DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON
4551 LLEWELLYN AVENUE, SUITE 5000
FORT GEORGE G. MEADE, MARYLAND 20755-5000

REPLY TO ATTENTION OF:

December 19, 2014

Environmental Division

Ms. Elisabeth Green
Federal Facilities Division
Maryland Department of the Environment
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230

Dear Ms. Green:

Enclosed please find the *Final Remedial Action Completion Report (Report)* for the Phoenix Military Reservation for your review and comment. The Draft Report was revised based on your verbal comments received on December 4, 2014. Copies of the report have been furnished to John Burchette (U.S. Environmental Protection Agency), Francis Coulters (U.S. Army Environmental Command), and Kevin Koepenick (Baltimore County).

If you have any questions, please feel free to contact Ms. Denise Tegtmeyer at (301) 677-9559 or me at (301) 677-7999.

Sincerely,

George B. Knight, PG
Acting Program Manager, Installation Restoration Program
Directorate of Public Works-Environmental Division

Enclosure

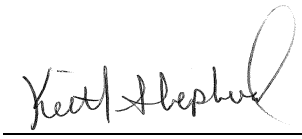
ARCADIS

Imagine the result

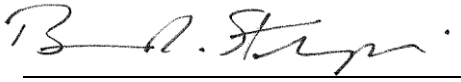
Final Remedial Action Completion Report

Phoenix Military Reservation, Jacksonville, Maryland

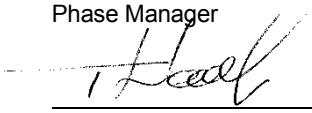
December 2014



Keith Shepherd,
Task Manager



Brian Stempowski
Phase Manager



Tim Llewellyn
Project Manager

Final Remedial Action Completion Report

Phoenix Military Reservation
Jacksonville, Maryland

Prepared for:
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Date:
December 2014

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List of Acronyms and Abbreviations

µg/L	micrograms per liter
ARCADIS	ARCADIS U.S., Inc.
Army	United States Army
BGE	Baltimore Gas and Electric
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DGR	Directed Groundwater Recirculation
E&SCs	erosion and sediment controls
ESE	Environmental Science and Engineering, Inc.
FCA	Fire Control Area
FGGM	Fort George G. Meade
ft	feet or foot
HDPE	High Density Polyethylene
IDW	Investigation Derived Waste
IRP	Installation Restoration Program
LCA	Launch Control Area
LTM	Long-term Monitoring
LUC	Land Use Control
MCL	Maximum Contaminant Level
MDARNG	Maryland Army National Guard
MDE	Maryland Department of the Environment
msl	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PMR	Phoenix Military Reservation

List of Acronyms and Abbreviations continued

RACR	Remedial Action Completion Report
RAO	Remedial Action Objectives
RD	Remedial Design
TCE	Trichloroethene
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Executive Summary

This Remedial Action Completion Report summarizes the remedial activities completed at the Phoenix Military Reservation (PMR) located in Jacksonville, Maryland, (herein after referred to as "the Site") to address the potential risks posed by elevated concentrations of volatile organic compounds in groundwater at the Site.

Subsequent to the alternatives analysis conducted in the Focused Feasibility Study (ARCADIS, 2013a), a Final Decision Document (Army; 2013) authorizing the selected remedial alternative was signed by the United States Army on October 2, 2013, and approved by the Maryland Department of the Environment on September 25, 2013. The remedial action selected for the PMR was Directed Groundwater Recirculation (DGR), Monitored Natural Attenuation, and Land Use Controls. A Remedial Design (ARCADIS, 2014) was developed to direct the implementation of the remedial activities and was finalized in March 2014.

The remedial action was implemented during multiple mobilizations between March 2014 and June 2014 and consisted of the following components:

- Installation and development of three injection wells;
- Installation and development of one monitoring well;
- Off-Site disposal of soil cuttings, purged groundwater, and general refuse generated during installation of the injection and monitoring wells;
- Trenching activities associated with the installation of the subsurface piping network including, 1.5-inch high density polyethylene (HDPE) piping conduit for the electrical power supply line, influent line from the extraction well to the treatment building, effluent lines from the treatment building to the injection wells. In total, approximately 1,100 feet of 1.5-inch HDPE pipe was installed.
- Installation of one electrical transformer to power the DGR treatment system and electrical wiring necessary to provide electricity to system controls, sumps, and other electrical components;
- Placement of the pre-fabricated building and installation of the conveyance piping, granular activated carbon vessels, transfers pumps, instrumentation and flow controls, and piping manifolds;

- Completion of startup/shakedown testing and operation of the DGR treatment system; and

- Site restoration and demobilization.

1. Overview

ARCADIS U.S. Inc. (ARCADIS) has been retained by the United States Army Environmental Command to perform Installation Restoration Program (IRP) activities at the Phoenix Military Reservation (PMR), a Fort George G. Meade (FGGM) sub-installation located in Jacksonville, Maryland. This work is being conducted under a Performance Based Contract associated with the IRP at FGGM. The full scope of services for this contract is defined in Contract W91ZLK-05-D-0015: Task 0005.

The IRP activities at PMR are conducted under the United States Army's (Army's) Defense Environmental Restoration Program and operate principally under the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act of 1986 and National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 Code of Federal Regulations 300). The Maryland Department of the Environment (MDE) is the lead regulatory agency for PMR; however; coordination and input are provided by the United States Environmental Protection Agency (USEPA) Region III, and as appropriate, with other signatories of the FGGM Federal Facility Agreement.

The Final Decision Document (Army, 2013) authorizing the selected remedial alternative was signed by the Army on October 2, 2013, and approved by the MDE on September 25, 2013. The remedial action selected for the PMR was Directed Groundwater Recirculation (DGR), Monitored Natural Attenuation, and Land Use Controls (LUCs).

This Remedial Action Completion Report (RACR) presents a description of the remedial actions implemented at PMR.

1.1 Site Background

PMR is a sub-installation of FGGM. The PMR Fire Control area (FCA) is located approximately one-half mile west of Jacksonville, Maryland, in northeastern Baltimore County (**Figure 1**). The PMR formerly consisted of two parcels of land: the FCA and the Launch Control Area (LCA). The FCA and LCA each occupy approximately 17 acres of land and are approximately one-half mile apart. They occupy two adjacent hilltops separated by a valley through which the Greene Branch flows (Environmental Science and Engineering, Inc. [ESE], 1983). The area surrounding these facilities is rural and residential. The LCA was divested by the Army prior to this investigation and is no longer considered to be part of the PMR.

The PMR was originally developed in 1954 as a Nike Ajax missile site. In 1958, the Site was modified to use the Nike Hercules missiles. Active-duty Army personnel under the command of the Army Air Defense Command manned the Site until 1962, when the Maryland Army National Guard (MDARNG) assumed command. In 1966, the Nike missile program was terminated, and the Site remained relatively inactive until 1974 (ESE, 1983). In 1974, the Army granted the MDARNG a five-year lease of the FCA and its improvements. The MDARNG used the facility as a year-round training ground for its Military Police Company. In 1979, the MDARNG requested and was granted a five-year extension. The MDARNG ceased active operations in 1982, with the buildings being demolished shortly thereafter; the Site has been unoccupied since that time. Historical photographs indicate that the area was farmed prior to the installation of the FCA and more recently maintained as lawn to facilitate site access and visibility. Since the cessation of Army activities on the Site, lawn maintenance has been suspended over most of the Site. Adjacent landowners maintain their properties as extensive lawn areas and pastureland for horses. The area is no longer being commercially farmed. The PMR is currently vacant and surrounded by a fence.

1.2 Chronology of Events

The following is a brief chronology of events associated with PMR:

Date	Event
September 2013	Final Decision Document (Army, 2013) issued.
March 2014	Final Remedial Design (RD;(ARCADIS, 2014) issued.
March – April 2014	Installation and development of monitoring well FCA-26 and injection wells IW-01 - IW-03.
April 2014	Completed baseline groundwater sampling.
March – May 2014	Trenching activities for subsurface electrical pipe conduit and DGR system influent and effluent conveyance piping.
June 2014	Completion of treatment building, associated infrastructure, and Site restoration.
June – July 2014	Startup and shakedown of the DGR treatment system commenced the week of June 30, 2014. Startup/shakedown testing commenced into the following week. A follow up Site Inspection was completed on July 15, 2014 to document completion of the remedial actions and generate a punch list of items for consideration.

2. Remedial Action Objectives

The Remedial Action Objectives (RAOs), as stated in the Decision Document (Army, 2013), are based on the potential risks associated with elevated volatile organic compound (VOC) concentrations in groundwater. The RAOs for the Site at are as follows:

- Prevent human exposure to groundwater that would cause unacceptable risk over the duration of the response action.

- Achieve Maximum Contaminant Levels (MCLs) for the identified constituents of concern in groundwater in a reasonable timeframe thereby restoring groundwater to its beneficial use.

3. Remedial Action

The Remedial Design (RD) (ARCADIS, 2014) was developed to direct the implementation of the remedial action taken at PMR and was finalized in March 2014. The remedial action taken at PMR was implemented in accordance with the RD and included the following components:

- Installation and development of three injection wells;
- Installation and development of one monitoring well;
- Off-Site disposal of soil cuttings, purged groundwater, and general refuse generated during installation of the injection and monitoring wells;
- Trenching activities associated with the installation of the subsurface piping network including, 1.5-inch high density polyethylene (HDPE) piping conduit for the electrical power supply line, influent line from the extraction well to the treatment building, effluent lines from the treatment building to the injection wells. In total, approximately 1,100 feet of 1.5-inch HDPE pipe was installed.
- Installation of one electrical transformer to power the DGR treatment system and electrical wiring necessary to provide electricity to system controls, sumps, and other electrical components;
- Placement of the pre-fabricated building and installation of the conveyance piping, granular activated carbon vessels, transfers pumps, instrumentation and flow controls, and piping manifolds;
- Completion of startup/shakedown testing and operation of the DGR treatment system; and
- Site restoration and demobilization.

4. Demonstration of Completion

The following sections discuss the construction and operation of the DGR treatment system installed at PMR in accordance with the RD (ARCADIS, 2014). A photo log documenting construction activities is provided as **Appendix A**.

4.1 Permitting and Compliance

The requirements of the Water Appropriations Permitting Equivalency were met during implementation of the remedial action at PMR. However, it should be noted that State of Maryland Well Permits for injection and monitoring wells were issued by the Baltimore County Health Department. In addition, electrical work and treatment building installation associated with the DGR treatment system were completed and inspected in accordance with Baltimore County permitting requirements.

4.2 Mobilization and Site Preparation

Implementation of the remedial action at PMR was conducted in two mobilizations. Well installation, baseline groundwater sampling, and trenching for subsurface conveyance piping along with system build-out, and Site restoration were completed during one mobilization. A second mobilization was necessary for system startup and shakedown following completion of the electrical infrastructure by Baltimore Gas and Electric (BGE). Prior to each mobilization, site preparation was conducted as appropriate for each task. In general, site preparation consisted of establishment of staging areas, mobilizing equipment and materials, and installing safety protection devices (e.g., traffic controls, fencing, signs, cones, and markers).

Installation of the subsurface piping was conducted via open trenching; however, trench transects were chosen to limit grubbing and clearing and minimize impacts to vegetation and surrounding foliage. Similarly, well locations and the location of the remedial building were chosen to minimize the amount of clearing and tree grubbing and overall impacts to the surrounding environment.

Soil erosion and sediment controls (E&SCs) were implemented in accordance with the Standards and Specification for Soil Erosion and Sediment Control in Maryland (MDE, 2011). All temporary E&SCs were in place prior to the initiation of earth disturbing activities. The E&SC measures were removed following the final Site Inspection completed in July 2014.

4.3 Baseline Groundwater Sampling

A synoptic water level elevation survey was completed on April 14, 2014 prior to baseline groundwater sampling activities or startup of the DGR system. Seven monitoring wells, FCA-01, FCA-03, FCA-05, FCA-07, FCA-09, FCA-25, and FCA-26 located across the Site included in the monitoring program detailed in the RD (ARCADIS, 2014) were gauged for depth to groundwater. **Table 1** presents the groundwater elevations for the monitoring wells included in the monitoring program. Groundwater elevations ranged from 535.34 feet (ft) mean seal level (msl) (FCA-09) to 551.58 ft msl (FCA-26).

Baseline groundwater sampling was conducted between April 14, 2014, and May 7, 2014. Groundwater samples were collected from the same seven monitoring wells FCA-01, FCA-03, FCA-05, FCA-07, FCA-09, FCA-25, and FCA-26 and analyzed for VOCs via USEPA Method 8260B. Groundwater samples were sent to Shealy Environmental Services in Columbia, South Carolina, for laboratory analysis. Level 2 Data Validation was completed on 100 percent of the data by Laboratory Data Consultants Inc. of Carlsbad, California, in accordance with the FGGM site-wide Quality Assurance Project Plan (ARCADIS, 2010). Laboratory Reports and Data Validation Reports for the baseline analytical data are provided as **Appendix B1 and B2**, respectively. Monitoring well locations are displayed on **Figure 2**. Analytical results are summarized in **Table 2,** and MCL exceedances are summarized below. Groundwater sampling logs are included in **Appendix C**.

- Trichloroethene (TCE) exceeded its MCL of 5 micrograms per liter (µg/L) at four locations at concentrations between 5.5 µg/L (FCA-07) and 230 J µg/L (FCA-01 duplicate).
- Cis-1,2-Dichloroethene exceeded its MCL of 70 µg/L at one location (FCA-26) at a concentration of 230 µg/L.

4.4 Utility Clearance

Prior to initiation of intrusive activities, a utility clearance using multiple lines of evidence was conducted and included current Miss Utility of Maryland notifications, a utility locate conducted by a private utility locator, and a desktop review of available Site drawings. Additionally, a FGGM dig permit was obtained prior to the initiation of intrusive activities and was updated, as necessary, for the duration of the project.

4.5 Directed Groundwater Recirculation System Installation

The following subsections summarize the installation of the DGR treatment system at PMR. Survey data reports are provided in **Appendix D**.

4.5.1 Well Installation

In accordance with the RD (ARCADIS, 2014), three injection wells and one monitoring well were installed at PMR utilizing air rotary drilling methodologies. Well installation was conducted from March 31, 2014, to April 16, 2014, by a Maryland licensed driller with oversight from an ARCADIS geologist. Soil lithology was logged by ARCADIS field personnel. Well development was conducted between 24 and 48 hours following well installation to ensure removal of fine grained sediments from the well screen. Due to the lack of bedrock fractures noted in the rock cores collected at the proposed screen intervals at IW-3, the injection well was drilled to a total depth of 75 ft below ground surface (bgs) and constructed as an open borehole well.

Investigation derived waste (IDW) generated during well installation activities (i.e., slurry material and purged groundwater) is discussed in Section 4.6. Well construction details including survey coordinates are provided in **Table 3**and surveyed well locations are presented on **Figure 2**. Soil boring logs, well construction diagrams, well development logs, and Maryland Well Completion Permits are provided in **Appendix C**.

Following well development activities, injection well drop tubes were installed in each injection well at depths below the water table. The submersible pump (QED Model AP2B) was installed in the extraction well (FCA-01) at a depth of 57 ft bgs.

4.5.2 Trenching

The subsurface piping infrastructure associated with electrical supply feed, conveyance of untreated influent from the extraction well to the treatment system and treated effluent from the treatment system to the injection wells was installed between March 2014 and May 2014 via open trenching methodologies.

The influent and effluent piping infrastructure was installed between 3 to 4 ft bgs using 1 1/2- inch HDPE pipe wrapped with tracer wire (in areas without electrical wire) to facilitate identification during future utility locate procedures. 1 1/2- inch HDPE conduit was also installed to convey electrical wiring from the transformer to the treatment building and air supply line from the treatment building to the extraction well for pump operation.

4.5.3 Treatment Building Completion

The DGR treatment system is housed in a pre-fabricated 10 ft x 10 ft wooden shed in accordance with the design specifications presented in the RD (ARCADIS, 2014). The pre-fabricated shed was delivered to the Site on April 7, 2014, and was leveled and secured to the gravel foundation constructed on the southeast side of FCA-26 (see **Figure 2**). Following installation of the subsurface piping infrastructure, the electrical and influent and effluent conveyance pipes were connected to the appropriate connections on the treatment system building. PID-1 provided in Appendix A of the RD (ARCADIS, 2014) provides detail on the infrastructure and various components installed inside the treatment building. Electrical leads were established within the main control panel inside the treatment building, and final connections for system controls were wired to the control panel accordingly. The Operational and Maintenance Manual for the DGR System is provided as **Appendix E**.

4.5.4 System Start-Up and Shake Down

Startup and shakedown of the DGR treatment system commenced the week of June 30, 2014. Startup/shakedown testing commenced into the following week and included the following components:

- Operational testing of the submersible pump and pump controls;
- Operational testing of all controls and interlocks of the system;
- Influent and effluent sampling; and
- System optimization to achieve treatment requirements and maximize extraction and injection rates.

Influent and effluent groundwater samples were collected on June 30, 2014, prior to implementing re-injection to confirm treatment. Samples were submitted to Eurofins Laboratory for analysis of VOCs via USEPA Method 8260B. Sixteen VOCs were detected at concentrations above reporting limits in the influent sample, including TCE. No VOCs were detected in the effluent sample above method detection limits. Analytical laboratory reports for influent and effluent groundwater samples collected during system startup are provided in **Appendix F**. System startup field logs are presented in **Appendix G**.

4.6 Investigation Derived Waste

IDW generated during implementation of the remedial action at PMR includes the following:

- Groundwater generated during well installation and development activities; and
- Soil/rock cuttings and general refuse generated during well installation;

Soil/rock cuttings and groundwater generated during the well installation were characterized, labeled, manifested, and disposed of off-Site. Waste manifests are provided in **Appendix H**.

4.7 Site Restoration and Demobilization

ARCADIS and subcontractors removed construction materials and demobilized from the Site on May 9, 2014, pending BGE completion of the transformer installation. Site restoration activities were completed before the demobilization date. Grass seed and straw were installed to stabilize and re-vegetate the ground surface at areas disturbed during construction activities. E&SC measures (i.e., silt fence) were removed promptly following the final Site inspection completed on July 15, 2014.

One LUC sign was installed on the DGR treatment building on October 14, 2014 as proposed in the RD (ARCADIS, 2014) and as depicted on **Figure 3**. The sign installed was approved by the Army and is consistent with LUCs installed at other FGGM sites.

4.8 Deviations from Remedial Design

The remedial action was conducted in accordance with the RD (ARCADIS, 2014), with minor exception. Deviations are described in additional detail where appropriate within this report and are listed below for reference purposes:

- Well Construction – Due to the lack of bedrock fractures noted in the rock cores collected within the proposed screen interval at IW-3, the injection well was drilled to a total depth of 75 ft bgs and constructed as an open borehole well.
- Extraction well pump – To better accommodate the anticipated low extraction flow rate at FCA-01, an air driven pneumatic pump was installed instead of an electrical submersible pump.

4.9 Final Inspection

A final Site inspection was conducted on July 15, 2014, following Site restoration activities with representatives from FGGM, the MDE, and ARCADIS. A photo log documenting the remedial actions completed at the Site including Site restoration is provided as **Appendix A**. The following punch list item was noted and promptly addressed following the Site inspection: Removal of all E&SC measures (i.e., silt fence).

5. Ongoing Activities

Following installation of the DGR system, long-term monitoring (LTM) of groundwater and long-term operation of the DGR treatment system were implemented at PMR in accordance with the monitoring program developed in the RD (ARCADIS, 2014) and the Operation and Maintenance Manual developed for the system (**Appendix E**). LTM includes both annual MNA sampling and performance monitoring of the DGR system at a subset of the wells in the MNA network. Performance monitoring will be conducted quarterly for the first two years following remedy implementation and annually thereafter. LTM data (i.e. from monitoring well sampling) will be presented in quarterly monitoring reports submitted separate from this RACR. The first quarterly monitoring report was submitted in November 2014. Additional ongoing activities will include annual site inspections and the completion of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 5-year reviews.

6. Community Relations

In accordance with the NCP, public participation is required to promote active communication between the communities affected by the remedial action at the Site. This public participation requirement of the NCP has been fulfilled by the Army in the following manner:

- Public Comment Period – A public notice was published in the North County News (a local newspaper) on August 15, 2013, announcing the availability of the Proposed Plan (ARCADIS, 2013b) for public review and comment during the public comment period from August 15, 2013, to September 13, 2013.

- Information Repositories – The Administrative Record for the Site including the RD (ARCADIS, 2014) and other supporting documents pertaining to PMR is located at two information repositories established by FGGM. The repositories are accessible in accordance with the American Disabilities Act, have copy facilities, and are available to the community during normal business hours. Information repositories are maintained at the following locations: Cockeysville Branch Library (9833 Greenside Drive, Cockeysville, Maryland 21030) and the Fort Meade Environmental Division office (Building 2460, 85th Medical Battalion Avenue, Fort Meade, Maryland).

- A Fact Sheet detailing the remedial actions taken at PMR was distributed to local residents and was available on-site during construction activities. Additional project information was made available to the public on Fort Meade's Environmental Management System website at www.ftmeade.army.mil/environment. In addition, project information was forwarded to the Jacksonville Community Association to notify residents in the area of the construction activities.

7. References

ARCADIS U.S., Inc. (ARCADIS). 2010. Final Quality Assurance Project Plan, Fort George G. Meade, Maryland. March.

ARCADIS. 2013a. Focused Feasibility Study, Phoenix Military Reservation, Jacksonville, Maryland. Final. June.

ARCADIS. 2013b. Proposed Plan, Phoenix Military Reservation, Jacksonville, Maryland. Final. August.

ARCADIS. 2014. Remedial Design, Phoenix Military Reservation, Jacksonville, Maryland. Final. March 2013.

Environmental Science and Engineering, Inc (ESE). 1983. Assessment of Contamination - Phoenix Military Reservation.

Maryland Department of the Environment. 2011. Standards and Specifications for Soil Erosion and Sediment Control. Water Management Association with the Natural Resources Conservation Service and Maryland Association of Soil Conservation Districts. October.

United States Army. 2013. Decision Document, Phoenix Military Reservation, Jacksonville, Maryland. Final. September.

Tables

Table 1
Groundwater Elevations
Phoenix Military Reservation
Jacksonville, Maryland

Monitoring Well ID	Installation Date	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Top of Screen (ft msl)	Bottom of screen (ft msl)	Ground Elevation (ft msl)	TOC Elevation (ft msl)	April 2014 Depth to Groundwater (ft bTOC)	April 2014 Groundwater Elevation (ft msl)
FCA-1	November-82	62	72	498.39	488.39	560.39	563.02	21.05	541.97
FCA-3	October-82 / May-06	70	80	490.60	480.60	560.60	563.19	20.56	542.63
FCA-5	October-82	65	75	512.13	502.13	577.13	577.85	34.56	543.29
FCA-7	October-82 / May-06	84	94	492.22	482.22	576.22	578.54	33.31	545.23
FCA-9	November-82	71	81	480.58	470.58	551.58	554.22	18.88	535.34
FCA-25	May-11	70	85	505.20	490.20	575.20	578.09	35.64	542.45
FCA-26	April-14	62.5	72.5	512.70	502.70	575.20	578.09	26.51	551.58

Notes:
ft bgs = feet below ground surface
ft bTOC = feet below top of casing
msl = mean sea level
TOC = Top of Casing

Table 2
Baseline Analytical Results
Phoenix Military Reservation
Jacksonville, Maryland

				Location	FCA-1	FCA-1	FCA-3	FCA-5	FCA-7	FCA-9	FCA-25	FCA-26
				Date	4/16/2014	4/16/2014	5/7/2014	4/17/2014	4/14/2014	5/6/2014	5/6/2014	5/7/2014
				Type	N	FD	N	N	N	N	N	N
				Facility Code	Phoenix	Phoenix	Phoenix	Phoenix	Phoenix	Phoenix	Phoenix	Phoenix
Analytic Method	Chemical	Unit	Fraction	USEPA MCL								
SW8260	1,1,1,2-Tetrachloroethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,1,1-Trichloroethane	ug/l	N	200	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,1,2,2-Tetrachloroethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,1,2-Trichloroethane	ug/l	N	5	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,1-Dichloroethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,1-Dichloroethene	ug/l	N	7	0.37 J	0.41 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	0.48 J
SW8260	1,1-Dichloropropene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2,3-Trichlorobenzene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2,3-Trichloropropane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2,4-Trichlorobenzene	ug/l	N	70	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2,4-Trimethylbenzene	ug/l	N		< 0.50 UJ	1.2 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2-Dibromo-3-chloropropane	ug/l	N	0.2	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2-Dibromoethane	ug/l	N	0.05	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2-Dichlorobenzene	ug/l	N	600	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2-Dichloroethane	ug/l	N	5	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,2-Dichloropropane	ug/l	N	5	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,3,5-Trimethylbenzene	ug/l	N		< 0.50 UJ	1.3 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,3-Dichlorobenzene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,3-Dichloropropane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	1,4-Dichlorobenzene	ug/l	N	75	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	2,2-Dichloropropane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	2-Butanone	ug/l	N		< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SW8260	2-Chlorotoluene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	4-Chlorotoluene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	4-Methyl-2-Pentanone	ug/l	N		< 10 UJ	< 10 UJ	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SW8260	Acetone	ug/l	N		< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SW8260	Benzene	ug/l	N	5	0.27 J	0.31 J	< 0.50 U	0.20 J	0.30 J	< 0.50 U	< 0.50 U	0.27 J
SW8260	Bromobenzene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Bromodichloromethane	ug/l	N	80	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Bromoform	ug/l	N	80	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Bromomethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Carbon Disulfide	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	0.34 J	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Carbon Tetrachloride	ug/l	N	5	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	CFC-11	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	CFC-12	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Chlorobenzene	ug/l	N	100	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Chlorobromomethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Chlorodibromomethane	ug/l	N	80	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Chloroethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Chloroform	ug/l	N	80	< 0.50 UJ	0.17 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Chloromethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	cis-1,2-Dichloroethene	ug/l	N	70	27	30	2.9	0.83	1.4	< 0.50 U	< 0.50 U	230
SW8260	cis-1,3-Dichloropropene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Cymene	ug/l	N		0.41 J	0.38 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Dibromomethane	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Dichloromethane	ug/l	N	3000	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Ethylbenzene	ug/l	N	500000	< 0.50 UJ	0.23 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Hexachloro-1,3-butadiene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Isopropylbenzene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	m,p-Xylene	ug/l	N		< 0.50 UJ	1.2 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Methyl N-Butyl Ketone	ug/l	N		< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U	< 10 U
SW8260	Methyl-tert-butylether	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Naphthalene	ug/l	N		2.6	2.8	0.47 J	0.98	0.71	< 0.50 U	< 0.50 U	0.40 J
SW8260	N-Butylbenzene	ug/l	N		0.39 J	0.47 J	< 0.50 U	0.19 J	0.23 J	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	N-Propylbenzene	ug/l	N		< 0.50 UJ	0.10 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	o-Xylene	ug/l	N		1.2	1.3	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	sec-Butylbenzene	ug/l	N		1.6	1.9	0.47 J	1.7	2.5	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Styrene (Monomer)	ug/l	N	100	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	tert-Butylbenzene	ug/l	N		< 0.50 U	0.52	< 0.50 U	< 0.50 U	0.29 J	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Tetrachloroethene	ug/l	N	5	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Toluene	ug/l	N	1000	< 0.50 U	< 0.50 U	< 0.50 U	0.38 J	0.83	< 0.50 U	< 0.50 U	0.96
SW8260	Total Xylenes	ug/l	N	10000	1.2 J	2.5 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	trans-1,2-Dichloroethene	ug/l	N	100	0.34 J	0.36 J	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	0.45 J
SW8260	trans-1,3-Dichloropropene	ug/l	N		< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
SW8260	Trichloroethene	ug/l	N	5	220	230	22	3.5	5.5	0.30 J	< 0.50 U	160
SW8260	Vinyl chloride	ug/l	N	2	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U

Notes:
< U - analyte not detected above method detection limit
MCL - Maximum Contaminant Level
FD - field duplicate
N - Normal
J - Estimated detection less than the practical quantation limit and greater that the method detection limit
ug/L - micrograms per liter
MCL exceedances are shaded

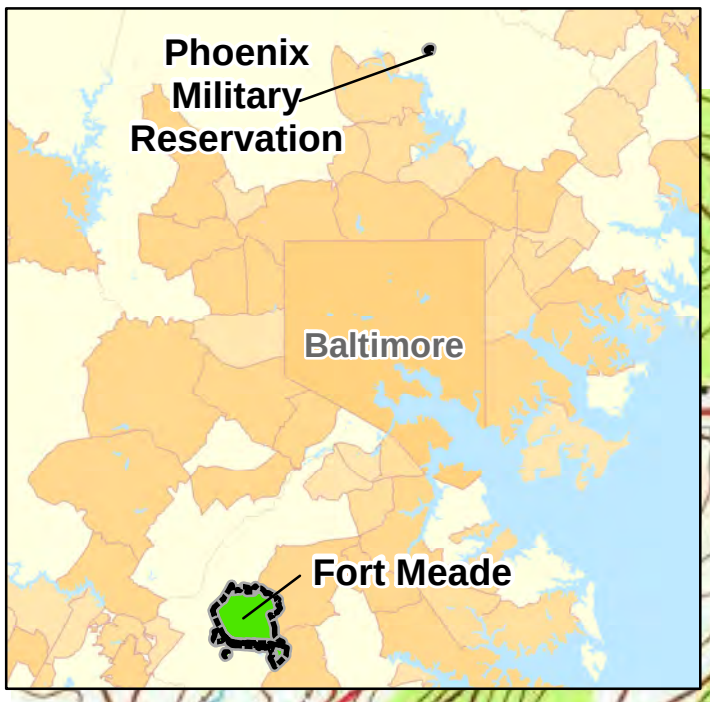
Table 3
Well Construction Details
Phoenix Military Reservation
Jacksonville, Maryland

Well ID	Installation Date	Northing	Easting	Ground Surface Elevation (ft msl)	Measuring Point Elevation	Screened Interval (ft bgs)	Screen Length (ft)	Screen Material Slot Size (inches)	Casing Diameter (inches)	Well Casing Construction	Bottom of Pump (ft bgs)
Extraction Wells											
FCA-01	November-1982	670624.0	1430838.0	560.8	559.92	62 - 72	10	PVC - 0.01	2	Schedule 40 PVC	57
Injection Wells											
IW-1	4/10/2014	670714.8	1430103.1	562.2	560.71	57 - 72	15	Stainless Steel - 0.02	4	Carbon Steel	-
IW-2	4/8/2014	670548.6	1430933.9	571.7	570.11	45 - 60	15	Stainless Steel - 0.02	4	Carbon Steel	-
IW-3	4/10/2014 - 4/14/2014	670485.6	1430748.1	573.5	571.84	Open Borehole[1]	--	--	--	--	-
Monitoring Wells											
FCA-26	4/3/2014	670601.5	1430884.7	565.9	568.44	62.5 - 72.5	10	PVC - 0.02	2	Schedule 40 PVC	-

Notes:
[1] - IW-3 was drilled to a total depth of 75 feet below ground surface and constructed with an open borehole.
1. Northing and easting coordinates are relative to the North American Datum (NAD) 83/10, Maryland.
2. Vertical elevations are presented in feet above mean sea level (ft msl) and are relative to the North American Vertical Datum (NAVD) 1988.
ft - feet
ft bgs - feet below ground surface
PVC - polyvinyl chloride

Figures

CITY: MPLS DIV/GROUP: IM DB: MG LD: PIC: PM: TM: TR:
PHOENIX MR
Path: Z:\GISPROJECTS_ENV\Fort_Meade\Phoenix MR\SITE_LOCATION\MNA_Meeting\mxd\2014\Site_Location_20140716.mxd



JACKSONVILLE

GREENE BRANCH

PHOENIX MILITARY RESERVATION

LOCH RAVEN
RESERVOIR

0 0.25 0.5
APPROXIMATE SCALE IN MILES

PHOENIX MILITARY RESERVATION
JACKSONVILLE, MARYLAND

SITE LOCATION

ARCADIS

FIGURE
1

CITY: MPLS DIV/GROUP: IM DB: MG LD: KS
PHOENIX MR
Path: Z:\GISPROJECTS_ENV\Fort_Meade\Phoenix MR\SITE_LOCATION\MNA_Meeting\mxd\2014\GW_Recirculation_Layout_20140716.mxd

FCA-15
ND

FCA-21
0.60 J

FCA-17
ND

FCA-19
ND

FCA-13
0.17 J

FCA-9
0.82 J

FCA-3
25

IW-1

FCA-1
250

FCA-26

100

IW-2

10

IW-3

FCA-7
7.40

5

FCA-25
ND

FCA-5
3.9 J

10' x 10'
EQUIPMENT
COMPOUND

ELECTRIC METER
AND CONTROL BOX

CONCRETE PAD AND
ELECTRIC JUNCTION BOX

Natural Spring

Major Western Lineament

Minor Western Lineament

Major Eastern Lineament

Minor Eastern Lineament

Sunnybrook Rd.

MOLLIE CT

0 200 400
SCALE IN FEET

Legend

May 2011 Trichloroethene Concentration

- 5 µg/L
- 10 µg/L
- 100 µg/L
- 5 TCE concentration in µg/L

- Deep Monitoring Well Location
- Lineament
- Stream
- Natural Spring
- House
- Extraction Well
- Recirculation Well
- Electrical Feed
- Water Conveyance
- Approximate Site Boundary

Note: ND = Non-Detect
J = estimated concentration
µg/L = micrograms per liter

PHOENIX MILITARY RESERVATION
JACKSONVILLE, MARYLAND

DIRECTED GROUNDWATER RECIRCULATION LAYOUT

ARCADIS

FIGURE
2

CITY: MPLS DIV/GROUP: IM DB: MG LD: KS
PHOENIX MR
Path: Z:\GISPROJECTS_ENV\Fort_Meade\Phoenix MR\SITE_LOCATION\MNA_Meeting\mxd\2014\LandUse_Signage_20140812_v1.mxd

Major Western Lineament
Minor Western Lineament
Minor Eastern Lineament
Major Eastern Lineament
Natural Spring
Sunnybrook Rd.

10' x 10'
EQUIPMENT COMPOUND
SIGN TO BE PLACED ON
NORTH SIDE OF BUILDING

SIGN (1 TOTAL) SHALL APPEAR AS SHOWN BELOW:

NOTICE

ENVIRONMENTALLY RESTRICTED AREA

GROUNDWATER USE RESTRICTED

CALL FORT MEADE ENVIRONMENTAL DIVISION (301) 677-9648

18" X 12" ALUMINUM SIGN

Legend

- Sign Location
- Extent of Land Use Controls
- Approximate Site Boundary
- Lineament
- Stream
- Natural Spring
- House

0 200 400
SCALE IN FEET

PHOENIX MILITARY RESERVATION
JACKSONVILLE, MARYLAND

LAND USE CONTROL SIGNAGE

ARCADIS

FIGURE
3

Appendix A

Photo Log

Remedial Action Completion Report
Phoenix Military Reservation
Jacksonville, Maryland

Photo 1: Trench installation between the power transformer to the treatment building.

Date: April 4, 2014

Location Taken: Near entrance gate.

Direction Facing: Northeast

Photo 2: Electrical conduit installation between the main power supply feed and transformer installed.

Date: April 4, 2014

Location Taken: Near entrance gate.

Direction Facing: Southwest

Photo 3: Installation of effluent pipe from treatment building to IW-3.

Date: April 2, 2014

Location Taken: Southwest of treatment building.

Direction Facing: Northeast

Photo 4: Drilling activities at FCA-26.

Date: April 2, 2014

Location Taken: Near treatment building.

Direction Facing: Northwest

Photo 5: Treatment building foundation construction.
Date: April 3, 2014
Location Taken: At treatment building.
Direction Facing: Southwest

Photo 6: Electrical meter stanchion installation.
Date: April 4, 2014
Location Taken: Near entrance gate.
Direction Facing: Southwest

Photo 7: Rock core collected at IW-2.
Date: April 4 , 2014
Location Taken: IW-2.
Direction Facing: N/A

Photo 8: Treatment building in place.
Date: April 7, 2014
Location Taken: At treatment building.
Direction Facing: Southwest

Photo 9: Drilling activities at IW-1.
Date: April 8, 2014
Location Taken: IW-1.
Direction Facing: Northwest

Photo 10: Insulation install inside the treatment building.
Date: April 8, 2014
Location Taken: At treatment building.
Direction Facing: West

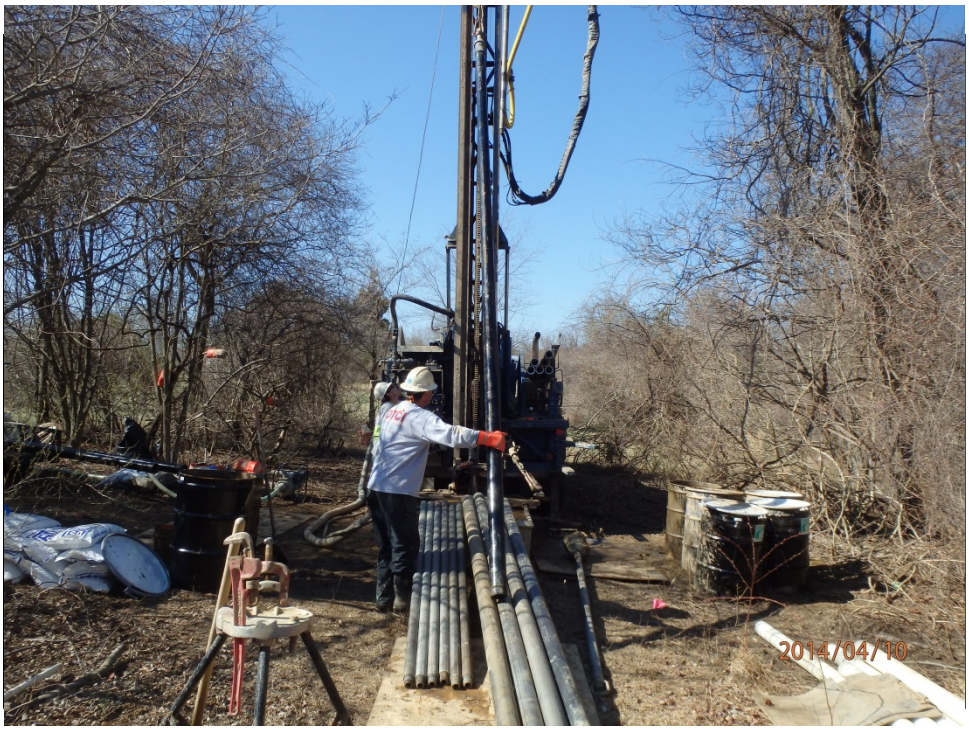


Photo 11: Well construction at IW-1.
Date: April 10, 2014
Location Taken: IW-1.
Direction Facing: Southwest

Photo 12: Well Development at IW-2.
Date: April 16, 2014
Location Taken: IW-2.
Direction Facing: Southwest

Photo 13: Vault and wellhead completion at IW-2.
Date: May 8, 2014
Location Taken: IW-2.
Direction Facing: West

Photo 14: Treatment building construction.
Date: May 8, 2014
Location Taken: Treatment building.
Direction Facing: Southwest

Photo 15: Treatment building completion.
Date: May 5, 2014
Location Taken: Treatment building.
Direction Facing: Southwest

Photo 16: FCA-01 following Site restoration.
Date: June 21, 2014
Location Taken: FCA-01.
Direction Facing: West

Photo 17: Photo of LUC sign installed on the treatment building
Date: October 14, 2014
Location Taken: Treatment building.
Direction Facing: South

Appendix B

Analytical Laboratory Reports and
Data Validation Reports (on CD)

Appendix C

Field Logs (on CD)

Appendix D

Survey Report (on CD)

Appendix E

Directed Groundwater
Recirculation System Operation
and Maintenance Manual

Appendix F

Analytical Laboratory Reports for
DGR System Influent/Effluent
(on CD)

Appendix G

System Startup Field Logs
(on CD)

Appendix H

Waste Manifests (on CD)