

In order to evaluate possible flow regimes in the GWTS and the types of IDW discharge, four modeling scenarios were performed:

- Model Run #1 utilized the minimum flow conditions (120 gpm) from extraction wells and discharge of 55 gallons of IDW to the in-floor sump.

- Model Run #2 utilized the maximum flow conditions (400 gpm) from extraction wells and discharge of 55 gallons of IDW to the in-floor sump.

- Model Run #3 utilized the minimum flow conditions (120 gpm) from extraction wells and discharge of 21,000 gallons of IDW to the in-floor sump.

- Model Run #4 utilized the maximum flow conditions (400 gpm) from extraction wells and discharge of 21,000 gallons of IDW to the in-floor sump.

ASSUMPTIONS

Assumptions were made to simplify the system being modeled:

- The tank was modeled as a constant volume (3,000 gallons) continuously stirred tank reactor.

- The sump was assumed to act as a diffusion-less plug flow reactor with a capacity of either 55 or 21,000 gallons and a flow through rate of 35 gpm. The flow rate of 35 gpm is a conservative estimate of the existing sump pump's maximum flowrate. As AQUASIM is a modeling tool designed for continuous systems, the sump could not be modeled without undergoing continuous flow. As such, after all of the IDW is advected from the plug flow reactor, water continues to flow through the plug flow reactor with the same composition as that of the extraction wells. This adds only a minor amount of dilution to the concentrations modeled in the influent tank after the peak concentrations have been achieved.

- Each model run calculates the influent limits with and without the sand filter installation. The sand filters were assumed to catalyze all dissolved iron and manganese at 10,000 µg/L down to 1 µg/L. This assumption stems from the information provided by the manufacturer; additional information, including the manufacturer's removal statement, is provided in Attachment 2.

RESULTS

Tables 3A and 3B summarize maximum IDW water concentrations that can be discharged to the GWTS under various system flow regimes and IDW volumes with sand filters installed. Table 3C summarizes the maximum IDW water concentrations that can be discharged to the GWTS under the various system flow regimes and IDW volumes without sand filters installed. Figures 3A through 3D provide the model diagrams for the four different model run conditions. Graphical model outputs, raw data outputs, and source model for all four runs can be found in Attachment 3. The model diagrams show the results of the run and a comparison with the maximum influent concentrations reaching the lead GAC vessel to meet

effluent limits. All concentrations produced by the model runs were below the maximum influent concentration limits. Maximum IDW concentrations for 400 gpm operating conditions are established from Figure 3B (with and without sand filters).

CONCLUSION

Maximum organic and inorganic concentrations of non-hazardous IDW water have been established for both small and large volumes of IDW under both minimum and maximum flow rates through the GWTS. Based on modeling results, IDW water should not pose a significant impact on the influent concentrations reaching the lead GAC vessel. IDW water concentrations must be documented and compared to the input values modeled for acceptance to the GWTS. If outside the input parameters modeled, the model should be run for that IDW specific concentrations and GWTS flow regimes that will ensure the lead GAC influent limit will not be exceeded.

At no time are the GWTS effluent limits exceeded because both Treatment Train #1 and Treatment Train #2 have a second 20,000 pound lag GAC unit in series behind the lead GAC. When breakthrough occurs in the lead GAC vessel, process flow is switched from the lead GAC vessel to the lag GAC vessel, and the former lead GAC vessel is scheduled for carbon change out.

REFERENCES

Reichert, P. 1994. A*QUASIM - A tool for simulation and data analysis of aquatic systems.* Water Science and Technology. 30(2) Vol. 21-30 p.

Figures

3A Small Volume Investigation-Derived Waste Water Processing at Minimum Flow Conditions, Model Run #1

3B Small Volume Investigation-Derived Waste Water Processing at Maximum Flow Conditions, Model Run #2

3C Large Volume Investigation-Derived Waste Water Processing at Minimum Flow Conditions, Model Run #3

3D Large Volume Investigation-Derived Waste Water Processing at Maximum Flow Conditions, Model Run #4

Tables

3A Small Volume Investigation-Derived Waste Water Production – Maximum Investigation-Derived Waste Water Concentrations Discharged to Sump with Sand Filters Installed

3B Large Volume Investigation-Derived Waste Water Production – Maximum Investigation-Derived Waste Water Concentrations Discharged to Sump with Sand Filters Installed

3C Small and Large Volume Investigation-Derived Waste Water Production – Maximum Investigation-Derived Waste Water Concentrations Discharged to Sump without Sand Filters

Attachments

3A Graphical Model Outputs

3B Raw Model Outputs

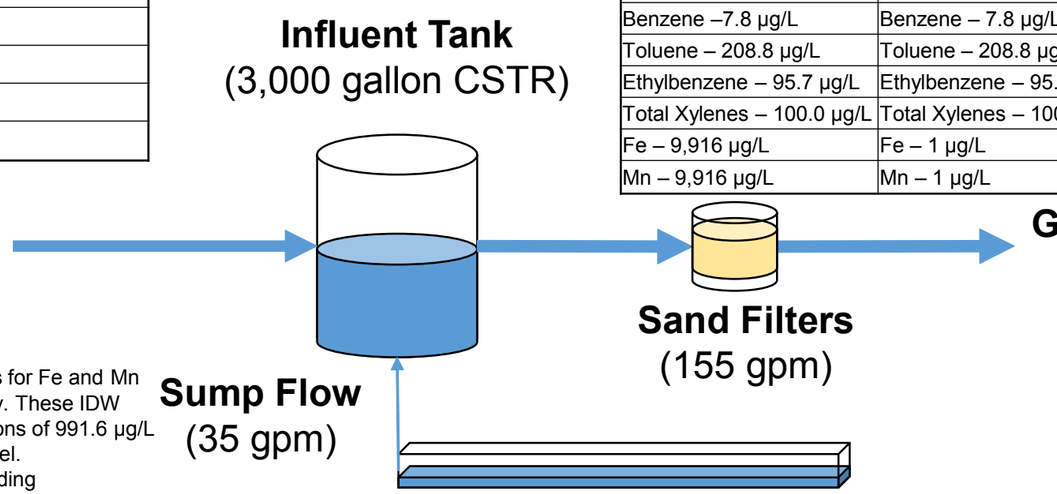
3C Source Model Code and AQUASIM Manual

3D Simple Mixing Model Output Table

FIGURES

Extraction Well Water and Influent Tank Initial Composition
EDB – 0.075 µg/L
BTEX – 0 µg/L (all)
Fe – 0 µg/L
Mn – 0 µg/L

Comparison of Model Run #1 to TIGG Maximum Lead GAC Loading Concentrations		
Influent Modeled Concentrations to the Sand Filters[1]	**Influent Modeled Concentrations Reaching the Lead GAC Vessel**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[2]**
EDB – 19.2 µg/L	EDB – 19.2 µg/L	EDB – 20 µg/L
Benzene –7.8 µg/L	Benzene – 7.8 µg/L	Benzene – 450 µg/L
Toluene – 208.8 µg/L	Toluene – 208.8 µg/L	Toluene – 212 µg/L
Ethylbenzene – 95.7 µg/L	Ethylbenzene – 95.7 µg/L	Ethylbenzene – 102 µg/L
Total Xylenes – 100.0 µg/L	Total Xylenes – 100.0 µg/L	Total Xylenes – 110 µg/L
Fe – 9,916 µg/L	Fe – 1 µg/L	Fe – 1,000 µg/L
Mn – 9,916 µg/L	Mn – 1 µg/L	Mn – 200 µg/L



Maximum IDW Water Concentrations Discharged to Sump	
EDB – 1,100 µg/L	Benzene – 450 µg/L
Toluene – 12,000 µg/L	Ethylbenzene – 5,500 µg/L
Total Xylenes – 5,750 µg/L	Fe – 570,000 µg/L
Mn – 570,000 µg/L	

Notes:

[1] Prior to sand filter installation, IDW water concentrations for Fe and Mn will not exceed 57,000 µg/L and 11,000 µg/L, respectively. These IDW water concentrations will result in Fe and Mn concentrations of 991.6 µg/L and 191.4 µg/L, respectively, to reach the lead GAC vessel.

[2] Lead GAC breakthrough at 175 days with maximum loading concentrations at a continuous flow rate of 400 gpm.

µg/L = microgram(s) per liter
BTEX = benzene, toluene, ethylbenzene, and total xylenes
CSTR = continuously stirred tank reactor
EDB = ethylene dibromide (1,2-dibromoethane)
Fe = dissolved iron
GAC = granular activated carbon
gpm = gallons per minute
IDW = investigation derived waste
Mn = dissolved manganese
PFR = plug flow reactor
Q = quarter

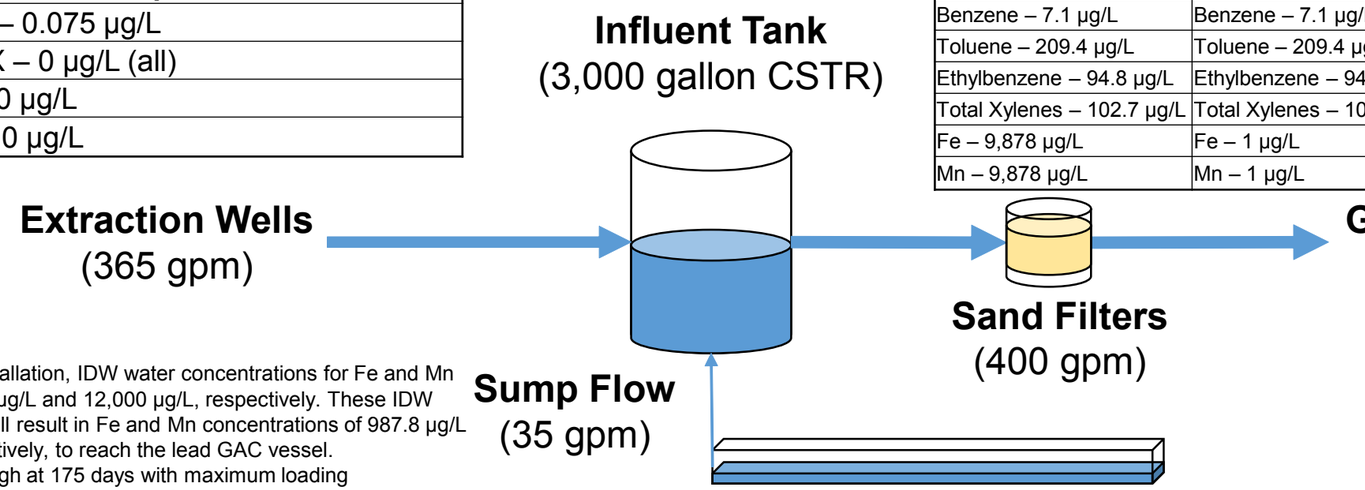
TECHNICIAL MEMORANDUM ESTABLISHING
MAXIMUM INFLUENT LIMITS TO THE
GROUNDWATER TREATMENT SYSTEM
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 3A

SMALL VOLUME IDW WATER PROCESSING
AT MINIMUM FLOW CONDITIONS
MODEL RUN #1

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Extraction Well Water and Influent Tank Initial Composition
EDB – 0.075 µg/L
BTEX – 0 µg/L (all)
Fe – 0 µg/L
Mn – 0 µg/L



Comparison of Model Run #2 to TIGG Maximum Lead GAC Loading Concentrations		
Influent Modeled Concentrations to the Sand Filters[1]	**Influent Modeled Concentrations Reaching the Lead GAC Vessel**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[2]**
EDB – 19.8 µg/L	EDB – 19.8 µg/L	EDB – 20 µg/L
Benzene – 7.1 µg/L	Benzene – 7.1 µg/L	Benzene – 450 µg/L
Toluene – 209.4 µg/L	Toluene – 209.4 µg/L	Toluene – 212 µg/L
Ethylbenzene – 94.8 µg/L	Ethylbenzene – 94.8 µg/L	Ethylbenzene – 102 µg/L
Total Xylenes – 102.7 µg/L	Total Xylenes – 102.7 µg/L	Total Xylenes – 110 µg/L
Fe – 9,878 µg/L	Fe – 1 µg/L	Fe – 1,000 µg/L
Mn – 9,878 µg/L	Mn – 1 µg/L	Mn – 200 µg/L

Maximum IDW Water Concentrations Discharged to Sump	
EDB – 1,250 µg/L	Benzene – 450 µg/L
Toluene – 13,250 µg/L	Ethylbenzene – 6,000 µg/L
Total Xylenes – 6,500 µg/L	Fe – 625,000 µg/L
Mn – 625,000 µg/L	

Notes:

[1] Prior to sand filter installation, IDW water concentrations for Fe and Mn will not exceed 62,500 µg/L and 12,000 µg/L, respectively. These IDW water concentrations will result in Fe and Mn concentrations of 987.8 µg/L and 189.7 µg/L, respectively, to reach the lead GAC vessel.

[2] Lead GAC breakthrough at 175 days with maximum loading concentrations at a continuous flow rate of 400 gpm.

µg/L = microgram(s) per liter
BTEX = benzene, toluene, ethylbenzene, and total xylenes
CSTR = continuously stirred tank reactor
EDB = ethylene dibromide (1,2-dibromoethane)
Fe = dissolved iron
GAC = granular activated carbon
gpm = gallons per minute
IDW = investigation derived waste
Mn = dissolved manganese
PFR = plug flow reactor
Q = quarter

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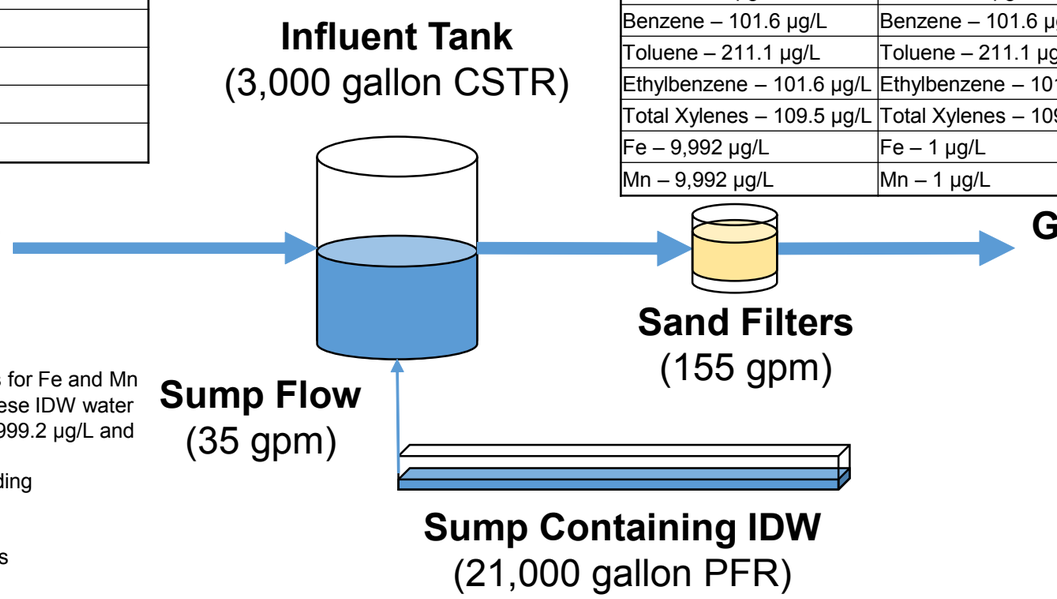
FIGURE 3B

SMALL VOLUME IDW WATER PROCESSING
AT MAXIMUM FLOW CONDITIONS
MODEL RUN #2

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Extraction Well Water and Influent Tank Initial Composition
EDB – 0.075 µg/L
BTEX – 0 µg/L (all)
Fe – 0 µg/L
Mn – 0 µg/L

Comparison of Model Run #3 to TIGG Maximum Lead GAC Loading Concentrations		
Influent Modeled Concentrations to the Sand Filters[1]	**Influent Modeled Concentrations Reaching the Lead GAC Vessel**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[2]**
EDB – 19.9 µg/L	EDB – 19.9 µg/L	EDB – 20 µg/L
Benzene – 101.6 µg/L	Benzene – 101.6 µg/L	Benzene – 450 µg/L
Toluene – 211.1 µg/L	Toluene – 211.1 µg/L	Toluene – 212 µg/L
Ethylbenzene – 101.6 µg/L	Ethylbenzene – 101.6 µg/L	Ethylbenzene – 102 µg/L
Total Xylenes – 109.5 µg/L	Total Xylenes – 109.5 µg/L	Total Xylenes – 110 µg/L
Fe – 9,992 µg/L	Fe – 1 µg/L	Fe – 1,000 µg/L
Mn – 9,992 µg/L	Mn – 1 µg/L	Mn – 200 µg/L



Maximum IDW Water Concentrations Discharged to Sump	
EDB – 88 µg/L	Benzene – 450 µg/L
Toluene – 935 µg/L	Ethylbenzene – 450 µg/L
Total Xylenes – 485 µg/L	Fe – 44,250 µg/L
Mn – 44,250 µg/L	

Notes:

[1] Prior to sand filter installation, IDW water concentrations for Fe and Mn will not exceed 4,425 µg/L and 880 µg/L, respectively. These IDW water concentrations will result in Fe and Mn concentrations of 999.2 µg/L and 198.7 µg/L, respectively, to reach the lead GAC vessel.

[2] Lead GAC breakthrough at 175 days with maximum loading concentrations at a continuous flow rate of 400 gpm.

µg/L = microgram(s) per liter
BTEX = benzene, toluene, ethylbenzene, and total xylenes
CSTR = continuously stirred tank reactor
EDB = ethylene dibromide (1,2-dibromoethane)
Fe = dissolved iron
GAC = granular activated carbon
gpm = gallons per minute
IDW = investigation derived waste
Mn = dissolved manganese
PFR = plug flow reactor
Q = quarter

TECHNICIAL MEMORANDUM ESTABLISHING
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KIRTLAND AIR FORCE BASE, NEW MEXICO

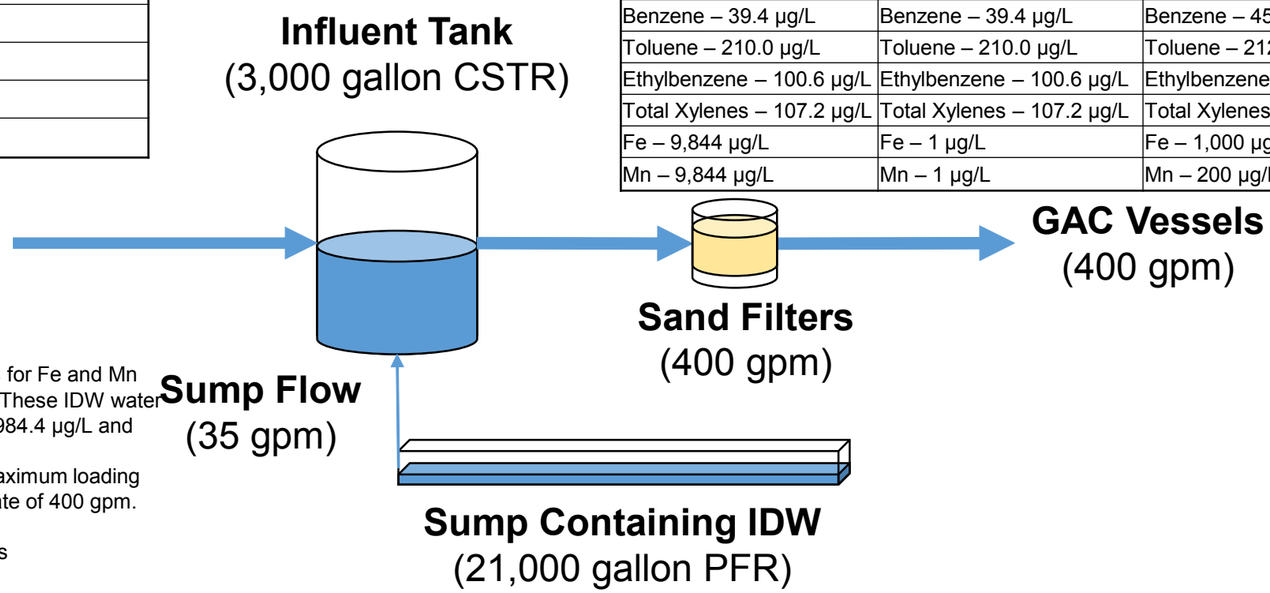
FIGURE 3C

LARGE VOLUME IDW WATER PROCESSING
AT MINIMUM FLOW CONDITIONS
MODEL RUN #3

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Extraction Well Water and Influent Tank Initial Composition
EDB – 0.075 µg/L
BTEX – 0 µg/L (all)
Fe – 0 µg/L
Mn – 0 µg/L

Comparison of Model Run #4 to TIGG Maximum Lead GAC Loading Concentrations		
Influent Modeled Concentrations to the Sand Filters[1]	**Influent Modeled Concentrations Reaching the Lead GAC Vessel**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[2]**
EDB – 19.8 µg/L	EDB – 19.8 µg/L	EDB – 20 µg/L
Benzene – 39.4 µg/L	Benzene – 39.4 µg/L	Benzene – 450 µg/L
Toluene – 210.0 µg/L	Toluene – 210.0 µg/L	Toluene – 212 µg/L
Ethylbenzene – 100.6 µg/L	Ethylbenzene – 100.6 µg/L	Ethylbenzene – 102 µg/L
Total Xylenes – 107.2 µg/L	Total Xylenes – 107.2 µg/L	Total Xylenes – 110 µg/L
Fe – 9,844 µg/L	Fe – 1 µg/L	Fe – 1,000 µg/L
Mn – 9,844 µg/L	Mn – 1 µg/L	Mn – 200 µg/L



Maximum IDW Water Concentrations Discharged to Sump	
EDB – 225 µg/L	Benzene – 450 µg/L
Toluene – 2,400 µg/L	Ethylbenzene – 1,150 µg/L
Total Xylenes – 1,225 µg/L	Fe – 112,500 µg/L
Mn – 112,500 µg/L	

Notes:

[1] Prior to sand filter installation, IDW water concentrations for Fe and Mn will not exceed 11,250 µg/L and 2,250 µg/L, respectively. These IDW water concentrations will result in Fe and Mn concentrations of 984.4 µg/L and 196.9 µg/L, respectively, to reach the lead GAC vessel.

[2] Lead GAC breakthrough of organics at 175 days with maximum loading concentrations calculated by TIGG at a continuous flow rate of 400 gpm.

µg/L = microgram(s) per liter
BTEX = benzene, toluene, ethylbenzene, and total xylenes
CSTR = continuously stirred tank reactor
EDB = ethylene dibromide (1,2-dibromoethane)
Fe = dissolved iron
GAC = granular activated carbon
gpm = gallons per minute
IDW = investigation derived waste
Mn = dissolved manganese
PFR = plug flow reactor
Q = quarter

TECHNICIAL MEMORANDUM ESTABLISHING
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KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 3D

LARGE VOLUME IDW WATER PROCESSING
AT MAXIMUM FLOW CONDITIONS
MODEL RUN #4

TABLES

Table 3A
Small Volume IDW Water Production - Maximum IDW Water Concentrations Discharged to Sump with Sand Filters Installed

Minimum Flow Conditions - Model Run #1			
Analyte	**Influent Modeled Concentrations to the Sand Filters (µg/L)**	**Influent Modeled Concentrations Reaching the Lead GAC Vessel (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.2	19.2	20
Benzene	7.8	7.8	450
Toluene	208.8	208.8	212
Ethylbenzene	95.7	95.7	102
Total Xylenes	100.0	100.0	110
Dissolved Iron	9,916	1.0	1,000
Dissolved Manganese	9,916	1.0	200
Maximum Flow Conditions - Model Run #2			
Analyte	**Influent Modeled Concentrations to the Sand Filters (µg/L)**	**Influent Modeled Concentrations Reaching the Lead GAC Vessel (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.8	19.8	20
Benzene	7.1	7.1	450
Toluene	209.4	209.4	212
Ethylbenzene	94.8	94.8	102
Total Xylenes	10.7	10.7	110
Dissolved Iron	9,878	1.0	1,000
Dissolved Manganese	9,878	1.0	200

[1] Concentrations result in modeled breakthrough of the lead GAC after 175 days at conservative flow rate of 400 gpm.
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GAC = granular activated carbon

Table 3B
Large Volume IDW Water Production - Maximum IDW Water Concentrations Discharged to Sump with Sand Filters Installed

Minimum Flow Conditions - Model Run #3			
Analyte	**Influent Modeled Concentrations to the Sand Filters (µg/L)**	**Influent Modeled Concentrations Reaching the Lead GAC Vessel (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.9	19.9	20
Benzene	101.6	101.6	450
Toluene	211.1	211.1	212
Ethylbenzene	101.6	101.6	102
Total Xylenes	109.5	109.5	110
Dissolved Iron	9,992	1.0	1,000
Dissolved Manganese	9,992	1.0	200
Maximum Flow Conditions - Model Run #4			
Analyte	**Influent Modeled Concentrations to the Sand Filters (µg/L)**	**Influent Modeled Concentrations Reaching the Lead GAC Vessel (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.8	19.8	20
Benzene	39.4	39.4	450
Toluene	210.0	210.0	212
Ethylbenzene	100.6	100.6	102
Total Xylenes	107.2	107.2	110
Dissolved Iron	9,844	1.0	1,000
Dissolved Manganese	9,844	1.0	200

[1] Concentrations result in modeled breakthrough of the lead GAC after 175 days at conservative flow rate of 400 gpm.
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GAC = granular activated carbon

Table 3C
Small and Large Volume IDW Water Production -
Maximum IDW Water Concentrations Discharged to Sump Without Sand Filters Installed

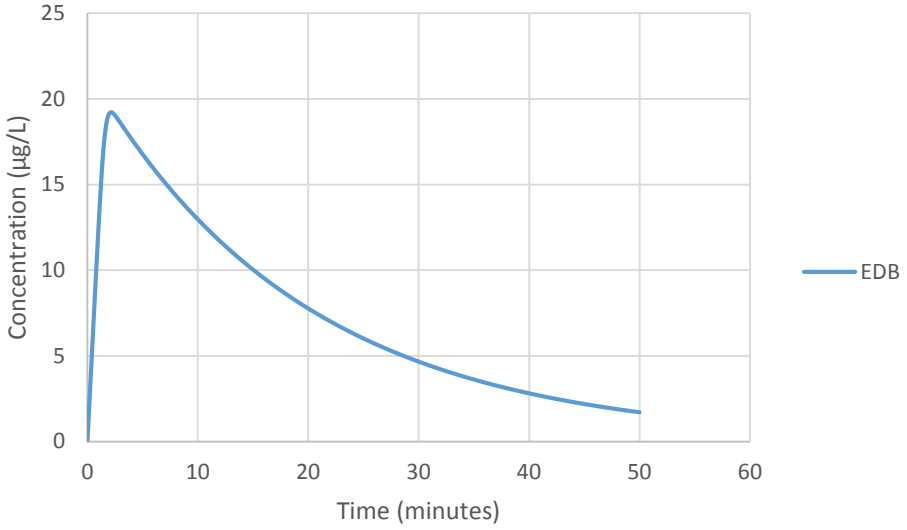
Minimum Flow Conditions - Model Run #1		
Analyte	**Influent Modeled Concentrations Reaching the Lead GAC Vessel without Sand Filters (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.2	20
Benzene	7.8	450
Toluene	208.8	212
Ethylbenzene	95.7	102
Total Xylenes	100.0	110
Dissolved Iron	57,000	1,000
Dissolved Manganese	11,000	200
Maximum Flow Conditions - Model Run #2		
Analyte	**Influent Modeled Concentrations Reaching the Lead GAC Vessel without Sand Filters (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.8	20
Benzene	7.1	450
Toluene	209.4	212
Ethylbenzene	94.8	102
Total Xylenes	10.7	110
Dissolved Iron	62,500	1,000
Dissolved Manganese	12,000	200
Minimum Flow Conditions - Model Run #3		
Analyte	**Influent Modeled Concentrations Reaching the Lead GAC Vessel without Sand Filters (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.9	20
Benzene	101.6	450
Toluene	211.1	212
Ethylbenzene	101.6	102
Total Xylenes	109.5	110
Dissolved Iron	4,425	1,000
Dissolved Manganese	880	200
Maximum Flow Conditions - Model Run #4		
Analyte	**Influent Modeled Concentrations Reaching the Lead GAC Vessel without Sand Filters (µg/L)**	**Maximum Influent Concentrations Reaching the Lead GAC Vessel to Meet Effluent Limits[1] (µg/L)**
EDB	19.8	20
Benzene	39.4	450
Toluene	210	212
Ethylbenzene	100.6	102
Total Xylenes	107.2	110
Dissolved Iron	11,250	1,000
Dissolved Manganese	2,250	200

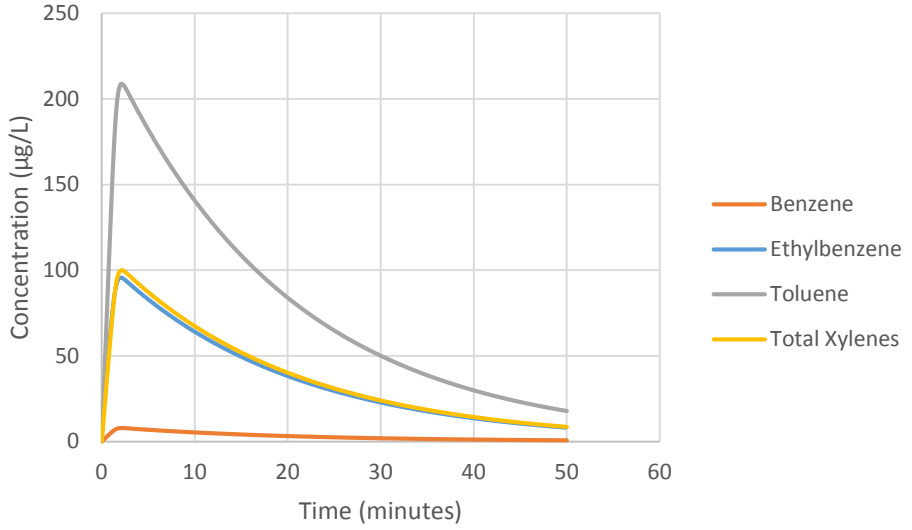
[1] Concentrations result in modeled breakthrough of the lead GAC after 175 days at conservative flow rate of 400 gpm.
µg/L = microgram(s) per liter
EDB = ethylene dibromide
GAC = granular activated carbon

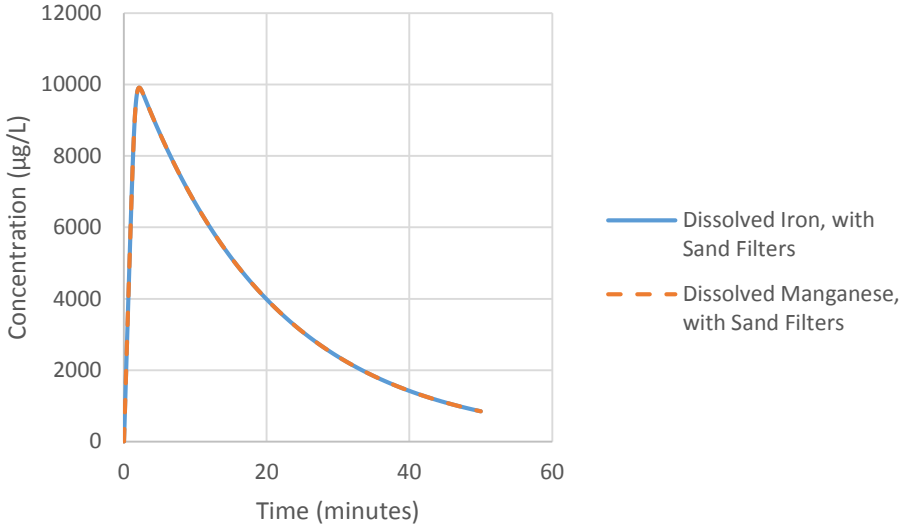
ATTACHMENT 3A

GRAPHICAL MODEL OUTPUTS

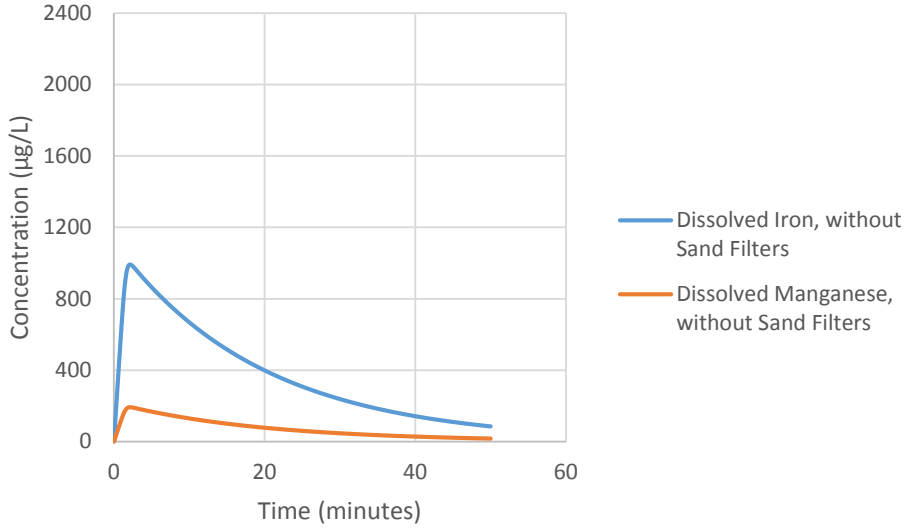
Small Volume IDW Water Processing at Minimum Flow Conditions Model Run #1





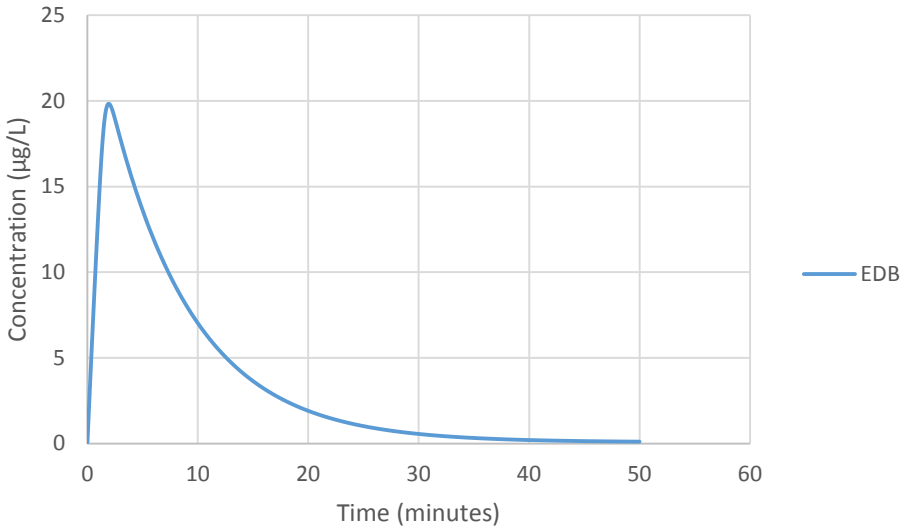


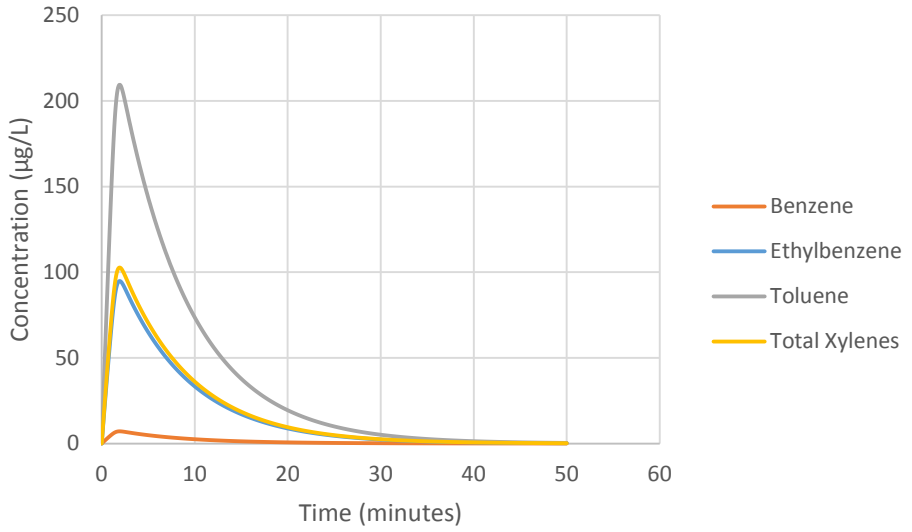
Dissolved Metals Concentrations With Sand Filters

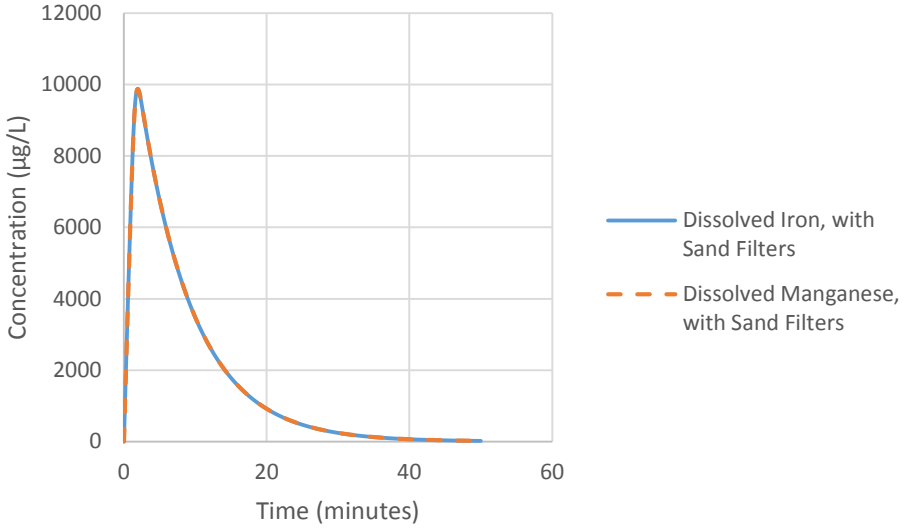


Dissolved Metals Concentrations Without Sand Filters

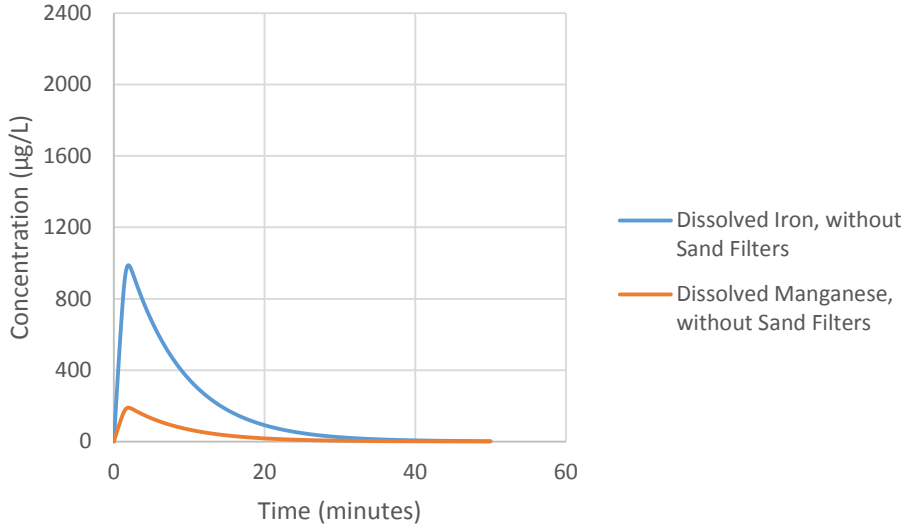
Small Volume IDW Water Processing at Maximum Flow Conditions Model Run #2





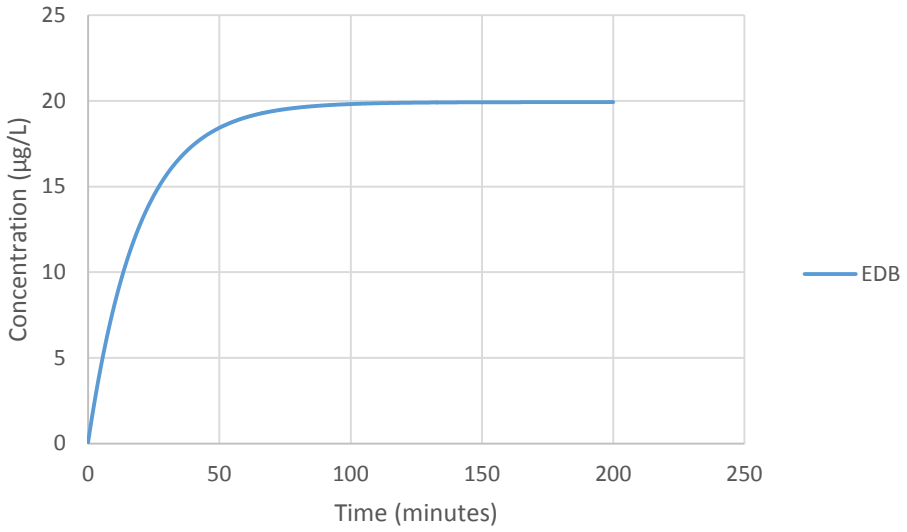


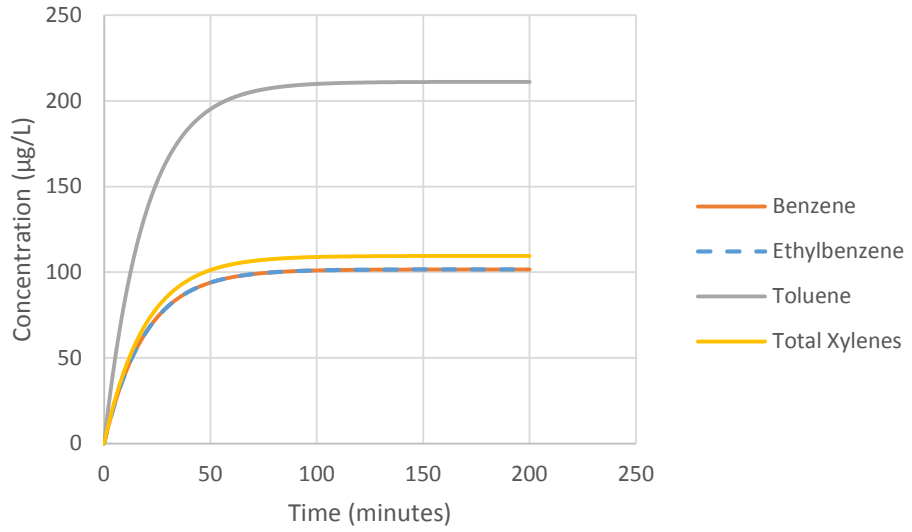
Dissolved Metals Concentrations With Sand Filters

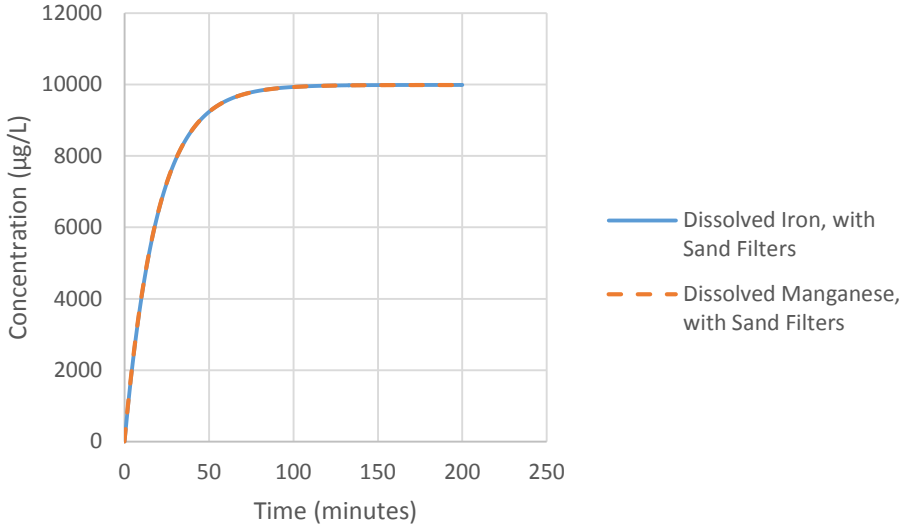


Dissolved Metals Concentrations Without Sand Filters

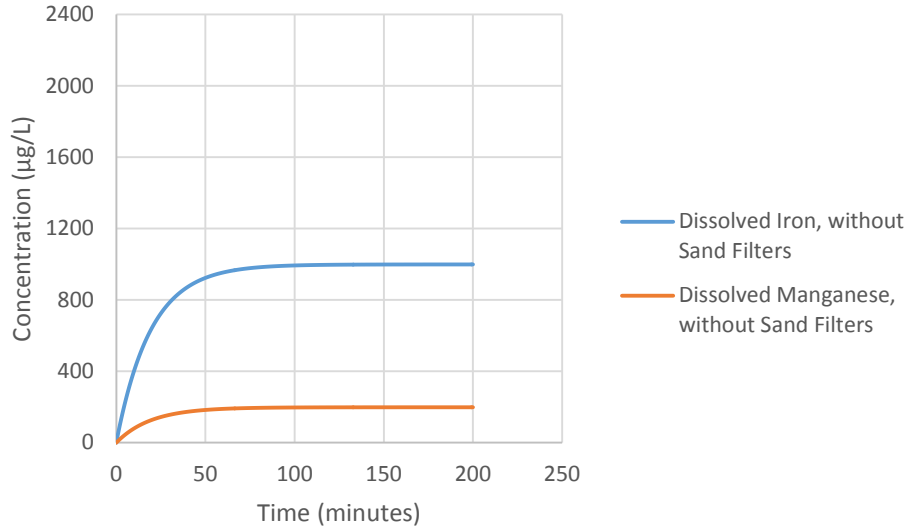
Large Volume IDW Water Processing at Minimum Flow Conditions Model Run #3





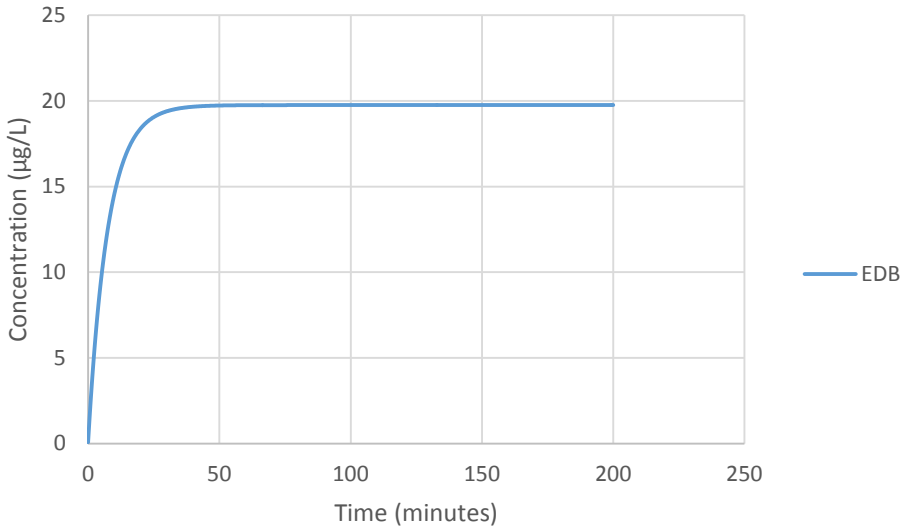


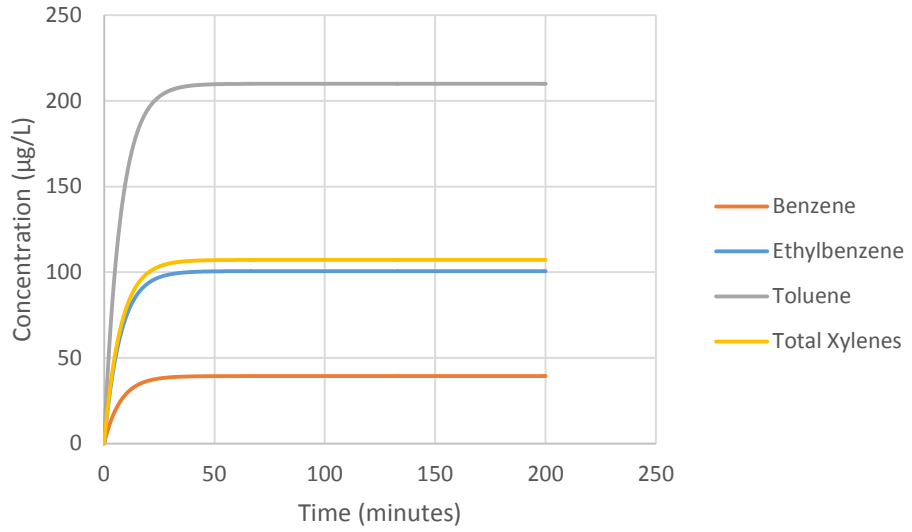
Dissolved Metals Concentrations With Sand Filters

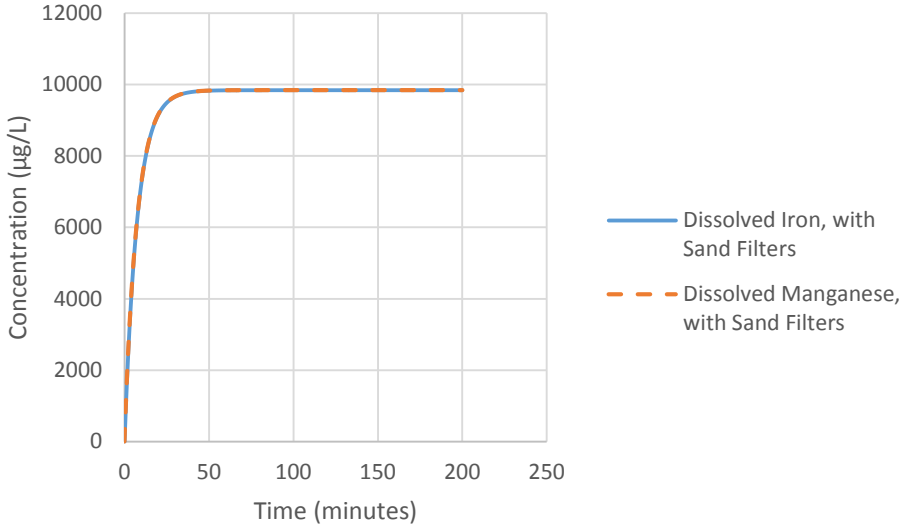


Dissolved Metals Concentrations Without Sand Filters

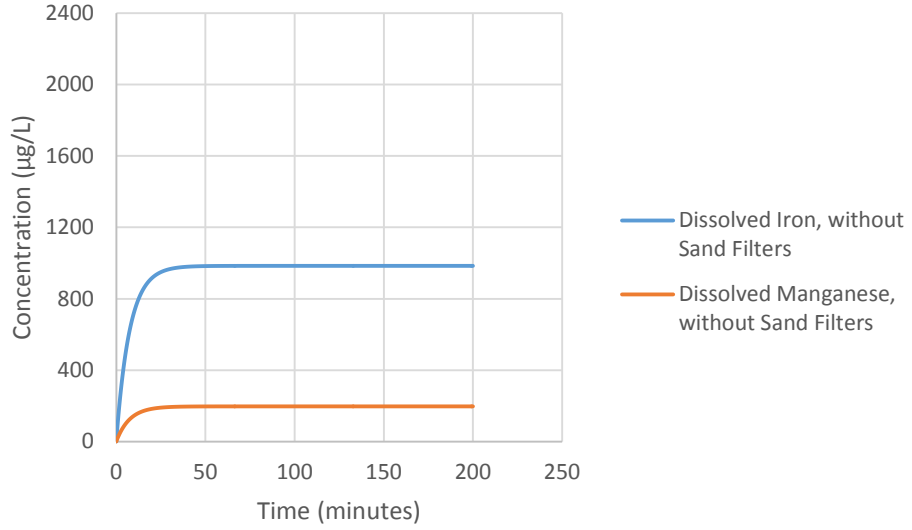
Large Volume IDW Water Processing at Maximum Flow Conditions Model Run #4







Dissolved Metals Concentrations With Sand Filters



Dissolved Metals Concentrations Without Sand Filters

ATTACHMENT 3B

RAW MODEL OUTPUTS

(Provided on Compact Disc)

ATTACHMENT 3C

SOURCE MODEL CODE AND AQUASIM MANUAL

(Provided on Compact Disc)

ATTACHMENT 3D

SIMPLE MIXING MODEL OUTPUT TABLE

Table 3D
Maximum Influent Concentrations to Meet Effluent Limits

Analyte	Maximum Influent Concentrations Reaching the Lead GAC Vessel[1] (µg/L)	Maximum Concentrations of IDW Water to be Processed by the GWTS with Sand Filters[2] (µg/L)	Maximum Concentrations of Water Produced from a Single Extraction Well with Sand Filters[3] (µg/L)
EDB	20	1,250	41
Benzene	450	450	405
Toluene	212	13,250	436
Ethylbenzene	102	6,000	210
Total Xylenes	110	6,500	226
Dissolved Iron	1,000	625,000	20,571
Dissolved Manganese	200	625,000	20,571

Footnotes:

[1] Influent concentrations measured at the influent sample location. Influent concentrations result in modeled breakthrough of the lead GAC after 175 days at conservative flow rate of 400 gpm.

[2] Maxiumum IDW concentrations presented were generated from the AQUASIM Model. The following two simple batch mixing calculations for EDB and dissolved manganese provide a check to ensure that the model is operating properly:

$$[(Ci) \times (Vi) + (Ce) \times (Vi+Ve)] / (Vt) = Ct$$
$$[(1{,}250\ \mu g/L) \times (55\ gal) + (0.075\ \mu g/L) \times (3{,}000\ gal + 730\ gal)] / (3785\ gal) = 18.2\ \mu g/L$$

Ci = the concentration of EDB in the IDW in µg/L

Vi = the volume of IDW processed by the GWTS in gallons

Ce = the average concentration of EDB from the extraction wells in µg/L

Vi = the initial volume of the influent tank in gallons

Ve = the volume of water provided from the extraction wells over the course of two minutes in gallons

Vt = the total volume of the IDW, tank, and from the extraction wells in gallons

Ct = the concentration of EDB in the total volume of water prior to sand filters

Assumes all IDW is transfered to the influent tank over two minutes, complete mixing in the influent tank, and no outflow of water.

$$[(Ci) \times (Vi) + (Ce) \times (Vi+Ve)] / (Vt) = Ct$$
$$[(625{,}000\ \mu g/L) \times (55\ gal) + (0\ \mu g/L) \times (3{,}000\ gal + 730\ gal)] / (3785\ gal) = 9082\ \mu g/L \times 0.0001(SFR) = 0.9082\ \mu g/L$$

Ci = the concentration of dissolved manganese in the IDW in µg/L

Vi = the volume of IDW processed by the GWTS in gallons

Ce = the average concentration of dissolved manganese from the extraction wells in µg/L

Vi = the initial volume of the influent tank in gallons

Ve = the volume of water provided from the extraction wells over the course of two minutes in gallons

Vt = the total volume of the IDW, tank, and from the extraction wells in gallons

Ct = the concentration of dissolved manganese in the total volume of water prior to sand filters

SFR = Sand Filter Reduction is 10,000 µg/L of dissolved manganese to below 1 µg/L

Assumes all IDW is transfered to the influent tank over two minutes, complete mixing in the influent tank, no outflow of water (batch process)

Table 3D
Maximum Influent Concentrations to Meet Effluent Limits

[3] Maximum concentrations of water produced from a single well were calculated assuming a maximum well flowrate of 175 gpm and a maximum system flowrate of 400 gpm. The following simple continuous mixing calculation was used to calculate the values listed above:

$$[(Ce) \times (Qe) + (Ch) \times (Qh)] / (Qt) = Ct$$
$$[(0.075\ \mu g/L) \times (225\ gal) + (41\ \mu g/L) \times (175\ gal)] / (400\ gal) = 18\ \mu g/L$$

Ce = the average concentration of EDB from the extraction wells in µg/L

Qe = the flow of water provided from the extraction wells in gpm

Ch = the concentration of EDB in the high concentration well in µg/L

Qh = the flow of water provided from the high concentration extraction well in gpm

Qt = the total flow of water extracted from all extraction wells in gpm

Ct = the concentration of EDB in the influent water in µg/L

Assumes complete mixing of the extraction well water, calculated concentrations cannot exceed 90% of Maximum influnet concentrations reaching the Lead GAC Vessel, and the sand filters can treat up to 10,000 µg/L of dissolved manganese to below 1 µg/L.

Acronyms and Abbreviations:

EDB = ethylene dibromide

GAC = granular activated carbon

gal = gallons

GCMP = golf course main pond

gpm = gallons per minute

IDW = investigation-derived waste

MCL = Maximum Contaminant Level