FINAL

Decision Document
Manassas Air Force Communication Facility
Independent Hill, Virginia

FUDS Project No.: C03VA051902

Prepared by:

US Army Corps
of Engineers®
BUILDING STRONG®

October 2021

This page intentionally left blank

TABLE OF CONTENTS

1.0 DECLARATION ... 1
1.1 Site Name and Location ... 1
1.2 Statement of Basis and Purpose ... 1
1.3 Assessment of the Site ... 1
1.4 Description of Selected Remedy ... 2
1.5 Statutory Determinations ... 2
1.6 Decision Document Data Certification Checklist ... 2
1.7 Authorizing Signatures ... 3
2.0 DECISION SUMMARY ... 5
2.1 Site Name, Location and Description ... 5
2.2 Site History ... 5
2.3 Previous Investigations ... 5
2.3.1 Environmental Investigations Prior to Remedial Investigation ... 5
2.3.2 Remedial Investigation ... 7
2.3.3 Supplemental Site Characterization ... 7
2.3.4 Monitored Natural Attenuation Study ... 7
2.3.5 Feasibility Study ... 7
2.3.6 Proposed Plan ... 8
2.4 Community Participation ... 8
2.5 Scope and Role of Response Action ... 9
2.6 Site Characteristics ... 9
2.6.1 Aquifer Characterization ... 9
2.6.2 Contaminants of Concern ... 10
2.6.3 Extent of Contamination ... 10
2.7 Current and Potential Future Land Use and Land Use Control ... 11
2.8 Summary of Site Risks ... 11
2.9 Remedial Action Objectives ... 12
2.10 Description of Potential Remedial Alternatives ... 13
2.11 Summary of Comparative Analysis of Potential Remedial Alternatives ... 16
2.11.1 Overall Protection of Human Health and the Environment ... 16
2.11.2 Compliance with ARARs ... 16
2.11.3 Long-Term Effectiveness and Permanence ... 16
2.11.4 Reduction of Toxicity, Mobility, and Volume through Treatment ... 17
2.11.5 Short-Term Effectiveness ... 17
2.11.6 Implementability ... 17
2.11.7 Cost ... 17
2.11.8 State Acceptance ... 18
2.11.9 Community Acceptance ... 18
2.12 Principal Threat Waste ... 18
2.13 Selected Remedy ... 18
2.13.1 Description of Selected Remedy ... 18
2.13.2 Summary of Rationale for Selected Remedy ... 21

2.13.3 Summary of Estimated Remedial Costs 22
2.13.4 Expected Outcomes of Selected Remedy 22
2.14 Statutory Determinations 22
2.14.1 Protection of Human Health and the Environment 22
2.14.2 Compliance with ARARs 22
2.14.3 Cost-Effectiveness 22
2.14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies .. 23
2.14.5 Preference for Treatment as a Principal Element 23
2.15 Documentation of Significant Changes 23
3.0 RESPONSIVENESS SUMMARY 25
4.0 REFERENCES 29

List of Tables

Table 1. Potential ARARs
Table 2. Comparison of Remedial Alternatives
Table 3. Alternative 5 Cost Estimate

List of Figures

Figure 1. Site Location
Figure 2. Site Map
Figure 3. Schematic Cross Section of Three Hydrostratigraphic Zones
Figure 4. 3-D Rendering of TCE Plume (East-West)
Figure 5. Extent of TCE Contamination in Three Hydrostratigraphic Zones (data collected in February 2017)

List of Appendices

Appendix A Public Meeting Summary
Appendix B Declaration of Restrictive Covenants

LIST OF ABBREVIATIONS AND ACRONYMS

1,1-DCA	1,1-Dichloroethane
1,2-DCA	1,2-Dichloroethane
1,1-DCE	1,1-Dichloroethene
µg/L	micrograms per liter
ASA	Assistant Secretary of the Army
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
cis-1,2-DCE	cis-1,2-Dichloroethene
CVOCs	chlorinated volatile organic compounds
DD	Decision Document
DERP	Defense Environmental Restoration Program
DHC	Dehalococcoides spp.
DoD	Department of Defense
DORC	Declaration of Restrictive Covenants
FS	Feasibility Study
ft	foot/feet
FUDS	Formerly Used Defense Sites
GAC	granular activated carbon
GRA	general response action
Hana	Hana Engineers & Consultants, LLC
HHRA	human health risk assessment
HQ	hazard quotient
IE&E	Installations, Energy and Environment
IGD	Interim Guidance Document
ISCO	In Situ Chemical Oxidation
ISCT	In Situ Chemical Treatment
ISCR	In-situ Chemical Reduction
ISEB	In Situ Enhanced Bioremediation
LTM	Long-Term Management
LUC	land use control
MAFCF	Manassas Air Force Communications Facility
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
MNA	monitored natural attenuation
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
PA	Preliminary Assessment

PCE	tetrachloroethylene
PP	Proposed Plan
PWCS	Prince William County Schools
RA	Remedial Action
RAO	remedial action objective
RD	remedial design
RG	remediation goal
RI	Remedial Investigation
SI	Site Inspection
SSC	Supplemental Site Characterization
TCE	trichloroethene
TMV	toxicity, mobility, and volume
UECA	Uniform Environmental Covenants Act
USACE	U.S. Army Corps of Engineers
U.S.	United States
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
UU/UE	unlimited use and unrestricted exposure
VA	Virginia
VDEQ	Virginia Department of Environmental Quality
VDWM	Virginia Department of Waste Management
VISL	Vapor Intrusion Screening Level
VOC	volatile organic compound
VC	vinyl chloride

1.0 DECLARATION

1.1 Site Name and Location

The subject of this Decision Document (DD) is the former Manassas Air Force Communications Facility (MAFCF), located in Independent Hill, Virginia (VA). The facility consisted of approximately 50.1 acres, bounded by Joplin Road (Route 619) on the east and Aden Road on the north, in Prince William County, VA (**Figure 1**). The site lies just north and west of Prince William Forest Park and is bordered on the west and south by Marine Corps Base (MCB) Quantico. The site is currently owned and operated by Prince William County Schools (PWCS) for the purpose of school administration and for the operation of the Independent Hill Complex (**Figure 2)**.

1.2 Statement of Basis and Purpose

This DD presents the U.S. Army Corps of Engineers (USACE) Baltimore District's selected Remedial Action (RA) to address the contaminated groundwater on the property. The contaminant of concern (COC) plumes in groundwater are associated with the past land use activities by the Department of Defense (DoD) at the MAFCF. The MAFCF is listed in the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) with FUDS Project Number C03VA051902. The USACE Baltimore District is the lead agency for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions concerning this FUDS.

The RA was chosen in accordance with the requirements of CERCLA, 42 United States (U.S.) Code (USC) § 9601 *et seq.* as amended by the Superfund Amendments and Reauthorization Act and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The USACE Baltimore District based its decision on information contained in the Administrative Record file for the MAFCF. Comments received on the Proposed Plan (PP) from the Virginia Department of Environmental Quality (VDEQ) and the general public were considered during the selection of the final remedy. All VDEQ comments were resolved prior to the finalization of the PP and before the public comment period. The public comments and associated responses received during the public comment period are documented in Section 3.0 Responsiveness Summary of this DD.

1.3 Assessment of the Site

The response action selected in this DD is necessary and appropriate for protecting human health and the environment from potential exposure to the groundwater contamination at this site. Based on data collected throughout the environmental investigations and human health risk assessment (HHRA) for the site, eight chlorinated volatile organic compounds (CVOCs) (tetrachloroethylene [PCE], trichloroethene [TCE], cis-1,2-Dichloroethene [cis-1,2-DCE], trans-1,2-Dichloroethene [trans-1,2-DCE], 1,1-Dichloroethene [1,1-DCE], 1,2-Dichloroethane [1,2-DCA], 1,1-Dichloroethane [1,1-DCA], and vinyl chloride [VC]) were determined to be COCs for site groundwater. The potential use of groundwater as a future tap water source for future residents poses an unacceptable risk.

1.4 Description of Selected Remedy

USACE selected Remedial Alternative 5, In Situ Chemical Treatment (ISCT) in Source Areas followed with In Situ Enhanced Bioremediation (ISEB) in Plume Areas to address the groundwater contamination. The major components of the selected remedy include:

- Pre-remedial design (RD) parameter optimization study.
- Design and implement ISCT in identified source areas.
- Design and implement ISEB in residual plume areas subsequent to ISCT application.
- Monitored natural attenuation (MNA).
- Groundwater sampling and analysis.

1.5 Statutory Determinations

The selected RA is protective of human health and the environment; complies with Applicable or Relevant and Appropriate Requirements (ARARs); is cost-effective; and utilizes permanent solutions to address the potential risk associated with the localized groundwater plumes. The selected remedial alternative satisfies the statutory preference for treatment as a principal element of the remedy, permanently and significantly reducing the toxicity, mobility, and volume (TMV) of the COCs. The selected RA will likely result in COC concentrations on-site above levels that allow for unlimited use and unrestricted exposure (UU/UE) longer than five years; therefore, CERCLA five-year reviews will be conducted after initiation of the selected RA and will continue until the groundwater remediation goals (RGs) have been achieved. All remedial activities, including mixing, injection, and follow-up sampling, will be conducted in accordance with site safety and health plans and will pose no danger to the surrounding community or workers, or to the environment.

1.6 Decision Document Data Certification Checklist

The following bulleted information related to the selected RA is included in the Decision Summary section of this document and satisfies the certification requirements for this DD.

- Identified COCs (PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, 1,2-DCA, 1,1-DCA, and VC) and their reported concentrations in groundwater.
- Baseline human health risk values represented by the concentrations of COCs in groundwater.
- Basis for the RA.
- Potential source materials constituting principal threats.
- Current and reasonably anticipated future land use assumptions.
- Estimated capital, annual operations and maintenance (O&M), and total present worth costs.
- Key factors that led to selecting the remedy.
- Description of the selected RA.

Additional site information, including the Remedial Investigation (RI) Report (Versar, 2013), Feasibility Study (FS) (Hana, 2019) and PP (Hana, 2020), can be found in the Administrative Record file, located at the PWCS Facilities Services Administration Office, 14800 Joplin Road, Independent Hill, VA 20112.

1.7 Authorizing Signatures

This DD presents the RA decision for the former MAFCF under the HTRW FUDS Program. USACE is the lead agency for the FUDS and developed this DD in accordance with CERCLA, as amended by SARA, and the NCP. This DD will be incorporated into the existing Administrative Record files. The AR is available for public review at the Administrative Record file, located at the PWCS Facilities Services Administration Office, 14800 Joplin Road, Independent Hill, VA 20112. The addition of the DD completes the AR for the former MAFCF.

The DoD is the lead agency under the DERP for the former MAFCF FUDS and USACE has developed this DD for DoD. This DD is consistent with CERCLA, as amended, and the NCP. The DD is approved by the undersigned, pursuant to the delegated authority in the Assistant Secretary of the Army (ASA) for Installations, Energy and Environment (IE&E) memorandum dated 24 June 2019, subject: Assignment of Mission Execution Functions Associated with DoD Lead Agent Responsibilities for the FUDS Program, and the 9 February 2017 Memo Interim Guidance Document (IGD) for the FUDS DD Staffing and Approval.

APPROVED:

BAKER.KAREN.J.1137993380 Digitally signed by BAKER.KAREN.J.1137993380
Date: 2021.12.13 08:44:01 -05'00'

KAREN J. BAKER **Date**
Programs Director
North Atlantic Division

This page intentionally left blank

2.0 DECISION SUMMARY

2.1 Site Name, Location and Description

The former MAFCF is located in Independent Hill of Prince William County, VA, approximately 11 miles southwest of Manassas, VA. The facility consisted of approximately 50.1 acres, bounded by Joplin Road (Route 619) on the east and Aden Road on the north in Prince William County, VA (**Figure 1**). The site lies just north and west of Prince William Forest Park and is bordered on the west and south by MCB Quantico. The site is currently owned and operated by PWCS for the purpose of school administration and for the operation of the Independent Hill Complex (**Figure 2**). Operations at the Complex include facilities services (i.e., planning, new construction, maintenance), food services, transportation, supply services, and other educational support services (i.e., Head Start, Child Find, adult education, testing, and information technology support). In the central portion of the site, MHz Networks maintains a television transmitter tower with two associated support buildings (**Figure 2)**. The tower and the buildings are not maintained by PWCS.

2.2 Site History

MAFCF was one of many parcels of federal land annexed in 1943 to MCB Quantico. From 1952 to 1959, the DoD used it as an aircraft control and warning station in the Air Defense Command radar network, although the Marine Corps did not formally transfer the land to the U.S. Air Force until 1956. During that time, DoD owned 32 buildings, security and fencing, service facilities, roads, sidewalks, parking areas, utilities, nine single-family residential units, and other miscellaneous accessories. The DoD declared the installation excess to the needs of the Air Force in 1964. Between 1968 and 1975, the site, encompassing a total of 50.1 acres, was transferred to the PWCS (Versar, 2013).

2.3 Previous Investigations

2.3.1 Environmental Investigations Prior to Remedial Investigation

A variety of environmental investigations were performed prior to the more comprehensive RI. A summary of these pre-RI investigations is provided below. Additional details can be found in the RI Report (Versar, 2013).

- <u>1986, Preliminary Assessment (PA) by Virginia Department of Waste Management (VDWM):</u> Water samples were collected at five drinking water production wells (PW-1, PW-2, PW-3, PW-4, and PW-5). The five wells were closed in 1986 when the site was connected to the county water system as a result of the detection of TCE in these production wells.

- <u>1989, Final Engineering Report by Sirrine Environmental Consultants, Inc.:</u> The report considered several historical potential sources of contamination at MAFCF, including underground storage tanks, several drums of chlorinated solvents reportedly present during the 1950s, and an old sanitary seepage field. Surface and subsurface media were sampled, with results showing elevated levels of chlorinated solvent contamination in some areas.

No sources were discovered, aside from petroleum detections consistent with known locations of the underground storage tanks now used by PWCS.

- 1991, Site Screening Inspection Follow-up by VDWM: The screening evaluated risk to students at Independent Hill Schools because of contaminated soil. It included soil sampling and risk assessment. The inspection found the carcinogenic risks to be very low and to not pose an imminent threat to public health.

- 1991, Asbestos-containing Material Investigation by Weston: An investigation was conducted focusing on the presence of asbestos in the former housing area. Asbestos was found in the former housing units, and some metal and petroleum compounds were detected in exceedance of naturally occurring levels in the soil.

- 1998, PA/Site Inspection (SI) by Ecology and Environment Inc.: This study was completed for the former Faught property, located east of MAFCF. The property was a former construction contracting business and landfill. Metals were detected in soil and groundwater, but they were determined not to be related to the MAFCF, and groundwater was determined to flow away from MAFCF.

- 2000, Historical Aerial Photography Investigation by USACE-Topographic Engineering Center: Historical aerial photography investigations were conducted on ground scars and potential waste disposal areas from 1953 and 1963 photos. Based on ground truthing, the scars and disposal area “trenches” were found to be constructed drainage swales.

- 2003, Desktop Audit Summary Report for Site Screening Process by MicroPact: Documents were evaluated to determine whether operations at or around the site were likely to have resulted in a release of hazardous materials. The report compiled a list of potential COCs in soil, surface water and groundwater. It also included an interview with a past employee who believed radioactive debris was buried in two locations on-site: one near the former Army housing area, the other in the location of the present Verizon cellular phone tower in the northwest portion of the site. No records were found substantiating this claim.

- 2003, Radiation Reconnaissance Survey by MicroPact: The survey was performed along the perimeter of the Verizon property. No radiation levels above background levels were detected.

- 2006, Environmental Investigation by MicroPact: This investigation focused on potential burial of radioactive wastes, potential for TCE vapor intrusion into indoor air at the Independent Hill School and an evaluation of the potential source for TCE contamination, and a groundwater use survey for the vicinity of the site. This study concluded no risk to the students. In addition, the abandoned drinking water supply well next to the school showed no concerns. No evidence of the presence of buried radioactive materials was discovered.

- 2007, PA/SI by Versar: The CERCLA PA/SI reviewed and verified all available information generated by previous investigations and determined the MAFCF’s status under the FUDS program. No confirmed source of history of known waste disposal was identified. The report recommended further investigation.

2.3.2 Remedial Investigation

The RI was conducted by Versar from 2008 to 2013. The RI Report (Versa, 2013) provided detailed information on these investigations. The RI evaluated the potential presence and extent of on-site contamination, potential for off-site migration of contaminants, and impacts on human health and the environment via baseline human health and ecological risk assessments. The nature and extent of contaminants present in soil, sediment, surface water, groundwater, and sub-slab vapor were determined through sampling and analysis. Field activities during the RI included Membrane Interface Probe, soil sampling, well installation and groundwater sampling, surface water / sediment sampling, real-time VOC groundwater sampling, and sub-slab VOC sampling. Findings indicated that concentrations of chlorinated solvents present in groundwater presented potentially unacceptable long-term risks to residents. While groundwater on site is not used for potable purposes, usable groundwater is considered a resource in Virginia and was evaluated as a potential source of potable water for exposure to groundwater in the baseline risk assessment.

2.3.3 Supplemental Site Characterization

Subsequent to the RI, a Supplemental Site Characterization (SSC) was conducted to further assess groundwater and soil gas at MAFCF. The SSC also characterized soil that would be disturbed during construction of a new PWCS maintenance building and its associated infrastructure. Field activities included test borings, soil and soil gas sampling, and installation and sampling of groundwater monitoring wells. Results are discussed in the SSC Report (A-Zone, 2018). The extent of groundwater impacts was further delineated at MAFCF. Based on sub-slab soil gas sampling results, USACE (2018) evaluated the vapor intrusion risks from soil gas and determined that there was no vapor intrusion risk to site users (workers and visitors).

2.3.4 Monitored Natural Attenuation Study

Hana completed two rounds of biological testing, the first with standard bio-traps and the second with biostimulation and bioaugmentation bio-traps, in 2016 to determine whether bioremediation via reductive dechlorination was a suitable remedial alternative for MAFCF. The results are documented in Hana (2018). No detectable levels of Dehalococcoides spp. (DHC), tceA gene, bvcA gene, or vcrA gene were present at the site during the first testing, whereas measurable levels of DHC were present in all three units (MNA, biostimulation, and bioaugmentation) during the second testing. In addition, tceA gene and vcrA gene were present, indicating the presence of the enzyme responsible for reductive dechlorination of TCE to DCE and from cis-DCE and VC to ethene.

2.3.5 Feasibility Study

The FS was completed in 2019, and the results of the FS were presented in the Final FS Report (Hana, 2019). The FS presents a detailed analysis of six potential remedial alternatives:

- Alternative 1: No Action
- Alternative 2: MNA
- Alternative 3: ISEB in Source Areas

- Alternative 4: ISCO in Source Areas
- Alternative 5[1]: ISCT in Source Areas Followed with ISEB in Plume Areas
- Alternative 6: Groundwater Extraction & Treatment in Source Areas

The strengths and weaknesses of the remedial alternatives relative to one another were evaluated with respect to each of the nine criteria required by the NCP, 40 Code of Federal Regulations (CFR) 300.430(e)(9)(iii).

2.3.6 Proposed Plan

The PP presents the preferred remedy to remediate the groundwater at MAFCF and rationales for such a selection (Hana, 2020). The PP fulfills the public participation requirements of the CERCLA Section 117(a). The selected remedy is Remedial Alternative 5: ISCT in Source Areas Followed with ISEB in Plume Areas.

2.4 Community Participation

USACE has satisfied the public participation requirements of CERCLA and the NCP (40 CFR § 300.430(f)(3)) during the investigation of this site and the selection of the RA. Associated project documents have been updated on a regular basis in the Administrative Record and the information repository maintained on site at the PWCS Facilities Services Administrative Office, Independent Hill Administrative Complex, Building 51, 14800 Joplin Road, Manassas, VA 20112. A Community Relations Plan was prepared and implemented to keep the public informed of site activities and to invite community input. As part of the plan, community members were asked about their interest in the project. Based on low community interest in the project, the USACE Baltimore District rendered a negative determination in 2015 for the establishment of a Restoration Advisory Board at the site.

The PP was made available to the public on September 1, 2020, at www.nab.usace.army.mil/EnvironmentalNotices and at the Facilities Services Administrative Office, Independent Hill Complex, Building 51, 14800 Joplin Road, Manassas, VA 20112. A notice of availability of the PP and notification of the public meeting date were published on the PWCS, USACE Baltimore District, and Prince William Living websites and the PWCS Twitter page. USACE held a virtual public meeting on September 22, 2020, with the intent of allowing community attendees the opportunity to interact with the project delivery team and to discuss the proposed RA.

During the virtual public meeting, a brief history of the RI efforts was imparted to interested community members. USACE explained that groundwater at the site — specifically the contaminated groundwater — is not currently a source of drinking water in the area and that the

1 In the FS and PP reports, Alternative 5 was described as ISCO in Source Areas Followed with ISEB in Plume Areas. To ensure consideration of all applicable amendments including any emerging ones, the treatment technology in the source area is expanded to include In-situ Chemical Reduction (ISCR) amendments. Such a change does not affect the alternative evaluation results but give additional flexibility in amendment selection in RA. As a result, Alternative 5 is described as ISCT in Source Areas Followed with ISEB in Plume Areas throughout this DD.

most recent sample data indicate that concentrations of COCs are greater than the RGs confined within the underlying aquifers.

In accordance with the NCP, a public comment period was afforded to review the proposed RA between September 1, 2020, (i.e., the date immediately following publication of the public notice) and October 5, 2020.

2.5 Scope and Role of Response Action

The USACE Baltimore District will execute the selected RA for contaminated groundwater at MAFCF in a manner that is consistent with CERCLA and the NCP.

In accordance with the DERP Manual and FUDS Program Policy (Department of the Army, 2004), USACE considers RA as a response for sites where contamination exists that poses unacceptable risk to human health and the environment from historical DoD activities.

The overall role of the response action for this site is to reduce COC concentrations in site groundwater to concentrations less than or equal to the RGs to mitigate risk.

2.6 Site Characteristics

With the completion of the RI and SSC Reports, and throughout the environmental investigations conducted at the site, a complete list of COCs has been developed, the full lateral and vertical extent of contamination has been defined, and site risk has been assessed.

2.6.1 Aquifer Characterization

MAFCF is located within the Piedmont Physiographic Province of Virginia, which is dominated by hard, crystalline igneous and metamorphic formations, with saprolitic deposits overlying the bedrock. The lithology across MAFCF is highly variable and consistent with the regional lithology. The highly weathered shallow units below the topsoil at MAFCF are largely saprolite, which is chemically altered (i.e., weathered) bedrock. Saprolitic material of both the phyllite and the gneiss-like units occur at the site from as shallow as a few feet (ft) below ground surface (bgs) to approximately 50 ft bgs, before transitioning to weathered, more competent units of the same. The competent bedrock at the site, which consist of schist, quartz, quartzite, and gneiss, reaches a depth of approximately 170 ft bgs. Several quartz veins are present in the subsurface materials across the site and occur at depths from as shallow as 4 ft bgs to depths greater than 74 ft bgs. Fractures were reported in the competent bedrock at depths ranging from 69 ft bgs to 151 ft bgs. Based on borehole geophysical logging and packer testing completed during the SSC, these fractures may be water-producing. **Figure 3** shows the schematic cross section that highlights the three hydrostratigraphic units of the site.

Twenty-three permanent monitoring wells are present at MAFCF for groundwater level gauging and groundwater sampling. These wells were screened in three distinct intervals: shallow, intermediate, and deep zones. These three zones correspond with the saprolite, transition and competent bedrock, respectively. Screened intervals for the shallow wells are set at depths of 10 to 42 ft bgs. Screened intervals for the intermediate wells are set at depths of 42 to 90 ft bgs. The screened intervals for the deep wells are set at 85 to 170 ft bgs.

Although groundwater at MAFCF is monitored in three hydrostratigraphic zones, no continuous and ubiquitous aquitards were identified between these three zones. Shallow groundwater flow at the site appears to generally follow site topography, while groundwater within the bedrock follows the shallow groundwater and flows primarily to the west, but the groundwater flow within the bedrock is likely to also be influenced by bedrock fractures when they are present. Borehole geophysics and packer testing indicate that deep groundwater at MAFCF occurs in fractures or fracture zones, while the fracture density varies from one location to another. Packer testing completed in 2016 suggests varying degrees of interconnection between fractures in the deep zone (SSC, 2018).

2.6.2 Contaminants of Concern

Based on data collected throughout historical environmental investigations, groundwater at MAFCF has been impacted primarily by TCE and related degradation products. The following COCs were identified in groundwater:

- Tetrachloroethylene (PCE)
- Trichloroethene (TCE)
- Cis-1,2-Dichloroethene (cis-1,2-DCE)
- Trans-1,2-Dichloroethene (trans-1,2-DCE)
- 1,1-Dichloroethene (1,1-DCE)
- 1,2-Dichloroethane (1,2-DCA)
- 1,1-Dichloroethane (1,1-DCA)
- Vinyl Chloride (VC)

The results of the HHRA performed during the RI phase (discussed in Section 2.8) indicate that these compounds pose a potential risk to human health at the site and are to be considered COCs for the site.

2.6.3 Extent of Contamination

The extent of groundwater contamination at MAFCF was investigated during the RI (Versar, 2013) and the SSC (A-Zone, 2018). **Figure 4** shows the TCE concentration distributions in the three hydrostratigraphic zones consisting of saprolite, transition zone and competent bedrock based on results of the groundwater samples collected in February 2017. The plume configurations including those beneath the buildings were based on interpolation of data at the monitoring wells. Although no monitoring wells were present within the building footprint, extensive source investigations were conducted at the building site prior to their construction, and no significant soil and groundwater impacts were identified (A-Zone, 2018). TCE is the most prevalent COC at the Site, and its extent represents the worst scenario of the extent of contamination. The plumes are generally oriented in a westerly path consistent with the regional groundwater flow. Shallow groundwater at MAFCF appears to discharge to the unnamed tributary of South Fork Quantico Creek located west of the site on MCB Quantico property (**Figure 2**). Groundwater within the transition and deep bedrock zones are influenced by bedrock fractures, with the transition zone providing recharge for the deep zone.

The highest TCE concentrations in the three zones, 1,670 micrograms per liter (µg/L) in the saprolite, 10,500 µg/L in the transition zone, and 187 µg/L in the bedrock, occurred at MW-7A, MW-7B, and MW-7C, respectively. The MW-7 cluster wells are believed to be in the former source area. The highest cis-1,2-DCE concentration of 4,530 µg/L was also detected at MW-7B, and the highest VC concentration of 12.9 µg/L occurred at MW-7A.

The lateral extents of TCE contamination were limited within the property boundary (**Figure 5**). However, the lateral extent of TCE contamination is not as well-defined in the bedrock as it is in the saprolite or transition zone. TCE concentrations of 39.7 µg/L and 23.6 µg/L were detected at two bedrock wells, MW-2C and MW-2D, located just east of the property boundary. Since monitoring wells have not been installed on the western side of the property boundary, additional data will be needed to confirm this plume interpretation. In terms of the vertical extent of contamination, a TCE concentration of 23.6 µg/L was detected in MW-2D, which is the deepest bedrock monitoring well installed at the site, with a screening interval between 155 and 170 ft bgs.

2.7 Current and Potential Future Land Use and Land Use Control

The site is currently owned and operated by PWCS as the Independent Hill Complex (**Figure 2**). The current land use includes education, industry, and commercial use. No drinking water supply wells are currently present on the MAFCF property. Land use of the site is expected to remain unchanged for the foreseeable future.

Uniform Environmental Covenants Act (UECA) agreement was used as a land use control mechanism during remedial alternative analysis in the FS and PP reports (Hana, 2019; 2020). USACE coordinated with USACE Office of the Chief Counsel (CECC-E) to include the UECA as part of the preferred alternative. In preparation of this DD, USACE, VDEQ, and PWCS had extensive discussions on land use control of the site and reached the consensus that a Declaration of Restrictive Covenants (DORC) is more implementable and the best land use control mechanism for the site. The DORC is implemented by PWCS in favor of the VDEQ. The DORC will ensure that no drinking water wells are installed on the property. Because implementation of the DORC occurred prior to the final DD, the DORC is considered to be an existing condition. The DORC is included as **Appendix B**.

2.8 Summary of Site Risks

A risk assessment was completed as part of the RI/Risk Assessment (Versar, 2013) to determine baseline cancer risks and non-cancer hazards associated with exposure to groundwater at the site on human receptors. The HHRA evaluated cumulative risks to a construction worker and a potential future resident adult and resident child. The resident (adult and child) was evaluated for exposure to groundwater as a tap water source. The construction worker was evaluated for exposure to groundwater while working in a trench.

Risk evaluation for the resident (adult and child) was based on exposure pathways including ingestion of, dermal contact with, and inhalation of COCs in groundwater. The non-carcinogenic hazards for the resident child and resident adult were found to be above the acceptable hazard quotient (HQ) of 1. TCE, VC, 1,2-DCE (total), and cis-1,2-DCE were found to have chemical-specific HQs greater than 1. Incremental lifetime carcinogenic risks for the resident (adult and child) were above the upper end of the U.S. Environmental Protection Agency (USEPA) acceptable carcinogenic risk range of 10^{-6} (one additional cancer case out of a population of one million) to 10^{-4} (one excess cancer case out of a population of 10,000), as defined by the NCP (USEPA, 1988). Both TCE and VC were found to have carcinogenic risks above 10^{-4} for the groundwater ingestion exposure pathway. Therefore, health concerns exist regarding use of groundwater as a tap water source at MAFCF. However, because there is no current access to the groundwater on the site as tap water, no current unacceptable risk exists.

The construction worker was evaluated for incidental ingestion of, dermal contact with, and inhalation of COCs from groundwater while in a trench. Results for the construction worker exposure to groundwater via ingestion and dermal contact were found to be below the carcinogenic risk range. However, the vapor intrusion of soil gas into trenches was a concern, and non-carcinogenic hazards for the construction worker were found to be above the acceptable HQ level.

In addition, the resident adult was evaluated for vapor inhalation risk during showering. Results were found to be below both the acceptable carcinogenic risk range and non-carcinogenic hazard thresholds. Because the RI (Versar, 2013) identified vapor intrusion of soil gas into site buildings as a concern, additional sub-slab soil gas samples were collected during SSC (A-Zone, 2018). The potential residential vapor intrusion risks were evaluated by USACE (2018) using the USEPA Vapor Intrusion Screening Level (VISL) Model. The VISL evaluation concluded that exposure to soil vapors would not present unacceptable risk and hazards for residents. There is no need for notification and monitoring in the existing buildings, which were constructed with vapor barriers as an additional measure to ensure protectiveness.

As a result of the unacceptable risks posed by potential future exposure to the COCs in groundwater, these COCs are to be addressed via RA.

2.9 Remedial Action Objectives

Remedial action objectives (RAOs) are developed to address the COCs, media of concern, potential exposure pathways, and RGs. The RGs are groundwater contaminant concentrations/cleanup levels to be achieved through remedial action, levels set to the same values as the USEPA Maximum Contaminant Levels (MCLs) for the COCs, with exception of 1,1-DCA. An MCL was not available for 1,1-DCA, which is unregulated in Virginia Waterworks Regulations 12VAC5-590-440. A risk-based screening level was calculated at the risk level of 10^{-5} and used as the RG.

- PCE: 5.0 µg/L
- TCE: 5.0 µg/L
- cis-1,2-DCE: 70 µg/L
- trans-1,2-DCE: 100 µg/L
- 1,1-DCE: 7.0 µg/L
- 1,2-DCA: 5.0 µg/L

- 1,1-DCA: 28 µg/L
- VC: 2.0 µg/L

The following RAOs were developed during the FS for MAFCF (Hana, 2019):

1. Restore groundwater for use as a source of drinking water and prevent exposure to groundwater with contaminant levels greater than RGs through ingestion, inhalation, and dermal contact.
2. Prevent off-site (beyond the property boundary) migration of the groundwater contaminant plume to the MCB Quantico property at concentrations above the RGs.

2.10 Description of Potential Remedial Alternatives

To satisfy the RAOs for groundwater at the site, potential general response actions (GRAs) and associated technologies were identified and screened during the FS as potential RAs. The GRAs considered were:

- Passive Response Actions (implementation of land use controls (LUCs) and/or monitoring options).
- Active Response Actions (implementation of technologies of removal, containment, ex situ and/or in situ treatment, and disposal).

Based on the RI results and evaluation of the GRAs, six potential remedial alternatives were developed and analyzed. Details are presented in the FS Report (Hana, 2019). The six remedial alternatives analyzed were:

- Alternative 1: No Action.
- Alternative 2: MNA.
- Alternative 3: ISEB in Source Areas.
- Alternative 4: ISCO in Source Areas.
- Alternative 5: ISCT in Source Areas Followed with ISEB in Plume Areas.
- Alternative 6: Groundwater Extraction & Treatment in Source Areas.

During the FS, detailed analysis was performed for each remedial alternative by comparing against the first seven (threshold and primary balancing criteria) of the nine evaluation criteria identified by the NCP, 40 CFR 300.430(e)(9)(iii).

State acceptance and community acceptance are the other two evaluation modifying criteria. VDEQ reviewed the RI, FS and PP reports and provided comments, which were addressed before each report was finalized. Community acceptance has been obtained through the public comment process, as documented in **Appendix A** of this DD.

Threshold Criteria

- *Overall Protection of Human Health and the Environment* – used to determine whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls or treatment.

- *Compliance with ARARs* – used to evaluate whether the alternative meets federal and state environmental statutes, regulations, or other site-specific requirements, or whether a waiver is justified. **Table 1** presents the identified ARARs, which are National Primary Drinking Water Standards (40 CFR §141.61(a)) – Establishes MCLs. Use of these standards is required by the NCP. No action-specific or location-specific ARARs were identified for groundwater at MAFCF.

Primary Balancing Criteria

- *Long-Term Effectiveness* – used to determine the ability of the alternative to maintain the protection of human health and the environment over time (for comparison purposes, alternatives were evaluated in the FS to a time period of 30 years).
- *Short-Term Effectiveness* – used to consider the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.
- *Reduction in TMV through Treatment* – used to evaluate an alternative's use of treatment to reduce excessive risks, migration, or amount of COCs.
- *Implementability* – used to evaluate the technical and administrative feasibility of implementing the alternative.
- *Cost* – used to estimate capital and annual costs in present dollars to implement the remedial alternative.

Modifying Criteria

- *State Acceptance* – used to evaluate the acceptance of the alternative by VDEQ, the lead regulator for non-National Priority List FUDS in VA.
- *Community Acceptance* – used to evaluate the acceptance of the alternative by the public.

Details of the screening process and a comparison of the remedial alternatives against one another are available in the FS Report (Hana, 2019). **Table 2** provides a color-coded summary of the screening results, with green being favorable, yellow being neutral, and red being not favorable. A brief description of each alternative is provided below:

Alternative 1 – No Action

The No Action alternative is used as a baseline, reflecting current conditions without remediation. This alternative is required under the NCP for the FS process and is used for comparison with each of the other alternatives. The current conditions include a DORC that ensures that no drinking water wells are installed on the property. In this alternative, no groundwater monitoring and/or remediation would be conducted, and existing monitoring wells would not be removed. Any improvement of the groundwater quality would be through natural attenuation including biodegradation, adsorption to aquifer material, mineral precipitation, outgassing, dispersion, and dilution.

In addition, any improvement or further degradation of groundwater quality would not be documented through monitoring. The alternative provides a baseline for comparison of risk reduction achieved by other treatment alternatives.

Alternative 2 – MNA

This alternative includes long-term groundwater monitoring of the natural attenuation of COCs. Improvement of the groundwater quality through natural attenuation is documented through monitoring. Because the DORC[2] is implemented prior to the final DD, the DORC is considered to be an existing condition, and the land use control component is no longer needed during remediation. As a result, land use control component is no longer included in the remedial alternatives.

Alternative 3 – ISEB in Source Areas

This alternative includes the MNA component as discussed in Alternative 2 and in situ degradation of COCs in groundwater via enhanced bioremediation. A substrate would be injected into groundwater contamination source areas to enhance the biological degradation processes already occurring. The purpose of the substrate addition is to promote environmental conditions necessary for biodegradation of the chlorinated solvents. The substrate provides a carbon source for naturally occurring microorganisms to consume oxygen and other electron acceptors and a source of hydrogen necessary for anaerobic biodegradation processes.

Alternative 4 – ISCO in Source Areas

This alternative includes the MNA component as discussed in Alternative 2 and in situ destruction of COCs in groundwater via chemical oxidation. In this alternative, a chemical oxidant would be injected into groundwater contamination source areas to oxidize contaminants. Several different forms of oxidants have been used for ISCO, including permanganate (MnO_4^-), Fenton's hydrogen peroxide (H_2O_2) and ferrous iron (Fe^{+2}) or catalyzed hydrogen peroxide (CHP), ozone (O_3), and persulfate ($S_2O_8^{2-}$). In addition, proprietary oxidants exist, such as RegenOx® by Regenesis Bioremediation Products. These oxidants are considered effective for oxidizing TCE and its degradation products, DCE and VC.

Alternative 5 – ISCT in Source Areas Followed with ISEB in Plume Areas

This alternative proposes a remedy that combines ISCT and ISEB. The ISCT treatment would focus in groundwater contamination source areas to remove mass, whereas the ISEB would be applied as a follow-on phase to the residual plume areas to reduce the plume footprints and the time to reach RAOs. The alternative also includes the MNA component as discussed in Alternative 2.

Alternative 6 – Groundwater Extraction & Treatment for Source Control & Plume Reduction

In addition to the MNA component as discussed in Alternative 2, this alternative includes groundwater extraction and discharge and an ex-situ granular activated carbon (GAC) treatment system. In this alternative, pumping wells would be installed and developed to extract contaminated groundwater and remove contaminant mass in the source areas. The extracted

---

2 UECA agreement was used as a land use control mechanism during remedial alternative analysis in the FS and PP reports.

groundwater would be treated through a series of canisters containing GAC, to which dissolved COCs in groundwater adsorb. The treated water would be discharged to either on-site storm drains or the nearby creek. Both influent and effluent sampling for site-specific COCs is performed to assess remedial effectiveness.

2.11 Summary of Comparative Analysis of Potential Remedial Alternatives

A summary of the comparison of potential remedial alternatives conducted for the FS (Hana, 2019) is presented in **Table 3**.

2.11.1 Overall Protection of Human Health and the Environment

The existing DORC ensures protection of human health and the environment at the site for all alternatives. However, Alternative 1 does not provide any groundwater treatment or monitoring activities to verify the protection. Alternative 2 is protective of human health and the environment and minimizing the potential for off-site exposure through MNA. Alternatives 3 through 6 are also protective, as they include Alternative 2's MNA, in addition to treatment of the impacted groundwater.

2.11.2 Compliance with ARARs

Alternatives 2 through 6 meet the federal and state ARARs by preventing exposure to contaminated groundwater on-site. Various treatments proposed in Alternatives 3 through 6 would also minimize potential for off-site migration. Alternative 1 may comply with the ARARs; however, no monitoring data is collected to demonstrate the compliance.

2.11.3 Long-Term Effectiveness and Permanence

Alternative 2 provides adequate long-term effectiveness by monitoring plume concentrations. Alternatives 3 through 6 provide a higher degree of long-term effectiveness, as they involve treatment of the source and/or plume areas. The long-term effectiveness of these alternatives is dependent on the amount of mass reduction achieved and the ability of MNA to reduce plume concentrations over time. Pre-design or optimization studies would benefit any of these alternatives (3 through 6) to enhance long-term effectiveness. While Alternative 6 provides long-term effectiveness with respect to treatment of the groundwater plume, the O&M required for an active treatment system, coupled with the time it takes to achieve significant mass reduction, creates secondary long-term concerns not associated with Alternatives 3 through 5. Alternative 1 may provide reduction of TMV similar to Alternative 2; however, it does not provide any monitoring to demonstrate the reduction.

The timeframe for achieving MCLs were evaluated for Alternatives 2 through 5 with modeling (Hana, 2019). In Alternative 2, the contaminant concentrations in groundwater are expected to gradually attenuate through natural processes to the MCLs in over 300 years. Alternative 1 would have similar timeframe to Alternative 2; however, no data would be collected to demonstrate the MNA process. In Alternative 3, the timeframe was estimated to be up to 227 years. In Alternative 4, the timeframe would vary from 129 to 248 years, depending on the amount of source mass reduction achieved. In Alternative 5, the estimated timeframe would vary from 1 to 104 years, depending on the amount of source mass reduction and biodegradation rates. These estimated timeframes are more applicable to the shallow and intermediate zones, whereas the fate and transport processes in the deep fractured bedrock are too complicated for timeframe estimation. No quantitative estimate of the cleanup timeframe was conducted for Alternative 6; however, pump-and-treat method is known to have difficulty in achieving MCLs at sites with high CVOC concentrations in fractured bedrock.

2.11.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternatives 1 and 2 will only passively reduce toxicity and volume of COCs in groundwater through natural attenuation processes, while Alternatives 3 through 6 will actively and passively reduce the toxicity and volume. The phased ISCT/ISEB approach in Alternative 5 provides a higher degree of reduction in toxicity and volume than ISEB (Alternative 3) or ISCO (Alternative 4) alone. Alternative 6 provides toxicity and volume reduction but may be less efficient than other alternatives at reducing concentrations and mass, with respect to groundwater volume and length of treatment. Alternatives 3 through 5 would not directly reduce mobility of the contaminants but may be effective in controlling further downgradient plume migration through source mass reduction. Alternative 6 provides some reduction in mobility through hydraulic control.

2.11.5 Short-Term Effectiveness

Alternatives 1 through 6 are effective in the short term, protecting human health and the environment through preventing exposure while the remedial alternatives are implemented. Personal protective equipment would be required to protect personnel working on remedial activities and subsequent groundwater monitoring to limit exposure to groundwater contamination. Alternatives 3 through 5 involve installation of injection wells, which create temporary disruptions to landowner activities. Alternatives 4 and 5 involve ISCT, and thus have potential to mobilize metals into groundwater, which is a lesser concern for alternatives 3 and 6. However, subsurface conditions would be expected to revert to natural (alternative 4) or enhanced (alternative 5) conditions over time. Alternative 6 creates potentially significant disruptions to landowner operations resulting from the amount of space required for an ex-situ groundwater treatment and conveyance system.

2.11.6 Implementability

Alternative 1 poses no issues with respect to implementability. Alternative 2 poses very few issues, and it would be easy to coordinate monitoring activities. Alternatives 3 through 5 are slightly more difficult to implement than Alternatives 1 and 2, because they involve temporary disruptions to landowner operations during injections. However, these alternatives involve only temporary disruptions that could be readily managed through close coordination with the landowner. Alternative 6 would be difficult to implement because of the space restrictions and complexities associated with constructing and operating a long-term aboveground groundwater treatment system at a newly renovated and active administrative and education facility.

2.11.7 Cost

The estimated cost associated with each of the remaining alternatives is presented in **Table 2**. The ranking of least expensive alternative to most expensive alternative according to present worth is: Alternative 1 ($0), Alternative 2 ($1,559,000), Alternative 3 ($2,615,000), Alternative 4 ($2,735,000), Alternative 5 ($3,057,000), and Alternative 6 ($4,107,000).

2.11.8 State Acceptance

VDEQ has reviewed the PP, and their comments have been resolved. VDEQ accepted selection of Alternative 5 as the preferred remedial alternative.

2.11.9 Community Acceptance

Community acceptance has been obtained through the public comment process (**Appendix A**) and participation in the public meeting. No different opinions were expressed from community members on remedial alternative evaluation and selection of Alternative 5 as the preferred remedial alternative.

2.12 Principal Threat Waste

Principal threat wastes are those source materials considered to be highly toxic and/or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. No source materials were identified at MAFCF from various environmental investigations. Groundwater is not considered a source material, nor is the COC contamination present in the groundwater considered a source material. The groundwater contamination at the site is not a principal threat waste. No source materials and no principal threat wastes are present on the site.

2.13 Selected Remedy

Based on detailed analysis conducted during the FS (Hana, 2019), Alternative 5 – ISCT in Source Areas Followed with ISEB in Plume Areas has been chosen by USACE as the selected remedy to address the groundwater contamination. The areas to be treated with each active technology will be determined during the RD. Based on TCE plumes delineated during RI, the ISCT would be implemented first to target the MW-7 area where TCE concentrations are higher than 100 µg/L. This area is upgradient of the building and would help remediate groundwater beneath the building. ISEB would be implemented after ISCT application to target the residual TCE hot spots. Different concentration cutoffs may be used for ISEB treatment, depending on the plume location. A lower concentration cutoff would be used for plumes near the property boundary. MNA is an essential component of Alternative 5 to demonstrate any reduction of contamination by natural attenuation processes. Implementation of the DORC (**Appendix B**) will limit public exposure to contaminated groundwater and will ensure that no drinking water wells are installed on the property. Because implementation of the DORC occurred prior to the final DD, the DORC is considered to be an existing condition, and the land use control component is not part of the selected remedy. The selected alternatives are chosen to achieve the RAOs in a reasonable time frame. Based on fate and transport modeling conducted during FS, the estimated timeframe would vary from 1 to 104 years, depending on the amount of source mass reduction and biodegradation rates. Aquifer heterogeneity and matrix diffusion may increase the remediation time frame. The actual time frame would consistently be reassessed based on the fate and transport modeling or analysis of statistical trend data.

2.13.1 Description of Selected Remedy

The selected remedy includes a pre-RD parameter optimization study, MNA, monitoring of COC concentrations in groundwater, a combined remedial action consisting of both ISEB and

ISCT, and an adaptive management. Both ISEB and ISCT applications would be moderately complex to implement at the site.

Pre-Remedial Design Parameter Optimization Study

In addition to MNA, active remedial actions consisting of both ISCT and ISEB would be performed. The combined remedial approach would be moderately complex to implement at the site. A RD would be needed to implement the alternative. Because of the heterogeneous conditions of the aquifers, a pre-RD study would be necessary to have better understanding of the COC mass distribution, evaluate efficacy of the selected remedy in treating the contaminated groundwater at the site, and determine the appropriate agents (treatment chemicals in the source area and substrates in the plume), required doses, and injection volumes to use to treat the groundwater. In addition to baseline groundwater sampling and analysis, additional monitoring wells will be installed around the building, downgradient of MW-7 cluster wells and on the western side the property boundary for the RD. The pre-RD study will also optimize injection protocol, specifications, mechanical layout, process flow diagram, and field monitoring protocol. Optimum aquifer conditions would have to be maintained and the appropriate locations and number of injection points would need to be determined for effective in-situ treatment. Because the selected in situ remediation technologies rely on introduction of amendments into the subsurface to achieve the remedial goals, amendment delivery techniques such as pressure pulsing, pneumatic fracturing, and groundwater recirculation will be reviewed in the Pre-RD study to optimize injection delivery at the site. Based on results from the pre-RD study, the injection points will be designed to achieve an adequate distribution of amendments to the subsurface. This is particularly essential for the ISEB application because of the lower-than-optimal pH condition in the groundwater.

MNA with Groundwater Monitoring

MNA is an essential component of Alternative 5. Implementation of MNA will demonstrate any reduction of contamination by natural attenuation processes. To document any natural attenuation that may be occurring, a groundwater monitoring program would be implemented for the site. A plan for long-term monitoring (LTM) of groundwater would be prepared. LTM data would be used to determine the effectiveness of the combined remedy.

ISCT in Source Areas

The ISCT treatment would focus on the source area in the vicinity of cluster wells MW-7. Injection wells would be used for the introduction of an environmentally safe treatment chemical into the high-concentration areas of the contaminant plumes (“hot spots”). Based on the current understanding of the aquifer conditions as presented in the RI (Versar, 2013) and discussions in the FS Report (Hana, 2019), the ISCT injection wells would be constructed to target the hot spots in all three hydrostratigraphic zones. Both ISCO and ISCR amendments are candidates for in-situ applications. Effectiveness of the ISCT in reducing COC mass, particularly TCE, cis-DCE, and VC concentrations in the groundwater, would be monitored regularly (in conjunction with the MNA component of the selected remedy) to determine if additional rounds of ISCT injection are needed.

The effectiveness of the treatment is dependent on the rate of spreading and completeness of the treatment media coverage. Because of the heterogeneity of the water-bearing units, the actual treatment rate and coverage may vary, and multiple treatments could be necessary.

ISEB in Plume Areas

The ISEB treatment would follow the ISCT treatment to further reduce the COC concentrations in the remaining plume area. The focus areas would be downgradient of MW-7 and in the vicinity of cluster wells MW-2. Injection wells would be constructed for the introduction of an environmentally safe substrate into the appropriate hydrostratigraphic zones. Effectiveness of the ISEB in reducing COC mass, particularly TCE, cis-DCE, and VC concentrations in the groundwater, would be monitored regularly (in conjunction with the MNA component of the selected remedy) to determine if additional rounds of ISEB injection are needed.

The effectiveness of the treatment is dependent on the rate of spreading and completeness of the treatment media coverage. Because of the heterogeneity of the water-bearing units, the actual treatment rate and coverage may vary, and multiple treatments could be necessary.

Adaptive Management Approach with the Selected Remedy

Groundwater at MAFCF occurs in three water-bearing zones: the shallow saprolite zone, the intermediate transitional zone, and the fractured bedrock zone. The extent of groundwater impact is delineated relatively well in the two upper zones. The limited amount of groundwater data in the bedrock aquifer indicates that the COC plume has not migrated off the property boundary. However, additional data, including off-site monitoring wells, would be needed to monitor any offsite migration to the MCB Quantico property for the remedial design. The additional data collection and installation of the off-site monitoring wells would be performed in the pre-RD studies. Concentrations of COCs are much higher (2 orders of magnitude for TCE) in the upper zones than in bedrock; therefore, the upper two zones are the primary focus of the assembled remedial alternatives.

Based on results from pre-RD study, threshold criteria might be developed during remedial design for transition from active treatment to MNA. The threshold criteria would represent either a plateau level or point of diminishing returns where active treatment is no longer capable of continued appreciable progress versus MNA towards the attainment of the groundwater RGs.

The selected remedy will be considered complete once concentration data indicate statistically that all COCs are at or below RGs in all groundwater sampling locations. The specific statistical methods would be included in the LTM plan, and some are recommended by USEPA (2014). This alternative would result in contaminants remaining within groundwater at the site above proposed cleanup levels during the remedial action. Because the remedial action is expected to take longer than five years, five-year reviews will occur prior to the completion of the remedial action. The five-year reviews are not a component of the selected remedy. A policy review consistent with USEPA guidance requires that the site be reviewed at least once every five years, to ensure the protectiveness of the remedy prior to completion, and that reviews continue until the groundwater RGs have been achieved.

The primary challenge with any remedial alternative is achieving the low concentrations (i.e., RGs) of COCs. This challenge is primarily due to the high on-site concentrations (TCE>10,000 µg/L) and complex site hydrogeology. The process of matrix-diffusion often results in long-term concentrations (i.e., asymptotic conditions) above RGs, even after active treatment of the existing groundwater plume is completed. Given the complex geology of the site, it is possible that plateau conditions could arise prior to COC concentrations attaining the RGs within a reasonable timeframe after the implementation of the ISCT and ISEB treatments. If the LTM data suggests level-off of the contaminant concentration above RGs, USACE would take an adaptive management approach in the remedial design to give options of performing additional rounds of reagent injections at critical locations of the aquifers or select other in-situ technologies to ensure that the RGs are achieved within a reasonable timeframe. The adaptive management is part of the selected remedy and provides flexibility for complicated sites like MAFCF to evaluate the necessity of using other technologies or amendments and/or re-evaluate the overall remedial objectives. Other technologies may include those presented in the FS Report (Hana, 2019) or newly developed ones that can be applicable to the site conditions. Monitoring data should be used to verify that groundwater with concentrations of COCs above RGs are not migrating off-site.

2.13.2 Summary of Rationale for Selected Remedy

Alternative 5 is selected based on the following reasons:

- The combined remedial approach will meet the threshold criteria of overall protection of human health and the environment and comply with ARARs. Implementation of this selected remedy will reduce the potential risk associated with the COCs in the groundwater in a reasonable time frame, attaining the RGs of COCs.
- The different components of the selected remedy have been successfully applied at sites with similar conditions to those at this site. They are expected to be effective in the short term and long term. Effectiveness of ISEB and ISCT has been documented in scholarly journals such as Applied and Environmental Microbiology (Hopkins et. al., 1993) and in regulatory technical paper series such as U.S. Environmental Protection Agency: Engineering Issue (Huling and Pivetz, 2006).
- The existing groundwater MW network, as well as project team's knowledge of the site conditions and experience at sites with similar hydrogeologic conditions makes this alternative favorable and implementable.
- The construction and O&M costs were developed during the FS. The estimated costs are considered reasonable, effective, and consistent with industry standard.
- The regulatory agency, VDEQ, and the community have accepted its implementation at this site.
- The Remedial Action Construction phase and the Remedial Action Operation phase for this alternative will result in minimal disturbances to the site and will not pose risks to the community or on-site workers.

- The adaptive management approach will provide the flexibility of adjusting or revising the remedy if newly collected data deem necessary.

2.13.3 Summary of Estimated Remedial Costs

The approximate cost associated with the selected remedial alternative is presented in **Table 3**. The total cost for Alternative 5 is approximately $3,057,000, consisting of $1,529,000 capital expenses and $1,528,000 O&M. **Table 3** also presents the basis of the estimated cost. The detailed breakdowns of the cost are included in the FS Report (Hana, 2019).

2.13.4 Expected Outcomes of Selected Remedy

The selected remedial action alternative will address the concentrations of the COCs in groundwater, eliminating unacceptable risks to human health, and attaining the RGs of the COCs. Since the DORC will prevent the use of groundwater as drinking water, additional LUCs will not be required to prevent exposure under CERCLA.

2.14 Statutory Determinations

The Selected Remedy satisfies the statutory requirements of CERCLA Section 121 and the NCP, as described in the following paragraphs.

2.14.1 Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment. It takes an active and focused approach by targeting COC concentrations in groundwater, thereby reducing mass and volume of the entire COC plume. The selected remedy would achieve the RAOs in a timely manner and would satisfy CERCLA Section 121. The microbial and/or chemical amendments are naturally occurring microorganisms and/or elements and would pose little or no risk to on-site handlers. There will be no exposure by the community to microbial and/or chemical amendments. Microbial and/or chemical amendments will be used according to the manufacturer's instruction and under the purview of a site-specific health and safety plan that will further reduce potential risk to on-site handlers. Additionally, during remedial activities, the use of personal protective equipment, health and safety monitoring, and compliance with the safety and health plan will greatly reduce the potential exposure risks to microbial and/or chemical amendments, COCs, and general construction risks to workers.

2.14.2 Compliance with ARARs

The selected remedy complies with the ARARs by reducing the groundwater COCs to the promulgated MCL values.

2.14.3 Cost-Effectiveness

A cost-effective remedy is one whose costs are proportional to its overall effectiveness. Additionally, the overall effectiveness of a remedy is evaluated based on long-term effectiveness and permanence; reduction in TMV; and short-term effectiveness.

Based on these criteria, the selected remedial alternative is cost-effective. The selected remedial alternative has a total present worth cost of approximately $3.057 million. The cost includes capital expenses of the combined remedy, four years of quarterly sampling, six five-year reviews, and up to 26 years of annual groundwater sampling utilizing the current MW network. The selected remedy also provides long-term and short-term effectiveness.

2.14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy represents the maximum extent to which permanent treatment technologies can be utilized in a practical manner at the site. ISEB and ISCT with MNA will achieve reduction and elimination of COCs within the groundwater plume entirely in situ. ISEB and ISCT with MNA provides the best balance of trade-offs in terms of the five balancing criteria (e.g., long-term effectiveness and permanence, reduction of TMV through treatment, short-term effectiveness, implementability, and cost), while also considering the preference for treatment as a principal element and considering VDEQ and community acceptance. ISEB and ISCT with MNA satisfy the CERCLA Section 121 (b) statutory preference for RAs that involve permanent and significant reductions in the volume, toxicity, and/or mobility of contamination through treatment.

The selected remedy treats the COCs, thereby achieving significant reductions in their concentrations in groundwater and providing long-term effectiveness. Long-term effectiveness will be achieved through the reduction of COC concentrations to less than or equal to the RGs. Based on the comparative analysis of potential remedial alternatives, the selected remedy does not present substantially different short-term risks from other potential remedies. Potential risks to human health from the selected remedy would be minimized by taking appropriate measures prior to the execution of any work and complying with applicable state requirements. On-site workers will be protected during the site activities by following standard safety measures and complying with a site-specific health and safety plan. Therefore, site activities would not present any danger to the surrounding community, workers or the environment. There are no special implementability issues that set the selected remedy apart from any of the other remedies evaluated.

2.14.5 Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment as a principal element by reducing the COCs in groundwater through treatment technologies.

2.15 Documentation of Significant Changes

The PP was released for public review on September 1, 2020, and a virtual public meeting was conducted on September 22, 2020. A public comment period was provided between September 1, 2020 and October 5, 2020. In compliance with the requirements of CERCLA and providing the opportunity for the public to review and comment on the proposed RA, USACE determined that there are no significant amendments to be made to the proposed RA as originally documented in the PP.

This page intentionally left blank

3.0 RESPONSIVENESS SUMMARY

The USACE Baltimore District provided public notice and the opportunity to comment on the PP in accordance with requirements of CERCLA and the NCP. The NCP calls for a document that summarizes the proposed RA alternatives, including the agency-selected alternative, and provides for public participation and comments in reviewing the PP.

A Public Meeting Summary is included as **Appendix A** to this DD. It summarizes the materials USACE presented to community members and other attendees at the public meeting, held on September 22, 2020.

The intent of the public meeting was to allow community attendees the opportunity to interact with the project delivery team and discuss the proposed RA. A public comment period was provided between September 1, 2020 (the date the notice was made available to the public) and October 5, 2020.

During the public meeting, a brief history of RI efforts was imparted to community members. USACE explained that groundwater is not a source of drinking water in the area, that RI efforts over the years have defined the boundaries of the contamination plume, and that the site will be remediated to a residential standard.

Written questions in two separate emails from one community member who also participated in the public meeting were received after the public meeting. No additional comments were received by USACE during the public comment period. The responses from USACE to the questions are provided below.

Public Question #1: If contamination had been known about on the property since back in the late ’80s and cleaning it up at that time would have been minimal because there would have been less plume and in a more concentrated area, why wasn't it done then?

USACE Response: Investigations at the site followed the CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) process, starting with Preliminary Assessment, through Site Inspection, Remedial Investigation, Feasibility Study, to the Proposed Plan. Additional data were collected to better define the impacted media and their nature and extent. The nature and extent of the contamination plume was not delineated until 2015, when the Remedial Investigation and Supplemental Site Characterization were completed. USACE became formally involved in the investigation in circa 1989 when the site went through the Defense Environmental Restoration Account Finding of Fact and Determination of DoD Responsibility process through the FUDS Program. The Army is DoD’s lead agent for the FUDS Program. The USACE executes the FUDS Program on behalf of the Army and DoD. The Army and DoD are dedicated to protecting human health and the environment by investigating and, if required, cleaning up potential contamination or munitions that may remain on these properties from past DoD activities.

Public Question #2: And if it wasn't so important to clean it up then, and we're absolutely positive that no drinking wells will be built in this area and the contamination will not seep into the nearest creek affecting aquatic animals, and the risk for the environment isn't a concern, then why now? I understand containing the plume, as no one wants to get more people involved then necessary.

USACE Response: It is true that no drinking wells are present at the site, and there is no current adverse risk to the environment. The selected remedy includes a land use control component[3] that will proactively ensure no drinking water wells will be installed before completion of the remediation. While groundwater on site is not currently used for potable purposes, there is an unacceptable risk of exposure based on the contaminant concentrations in groundwater to potential future residents, thus requiring remedial action.

Public Question #3: Ok, then you get the go-ahead with using the ISCO and ISEB, follow through with the 5 year plan until...? After 5 years if everything is good then we move on? What is the possibility of recontamination?

USACE Response: The selected remedy will prevent exposure to contaminated groundwater (and the possibility of recontamination) through the land use control component[3]. The active remedial actions of ISCT and ISEB will reduce toxicity and volume of the contaminants. In accordance with CERCLA, assessment is conducted on the protectiveness of the remedy and adequate progress toward the attainment of the groundwater RGs. No change to the remedy is needed after the five-year reviews if the remedy is found to be functioning as designed. The five-year reviews indeed provide opportunities to optimize the remedy components if necessary or re-evaluate the overall remedy, and remediation time frame.

Public Question #4: I think this is the last one, but you mentioned that PWCS had undergone a big reconstruction project (it is likely this question may be for Mr. French)...if cleaning up the contamination is such a big deal now, then why wasn't extraction and cleanup/neutralization/whatever you want to call it, done then? This is where my ignorance really kicks in, but it would seem that the area would have been clear of obstructions and people (besides construction crew) and money was already being spent to rebuild...it would just seem logical to do it then. Or am I misunderstanding what would have had to happen? Or better question why not just treat it then?

USACE Response: PWCS's construction project involved disturbance of shallow soil only. Various site investigations did not identify contamination source areas in the soil and there was no identified risk to exposure to the site soil. Therefore, there was no need for soil remediation. The environmental concern at the site is limited to groundwater, which is the remediation medium of the PP. As explained in response to Comment #1, the nature and extent of the contamination plume was not delineated by USACE until 2015 when the Remedial Investigation and Supplemental Site Characterization were completed. After the nature and extent of the contamination are defined, CERCLA requires a Feasibility Study, Proposed Plan, and Decision Document before any remedial actions can be implemented at the site. Data were still being collected to understand the site better when the PWCS was under reconstruction. If an immediate risk to human health had been identified during the investigation process, CERCLA allows for some response actions to be taken sooner.

3 Because the DORC is implemented as an existing condition of the site, the land use control component is no longer needed during the remedial action.

Public Question #5: Was the source of contamination ever talked about? And has it been removed or neutralized? And if not, are you sure that the treatment planned will neutralize the source and no further contamination will occur?

USACE Response: Yes, the source of contamination was discussed. An investigation completed in 1989 by USACE considered several historical potential sources that could have contributed to the known groundwater contamination at MAFCF, including underground storage tanks, several drums of TCE reportedly present on site during the 1950s, an old sanitary seepage field, two drainage ditches, and one reportedly buried drum containing an unknown substance. As discussed in Section 2.3.1, no sources were discovered, aside from petroleum detections consistent with known locations of the underground storage tanks now used by PWCS. Additional source investigations were conducted by USACE during the Preliminary Assessment and Site Inspection in 2007; however, no source of known waste disposal was identified that could be linked to the groundwater contamination.

Based on data collected from the various investigations, the most heavily contaminated groundwater is located near MW-7 cluster wells. The selected remedy will treat this area using ISCT. ISCT is a proven technology to treat groundwater contaminated with chlorinated hydrocarbons. No further contamination is anticipated.

Public Question #6: Is the guilty military branch using their funds to help pay for the cost of this? Or is it left up to PWCS to pay for the treatment? Or I guess what I'm trying to really ask here, who is responsible for the payment of treatment?

USACE Response: The MAFCF site is listed in the Defense Environmental Restoration Program for Formerly Used Defense Sites (FUDS), with a FUDS Project Number of C03VA0519. The FUDS program has set-aside funding for this remediation effort. Congress appropriates money to the FUDS program to pay for restoration of eligible sites.

This page intentionally left blank

4.0 REFERENCES

A-Zone Environmental Services, LLC. 2018. Final Supplemental Site Characterization Report, Former Manassas Air Force Communication Facility, Independent Hill, Virginia. April.

Department of the Army, 2004. Environmental Quality Formerly Used Defense Sites (FUDS) Program Policy, ER 200-3-1. May.

Hana Engineers and Consultants, LLC (Hana), 2018. Updated Conceptual Site Model, Manassas Air Force Communication Facility, Independent Hill, Virginia. September.

Hana, 2019. Final Feasibility Study, Manassas Air Force Communication Facility, Independent Hill, Virginia. August.

Hana, 2020. Final Proposed Plan, Manassas Air Force Communication Facility, Independent Hill, Virginia. September.

Hopkins, G.D., L. Semprini, and P.L. McCarty, 1993. Microcosm and In Situ Field Studies of Enhanced Biotransformation of Trichloroethylene by Phenol-Utilizing Microorganisms. Applied and Environmental Microbiology, July 1993, p. 2277-2285

Huling, Scott G. and Bruce E. Pivetz, 2006. In-Situ Chemical Oxidation. United States Environmental Protection Agency: Engineering Issue, August 2006.

United States Army Corps of Engineers (USACE), Baltimore District, 2018. Residential Risk Characterization from Hypothetical Vapor Intrusion, Former Manassas Air Force Communication Facility, Independent Hill, Virginia. August.

USEPA, 2015. U.S. Environmental Protection Agency, Mid-Atlantic Risk Assessment. Maximum Contaminant Levels, Regional Screening Level Summary Table. November.

USEPA, 2014. Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well, OSWER 9283.1-44. August.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. USEPA 540/G-89/004, OSWER 9355.3-01. October.

Versar Inc., 2013. Final Remedial Investigation/Risk Assessment Report for the Manassas Air Force Communication Facility, Independent Hill, Virginia. August.

TABLES

This page intentionally left blank

Table 1. Potential ARARs

Chemical-Specific ARARs
▪ National Primary Drinking Water Standards (40 CFR §141.61(a)) – Establishes MCLs, which are health-based standards for public water systems. Use of these standards is required by the NCP. ▪ The MCLs are Relevant and Appropriate requirements.
Location-Specific ARARs
▪ None.
Action-Specific ARARs
▪ None.

Table 2. Comparison of Remedial Alternatives

Alternative	Protection of Human Health and Environment	Compliance with ARARs	Short-Term Effectiveness / Long-Term Effectiveness	Reduction in TMV	Implementability	Estimated Present Worth Cost ($ times 1000)	Anticipated State Acceptance	Anticipated Community Acceptance
1. No Further Action	No	No	Not effective	No	Easy	$0	Low	Low
2. MNA with LUCs	Yes	Yes	Short-Term: Yes, through preventing exposure Long-Term: Yes	Yes (passive only)	Easy to Moderate	$1,559	Low	Medium
3. ISEB in Source Areas	Yes	Yes	Short-Term: Yes, through preventing exposure Long-Term: Yes, but dependent on amount of mass reduction achieved and ability of MNA to reduce plume concentrations over time	Yes	Moderate to Difficult	$2,615	Medium	Medium
4. ISCO in Source Areas	Yes	Yes	Short-Term: Yes, through preventing exposure Long-Term: Yes, but dependent on amount of mass reduction achieved and ability of MNA to reduce plume concentrations over time	Yes	Moderate to Difficult	$2,735	Medium	Medium
5. ISCT in Source Areas Followed with ISEB in Plume Areas	Yes	Yes	Short-Term: Yes, through preventing exposure Long-Term: Yes, but dependent on amount of mass reduction achieved and ability of ISEB & MNA to reduce plume concentrations over time	Yes	Moderate to Difficult	$3,057[4]	High	Medium
6. Groundwater Extraction & Treatment in Source Areas	Yes	Yes	Short-Term: Yes, through preventing exposure Long-Term: Yes, but dependent on amount of mass reduction achieved and ability of MNA to reduce plume concentrations over time. O&M creates secondary long-term concerns.	Yes	Difficult	$4,107	Medium	Low

Outcome Neutral (yellow)
Outcome Not Favorable (red)
Outcome Favorable (green)

4 The cost estimate is based on ISCO in the source area.

Table 3. Alternative 5 Cost Estimate

Category	Present Worth Cost ($ times 1,000)	Basis of Cost
Capital Cost	$1,529	▪ Additional site characterization of fractured bedrock on western side of property line. ▪ Perform pre-RD parameter optimization study ▪ Develop a RD work plan using ISCT in source areas and ISEB in plume areas ▪ Drill and construct 20 injection wells targeting TCE high concentration areas in the three water-bearing zones, 13 injections for ISCT and 7 injection wells for ISEB. ▪ Assume 15 ft radius of influence and a porosity of 0.24; 15 wells at depth of 60 ft and 5 wells at depth of 150 ft ▪ Cost for ~5,000 gallons of substrate and pH buffer ▪ ISCO injection implementation ▪ Apply ISEB to plume areas for hot-spot treatment using injection well network after ISCT source area treatment ▪ Performance monitoring with quarterly sampling for 4 years, 2 years after ISCT application and 2 additional years after ISEB application ▪ Prepare a remedial action construction report ▪ Initial round of sampling for CVOCs, metals and MNA parameters and reporting
O&M	$1,528	▪ Quarterly groundwater sampling at ~30 monitoring wells and analysis of CVOCs and MNA parameters in first four years ▪ Annual groundwater sampling at ~30 monitoring wells and analysis of CVOCs and MNA parameters in the remaining 26 years ▪ Prepare annual MNA monitoring report including trend analysis and groundwater monitoring optimization recommendation ▪ Repair/replace 5 wells per year in years 1 and 2 and 2 wells per year in years 3 - 30. ▪ Conduct six five-year reviews; includes site visit(s), data evaluation and reporting

FIGURES

This page intentionally left blank

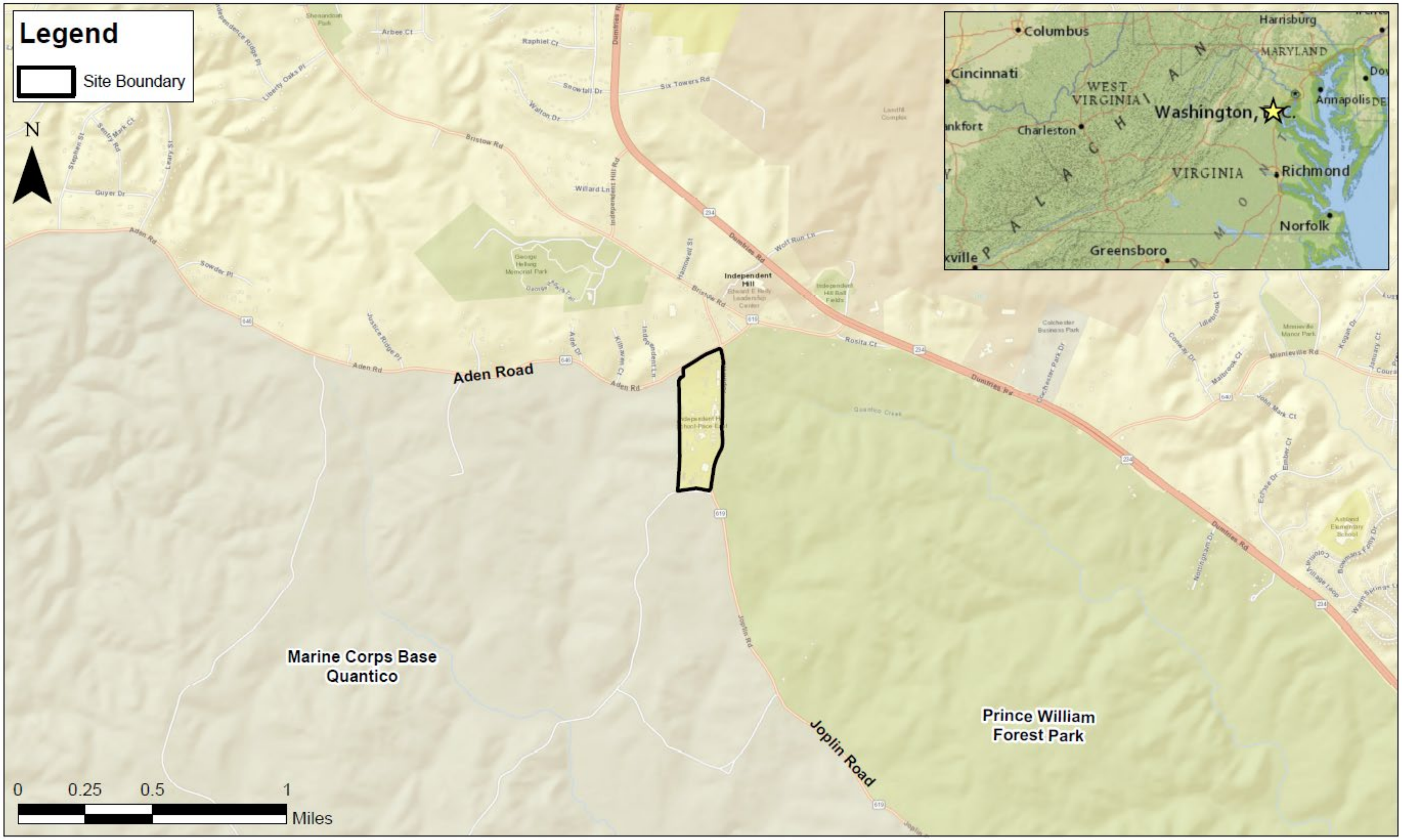

Figure 1. Site Location

Figure 2. Site Map

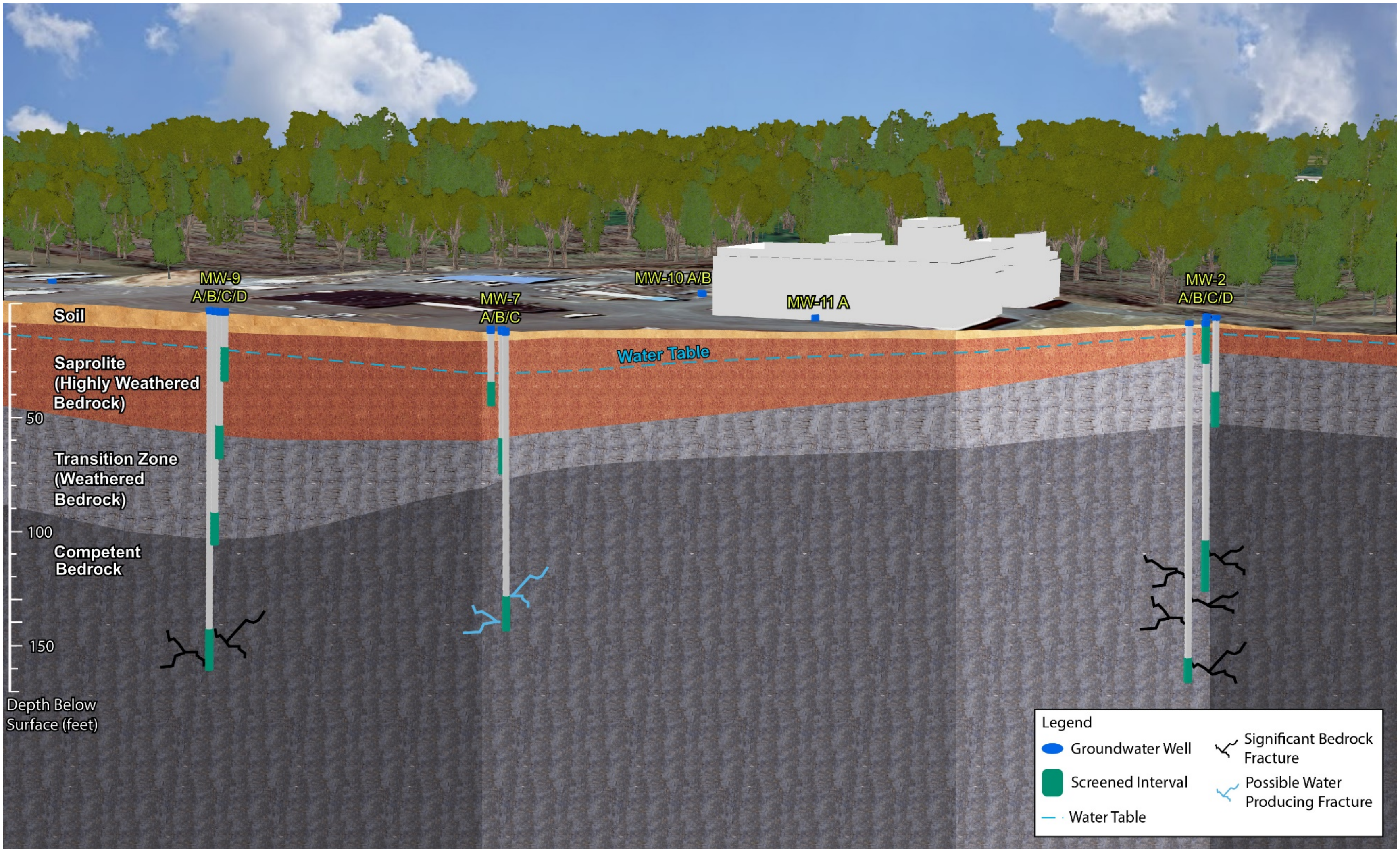

Figure 3. Schematic Cross-Section of Three Hydrostratigraphic Zones

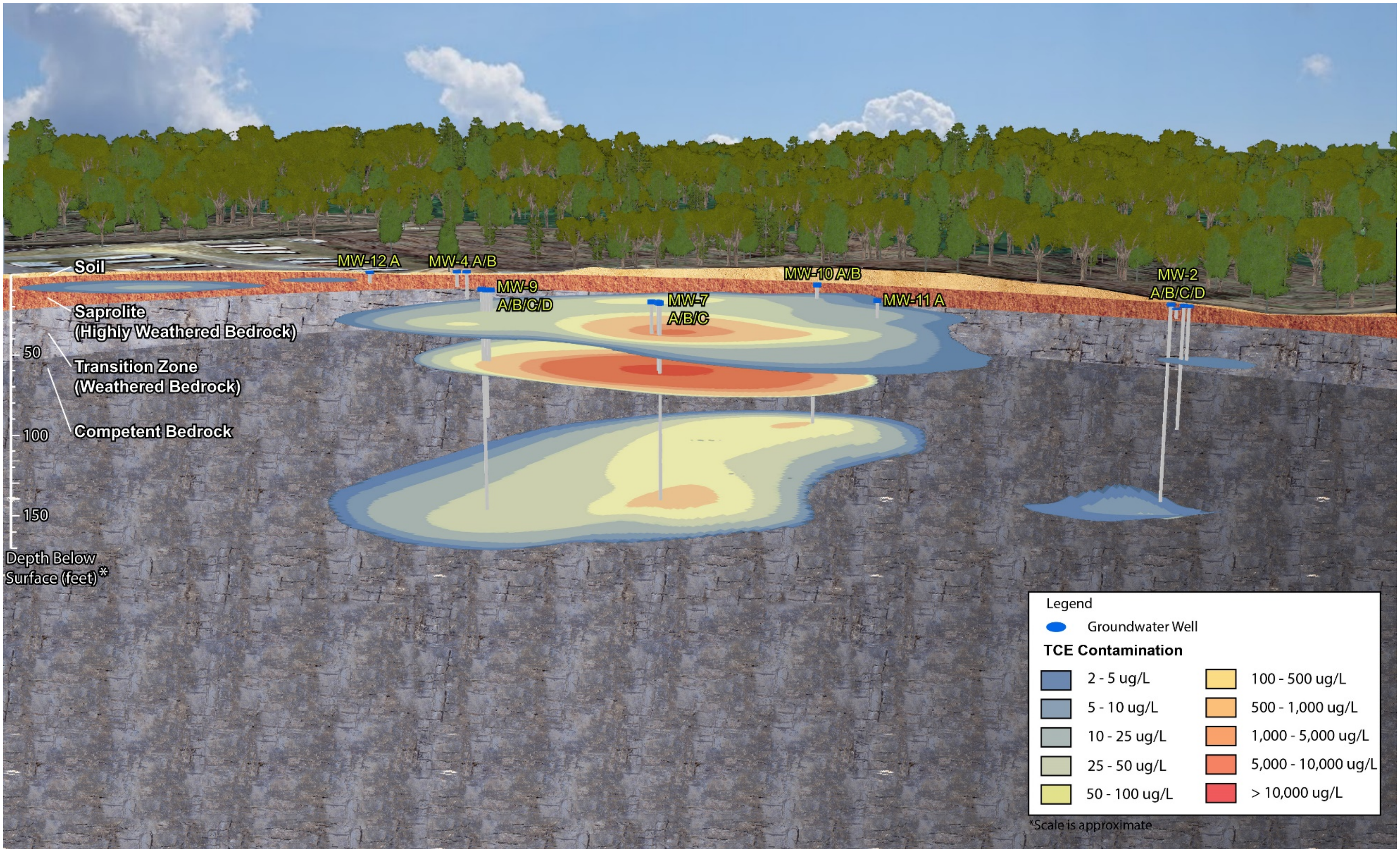

Figure 4. 3-D Rendering of TCE Plume (East-West)

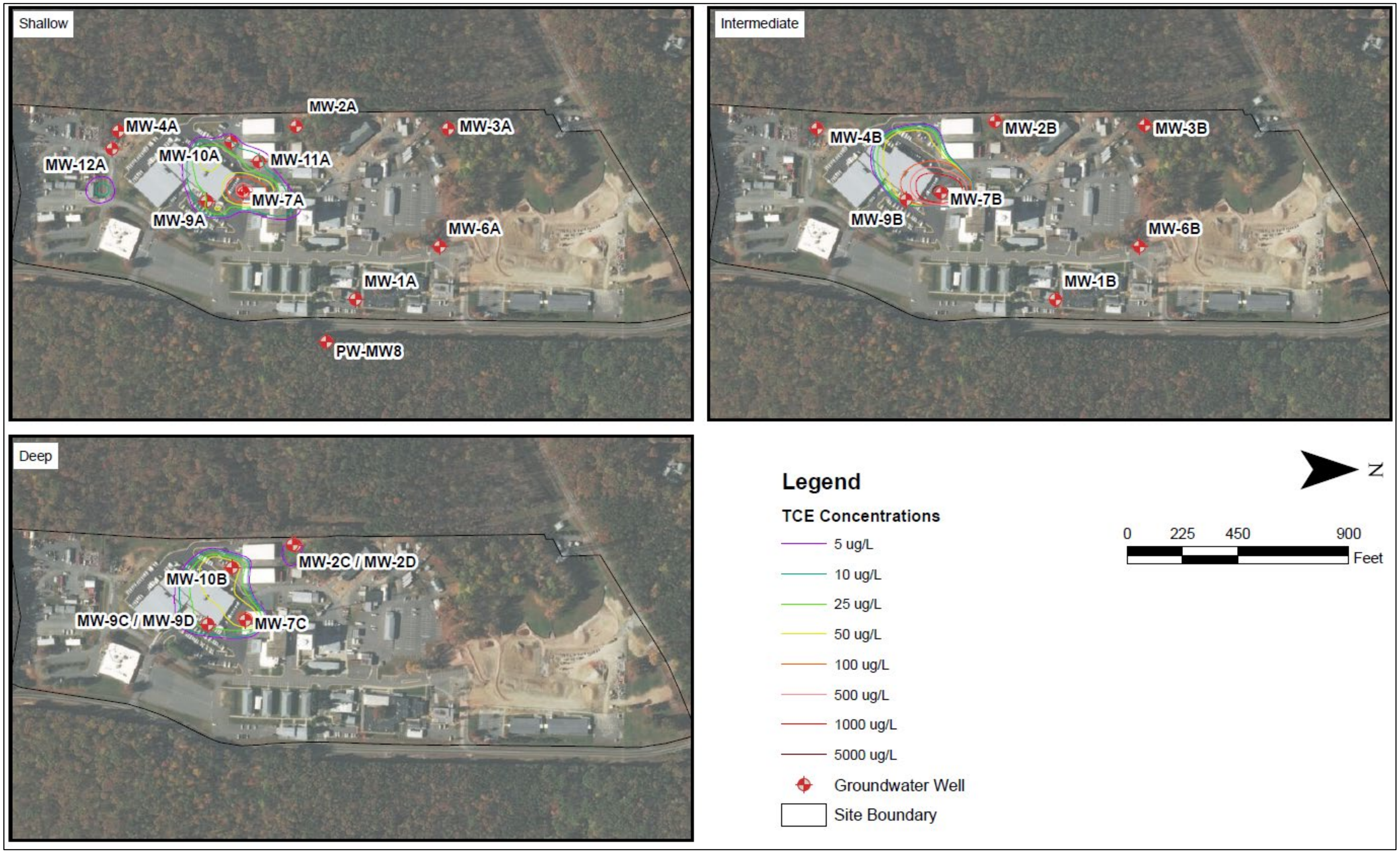

Figure 5. Extent of TCE Contamination in Three Hydrostratigraphic Zones (data collected in February 2017)

APPENDIX A

Public Meeting Summary:
Former Manassas Air Force Communication Facility
Independent Hill, Virginia
Proposed Plan

Tuesday, September 22, 2020 – 7:00 to 9:00 pm

This page intentionally left blank

<u>Transcript</u>

The U.S. Army Corps of Engineers, Baltimore District Presentation of the Proposed Plan associated with Environmental Studies and Findings of CERCLA for the Formerly Used Defense Site Program at the Former Manassas Air Force Communications Facility (now the Independent Hill Complex) Independent Hill (Manassas), Virginia

22 September 2020, 7:00 – 9:00 PM

Attendees:

Brent Graybill, Project Manager, US Army Corps of Engineers Baltimore District

Ed Hughes, FUDS Program Manager, US Army Corps of Engineers Baltimore District

Wade Smith, Virginia Department of Environmental Quality

Wayne French, Prince William County Schools

Christina Jettie, Hana Engineers and Consultants, LLC

Jeff Zoeckler, Hana Engineers and Consultants, LLC

Wanfang Zhou, Hana Engineers and Consultants, LLC

Amanda White, Community Member

BRENT GRAYBILL: …Christina Jettie and Wanfang from Hana Engineers. We have Wayne French from the Prince William County Public Schools, from the actual site. We have Wade Smith from Virginia DEQ, Ed Hughes, the FUDS program manager, and Amanda, who I do not know — and that's OK.

I'm gonna go ahead and get started with the briefing then, Christina, and just roll through these slides.

CHRISTINA JETTIE: Ok

BRENT GRAYBILL: And forgive me everybody, this is my first try at running one of these myself, so I appreciate your patience.

Good evening and thanks for making time to join us virtually in our public meeting tonight and presentation of the Proposed Plan for the environmental cleanup project for this property.

If you would please mute your phones and cameras turned off for respect to others so background noise or otherwise isn't an issue.

As I said before my name is Brent Graybill, and I'm the project manager for the Formerly Used Defense Sites, or FUDS project, under the Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA process, at the former Manassas Air Force Communications Facility, currently known as the Prince William County Public Schools Independent Hill Complex in Independent Hill, or Manassas, Va.

This is a non-classified informational briefing for public presentation by the US Army Corps of Engineers and its contractor, Hana Engineers, to members of the Prince William County Public Schools board, local governmental agencies, site users and tenants of the site, as well as interested members of the public.

The purpose of this public presentation is to familiarize the public with the project and the Proposed Plan for the site's cleanup, then formally discuss where we were, where we are now, and where we hope to be as next steps as a team, in order to solicit public questions or comments associated with the FUDS project's proposed path forward.

Ok you can go to slide 2.

The former Manassas Air Force Communications Facility is located in Independent Hill, Va. The facility consisted of approximately 50.1 acres now bounded by Joplin Road, which is also Route 619, and Aden Road in Prince William County, Va. The site lies just north and west of Prince William Forest Park and is bordered on the west and south by Quantico Marine Base and is within the upper reaches of the Quantico Creek Watershed. The site is currently operated by Prince William County Schools, and operations of the complex include facilities, food services, transportation, supply services and other educational support services to include the Independence Nontraditional School in the northern end of the property.

Next on slide 3, I'd like to talk briefly about the history associated with this property.

Ok, the site's history. The property was owned by the DoD, or US Marine Corps, since 1943, making this a Formerly Used Defense Site, or FUDS. We will elaborate on the significance of that in a little bit. The property then was used as an aircraft control and warning station in the Air Defense Command Radar Network from 1952 to 1959 for the triangulation of the location of incoming enemy bombers. The Department of Defense declared the installation excess to the needs of the Air Force in 1964, about the same time bombers were considered somewhat obsolete in delivering of enemy ordnance. And in 1968 the government deeded approximately 45 acres in fee-owned land and 32 buildings to the Prince William County School Board.

I'd like to take a moment now to explain the program under which we are performing the work and the acronyms we use associated with this type of project.

That takes us to slide 4.

CHRISTINA JETTIE: Hey Brent, just to confirm, it is showing the proper slides, correct?

BRENT GRAYBILL: Uh yeah. Let me see here…

CHRISTINA JETTIE: Ok, ok just making sure.

BRENT GRAYBILL: Double check... Yeah, slide 4.

CHRISTINA JETTIE: Ok great.

Ok the slide shows the flowchart of the Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA's phased approach to cleanups we follow after we determine the site is a Formerly Used Defense Site, and are then funded to do this work under FUDS.

As a result of growing public concern and increased knowledge of the environment, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA, in 1980. CERCLA provided a requirement and a framework for identifying, investigating, and cleaning up hazardous substances resulting from past practices. Congress amended CERCLA in 1986 establishing the Defense Environmental Restoration Program, or DERP, and its budgetary funding mechanism, the Defense Environmental Restoration Account, or DERA.

Under this program and funding the Department of Defense addresses contamination on properties that were formerly owned, leased, possessed, or operated by DoD. Such properties are known as Formerly Used Defense Sites, or FUDS. The Army is the execution agent for the FUDS program, and the US Army Corps of Engineers is the agent that manages and executes environmental cleanup projects and other associated responsibilities on FUDS properties on behalf of DoD.

The Corps of Engineers is currently conducting this FUDS work using the phased processes under CERCLA. This law provides broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.

Thought I'd give a quick summary of the Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA, process and the phases we are orchestrating this specific project under. Start with, Where We Were. After investigations, or preliminary assessments, or PA — you also see site inspection, or SI, in the flowchart — remedial investigations were performed to determine historic ownership uses, nature and extent, which is the characterization of the risks on the property and to delineate the risks.

Where we are now: The most feasible… *(Interruption by AT&T access code message for someone to join the conference)*

I'm sorry, did you guys — I must've cut out. Did every — can everybody still hear me?

SOMEONE (UNKNOWN): Yeah we can.

BRENT GRAYBILL: Ok.

SOMEONE (UNKNOWN): And now you're back.

BRENT GRAYBILL: All right. Where we were after investigations, or the PA or SI, as you can see as the preliminary assessment of the site inspection on the flowchart, and then a remedial investigation, or RI, were performed to determine the historic ownership or uses, and nature and extent, or characterization of the risks on the property, and to delineate the risks. The feasibility study or FS then used the investigative data and nine CERCLA evaluation criteria, which we will discuss later in the presentation, to evaluate remedial action alternatives and then propose the most feasible alternative to address risks.

Where we are now: The most feasible alternative was documented in the Proposed Plan, or PP, which we have prepared for the public with a 30-day response period, and followed by this public presentation, to solicit questions or comments from the public about the Proposed Plan. Proposed Plan comments will then be incorporated and the preferred alternative, if selected by all, would be confirmed in a follow-on Decision Document, or DD, to formally record the vetted action to be taken at the site where historic releases have taken place and potential hazards to the public remain.

The DD is also the funding approval mechanism used to justify and receive funding from headquarters to perform the action on site.

Where we are going: After the DD is signed and approved, as you can see from the flowchart, stating generally what actions are funded to take, the team then develops the Remedial Designs, or RDs, specifically agreeing on how or selecting the best technological approach to the action. The "how" will become the Scope of Work, which also then drives the "when," which is when the work can happen, or the Period of Performance, leading ultimately into the Remedial Action, or the RA, selected by all for the site.

Again, like I said before, we are currently in the PP or the Proposed Plan phase of this former Manassas Air Force Communications Facility project. The purpose of the Proposed Plan is to present the preferred alternative for cleaning up the contaminated groundwater at the site. The proposed alternative for the Remedial Design or Remedial Action phase of this project entails in situ chemical oxidation, or ISCO, in source areas for mass removal, followed by in situ enhanced biodegradation, or ISEB, in residual plume areas, which we will cover in detail later in the presentation.

Now I'd like to take some time to discuss some of the previous studies performed historically, and the important findings from them that brought us to this point.

Takes us to slide 5.

Ok, previous studies and findings: In 1986, the Virginia Department of Waste Management performed an assessment of the former drinking water production wells where petroleum and chlorinated solvents were detected in sample results of the groundwater. As a result, the Prince William County School Board abandoned the water system and tied into the county water system. In 1987 the Corps conducted confirmatory studies of the groundwater and determined that the 45-acre fee-owned portion of this parcel was formerly used by the DoD. This made it eligible for the Defense Environmental Restoration Program, or DERP, mentioned earlier. It also allowed it to be part of the FUDS program, Formerly Used Defense Sites program.

In 1989, an engineering report showed several historic potential sources of contamination, including underground storage tanks, drums of chlorinated solvents reportedly present in the '50s, and an old sanitary seepage field. Surface and subsurface samples were taken; the results identified elevated levels of chlorinated solvents and contamination in some areas, yet no sources were discovered. This was followed up by a Virginia Department of Health Bureau of Toxic Substances inspection of the school with a risk assessment. The risk assessment found no imminent threat to public health. In 1998, once the Corps established the property as a FUDS and was approved and funded to do the work, the project team started conducting a series of studies to determine if contamination associated with the former DoD use is present above by the Virginia Department of Environmental Quality Standards.

The Corps conducted a site investigation of the neighboring Faught property. Detection of metals in these locations were determined to not be related to the detections at the former Manassas Air Force Communications Facility property.

In 2000, historical aerial photo investigations were conducted and identified ground scars and potential waste sites in 1953 and 1963 photos. Based on groundtruthing, the scars and disposal areas or "trenches" were found to be constructed drainage swales.

A sampling report in 2006 for indoor air and water quality potentially impacted by chlorinated solvents from the groundwater plume and potential radioactive material disposal concluded that there was no risk to students as no evidence of buried radioactive materials was ever discovered.

In 2007, a preliminary assessment was completed and recommended further sampling to investigate the presence of chlorinated volatile organic compounds in the groundwater and surface water at the site.

And in 2009, shallow groundwater data collected confirmed the presence of chlorinated volatile organic compounds in the groundwater at the site.

In 2013, a Remedial Investigation, or RI, was completed which included additional soil, surface water, sediment, groundwater, and sub-slab soil gas vapor sampling. Findings indicated that concentrations of chlorinated volatile organic compounds present in groundwater and soil gas presented potential unacceptable long-term risks to hypothetical future residents.

A supplemental site characterization was performed in 2015 to further assess groundwater and soil gas. Additional groundwater sampling further determined the extent of groundwater impacts of these chlorinated volatile organic compounds, but soil gas sampling determined there were no vapor intrusion risks to current site users.

2019 – A feasibility was completed which presented a detailed analysis of potential remedial alternatives for the site. And that rolled into the Proposed Plan that we're talking about today that was developed from the feasibility studies and which the preferred remedial alternative was selected, based upon those nine CERCLA evaluation criteria we will explain in detail later in this presentation.

That was a lot of information on the history and what we've done out there so far. I'd like to turn the talk over to Hana Engineers, our contractor for this FUDS project, to present the information associated with the residual risks on site. I guess that would be slide No. 6, Christina.

CHRISTINA JETTIE: Hi everybody, this is — as Brent said, this is Christina Jettie with Hana Engineers, and I will be discussing our upcoming actions at the site. So, recently a risk assessment was completed at the site which included an ecological and a human health risk assessment. The ecological risk assessment was conducted on exposures to the three media that are pertinent at the site: soil, sediment, and surface water. The risk to terrestrial species from exposure to soil was likely to be minimal. As well, as the risk to the aquatic species and exposure to sediment and surface water was likely to be localized and have little effect on the aquatic communities at the site.

Our baseline human health risk assessment was completed on five media: soil, sediment, surface water, soil gas, and groundwater. The exposure to the sediment, the surface water, and the soil at the site did not exceed human health risk levels. The hypothetical exposure to soil gas did result in an exceedance of human health risk levels, as well as the hypothetical exposure to groundwater at the site resulted in an exceedance of human health risk levels.

Just to let you know…

ED HUGHES: Christina, is there anything you can do to turn your volume up a little bit?

CHRISTINA JETTIE: I can try – I can try and talk closer. Is this better?

ED HUGHES: Brent was nice and loud, but it got… it became harder to hear when you started.

CHRISTINA JETTIE: Ok

ED HUGHES: Didn't do anything. This is Ed Hughes by the way

CHRISTINA JETTIE: Thank you, Ed. Let me see… move locations and see if that helps

JEFF ZOECKLER: I'm here…

CHRISTINA JETTIE: Oh, is that you Jeff?

SOMEONE (UNKNOWN): Hey there Jeff.

JEFF ZOECKLER: Yeah, sorry guys.

CHRISTINA JETTIE: No worries.

SOMEONE (UNKNOWN): It's all right we had a heck of a time getting this going on.

CHRISTINA JETTIE: Well, I guess I will let Jeff take over, since he seems to be loud and clear – I'm not sure what's going on with my mic.

JEFF ZOECKLER: Ok, sorry, sorry I'm late everyone. I had some technical difficulties. But…

CHRISTINA JETTIE: We did…

JEFF ZOECKLER: Looks like we're on slide 6?

CHRISTINA JETTIE: Yeah, and I went through this slide. One thing I did want to reiterate with this slide, especially with the risk assessment, is that the risk assessment did determine that a worker would have to spend four day… four hours a day on site for 125 days a year, working for a year in order for there to be any health risk. So... we'll be …

BRENT GRAYBILL: That's a very good point.

CHRISTINA JETTIE: …discussing this more, but we wanted to let you know, that the risk is not a high risk, it fairly varies and we'll be talking about that more in the presentation. Jeff do you want to take over talking about vapor intrusion?

JEFF ZOECKLER: Yeah, let me… I'll do a quick introduction to myself since I may have missed that. But this is Jeff Zoeckler. I've played various roles on the project over the years from an engineer to a project manager, and now I'm … [garbled]

ED HUGHES: I can hear you worse than Christina.

BRENT GRAYBILL: Ed's saying they can't hear you even worse than Christina.

JEFF ZOECKLER: Ok, well that's not good. See… Is that any better?

[garbled]

ED HUGHES: Kinda worse.

JEFF ZOECKLER: I'm sorry about that.

CHRISTINA JETTIE: I can hear you loud and clear.

BRENT GRAYBILL: Yeah you're not too bad for me.

SOMEONE (Unknown): Yeah, loud and clear here too. Go ahead Jeff, just continue to — Ed will have to turn up his volume.

ED HUGHES: Yeah well then don't worry about me, if you guys, if everybody else is ok. I was just trying to speak up in case everybody else was having problems. But go for it. If everybody's fine don't worry about me.

JEFF ZOECKLER: Ok I'll speak as loud and clear as I can.

BRENT GRAYBILL: Yeah you sound good Jeff, you sound good now.

JEFF ZOECKLER: Ok so one of the aspects of the risk assessment with the vapor intrusion evaluation — there have been a few rounds of vapor intrusion soil gas sampling at the site, and the initial sampling, there were some concerns over the quality of the data and the amount of the data collected, so in 2017 and '18 as part of the supplemental site characterization, the Corps and their contractor, A-Zone, with the support of Hana collected additional soil gas samples and to further evaluate the vapor intrusion pathway, and ultimately through that risk assessment process — which is a very conservative process — it was determined that the vapor intrusion risk was minimal, and that was for the … for both the industrial site users and the residential site users. So ultimately over the risk assessment process it was found that the soil gas had minimal risk and that that pathway did not need to be addressed in the feasibility study, which is the process after the remedial investigation.

Any questions on the vapor intrusion assessment?

Ok, I'll move on to the next slide.

So, with the vapor intrusion not being a major issue with respect to risk, the one area where there was a potential risk, and this is again, we use the term "hypothetical," but that is the way that we evaluate risk in the future, is that to assume that someone was using the groundwater as the drinking water. So, if you were to assume that a site user resident was to ingest groundwater, there is a potential risk, so therefore that is a risk to human health that needed to be further evaluated, and the process for evaluating that risk is addressed in both the feasibility study and the Proposed Plan. Which this meeting is the result of the Proposed Plan to present an alternative to address that potential risk to the groundwater.

So here we have a pretty good figure here that shows the extent of the groundwater contamination in the subsurface. There is both impact in the shallow groundwater and in the intermediate and deeper groundwater. These are chlorinated volatile organic compounds at the site and although the source is not definitively known, the review of aerial photographs indicate that there was likely some sort of disposal at the site, I think it goes back to the ’40s or ’50s. And we don’t know the exact source, but we know the approximate area, the approximate location of the source, and it's suspected that that was basically some sort of disposal activity that ultimately led to this hot spot in groundwater, which over years created the groundwater plume at the site that we are addressing in this feasibility study in this proposed plan that has been presented for the site. And that is near the Monitoring Well 7 cluster which you will see again in a couple of figures coming up.

Next slide please.

So again, we sort of have — we have a layered system here where we have a shallow groundwater system that contains saprolite, and saprolite is basically a weathered bedrock. It’s — the bedrock in this area is a combination of metamorphic and igneous bedrock and then over the years that bedrock gets weathered into a soil that is, I guess, is sort of like a clay and silt and sand mix. That’s kind of what you have in this area. From 10 to, say, 40 feet we have the saprolite and then that slowly transitions into more of a solid bedrock over as you get deeper and then ultimately you hit in this area you hit bedrock between 85 and 170 feet.

That bedrock again is igneous and metamorphic. It's very hard and the groundwater gets into the bedrock through fractures and primarily flows through fractures in the bedrock.

So, receptors at the site: We have primarily an administrative function and maintenance function at the site, at least in the area where the groundwater contamination is. The school itself, especially the new school area that lies to the north of the site — and there’s no residents currently on this property. Again, as we mentioned before, the drinking water supply wells on the property — there are no drinking water supply wells on this property.

So here we have sort of a capture of the extent of groundwater impact in each different layer. Again, the shallow, which is the saprolite layer. The intermediate layer is the… for that transition layer between the saprolite and the bedrock aquifer, and then we have the deep layer, which is the bedrock aquifer itself. You see we point out in the second picture here — we see that that's what I was discussing with the Independence Nontraditional School. That's the newer school development, which lies to the northeast corner of the property which is quite a bit away from this area that we’re discussing.

BRENT GRAYBILL: And it’s upgradient as well.

JEFF ZOECKLER: Correct, its groundwater basically flows — essentially flows from west to east at the site and the school is … cross and upgradient of the groundwater contaminant plumes.

BRENT GRAYBILL: Is it west to east or east to west? I’m sorry to be so difficult Jeff.

JEFF ZOECKLER: Let me make sure I’m looking at it right.

BRENT GRAYBILL: I think it’s going from east to west.

JEFF ZOECKLER: You’re right — east to west

BRENT GRAYBILL: Right Right.

JEFF ZOECKLER: And the new school is in the northeast corner.

BRENT GRAYBILL: Yes — Right. Right.

JEFF ZOECKLER: Next slide.

So again, this was a chlorinated volatile organic compound plume which is a set of compounds that is pretty common that we deal with in the environmental cleanup industry. They're related to solvents for the most part and commonly found at a lot of different sites — commercial and — former commercial and industrial, and also military sites. They're a class of solvents that was used for a long period of time in the 20th century. It consists of perchloroethylene, trichloroethylene, and then these other compounds like the dichloroethylene are basically they're the breakdown products from the degradation of the original solvent — that is your DCE, DCA and ultimately your vinyl chloride compounds.

So, the EPA has established MCLs — drinking water standards — for many of these compounds and in addition to the risk assessment process that we use in CERCLA, we also use these drinking water standards as our cleanup goals in developing feasibility studies and remediation, remedial designs for the site. So even though no one's using the drinking water, these are still basically our ultimate cleanup goals. Because no one's using the water, that allows us, I guess more time to use, I guess less aggressive solutions to ultimately meet those goals.

That kind of leads into the next slide.

Here are basically our goals for the site. The goal in a sense is to prevent exposure to these compounds and that means prevent exposure through ingestion, inhalation, or dermal contact, and until we can meet these remediation goals that — the remedial goals are in this blue box here that you see here on the site. The second part of the remedial action objective is to make sure that the groundwater plume is not migrating off-site because we can control — because of the involvement of Prince William County School and the partnership that they've had with the Corps over the years — we can control what's on-site through this, through our remedial alternative, but we can't control off-site, so one of our goals is to make sure that the plume is staying on-site, not going off-site onto the Quantico property and if that does happen, if that were to happen, then obviously you'd bring in another set of stakeholders on Quantico that would have to be involved. But you would still be able to prevent exposure, but our goal is to keep it on-site where we can control exposure to the groundwater.

Next slide please. So, under CERCLA, Superfund in other words, we [garbled] evaluate five or six alternatives to address the contamination in groundwater. One of them is always No Action to be used as the baseline, so what would be the result — if we didn't do anything would that be acceptable under the National Contingency Plan evaluation. That's always used as the baseline and then we develop several other alternatives with mixed — they all have to be capable of addressing the contamination in that we evaluate them against a set of criteria, which is established in the National Contingency Plan. But these are the six alternatives that were evaluated. I'll run through them real quick. The second one is monitored natural attenuation. That's essentially allowing the natural processes which over time will basically degrade the groundwater plume and eventually meet the criteria. Now that can take many, many years. So that has to be considered in the evaluation, but it's essentially allowing the nature to take its course and monitor the groundwater plume as you're allowing that to happen.

Next one is in situ enhanced biodegradation in the source areas, so that's basically monitored natural attenuation but finding ways to enhance and speed up that process, particularly in the source areas. And there's different ways of doing that. It can be through injections of nutrients or other chemical compounds or actually injecting bacteria that can degrade these compounds into the ground. So there's different ways of enhancing the rate of biodegradation at the site. Another alternative that we looked at was in situ chemical oxidation which basically involves injecting oxidants in the ground which can rapidly attack, break down the chlorinated solvent compounds and reduce concentrations in the source area.

A fifth alternative that we looked at was chemical oxidation followed by enhanced biodegradation. So that would basically be addressing the source area more aggressively and then coming in after that and looking for ways to enhance the rate of biodegradation in the plume. So, basically, a combination of alternatives three and four.

The last alternative was alternative six and that's groundwater extraction and treatment in the source areas. That's basically installing extraction wells, extracting the groundwater, treating it by some method on the surface and then either discharging that water in some … either back to the water body or to the local DOTW or potentially back into the subsurface. Groundwater extraction and treatment has traditionally been used a lot in the 1980s and '90s. Typically requires a robust system aboveground. High — it's very high in O&M, operation and maintenance, level of effort and cost. So those are some of the things that come along with a groundwater extraction and treatment.

BRENT GRAYBILL: Well so that's a huge construction footprint on site. Realize the school had a pretty recent significant renovation of the same area down there not only its surfaces, but buildings, administration, offices, those kind of things.

JEFF ZOECKLER: Right, there's pros and cons to each of these alternatives but one of the cons in the alternative 6 is the space and the energy and the operation and maintenance associated with maintaining an extraction and treatment system. Which is one of the considerations that we follow I guess, probably coming up in the next slide.

SOMEONE (UNKNOWN): Right.

So, yeah, under the National Contingency Plan, which is basically the law that is followed, the process that is followed in evaluating these alternatives in the feasibility study, we look at nine criteria in total. There's two threshold criteria, that means any alternative — any alternative that you present other than the no-action alternative must be protective of human health and the environment, and it must comply with the ARARs, which is the applicable relevant and appropriate requirements. So that's sort of like — those two criteria have to be met with any alternative that you present. The next five are the eval… — the primary criteria that we evaluate once you've met the threshold criteria you use five other alternatives to evaluate the best or preferred alternative. These again are long-term effectiveness and permanence, reduction of toxicity, mobility, and volume of the contaminants. What is the short-term effectiveness, what is the implementability? And what is the cost? Now, some of these are definitely related — we mentioned the o&m costs associated with the big pump-and-treat system. What are the impacts to that on the landowner? What are the... I mean can he even do it, things like that. So in evaluating these alternatives these are really the five primary criteria we use to select a preferred alternative or what we're presenting here tonight as the preferred alternative.

And then there's also two other factors that you have to consider, and that's basically what is the regulatory acceptance of the alternative and what is the community acceptance. And that's — we've been addressing the regulatory acceptance through our partnership with DEQ and the community acceptance, this is part of the process here tonight. What does the community think about the alternative? And those are weighed in the feasibility study and the Proposed Plan, and this is sort of the last piece of that is the Proposed Plan and Decision Document process.

So, the next slide.

Again, this goes into our preferred alternative, which is basically alternative 5. Ultimately it was the combination of the alternatives three and four. Which is — we have a pretty small area which we considered the source area at the site. We had some pretty relatively high concentrations of PCE and other chlorinated compounds but it’s in a fairly localized area. So given that it's not widespread from a source area perspective, we can address that through chemical oxidation and really focus in on the small area where we know that this was the original source area and the chlorinated compounds that are contributing to the other areas of the plume once we can address those source areas then that will allow us to treat the other areas of the plume downgradient.

So, the second part of the alternative is the enhanced biodegradation and so once we have been able to address the source area, then we can look at more passive means of addressing the outer and downgradient areas of the plume. That basically means creating conditions in the subsurface — geochemical and biological conditions in the subsurface — that will allow the natural biodegradation that’s already occurring at the site based on previous testing that’s been done — allow that to increase its rates and be more successful in degrading these compounds all the way down to below the remediation goals.

And we know that will still take some time but by … by enhancing the conditions in the subsurface we can at least speed it up and monitor the groundwater until we reach those conditions. So that's also bullet two and three here. That's basically — the monitoring part of it is bullet three. So, we are increasing the rate of degradation while also monitoring it to make sure that it’s on track to eventually meet the remediation goals.

The last part of this is the land-use control part and that is basically to ensure that there are no drinking water wells installed. Of course, there’s no expectation that there would be any drinking water wells installed at the site. They're already on supplied — publicly supplied water. But this land use control part of it is basically a reassurance that there will not be any drinking water wells installed at the site and it will not be, sometime in the future, used for — the groundwater will not be used for drinking water as long as concentrations are above this remedial goal. So, it’s just a reassurance that there will be no exposure to the impacted groundwater.

And this is not something that the Corps of Engineers is a part of, this was going to be an agreement basically between Prince William County Schools and the local planning department that “Hey, we’re not… if we were to sell this property — if the Prince William County Schools were to sell this property, this land use control, which is basically an environmental covenant, will carry over to whoever buys the property.” And then it will remain in place until it has been demonstrated that the remediation goals have been met.

SOMEONE (UNKNOWN): Well said, Jeff.

JEFF ZOECKLER: Thanks. Next slide. Man, this one's got a lot of bullets.

Again, so the preferred alternative, what we are presenting here tonight, is a combination of enhanced biodegradation and chemical oxidation. The next step will be a remedial design — if there are no major comments that would cause the Corps to change the alternative, the next step will be a remedial design needed to basically determine all the details, the design details to implement the alternative. It's a fairly complex site from a hydrogeology perspective, so although we are able to determine that this is the preferred alternative, there's still a lot of data that needs to be collected and parameters to basically refine the pieces of that alternative.

So, on that [garbled] with the remedial design stu… there will be a pre-remedial design study needed to basically refine those parameters. Required doses for injecting oxidants into the ground, determining the appropriate buffer solutions and injection volumes used to treat groundwater. So once this alternative has been selected and documented as the alternative the next step will basically be to refine the engineering details of that alternative so it can actually be implemented.

And once we actually — once we get those parameters done and determined we can actually go out and do the injection work that needs to be done to address the source area and also create the conditions favorable for biodegradation at the site. The whole time any of this is occurring we'll be doing groundwater monitoring will be part of the preferred alternative to ensure that concentrations and the size of the plume — monitor the size of the plume as we're implementing, both during and after the remedial action on… groundwater monitoring will be part of it. During the implementation of the alternative and the monitoring we'll evaluate the data to be looking at trends, make sure that concentrations are decreasing as they should and make sure that the plume is stable and not migrating off-site or to other areas of the site.

We will ensure, or I guess the Prince William County Schools through the environmental covenant agreement that is planned for the site — that covenant will ensure that there is no exposure as mentioned before until the remediation goals are met, so that's another key part of the alternative. Again, as we mentioned, that covenant, environmental covenant will remain in place until concentrations are below the remediation goals set for the site. And the process that Corps of Engineers uses for that under CERCLA, required to under CERCLA, is that — is basically a five-year review process. So, they'll look at the monitoring data and basically evaluate the success of the alternative every five years and then give that information to the, to Prince William County Schools and then we can determine — basically evaluate the success of the remediation over time and at some point, hopefully we've met — those criteria have been met and that environmental covenant can be removed. That won't happen until the five-year review process kind of confirms that.

BRENT GRAYBILL: Thanks, Jeff.

JEFF ZOECKLER: Yep.

BRENT GRAYBILL: And those five-year reviews go on into perpetuity until we've reached our goals, and like Jeff was saying the five-year reports not only go to the school, but they get publicized to the public as well, so the public knows where we stand on this project. And obviously if they had any questions, they could contact us.

So that takes us to slide 18. As we said earlier in explaining where we are now in the phased CERCLA process, public presentation of the Proposed Plan and best alternative, our next steps involve the public. The question is, "Are you OK with your understanding of the proposed alternative we presented in the Proposed Plan?" You still have time to comment, if need be, during the 30-day response period which ends Oct. 2, 2020.

Your comments will feed a responsiveness summary that's made part of the Decision Document as we mentioned earlier for former, formal — to formally record and for funding approval. Be sure to take a look at the information provided on the link and let us know what else you may need to form your own questions about the project. Thanks again for making time for this and for having a hand in the decision made regarding the actions determined to be best for the site and protecting human health and the environment for this FUDS project.

My point of contact information is on the next slide for submission of any questions or comments you might have either tonight or via mail or email until 2 October 2020. This concludes the FUDS Manassas project public presentation of the Proposed Plan unless anybody has any questions or comments now for us.

I guess Christina, you could take us to the last slide as well.

CHRISTINA JETTIE: We are on the last slide right now.

BRENT GRAYBILL: Ok, and I'm sure if anybody has any comments — most folks on this call we know, and you don't have to provide any comments or questions now. You can always email me later or if you want to do it snail mail we could — my mailing address is on there. Please feel free to give us a call or send us a comment or any questions you may have about what we've presented this evening. And thanks again for your time.

WADE SMITH: This is Wade — thanks everyone. Brent, you did a great job. [Unintelligible] Appreciate Wayne's time on a busy night. But, just setting us up in these trying times, appreciate everyone's time. We needed to check those boxes. The box to get the public involvement. If there's any questions from the public now would be a good time.

BRENT GRAYBILL: Yeah, and they definitely have until 2 October. A lot of times people don't want to speak up. So, you know, you're right Wayne, they could ask us now or get back to me on the side whenever they feel comfortable doing so until 2 October and it's important that we get something back from the public in order to populate our responsiveness summary in the Decision Document for headquarters, to show, you know, the public had some interest in what we were doing out here, so. Thank you all very much. Wade, did you have anything to say, or anybody else who's part of VDT, and part of the team?

WAYNE FRENCH: Not me.

WADE SMITH: It was me.

BRENT GRAYBILL: Say again?

WADE SMITH: That was me earlier

BRENT GRAYBILL: Oh ok. Ok. All right. Hey, thanks, I appreciate it, Wade, and appreciate everybody else attending. Thank you, Hana Engineers for swooping in and making this sound way more professional than it could have been on my end.

JEFF ZOECKLER: Sorry I was — Sorry I was late, too. I apologize to everyone for that.

BRENT GRAYBILL: No sweat. I think next time I do this I'll be a little more polished and understand how these virtual meetings happen; but let me tell you it was an education for me as well. Thank you all so much for your time and I'll keep everybody informed on whether I get any comments, so then we know, you know, as a team what we receive from the public or otherwise. So, if you get anything on your own, please let us know too if they contact the school district or anyone else — please let me know. I guess that's it. I'll go ahead and conclude the meeting unless anybody's got anything else. Thank you so much.

JEFF ZOECKLER: Thank you.

BRENT GRAYBILL: Okay. Talk to you later. Thanks again.

Bye.

SOMEONE (UNKNOWN): Thanks everybody. Good work.

APPENDIX B

Declaration of Restrictive Covenants

This page intentionally left blank

This document was prepared by,
and after recording, return to:

202106170072798
Prince William County, VA
06/17/2021 03:28 PM Pgs: 3
Jacqueline C Smith, Esq., Clerk

Gifford R. Hampshire
Blankingship & Keith, P.C.
4020 University Drive
Suite 300
Fairfax, Virginia 22030
Box 42

GPIN 7891-63-1590
Property Address:
14780-14800 Joplin Road
Manassas, VA 20112

DECLARATION OF RESTRICTIVE COVENANTS

This Declaration of Restrictive Covenants (this "Declaration") is made this 5th day of May, 2021 by Prince William County School Board ("Grantor") in favor of the Virginia Department of Environmental Quality ("DEQ") ("Grantee").

RECITALS

A. Grantor is the owner in fee simple of certain real property, hereinafter called "Restricted Property", comprised of approximately 46.6 acres, located at 14780-14800 Joplin Road, Manassas, Virginia 20112 in the Coles Magisterial District of Prince William County and identified by County tax records as GPIN 9891-63-1590 having acquired this property by deeds recorded in the Land Records of Prince William County at Deed Book 1182, Page 238, Deed Book 830, Page 412 and Deed Book 466, Page 540.

B. The Restricted Property is subject to this covenant.

C. Grantor is required to prohibit the use of groundwater beneath the Restricted Property for purposes other than environmental testing. No drinking water wells shall be permitted to be constructed within the identified boundaries of the Restricted Property.

D. Grantor acknowledges that these land use restrictions and other terms of this Declaration may only be changed, modified, amended, or revoked upon express written approval for the change, modification, amendment, or revocation of this

Declaration from the DEQ that is witnessed, authenticated, and recorded pursuant to the laws of the Commonwealth of Virginia with such amendment, modification, or revocation instrument.

AGREEMENTS

NOW, THEREFORE, in consideration of (i) the facts set forth hereinabove (which are hereby incorporated into and made a part of this Declaration), (ii) the covenants and agreements contained herein, and (iii) prior other good and valuable consideration, the receipt, adequacy and sufficiency of which are hereby acknowledged, Grantor hereby agrees and covenants as follows:

1. Deed Restrictions and Covenants. Grantor hereby enters into the following covenants and deed restrictions on behalf of itself and its successors and assigns:

(a) These land use restrictions and other terms of this Declaration may be changed, modified, or revoked only upon express written approval of the DEQ that is witnessed, authenticated, and recorded pursuant to the laws of the Commonwealth of Virginia, and

(b) The use of groundwater beneath the Restricted Property for purposes other than environmental testing is prohibited, unless it is demonstrated to the DEQ that (i) such use would not pose an unacceptable risk to human health and the environment, (ii) would not interfere with or adversely impact compliance with the final remedy, and (iii) the DEQ provides written approval for such non-testing use.

2. Miscellaneous

(a) The terms and conditions of this Declaration shall bind Grantor, its successors and assigns to the extent of their legal and/or equitable interest in Restricted Property, and this Declaration shall run with the land in perpetuity and be binding to the Restricted Property and its owner(s) forever.

(b) The terms and conditions of this Declaration shall be both explicitly included in any transfer, conveyance, or encumbrance of the Restricted Property or any part thereof, and instrument of transfer, conveyance, or encumbrance affecting all or any part of Restricted Property shall set forth the terms and conditions of this document.

(c) If any provision of this Declaration, or the application thereof to any person or circumstance, is found to be invalid, the remainder of the provisions of this Declaration, or the application of such provisions to persons or circumstances other than those as to which it is found to be invalid, as the case may be, shall not be affected thereby.

(d) This Declaration shall be construed in accordance with the laws of the Commonwealth of Virginia.

IN WITNESS WHEREOF, the parties hereto have executed this Declaration on the date set forth above.

GRANTOR

PRINCE WILLIAM COUNTY SCHOOL BOARD

By: ______________________

Name: Babur Lateef

Title: Chairman-At-Large

STATE OF VIRGINIA
COUNTY/CITY OF PRINCE WILLIAM to-wit:

I, the undersigned Notary Public of and for the jurisdiction aforesaid, do hereby certify that Babur Lateef, ____________ of Prince William County School Board, whose name is signed to the foregoing Deed dated 5 May 2021, has this date appeared before me, and acknowledged the same.

Given under my hand and seal this 17th day of June, 2021

____
NOTARY PUBLIC
Registration

No. 778898

My commission expires: 28 February 2022

WAYNE J. FRENCH NOTARY PUBLIC REG. #7788998 MY COMMISSION EXPIRES 2/28/2022 COMMONWEALTH OF VIRGINIA