Final
Remedial Investigation at SWMU 56

PERFORMANCE-BASED RESTORATION
JOINT BASE ANDREWS NAVAL AIR FACILITY WASHINGTON
CAMP SPRINGS, MARYLAND

Contract W9128F-13-D-0002, DO #0004

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Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
°F	degrees Fahrenheit
ADR	automated data review
AFB	Air Force Base
AOI	area of interest
B[a]P	benzo(a)pyrene
Bay West	Bay West LLC
BERA	Basewide Ecological Risk Assessment
bgs	below ground surface
BRA	baseline risk assessment
BTOC	below top of casing
CEM	conceptual exposure model
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COMAR	Code of Maryland Regulations
COPC	chemicals of potential concern
CSF	carcinogenic slope factor
CSM	conceptual site model
DCE	cis-1,2-dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DERA	Defense Environmental Restoration Account
DO	Delivery Order
DoD	Department of Defense
DPT	direct push technology
EPC	exposure point concentration
ESCC	ecological screening criteria comparison
ERP	Environmental Restoration Program
FFA	Federal Facilities Agreement
f_{oc}	fraction of organic carbon
FS	feasibility study
ft	foot/feet
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IDW	investigation-derived waste
IRIS	Integrated Risk Information System
JBA	Joint Base Andrews Naval Air Facility Washington
K_d	distribution coefficient
K_{oc}	organic carbon partitioning coefficient
LOD	limit of detection
MCL	maximum contaminant level
MCPP	2-4-chloro-2-methylphenoxypropanoic acid
MDE	Maryland Department of the Environment
mg/kg	milligrams per kilogram
mL	milliliter
mL/min	milliliters per minute
MS/MSD	matrix spike/matrix spike duplicate
MTCA	Model Toxics Control Act
MW	monitoring well
NTU	nephelometric turbidity unit
OSWER	Office of Solid Waste and Emergency Response
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QSM	quality systems manual
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RI	remedial investigation
ROD	record of decision
RSL	regional screening level
SB	soil boring
SI	site investigation
SSL	soil screening level
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TAL	target analyte list
TCE	trichloroethene
TCL	target compound list
TestAmerica.	TestAmerica Laboratories, Inc.
TMW	temporary monitoring well
TPH	total petroleum hydrocarbons

UCL	upper concentration limit
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	underground storage tank
UTL	upper tolerance limit
UU/UE	unlimited use/unrestricted exposure
VC	vinyl chloride
VISL	vapor intrusion screening level
VOC	volatile organic compound
WSSC	Washington Suburban Sanitary Commission

EXECUTIVE SUMMARY

A Remedial Investigation (RI) was conducted at Solid Waste Management Unit (SWMU) 56 at Joint Base Andrews Naval Air Facility Washington (JBA), located near the community of Camp Springs, Maryland. The RI report is prepared under the United States Army Corps of Engineers (USACE) - Omaha District Performance-Based Contract W9128F-13-D-0002, Delivery Order No. 0004.

The Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) presenting the scope of the RI field program was accepted by the United States Environmental Protection Agency (USEPA), the Maryland Department of Environment (MDE), and Prince George's County Health Department in September 2016. The objective of this RI is to determine the nature and extent of chemicals of potential concern (COPCs) in soil and groundwater at SWMU 56 and determine the degree of risk at SWMU 56 by using recently collected data, including groundwater and soil samples collected in 2012 and 2016. The RI process serves as the mechanism for data collection to identify source(s) and migration pathway characteristics and for collection of other relevant information required for the Baseline Risk Assessment (BRA) and Feasibility Study (FS) processes. The FS process uses the information collected in the RI to evaluate remedial alternatives for controlling potential risks to human health and the environment.

SWMU 56, as designated in the Environmental Restoration Program (ERP) at JBA, encompasses an asphalt-paved storage area, designated the Civil Engineering Storage Yard. SWMU 56 is bounded by Building 3440 on the north, Pennsylvania Avenue on the east, Building 3441 on the west, and Storage Yard fence line on the south.

Historical reports indicated that SWMU 56, also known as SA-056, is a 75-foot (ft)-by-150-ft fenced area near former Building 3459 which was demolished in 1994. It was reported that SWMU 56 previously stored construction material including lumber, paint, thinners, roofing material, asphalt, pipes and pipe fittings, used and new household appliances, non-polychlorinated biphenyl (PCB) transformers, and miscellaneous drums. It has also been noted that drums containing "flammable" and "hazardous" warning labels and additional drums containing viscous asphalt were observed to be leaking (MDE, 1988).

SWMU 56 is also located directly adjacent to and within the groundwater contaminant plume associated with ST-14. The primary groundwater contaminants of concern (COCs) identified for ST-14 include trichloroethene (TCE), vinyl chloride (VC), carbon tetrachloride, benzene, toluene, and xylenes. A Record of Decision (ROD), signed in September 2007, identified site-wide enhanced in-situ biodegradation with groundwater monitoring and institutional controls as the major components of the selected remedy for ST-14. The ST-14 ROD (USEPA, 2007) addresses both the COCs and their respective degradation products (cis-1,2-dichloroethene and chloroform for example). The TCE plume associated with ST-14 overlies a portion of SWMU 56 (AECOM, 2010). Other contaminant plumes associated with ST-14 are located north of SWMU 56 (AECOM, 2010).

To assess the nature and extent of contamination at SWMU 56, field investigations were conducted in December 2012 and April 2016 and consisted of:

- Site reconnaissance and aerial image review;
- Soil and groundwater sampling;
- Quality assurance/quality control (QA/QC) sample collection and data review; and
- Investigation-derived waste (IDW) management.

During the 2012 Phase I RI, nine borings, labeled as temporary monitoring wells (TMWs) were advanced at SWMU 56. A total 15 soil samples (including one field duplicate) were collected and

10 groundwater samples (including one field duplicate) were collected from the TMWs and analyzed for:

- Target compound list (TCL) volatile organic compounds (VOCs);
- TCL polynuclear aromatic hydrocarbons (PAHs);
- TCL semi-volatile organic compounds (SVOCs);
- TCL pesticides;
- TCL PCBs;
- TCL herbicides; and
- Target analyte list (TAL) metals.

A total of 23 metals, 2 pesticides, 9 VOCs, 1 SVOC, and 16 PAHs were detected in soils collected at SWMU 56 in 2012. Aluminum, arsenic, chromium, cobalt, iron, thallium and benzo(a)pyrene (B[a]P) were detected above the residential soil Regional Screening Levels (RSLs; target hazard quotient=0.1, target risk=10^{-6}; USEPA, May 2016a), and were selected as soil COPCs and carried through the Human Health Risk Assessment (HHRA) within this report. Soil samples from seven additional borings advanced in 2016 were analyzed for barium to delineate contamination reported in the Phase I RI. Following 2016 sampling it was determined that barium was incorrectly identified as a COPC due to unit conversion (**Section 4.2.2.1**). It is notable that many of the soil COPCs were detected at concentrations less than basewide background upper tolerance limits (UTLs); however, the basewide background UTLs were not used to screen out COPCs (USEPA, 2013).

Due to the high turbidity of the 2012 groundwater samples collected from the TMWs, additional investigation using permanent construction monitoring wells was recommended to confirm the presence of contamination, if any, in groundwater. The groundwater data from the Phase I RI were used to determine the analytical approach for 2016 RI. These 2012 TMW data were not used for the determination of COPCs and risk assessment within this RI Report. The April 2016 investigation, conducted in accordance with the RI UFP-QAPP (Bay West, 2016) included the installation and sampling of six permanent construction monitoring wells. The samples collected from these permanent monitoring wells were submitted for the following analysis: TAL metals (total and dissolved), TCL herbicides, TCL VOCs, and TCL PAHs. A total of 24 metals, 8 VOCs, and 9 PAHs were detected in RI groundwater samples collected in 2016. The results were compared to the federal Maximum Contaminant Levels (MCLs), or the USEPA tap water RSLs (target hazard quotient=0.1, target risk=10^{-6}; USEPA, May 2016). Nine metals (aluminum, arsenic, cadmium, chromium, cobalt, iron, manganese, mercury and thallium) and two PAHs (benzo[b]fluoranthene and benzo[a]anthracene) exceeded at least one of the screening criteria and were selected as COPCs and carried through the HHRA. As noted throughout this report, chloroform and TCE were detected in SWMU 56 RI groundwater samples in exceedance of their respective RSLs and VISLs. SWMU 56 is collocated with ST-14. Chloroform and TCE are known contaminants and are currently being remediated in accordance with the ST-14 ROD. Therefore, chloroform and TCE were not selected as COPCs and were not carried through the HHRA. However, further evaluation of VI as it relates to chloroform and TCE is warranted and is planned to be conducted in support of ongoing ST-14 remediation.

An HHRA was performed to evaluate the potential human health risks and hazards posed by the concentration of COPCs detected at the site. The calculated soil and groundwater risks appear to be largely related to background levels of several metals; therefore, no COCs associated with SWMU 56 are proposed based on residential exposure.

An ecological risk evaluation was also conducted and determined that no complete transport and/or exposure pathways for ecological receptors exist at the site. Therefore, no further ecological risk assessment is warranted.

Given that no COCs were proposed at SWMU 56 based on residential exposure, No Action is recommended and no feasibility study is required. In order to select No Action for SWMU 56, submittal of a Proposed Plan and ROD are recommended.

1.0 INTRODUCTION

1.1 Purpose of Report

This Remedial Investigation (RI) Report has been prepared by Bay West LLC (Bay West) for Solid Waste Management Unit (SWMU) 56 at Joint Base Andrews Naval Air Facility Washington (JBA), located near the community of Camp Springs, Maryland (**Figure 1-1**). This RI Report is prepared under the United States Army Corps of Engineers (USACE) - Omaha District Performance-Based Contract W9128F-13-D-0002, Delivery Order No. 0004.

The Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) presenting the scope of the RI was approved by the United States Environmental Protection Agency (USEPA), the Maryland Department of Environment (MDE), and Prince George's County Health Department in September of 2016. The objective of this RI is to determine the nature and extent of chemicals of potential concern (COPCs) in soil and groundwater at SWMU 56 and determine the degree of risk at SWMU 56 by using recently collected data. Data for the RI was obtained from groundwater and soil samples collected in 2012 and 2016. The RI process serves as the mechanism for data collection to identify source(s) and migration pathway characteristics and for collection of other relevant information required for the Baseline Risk Assessment (BRA) and Feasibility Study (FS) processes. The FS process uses the information collected in the RI to evaluate remedial alternatives for controlling potential risks to human health and the environment posed by site contamination.

The specific objectives of the RI at SWMU 56 include the following:

- Determine the nature and extent of contamination in site soil and groundwater; and
- Complete a site-specific baseline risk assessment.

1.2 Site Background

JBA is located in Prince George's County, Maryland (**Figure 1-1**), near the community of Camp Springs, Maryland. Washington, D.C. is located approximately 5 miles northwest of the Base. The Base occupies approximately 4,300 acres and consists of runways, airfield operations, an industrial area, and housing and recreational facilities.

JBA was originally established as the Camp Springs Army Air Field on August 25, 1942. The name was changed to Andrews Air Force Base (AFB) in 1947, when the U.S. Air Force (USAF) was established as a separate military service. The Base has served as headquarters at various times for the Continental Air Command, the Strategic Air Command, the Military Air Transport Service, and the USAF Systems Command. The current major tenant command is the Andrews Naval Air Facility. The missions of the Andrews Naval Air Facility are flight operations and photographic reconnaissance. In 1992, Andrews AFB became an Air Mobility Command Base. In 2009, the name of the base was officially changed to JBA to more accurately reflect the joint nature of the missions and operations at the Base. In 2011, the USAF and USEPA entered into a Federal Facilities Agreement (FFA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120, relating to the investigation and remediation of releases at JBA (USAF/USEPA, 2011).

In May 1999, JBA was added to the National Priorities List. The National Superfund electronic database identification number for the Base is MD0570024000. SWMU 56 was identified in Section 6.7.2.12 of the FFA between the USEPA and (USAF/USEPA, 2011).

1.3 Site History and Description

SWMU 56, as designated in the Environmental Restoration Program (ERP) at JBA, encompasses an asphalt-paved storage area, designated the Civil Engineering Storage Yard (**Figure 1-2**). SWMU 56 is bounded by Building 3440 on the north, Pennsylvania Avenue on the east, Building 3441 on the west, and Storage Yard fence line on the south (**Figure 1-3**). Based on a historical aerial image review and discussions with the project stakeholders, SWMU 56 (**Figure 1-3**) is located east of Buildings 3441 and 3443, south of buildings 3449, 3440, and 3434, and both west and north of the Storage Yard fence line (an approximate area of 460 feet [ft] by 200 ft). Historical reports indicated that SWMU 56, also known as SA-056, is a 75-ft-by-150-ft fenced area near former Building 3459 which was demolished in 1994. Based on historical aerials from 1943 to 1990, it appears that the area used for storage may have moved locations over the years (**Appendix B**). As of 1988, SWMU 56 was reportedly fenced and had no retention curbs or trenches (MDE, 1988).

SWMU 56 historically stored construction materials including lumber, paint, thinners, roofing material, asphalt, pipes and pipe fittings, used and new household appliances, non-polychlorinated biphenyl (PCB) transformers, and miscellaneous drums. It was reported that drums with “flammable” and “hazardous” warning labels and additional drums containing viscous asphalt were observed to be leaking (MDE, 1988). SWMU 56 was also observed to have no retention curb or collection trench installed around the site to collect leaking materials or stormwater from migrating off-site. During the site visit conducted on September 13, 2011, there were small isolated secondary containment pads present that had retention curbs to contain possible material spillage on the containment pad (Bay West, 2012). SWMU 56 is currently zoned as industrial and used as a storage yard for the JBA Civil Engineering Department. Future land use is designated as industrial and administrative.

1.4 Summary of Previous Investigations

To date, no removal actions have been completed at SWMU 56; however, environmental investigations have been conducted at the base since 1985 and are being conducted under the USAF ERP. The ERP was developed by the Department of Defense (DoD) in 1981 to identify, investigate, and clean up environmentally contaminated sites on military bases. SWMU 56 was identified as a compliance restoration site through the ERP, following the discovery of the persistently high pH (greater than 11) at ST14-MW35 during ST-14 Long-Term Groundwater Monitoring. ST14-MW35 was installed in 2002 (Shaw, 2005) and has since been monitored as part of the ST-14 ERP in accordance with CERCLA and the ST-14 Record of Decision (ROD) dated September 2007.

1.4.1 ST-14 Underground Storage Tank Removal (1992)

Nearby ST-14 has undergone a number of investigations since 1992 following the removal of two 10,000-gallon underground storage tanks (USTs), a 250-gallon waste motor oil UST, and petroleum-contaminated soil between 1983 and 1986 (D&M, 1994).

1.4.2 Remedial Actions (2007-2010)

ST-14 currently has an approved ROD. The primary groundwater contaminants of concern (COCs) identified for ST-14 include: trichloroethene (TCE), vinyl chloride (VC), carbon tetrachloride, benzene, toluene, and xylenes. The ST-14 ROD (USEPA, 2007) addresses both the COCs and their respective degradation products (cis-1,2-dichloroethene and chloroform for example). Remedial actions were implemented for ST-14 between 2007 and 2010, including a series of injections of a carbon substrate (sodium lactate) to enhance reductive dechlorination through a series of injection points and wells. Several sodium lactate injection events were completed within and adjacent to SWMU 56 (AECOM, 2010).

1.4.3 ST14-MW35 High pH Investigation (2009)

In 2009, URS completed the Final Evaluation Report for Air Force Compliance Clean-Up Sites, Identification and Evaluation of Defense Environmental Restoration Account (DERA) Eligibility report which included a shallow subsurface soil (0 to 2 ft below ground surface [bgs]) investigation surrounding ST14-MW35 to evaluate possible causes of the high pH detections in the groundwater. The locations of the previous subsurface soil samples are shown on **Figure 1-2**. Based on the 2009 analytical results, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and pesticide compounds were detected; however, they did not exceed the USEPA regional screening levels (RSLs) for soil. PCBs were not detected (URS, 2009). The horizontal and vertical extents of the VOC, SVOC, pesticide, and total petroleum hydrocarbon (TPH) detections were not evaluated at that time. In addition, a source was not identified.

1.4.4 ST-14 Long-Term Monitoring (2010)

In June 2010, AECOM completed a Long-Term Monitoring Report for ST-14 which identified ST14-MW35 on the eastern boundary of the ST-14 TCE plume. All other contaminant plumes associated with ST-14 are located north of ST14-MW35. The report also stated that the high pH condition at ST14-MW35 is likely caused by grout contamination in the monitoring well and is not suspected to be representative of the local aquifer conditions (AECOM, 2010). During long-term monitoring work completed at ST-14, ST14-MW35 has been purged at varying flow rates. At increased purge flow rates, the pH is initially high, but then decreases with time.

1.4.5 SWMU 56 Phase I Remedial Investigation (2012)

A Phase I RI (Bay West, 2013) was completed to determine whether hazardous substances were released to the environment and whether hazardous substances have impacted the environment in excess of human health or environmental exposure criteria. The Phase I RI consisted of:

- A sampling and reporting effort equivalent to a preliminary assessment/site investigation (PA/SI) as defined by the National Oil and Hazardous Substances Contingency Plan, minus the Hazard Rating Score;
- A Human Health and Ecological Screening Criteria Comparison; and
- The development of a conceptual site model (CSM) with defined exposure pathways.

The 2012 SWMU 56 Phase I RI field work included the advancement of nine soil borings identified as temporary monitoring wells (TMWs; **Figure 1-3**). A total of 15 soil samples (including one field duplicate) were collected and 10 groundwater samples (including one field duplicate) were collected from the TMWs and analyzed for: target compound list (TCL) VOCs; TCL polynuclear aromatic hydrocarbons (PAHs); TCL SVOCs; TCL pesticides; TCL PCBs; TCL herbicides; and target analyte list (TAL) metals.

The Final Phase I RI concluded that chemicals exceeding established screening criteria were present in soil and groundwater at SWMU 56 and that an RI, including additional sampling and a baseline Human Health Risk Assessment (HHRA), was warranted. The results of this 2012 Phase I RI were ultimately used to identify data gaps and design the 2016 RI sampling effort (Bay West, 2016).

Based on the 2012 results presented in the Phase I RI (Bay West, 2013), four initial soil COPCs (arsenic, chromium, barium, and benzo[a]pyrene [B[a]P]) were identified due to detections in exceedance of their residential RSLs (target hazard quotient=1.0, target risk=10^{-6}; USEPA, May 2014) at the time of scoping this RI. Arsenic and chromium concentrations detected in Phase I RI soil samples did not exceed the basewide background upper tolerance limit (UTL) concentrations and therefore additional sampling of arsenic or chromium was unnecessary (Bay West, 2016). Additionally, B[a]P concentrations detected in shallow subsurface soil samples (2-4 ft bgs) only slightly exceeded the residential RSL (15 micrograms per kilogram [µg/kg], target risk=$1x10^{-6}$) at two Phase I RI sample locations directly below asphalt pavement. Based on discussions with the USEPA during review of the draft UFP-QAPP, additional soil sampling and analysis for B[a]P during the 2016 investigation was deemed unnecessary (Bay West, 2016). Additional soil sampling conducted in 2016 for barium only in accordance with the SWMU 56 RI UFP-QAPP is discussed within this RI Report. The list of soil COPCs (total of seven) carried through the HHRA within this report, differs from this initial list (total of 4) due to the use of a different RSLs (target hazard quotient=0.1, target risk=10-6; USEPA, May 2016) and the initial mis-identification of barium as a (**Section 4.2.2.1**).

Based on Phase I RI analytical results, the following were identified as initial groundwater COPCs in need of additional sampling as a part of the 2016 investigation (Bay West, 2016):

VOCs
- Chloroform
- TCE

TCL PAHs
- benzo[b]fluoranthene
- dibenz(a,h)anthracene
- indeno[1,2,3-cd]pyrene

Herbicides
- 2-4-chloro-2-methylphenoxypropanoic acid [MCPP]

Metals
- Aluminum
- Arsenic
- Chromium [total]
- Cobalt
- Iron
- Lead
- Manganese
- Thallium

The 2012 Phase I RI groundwater samples were collected from the TMWs and the 2016 RI UFP-QAPP called for the use of permanent construction monitoring wells to confirm the presence of contamination, if any, in groundwater at SWMU 56. The 2012 groundwater data from the Phase I RI were used for screening and to determine the analytical approach for the RI, but were not used for the ultimate determination of COPCs or risk assessment within this report. Additional groundwater investigations conducted in 2016 in accordance with the SWMU 56 RI UFP-QAPP are discussed within this RI Report.

The Phase I RI included an ecological screening criteria comparison (ESCC). The primary objective of the ESCC was to assess potential ecological impacts under current conditions resulting from site-related chemicals. Given that the site is completely paved, and based on groundwater travel times to the nearest surface water (Charles Branch), the ESCC determined that no complete transport and/or exposure pathways for ecological receptors exist at the site. It was therefore concluded and approved that no chemicals detected at the site pose a risk to ecological receptors and no further ecological risk assessment is warranted. This evaluation has been carried forward to this RI Report.

The SWMU 56 Phase I RI included investigations of the high pH at ST14-MW35 and soil at the Building 3459 Area of Interest (AOI) in accordance with the SWMU 56 Final Phase I RI UFP-QAPP (Bay West, 2012). The USEPA/MDE-approved Final Phase I RI Report concluded that additional investigation of the Building 3459 AOI was not warranted and high pH at ST14-MW35 is attributed to construction of the well (Bay West, 2013).

1.4.6 ST14-MW35 Groundwater Sampling Event (2015)

In November 2015, AMEC completed a remedial action-operations sampling event at ST14-MW35. TCE was detected in the ST14-MW35 groundwater sample at a concentration of 34 micrograms per liter (µg/L), which exceeds the USEPA residential RSL (0.44 µg/L) and Maximum Contaminant Level (MCL; 5 µg/L). No other ST-14 contaminants (including chloroform) exceeded their respective regulatory standards at ST14-MW35 during this 2015 sampling event. A map showing the ST-14 TCE plume configuration as of Fall 2015 is included in **Appendix A**. TCE has been detected in exceedance of its MCL at ST14-MW35 in 14 of the 15 long-term monitoring groundwater sampling events conducted between 2007 to 2015 (AMEC, 2016).

1.5 Report Organization

This RI Report is organized as follows:

- **Section 1.0** – Introduction: Provides the RI purpose and objective, site description, and a summary of previous investigations.
- **Section 2.0** – Study Area Investigation: Provides the site physical characteristics and a description of field programs applied during the RI.
- **Section 3.0** – Physical Characteristics of the Study Area: Provides a description of the basewide geology and hydrogeology.
- **Section 4.0** – Remedial Investigation Results: Provides a discussion of investigation results and field observations.
- **Section 5.0** – Contaminant Fate and Transport: Provides a discussion on fate and transport of contaminants detected at the site.
- **Section 6.0** – Baseline Risk Assessment: Includes HHRA and Screening Level Ecological Risk Assessment.
- **Section 7.0** – Conclusions and Recommendations.
- **Section 8.0** – References: Provides the references cited in the RI Report.
- **Appendix A** – Fall 2015 ST-14 TCE Plume Map
- **Appendix B** – Historical Figures and Aerial Images
- **Appendix C** – 2012 Field Documentation
- **Appendix D** – 2016 Field Documentation
- **Appendix E** – Data Validation Reports (provided as separate folder on this DVD)
- **Appendix F** – Laboratory Analytical Packages (provided as separate folder on this DVD)
- **Appendix G** – RAGS Part D Risk Assessment Tables
- **Appendix H** – Regulatory Comment Worksheet

2.0 STUDY AREA INVESTIGATION

This section describes the field activities and methods used during the 2012 and 2016 investigations to evaluate possible soil and groundwater contamination within the boundaries of SWMU 56.

The field activities included the following:

- Site permits and utility locate;
- Site reconnaissance and aerial image review;
- Environmental sampling consisting of the following:
  - Subsurface soil sampling; and
  - Groundwater sampling from TMWs and newly installed permanent monitoring wells.
- Quality assurance/quality control (QA/QC) sample collection and data review; and
- Investigation-derived waste (IDW) management.

These activities are discussed in the following subsections.

2.1 Site Reconnaissance and Aerial Image Review

Prior to the initiation of the 2012 Phase I RI field activities at SWMU 56, a review of aerial imagery from 1943 to 2010 was conducted to determine the location of miscellaneous material storage. Information obtained during the aerial imagery review was used to select the locations of each TMW. The aerial images reviewed during this RI are included in **Appendix B**. The results of the aerial imagery review are presented in **Section 4.1**.

2.2 Environmental Sampling

From December 3-7, 2012, environmental sampling at SWMU 56 was conducted in accordance with the Phase I RI UFP-QAPP (Bay West, 2012), and from April 1-16, 2016, environmental sampling was conducted in accordance with the RI UFP-QAPP (Bay West, 2016). Environmental sample collection consisted of subsurface soil and groundwater samples which are described in the following subsections. The sampling locations are shown on **Figure 1-3**. The results from the environmental sampling are discussed in **Section 4.2**.

2.2.1 Soil Investigations

The soil investigation was conducted to determine the nature and extent of contamination, if any, in subsurface soils at SWMU 56. This was accomplished by conducting field screening and sampling in two phases using a direct push technology (DPT) rig to collect soil samples for lithologic logging, headspace screening using a photoionization detector (PID), and laboratory analysis. It is noted that SWMU 56 is entirely paved and no surface soils exist at the site; therefore, surface soils could not be sampled and were not considered a medium of interest during either phase of the investigation at SWMU 56.

2.2.1.1 2012 Soil Sampling

During the 2012 RI event, a total of nine soil borings (identified as TMW01 through TMW09 on **Figure 1-3**) were advanced with a DPT Geoprobe™ 6820 drill rig to a depth of approximately 30 ft bgs. Soil was collected from each TMW using 4-ft Macro-Core samplers. Soil cores were logged, documented, and headspace screened for organic vapors using a PID. Soil descriptions were logged in accordance with the Unified Soil Classification System (USCS) and recorded on the TMW boring logs (**Appendix C**). Observations recorded on the logs include descriptions of soil type, grain size distribution, changes in lithology, soil stains, olfactory observations (mild to strong), soil moisture, depth intervals of laboratory samples, sample recovery, total depth of boring, pH screening results, and PID screening results. Soil pH screening was conducted using a Hanna HI 99121 direct soil pH measurement kit.

Soil was collected for physical classification and headspace analysis continuously from the ground surface to the terminus depth of each TMW and logged by a field geologist as described above. Soil samples were collected for laboratory analysis in accordance with the UFP-QAPP (Bay West, 2012). Soil collected for VOC analysis was collected directly from the Macro-Core sampler and placed in laboratory containers (40-milliliter [mL] vials) as soon as possible after the sampler was opened. Soil was field screened for VOCs using a handheld PID at 2-ft intervals. One or two samples were selected from each TMW for fixed-base laboratory analysis based on the following criteria:

- Interval corresponding to the highest pH, PID result, or olfactory/visual indication of contamination; and
- Interval directly above the soil/groundwater interface.

A total of 14 soil samples and one field duplicate were collected, labeled, sealed under chain-of-custody, and shipped to TestAmerica Laboratories, Inc., (TestAmerica) in Denver, Colorado. These soil samples were analyzed using the following methods:

- TCL VOCs by SW-846 Method 8260B;
- TCL PAHs by SW-846 Method 8270-SIM;
- TCL SVOCs by SW-846 Method 8270D;
- TCL pesticides by SW-846 Method 8081B;
- PCBs by SW-846 Method 8082A;
- TCL herbicides by SW-846 Method 8151A; and
- TAL metals by SW-846 Methods 6010B, 6020A, and 7471B.

2.2.1.2 2016 Soil Sampling

During the 2016 RI event, a total of seven soil borings (identified SB05 through SB11 on **Figure 1-3**) were advanced with a DPT Geoprobe™ 6820 drill rig to a depth of 11 ft bgs. Soil was collected from each monitoring well using 5-ft Macro-Core samplers. Soil cores were logged, documented, and headspace screened for organic vapors using a PID. Soil descriptions were logged in accordance with the USCS and recorded on the boring logs (**Appendix D**). Observations recorded on the logs include descriptions of soil type, changes in lithology, soil stains, olfactory observations (mild to strong), soil moisture, depth intervals of laboratory samples, sample recovery, total depth of boring, and PID screening results. Headspace screening technique was conducted in accordance with the UFP-QAPP (Bay West, 2016). Soil was collected for physical classification and headspace analysis continuously from the ground surface to the terminus depth of each soil boring and logged by a field geologist as described above in accordance with the UFP-QAPP.

The objective of the 2016 soil sampling effort was to confirm and delineate the barium contamination in the 2-4 ft bgs TMW06 soil sample reported in the Phase I RI (Bay West, 2013). To that end, the seven soil borings advanced in April 2016 were located near and surrounding the location of TMW06. Three samples from each soil boring, at pre-selected intervals (2-4, 5-7 and 9-11 ft bgs intervals) were submitted for fixed-base laboratory analysis. A total of 21 soil samples and three field duplicates were collected, labeled, sealed under chain-of-custody, and shipped to TestAmerica in Denver, Colorado and analyzed for barium.

2.2.2 Groundwater Investigation

The groundwater investigation was conducted to determine if contamination in groundwater at SWMU 56 is present and the nature and extent of any contamination. This was accomplished in two phases. The 2012 Phase I RI groundwater samples were collected from borings (identified as TMWs) and were analyzed using a broad suite of laboratory based methods. The 2016 RI groundwater sampling employed permanent construction monitoring wells and COPC-specific laboratory-based analysis in accordance with the RI UFP-QAPP (Bay West, 2016).

2.2.3 2012 Phase I RI Groundwater Sampling

During the 2012 Phase I RI event, groundwater samples were collected from nine TMWs at SWMU 56 (identified as TMW01 through TMW09 on **Figure 1-3**). The TMWs were advanced using a Geoprobe® DPT stainless-steel retractable screen sampler. After the DPT groundwater sampler was installed and the screen was retracted, groundwater was purged at a rate of 300 to 500 milliliters per minute (mL/min) from the TMW to remove sediment using a variable speed peristaltic pump and Teflon-lined tubing in accordance with the UFP-QAPP (Bay West, 2012). Turbidity and pH were measured during purging using a flow-through cell water quality meter. The groundwater sampling goal for turbidity was 10 nephelometric turbidity units (NTUs) prior to sampling; however, this goal was not always obtainable due to site conditions. Deviations from this goal were documented in the field logbook and are discussed in **Section 4.2.3**.

Once the TMW was purged, low-flow purging (approximately 150 mL/min) and sampling techniques were used during the collection of groundwater samples for laboratory analysis to further minimize turbidity in the samples. A final turbidity reading was recorded prior to collecting groundwater samples. If groundwater reached the turbidity goal of 10 NTUs during high flow purging (300 mL/min to 500 mL/min), the flow rate was not adjusted prior to sample collection. Photographs of initial and final purge water and groundwater sample collection forms containing sample collection information and field parameters are included in **Appendix C**. A total of nine groundwater samples and one field duplicate were collected, labeled, sealed under chain-of-custody, and shipped to TestAmerica. These groundwater samples were analyzed using the following methods:

- TCL VOCs by SW-846 Method 8260B;
- TCL PAHs by SW-846 Method 8270-SIM;
- TCL SVOCs by SW-846 Method 8270D;
- TCL pesticides by SW-846 Method 8081B;
- PCBs by SW-846 Method 8082A;
- TCL herbicides by SW-846 Method 8151A; and
- TAL metals by SW-846 Methods 6010B, 6020A, and 7471B.

2.2.3.1 2016 RI Groundwater Sampling

During the 2016 RI event, six permanent construction monitoring wells (identified as SWMU56-MW01 through SWMU56-MW06 on **Figure 1-3**) were installed and sampled to provide groundwater samples representative of the surrounding shallow groundwater. The groundwater sampling from the newly installed monitoring wells was used confirm analytical results and, if necessary, define the extent of the COPCs (metals, herbicides, VOCs, and PAHs) identified from the Phase I RI TMW analytical results. The six permanent construction monitoring wells were installed, developed, and sampled in accordance with the RI UFP-QAPP (Bay West, 2016). The groundwater data from the Phase I RI were used for screening and to determine the analytical approach for the RI, but were not used for the determination of COPCs or risk assessment within this report.

Monitoring wells were installed in borings advanced using hollow-stem augers. Monitoring well lithologic logs and construction diagrams are presented in **Appendix D**. Each well was identified with a designation in conformance with the standard JBA naming convention ("Site Name – Location ID"). Monitoring wells were identified as SWMU56-MW01, SWMU56-MW02, SWMU56-MW03, SWMU56-MW04, SWMU56-MW05, and SWMU56-MW06 (**Figure 1-3**). Each of these wells was installed to depths ranging from 31.5 to 35 ft bgs and with the bottom of the well screen set approximately at the top surface of the Calvert Formation. The location of the Calvert Formation was confirmed at each location by visual observation.

The monitoring wells were constructed of flush-threaded, 2-inch inner diameter, Schedule 40 polyvinyl chloride (PVC) riser and 15-ft lengths of 2-inch diameter Schedule 40 PVC with 0.010-inch slotted screen. A sand filter pack was placed around the monitoring well screen and extended 2 ft above the top of the screen slots. A seal consisting of 2 to 4 ft of bentonite pellets was placed above the filter sand. The seal was composed of commercially manufactured, solvent-free, sodium-bentonite pellets. If the bentonite seal was positioned above the water table, the bentonite was installed in 1-ft lifts with each hydrated a minimum of 30 minutes between lifts before proceeding. Clean, potable water was added to hydrate the bentonite. After the placement of the final lift, the bentonite seal was allowed to hydrate an additional hour before grouting began. A cement-bentonite grout seal was placed in the annular space above the bentonite seal. The cement-bentonite grout seal extended from the top of the bentonite seal to land surface. Grouting was completed as a continuous operation in the presence of an experienced geologist. The grout was pumped into the annular space under pressure using a rigid tremie pipe placed at the top of the bentonite seal to ensure a continuous grout seal. Well-head protection was provided for each monitoring well. A 12-inch diameter, watertight steel vault was installed flush with the ground surface. The monitoring wells were surveyed by a licensed surveyor (accurate to 0.01-ft). Monitoring well development was performed following well installation. Specific conductance, temperature, turbidity, and pH measurements were taken and recorded at the start, twice during, and at the conclusion of well development. A well was considered fully developed when all the following criteria were met:

- The well water was clear to the unaided eye, and turbidity measurements from well development water varied by less than approximately 10 percent;
- The sediment thickness remaining in the well was less than one percent of the screen length; and
- The total volume of water removed from the well equaled five times the standing water volume in the well (including the well screen and casing plus saturated annulus, assuming 30 percent porosity), plus the volume of drilling fluid lost.

Monitoring well development logs, lithologic logs, and construction diagrams are presented in **Appendix D**. A summary of construction details is presented in **Table 2-1**.

Depth to groundwater data were collected from each monitoring well to allow interpretation of groundwater flow direction and contaminant migration pathways. A complete synoptic round of groundwater level measurements was made after all monitoring well installations were completed.

A total of six groundwater samples and one field duplicate were collected, labeled, sealed under chain-of-custody, and shipped to TestAmerica. These groundwater samples were analyzed using the following methods in accordance with the UFP-QAPP (Bay West, 2016):

- TCL VOCs by SW-846 Method 8260B;
- TCL PAHs by SW-846 Method 8270-SIM;
- TCL herbicides by SW-846 Method 8151A; and
- TAL metals (totals and dissolved) by SW-846 Methods 6010B, 6020A, and 7471B.

Monitoring wells were sampled using low-flow procedures in accordance with the UFP-QAPP and Basewide Standard Field Procedures (Bay West, 2013b). Groundwater sampling logs are presented in **Appendix D**. Laboratory analytical results are discussed in **Section 4.2.4**.

2.3 Sample Quality Assurance/Quality Control Measures

QA/QC samples collected as part of the soil and groundwater investigation include matrix spike/matrix spike duplicates (MS/MSD), field duplicates, equipment rinsate blanks, trip blanks, temperature blanks, and field blanks. The results of the QA/QC sampling and data evaluation are presented in **Section 4.3**.

2.3.1 Field Quality Assurance/Quality Control

Field QC samples included field duplicates, MS/MSDs, equipment rinsate blanks, trip blanks (VOCs only), temperature blanks, and field blanks. Field duplicates were collected at the required frequency of 10 percent per method and matrix. Equipment rinsate blanks were collected at the required frequency of 5 percent per method and matrix, only when non-disposable sampling equipment was used. Field blanks were collected at the required frequency of one per source of water (e.g. decontamination rinse water). One trip blank was included in each cooler with VOC samples and temperature blanks were included in all sample coolers.

QC procedures for pH, specific conductance, temperature, and turbidity measurements during groundwater sampling and PID screening during soil sampling included calibrating the instruments, as specified in the UFP-QAPP.

2.3.2 Laboratory Quality Assurance/Quality Control

MS/MSDs were analyzed at a frequency of 5 percent per method and matrix. A triple volume of groundwater samples was collected to ensure adequate sample volume for MS/MSD analysis. In addition, the laboratory analyzed method blanks and laboratory control samples at a frequency of 5 percent per method and matrix. If an MS/MSD was not included in an analytical batch, a laboratory control sample duplicate was analyzed in order to measure precision. Surrogates were also spiked into all organic field and QC samples.

2.3.3 Data Validation and Verification

Laboratory Data Consultants, Inc. Automated Data Review (ADR) software was used to perform an automated data review equivalent to an USEPA Tier II evaluation and to provide preliminary discrete data qualification. During the full data validation, data were evaluated for precision, accuracy, representativeness, completeness, comparability, and sensitivity. Data qualifiers were appended to each result, as necessary, in the electronic data deliverables with validation criteria set at 100% of USEPA Tier III Validation in accordance with the DoD Quality Systems Manual (QSM) for Environmental Laboratories. The Tier III Validation for the 2012 Phase I RI data was completed in accordance with QSM 4.2 (DoD, 2010), the USEPA's National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2008) and the USEPA's National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2010) and the approved Phase I RI QAPP (Bay West, 2012). The Tier III Validation for the 2016 data was completed in accordance with QSM 5.0 (DoD, 2013), the USEPA's National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2014a) and the USEPA's National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2014b) and the approved RI QAPP (Bay West, 2016). Data validation reports are included as **Appendix E** and laboratory analytical reports are included in **Appendix F**.

2.3.4 Decontamination Procedures

All drilling and sampling equipment utilized during the SWMU 56 field investigations was decontaminated in accordance with the UFP-QAPPs. Prior to drilling activities, an equipment decontamination station was constructed on-site. Equipment was decontaminated prior to its initial use and all subsequent sampling. Sampling equipment decontamination procedures included scrubbing with potable water and a non-phosphate detergent and subsequent rinsing with potable water and deionized water.

2.4 Investigation Derived Waste

IDW was generated during advancement of soil borings, monitoring well installations, monitoring well development, monitoring well purging, and decontamination processes. IDW was segregated into solids and liquids, containerized, sampled for disposal categorization, and temporarily held at JBA while awaiting appropriate off-site disposal. IDW is discussed in **Section 4.4**.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section presents the results of field observations and measurements noted during the RI field efforts in addition to the Basewide conditions at JBA. SWMU 56 encompasses an asphalt-paved storage area, designated the Civil Engineering Storage Yard, centrally located on the eastern half of the base, immediately south of Building 3440. SWMU 56 is currently zoned as industrial and used as a storage yard for the JBA Civil Engineering Department. Future land use is designated as industrial and administrative.

3.1 Geology

3.1.1 Regional Geology

JBA is located within the Atlantic Coastal Plain physiographic province, 12 miles east of the Atlantic Coastal Plain and Appalachian Piedmont fall line. The Coastal Plain is characterized by an eastward thickening wedge of unconsolidated sediments, which overlap the rocks of the eastern piedmont. These unconsolidated sediments consist of gravel, sand, silt, and clay, which were derived from erosion of the piedmont and mountains to the west. The Coastal Plain deposits range in age from Cretaceous to Recent and are approximately 1,600 ft thick in the JBA area. The upper 300 ft consists of, from stratigraphically highest to lowest (i.e., from youngest to oldest): the Upland (Pliocene) Deposits (approximately 3 to 55 ft thick); the Calvert Formation (70 to 100 ft thick); the Nanjemoy Formation (70 to 125 ft thick); the Marlboro Clay (0 to 20 ft thick); and the Aquia Formation (100 to 140 ft thick). The Coastal Plain sediments overlie Pre-Cambrian-age metamorphic crystalline basement rocks (Earth Tech, 2001).

Except for the Upland deposits, the Coastal Plain formations strike northeast and dip gently to the southeast. The Upland Deposits consist of interbedded brown to gray silt and clay, sand, and gravel. The Calvert Formation is part of the Chesapeake Group in Maryland, which also includes the Choptank and St. Mary's formations. The Calvert Formation on the western shore is subdivided into the basal Fairhaven Member and the overlying Plum Point Marl Member. The Fairhaven Member ranges in color from brown to white and consists mostly of diatoms in a very fine quartz matrix. Some calcareous material may be present at base of member. The Plum Point Member is described as a series of bluish green to grayish brown and buff sandy clay and marls, containing organic remains, including diatoms (CH2M Hill, 2004).

3.1.2 Site Geology

The land surface at SWMU 56 is generally flat and entirely paved, with elevations ranging from 271.25 to 268.86 ft above mean sea level. Soils consist of partially saturated Quaternary Upland Deposits comprised of three stratigraphic lithologies: silt-clay; an intermediate sand and gravel stratum; and underlying silty fine sand (IT, 2000). The Calvert Formation is generally encountered at 30 to 35 ft bgs at SWMU 56. The Miocene-age Calvert Formation consists of a thick stratigraphic sequence of lower permeability interbedded greenish-gray silt, clay, and fine sand.

3.2 Hydrogeology

3.2.1 Regional Hydrogeology

Both unconfined and confined aquifers are present in Prince George's County and specifically JBA. Unconfined groundwater units consist of sediments that are in direct contact with atmospheric pressure, whereas confined aquifers are overlain by an impervious or semi-impervious layer of geologic material. Confined aquifers are, therefore, under increased hydrostatic pressure. Precipitation evaporates, infiltrates, or runs off after contact with the ground. A percentage of water from precipitation recharges the hydrostratigraphic units. Hydrostratigraphic units consist of gravel, sand, silt, and clay, or combinations thereof, which behave in a similar and synergistic way to either transmit or retard the movement of groundwater both vertically and horizontally. Groundwater moves through the pore spaces of these hydrostratigraphic units until removal through springs and seeps (next to surface water bodies) or by wells or plant roots (Earth Tech, 2001).

An unconfined groundwater table is present within the surficial Upland Deposits underlying JBA that is derived primarily from precipitation recharge in the vicinity of JBA. The movement of the unconfined groundwater tends to be towards local surface waters. Below the Upland Deposits are the Calvert, Nanjemoy, and Marlboro confining formations followed by the water-bearing Aquia formation. The confining formations separate the Upland Deposits groundwater table from the deeper Aquia formation aquifer.

JBA and most of Prince George’s County obtains its potable water supplies from the Washington Suburban Sanitary Commission (WSSC) water utility. The source of the potable water supply is surface water from the Potomac and Patuxent Rivers. No drinking water supply wells are located on JBA and drinking water supply wells are not permitted on JBA.

3.2.2 Site Hydrogeology

The depth to groundwater at SWMU 56 in 2016 measured approximately 13 to 15 ft bgs. The downward migration of groundwater is limited by the Calvert Formation at a depth of approximately 30 to 35 ft bgs.

Groundwater at ST-14 has historically been reported flowing toward the east and northeast; and groundwater flow specifically at SWMU 56 was determined to be consistent with this flow direction (**Figure 3-1**). Hydraulic conductivity at ST-14, which includes SWMU 56, has been estimated to range between 0.24 and 3.4 ft per day (IT, 2000). Based on an effective porosity 0.3 and a hydraulic gradient of 0.01 (from SWMU 56 April 2016 gauging), groundwater velocities across the site are estimated to be 2.92 to 41 ft per year.

Based on the Basewide CSM, SWMU 56 is located immediately south of localized groundwater divide (Bay West, 2014). Groundwater from the site flows east to the Charles Branch, approximately 1,000 ft from SWMU 56. Drinking water supply wells are not permitted on JBA, and SWMU 56 is located approximately 1,400 ft from the east installation boundary line (the closest boundary). Therefore, there are no drinking water supply wells within a minimum of 1,400 ft of the site.

3.3 Surface Water Hydrology

3.3.1 Regional Surface Water Hydrology

JBA is situated on a drainage divide between the Potomac River Basin to the west and the Patuxent River Basin to the east. Surface water originating in the north, west, and south portions of the Base is discharged to the Potomac River via Henson Creek, the Meetinghouse and Paynes Branches of Tinker Creek, and Piscataway Creek. Surface water originating in the eastern portion of the Base flows to the Patuxent River via Cabin Branch and Charles Branch of Western Branch (CH2M Hill, 2005).

The Potomac River and its tributaries identified above are listed in the Code of Maryland Regulations (COMAR) Stream Use Classification Index as Use-IP (Water Contact Recreation and Protection of Aquatic Life). The Patuxent River and its tributaries are also listed in the COMAR Stream Use Classification Index as Use-IP (EA, 2012).

3.3.2 Site Surface Water Hydrology

SWMU 56 is located on the eastern side of the surface water drainage divide. Based on the existing site topography and adjacent stormwater system, surface water from SWMU 56 drains east to the southern Charles Branch, which is located approximately 510 ft southeast of the site and is the closest surface water body. The Charles Branch ultimately drains into the Patuxent River. There are no surface water bodies or creeks within or in the immediate vicinity of SWMU 56.

3.4 Demography and Land Use

3.4.1 Basewide Demography and Land Use

The Base is home to more than 60 units, including 2 major headquarters, 6 wings, and about 17,000 Air Force, Air Force Reserve, Air National Guard, Army, Navy, and Marine Corps service members, civilians, and their families (JBA, 2013). Residential housing, consisting of occupied and unoccupied housing, is the second largest land use area on Base. On-Base housing consists of single-family, duplex-type developments, and high-density apartments. The majority of housing is located on the west side of the Base. One residential area is located east of the airfield. Outdoor recreation land use includes golf courses, ball fields, a tennis court, a running track, and picnic areas and the majority are located on the west side of the Base.

Land use adjacent to JBA includes light industrial, commercial, residential, and undeveloped areas. On the north side of the Base, there is a business park and light industrial area. Most of the area northeast of the Base is currently undeveloped. The area just south of the Base is primarily residential and undeveloped land. Some of the land south of the residential area is used for commercial purposes. Land use on the west side of the base consists of residential, commercial (shopping centers and office), light industrial, and few areas of undeveloped land. On the east side of the Base, land use includes light industrial/business park and residential.

3.4.2 Site Demography and Land Use

SWMU 56 is currently zoned as industrial and used as a storage yard for JBA's Civil Engineering Department. The future planned land use for the site is industrial and administrative.

3.5 Habitats and Biology

In 2005, a Basewide Ecological Risk Assessment (BERA) was completed to provide a basic conceptual model for the evaluation of potential ecological risks on JBA (CH2M Hill, 2005). The following sections on basewide and site-specific habitat and biology are summarized from the BERA.

3.5.1 Basewide Habitats and Biology

3.5.1.1 Wetland and Aquatic Habitats

Wetland and aquatic habitats occur infrequently on JBA. Wetlands, which comprise only about two percent of the JBA land area, are mainly associated with the borders of stream channels. The headwaters of five streams are located on-Base, including Piscataway Creek, Henson Creek, Tinkers Creek (Paynes and Meetinghouse Branches), Cabin Branch (North and South Branches), and Charles Branch. There are five small ponds and one larger surface water body (Base Lake) that encompass a total area of approximately 20 acres (CH2M Hill, 2005).

3.5.1.2 Terrestrial Habitats

JBA is located in the Oak-Pine Forest Region, originally characterized by oaks and hickories, with pines prevalent on sites with poorer soils. Vegetative communities at JBA currently consist of extensively managed areas and unmanaged patches of natural plant communities. Approximately 85 percent of JBA is either developed (e.g., housing, buildings, roads, and runways) or intensely managed. The intensely managed areas include lawns, golf course fairways and greens, and recreational fields, as well as the runway borders, the infield, and approach clear zones.

Unimproved areas contain ecological communities such as mixed hardwood forests, mixed hardwood/pine forests, oak forests, oak/hickory forests, oak/pine forests, pine forests, red maple swamp, and shallow emergent marsh.

3.5.1.3 Biota

Various species of birds, mammals, reptiles, amphibians, and aquatic organisms have been observed at JBA and reported in historical documents. The following summarizes the number of species that have been identified in each category:

Species Category	No. of Species on-Base
Birds	68
Mammals	11
Reptiles	1
Amphibians	3
Fish:	
- Base Lake and Golf Course Ponds	13
- Berry Pond	1
- Piscataway Creek	27
- Paynes Branch	8
- Meetinghouse Branch	7
- Cabin Branch	0
- Henson Creek	Habitat Limited, Not Surveyed
- Charles Branch	Habitat Limited, Not Surveyed

There is one Federally-listed endangered plant, the sandplain gerardia (*Agalinis acuta*), on JBA, according to a 1997 Basewide survey. In addition, the bald eagle (*Haliaeetus leucocephalus*; formerly a Federally-listed threatened species), has been observed at Base Lake during winter bird surveys. No bald eagle nests have been found on JBA to date, and it has been reported the eagles were likely transients from the Chesapeake Bay. No additional state or federally listed threatened or endangered species have been identified on JBA (Geo-Marine, 2001).

3.5.2 Site Habitat and Biology

SWMU 56 consists of a flat, paved, storage area surrounded by maintenance and storage buildings. The current and future land use in the vicinity of SWMU 56 is industrial. SWMU 56 provides no suitable habitat for terrestrial receptors. SWMU 56 is located in the Charles Branch drainage, which drains the area between the central portion of East Perimeter Road and Dower House Road. The Charles Branch has a relatively poor habitat quality for aquatic biota (CH2M Hill, 2005). There is no direct connection to surface water or sediment at SWMU 56. Groundwater from SWMU 56 flows under unconfined conditions to the northeast. The groundwater gradient is fairly flat with seepage velocity estimated at 2.92 to 41 ft per year. Therefore, significant transport of groundwater constituents from SWMU 56 to Charles Branch is unlikely to occur, and impacts to surface waters and sediments were considered incomplete.

3.6 Meteorology and Climate

JBA has a continental type of climate with well-defined seasons in a transition zone between a humid continental climate zone to the north and west and a humid subtropical climate zone to the south. Both of these zones, in addition to the nearby water bodies, influence the climate at JBA. JBA is on the upper end of a peninsula formed by the Potomac River on the west and south and the Chesapeake Bay on the east. Further to the east, across the Delmarva Peninsula, is the Atlantic Ocean.

Based on data collected at the Upper Marlboro National Climatic Data Center Station located approximately 5 miles to the northeast of the Base, the mean annual temperature for JBA is 54 degrees Fahrenheit (°F), with the warmest month being July (monthly average temperature of 76°F) and the coldest month being January (monthly average temperature of 32°F). The annual precipitation at JBA averages about 42 inches of rain, and the monthly distribution of precipitation is fairly uniform during the year (URS, 2006).

4.0 REMEDIAL INVESTIGATION RESULTS

The results obtained during the RI for each of the tasks described in **Section 2.0** are summarized in this section.

4.1 Site Reconnaissance Aerial Image Review

As discussed in **Section 2.1**, during the preparation of the Phase I RI UFP-QAPP, Bay West conducted a thorough review of aerial images from 1943 to 2010 to define the SWMU 56 boundaries. Bay West identified areas of historical storage based on the selected historical aerial images. The aerial images used during the UFP-QAPP are included in **Appendix B**. It should be noted that some of the provided aerial images were not georeferenced to the current site conditions. The following items were noted during the historical aerial review:

- **1943** – No evidence of storage within the SWMU 56. All access ways and driveways appear to be gravel.
- **1948** – No evidence of storage within the SWMU 56. All access ways and driveways appear to be gravel. Buildings 3459 and 3448 are constructed.
- **1950** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be gravel. Buildings 3444 and 3457 are constructed.
- **1955** – Storage area within the SWMU 56. All access ways and driveways appear to be gravel. Portions of Buildings 3449 and 3447 are constructed.
- **1964** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be paved. Portions of Buildings 3449 and 3447 are constructed.
- **1968** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be paved and striped.
- **1971** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be paved and striped.
- **1974** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be paved and striped.
- **1982** – Minimal exterior storage is visible on the aerial image. All access ways and driveways appear to be paved and striped. Portions of Buildings 3440 and 3451 are constructed.
- **2000** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be paved and striped. Buildings 3441 and 3442 are constructed. Building 3459 has been demolished.
- **2003** – Minimal exterior storage is visible on the aerial image. All access ways and driveways appear to be paved and striped.
- **2005** – Storage within the SWMU 56 is evident. All access ways and driveways appear to be paved and striped.
- **2007** – Storage within the SWMU 56 is evident on the east side of the area. All access ways and driveways appear to be paved and striped.

4.2 Environmental Sampling

Environmental sampling was conducted in accordance with the Phase I RI UFP-QAPP and RI UFP-QAPP developed by Bay West and approved by the project stakeholders as described in **Section 2.2**. The following sections present the results of soil and groundwater sampling. Soil analytical results are compared within this section to the May 2016 USEPA residential RSLs for a 1 x 10^{-6} carcinogenic risk level and hazard quotient (HQ) of 1.0 (USEPA, 2016a) for screening purposes. Groundwater analytical results within this section are compared to USEPA MCLs (USEPA, 2012) or the May 2016 USEPA residential RSLs for a 1 x 10^{-6} carcinogenic risk level and HQ of 1.0 (USEPA, 2016a) where no MCL is established for screening purposes. Note, that RSLs were adjusted to an HQ of 0.1 for COPC identification elsewhere in the report. The sampling results were also compared to the basewide background UTLs for surface soil, subsurface soil, and groundwater, when available (CH2MHill, 2004).

4.2.1 2012 Soil Sampling

During the 2012 Phase I RI event, nine borings, identified as TMWs, were advanced in SWMU 56 to a depth of approximately 30 ft bgs. Each TMW was completed through asphalt. Soil samples were collected continuously from the ground surface to the bottom of each TMW. Soil encountered in the TMWs generally consisted of 5 ft of brown to dark gray clay with sand and gravel (fill material), underlain by grayish brown clay, silt, and fine sand to 10 ft bgs (shallow upland deposits), underlain by yellowish brown to brownish yellow, medium to coarse sands with varying amounts of gravel and clay to approximately 20 ft bgs (intermediate upland deposits), underlain by yellow fine sand with silt to the extent of the TMW (deep upland deposits). The Calvert Formation was encountered in TMW02 and TMW08 at a depth of 30 ft bgs and consisted of dark greenish gray clay. Groundwater was typically encountered at 14 to 16 ft bgs. A cross-section of the lithology observed at the site is presented on **Figure 4-2**. Boring logs including full lithology descriptions are included in **Appendix C**.

No physical indications of contamination (staining, odor, sheen, etc.) were observed during field screening in the TMW borings, with the exception of a 1-inch black clay layer in TMW02 at 3 ft bgs that was possibly stained. TMW02 also exhibited the highest pH measurement of 8.39 at 2 to 4 ft bgs; therefore, the 2- to 4-ft interval was submitted for laboratory analysis. At TMW01, TMW03, TMW05, and TMW06, the intervals with the highest PID readings above groundwater were sampled and submitted for laboratory analysis. Soil samples collected from soil borings TMW04, TMW07, TMW08, and TMW09 exhibited no field screening or headspace reading indication of contamination; therefore, samples were collected from the interval directly above the soil/groundwater interface. A field duplicate was collected from TMW01. A summary of 2012 soil screening results and sample collection is presented in **Table 4-1a**. The soil detections are presented in **Table 4-2** and sample locations are shown on **Figure 1-3**. The following sections provide a summary of the soil sampling analytical results.

4.2.1.1 VOCs

VOCs were detected in six soil samples. The following summarizes the VOC detections, number of detections, and detection ranges:

- 1,3,5-trimethylbenzene – one detection at 0.61 µg/kg;
- 2-butanone – three detections ranging from 7.8 to 20 µg/kg;
- Acetone – four detections ranging from 9.6 to 97 µg/kg;
- Carbon disulfide – three detections ranging from 0.44 to 0.87 µg/kg;
- cis-1,2-dichloroethene – two detections ranging from 50 to 120 µg/kg;
- Tetrachloroethene – one detection at 1.8 µg/kg;
- Toluene – one detection at 1.2 µg/kg;
- trans-1,2-dichloroethene – two detections ranging from 4.4 to 9.6 µg/kg; and
- Trichloroethene – two detections ranging from 0.49 to 34 µg/kg.

None of the above concentrations exceeded their respective USEPA residential RSLs (USEPA, 2016a).

4.2.1.2 PAHs

PAHs were detected in four soil samples collected from 2-4 ft bgs, directly beneath the asphalt paved surface and fill. The following summarizes the PAH detections, number of detections, and detection ranges:

- Acenaphthene – one detection at 2.2 µg/kg;
- Acenaphthylene – three detections ranging from 1.0 to 7.7 µg/kg;
- Anthracene – two detections ranging from 3.7 to 5.6 µg/kg;
- Benzo[a]anthracene – three detections ranging from 1.9 to 14 µg/kg;
- B[a]P – three detections ranging from 2.2 to 18 µg/kg;
- Benzo[b]fluoranthene – three detections ranging from 5.3 to 34 µg/kg;
- Benzo[g,h,i]perylene – three detections ranging from 4.0 to 18 µg/kg;
- Benzo[k]fluoranthene – three detections ranging from 1.5 to 9.4 µg/kg;
- Chrysene – three detections ranging from 3.7 to 30 µg/kg;
- Dibenz(a,h)anthracene – two detections ranging from 3.4 to 3.9 µg/kg;
- Fluoranthene – three detections ranging from 3.5 to 35 µg/kg;
- Fluorene – two detections ranging from 4.0 to 5.4 µg/kg;
- Indeno[1,2,3-cd]pyrene – three detections ranging from 3.1 to 17 µg/kg;
- Naphthalene – four detections ranging from 0.66 to 37 µg/kg;
- Phenanthrene – three detections ranging from 2.1 to 28 µg/kg; and
- Pyrene – three detections ranging from 4.0 to 42 µg/kg.

B[a]P was detected in two samples collected from 2-4 ft bgs at concentrations of 16 and 18 µg/kg at TMW02 and TMW01 (**Figure 4-1**), respectively, that exceeded or equaled the USEPA residential RSL of 16 µg/kg and basewide background soil boring UTL concentration (3.5 µg/kg).

4.2.1.3 SVOCs

SVOCs were detected in six soil samples and the field duplicate. The following summarizes the SVOC detections, number of detections, and detection ranges:

- Benzyl alcohol – seven detections ranging from 22 to 47 µg/kg

The above concentrations do not exceed the benzyl alcohol residential RSL (6,300,000 µg/kg).

4.2.1.4 Pesticides

Pesticides were detected in two soil samples. The following summarizes the pesticide detections, number of detections, and detection ranges:

- 4,4’-dichlorodiphenyldichloroethane (DDD) – two detections ranging from 1.7 to 1.8 µg/kg; and
- 4,4’-dichlorodiphenyldichloroethylene (DDE) – two detections ranging from 1.2 to 4.7 µg/kg.

None of the above concentrations exceeded their respective USEPA residential RSLs (USEPA, 2012).

4.2.1.5 PCBs

No PCBs were detected greater than the limit of detection (LOD) in the soil samples.

4.2.1.6 Herbicides

No herbicides were detected greater than the LOD in the soil samples.

4.2.1.7 Metals

Metals were detected in all of the soil samples and the field duplicate. The following summarizes the metal detections, number of detections, and detection ranges:

- Aluminum – 15 detections ranging from 1,600 to 24,000 milligrams per kilogram (mg/kg);
- Arsenic – 15 detections ranging from 0.37 to 2.9 mg/kg;
- Barium – 15 detections ranging from 4.3 to 42 mg/kg;
- Beryllium – 15 detections ranging from 0.025 to 0.31 mg/kg;
- Cadmium – 15 detections ranging from 0.029 to 0.18 mg/kg;
- Calcium – 15 detections ranging from 20 to 1,100 mg/kg;
- Chromium – 15 detections ranging from 2.4 to 22 mg/kg;
- Cobalt – 15 detections ranging from 0.1 to 2.7 mg/kg;
- Copper – 15 detections ranging from 1 to 5.2 mg/kg;
- Iron – 15 detections ranging from 1,200 to 21,000 mg/kg;
- Lead – 15 detections ranging from 0.89 to 16 mg/kg;
- Magnesium – 15 detections ranging from 33 to 800 mg/kg;
- Manganese – 15 detections ranging from 0.94 to 39 mg/kg;
- Mercury – four detections ranging from 0.011 to 0.024 mg/kg;
- Molybdenum – 15 detections ranging from 0.081 to 1.0 mg/kg;
- Nickel – 15 detections ranging from 0.32 to 5.4 mg/kg;
- Potassium – 15 detections ranging from 68 to 440 mg/kg;
- Selenium – 15 detections ranging from 0.17 to 0.85 mg/kg;
- Silver – seven detections ranging from 0.021 [in duplicate]to 0.045 mg/kg;
- Sodium – four detections ranging from 75 to 600 mg/kg;
- Thallium – 15 detections ranging from 0.011 to 0.21 mg/kg;
- Vanadium – 15 detections ranging from 2.6 to 37 mg/kg; and
- Zinc – 15 detections ranging from 0.58 to 20 mg/kg.

Arsenic was detected at concentrations in exceedance of the USEPA residential RSL of 0.68 mg/kg in eight subsurface soil samples; however, all detected concentrations were below the basewide background soil boring UTL concentration (5.7 mg/kg). The unspeciated chromium concentrations in all soil samples exceeded the residential RSL for hexavalent chromium (0.3 mg/kg), but did not exceed the residential RSL for trivalent chromium (120,000 mg/kg) or the basewide background soil boring UTL for total chromium (31.2 mg/kg).

4.2.2 2016 Soil Sampling

During the 2016 RI event, seven borings were advanced at SWMU 56 to a depth of approximately 11 ft bgs. Each boring was completed through asphalt. Soil samples were collected continuously from the ground surface to the bottom of each boring. Soil encountered in the borings was consistent with observations made in the 2012 borings (**Section 4.2.1**). Boring logs including full lithology descriptions are included in **Appendix D**.

No physical indications of contamination (staining, odor, sheen, etc.) were observed during field screening in the borings. Three samples from each soil boring, at pre-selected intervals (2-4, 5-7 and 9-11 ft bgs intervals) were submitted for laboratory analysis of barium. The objective of the 2016 soil sampling effort was to confirm and delineate the barium contamination reported in the TMW06 2-4 ft bgs soil sample in the Phase I RI (Bay West, 2016). To that end, the seven soil borings advanced in April 2016 were located near and surrounding the location of TMW06 (**Figure 1-3**). A summary of 2016 soil screening results and sample collection is presented in **Table 4-1b**. The soil detections are presented in **Table 4-2**. The following section provides a summary of the soil sampling analytical results.

4.2.2.1 Barium

Barium was detected in all 21 soil samples and three field duplicates. The following summarizes detections, number of detections, and detection ranges:

- Barium – 15 detections ranging from 11 to 71 mg/kg

During the 2012 RI, barium was reportedly detected in one soil sample that exceeded the USEPA residential RSL of 15,000 mg/kg. This detected concentration was reportedly present in the 2-4 ft bgs sample from TMW06. The 2016 soil sampling was designed to confirm and delineate this reported barium contamination. Upon initial analysis of the 2016 soil data, it was noted that elevated barium concentrations were not detected in any 2016 samples. This prompted Bay West to re-evaluate the results presented in the 2012 Phase I RI. It was discovered that there was unit conversion error during table creation for the barium results from one electronic lab deliverable (containing results for three soil samples). For example, the 2012 Phase I RI reported the barium concentrations in the 2-4 ft soil sample from TMW06 to be 42,000 mg/kg; however, the actual result was 42 mg/kg. Although the error was believed to isolated, Bay West reprocessed the entire 2012 set of analytical data for use in this report. Upon reprocessing, no detected concentrations of barium in 2012 soil samples collected at SWMU 56 exceeded the RSL of 15,000 mg/kg.

4.2.3 2012 Groundwater Sampling

Groundwater samples were collected from each TMW using the procedures described in **Section 2.4**. The groundwater sampling turbidity goal of 10 NTUs, prior to sampling, was attained for each of the groundwater samples, with the exception of TMW02, TMW05, and TMW08, which had final turbidity readings of 1,028.5, 12.6, and 52.2 NTUs, respectively. After purging TMW05 and TMW08 for a minimum of two hours, turbidity did not reach 10 NTUs; therefore, the peristaltic pump was set to the minimum pumping rate of 150 mL/min and water samples were collected. At TMW02, the recharge rate was not sufficient to collect more than one turbidity reading. After recording one turbidity reading and purging for two hours, the water sample was then collected at the minimum pumping rate of 150 mL/min. Turbid groundwater samples can cause naturally-occurring metals that are sorbed to suspended solids to desorb into solution during the sample preservation process, causing elevated levels of metals to be detected. Water levels within the TMW casings could not be measured because the diameter of the water level indicator probe was greater than the diameter of the top of the DPT groundwater sampler; however, groundwater was measured at 14.01 ft below top of casing (BTOC) in ST14-MW35. The location of ST14-MW35 is detailed on **Figure 1-3**. The field documents are provided in **Appendix C**. The groundwater data from the Phase I RI were used for screening and to determine the analytical approach for the 2016 RI, but have not been used for the determination of COPCs or risk assessment within this report. Groundwater detections from 2012 TMW groundwater sampling are presented in **Table 4-3**. The following sections provide a summary of the 2012 groundwater results.

4.2.3.1 VOCs

VOCs were detected in seven groundwater samples and the field duplicate. The following summarizes the VOC detections, the number of detections, and detection ranges:

- 1,1-Dichloroethane – one detection at 0.21 µg/L;
- 1,1-Dichloroethene – three detections ranging from 0.17 to 0.53 µg/L;
- Chloroform – four detections ranging from 0.33 to 490 µg/L;
- DCE – six detections ranging from 0.16 to 4.9 µg/L;
- TCE – seven detections ranging from 0.31 to 45 µg/L; and
- Trichlorofluoromethane – one detection at 0.93 µg/L.

Chloroform was detected in four samples at TMW-04, TMW-05, TMW-06, and TMW-07 at concentrations that exceeded the USEPA tap water RSL of 0.220 µg/L. Chloroform was detected in one sample at TMW-04 at a concentration that exceeded the MCL of 80 µg/L. TCE was detected in six samples (including the field duplicate) at TMW-01, TMW-02, TMW-05, TMW-06, and TMW-09 at concentrations that exceeded the USEPA tap water RSL of 0.490 µg/L. TCE was detected in five samples (including the field duplicate) at TMW-01, TMW-05, TMW-06 and TMW-09 at concentrations that exceeded the USEPA MCL of 5 µg/L. It is noted that SWMU 56 lies within the footprint of ST-14. Chloroform and TCE are currently being addressed in the ST-14 ROD (USEPA, 2007).

4.2.3.2 PAHs

PAHs were detected in all of the groundwater samples including the field duplicate. The following summarizes the VOC detections, number of detections, and detection ranges:

- Anthracene – one detection at 0.029 µg/L;
- Benzo(g,h,i)perylene – one detection at 0.15 µg/L;
- Benzo[b]fluoranthene – one detection at 0.17 µg/L;
- Benzo[g,h,i]perylene – one detection at 0.15 µg/L;
- Benzo[k]fluoranthene – one detection at 0.17 µg/L;
- Dibenz(a,h)anthracene – one detection at 0.16 µg/L;
- Fluoranthene – one detection at 0.092 µg/L;
- Fluorene – two detections ranging from 0.067 to 0.14 µg/L;
- Indeno[1,2,3-cd]pyrene – one detection at 0.17 µg/L;
- Naphthalene – 10 detections ranging from 0.0072 to 0.13 µg/L; and
- Phenanthrene – two detections ranging from 0.11 to 0.23 µg/L.

Benzo[b]fluoranthene, dibenz(a,h)anthracene, benzo[a]anthracene, and indeno[1,2,3-cd]pyrene were detected in TMW-05 at concentrations that exceeded the respective USEPA tap water RSLs.

4.2.3.3 SVOCs

Diethyl phthalate was detected in TMW-06 at a concentration of 0.53 µg/L. No other SVOCs were detected. The diethyl phthalate detection did not exceed the USEPA tap water RSL of 15,000 µg/L.

4.2.3.4 Pesticides

No pesticides were detected greater than the LOD in the groundwater samples.

4.2.3.5 PCBs

No PCBs were detected greater than the LOD in the groundwater samples.

4.2.3.6 Herbicides

2-4-chloro-2-methylphenoxypropanoic acid (MCPP) was detected at TMW-05 at a concentration of 33 µg/L and at TMW-07 at a concentration of 35 µg/L. No other herbicides were detected. The detections of MCPP exceeded the USEPA tap water RSL of 16 µg/L.

4.2.3.7 Metals

Metals were detected in all of the groundwater samples including the field duplicate. The following is a list of metal detections, number of detections, and detection ranges:

- Aluminum – 10 detections ranging from 57 to 21,000 µg/L;
- Arsenic – three detections ranging from 0.41 to 21 µg/L;
- Barium – 10 detections ranging from 19 to 210 µg/L;
- Beryllium – 10 detections ranging from 0.085 to 1.9 µg/L;
- Cadmium – 10 detections ranging from 0.14 to 2.4 µg/L;
- Calcium – 10 detections ranging from 1,600 to 11,000 µg/L;
- Chromium (Total) – 10 detections ranging from 1.0 to 170 µg/L;
- Cobalt – 10 detections ranging from 1.0 to 95 µg/L;
- Copper – three detections ranging from 5.2 to 310 µg/L;
- Iron – 10 detections ranging from 740 to 110,000 µg/L;
- Lead – 10 detections ranging from 0.22 to 24 µg/L;
- Magnesium – 10 detections ranging from 750 to 9,100 µg/L;
- Manganese – 10 detections ranging from 19 to 390 µg/L
- Mercury – five detections ranging from 0.065 to 0.39 µg/L;
- Molybdenum – nine detections ranging from 0.19 to 45 µg/L;
- Nickel – 10 detections ranging from 3.8 to 150 µg/L;
- Potassium – 10 detections ranging from 750 to 4,100 µg/L;
- Selenium – two detections ranging from 0.99 to 3.0 µg/L;
- Silver – one detection ranging from 0.36 µg/L;
- Sodium – 10 detections ranging from 3,700 to 57,000 µg/L;
- Thallium – five detections ranging from 0.063 to 1.5 µg/L;
- Vanadium – four detections ranging from 0.77 to 59 µg/L; and
- Zinc – seven detections ranging from 9.0 to 190 µg/L.

The following metals were detected at concentrations that exceeded their respective USEPA MCLs or USEPA tap water RSLs. Comparisons to background UTL concentrations have also been included.

- Aluminum was detected in the groundwater sample collected from TMW02 in exceedance of the USEPA tap water RSL (2,000 µg/L) and below the basewide background UTL concentration (2,700 µg/L).
- Arsenic was detected in groundwater samples collected from TMW02, TMW05, and TMW08 in exceedance of the USEPA tap water RSL (0.052 µg/L). Arsenic was detected in the groundwater sample collected from TMW02 in exceedance of the MCL (10 µg/L).
- Chromium (total) was detected in all groundwater samples collected from TMWs in 2012 in exceedance of the USEPA tap water RSL for hexavalent chromium (0.035 µg/L). All detected chromium concentrations, with the exception of the sample collected from

TMW02, were below the USEPA residential RSL for trivalent chromium (22,000 µg/L), USEPA MCL (100 µg/L), and the basewide background UTL concentration (34.3 µg/L).

- Cobalt was detected in groundwater samples collected from TMW02 and TMW05 at concentrations that exceeded USEPA tap water RSL of 6.0 µg/L; however, the concentration detected in the groundwater sample from TMW05 was below the basewide background UTL concentration (22.2 µg/L).
- Iron was detected in the groundwater sample collected from TMW02 in exceedance of the USEPA tap water RSL (14,000 µg/L) and above the basewide background UTL concentration (27,000 µg/L).
- Lead was detected in the groundwater sample collected from TMW02 in exceedance of the USEPA tap water RSL (15µg/L), the MCL (15µg/L), and the basewide background UTL concentration (9.5 µg/L).
- Thallium was detected in the groundwater sample collected from TMW02 in exceedance of the USEPA tap water RSL (0.2 µg/L), but below the MCL (2 µg/L).

4.2.4 2016 Groundwater Sampling

During the 2016 RI event, six permanent monitoring wells were advanced at SWMU 56 to a depth of approximately 30 to 35 ft bgs (**Table 2-1**). Each monitoring well was completed through asphalt. Soil samples were collected and logged for lithology continuously from the ground surface to the bottom of each monitoring well. Soil encountered in the monitoring wells generally consisted of 5 ft of brown to dark gray clay with sand and gravel (fill material), underlain by grayish brown clay, silt, and fine sand to 10 ft bgs (shallow upland deposits), underlain by yellowish brown to brownish yellow, medium to coarse sands with varying amounts of gravel and clay to approximately 20 ft bgs (intermediate upland deposits), underlain by yellow fine sand with silt to the extent of the monitoring well (deep upland deposits). The Calvert Formation was encountered in each of the monitoring wells at a depth of approximately 30-35 ft bgs and consisted of dark greenish gray clay. A cross-section of the lithology observed at the site is presented on **Figure 4-2** (A-A' cross-section plan view is included on **Figure 1-3**). Monitoring well logs are included in **Appendix D**.

Groundwater samples were collected from each monitoring well using the procedures described in **Section 2.2.3.1**. The groundwater sampling turbidity goal of 10 NTUs, prior to sampling, was attained for each of the groundwater samples. Water levels within the monitoring well casings ranged from 13.11 ft BTOC and 15.57 ft BTOC. Positive analytical detections in groundwater samples are presented in Table 4-4. A summary of the field-based groundwater stabilization parameters (pH, specific conductivity, temperature, turbidity, dissolved oxygen, and oxidation-reduction potential) is included as **Table 4-6**. The following sections provide a summary of the groundwater results:

4.2.4.1 VOCs

VOCs were detected in six groundwater samples and one field duplicate. The following summarizes the VOC detections, the number of detections, and detection ranges:

- 1,1-Dichloroethane – one detection at 0.21 µg/L;
- 1,1-Dichloroethene – five detections ranging from 0.17 to 0.44 µg/L;
- Acetone – five detections ranging from 3.0 to 5.6 µg/L;
- Chloroform – seven detections ranging from 0.33 to 3.1 µg/L;
- DCE – seven detections ranging from 0.25 to 14 µg/L;
- Tetrachloroethene – one detection at 4.7 µg/L;
- Trans-1,2-Dichloroethene – one detection at 0.18 µg/L; and

- TCE – seven detections ranging from 0.39 to 36 µg/L.

Chloroform was detected in groundwater samples collected from all six monitoring wells (including the field duplicate) at concentrations that exceeded the USEPA tap water RSL of 0.220 µg/L, but no detected concentrations exceeded the MCL of 80 µg/L. TCE was detected in groundwater samples (including field duplicate) collected from SWMU56-MW01, SWMU56-MW02, SWMU56-MW04, SWMU56-MW05, and SWMU56-MW06 at concentrations that exceeded the USEPA tap water RSL of 0.490 µg/L and was detected in samples at SWMU56-MW01, SWMU56-MW02, SWMU56-MW04, and SWMU56-MW05 at concentrations that exceeded the USEPA MCL of 5 µg/L.

It is noted that SWMU 56 lies within the footprint of ST-14. The maximum groundwater concentration detected during 2016 ST-14 RA-O monitoring was 11 µg/L for chloroform and 360 µg/L for TCE. Chloroform and TCE are currently being addressed in the ST-14 ROD (USAF, USEPA, and MDE, 2007).

4.2.4.2 PAHs

PAHs were detected in six groundwater samples including the field duplicate. The following summarizes the PAH detections, number of detections, and detection ranges:

- Benzo[g,h,i]perylene – one detection at 0.018 µg/L;
- Benzo[a]anthracene – one detection at 0.016 µg/L;
- Benzo[b]fluoranthene – one detection at 0.037 µg/L;
- Benzo[k]fluoranthene – one detection at 0.011 µg/L;
- Chrysene – one detection at 0.033 µg/L;
- Fluoranthene – three detections ranging from 0.073 to 0.17 µg/L;
- Fluorene – six detections ranging from 0.020 to 0.071 µg/L;
- Indeno[1,2,3-cd]pyrene – one detection at 0.019 µg/L; and
- Phenanthrene – five detections ranging from 0.020 to 0.071 µg/L.

Benzo[a]anthracene and benzo[b]fluoranthene were detected in SWMU56-MW03 at concentrations that exceeded the respective USEPA tap water RSLs of 0.012 µg/L and 0.034 µg/L, respectively.

4.2.4.3 Herbicides

No herbicides were detected greater than the LOD in the groundwater samples.

4.2.4.4 Metals

Metals were detected in all six of the groundwater samples and the field duplicate sample. Both dissolved and total metals were analyzed; however, only analytical results for total metals are discussed herein. The following is a list of metal (totals) detections, number of detections, and detection ranges:

- Aluminum – seven detections ranging from 270 to 2400 µg/L;
- Antimony – two detections ranging from 0.67 to 0.94 µg/L;
- Arsenic – five detections ranging from at 0.38 to 0.77 µg/L;
- Barium – seven detections ranging from 64 to 180 µg/L;
- Beryllium – five detections ranging from 0.13 to 0.45 µg/L;
- Cadmium – four detections ranging from 0.38 to 1.1 µg/L;
- Calcium – seven detections ranging from 4,600 to 36,000 µg/L;

- Chromium (total) – six detections ranging 0.68 to 11 µg/L;
- Cobalt – seven detections ranging from 2.7 to 10 µg/L;
- Copper – seven detections ranging from 0.7 to 4.2 µg/L;
- Iron – seven detections ranging from 510 to 2100 µg/L;
- Lead – four detections ranging from 0.38 to 0.58 µg/L;
- Magnesium – seven detections ranging from 3200 to 8900 µg/L;
- Manganese – seven detections ranging from 120 to 340 µg/L;
- Mercury – two detections ranging from 0.027 to 0.068 µg/L;
- Molybdenum – five detections ranging from 0.31 to 5.0 µg/L;
- Nickel – seven detections ranging from 4.7 to 14 µg/L;
- Potassium – seven detections ranging from 900 to 40,000 µg/L;
- Selenium – three detections ranging from 0.75 to 0.88 µg/L;
- Sodium – seven detections ranging from 29,000 to 92,000 µg/L;
- Thallium – four detections ranging from 0.071 to 0.18 µg/L;
- Vanadium – five detection ranging 0.82 to 2.9 µg/L; and
- Zinc – seven detections ranging from 12 to 89 µg/L.

The following metals were detected at concentrations that exceeded their respective USEPA MCLs or USEPA tap water RSLs. Comparisons to background UTL concentrations have also been included.

- Arsenic was detected in groundwater samples collected from MW01, MW03, MW04, and MW05 in exceedance of the USEPA tap water RSL; however, all detected arsenic concentrations were below the USEPA MCL.
- Chromium (total) was detected in groundwater samples collected from SWMU56-MW01, SWMU56-MW02, SWMU56-MW03, SWMU56-MW04, and SWMU56-MW05 in exceedance of the USEPA tap water RSL for hexavalent chromium (0.035 µg/L); however, all detected chromium concentrations are below the USEPA tap water RSL for trivalent chromium (22,000 µg/L), USEPA MCL (100 µg/L), and the basewide background UTL concentration (34.3 µg/L).
- Cobalt was detected in groundwater samples collected from SWMU56-MW01 and SWMU56-MW05 at concentrations that exceeded USEPA tap water RSL of 6.0 µg/L; however, concentrations detected in groundwater samples from both wells were below the basewide background UTL concentration (22.2 µg/L).

4.2.4.5 Vapor Intrusion Screening Level Comparison

The 2016 RI groundwater data were screened against the USEPA's Vapor Intrusion Screening Level (VISL) calculator in accordance with the UFP-QAPP (Bay West, 2016). Groundwater detections in comparison to the target groundwater concentrations for residential and commercial exposure produced by USEPA's VISL (USEPA, 2016b) are presented in **Table 4-5**.

Chloroform was detected in groundwater samples collected from MW01, MW04, (including field duplicate) and MW06 at concentrations that exceeded the VISL target residential groundwater concentration of 0.81 µg/L. Chloroform was detected in groundwater samples below the VISL target commercial groundwater concentration (**Table 4-5**).

TCE was detected in groundwater samples (including field duplicate) collected from SWMU56-MW01, SWMU56-MW02, SWMU56-MW04, SWMU56-MW05, and SWMU56-MW06 at concentrations that exceeded the VISL target residential groundwater concentration of 1.2 µg/L.

TCE was detected in groundwater samples (including field duplicate) collected from SWMU56-MW01, SWMU56-MW02, SWMU56-MW04 and SWMU56-MW05 at concentrations that exceeded the VISL target commercial groundwater concentration of 1.2 µg/L. It is noted that SWMU 56 is collocated with ST-14. Residential exposure to chloroform and TCE is currently being addressed in the ST-14 ROD via institutional controls that restrict residential use (USAF, USEPA, and MDE, 2007). However, further evaluation of VI as it relates to chloroform and TCE is warranted and is planned to be conducted in support of ongoing ST-14 site remediation.

4.3 Sample Quality Assurance/Quality Control Measures

For the 2012 and 2016 events, all laboratory analytical data were validated by Bay West. Data validation results are discussed in the Data Validation Report included in **Appendix E**. All data were determined to be usable or usable as qualified.

4.4 Investigation Derived Waste

The handling of wastes derived from the sampling effort (soil, purge water, and decontamination fluids) followed USEPA and MDE regulatory requirements. Characterization sampling of the soil and water generated during the RI activities demonstrated that the material was non-hazardous, and the IDW was transported to appropriately permitted disposal facilities at the completion of the field work.

4.5 Conceptual Site Model Summary

The CSM for SWMU 56 is based on data from site background, environmental setting, and analytical data collected during the RI field efforts. The potential contaminant sources at SWMU 56 are solvents and other liquid wastes that were used or stored at the site and may have been spilled or otherwise discharged onto the ground in the vicinity of the storage area.

The soils encountered at SWMU 56 are typical of those encountered throughout JBA, with upland deposits consisting of finer-grained silts and silty clay overlying coarser-grained sands and gravels to a depth of approximately 30 to 35 ft bgs, beneath which the Calvert Formation is encountered throughout the site. The Calvert Formation consists of a dark greenish gray clay with silt and fine sand, and acts as a regional aquitard. The depth to groundwater at the site ranges from approximately 13 to 16 ft bgs across the site.

Metals, pesticides, VOCs, SVOCs, and PAHs were detected in site soil; however, only B[a]P, chromium, and arsenic exceeded their USEPA residential RSL values (**Section 4.2.1**; USEPA, 2016a). The arsenic concentrations detected in soil were all below the basewide background UTLs. The unspeciated chromium concentrations in all soil samples exceeded the residential RSL for hexavalent chromium (0.3 mg/kg), but did not exceed the residential RSL for trivalent chromium (120,000 mg/kg) or the basewide background soil boring UTL for total chromium (31.2 mg/kg). The B[a]P concentrations slightly exceeded its residential RSL (16 µg/kg, set at an excess cancer risk of $1x10^{-6}$) at one Phase I RI sample location, TMW01 (18 µg/kg), and equaled it at one sample location, TMW02 (16 µg/kg). These soil samples were collected from 2-4 ft bgs directly below the asphalt pavement and associated fill. Additionally, these B[a]P concentrations are an order of magnitude below the basewide background surface soil UTL concentration (120 µg/L).

Metals, VOCs, and PAHs were detected in groundwater samples collected from permanent construction monitoring wells installed at SWMU 56 as part of the 2016 RI activities. TCE was detected in groundwater samples collected from four out of the six SWMU 56 wells in exceedance of the MCL (5 µg/L). As noted previously, SWMU 56 lies within the footprint of ST-14. The concentrations detected in SWMU 56 wells were similar to those detected in nearby ST-14 wells and TCE is already addressed in the ST-14 ROD (USEPA,2007). TCE groundwater concentrations are therefore considered attributable to ST-14 and not a SWMU 56 release.

Benzo[b]fluoranthene and benzo[a]anthracene were detected in groundwater samples collected from one monitoring well (SWMU56-MW03) in exceedance of their RSLs. The benzo[b]fluoranthene and benzo[a]anthracene concentrations detected in SWMU56-MW03 slightly exceeded (within 0.004 µg/L) their RSLs (0.034 µg/L and 0.012 µg/L, respectively). Given the solubility of these PAHs, their detected concentrations are not believed to be associated with a plume and are likely attributable to small amounts of sediment in the groundwater sample (**Table 4-6**).

The site is currently used for commercial/industrial purposes, and future land use will likely remain commercial/industrial. Transport and exposure pathways are not complete or potentially complete at the site for ecological receptors. There is no current use of, or exposure to, groundwater, as potable water is currently supplied to JBA by the WSSC, and it is anticipated that this will continue in the foreseeable future. Potential receptors include current and future industrial/commercial workers, future construction/utility workers, and future hypothetical on-site residents. Exposure pathways include ingestion, dermal contact, and inhalation of particulates from soils, and ingestion, dermal contact, and inhalation of vapors from groundwater. The potential exposure pathway for trespassers is considered incomplete.

5.0 CONTAMINANT FATE AND TRANSPORT

The fate and transport of chemicals are dependent on a wide variety of factors. Fate refers to the expected final state that an element, compound, or group of compounds will reach following release to the environment. Transport refers to the mechanisms and rates of migration of chemicals away from the source area.

Several organic and inorganic constituents were detected in environmental media at SWMU 56. This discussion focuses on the constituents that were identified as COPCs for the BRA, which are presented in **Section 6.0**.

The COPCs evaluated for fate and transport mechanisms are listed below.

Metals:

- Aluminum
- Arsenic
- Cadmium
- Chromium
- Cobalt
- Iron
- Manganese
- Mercury
- Thallium

PAHs:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene

The following subsections discuss routes of migration at SWMU 56 and factors affecting persistence, fate, and transport of contaminants in general and on a site-specific basis for COPCs identified for SWMU 56.

5.1 Potential Routes of Migration

Several routes of migration are possible for SWMU 56 contaminants through multiple media including soil and groundwater. These routes are summarized below.

5.1.1 Soil

Organic and inorganic constituents, including PAHs and metals, were detected in subsurface soil samples at SWMU 56. One PAH and metals were identified as COPCs in soil. These contaminants may be released directly to surface or subsurface soil, or may reach surface soil via runoff or fugitive dust from nearby surfaces. Further migration in the soil may occur through leaching and infiltration.

5.1.2 Groundwater

Organic and inorganic constituents, including PAHs, and metals were detected in groundwater samples at SWMU 56. The COPCs identified for SWMU 56 groundwater include PAHs and metals.

Contaminants may reach groundwater via infiltration or leaching from subsurface soil. Groundwater flow is the major mechanism for transporting dissolved constituents in groundwater. The rate of migration of groundwater contaminants is largely controlled by groundwater flow rate, physical properties of the contaminants, seepage velocity, and natural attenuation.

5.2 Contaminant Persistence

The persistence and fate of chemical constituents in the environment depend on various chemical, physical, and biological processes. The predominant processes affecting the environmental persistence and fate of chemical constituents include solubility, photolysis, volatilization, hydrolysis, oxidation, chemical speciation/oxidation state, complexation, precipitation or co-precipitation, cationic exchange, sorption, and biodegradation or biotransformation. These processes are briefly summarized below.

5.2.1 Solubility

The solubility of chemical constituents in water is important in assessing their mobility in the environment. This is particularly important for the transport and ultimate fate of chemicals from soil and sediment to water (i.e., groundwater and surface water). Generally, for organic constituents, aqueous solubility is a function of molecular size, molecular polarity, temperature, and the presence of other dissolved organic co-solvents. For metals and other inorganic parameters, solubility is generally controlled by chemical speciation, pH, redox potential (Eh), the presence of oxygen, and the presence of dissolved and/or colloidal organic compounds (e.g., humic and fulvic acids) or other inorganic ion species (e.g., hydroxides and sulfates) (USEPA, 1979). Increased solubility is usually directly related to increased environmental mobility with groundwater or surface water being the principal transport medium. Therefore, solubility is a significant factor affecting the fate of a compound or element in the water environment.

5.2.2 Photolysis

Many chemical constituents, particularly organic compounds, are susceptible to photolytic degradation either directly or indirectly. Direct photolysis involves a splitting of the chemical compound by light, whereas indirect photolysis occurs when another compound is transformed by light into a reactive species (usually a hydroxyl radical) that reacts with and modifies the original compound. In general, photolysis primarily occurs within the atmosphere, although it may also occur to a limited extent in surface water or soil under certain environmental conditions (USEPA, 1979).

5.2.3 Volatilization

Volatilization of organic chemicals from soil or water to the atmosphere is an important pathway for chemicals with high vapor pressures. For organic compounds, volatilization is a function of partial pressure gradients, temperature, and molecular size, and is more likely to occur for compounds with low molecular weights. In addition, certain metals such as mercury, arsenic, and lead are capable of undergoing biologically mediated transformation (i.e., alkylation) that forms volatile end products. Volatilization is important for the transport of certain chemical constituents from surface and subsurface soil (i.e., vadose zone), sediment, and surface water, and is evaluated using Henry’s law and other associated chemical-specific rate constants.

5.2.4 Hydrolysis

Hydrolysis involves the decomposition of a chemical compound by its reaction with water. The rate of reaction may be promoted by acid (hydronium ion, [H_3O^+]) and/or base (hydroxyl ion, [OH^-]) compounds. In general, most organic compounds are resistant to hydrolytic reactions unless they contain a functional group (or groups) capable of reacting with water. Metallic compounds, however, generally dissociate readily in water depending upon the aqueous environmental conditions (e.g., pH and ionic strength). For metals, hydrolytic dissociation is an indirect process affecting the primary fate and transport mechanism of aqueous solubility.

5.2.5 Oxidation

The direct oxidation of organic compounds in natural environmental matrices may occur, but this is generally a slow, insignificant transformation mechanism of minimal importance (USEPA, 1979). However, some inorganic compounds may be rapidly oxidized under naturally occurring environmental conditions when the surrounding environment changes from anaerobic to aerobic conditions.

5.2.6 Chemical Speciation/Oxidation States

Chemical speciation is important, primarily for metals that may exist in multiple oxidation states in the environment, particularly within aqueous matrices. In general, the oxidation state of metals in an aqueous environment depends primarily upon the relative stability of possible valence states (which are element-specific), oxygen availability, pH and Eh conditions, and the presence of available complexing agents and/or other cations and anions (USEPA, 1979). Because various metallic species exhibit different aqueous solubility and mobility within soils and/or sediments (USEPA, 1979), the oxidation state of an individual metal will greatly affect its environmental mobility.

5.2.7 Complexation

For metals, complexation with various ligands is an important process because these complexes may be highly soluble in water. Complexation may, therefore, greatly enhance mobility within environmental matrices, particularly in groundwater and surface water, depending upon the aqueous solubility of the resulting complex. Complexation depends upon numerous factors such as pH, Eh, type and concentration of complexing ligands, and other ions present (USEPA, 1979).

Most metals are capable of forming numerous organic and/or inorganic complexes in the natural environment (USEPA, 1979). Metals may form organo-metallic complexes, especially with naturally occurring organic acids (i.e., humic and fulvic acids). In some cases, these metallic species may exhibit varying affinities for different organic ligands (i.e., mercury and arsenic for amino acids and their derivatives) (USEPA, 1979). Metals may also form metallo-inorganic complexes with inorganic ligands such as carbonate, halogens (usually chlorine), hydroxyl, and sulfate (USEPA, 1979). However, organo-metallic complex formation is usually favored over metallo-inorganic complexes.

5.2.8 Precipitation and Co-Precipitation

Both chemical precipitation and co-precipitation are important removal mechanisms, particularly for metals and metallo-cyanides in the environment. Precipitation and/or co-precipitation reactions depend on numerous aqueous environmental conditions such as pH, Eh, organic ligands present, oxygen content, and cationic and anionic species present (USEPA, 1979). Depending on the specific conditions, the removal of aqueous metallic species and metallo-cyanides from groundwater and/or surface water can greatly affect the environmental mobility of individual metals, hence their ultimate fate and transport.

5.2.9 Cation Exchange

Cation exchange is important primarily for metals and other ions that may substitute with other cations of similar charge and size within the lattice structure of clay minerals in soil and/or sediment. This process, therefore, can significantly affect the mobility of an aqueous metal cation by removing it from solution under certain environmental conditions.

5.2.10 Sorption

The sorption of chemical constituents by inorganic particulate matter (i.e., soil or sediment) and organic compounds is an important process that affects mobility in the environment. This process is particularly important for the fate and transport of chemicals from soil or sediment to aqueous media (i.e., groundwater and surface water). In general, most metals exhibit a potential for adsorption to inorganic particulate matter and organic compounds (USEPA, 1979). Organic compounds also exhibit sorptive capability but show greater variability in their ability to sorb to particulate or organic matter. The tendency for organic compounds to sorb to soils or sediment is reflected in their organic carbon partitioning coefficients (K_{oc}). K_{oc} is a measure of relative adsorption potential, with higher values indicating greater sorption potential. Actual adsorption is chemical-specific and is largely dependent on the organic content of the soil. The fraction of organic carbon, f_{oc}, in soil multiplied by the K_{oc} is defined as the distribution coefficient (K_d). The K_d is a ratio of the concentration adsorbed to the concentration partitioned to water.

Regardless of chemical class, sorption is a reversible process, whereby desorption can be favored over sorption under certain environmental conditions (e.g., low pH for metals). For organic compounds in general, as the molecular weight increases and the aqueous solubility decreases (i.e., low polarity and high hydrophobicity), the sorptive binding affinity increases (i.e., K_{oc} increases). The tendency for chemical constituents to adsorb to inorganic particulate and/or organic compounds is a particularly important process because sorption to soils and/or sediments can effectively reduce a chemical constituent's mobility.

5.2.11 Biodegradation or Biotransformation

Biodegradation is a result of the enzyme-catalyzed transformation of chemicals. Organisms require energy, carbon, and essential nutrients from the environment for their growth and maintenance. In the process, chemicals from the environment will be transformed by enzymes into a form that can be used by the organism. The biodegradation rate, or the rate at which contaminants will be degraded, is a function of microbial biomass and a chemical's concentration under the given environmental conditions. When a pollutant is introduced into the environment, there is often a lag time before biodegradation begins as the organism generates an enzyme capable of digesting the chemical. Cometabolism occurs when a pollutant can be biotransformed only in the presence of another compound that serves as a carbon and energy source (USEPA, 1979).

5.3 Site-Specific Fate and Persistence

This section discusses the persistence and fate characteristics for COPCs at SWMU 56, presented in **Section 5.0**. These constituents are summarized below by for SWMU 56.

5.3.1 PAHs

PAHs were identified as COPCs in soil and groundwater at SWMU 56. PAHs are a group of chemicals that are formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances. PAHs can either be man-made or occur naturally. A few of the PAHs are used in medicines and to make dyes, plastics, and pesticides, while others are contained in asphalt used in road construction. There are more than 100 different PAH compounds (ATSDR, 1995).

In air, PAHs are found sorbed to particulates and as gases. Particle-bound PAHs can be transported long distances and are removed from the atmosphere through precipitation and dry deposition. PAHs are transported in surface water by volatilization and sorption to settling particles. The compounds are transformed in surface water by photo-oxidation, chemical oxidation, and microbial metabolism. Sorption of PAHs to soil and sediment increases with increasing organic content and is also directly dependent upon particle size. Microbial metabolism is the major process for degradation of PAHs in soil environments. PAHs have relatively low solubility and a moderate tendency to sorb to organic carbon in soil or sediment. If transported through soils by either leaching or colloidal movement, PAHs can enter groundwater and be transported within an aquifer (ATSDR, 1995).

5.3.2 Metals

Nine inorganics were identified as COPCs in soil and groundwater. The metals identified as COPCs at SWMU 56 may be naturally occurring, and a comparison to JBA Basewide background UTLs is presented in the analytical tables provided in **Section 4.0**. Further discussion of naturally occurring metals is provided in the BRA (**Section 6.0**). The environmental fate and persistence of inorganic COPCs at SWMU 56 is discussed below.

Aluminum is a COPC in soil and groundwater at SWMU 56. Aluminum is abundant in the earth's crust, and can be released through natural weathering processes. In the environment, aluminum exists in only one oxidation state (Al^{+3}), and does not undergo oxidation-reduction reactions. Aluminum can react to form complexes, and the fate and transport of aluminum in soil is controlled by environmental factors such as pH, salinity, and the presence of species with which aluminum may complex (ATSDR, 2008).

Arsenic is a COPC in soil and groundwater at SWMU 56. Arsenic is widely distributed in the earth's crust and occurs naturally in soil and many kinds of rock. Arsenic found in soil generally forms insoluble and relatively immobile complexes with iron, aluminum, and magnesium oxides found in surface soils. However, soluble forms of arsenic, which may leach to groundwater, may be released under reducing conditions. Arsenic primarily exists in aquatic systems in two oxidation states, arsenate (As^{5+}) and arsenite (As^{3+}). Arsenic may undergo a variety of reactions in the environment, including oxidation-reduction reactions, ligand exchange, precipitation, and biotransformation. These reactions are influenced by Eh, pH, metal sulfide and sulfide ion concentrations, iron concentration, temperature, and salinity (ATSDR, 2007b).

Cadmium is a COPC in groundwater at SWMU 56. Cadmium is a metal found in the earth's crust, associated with zinc, lead, and copper ores. The mobility of cadmium and its compounds in soil depends on several factors such as pH and the amount of organic matter. Cadmium generally binds strongly to organic matter, resulting in its immobilization in the soil. Cadmium partitions primarily to soil (80-90 percent) when released to the environment. Because cadmium exists only in the +2 oxidation state in water, aqueous cadmium is not strongly influenced by the oxidizing or reducing potential of the water. However, under reducing conditions, cadmium may form cadmium sulfide, which is poorly soluble and tends to precipitate. While soluble forms may migrate in water, cadmium is relatively immobile in insoluble complexes or adsorbed to sediments (ATSDR, 2012a).

Chromium is a COPC in soil and groundwater at SWMU 56. Chromium is present in in most soils predominantly as trivalent chromium (Cr^{3+}). Trivalent chromium has very low solubility and is relatively immobile in the environment, with low toxicity. The oxidized form of chromium (hexavalent chromium, or Cr^{6+}), is less likely to be present in soil. Hexavalent chromium is relatively soluble, mobile, and has greater toxicity. The reduction of hexavalent chromium to trivalent chromium is possible in aerobic soils that contain appropriate organic energy sources to carry out the redox reaction, with the reduction of hexavalent chromium to trivalent chromium facilitated by low pH. Soluble and unadsorbed hexavalent chromium and trivalent chromium complexes in soil may leach into groundwater. The leachability of hexavalent chromium in the soil increases as the pH of the soil increases. Conversely, lower pH present in acid rain may facilitate leaching of acid-soluble trivalent chromium complexes and hexavalent chromium compounds in soil (ATSDR, 2012b). There are no known sources of hexavalent chromium at OW-C3640.

Cobalt is a COPC in soil and groundwater at SWMU 56. Cobalt commonly occurs in the 0, +2, and +3 valence states. The speciation of cobalt in soil or sediment depends on the nature of the soil or sediment, concentration of chelating/complexing agents, pH, and Eh of the soil. Dissolved cobalt may be absorbed by ion exchange and other mechanisms, or may form complexes with fulvic acids, humic acid, or other organic ligands in soil. Cobalt forms oxides, nitrates, and amines, as well as chloride, sulfate, and acetate compounds. Aqueous species of Co^{3+} do not appear to be thermodynamically stable under Eh and pH conditions that normally occur in natural waters. Co^{2+} compounds are moderately soluble in groundwater or surface water and are expected to migrate with the water (ATSDR, 2004).

Iron is a COPC in soil and groundwater at SWMU 56. Iron is abundant element in the earth's crust, though dissolved concentrations present in groundwater are generally low. The chemical behavior of iron and its solubility depend upon the oxidation intensity and pH of the environmental system in which it is found. Iron exists in two valence states (Fe^{2+} and Fe^{3+}), with the Fe^{2+} or ferrous form the most common form of iron found in solution under reducing conditions in groundwater. Dissolved iron generally sorbs to sediment and may precipitate as iron hydroxide or may oxidize to form iron oxides and iron oxyhydroxides (USEPA, 1979). Iron also may complex with organic molecules, especially fulvic and humic acids. Aerated or flowing water with a pH in the range of 6.5 to 8.5 should contain little dissolved iron.

Manganese is a COPC in groundwater at SWMU 56. Manganese is generally found in the environment in the Mn^{2+}, Mn^{3+}, or Mn^{4+} oxidation states. As with many other metals, the transport and partitioning of manganese in the environment is controlled by the solubility of the form of manganese present. The oxidation state of manganese is determined by pH, Eh, and available anions. Mn^{2+} predominates in most waters (pH 4 to 7), but may become oxidized under alkaline conditions at pH >8. The principal anion associated with Mn^{2+} in water is usually carbonate (CO_3^{-2}), and the concentration of manganese is limited by the relatively low solubility (65 milligrams per liter) of manganese carbonate. The oxidation state of manganese in soils and sediments may be altered by microbial activity (ATSDR, 2012c).

Thallium is a COPC in soil and groundwater at SWMU 56. Thallium exists in the environment in two oxidation states, Tl^{+} and Tl^{3+}. Tl^{+} is the more common and stable form. Thallium is very stable in the environment. Tl^{+} forms complexes in solution with halogens, oxygen, and sulfur, and can precipitate from water as solid mineral phases. However, thallium chloride, sulfate, carbonate, bromide, and hydroxide are very soluble in water (ATSDR, 1992). Thallium has a moderate affinity for adsorption to solid phases.

6.0 BASELINE RISK ASSESSMENT

This BRA is for current and foreseeable future groundwater and soil exposures at SWMU 56, excluding the chlorinated VOC groundwater plume associated with ST-14. The site currently consists of a paved, 75-ft-by-150-ft fenced area. Although current land use is commercial/industrial and is not expected to change in the future, future residential land use has also been evaluated for planning purposes. Potential receptors include current and future industrial/commercial workers, construction and utility workers, and potential future on-site residents.

The primary objective of the HHRA is to determine whether constituents detected in soil and groundwater pose an unacceptable health hazard or risk for potentially exposed human populations under baseline conditions to assist in evaluation of remedial actions that may be needed to allow for site closure under unlimited use and unrestricted exposure (UU/UE) conditions.

There are no on-site surface water, sediment, or surface soil features at SWMU 56; however, an ecological risk evaluation was conducted to assess potential ecological impacts.

6.1 Human Health Evaluation

The HHRA includes the following general steps:

- Data Collection and Evaluation;
- Exposure Assessment;
- Toxicity Assessment;
- Risk Characterization; and
- Uncertainty Analysis.

In the data evaluation, available chemical data are reviewed and selected for use in the risk assessment. The risk assessment data undergo an initial screening process to identify COPCs. This process involves comparing the maximum detected site concentrations with appropriate screening criteria. COPCs are the focus of the site-specific HHRA.

In the exposure assessment, a Conceptual Exposure Model (CEM) is developed to identify potential exposure pathways. Both current and future exposure is considered. Site background is evaluated as appropriate and site-specific pathways that could lead to exposure are identified.

In the toxicity assessment, toxicity values are obtained from regulatory sources, including USEPA's Integrated Risk Information System (IRIS) and the National Center for Environmental Assessment. These values are used to evaluate both non-carcinogenic and carcinogenic health effects from potential exposures to COPCs (via the pathways identified in the CEM). For this Screening-Level HHRA, RSLs developed by USEPA were used to assess risks for both non-carcinogens and carcinogens.

In the risk characterization, exposure point concentrations (EPCs) were combined with the RSLs to predict the site-specific health effects for each receptor, pathway, and COPC. Background UTL concentrations of any COPCs are also considered at this point. The individual responses, in the form of non-carcinogenic HQs or individual cancer risks, are then summed to give the total non-carcinogenic hazard index (HI) and cumulative risk. Calculated values are compared to target levels considered acceptable by regulatory agencies. If the HI and cumulative risk exceed acceptable levels, those chemicals contributing to excess risk are retained as COCs for the FS. In the final section of the risk characterization, the uncertainties analysis, the assumptions and uncertainties associated with each step are identified and evaluated.

This HHRA has been completed in general accordance with *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual* (RAGS) (USEPA, 1989) and the following associated guidance documents:

- Supplemental Guidance for Developing Soil Screening Levels (SSLs), Office of Solid Waste and Emergency Response (OSWER) 9355.3-64 (USEPA, 2002a);
- RAGS, Volume 1, Part D – Standardized Planning, Reporting and Review of Superfund Risk Assessments (USEPA, 2001).
- RAGS, Volume 1, Part E – Supplemental Guidance for Dermal Risk Assessment (USEPA, 2004);
- RAGS, Volume 1, Part F – Supplemental Guidance for Inhalation Risk Assessment (USEPA, 2009a).

6.1.1 Chemicals of Potential Concern

Soil and groundwater at the site were collected and analyzed for metals, VOCs, SVOCs, PAHs, pesticides, herbicides, and PCBs. Concentrations of constituents detected in these media were compared with screening criteria to determine if further assessment was needed.

6.1.1.1 Data Used in the Risk Assessment

Sampling of SWMU 56 included collection of soil to the water table and groundwater, as discussed in **Section 4.0**. For the purpose of this HHRA, the soil data from both 2012 and 2016 investigations were used. However, as discussed previously, only groundwater from permanent-construction monitoring wells installed in 2016 were used as representative of current site conditions in groundwater. The presentation HHRA data have been sorted as soils and groundwater. It is noted that the site is completely paved and no surface soil is present. COPCs in soil were identified through comparison to USEPA RSLs for residential soil exposures (USEPA, 2016a). For initial screening purposes, RSLs were adjusted to a HI of 0.1 for non-carcinogenic effects with RSLs for carcinogens using a cancer risk level of 1 x 10^{-6}. Screening and COPC selection tables are provided in **Appendix G, Tables G-2.1** for soils and **Table G-2.2** for groundwater. COPCs in groundwater (**Table G-2.2**) were identified through comparison to both USEPA RSLs for tap water and MCLs (USEPA, 2016a). The COPC screening tables provide the following information:

1. Minimum and maximum detected concentrations.
2. Location of maximum detected concentrations.
3. Detection frequency.
4. Range of detection limits.
5. Maximum detected concentration used for screening comparison.
6. Screening toxicity values. An HI of 0.1 and a cancer risk of 10^{-6} were used in the assessment.
7. Background UTL concentrations, although the background concentrations were not used to identify COPCs (CH2MHill, 2004).
8. Indication of constituents selected and rationale for selection.

A total of 14 soil samples were collected from 9 borings advanced at the site and analyzed for metals, VOCs, SVOCs, PAHs, pesticides, herbicides, and PCBs. In 2016, an additional 21 soil samples were collected from 7 borings advanced at the site and analyzed for barium only (**Section 4.2.2**). Results of the sampling and analysis are summarized in **Table G-2.1**.

In groundwater, samples were collected from permanent wells installed in six locations and analyzed for dissolved and total metals, VOCs, and PAHs. A duplicate sample was also collected. Results of the sampling and analysis are summarized in **Table G-2.2**. As noted previously, only data from permanent wells were used.

6.1.2 Data Usability Evaluation

The analytical data for soil and groundwater samples have undergone a data validation process where the data quality were evaluated and data of reliable quality were retained. The data were further reviewed for adequacy for risk evaluation purposes. All positively detected results were initially included, including those with data qualifiers. Data with "J," qualifiers were considered positive detections, and the reported concentrations were used for statistical purposes and in the Risk Evaluation. Data with "U" qualifiers were considered non-detect, and either the reported value (if there was one) or the method detection limit was used for statistical purposes.

If duplicate samples were analyzed, the data were used as follows:

- The higher of the two detected concentrations was used.
- If one result was non-detect, the detected concentration was used.
- The undiluted reporting limit was used if both results were non-detections.

6.1.3 Soil COPCs Selected for the Risk Assessment

Soil samples collected in December 2012 and April 2016 were evaluated for the HHRA. Soils were collected from multiple depth intervals from 2 ft bgs to the underlying water table. COPCs in soil were identified through comparison to USEPA RSLs for residential soil exposures (USEPA, 2016a). Although future land use is expected to remain commercial/industrial, the residential RSLs were used in the screening process to assure that COPCs that might present a risk to human receptors were identified and included in the HHRA. **Table G-2.1** summarizes the soil data used for the HHRA. A total of 23 metals/inorganic compounds, 9 VOCs, 1 SVOC, 16 PAHs, and 2 pesticides were detected in soils. Only seven constituents (the metals aluminum, arsenic, chromium, cobalt, iron, thallium, and the PAH B[a]P) were reported over the residential soil RSL and were therefore the only constituents carried through the HHRA for soil. The maximum concentrations of the 7 metals selected as COPCs are below their respective basewide background soil boring UTLs. However, in accordance with USEPA guidance (USEPA, 2002b), COPCs with concentrations above risk-based screening levels, but below background UTL concentrations, were not screened out at this point, but were carried through quantitative risk assessment. For screening purposes, chromium soil concentrations were compared to the residential RSL for hexavalent chromium, although hexavalent chromium is unlikely to be present.

In addition to addressing direct and indirect exposures to environmental media by human receptors, this HHRA also compared the site soil sample concentrations to the USEPA SSLs protective of groundwater in order to identify potential sources of groundwater contamination.

Based on the comparison to SSLs, eight metals/inorganics (arsenic, chromium, cobalt, iron, lead, manganese, selenium, and thallium), two VOCs (cis-1,2-DCE and TCE) and two PAHs (benzo(a)anthracene and naphthalene) were detected in soils at concentrations greater than the SSLs. Of the metals detected at concentrations greater than the SSLs, seven (arsenic, chromium, cobalt, iron, lead, manganese, and thallium) were not detected at concentrations greater than the basewide background UTLs (CH2MHill, 2004). The seventh metal (selenium) has no established basewide background UTL (CH2MHill, 2004) but groundwater concentrations were lower than expected background concentrations in groundwater (see below). The VOCs and PAHs were detected at low frequencies (3 of 14 samples or less). While the detection of soil concentrations greater than the SSL indicates that soils could serve as an ongoing source material for the migration of contaminants into groundwater via leaching, a consideration of groundwater analytical data is more valid for this pathway.

6.1.4 Groundwater COPCs Selected for the Risk Assessment

Groundwater samples collected from permanent construction monitoring wells (SWMU56-MW01 through SWMU56-MW06) in April 2016 comprise the groundwater dataset for the HHRA. Groundwater data collected during this event were used, as they represent the most current data and have documented data quality validation. For the purpose of this HHRA, the total metals (rather than dissolved) dataset was used. This dataset was used for assessing risk from direct exposures associated with the use of groundwater as potable water and direct exposures during intrusive activities. **Table G-2.2** summarizes the groundwater dataset used to characterize groundwater conditions at the SWMU 56 site. A total of 22 metals/inorganics, 8 VOCs, and 9 PAHs were detected in groundwater at the site. COPCs in groundwater were identified through comparison to USEPA RSLs for tap water (USEPA, 2016a). Nine metals/inorganics and two PAHs were detected at concentrations greater than the tap water RSLs and identified as groundwater COPCs. Two VOCs (chloroform and TCE) were detected in at concentrations greater than the tap water RSLs. Residential exposure to chloroform and TCE are currently being addressed in the ST-14 ROD (USEPA, 2007), and for this reason were not selected as COPCs. Four metals, which are also essential nutrients (calcium, magnesium, potassium, and sodium), did not have an RSL, but they did have background UTLs. With the exception of potassium, these metals were detected at concentrations less than their respective background UTLs. Potassium was detected in each of the groundwater samples, and exceeded the background UTL (18.3 mg/L) in samples (parent and duplicate) collected from SWMU56-MW04 (40 mg/L and 38 mg/L). However, potassium is an essential nutrient, and for this reason it was not selected as a COPC. It should be noted that five of the identified COPCs (arsenic, cadmium, chromium, mercury and thallium) were not detected at concentrations greater than their federal primary MCLs (USEPA, 2012). It should also be noted that five of the metals selected as COPCs (aluminum, cadmium, chromium, cobalt, and iron) did not exceed their respective basewide background UTL concentrations. Finally, the total chromium groundwater concentrations were compared to the tap water RSL for hexavalent chromium. The COPCs for groundwater are listed below; those with an asterisk (*) were detected at concentrations less than their MCLs:

- Aluminum
- Arsenic*
- Cadmium*
- Chromium (total) *
- Cobalt
- Iron
- Manganese
- Mercury*
- Thallium*
- Benzo[b]fluoranthene
- Benzo[a]anthracene

6.1.5 Human Exposure Assessment

The objectives of the exposure assessment are to identify actual or potential exposure pathways, to characterize the potentially exposed populations, and to determine the extent of any exposure. The following section presents the elements of the exposure assessment, including the CEM, calculation of exposure point concentrations, and exposure assumptions.

6.1.5.1 Conceptual Exposure Model

The CEM is a tool to identify the exposure pathways for HHRA evaluation. The HHRA CEM is shown on **Figure 6-1**, **Figure 6-2**, and in **Table G-1.1**.

An exposure pathway is the mechanism by which receptors may come into contact with COPCs. A complete exposure pathway has four components, defined by USEPA (1989) as follows:

1. A source and mechanism of chemical release (i.e., a source of contamination);
2. An environmental retention or transport medium for the release chemical;
3. A point of potential human contact with the contaminated medium (i.e., an exposure point); and
4. A route of exposure at the exposure point (e.g., ingestion, inhalation, or dermal contact).

If any one of these factors is absent, exposure cannot occur because the receptor will not be able to come into contact with the chemical. Establishing complete or potentially complete pathways and eliminating pathways that either will not occur or that would only pose risks well below those posed by other routes is a critical first step in exposure assessment.

The following complete or potentially complete pathways were identified for evaluation in the HHRA for future on-site commercial workers, construction workers, and potential on-site residential receptors. It is assumed that subsurface soil may be brought to ground surface in the future during excavations and re-grading so that future receptors may be exposed to both surface and subsurface soil (0 to 15 ft in depth).

The following soil exposure pathways are complete or potentially complete (**Figure 6-1**):

- The inhalation of VOC-contaminated soil vapor that has migrated from groundwater transport and exposure pathway is potentially complete for all human receptors, including workers.
- The inhalation of contaminated airborne soil particles via the fugitive dust transport and exposure pathway is potentially complete for current intrusive site workers and future residents.
- The incidental ingestion of and dermal contact with the contaminated inland surface water and sediments via precipitation and runoff transport and exposure pathway is potentially complete for future residents.
- The inhalation of dust, incidental ingestion of, and dermal contact with the contaminated surface soil transport and exposure pathway is complete for the intrusive site worker and potentially complete for future residents.
- The inhalation of dust, incidental ingestion of, and dermal contact with the contaminated subsurface soil transport and exposure pathway is complete for the intrusive site worker and potentially complete for the future resident.
- The incidental ingestion of and dermal contact with contaminated shallow groundwater transport and exposure pathway is potentially complete if the site worker is working at a depth in which groundwater would be encountered.

The following groundwater exposure pathways are potentially complete (**Figure 6-2**):

- Incidental ingestion of and dermal contact with contaminated groundwater is potentially complete for intrusive site workers and future residents. (This pathway will be complete if the intrusive site worker is working at a depth in which groundwater is encountered).

The inhalation of VOC-contaminated soil vapor that has migrated from groundwater transport and exposure pathway is potentially complete for all human receptors. A potential transport and exposure pathway for future residents includes the incidental ingestion of and dermal contact with contaminated surface water in the Charles Branch if shallow groundwater migrates and seeps to the stream. Using the most conservative hydraulic conductivity values for the site (3.4 ft per day, **Section 3.2.2**) to calculate the effective velocity of groundwater, it would take approximately 24 years for groundwater to travel from the site to the Charles Branch via the approximately 1,000-ft groundwater flow path from the site to the Charles Branch. Therefore, this pathway is not considered to be complete.

The commercial/industrial land use surrounding SWMU 56 is expected to continue in the future. The current commercial worker receptor was assumed to work both indoors and out-of-doors; open bay doors on maintenance buildings would allow soil to be brought indoors by wind and foot/vehicle traffic. Direct exposure to site soils is limited due to the land surface being covered by asphalt/concrete parking areas and buildings but has been evaluated (incidental ingestion, dermal contact, and inhalation of particulates).

The use of groundwater as a potable water source is unlikely since potable water is currently supplied to JBA by WSSC and it is anticipated that potable water will be supplied to JBA by WSSC in the future. In addition, there is a state prohibition of the use of groundwater as potable water if public water is available. However, the pathway has been evaluated for current commercial workers in the HHRA (ingestion and dermal contact).

Future construction/utility workers may come into direct contact with soils during intrusive activities. Groundwater at the site exists under unconfined conditions. Depth to groundwater measurements collected in April 2016 ranged in depths from 13-16 ft BTOC. Therefore, direct contact pathways for groundwater (i.e., incidental ingestions and dermal contact) are considered complete for this receptor. Construction workers may also be exposed to soil particulates emitted to outdoor air during site activities via the inhalation pathway.

Future site industrial/commercial workers may come into contact with soil that has been brought to the ground surface during future construction or intrusive activities. Direct exposure to soils via incidental ingestion, dermal contact, and inhalation of soil particulates has been evaluated. JBA is supplied potable water by WSSC, and future exposure to groundwater as a potable water source is unlikely due to a state prohibition.

On-site residential exposures are unlikely because future land use is expected to remain commercial/industrial for SWMU 56; however, hypothetical future residential exposures were evaluated to provide information for decision making. Direct exposure to site soils via incidental ingestion, dermal contact, and inhalation of soil particulates has been evaluated. In addition, use of groundwater as a potable water source in the future has been assumed under a hypothetical future residential scenario, and this pathway has been evaluated for the HHRA (ingestion, dermal contact, and inhalation of volatiles).

A fence is present around the perimeter of the site, and access to this site, in the interior of JBA, is restricted by guards at the JBA entrance gates. Exposure pathways for soil and groundwater for the trespasser receptor were considered incomplete.

6.1.5.2 Exposure Point Concentrations

The concentration of chemical constituents in a medium to which an individual is exposed is termed the exposure point concentration (EPC). In developing the EPC, the objective is to identify a conservative estimate of the average concentration contacted by a receptor at the Exposure Point over the exposure period. The EPC therefore should be conservative (health protective) and representative of concentrations that may be encountered at the site. USEPA guidance considers Upper Confidence Limits (UCLs) of the data to be conservative (health protective) representations of site concentrations. However, maximum detected concentrations were used as EPCs for this screening HHRA.

Soil. The maximum detected concentrations were used as the EPCs for site soils. The EPCs for soils are listed in **Table G-6.1**.

Groundwater. The maximum detected concentrations were used as the EPCs for site groundwater. Too few data points were available to calculate a UCL. The EPCs for groundwater are listed in **Table G-6.2**.

6.1.6 Human Toxicity Assessment

The toxicity of a constituent includes the nature of the effect caused by the constituent and the dose required to cause this effect. Toxicity is generally divided into two broad categories, systemic or non-carcinogenic effects and carcinogenicity. All constituents have some systemic toxicity (i.e., can adversely affect systems of the body) but not all are carcinogens. Toxicity values (reference doses [RfDs] and reference concentrations [RfCs] for non-carcinogenic effects and carcinogenic slope factors [CSFs] for carcinogens) are used to assess the toxic potency of each constituent. The USEPA has developed toxicity values that reflect the magnitude of adverse non-carcinogenic and carcinogenic effects from exposure to specific chemicals. The toxicity values for this risk assessment have been taken from the USEPA's IRIS or Provisional Peer-Reviewed Toxicity Values online databases and the most current USEPA RSL table (USEPA, 2016a).

6.1.6.1 Toxicity Values for Non-Carcinogenic Effects

Chemical's effects other than cancer and gene mutations are often referred to as "systemic toxicants" because of their effects on the function of various organ systems. Chemicals considered to be carcinogenic also exhibit systemic toxicity effects. For most non-carcinogenic effects, there is a dose below which effects are not expected to occur, (i.e., a dose threshold). This distinguishes systemic toxicants from carcinogens, for which any exposure is presumed to have some risk (i.e., there is no threshold dose). In developing toxicity values for evaluating non-carcinogenic effects, the standard approach is to identify the upper bound of this tolerance range or threshold and to establish the toxicity values based on this threshold.

The toxicity values used in evaluating non-carcinogenic effects is the RfD for oral and dermal exposure and the RfC for inhalation exposure. The RfD and RfC are defined as a provisional estimate of a daily exposure level for the human population, including sensitive subpopulations that are likely to be without appreciable risk of deleterious effects during a portion of a lifetime or a lifetime (chronic). Chronic RfDs are specifically developed to be protective for long-term exposures (i.e., 7 years to a lifetime [70 years]) and subchronic RfDs (if available) are developed to be protective of short-term exposures. Subchronic RfDs can be used for construction/utility worker exposure scenarios and chronic RfDs were used in industrial/commercial worker and residential scenarios. These RfDs were used as the basis for the USEPA RSLs that are based on non-carcinogenic effects. The RSLs (HQ equal to 1.0) for non-carcinogens are presented in **Tables G-6.1** and **G-6.2**.

6.1.6.2 Toxicity Values for Carcinogenic Effects

Carcinogenesis, unlike most non-carcinogenic health effects, is generally thought to be a non-threshold effect. The USEPA assumes that a small number of molecular events can cause changes in a single cell that can lead to uncontrolled cellular growth. This hypothesized mechanism for carcinogenesis is referred to as "non-threshold" because there is believed to be essentially no level of exposure to such a chemical that does not pose a finite probability of generating a carcinogenic response.

To evaluate carcinogenic effects, the USEPA uses a two-part evaluation in which the chemical is first assigned a weight-of-evidence classification, and then a CSF is calculated. These indices are derived for both oral and inhalation exposures. The weight-of-evidence classification is based on an evaluation of available data to determine the likelihood that the chemical is a human carcinogen. Chemicals with the strongest evidence of human carcinogenicity are denoted with Class A, B1, or B2, while chemicals with less supporting evidence are classified as C or D. The slope factor quantitatively defines the relationship between the dose and the response. The slope factor is generally expressed as a plausible upper-bound estimate of the probability of response occurring per unit of chemical. USEPA slope factors are used as the basis for the cancer risk-based USEPA RSLs. The RSLs (excess cancer risk equal to 1 x 10^{-6}) are presented in **Table G-6.1** and **G-6.2**.

6.1.6.3 Toxicity Assessment of Dermal Exposures

RfDs or CSFs have not been derived specifically for dermal absorption. To assess risks from dermal exposure, the dermal absorption of the chemical relative to the absorption of the orally-administered dose is used to adjust the exposure dose and account for this relative absorption difference (USEPA, 1989). Oral RfDs and CSFs are used to assess risks from dermal exposure and these values were used in the RSLs noted above.

6.1.7 Human Health Risk Characterization

Risk evaluation methods applied are based on the USEPA Region 9 guidance on using RSLs (USEPA, 2013) for screening-level risk assessments. Using this methodology, carcinogenic risks and non-carcinogenic hazards are calculated based on the ratio of detected chemical concentrations to screening levels, specifically the USEPA RSLs (USEPA, 2016a). This HHRA approach is consistent with USEPA guidance set forth in the *Risk Assessment Guidelines for Superfund: Volume I Human Health Evaluation Manual* (USEPA, 1989) and USACE guidance cited in the *Risk Assessment Handbook: Volume I Human Health Assessment* (USACE, 1995).

6.1.7.1 Hazards for Non-Carcinogenic Effects

An HQ was first derived by dividing the soil EPC for each constituent by the industrial- or residential-based USEPA RSL for non-carcinogenic effects based on a target HQ of 1. Because there are multiple chemicals at the site, the HQ for each chemical is added to derive the site-wide HI. An HI of 1 or less is considered protective of human health under USEPA guidelines. The equation used to estimate the HI is as follows:

Hazard Index = [(concentration A / RSL A) + (concentration B / RSL B) +…+
(concentration Z / RSL Z)]

Using site soil data in this equation, the HI = [(24000/77000 (0.31; aluminum) + 22/120,000 (0.00018; chromium) + 2.7/23 (0.12; cobalt) + 21,000/55,000 (0.38; iron) + 0.21/0.78 (0.27; thallium)] (**Table G-6.1**). Using USEPA soil RSLs for residential exposure, the calculated HI sums to 1 (**Table G-6.1**), which does not exceed the target HI of 1.

Based on an HI of 1, the site soil does not pose a risk to human health for residential-type uses and would also not pose a non-cancer hazard for exposures of lower frequency and duration, such as industrial or construction exposure.

This same approach was used for groundwater, with the resulting HI = [(2400/20000 (0.1; aluminum) + 1.1/9 (0.1; cadmium) + 11/16,000 (0.001; chromium) + 10/6 (1.7; cobalt) + 2100/14,000 (0.2; iron) + 340/430 (0.8; manganese) + 0.68/0.63 (0.1; mercury) + 0.18/0.2 (0.3; thallium)] (**Table G-6.2**). Using USEPA RSLs for residential exposure to tap water, the calculated HI sums to 3 (**Table G-6.2**), which exceeds the target HI of 1. Based on this exceedance, use of site groundwater as a source of potable water would pose a risk to human health for residential-type uses. However, chemicals present in groundwater at background levels were initially included in this calculation, and background is discussed further below.

6.1.7.2 Estimated Cancer Risk

Cancer risk estimates can also be calculated for detected COPCs classified as carcinogens by the USEPA using a screening approach suggested by the USEPA Region 9. Chemicals present at background levels were initially included in this calculation but results are also provided with background chemicals excluded from this evaluation in the following section.

Site-specific EPCs for each chemical are divided by the target criterion (USEPA RSL) based on carcinogenic effects. The EPCs are then multiplied by 1 x 10^{-6}, the target risk level used in establishing the RSLs to estimate chemical-specific risk. The EPCs, RSLs, and resulting cancer risks are presented below.

The only carcinogenic chemicals detected at the site in soil are arsenic, chromium, and the PAH B[a]P. The risks for these constituents are summed to arrive at the total site risk. The equation used to estimate cancer risk is:

> Risk = [(concentration A / RSL A) + (concentration B / RSL B) +…+ (concentration Z / RSL Z)] x 10^{-6}.

Using this approach, estimated total site risk calculated for residential exposure are: Risk = [(2.9/0.68 x 10^{-6} or 4 x 10^{-6} (arsenic)) + (22/0.3 x 10^{-6} or 7 x 10^{-5} (hexavalent chromium)) + (18/16 x 10^{-6} or 1 x 10^{-6} (B[a]P))] (**Table G-6.1**). The total risk for site constituents in soils is therefore 8 x 10^{-5} (**Table G-6.1**). USEPA's acceptable incremental lifetime cancer risk threshold is 1 x 10^{-6} with a target risk range for remediation of 10^{-4} to 10^{-6}, meaning remedial options resulting in a risk falling within this range are generally acceptable. The estimated total cancer risk for soils in SWMU 56 of 8 x 10^{-5} is above the USEPA target risk of 10^{-6} but within the USEPA acceptable risk range for remediation. This risk is primarily associated with the presence of hexavalent chromium, which is considered unlikely to actually be present at the site (chromium was not speciated; hexavalent chromium is fairly reactive; and except near defined sources, which were not established for SWMU 56, is seldom actually present in the environment). As noted above, background levels of site soil constituents are considered further below.

For groundwater, a similar approach was used to estimate total site risk for potable water use and the calculated risks associated with COPCs in groundwater if it were to be used as a source of tap water are: Risk = [(0.77/0.052 x 10^{-6} or 1 x 10^{-5} (arsenic)) + (11/0.035 x 10^{-6} or 3 x 10^{-4} (hexavalent chromium)) + (0.016/0.012 x 10^{-6} or 1 x 10^{-6} (Benzo[a]anthracene)) + (0.037/0.034 x 10^{-6} or 1 x 10^{-6} (Benzo[b]fluoranthene))] (**Table G-6.2**). The total risk for site constituents in groundwater, assuming use as a source of tap water, is therefore 3 x 10^{-4} (**Table G-6.2**). USEPA's acceptable incremental lifetime cancer risk threshold is 1 x 10^{-6} with a target risk range for remediation of 10^{-4} to 10^{-6}, meaning remedial options resulting in a risk falling within this range are generally acceptable. The estimated total cancer risk for groundwater in SWMU 56 of 3 x 10^{-4} is above the USEPA target risk of 10^{-6} and above the upper end of the USEPA acceptable risk range for remediation. Again, this risk is primarily associated with the presence of hexavalent chromium, which, as noted above, is considered unlikely to actually be present at the site. As noted above, background levels of site constituents in groundwater are considered further below.

6.1.7.3 Site Background

Certain materials, most notably the metals, are naturally occurring in the environment. Other constituents, such as certain organochlorine pesticides, have become ubiquitous in our environment as a result of their persistence in the environment and their widespread use. Still other constituents, including the PAHs, occur both naturally and as a result of widespread human use of the materials or of processes that generate the materials. Constituents that are present at a site as a result of either a natural source or a ubiquitous anthropogenic source (e.g., PAHs) are considered to be present at background levels. Under most regulatory guidance, the presence of constituents at levels that are consistent with background does not pose a significant risk at the site. Background concentrations for constituents in surface soil, subsurface soil, and groundwater at JBA were determined by CH2M Hill in 2004. These background concentrations are described in a Basewide Background Study (CH2M Hill, 2004) and results of the study were used to calculate UTL. Maximum concentrations of chemicals detected at the site in soil and groundwater can be compared with these UTLs to further assess the potential for the site to pose risks.

Chemicals present in soil at background levels were initially included in the non-cancer hazard calculation, which showed an HI equal to the target HI of 1. Maximum concentrations of site COPCs in soil are compared with the basewide background UTL concentrations (CH2M Hill, 2004) in **Table G-6.1**. Based on this comparison, all the site constituents are present at concentrations consistent with background. Consequently, with background considered, the COPCs in soil at SWMU 56 do not pose a non-cancer risk for residential exposure. This soil would also not pose a non-cancer hazard for exposures of lower frequency and duration, such as industrial use or contact during construction.

In assessing cancer risk, chemicals present in soil at background levels were initially included in the calculations, which showed a total risk for site constituents in soils of 8 x 10^{-5}, with much of this risk attributable to chromium (assumed to be chromium IV). The total risk is above USEPA's acceptable incremental lifetime cancer risk threshold of 1 x 10^{-6}, but within the target risk range for remediation of 10^{-4} to 10^{-6}. Maximum concentrations of site COPCs in soil are compared with the background UTL values (CH2M Hill, 2004) in **Table G-6.1**. Based on this comparison, arsenic and chromium are present at concentrations below background. B[a]P was detected (maximum detection = 18 µg/kg) in site soil above basewide soil boring background UTL concentration (3.5 µg/kg), but below the basewide surface soil background UTL concentrations (120 µg/kg). The maximum detected concentration of B[a]P presents a risk of 1 x 10^{-6}.

For groundwater, the maximum detected concentrations of COPCs are compared with the background UTL values in **Table G-6.2**. Based on this comparison, only manganese, mercury and thallium (no background UTL was calculated for mercury and thallium) are present at levels exceeding background UTLs. Summing the HQs for just these three chemicals results in an HI of 1, equal to the HI target of 1.

In assessing cancer risk for groundwater, chemicals present at background levels were initially included in the calculations, which showed a total risk for constituents in tap water of 3 x 10^{-4}, with much of this risk attributable to hexavalent chromium. The total risk is above USEPA's acceptable incremental lifetime cancer risk threshold of 1 x 10^{-6} and the target risk range for remediation of 10^{-4} to 10^{-6}. Maximum concentrations of site COPCs in groundwater are compared with the background UTL values (CH2M Hill, 2004) in **Table G-6.2**, and based on this comparison, chromium is present at concentrations consistent with background. Although their detections may be related to background, background UTLs are not established for the three other groundwater COPCs (arsenic, benzo[a]anthracene, and benzo[b]fluoranthene) presenting a cancer risk. These other constituents pose a total risk of 2 x 10^{-5} associated with the maximum concentration of these constituents.

6.1.8 Uncertainties

Uncertainty is inherent in the risk assessment process. Exposure is hypothetical, and the calculations are based in part on assumed conditions. An important part of the risk assessment process is characterizing the main underlying uncertainties. Understanding the uncertainties is important for the interpretation and ultimate use of the risk assessment results because actual risk may be underestimated or overestimated.

6.1.8.1 Uncertainties and Assumptions Associated with the Exposure Assessment

The data used for this HHRA included estimated data. This may tend to underestimate or overestimate risk. However, the overall effect of this bias is likely to be small given other uncertainties in the assessment.

The risk assessment assumes that current levels detected in the soil and groundwater will remain unchanged over 30 years. This assumption tends to overestimate risks as some constituents may degrade or migrate with time. In addition, the risk assessment assumes that the levels are consistent across the site. Chemicals and their concentrations vary by location at the site.

The total metals groundwater datasets were used to estimate EPCs for this Risk Evaluation. Using the total metals dataset may overestimate risk, as total metals include constituents bound to particulate matter that may not migrate to a future potable well over time.

Data from six locations were used to estimate the groundwater EPCs for the site as a whole. Use of data from these monitoring points may potentially underestimate or overestimate EPCs for groundwater COPCs. Maximum concentrations were used.

The actual exposure rate and duration at any given location may vary over time rather than remain stable. Assuming that exposure intakes are stable and not subject to variation may underestimate or overestimate risk.

The assumption that groundwater at SWMU 56 is used as potable water is unlikely because public water is supplied by WSSC, and the state prohibits the use of groundwater for potable water if public water is available. In addition, there is high turbidity in the shallow groundwater at SWMU 56 which would discourage its use as a source of potable water.

6.1.8.2 Uncertainties and Assumptions Associated with the Toxicity Assessment

There are substantial uncertainties associated with use of toxicity data extrapolated from animals to humans. In some instances, biological pathways and mechanisms of metabolism differ significantly between mammalian species. As a result of these differences, humans may be either more or less sensitive than the surrogate laboratory species. The application of uncertainty factors in USEPA’s RfD assumes that humans may be more sensitive, although this is not always the case. This extrapolation may tend to either underestimate or overestimate risk.

Incorporation of variability in response among individuals in the population is entirely appropriate to ensure that members of the exposed population are protected. That portion of the uncertainty factor that represents true uncertainty, however, may result in overestimation of risk.

Total chromium was assumed conservatively to be hexavalent chromium although hexavalent chromium was not reportedly used at the site. Hexavalent chromium is much more toxic that chromium (III). Use of hexavalent chromium toxicity data may result in an overestimation of risk from this constituent.

6.2 Ecological Risk Evaluation

The primary objective of the Ecological Risk Evaluation is to assess potential ecological impacts under current conditions resulting from site-related chemicals. It evaluates if any of the following three conditions exist:

1. Ecological habitat is present on, adjacent to, or potentially impacted by the site;
2. There are possible chemical transport pathways from the site to ecological receptors; and
3. The site contains chemicals exceeding ecological screening benchmarks.

If all three of these conditions are met for a site, a potential risk to the environment is present and additional ecological evaluation may be appropriate. If one or more of the three conditions are not met, there is no risk to ecological receptor species and no further ecological evaluation is warranted. Even with a source of chemicals, without ecological receptors or a pathway for exposure of the receptors, there is no ecological risk.

The BERA (CH2M Hill, 2004) was used to assess site habitats and to determine potential ecological receptors based on the overall drainage area in which SWMU 56 is located (**Section 3.5**). The combination of site habitats and potential ecological receptors were then used to determine the potential for complete transport and exposure pathways.

SWMU 56 currently is completely paved with asphalt. There is no surface soil, sediment, or surface water and therefore no ecological habitat at SWMU 56 (**Section 3.5.2**). The pavement limits both the habitat present and possible exposure to soil; therefore, there are no complete soil transport and exposure pathways for ecological receptors (**Figure 6-1**).

A potentially complete groundwater transport and exposure pathway for ecological receptors exists via ingestion of and dermal contact with inland surface water if contaminated groundwater seeps to the Charles Branch. Potential receptors within the Charles Branch Drainage Area are discussed in **Section 3.5**; however, as identified in the BERA, the Charles Branch has a relatively poor habitat quality for aquatic biota. In addition, using the most conservative hydraulic conductivity values for the site, as discussed in **Section 3.2.2**, to calculate the effective velocity of groundwater, it would take approximately 24 years for groundwater to travel from the site to the Charles Branch, located approximately 1,000 ft from the site, allowing for chemicals to naturally attenuate prior to reaching any surface water body. Therefore, this pathway is not considered to be complete and no complete exposure pathways for ecological receptors exist at the site (**Figure 6-2**).

Chemicals may be present in SWMU 56 soil and groundwater at concentrations that pose a potential risk to ecological receptors; however, no complete transport and/or exposure pathways for ecological receptors exist at the site. Therefore, no chemicals detected at the site pose a risk to ecological receptors and no further ecological risk evaluation is warranted. It is noted that a similar evaluation and conclusion was included in the EPA/MDE-approved Final SWMU 56 Phase I RI Report (Bay West, 2013).

6.3 Baseline Risk Assessment Conclusions

The HHRA considered potential exposures to soils and groundwater present at SWMU 56 at JBA. Although current land use is commercial/industrial and is not expected to change in the future, a residential land use scenario was evaluated to allow for site closure under UU/UE conditions. Constituent concentrations were compared to residential soil and tap water screening values to identify COPCs. Maximum detected concentrations were then used as EPCs for each medium and COPC.

The non-cancer HI for residential use of SWMU 56 soil was equal to the target HI of 1, indicating that residential use of the site in the future would not pose unacceptable hazards. This also indicates that other, less intrusive uses such as commercial or industrial use, or construction worker exposure would not pose unacceptable hazards. In addition, all of the non-carcinogenic soil COPCs are present at concentrations less than basewide background soil boring UTLs. The cancer risk from residential use of SWMU 56 soil was 8 x 10^{-5}, above USEPA's acceptable incremental lifetime cancer risk threshold of 1 x 10^{-6} but within the target risk range for remediation of 10^{-4} to 10^{-6}. The two chemicals most responsible for this risk, arsenic and chromium, are present at concentrations less than basewide background soil boring UTLs. The cancer risk from the maximum detected concentrations of B[a]P, the only other carcinogenic soil COPC, was 1 x 10^{-6}. Therefore, no soil COPCs were retained as COCs.

The non-cancer HI for residential use of SWMU 56 groundwater was above the target HI of 1. Much of this hazard was attributed to cobalt, which was present at concentrations below the basewide background UTL concentration. Excluding constituents present at levels consistent with background, an HI of 1 is calculated due to thallium, mercury and manganese. Per direction of USEPA, preliminary remediation goals (PRGs) are to be based on MCLs when available or a non-cancer target HI=1. The maximum concentration of concentration of thallium (0.18 µg/L) is below the tap water RSL (at target HI=1) of 0.2 µg/L and the MCL of 2 µg/L. The maximum concentration of concentration of mercury (0.068 µg/L) is below the tap water RSL (at target HI=1) of 0.63 µg/L and the MCL of 2 µg/L. The maximum concentration of manganese (340 µg/L) is below the tap water RSL (at target HI=1) of 430 µg/L. Given that the maximum concentrations of thallium, mercury and manganese were below potential PRGs, no groundwater COCs are proposed on the basis of the groundwater HI.

This indicates that use of site groundwater as a source of potable water in the future would not pose unacceptable hazards. This also indicates that other, less intensive uses of groundwater such as commercial or industrial use, or construction worker exposure would not pose unacceptable hazards.

Also for groundwater, the cancer risk for residential use of the site was 3 x 10^{-4}, above both USEPA's acceptable incremental lifetime cancer risk threshold of 1 x 10^{-6} and the target risk range for remediation of 10^{-4} to 10^{-6}. A consideration of background indicated that the chemical most responsible for this risk, chromium, is present at concentrations below the basewide background UTL concentration. Excluding chromium, a risk of 2 x 10^{-5} is associated with the maximum concentration of site constituents and use of site groundwater as a source of potable water. However, arsenic was primarily responsible for this exceedance, and arsenic was present at a maximum concentration of 0.77 µg/L, which is below the MCL (10 µg/L). The two PAHs (benzo[a]anthracene and benzo[b]fluoranthene detected in one sample), which account for the remainder of this risk, pose a calculated risk of 2 x 10^{-6}. This is slightly above the USEPA's acceptable incremental lifetime cancer risk threshold of 1 x 10^{-6}, but is at the low end of the target risk range for remediation of 10^{-4} to 10^{-6} even for future use of site groundwater as a source of potable water, an unlikely scenario. Hazards and risks for other exposures, such as commercial or industrial water use, would be lower. Therefore, no groundwater COPCs were retained as COCs.

The ecological risk evaluation determined that chemicals may be present in SWMU 56 soil and groundwater at concentrations that pose a potential risk to ecological receptors; however, no complete transport and/or exposure pathways for ecological receptors exist at the site. Therefore, no chemicals detected at the site pose a risk to ecological receptors and no further ecological risk evaluation is warranted. It is noted that a similar evaluation and conclusion was included in the EPA/MDE-approved Final SWMU 56 Phase I RI Report (Bay West, 2013).

7.0 CONCLUSIONS AND RECOMMENDATIONS

The objective of this RI was to determine whether hazardous substances were released to the environment and/or whether hazardous substances have impacted the environment exceeding human health or environmental exposure criteria, resulting in a determination of COPCs that require evaluation in an FS for the site. Soil and groundwater analytical data were evaluated by performing an HHRA to assess if hazardous substances detected in soil and groundwater pose a potential risk to human health. The HHRA compared constituents detected at SWMU 56 in soil and groundwater to applicable risk-based screening criteria.

The following sections present the conclusions and recommendations of the RI.

7.1 Conclusions

Based on the results from the RI, no COCs have proposed for soil or groundwater. The results from the RI sampling and HHRA for soil and groundwater are summarized below.

7.1.1 Soil

Analytical soil samples were collected from 16 soil borings that were advanced at SWMU 56 during two separate field efforts and analyzed for VOCs, SVOCs, PAHs, pesticides, herbicides, PCBs, and metals. A total of 23 metals, 2 pesticides, 9 VOCs, 1 SVOC, and 16 PAHs were detected in soil. The HHRA compared results to the USEPA residential RSLs (USEPA, May 2016a). Aluminum, arsenic, chromium, cobalt, iron, thallium, and B[a]P were detected above the residential soil RSLs (target hazard quotient=0.1, target risk=10^{-6}; USEPA, May 2016a); therefore, they were selected as COPCs and carried through the HHRA. Based on the results of the HHRA, site soils present a HI of 1 and the excess cancer risks for soil exposures are associated with arsenic and chromium. However, concentrations of arsenic and chromium are below the basewide background UTL concentrations, indicating that SWMU 56 soils are not impacted by previous site activity. Therefore, no COCs were retained for soil.

7.1.2 Groundwater

Groundwater samples were collected from nine temporary borings in 2012. Groundwater samples were submitted to TestAmerica and analyzed for VOCs, SVOCs, PAHs, pesticides, herbicides, PCBs, and metals. Several individual constituents were detected above tap water RSLs in these samples; however, due to the turbidity of these samples collected from the TMWs, additional investigation using permanent construction monitoring wells was recommended. The results from the 2012 temporary monitoring samples were used to determine the analytical approach of further investigation. In 2016, samples were collected from six newly installed permanent monitoring wells and analyzed for metals, PAHs, pesticides, and VOCs. A total of 24 metals, 8 VOCs, and 9 PAHs were detected in groundwater samples collected in 2016. The HHRA compared results to the USEPA tap water RSLs (USEPA, May 2016a). The constituents listed below were detected above the tap water RSLs and therefore were selected as COPCs; those with an asterisk were detected at concentrations less than their MCLs:

- Aluminum
- Arsenic*
- Cadmium*
- Chromium (total) *
- Cobalt
- Iron
- Manganese
- Mercury*
- Thallium*
- Benzo[b]fluoranthene
- Benzo[a]anthracene

As noted throughout this report, chloroform and TCE were detected in SWMU 56 RI groundwater samples in exceedance of their respective RSLs and VISLs. SWMU 56 is collocated with ST-14. Chloroform and TCE are known contaminants and are currently being remediated in accordance with the ST-14 ROD. Therefore, chloroform and TCE were not selected as COPCs and not carried through the HHRA. However, further evaluation of VI as it relates to chloroform and TCE is warranted and is planned to be conducted in support of ongoing ST-14 site remediation.

Only one groundwater COPC, cobalt, contributed an HQ greater than 1 and its maximum detected concentration was less than the established basewide background UTL concentration. The risks associated with cobalt are therefore attributable to background. The cancer risk for residential use of the site groundwater was 3 x 10^{-4}. Two groundwater COPCs, chromium and arsenic, individually contributed to risk in excess of 1 x 10^{-6}. Chromium was present at concentrations below the basewide background UTL concentration. Arsenic, which does not have a basewide background UTL concentration, was present at a maximum concentration of 0.77 µg/liter, which is below the MCL (10 µg/L). Therefore, no groundwater COPCs were retained as proposed COCs.

7.2 Recommendations

The objective of this RI was to determine whether hazardous substances were released to the environment, and/or whether hazardous substances have impacted the environment exceeding human health or environmental exposure criteria. Analysis of the data gathered during this RI indicates that constituents detected in the soil or groundwater do not present unacceptable risks to human health and/or the environment. Given that no COCs are proposed for soil and groundwater at SWMU 56, No Action is recommended and no feasibility study is required. This statement fulfills the requirement for a "concise FS statement" in subsection 9.2.5 of the FFA and the requirement to "report upon a FS" in subsection 9.2.7 FFA. In order to select No Action for SWMU 56, submittal of a Proposed Plan and ROD is recommended.

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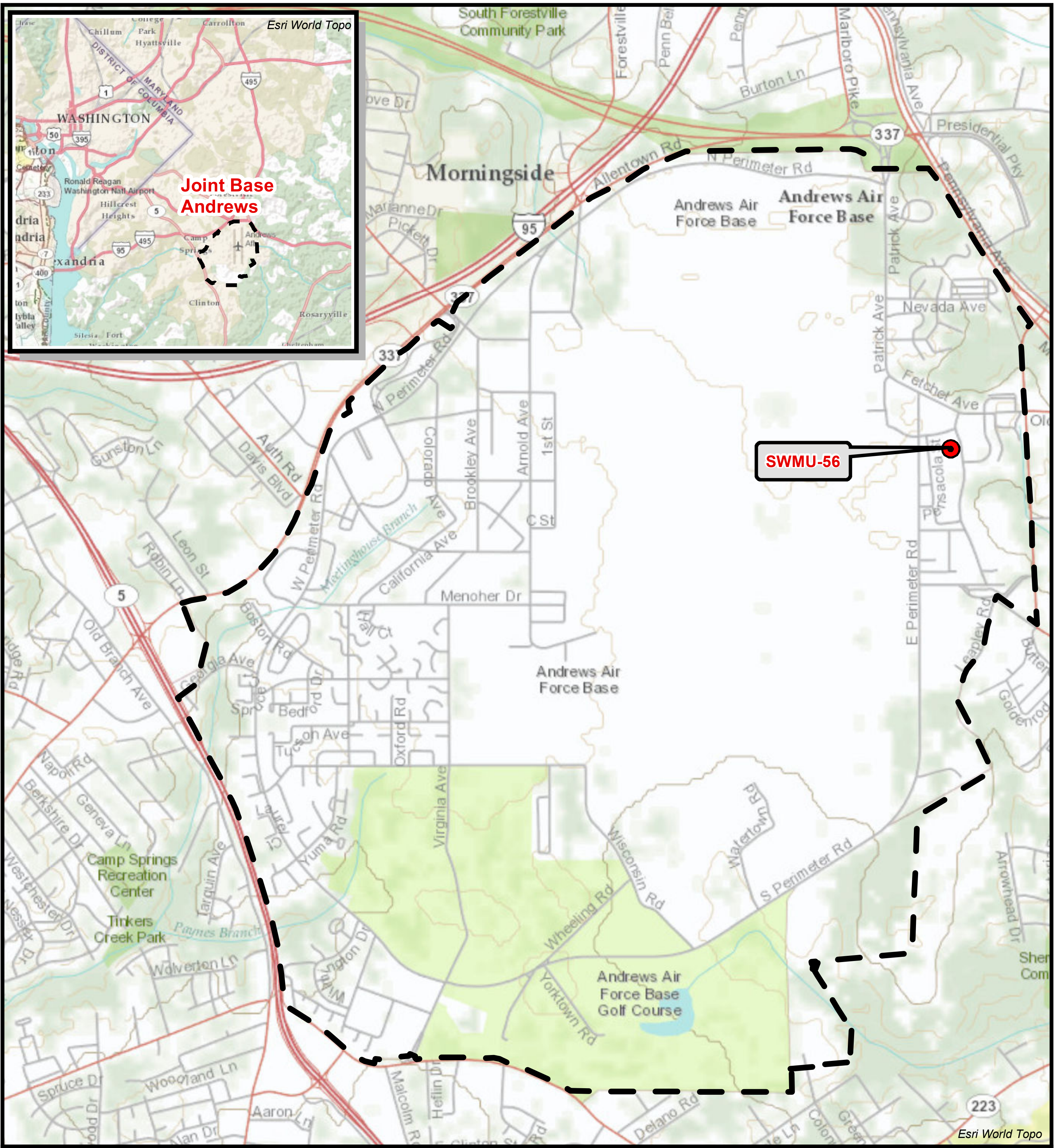
Figures



N
W E
S

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

● Site of Interest

▭ Installation Boundary

Figure 1-1

SWMU-56 Site Location Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 5/2/2012 Project No. J110202

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Andrews_AFB\110202\MapDocs\SWMU_56\SWMU 56 Figure 1 Site Location.mxd

▲ Groundwater DPT (Dames & Moore, 1992)
● DP Groundwater Sample (IT, 2000)
● DP Groundwater Sample (MACTEC, 2005)
◉ DP Groundwater Sample (MACTEC, 2010)

Ⓜ Manhole
○ Historical Soil Sample 0-2 Feet (URS 2009)
⊕ Existing ST-14 Monitoring Well
⊕ Existing ST-14 Injection Well
▩ Temporary Monitoring Point
SS — Sanitary Sewer
W — Existing Watermain
X — Existing Fence
▭ Former Building 3459 Approximate Footprint (Demolished 1994)
3449 Building Number
▭ SWMU 56

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Figure 1-2

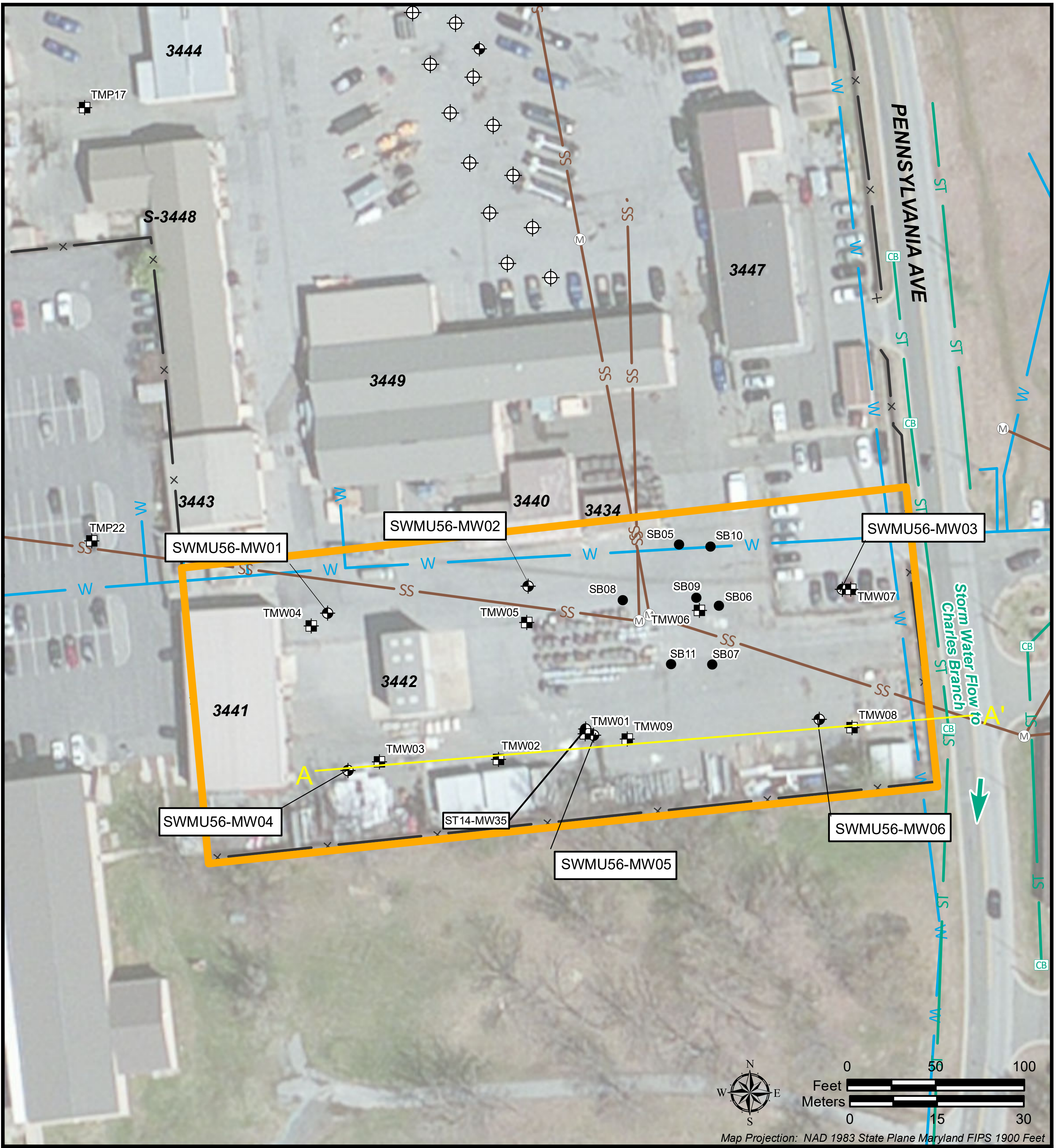
Existing Features
and Historical Investigations
in the Vicinity of SWMU 56

Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 5/29/2012 Project No. J110202

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Andrews_AFB\110202\MapDocs\SWMU_56\SWMU 56 Figure 2 Site Map.mxd



- ✚ Temporary Monitoring Well (2012)
- ⊕ Monitoring Well
- ● Soil Boring
- ⊕ Existing ST-14 Injection Well
- ▭ SWMU 56
- Stormsewer Line
- Wastewater Line
- Water Main
- Cross Section Line (See Figure 4-1)
- Ⓜ MANHOLE
- ×— Fence

Figure 1-3

SWMU 56 RI
Sample Locations

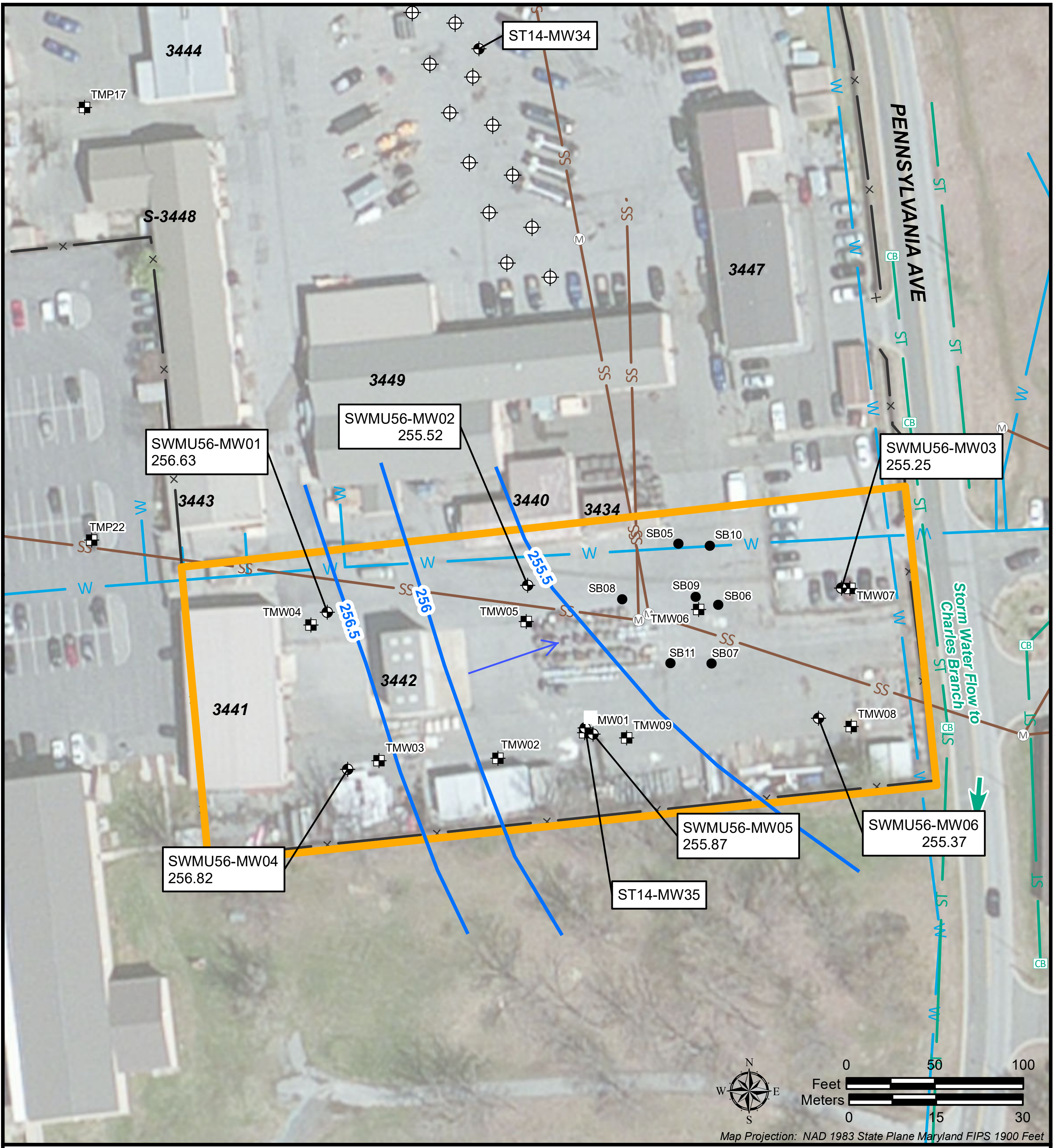
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Date Drawn/Revised: 8/8/2016 Project No. J140588

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Andrews_AFB\BaseWide\MapDocs\SWMU56\001_SWMU56_Sample_Results\J140588 002 FIG X SWMU56 Sample locations.mxd

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Andrews_AFB\BaseWide\MapDocs\SWMU56\001_SWMU56_Sample_Results\J140588 003 FIG 03-01 SWMU56 groundwater contours.mxd



⊕ Monitoring Well
✚ Temporary Monitoring Well
● Soil Boring
⊕ Existing ST-14 Injection Well
— Groundwater Contour, elevation in feet AMSL
▭ SWMU 56
→ Groundwater Flow Direction

Ⓜ MANHOLE
CB Catch Basin
Ⓜ MANHOLE
× — Fence
— Stormsewer Line
— Wastewater Line
— Water Main
*Values are elevation in feet AMSL

Figure 3-1

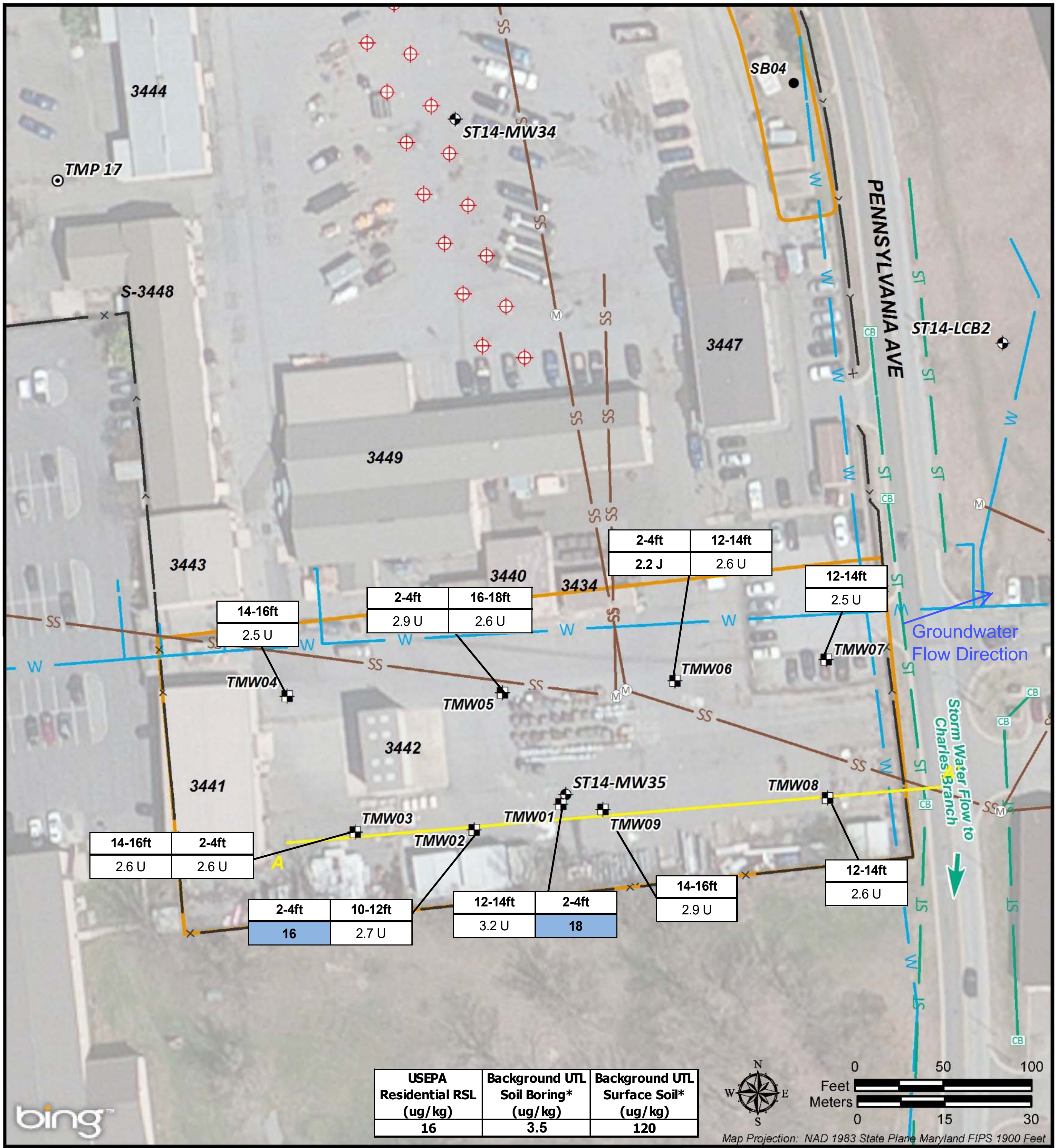
Groundwater Potentiometric Surface Map (March 2016)

SWMU 56

Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Date Drawn/Revised: 11/14/2016 Project No. J140588



USEPA Residential RSL (ug/kg)	Background UTL Soil Boring* (ug/kg)	Background UTL Surface Soil* (ug/kg)
16	3.5	120

Existing Features

3449	Building Number
× —	Fence
W	Watermain
SS —	Sanitary Sewer
ST —	Storm Sewer
Ⓜ	Manhole
CB	Catch Basin
◆	ST-14 Monitoring Well
⊕	ST-14 Injection Well
⊙	ST-14 Temporary Monitoring Point
▭	SWMU 56 Areas of Interest

Phase I RI Investigation

▣	Temporary Monitoring Well
●	Soil Boring

Bold values indicate the analyte was detected.

🟦	Result exceeds established screening criteria and the Background UTL.

All analyte concentrations are reported in µg/kg.

* Basewide Background Study Report March 2004 (CH2M Hill 2004).

U = The analyte was not detected and is reported as less than the LOD or as defined by the client.

Figure 4-1

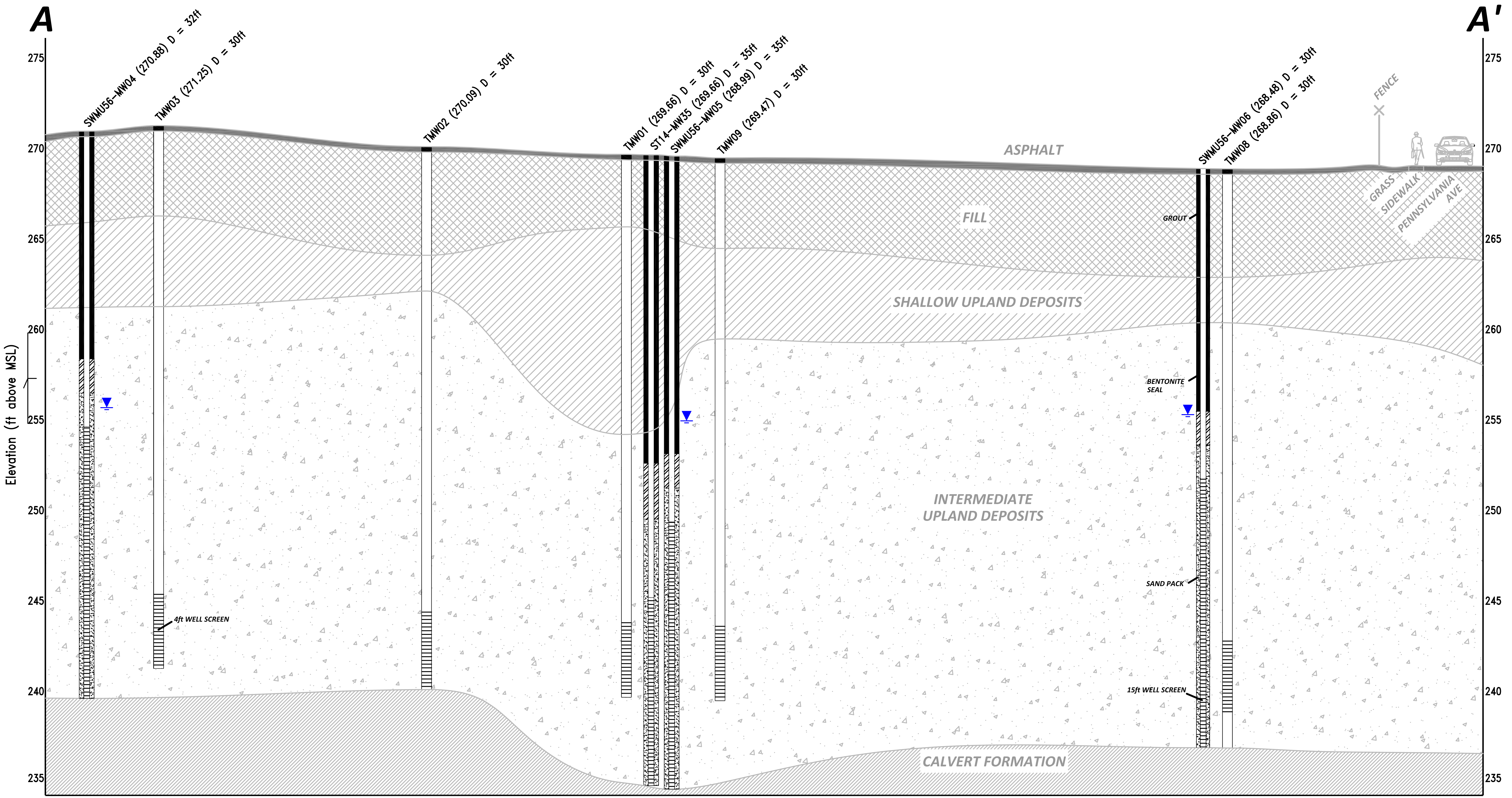
Benzo[a]pyrene Concentrations in Soil Samples

SWMU 56 Phase I RI

Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: S.G. Date Drawn/Revised: 11/11/2014 Project No. J140588



■ Asphalt Surface

▦ Fill

▨ Grayish Brown Clay, Silt, and Fine Sand

⬚ Brownish Yellow Medium to Course Sand

▨ Greenish Gray Clay

▼ Groundwater Level

TMW01 (254.16) Temporary Monitoring Well ID with Feet Above Mean Sea Level

D = 30ft Depth of Well is 30 feet

Note: A – A' Plan View Detailed on Figure 3-1

VERTICAL SCALE (FEET) 5

HORIZONTAL SCALE (FEET) 25

ENGR'G		DATE
DRAWN	G.S.	1/21/13
REV.	S.G.	8/11/16

Bay West
Customer-Focused Environmental & Industrial Solutions

PROJECT NAME

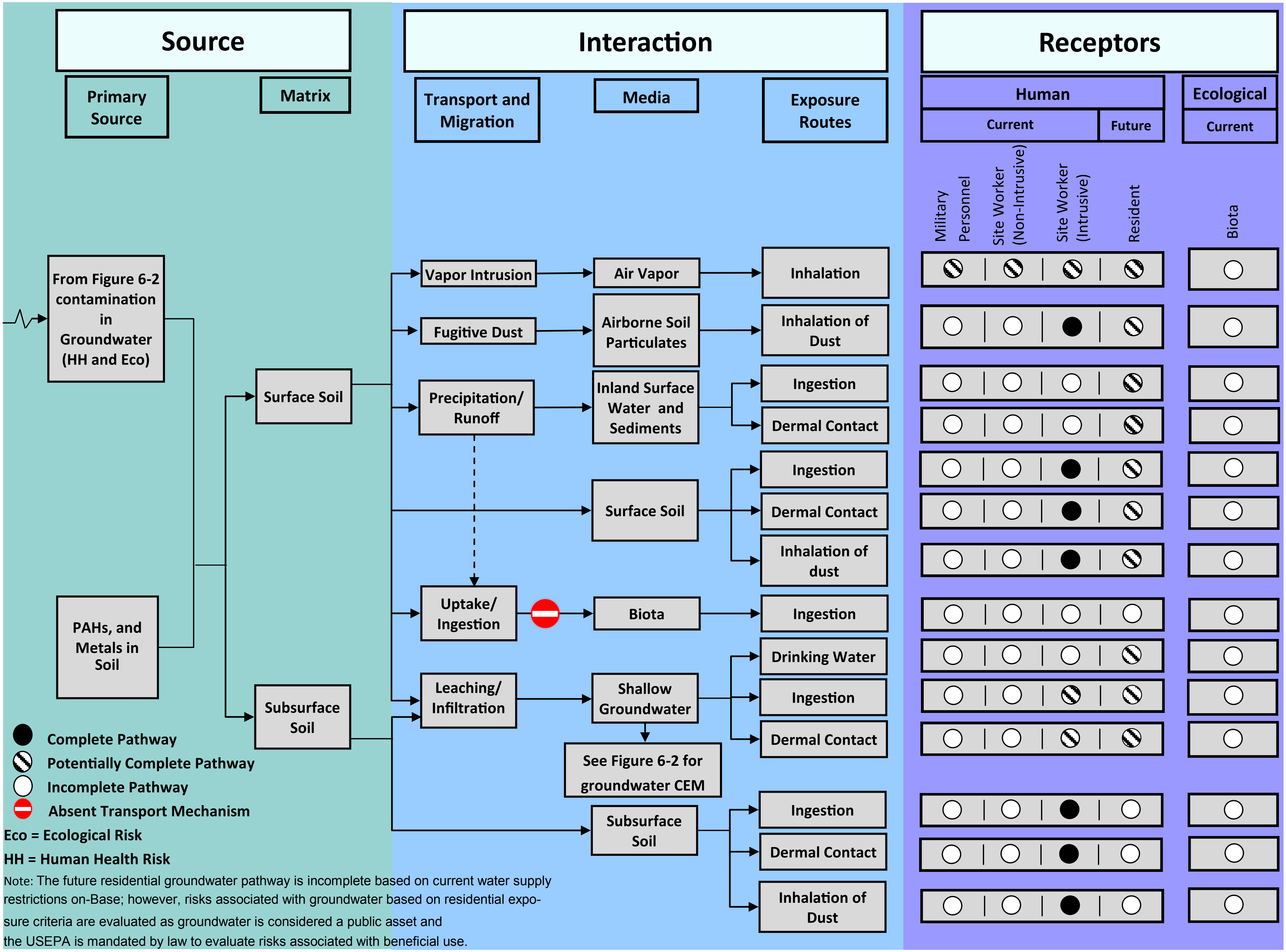
TITLE CROSS-SECTION A TO A'

DWG. NO. J140588

SCALE

FIGURE # 4-2

Figure 6-1 SWMU 56 Conceptual Exposure Model for Soil

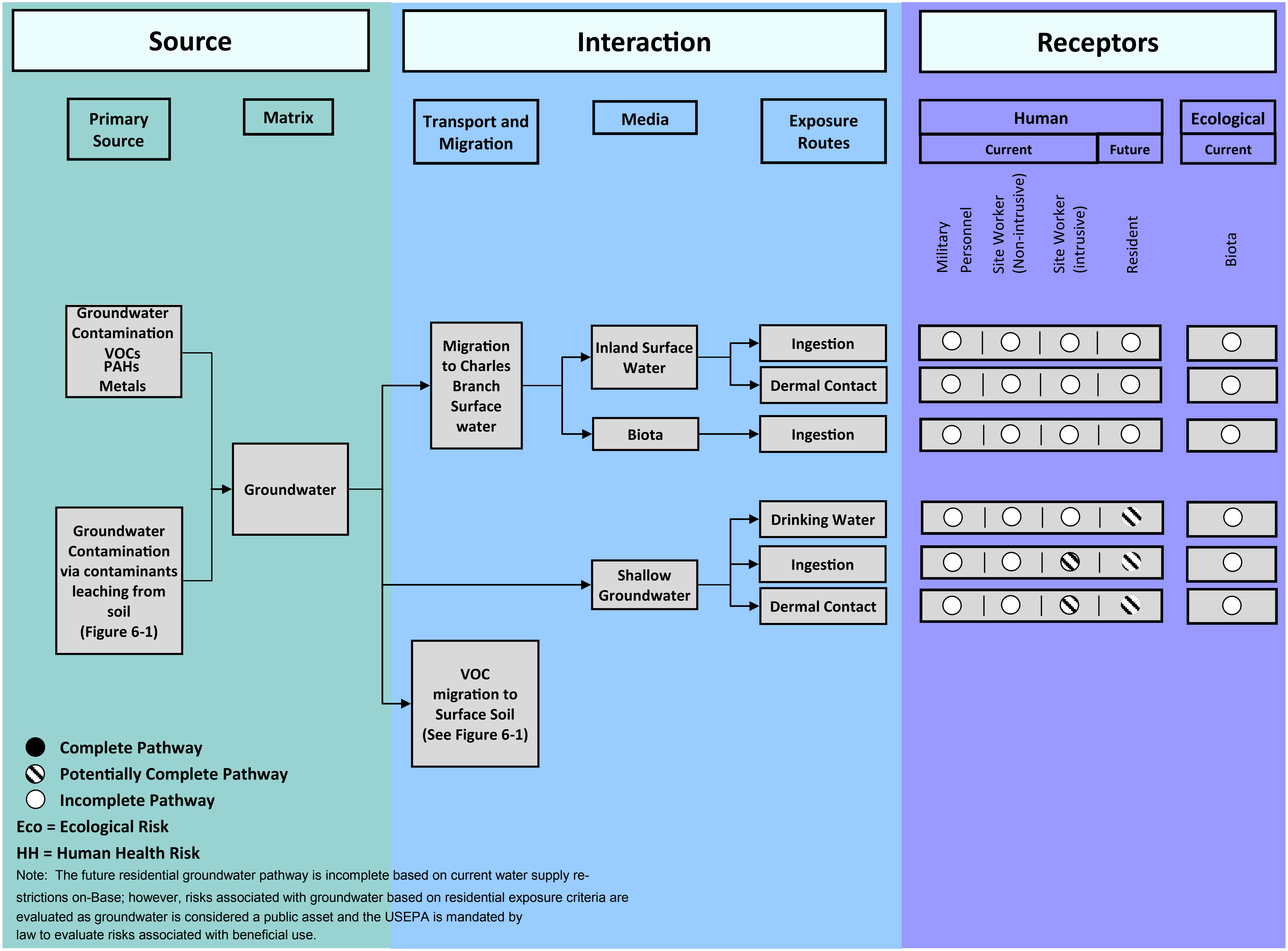


		Human				Ecological
		Current			Future	Current
Media	Exposure Routes	Military Personnel	Site Worker (Non-Intrusive)	Site Worker (Intrusive)	Resident	Biota
Air Vapor	Inhalation	▨	▨	▨	▨	○
Airborne Soil Particulates	Inhalation of Dust	○	○	●	▨	○
Inland Surface Water and Sediments	Ingestion	○	○	○	▨	○
	Dermal Contact	○	○	○	▨	○
Surface Soil	Ingestion	○	○	●	▨	○
	Dermal Contact	○	○	●	▨	○
	Inhalation of dust	○	○	●	▨	○
Biota	Ingestion	○	○	○	○	○
Shallow Groundwater	Drinking Water	○	○	○	▨	○
	Ingestion	○	○	▨	▨	○
	Dermal Contact	○	○	▨	▨	○
Subsurface Soil	Ingestion	○	○	●	○	○
	Dermal Contact	○	○	●	○	○
	Inhalation of Dust	○	○	●	○	○

● Complete Pathway
▨ Potentially Complete Pathway
○ Incomplete Pathway
⛔ Absent Transport Mechanism
Eco = Ecological Risk
HH = Human Health Risk

Note: The future residential groundwater pathway is incomplete based on current water supply restrictions on-Base; however, risks associated with groundwater based on residential exposure criteria are evaluated as groundwater is considered a public asset and the USEPA is mandated by law to evaluate risks associated with beneficial use.

Figure 6-2 SWMU 56 Conceptual Exposure Model for Groundwater



		Military Personnel	Site Worker (Non-intrusive)	Site Worker (intrusive)	Resident	Biota
Inland Surface Water	Ingestion	○	○	○	○	○
Inland Surface Water	Dermal Contact	○	○	○	○	○
Biota	Ingestion	○	○	○	○	○
Shallow Groundwater	Drinking Water	○	○	○	▨	○
Shallow Groundwater	Ingestion	○	○	▨	▨	○
Shallow Groundwater	Dermal Contact	○	○	▨	▨	○

● Complete Pathway
▨ Potentially Complete Pathway
○ Incomplete Pathway
Eco = Ecological Risk
HH = Human Health Risk

Note: The future residential groundwater pathway is incomplete based on current water supply restrictions on-Base; however, risks associated with groundwater based on residential exposure criteria are evaluated as groundwater is considered a public asset and the USEPA is mandated by law to evaluate risks associated with beneficial use.

Tables

Table 2-1: Monitoring Well Construction
SWMU 56
Joint Base Andrews Naval Air Facility Washington

Montioring Well Identification Number	Northing [1] (ft)	Easting[1] (ft)	Well Diameter (inches)	Screened Interval (ft bgs)	Well Depth (ft bgs)	Ground Surface Elevation[2] (ft)	Top of Casing Elevation[2] (ft)	Depth to Water April 2016 (ft BTOC)	Groundwater Elevation April 2016 (ft)
SWMU56-MW01	417680.17	1353677.87	2	16.5-31.5	31.5	272.16	271.90	15.27	256.63
SWMU56-MW02	417695.30	1353791.22	2	20-35	35	271.37	271.09	15.57	255.52
SWMU56-MW03	417693.62	1353968.58	2	17-32	32	370.52	270.32	15.07	255.25
SWMU56-MW04	417591.04	1353689.51	2	17-32	32	271.13	270.88	14.06	256.82
SWMU56-MW05	417611.12	1353828.12	2	20-35	35	269.23	268.99	13.12	255.87
SWMU56-MW06	417619.97	1353955.66	2	15-30	30	268.71	268.48	13.11	255.37

Notes:

1-VERTICAL DATUM= NAVD 88

2- HORIZONTAL DATUM = Maryland Coordinate System NAD83

ft = feet

btoc= below top of casing

bgs= below ground surface

Table 4-1a: 2012 Soil Field Screening Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington
Camp Springs, Maryland

Boring ID	Total Depth (ft bgs)	PID Range (ppm)		pH Range (S.U.)		Evidence of Contamination	Sample Interval (ft bgs)	Laboratory Sample Interval Selection Criteria
		Lowest	Highest	Lowest	Highest			
TMW-01	30	0.5	2.6	4.47	6.83	None observed	2 – 4	Highest PID reading
		(0-2 ft)	(2-4 ft)	(16-18 ft)	(0-2 ft)		12 – 14	Interval above groundwater
TMW-02	30	1.4	4.4	4.81	8.39	1 inch of stained black organic material at 3 ft	2 – 4	Highest PID reading, highest pH, area of possible contamination
		(8-10 ft)	(2-4 ft)	(8-10 ft)	(2-4 ft)		10 – 12	Interval above groundwater
TMW-03	30	1	2.9	6.35	7.97	None observed	2 – 4	Near surface sample
		(0-2 ft)	(22-24 ft)	(6-8 ft)	(26-28 ft)		14 – 16	Interval above groundwater
TMW-04	30	1.4	5.8	6.88	7.1	None observed	14 – 16	Interval above groundwater
		(2-4 ft)	(20-22 ft)	(28-30 ft)	(14-16 ft)			
TMW-05	30	2.6	6.3	6.72	7.11	None observed	2 – 4	Highest PID reading near surface
		(28-30 ft)	(14-16 ft)	(20-22 ft)	(6-8 ft)		16 – 18	Interval above groundwater
TMW-06	30	2	6.9	4.31	6.05	None observed	2 – 4	Highest PID reading
		(20-22 ft)	(2-4 ft)	(12-14 ft)	(0-2 ft)		12 – 14	Interval above groundwater
TMW-07	30	0.4	2.7	5.24	7	None observed	12 – 14	Interval above groundwater
		(8-10 ft)	(20-22 ft)	(2-4 ft)	(24-26 ft)			
TMW-08	32	0.8	2.1	4.41	5.49	None observed	12 – 14	Interval above groundwater
		(8-10 ft)	(0-2 ft)	(26-28 ft)	(12-14 ft)			
TMW-09	30	0.8	3.7	6.54	7.79	None observed	14 – 16	Interval above groundwater
		(22-24 ft)	(18-22 ft)	(6-8 ft)	(28-30 ft)			

Acronyms:
ft = feet
ft bgs = feet below ground surface
ID = identification
PID = photoionization detector
ppm = parts per million
TMW = temporary monitoring well
S.U. = standard unit

Table 4-1b: 2016 Soil Field Screening Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington
Camp Springs, Maryland

Boring ID	Total Depth (ft bgs)	PID	Evidence of Contamination	Sample Interval	Laboratory Sample Interval Selection Criteria
		(ppm)		(ft bgs)	
SWMU56-SB05	11	1.7	None observed	2 – 4	Interval below asphalt
		4		5 – 7	Interval midpoint of asphalt and groundwater
		2.9		9 – 11	Interval above groundwater
SWMU56-SB06	11	1.4	None observed	2 – 4	Interval below asphalt
		3.2		5 – 7	Interval midpoint of asphalt and groundwater
		3.2		9 – 11	Interval above groundwater
SWMU56-SB07	11	1.2	None observed	2 – 4	Interval below asphalt
		1.4		5 – 7	Interval midpoint of asphalt and groundwater
		1.2		9 – 11	Interval above groundwater
SWMU56-SB08	11	1.4	None observed	2 – 4	Interval below asphalt
		2.4		5 – 7	Interval midpoint of asphalt and groundwater
		1.9		9 – 11	Interval above groundwater
SWMU56-SB09	11	3	None observed	2 – 4	Interval below asphalt
		9.9		5 – 7	Interval midpoint of asphalt and groundwater
		3.3		9 – 11	Interval above groundwater
SWMU56-SB10	11	1.3	None observed	2 – 4	Interval below asphalt
		1.7		5 – 7	Interval midpoint of asphalt and groundwater
		1.7		9 – 11	Interval above groundwater
SWMU56-SB11	11	1.5	None observed	2 – 4	Interval below asphalt
		4.5		5 – 7	Interval midpoint of asphalt and groundwater
		1.7		9 – 11	Interval above groundwater

PID = photoionization detector
ppm = parts per million
ft bgs = feet below ground surface

Table 4-2: Soil Analytical Positive Results Summary

SWMU 56

Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

BORING NAME				SWMU56-TMW01	SWMU56-TMW01	SWMU56-TMW01	SWMU56-TMW02	SWMU56-TMW02	SWMU56-TMW03	SWMU56-TMW03	SWMU56-TMW04	SWMU56-TMW05	SWMU56-TMW05	SWMU56-TMW06	SWMU56-TMW06	SWMU56-TMW07
SAMPLE DATE				12/6/2012	12/6/2012	12/6/2012	12/6/2012	12/6/2012	12/7/2012	12/7/2012	12/7/2012	12/7/2012	12/7/2012	12/5/2012	12/5/2012	12/4/2012
SAMPLE TYPE CODE				N	N	FD	N	N	N	N	N	N	N	N	N	N
SAMPLE INTERVAL				2-4	12-14	12-14	2-4	10-12	14-16	2-4	14-16	2-4	16-18	2-4	12-14	12-14
CHEMICAL NAME	RSL	BG	BG SS													
Metals (SW6010B) mg/kg																
Aluminum	77000	27900	15000	**12000**	**4300**	**5100**	**11000**	**7000**	**24000**	**4800**	**3600**	**24000**	**4100 J**	**18000**	**2900**	**1800**
Calcium	NE	945	2300	**580**	**150**	**150**	**1100**	**130**	**46 J**	**38 J**	**67 J**	**320**	**30 J**	**480**	**29 J**	**57 J**
Iron	55000	22800	18000	**10000**	**1400**	**1500**	**9100**	**6400**	**21000**	**1800**	**3100**	**21000**	**2300 J**	**16000**	**1300**	**3200**
Magnesium	NE	1100	1200	**640**	**130**	**140**	**800**	**140**	**720**	**92**	**78**	**680**	**68**	**790**	**63**	**42**
Potassium	NE	843	1000	**330**	**240 J**	**330**	**360**	**160 J**	**350**	**110 J**	**92 J**	**400**	**210 J**	**440**	**220 J**	**89 J**
Sodium	NE	43.4	53	**75 J**	< 120 U	< 96 U	**82 J**	< 95 U	< 100 U	**600**	< 97 U	**120 J**	< 100 U	< 100 U	< 100 U	< 92 U
Metals (SW6020A) mg/kg																
Arsenic	0.68	5.70	3.7	**2.1**	**0.37 J**	**0.53**	**2.4**	**1.2**	**2.7**	**0.5**	**0.84**	**2.5**	**0.6**	**2.5**	**0.41 J**	**0.54**
Barium	15000	53.6	74	**31**	**10**	**11**	**40**	**11**	**42**	**7.5**	**7.4**	**40**	**13**	**42**	**9.3**	**5.8**
Beryllium	160	1.06	0.73	**0.25**	**0.042 J**	**0.094 J**	**0.24**	**0.068 J**	**0.27**	**0.033 J**	**0.05 J**	**0.22**	**0.043 J**	**0.31**	**0.053 J**	**0.025 J**
Cadmium	71	0.0390	0.10	**0.15**	**0.055 J**	**0.097 J**	**0.14**	**0.054 J**	**0.17**	**0.069 J**	**0.053 J**	**0.17**	**0.058 J**	**0.18**	**0.065 J**	**0.038 J**
Chromium	0.3*	31.2	20	**13**	**3.7 J**	**6.2 J**	**14**	**5.5**	**21**	**4.1**	**4.5**	**22**	**3.2**	**19**	**4.5**	**2.4**
Cobalt	23	6.20	10	**1.9**	**0.2 J**	**0.33 J**	**1.8**	**0.16**	**1.7**	**0.17**	**0.2**	**1.6**	**0.11**	**2.7**	**0.16**	**0.1**
Copper	3100	11.2	7.0	**5.2**	**1.1 J**	**1.7 J**	**3.9**	**1.4 J**	**4.3**	**1.5 J**	**2.3 J**	**3.7**	**2.9**	**4.1**	**1.5 J**	**1 J**
Lead	400	37.1	99	**16**	**1.8 J**	**3.2 J**	**12**	**2.4**	**9.3**	**1.5**	**1.9**	**10**	**1.9**	**9.8**	**3.6**	**1.1**
Manganese	1800	174	440	**36**	**3.6 J**	**5.8 J**	**39**	**1.1**	**8.7**	**1.3**	**1.8**	**15**	**1.1**	**35**	**1.4**	**0.94**
Molybdenum	390	1.42	1.7	**0.25**	**0.081 J**	**0.1 J**	**0.31**	**0.085 J**	**0.23**	**0.084 J**	**0.16 J**	**0.22 J**	**0.31 J**	**0.33**	**0.11 J**	**0.097 J**
Nickel	1500	11.3	8.9	**4.3**	**0.54 J**	**0.92 J**	**4.9**	**0.5**	**4.5**	**0.61**	**0.78**	**4.2**	**0.42**	**5.4**	**0.42**	**0.32 J**
Selenium	390	NE	NE	**0.68**	**0.31 J**	**0.48 J**	**0.85**	**0.32 J**	**0.68**	**0.4 J**	**0.42 J**	**0.7**	**0.47 J**	**0.68**	**0.31 J**	**0.26 J**
Silver	390	NE	0.17	**0.045 J**	< 0.071 U	**0.021 J**	**0.031 J**	< 0.065 U	**0.026 J**	< 0.059 U	**0.026 J**	**0.034 J**	< 0.057 U	**0.034 J**	< 0.057 U	< 0.06 U
Thallium	0.78	0.332	0.43	**0.12**	**0.037 J**	**0.065 J**	**0.15**	**0.035 J**	**0.18**	**0.026 J**	**0.027 J**	**0.19**	**0.03 J**	**0.21**	**0.042 J**	**0.047 J**
Vanadium	390	40.0	32	**22**	**5.5 J**	**9.9 J**	**22**	**6.8**	**36**	**3.6**	**6.7**	**37**	**4.9 J**	**33**	**6.7**	**3.8**
Zinc	23000	29.2	37	**20**	**1.5 J**	**2.4 J**	**15**	**1 J**	**8.2**	**1 J**	**1.3 J**	**8.6**	**0.75 J**	**15**	**0.96 J**	**0.58 J**
Mercury (SW7471B) mg/kg																
Mercury	11	0.0670	0.10	**0.021**	< 0.018 U	< 0.015 U	**0.024**	< 0.017 U	< 0.016 U	< 0.016 U	< 0.015 U	**0.022**	< 0.015 U	**0.011 J**	< 0.015 U	< 0.016 U
Pesticides (SW8081A) ug/kg																
4,4'-DDD	2300	NE	NE	**1.8 J**	0.86 U	0.72 U	**1.7 J**	0.74 U	0.73 U	0.74 U	0.73 U	0.77 U	0.74 U	0.79 U	0.75 U	0.73 U
4,4'-DDE	2000	NE	NE	**1.2 J**	0.58 U	0.48 U	**4.7**	0.49 U	0.49 U	0.49 U	0.48 U	0.51 U	0.50 U	0.53 U	0.50 U	0.49 U
VOCs (SW8260B) ug/kg																
1,3,5-Trimethylbenzene	780000	NE	NE	**0.61 J**	1.1 U	0.78 U	1.1 U	0.80 U	0.75 U	0.78 U	0.69 U	1.0 U	0.81 U	0.78 U	0.99 U	1.1 U
2-Butanone (MEK)	27000000	NE	NE	**13 J**	6.9 U	5.0 U	**20 J**	5.1 U	4.8 U	5.0 U	4.4 U	6.5 U	5.2 U	**7.8 J**	6.3 U	7.0 U
Acetone	61000000	NE	NE	**96 J**	**9.6 J**	16 U	**97 J**	16 U	15 U	16 U	14 U	21 U	16 U	**97**	9.9 U	11 U
Carbon disulfide	770000	NE	NE	**0.44 J**	1.1 U	0.78 U	**0.87 J**	0.80 U	0.75 U	0.78 U	0.69 U	1.0 U	**0.53 J**	0.78 U	0.99 U	1.1 U
cis-1,2-Dichloroethene	160000	NE	NE	0.76 U	1.1 U	0.78 U	**120 J**	0.80 U	0.75 U	0.78 U	0.69 U	1.0 U	0.81 U	**50**	0.99 U	1.1 U
Tetrachloroethene	24000	NE	NE	0.76 U	1.1 U	0.78 U	1.1 U	0.80 U	0.75 U	0.78 U	0.69 U	1.0 U	0.81 U	**1.8 J**	0.99 U	1.1 U
Toluene	4900000	NE	NE	0.76 U	1.1 U	0.78 U	**1.2 J**	0.80 U	0.75 U	0.78 U	0.69 U	1.0 U	0.81 U	0.78 U	0.99 U	1.1 U
trans-1,2-Dichloroethene	1600000	NE	NE	0.76 U	1.1 U	0.78 U	**9.6 J**	0.80 U	0.75 U	0.78 U	0.69 U	1.0 U	0.81 U	**4.4**	0.99 U	1.1 U
Trichloroethene	940	NE	NE	0.61 U	0.86 U	0.63 U	0.89 U	0.64 U	0.60 U	0.62 U	0.55 U	0.82 U	0.65 U	**34**	**0.49 J**	0.88 U

Table 4-2: Soil Analytical Positive Results Summary

SWMU 56

Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

BORING NAME				SWMU56-TMW01	SWMU56-TMW01	SWMU56-TMW01	SWMU56-TMW02	SWMU56-TMW02	SWMU56-TMW03	SWMU56-TMW03	SWMU56-TMW04	SWMU56-TMW05	SWMU56-TMW05	SWMU56-TMW06	SWMU56-TMW06	SWMU56-TMW07
SAMPLE DATE				12/6/2012	12/6/2012	12/6/2012	12/6/2012	12/6/2012	12/7/2012	12/7/2012	12/7/2012	12/7/2012	12/7/2012	12/5/2012	12/5/2012	12/4/2012
SAMPLE TYPE CODE				N	N	FD	N	N	N	N	N	N	N	N	N	N
SAMPLE INTERVAL				2-4	12-14	12-14	2-4	10-12	14-16	2-4	14-16	2-4	16-18	2-4	12-14	12-14
CHEMICAL NAME	**RSL**	**BG**	**BG SS**													
SVOCs (SW8270C) ug/kg																
Benzyl alcohol	6300000	NE	NE	38 U	41 U	**26 J**	**42 J**	**39 J**	680 U	340 U	340 U	**47 J**	360 U	**42 J**	**27 J**	35 U
PAH (SW8270C SIM) ug/kg																
Acenaphthene	3600000	45.9	250	**2.2 J**	0.34 U	0.27 U	0.31 U	0.29 U	0.28 U	0.27 U	0.27 U	0.31 U	0.28 U	0.31 U	0.28 U	0.27 U
Acenaphthylene	NE	8.8	42	**7.7**	0.84 U	0.68 U	**4.0 J**	0.72 U	0.70 U	0.69 U	0.68 U	0.77 U	0.69 U	**1.0 J**	0.71 U	0.67 U
Anthracene	18000000	NE	4.9	**5.6**	3.2 U	2.5 U	**3.7 J**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	2.9 U	2.6 U	2.5 U
Benzo (g,h,i)perylene	NE	4.8	33	**18**	3.2 U	2.5 U	**12**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**4.0 J**	2.6 U	2.5 U
Benzo[a]anthracene	160	11.2	32	**14**	3.2 U	2.5 U	**14**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**1.9 J**	2.6 U	2.5 U
Benzo[a]pyrene	16	3.5	120	**18**	3.2 U	2.5 U	**16**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**2.2 J**	2.6 U	2.5 U
Benzo[b]fluoranthene	160	7.6	31	**34**	3.2 U	2.5 U	**23**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**5.3 J**	2.6 U	2.5 U
Benzo[k]fluoranthene	1600	NE	9.4	**9.4**	3.2 U	2.5 U	**7.6**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**1.5 J**	2.6 U	2.5 U
Chrysene	16000	26.6	58	**30**	3.2 U	2.5 U	**25**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**3.7 J**	2.6 U	2.5 U
Dibenz(a,h)anthracene	16	17	66	**3.9 J**	3.2 U	2.5 U	**3.4 J**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	2.9 U	2.6 U	2.5 U
Fluoranthene	2400000	22.6	82	**35**	3.2 U	2.5 U	**23**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**3.5 J**	2.6 U	2.5 U
Fluorene	2400000	11.8	17	**5.4 J**	0.84 U	0.68 U	**4.0 J**	0.72 U	0.70 U	0.69 U	0.68 U	0.77 U	0.69 U	0.77 U	0.71 U	0.67 U
Indeno[1,2,3-cd]pyrene	160	5.8	38	**17**	3.2 U	2.5 U	**11**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**3.1 J**	2.6 U	2.5 U
Naphthalene	3800	NE	8.2	**22**	0.84 U	0.68 U	**37**	0.72 U	0.70 U	0.69 U	0.68 U	**0.66 J**	0.69 U	**1.2 J**	0.71 U	0.67 U
Phenanthrene	NE	9.3	41	**24**	3.2 U	2.5 U	**28**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**2.1 J**	2.6 U	2.5 U
Pyrene	1800000	13.9	92	**42**	3.2 U	2.5 U	**31**	2.7 U	2.6 U	2.6 U	2.5 U	2.9 U	2.6 U	**4.0 J**	2.6 U	2.5 U

Notes:

Bold values indicate the analyte was detected.

Result exceeds Res. RSL

Notes:

RSL= Residential Soil Regional Screening Level (RSL) Hazard Index of 1.0 and 1 x 10-6 carcinogenic risk (May 2016)

Qualifiers:

J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not met.
U = The analyte was not detected and is reported as less than the Limit of Detection (LOD) or as defined by the client.
UJ = The analyte was not detected in the sample. The LOD (or LOQ) should be considered estimated and may be inaccurate or imprecise.
BG= Background soil boring upper threshold limit (UTL) as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).
BG SS = Background surface soil concentration is the UTL as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).
* RSL for hexavalent chromium. The RSL for trivalent chromium is 120,000 ug/L.

Acronyms:

NA = not analyzed
NE = none established
PAHs = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOC = semi-volatile organic compound
VOC = volatile organic compound
N= Normal
FD= Field Duplicate

Table 4-2: Soil Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

BORING NAME		SWMU56-TMW08	SWMU56-TMW09	SWMU56-SB05	SWMU56-SB05	SWMU56-SB05	SWMU56-SB06	SWMU56-SB06	SWMU56-SB06	SWMU56-SB06	SWMU56-SB07	SWMU56-SB07	SWMU56-SB07	SWMU56-SB08	SWMU56-SB08	SWMU56-SB08
SAMPLE DATE		12/5/2012	12/6/2012	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016
SAMPLE TYPE CODE		N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N
SAMPLE INTERVAL		12-14	14-16	2-4	5-7	9-11	2-4	5-7	9-11	5-7	2-4	5-7	9-11	2-4	5-7	9-11
CHEMICAL NAME	RSL															
Metals (SW6010B) mg/kg																
Aluminum	77000	**1600**	**4800**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	NE	**150**	**20 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	55000	**14000**	**1200**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	NE	**33**	**130**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NE	**68 J**	**230 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NE	< 96 U	< 100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (SW6020A) mg/kg																
Arsenic	0.68	**2.9**	**0.57**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	15000	**4.3**	**13**	**48**	**47**	**29**	**35**	**31**	**11**	**26**	**29**	**71**	**11**	**44 J**	**23**	**13 J**
Beryllium	160	**0.036 J**	**0.083 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	71	**0.029 J**	**0.081 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	0.3*	**11**	**3.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	23	**0.16**	**0.25**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	3100	**2 J**	**1.4 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	400	**0.89**	**1.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1800	**4.2**	**1.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	390	**1**	**0.17 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1500	**0.95**	**0.59**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	390	**0.17 J**	**0.42 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	390	< 0.058 U	< 0.069 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.78	**0.011 J**	**0.041 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	390	**2.6**	**6.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	23000	**2.1 J**	**1.5 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury (SW7471B) mg/kg																
Mercury	11	< 0.016 U	< 0.016 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides (SW8081A) ug/kg																
4,4'-DDD	2300	0.72 U	0.78 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	2000	0.48 U	0.52 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOCs (SW8260B) ug/kg																
1,3,5-Trimethylbenzene	780000	0.83 U	0.98 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	27000000	5.3 U	6.2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	61000000	8.3 U	20 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	770000	0.83 U	0.98 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	160000	0.83 U	0.98 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	24000	0.83 U	0.98 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	4900000	0.83 U	0.98 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	1600000	0.83 U	0.98 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	940	0.66 U	0.78 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4-2: Soil Analytical Positive Results Summary

SWMU 56

Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

	BORING NAME	**SWMU56-TMW08**	**SWMU56-TMW09**	**SWMU56-SB05**	**SWMU56-SB05**	**SWMU56-SB05**	**SWMU56-SB06**	**SWMU56-SB06**	**SWMU56-SB06**	**SWMU56-SB06**	**SWMU56-SB07**	**SWMU56-SB07**	**SWMU56-SB07**	**SWMU56-SB08**	**SWMU56-SB08**	**SWMU56-SB08**
	SAMPLE DATE	**12/5/2012**	**12/6/2012**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**
	SAMPLE TYPE CODE	N	N	N	N	N	N	N	N	FD	N	N	N	N	N	N
	SAMPLE INTERVAL	**12-14**	**14-16**	**2-4**	**5-7**	**9-11**	**2-4**	**5-7**	**9-11**	**5-7**	**2-4**	**5-7**	**9-11**	**2-4**	**5-7**	**9-11**
CHEMICAL NAME	**RSL**															
SVOCs (SW8270C) ug/kg																
Benzyl alcohol	6300000	**22 J**	390 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (SW8270C SIM) ug/kg																
Acenaphthene	3600000	0.27 U	0.31 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NE	0.68 U	0.77 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	18000000	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo (g,h,i)perylene	NE	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	160	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	16	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	160	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	1600	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	16000	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	16	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2400000	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2400000	0.68 U	0.77 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	160	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3800	0.68 U	0.77 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NE	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1800000	2.6 U	2.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold values indicate the analyte was detected.

Result exceeds Res. RSL

Notes:

RSL= Residential Soil Regional Screening Level (RSL) Hazard Index of 1.0 and 1 x 10-6 carcinogenic risk (May 2016)

Qualifiers:

J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not met.
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BG= Background soil boring upper threshold limit (UTL) as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).
BG SS = Background surface soil concentration is the UTL as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).

Acronyms:

NA = not analyzed
NE = none established
PAHs = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOC = semi-volatile organic compound
VOC = volatile organic compound
N= Normal
FD= Field Duplicate

Table 4-2: Soil Analytical Positive Results Summary

SWMU 56

Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

BORING NAME		SWMU56-SB08	SWMU56-SB09	SWMU56-SB09	SWMU56-SB09	SWMU56-SB09	SWMU56-SB10	SWMU56-SB10	SWMU56-SB10	SWMU56-SB11	SWMU56-SB11	SWMU56-SB11
SAMPLE DATE		4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016	4/2/2016
SAMPLE TYPE CODE		FD	N	N	N	FD	N	N	N	N	N	N
SAMPLE INTERVAL		9-11	2-4	5-7	9-11	9-11	2-4	5-7	9-11	2-4	5-7	9-11
CHEMICAL NAME	RSL											
Metals (SW6010B) mg/kg												
Aluminum	77000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	55000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (SW6020A) mg/kg												
Arsenic	0.68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	15000	**16 J**	**40**	**23**	**8.9 J**	**12 J**	**39**	**18**	**16**	**34**	**53**	**12**
Beryllium	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	0.3*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	3100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.78	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	23000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury (SW7471B) mg/kg												
Mercury	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides (SW8081A) ug/kg												
4,4'-DDD	2300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VOCs (SW8260B) ug/kg												
1,3,5-Trimethylbenzene	780000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	27000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	61000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide	770000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	160000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	24000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	4900000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	1600000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	940	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4-2: Soil Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

BORING NAME		**SWMU56-SB08**	**SWMU56-SB09**	**SWMU56-SB09**	**SWMU56-SB09**	**SWMU56-SB09**	**SWMU56-SB10**	**SWMU56-SB10**	**SWMU56-SB10**	**SWMU56-SB11**	**SWMU56-SB11**	**SWMU56-SB11**
SAMPLE DATE		**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**	**4/2/2016**
SAMPLE TYPE CODE		FD	N	N	N	FD	N	N	N	N	N	N
SAMPLE INTERVAL		**9-11**	**2-4**	**5-7**	**9-11**	**9-11**	**2-4**	**5-7**	**9-11**	**2-4**	**5-7**	**9-11**
CHEMICAL NAME	**RSL**											
SVOCs (SW8270C) ug/kg												
Benzyl alcohol	6300000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PAH (SW8270C SIM) ug/kg												
Acenaphthene	3600000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	18000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo (g,h,i)perylene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]anthracene	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[k]fluoranthene	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	16000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	2400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	2400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-cd]pyrene	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	3800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	1800000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Bold values indicate the analyte was detected.

Result exceeds Res. RSL

Notes:

RSL= Residential Soil Regional Screening Level (RSL) Hazard Index of 1.0 and 1 x 10-6 carcinogenic risk (May 2016)

Qualifiers:

J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not
U = The analyte was not detected and is reported as less than the Limit of Detection (LOD) or as defined by the client.
UJ = The analyte was not detected in the sample. The LOD (or LOQ) should be considered estimated and may be inaccurate or imprecise.
BG= Background soil boring upper threshold limit (UTL) as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).
BG SS = Background surface soil concentration is the UTL as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).

Acronyms:

NA = not analyzed
NE = none established
PAHs = polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOC = semi-volatile organic compound
VOC = volatile organic compound
N= Normal
FD= Field Duplicate

Table 4-3: 2012 Groundwater Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

				Well ID	SWMU56-TMW01	SWMU56-TMW01 (DUP)	SWMU56-TMW02	SWMU56-TMW03	SWMU56-TMW04	SWMU56-TMW05	SWMU56-TMW06	SWMU56-TMW07	SWMU56-TMW08	SWMU56-TMW09
	RSL[1]	MCL[2]	Screening Criteria[3]	BG[4]	12/5/2012	12/5/2012	12/5/2012	12/6/2012	12/6/2012	12/4/2012	12/3/2012	12/4/2012	12/4/2012	12/5/2012
Metals (SW6010B) Totals														
Aluminum	20000	NE	20000	27000	160 J	73 J	21000	220 J	57 J	1700	480	180 J	660	110 J
Calcium	NE	NE	NE	167000	2400	2300	4400	11000	3700	7700	6300	3700	1800	1600
Iron	14000	NE	14000	20100	1200 J	890 J	110000	2400	740	3500	2900	1300	3100	1100
Magnesium	NE	NE	NE	16000	1100	1100	3300	4200	1400	9100	2900	1400	750	990
Potassium	NE	NE	NE	18300	870 J	870 J	4100	1500 J	1200 J	1900 J	1400 J	1500 J	1200 J	750 J
Sodium	NE	NE	NE	110000	6000	5800	3700 J	47000	9400	57000	25000	7100	3800 J	5500
Metals (SW6020A) Totals														
Arsenic	0.0520	10.0	10.0	--	< 1.0 U	< 1.0 U	21	< 1.0 U	< 1.0 U	0.68 J	< 1.0 U	< 1.0 U	0.41 J	< 1.0 U
Antimony	7.80	6.00	6.00	--	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U	< 0.60 U
Barium	3800	2000	2000	76.6	24	23	75	110	35	210	66	40	19	21
Beryllium	25.0	4.00	4.00	--	0.087 J	0.098 J	1.9	0.46 J	0.17 J	0.32 J	0.25 J	0.18 J	0.15 J	0.085 J
Cadmium	9.20	5.00	5.00	2.6	0.25 J	0.26 J	2.4	1.0	0.47 J	0.39 J	0.48 J	0.43 J	0.15 J	0.14 J
Chromium	0.035*	100	100	34.3	2.7 J	1.7 J	170	3.4 J	1.0 J	3.1 J	2.0 J	2.6 J	2.8 J	1.6 J
Cobalt	6.00	NE	6.00	22.2	1.3	1.3	95	3.6	1.5	13	3.7	2.7	1.0	1.2
Copper	800	1300	1300	29.1	1.7 U	1.4 J	310	1.5 U	0.84 U	3.8 U	2.2 U	5.2	2.0 U	44
Lead	15.0	15.0	15.0	9.5	0.22 J	< 0.50 U	24	0.29 J	0.69 J	0.86 J	0.75 J	0.34 J	0.23 J	2.0 J
Manganese	430	NE	430	160	28	28	280	100	30	390	140	45	19	26
Molybdenum	100	NE	100	1.99	0.48 J	0.25 J	45	0.41 J	< 0.40 U	0.31 J	0.33 J	0.24 J	0.46 J	0.19 J
Nickel	390	NE	390	20.2	6.8	6.4	150	15	4.0	14	13	26	3.8	4.1
Selenium	100	50.0	50.0	2.6	< 2.0 U	< 2.0 U	3.0 J	< 2.0 U	< 2.0 U	0.99 J	< 2.0 U	< 2.0 U	< 2.0 U	< 2.0 U
Silver	94.0	NE	94.0	--	< 0.10 U	< 0.10 U	0.36 J	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
Thallium	0.20	2.00	2.00	--	< 0.10 U	< 0.10 U	1.5	0.063 J	0.081 J	0.091 J	0.080 J	< 0.10 U	< 0.10 U	< 0.10 U
Vanadium	86.0	NE	86.0	15.9	< 1.0 U	< 1.0 U	59	< 1.0 U	< 1.0 U	1.5 J	0.77 J	< 1.0 U	1.2 J	< 1.0 U
Zinc	6000	NE	6000	415	6.5 U	7.5 J	190	19 J	9.0 J	13 J	25	16 J	8.6 U	28
Mercury (SW7470A) Totals														
Mercury	0.630	2.00	2.00	--	< 0.080 U	< 0.080 U	0.15 J	0.15 J	0.39	0.065 J	0.25	< 0.080 U	< 0.080 U	< 0.080 U
Herbicides (SW8151A)														
MCPP	16.0	NE	16.0	--	< 100 U	< 100 U	< 100 U	< 100 U	< 96 U	33 J	< 96 U	35 J	< 91 U	< 100 U
VOCs (SW8260B)														
1,1-Dichloroethane	2.80	NE	2.80	--	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U	0.21 J	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U
1,1-Dichloroethene	280	7.00	7.00	--	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U	0.17 J	0.53 J	0.30 J	< 0.20 U	< 0.20 U	< 0.20 U
Chloroform	0.220	80	80	--	< 0.20 U	< 0.20 U	< 0.20 U	< 0.20 U	490	0.38 J	0.81 J	0.33 J	< 0.20 U	< 0.20 U
cis-1,2-Dichloroethene	36.0	70.0	70.0	--	1.4	1.6	0.16 J	< 0.20 U	0.49 U	9.0	4.9	< 0.20 U	< 0.20 U	1.1
Trichloroethene	0.490	5.00	5.00	--	17	19	3.5	< 0.20 U	4.2 U	45	29	0.31 J	< 0.20 U	13
Trichlorofluoromethane	5200	NE	5200	--	< 0.80 U	< 0.80 U	< 0.80 U	< 0.80 U	0.93 J	< 0.80 U	< 0.80 U	< 0.80 U	< 0.80 U	< 0.80 U

Table 4-3: 2012 Groundwater Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

				Well ID	SWMU56-TMW01	SWMU56-TMW01 (DUP)	SWMU56-TMW02	SWMU56-TMW03	SWMU56-TMW04	SWMU56-TMW05	SWMU56-TMW06	SWMU56-TMW07	SWMU56-TMW08	SWMU56-TMW09
	RSL[1]	MCL[2]	Screening Criteria[3]	BG[4]	12/5/2012	12/5/2012	12/5/2012	12/6/2012	12/6/2012	12/4/2012	12/3/2012	12/4/2012	12/4/2012	12/5/2012
SVOCs (SW8270C)														
Diethyl phthalate	15000	NE	15000	--	< 0.96 U	< 1.1 U	< 1.1 U	< 1.1 U	< 1.1 U	< 0.98 U	**0.53 J**	< 1.1 U	< 1.1 U	< 0.96 U
PAH (SW8270C SIM)														
Anthracene	1800	NE	1800	--	< 0.020 U	< 0.020 U	< 0.021 U	< 0.022 U	< 0.021 U	**0.029 J**	< 0.020 U	< 0.022 U	< 0.020 U	< 0.022 U
Benzo (g,h,i)perylene	NE	NE	NE	--	< 0.010 U	0.0043 UJ	0.0046 U	< 0.011 U	< 0.011 U	**0.15 J**	< 0.010 U	< 0.011 U	< 0.010 U	0.0052 U
Benzo[a]anthracene	0.0120	NE	0.0120	--	0.0052 UJ	0.0047 UJ	0.0041 U	< 0.011 U	< 0.011 U	**0.11 J**	0.0033 U	< 0.011 U	< 0.010 U	0.0064 U
Benzo[b]fluoranthene	0.0340	NE	0.0340	--	0.0041 UJ	0.0041 UJ	0.0038 U	0.0050 UJ	< 0.011 U	**0.17 J**	0.0036 U	0.0041 U	0.0035 U	0.0065 U
Benzo[k]fluoranthene	0.340	NE	0.340	--	< 0.010 U	< 0.0099 U	< 0.011 U	< 0.011 U	< 0.011 U	**0.17 J**	< 0.010 U	< 0.011 U	< 0.010 U	< 0.011 U
Dibenz(a,h)anthracene	0.00340	NE	0.00340	--	< 0.010 U	< 0.0099 U	< 0.011 U	< 0.011 U	< 0.011 U	**0.16 J**	< 0.010 U	< 0.011 U	< 0.010 U	< 0.011 U
Fluoranthene	800	NE	800	--	< 0.010 U	< 0.0099 U	< 0.011 U	**0.092 J**	0.0059 U	0.14 UJ	< 0.010 U	< 0.011 U	< 0.010 U	< 0.011 U
Fluorene	290	NE	290	--	< 0.020 U	< 0.020 U	< 0.021 U	**0.14 J**	**0.067 J**	< 0.019 U	< 0.020 U	< 0.022 U	< 0.020 U	< 0.022 U
Indeno[1,2,3-cd]pyrene	0.0340	NE	0.0340	--	< 0.020 U	< 0.020 U	< 0.021 U	< 0.022 U	< 0.021 U	**0.17 J**	< 0.020 U	< 0.022 U	< 0.020 U	< 0.022 U
Naphthalene	0.170	NE	0.170	--	**0.0072 J**	**0.0086 J**	**0.0079 J**	**0.039 J**	**0.13**	**0.0075 J**	**0.021 J**	**0.0079 J**	**0.016 J**	**0.0080 J**
Phenanthrene	NE	NE	NE	--	< 0.012 U	< 0.012 U	< 0.013 U	**0.23 J**	**0.11**	0.055 UJ	0.015 U	< 0.013 U	< 0.012 U	< 0.013 U

Bold values indicate the analyte was detected.
Underlined results exceed RSL.
Red results exceed MCL.
Result exceeds established screening criteria (MCL or Tapwater RSL where no MCL is established.

Notes:
All analyte concentrations are reported in µg/L.
[1] Tapwater Regional Screening Level (RSL) Hazard Index of 1.0 and 1 x 10^{-6} carcinogenic risk (May 2016)
[2] USEPA's Maximum Contaminant Levels (MCLs)
[3] Screening Criteria is MCL or Tapwater RSL where no MCL is established.
[4] Background groundwater concentration is the UTL as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004)
* RSL for hexavalent chromium. The RSL for trivalent chromium is 22,000 ug/L.

Qualifiers:
J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not met
U = The analyte was not detected and is reported as less than the Limit of Detection (LOD) or as defined by the client
UJ = The analyte was not detected in the sample. The LOD (or LOQ) should be considered estimated and may be inaccurate or imprecise

Acronyms:
µg/L = microgram per liter
NA = not analyzed
NE = none established
PAHs = polynuclear aromatic hydrocarbons
SVOC = semi-volatile organic compound
VOC = volatile organic compound

Table 4-4: 2016 Groundwater Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

				WELL ID	SWMU56-MW01	SWMU56-MW02	SWMU56-MW03	SWMU56-MW04	SWMU56-MW04 (DUP)	SWMU56-MW05	SWMU56-MW06
				Sample Date	4/9/2016	4/9/2016	4/14/2016	4/12/2016	4/12/2016	4/14/2016	4/14/2016
Chemical Name	**RSL[1]**	**MCL[2]**	**Screening Criteria[3]**	**BG[4]**							
Metals (SW6010B) Dissolved											
Aluminum	20000	NE	20000	1300	**330**	**32 J**	**41 J**	**180 J**	**170 J**	**190 J**	**120 J**
Calcium	NE	NE	NE	97000	**12000**	**9000**	**14000**	**28000**	**28000**	**12000**	**4400**
Iron	14000	NE	14000	650	**150**	**22 J**	< 85 U	< 85 U	< 85 U	**310**	**590**
Magnesium	NE	NE	NE	16000	**7300**	**4300**	**7700**	**5900**	**5800**	**7600**	**2800**
Potassium	NE	NE	NE	7300	**3400**	**1800 J**	**5700**	**32000**	**33000**	**4200**	**1000 J**
Sodium	NE	NE	NE	110000	**80000**	**40000**	**59000**	**84000**	**83000**	**50000**	**29000**
Metals (SW6020A) Totals											
Aluminum	20000	NE	26900	27000	**2400 J**	**1100**	**1600**	**1100**	**1000**	**410**	**270 J**
Calcium	NE	NE	NE	167000	**12000**	**9100**	**16000**	**36000**	**35000**	**13000**	**4600**
Iron	14000	NE	14000	20100	**2000 J**	**1400**	**2100**	**510**	**560**	**610**	**730**
Magnesium	NE	NE	NE	16000	**7600**	**4400**	**8900**	**6800**	**6700**	**8700**	**3200**
Potassium	NE	NE	NE	18300	**3700**	**1900 J**	**6200**	**40000**	**38000**	**4300**	**900 J**
Sodium	NE	NE	NE	110000	**82000**	**39000**	**61000**	**92000**	**88000**	**52000**	**29000**
Metals (SW6020A) Dissolved											
Antimony	7.8	6.00	6.00	--	< 1.0 U	< 1.0 U	**0.73 J**	**0.56 J**	< 1 U	< 1 U	< 1 U
Arsenic	0.0520	10.0	10.0	--	< 1.0 U	< 1.0 U	< 1 U	**0.38 J**	**0.37 J**	< 1 U	< 1 U
Barium	3800	2000	2000	71	**140**	**68**	**110**	**160**	**160**	**160**	**62**
Beryllium	25.0	4.00	4.00	--	**0.37 J**	**0.15 J**	**0.14 J**	**0.1 J**	< 0.3 U	**0.4 J**	**0.31 J**
Cadmium	9.20	5.00	5.00	1.8	**1.0**	< 1.0 U	< 1 U	**0.56 J**	< 1 U	**0.45 J**	**0.29 J**
Chromium	0.035*	100	100	2.0	< 1.8 U	< 1.8 U	< 1.8 U	**9.6 J**	**9.2 J**	< 1.8 U	< 1.8 U
Cobalt	6.00	NE	6.00	12	**10**	**4.4**	**2.5**	**3.4**	**3.4**	**9.8**	**5.4**
Copper	800	1300	1300	8.7	**3.1**	**2.5**	**1.5 J**	< 1.8 U	< 1.8 U	**3.1**	**0.66 J**
Lead	15.0	15.0	15.0	3.4	< 0.70 U	< 0.70 U	< 0.7 U	< 0.7 U	< 0.7 U	**0.51 J**	< 0.7 U
Manganese	430	NE	430	160	**340 J**	**150**	**140**	**250**	**240**	**240**	**120**
Molybdenum	100	NE	100	1.4	< 0.50 U	< 0.50 U	**0.18 J**	**3.6**	**3.5**	**0.23 J**	< 0.5 U
Nickel	390	NE	390	9.2	**13**	**5.5**	**4.1**	**5.4**	**5.5**	**13**	**4.8**
Selenium	100	50.0	50.0	--	**0.81 J**	< 2.0 U	< 2 U	**0.88 J**	**0.78 J**	< 2 U	< 2 U
Silver	94.0	NE	94.0	--	< 0.10 U	< 0.10 U	**0.051 J**	**0.038 J**	< 0.1 U	< 0.1 U	< 0.1 U
Thallium	0.20	2.00	2.00	--	**0.087 J**	< 0.20 U	**0.15 J**	**0.17 J**	**0.1 J**	**0.055 J**	**0.082 J**
Vanadium	86.0	NE	86.0	--	< 2.0 U	< 2.0 U	< 2 U	**2.3 J**	**2 J**	< 2 U	< 2 U
Zinc	6000	--	6000	130	**33**	**41**	**14 J**	**78**	**72**	**19 J**	**13 J**

Table 4-4: 2016 Groundwater Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

				WELL ID **Sample Date**	**SWMU56-MW01** **4/9/2016**	**SWMU56-MW02** **4/9/2016**	**SWMU56-MW03** **4/14/2016**	**SWMU56-MW04** **4/12/2016**	**SWMU56-MW04 (DUP)** **4/12/2016**	**SWMU56-MW05** **4/14/2016**	**SWMU56-MW06** **4/14/2016**
Chemical Name	**RSL[1]**	**MCL[2]**	**Screening Criteria[3]**	**BG[4]**							
Metals (SW6020A) Totals											
Antimony	7.80	6.00	6.00	--	< 1.0 U	**0.67 J**	< 1 U	**0.94 J**	< 1 U	< 1 U	< 1 U
Arsenic	0.0520	10.0	10.0	--	**0.57 J**	< 1.0 U	**0.57 J**	**0.64 J**	**0.77 J**	**0.38 J**	< 1 U
Barium	3800	2000	2000	76.6	**150 J**	**72**	**110**	**150**	**180**	**140**	**64**
Beryllium	25.0	4.00	4.00	--	**0.45 J**	**0.23 J**	< 0.3 U	< 0.3 U	**0.13 J**	**0.25 J**	**0.22 J**
Cadmium	9.20	5.00	5.00	2.6	**1.1**	< 1.0 U	< 1 U	**0.38 J**	**0.38 J**	**0.44 J**	< 1 U
Chromium	0.035*	100	100	34.3	**2.6 J**	**0.76 J**	**2.6 J**	**10**	**11**	**0.68 J**	< 1.8 U
Cobalt	6.00	NE	6.00	22.2	**10**	**4.5**	**2.7**	**3.4**	**3.6**	**8.6**	**5.7**
Copper	800	1300	1300	29.1	**4.2**	**3.0**	**1.6 J**	**0.6 J**	**0.7 J**	**0.83 J**	**0.64 J**
Lead	15.0	15.0	15.0	9.5	**0.41 J**	**0.38 J**	**0.58 J**	< 0.7 U	< 0.7 U	**0.54 J**	< 0.7 U
Manganese	430	NE	430	160	**340**	**150**	**140**	**230**	**260**	**220**	**120**
Molybdenum	100	NE	100	1.99	**0.34 J**	< 0.50 U	**0.37 J**	**4.5**	**5.0**	**0.31 J**	< 0.5 U
Nickel	390	NE	390	20.2	**14**	**4.9**	**4.7**	**5.4**	**6.1**	**12**	**4.8**
Selenium	100	50.0	50.0	2.6	**0.88 J**	< 2.0 U	< 2 U	**0.75 J**	**0.84 J**	< 2 U	< 2 U
Silver	94.0	NE	94.0	--	< 0.10 U	< 0.10 U	< 0.1 U	< 0.06 U	< 0.1 U	< 0.1 U	< 0.1 U
Thallium	0.20	2.00	2.00	--	< 0.20 U	< 0.20 U	**0.071 J**	**0.18 J**	**0.13 J**	**0.057 J**	< 0.2 U
Vanadium	86.0	NE	86.0	15.9	**1.8 J**	**0.82 J**	**1.9 J**	**2.4 J**	**2.9 J**	< 2 U	< 2 U
Zinc	6000	NE	6000	415	**34**	**44**	**18 J**	**62 J**	**89 J**	**16 J**	**12 J**
Mercury (SW7470A)											
Mercury (Dissolved)	0.630	2.00	2.00	--	< 0.080 U	< 0.080 U	< 0.08 U	< 0.08 U	< 0.08 U	**0.027 J**	< 0.08 U
Mercury (Total)	0.630	2.00	2.00	--	< 0.080 U	< 0.080 U	< 0.08 U	**0.027 J**	< 0.08 U	**0.068 J**	< 0.08 U

Table 4-4: 2016 Groundwater Analytical Positive Results Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

				WELL ID	SWMU56-MW01	SWMU56-MW02	SWMU56-MW03	SWMU56-MW04	SWMU56-MW04 (DUP)	SWMU56-MW05	SWMU56-MW06
				Sample Date	4/9/2016	4/9/2016	4/14/2016	4/12/2016	4/12/2016	4/14/2016	4/14/2016
Chemical Name	**RSL[1]**	**MCL[2]**	**Screening Criteria[3]**	**BG[4]**							
VOCs (SW8260B)											
1,1-Dichloroethane	2.80	NE	2.80	--	< 0.80 U	< 0.80 U	< 0.8 U	< 0.8 U	< 0.8 U	**0.21 J**	< 0.8 U
1,1-Dichloroethene	280	7.00	7.00	--	**0.19 J**	**0.17 J**	< 0.8 U	**0.17 J**	**0.18 J**	**0.44 J**	< 0.8 U
Acetone	14000	NE	14000	--	< 6.4 U	**3.0 J**	**3.1 J**	**4.8 J**	**5.6 J**	**3.3 J**	< 6.4 U
Chloroform	0.220	80	80	--	**3.1**	**0.42 J**	**0.33 J**	**1**	**1.1**	**0.77 J**	**0.81 J**
cis-1,2-Dichloroethene	36.0	70.0	70.0	--	**6.0**	**3.0**	**0.26 J**	**7.5**	**7.8**	**14**	**0.25 J**
Tetrachloroethene	11.0	5.00	5.00	--	< 0.40 U	< 0.40 U	**4.7**	< 0.4 U	< 0.4 U	< 0.4 U	< 0.4 U
trans-1,2-Dichloroethene	360	100	100	--	< 0.40 U	< 0.40 U	< 0.4 U	< 0.4 U	< 0.4 U	**0.18 J**	< 0.4 U
Trichloroethene	0.490	5.00	5.00	--	**12 J**	**12**	**0.39 J**	**13**	**14**	**36**	**1.7**
PAH (SW8270D SIM)											
Benzo (g,h,i)perylene	NE	NE	NE	--	< 0.013 U	< 0.012 U	**0.018 J**	< 0.012 U	< 0.012 U	< 0.012 U	< 0.012 UJ
Benzo[a]anthracene	0.0120	NE	0.0120	--	< 0.013 U	< 0.012 U	**0.016 J**	< 0.012 U	< 0.012 U	< 0.012 U	< 0.012 UJ
Benzo[b]fluoranthene	0.0340	NE	0.0340	--	< 0.013 U	< 0.012 U	**0.037 J**	< 0.012 U	< 0.012 U	< 0.012 U	< 0.012 UJ
Benzo[k]fluoranthene	0.340	NE	0.340	--	< 0.013 U	< 0.012 U	**0.011 J**	< 0.012 U	< 0.012 U	< 0.012 U	< 0.012 UJ
Chrysene	3.40	NE	3.40	--	< 0.013 U	< 0.012 U	**0.033 J**	< 0.012 U	< 0.012 U	< 0.012 U	< 0.012 UJ
Fluoranthene	800	NE	800	--	< 0.013 U	< 0.012 U	**0.073 J**	**0.17**	**0.17**	< 0.012 U	< 0.012 UJ
Fluorene	290	NE	290	--	**0.020 J**	**0.049 J**	**0.071 J**	**0.065 J**	**0.075 J**	**0.055 J**	< 0.02 UJ
Indeno[1,2,3-cd]pyrene	0.0340	NE	0.0340	--	< 0.021 U	< 0.020 U	**0.019 J**	< 0.019 U	< 0.019 U	< 0.02 U	< 0.02 UJ
Phenanthrene	NE	NE	NE	--	< 0.021 U	**0.099**	**0.16**	**0.098**	**0.1**	**0.07 J**	< 0.02 UJ

Bold values indicate the analyte was detected
Underlined results exceed RSL.
Red results exceed MCL.
Result exceeds established screening criteria (MCL or Tapwater RSL where no MCL is established.

Notes:
All analyte concentrations are reported in µg/L
[1]Tapwater Regional Screening Level (RSL) Hazard Index of 1.0 and 1 x 10^{6} carcinogenic risk (May 2016)
[2]USEPA's Maximum Contaminant Levels (MCLs)
[3]Screening Criteria is MCL or Tapwater RSL where no MCL is established.
[4]Background groundwater concentration is the UTL as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).
* RSL for hexavalent chromium. The RSL for trivalent chromium is 22,000 ug/L.

Qualifiers:
J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not me
U = The analyte was not detected and is reported as less than the Limit of Detection (LOD) or as defined by the clien
UJ = The analyte was not detected in the sample. The LOD (or LOQ) should be considered estimated and may be inaccurate or imprecise

Acronyms:
µg/L = microgram per liter
NE = none established
PAHs = polynuclear aromatic hydrocarbons
VOC = volatile organic compound

Table 4-5: 2016 Groundwater VISL Screening

SWMU 56

Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland

WELL ID **Sample Date**			**SWMU56-MW01** **4/9/2016**	**SWMU56-MW02** **4/9/2016**	**SWMU56-MW03** **4/14/2016**	**SWMU56-MW04** **4/12/2016**	**SWMU56-MW04 (DUP)** **4/12/2016**	**SWMU56-MW05** **4/14/2016**	**SWMU56-MW06** **4/14/2016**
	VISL								
	Res.	**Com.**							
Mercury (SW7470A)									
Mercury (Dissolved)	0.89	3.7	< 0.080 U	< 0.080 U	< 0.08 U	< 0.08 U	< 0.08 U	**0.027 J**	< 0.08 U
Mercury (Total)	0.89	3.7	< 0.080 U	< 0.080 U	< 0.08 U	**0.027 J**	< 0.08 U	**0.068 J**	< 0.08 U
VOCs (SW8260B)									
1,1-Dichloroethane	7.6	33	< 0.80 U	< 0.80 U	< 0.8 U	< 0.8 U	< 0.8 U	**0.21 J**	< 0.8 U
1,1-Dichloroethene	200	820	**0.19 J**	**0.17 J**	< 0.8 U	**0.17 J**	**0.18 J**	**0.44 J**	< 0.8 U
Acetone	2E+07	9.5E+07	< 6.4 U	**3.0 J**	**3.1 J**	**4.8 J**	**5.6 J**	**3.3 J**	< 6.4 U
Chloroform	0.81	3.6	**3.1**	**0.42 J**	**0.33 J**	**1**	**1.1**	**0.77 J**	**0.81 J**
Tetrachloroethene	15	65	< 0.40 U	< 0.40 U	**4.7**	< 0.4 U	< 0.4 U	< 0.4 U	< 0.4 U
Trichloroethene	1.2	7.4	**12 J**	**12**	**0.39 J**	**13**	**14**	**36**	**1.7**

Bold values indicate the analyte was detected.

Result exceeds Res. VISL

Result exceeds Res. and Com. VISL

Notes:

Only detected analyte with VISLs are included.

All analyte concentrations are reported in µg/L.

VISL= The Target Groundwater Concentration @ Target Cancer Risk of 1E-06 or Target Hazard Quotient =1.0. Using default average groundwater temperature of 25°C. (USEPA, 2016b).

Res.= Residential VISL

Com.= Commercial VISL

NE = None Established"

[1] The Background Upper Tolerance Limit (UTL) is from the Basewide Background Study Report March 2004 (CH2M Hill 2004).

Qualifiers:

J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not met.

U = The analyte was not detected and is reported as less than the Limit of Detection (LOD) or as defined by the client.

UJ = The analyte was not detected in the sample. The LOD (or LOQ) should be considered estimated and may be inaccurate or imprecise.

Acronyms:

µg/L = microgram per liter

PAHs = polynuclear aromatic hydrocarbons

VOC = volatile organic compound

Table 4-6: Groundwater Field Parameter Summary
SWMU 56
Joint Base Andrews Naval Air Facility Washington
Camp Springs, Maryland

Monitoring Well:	**SWMU56-MW01**	**SWMU56-MW02**	**SWMU56-MW03**	**SWMU56-MW04**	**SWMU56-MW05**	**SWMU56-MW06**
Date:	4/9/2016	4/9/2016	4/14/2016	4/12/2016	4/14/2016	4/14/2016
pH (Standard Units)	4.86	5.69	5.84	6.72	4.79	4.10
Specific Conductivity (mS/cm)	0.602	0.265	0.535	0.730	0.467	0.233
Temperature (°C)	13.84	12.52	15.10	14.41	17.73	15.09
Turbidity (NTU)	9.0	9.0	4.5	7.2	0.0	3.5
Dissolved Oxygen (mg/L)	0.56	7.76	1.56	2.33	1.75	2.21
ORP (mV)	255.1	243.1	157.9	-35	251.7	244.7

Notes:

°C = degrees Celsius

mS/cm = millisiemens per centimeter

mg/L = milligrams per liter

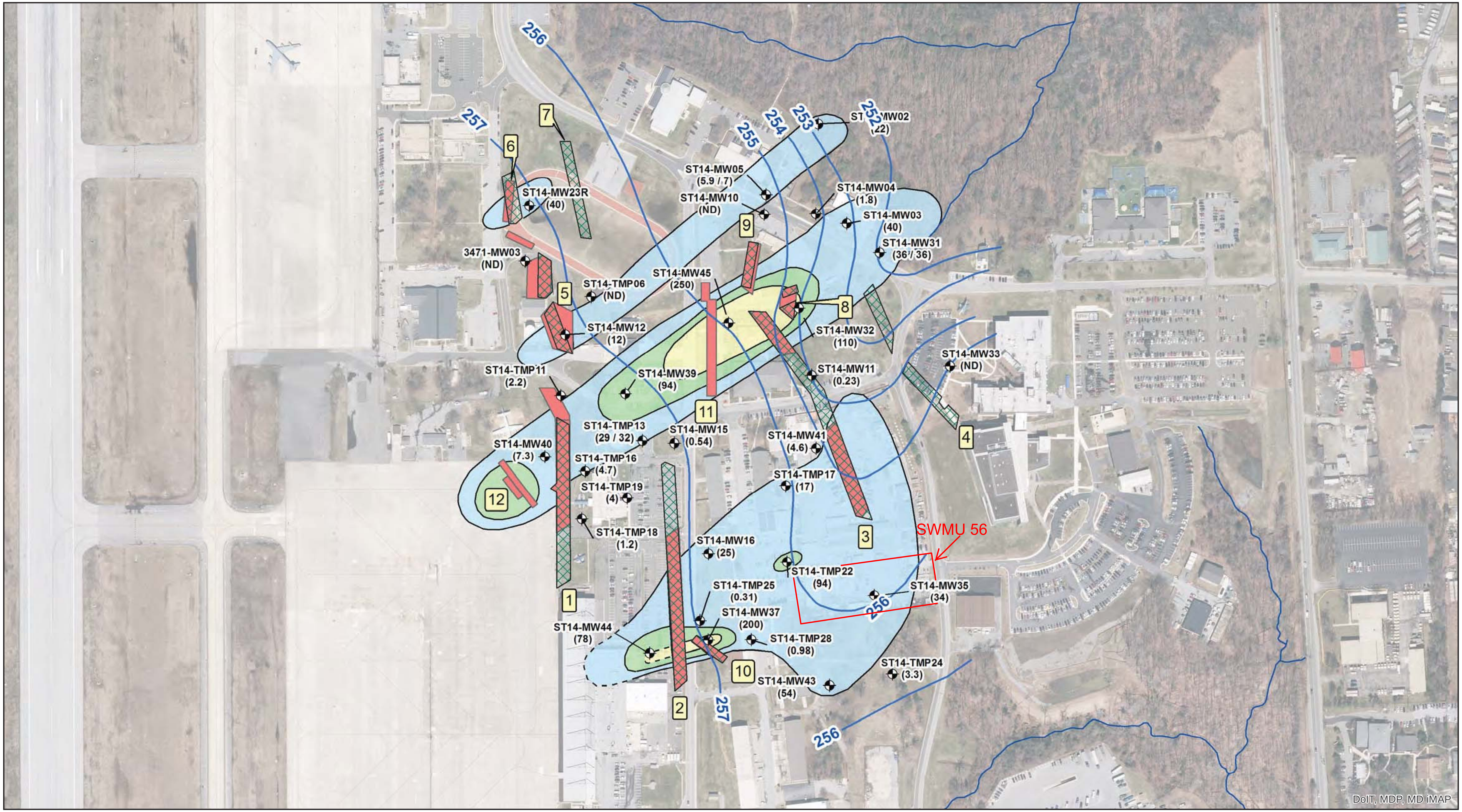
mV = millivolts

NTU = nephelometric turbidity units

ORP = oxidation reduction potential

Appendix A

Fall 2015 ST-14 TCE Plume Map



Note:
TCE = Trichloroethene
ND = Not Detected
Results are in ug/L (micrograms per liter).

N

0 150 300
Feet

Legend

🟦 TCE Concentration 5 to 50 ug/L
🟩 TCE Concentration 50 to 100 ug/L
🟨 TCE Concentration greater than 100 ug/L
— Groundwater Contours Dec 2015

⊕ Monitoring Well Location
▨ Sodium Lactate Injection Area (2007-2009)
🟥 EOS Pro Injection Area (2015)
2 Injection Barrier Number

amec foster wheeler

Figure ST14-8
ST-14 Interpreted TCE Plume, Fall 2015

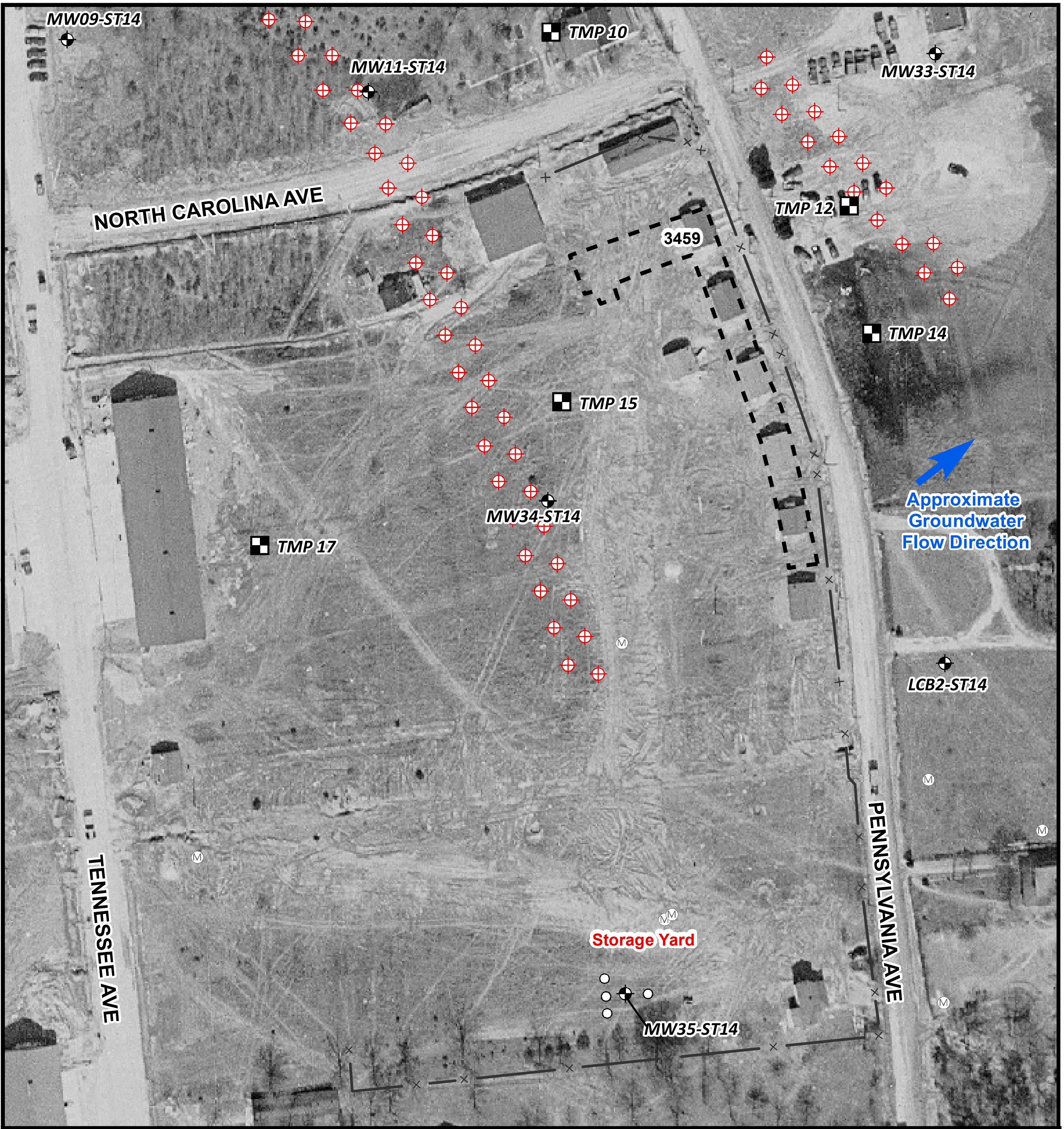
2015 RA-O Groundwater Monitoring Report
Joint Base Andrews, Maryland

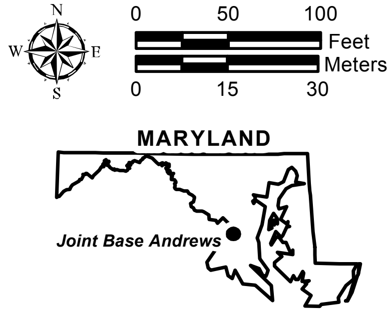
Prepared/Date: JEB 05/25/16	Checked/Date: RRA 05/25/16

Document: C:\Users\jeffrey.brandow\Desktop\JBA stuff\ST14\ST14_Contamination_Plumes_2015_11x17LS_BJ comment.mxd PDF: C:\Users\jeffrey.brandow\Desktop\JBA stuff\ST14\2015 RAO Report\Revised_Fig_14-8_TCEplume.pdf 5/25/2016 10:47 AM jeffrey.brandow

Appendix B

Historical Figures and Aerial Images





○ Previous Sample Location (URS 2009)
● Monitoring Well Location
⊕ Injection Well for ST-14
▚ Temporary Monitoring Point for ST-14
X — Existing Fence
▭ Former Building 3459 (Demolished 1994)

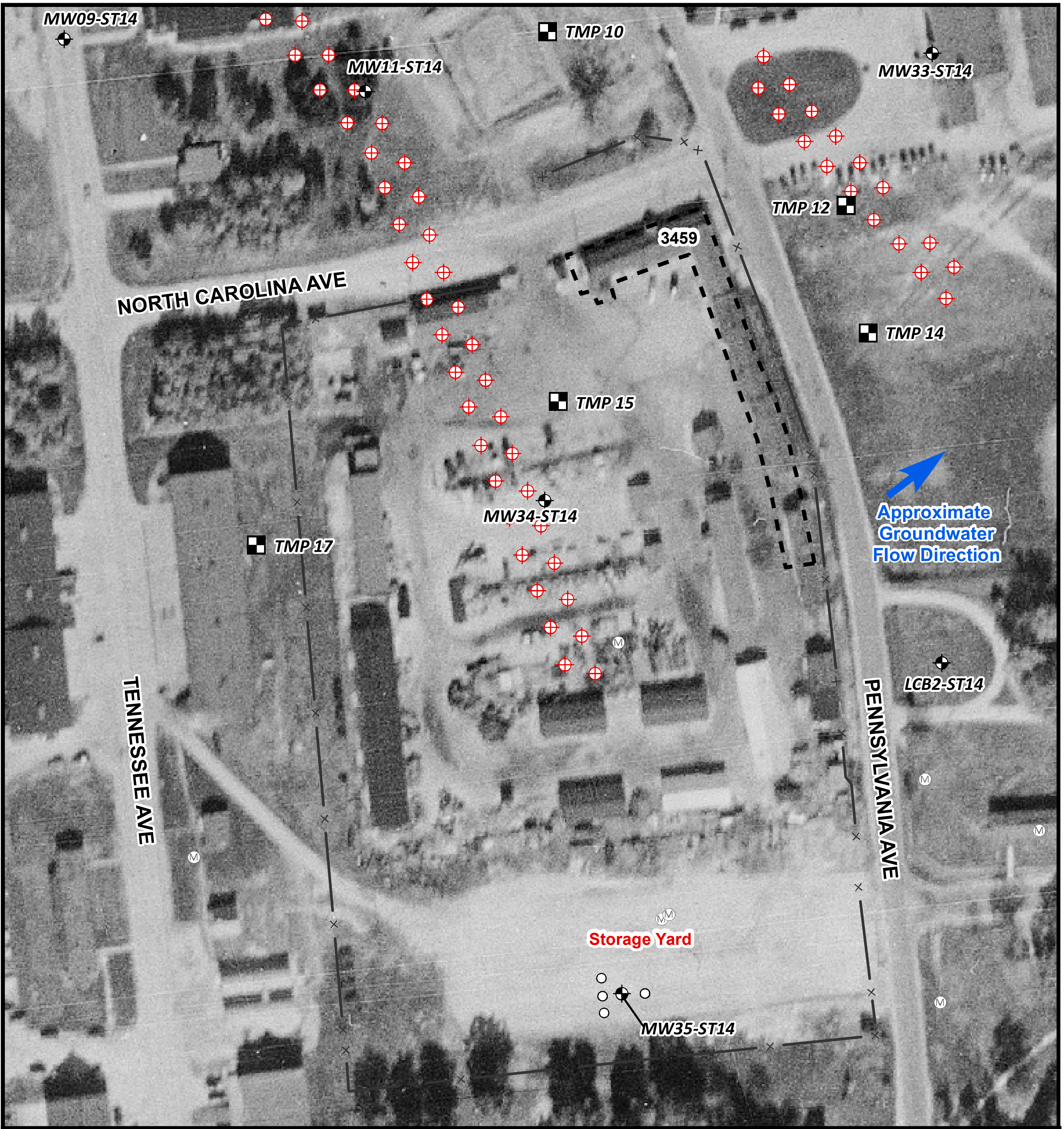
Figure 3A

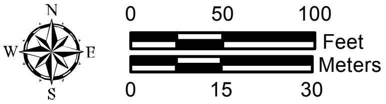
SWMU 56 1943 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/14/2012 Project No. J110202





○ Previous Sample Location (URS 2009)

● Monitoring Well Location

⊕ Injection Well for ST-14

▨ Temporary Monitoring Point for ST-14

X — Existing Fence

▭ Former Building 3459
(Demolished 1994)

Figure 3B

SWMU 56 1948 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202

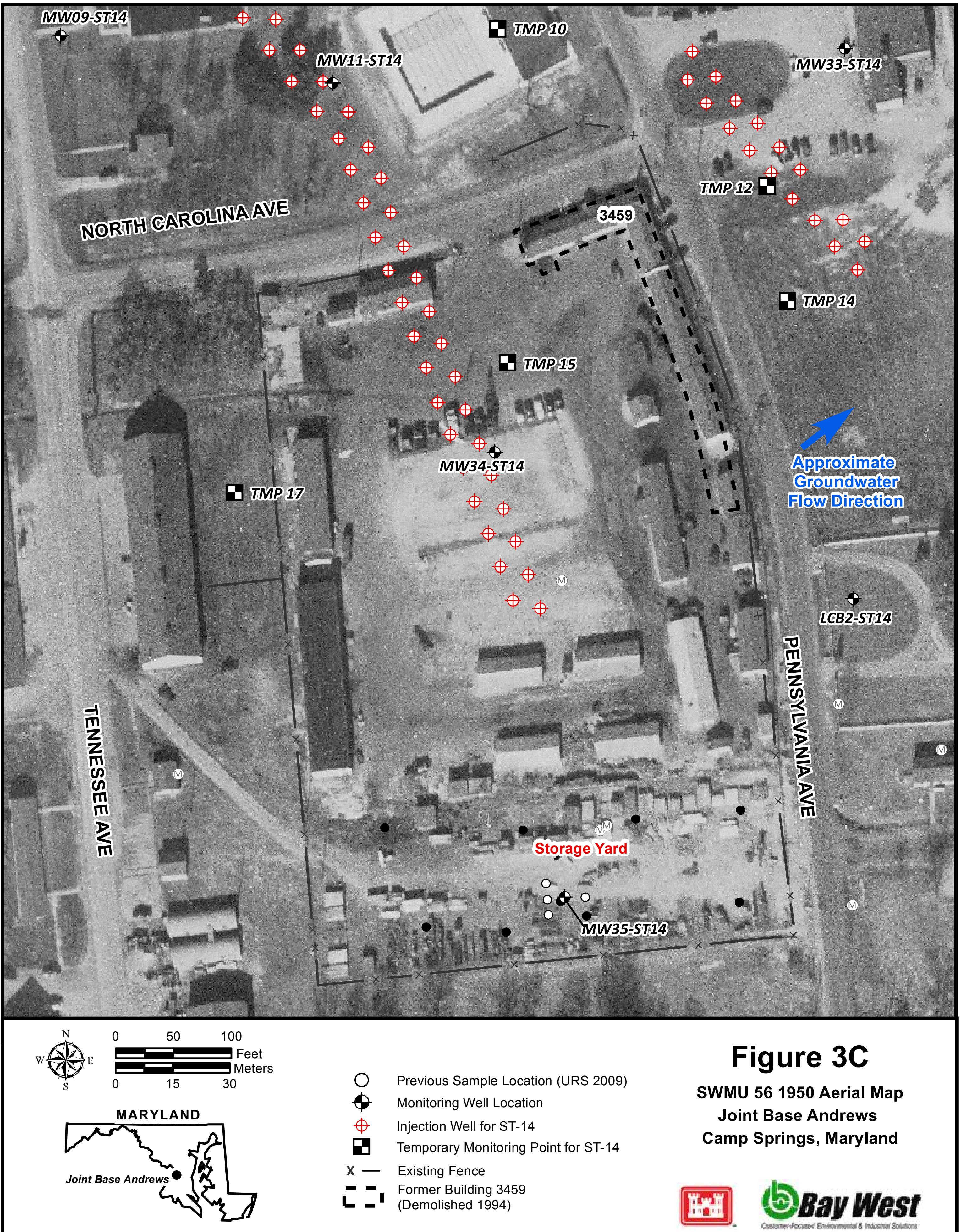


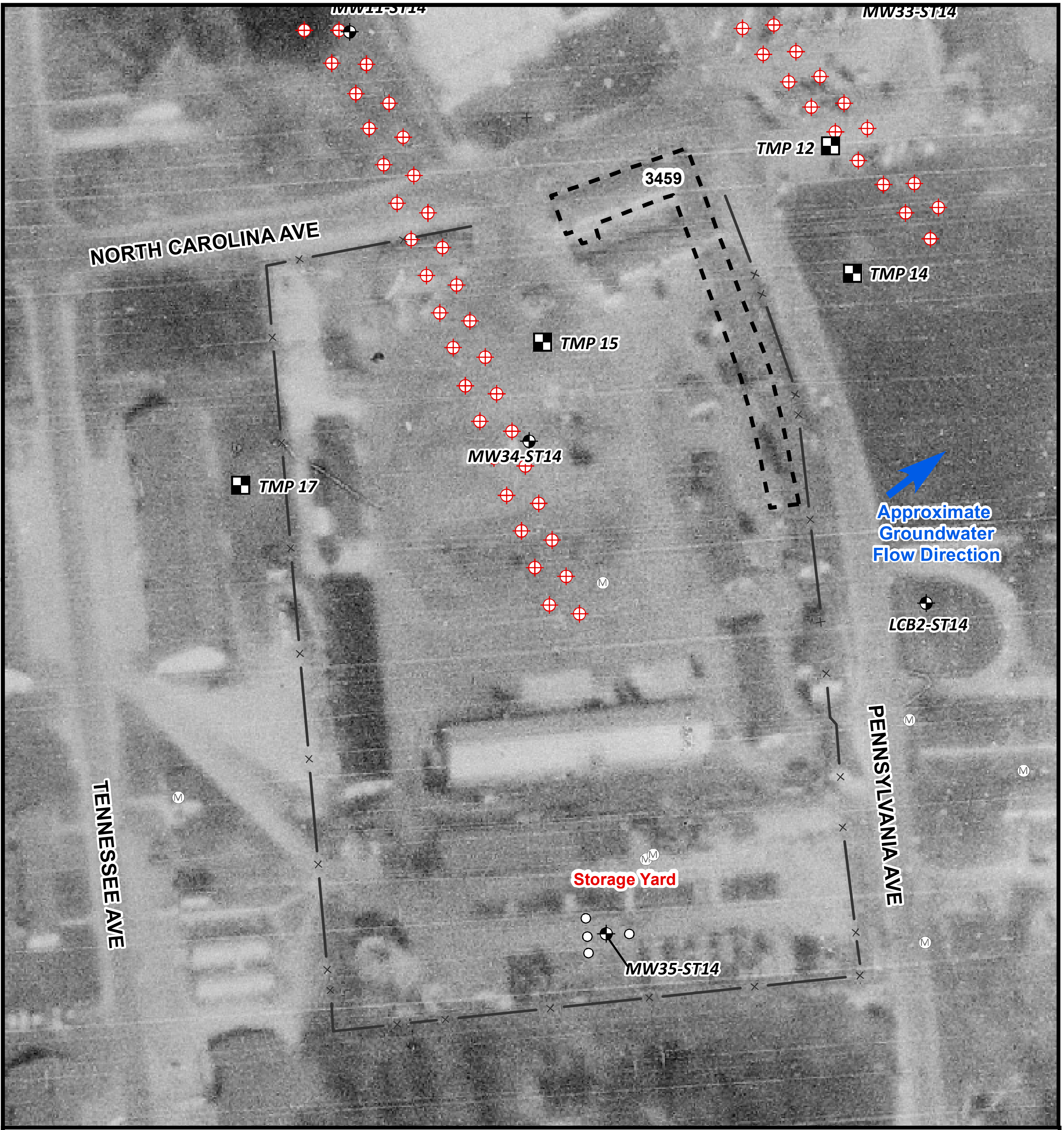
Figure 3C

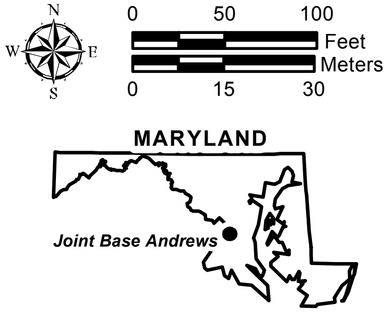
SWMU 56 1950 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202





○ Previous Sample Location (URS 2009)

⊕ Monitoring Well Location

⊕ Injection Well for ST-14

▨ Temporary Monitoring Point for ST-14

X — Existing Fence

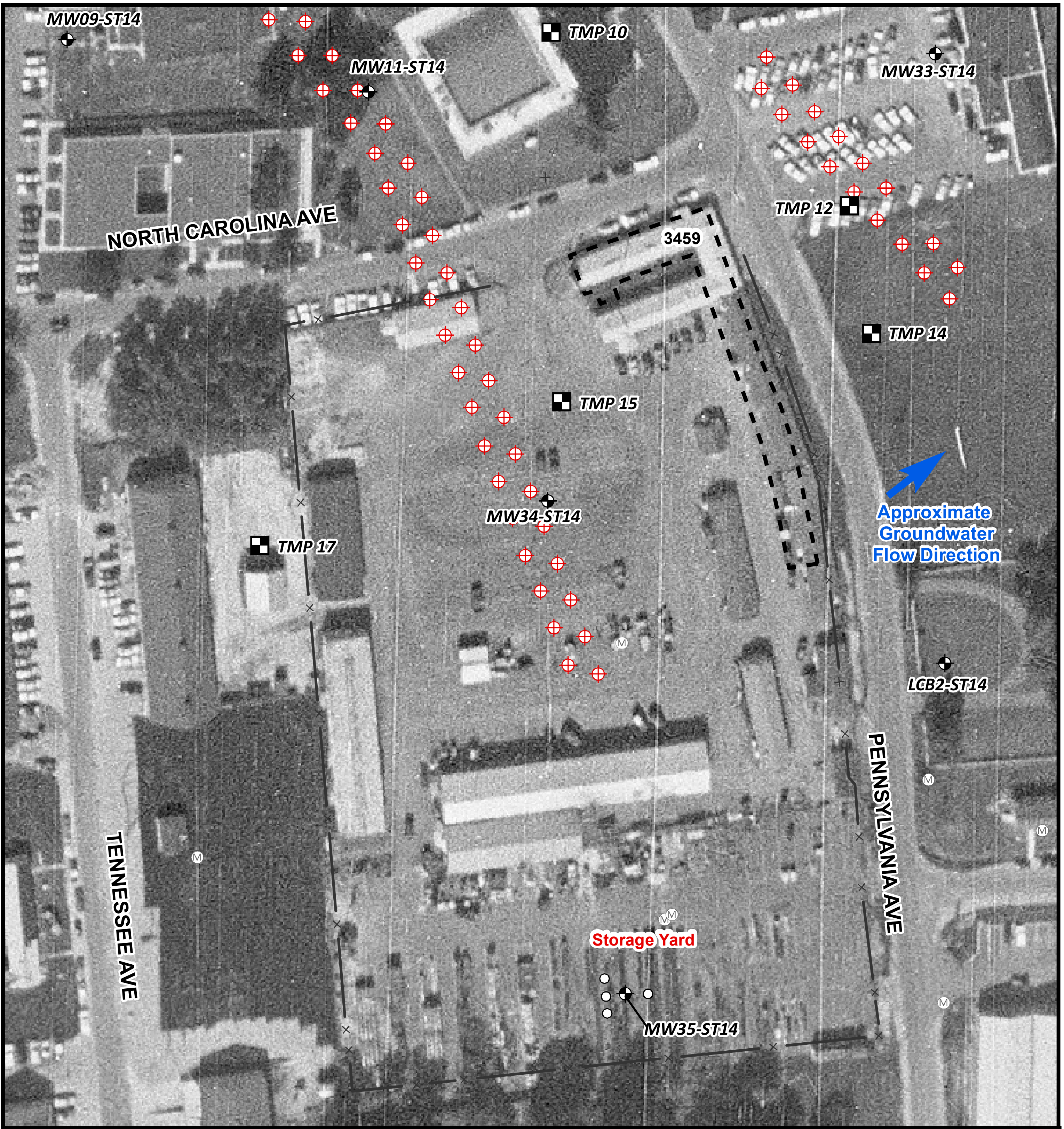
▭ Former Building 3459 (Demolished 1994)

Figure 3D

SWMU 56 1955 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202



○ Previous Sample Location (URS 2009)

Monitoring Well Location

Injection Well for ST-14

Temporary Monitoring Point for ST-14

X — Existing Fence

Former Building 3459 (Demolished 1994)

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Figure 3E

SWMU 56 1964 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202

○ Previous Sample Location (URS 2009)
⊕ Monitoring Well Location
⊕ Injection Well for ST-14
▚ Temporary Monitoring Point for ST-14
X — Existing Fence
▭ Former Building 3459 (Demolished 1994)

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Figure 3F

SWMU 56 1968 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202

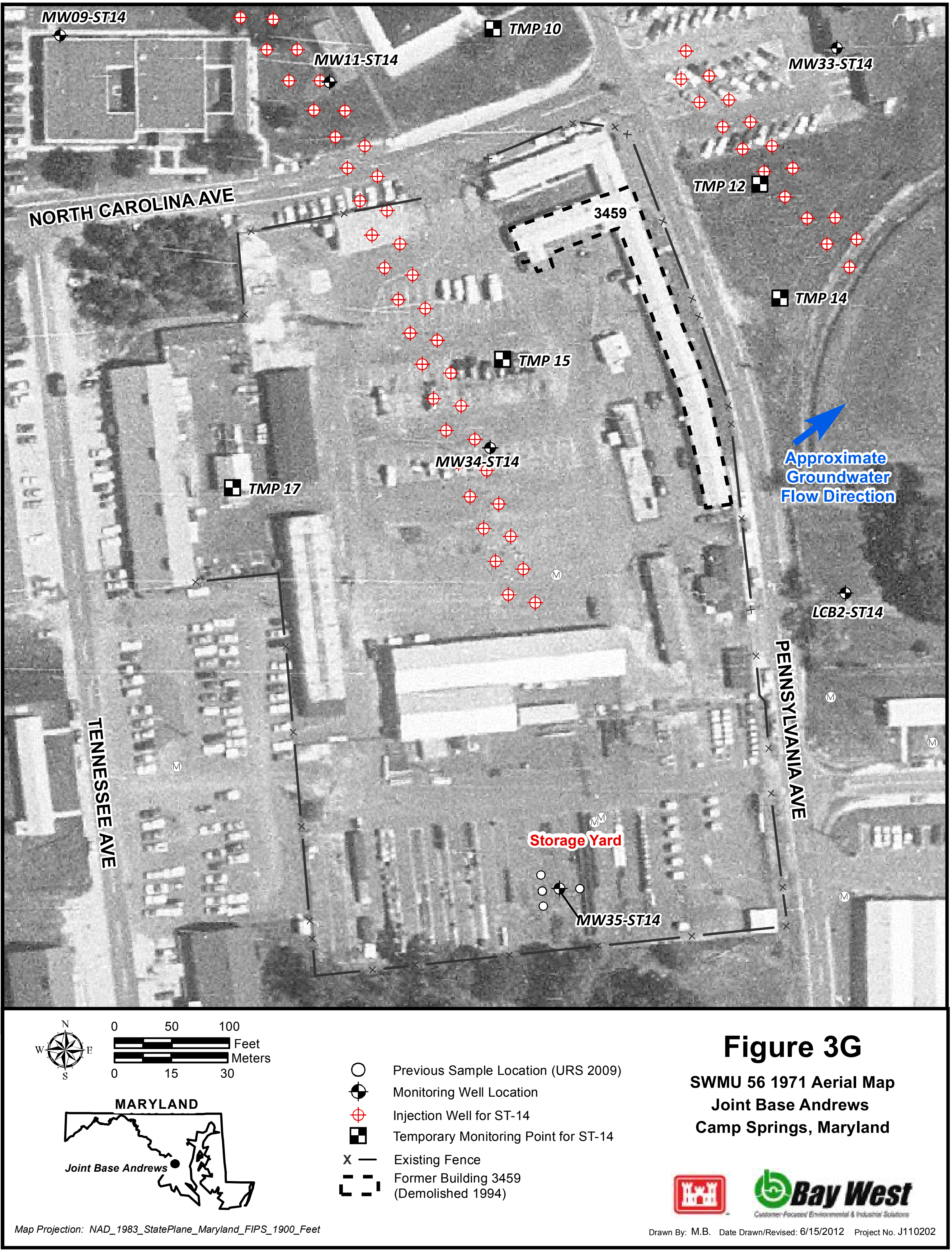
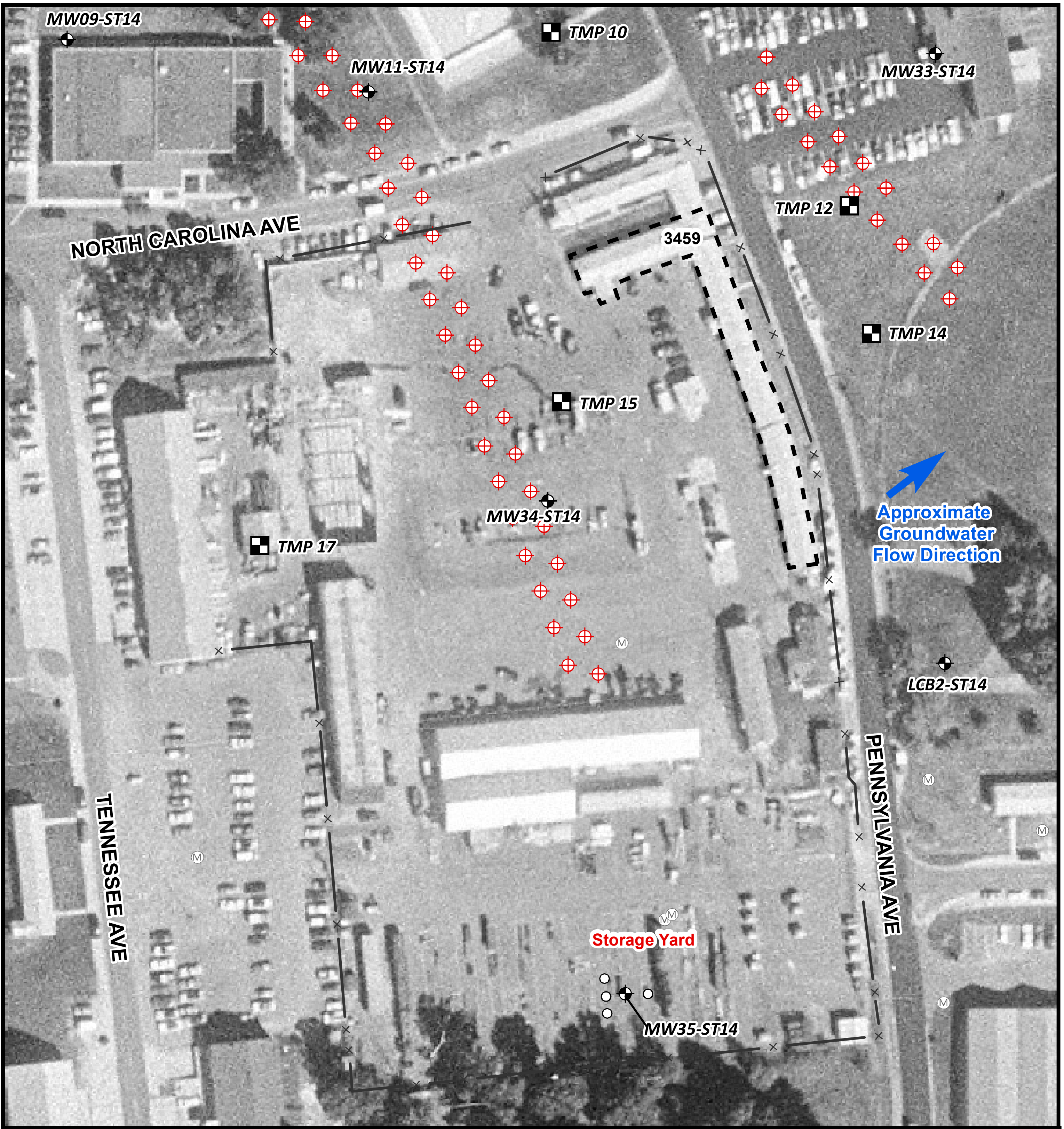


Figure 3G

SWMU 56 1971 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202



○ Previous Sample Location (URS 2009)

Monitoring Well Location

Injection Well for ST-14

Temporary Monitoring Point for ST-14

X — Existing Fence

Former Building 3459 (Demolished 1994)

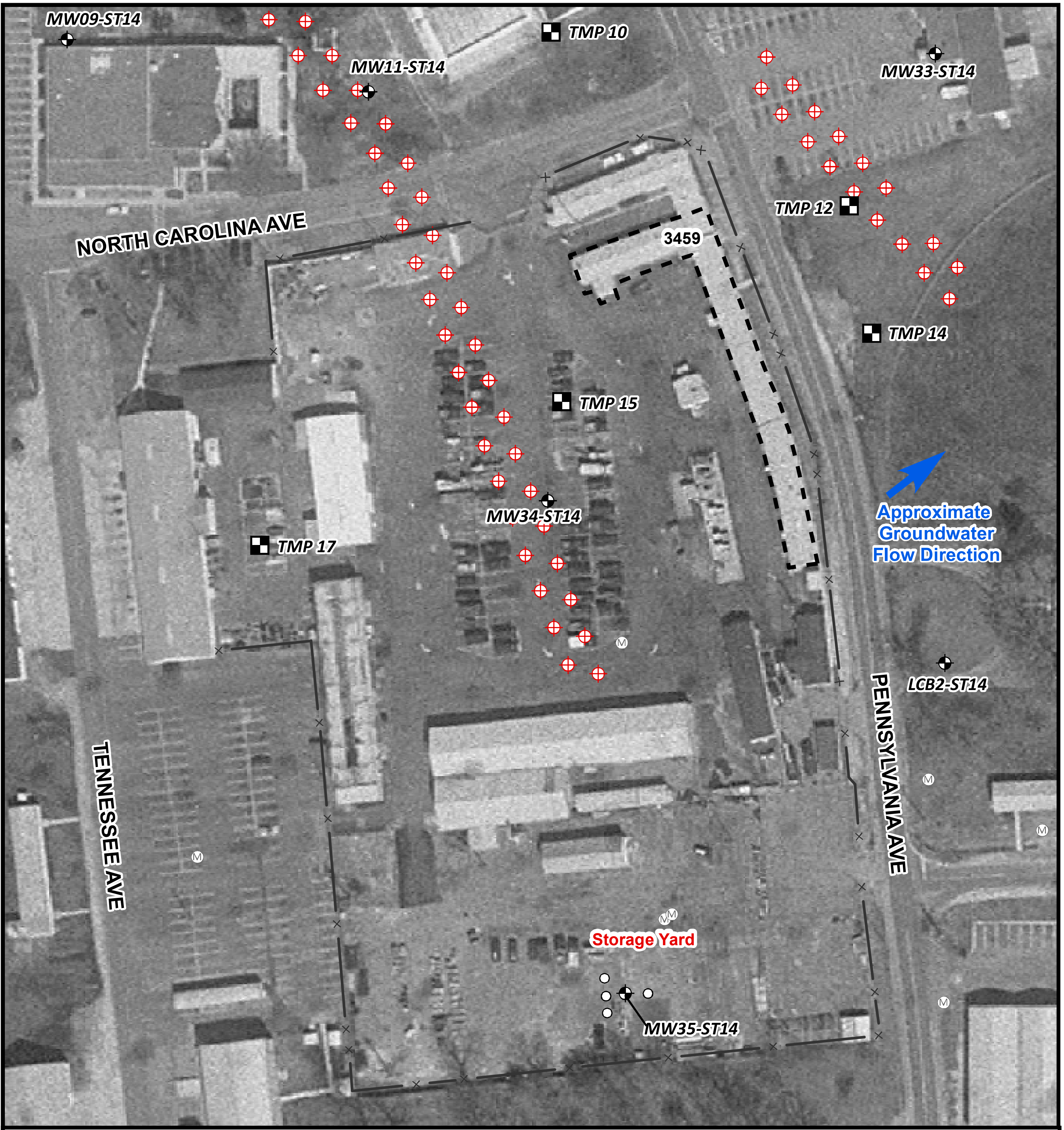
Figure 3H

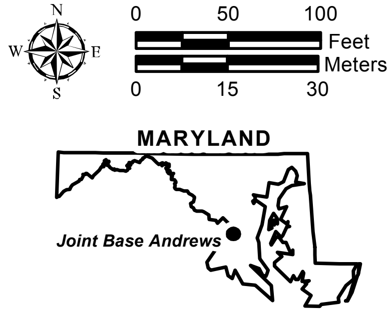
SWMU 56 1974 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202





○ Previous Sample Location (URS 2009)

⊕ Monitoring Well Location

⊕ Injection Well for ST-14

▨ Temporary Monitoring Point for ST-14

X — Existing Fence

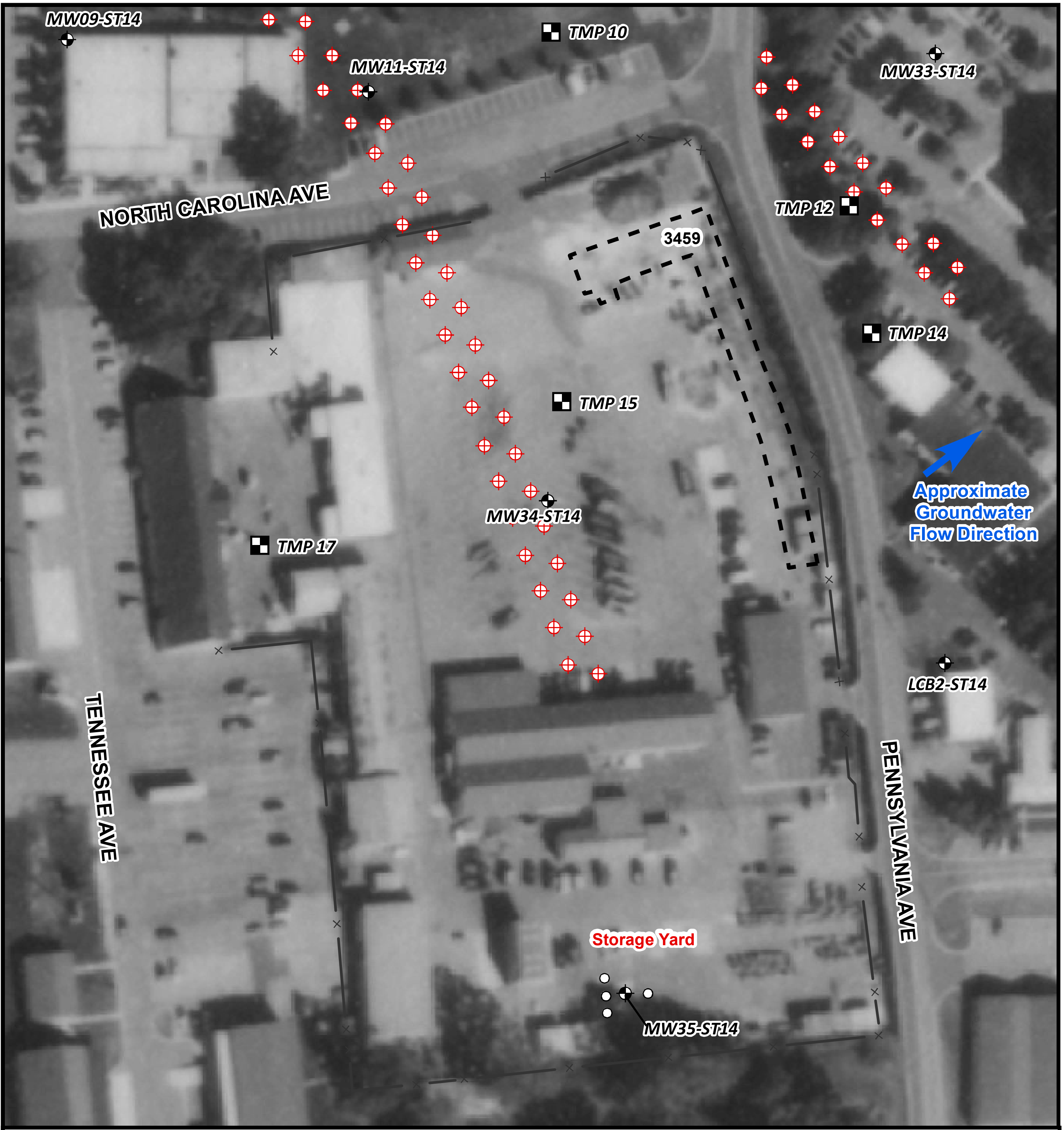
▭ Former Building 3459 (Demolished 1994)

Figure 3I

SWMU 56 1982 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202



N
W E
S

0 50 100 Feet
0 15 30 Meters

- ○ Previous Sample Location (URS 2009)
- ● Monitoring Well Location
- ⊕ Injection Well for ST-14
- ▨ Temporary Monitoring Point for ST-14
- X — Existing Fence
- ▭ Former Building 3459 (Demolished 1994)

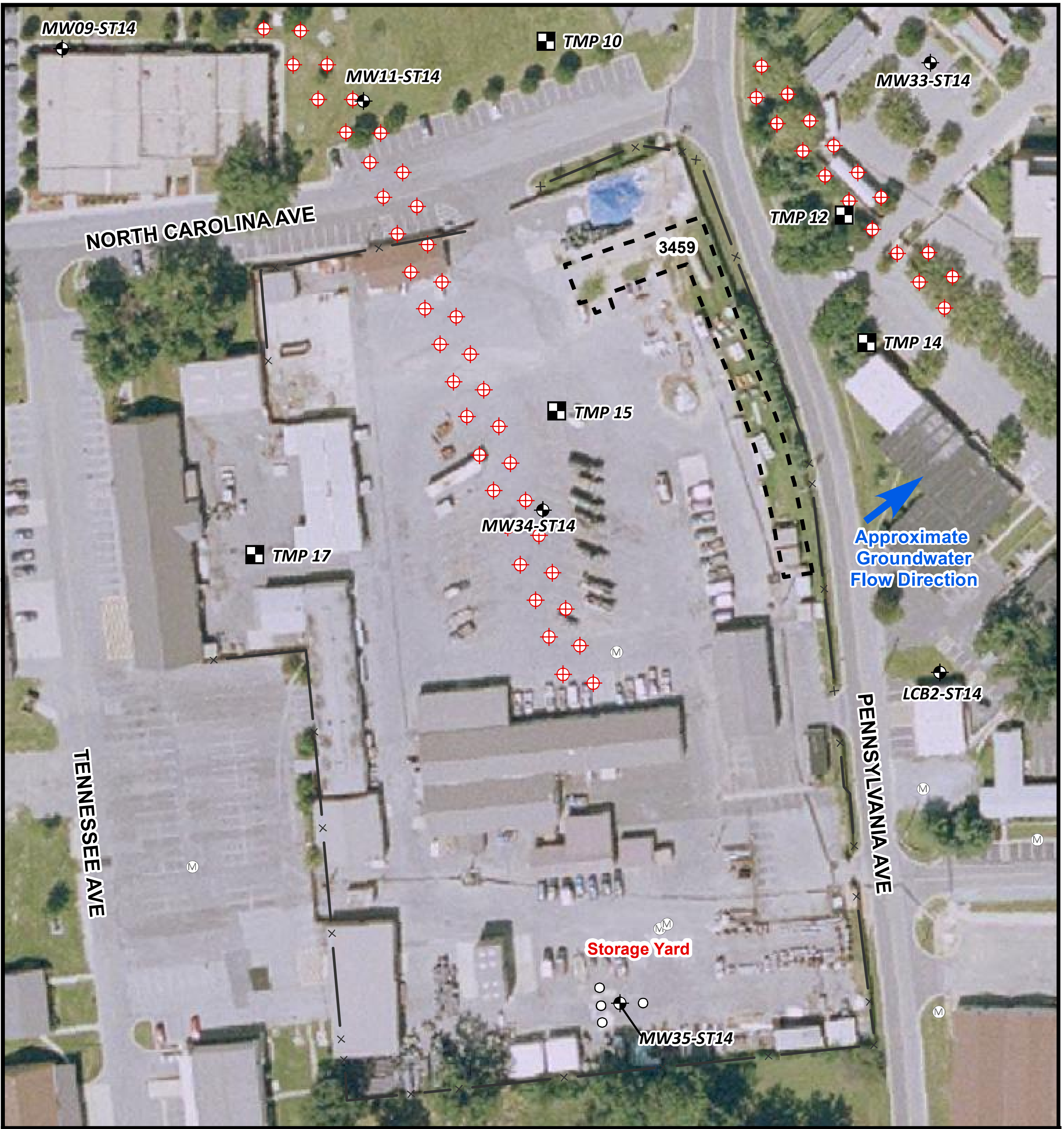
Figure 3J

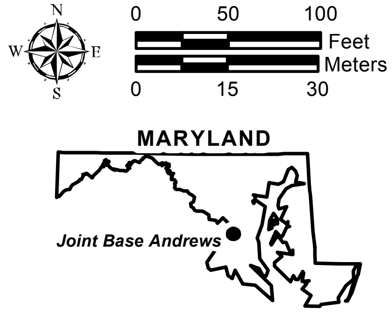
SWMU 56 2000 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202





○ Previous Sample Location (URS 2009)

⊕ Monitoring Well Location

⊕ Injection Well for ST-14

▚ Temporary Monitoring Point for ST-14

X — Existing Fence

⬚ Former Building 3459
(Demolished 1994)

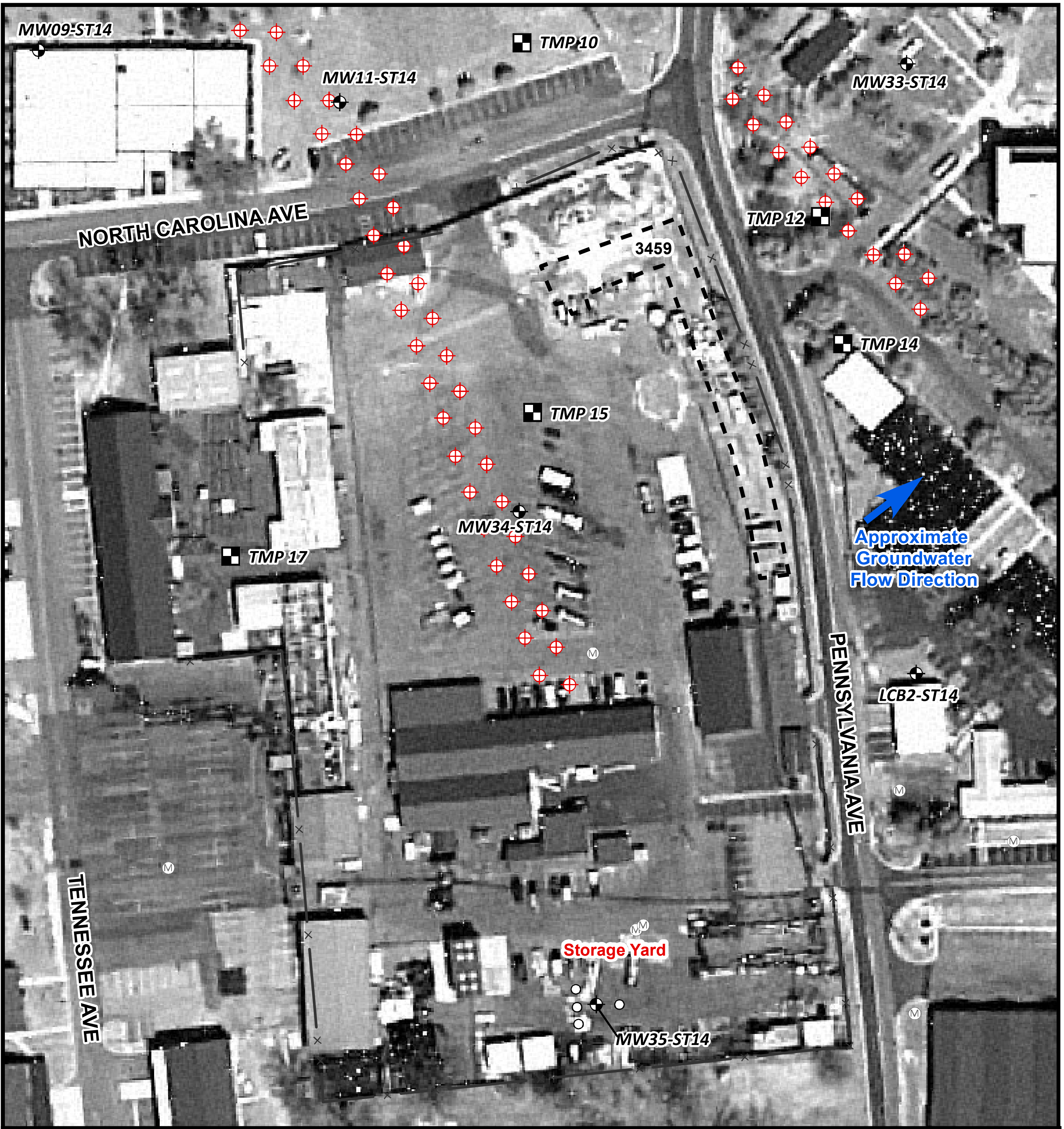
Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Figure 3K

SWMU 56 2003 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202



N
W E
S

0 50 100 Feet

0 15 30 Meters

○ Previous Sample Location (URS 2009)

Monitoring Well Location

Injection Well for ST-14

Temporary Monitoring Point for ST-14

x — Existing Fence

Former Building 3459 (Demolished 1994)

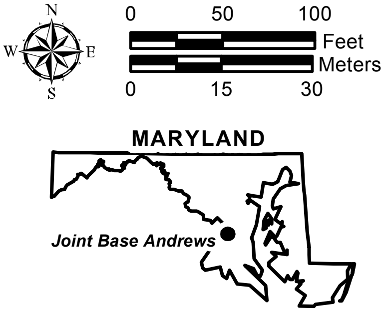
Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Figure 3L

SWMU 56 2005 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202



○ Previous Sample Location (URS 2009)

⊕ Monitoring Well Location

⊕ Injection Well for ST-14

▨ Temporary Monitoring Point for ST-14

X — Existing Fence

- - Former Building 3459
(Demolished 1994)

Figure 3M

SWMU 56 2007 Aerial Map
Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Map Projection: NAD_1983_StatePlane_Maryland_FIPS_1900_Feet

Drawn By: M.B. Date Drawn/Revised: 6/15/2012 Project No. J110202

Appendix C

2012 Field Documentation

Appendix C-1

Soil Borings Logs

Bay West, Inc
5 Empire Drive
St. Paul, MN 55103
Telephone: 651-291-0456
Fax: 651-291-0099

Page **1** of **1**

SOIL BORING LOG

BOREHOLE LOCATION SKETCH MAP

N

BOREHOLE NO. **TMW-01**

PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**

LOCATION **Joint Base Andrews**
Camp Springs, Maryland

APPROVED BY

DRILLING CONTRACTOR **Vironex**

DRILLER'S NAME **Austin Hittinger**

DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**

SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**

START - FINISH DATE **12/6/12 - 12/6/12**

LOGGED BY **Paul Raymaker**

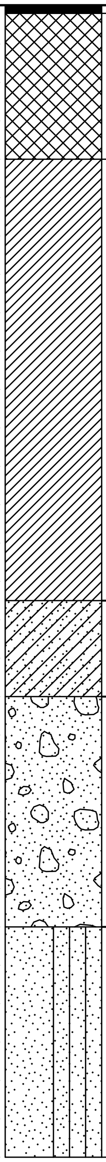
SAMPLING METHOD **Grab**

ELEVATION OF: (FT.)

GROUND SURFACE **269.66**

GW SURFACE **254.16**

GW ELEVATION DATE **12/6/12**



Depth, ft bgs		Visual Description	Analytical Sample Number	Headspace Values (ppm)
		ASPHALT		
		CLAY (CL), dark gray, with sand and gravel, medium stiff, moist [Fill]		0.5
			SO07	2.6
		CLAY (CL), gray, gravelly, with sand, medium stiff, moist [Shallow Upland Deposits]		
5				1.7
				0.7
				0.5
10				
				0.6
			SO05	0.6
15				
	▽			0.5
		CLAYEY SAND (SC), gray, medium- to coarse-grained, with gravel, medium dense, wet [Intermediate Upland Deposits]		
				1.1
		GRAVELLY SAND (SPG), brownish yellow, medium to coarse-grained, with silt, medium dense, wet		
				0.8
20				
				0.9
				1.0
		SAND WITH SILT (SP-SM), brownish yellow, fine-grained, 0.1 inch layers of white fine-grained sand, medium dense, wet		
25				1.4
				0.7
				0.6
30				

SOIL BORING LOG JBA-SWMU56.GPJ BAY WEST BORING LOG TEMPLATE.GDT 1/16/13

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SOIL BORING LOG

BOREHOLE NO. **TMW-02**

BOREHOLE LOCATION SKETCH MAP

N

PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**

LOCATION **Joint Base Andrews**
Camp Springs, Maryland

APPROVED BY

DRILLING CONTRACTOR **Vironex**

DRILLER'S NAME **Austin Hittinger**

DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**

SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**

START - FINISH DATE **12/6/12 - 12/6/12**

LOGGED BY **Paul Raymaker**

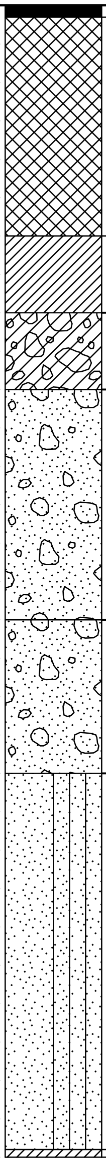
SAMPLING METHOD **Grab**

ELEVATION OF: (FT.)

GROUND SURFACE **270.09**

GW SURFACE **254.09**

GW ELEVATION DATE **12/6/12**



Depth, ft bgs	Graphic Log	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
		ASPHALT			
		CLAY (CL), yellowish brown, trace sand and organics, low plasticity, medium stiff, moist [Fill]			2.4
		-1 inch layer of black organics and rootlets	SO08		4.4
5					4.0
		CLAY (CL), gray, with sand, trace gravel and organics, low plasticity, very stiff, moist [Shallow Upland Deposits]			3.1
		CLAYEY GRAVEL (GC), fine-grained, sub-rounded, with sand, moist [Intermediate Upland Deposits]			1.4
10		GRAVELLY SAND (SPG), pale brown, medium- to coarse-grained, with clay, dense, moist	SO09		2.5
					2.7
15				○	No Recovery
▽		GRAVELLY SAND (SPG), brownish yellow, medium- to coarse-grained, with silt, medium dense, wet			3.3
					2.4
20		SAND WITH SILT (SP-SM), yellow, fine-grained, 0.2 inch lenses of white fine-grained sand, medium dense, wet			2.4
					1.6
25					2.7
					1.8
					1.5
30		CLAY (CL), dark greenish gray, medium plasticity, stiff, moist [Calvert Formation]			

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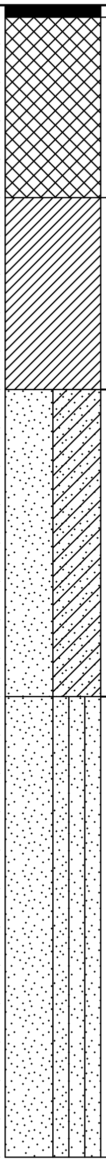
SOIL BORING LOG

BOREHOLE NO.	**TMW-03**
PROJECT NO. / NAME	**J110202.PA.0 / SWMU56 Phase I RI**
APPROVED BY	
LOCATION	**Joint Base Andrews** **Camp Springs, Maryland**
DRILLING CONTRACTOR	**Vironex**
DRILLER'S NAME	**Brody**
DRILLING EQUIPMENT / METHOD	**6820 Geoprobe / Direct Push Technology**
SIZE / TYPE OF BIT	**2 inch / 4 foot Macro-Core**
START - FINISH DATE	**12/7/12 - 12/7/12**
LOGGED BY	**Paul Raymaker**
SAMPLING METHOD	**Grab**
ELEVATION OF: (FT.)	
GROUND SURFACE	**271.25**
GW SURFACE	**255.25**
GW ELEVATION DATE	**12/7/12**

BOREHOLE LOCATION SKETCH MAP

N



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT		
	CLAY (CL), yellowish brown, trace sand, stiff, low plasticity, moist [Fill]		1.0
		SO12	1.7
5	CLAY (CL), grayish brown, trace gravel, very stiff, low plasticity, moist [Shallow Upland Deposits]		2.0
			2.4
	-increased gravel and sand content		2.0
10	GRAVELLY SAND WITH CLAY (SP-SC), grayish brown, medium- to coarse-grained, dense, moist [Intermediate Upland Deposits]		2.1
			1.5
15		SO11	2.3
▽	-color change to brownish yellow, wet		1.5
	SAND WITH SILT (SP-SM), brownish yellow, fine-grained, medium dense, wet		1.4
20			2.8
			2.9
25			2.2
			2.8
			2.6
30			

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SOIL BORING LOG

BOREHOLE NO. **TMW-04**

PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**

APPROVED BY

LOCATION **Joint Base Andrews**
Camp Springs, Maryland

BOREHOLE LOCATION SKETCH MAP

N

DRILLING CONTRACTOR **Vironex**

DRILLER'S NAME **Brody**

DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**

SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**

START - FINISH DATE **12/7/12 - 12/7/12**

LOGGED BY **Paul Raymaker**

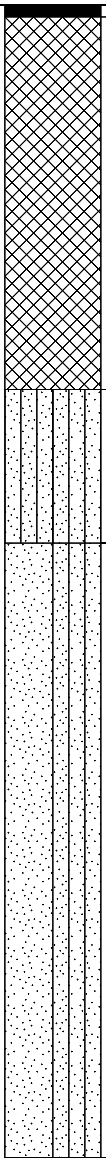
SAMPLING METHOD **Grab**

ELEVATION OF: (FT.) GROUND SURFACE **272.54**

GW SURFACE **256.54**

GW ELEVATION DATE **12/7/12**

Graphic Log



Depth, ft bgs		Visual Description	Analytical Sample Number	Headspace Values (ppm)
		ASPHALT		
		CLAY (CL), yellowish brown, trace sand and organics, stiff, low plasticity, moist [Fill]		2.0
				1.3
5				3.6
		-Increasing sand content		
				3.4
				3.4
10		SILTY SAND (SM), grayish brown, medium- to coarse-grained, with gravel, medium dense, moist [Shallow Upland Deposits]		
				4.4
		-Gravelly		
				3.6
		SAND WITH SILT (SP-SM), brownish yellow, medium-grained, with gravel, medium dense, moist [Intermediate Upland Deposits]		
15			SO13	3.5
	▽	-Wet		
				3.3
				3.8
20				
				5.8
		-Grades to fine-grained sand, 0.2 inch white fine-grained sand lenses		
				5.1
25				4.8
				4.8
				4.8
30				

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SOIL BORING LOG

BOREHOLE NO. **TMW-05**

BOREHOLE LOCATION SKETCH MAP

N

PROJECT NO. / NAME: **J110202.PA.0 / SWMU56 Phase I RI**

LOCATION: **Joint Base Andrews**
Camp Springs, Maryland

APPROVED BY

DRILLING CONTRACTOR: **Vironex**

DRILLER'S NAME: **Brody**

DRILLING EQUIPMENT / METHOD: **6820 Geoprobe / Direct Push Technology**

SIZE / TYPE OF BIT: **2 inch / 4 foot Macro-Core**

START - FINISH DATE: **12/7/12 - 12/7/12**

LOGGED BY: **Paul Raymaker**

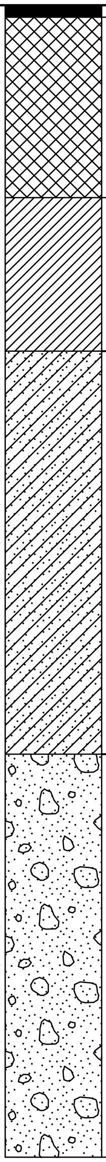
SAMPLING METHOD: **Grab**

ELEVATION OF: (FT.)

GROUND SURFACE: **271.32**

GW SURFACE: **253.32**

GW ELEVATION DATE: **12/7/12**



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT CLAY (CL), yellowish brown, trace sand, gravel, and organics, low plasticity, moist [Fill]		4.0
		SO14	5.4
5	CLAY (CL), grayish brown, trace sand and gravel, low plasticity, moist [Shallow Upland Deposits]		4.3
			3.3
	CLAYEY SAND (SC), light brownish gray, fine- to medium-grained, with gravel, dense, moist [Intermediate Upland Deposits]		3.3
10			
			4.6
			4.8
	-Gravelly		
15			6.3
		SO15	4.4
▽	-Wet		
			2.1
20	GRAVELLY SAND (SPG), yellow, medium- to coarse-grained, with silt, medium dense, wet		
			4.0
			3.5
25			4.5
			4.2
			2.6
30			

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SOIL BORING LOG

BOREHOLE NO. **TMW-06**

BOREHOLE LOCATION SKETCH MAP

N

PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**

LOCATION **Joint Base Andrews**
Camp Springs, Maryland

APPROVED BY

DRILLING CONTRACTOR **Vironex**

DRILLER'S NAME **Austin Hittinger**

DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**

SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**

START - FINISH DATE **12/5/12 - 12/5/12**

LOGGED BY **Paul Raymaker**

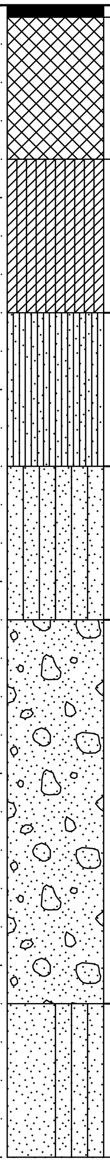
SAMPLING METHOD **Grab**

ELEVATION OF: (FT.)

GROUND SURFACE **270.89**

GW SURFACE **254.89**

GW ELEVATION DATE **12/5/12**



Depth, ft bgs	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
	ASPHALT SILT (ML), gray, with trace sand and gravel, medium stiff, dry [Fill]			3.5
		SO02		6.9
5	SILTY CLAY (CL-ML), yellowish brown, very stiff, moist			2.6
				3.8
	SANDY SILT (MLS), gray, with clay and trace gravel, very stiff, moist [Shallow Upland Deposits]			5.6
10				4.2
	SILTY SAND (SM), red, fine- to medium-grained, with gravel, dense, moist [Intermediate Upland Deposits]	SO03		3.3
15			○	No Recovery
▽	GRAVELLY SAND (SPG), yellow, medium- to coarse-grained, with silt, medium dense, wet			3.8
				4.1
20				2.0
	-Lens of fine sand			4.3
25				5.7
	SAND WITH SILT (SP-SM), yellow, fine-grained, 0.2 inch lenses of white fine sand, medium dense, wet			5.4
30				4.3

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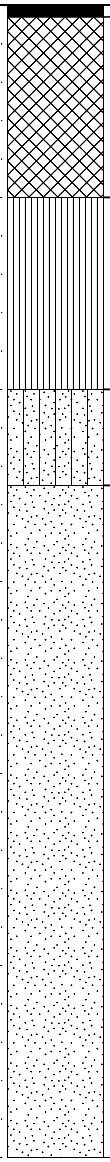
SOIL BORING LOG

BOREHOLE NO. **TMW-07**		BOREHOLE LOCATION SKETCH MAP N
PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**	LOCATION **Joint Base Andrews** **Camp Springs, Maryland**	
APPROVED BY		
DRILLING CONTRACTOR **Vironex**	DRILLER'S NAME **Austin Hittinger**	
DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**	SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**	START - FINISH DATE **12/4/12 - 12/4/12**
LOGGED BY **Paul Raymaker**	SAMPLING METHOD **Grab**	
ELEVATION OF: (FT.) GROUND SURFACE **270.74**	GW SURFACE **256.74**	GW ELEVATION DATE **12/4/12**



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT		
	SILTY CLAY (CL-ML), yellowish brown, trace sand and gravel and organics, moderate plasticity, stiff, moist [Fill]		0.5
			0.7
5	SILT (ML), gray, with sand, medium stiff, moist [Shallow Upland Deposits]		1.0
			0.4
	-Becomes gravelly		0.7
10	SILT SAND (SM), gray, medium- to coarse-grained, with gravel, dense, moist [Intermediate Upland Deposits]		0.7
	SAND (SP), yellowish brown, medium-grained, with gravel and trace silt, medium dense, moist	SO01	1.7
▽	-Wet		
15			No Recovery
	-Grades to coarse-grained sand		2.0
			No Recovery
20	-Grades to fine-grained sand		2.7
			No Recovery
25			
			2.6
30			

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BOREHOLE LOCATION SKETCH MAP

N

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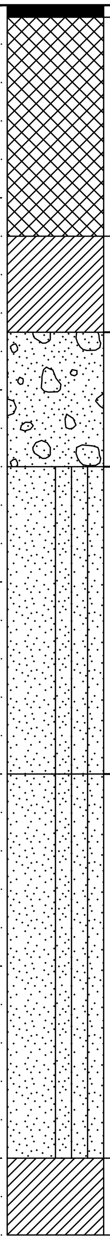
SOIL BORING LOG

BOREHOLE NO.
TMW-08

PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**	LOCATION **Joint Base Andrews** **Camp Springs, Maryland**	
APPROVED BY		
DRILLING CONTRACTOR **Vironex**	DRILLER'S NAME **Austin Hittinger**	
DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**	SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**	START - FINISH DATE **12/5/12 - 12/5/12**
LOGGED BY **Paul Raymaker**	SAMPLING METHOD **Grab**	
ELEVATION OF: (FT.) GROUND SURFACE **268.86**	GW SURFACE **254.86**	GW ELEVATION DATE **12/5/12**



Depth, ft bgs	Graphic Log	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
		ASPHALT			
		CLAY (CL), dark yellowish brown, with trace sand and gravel, stiff, moist [Fill]			2.1
					1.5
5					0.9
		CLAY (CL), grayish brown, with sand, trace gravel, stiff, moist [Shallow Upland Deposits]		○	No recovery
		GRAVELLY SAND (SPG), yellow, medium-grained, with silt, dense, moist [Intermediate Upland Deposits]			0.8
10					
				○	No recovery
		SAND WITH SILT (SP-SM), yellow, medium-grained, with gravel, medium dense, moist			
▽			SO04		1.2
		-Color change to brownish yellow, wet			
15					1.5
		-Color change to yellow			
					1.8
					1.3
20		SAND WITH SILT (SP-SM), yellow, fine-grained, medium dense, wet			
					1.1
					1.4
25					1.1
					1.1
					1.0
30		CLAY (CL), dark greenish gray, trace sand, medium stiff, moderate plasticity, moist [Calvert Formation]			

SOIL BORING LOG JBA-SWMU56.GPJ BAY WEST BORING LOG TEMPLATE.GDT 1/16/13

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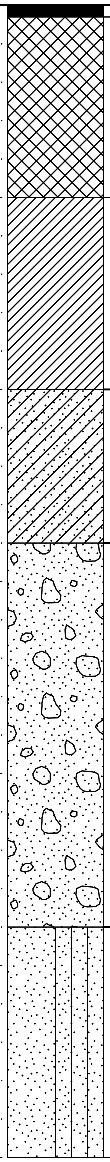
SOIL BORING LOG

BOREHOLE NO. **TMW-09**

BOREHOLE LOCATION SKETCH MAP

N

PROJECT NO. / NAME **J110202.PA.0 / SWMU56 Phase I RI**
LOCATION **Joint Base Andrews**
Camp Springs, Maryland
APPROVED BY
DRILLING CONTRACTOR **Vironex**
DRILLER'S NAME **Austin Hittinger**
DRILLING EQUIPMENT / METHOD **6820 Geoprobe / Direct Push Technology**
SIZE / TYPE OF BIT **2 inch / 4 foot Macro-Core**
START - FINISH DATE **12/6/12 - 12/6/12**
LOGGED BY **Paul Raymaker**
SAMPLING METHOD **Grab**
ELEVATION OF: (FT.)
GROUND SURFACE **269.47**
GW SURFACE **253.47**
GW ELEVATION DATE **12/6/12**



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT		
	SILTY CLAY (CL-ML), grayish brown, with gravel and sand, trace organics, low plasticity, moderately stiff, moist [Fill]		2.3
			3.6
5	CLAY (CL), brown, medium plasticity, soft, moist [Shallow Upland Deposits]		3.6
	-Color change to grayish brown, trace sand		2.9
	-Increasing sand content		2.8
10	CLAYEY SAND (SC), grayish brown, fine-grained, trace gravel, dense, moist [Intermediate Upland Deposits]		1.0
	-Increasing gravel		2.5
15	GRAVELLY SAND (SPG), pale brown, fine- to medium-grained, with clay, dense, moist	SO10	3.6
▽	-Grades to medium- to coarse-grained sand, wet		3.4
	-Color change to brownish yellow		3.7
20			3.7
			0.8
25	SAND WITH SILT (SP-SM), brownish yellow, fine-grained, medium dense, wet		1.5
			2.0
			2.3
30			

Appendix C-2

Soil Sample Collection Forms

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU56 - JBA

PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56-TMW01-S005

BORING NO. TMW01

DATE/TIME COLLECTED: 12/6/12 @ 0900

PERSONNEL: Paul Reymacher
Amanda Maloney

SAMPLE METHOD / DEPTH: Grab / 12-14

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: [✓ YES] NO

DUPLICATE SAMPLE NO. SWMU56-TMW01-S006 @ 0910

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
8 x 4oz Jar	None	DRO, PCB, PAH, Pest, Herb, Metals
6x VoAs 40Ml	2x MEOH, 4x DI	VOCs
4x 40ml VOA	MEOH	GRO

OVA MEASUREMENTS

Background 0.0

Breathing zone

Boring

Headspace 0.6

SAMPLE DESCRIPTION

DEPTH: 12-14 DESCRIPTION: Gray gravelly Clay w/Sand, med stiff, Moist

GENERAL COMMENTS:

~~Soil bor~~ Additional soil boring Advanced directly adjacent to original boring and discretely sampled from 12-14 ft bgs to collect additional soil for lab analysis

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA - SWMU56
PROJECT NO. J110202.PA.0
SAMPLE NO. SWMU56-TMW01-S007
BORING NO. TMW01
DATE/TIME COLLECTED: 12/6/12 @ 0843
PERSONNEL: Paul Reynolds
Amanda Maloney
SAMPLE METHOD / DEPTH: grab / 2-4
SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO. NA
SAMPLE QC DUPLICATE: YES [✓ NO]
DUPLICATE SAMPLE NO. NA
MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz VOA	None	DRO, PCB, PAH, Pest, Herb, Metals
3x 40ml VOA	2x DI, 1x MEOH	VOCs
2x 40ml VOA	2x MEOH	GRO

OVA MEASUREMENTS

Background	0
Breathing zone	
Boring	
Headspace	2.6

SAMPLE DESCRIPTION

DEPTH: 2-4
DESCRIPTION: Dark Gray Clay w/sand and gravel, medium Stiff, Moist

GENERAL COMMENTS
Highest PID reading, Higher than Average pH (6.58)

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA - SWMU56

PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56-TMW02-S008

BORING NO. TMW02

DATE/TIME COLLECTED: 12/6/12 @ 1132

SAMPLE METHOD / DEPTH: grab / 2-4

PERSONNEL: Paul Roy[illegible]
Amanda Maloney

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SAMPLE QC DUPLICATE: YES [✓ NO]

MS/MSD REQUESTED: YES [✓ NO]

SPLIT SAMPLE NO. NA

DUPLICATE SAMPLE NO. NA

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4 x 4oz Jar	None	DRO, PCB, PAH, Pest, Herb, Metals
2x 40ml VOA	2 x DI, 1x MEOH	VOCs
2 x 40ml VOA	2 x MEOH	GRO

OVA MEASUREMENTS

Background	0
Breathing zone	
Boring	
Headspace	4.4

SAMPLE DESCRIPTION

DEPTH: 2-4 DESCRIPTION: Yellowish Brown Clay w/trace Sand and organics, low plasticity, M. Stiff, moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA-SWMU56

PROJECT NO. J/10202.94.0

SAMPLE NO. SWMU56-TMW02-S009

BORING NO. TMW02

DATE/TIME COLLECTED: 12/6/12@ 1147

PERSONNEL: Paul Raymaker
Amanda Malaney

SAMPLE METHOD / DEPTH: Grab / ~~#~~10-12

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jars	None	DRO, PAH, PCB, Pest, Herb, Metals
3x VOAs 40ml	2x DI 1x MEOH	VOCs
2x 40ml VOA	2 x MEOH	GRO

OVA MEASUREMENTS

Background	0
Breathing zone	
Boring	
Headspace	2.5

SAMPLE DESCRIPTION

DEPTH: 10-12 DESCRIPTION: Pale Brown Gravelly M-C Sand w/Clay, Damp Moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA SWMU56 PROJECT NO. J1102O2.PA0

SAMPLE NO. SWMU56 - TMW03 - SO11 BORING NO. TMW03

DATE/TIME COLLECTED: 12/7/12 @ 0850 PERSONNEL: Paul [illegible] KS

SAMPLE METHOD / DEPTH: grab / 14-16 Amanda Maloney

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jars	None	DRO, PCB, PAH, Pest, Herb, Metals
3x 40ml VOA	2x DI, 1x MEOH	VOCs
2x 40ml VOA	2x MEOH	GRO

OVA MEASUREMENTS

Background	0
Breathing zone	
Boring	
Headspace	2.3

SAMPLE DESCRIPTION

DEPTH: 14-16 DESCRIPTION: Greyish Brown gravelly Medium to Coarse Sand with Clay, Dense, moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU56 - JBA
PROJECT NO. J1/0202.PA.O
SAMPLE NO. SWMU56-TMW 03 - S012
BORING NO. TMW03
DATE/TIME COLLECTED: 12/7/12 @ 0805
PERSONNEL: [illegible]
Amanda Maloney
SAMPLE METHOD / DEPTH: Grab / 2-4
SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO. NA
SAMPLE QC DUPLICATE: YES [✓ NO]
DUPLICATE SAMPLE NO. NA
MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jar	None	DRO PCB PAH Pest Herb metals
3x 40ml VOA	2x DI, 1xMEOH	VOCs
2x 40ml VOA	2xMEOH	GRO

OVA MEASUREMENTS

Background ~~17~~ 6
Breathing zone
Boring
Headspace 1.7

SAMPLE DESCRIPTION

DEPTH: 2-4
DESCRIPTION: Yellowish Brown Clay w/trace Sand, Stiff, Moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU56 - JBA

PROJECT NO. J110202.PA O

SAMPLE NO. SWMU56-TMW04-SO13

BORING NO. TMW04

DATE/TIME COLLECTED: 12/7/12 @ 1105

PERSONNEL: Paul Raymaks
Amanda McInerney

SAMPLE METHOD / DEPTH: Grab / 14-16

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4 x 4oz Jar	None	DRO, PCB, PAHs, Pest, Herb, Metals
3 x 40ml VOA	2 x DI, 1x MEOH	VOCs
2 x 40ml VOA	2 x MEOH	GRO

OVA MEASUREMENTS

Background ~~3.5~~ 0

Breathing zone

Boring

Headspace 3.5

SAMPLE DESCRIPTION

DEPTH: 14-16 DESCRIPTION: Brownish Yellow Medium Sand w/silt and gravel, M. dense, moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU56 - JBA
PROJECT NO. J110202.PAO
SAMPLE NO. SWMU56-TMW05-S014
BORING NO. TMW05
DATE/TIME COLLECTED: 12/7/12 @1210
PERSONNEL: [illegible] / Amanda McInerney
SAMPLE METHOD / DEPTH: Grab 2-4
SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO. NA
SAMPLE QC DUPLICATE: YES [✓ NO]
DUPLICATE SAMPLE NO. NA
MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz JAR	None	PCB, DRO, PAH, Pest, Herb, Metals
3x 40ml VOA	2x DI, 1x MEOH	VOCs
2x 40ml VOA	2x MEOH	GRO

OVA MEASUREMENTS

Background: 0
Breathing zone:
Boring:
Headspace: 5.4

SAMPLE DESCRIPTION

DEPTH: 2-4
DESCRIPTION: Yellowish Brown Clay w/ trace Sand Gravel and organics

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU56 - JBA

PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56 - TMW05 - SO~~14~~15

BORING NO. TMW05

DATE/TIME COLLECTED: 12/7/12 @ ~~1210~~ 1230 AM

PERSONNEL: Paul Raymaker
Amanda Maloney

SAMPLE METHOD / DEPTH: grab / 16-18

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: [✓ YES] NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
12x 4oz Jars	None	DRO, PCB, PAH, Pest, Herb, Metals
9 x 40ml VOA	6x DI, 3x MEOH	VOCs
6 x 40ml VOA	6x MEOH	GRO

OVA MEASUREMENTS

Background	0
Breathing zone	
Boring	
Headspace	4.4

SAMPLE DESCRIPTION

DEPTH: 16-18 DESCRIPTION: Brownish Gray Gravelly Clayey Medium Sand, Dense, moist

GENERAL COMMENTS Tripple Volume collected for MS/MSD, additional boring advanced directly adjacent to Boring to collect additional Soil @ 16-18ft

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA - SWMU56

PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56 - TMW06-S002

BORING NO. TMW06

DATE/TIME COLLECTED: 12/5/12 @1133

PERSONNEL: Paul Raymaker

SAMPLE METHOD / DEPTH: grab ~~ft~~ 2-4 ft. bgs

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jar	None	DRO PCB, PAH, Pest, Herb
3x 40ml VOA	1 MeOH, 2 DI	VOCs
2x 40ml VOA	2 MeOH	GRO

OVA MEASUREMENTS

Background	0.0
Breathing zone	
Boring	
Headspace	6.9 ppm

SAMPLE DESCRIPTION

DEPTH: 2-4ft DESCRIPTION: Gray to Yellowish Brown, Silt w trace Sand, Clay and gravel, moist, medium Stiff

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA ~~SWMU~~ SWMU 56

PROJECT NO. J110202

SAMPLE NO. SWMU56-TMW06-S003

BORING NO. TMW06

DATE/TIME COLLECTED: 12/5/12 @ 1155

PERSONNEL: Paul Raymaker
Amanda Maloney

SAMPLE METHOD / DEPTH: grab / 12-14

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jar	None	DRO, PCB, PAH, Pest, Herb, Metals
3x 40mL VOA	2x DI, 1x MEOH	VOCs
2x 40ml VOA	2x MEOH	GRO

OVA MEASUREMENTS

Background 0.0

Breathing zone

Boring

Headspace 3.3

SAMPLE DESCRIPTION

DEPTH: 12-14 DESCRIPTION: Red (2.5YR4/6) Silty Fine to medium Sand with gravel, Dense, Moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA SWMU56

PROJECT NO. 110202.PA.0

SAMPLE NO. SWMU56-TMW07-SO01

BORING NO. TMW07

DATE/TIME COLLECTED: 17/4/12 @ 0850

PERSONNEL: Paul Reymaker
Amanda Maloney

SAMPLE METHOD / DEPTH: grab/12-14'

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jars	None	DRO, PCBs, PAHs, Pests, Herb, Metals
3x VOA 40ML	2xDI, 1xMEOH	VOCs
2x VOA 40ML	2x MEOH	

OVA MEASUREMENTS

Background	0.0
Breathing zone	
Boring	
Headspace	1.7

SAMPLE DESCRIPTION

DEPTH: 12-14 DESCRIPTION: Yellowish Brown Medium Sand with gravel, trace silt, Moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA - SWMU56 PROJECT NO. J1/0202.1A.0

SAMPLE NO. SWMU56 - TMW08 - S004 BORING NO. TMW08

DATE/TIME COLLECTED: 12/5/12 @ 1445 PERSONNEL: Paul [illegible]

SAMPLE METHOD / DEPTH: Grab 12-14 Amanda Malaney

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jar	None	DRO, PCB, PAH, Pest, Herb, Metals
3x 40ml VOA	1x MEOH, 2x DI	VOCs
2x 40ml VOA	2x MEOH	GRO

OVA MEASUREMENTS

Background 0.0

Breathing zone

Boring

Headspace 1.2

SAMPLE DESCRIPTION

DEPTH: 12-14 DESCRIPTION: yellow medium Sand with Silt and gravel, M. dense, moist

GENERAL COMMENTS

Boring advanced directly adjacent to original boring, discrete sampled from 12-14 to obtain additional soil for sampling. VOCs & GRO collected from original Boring. Soil for other analytes Homogenized.

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JPA - SWMU56
PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56-TMW09-S010
BORING NO. TMW09

DATE/TIME COLLECTED: 12/6/12 @ 1430
PERSONNEL: Paul Reymaker
Amanda ~~[illegible]~~ Maloney

SAMPLE METHOD / DEPTH: Grab / 14-16
SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE
SAMPLE QA SPLIT: YES [✓ NO]
SAMPLE QC DUPLICATE: YES [✓ NO]
MS/MSD REQUESTED: YES [✓ NO]
SPLIT SAMPLE NO. NA
DUPLICATE SAMPLE NO. NA

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
4x 4oz Jar	None	DRO, PCB, PAH, Pest/Herb, Metals
3x 40ml VOA	2x DI, 1x MEOH	VOCs
2x40ml VOA	2x MEOH	GRO

OVA MEASUREMENTS

Background 0
Breathing zone
Boring
Headspace 3.6

SAMPLE DESCRIPTION

DEPTH: 14-16
DESCRIPTION: Pale brown Clayey gravelly F-M Sand
dense, moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU 56
PROJECT NO. J110202
SAMPLE NO. SWMU56-SB01
BORING NO. SB01
DATE/TIME COLLECTED: 12/03/12 / 1015
PERSONNEL: Paul Raymaker
Amanda Malaney
SAMPLE METHOD / DEPTH: macrocore / 1-2'
SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO. NA
SAMPLE QC DUPLICATE: YES [✓ NO]
DUPLICATE SAMPLE NO. ↓
MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
1-4oz	none	pesticides
1-4oz	↓	herbicides

OVA MEASUREMENTS

Background 0
Breathing zone
Boring
Headspace 0.6

SAMPLE DESCRIPTION

DEPTH:	DESCRIPTION:
1-2	Silt, dark greyish brown, med. stiff, moist

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU 56

PROJECT NO. J110202

SAMPLE NO. SWMU 56-SB02

BORING NO. SB02

DATE/TIME COLLECTED: 12/03/12 | 1030

PERSONNEL: Paul Raymaker
Amanda Malaney

SAMPLE METHOD / DEPTH: macrocore / 1-2

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. ↓

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
1-4oz.	none	pesticides
1-4oz,	↓	herbicides

OVA MEASUREMENTS

Background 0

Breathing zone

Boring

Headspace 0.5

SAMPLE DESCRIPTION

DEPTH: 1-2

DESCRIPTION: clayey silt, (yellowish brown)(10 YR 5/8), w/ gravel, med. dense, moist to dry

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU 56

PROJECT NO. J110202

SAMPLE NO. SWMU56-SB03

BORING NO. SB03

DATE/TIME COLLECTED: 12/03/12 / 1045

SAMPLE METHOD / DEPTH: macrocore / 1-2

PERSONNEL: Paul Kaymaker
Amanda Malanay

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SAMPLE QC DUPLICATE: YES [✓ NO]

MS/MSD REQUESTED: YES [✓ NO]

SPLIT SAMPLE NO. NA

DUPLICATE SAMPLE NO. ↓

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
1-4oz	none	pesticides
1-4oz	↓	herbicides

OVA MEASUREMENTS

Background 0

Breathing zone

Boring

Headspace 1.3

SAMPLE DESCRIPTION

DEPTH: 1-2 DESCRIPTION: gravelly sand yellowish brown (10YR5/6), loose, moist to dry

GENERAL COMMENTS

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: SWMU 56

PROJECT NO. J110202

SAMPLE NO. SWMU 56-SB04

BORING NO. SB04

DATE/TIME COLLECTED: 12/03/12 / 1100

PERSONNEL: Paul Raymaker
Amanda Malaney

SAMPLE METHOD / DEPTH: macrocore / 1-2

SAMPLE MEDIA: [✓ SOIL] SEDIMENT SLUDGE

SAMPLE QA SPLIT: YES [✓ NO]

SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO]

DUPLICATE SAMPLE NO. ↓

MS/MSD REQUESTED: YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
1-4oz.	none	pesticides
1-4oz,	↓	herbicides

OVA MEASUREMENTS

Background: 0

Breathing zone:

Boring:

Headspace: 1.0

SAMPLE DESCRIPTION

DEPTH: 1-~~2~~1.5 DESCRIPTION: silty fine sand w/ gravel; organics, yellowish brown (10YR 3/2), loose

1.5-2 sandy clay, yellowish brown (10YR 5/6), m stiff, w/gravel

GENERAL COMMENTS

Appendix C-3

Groundwater Sampling Forms

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA - SWMU56 PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56 - TMW01-GW05 WELL NO. TMW01

DATE/TIME COLLECTED 12/5/12 voa 0845 PERSONNEL Amanda Maloney

SAMPLE METHOD peristaltic / grab Paul Raymaker

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: [✓ YES] NO DUPLICATE SAMPLE NO. SWMU56 -TMW01 - GW06 @850

MS/MSD REQUESTED YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
20 x 1L Amber	None	DRO, PAH, PCB, Pest, Herb
12 x 40 ml VOA	HCl	GRO, VOC;
2 x 500ml Poly	HNO3	Metals

WELL PURGING DATA

Date	12/5/12	Well Depth (ft. BTOC)	30ft
Time Started	0745	Depth to Water (ft BTOC)	NA
Time Completed	0840	Water Column Length	
Hnu Measurements		Volume of Water in Well (gal)	
Background	NA	Casing Volumes to Purge	
Breathing Zone		Minimum to Purge (gal)	
Well Head		Actual Purge (gal)	

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
0805	8L	5.23					333.2
0811	10.4L	5.12					177.0
0820	14L	5.03					56.0
0830	18L	4.97					18.1
0840	22L	4.97					9.9

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/5/12

GENERAL COMMENTS

- Tubing intake @ 28' bgs
- Duplicate Sample Collected
- purge rate ~~300~~ AM 400mL/min.
- Sample collection rate 300 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA PBC/SWMU-56
PROJECT NO. TMW-02
SAMPLE NO. SWMU56-TMW02-GW08
WELL NO. J110202-PA.0
DATE/TIME COLLECTED 5DEC12/ 1410
PERSONNEL JMH
SAMPLE METHOD Peristaltic / Grab.

SAMPLE MEDIA: [✓ Groundwater] Surface Water
SAMPLE QA SPLIT: YES [✓ NO]
SPLIT SAMPLE NO. NA
SAMPLE QC DUPLICATE: YES [✓ NO]
DUPLICATE SAMPLE NO. NA.
MS/MSD REQUESTED YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
6-40mL VOA	HCl	VOCs/GRO
1-500mL Poly	HNO3	metals
10-1L amber	None	Pesti/Herbi
		DRO/PAH
		PCB

WELL PURGING DATA

Date 12/05/12
Time Started 1130
Time Completed 1400
Hnu Measurements
Background NA
Breathing Zone
Well Head ↓

Well Depth (ft. BTOC) 30
Depth to Water (ft BTOC) NA
Water Column Length
Volume of Water in Well (gal)
Casing Volumes to Purge
Minimum to Purge (gal)
Actual Purge (gal) ↓

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
1130- 1400	0.5L	removed during development w/ surging.					
	0.5L	removed for reading below					
1400		5.73					1028.5

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/05/12

GENERAL COMMENTS

- Poor recharge after 25 hrs surging & development
obtained volume for initial pH reading.
Pump at lowest setting

- tubing intake at 28' bgs

- Sample collection rate ~150 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA-SWMU56 04 PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56-TMW03-GW~~10~~ WELL NO. TMW03

DATE/TIME COLLECTED 12/6/12 / 0950 PERSONNEL Jim H.

SAMPLE METHOD Peristaltic / Grab

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10 x 1L Amber	None	DRO, PAHs, PCBs, Pest, Herb
6 x 40ml VOA	HCl	GRO, VOCs
1 x 500ml Poly	HNO3	Metals

WELL PURGING DATA

Date 12/6/12

Time Started 0845

Time Completed 0950

Hnu Measurements

Background N/A

Breathing Zone ↓

Well Head ↓

Well Depth (ft. BTOC) PRR ~~30 ft~~ 28

Depth to Water (ft BTOC) NA

Water Column Length

Volume of Water in Well (gal) ↓

Casing Volumes to Purge

Minimum to Purge (gal)

Actual Purge (gal) ↓

FIELD MEASUREMENTS

Time	Amount Purged (~~gal~~) L	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
0855	5	6.13					87.2
0900	7.5	5.26		reduced	rate 200mL/min		79.3
0920	11.5	5.09		increased	rate 500mL/min		110.0
0930	16.5	5.06					48.3
0945	19.0	5.03					9.0

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	N/A	
Water Quality Meter	YSI 6820 V2	12/6/12

GENERAL COMMENTS

- Start @ 500 mL/min.
- tubing intake @ 26' bgs
- sample collection rate 500 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA-SWMU56 PROJECT NO. J110202.PA.D

SAMPLE NO. SWMU56-TMW04-GW~~09~~ 10 WELL NO. TMW04

DATE/TIME COLLECTED 12/6/12 / 1115 PERSONNEL Jim H.

SAMPLE METHOD Peristaltic / Grab.

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED YES [✓ NO]

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10x 1L Amber	None	DRO, PCB, PAH, Pest, Herb
~~#~~ 6x 40ml VOA	HCl	GRO, VOCs
1x 500ml Poly	HNO3	Metals

WELL PURGING DATA

Date	12/6/12	Well Depth (ft. BTOC)	30
Time Started	1043	Depth to Water (ft BTOC)	NA
Time Completed	1112	Water Column Length	
Hnu Measurements		Volume of Water in Well (gal)	
Background	N/A	Casing Volumes to Purge	
Breathing Zone		Minimum to Purge (gal)	
Well Head		Actual Purge (gal)	

FIELD MEASUREMENTS

Time	Amount Purged (~~gal~~ L)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
1053	5.0	5.51					349.2
1103	10.0	5.03					60.6
1108	12.5	4.97	reduced to 100mL/min				13.9
1110	13.0	4.96					8.4
1112	14.0	4.96					0.5

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/6/12

GENERAL COMMENTS

initial dev. @ 500 mL/min.

- tubing intake @ 28' bgs

- sample collection rate @ 100 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA - SWMU56

PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56-TMW05-GW04

WELL NO. SWMU56-TMW05

DATE/TIME COLLECTED 12/4/[illegible] @ 1530

PERSONNEL Amanda Malaney
Paul Raymaker

SAMPLE METHOD Peristaltic pump/grab

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO]

SAMPLE QC DUPLICATE: YES [✓ NO]

MS/MSD REQUESTED YES [✓ NO]

SPLIT SAMPLE NO. NA

DUPLICATE SAMPLE NO. ↓

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10 - 1L amber	none	PCB, PAH, pest., herb., DRO
6 - 40mL vial	HCL	VOCs, GRO
1 - 500 mL plastic	HNO3	metals

WELL PURGING DATA

Date 12/04/12

Time Started 1330

Time Completed 1530

Hnu Measurements

Background NA

Breathing Zone ↓

Well Head ↓

Well Depth (ft. BTOC) 30' bgs

Depth to Water (ft BTOC) NA

Water Column Length ↓

Volume of Water in Well (gal)

Casing Volumes to Purge

Minimum to Purge (gal)

Actual Purge (gal) ↓

FIELD MEASUREMENTS

Time	Amount Purged (~~gal~~)L	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
1330		4.62					1294.8
1415	22.5	4.41					58.1
1445	37.5	4.39					43.2
1455	42.5	4.38					28.0
1505	47.5	4.38					22.9
1515	52.5	4.38					21.7
1525	57.5	4.37					12.7
1530	60.0	4.37					12.6

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/04/12

GENERAL COMMENTS

-tubing intake set @ 28' bgs

-purge rate 500 mL/min

-Sample collection rate ~150 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME SWMU56

PROJECT NO. JBA J110202.PA.0

SAMPLE NO. SWMU56-TMW06-~~01~~ GW01 PAR

WELL NO. SWMU56-TMW06

DATE/TIME COLLECTED 12/3/12 @ 1410

SAMPLE METHOD Low Flow Peristaltic

PERSONNEL Paul Raymaker
Amanda Malaney

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO]

SAMPLE QC DUPLICATE: YES [✓ NO]

MS/MSD REQUESTED YES [✓ NO]

SPLIT SAMPLE NO. NA

DUPLICATE SAMPLE NO. ↓

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10x 1L Amber	None	DRO, PAH, Pest/Herb, PCB,
6x 40 mL VOA	HCL	VOCs GRO
1x 500mL Poly	HNO3	Metals

WELL PURGING DATA

Date 12/3/12

Time Started ~~1338~~ 1328

Time Completed (AM) 1403 PAR ~~1540~~ ~~1530~~ (AM)

Hnu Measurements

Background NA

Breathing Zone ↓

Well Head ↓

Well Depth (ft. BTOC) 30ft

Depth to Water (ft BTOC) NA

Water Column Length NA

Volume of Water in Well (gal) ↓

Casing Volumes to Purge ↓

Minimum to Purge (gal) ↓

Actual Purge (gal) ↓

FIELD MEASUREMENTS

Time PAR	Amount Purged (gal)	pH	~~Temperature (°C)~~ Amount Purged (L)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
1330		6.01	1				1304.6
1340	1.3	4.78	6				40
1345	2.0	4.75	8.5				30.1
1355		4.73	13.5				20.7
1400		4.70	16				12.1
1403	4.4	4.73	17.5				10.0

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/3/12

GENERAL COMMENTS

- Unable to Monitor Groundwater level. Probe does not fit in Temp Well Casing
- tubing intake at 28' bgs

purge rate - 500 mL/min

sample collection rate - ~~100~~ 150 (AM) mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA/PBC - SMMU-56 PROJECT NO. J110202 - PA.0

SAMPLE NO. SWMU56-TMW07~~-05~~ GW03 WELL NO. TMW-07

DATE/TIME COLLECTED 4DEC12 / 1215 PERSONNEL Hubbell

SAMPLE METHOD peristaltic / Grab.

SAMPLE MEDIA: Groundwater Surface Water

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. N/A

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO. N/A.

MS/MSD REQUESTED [✓ YES] NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
30 x 1L amber	none	DRO, pest., herb., PCB, PAH
18 x 40mL vials	hcl	VOCs, GRO
3x500mL plastic	HNO3	metals

WELL PURGING DATA

Date	4DEC12	Well Depth (ft. BTOC)	30
Time Started	1050	Depth to Water (ft BTOC)	NA
Time Completed	1210	Water Column Length	
Hnu Measurements		Volume of Water in Well (gal)	
Background	0	Casing Volumes to Purge	
Breathing Zone	0	Minimum to Purge (gal)	
Well Head	0	Actual Purge (gal)	

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
1050	1.5L	initial sediment removal + Development.					
1135	2.5L	5.09					19.7
1145	6.5L	4.90					8.0
1200	12.5L	4.77					3.7
1205	13.3L	4.75					3.2
1210	14.1L	4.75					

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	N/A.	
Water Quality Meter	YSI 650 MDS 10820 V2	4DEC12

GENERAL COMMENTS

initial Purge rate @ 400mL/min.

Sample collection rate - 400mL/min

- tubing intake at 28' bgs

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA - SWMU56

PROJECT NO. J110202. PA.0

SAMPLE NO. SWMU56-TMW08-~~02~~ GW02 am

WELL NO. SWMU56-TMW08

DATE/TIME COLLECTED 12/04/12 / ~~1045~~ am 1120

SAMPLE METHOD peristaltic pump

PERSONNEL Amanda Malaney
Jim Hubbell

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO]

SAMPLE QC DUPLICATE: YES [✓ NO]

MS/MSD REQUESTED YES [✓ NO]

SPLIT SAMPLE NO. NA

DUPLICATE SAMPLE NO. ↓

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
9 ~~10~~ x 1L amber	none	DRO, PAH, pest., herb. PCB
6 x 40mL vial	hcl	VOCs, GRO
1 x 500mL plastic	HNO3	metals

1 amber broke

WELL PURGING DATA

Date ~~12/3/12~~ am 12/04/12

Time Started 0800

Time Completed 1115

Hnu Measurements

Background NA

Breathing Zone ↓

Well Head ↓

Well Depth (ft. BTOC) 30 ft

Depth to Water (ft BTOC) NA

Water Column Length ↓

Volume of Water in Well (gal)

Casing Volumes to Purge

Minimum to Purge (gal)

Actual Purge (gal) ↓

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
0815		5.38					1240.9
0930	5	4.91					1013.1
1015	10	4.75					302.5
1040 am ~~1045~~	am ~~14~~ 13	4.74					56.4
1115	15	4.73					52.2

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/04/12

GENERAL COMMENTS

- unable to monitor GW level, probe does not fit in SS casing
- a lot of sediment in well, tubing had to be removed several times to clean check ball during initial purging
- tubing intake at 28' bgs

purge rate - 400 mL/min
samp. collection rate 150 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA -SWMU56 PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56-TMW09-GW07 WELL NO. TMW09

DATE/TIME COLLECTED ~~12/[illegible]/12~~ 12/5/12 @ 0950 PERSONNEL Paul Ruymacker

SAMPLE METHOD grab

SAMPLE MEDIA: [✓ Groundwater] Surface Water

SAMPLE QA SPLIT: YES [✓ NO] SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES [✓ NO] DUPLICATE SAMPLE NO. NA

MS/MSD REQUESTED YES NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10x 1L Amber	None	PCBs, PAH, DRO, Pest, Herb
6x 40ml VOA	HCl	GRO, VOC
1x 500ml Poly	HNO_3	Metals

WELL PURGING DATA

Date 12/5/12

Time Started 0845

Time Completed 0948

Hnu Measurements

Background NA

Breathing Zone

Well Head

Well Depth (ft. BTOC) 30 ft

Depth to Water (ft BTOC) NA

Water Column Length

Volume of Water in Well (gal)

Casing Volumes to Purge

Minimum to Purge (gal)

Actual Purge (gal)

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
0857	2.4L	5.29					852.5
0914	4.5L	5.18					232.8
0920	6.3L	5.16					171.6
0930	9.3L	5.06					56.6
0948	14.7L	5.00					7.8

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	YSI 6820 V2	12/5/12

GENERAL COMMENTS

Tubing intake @ 28 ft bgs

-purge & sample collection rate 300 mL/min

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA SWMU56 PROJECT NO. J110202.PA.0

SAMPLE NO. SWMU56- ~~AQ01~~ AQFB01 WELL NO. NA

DATE/TIME COLLECTED 12/3/12 @ 1515 PERSONNEL Paul Raymaker
SAMPLE METHOD ~~[illegible]~~ Direct from H_2O Tank Amanda Malahay

SAMPLE MEDIA: Groundwater Surface Water [✓ Source Water]
SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO.
MS/MSD REQUESTED YES NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10x 1L Amber	None	DRO, PCB, PAH, Pest, Herb
6x 40ml VOA	HCL	GRO, Voc
1 V 500ml Poly	HNO_3	Metals

WELL PURGING DATA

Date NA
Time Started
Time Completed
Hnu Measurements
Background
Breathing Zone
Well Head

Well Depth (ft. BTOC)
Depth to Water (ft BTOC)
Water Column Length
Volume of Water in Well (gal)
Casing Volumes to Purge
Minimum to Purge (gal)
Actual Purge (gal)

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
NA	NA	NA	NA	NA	NA	NA	NA

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	NA	

GENERAL COMMENTS

Field Blank

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME JBA SWMU56 PROJECT NO. J11002.PA.0

SAMPLE NO. SWMU56-AQEB01 WELL NO. NA

DATE/TIME COLLECTED 12/4/12 @ 1430 PERSONNEL Paul Ray[illegible]

SAMPLE METHOD

SAMPLE MEDIA: Groundwater Surface Water DI water/Equip Blank

SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. NA

SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO.

MS/MSD REQUESTED YES NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested
10x 1L Amber	None	DRO PAH PCB Pest Herb
6x 40mL VOA	HCl	GRO VOC
1x 500ml Poly	HNO_3	Metals

WELL PURGING DATA

Date NA

Time Started

Time Completed

Hnu Measurements

Background

Breathing Zone

Well Head

Well Depth (ft. BTOC)

Depth to Water (ft BTOC)

Water Column Length

Volume of Water in Well (gal)

Casing Volumes to Purge

Minimum to Purge (gal)

Actual Purge (gal)

FIELD MEASUREMENTS

Time	Amount Purged (gal)	pH	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU's)
NA							

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
Water Level Probe	NA	
Water Quality Meter	NA	

GENERAL COMMENTS

Groundwater Equipment blank

Appendix C-4

Investigation-Derived Waste Disposal Documentation

010968755

CVCC ~~173465~~

CleanVenture/CycleChem

NON-HAZARDOUS SOLID WASTE

The Environmental Services Source

BILL OF LADING

Generator's Name and Mailing Address JOINT BASE ANDREWS
ATTN: KEITH FREIHOFER
3466 NORTH CAROLINA AVE
Generator's Phone 301 858 3472 ANDREWS AFB, MD 20762

BOL SAME

Transporter 1 Company Name Clean Venture, Inc.

State Trans. ID-NJDEPE

Decal No.-

Transporter's Phone (410) 368-9170

Transporter 2 Company Name

State Trans. ID-NJDEPE

Decal No.-

Transporter's Phone ( )

Designated Facility Name and Site Address

Cycle Chem, Inc.
550 Industrial Drive
Lewisberry, PA 17339

10. US EPA ID Number PAD067098822

Facility's Phone (717) 938-4700

GENERATOR

	US DOT Description *(Including Proper Shipping Name, Hazard Class or Division, ID Number and Packing Group)*	Containers No.	Containers Type	Total Quantity	Unit Wt/Vol	Waste No.
a.	Non DOT/EPA Regulated Material (PURGE WATER)	X15	DM	X5100	P	None
b.	NON DOT/EPA REGULATED MATERIAL (SOIL CUTTINGS)	X5	DM	X2000	P	NONE
c.	NON DOT/EPA REGULATED MATERIAL (SLUDGE)	X11	DM	X2100	P	NONE
d.						

J. Additional Descriptions for Materials Listed Above

a. LF-05-5, OW C3 640-3, SS-27-1, SWMU-58-2, SWMU-60-1 BASEWIDE CSM-3

b. BASE WIDE CSM-5

c. BASEWIDE CSM-11

CCI Generator # and Product Codes:

24 hour Emergency Response Phone # (410) 368-9170

a)

Job# #6057.04.09

CVB - NEW

GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations and are non-hazardous by USEPA & applicable state regulations.

PLACARDS REQUIRED NO

PLACARDS SUPPLIED ☐ YES ☒ NO- FURNISHED BY CARRIER

Printed/Typed Name

Signature

Month Day Year 9·26·13

TRANSPORTER

Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name ANDREW FEESER

Signature Andrew Feeser

Month Day Year 9·26·13

Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name

Signature

Month Day Year

FACILITY

Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest.

Printed/Typed Name

Signature

Month Day Year

SIGNATURE AND INFORMATION *MUST* BE LEGIBLE ON ALL COPIES

COPY 1 - WHITE - GENERATOR COPY 2 - PINK - TRANSPORTER COPY 3 - BLUE - CycleChem COPY 4 - CANARY - FACILITY www.cyclochem.com

Cycle Chem, Inc.

217 South 1st St.
Elizabeth, NJ 07206
Phone: (908) 355-5800
Fax: (908) 355-0562

550 Industrial Dr.
Lewisberry, PA 17339
Phone: (717) 938-4700
Fax: (717) 938-3301

General Chemical Corporation

133-138 Leland St., Framingham, MA 01701
Phone: (508) 872-5000 Fax: (508) 875-5271

Material Profile Sheet
Gencode - Stream: ______ - ______
Process Code: ______

A. GENERATOR INFORMATION

EPA ID # MD0 570 024 000

GENERATOR NAME ANDREWS AIR FORCE BASE
MAILING ADDRESS 3466 NORTH CAROLINA AVE
ANDREWS AFB MD 20762
GENERATOR CONTACT PATRICIA GRAY
GENERATOR PHONE # 301 858 3472
SITE ADDRESS SAME
PICKUP COUNTY ______

BILLING COMPANY CU1-04
BILLING ADDRESS ______
BILLING CONTACT CHUCK PAGANO
BILLING PHONE # ______ FAX ______
PROCESS GENERATING WASTE: WELL DRILLING
NAME OF WASTE: WATER

B. PHYSICAL CHARACTERISTICS OF WASTE (AT 70o F)

Color/Physical Description: VARIES
Strong Incidental Odor Present? ○ Yes ● No
Wastewater: ○ Wastewater ● Non-wastewater
Specific Gravity: ______
Physical State: ☐ Single Phase ☐ Solid ☐ Gas/Aerosol ☐ Bi-Layered ☒ Liquid ☐ Lab Pack ☐ Multi-Layered ☐ Semi-Solid ☐ Powder ☐ Sludge

Liquid/Solid/Sludge
% Liquid 100
% Suspended Solids ______
% Sludge ______
% Solid ______
Dumpable? ○ Yes ○ No
Pumpable? ○ Yes ○ No
Pourable? ○ Yes ○ No

Flash Point: ○ Flash Point <74 F ○ Flash Point 101-140 F ○ Flash Point >200 F ○ Exact Flash Point: ______ ○ Flash Point 74-100 F ○ Flash Point 141-200 F ● No Flash Point
○ Open cup ● Closed cup
Ignitable Solid? ○ Yes ● No
pH: ○ <2.0 ○ 2.01-5.0 ● 5.01-9.0 ○ 9.01-12.49 ○ >12.5 ○ Exact pH ______

C. CHEMICAL COMPOSITION

ATTACHMENTS: ☐ MSDS attached ☐ Supplemental Analysis ☐ Additonal Information ☐ LDR Attachment

Chemical Composition	Percent	Minimum	Maximum
WATER FROM			
WELL DRILLING	100		

D. REGULATORY INFORMATION

Is it USEPA haz waste? ○ Yes ● No
USEPA Haz Codes: ______
EPA Sub Categories: ______
Is it STATE waste? ○ Yes ● No
STATE Haz Codes: ______
DOT Hazardous Material? ○ Yes ● No
Proper Shipping Name: NON DOT/EPA REGULATED MATERIAL
Hazard Class: ______ UN/NA #: NA P. G.: ______
RQ: ______ ERG#: ______

E. SHIPPING INFORMATION

Shipment Method:
○ Bulk Liquid - Tanker ○ Pallet(s) ● Drum(Size): 55G
○ Bulk Solid - Dmp Tlr ○ Tote(s)
○ Bulk Solid - Roll Off ○ Cubic Yard Box(s) ○ Other(Size): ______
Anticipated Volume: 10 Per YR
Quantity: ______ Price: ______ / Unit: ______

F. SPECIAL HANDLING CONSIDERATIONS

☐ Radioactive ☐ Etiologic/Medical Waste ☐ Fuming ☐ Phenolics
☐ PA RW SQG ☐ DRMS/DRMO Waste ☐ CERCLA Waste ☐ Asbestos
☐ No Land Filling ☐ Incinerate Only ☐ Recycle Only ☐ Other:

Indicate if waste contains any of the following:

	Non-Reg.	or Less Than		or Actual
PCBs	☒	☐	50 PPM	
Cyanides	☒	☐	250 PPM	
Phenolics	☒	☐	50 PPM	
Sulfides	☒	☐	500 PPM	
VOCs	☒	☐	500PPM	
Chlorides	☒	☐	1000 PPM	

G. TRANSPORTER ARRANGEMENTS

○ CCI/GCC Provides Transportation
○ Customer Delivers to CCI/GCC
○ Customer Delivers to End Facility via CCI/GCC
● Other: CUB

H. OTHER HAZARDOUS CHARACTERISTICS

☐ RCRA REACTIVE ☐ WATER REACTIVE ☐ RADIOACTIVE ☐ SUBJECT TO SUBPART FF BENZENE REG
☐ ETIOLOGICAL ☐ TSCA REG ☐ OXIDIZING MAT'L ☐ PYROPHORIC
☐ EXPLOSIVE/SHOCK SENSITIVE ☒ NONE OF THE ABOVE

1. Is this waste characteristically hazardous for metals or organics (EPA Waste Codes D004 through D043)? ○ Yes ○ No
If YES, please list the constituents and concentrations in section C.

2. Does this waste contain underlying hazardous constituents as defined in 40 CFR 268 Part 2, Section I at concentrations exceeding the UTS treatment standards? ○ Yes ○ No
If YES, please list the constituents and concentrations in section C.

GENERATOR CERTIFICATION: I hereby certify that all information submitted in this and all other attached documents is complete, contains true and accurate descriptions and is representative of the waste material, and that all relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. If CCI/GCC discovers, after having taken the delivery of the waste, that any waste does not conform to the identification or descriptions contained in this MPS then CCI/GCC shall provide notice to Generator and coordinate the return of the non conforming waste to the point of origin as set forth in the manifest or to such other locations designated in writing by the Generator. Generator agrees to reimburse CCI/GCC for all handling, packaging, cleanup and transportation costs or charges, damage to equipment and costs associated with lost time incurred by CCI/GCC during the receipt, handling, temporary storage and return of such non conforming waste to its point of origin or to such other location designated by the Generator. I hereby authorize CCI/GCC to amend and/or correct any information on the MPS with the full understanding that if any amendment or correction is performed, I will be contacted as such to issue any approval.

Authorized Signature ______ Title 11CES/CEIER Date 9/26/13

CCI/GCC APPROVAL
Sales Code ______
Tech Initials ______ Date ______
Management Initials ______ Date ______
Residual Waste / Form Code: ______

www.cyclechem.com

Cycle Chem, Inc.

217 South 1st St.
Elizabeth, NJ 07206
Phone: (908) 355-5800
Fax: (908) 355-0562

550 Industrial Dr.
Lewisberry, PA 17339
Phone: (717) 938-4700
Fax: (717) 938-3301

General Chemical Corporation

133-138 Leland St., Framingham, MA 01701
Phone: (508) 872-5000 Fax: (508) 875-5271

Material Profile Sheet
Gencode - Stream: ______ - ______
Process Code:

A. GENERATOR INFORMATION

EPA ID # MD0 570 024 000
GENERATOR NAME ANDREWS AIR FORCE BASE
MAILING ADDRESS 3466 NORTH CAROLINA AVE
ANDREWS AFB MD 20762
GENERATOR CONTACT PATRICIA GRAY
GENERATOR PHONE # 301 858 3472
SITE ADDRESS SAME
PICKUP COUNTY

BILLING COMPANY CUI-04
BILLING ADDRESS
BILLING CONTACT CHUCK PAGANO
BILLING PHONE # ______ FAX ______
PROCESS GENERATING WASTE: WELL DRILLING
NAME OF WASTE: SLUDGE

B. PHYSICAL CHARACTERISTICS OF WASTE (AT 70o F)

Color/Physical Description: VARIES
Strong Incidental Odor Present? ○ Yes ● No
Wastewater: ○ Wastewater ○ Non-wastewater
Specific Gravity:
Physical State: ☐ Single Phase ☐ Bi-Layered ☐ Multi-Layered ☐ Powder ☐ Solid ☐ Liquid ☐ Semi-Solid ☒ Sludge ☐ Gas/Aerosol ☐ Lab Pack
Flash Point: ○ Flash Point <74 F ○ Flash Point 74-100 F ○ Flash Point 101-140 F ○ Flash Point 141-200 F ○ Flash Point >200 F ● No Flash Point ○ Exact Flash Point: ______
○ Open cup ● Closed cup
Ignitable Solid? ○ Yes ● No
pH: ○ <2.0 ○ 2.01-5.0 ● 5.01-9.0 ○ 9.01-12.49 ○ >12.5 ○ Exact pH ______

Liquid/Solid/Sludge
% Liquid
% Suspended Solids
% Sludge 100
% Solid ~~100~~
Dumpable? ● Yes ○ No
Pumpable? ○ Yes ○ No
Pourable? ○ Yes ○ No

C. CHEMICAL COMPOSITION

ATTACHMENTS: ☐ MSDS attached ☐ Supplemental Analysis ☐ Additonal Information ☐ LDR Attachment

Chemical Composition	Percent	Minimum	Maximum
SOIL SLUDGE	50%		
WATER	50%		
	100		

D. REGULATORY INFORMATION

Is it USEPA haz waste? ○ Yes ● No
USEPA Haz Codes:
EPA Sub Categories:
Is it STATE waste? ○ Yes ● No
STATE Haz Codes:
DOT Hazardous Material? ○ Yes ● No
Proper Shipping Name: NON DOT/EPA REGULATED MATERIAL
Hazard Class: ______ UN/NA #: NA P. G.: ______
RQ: ______ ERG#: ______

E. SHIPPING INFORMATION

Shipment Method:
○ Bulk Liquid - Tanker ○ Pallet(s) ● Drum(Size): 55G
○ Bulk Solid - Dmp Tlr ○ Tote(s)
○ Bulk Solid - Roll Off ○ Cubic Yard Box(s) ○ Other(Size):
Anticipated Volume: 10 Per YR
Quantity: ______ Price: ______ / Unit: ______

F. SPECIAL HANDLING CONSIDERATIONS

☐ Radioactive ☐ Etiologic/Medical Waste ☐ Fuming ☐ Phenolics
☐ PA RW SQG ☐ DRMS/DRMO Waste ☐ CERCLA Waste ☐ Asbestos
☐ No Land Filling ☐ Incinerate Only ☐ Recycle Only ☐ Other:

Indicate if waste contains any of the following:

	Non-Reg.	or Less Than		or Actual
PCBs	☒	☐	50 PPM	
Cyanides	☒	☐	250 PPM	
Phenolics	☒	☐	50 PPM	
Sulfides	☒	☐	500 PPM	
VOCs	☒	☐	500PPM	
Chlorides	☒	☐	1000 PPM	

G. TRANSPORTER ARRANGEMENTS

○ CCI/GCC Provides Transportation ● Other:
○ Customer Delivers to CCI/GCC
○ Customer Delivers to End Facility via CCI/GCC

H. OTHER HAZARDOUS CHARACTERISTICS

☐ RCRA REACTIVE ☐ WATER REACTIVE ☐ RADIOACTIVE ☐ SUBJECT TO SUBPART FF BENZENE REG
☐ ETIOLOGICAL ☐ TSCA REG ☐ OXIDIZING MAT'L ☐ PYROPHORIC
☐ EXPLOSIVE/SHOCK SENSITIVE ☒ NONE OF THE ABOVE

1. Is this waste characteristically hazardous for metals or organics (EPA Waste Codes D004 through D043)? ○ Yes ● No
If YES, please list the constituents and concentrations in section C.

2. Does this waste contain underlying hazardous constituents as defined in 40 CFR 268 Part 2, Section I at concentrations exceeding the UTS treatment standards? ○ Yes ● No
If YES, please list the constituents and concentrations in section C.

GENERATOR CERTIFICATION: I hereby certify that all information submitted in this and all other attached documents is complete, contains true and accurate descriptions and is representative of the waste material, and that all relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. If CCI/GCC discovers, after having taken the delivery of the waste, that any waste does not conform to the identification or descriptions contained in this MPS then CCI/GCC shall provide notice to Generator and coordinate the return of the non conforming waste to the point of origin as set forth in the manifest or to such other locations designated in writing by the Generator. Generator agrees to reimburse CCI/GCC for all handling, packaging, cleanup and transportation costs or charges/damage to equipment and costs associated with lost time incurred by CCI/GCC during the receipt, handling, temporary storage and return of such non conforming waste to its point of origin or to such other location designated by the Generator. I hereby authorize CCI/GCC to amend and/or correct any information on the MPS with the full understanding that if any amendment or correction is performed, I will be contacted as such to issue any approval.

Authorized Signature ______ Title 11CES/CEIER Date 9/26 13

CCI/GCC APPROVAL
Sales Code ______
Tech Initials ______ Date ______
Management Initials ______ Date ______
Residual Waste / Form Code: ______

Cycle Chem, Inc.

217 South 1st St.
Elizabeth, NJ 07206
Phone: (908) 355-5800
Fax: (908) 355-0562

550 Industrial Dr.
Lewisberry, PA 17339
Phone: (717) 938-4700
Fax: (717) 938-3301

www.cyclechem.com

General Chemical Corporation

133-138 Leland St., Framingham, MA 01701
Phone: (508) 872-5000 Fax: (508) 875-5271

Material Profile Sheet
Gencode - Stream: ______ - ______
Process Code: ______

A. GENERATOR INFORMATION

EPA ID # MDO 570 024 000

GENERATOR NAME ANDREWS AIR FORCE BASE
MAILING ADDRESS 3466 NORTH CAROLINA AVE
ANDREWS AFB MD 20762
GENERATOR CONTACT PATRICIA GRAY
GENERATOR PHONE # 301 858 3472
SITE ADDRESS SAME
PICKUP COUNTY ______

BILLING COMPANY CUI-04
BILLING ADDRESS ______
BILLING CONTACT CHUCK PAGANO
BILLING PHONE # ______ FAX ______

PROCESS GENERATING WASTE: WELLDRILLING
NAME OF WASTE: SOIL CUTTINGS

B. PHYSICAL CHARACTERISTICS OF WASTE (AT 70o F)

Color/Physical Description: VARIES
Strong Incidental Odor Present? ○ Yes ● No
Wastewater: ○ Wastewater ● Non-wastewater
Specific Gravity: ______
Physical State: ☐ Single Phase ☑ Solid ☐ Gas/Aerosol ☐ Bi-Layered ☐ Liquid ☐ Lab Pack ☐ Multi-Layered ☐ Semi-Solid ☐ Powder ☐ Sludge

Liquid/Solid/Sludge
% Liquid ______
% Suspended Solids ______
% Sludge ______
% Solid 100
Dumpable? ● Yes ○ No
Pumpable? ○ Yes ○ No
Pourable? ○ Yes ○ No

Flash Point: ○ Flash Point <74 F ○ Flash Point 101-140 F ○ Flash Point >200 F ○ Exact Flash Point: ______ ○ Flash Point 74-100 F ○ Flash Point 141-200 F ● No Flash Point
○ Open cup ● Closed cup
Ignitable Solid? ○ Yes ● No
pH: ○ <2.0 ○ 2.01-5.0 ● 5.01-9.0 ○ 9.01-12.49 ○ >12.5 ○ Exact pH ______

C. CHEMICAL COMPOSITION

ATTACHMENTS: ☐ MSDS attached ☐ Supplemental Analysis ☐ Additonal Information ☐ LDR Attachment

Chemical Composition	Percent	Minimum	Maximum
SOIL CUTTINGS	100		

D. REGULATORY INFORMATION

Is it USEPA haz waste? ○ Yes ● No
USEPA Haz Codes: ______
EPA Sub Categories: ______
Is it STATE waste? ○ Yes ● No
STATE Haz Codes: ______
DOT Hazardous Material? ○ Yes ● No
Proper Shipping Name: NON DOT/EPA REGULATED MATERIAL
Hazard Class: ______ UN/NA #: N/A P. G.: ______
RQ: ______ ERG#: ______

E. SHIPPING INFORMATION

Shipment Method:
○ Bulk Liquid - Tanker ○ Pallet(s) ● Drum(Size): 55G
○ Bulk Solid - Dmp Tlr ○ Tote(s)
○ Bulk Solid - Roll Off ○ Cubic Yard Box(s) ○ Other(Size): ______
Anticipated Volume: 15 Per YR
Quantity: ______ Price: ______ / Unit: ______

F. SPECIAL HANDLING CONSIDERATIONS

☐ Radioactive ☐ Etiologic/Medical Waste ☐ Fuming ☐ Phenolics
☐ PA RW SQG ☐ DRMS/DRMO Waste ☐ CERCLA Waste ☐ Asbestos
☐ No Land Filling ☐ Incinerate Only ☐ Recycle Only ☐ Other:

Indicate if waste contains any of the following:

	Non-Reg.	or Less Than		or Actual
PCBs	☒	☐	50 PPM	______
Cyanides	☒	☐	250 PPM	______
Phenolics	☒	☐	50 PPM	______
Sulfides	☒	☐	500 PPM	______
VOCs	☒	☐	500PPM	______
Chlorides	☒	☐	1000 PPM	______

G. TRANSPORTER ARRANGEMENTS

○ CCI/GCC Provides Transportation
○ Customer Delivers to CCI/GCC
○ Customer Delivers to End Facility via CCI/GCC
● Other: CUB

H. OTHER HAZARDOUS CHARACTERISTICS

☐ RCRA REACTIVE
☐ WATER REACTIVE
☐ RADIOACTIVE
☐ SUBJECT TO SUBPART FF BENZENE REG
☐ ETIOLOGICAL
☐ TSCA REG
☐ OXIDIZING MAT'L
☐ PYROPHORIC
☐ EXPLOSIVE/SHOCK SENSITIVE
☑ NONE OF THE ABOVE

1. Is this waste characteristically hazardous for metals or organics (EPA Waste Codes D004 through D043)? ○ Yes ● No
If YES, please list the constituents and concentrations in section C.

2. Does this waste contain underlying hazardous constituents as defined in 40 CFR 268 Part 2, Section I at concentrations exceeding the UTS treatment standards? ○ Yes ○ No
If YES, please list the constituents and concentrations in section C.

GENERATOR CERTIFICATION: I hereby certify that all information submitted in this and all other attached documents is complete, contains true and accurate descriptions and is representative of the waste material, and that all relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. If CCI/GCC discovers, after having taken the delivery of the waste, that any waste does not conform to the identification or descriptions contained in this MPS then CCI/GCC shall provide notice to Generator and coordinate the return of the non conforming waste to the point of origin as set forth in the manifest or to such other locations designated in writing by the Generator. Generator agrees to reimburse CCI/GCC for all handling, packaging, cleanup and transportation costs or charges, damage to equipment and costs associated with lost time incurred by CCI/GCC during the receipt, handling, temporary storage and return of such non conforming waste to its point of origin or to such other location designated by the Generator. I hereby authorize CCI/GCC to amend and/or correct any information on the MPS with the full understanding that if any amendment or correction is performed, I will be contacted as such to issue any approval.

Authorized Signature ______ Title 11 CES/CEIER Date 9/26/17

CCI/GCC APPROVAL
Sales Code ______
Tech Initials ______ Date ______
Management Initials ______ Date ______
Residual Waste / Form Code: ______

Appendix C-5

Photo Log

View of:	SB-01
Facing:	North

View of:	SB-02 (foreground) and SB-03 (background)
Facing:	South

View of:	SB-04
Facing:	North

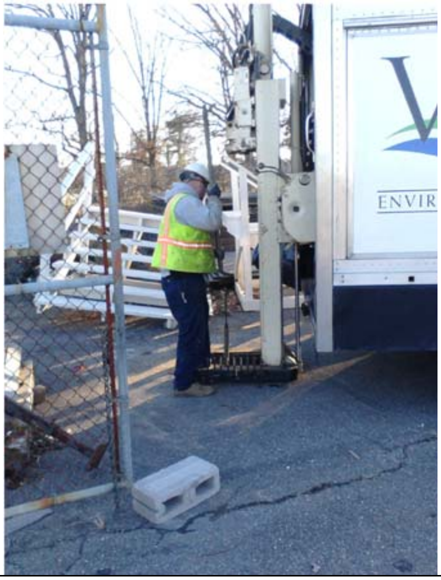
View of:	TMW-08
Facing:	East

View of:	TMW-07
Facing:	East

View of:	TMW-09, TMW-01, TMW-02, TMW-03 (foreground to background)
Facing:	West

View of:	TMW-05, TMW-04 (front to back)
Facing:	West

View of:	TMW-03
Facing:	West



View of: Drilling SWMU56-TMW07

View of: Purging SWMU56-TMW09

View of: SWMU56-TWM01, Initial Purge

View of: SWMU56-TMW01, Final Purge

View of: SWMU56-TWM02, Initial Purge

View of: SWMU56-TMW02, Final Purge

View of: SWMU56-TWM03, Initial Purge

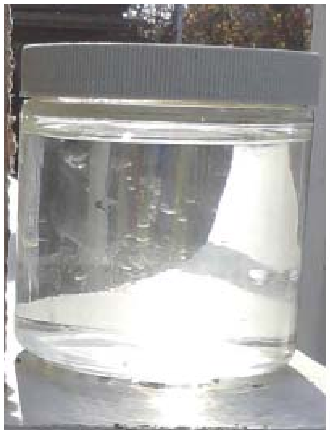
View of: SWMU56-TMW03, Final Purge

View of: SWMU56-TWM04, Initial Purge

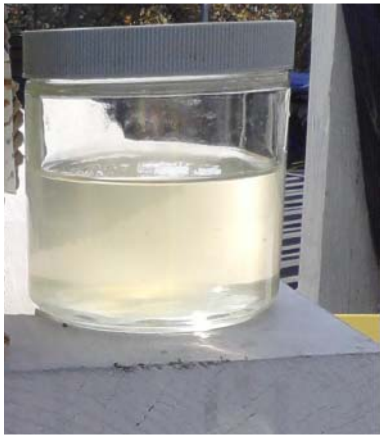
View of: SWMU56-TMW04, Final Purge

View of: SWMU56-TWM05, Initial Purge

View of: SWMU56-TMW05, Final Purge

			
View of:	SWMU56-TWM06, Initial Purge	View of:	SWMU56-TMW06, Final Purge
			
View of:	SWMU56-TWM07, Initial Purge	View of:	SWMU56-TMW07, Final Purge

View of: SWMU56-TWM08, Initial Purge



View of: SWMU56-TMW08, Final Purge

View of: SWMU56-TWM09, Initial Purge

View of: SWMU56-TMW09, Final Purge

Appendix D

2016 Field Documentation

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5 Empire Drive
St. Paul, MN 55103
Telephone: 1-800-279-0456
Fax: 651-291-0099

Customer-Focused Environmental & Industrial Solutions

BOREHOLE LOCATION SKETCH MAP

N

Page **1** of **1**

SOIL BORING LOG

BOREHOLE NO.
SWMU56-SB05

PROJECT NO. / NAME
J140588.0005 / SWMU56 Phase 1 RI

LOCATION
Joint Base Andrews
Camp Springs, Maryland

APPROVED BY
Josh Miller

DRILLING CONTRACTOR
Vironex

DRILLER'S NAME
Kyle

DRILLING EQUIPMENT / METHOD
Geoprobe / Direct Push Technology

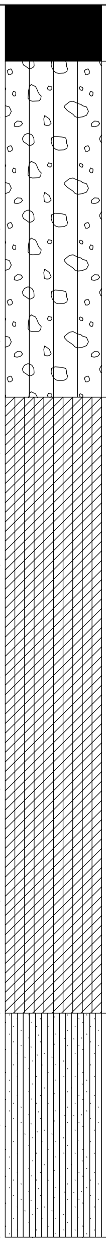
SIZE / TYPE OF BIT
2 inch / 4 foot

START - FINISH DATE
4/2/16 - 4/2/16

LOGGED BY
John Peper

SAMPLING METHOD
Grab

ELEVATION OF: (FT.)
GROUND SURFACE **271.46**
GW SURFACE **'**
GW ELEVATION DATE



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT		
	GRAVELLY SILT (MLG) - med-stiff, dry, no odor, non-cohesive		
1			2.1
2		SB05-SO-2-4	
3			1.7
	SILTY CLAY (CL-ML) - yellowish/dark brown, slight moist, stiff, no odor		
4		SB05-SO-5-7	
5			4.0
6			
7			3.2
8		SB05-SO-9-11	
9	SANDY SILT (MLS) - gray, stiff, slight moist, no odor		
			2.9
10			
11			

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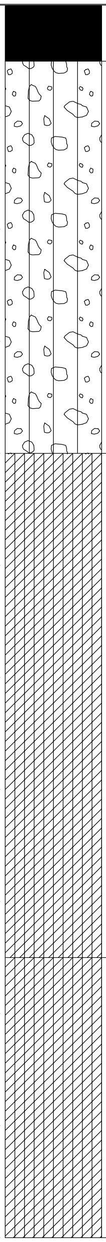
Page **1** of **1**

SOIL BORING LOG

BOREHOLE LOCATION SKETCH MAP

N

BOREHOLE NO. **SWMU56-SB06**		
PROJECT NO. / NAME **J140588.0005 / SWMU56 Phase 1 RI**	LOCATION **Joint Base Andrews** **Camp Springs, Maryland**	
APPROVED BY **Josh Miller**		
DRILLING CONTRACTOR **Vironex**	DRILLER'S NAME **Kyle**	
DRILLING EQUIPMENT / METHOD **Geoprobe / Direct Push Technology**	SIZE / TYPE OF BIT **2 inch / 4 foot**	START - FINISH DATE **4/2/16 - 4/2/16**
LOGGED BY **John Peper**	SAMPLING METHOD **Grab**	
ELEVATION OF: (FT.) — GROUND SURFACE **270.56**	GW SURFACE **'**	GW ELEVATION DATE



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT		
	GRAVELLY SILT (MLG) - med-stiff, dry, no odor, non-cohesive		
1			1.7
2		SB06-SO-2-4	
3			2.4
4	SILTY CLAY (CL-ML) - yellow/brown, moist, stiff, no odor	SB06-SO-5-7	
5			3.2
6			
7			1.8
8		SB06-SO-9-11	
	SILTY CLAY (CL-ML) - gray, cohesive, moist, no odor		
9			
			3.2
10			
11			

SOIL BORING LOG JBA-SWMU56 SOIL BORINGS.GPJ BAY WEST BORING LOG TEMPLATE.GDT 10/10/16

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Customer-Focused Environmental & Industrial Solutions

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BOREHOLE LOCATION SKETCH MAP

N

Page 1 of 1

SOIL BORING LOG

BOREHOLE NO. **SWMU56-SB07**

PROJECT NO. / NAME: **J140588.0005 / SWMU56 Phase 1 RI**

LOCATION: **Joint Base Andrews**
Camp Springs, Maryland

APPROVED BY: **Josh Miller**

DRILLING CONTRACTOR: **Vironex**

DRILLER'S NAME: **Kyle**

DRILLING EQUIPMENT / METHOD: **Geoprobe / Direct Push Technology**

SIZE / TYPE OF BIT: **2 inch / 4 foot**

START - FINISH DATE: **4/2/16 - 4/2/16**

LOGGED BY: **John Peper**

SAMPLING METHOD: **Grab**

ELEVATION OF: (FT.) GROUND SURFACE: **269.89**

GW SURFACE: **'**

GW ELEVATION DATE:

Depth, ft bgs	Graphic Log	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
		ASPHALT			
		GRAVELLY SILT (MLG) - gray, med-stiff, dry, no odor, non-cohesive			
1					1.2
2			SB07-SO-2-4		
3		SANDY CLAY (CLS) - yellow/brown, slight moist, very stiff			1.6
4			SB07-SO-5-7		
5					1.4
6					
7					1.2
8		SILTY CLAY (CL-ML) - gray, very stiff, moist, no odor	SB07-SO-9-11		
9					1.2
10					
11					

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5 Empire Drive
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Page 1 of 1

SOIL BORING LOG

BOREHOLE LOCATION SKETCH MAP

N

BOREHOLE NO.
SWMU56-SB08

PROJECT NO. / NAME
J140588.0005 / SWMU56 Phase 1 RI

LOCATION
Joint Base Andrews
Camp Springs, Maryland

APPROVED BY
Josh Miller

DRILLING CONTRACTOR
Vironex

DRILLER'S NAME
Kyle

DRILLING EQUIPMENT / METHOD
Geoprobe / Direct Push Technology

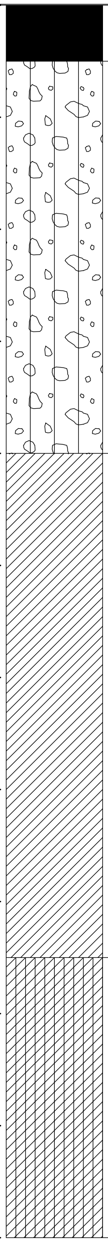
SIZE / TYPE OF BIT
2 inch / 4 foot

START - FINISH DATE
4/2/16 - 4/2/16

LOGGED BY
John Peper

SAMPLING METHOD
Grab

ELEVATION OF: (FT.)
GROUND SURFACE **271.05**
GW SURFACE **'**
GW ELEVATION DATE



Depth, ft bgs	Graphic Log	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
		ASPHALT			
		GRAVELLY SILT (MLG) - gray, med-stiff, non-cohesive, no odor, dry			
1					1.4
2			SB08-SO-2-4		
3					1.7
4		CLAY (CL) - yellow/brown, moist, stiff, no odor, cohesive	SB08-SO-5-7		
5					1.6
6					
7					1.5
8			SB08-SO-9-11		
		SILTY CLAY (CL-ML) - gray, stiff, moist, no odor, cohesive			
9					
					1.9
10					
11					

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Page **1** of **1**

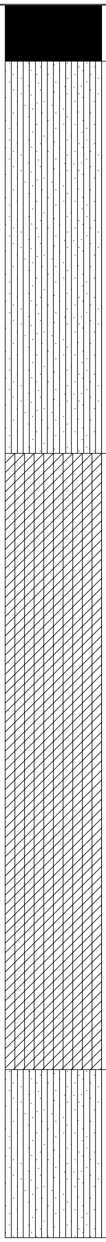
SOIL BORING LOG

BOREHOLE NO.
SWMU56-SB09

BOREHOLE LOCATION SKETCH MAP

N

PROJECT NO. / NAME **J140588.0005 / SWMU56 Phase 1 RI**	LOCATION **Joint Base Andrews** **Camp Springs, Maryland**
APPROVED BY **Josh Miller**	
DRILLING CONTRACTOR **Vironex**	DRILLER'S NAME **Kyle**
DRILLING EQUIPMENT / METHOD **Geoprobe / Direct Push Technology**	SIZE / TYPE OF BIT **2 inch / 4 foot**
START - FINISH DATE **4/2/16 - 4/2/16**	
LOGGED BY **John Peper**	SAMPLING METHOD **Grab**
ELEVATION OF: (FT.) GROUND SURFACE **270.76**	GW SURFACE **'**
GW ELEVATION DATE	



Depth, ft bgs	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
	ASPHALT			
	SANDY SILT (MLS) - gray, med-stiff, dry, non-cohesive, no odor			
1				3.0
2		SB09-SO-2-4		
3				4.8
4	SILTY CLAY (CL-ML) - yellow/brown, slight moist, cohesive, stiff, no odor	SB09-SO-5-7		
5				8.1
6				
7				4.1
8		SB09-SO-9-11		
9				
	SANDY SILT (MLS) - gray, stiff, moist, no odor			2.7
10				
11				

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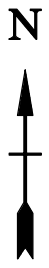
BOREHOLE LOCATION SKETCH MAP

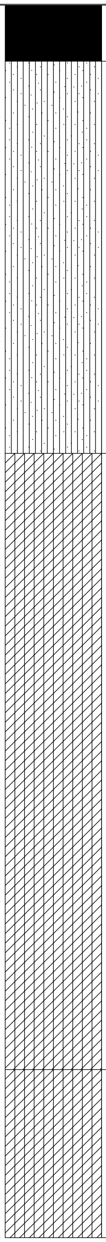


Page **1** of **1**

SOIL BORING LOG

BOREHOLE NO. **SWMU56-SB10**

PROJECT NO. / NAME **J140588.0005 / SWMU56 Phase 1 RI**
LOCATION **Joint Base Andrews**
Camp Springs, Maryland
APPROVED BY **Josh Miller**
DRILLING CONTRACTOR **Vironex**
DRILLER'S NAME **Kyle**
DRILLING EQUIPMENT / METHOD **Geoprobe / Direct Push Technology**
SIZE / TYPE OF BIT **2 inch / 4 foot**
START - FINISH DATE **4/2/16 - 4/2/16**
LOGGED BY **John Peper**
SAMPLING METHOD **Grab**
ELEVATION OF: (FT.) GROUND SURFACE **271.41**
GW SURFACE **'**
GW ELEVATION DATE



Depth, ft bgs	Visual Description	Analytical Sample Number	Headspace Values (ppm)
	ASPHALT		
	SANDY SILT (MLS) - dry, no odor, med-stiff, some gravel (5%)		
1			1.3
2		SB10-SO-2-4	
3			1.4
4	SILTY CLAY (CL-ML) - gray/yellow, slight moist, stiff, no odor	SB10-SO-5-7	
5			1.7
6			
7			1.5
8		SB10-SO-9-11	
9			
	SILTY CLAY (CL-ML) - gray, stiff, moist, no odor		1.7
10			
11			

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Page 1 of 1

BOREHOLE NO.
SWMU56-SB11

SOIL BORING LOG

BOREHOLE LOCATION SKETCH MAP

N

PROJECT NO. / NAME
J140588.0005 / SWMU56 Phase 1 RI

LOCATION
Joint Base Andrews
Camp Springs, Maryland

APPROVED BY
Josh Miller

DRILLING CONTRACTOR
Vironex

DRILLER'S NAME
Kyle

DRILLING EQUIPMENT / METHOD
Geoprobe / Direct Push Technology

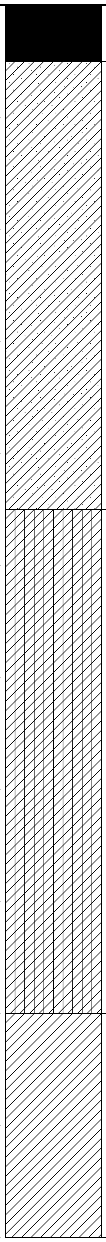
SIZE / TYPE OF BIT
2 inch / 4 foot

START - FINISH DATE
4/2/16 - 4/2/16

LOGGED BY
John Peper

SAMPLING METHOD
Grab

ELEVATION OF: (FT.)
GROUND SURFACE **270.01**
GW SURFACE **'**
GW ELEVATION DATE

Depth, ft bgs	Graphic Log	Visual Description	Analytical Sample Number	Sample Interval	Headspace Values (ppm)
		ASPHALT			
		SANDY CLAY (CLS) - gray, slight cohesive, dry, med-stiff, no odor			
1					1.5
2			SB11-SO-2-4		
3					1.7
4			SB11-SO-5-7		
		SILTY CLAY (CL-ML) - yellow/brown, moist, cohesive, stiff, no odor			
5					1.9
6					
7					1.7
8			SB11-SO-9-11		
9		CLAY (CL) - gray, stiff, moist, cohesive, no odor			
					1.7
10					
11					

Water Level Data Sheet

Project #	J140588
Project Name	JBA/SWMU56
Locations	SWMU56

Well Name	Date	Time	Depth to Water	Sounding Depth	Screen Placement	Pump Placement (ft BTOC)
SWMU56-MW01	4/9/2016	800	15.27	31.17	NA	NA
SWMU56-MW02	4/9/2016	805	15.57	35.3	NA	NA
SWMU56-MW03	4/9/2016	810	15.07	32.2	NA	NA
SWMU56-MW04	4/9/2016	815	14.06	31.49	NA	NA
SWMU56-MW05	4/9/2016	820	13.12	35.4	NA	NA
SWMU56-MW06	4/9/2016	825	13.11	29.61	NA	NA

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BOREHOLE LOCATION SKETCH MAP

N

See Figure

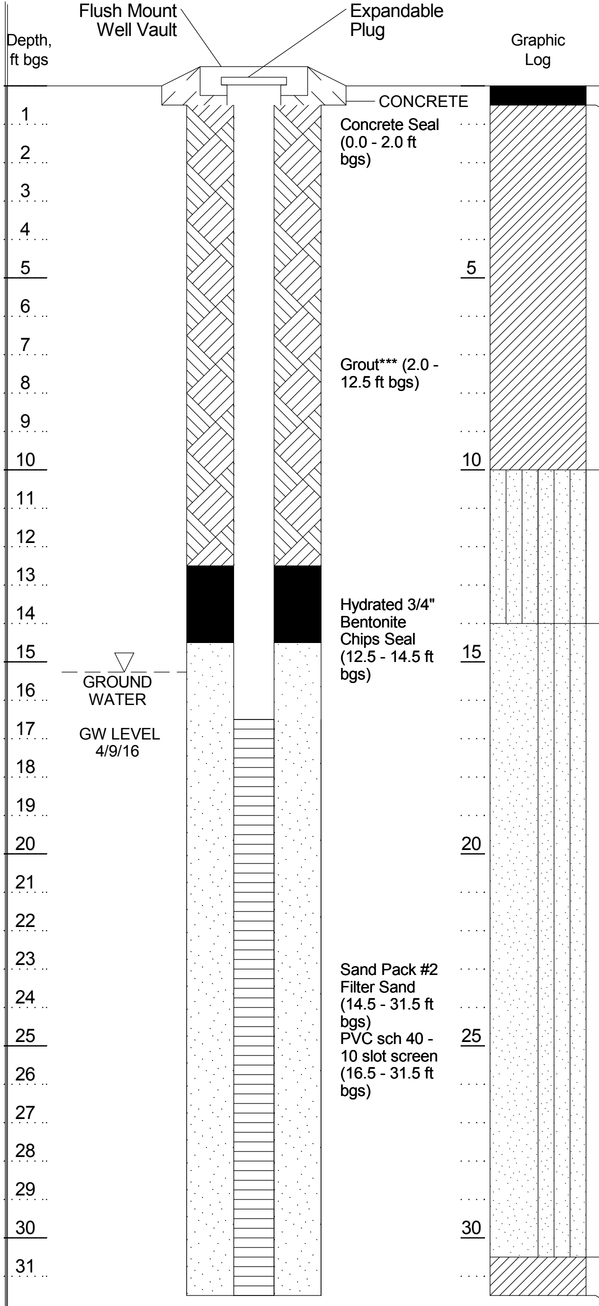
Page **1** of **1**

WELL CONSTRUCTION LOG

BOREHOLE NO. **SWMU56-MW01**			
PROJECT NO. / NAME **J140588 / SWMU56 Remedial Action**	LOCATION **SWMU56**		
APPROVED BY **Josh Miller**	**Joint Base Andrews, MD**		
DRILLING CONTRACTOR / DRILLER **Vironex / Kyle Schultz**	LOGGED BY **John Peper**		
DRILLING EQUIPMENT / METHOD **GeoProbe / Hollow Stem Auger**	SIZE / TYPE OF BIT **8 in**	SAMPLING METHOD **Direct Push**	START-FINISH DATE **3/30/16-3/31/16**

CASING MAT. / DIA. **PVC / 2"**
SCREEN: TYPE **Slotted** MAT **2" PVC** TOTAL LENGTH **15 ft** DIA. **0.010"** SLOT SIZE **10**

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GW DATE
	271.90	**271.90**	**255.4/240.4**	**256.63**	**4/9/16**



Visual Description

Asphalt

CLAY (CL) yellowish brown, trace sand and organics, stiff, low plasticity, moist

SILTY SAND (SM) grayish brown, medium to coarse grained, with gravel, med-density, moist

SAND WITH SILT (SP-SM) brownish yellow, medium grained with gravel, medium density, moist

CLAY (CL) Dark grayish green clay, med stiff, moderate plasticity, moist

Analytical Sample Number	Interval	OVA Headspace Values (ppm)
		2
		1.3
		3.6
		3.4
		3.4
		4.4
		3.6
		3.5
		3.3
		3.8
		5.8
		5.1
		4.8
		4.8
		4.8
		4.8

WELL CONSTRUCTION LOG JBA RI 2016 SWMU56 SWMU66.GPJ ENV LOG #1.GDT 1/3/17

Grout*** = 95 lbs Portland Cement to 5 lbs Bentonite to 8 gallons of water

Bay West
5 Empire Drive
St. Paul, MN 55103
Telephone: 1-800-279-0456
Fax: 651-291-0099

Customer-Focused Environmental & Industrial Solutions

Page **1** of **1**

WELL CONSTRUCTION LOG

BOREHOLE LOCATION SKETCH MAP

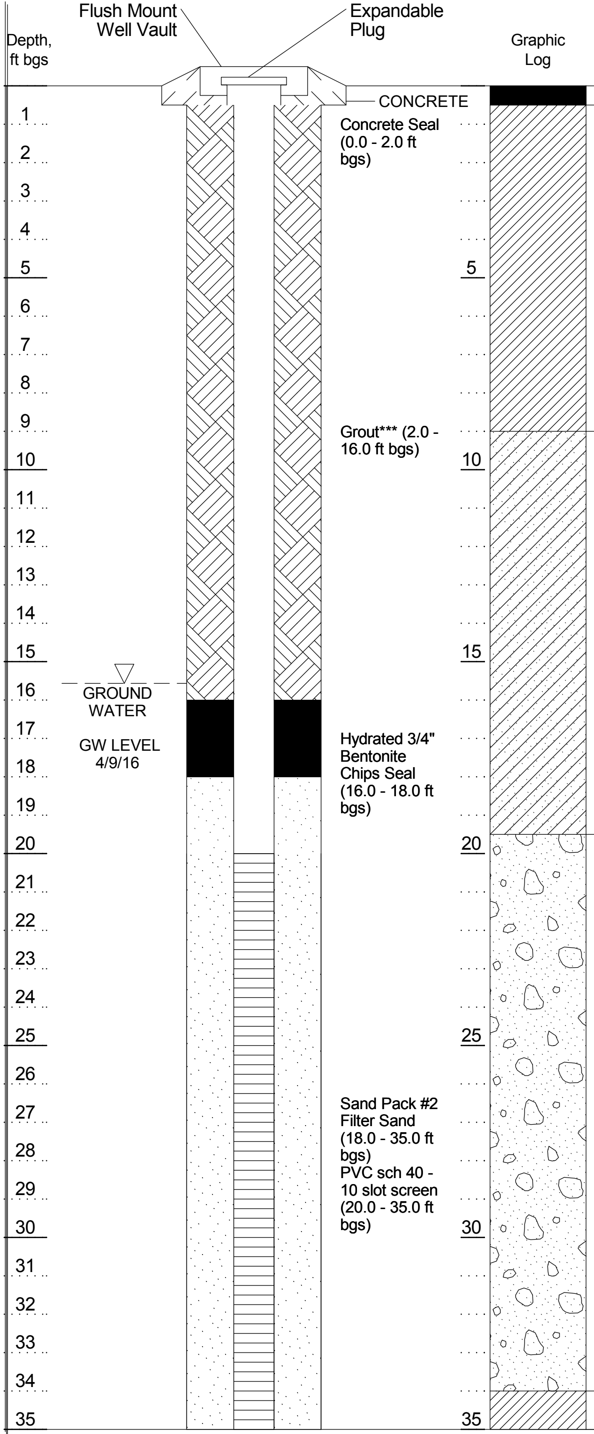
N

See Figure

BOREHOLE NO. **SWMU56-MW02**			
PROJECT NO. / NAME **J140588 / SWMU56 Remedial Action**	LOCATION **SWMU56** **Joint Base Andrews, MD**		
APPROVED BY **Josh Miller**			
DRILLING CONTRACTOR / DRILLER **Vironex / Kyle Schultz**	LOGGED BY **John Peper**		
DRILLING EQUIPMENT / METHOD **GeoProbe / Hollow Stem Auger**	SIZE / TYPE OF BIT **8 in**	SAMPLING METHOD **Direct Push**	START-FINISH DATE **3/29/16-3/30/16**

CASING MAT. / DIA.: **PVC / 2"**
SCREEN: TYPE **Slotted** MAT. **2" PVC** TOTAL LENGTH **15 ft** DIA. **0.010"** SLOT SIZE **10**

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GW DATE
	271.09	**271.09**	**251.09/236.09**	**255.52**	**4/9/16**



Visual Description	Analytical Sample Number	Interval	OVA Headspace Values (ppm)
Asphalt CLAY (CL) Yellowish brown Clay, trace sand, low plasticity, moist			4
			5.4
			4.3
			3.3
CLAYEY SAND (SC) Light brownish gray clayey sand, fg-mg, dense, moist			3.3
			4.6
			4.8
			6.3
			4.4
			2.1
GRAVELLY SAND (SPG) Yellow gravelly sand, medium-coarse grained, med-density, wet			4
			3.5
			4.5
			4.2
			2.6
			2.6
CLAY (CL) Dark grayish green clay, med stiff, moderate plasticity, moist			2.6

`Grout*** = 95 lbs Portland Cement to 5 lbs Bentonite to 8 gallons of water`

Bay West
Customer-Focused Environmental & Industrial Solutions

Bay West
5 Empire Drive
St. Paul, MN 55103
Telephone: 1-800-279-0456
Fax: 651-291-0099

Page 1 of 1

WELL CONSTRUCTION LOG

BOREHOLE LOCATION SKETCH MAP

N

See Figure

BOREHOLE NO. **SWMU56-MW03**

PROJECT NO. / NAME **J140588 / SWMU56 Remedial Action**

LOCATION **SWMU56**
Joint Base Andrews, MD

APPROVED BY **Josh Miller**

DRILLING CONTRACTOR / DRILLER **Vironex / Kyle Schultz**

LOGGED BY **John Peper**

DRILLING EQUIPMENT / METHOD **GeoProbe / Hollow Stem Auger**

SIZE / TYPE OF BIT **8 in**

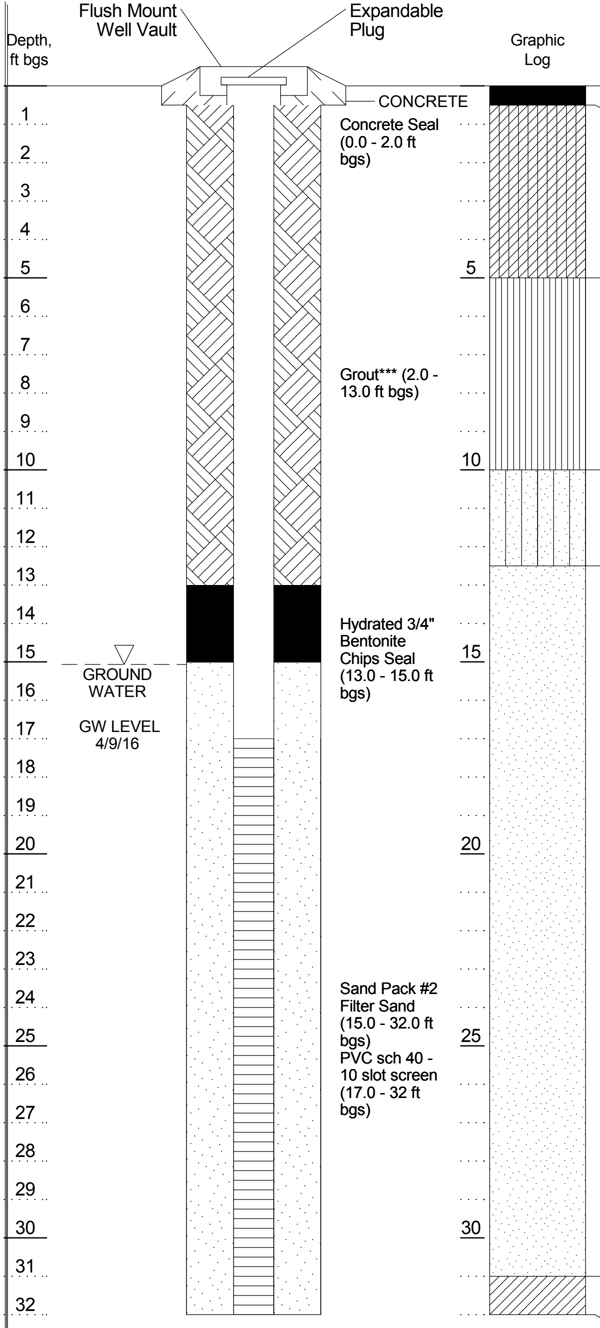
SAMPLING METHOD **Direct Push**

START-FINISH DATE **4/1/16-4/2/16**

CASING MAT. / DIA. **PVC / 2"**

SCREEN: TYPE **Slotted** MAT **2" PVC** TOTAL LENGTH **15 ft** DIA. **0.010"** SLOT SIZE **10**

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GW DATE
	270.32	**270.32**	**253.32/238.32**	**255.25**	**4/9/16**



Visual Description

Asphalt

SILTY CLAY (CL-ML) Yellow brown silty clay, organics, moderate plasticity, stiff, moist

SILT (ML) Gray silt, medium stiff, moist

SILTY SAND (SM) Silt and sand, gray, medium grained, dense, moist

SAND (SP) Yellowish brown sand, medium grained, trace silt, medium dense, moist

CLAY (CL) Dark grayish green clay, med stiff, moderate plasticity, moist

Analytical Sample Number	Interval	OVA Headspace Values (ppm)
		0.5
		0.7
		1
		0.4
		0.7
		0.7
		1.7
		1.7
		2
		1.7
		2.7
		2.7
		2.6
		2.6
		2.6
		2.6

Grout*** = 95 lbs Portland Cement to 5 lbs Bentonite to 8 gallons of water

Customer-Focused Environmental & Industrial Solutions
Bay West
5 Empire Drive
St. Paul, MN 55103
Telephone: 1-800-279-0456
Fax: 651-291-0099

Page **1** of **1**

WELL CONSTRUCTION LOG

BOREHOLE LOCATION SKETCH MAP

N

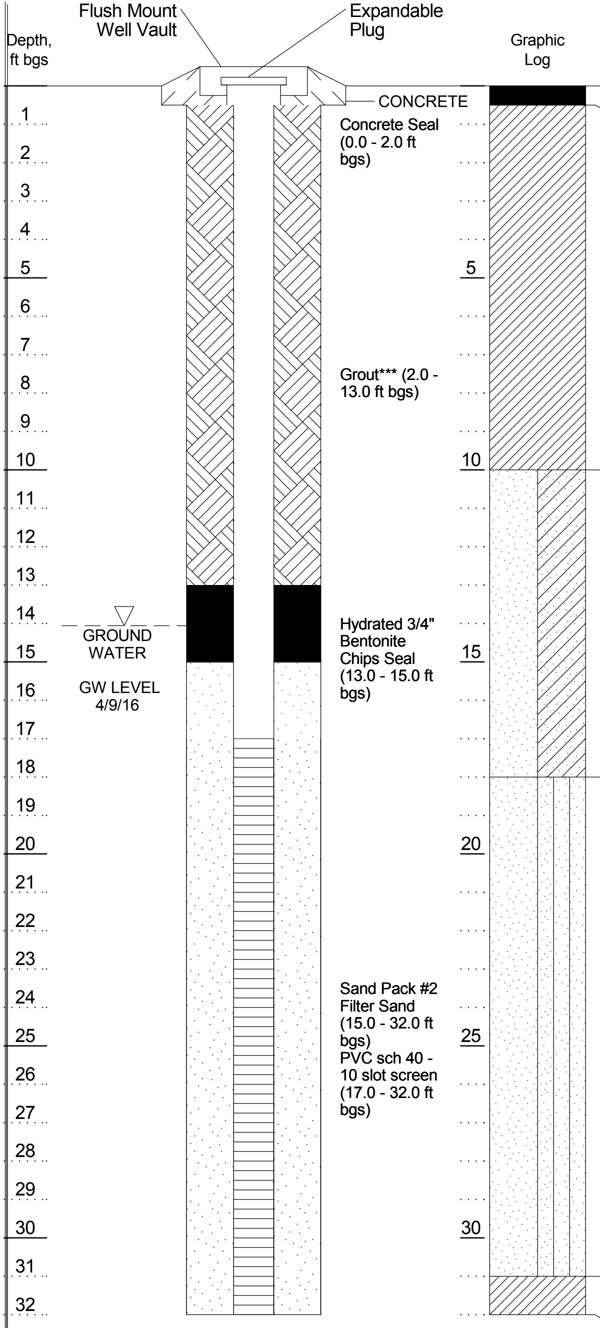
See Figure

BOREHOLE NO. **SWMU56-MW04**			
PROJECT NO. / NAME **J140588 / SWMU56 Remedial Action**	LOCATION **SWMU56** **Joint Base Andrews, MD**		
APPROVED BY **Josh Miller**			
DRILLING CONTRACTOR / DRILLER **Vironex / Kyle Schultz**	LOGGED BY **John Peper**		
DRILLING EQUIPMENT / METHOD **GeoProbe / Hollow Stem Auger**	SIZE / TYPE OF BIT **8 in**	SAMPLING METHOD **Direct Push**	START-FINISH DATE **3/31/16-4/1/16**

CASING MAT. / DIA. **PVC / 2"**

SCREEN: TYPE **Slotted** MAT. **2" PVC** TOTAL LENGTH **15 ft** DIA. **0.010"** SLOT SIZE **10**

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GW DATE
	270.88	**270.88**	**253.88/238.88**	**256.82**	**4/9/16**



Visual Description

Asphalt

CLAY (CL) Yellowish brown Clay, stiff, low plasticity, moist

GRAVELLY SAND WITH CLAY (SP-SC) Gravelly Sand with clay, grayish brown, med coarse grained, dense, moist

SAND WITH SILT (SP-SM) Sand with Silt, brownish yellow, fine grained, med-dense, wet

CLAY (CL) Dark grayish green clay, med stiff, moderate plasticity, moist

Analytical Sample Number	Interval	OVA Headspace Values (ppm)
		1
		1.7
		2
		2.4
		2
		2.1
		1.5
		2.3
		1.5
		1.4
		2.8
		2.9
		2.2
		2.8
		2.6
		2.6

Grout*** = 95 lbs Portland Cement to 5 lbs Bentonite to 8 gallons of water

Bay West
Customer-Focused Environmental & Industrial Solutions

Bay West
5 Empire Drive
St. Paul, MN 55103
Telephone: 1-800-279-0456
Fax: 651-291-0099

BOREHOLE LOCATION SKETCH MAP

N

See Figure

Page **1** of **1**

BOREHOLE NO.
SWMU56-MW05

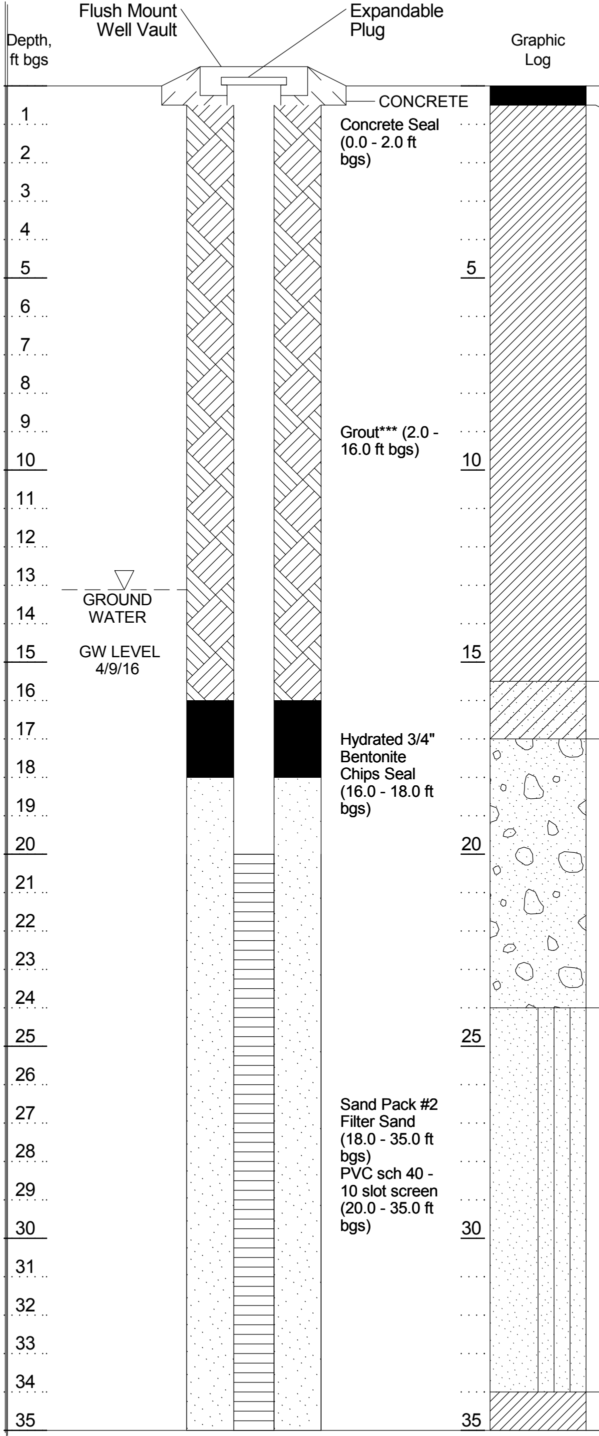
WELL CONSTRUCTION LOG

PROJECT NO. / NAME **J140588 / SWMU56 Remedial Action**	LOCATION **SWMU56**		
APPROVED BY **Josh Miller**	**Joint Base Andrews, MD**		
DRILLING CONTRACTOR / DRILLER **Vironex / Kyle Schultz**	LOGGED BY **John Peper**		
DRILLING EQUIPMENT / METHOD **GeoProbe / Hollow Stem Auger**	SIZE / TYPE OF BIT **8 in**	SAMPLING METHOD **Direct Push**	START-FINISH DATE **3/31/16-4/1/16**

CASING MAT. / DIA.
PVC / 2"

SCREEN:
TYPE **Slotted** MAT **2" PVC** TOTAL LENGTH **15 ft** DIA. **0.010"** SLOT SIZE **10**

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GW DATE
	268.99	**268.99**	**248.99/233.99**	**255.87**	**4/9/16**



Visual Description

Asphalt

CLAY (CL) Dark gray Clay, medium stiff, moist

CLAYEY SAND (SC) Gray clayey sand, med-coarse grained, med-dense, wet

GRAVELLY SAND (SPG) Brownish yellow gravelly sand, med-coarse grained, medium dense, wet

SAND WITH SILT (SP-SM) brownish yellow sand with silt, fine grained, medium dense, wet

CLAY (CL) Dark grayish green clay, med stiff, moderate plasticity, moist

Analytical Sample Number	Interval	OVA Headspace Values (ppm)
		0.5
		2.6
		1.7
		0.7
		0.5
		0.6
		0.6
		0.5
		1.1
		0.8
		0.9
		1
		1.4
		0.7
		0.6
		0.6
		0.6

Grout*** = 95 lbs Portland Cement to 5 lbs Bentonite to 8 gallons of water

Bay West
Customer-Focused Environmental & Industrial Solutions
Bay West
5 Empire Drive
St. Paul, MN 55103
Telephone: 1-800-279-0456
Fax: 651-291-0099

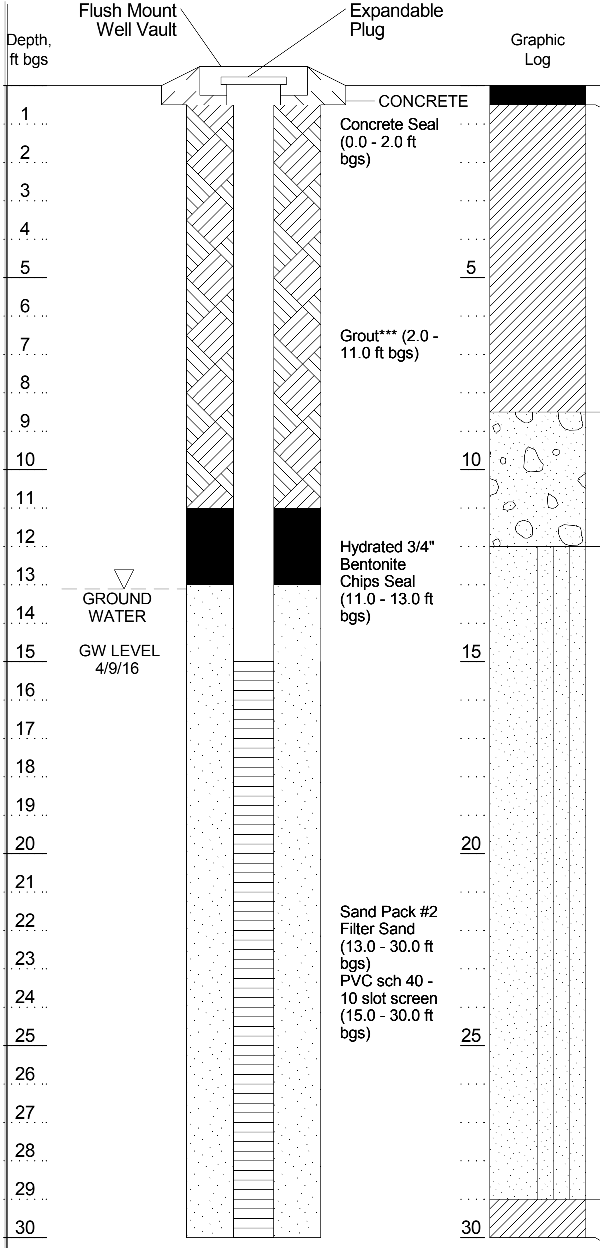
Page **1** of **1**

WELL CONSTRUCTION LOG

BOREHOLE LOCATION SKETCH MAP
N
See Figure

BOREHOLE NO.: **SWMU56-MW06**
PROJECT NO. / NAME: **J140588 / SWMU56 Remedial Action**
LOCATION: **SWMU56**
Joint Base Andrews, MD
APPROVED BY: **Josh Miller**
DRILLING CONTRACTOR / DRILLER: **Vironex / Kyle Schultz**
LOGGED BY: **John Peper**
DRILLING EQUIPMENT / METHOD: **GeoProbe / Hollow Stem Auger**
SIZE / TYPE OF BIT: **8 in**
SAMPLING METHOD: **Direct Push**
START-FINISH DATE: **4/1/16-4/2/16**
CASING MAT. / DIA.: **PVC / 2"**
SCREEN: TYPE **Slotted** MAT **2" PVC** TOTAL LENGTH **15 ft** DIA. **0.010"** SLOT SIZE **10**

ELEVATION OF: (FT.)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GW SURFACE	GW DATE
	268.48	**268.48**	**253.48/238.48**	**255.37**	**4/9/16**



Depth, ft bgs	Visual Description
0	Asphalt
	CLAY (CL) Dark yellowish brown clay, stiff, moist
9	GRAVELLY SAND (SPG) Yellow gravelly sand, med-grained, dense, moist
12	SAND WITH SILT (SP-SM) Yellow sand with silt, medium grained, med-density, moist
29	CLAY (CL) Dark grayish green clay, med stiff, moderate plasticity, moist

Analytical Sample Number

Interval	OVA Headspace Values (ppm)
0-2	2.1
2-4	1.5
4-6	0.9
6-8	0.9
8-10	0.8
10-12	0.8
12-14	1.2
14-16	1.5
16-18	1.8
18-20	1.3
20-22	1.1
22-24	1.4
24-26	1.1
26-28	1.1
28-30	1

WELL CONSTRUCTION LOG JBA RI 2016 SWMU56 SWMU66.GPJ ENV LOG #1.GDT 1/3/17

Grout*** = 95 lbs Portland Cement to 5 lbs Bentonite to 8 gallons of water

CALLED
2/22/16
1101 HRS

DEPARTMENT OF THE AIR FORCE
744TH COMMUNICATIONS SQUADRON (AFDW)
JOINT BASE ANDREWS, MARYLAND 20762-6116

MEMORANDUM FOR CUSTOMER

FROM: 744 CS/SCOW

SUBJECT: Dig Permit Contract

1. Customer acknowledges that the cables were clearly marked. Digging is restricted to hand tools within 3 feet of all marking. Customer must preserve the marks to indicate the location of all communication lines – failure to do so will dissolve this permit. Any damage to the cable or conduit will be the customer's responsibility to repair or replace. Any such repair work will be accomplished within 24 hours of the damage, and will return the infrastructure to its original condition.

2. In addition to the above, airfield permits must be verified by 744 CS/SCOW no later than two weeks prior to any excavation. Contractors must call 301-981-3674 to request this verification.

3. For renewal permits the customer certifies they have maintained all marks; they are agreeing to continue to do so. This is the same requirement as for initial permits.

4. Cables markings are valid for 30 days from the date this letter is signed.

5. This letter supersedes all previous letters of the same subject.

Customer Signature__________ Date 02-25-16

Customer Print Joseph Said Date 02-25-16

SCOW Signature__________ Date 2/25/16

BASE CIVIL ENGINEERING WORK CLEARANCE REQUEST

(Customer's please fill out questions 1-7)

DATE PREPARED 1/1/2016

1. Clearance is requested to proceed with work at SWMU56 – East of Building 3441, West of Pennsylvania Ave

On Work Order no. 0004 Contract No. W9128F-13-D-0002 Involving excavation or utility disturbance per attached sketch. The area ☒ Has ☐ Has not been staked or clearly marked

Dig Permit # 1177

2. TYPE OF FACILITY/WORK INVOLVED

☐ A. PAVEMENTS ☐ D. FIRE DETECTION & PROTECTION SYSTEMS ☐ G. AIRCRAFT OR VEHICULAR TRAFFIC FLOW

☐ B. DRAINAGE SYSTEMS ☐ E. UTILITY ☐ OVERHEAD ☐ UNDERGROUND ☐ H. SECURITY

☐ C. RAILROAD TRACKS ☐ F. COMM ☐ OVERHEAD ☐ UNDERGROUND ☒ I. OTHER

3. DATE CLEARANCE REQUIRED 2/1/2016

4. DATE OF CLEARANCE

5. SIGNATURE OF REQUESTING OFFICIAL (Please print, then sign) John Pepper John Pepper

6. TELEPHONE NO. 651-755-6791

7. ORGANIZATION Bay West / ERP

ORGANIZATION	REMARKS (Use Reverse for additional comments)	REVIEWER'S NAME AND INITIALS
8. BASE CIVIL ENGINEERING A. ELECTRICAL DISTRIBUTION **MUST CALL SHOP FOR COORDINATION 981-3689**	CLEAR [✓ MARKED] NOT CLEAR	25 Feb 16
B. 113TH DCANG (Bldg. 3236 Rm. 129) (IF DIGGING NEAR 113TH DCANG)	[✓ CLEAR] MARKED NOT CLEAR not 113 AREA	Lt MATTHEW Dulle MSD
C. WATER DISTRIBUTION (Bldg. R69)	CLEAR [✓ MARKED] NOT CLEAR	
D. POL DISTRIBUTION (Bldg. 3447)	[✓ CLEAR] MARKED NOT CLEAR	LRP
E. SEWER DESTRIBUTION (Bldg. R69)	CLEAR [✓ MARKED] NOT CLEAR	
F. ENVIRONMENTAL (Bldg. 3466)	[✓ CLEAR] MARKED NOT CLEAR	Steven Richards
G. PAVEMENTS/ GROUNDS (Bldg. 5026)	[✓ CLEAR] MARKED NOT CLEAR	AIC
H. FIRE PROTECTION (Bldg. 3464)	[✓ CLEAR] MARKED NOT CLEAR	
I. ZONE Pathfinder (Bldg. 3537 Rm. 1)	[✓ CLEAR] MARKED NOT CLEAR	
J. INSTALLATION RESTORATION (Bldg. 3466)	CLEAR [✓ MARKED] NOT CLEAR	
9. SECURITY FORCES (Bldg. 1602)		
10. SAFETY (Bldg. 1500 Rm. 2700)	Clear	
11. COMMUNICATIONS (Bldg. 1539 Rm. 23)	CLEAR [✓ MARKED] NOT CLEAR	SSgt 2/22
12. BASE OPERATIONS (Bldg. 1220 Rm. 143)IF DIGGING ON THE AIRFIELD)		
13. Miss Utility 1-800-257-7777	Ticket Number: 16024034	
14. COMMERCIAL UTILITY COMPANY ☒ TELEPHONE ☒ GAS ☐ ELECTRIC	***Customer to accomplish number 8B, 8I, 12, 13. Before turning AF Form 103 Package to 11 CES Customer Service.	

15. OTHER (Specify)

16. REQUESTED CLEARANCE ☐ APPROVED ☐ DISAPPROVED

17. TYPED NAME AND SIGNATURE OF APPROVING OFFICER (Chief of Operations Flight or Chief of Engineering Flight)

MSgt Danel Alvarado

17a. DATE SIGNED 22 Mar 16

AF IMT 103, 19940801, V3

52

2/19/2016

11th Civil Engineering Squadron
Customer Service Office
3465 North Carolina Ave, Room 106
Joint Base Andrews, MD 20762-4803
301-981-5151
11ces.cs@afncr.af.mil

Work Clearance Information Request Form

CONTACT INFORMATION

1. Date Requested	2. Organization/ Contracting Agency
1/1/2016	Bay West, LLC

3. Requestor's Last First, MI	4. Requestor's Phone	5. Requestor's E-mail
Peper John, D	651-755-6781	jpeper@baywest.com
6. COR/Project Manager's Last First, MI	7. COR/PM Phone	8. COR/PM E-mail
David Connolly	301-981-1653	david.connolly.2@us.af.mil

DIG SITE INFORMATION

9. Permit Type:	9a. If renewal, please include expiring dig permit number
☒ Initial ☐ Renewal	N/A

10. Dig Site Location

Fenced in Lot, East of Building 3441 and West of Pennsylvania Ave

11. Is the site on the airfield?	12. Is the site in a restricted area?	13. Is this site a 113 DCANG Area? (See page 3)
☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
14. Miss Utility Ticket Number	15. Work Order Number	16. Project/Contract Number
	N/A	W9128F-13-D-0002 DO#0004

DESCRIPTION OF WORK

17. Detailed Description of work and purpose of dig permit

In support of Joint Base Andrews Environmental Restoration Program SWMU 56, multiple Monitoring wells, Soil Borings, and sediment samples shall be completed to a depth of approximately 30 feet below grade surface within the Base boundaries denoted on the attached Figure. Work is to be completed in February 2015. Once work is completed, borings and surface disturbances shall be restored to original condition. Wells shall be installed and maintained according to Federal, State, and Local regulations

18. Is trenching needed?	18a. To what depth?	19. Is boring needed?	19a. To what depth?
☐ Yes ☒ No	N/A	☒ Yes ☐ No	Approx 30 feet

20. Will trenching cross any streets?	20a. Which streets:	21. Will cranes or aerial equipment be used?
☐ Yes ☒ No	N/A	☐ Yes ☒ No
22. Is hand digging Necessary?	22a. What will be the hand digging depth?	22b. Will there be left over soil?
☐ Yes ☒ No	N/A	☐ Yes ☒ No

23. Existing Lines (renewals only)

☐ Preserved ☐ Needs to be remarked (please specify which lines in additional comments)

24. Additional Comments:

CREATING A RENEWAL DIG PERMIT REQUEST

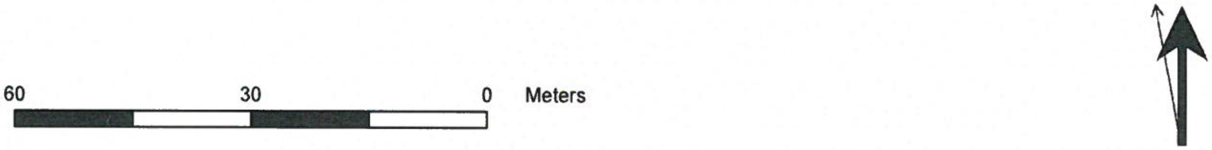
1. You must submit an initial dig permit if you answer yes to any of the following statements
   a. I need to expand my digging area from where I originally requested.
   b. I need all the lines remarked.
   c. My dig permit has expired past the 30 calendar day window.
2. If you answered no to all the questions above proceed with a renewal.
3. Complete and Sign a new Work Clearance Information Request Form
   a. You must acquire a new Miss Utility Ticket number and update any changed information.
4. You must use the same map from your original request.

THINGS TO KEEP IN MIND BEFORE DIGGING

- Dig Permits are only valid for 30 Calendar days from the date listed in the AF Form 103 block 17a
- Boring under roads and sidewalks is the base preferred method of Digging
- Any cutting or digging across roadways must be approved by the CE Contracting Office. If approved, patching/repairing must be in accordance with specifications and drawings as outlined by the contracting office.
- Customer Service Office will call the contractor/requester when the dig permit process has been completed.
- All lines marked in the proposed digging area must be maintained, even while the permit is still processing.
- For the initial process we require that you submit the permit no later than 21 calendar days before your estimated dig date. It is recommended that initial requests be submitted 30 calendar days before the estimated dig date. Inclement weather may increase processing time.
- For the renewal process we require that you submit the renewal 7 calendar days prior to its expiration date. It is recommended that requests for renewals be submitted 10 business days prior to the 30 calendar day expiration mark. Inclement weather may increase processing time.
- If you suspect or have hit/cut/damaged/uncovered any utility lines, immediately stop all work and contact CE Customer Service.
- CE will conduct periodic inspections to ensure compliance with current standards.

113 DC ANG AREAS

811	1217	1225	1226	1228	1234	1237	1238	2490	2493	2496	2498
3000	3001	3002	3004	3029	3030	3031	3032	3033	3040	3106	3108
3109	3110	3111	3112	3113	3114	3116	3119	3120	3121	3212	3213
3214	3215	3216	3217	3218	3222	3227	3236	3252	3282	4962	4963
4972	R-60	R-61	R-62	R-70	R-72	R-73					



DEPARTMENT OF THE AIR FORCE

Air Force District of Washington

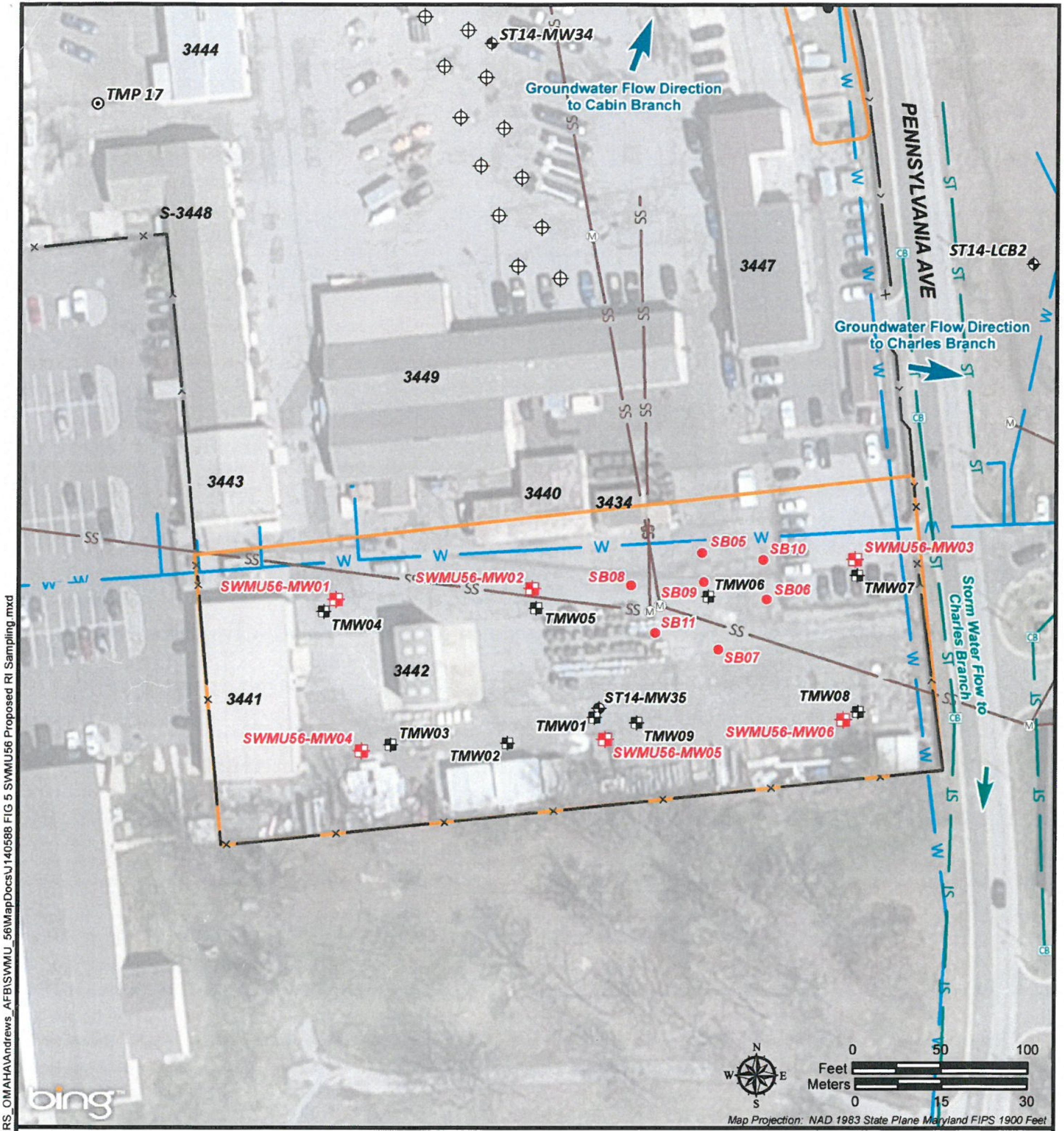
Digging Permit

JOINT BASE ANDREWS NAVAL FACILITY WASHINGTON

JOINT BASE ANDREWS, MARYLAND

SCALE 1 inch = 50 feet

MAP NO. G-TAB



Existing Features

3449	Building Number
× —	Fence
W	Watermain
SS —	Sanitary Sewer
ST —	Storm Sewer
Ⓜ	Manhole
CB	Catch Basin
⊕	ST-14 Monitoring Well
⊕	ST-14 Injection Well
⊙	ST-14 Temporary Monitoring Point
▭	SWMU 56

Phase I RI Investigation

⊞	Temporary Monitoring Well
●	Soil Boring

Proposed Features

⊞	Monitoring Well
●	Soil Boring
▲	Surface Water/Sediment Sample

Figure 5

Proposed RI Sampling
SWMU 56 Phase I RI

Joint Base Andrews
Camp Springs, Maryland

Bay West
Customer-Focused Environmental & Industrial Solutions

Drawn By: M.L. Date Drawn/Revised: 8/18/2015 Project No. J140588

Y:\Clients\US_ARMY_CORP_OF_ENGINEERS_OMAHA\Andrews_AFB\SWMU_56\MapDocs\J140588 FIG 5 SWMU56 Proposed RI Sampling.mxd

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-11

PROJECT J140588-0005

Inspector J. Pepper

SHEET 2 OF 2 SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		0-.5' Asphat					
	1		1.5				
	2	.5-4.5' sandy clay, gray					
		cohesive (slight), dry,	1.7				
	3	med-stiff, no odor					
	4						
	5	4.5-9 silty clay, yellow-brown, moist, cohesive, stiff, no odor	1.9				
	6						
	7		1.7				
	8						
	9	9-11 clay, gray, stiff	1.7				
	10	moist, cohesive, no odor					
	11						

Project J140588-0005

HOLE NO. SB-11

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-10

PROJECT J140588.0005

Inspector J. Peper

SHEET OF SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		0-.5' Asphalt					
	1	.5-4.[illegible] Sandy silt	1.3				
	2	some gravel ~5%, dry	—				
	3	no odor, med-stiff	1.4				
	4	4-9.5 silty clay Gray-	—				
	5	Yellow, slight moist,	1.7				
	6	stiff, no odor	—				
	7		1.5				
	8	9.5-11 silty clay, gray	—				
	9	stiff, moist, no odor					
	10		1.7				
	11		—				

Project J140588-0005

HOLE NO. SB-10

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-09

PROJECT J140588.0005

Inspector J. Peper

SHEET OF SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		0-.5' Asphalt					
	1		3.0				
	2	.5-4' sandy silt, gray med-stiff, dry, non-cohesive, no odor	–				
	3		4.8				
	4		–				
	5	4-9.5 silty clay, yellow brown, slight moist cohesive, stiff, no odor	8.1				
	6		–				
	7		4.1				
	8		–				
	9						
	10	9.5-11 sandy silt, gray stiff, moist, no odor.	2.7				
	11		–				

Project J140588.0005

HOLE NO. SB-09

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-08

PROJECT J140588.0005

Inspector J. Peper

SHEET 2 OF 2 SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
	1	0-.5 Asphalt	1.4				
	2	0.5-4' gravelly silt, gray med-stiff, non-cohesive no odor, dry					
	3		1.7				
	4						
	5	4-8.5' clay, Yellow-brown, moist, stiff, no odor, cohesive	1.6				
	6						
	7		1.5				
	8	8.5-11 silty clay, gray stiff, moist, no odor, cohesive.					
	9		1.9				
	10						
	11						

Project J140588.0005

HOLE NO. SB-08

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-07

PROJECT J140588.0005

Inspector J. Peper

SHEET 2 OF 2 SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		0-.5 Asphalt.					
	1		1.2				
	2	.5-3' gravelly silt, med-stiff gray, dry, no-odor non-cohesive					
	3		1.6				
	4						
	5	3-8' sandy clay, yellowish brown, slight moist very stiff	1.4				
	6						
	7		1.2				
	8	8-11' silty clay, gray very stiff, moist no odor					
	9						
	10		1.2				
	11						

Project J140588.0005

HOLE NO. SB-07

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-06

PROJECT JI40588

Inspector J. Peper

SHEET 2 OF 2 SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		0-.5 Asphalt					
	1	.5-4' sandy-gravelly silt medium stiff, dry no odor, non-cohesive	1.7				
	2						
	3		2.4				
	4	4-8.5' silty clay, yellow brown, moist, stiff no odor	3.2				
	5						
	6						
	7		1.8				
	8	8.5-11' sandy silty clay, gray, cohesive, moist no odor					
	9		3.2				
	10						
	11						

Project JI40588.0005

HOLE NO. SB-06

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE SB-05

PROJECT J140588.0005

Inspector J. Peper

SHEET 2 OF 2 SHEETS

ELEV. a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR COREBOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.
		0-.5 Asphalt					
	1		2.1				
		.5-3.5 sandy/gravelly silt					
	2	med-stiff, dry, no odor	1.7				
	3	non-cohesive					
	4	3.5-9 silty clay, yellowish					
	5	dark brown, slight moist,	4.0				
	6	stiff, no odor					
	7	9-11 sandy silt, gray	3.2				
	8	stiff, slight moist					
		no odor					
	9						
			2.9				
	10						
	11						

Project J140588.0005

HOLE NO. SB-05

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

WELL DEVELOPMENT LOG

Project: J140588.0005 SWMU56 RI
Well No: SWMU56-MW01
Project No: J140588.0005
Date: 4/1/16

WELL MEASUREMENTS

Well inside diameter: 2 in ft.
Depth of well casing: 31.17 ft.
Initial water level: 15.30 ft. below MP
Measuring point (MP): marked → North side
Fluid well casing volume: 2.54 gal.
Air temperature: 60°F
Weather conditions: Cloudy, breezy 5-10 mph, Rain

SAMPLING MEASUREMENT

DISCHARGE

Water level (ft. BMP)	15.30		15.41		15.68		15.75				15.91
Time	930		945		1000		1020				1045
Dicharge (Gal.)	1		8		15		22				30

WATER QUALITY DATA

pH	5.01		4.97		4.94		4.92				4.90
Conductivity (μMHOS/cm	0.522		0.540		0.567		0.584				0.595
Temperature (ºC)	13.80		13.71		13.68		13.65				13.66
Turbidity (NTUs)	604.1		314.2		54.1		19.2				7.4
Color	dark		cloudy		cloudy		clear				clear
Odor	None		None		None		None				None

Total discharge: 30 gallons
Casing volumes removed: 5+
Method of disposal of discharged water: Drums → disposed of off site.

31.17 total depth
− 15.30 depth to water
15.87 water column
× .16
2.54 gals
× 5
12.7 gals → 5 well vols.

QUALITY ASSURANCE

Sampling Method: Bailer / submersiable pump
Method to measure water level: Electric WL meter Solinst
Bailer ropes new or cleaned? new
pH meter no: YSI Calibrated: Daily
Conductivity meter no. YSI Calibrated: Daily
Comments: No tubing left in place, very dark to start but then cleared up.

1 ft³ = 7.481 gals

12.7 gals
+ 7.49 gals
20.19 gals

$\pi(.25ft)^2 = 0.19625\ ft^2 \times 17\ ft = 3.34\ ft^3 \times .30$ porosity $= 1.0008\ ft^3 \times \frac{7.481\ gals}{1\ ft3}$

15 ft screen sand pack
+ 2 ft above screen
17 ft sand Annulus.

= 7.49 gals in Annulus

WELL DEVELOPMENT LOG

Project: SWMU 56 RI
Well No: SWMU56-MW02
Project No: 5140588.0005
Date: 4/1/16

WELL MEASUREMENTS

Well inside diameter: 2 in ft.
Depth of well casing: 35.18 ft.
Initial water level: 15.51 ft. below MP
Measuring point (MP): marked North side
Fluid well casing volume: 3.147 gal.
Air temperature: 60°F
Weather conditions: Cloudy, wind 5-10 mph., Rain

SAMPLING MEASUREMENT

	x			x			x				x
DISCHARGE Water level (ft. BMP)	15.51			15.57			15.59				15.62
Time	800			825			855				915
Dicharge (Gal.)	1			11			22				33

WATER QUALITY DATA

pH	5.41			6.49			6.61				6.72
Conductivity (µMHOS/cm	.551			.302			.271				.251
Temperature (ºC)	11.71			11.21			11.07				11.02
Turbidity (NTUs)	814.1			101.9			13.2				5.2
Color	dark			cloudy			clear				clear
Odor	None			None			None				None

Total discharge: 33 gals
Casing volumes removed: 5 +
Method of disposal of discharged water: Drums → disposed of off site.

QUALITY ASSURANCE

Sampling Method: Bailer, submersible Pump.
Method to measure water level: Solonist water level meter
Bailer ropes new or cleaned? New
pH meter no: YSI
Calibrated: Daily
Conductivity meter no. YSI
Calibrated: Daily
Comments: N) tubing left in place
Very dark to start → very clear to end.

35.18 total depth
-15.51 depth to water
19.67
x .16
3.147 gals → 1 well vol.
x 5
$\boxed{15.74 \rightarrow 5 \text{ well vols.}}$

15.74 gals
+ 7.49 gals
$\boxed{23.23 \text{ gals}}$

$\pi (.25\,ft)^2 = 0.19625\,ft^2 \times 17\,ft = 3.34\,ft^3 \times .30 \text{ porosity} = 1.0008\,ft^3 \times \frac{7.481 \text{ gals}}{1\,ft^3} = \boxed{7.49 \text{ gals in Annulus}}$

15 ft screen pack + 2 ft above

WELL DEVELOPMENT LOG

Project: Swmu 56 RI
Project No: J140588.0005
Well No: Swmu 56 - MW03
Date: 4/3/16

WELL MEASUREMENTS

Well inside diameter: 2 in ft.
Depth of well casing: 32.20 ft.
Initial water level: 14.80 ft. below MP
Measuring point (MP): marked north side
Fluid well casing volume: 2.78 gal.
Air temperature: 40°F
Weather conditions: windy 10-20 mph

SAMPLING MEASUREMENT

DISCHARGE

	x			x			x				x
Water level (ft. BMP)	14.85			15.04			15.11				15.15
Time	1330			1400			1425				1450
Dicharge (Gal.)	1			10			20				30

WATER QUALITY DATA

pH	8.11			7.15			6.21				6.01
Conductivity (µMHOS/cm	.640			.551			.542				.540
Temperatúre (°C)	14.15			14.51			14.77				14.80
Turbidity (NTUs)	771.2			128.7			31.6				4.6
Color	dark			cloudy			clear				clear
Odor	No			No			No				No

Total discharge: 30 gals
Casing volumes removed: 5+
Method of disposal of discharged water: Drums off site

QUALITY ASSURANCE

Sampling Method: YSI, bailer, submersible Pump
Method to measure water level: Solonist 100 wl meter
Bailer ropes new or cleaned? new
pH meter no: YSI
Calibrated: Daily
Conductivity meter no. YSI
Calibrated: Daily
Comments: no tubing left.

32.20
-14.80
17.40 gals
× .16
2.78 well vol.
× 5
13.92 5x well volum

13.92
+ 7.49
21.41

$\pi(.25\,ft)^2 = 0.1960\ ft^2 \times 17\ ft = 3.34\ ft^3 \times .30$ porosity $= 1.0008\ ft^3 \times \frac{7.481}{1\ ft^3}$

= 7.49 gals in Annulus.

WELL DEVELOPMENT LOG

Project: SWMU56 RI
Well No: SWMU56-MW04
Project No: J140588.0005
Date: 4/1/16

WELL MEASUREMENTS

Well inside diameter: 2 in ft.
Depth of well casing: 31.49 ft.
Initial water level: 14.10 ft. below MP
Measuring point (MP): marked North side
Fluid well casing volume: 2.78 gal.
Air temperature: 60°F
Weather conditions: cloudy, Rain, wind 5-10 mph

SAMPLING MEASUREMENT

DISCHARGE

	X			X			X				X
Water level (ft. BMP)	14.10			14.48			14.51				14.55
Time	1130			1155			1220				1245
Dicharge (Gal.)	1			10			20				30

WATER QUALITY DATA

pH	8.21			7.31			6.70				6.65
Conductivity (μMHOS/cm	.667			.702			.732				.739
Temperature (ºC)	14.20			14.24			14.30				14.31
Turbidity (NTUs)	800.3			72.1			9.7				3.1
Color	dark			cloudy			clear				clear
Odor	None			None			None				None

Total discharge: 30 gallons
Casing volumes removed: 5+
Method of disposal of discharged water: Drums → disposed off off site.

QUALITY ASSURANCE

Sampling Method: YSI, bailer, submersiable Pump
Method to measure water level: Solinst 101 water level meter
Bailer ropes new or cleaned? new
pH meter no: YSI
Calibrated: Daily
Conductivity meter no. YSI
Calibrated: Daily
Comments: Very dark sediment rich to start, used bailer to removed much sed. no tubing left in place.

31.49
-14.10
17.39
x .16
2.78 gals → well vol
x 5
$\boxed{13.91 \text{ gals} \rightarrow 5 \text{ well vols.}}$

13.91 5 well vols
+ 7.49 Annulus
$\boxed{21.40 \text{ gals}}$

$$\pi(.25\,ft)^2 = 0.19625\,ft^2 \times 17\,ft = 3.34\,ft^3 \times .30 \text{ porosity} = 1.0008\,ft^3 \times \frac{7.481 \text{ gals}}{1\,ft3}$$

15 + 2 screen pack

$\boxed{= 7.49 \text{ gals in Annulus}}$

WELL DEVELOPMENT LOG

Project: SWMU56 RI
Well No: SWMU56-MW05
Project No: J1405846.0005
Date: 4/3/16

WELL MEASUREMENTS

Well inside diameter: 2 in ft.
Depth of well casing: 35.40 ft.
Initial water level: 12.81 ft. below MP
Measuring point (MP): marked North side
Fluid well casing volume: 3.61 gal.
Air temperature: 40°F
Weather conditions: 40°F wind 10-20 mph

SAMPLING MEASUREMENT

DISCHARGE

	x			x			x				x
Water level (ft. BMP)	12.85			13.02			13.21				13.25
Time	1200			1225			1250				1315
Dicharge (Gal.)	1			10			20				30

WATER QUALITY DATA

pH	6.02			5.71			5.58				5.51
Conductivity (µMHOS/cm	.441			.470			.471				.471
Temperature (°C)	17.21			17.39			17.53				17.59
Turbidity (NTUs)	709.2			101.9			21.6				1.2
Color	Dark			cloudy			cloudy				clear
Odor	NO			NO			NO				NO

Total discharge: 30 gallons
Casing volumes removed: 5+
Method of disposal of discharged water: Drums off site.

QUALITY ASSURANCE

Sampling Method: YSI, bailer, Submersible Pump.
Method to measure water level: Solinst 101 water level meter
Bailer ropes new or cleaned? New
pH meter no: YSI
Calibrated: Daily
Conductivity meter no. YSI
Calibrated: Daily
Comments: no tubing left in well.

35.40
− 12.81
22.59
× .16
3.61 gal → well vol.
× 5
18.07 gals → 5x well vol.

18.07 gal
+ 7.49 gal
$\boxed{25.56 \text{ gal}}$

$\pi(.25ft)^2 = 0.1960\,ft^2 \times 17\,ft = 3.34\,ft^3 \times .30$ porosity $= 1.0008\,ft^3 \times \frac{7.481 \text{ gals}}{1\,ft^3}$

$= 7.49$ gals in Annulus

15 well screen
2 filter pack

WELL DEVELOPMENT LOG

Project: SWMU 56 RI
Project No: J140584.005
Well No: SWMU56 - MW06
Date: 4/8/16

WELL MEASUREMENTS

Well inside diameter: 2 in ft.
Depth of well casing: 29.61 ft.
Initial water level: 13.20 ft. below MP
Measuring point (MP): marked, north side
Fluid well casing volume: 2.63 gal.
Air temperature: 40°F
Weather conditions: wind 10-20mph, cloudy

SAMPLING MEASUREMENT

DISCHARGE

	X			X			X				X
Water level (ft. BMP)	13.01			13.28			13.30				13.31
Time	1000			1030			1055				1120
Dicharge (Gal.)	1			10			20				30

WATER QUALITY DATA

pH	4.31			5.52			5.83				6.01
Conductivity (µMHOS/cm	301			.278			.255				.252
Temperature (ºC)	14.42			14.51			14.62				14.68
Turbidity (NTUs)	390.6			78.5			13.6				7.2
Color	dark			cloudy			clear				clear
Odor	None			None			None				None

Total discharge: 30 gallons
Casing volumes removed: 5+
Method of disposal of discharged water: Drums → disposal off site

QUALITY ASSURANCE

6920 V2

Sampling Method: YSI, bailer, submersible pump.
Method to measure water level: Solinst 101 water level meter
Bailer ropes new or cleaned? new
pH meter no: YSI 6920 V2
Calibrated: Daily
Conductivity meter no. YSI 6920 V2
Calibrated: Daily
Comments: very dark to start
no tubing left in place.

29.61 ft
− 13.20 ft
16.41 ft
x .16
2.63 gals → 1 well vol.
x 5
$\boxed{\text{13.13 gallons → 5x well vol}}$

13.13 gals
+ 7.49 gals
$\boxed{\text{20.62 gals}}$

$\pi(.25\text{ft})^2 = .1960\text{ ft}^2 \times 17\text{ ft} = 3.34\text{ ft}^3 \times .30\text{ porosity} = 1.0008\text{ ft}^3 \times \frac{7.481\text{ gal}}{1\text{ ft}^3}$

$\boxed{= \text{7.49 gals in Annulus}}$

15 ft screen
2 ft above screen

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU56

PROJECT NO. ~~J110202~~ J140588

SAMPLE NAME: SWMU56-MW01-GW02

WELL NO. MW-01

DATE: 4-9-16

SAMPLE TIME: 1550

PERSONNEL: HM

SAMPLE METHOD: bladder

SAMPLE MEDIA: ● GW ○ Surface Water

SAMPLE QA SPLIT: ☐ YES ☒ NO SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: ☐ YES ☒ NO DUPLICATE SAMPLE NO.

MS/MSD REQUESTED ☒ YES ☐ NO → FOR ALL PARAMETERS

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

21 bottles total

	Sample Container	Preservative	Analysis Requested
☐	Field Parameters Only	HCL	VOCs
☒	40 mL VOA Vial x9	HCL	VOCs
☒	~~250 mL Poly x1~~ 1 L Amber x4	None	~~Anions/Alkalinity~~ Herbicides
☒	500 ~~250~~ mL Poly x2	~~Zn Acetate/NaOH~~ HNO3	~~Sulfide~~ Diss Metals - field filtered
☒	~~250 Amber Glass x1~~ 500mL Poly x2	~~H_2SO_4~~ HNO3	~~TOC~~ Total Metals
☒	1 L Amber Glass x4	None	~~PCBs~~ PAHs

WELL PURGING DATA

Date: 4-9-16

Time Started: 1419

Time Completed: 1549

PID Measurements

Background	0.0
Breathing Zone	0.0
Well Head	0.0

YSI Reading Interval= 5 min

WELL DIAM (in): 2

Well Depth (ft. BTOC): 31.42

Depth to Water (ft BTOC): 15.40

Water Column Length: 15.60

Volume of Water in Well (liters): 9.44

Fill Cycle (sec): 15

Discharge Cycle (sec): 5

Purge Rate (liters/min): 0.25

Level of Drawdown (ft. BTOC): 0.53

Amount Purged (liters): 21.5

Pump Intake Depth: ~25.50

FIELD MEASUREMENTS

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.

3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Ferrous Fe= 0.19 mg/L + no dilution

Dissolved Mn= 0.8 mg/L

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
1424	1.25	5.04	13.36	0.501	NA	4.53	258.8	414.1	15.90
1429	2.5	5.09	13.63	0.508	↓	2.44	251.1	457.9	15.90
1434	3.75	5.07	13.89	0.515		1.46	248.9	360.5	15.90
1439	4.0	5.05	13.75	0.546		1.16	247.1	201.7	15.90
1444	5.25	5.04	13.85	0.568		1.03	246.3	130.1	15.90
1449	6.5	5.03	13.88	0.574		0.95	246.1	92.6	15.91
1454	7.75	4.99	13.86	0.587		0.85	248.4	74.3	15.91
1459	9.0	4.98	13.95	0.591		0.79	250.3	59.9	15.91
1504	10.25	4.95	13.88	0.590		0.74	251.2	50.2	15.91
1509	11.5	4.94	13.90	0.592		0.70	249.7	46.4	15.92
1514	12.75	4.92	13.83	0.592		0.68	248.6	40.0	15.92
1519	14.0	4.91	13.66	0.593		0.68	249.5	38.1	15.92
1524	15.25	4.90	13.78	0.599	↓	0.62	251.1	29.2	15.93

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	6920 V2	daily
Pump	QED MP50	NA
WL Meter	Solinst	NA

GENERAL COMMENTS:

- depth to water following pump placement ≈ 15.35
- install new well tubing & leave in
- pressure= ~20 psi

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU56

PROJECT NO. ~~J110202~~ J140588

SAMPLE NAME: SWMU56-MW01-GW02

WELL NO. MW-01

DATE: 4-9-14

SAMPLE TIME: 1550

PERSONNEL: HM

SAMPLE METHOD: bladder

SAMPLE MEDIA: ● GW ○ Surface Water

SAMPLE QA SPLIT: ☐ YES ☒ NO SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: ☐ YES ☒ NO DUPLICATE SAMPLE NO.

MS/MSD REQUESTED ☒ YES ☐ NO → ALL PARAMETERS

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

	Sample Container	Preservative	Analysis Requested
☐	40 mL VOA Vial x3	HCL	RSK-175
☐	40 mL VOA Vial x3	HCL	VOCs
☐	250 mL Poly x1	None	Anions/Alkalinity
☐	250 mL Poly x1	Zn Acetate/NaOH	Sulfide
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Poly x1	None	DHC

WELL PURGING DATA

see page 1

Date

Time Started

Time Completed

PID Measurements

Background 0.0

Breathing Zone 0.0

Well Head 0.0

YSI Reading Interval= min

WELL DIAM (in):

Well Depth (ft. BTOC)

Depth to Water (ft BTOC)

Water Column Length

Volume of Water in Well (liters)

Fill Cycle (sec)

Discharge Cycle (sec)

Purge Rate (liters/min)

Level of Drawdown (ft. BTOC)

Amount Purged (liters)

Pump Intake Depth

FIELD MEASUREMENTS

Ferrous Fe= mg/L

Dissolved Mn= mg/L

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.

3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
1529	16.5	4.88	13.84	0.598	NA	0.58	251.5	20.1	15.93
1534	17.75	4.88	13.90	0.599	↓	0.57	2526	11.4	15.93
1539	19.0	4.87	13.86	0.599	↓	0.56	253.0	9.7	15.93
1544	20.25	4.86	13.96	0.600	↓	0.56	254.0	9.2	15.93
1549	21.5	4.86	13.84	0.602	↓	0.56	255.1	9.0	15.93

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI		
Pump		
WL Meter		

GENERAL COMMENTS:

see page 1

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU 56

PROJECT NO. ~~JH0202~~ J140588

SAMPLE NAME: SWMU56-MW02-GW01

WELL NO. MW-02

DATE: 4-9-16

SAMPLE TIME: 1340

PERSONNEL: HM

SAMPLE METHOD: ~~[illegible]~~ bladder

SAMPLE MEDIA: ● GW ○ Surface Water

SAMPLE QA SPLIT: ☐ YES ☒ NO

SAMPLE QC DUPLICATE: ☐ YES ☒ NO

MS/MSD REQUESTED ☐ YES ☒ NO

SPLIT SAMPLE NO.

DUPLICATE SAMPLE NO.

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

9 bottles total

	Sample Container	Preservative	Analysis Requested
☐	40 mL VOA Vial x3	HCL	~~RSK-175~~ VOCs
☐	~~40 mL VOA Vial x3~~ 1L AG x2	~~HCL~~ None	~~VOCs~~ PAHs
☐	~~250 mL Poly x1~~ 1L AG x2	None	~~Anions/Alkalinity~~ Herbicides
☐	500 ~~250~~ mL Poly x1	~~Zn Acetate/NaOH~~ HNO_3	~~Sulfide~~ TAL TOTAL Metals
☐	~~250 Amber Glass x1~~ 500mL Poly x1	~~H_2SO_4~~ HNO_3	~~TOC~~ Diss. Metals-field filtered
☐	1 L Poly x1	None	DHC

WELL PURGING DATA

Date 4-9-16

Time Started 1146

Time Completed 1336

PID Measurements

Background	0.0
Breathing Zone	0.0
Well Head	0.0

YSI Reading Interval= 5 min

WELL DIAM (in): 2

Well Depth (ft. BTOC) 35.30

Depth to Water (ft BTOC) 15.65

Water Column Length 19.65

Volume of Water in Well (liters) 11.90

Fill Cycle (sec) ~~[illegible]~~ 15

Discharge Cycle (sec) 5

Purge Rate (liters/min) 0.30

Level of Drawdown (ft. BTOC) 0.10

Amount Purged (liters) 33

Pump Intake Depth ~29.50

FIELD MEASUREMENTS

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Ferrous Fe= 0.05 mg/L *no dilution

Dissolved Mn= 1.7 mg/L

	Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC	
			± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft	
	1151	1.5	5.08	11.09	0.470	NA	3.78	272.8	888.6	15.65	
	1156	3.0	5.54	9.06	0.263		7.58	222.0	121.9	15.65	
	1201	4.5	5.79	7.64	0.146		10.02	216.4	89.1	15.65	
	1206	6.0	6.00	7.28	0.123		10.22	209.3	22.8	15.65	
	1211	7.5	6.27	7.30	0.120		10.80	197.8	18.6	15.65	
	1216	9.0	6.34	7.26	0.102		11.20	178.2	16.9	15.65	
	1221	10.5	6.82	7.42	0.107		11.74	176.0	14.3	15.65	
	1226	12.0	7.49	7.68	0.095		12.31	171.9	19.6	15.65	
	1231	13.5	7.44	7.94	0.092		12.31	174.3	22.0	15.65	
*	1236	15.0	7.43	8.41	0.102		12.19	183.1	28.0	15.65	*
	1251	19.5	6.84	10.03	0.120		11.64	189.1	29.4	15.65	
	1256	21.0	6.74	10.51	0.133		11.32	182.7	27.4	15.65	
	1301	22.5	6.54	11.01	0.165	↓	10.73	185.0	30.3	15.65	

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	6920 V2	daily
Pump	QED MP50	NA
WL Meter	Solinst	NA

GENERAL COMMENTS:

-depth to water following pump placement = 15.65
-install new well tubing
-pressure = ~25 psi

* set up peristaltic pump to purge water from inside well vault - believe rain/surface run off was influencing unstable readings. Water was entering well casing from vault. *

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU 56

PROJECT NO. ~~J110202~~ J140588

SAMPLE NAME: SWMU56-MW02-GW01

WELL NO. MW-02

DATE: 4-9-16

SAMPLE TIME: 1340

PERSONNEL: HM

SAMPLE METHOD: bladder

SAMPLE MEDIA: ● GW ○ Surface Water

SAMPLE QA SPLIT: ☐ YES ☒ NO — SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: ☐ YES ☒ NO — DUPLICATE SAMPLE NO.

MS/MSD REQUESTED ☐ YES ☒ NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

	Sample Container	Preservative	Analysis Requested
☐	40 mL VOA Vial x3	HCL	RSK-175
☐	40 mL VOA Vial x3	HCL	VOCs
☐	250 mL Poly x1	None	Anions/Alkalinity
☐	250 mL Poly x1	Zn Acetate/NaOH	Sulfide
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Poly x1	None	DHC

WELL PURGING DATA

see page 1

Date

Time Started

Time Completed

PID Measurements

Background 0.0

Breathing Zone 0.0

Well Head 0.0

YSI Reading Interval= min

WELL DIAM (in):

Well Depth (ft. BTOC)

Depth to Water (ft BTOC)

Water Column Length

Volume of Water in Well (liters)

Fill Cycle (sec)

Discharge Cycle (sec)

Purge Rate (liters/min)

Level of Drawdown (ft. BTOC)

Amount Purged (liters)

Pump Intake Depth

FIELD MEASUREMENTS

Ferrous Fe= mg/L

Dissolved Mn= mg/L

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
1306	24.0	6.26	11.59	0.176	NA	10.25	195.7	28.8	15.71
1311	25.5	6.12	11.88	0.193		9.84	204.5	27.1	15.75
1316	27.0	5.94	12.16	0.214		8.25	216.9	11.3	15.75
1321	28.5	5.88	12.37	0.238		7.99	224.2	10.2	15.75
1326	30.0	5.74	12.35	0.258		7.90	238.6	9.6	15.75
1331	31.5	5.70	12.49	0.261		7.83	240.6	8.4	15.75
1336	33.0	5.69	12.52	0.265		7.76	243.1	9.0	15.75

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI		
Pump		
WL Meter		

GENERAL COMMENTS:

see page 1

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/SWMU56
PROJECT NO. 110202
SAMPLE NAME: SWMU56-MW03-GW05
WELL NO. MW03
DATE: 4/14/16
SAMPLE TIME: 9:39
PERSONNEL: DB
JP
SAMPLE METHOD: Bladder

SAMPLE MEDIA: ● GW ○ Surface Water
SAMPLE QA SPLIT: ☐ YES ☐ NO
SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: ☐ YES ☐ NO
DUPLICATE SAMPLE NO.
MS/MSD REQUESTED ☐ YES ☐ NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

2

	Sample Container	Preservative	Analysis Requested
☐	40 mL VOA Vial x3	HCL	RSK-175
☐	40 mL VOA Vial x3	HCL	VOCs
☐	250 mL Poly x1	None	Anions/Alkalinity
☐	250 mL Poly x1	Zn Acetate/NaOH	Sulfide
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Poly x1	None	DHC

WELL PURGING DATA

Date 4/14/16
Time Started 8:33
Time Completed 10:17
PID Measurements
Background 0.0
Breathing Zone 0.0
Well Head 0.0

YSI Reading Interval= min

WELL DIAM (in): 2in
Well Depth (ft. BTOC) 32.20
Depth to Water (ft BTOC) ~~15.20~~ 15.07
Water Column Length 17.13
Volume of Water in Well (liters) 53.78 ft3
Fill Cycle (sec) 24.0
Discharge Cycle (sec) 6.0
Purge Rate (liters/min) 200 ml/min
Level of Drawdown (ft. BTOC) 0
Amount Purged (liters) 12.5 Liters
Pump Intake Depth ~~22 ft~~

FIELD MEASUREMENTS

Ferrous Fe= 0.12 mg/L No Dilution
Dissolved Mn= 1.8 mg/L

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
8:39	0.5	8.54	14.30	0.641	N/A	7.59	92.5	55.3	15.07
8:44	1.5	8.22	14.68	0.626		4.73	95.1	66.3	15.07
8:49	2.5	7.80	14.81	0.618		3.94	101.2	66.5	15.07
8:54	3.5	7.54	14.74	0.611		3.54	106.5	54.3	15.07
8:59	4.5	7.11	14.90	0.579		2.94	112.4	47.9	15.07
9:04	5.5	6.62	14.94	0.661		2.39	125.0	24.7	15.07
9:09	6.5	6.21	14.94	0.549		1.93	139.9	18.5	15.07
9:14	7.5	6.00	14.88	0.543		1.74	150.9	13.9	15.07
9:19	8.5	5.90	15.00	0.540		1.60	158.9	12.8	15.07
9:24	9.5	5.89	15.02	0.541		1.58	158.9	10.0	15.07
9:29	10.5	5.88	15.04	0.539		1.57	158.5	8.8	15.07
9:34	11.5	5.88	15.05	0.538		1.58	158.0	4.8	15.07
9:39	12.5	5.84	15.10	0.535		1.56	157.9	4.5	15.07

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	6920	Daily
Pump	Bladder	N/A
WL Meter	TW#23000907	N/A

GENERAL COMMENTS:

- Depth to water after Pump: 15.02
- Left Tubing in Well.

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU 56
PROJECT NO. J140588
SAMPLE NAME: SWMU56-MW04-GW03
WELL NO. MW-04
DATE: 4/12/16
SAMPLE TIME: 1335
PERSONNEL: JP
SAMPLE METHOD: Bladder

SAMPLE MEDIA: ● GW ○ Surface Water
SAMPLE QA SPLIT: ☐ YES ☒ NO
SAMPLE QC DUPLICATE: ☐ YES ☒ NO
MS/MSD REQUESTED ☐ YES ☒ NO
SPLIT SAMPLE NO.
DUPLICATE SAMPLE NO. SWMU56-MW104-GW04

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

9 total bottles

	Sample Container	Preservative	Analysis Requested
x	40mL VOA vial x3	HCL	VOCs
☒	500 mL Poly x1	HNO_3	Diss. Metals - FIELD FILTERED
☒	500 mL Poly x1	HNO_3	Total Metals
☒	1 L Amber Glass x2	None	PAHs
☒	1 L Amber Glass x2	None	Herbicides
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Poly x1	None	DHC

DUP
9 total bottles

WELL PURGING DATA

Date 4/12/16
Time Started 1230
Time Completed
PID Measurements
Background 0.0
Breathing Zone 0.0
Well Head 0.0

YSI Reading Interval= 5 min min

WELL DIAM (in): 2
Well Depth (ft. BTOC) 31.49
Depth to Water (ft BTOC) 14.06
Water Column Length 17.43
Volume of Water in Well ~~(liters)~~ 2.78 gals
Fill Cycle (sec) 15
Discharge Cycle (sec) 5
Purge Rate (liters/min) 0.25
Level of Drawdown (ft. BTOC) 0
Amount Purged ~~(liters)~~ 15.25 gals
Pump Intake Depth ~25 ft

FIELD MEASUREMENTS

Ferrous Fe= 0.21 mg/L * No dilution
Dissolved Mn= 0.7 mg/L

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Time	Amount Purged (liters)	pH	Temperature (ºC)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
1235	1.25	7.01	14.33	0.704	NA	2.66	-18.1	40.8	14.08
1240	2.5	6.89	14.32	0.707		2.51	-20.7	30.6	14.10
1245	3.75	6.70	14.30	0.713		2.43	-26.8	21.7	14.12
1250	4.0	6.69	14.31	0.725		2.41	-27.4	20.1	14.15
1255	5.25	6.69	14.32	0.726		2.38	-30.6	19.7	14.17
1300	6.5	6.68	14.34	0.728		2.38	-29.4	18.6	14.18
1305	7.75	6.68	14.35	0.729		2.38	-30.1	17.2	14.18
1310	9.0	6.70	14.35	0.729		2.37	-31.6	16.3	14.18
1315	10.25	6.70	14.36	0.729		2.36	-32.7	15.1	14.18
1320	11.50	6.71	14.37	0.729		2.35	-33.1	9.2	14.19
1325	12.75	6.71	14.39	0.730		2.34	-34.2	8.6	14.18
1330	14.0	6.72	14.40	0.730		2.34	-34.6	7.1	14.18
1335	15.25	6.72	14.41	0.730		2.33	-35.0	7.2	14.18

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	6920 V2	Daily
Pump	QED MP50	NA
WL Meter	Solinst	N/A

GENERAL COMMENTS:

DUP Taken SWMU56-MW104-GW04 @ 1400

Page of

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU56

PROJECT NO. J.140588

SAMPLE NAME: SWMU56-MW05-GW07

WELL NO. MW05

DATE: 4/14/16

SAMPLE TIME: 14:14

PERSONNEL: DB

SAMPLE METHOD: Bladder

SAMPLE MEDIA: ● GW ○ Surface Water

SAMPLE QA SPLIT: ☐ YES ☐ NO

SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: ☐ YES ☐ NO

DUPLICATE SAMPLE NO.

MS/MSD REQUESTED ☐ YES ☐ NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

	Sample Container	Preservative	Analysis Requested
☐	Field Parameters Only	HCL	VOCs
☐	40 mL VOA Vial x3	HCL	VOCs
☐	250 mL Poly x1	None	Anions/Alkalinity
☐	250 mL Poly x1	Zn Acetate/NaOH	Sulfide
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Amber Glass x2	None	PCBs

WELL PURGING DATA

Date

Time Started 1:35

Time Completed 14:53

PID Measurements

Background	0.0
Breathing Zone	0.0
Well Head	0.0

YSI Reading Interval= 5 min

WELL DIAM (in): 2 in

Well Depth (ft. BTOC) 35.40

Depth to Water (ft BTOC) 13.12

Water Column Length

Volume of Water in Well (liters)

Fill Cycle (sec) 25

Discharge Cycle (sec) 5

Purge Rate (liters/min) 260 mL/min

Level of Drawdown (ft. BTOC) 0

Amount Purged (liters) 6.5 Lt

Pump Intake Depth

FIELD MEASUREMENTS

Ferrous Fe= 0.11 mg/L

Dissolved Mn= 3.5 mg/L **

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
~~1:42~~ 13:42	0.5	5.04	17.71	0.468		3.38	227.2	0.1	13.17
13:47	1.5	4.98	17.56	0.467		2.32	241.5	0.2	13.17
13:52	2.5	4.82	17.66	0.468		1.83	252.9	0.1	13.17
13:57	3.5	4.81	17.68	0.465		1.79	242.9	0.4	13.17
14.02	4.5	4.83	17.68	0.468		1.78	251.6	0.1	13.17
14:07	5.5	4.81	17.70	0.467		1.79	252.7	0.1	13.17
14:12	6.5	4.79	17.73	0.467		1.75	251.7	0.0	13.17

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	6920 V2	Daily
Pump	Bladder	N/A
WL Meter	2000907	N/A

GENERAL COMMENTS:

** Slight Cloudiness
- Left Tubing in well.

WATER SAMPLE COLLECTION FIELD SHEET

1/2

GENERAL INFORMATION

SITE NAME: JBA/ SWMU56 - MW06

PROJECT NO. J140588

SAMPLE NAME: SWMU56 - MW06 - GW06

WELL NO. MW06

DATE: 4/14/16

SAMPLE TIME: 1540

PERSONNEL: DB

SAMPLE METHOD: Bladder

SAMPLE MEDIA: ● GW ○ Surface Water

SAMPLE QA SPLIT: ☐ YES ☐ NO

SPLIT SAMPLE NO.

SAMPLE QC DUPLICATE: ☐ YES ☐ NO

DUPLICATE SAMPLE NO.

MS/MSD REQUESTED ☐ YES ☐ NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

	Sample Container	Preservative	Analysis Requested
☐	40 mL VOA Vial x3	HCL	RSK-175
☐	40 mL VOA Vial x3	HCL	VOCs
☐	250 mL Poly x1	None	Anions/Alkalinity
☐	250 mL Poly x1	Zn Acetate/NaOH	Sulfide
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Poly x1	None	DHC

WELL PURGING DATA

Date 4/14/16

Time Started 10:49

Time Completed

PID Measurements

Background 0.0

Breathing Zone 0.0

Well Head 0.0

YSI Reading Interval= 5 min

WELL DIAM (in): 2in

Well Depth (ft. BTOC) 29.61

Depth to Water (ft BTOC) 13.11

Water Column Length

Volume of Water in Well (liters)

Fill Cycle (sec) 15.0

Discharge Cycle (sec) 5.0

Purge Rate (liters/min) 300 mL/min

Level of Drawdown (ft. BTOC) 0

Amount Purged (liters) – Well was

Pump Intake Depth

FIELD MEASUREMENTS

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Ferrous Fe= mg/L

Dissolved Mn= mg/L

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
11:11	6.6	4.18	14.44	0.245	NA	3.39	185.9	330.6	13.21
11:16	8.1	4.12	14.31	0.225		2.71	193.6	344.6	13.21
11:21	9.6	4.09	14.47	0.236		2.46	199.8	315.1	13.21
11:26	10.1	4.09	14.44	0.242		2.31	200.2	332.0	13.21
11:31	12.6	4.11	14.48	0.243		2.22	201.4	205.8	13.21
11:36	14.1	4.10	14.51	0.241		2.15	206.0	125.9	13.21
11:41	16.6	4.12	14.50	0.245		2.05	207.2	78.0	13.21
11:46	18.1	4.15	14.52	0.247		2.01	207.1	82.7	13.21
11:51	19.6	4.20	14.68	0.250		1.98	208.8	78.4	13.21
11:56	21.1	4.26	14.61	0.244		2.01	210.1	72.3	13.21
~~11~~12:01	22.6	4.29	14.75	0.244		2.02	215.5	68.8	13.21
12:06	24.1	4.30	14.78	0.243		2.05	215.3	54.1	13.21
12:19	25.6	4.31	14.80	0.242		2.08	215.6	54.5	13.21

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	5920 V2	Daily
Pump	Bladder Pump	N/A
WL Meter	23000907	N/A

GENERAL COMMENTS:

20psi Throttle Setting

2/2

WATER SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: JBA/ SWMU56
PROJECT NO. J1405896
SAMPLE NAME: SWMU56-MW06-GW06
WELL NO. MW06
DATE: 4/16/14
SAMPLE TIME: 1540
PERSONNEL: DB
SAMPLE METHOD: Bladder

SAMPLE MEDIA: ● GW ○ Surface Water
SAMPLE QA SPLIT: ☐ YES ☐ NO
SPLIT SAMPLE NO.
SAMPLE QC DUPLICATE: ☐ YES ☐ NO
DUPLICATE SAMPLE NO.
MS/MSD REQUESTED ☐ YES ☐ NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

	Sample Container	Preservative	Analysis Requested
☐	40 mL VOA Vial x3	HCL	RSK-175
☐	40 mL VOA Vial x3	HCL	VOCs
☐	250 mL Poly x1	None	Anions/Alkalinity
☐	250 mL Poly x1	Zn Acetate/NaOH	Sulfide
☐	250 Amber Glass x1	H_2SO_4	TOC
☐	1 L Poly x1	None	DHC

WELL PURGING DATA

Date 4/14/16
Time Started 10:49
Time Completed 16:15
PID Measurements
Background 0.0
Breathing Zone 0.0
Well Head 0.0

YSI Reading Interval= 5 min

WELL DIAM (in):
Well Depth (ft. BTOC)
Depth to Water (ft BTOC)
Water Column Length
Volume of Water in Well (liters)
Fill Cycle (sec)
Discharge Cycle (sec)
Purge Rate (liters/min)
Level of Drawdown (ft. BTOC)
Amount Purged (liters)
Pump Intake Depth

See Page 1

FIELD MEASUREMENTS

1-Enter the first reading. 2-Select the current road hit th "Next Reading" button.
3-Correct the values for the 2nd reading.4- Correct values and repeat until stable.

Ferrous Fe= 0.24 mg/L *No Dilution
Dissolved Mn= 1.2 mg/L

Time	Amount Purged (liters)	pH	Temperature (°C)	Conductivity (mS/cm)	DO (mg/L)	ODO (mg/L	ORP (mV)	Turbidity (NTU's)	WL ft BTOC
		± 0.1	± 1.0°C	± 3%	± 10%	± 10%	± 10%	<10	<0.5 ft
12:16	27.1	4.32	14.83	0.248	N/A	2.10	214.8	55.1	13.21
12:21	28.6	4.35	14.90	0.252	↓	2.15	219.5	67.3	13.21
12:26	30.1	4.38	14.92	0.254		2.12	221.0	60.3	13.21
12:31	31.6	4.36	14.91	0.254		2.13	220.8		13.21
Well Was Surged and Purged with pump. Came back and Continued Readings.									
15:20	~133.0	4.01	15.05	0.235	↓	2.23	247.2	5.1	13.20
15:25	~134.5	4.08	15.09	0.232		2.23	246.6	40	13.20
15:30	~136.0	4.08	15.10	0.233		2.23	246.1	3.8	13.20
15:35	~137.5	4.10	15.09	0.233		2.21	244.7	3.5	13.20

FIELD EQUIPMENT AND CALIBRATION

	Model	Calibration
YSI	6920 V2	Daily
Pump	Bladder	N/A
WL Meter	23000907	N/A

GENERAL COMMENTS:

Well was Surged and purged with with peristaltic pump. Allowed to develop for ~3.0 hrs and bladder pump was reinstalled. Continue Readings after three hrs. Well purge rate ~~to~~ was 600ml/min ~101.4 Liters was purge In 2 hours and 49 mins.

Appendix E

Data Validation Reports

(provided as separate folder on this DVD)

Appendix F

Laboratory Analytical Packages

(provided as separate folder on this DVD)

Appendix G

RAGS Part D Risk Assessment Tables

Table G-1.1
Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current / Future	Surface Soil	Surface Soil	Commercial/Industrial Land Use	Site Worker	Adult	Ingestion	Onsite	Quant	Land use is currently Commercial/Industrial and likely to remain so in the future.
				Site Worker	Adult	Dermal	Onsite	Quant	Land use is currently Commercial/Industrial and likely to remain so in the future.
		Particulates	Fugitive Dust	Site Worker	Adult	Inhalation	Onsite	Quant	Land use is currently Commercial/Industrial and likely to remain so in the future.
	Soil	Vapors	Vapor Emissions	Site Worker	Adult	Inhalation	Onsite	NA	Exposure to vapors via the indoor air pathway are evaluated from indoor air samples collected in July 2014.
Future	Surface and Subsurface Soil	Subsurface Soil	Construction/Intrusive activities	Construction Worker	Adult	Ingestion	Onsite	Quant	Contact during future construction is possible.
				Construction Worker	Adult	Dermal	Onsite	Quant	Contact during future construction is possible.
		Particulates	Fugitive Dust	Construction Worker	Adult	Inhalation	Onsite	Quant	Contact during future construction is possible.
Future	Surface and Subsurface Soil	Surface Soil	Commercial/Industrial Land Use	Site Worker	Adult	Ingestion	Onsite	Quant	Soil at depth could be brought to the ground surface during construction/utility work in the future.
				Site Worker	Adult	Dermal	Onsite	Quant	Soil at depth could be brought to the ground surface during construction/utility work in the future.
		Particulates	Fugitive Dust	Site Worker	Adult	Inhalation	Onsite	Quant	Soil at depth could be brought to the ground surface during construction/utility work in the future.
	Soil	Vapors	Vapor Emissions	Site Worker	Adult	Inhalation	Onsite	NA	Exposure to vapors via the indoor air pathway are evaluated from indoor air samples collected in July 2014.
Future	Surface and Subsurface Soil	Surface Soil	Residential Land Use	Resident	Child/Adult	Ingestion	Onsite	Quant	Residential land use evaluated to address unrestricted land use.
				Resident	Child/Adult	Dermal	Onsite	Quant	Residential land use evaluated to address unrestricted land use.
		Particulates	Fugitive Dust	Resident	Child/Adult	Inhalation	Onsite	Quant	Residential land use evaluated to address unrestricted land use.
Future	Soil	Vapors	Vapor Emissions	Resident	Child/Adult	Inhalation	Onsite	NA	Exposure to vapors via the indoor air pathway are evaluated from indoor air samples collected in July 2014.
Current / Future	Groundwater	Groundwater	Incidental Contact-Handwashin	Site Worker	Adult	Ingestion	Onsite	Quant	Groundwater contact assumed to occur with handwashing only. No potable water use currently. No showering at work assumed.
				Site Worker	Adult	Dermal	Onsite	Quant	Groundwater contact assumed to occur with handwashing only. No potable water use currently. No showering at work assumed.
	Indoor Air	Vapor Intrusion	Vapor Emissions	Site Worker	Adult	Inhalation	Onsite	Quant	Residential land use evaluated to address unrestricted land use. Although groundwater is not currently used as a potable water source, it is possible.
Future	Groundwater	Groundwater	Incidental Contact	Construction Worker	Adult	Ingestion	Onsite	Quant	Groundwater depths vary. There is some potential for incidental contact.
				Construction Worker	Adult	Dermal	Onsite	Quant	Groundwater depths vary. There is some potential for incidental contact.
Future	Groundwater	Groundwater	Tap Water	Resident	Child/Adult	Ingestion	Onsite	Quant	Residential land use evaluated to address unrestricted land use. Although groundwater is not currently used as a potable water source, it is possible.
				Resident	Child/Adult	Dermal	Onsite	Quant	Residential land use evaluated to address unrestricted land use. Although groundwater is not currently used as a potable water source, it is possible.
		Air	Water vapors while using groundwater indoors	Resident	Child/Adult	Inhalation	Onsite	Quant	Residential land use evaluated to address unrestricted land use. Although groundwater is not currently used as a potable water source, it is possible.
	Indoor Air	Vapor Intrusion	Vapor Emissions	Resident	Child/Adult	Inhalation	Onsite	Quant	Exposure to vapors via the indoor air pathway are evaluated from indoor air samples collected in July 2014.

Table G-2.1
Occurrence, Distribution, and Selection of Chemicals of Potential Concern in Soil
Reasonable Maximum Exposure
SWMU 56- Joint Base Andrews Naval Air Facility Camp Springs, Maryland

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	Chemical	CAS Number	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limits	Concentration Used for Screening (1)	Background Value (2)	RSL Value (NC/C) (3)	SSL Protective of GW (4)	COPC Flag (Y/N) (5)	Rationale for Selection or Deletion (6)	Leaching COPC (Y/N) (7)
Soil	**Metals/Inorganics**														
	Aluminum	7429-90-5	1600	24000	mg/kg	SWMU56-TMW05	14 / 14	1.4 - 1.8	24000	27900	7700 NC	30000	**Y**	**ASL**	N
	Arsenic	7440-38-2	0.37 J	2.9	mg/kg	SWMU56-TMW08	14 / 14	0.046 -0.063	2.9	5.70	0.68 C	0.29	**Y**	**ASL**	**Y**
	Barium	7440-39-3	4.3	42	mg/kg	SWMU56-TMW06	35/35	0.066 - 0.087	42	53.6	1500 NC	82	N	BSL	N
	Beryllium	7440-41-7	0.025 J	0.31	mg/kg	SWMU56-TMW06	14 / 14	0.020 - 0.028	0.31	1.06	16 NC	3.2	N	BSL	N
	Cadmium	7440-43-9	0.029 J	0.18	mg/kg	SWMU56-TMW06	14 / 14	0.0085 - 0.011	0.18	0.0390	7 NC	0.38	N	BSL	N
	Calcium	7440-70-2	20 J	1100	mg/kg	SWMU56-TMW02	14 / 14	13 - 16	1100	945	NE	NE	N	NUT	N
	Chromium (8)	7440-47-3	2.4	22	mg/kg	SWMU56-TMW05	14 / 14	0.069 - 0.095	22	31.2	0.3 C	0.00067	**Y**	**ASL**	**Y**
	Cobalt	7440-48-4	0.1	2.7	mg/kg	SWMU56-TMW06	14 / 14	0.0082-0.006	2.7	6.20	2.3 NC	0.27	**Y**	**ASL**	**Y**
	Copper	7440-50-8	1 J	5.2	mg/kg	SWMU56-TMW01	14 / 14	0.088-0.064	5.2	11.2	310 NC	46	N	BSL	N
	Iron	7439-89-6	1200	21000	mg/kg	SWMU56-TMW03	14 / 14	4.4-3.5	21000	22800	5500 NC	350	**Y**	**ASL**	**Y**
	Lead	7439-92-1	0.89	16	mg/kg	SWMU56-TMW01	14 / 14	0.023-0.016	16	37.1	400	14	N	BSL	**Y**
	Magnesium	7439-95-4	33	800	mg/kg	SWMU56-TMW02	14 / 14	4.3-3.4	800	1100	NE	NE	N	NUT	N
	Manganese	7439-96-5	0.94	39	mg/kg	SWMU56-TMW02	14 / 14	0.03 - 0.041	39	174	180 NC	28	N	BSL	**Y**
	Mercury	7439-97-6	0.011 J	0.024	mg/kg	SWMU56-TMW02	4/14	0.0078-0.006	0.024	0.0670	1 NC	0.10	N	BSL	N
	Molybdenum	7439-98-7	0.081 J	1	mg/kg	SWMU56-TMW08	14 / 14	0.022-0.016	1	1.42	39 NC	2.0	N	BSL	N
	Nickel	7440-02-0	0.32 J	5.4	mg/kg	SWMU56-TMW06	14 / 14	0.031-0.023	5.4	11.3	150 NC	26	N	BSL	N
	Potassium	7440-09-7	68 J	440	mg/kg	SWMU56-TMW06	14 / 14	48-38	440	843	NE	NE	N	NUT	N
	Selenium	7782-49-2	0.17 J	0.85	mg/kg	SWMU56-TMW02	14 / 14	0.17-0.12	0.85	NE	39 NC	0.26	N	BSL	**Y**
	Silver	7440-22-4	0.021 J	0.045	mg/kg	SWMU56-TMW01	7/14	0.025-0.018	0.045	NE	39 NC	0.80	N	BSL	N
	Sodium	7440-23-5	75	600	mg/kg	SWMU56-TMW03	4/14	69-54	600	43.4	NE	NE	N	NUT	N
	Thallium	7440-28-0	0.011 J	0.21	mg/kg	SWMU56-TMW06	14 / 14	0.0044-0.0032	0.21	0.332	0.078 NC	0.14	**Y**	**ASL**	**Y**
	Vanadium	7440-62-2	2.6	37	mg/kg	SWMU56-TMW05	14 / 14	0.048-0.035	37	40.0	39 NC	86	N	BSL	N
	Zinc	7440-66-6	0.58 J	20	mg/kg	SWMU56-TMW01	14 / 14	0.39-0.29	20	29.2	2300 NC	370	N	BSL	N
	Pesticides														
	4,4'-DDD	72-54-8	1.7 J	1.8	ug/kg	SWMU56-TMW01	2/14	0.68-0.57	1.8	NE	2300 C	7.5	N	BSL	N
	4,4'-DDE	72-55-9	1.2 J	4.7	ug/kg	SWMU56-TMW02	2/14	0.3-0.25	4.7	NE	2000 C	11	N	BSL	N
	VOCs														
	1,3,5-Trimethylbenzene	108-67-8	0.61 J	0.61 J	ug/kg	SWMU56-TMW01	1/14	0.64-0.39	0.61 J	NE	78000 NC	170	N	BSL	N
	2-Butanone (MEK)	78-93-3	7.8 J	20 J	ug/kg	SWMU56-TMW02	3/14	2-1.3	20 J	NE	2700000 NC	1200	N	BSL	N
	Acetone	67-64-1	9.6 J	97	ug/kg	SWMU56-TMW06	4/14	6-3.7	97	NE	6100000 NC	2900	N	BSL	N
	Carbon disulfide	75-15-0	0.44 J	0.87 J	ug/kg	SWMU56-TMW02	3/14	0.47-0.29	0.87 J	NE	77000 NC	240	N	BSL	N
	cis-1,2-Dichloroethene	156-59-2	50	120 J	ug/kg	SWMU56-TMW02	2/14	0.62-0.39	120 J	NE	16000 NC	21	N	BSL	**Y**
	Tetrachloroethene	127-18-4	1.8 J	1.8 J	ug/kg	SWMU56-TMW06	1/14	0.66-0.41	1.8 J	NE	24000 NC	2.3	N	BSL	N
	Toluene	108-88-3	1.2 J	1.2 J	ug/kg	SWMU56-TMW02	1/14	0.77-0.48	1.2 J	NE	490000 NC	690	N	BSL	N
	trans-1,2-Dichloroethene	156-60-5	4.4	9.6 J	ug/kg	SWMU56-TMW02	2/14	0.44-0.27	9.6 J	NE	160000 NC	31	N	BSL	N
	Trichloroethene	79-01-6	0.49 J	34	ug/kg	SWMU56-TMW06	2/14	0.26-0.16	34	NE	94 NC	1.8	N	BSL	**Y**
	SVOCs														
	Benzyl alcohol	100-51-6	22 J	47 J	ug/kg	SWMU56-TMW05	7/14	20-10	47 J	NE	630000 NC	480	N	BSL	N

Table G-2.1
Occurrence, Distribution, and Selection of Chemicals of Potential Concern in Soil
Reasonable Maximum Exposure
SWMU 56- Joint Base Andrews Naval Air Facility Camp Springs, Maryland

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	Chemical	CAS Number	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limits	Concentration Used for Screening (1)	Background Value (2)	RSL Value (NC/C) (3)	SSL Protective of GW (4)	COPC Flag (Y/N) (5)	Rationale for Selection or Deletion (6)	Leaching COPC (Y/N) (7)
	PAHs														
	Acenaphthene	83-32-9	2.2 J	2.2 J	ug/kg	SWMU56-TMW01	1/14	0.2-0.16	2.2 J	45.9	360000 NC	5500	N	BSL	N
	Acenaphthylene (9)	208-96-8	1.0 J	7.7	ug/kg	SWMU56-TMW01	3/14	0.21-0.17	7.7	8.8	180000 (9) NC	13000 (9)	N	BSL	N
	Anthracene	120-12-7	3.7 J	5.6	ug/kg	SWMU56-TMW01	2/14	0.91-0.73	5.6	NE	1800000 NC	58000	N	BSL	N
	Benzo (g,h,i)perylene (9)	191-24-2	4.0 J	18	ug/kg	SWMU56-TMW01	3/14	1.4-1.1	18	4.8	180000 (9) NC	13000 (9)	N	BSL	N
	Benzo[a]anthracene	56-55-3	1.9 J	14	ug/kg	SWMU56-TMW01	3/14	1.1-0.91	14	11.2	160 C	4.2	N	BSL	**Y**
	Benzo[a]pyrene	50-32-8	2.2 J	18	ug/kg	SWMU56-TMW01	3/14	0.93-0.75	18	3.5	16 C	240	**Y**	**ASL**	N
	Benzo[b]fluoranthene	205-99-2	5.3 J	34	ug/kg	SWMU56-TMW01	3/14	1.5-1.2	34	7.6	160 C	41	N	BSL	N
	Benzo[k]fluoranthene	207-08-9	1.5 J	9.4	ug/kg	SWMU56-TMW01	3/14	1.3-1	9.4	NE	1600 C	400	N	BSL	N
	Chrysene	218-01-9	3.7 J	30	ug/kg	SWMU56-TMW01	3/14	1.3-1	30	26.6	16000 C	1200	N	BSL	N
	Dibenz(a,h)anthracene	53-70-3	3.4 J	3.9	ug/kg	SWMU56-TMW01	2/14	1.6-1.3	3.9	17	16 C	13	N	BSL	N
	Fluoranthene	206-44-0	3.5 J	35	ug/kg	SWMU56-TMW01	3/14	1.3-1	35	22.6	240000 NC	89000	N	BSL	N
	Fluorene	86-73-7	4.0 J	5.4 J	ug/kg	SWMU56-TMW01	2/14	0.59-0.47	5.4 J	11.8	240000 NC	5400	N	BSL	N
	Indeno[1,2,3-cd]pyrene	193-39-5	3.1 J	17	ug/kg	SWMU56-TMW01	3/14	1.4-1.1	17	5.8	160 C	130	N	BSL	N
	Naphthalene	91-20-3	0.66 J	37	ug/kg	SWMU56-TMW01	4/14	0.41-0.33	37	NE	3800 C	0.54	N	BSL	**Y**
	Phenanthrene (9)	85-01-8	2.1 J	28	ug/kg	SWMU56-TMW02	3/14	1.4-1.1	28	9.3	180000 (9) NC	13000 (9)	N	BSL	N
	Pyrene	129-00-0	4.0 J	42	ug/kg	SWMU56-TMW01	3/14	1.4-1.1	42	13.9	180000 NC	13000	N	BSL	N

Notes

Bold = Constituents are selected at Constituents of Potential Concern.

(1) Maximum concentration detected used for screening.

(2) Background concentration is the upper threshold limit (UTL) as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).

(3) Compounds screened versus residential soil values, USEPA RSLs, May 2016 (THQ=0.1, TR = 1E-6).

(4) Value from USEPA RSLs, May 2016 (HQ = 0.1, TR = 1E-6) Value is MCL-based SSL (DAF=1); if MCL-based SSL was not available, risk-based SSL selected

(5) Constituent selected as a COPC if the concentration used for screening is above the RSL.

(6) Rationale Codes:

Selection Reason: ASL - Above Screening Level
Deletion Reason: BSL - Equal to or Below Screening Level
Deletion Reason: NUT - Chemical is an essential nutrient; non-toxic

(7) Constituent selected as leaching COPC if the concentration used for screening is above the SSL protective of groundwater (DAF=1).

(8) Chromium VI assumed as chromium was not speciated.

(9) RSL for pyrene used for this compound.

RSL = Regional Screening Level
SSL = Soil Screening Level
C = carcinogen
NC = noncarcinogen
GW = groundwater
NE= None Established

COPC = constituent of potential concern
Y = yes
N = no
mg/kg = milligrams per kilogram
ug/kg= micrograms per kilogram

Table G-2.2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern in Groundwater
Reasonable Maximum Exposure
SWMU 56- Joint Base Andrews Naval Air Facility Camp Springs, Maryland

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical	CAS Number	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Greater than Background?	RSL Value (NC/C) (3)	Potential ARAR Value	Potential ARAR Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Groundwater / Tapwater	**Metals/Inorganics**															
	Aluminum	7429-90-5	270 J	2400 J	ug/L	SWMU56-MW01	6 / 6	18 - 18	2400 J	27000	Y	2000 NC	200	SMCL	**Y**	**ASL**
	Arsenic	7440-38-2	0.38 J	0.77 J	ug/L	SWMU56-MW04	4 / 6	0.33 - 0.33	0.77 J	NE	NA	0.0520 C	10.0	MCL	**Y**	**ASL**
	Barium	7440-39-3	64	180	ug/L	SWMU56-MW04	6 / 6	0.29 - 0.29	180	76.6	N	380 NC	2000	MCL	N	BSL
	Beryllium	7440-41-7	0.1 J	0.45 J	ug/L	SWMU56-MW01	4 / 6	0.08 - 0.08	0.45 J	NE	NA	2.5 NC	4.00	MCL	N	BSL
	Cadmium	7440-43-9	0.38 J	1.1	ug/L	SWMU56-MW01	3 / 6	0.27 - 0.27	1.1	2.6	N	0.9 NC	5.00	MCL	**Y**	**ASL**
	Calcium	7440-70-2	4600	36000	ug/L	SWMU56-MW04	6 / 6	35 - 35	36000	167000	N	NE			N	EN
	Chromium (5)	7440-47-3	0.68 J	11	ug/L	SWMU56-MW04	5 / 6	0.5 - 0.5	11	34.3	N	0.035 (5) C	100	MCL	**Y**	**ASL**
	Cobalt	7440-48-4	2.7	10	ug/L	SWMU56-MW01	6 / 6	0.054 - 0.054	10	22.2	N	0.6 NC			**Y**	**ASL**
	Copper	7440-50-8	0.64 J	4.2	ug/L	SWMU56-MW01	6 / 6	0.56 - 0.56	4.2	29.1	N	80 NC	1300	MCL	N	BSL
	Iron	7439-89-6	560	2100	ug/L	SWMU56-MW03	6 / 6	22 - 22	2100	20100	N	1400 NC			**Y**	**ASL**
	Lead	7439-92-1	0.38 J	0.58 J	ug/L	SWMU56-MW03	4 / 6	0.18 - 0.18	0.58 J	9.5	N	15.0 L	15.0	MCL	N	BSL
	Magnesium	7439-95-4	3200	8900	ug/L	SWMU56-MW03	6 / 6	11 - 11	8900	16000	N	NE			N	EN
	Manganese	7439-96-5	120 J	340	ug/L	SWMU56-MW01	6 / 6	0.31 - 0.31	340	160	Y	43 NC	50	SMCL	**Y**	**ASL**
	Mercury	7439-97-6	0.027 J	0.068 J	ug/L	SWMU56-MW05	2 / 6	0.027 - 0.027	0.068 J	NE	NA	0.063 NC	2.00	MCL	**Y**	**ASL**
	Molybdenum	7439-98-7	0.31 J	5	ug/L	SWMU56-MW04	4 / 6	0.14 - 0.14	5	1.59	Y	10 NC			N	BSL
	Nickel	7440-02-0	4.7	14	ug/L	SWMU56-MW01	6 / 6	0.3 - 0.3	14	20.2	N	39 NC			N	BSL
	Potassium	7440-09-7	900 J	40000	ug/L	SWMU56-MW04	6 / 6	240 - 240	40000	18300	Y	NE			N	EN
	Selenium	7782-49-2	0.84 J	0.88 J	ug/L	SWMU56-MW01	2 / 6	0.7 - 0.7	0.88 J	2.6	N	10 NC	50.0	MCL	N	BSL
	Sodium	7440-23-5	29000	92000	ug/L	SWMU56-MW04	6 / 6	92 - 92	92000	110000	N	NE			N	EN
	Thallium	7440-28-0	0.057 J	0.18 J	ug/L	SWMU56-MW04	3 / 6	0.05 - 0.05	0.18 J	NE	NA	0.02 NC	2.00	MCL	**Y**	**ASL**
	Vanadium	7440-62-2	0.82 J	2.9 J	ug/L	SWMU56-MW04	4 / 6	0.5 - 0.5	2.9 J	15.9	N	8.6 NC			N	BSL
	Zinc	7440-66-6	12 J	89 J	ug/L	SWMU56-MW04	6 / 6	2 - 2	89 J	415	N	600 NC	5000	SMCL	N	BSL
	VOCs															
	1,1-Dichloroethane	75-34-3	0.21 J	0.21 J	ug/L	SWMU56-MW05	1 / 6	0.16 - 0.16	0.21 J	NE	NA	2.80 C			N	BSL
	1,1-Dichloroethene	75-35-4	0.17 J	0.44 J	ug/L	SWMU56-MW05	4 / 6	0.14 - 0.14	0.44 J	NE	NA	280 NC	7.00	MCL	N	BSL
	Acetone	67-64-1	3 J	5.6 J	ug/L	SWMU56-MW04	4 / 6	1.9 - 1.9	5.6 J	NE	NA	14000			N	BSL
	Chloroform	67-66-3	0.33 J	3.1	ug/L	SWMU56-MW01	6 / 6	0.16 - 0.16	3.1	NE	NA	0.220 C	80	MCL	N	ROD
	cis-1,2-Dichloroethene	156-59-2	0.25 J	14	ug/L	SWMU56-MW05	6 / 6	0.15 - 0.15	14	NE	NA	36.0 NC	70.0	MCL	N	BSL
	Tetrachloroethene	127-18-4	4.7	4.7	ug/L	SWMU56-MW03	1 / 6	0.2 - 0.2	4.7	NE	NA	11.0 C	5.00	MCL	N	BSL
	trans-1,2-Dichloroethene	156-60-5	0.18 J	0.18 J	ug/L	SWMU56-MW05	1 / 6	0.15 - 0.15	0.18 J	NE	NA	36 NC	100	MCL	N	BSL
	Trichloroethene	79-01-6	0.39 J	36	ug/L	SWMU56-MW05	6 / 6	0.16 - 0.16	36	NE	NA	0.490 C	5.00	MCL	N	ROD
	PAHs															
	Benzo (g,h,i)perylene	191-24-2	0.018 J	0.018 J	ug/L	SWMU56-MW03	1 / 6	0.0034 - 0.0041	0.018 J	NE	NA	12 (6) NC			N	BSL
	Benzo[a]anthracene	56-55-3	0.016 J	0.016 J	ug/L	SWMU56-MW03	1 / 6	0.0031 - 0.0037	0.016 J	NE	NA	0.0120 C			**Y**	**ASL**
	Benzo[b]fluoranthene	205-99-2	0.037 J	0.037 J	ug/L	SWMU56-MW03	1 / 6	0.0033 - 0.0039	0.037 J	NE	NA	0.0340 C			**Y**	**ASL**
	Benzo[k]fluoranthene	207-08-9	0.011 J	0.011 J	ug/L	SWMU56-MW03	1 / 6	0.0034 - 0.0041	0.011 J	NE	NA	0.340 C			N	BSL
	Chrysene	218-01-9	0.033 J	0.033 J	ug/L	SWMU56-MW03	1 / 6	0.0031 - 0.0037	0.033 J	NE	NA	3.40 C			N	BSL
	Fluoranthene	206-44-0	0.073 J	0.17	ug/L	SWMU56-MW04	2 / 6	0.0044 - 0.0052	0.17	NE	NA	80 NC			N	BSL
	Fluorene	86-73-7	0.020 J	0.075 J	ug/L	SWMU56-MW04	5 / 6	0.018 - 0.022	0.075 J	NE	NA	29 NC			N	BSL
	Indeno[1,2,3-cd]pyrene	193-39-5	0.019 J	0.019 J	ug/L	SWMU56-MW03	1 / 6	0.014 - 0.017	0.019 J	NE	NA	0.0340 C			N	BSL
	Phenanthrene	85-01-8	0.07 J	0.16	ug/L	SWMU56-MW03	4 / 6	0.0094 - 0.011	0.16	NE	NA	12 (6) NC			N	BSL

Table G-2.2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern in Groundwater
Reasonable Maximum Exposure
SWMU 56- Joint Base Andrews Naval Air Facility Camp Springs, Maryland

Notes:

Bold = Constituents are selected at Constituents of Potential Concern.
(1) Maximum detected concentration used for screening.
(2) Basewide Background Upper Tolerance Levels for Total Metals as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).
(3) Compounds screened versus residential tapwater values, USEPA Regional Screening Levels (RSLs), May 2016.
(4) Rationale Codes:
    Selection Reason: ASL - Above Screening Level estimated value.
    Deletion Reason: BSL - Below Screening Level
    Deletion Reason: EN - Compound is an essential nutrient.
    Deletion Reason: ROD - Currently addressed under the ST-14 ROD.
(5) Residential tapwater RSL for Chromium IV used for screening total chromium.
(6) Pyrene RSL value used as surrogate value

Definitions:

NA - Not Available
C - Carcinogen
Y - Yes
N - No

NC - Noncarcinogen
COPC - Constituent of Potential Concern
ug/L= micrograms per liter

J = The reported positive result is considered estimated because the result is less than the limit of quantification (LOQ) or because certain quality control criteria were not met.

Table G-6.1
Summary of Chemical Cancer and Non-Cancer Risks: Soil
SWMU 56- Joint Base Andrews Naval Air Facility Camp Springs, Maryland

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	COPC	Units	CAS Number	RSL Value (NC/C) (1,2)		EPC (3)	NC (EPC/RSL)	Cancer Risk (EPC/RSL)	Background UTL Value (4)	Greater than Background?
Soil	**Aluminum**	mg/kg	7429-90-5	77000	NC	24000	0.31		27900	N
	Arsenic	mg/kg	7440-38-2	0.68	C	2.9	--	4E-06	5.70	N
	Chromium	mg/kg	7440-47-3	0.3/120,000	C/NC	22	0.00	7E-05	31.2	N
	Cobalt	mg/kg	7440-48-4	23	NC	2.7	0.12		6.20	N
	Iron	mg/kg	7439-89-6	55000	NC	21000	0.38		22800	N
	Thallium	mg/kg	7440-28-0	0.78	NC	0.21	0.27		0.332	N
	Benzo[a]pyrene	ug/kg	50-32-8	16	C	18	--	1E-06	3.5	N
						SUM	1	8E-05		

Totals:

HI =	1
Cancer Risk=	8E-05

Notes

(1) Compounds screened versus residential soil values, USEPA RSLs, May 2016 (THQ=1.0, TR = 1E-6).
(2) Chromium was not speciated; first value is for Cr VI, second is for Cr III.
(3) Maximum concentration detected used for screening HHRA.
(4) Background concentration is the upper threshold limit (UTL) as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).

RSL = Regional Screening Level
SSL = Soil Screening Level
C = carcinogen
NC = noncarcinogen
GW = groundwater
NE= None Established

COPC = constituent of potential concern
Y = yes
N = no
mg/kg = milligrams per kilogram
ug/kg= micrograms per kilogram
EPC= Exposure Point Concentration

Table G-6.2

Summary of Chemical Cancer and Non-Cancer Risks: Groundwater

SWMU 56- Joint Base Andrews Naval Air Facility Camp Springs, Maryland

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	**Chemical**	**CAS Number**	**RSL Value (NC/C) (1,2)**		**Exposure Point Concentration (3)**	**NC** (EPC/RSL)	**Cancer Risk** (EPC/RSL)	**Background Value (4)**	**Greater than Background?**
Groundwater / Tapwater	**Aluminum**	7429-90-5	20000	NC	2400 J	0.1	--	27000	N
	Arsenic	7440-38-2	0.0520	C	0.77 J	--	1.5E-05	NE	NA
	Cadmium	7440-43-9	9	NC	1.1	0.1	--	2.6	N
	Chromium (4)	7440-47-3	0.035/16000	C/NC	11	0.001	3.1E-04	34.3	N
	Cobalt	7440-48-4	6	NC	10	1.7	--	22.2	N
	Iron	7439-89-6	14000	NC	2100	0.2	--	20100	N
	Manganese	7439-96-5	430	NC	340	0.8	--	160	**Y**
	Mercury	7439-97-6	0.63	NC	0.068 J	0.1	--	NE	NA
	Thallium	7440-28-0	0.2	NC	0.18	0.3		NE	NA
	Benzo[a]anthracene	56-55-3	0.0120	C	0.016 J	--	1.3E-06	NE	NA
	Benzo[b]fluoranthene	205-99-2	0.0340	C	0.037 J	--	1.1E-06	NE	NA
					SUM	3	3E-04		

Totals:

HI =	3
Cancer Risk=	3E-04

(1) Compounds screened versus residential tapwater values, USEPA Regional Screening Levels (RSLs), May 2016 (THQ = 1; TR=10-6).

(2) Chromium was not speciated; first value is for Cr VI, second is for Cr III.

(3) Maximum concentration detected used for screening HHRA.

(4) Background concentration is the upper threshold limit (UTL) as reported in Basewide Background Study for Andrews Air Force Base (CH2M, 2004).

Definitions:

NA - Not Available	NC - Noncarcinogen
C - Carcinogen	COPC - Constituent of Potential Concern
Y - Yes	ug/L= micrograms per liter
N - No	

Appendix H

Regulatory Comment Worksheet

Comments to the
Draft Final Remedial Investigation (and associated RTCs at SWMU 56)
Performance-Based Restoration
Joint Base Andrews, Camp Springs, Maryland

<table>
<tr><th>Comment #</th><th>Comment</th><th>A, D, E, FD or X[1]</th><th>Response</th><th>A or D[2]</th></tr>
<tr><td colspan="5">Note: Based on discussions at the March 2018 Tier I regarding VI risks due to ST-14 contaminants will be addressed in the future at ST-14.

The following language (showing in red and included in the attached redlined version) has been added to the executive summary and conclusions within the RI report. This language will also be carried forward to the PP and ROD for SWMU 56.

<i>“As noted throughout this report, chloroform and TCE were detected in SWMU 56 RI groundwater samples in exceedance of their respective RSLs and VISLs. SWMU 56 is collocated with ST-14. Chloroform and TCE are known contaminants and are currently being remediated in accordance with the ST-14 ROD. Therefore, chloroform and TCE were not selected as COPCs and were not carried through the HHRA. However, further evaluation of VI as it relates to chloroform and TCE is warranted and is planned to be conducted in support of ongoing ST-14 remediation.”</i></td></tr>
<tr><td colspan="5">USEPA Project Manager (Andy Sochanski) – Comments Received: January 11, 2018</td></tr>
<tr><td>1.</td><td>Comment 3 and RTCs. VI risk was not calculated for workers nor residents. If a VI risk is exceeded, ICs are necessary. The only way to evaluate if ICs are necessary is to calculate a VI risk.</td><td>E</td><td>The risk assessment for ST-14 calculated VI risks and found them to be unacceptable for residential use. Therefore, VI risks for residential use are a part RAOs and addressed through ICs that prevent residential use.

VI risk for workers was evaluated at ST-14, but was not calculated in the ST-14 risk assessment. VI risks for commercial/industrial are not currently addressed in the ST-14 ROD.

The following was added to Section 4.2.4.5:</td><td></td></tr>
</table>

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[1] A = agree D = disagree E = explanation FD = needs further discussion X = take exception to

			"It is noted that SWMU 56 is collocated with ST-14. Residential exposure to chloroform and TCE is currently being addressed in the ST-14 ROD via institutional controls that restrict residential use (USAF, USEPA, and MDE, 2007). However, further evaluation of VI as it relates to chloroform and TCE is warranted and is planned to be conducted in support of ongoing ST-14 site remediation."	
2.	Comment 5 and the Response states there is a VI risk. • In sampling conducted ~n 2012, chloroform was detected at concentrations ranging from 0.33 - 490 ug/L. TCE ranged from 0.31 to 45 ~g/L. • •In 2016 sampling, only trace levels of chloroform (up to 3.1 ug/L) were detected, while TCE was observed at 0.39 to 36 ug/L. • Regarding VI, according to Section 4.2.4.5 (Vapor Intrusion Screening Level Comparison): "Chloroform was detected in groundwater samples ... at concentrations that exceeded the VISL target groundwater concentration of 0.81 ug/L. TCE was detected in groundwater samples ... at concentrations that exceeded the VISL target groundwater concentration of 1.2 ug/L. It is noted that SWMU 56 lies within the footprint of ST-14. Chloroform and TCE are currently being addressed in the ST-14 ROD." The text above in red is garnered from the draft RI report. However, the report is incorrect as EPA" review detailed.	E	See response to comment #1.	

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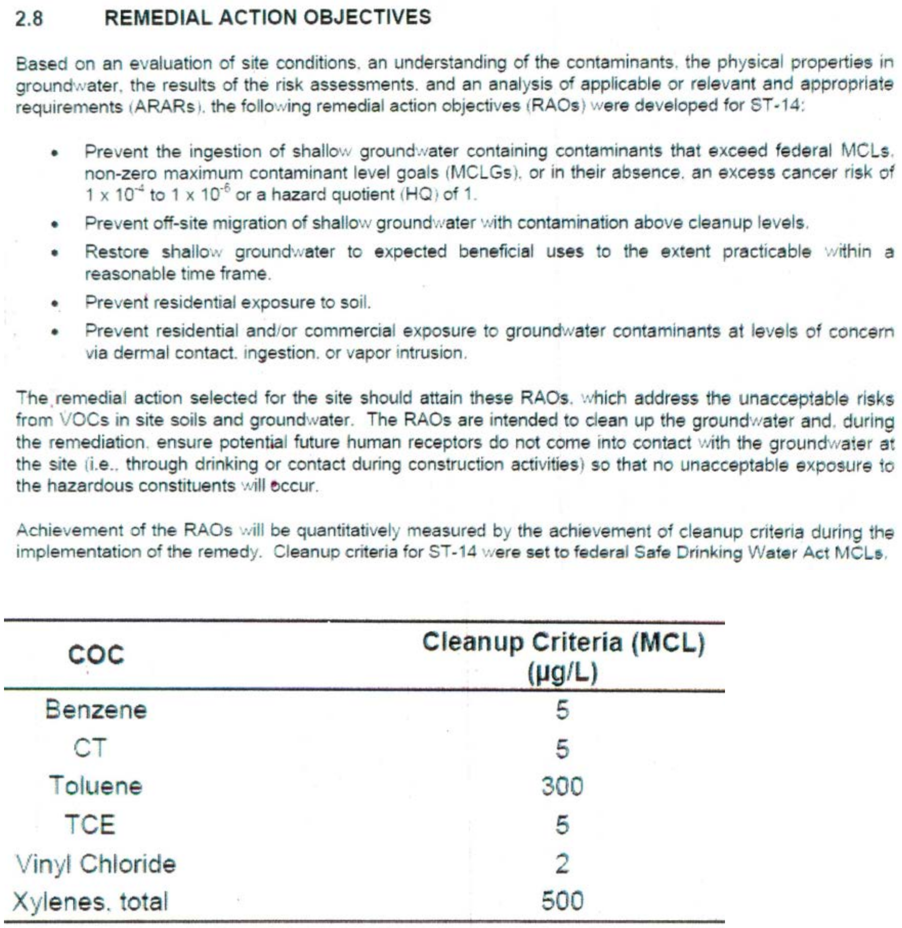
[1]A = agree D = disagree E = explanation FD = needs further discussion X = take exception to

<table>
<tr>
<td>3.</td>
<td>As previously stated the ST-14 ROD does not address chloroform. The text and table is taken from the ST-14 ROD.



2.8 REMEDIAL ACTION OBJECTIVES

Based on an evaluation of site conditions, an understanding of the contaminants, the physical properties in groundwater, the results of the risk assessments, and an analysis of applicable or relevant and appropriate requirements (ARARs), the following remedial action objectives (RAOs) were developed for ST-14:

- Prevent the ingestion of shallow groundwater containing contaminants that exceed federal MCLs, non-zero maximum contaminant level goals (MCLGs), or in their absence, an excess cancer risk of 1×10^{-4} to 1×10^{-6} or a hazard quotient (HQ) of 1.
- Prevent off-site migration of shallow groundwater with contamination above cleanup levels.
- Restore shallow groundwater to expected beneficial uses to the extent practicable within a reasonable time frame.
- Prevent residential exposure to soil.
- Prevent residential and/or commercial exposure to groundwater contaminants at levels of concern via dermal contact, ingestion, or vapor intrusion.

The remedial action selected for the site should attain these RAOs, which address the unacceptable risks from VOCs in site soils and groundwater. The RAOs are intended to clean up the groundwater and, during the remediation, ensure potential future human receptors do not come into contact with the groundwater at the site (i.e., through drinking or contact during construction activities) so that no unacceptable exposure to the hazardous constituents will occur.

Achievement of the RAOs will be quantitatively measured by the achievement of cleanup criteria during the implementation of the remedy. Cleanup criteria for ST-14 were set to federal Safe Drinking Water Act MCLs.

<table>
<tr><th>COC</th><th>Cleanup Criteria (MCL) (µg/L)</th></tr>
<tr><td>Benzene</td><td>5</td></tr>
<tr><td>CT</td><td>5</td></tr>
<tr><td>Toluene</td><td>300</td></tr>
<tr><td>TCE</td><td>5</td></tr>
<tr><td>Vinyl Chloride</td><td>2</td></tr>
<tr><td>Xylenes, total</td><td>500</td></tr>
</table>
</td>
<td>E</td>
<td>The Draft SWMU 56 RI does not assert that chloroform is an ST-14 COC. It acknowledges that it is addressed in the ST-14 ROD as a degradation product. The Draft RI (pg ES-1 and pg 1-5) states the following:

“The primary groundwater contaminants of concern (COCs) identified for ST-14 include trichloroethene (TCE), vinyl chloride (VC), carbon tetrachloride, benzene, toluene, and xylenes. A Record of Decision (ROD), signed in September 2007, identified site-wide enhanced in-situ biodegradation with groundwater monitoring and institutional controls as the major components of the selected remedy for ST-14. The ST-14 ROD (USEPA, 2007) addresses both the COCs and their respective degradation products (cis-1,2-dichloroethene and chloroform for example).”

See page 2-24 of the ST-14 ROD for the specific mention of chloroform as a metabolite of CT addressed in the ROD.</td>
<td></td>
</tr>
</table>

---

[1] A = agree D = disagree E = explanation FD = needs further discussion X = take exception to

<table>
<tr>
<td>4.</td>
<td>Furthermore, the ST-14 ROD states the following:

<i>2.12 SELECTED REMEDY FOR GROUNDWATER</i>
<i>"Based on the evaluation of the remedial alternatives, Alternative 4 is the selected remedy for the remediation of benzene, CT, and TCE contamination in groundwater at ST-14."</i>

There is no mention of chloroform as a COC or degradation product.</td>
<td>E</td>
<td>See response to comment #3.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Comment 5 and RTC continued.

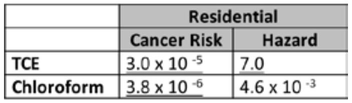
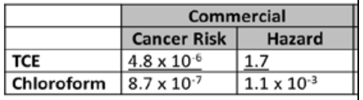
• Based on the 2012 dataset (which was not considered in the BLRA), the maximum groundwater levels of chloroform (490 ug/L) and TCE (45 ug/L) generate the following
VI risks:

residential exposure scenario: cancer = 6.4E-04 (due primarily to chloroform) and HI = 9.1 (due to TCE)
commercial exposure scenario: cancer = 1.5E-04 (due primarily to chloroform) and HI = 2.3 (due to TCE)

• Based on the 2016 dataset, the maximum groundwater levels of chloroform (3 .1 ug/L) and TCE (36 ug/L) generate the following VI risks:

residential exposure scenario: cancer = 3.4E-05 (due primarily to TCE) and HI = 7.0 (due to TCE)
commercial exposure scenario: cancer= 5.7E-06 (due primarily to chloroform) and HI = l. 7 (due to TCE)

Therefore, there is a VI at SWMU56 due to chloroform or TCE which is NOT a contaminant of concern at ST·l4. The ROD does not address VI risk or the degradation products.</td>
<td>E</td>
<td>The VI risks using the 2016 data is shown below (note that commercial VI cancer risk is not due to chloroform.)


<table>
<tr><td></td><td colspan="2">Residential</td></tr>
<tr><td></td><td>Cancer Risk</td><td>Hazard</td></tr>
<tr><td>TCE</td><td>3.0×10^{-5}</td><td>7.0</td></tr>
<tr><td>Chloroform</td><td>3.8×10^{-6}</td><td>4.6×10^{-3}</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">Commercial</td></tr>
<tr><td></td><td>Cancer Risk</td><td>Hazard</td></tr>
<tr><td>TCE</td><td>4.8×10^{-6}</td><td>1.7</td></tr>
<tr><td>Chloroform</td><td>8.7×10^{-7}</td><td>1.1×10^{-3}</td></tr>
</table>

As stated in response to comment #1, VI risk for residents is addressed in the ST-14 ROD.

Commercial VI risk (as shown above) is due to TCE, which is attributable to ST-14. Based on Tier I discussions and as stated in the general comment at the beginning of these RTCs, VI due to ST-14 contaminants will be addressed as a part of future ST-14 activities.</td>
<td></td>
</tr>
</table>

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[1] A = agree D = disagree E = explanation FD = needs further discussion X = take exception to

			Language has been added to this RI and will be carried forward in the PP and ROD.	
6.	Table 4-5: 2016 Groundwater VISL Screening identifies a VI risk which must be addressed. Therefore, it appears prudent that the VI risk required ICs.	E	See response to previous comments regarding VI risk at ST-14.	
7.	Comment 25 and Response. Please see comments above. Your response in incorrect as noted above.	E	See response to previous comment regarding chloroform in the ST-14 ROD.	
8.	Response to comment 31. "The Draft RI does not assert that chloroform is a COC in the ST-14 ROD." This is correct. Therefore, chloroform is not being addressed in the ST-14 ROD.	E	See response to previous comment regarding chloroform in the ST-14 ROD.	
9.	Response to comment 33: ICs are required. We either amend the ST-14 ROD for VI at for SWMU56 or we add ICs for the VI risk for SWMU56 until the risk is gone and until UUUE is achieved at ST-14.	E	See response to previous comments regarding VI risk at ST-14.	
10.	The above comments must be addressed in the report.	A	See general comment at the beginning of these RTCs. VI due to TCE will be addressed as a part of future ST-14 activities. Language has been added to this RI and will be carried forward in the PP and ROD.	

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Date: April 19, 2018

Mr. Bill Burris, Chief
Environmental Restoration
11th CES/CEAN
3446 North Carolina Ave.
Joint Base Andrews, MD 20762-4803

Re: Draft RI SWMU 56 RTCs V2
Andrews AFB Joint Base Andrews

Dear Mr. Burris:

The EPA has reviewed the Response To Comments (RTCs) V2 Draft Final Remedial Investigation at SWMU 56 Performance-Based Restoration, Joint Base Andrews Naval Air Facility Washington, Camp Springs, Maryland, Contract W9128F-13-D-0002, DO #0004, August 2017, Version: 00 and the response to comments. EPA is pleased to provide you the following comments.

EPA Review

1. The responses are generally acceptable. The remedial investigation, summary and conclusions, as well as the proposed plan and record of decision (ROD) will need to be explicitly clear as to the rational for no action and that the VI risk will be address under ST-14. A timetable to incorporate the VI risk due the contaminated groundwater at ST-14 will need to be detailed. The VI risk at the Civil Engineering Yard will need to be address as an ESD for ST-14. The other occupied building will need to be evaluated for VI risk.

Thank you. As always, if you have questions about this letter, please feel free to contact me. My e-mail address is sochanski.andy@epa.gov and my telephone number is 215-814-3370.

Sincerely,

S Andrew Sochanski, P.G., RPM
Federal Facilities Branch (3HS11)

cc: Peggy Williams, MDE LMD/FF
Kenneth A. Clare, PGCHD