Final PROPOSED PLAN

HAA-17 TCE GROUNDWATER CONTAMINATION SITE

SAVANNAH, GEORGIA

Date: To Be Determined (TBD)

HUNTER ARMY AIRFIELD, GEORGIA

3d Inf Div (Mech)

Hunter Army Airfield Proposed Plan

This **Proposed Plan** identifies the Preferred Alternative for remediating the contaminated groundwater impacts at the Hunter Army Airfield (HAAF) HAA-17 Trichloroethylene (TCE) Groundwater Contamination Site and provides the rationale for this recommendation. Additionally, alternative remedies that were evaluated for this site are provided. This document is issued by HAAF the responsible party for site activities, and the Georgia Environmental Protection Division (GAEPD), which oversees regulatory actions for this site. HAAF, in consultation with GAEPD, will select a final remedy after reviewing and considering all information submitted during the 30-day public comment period. HAAF, in consultation with GAEPD, may modify the Preferred Alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives in this Proposed Plan. Please note body text shown in **bold** that does not represent a section heading is defined in the glossary.

HAAF is issuing this Proposed Plan as part of its public participation responsibilities under Section 117 of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** of 1980, as amended, 42 United States Code § 9617, as amended by the Superfund Amendments and Reauthorization Act, and Section 300.430(f)(ii) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R.§ 300.430(f)(ii)**. This Proposed Plan summarizes information that can be found in greater detail in the **Remedial Investigation/Feasibility Study (RI/FS)** Report (Arcadis, 2019) and other documents contained in the **Administrative Record** file for this site. HAAF and the GAEPD encourage the public to review these provided documents to gain a more comprehensive understanding of the site, as well as remedial activities that have been conducted at the site.

DATES TO REMEMBER

PUBLIC COMMENT PERIOD:

Date: TBD

HAAF will accept written comments on the Proposed Plan during the 30-day public comment period.

PUBLIC MEETING:

Date: TBD

6:00 p.m. – 8:00 p.m.

HAAF will hold a public meeting to clarify any questions regarding the Proposed Plan and all remedial alternatives presented in the Feasibility Study. Oral and written comments will be accepted at the meeting. The meeting will be held at the Southwest Chatham Library, located at: 14097 Abercorn Street, Savannah, GA 31419 at 6:00 p.m.

For more information, see the Administrative Record for the Site at the following locations:

Fort Stewart
DPW Prevention & Compliance Branch
1550 Veterans Parkway, Building 1137
Fort Stewart, Georgia 31314
(912)315-5144 or (912)767-2010
Hours: Mon. – Fri.
8:00 a.m. – 4:00 p.m.

Website:
https://home.army.mil/stewart/index.php/about/Garrison/DPW/environmental/prevention-and-compliance/adminrecord

This Proposed Plan includes the following sections:

SITE BACKGROUND

HAAF is an active military installation located in Savannah, Georgia, with areas of industrial, commercial, and temporary residential properties occupied by a variety of administrative, maintenance, and barracks facilities, as well as an active airfield. HAA-17 is located in the northern portion of HAAF. A site map depicting the HAA-17 area is included as *Figure 1*. Former and current facilities identified as potential sources of **constituents of potential concern (COPCs)** in the investigation area are described below.

HAA-17 AREAS OF INVESTIGATION

Former USTs 25 & 26

From October 1989 until July 1998, **underground storage tanks (USTs)** 25 & 26 were utilized at an active service station located in the 260th Quarter Master Motor Pool along Tubb Road. The location of the former USTs 25 & 26 is shown on *Figure 1*. UST 25 had a capacity of 25,000 gallons and stored diesel fuel. UST 26 had a capacity of 6,000 gallons and stored gasoline. The USTs and associated piping were abandoned in place in July 1998. In 1999, investigations were initiated to evaluate the potential groundwater and soil impacts. The initial investigatory analytical results identified **volatile organic compounds (VOCs)**, including petroleum hydrocarbons (benzene) and chlorinated hydrocarbons particularly TCE (as well as 1,2-dichloroethene [1,2-DCE], 1,1-dichloroethane [1,1-DCA], and 1,2-DCA) in groundwater. USTs 25 &26 were removed in 2006. An Interim Remedial Action (IRA) was implemented to remove contaminated soil/free product to rapidly remediate the free product historically found in two wells. Subsequent sampling and monitoring indicated compliance with USTs 25 & 26 **Corrective Action Plan (CAP)** – Part B closure criteria and a No Further Action Required status granted for petroleum hydrocarbon impacts for benzene by the GAEPD Underground Storage Tank Management Program in a letter dated August 19, 2008. The chlorinated hydrocarbons were to be addressed in a separate remedial action.

Former Purge Facility

The former HAAF Purge Facility is located in the southern section of the investigation area and was used to clean tanker trucks that stored and transported petroleum products, mainly Jet Propellant 8 (JP-8). The former Purge Facility is no longer used for cleaning tanker trucks. The location of the former Purge Facility is shown on *Figure 1*. In 2006, TCE was detected in one deep groundwater well**,** as well as metals chromium and barium. Subsequent sampling indicated that the metals detections in groundwater were likely associated with high turbidity in the samples. Arsenic was found in soil samples collected in 2006 along a surface draining pathway feature at concentrations above United States Environmental Protection Agency (USEPA) residential regulatory standards but below USEPA industrial regulatory standards**.**

Building 1290

Building 1290 is located in the western section of the investigation area, adjacent to the airfield. It is an aircraft hangar that formerly had a degreasing system located in the corner of the facility. The location of Building 1290 is shown on *Figure 1*. In 2007 and 2008, TCE was not detected in monitoring wells surrounding Building 1290. In the 20 soil sample locations around and downgradient of Building 1290, no VOCs were detected at levels above residential or industrial **Regional Screening Levels (RSLs)** and no apparent sources were identified.

Other Facilities

Other facilities previously located in the investigation area include a former dry-cleaning facility that was located east of Building 1290. The location of the former dry-cleaning facility is shown on *Figure 1*. A new building now covers the location. The former weapons cleaning facility was located south of the former dry cleaner. The Strategic Air Command (SAC) special weapons area was formerly located west of the former UST 25 & 26 area. From 1950 through 1963, HAAF operated as a SAC Air Force Base. This training area was used to train personnel in assembling and handling special weapons, including routine maintenance procedures. All of these areas associated with former or current facilities, which are west and upgradient of the impacts around the former UST area, were investigated as potential sources but only low concentrations of TCE not indicative of a source were detected.

SITE CHARACTERISTICS

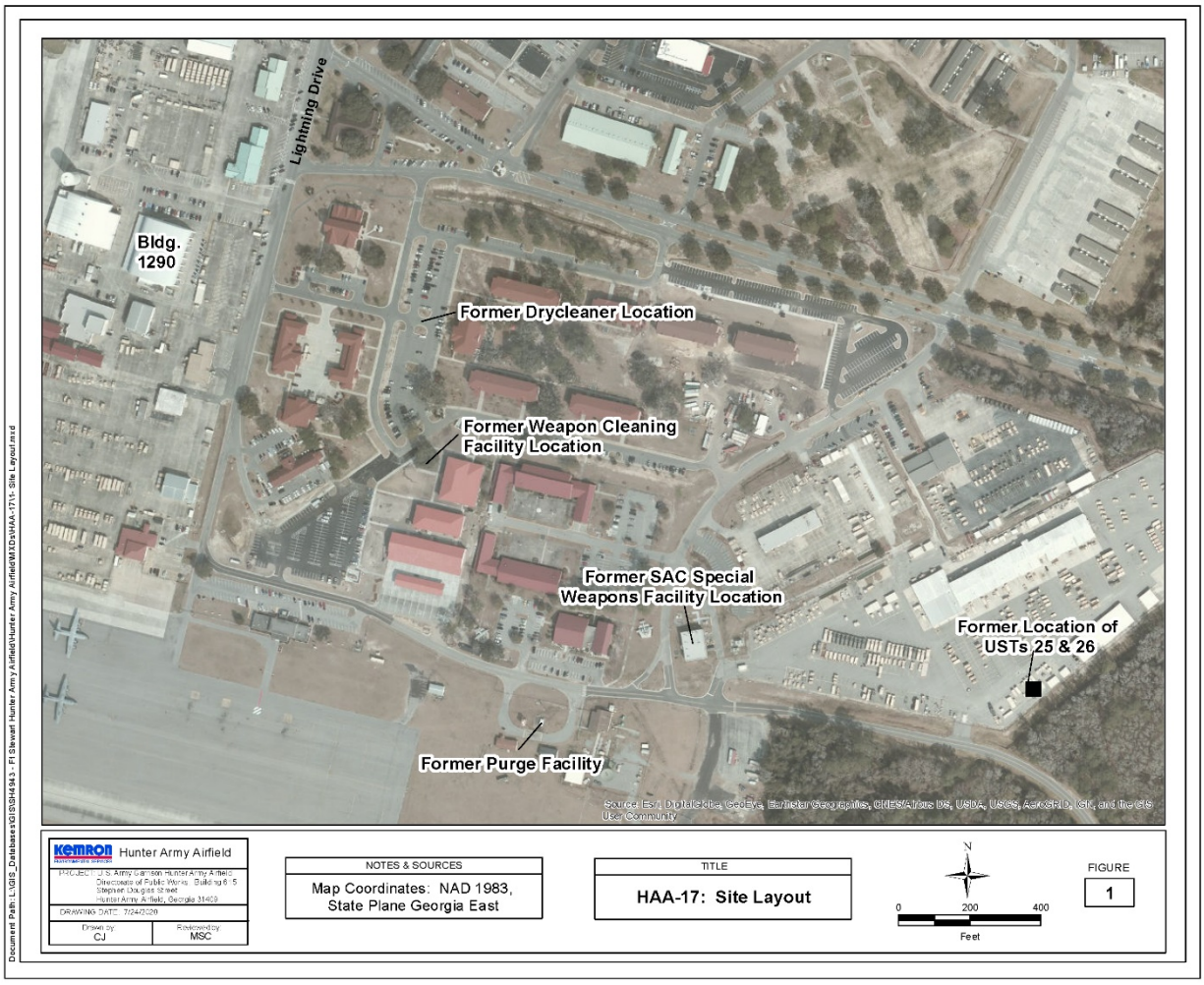
HAAF conducted RI/FS from 2009 to 2015 to investigate the extent and source of TCE impacts in soil and groundwater at HAA-17, including impacts at the

former USTs 25 & 26 area, upgradient areas previously identified as of potential concern, and the area east of the drainage canal. Additionally, investigation of metals detected at the purge facility was conducted.

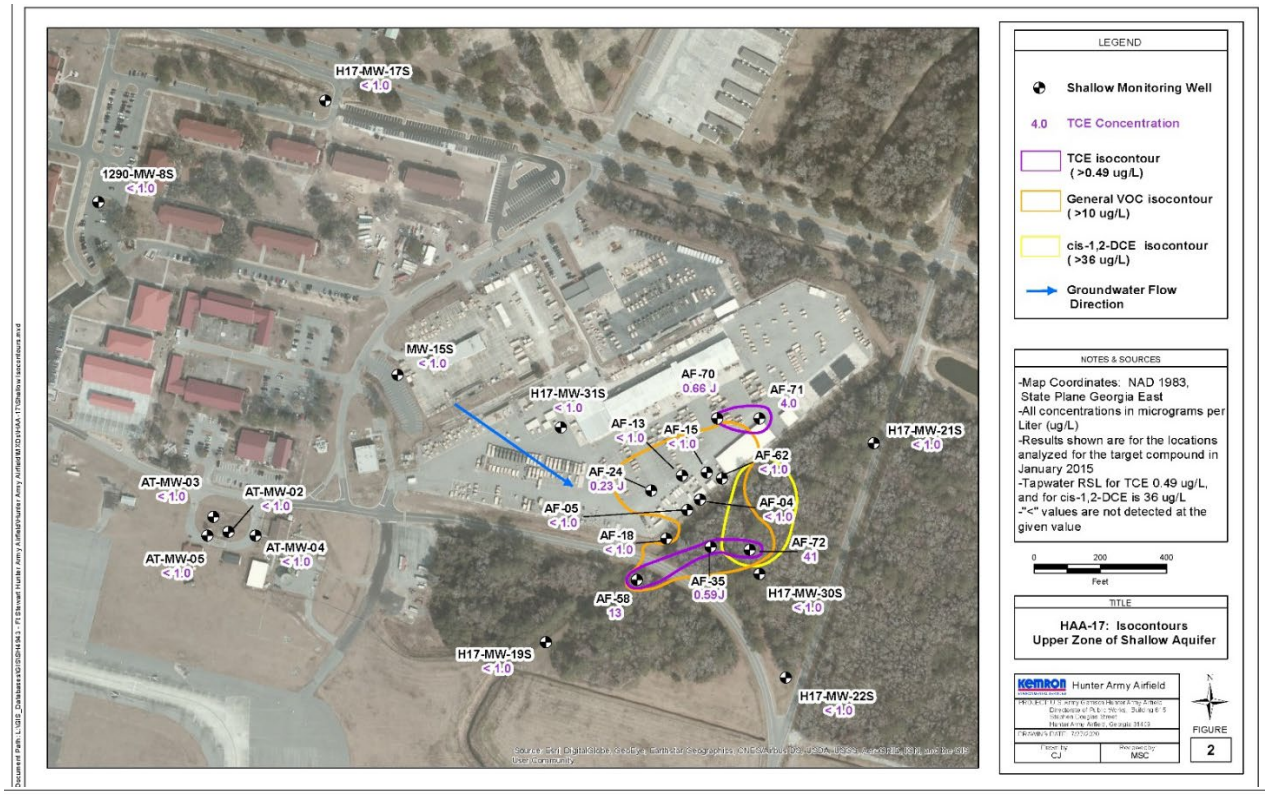
Multiple soil and groundwater investigations indicate that the former USTs 25 & 26 area is the primary source of TCE impacts in the investigation area. Investigations conducted in the areas upgradient of former USTs 25 & 26 yielded a few low detections of dissolved TCE concentrations in groundwater, providing little evidence of a source upgradient of the former UST locations. TCE impacts have been observed predominantly at the 20- to 30-feet below ground surface (ft bgs) and 30- to 40-ft bgs intervals in the former USTs 25 & 26 area. The areal extent of TCE impacts decreases with depth, with the highest TCE concentrations occurring predominantly in the 20- to 30-ft bgs interval just above the upper clay layer identified in the geophysical survey. Membrane interface probe points and boring samples from locations near the western end of Building 1345 in the former UST area had the highest TCE impact results. Groundwater sampling at the purge facility in 2010 and 2015 indicated chromium, barium, and arsenic did not exceed the USEPA **maximum contaminant levels (MCLs**) in any sample collected. Based on monitoring data collected to date, the target **constituents of concern (COCs)** in groundwater are TCE and its daughter products, cis-1,2- dichloroethylene (cis-1,2-DCE) and vinyl chloride (VC), as well as benzene. TCE groundwater concentration plumes in the shallow (20-ft to 30-ft bgs) and deep zones (30-ft to 40-ft bgs) from the groundwater sampling event conducted in 2015 are shown in *Figures 2 and 3*, respectively.

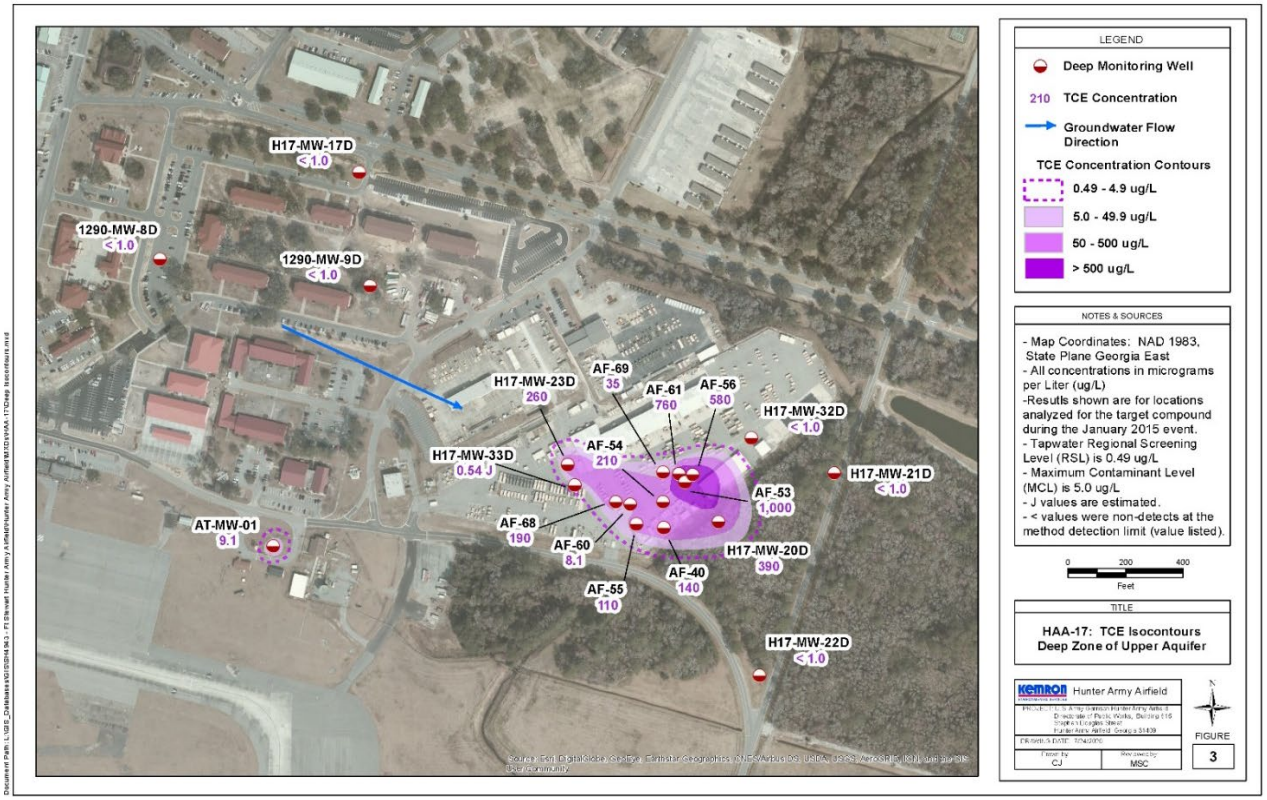
SCOPE AND ROLE OF ACTION

This proposed action as described in the following sections, will be the final action for this site. The **Remedial Action Objectives (RAOs)** for HAA-17 are to prevent existing and future exposure to contaminants associated groundwater by the utilization of the remedial alternatives provided in this Proposed Plan. The proposed alternative will result in the permanent reduction of toxicity, mobility, and volume of contaminants at HAA-17.



Figures 2 and 3 (below) depict the extent of TCE contamination in the shallow and deep groundwater zones from the most recent groundwater sampling event at HAA-17 in 2015. Where only TCE is shown, it provides sufficient areal coverage for other VOCs at the site.





SUMMARY OF SITE RISKS

As part of the RI/FS, HAAF conducted a baseline risk assessment to determine the current and future risks from COPCs on human health, and the environment.

Currently, there are no plans to redevelop HAA-17 for residential purposes. However, land use could change sometime in the future; therefore, both commercial exposure scenarios and residential exposure scenarios for hypothetical future residential land use was evaluated in the Human Health Risk Assessment (HHRA). It is HAAF's current judgement that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect human health or the environment from actual or potential risks from contaminants at the site.

Human Health Risks

HAAF performed a HHRA, which evaluated potential exposure to constituents in soil, groundwater, sediment, and surface water at HAA-17. The available data were evaluated and compared to applicable screening levels. COPCs were identified for soil and groundwater. None of the constituents detected in sediment or surface water exceeded applicable screening levels. The use of groundwater as a potable water source drives the risk assessment. The risks from exposure to soil and groundwater not used as a potable water supply were within the USEPA target risk range and the non-cancer hazards were less than the benchmark of 1, with the exception of construction or utility worker exposure to TCE in groundwater. Remedial goals were calculated for those constituents with excess lifetime cancer risks greater than 1×10^{-6} or a hazard index greater than 1.

Ecological Risks

The Ecological Risk Assessment performed as part of the RI/FS presents the results through Step 3a of a Baseline Ecological Risk Assessment (BERA) for **ecological receptors** at the site based on evaluation of available habitat, areal extent of the constituents of potential ecological concern (COPECs), and direct contact and food-chain **hazard quotients (HQs)**. Potential risks were characterized for ecological receptors at the site by considering direct contact with COPECs in surface soil (0 to 1 ft bgs), soil (0 to 4 ft bgs) and through ingestion of prey tissue via food web modeling. Overall, the potential ecological risks are considered negligible for exposure to site surface soil and sediment.

Constituents of Concern

HAA-17 TCE Groundwater Contamination Site

HAAF and GAEPD have identified the following contaminants that pose the greatest potential risk to human health at this site.

TCE: TCE, detected in groundwater during investigations within shallow and deep zones conducted from 1999 to 2015. Particularly, TCE was detected at the former USTs 25 & 26 at a maximum of 7,730 ug/L in December 2000. TCE concentrations have decreased substantially in groundwater since, but are still present. TCE is commonly used as a solvent to eradicate grease from metal. Physiological effects of TCE exposure include dermatitis, central nervous system (CNS) depression, neurological abnormalities, liver damage, abdominal pain, nausea, and vomiting. TCE is reasonably projected to be a human carcinogen.

Cis-1,2- DCE: Cis-1,2-DCE detections in groundwater ranged from 0.4 µg/L to 378 µg/L in the shallow zone, and 1.1 µg/L to 110 µg/L in the deep zone during investigations held from 1999 to 2015. In 2015, cis-1,2- DCE concentrations exceeded USEPA regulatory standards in several deep zone monitoring wells. Cis-1,2-DCE is commonly used to is used in chemical mixtures, to produce solvents, and is a daughter product of TCE. Cis-1,2-DCE has been identified to cause physiological effects including liver and kidney damage, drowsiness, nausea, and cardiovascular complications. Cis-1,2-DCE is reasonably projected to be a human carcinogen.

VC: VC detections in groundwater ranged from 0.35 µg/L to 27.3 µg/L in in the shallow zone, and 0.074µg/L to 2.5 µg/L in in the deep zone from 1999 to 2015. During the 2015 groundwater investigation, 4 monitoring wells and 5 monitoring wells exceeded USEPA regulatory standards in the shallow and deep zones, respectively. VC is used to manufacture polyvinyl chloride (PVC), and is a daughter product of TCE. Adverse health effects of VC include CNS depression, ataxia, tingling of extremities, visual disturbances, coma, and death. VC can aggravate the eyes, mucous membranes, and the respiratory tract. VC is a known human carcinogen.

Benzene: Benzene has been detected in the shallow and deep groundwater zones above USEPA regulatory standards in several monitoring wells in 2015. Overall, benzene has ranged from 0.12 µg/L to 9,920 µg/L in the deep and shallow zones from 1999 to 2015. Benzene concentrations have decreased significantly since investigations began at HAA-17. Benzene is a natural constituent of crude oil and is one of the most utilized chemical compounds to date. Physiological effects of benzene include neurological and immunological damage. Benzene is classified as a known human carcinogen.

Chromium: During the purge facility investigation in 2006, chromium was detected in soil below the industrial RSL. In 2006, chromium was detected in groundwater samples from the purge facility monitoring wells. During the 2010 and 2015 groundwater sampling events, chromium was not detected in groundwater near the purge facility above the MCL. Chromium is a RCRA metal found in two forms. Trivalent chromium is safe for humans. Hexavalent chromium is a toxin that can cause dermatological problems and lung cancer.

Most COPECs have HQs below 1. While the HQ for exposure to high molecular weight polycyclic aromatic hydrocarbons in soil is slightly above 1, population-level effects for terrestrial receptors are not expected because concentrations are within documented background ranges. Based on this assessment, potential ecological risks at the site are considered negligible.

REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for the remediation of groundwater at the site include the following:

1. Reduce potential cancer risk and potential non-cancer health hazards for people (i.e., site workers and construction workers) exposed to TCE and other COCs in contaminated groundwater;
2. Reduce potential exposure of ecological receptors to TCE and other COCs in groundwater; and
3. Prevent potential for migration of unacceptable levels of TCE and other COCs to offsite locations.

The proposed action will reduce the risk associated with exposure to contaminated groundwater above target levels. For site groundwater, HAAF has established Preliminary Remediation Goals (PRGs) in accordance with USEPA MCLs under the Safe Drinking Water Act:

- Groundwater:
  - TCE – 5 µg/L
  - cis-1,2-DCE – 70 µg/L
  - VC – 2 µg/L
  - Benzene – 5 µg/L
  - Chromium (total) – 100 µg/L

SUMMARY OF REMEDIAL ALTERNATIVES

Remedial alternatives for the HAA-17 Site are presented below. The alternatives are in consecutive order to correspond with their order in the RI/FS Report. Each alternative has been screened for effectiveness, implementability, and cost to determine which process options should be used in the development of remedial alternatives General Response Actions (GRAs).

Remedial Alternatives

Alternative 1: No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0

Under this alternative, HAAF would take no action at the site to reduce the concentrations of or control exposure to the soil and groundwater contamination. The No Action technology, by definition, involves no remedial action at the site and, therefore, has no technological barriers. The potential risks to human health and the environment identified in the risk assessment would not be mitigated by this response. This alternative was evaluated as required by USEPA guidance.

Alternative 2: ISCO for Source Area, MNA, and LUCs

Estimated Capital Cost: $208,592
Estimated Annual O&M Cost: $174,232 (injection years)
Estimated Present Worth Cost: $971,382
Estimated Construction Timeframe: 2 years
Time to Achieve RAOs: 15 years

Alternative 2 includes **in situ chemical injection (ISCO)** via 40 direct push injection points of approximately 35,000 gallons total of an oxidant solution (such as sodium persulfate) over a total of two injection events. The alternative also utilizes **monitored natural attenuation (MNA)** and land use controls (LUCs). Under this alternative, groundwater would be remediated by a combination of natural attenuation and ISCO. ISCO introduces oxidizing compounds to the aquifer for the purpose of chemically destroying contaminants. ISCO would be deployed for remediation of the source zone in the area of the former USTs 25 & 26. A temporary above-ground injection system would be constructed to deliver the ISCO solution to the temporary injection locations in the treatment area. MNA would be relied upon to treat residual COCs in the other areas to achieve the RAOs. The oxidizing chemistry that would most likely be optimal is sodium persulfate (oxidizer) and an activator such as sodium hydroxide.

Applicable LUCs would entail prohibition of potable water well installation and groundwater consumption to address unacceptable potential risks to hypothetical future adult and child residents exposed to groundwater via ingestion.

Although the shallow nature and low hydraulic conductivity of the aquifer makes it unsuitable for potable water wells, restrictions would be applied to provide assurances that potable use of groundwater does not occur. Restrictions would remain in place until groundwater quality is consistently below MCLs for all COCs. LUCs would also include CERCLA five-year reviews.

After each injection event, eight performance sampling events consisting of five wells for VOCs, sulfate, and persulfate anion will take place within the focused treatment area. Sampling events will be conducted weekly for 1 month; monthly for 2 months; then at 6 months and 12 months. Once the injection and initial performance monitoring events are complete, semi-annual MNA monitoring for VOCs and total and dissolved chromium will be implemented.

Finally, annual MNA monitoring for VOCs and total and dissolved chromium will be conducted. These groundwater monitoring programs will track progress of remediation, to ensure that conditions remain favorable for continued natural attenuation, and to determine when the RAOs have been achieved. Based on the results of groundwater monitoring, an additional injection may be necessary in order to meet RAOs.

Alternative 3: ERD (with carbon substrate injection), MNA, and LUCs

Estimated Capital Cost: $160,767
Estimated Present Worth Cost: $846,503
Estimated Construction Timeframe: 1 year
Estimated Time to Achieve RAOs: 14.9 years

Alternative 3 will implement an **enhanced reductive dechlorination (ERD)** system to enhance the mass removal associated with the TCE and cis-1, 2-DCE impacted groundwater. Alternative 3 involves a one-time injection of **emulsified vegetable oil (EVO)** from a network of temporary direct push injection points to establish a long-lived source of organic carbon to promote degradation of chlorinated VOCs. This alternative will target one source area (exceedances of 500 µg/L TCE). Exact quantity and location of injection points are pending the results of baseline sampling.

Continuing performance monitoring sampling events will be conducted after the injection to monitor the efficiency and performance of the injection and MNA. Once the injection and initial performance monitoring events are complete, MNA monitoring for VOCs and total and dissolved chromium will be implemented.

These groundwater monitoring programs will track progress of remediation, to ensure that conditions remain favorable for continued natural attenuation, and to determine when the RAOs have been achieved.

Based on the results of the groundwater monitoring programs, an additional injection of EVO may be needed to meet RAOs.

Implementation of an **in situ reductive zone (IRZ)** will reduce the higher concentration zone within an estimated 3 years of operation, then allow for the residual mass to attenuate naturally. Long-term monitoring of downgradient monitoring wells and any

SUMMARY OF REMEDIAL ALTERNATIVES
HAA-17 TCE Groundwater Contamination Site

Media	RI/FS Designation	Description
Groundwater	Alternative 1	No Action
	Alternative 2	In situ chemical oxidation via injection wells; monitoring; land use controls
	Alternative 3	Enhanced reductive dechlorination system; injection of emulsified vegetable oil; monitoring; land use controls
	Alternative 4	Groundwater extraction; ex-situ treatment and disposal; monitoring; land use controls

necessary new monitoring well installations at the site will also be conducted to ensure that the selected remedy continues to be effective. Finally, the remedy will include CERCLA five-year reviews. Under CERCLA 121c, any remedial action that results in contaminants remaining onsite at concentrations greater than those allowing unrestricted use must be reviewed as least once every 5 years. Until RAOs are achieved thru natural attenuation of the residual mass, concentrations of COCs in groundwater will remain that preclude the unrestricted use of the site under this alternative. During five-year site reviews, an assessment is made of whether the implemented remedy continues to be protective of human health and the environment, or whether the implementation of additional remedial action is appropriate.

Similar to Alternative 2, Alternative 3 includes LUCs to prohibit installation of water wells within or downgradient of the source area and periodic review of site use and maintenance of paved areas. Alternative 3 will mitigate the risks to the industrial worker via carbon substrate injection and subsequent ERD of COCs. Long-term monitoring would be implemented to control the remaining risk/hazards associated with COCs that remain in excess of unrestricted use.

Alternative 4: Groundwater Extraction, MNA, and LUCs

Estimated Capital Cost: $903,226
Estimated Annual O&M Cost: $402,825
Estimated Present Worth Cost: $2,862,184
Estimated Construction Timeframe: 2 years
Estimated Time to Achieve RAOs: 15 years

Alternative 4 includes a combination of natural attenuation, groundwater extraction, and ex-situ treatment and disposal. MNA would be relied upon to treat residual COCs in the downgradient areas to achieve the RAOs.

A treatment system consisting of two granular activated carbon (GAC) units (one lead, one lag) and a low-profile air stripper would be used to treat the influent groundwater. A multimedia filter would be part of the treatment system to remove any large particles in the influent groundwater in order to maximize efficiency of the GAC units and the air stripper. The effluent groundwater would then be discharged to surface water drains located around the perimeter of the buildings or the proximate canal, which would require permitting. MNA would be relied upon to treat residual COCs in the peripheral areas to achieve the RAOs.

The well network would consist of seven extraction wells installed on 20-ft centers. The extraction wells would have a larger diameter (no less than 4-inches) than the monitoring wells in order to maximize the productivity of each well. To house all equipment for the extraction systems, a treatment building would be constructed.

Excavation would be required to lay piping from the treatment buildings to the respective extraction wells. Trenches would be dug to a depth of 3 ft bgs, and piping would be installed. After each length of pipe is installed, the trench would be backfilled with native material. Well vaults would be installed at each extraction well for both systems. The system would draw groundwater from all extraction wells concurrently. The extraction well transects would be designed to capture the groundwater flux, thus eliminating migration beyond the extraction transect.

Similar to Alternatives 2 and 3, Alternative 4 includes LUCs to prohibit installation of water wells within or downgradient of the source area and periodic review of site use and maintenance of paved areas. LUCs would also include CERCLA five-year reviews.

A groundwater monitoring program would be implemented to track the progress of remediation to ensure that conditions remain favorable for continued natural attenuation and to determine when the RAOs have been achieved. The long-term monitoring well network would incorporate some of the existing monitoring wells plus new monitoring wells installed as part of the active remedy. Low-flow sampling technology would be used to collect groundwater samples for VOCs and total and dissolved chromium.

EVALUATION CRITERIA FOR REMEDIAL ALTERNATIVES
Overall Protectiveness of Human Health and the Environment determines whether alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, whether a waiver is justified.
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 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.
Short-term Effectiveness considers the length of time needed to implement and the risks the alternative poses to workers, residents, and the environment during implementation.
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.
State/Support Agency Acceptance considers whether the State agrees with the HAAF's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

EVALUATION OF REMEDIAL ALTERNATIVES

Section 300.430(e)(9) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) lists nine criteria against which each remedial alternative must be assessed. The acceptability or performance of each alternative against the criteria is evaluated individually so that relative strengths and weaknesses may be identified.

The first two threshold criteria (must be met by each alternative) are:

- Protection of human health and the environment; and
- Compliance with (applicable or relevant and appropriate requirements) ARARs.

The next five primary balancing criteria provide the basis for analysis:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, volume, or mass through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

The final two criteria, state acceptance and community acceptance, are analyzed following comments on the Proposed Plan.

1. Protection of Human Health and the Environment

Each remedial alternative except the "no action" alternative would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or LUCs. Alternative 2's ISCO of impacted groundwater would degrade chlorinated volatile organic compounds (CVOCs) through oxidation. The introduction of an oxidizer and activator solution into the aqueous environment reduces total CVOC mass in the source area. ISCO may temporarily reduce natural attenuation of CVOCs. ISCO further enhances the protection of human health and environment by oxidizing COCs that exceed the PRGs within the mass flux portion of the contamination plume.

Alternative 3 would provide ERD of impacted groundwater and would enhance natural biological degradation by stimulating naturally-occurring bacterial populations that can break down CVOCs. The IRZ further enhances the protection of human health and environment by degrading COCs that exceed the PRGs within the mass flux portion of the contamination plume. Alternative 4's extraction and treatment of groundwater further enhances the protection of human health and environment by creating a gradient for containment of the contamination plume.

2. Compliance with ARARs

All groundwater alternatives except "no action" alternative would meet their respective **applicable or relevant and appropriate requirements** (ARARs) from Federal and State laws.

3. Long-term Effectiveness and Permanence

Alternatives 2, 3, and 4 target the higher concentration zones in the USTs 25 & 26 areas to treat the mass flux of the contamination plume. Alternatives 2 and 3 create an IRZ that would continue to attenuate CVOCs. For Alternative 2, an additional ISCO injection may be necessary to achieve required source reduction.

4. Reduction of Toxicity, Mobility, Volume, and Mass

Alternatives 2, 3, and 4 would target the higher concentration zone and accelerate the reduction in volume and toxicity. Reduction of the mobility, toxicity, and volume of COCs would be confirmed through regular groundwater monitoring for each proposed alternative.

5. Short-Term Effectiveness

Alternative 2, which requires use of hazardous chemicals, would result in moderate short-term risks to the community, workers, and the environment. The chemicals used for ISCO would be handled in compliance with all health and safety requirements. This approach would result in rapid oxidation of dissolved phase COCs.

Alternative 3 would result in minimal risks to the community, workers, and the environment. Degradable carbon that would be used to create the IRZ would be in the form of molasses, corn syrup, whey, or other similar products that would not result in additional risks to the community, workers, and the environment.

Alternative 4 would result in minimal risks to the community, workers, and the environment. Groundwater would be treated to meet required standards and would not result in additional risks to the community, workers, and the environment.

Alternative 2, 3, and 4 would handle purge water from monitoring well sampling using approved methods.

6. Implementability

Alternative 2 and 3 are both technically and administratively feasible. Alternatives 2 and 3 would require temporary injection points to implement ISCO and IRZ, respectively. Injection points would be installed using standard DPT or drilling methods and materials. These services are readily available, as are the services and materials necessary for the collection and analysis of groundwater samples.

Similar to Alternatives 2 and 3, Alternative 4 is both technically and administratively feasible. Extraction wells would be required to implement the strategy. Wells would be installed using standard well drilling methods and materials. These services are readily available, as are the services and materials necessary for the collection and analysis of groundwater samples.

7. Cost

The estimated present worth cost of Alternative 3 is less than Alternative 2 and Alternative 4. When comparing the total allotted time to complete remediation, LUCs, and MNA for each alternative, Alternative 3 is the least costly with the same amount of approximate time to complete remedial goals.

8. State/Support Agency Acceptance

This criterion will be addressed in the Record of Decision (ROD) once public or other support agency comments on the RI/FS and Proposed Plan have been received.

9. Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the Record of Decision (ROD) for this site.

PREFERRED ALTERNATIVE

The preferred alternative selected for remediating the HAA-17 TCE Groundwater Contamination Site is Alternative 3, which consists of ERD, MNA, and LUCs to address risks identified in the Risk Assessment, specifically ingestion of impacted groundwater and industrial and construction worker exposure to

impacted groundwater. This alternative is implementable, effective in meeting the RAOs, and is reasonable with respect to present-worth cost. Of the remedial alternatives, Alternative 3 was rated the most favorable. All of the alternatives are implementable. However, Alternative 3 meets the RAOs, is effective in mitigating and controlling risks at the site, and results in the reduction of the volume and mobility of onsite waste. Furthermore, Alternative 3 eliminates the risks and costs associated with hazardous chemical handling and O&M of an operating system at the active site.

Based on the information available at this time, HAAF and the State of Georgia believe the preferred alternative would be protective of human health and the environment, would comply with ARARs, would be cost-effective, and would utilize permanent solutions to the maximum extent practicable. The Preferred Alternative can change in response to public comment or new information.

COMMUNITY PARTICIPATION

HAAF and GAEPD will provide information regarding the cleanup of the HAA-17 TCE Groundwater Contamination Site to the public through public meetings, the Administrative Record file for the site, and announcements published in the Savannah Morning News. HAAF and the State encourage the public to review these documents pertaining to investigative activities that have been conducted at the site to gain a more comprehensive understanding of HAA-17 and its activities.

The dates for the public comment period, the date, location, and time of the public meeting, and the locations of the Administrative Record files, are provided on the front page of this Proposed Plan.

For further information on the HAA-17 TCE Groundwater Contamination Site, please contact:

Algeana L Stevenson
Remediation Section Leader/Chemical Engineer
DPW Prevention & Compliance Branch
1550 Veterans Parkway, Building 1137
Fort Stewart, Georgia 31314
(912) 315-5144
Hours: Monday – Friday
8:00 a.m. – 4:00 p.m.

The Administrative Record is also available online at:
https://home.army.mil/stewart/index.php/about/Garrison/DPW/environmental/prevention-and-compliance/adminrecord

GLOSSARY OF TERMS

Administrative Record - The collection of documents that is utilized and provides logic for the selection of a particular response at a site. Documents that are included are applicable documents that were relied upon in choosing the response action, as well as applicable documents that were considered, but were rejected after evaluation. This file is available for public review and a copy maintained near the Site. The Hunter Army Airfield Administrative Record file is maintained at the DPW Prevention & Compliance Branch at Fort Stewart, 1550 Veterans Parkway Bldg 1137, Fort Stewart, GA. The Administrative Record is also available on-line at: https://home.army.mil/stewart/index.php/about/Garrison/DPW/environmental/prevention-and-compliance/adminrecord

Applicable or relevant and appropriate requirements (ARARs) - Applicable requirements mean those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at the subject site. Relevant and appropriate requirements mean those cleanup standards that address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site.

These requirements may vary among varying sites and alternatives.

Comprehensive Environmental Response, Compensation Liability Act (CERCLA) – Also known as "Superfund", this act was passed in 1980 to respond directly to releases or threats of release of hazardous substances that may endanger public health or the environment.

Constituents of Concern (COC) - Pollutants that are identified through the risk assessment process as being the main chemicals of concern that may cause unacceptable human health and/or ecological risk.

Constituent of Potential Concern (COPC) - Any chemical that has proven to pose a possible risk to a site. COPCs are typically contaminants which may or may not have the likelihood to have adverse effects to surrounding plants or animals, and to human health.

Corrective Action Plan (CAP) - A step-by-step plan established to attain targeted remedial outcomes.

Ecological Receptors - Plants and animals, apart from humans, that could be harmfully affected by constituents of potential concern or constituents of concern.

Emulsified Vegetable Oil (EVO) - Utilized as an energy provider for microbes that process and degrade the constituents of concern identified within an area identified to have environmental contamination.

Enhanced Reductive Dechlorination (ERD) - A variation of in situ bioremediation used to promote anaerobic organic dechlorination of volatile organic compounds within the subsurface by co-metabolic and direct degradation processes.

Feasibility Study - A document that evaluates, assesses, and identifies in detail remediation options for a site. The Remedial Investigation is completed prior to drafting the Feasibility Study

Hazard Quotient (HQ) - The calculated potential exposure ratio to a material and the level at which no negative effects are anticipated.

In Situ Chemical Injection (ISCO) - Occurring at the site of contamination or pollution, an advanced oxidation process and design utilized to decrease the amount of targeted environmental contaminants.

In Situ Reductive Zone (IRZ) - a location in a groundwater system where anaerobic conditions have been identified and created to reduce volatile organic compounds in groundwater.

Maximum Contaminant Level (MCL) - Standards that are established by the USEPA for drinking water quality. This provides the permissible limit on the amount of a material that is allowed in public water systems under the Safe Drinking Water Act.

Monitored Natural Attenuation (MNA) - A variety of biological, chemical, or physical processes that enable the reduction of the mass, mobility, toxicity, volume, or concentration of contaminants in soil or groundwater without human interaction. MNA processes are enacted under favorable conditions.

National Oil and Hazardous Substances Pollution Contingency Plan, (NCP) or National Contingency Plan (40 Code of Federal Regulations [C.F.R.] Part 300) - Delivers an organized structure and procedure for responding to releases of oil and hazardous

chemicals, pollutants, and contaminants into the environment.

Proposed Plan - A document released to the public in which the findings of the Remedial Investigation and Feasibility Study are summarized to identify the preferred cleanup plan for a site. The reasoning for the publication of the proposed plan is to provide the public with an opportunity to comment on the preferred cleanup plan, as well as alternative plans that are under consideration and to participate in the selection of the cleanup plan at a site.

Remedial Action Objective (RAO) - A goal that is site-specific with the intention of protecting the environment and human health. Remedial Action Objectives provide guidance for the development of options for cleanup and must be met by cleanup plans selected for a site.

Remedial action objectives also provide assistance in attaining a satisfactory level of protection for human health and the environment.

Remedial Investigation - Conducted prior to a feasibility study; a detailed study designed to determine the location of contaminants and identify the amount of constituents of concern at an environmental contamination site. The remedial investigation establishes site cleanup criteria, as well.

Regional Screening Level (RSL) - USEPA standards established to identify acceptable and safe soil screening values for contaminants at environmental sites.

Underground Storage Tanks (USTs) - A tank and any underground piping associated with the functionality of the tank that has at least 10% of its combined volume underground. USTs hold various substances for commercial and industrial use.

Volatile Organic Compound (VOC) - Organic chemicals that easily evaporate under normal temperature and pressure conditions found in the atmosphere. VOCs are usually found in petroleum products such as gasoline and cleaning solvents.

REFERENCES

Arcadis. 2019. Remedial Investigation and Feasibility Study, HAA-17 – TCE Groundwater Contamination. Hunter Army Airfield. February

CERCLA. Comprehensive Environmental Response, Compensation, and Liability Act of 1980. 42 United States Code 9601 et seq.

NCP. National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Overview. 40 CFR 300.

USEPA. 2020. Regional Screening Levels Summary Table. May 2020. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables