# FINAL

# Proposed Plan
# Manassas Air Force Communication Facility
## Independent Hill, Virginia

**United States Army Corps of Engineers**

Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

Norfolk District
803 Front Street
Norfolk, Virginia 23510-1096

September 2020

Revision Number: 0

## 1.0 INTRODUCTION

This **Proposed Plan** identifies the preferred alternative for cleaning up the contaminated groundwater at the Former Manassas Air Force Communication Facility (MAFCF) in Independent Hill, Virginia. **Figure 1** shows the location of the Site.

The preferred alternative is in-situ chemical oxidation (ISCO) in source areas followed with in-situ enhanced biodegradation (ISEB) in plume areas. This plan summarizes all the remedial alternatives evaluated and discusses the reasons for choosing the preferred alternative.

This document is issued by the United States Army Corps of Engineers (USACE) on behalf of the Department of Defense (DoD) in cooperation with the **Virginia Department of Environmental Quality (VDEQ)**, the support agency. The public is encouraged to review and comment on the **Proposed Plan**. USACE, as the lead agency, in cooperation with VDEQ, will select a final remedy for the Site after reviewing and considering all information submitted during the public comment period of no less than 30 days. It is important that the public provides input on each alternative considered, not just the preferred alternative. The preferred alternative may be modified, or another response action presented in the **Proposed Plan** may be selected based on new information or public comments. This **Proposed Plan** was prepared using guidance provided in the *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (U.S. Environmental Protection Agency [USEPA], 1999). Note: Terms in **Bold** are included in the Glossary of Terms.

USACE is issuing the **Proposed Plan** as part of its public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The **Proposed Plan** fulfills the public participation requirements of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** Section 117(a). The MAFCF is not on the U.S Environmental Protection Agency's (USEPA) National Priorities List; however, the USACE in representation of the DoD as the lead agency, manages FUDS sites in accordance with the **CERCLA** process. **CERCLA** specifies that the lead agency (USACE) must publish a plan outlining **remedial alternatives** evaluated for the Site and identify the preferred alternative (NCP §300.430(f)(3)(i)(A). The **Proposed Plan** summarizes information that can be found in greater detail in the Final **Remedial Investigation** /

**MARK YOUR CALENDAR**

**Public Comment Period:**
2 September through 2 October 2020

**Submit Written Comments:**
USACE will accept written comments on the Proposed Plan during the public comment period. Oral comments can be submitted during the public meeting. Written comments should be addressed to:

Brent Graybill, PM
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2 Hopkins Plaza
Baltimore, Maryland 21201
410-962-4258
Brent.M.Graybill@usace.army.mil

**Public Meeting Schedule:**
22 September 2020, 7:00 – 9:00 PM

**Attend Public Meeting:**
USACE will hold a virtual public meeting to discuss the Proposed Plan for the MAFCF at:
Web Conference URL: https://www.webmeeting.att.com
Meeting Number: 844-767-5679 or 409-207-6967
Access Code: 3569253

**Risk Assessment** Report (Versar, 2013), the Final Supplemental Site Characterization Report (A-Zone, 2018), and the Final **Feasibility Study** Report (Hana, 2019). These reports are available for public review at www.nab.usace.army.mil/EnvironmentalNotices/ and included in the Administrative Record file established for the project at Prince William County Schools (PWCS)—Independent Hill School Document Library, 14800 Joplin Road, Independent Hill, VA 20112 and are available for review during normal business hours. USACE encourages the public to review the **Proposed Plan** and other relevant documents to gain a more comprehensive understanding of activities that have been conducted at the Site.

**Figure 2** summarizes the process flow and public participation steps in achieving remedy selection (USEPA, 1999).

USACE's responses to public comments on the MAFCF **Proposed Plan** will appear in a responsiveness summary section of the **Decision Document.**

## 2.0 SITE BACKGROUND

MAFCF was one of many parcels of federal land annexed in 1943 to Marine Corps Base (MCB) Quantico. By 1952, MAFCF assumed operational status as an aircraft control and warning station for the Eastern Defense Command Radar Network. However, the land was not formally transferred to the United States Air Force by the Marine Corps until 1956. In total 50.1 acres were transferred. The site was inactive by 1965 at the latest (Versar, 2013).

Between 1968 and 1975 the Site was transferred to the PWCS. The site is currently owned and operated by PWCS as the Independent Hill Complex (**Figure 3**). 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. The tower and the buildings are not maintained by PWCS.

Based on Versar (2013), there were five drinking water production wells (PW-1, PW-2, PW-3, PW-4, and PW-5) on the MAFCF property in the past. Production wells PW-1 (210 feet deep), PW-2 (233 feet deep), and PW-3 (295 feet) supplied the Site's drinking water needs until 1986 when the Site was connected to the county water system as a result of the detection of trichloroethene (TCE) in PW-1 and PW-5. All the water supply wells had been abandoned and sealed by Prince William County as of September 2006 (Versar, 2013). No drinking water supply wells are currently present on the MAFCF property.

Future land use of the site is expected to remain unchanged for the foreseeable future.

An initial investigation of MAFCF completed in 1989 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 (Versar, 2013). There is no evidence that the drums or the place where the drums were stored were ever located (Versar, 2013).

Since 1989, a variety of environmental investigations have been conducted at MAFCF. A Remedial Investigation (RI) completed in 2013 indicated that concentrations of chlorinated solvents present in groundwater were health concerns for use of groundwater as a potable water source. The vapor intrusion of soil gas into site buildings was also identified as a potential concern to site workers. A Supplemental Site Characterization (SSC) completed in 2016 further assessed groundwater and soil gas risks at MAFCF to support an evaluation of remedial alternatives to address the risks. These remedial alternatives were identified and evaluated in the 2019 **Feasibility Study (FS)**.

## 3.0 SITE CHARACTERISTICS

With completion of the RI and SSC at the Site, a complete list of constituents of concern (COCs) has been developed; the lateral and vertical extent of contamination on MAFCF property has been reasonably defined; and site risk has been assessed.

**Constituents 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)

**Extent of Contamination**

The extent of groundwater contamination at MAFCF was investigated during the RI (Versar, 2013) and SSC (A-Zone, 2018). **Figure 4** shows the TCE concentration distributions in three hydrostratigraphic zones consisting of saprolite, transition zone, and competent bedrock based on results of the groundwater samples collected in February 2017. TCE is the primary COC at the Site, as it represents the highest concentration and greatest extent of contamination with respect to risk. The plumes are generally orientated in a westerly to northwesterly 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 3**). Groundwater within the transition and deep bedrock zones is 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, whereas 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 those in the saprolite and transition zones. 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 site boundary. Since monitoring wells have not been installed on the MCB Quantico property located west of the site, 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 to 170 feet below ground surface.

## 4.0 SCOPE AND ROLE

Past activities have resulted in a release of hazardous substances at the Site. The role of the preferred alternative selected for the Site is to reduce the risk associated with chemicals of concern to human health at the Site for the current and reasonably anticipated future land use. Through the use of treatment technologies, the preferred alternative will reduce the toxicity, mobility, and volume of the COCs that pose unacceptable risks at the Site.

## 5.0 SUMMARY OF SITE RISKS

A human health risk assessment (HHRA) and an ecological risk assessment were completed as part of the Remedial Investigation/Risk Assessment (Versar, 2013). The ecological risk assessment was conducted on exposures to soil, sediment, and surface water at the Site. Risk to terrestrial species is likely to be minimal for most communities due to the small area and degraded habitat of the MAFCF. Risk to aquatic species is likely to be localized and quickly diluted and, thus, to have little effect on aquatic communities (Versar, 2013). The ecological risk assessment was not conducted for the groundwater because there was no exposure pathway for the ecological receptors.

The HHRA evaluated baseline cancer risks and non-cancer hazards associated with exposure to groundwater for construction worker and resident (adult and child) receptors at the Site. While groundwater on site is not currently 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. The construction worker was evaluated for exposure to groundwater while working in a trench. **Table 1** summarizes the HHRA results.

Risk evaluation for the resident (adult and child) was based on exposure pathways of 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 USEPA upper end of the acceptable carcinogenic risk threshold 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 ingestion pathway. Therefore, health concerns exist for use of groundwater as a tap water source at the MAFCF.

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 threshold. 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 carcinogenic risk 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 the SSC (A-Zone, 2018). The potential residential vapor intrusion risks were evaluated by USACE (2018), and the risk assessment concluded that exposure to soil vapors would not present unacceptable risk and hazards for future residents. In addition, precautionary measures including vapor barriers or ventilation systems are already in place as part of standard design practice for any new buildings in PWCS.

## 6.0 REMEDIAL ACTION OBJECTIVES

**Remedial action objectives** (RAOs) are developed to address the COCs, media of concern, potential exposure pathways, and preliminary remediation goals (PRGs). The PRGs are the proposed groundwater contaminant concentrations/cleanup levels to be achieved through remedial action, which are based upon the values of 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, so its PRG was calculated at the risk level of $10^{-5}$.

- 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]
- 1,1-DCE: 7.0 µg/L
- 1,2-DCA: 5.0 µg/L
- 1,1-DCA: 28 µg/L[2]
- VC: 2.0 µg/L

The following RAOs were developed during the **Feasibility Study** (Hana, 2019) for MAFCF:

1. For protection of human health, prevent exposure to groundwater with contaminant levels greater than PRGs 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 PRGs.

## 7.0 SUMMARY OF REMEDIAL ALTERNATIVES

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

- No Action
- 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)

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[1] 1,2-DCE (Total) consists of cis-1,2-DCE and trans-1,2-DCE, the MCL of 170 µg/L was used for 1,2-DCE (Total) in the Feasibility Study Report (Hana, 2019). Because no MCL for 1,2-DCE (Total) was explicitly established by USEPA and the MCLs for both cis-1,2-DCE and trans-1,2-DCE are available, the 1,2-DCE (Total) PRG was replaced by the trans-1,2-DCE PRG in this **Proposed Plan**.

[2] The PRG was calculated and reported at 224 µg/L in the Feasibility Study Report (Hana, 2019) using user-defined parameters. When the default inputs were used, the calculated PRG was 28 µg/L, which is 10 times of the USEPA Tapwater Regional Screening Level of 2.8 µg/L at risk level of $10^{-6}$. The default inputs values are more conservative and used in this **Proposed Plan.**

Based on the RI results and evaluation of the GRAs, the following six **remedial alternatives** were identified for further analysis:

- Alternative 1: No Action
- Alternative 2: Monitored Natural Attenuation (MNA)
- Alternative 3: ISEB in Source Areas
- Alternative 4: ISCO in Source Areas
- Alternative 5: ISCO in Source Areas Followed with ISEB in Plume Areas
- Alternative 6: Groundwater Extraction & Treatment in Source Areas

**Alternative Descriptions**

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. In this alternative, no LUCs would be implemented, no groundwater monitoring and/or remediation would be conducted, and existing monitoring wells would not be removed.

In addition, any improvement of the groundwater quality through natural processes including biodegradation, adsorption to aquifer material, mineral precipitation outgassing, dispersion, and dilution 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. There are no costs associated with this alternative.

**Alternative 2 – MNA**

This alternative includes long-term groundwater monitoring of the natural attenuation of COCs, which relies on natural processes to decrease or “attenuate” COCs in groundwater, and the implementation of LUCs. The landowner (PWCS) is willing to implement a Uniform Environmental Covenants Act (UECA) agreement, as a LUC, which will ensure that no drinking water wells are installed on the property and groundwater will not be used for drinking water. The Virginia UECA guidelines are described in 9-VAC15-90. The use of UECA to implement LUCs is readily used and supported by VDEQ, particularly for sites with single landowner and no plans to change land use. USACE has coordinated with USACE Office of the Chief Counsel (CECC-E) and received concurrence on 24 February 2020 for including the UECA as part of Alternative 2. Since the UECA will prevent the use of groundwater as drinking water, other LUCs will not be required to prevent exposure. The UECA agreement will be formalized at the time of **Decision Document** finalization.

**Alternative 3 – ISEB in Source Areas**

This alternative includes MNA and UECA 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 the anaerobic biodegradation processes.

**Alternative 4 – ISCO In Source Areas**

This alternative includes MNA and UECA 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, there are proprietary oxidants, such as RegenOx® by Regenesis Bioremediation Products. These oxidants are considered effective for oxidizing TCE and its degradation products, DCE and VC.

**Alternative 5 – ISCO in Source Areas Followed with ISEB in Plume Areas**

This alternative proposes a remedy that combines ISCO and ISEB. The ISCO treatment would focus on 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 and UECA as discussed in Alternative 2.

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

In addition to the MNA and UECA 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 to remove contaminant mass in the source areas. The extracted 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 onsite storm drains or the nearby creek. Both influent and effluent sampling for site-specific COCs are also performed to assess remedial effectiveness.

## 8.0 EVALUATION OF REMEDIAL ALTERNATIVES

Nine criteria are used to evaluate the different **remedial alternatives** individually and against each other in order to select a remedy. This section of the **Proposed Plan** profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other alternatives under consideration. The nine evaluation criteria are discussed below. The "Detailed Analysis of Alternatives" is presented in the **Feasibility Study** (Hana, 2019). **Table 2** provides a summary of the screening results with green being favorable, yellow being neutral, and red being not favorable.

Criteria 1 and 2 are threshold criteria that must be met for an alternative to be selected. Criteria 3 through 7 are balancing criteria, which are used to evaluate which alternative(s) most effectively accomplish cleanup goals. Regulatory acceptance and community acceptance are modifying criteria and will be documented in the **Decision Document** following agency and public comments on this **Proposed Plan**.

***Threshold Criteria***

- **Overall Protectiveness of Human Health and the Environment** determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
- **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the Site, or whether a waiver is justified. **Table 3** presents the preliminary ARARs.

***Primary Balancing Criteria***

- **Short-term Effectiveness** considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
- **Long-term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
- **Reduction of Toxicity, Mobility, or Volume (TMV) of Contaminants through Treatment** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
- **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
- **Cost** includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

***Modifying Criteria***

- **State/Support Agency Acceptance** considers whether the state agrees with the USACE's analyses and recommendations, as described in the **Remedial Investigation Report**, **Feasibility Study** Report, and **Proposed Plan**.
- **Community Acceptance** considers whether the local community agrees with USACE's analyses and preferred alternative. Comments received on the **Proposed Plan** are an important indicator of community acceptance.

**Overall Protection of Human Health and Environment**

Alternative 1 is not expected to protect human health or the environment as it does not provide any groundwater treatment, LUCs, or monitoring activities. Alternative 2 is protective of human health and the environment, by preventing exposure to contaminated groundwater through a LUC and minimizing the potential for off-site exposure through MNA. Alternatives 3 through 6 are also protective as they include Alternative 2's response actions of a LUC and MNA, in addition to treatment of the impacted groundwater.

**Compliance with ARARs**

Alternatives 2 through 6 meet all federal and state chemical-, location-, and action-specific ARARs by preventing exposure to contaminated groundwater through the UECA. Various treatments proposed in Alternatives 3 through 6 would also minimize potential for off-site migration. Alternative 1 does not comply with chemical-specific ARARs.

**Short-Term Effectiveness**

Alternatives 2 through 6 are effective short-term in 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 involved installation of injection wells, which create temporary disruptions to landowner activities. Alternatives 4 and 5 involve ISCO, 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 due to the amount of space required for an ex-situ groundwater treatment and conveyance system. Alternative 1 does not provide short-term effectiveness.

**Long-Term Effectiveness and Permanence**

Alternative 2 provides adequate long-term effectiveness by preventing exposure and monitoring plume concentrations. Alternatives 3 through 6 provide a higher degree of long-term effectiveness, since 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 operation and maintenance required for an active treatment system and the time it takes to achieve significant mass reduction, creates secondary long-term concerns not associated with alternatives 3 through 5. Alternative 1 does not provide long-term effectiveness as it does not provide any groundwater treatment, LUCs or monitoring.

**Reduction of TMV Through Treatment**

Alternative 2 will only passively reduce toxicity and volume of COCs in groundwater through natural attenuation processes, while alternatives 3 through 6 will actively reduce the toxicity and volume. The phased ISCO/ISEB approach in Alternative 5 provides a higher degree of toxicity and volume reduction 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. Alternative 1 does not provide reduction of TMV as it does not provide any groundwater treatment, LUCs or monitoring.

**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 only involve temporary disruptions that could be readily managed through close coordination with the landowner. Alternative 6 would be difficult to implement due to 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 educational facility.

**Cost**

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).

**State Agency and Community Acceptance**

First, the state regulatory agency reviews and concurs with the preferred alternative presented in the **Proposed Plan**. Then, the community acceptance is pursued and addressed during the **Proposed Plan** comment period and associated/follow-on public presentation meeting. Information about state agency and community acceptance from the **Proposed Plan** presentation efforts will be incorporated into the **Decision Document**.

## 9.0 PREFERRED ALTERNATIVE

Based on detailed analysis conducted during the FS (Hana, 2019), Alternative 5 – ISCO in Source Areas Followed with ISEB in Plume Areas has been chosen by USACE as the preferred remedial action alternative to address the groundwater contamination. The preferred alternative is chosen to achieve the PRGs in a reasonable time frame. A 30-year time frame was used in the FS for cost comparison purposes. The groundwater modeling results indicated that the 30-year time frame could be achieved only in modeling scenarios that assumed 10-time increase in biodegradation rate and source mass reduction ranging from 30% to 90%. Oversimplification of the heterogeneous lithology and over optimism of the degradation rates, in particular for DCE and VC daughter products, suggest longer time frames to achieve the PRGs. The actual time frame would be consistently reassessed based on statistical trend analysis of monitoring data. The main components of the preferred alternative are discussed below.

**<u>MNA with LUCs</u>**

Implementation of MNA with LUCs will limit public exposure to contaminated groundwater while demonstrating 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 groundwater long-term monitoring (LTM) would be prepared. For implementation of this component, it is assumed that no new MWs would be required to be installed.

The location and number of MWs would be reviewed on an annual basis, in cooperation with VDEQ. Any MW that is proposed for long-term monitoring that becomes damaged, or requires removal due to unrelated site activities, would be replaced or repaired, as needed. The need for continuing the long-term monitoring at the location would be evaluated based on existing and expected future groundwater conditions. All water sampling results and performance monitoring, and the results of the review, would be provided in an LTM report. The LTM report would use statistical methods to characterize decreasing trends of COCs at specific locations, as well as statistically determine any change over time to the overall shape of the plume. LTM data would be used to determine the effectiveness of the combined remedy.

The landowner (PWCS) is willing to implement a UECA agreement as the LUC measure, which will ensure that no drinking water wells are installed on the property. The Virginia UECA guidelines are described in 9-VAC15-90. Since the UECA will prevent the use of groundwater as drinking water, other LUCs will not be required to prevent exposure. USACE has coordinated with USACE Office of the Chief Counsel (CECC-E) and received concurrence on 24 February 2020 for including the UECA as part of the preferred alternative. The UECA agreement will be formalized at the time of **Decision Document** finalization.

**Combined Remedial Approach**

In addition to MNA with LUCs, active remedial actions consisting of both ISCO and ISEB would be performed. The combined remedial approach would be moderately complex to implement at the Site. A remedial design would be needed to implement the alternative. Because of the heterogeneous conditions of the aquifers, pre-remedial studies would be necessary in order to have a better understanding of the COC mass distribution and determine the appropriate agents (chemical oxidants in the source area and substrates in the plume), required concentrations, and injection volumes to use to treat the groundwater. The pre-remedial studies would evaluate the amendment delivery vehicles to select the optimal approaches that are complementary to the current site conditions and provide essential data for remedial design to account for mutually exclusive requirements on subsurface redox conditions for ISCO and ISEB. 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. This is particularly essential for the ISEB application because of the lower than optimal pH condition in the groundwater.

**ISCO in Source Areas**

The ISCO 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 chemical oxidant 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 (Versa, 2013) and discussions in the FS Report (Hana, 2019), the ISCO injection wells would be constructed to target the hot spots in all the three hydrostratigraphic zones. Effectiveness of the ISCO in reducing COC mass, in particular TCE, cis-DCE, and VC concentrations in the groundwater, would be monitored quarterly for two years (in conjunction with the MNA component of the preferred remedial alternative) to determine if additional rounds of ISCO injection are needed.

The effectiveness of the treatment is dependent on the rate of spreading and completeness of the treatment media coverage. Due to 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 ISCO 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, in particular TCE, cis-DCE, and VC concentrations in the groundwater, would be monitored quarterly for two years (in conjunction with the MNA component of the preferred remedial alternative) 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. Due to the heterogeneity of the water-bearing units, the actual treatment rate and coverage may vary, and multiple treatments could be necessary.

All monitoring well data would be evaluated annually, and adjustments to the sampling program, if required and necessary, would be recommended at that time. Any well proposed for long-term monitoring that becomes damaged or is required to be removed due to remedial action or other activities, would be replaced or repaired, as needed. The long-term monitoring would continue until concentrations are below the groundwater PRGs. All water quality and review results would be provided in Annual Monitoring Reports.

**Challenges in Achieving PRGs with the Preferred Remedial Alternative**

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 verify that the plume has not migrated off-site. The additional data collection and installation of the off-site monitoring wells would be performed in the pre-remedial studies, in cooperation with VDEQ. 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.

The primary challenge with any remedial alternative is achieving the low concentrations (i.e., PRGs) 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) well above PRGs, 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 PRGs within a reasonable timeframe after the implementation of the ISCO and ISEB treatments. USACE would take an adaptive approach in the remedial design to give options of performing additional rounds of reagent injections at critical locations of the aquifers to ensure that persistent level-off of the contaminant concentration would not occur and the PRGs are achieved within a reasonable timeframe. Monitoring data should be used to verify that groundwater with concentrations of COCs above PRGs is not migrating off-site.

Based on results from pre-remedial studies, 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 PRGs.

The implementation of the preferred remedial alternative would be considered complete once concentration data indicates statistically that all COCs are at or below PRGs in all groundwater sampling locations. The specific statistical methods would be included in the LTM plan, and some are recommended by USEPA (2014; 2009). Because this alternative would result in contaminants remaining within groundwater at the site above proposed cleanup levels prior to completion, CERCLA requires that the site be reviewed at least once every five years to ensure the protectiveness of the remedy and adequate progress toward the attainment of the groundwater PRGs. The five-year reviews would also provide opportunities to optimize the remedy components or reevaluate the overall remedy, remediation timeframe, and groundwater PRGs.

## 10.0 COMMUNITY PARTICIPATION

Public input is important to the decision-making process. Nearby residents and other interested parties are encouraged to use the comment period for questions and concerns about the preferred alternative for the Site. USACE will summarize and respond to public comments in a responsiveness summary, which will become part of the official **Decision Documen**t.

### How to Submit Comments

The USACE is seeking comments on the actions recommended in this Proposed Plan. The Public Comment Period for the MAFCF **Proposed Plan** offers the public an opportunity to provide input to the process of evaluating **remedial alternatives** for the Site. The Public Comment Period will begin on 1 September 2020 and end on 5 October 2020, during which comments will be accepted and considered prior to a final selection of the remedy. In addition, a virtual public meeting will be held on 22 September 2020 from 7:00 to 9:00 PM. The Web Conference URL is https://www.webmeeting.att.com with Meeting Number 844-767-5679 or 409-207-6967 and Access Code 3569253. The meeting will provide an additional opportunity for the public to submit comments regarding the **Proposed Plan**. Comments may be written or submitted orally at the meeting. All interested parties are encouraged to attend the meeting to learn more about the alternatives proposed for the Site. A template for public comments is attached at the end of this document.

To submit written comments during the Public Comment Period or to obtain further information, please contact the following representative:

Brent Graybill, PM
USACE-Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201
410-962-4258
Brent.M.Graybill@usace.army.mil

Written comments on the MAFCF Proposed Plan must be postmarked no later than 5 October 2020.

### Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the Public Comment Period ends. It is important that the public provides input on each alternative considered, not just the preferred alternative. The input the public provides may result in the selection of a final remedial action that differs from the preferred alternative proposed in this Proposed Plan.

### Decision Document

Following the public comment period, USACE will issue a **Decision Document**. The **Decision Document** will detail the **remedial action** selected for the Site. The **Decision Document** will also include USACE's responses to comments received during the Public Comment Period.

**PUBLIC MEETING NOTICE**

**Date**
22 September 2020

**Time**
7:00 - 9:00 PM

**Location of Public Meeting**

USACE will hold a virtual public meeting to discuss the Proposed Plan for the MAFCF at:
Web Conference URL:
https://www.webmeeting.att.com
Meeting Number: 844-767-5679 or 409-207-6967
Access Code: 3569253

**Location of Administrative Record**

This Proposed Plan, as well as any additional supporting documents, are available to the public at *www.nab.usace.army.mil/EnvironmentalNotices/* and the location of the Administrative Record located at:

PWCS—Independent Hill School Document Library,
14800 Joplin Road
Independent Hill, VA 20112
(703) 791-8801

## 11.0 REFERENCES

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

Hana Engineers and Consultants, LLC (Hana), 2019. Final Feasibility Study, Manassas Air Force Communication Facility, Independent Hill, Virginia. August.

U.S. Environmental Protection Agency (USEPA). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. USEPA 540/G-89/004, OSWER 9355.3-01. October.

U.S. Environmental Protection Agency (USEPA). 2014. Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well, OSWER 9283.1-44. August.

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. EPA 530/R-09-007, March.

USEPA. 1999. A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents. USEPA 540/R-98/031, OSWER 9200.1-23P. July.

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

**Table 1. Summary of HHRA (Versar, 2013; USACE, 2018)**

| Exposure Route | Receptor | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Construction Workers | | Residential Adults | | Residential Children | | Cumulative Residential Lifetime (Children + Adults) | |
| | Carcinogenic Risk | Hazard Index | Carcinogenic Risk | Hazard Index | Carcinogenic Risk | Hazard Index | Carcinogenic Risk | Hazard Index |
| Groundwater ingestion | 4.87E-07 | 1.44 | 3.27E-03 | 403 | 1.91E-03 | 941 | 5.18E-03 | 1,340 |
| Groundwater dermal contact | 4.54E-06 | 13.7 | 5.41E-04 | 68.4 | 3.03E-04 | 153 | 8.44E-04 | 222 |
| Subslab soil gas inhalation | | | 2.78E-03 | 88.2 | 6.95E-4 | 88.2 | 3.47E-03 | 176 |
| Vapor inhalation in trench | 1.73E-04 | 1460 | | | | | | |
| Vapor inhalation during showering | | | 7.33E-09 | 0.0248 | | | 7.33E-09 | 0.0248 |
| Primary Drive COC | TCE | TCE | TCE, VC | TCE, cis-1,2-DCE, 1,2-DCE (total) | TCE, VC | TCE, cis-1,2-DCE, 1,2-DCE (total) | TCE, VC | TCE, cis-1,2-DCE, 1,2-DCE (total) |
| Subslab soil gas inhalation (based on data from SSC [A-Zone, 2018]) | | | 9.24E-06 | 0.65 | | | | |

Blank cell: Incomplete pathway/Not analyzed if most conservative pathway indicated no risk.

**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 | Yes | Yes | Short-Term: Yes, through preventing exposure<br>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<br>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<br>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. ISCO in Source Areas Followed with ISEB in Plume Areas | Yes | Yes | Short-Term: Yes, through preventing exposure<br>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 | High | Medium |
| 6. Groundwater Extraction & Treatment in Source Areas | Yes | Yes | Short-Term: Yes, through preventing exposure<br>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)

**Table 3. Preliminary ARARs**

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

* Note that procedural requirements such as 40 CFR 263 must be followed during the remedial action, but they are not considered ARARs.

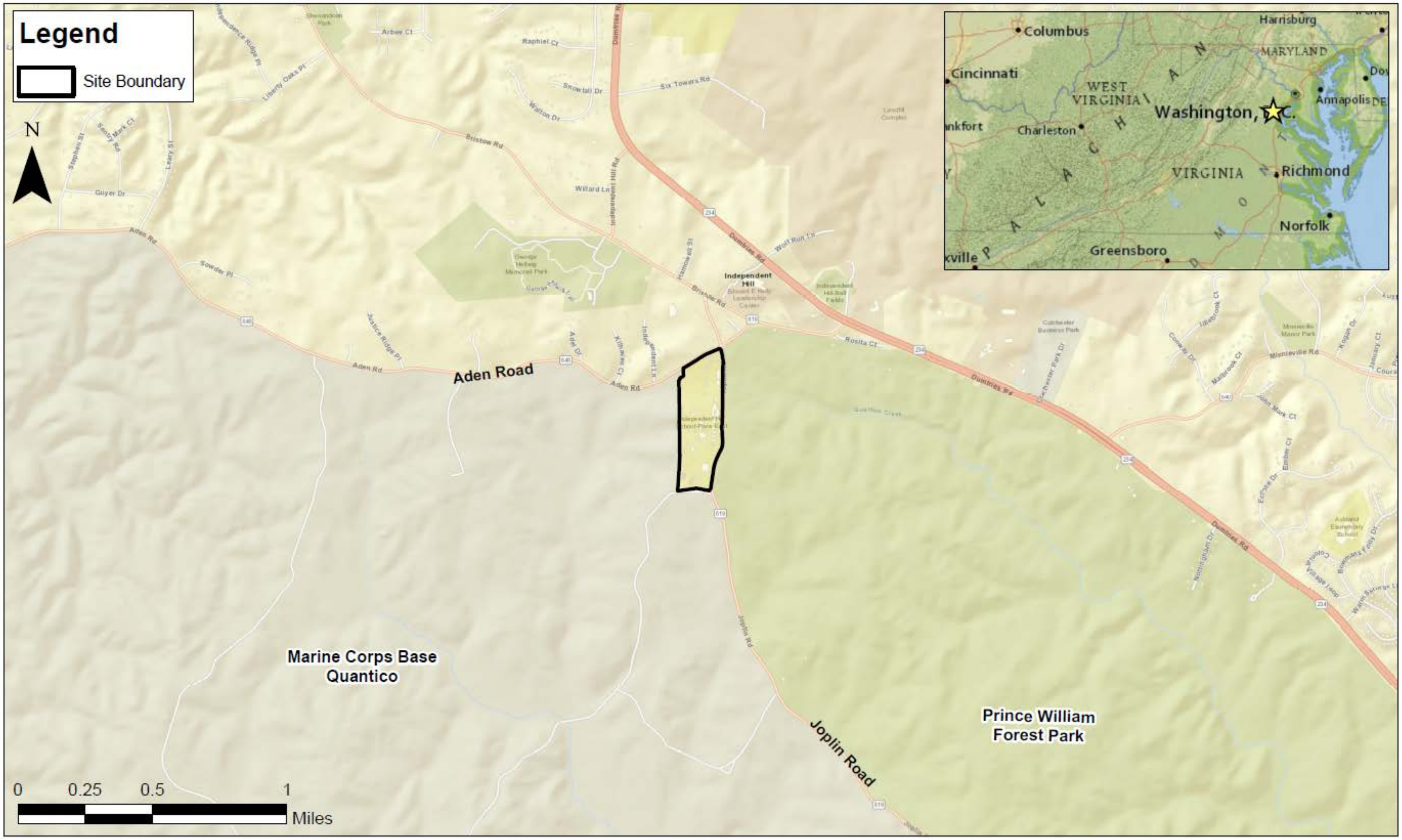


**Figure 1. Site Location**

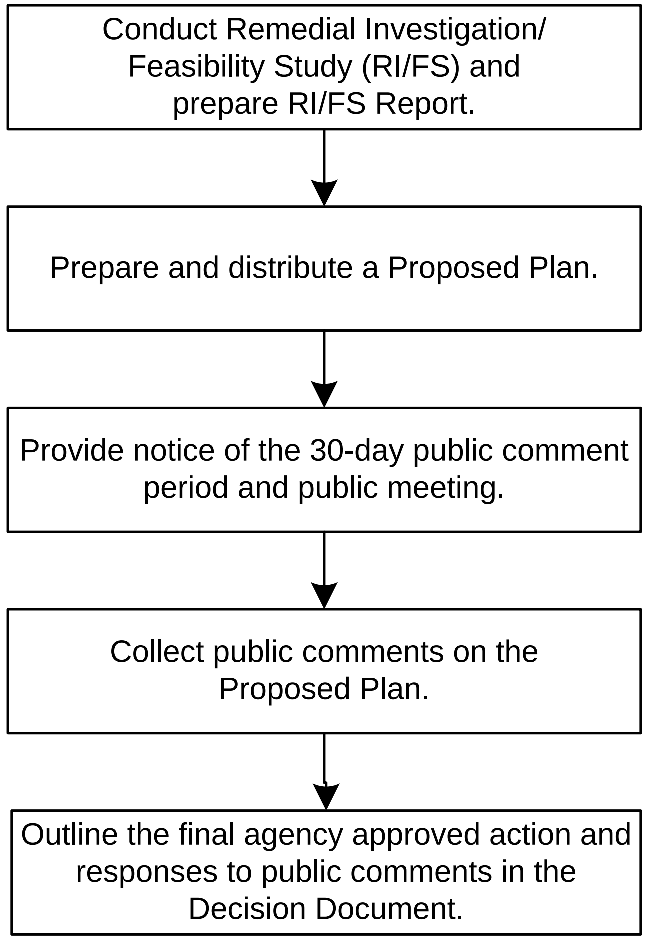


**Figure 2. Public Participation Process**


**Figure 3. Site Map**

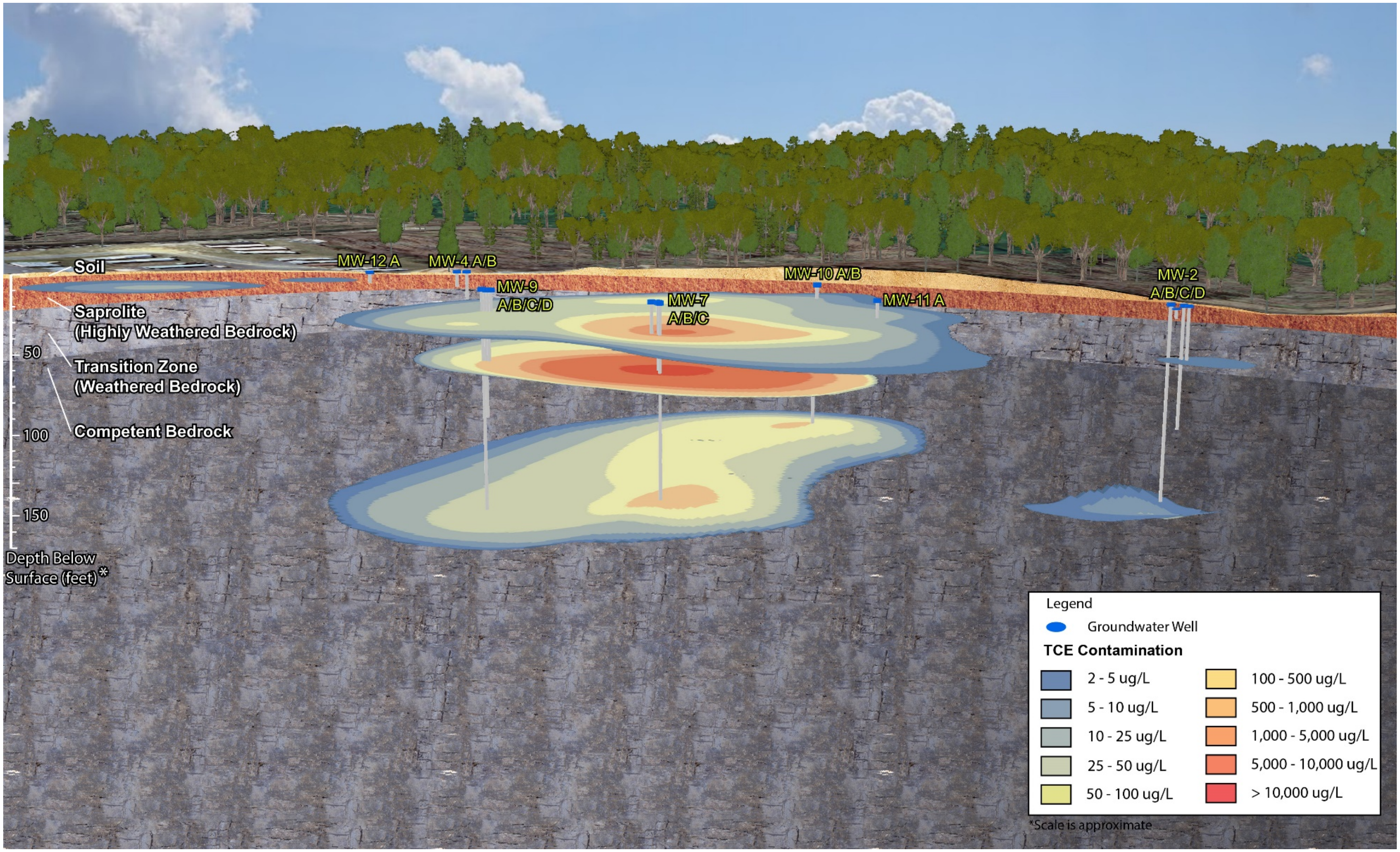


**Figure 4. 3-D Rendering of TCE Plume (East-West)**

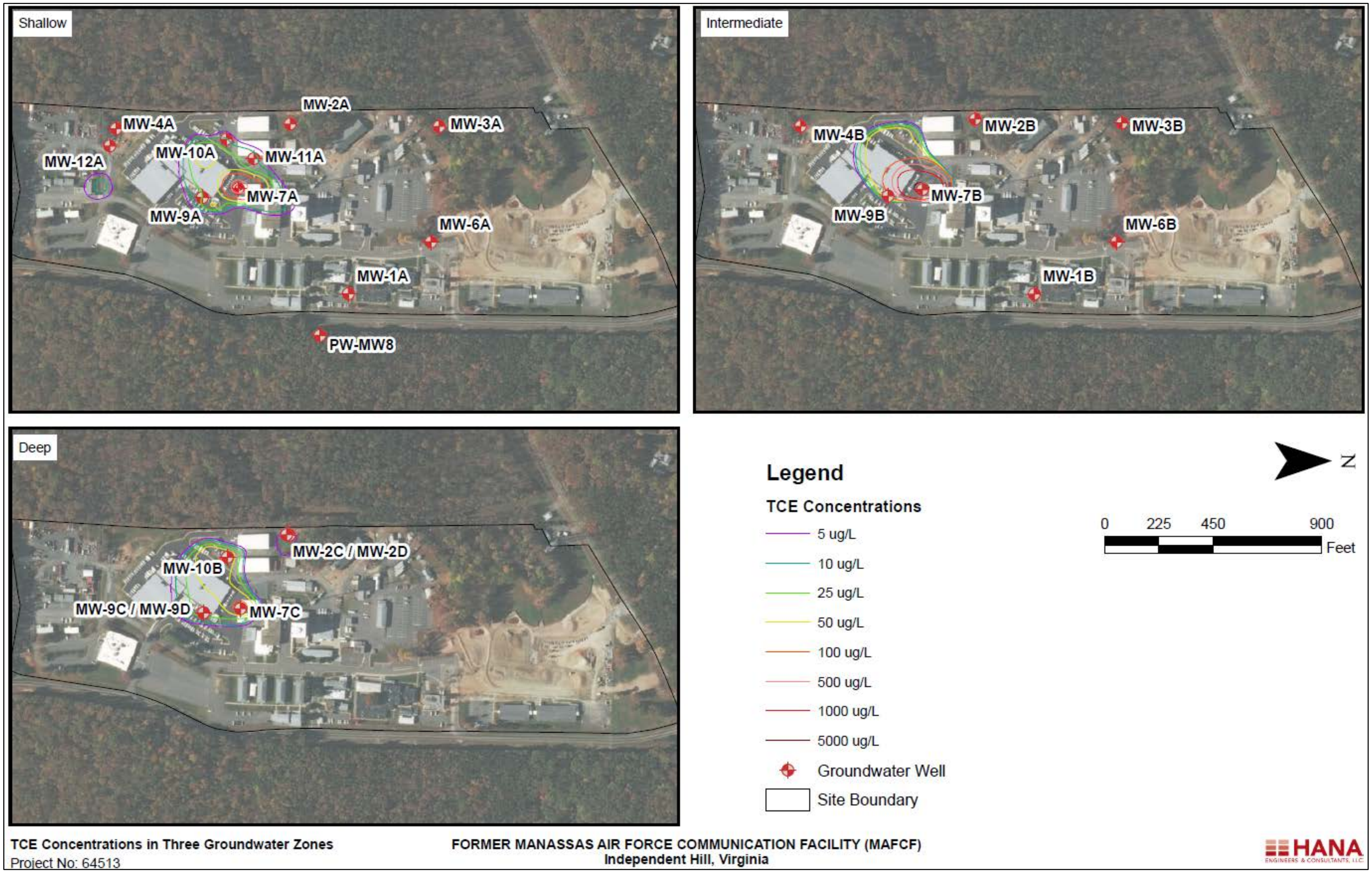


**Figure 5 Extent of TCE contamination in three hydrostratigraphic zones at MAFCF**

## GLOSSARY OF TERMS

| | |
|---|---|
| Applicable or Relevant and Appropriate Requirements (ARARs) | Cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that directly and fully address (or address situations similar to) a hazardous substance, pollutant, contaminant, action, location, or other circumstance at a CERCLA site.<br><br>Action-specific ARARs: Action-specific limitations on "actions" associated with a remedial action.<br><br>Chemical-specific ARARs: Chemical-specific standards established for specific chemicals found on the Site.<br><br>Location-specific ARARs: Location-specific restrictions based on the location of the Site. |
| Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) | A Federal law enacted in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act, which concerns investigation and response actions regarding hazardous substances, pollutants, and contaminants. |
| Decision Document | A public document that describes the remedy selected for a site, describes the basis for the choice of that remedy, and provides responses to public comments. The Decision Document is created from information generated during the Remedial Investigation/Feasibility Study. |
| Exposure Pathway | The route a substance takes from its source (where it begins) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. |
| Feasibility Study | An evaluation of potential remedial technologies and treatment options that can be used to clean up a site. |
| Present Net Worth | The sum of the present values of the individual cash flows of the same entity. |
| Proposed Plan | In the first step in the remedy selection process, the lead agency identifies the alternative that best meets the requirements of CERCLA and the National Oil and Hazardous Substances and Pollution Contingency Plan and presents that alternative to the public in a proposed plan. The purpose of the proposed plan is to supplement the Remedial Investigation/Feasibility Study and provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of remedial action at a site. |
| Remedial Action | The actions consistent with the permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment to prevent or minimize the release of hazardous substances so they do not migrate to cause substantial danger to present or future public health, welfare, or the environment. |
| Remedial Alternative | Combination of various technologies (e.g., removal, containment, treatment) identified for a site cleanup. |

| | |
|---|---|
| Remedial Action Objective | Objective established for remedial actions to guide the development of alternatives and to focus the comparison of acceptable remedial action alternatives, if warranted. Remedial action objectives also assist in clarifying the goal of minimizing risk and achieving an acceptable level of protection for human health and the environment. |
| Remedial Investigation | A study of a site that provides information supporting the evaluation of the need for a remedy and/or selection of a remedy for a site where hazardous substances have been disposed. The remedial investigation identifies the nature and extent of contamination at a site. |

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| µg/L | micrograms per liter |
| ARAR | applicable or relevant and appropriate requirement |
| CECC-E | Office of the Chief Counsel |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COC | contaminant of concern |
| DCA | Dichloroethane |
| DCE | Dichloroethene |
| DD | Decision Document |
| FS | Feasibility Study |
| ft | feet |
| GAC | granular activated carbon |
| GRA | general response actions |
| HHRA | Human Health Risk Assessment |
| HQ | hazard quotient |
| HRC™ | Hydrogen Release Compound |
| ISCO | in-situ chemical oxidation |
| ISEB | in-situ enhanced biodegradation |
| LTM | long-term monitoring |
| LUC | land use controls |
| MAFCF | Manassas Air Force Communication Facility |
| MCB | Marine Corps Base |
| MCL | maximum contaminant level |
| MNA | monitored natural attenuation |
| NCP | National Contingency Plan |
| PCE | Tetrachloroethylene |
| PP | Proposed Plan |
| PRG | preliminary remediation goal |
| PWCS | Prince William County Schools |
| RAO | remedial action objective |
| RI | Remedial Investigation |
| RSL | regional screening level |
| SSC | Supplemental Site Characterization |
| TCE | Trichloroethene |

| | |
|---|---|
| TMV | Toxicity, Mobility, or Volume |
| UECA | Uniform Environmental Covenants Act |
| U.S. | United States |
| USACE | U.S. Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| VC | Vinyl Chloride |
| VDEQ | Virginia Department of Environmental Quality |

## Please Write Your Comments Below:

Your input on the Proposed Plan for Manassas Air Force Communication Facility, Independent Hill, Virginia is important to USACE. Comments provided by the public are valuable in helping USACE select a final remedy for the site.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by **2s October 2020**. If you have questions regarding the comment period, please contact Mr. Brent Graybill at 410-962-4258 or Brent.M.Graybill@usace.army.mil.