United States Army
Corps of Engineers

Formerly Used Defense Sites Program

Final Decision Document

Hazardous, Toxic, and Radioactive Waste (HTRW)

Project # F10AK003605
Aircraft Control and Warning Main Complex
Formerly Used Defense Site (FUDS)

Unalakleet, Alaska

September 2021

U.S. Army Corps of Engineers - Alaska District
P.O. Box 6898
JBER, Alaska 99506-0898

F10AK003605_05.09_0501_a
1200C PERM

(intentionally blank)

Contents

List of Tables

List of Figures

List of Attachments

(intentionally blank)

Acronyms and Abbreviations

AAC	Alaska Administrative Code
ACLs	Alternate Cleanup Levels
AC&W	Aircraft Control and Warning
ADEC	Alaska Department of Environmental Conservation
AFS	Air Force Station
ARAR	Applicable or Relevant and Appropriate Requirement
ASTs	Above ground storage tanks
BaP	Benzo(a)pyrene
BD/DR	Building Demolition / Debris Removal
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminant of Concern
COPCs	Contaminants of Potential Concern
CSM	Conceptual Site Model
DD	Decision Document
DDT	4,4'-dichloro diphenyl trichloroethane
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DoD	U.S. Department of Defense
DRO	Diesel Range Organics
EPA	Environmental Protection Agency
FUDS	Formerly Used Defense Sites
FS	Feasibility Study
Ft^2	Square feet
HH	Human Health
HI	Hazard Index
ICs	Institutional Controls
LUC	Land Use Control
mg/kg	Milligrams per Kilogram
mg/l	Milligrams per liter
MI	Multi Incremental

µg	Micrograms
µg/l	Micrograms per Liter
MMRP	Military Munitions Response Program
MTGW	Migration to Ground Water
MW	Monitoring Well
NCP	National Oil and Hazardous Substance Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
PAHs	Polycyclic Aromatic Hydrocarbons
PAL	Project Action Limit
PCBs	Polychlorinated bisphenols
POL	Petroleum, oil, and lubricants
RAOs	Remedial Action Objectives
RBSLs	Risk Based Screening Levels
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RRO	Residual Range Organics
SVOCs	Semi volatile Organic Compounds
TCE	Trichloroethylene
TOC	Total Organic Carbon
TMV	Toxicity, Mobility and Volume
TRL	Target Risk Level
USACE	US Army Corps of Engineers
USTs	Underground storage tanks
UU/UE	Unlimited Use and Unrestricted Exposure
VOCs	Volatile Organic Compounds
Yd^3	Cubic yards

EXECUTIVE SUMMARY

ES.1 This Decision Document (DD) presents the selected remedy for the Unalakleet Air Force Station (AFS), Formerly Used Defense Site (FUDS) Project Number F10AK0036-05. All contamination pertaining to this DD is associated with the former Aircraft Control and Warning (AC&W) Main Complex; herein referred to as the AC&W Site or "Site".

The selected remedy is based upon the Administrative Record for this site, and the numerous investigations and remedial actions have occurred at the Unalakleet AFS FUDS prior to, during, and following the demolition of the Unalakleet AFS AC&W Main Station Complex. Between 2010 and 2013, remedial activities (Excavation and Off-site Treatment/Disposal) were completed at the former AC&W main complex. Further remedial investigation (RI) activities were conducted in 2015 to evaluate any remaining contamination as part of a feasibility study (FS) for potential future remedial activities. The DD summarizes these activities.

ES.2 The Site is located approximately 3.5 miles north-northeast of the village of Unalakleet, Alaska. After WWII, Unalakleet AFS was constructed as part of a defense network of aircraft warning and communication relay systems. The Site consists of an approximately 22.6 acres of vacant land owned by the Unalakleet Native Corporation (BLM 2017). All that currently remains at the site is one fractured concrete slab foundation under two feet (ft) of fill material.

In accordance with Defense Environmental Restoration Program (DERP)-FUDS (10 United States Code 2701 et seq), this DD presents the selected remedy for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contaminants. CERCLA contaminants of concern (COCs) present in soil include polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) in soil. No COCs were identified in groundwater or seeps located downslope of the AC&W Site.

Fuel contaminants in soil above risk-based cleanup levels that are indicative of imminent and substantial endangerment (ISE) include diesel range organics (DRO) and polyaromatic hydrocarbons (PAHs).

Petroleum, oils, and lubricants (POL) is excluded from CERCLA as a contaminant of concern. However, CERCLA and petroleum contaminants in soil exist in many of the same locations, and the POL is being addressed under the authority of the Defense Environmental Restoration Program (DERP), United States Code, Title 10, Section 2701, et seq. The DERP provides authority to cleanup petroleum contamination if it poses an imminent and substantial endangerment to public health, welfare, or the environment. The selected remedy will address both types of contamination.

ES.3 The selected remedy is Hot Spot Excavation and Phytoremediation. The estimated cost of the Selected Remedy is $4.15 million. The remedy would be completed in approximately 20 years and is expected to achieve an unlimited use/unrestricted exposure (UU/UE) under CERCLA, and Cleanup Complete status from the State of Alaska. Therefore, five-year reviews under CERCLA may be necessary.

ES.4 The selected remedy complies with Applicable or Relevant and Appropriate Requirements (ARARs) and will be protective of human health and the environment. The selected remedy includes the following components:

1) The selective excavation of hot spots (an estimated 2,504 yd^3 of soil) to remove TCE contamination and 40 yd^3 of soil to remove PCB contaminated soil.

2) Planting of non-invasive species to promote degradation of COCs through phytoremediation.

3) A vehicle barrier and associated signage would serve as land use controls (LUCs) for the phytoremediation treatment area for the estimated 20-year duration of treatment.

4) Performance monitoring would be conducted every 5 years until the remedial action objectives (RAOs) are met.

Decision Document
Unalakleet AFS AC&W Main Complex
Formerly Used Defense Site

Part 1: Declaration

1.1 Project Name and Location

The Defense Environmental Restoration Program for the Formerly Used Defense Site (DERP-FUDS) project name is the Unalakleet Air Force Station (AFS), Aircraft Control and Warning (AC&W) Main Complex, herein referred to as the AC&W Site or "Site". The Project Number is F10AK0036-05. The former Site is located approximately 3.5 miles north-northeast of the village of Unalakleet, Alaska, and consists of an approximate 22.6-acre area of vacant land owned by the Unalakleet Native Corporation (BLM 2017). The location of the Site is shown on Figure 1.The Unalakleet AFS FUDS is not listed on the National Priorities List (NPL).

1.2 Statement of Basis and Purpose

This Decision Document (DD) presents the U.S. Army Corps of Engineers (USACE) Selected Remedy of the Site which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

Petroleum, oils, and lubricants (POLs) at the site are being addressed under the authority of the DERP, United States Code, Title 10, Section 2701, et seq. The DERP provides authority to cleanup petroleum contamination if it poses an imminent and substantial endangerment to public health, welfare, or the environment. This decision is based upon the Administrative Record file for this project, and the State of Alaska concurs with the selected remedy.

Detailed information supporting the selected remedial action is contained in the administrative record file for this site, located at the USACE, Alaska District (USACE-AK) Office on Joint Base Elmendorf-Richardson (JBER), Alaska, and the information repository located in the Unalakleet city office.

1.3 Assessment of Site

The remedy selected in this DD is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment from soil. CERCLA contaminants of concern (COCs) include polychlorinated biphenyls (PCBs) and trichloroethylene (TCE). Petroleum contamination posing an imminent and substantial endangerment to public health, welfare, or the environment

includes polyaromatic hydrocarbons (PAHs) and diesel range organics (DRO). No COCs were identified in groundwater or seeps located downslope of the AC&W Site.

1.4 Description of the Selected Remedy

The selected remedy presented in this DD is protective of human health and the environment. The selected remedy consists of two primary components that include excavation of impacted soil above cleanup levels at discrete locations referred to as "hot-spots"; and, using non-invasive plant species (e.g., native willows) to reduce COCs in shallow soils.

The selected remedy includes the following:

- Excavation of contaminated soil hotspots. This includes the selective excavation of an estimated 2,504 cubic yards (cy) of soil to remove TCE impacted soils and 40 cy of soil to remove PCB impacted soil. Areas of excavated soil will be backfilled with clean fill obtained locally.

- Non-invasive plant species (e.g., native willow) would be planted and cultivated in areas of soil above cleanup levels to extract, sequester or degrade COCs that coincide with the effective depth of root penetration of the plant. Plant species would be selected to withstand local climatic conditions. Cultivation would be enhanced through soil amendments and fertilization. Minimal maintenance would be required to facilitate root system establishment and would include installation of barriers to prevent vehicles from disturbing the treatment area, and signs warning people not to harvest or disturb the vegetation.

- Performance monitoring would be conducted annually. Performance monitoring activities would include collection of soil samples and analysis to evaluate phytoremediation progress relative to RAOs. Five-year reviews would be conducted until RAOs are met, with estimated completion in 20 years and Site-closeout.

- Since PCB compounds are not considered suitable for phytoremediation treatment, one discrete area of PCB contamination would be addressed through soil removal.

- Excavated soils would be shipped off Site for disposal.

1.5 Statutory Determinations

The Department of Defense (DoD) is authorized to carry out a program of environmental restoration at former military sites pursuant to the Defense Environmental Restoration Account (DERA), which authorizes the DERP (10 USC 2701 et seq). Under DERP, FUDS properties are defined as real property that was owned by, leased to, or otherwise possessed by the United States and under the jurisdiction of the Secretary of Defense and that was transferred from DoD control prior to 17 October 1986.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e. reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). This is because the predominant volume of impacted soils is treated *in situ* through the process of phytoremediation.

Since this remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure (UU/UE), but it will take more than five years to attain remedial action objectives and cleanup levels, a policy review will be completed every five years after the initiation of the on-site field work for implementation of the remedy to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 Decision Document Data Certification Checklist

The following information is included in the Decision Summary section of this Decision Document. Additional information can be found in the Administrative Record File for this project.

- Current and reasonably anticipated future land use assumptions (Section 2.8).
- COCs and their respective concentrations (Section 2.9).
- Calculations of the risks presented by the COCs (Section 2.9).
- Cleanup levels established for COCs and the basis of these levels (Section 2.10).
- Key factors that led to selecting the remedy (Section 2.13).
- Potential land use that will be available at the project as a result of the Selected Remedy (Section 2.14).
- Estimated costs and timeframe over which the remedy is projected (Section 2.14).

1.7 Authorizing Signatures

This Decision Document presents the selected remedy for the Unalakleet Air Force Station Aircraft Control and Warning Main Complex project. This Decision Document has been developed consistent with CERCLA, as amended, and the National Oil and Hazardous Substance Contingency Plan (NCP). This Decision Document will be incorporated into the larger Administrative Record file for the Unalakleet Air Force Station Aircraft Control and Warning Main Complex project for public view at the two

following Information Repositories: (1) Native Village of Unalakleet, PO Box 270, Unalakleet, Alaska 99684; (2) Alaska District Office on Joint Base Elmendorf-Richardson, Alaska. This Decision Document, presenting the selected remedy with a total present-worth cost estimate of $4.15 million is approved by the undersigned, pursuant to Memorandum CEMP-CED (200-1a), SUBJECT: Interim Guidance Document (IGD) for the Formerly Used Defense Sites (FUDS) Decision Document (DD) Staffing and Approval, 10 August 2019, and to Engineer Regulation 200-3-1, FUDS Program Policy.

APPROVED:

LILLY.DAMON.P.1012425810 Digitally signed by LILLY.DAMON.P.1012425810 Date: 2021.09.27 11:06:14 -10'00'

9/27/21

DAMON P. LILLY, SES
Director of Programs
US Army Corps of Engineers
Pacific Ocean Division

Date

Part 2: Decision Summary

This Decision Summary provides an overview of the conditions at the Unalakleet Formerly Used Defense Site (FUDS), project number F10AK0036-05. It summarizes the data from the remedial investigation phase, describes the remedial alternatives considered, and analyzes the alternatives compared to the criteria set forth in the National Contingency Plan (NCP). The Decision Summary explains the rationale for selecting the remedy, and how the remedy satisfies the statutory requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

2.1 Site Name, Location, and Description

The Unalakleet Air Force Station Aircraft Control and Warning (AC&W) Site is located approximately 3.5 miles north-northeast of the village of Unalakleet, Alaska and consists of approximately 22.6 acres of vacant land (Figure 1). The lead agency is the Department of Defense (DoD) through the Alaska District of the USACE. The support agency is the Alaska Department of Environmental Conservation (ADEC). The Site is presently owned by the Unalakleet Native Corporation (BLM 2017). The source of cleanup funds is DERP-FUDS.

The Site was built on a hilltop that was blasted to create building pads and roads as part of the overall Unalakleet AFS. The hilltop was originally at an elevation of 705 feet and was blasted down to an elevation of approximately 681 to 684 feet. In some areas, up to 15 feet of bedrock was removed to install subsurface utilities and USTs. Hill slopes in the area are typically less than 12 percent (USACE 2003b).

The vacant Site formerly contained a variety of infrastructure which is now limited to one fractured concrete slab foundation under 2 feet (ft) of fill material and a closed ADEC-permitted non-municipal monofill known to contain asbestos-containing materials.

2.2 Site History

U.S. military interest in Unalakleet began during World War II (WWII) when an aircraft runway was constructed to support aircraft transfer to the Soviet Union under the lend-lease agreement. After WWII, Unalakleet AFS was constructed as part of a defense network of aircraft warning and communication relay systems. The AFS contained an AC&W station and a White Alice Communications System radio relay station. The system was operational by the U.S. Air Force from 1958 until it was abandoned in 1978 (USACE 2003a).

The Site formerly contained a variety of infrastructure, including a Composite Building, two radar buildings, two radar dome towers, a well pad, two water pump houses and water pipelines, two main underground storage tanks (USTs) adjacent to the Composite Building, a fuel filling station, two, 323,400-gallon fuel aboveground storage tanks (ASTs) and fuel pipelines, a sewage system (building with outfall pipelines), a generator building, a munitions building, several concrete structures (pads, cradles, footings, piers), dry transformers, three pole-mounted oil type transformers, and a small leading capacitor

(Figure 2). All of the above buildings and associated infrastructure were demolished between 1993 and 1995.

The Composite Building provided a general living space, including food service, recreational and laundry facilities, administrative offices, and a water plant. It also provided internal heating, electrical generation, and a six-bay automotive shop that serviced small vehicles and heavy equipment. Potential contaminants associated with this building include water softeners, water filtration chemicals, descaling chemicals, soaps, and general use cleaning chemicals. Lead from batteries, POLs, PCBs, antifreeze, and cleaning solvents would likely be associated with the motor pool and power/heat generation facilities. In addition, the Radar Building and Dome Towers contained transformers and other electrical equipment. Contaminants associated with the operation of these buildings would have been PCBs and POLs. Cleaning and maintenance of electrical systems may have included the use of chlorinated solvents. The Sewage Treatment building and associated pipelines had the potential to include all the above-listed COCs.

2.3 Investigation and Remedial Action History

The USACE-AK conducted a series of site investigations and removal actions at the Site between 1985 and 2006. Between 2010 and 2013 seasonal remedial activities (Excavation and Off-site Treatment/Disposal) were performed to eliminate future risk to humans and the environment at the former AC&W Site. In total, approximately 3,900 cubic yards (yd^3) of impacted soil was removed from the Site during this time (USACE 2016). The following sections present details of the previous investigations and removal actions at the Site.

2.3.1 Initial Site Inspection (1989)

Soil samples were collected as part of an initial site inspection performed in 1989 to evaluate potentially contaminated areas at Unalakleet AFS. PAHs, PCBs, pesticides, petroleum hydrocarbons, and metals were detected in soil samples collected near the Composite Building (USACE 1989).

2.3.2 Initial Remedial Actions (1993-1995)

A removal action was initiated in 1993 to begin site cleanup. Through this effort, the contractor demolished infrastructure, including storage tanks, and collected soil samples from onsite areas of concern and had them analyzed in part for PCBs, DRO, gasoline range organics (GRO), total petroleum hydrocarbons, and benzene, toluene, ethylbenzene, xylenes. Samples collected along the southern edge of the Composite Building had PCBs and DRO up to maximum concentrations of 62,000 milligrams per kilogram (mg/kg) and 29,000 mg/kg, respectively. DRO contaminated soil was excavated with some of that volume documented as being thermally treated on site. Construction debris were cut up and buried on site in the landfill.

The USACE selected a second contractor in 1995 to complete the original work and provide a Final Remedial Action Report after the original contractor filed for bankruptcy.

The demolition of all remaining structures associated with the station's former AC&W main complex with construction debris buried in the landfill. Additional excavation and onsite thermal treatment of fuel-contaminated soil was also performed. The concrete slab at the former Composite Building was fractured every 5 ft using an excavator and covered with approximately 2 ft of soil. Although the source of the fill material was not clearly documented, it was later suspected that thermally treated soil was used. Concentrations of PCBs in soil at the southern end of the Composite Building after excavation ranged from 2 mg/kg to 48 mg/kg. Post-excavation DRO concentrations in this same area ranged from 90 mg/kg to 1,000 mg/kg (USACE 2001).

The Draft Remedial Action Report provided by the contractor following completion of the 1995 field work was inadequate, along with subsequent resubmittals. As a result, USACE compiled and presented information from both contractors into a Final Remedial Action Report (USACE 2001). The following is a recounting of the 1993–1995 removal action for [then] identified areas of concern:

- A 25-ft by 50-ft fuel filling station and its foundation were demolished near the northwest edge of the site. Samples collected at the surface upon removal of the foundation indicated concentrations of DRO up to 6,200 mg/kg. Soil under the foundation was subsequently excavated to 3 ft during remedial activities and may have been thermally treated on site; however, documentation of onsite treatment and/or disposal of excavated soils are not available. Confirmation soil samples collected at the limits of the excavation indicated remaining DRO and GRO contamination up to 2,700 and 480 mg/kg, respectively.

- An 80-ft by 40-ft sewer building was demolished and disposed of in the onsite landfill. A sewer line leading from the sewage treatment plant was removed where exposed, capped where it was buried, and left in place. Samples were collected at the downgradient outfall area in 1993, but no remedial activities took place in 1995 as concentrations detected in samples were below the revised cleanup criteria.

- A northern 7,700-barrel (323,400-gallon) diesel AST was cut-up and buried in the onsite landfill during remedial activities. Approximately 58 yd^3 was excavated from the northern AST area and stockpiled. Sample results from surface soils showed DRO concentrations in two samples marginally greater than [the then] cleanup criterion (100 mg/kg); excavation floor sample results ranged from 100 to 8,700 mg/kg. Disposition of these soils is unknown but is theorized to have been added to an approximate 1,000-yd^3 soil stockpile created at this location following decommission of the AST. This stockpile consisted of excavated soil from various areas on site and included 20 yd^3 of sludge (with rinse water and fines) from the sewage tank. The sludge from the sewage tank contained DRO, sulfide, and arsenic at concentrations of 58,000, 8,630, and 12 mg/kg, respectively. The entire soil stockpile (1,000 yd^3) was treated on site during remedial activities using a low-temperature thermal desorption unit that was set up just west of this location. Following treatment, a portion of the stockpiled area was over-excavated to 5 ft below ground surface (bgs) and subsequently graded and seeded. Final disposition of the over-excavated soils is undocumented.

- A southern 7,700-barrel (323,400-gallon) diesel AST was cut-up and buried in the onsite landfill during remedial activities. Surface soil samples showed DRO concentrations ranging from non-detect to 9,600 mg/kg, and the area was subsequently excavated to 3 ft bgs. Approximately 235 yd^3 of contaminated soil was excavated and thermally treated on site. The excavation was not backfilled, and the tank base material (deteriorated asphalt) was left on site. Confirmation soil samples collected upon completion of the excavation showed remaining estimated total petroleum hydrocarbon concentrations up to 5,700 mg/kg. Approximately 1,450 yd^3 of additional soil was subsequently excavated in 1995 from depths reaching 13 ft bgs. The excavated soils were thermally treated on site; however, confirmation samples collected at depth showed DRO concentrations remained at concentrations up to 3,190 mg/kg.

- Two water pumphouses were demolished and buried the debris in the onsite landfill. Approximately 20 yd^3 were excavated and thermally treated from pumphouse #1. The well pad was demolished and excavated and thermally treated approximately 2 yd^3 of additional soil. A buried, rusting fuel tank was unearthed near pumphouse #2, and a surface soil sample collected at this location detected DRO at a concentration of 1,100 mg/kg; a deeper sample collected beneath the day tank pad did not detect DRO.

- The Composite Building was demolished. Building debris and approximately 80,000 square feet (ft^2) of asbestos-containing material was disposed of in the onsite landfill.

- Decommissioned PCB transformers were stored at the southern end of the composite building prior to disposal. Approximately 2 yd^3 of PCB-contaminated soil was excavated, drummed, and removed for offsite disposal.

- One 5,000-gallon gasoline UST located south of the Composite Building was drained, cut-up, triple rinsed, removed, crushed, and buried in the onsite landfill during remedial activities. The UST overburden soils were thermally treated on site and used as backfill; however, this volume is not documented.

- One 10,000-gallon diesel UST located at the southwest corner of the Composite Building was drained, cut-up, triple rinsed, removed, crushed, and buried in the onsite landfill during remedial activities. Although the volume is not documented, the UST overburden soils were thermally treated on site and used as backfill.

COCs at the former AC&W main complex identified from the above removal actions included asbestos-containing materials, GRO, DRO, residual range organics (RRO), semivolitile organic compounds (SVOCs), and pesticides/PCBs. The approximately 250-ft by 250-ft onsite landfill is a potential waste area. There are signs indicating that asbestos-containing material is buried there.

2.3.3 Site Investigations (1999-2002)

Multiple site investigations were conducted by USACE between 1999 and 2002 to assess FUDS-eligible contamination associated with the Unalakleet AFS, which included the former AC&W main complex.

In 1999 and 2000, personnel from the Alaska District toured the Unalakleet area to search for and evaluate additional sites for military material and/or contamination that would be eligible for removal or remediation under the FUDS program. Specific reference to activities performed at the former AC&W main complex was not identified. Following a 2001 public meeting in which community members identified concerns in harvesting local vegetation, the team chemist collected six soil samples in the vicinity of the former DEW Line Site because it was the area most likely to have pesticides. Two of the samples had positive results for 4,4'-dichloro diphenyl trichloroethane (DDT); however, neither one of these results was greater than the regulatory screening level of 2.4 mg/kg (USACE 2002).

In 2002, contractor personnel performed a site walkover visit at the former AC&W main complex as part of a preliminary assessment for the former Unalakleet AFS. No distinguishable soil staining or odors were noted at that time. The only observable evidence of previous activities were two 2-ft^2 excavations at an area where decommissioned PCB transformers were stored prior to disposal, and signs indicating that asbestos-containing material is buried in the onsite landfill (USACE 2003a).

Data from the above investigations and prior activities was used to create an Engineering Evaluation and Cost Analysis, which recommended that further investigations be conducted for Site 25 (USACE 2003b).

2.3.4 Site Characterization/Remedial Investigation (2005-2006)

Work at the Unalakleet AFS FUDS resumed with site characterization/RI activities performed over a 2-year period. The scope of work included interim removal action, remedial investigation, and site characterization at numerous disconnected DoD-use locations in the Unalakleet area. The following summary is specific to those activities that occurred at the AC&W main complex (USACE 2006, 2007).

In 2005, site characterization activities through test pit excavation with field screening and analytical sampling of soil was performed to evaluate potentially remaining COCs at 10 areas of concern at the former AC&W main complex. A total of 236 test pits and 2 trenches were advanced to depths ranging from 0.5 to 10 ft bgs with over 800 field screening and analytical samples collected. DRO, PAHs, pesticides, and volatile organic compounds (VOCs) were detected in soil above respective ADEC cleanup levels at one or more of the following nine areas[1]:

[1] ADEC Method Two cleanup criteria were not detected in any of the nine soil samples submitted for analysis from 16 test pits excavated to depths ranging between 2 and 4 ft bgs at the Water Pump House No. 2 area.

- Fuel Filling Station: 1 of 12 analytical sampling locations from 16 test pits excavated to 3 ft bgs exceeded the ADEC cleanup level for DRO (360 mg/kg). Two of the samples were submitted for an expanded analytical suite; none of which identified further ADEC cleanup level exceedances.

- North Fuel AST and Thermal Treatment Site: 8 of 26 analytical sampling locations from 36 test pits excavated between 1 and 5 ft bgs exceeded the ADEC cleanup level for DRO (250 to 730 mg/kg). 1 of 4 samples submitted for an expanded analytical suite also contained pesticides (DDT at 24 mg/kg) and PAHs (benzo[a]anthracene at 6 mg/kg, benzo[a]pyrene at 1 mg/kg, and dibenzo[a,h]anthracene at 1 mg/kg) in excess of ADEC cleanup levels.

- South Fuel AST: 5 of 23 analytical sampling locations from 25 test pits excavated between 4.5 and 10 ft bgs exceeded the ADEC cleanup level for DRO (260 to 5,900 mg/kg). Four of the samples were submitted for an expanded analytical suite; none of which identified further ADEC cleanup level exceedances.

- Transformer Staging Area: 1 of 25 analytical sampling locations from 25 test pits excavated between 1 and 2 ft bgs exceeded the ADEC cleanup level for DRO (290 mg/kg). 1 of 3 samples submitted for an expanded analytical suite also contained VOCs (TCE at 0.046 mg/kg) and PAHs (benzo[a]anthracene at 8.2 mg/kg, benzo[a]pyrene at 7.8 mg/kg, and dibenzo[a,h]anthracene at 1.1 mg/kg) in excess of ADEC cleanup levels. Estimated concentrations of PCBs were found in several samples; however, none exceeded the ADEC Method Two cleanup criterion of 1 mg/kg.

- North Dome Tower: 8 of 16 analytical sampling locations from 36 test pits excavated to 2 ft bgs exceeded the ADEC cleanup level for DRO (300 to 1,100 mg/kg). Both samples submitted for an expanded analytical suite also contained benzo(a)pyrene (4.7 to 15 mg/kg) above the ADEC cleanup level; one of which also contained benzo(a)anthracene (16.0 mg/kg) and dibenzo(a,h)-anthracene (2.3 mg/kg).

- South Dome Tower: 2 of 11 analytical sampling locations from 46 test pits excavated to 0.5 ft bgs exceeded the ADEC cleanup level for DRO (650 to 1,125 mg/kg). One of the samples was submitted for an expanded analytical suite with no further ADEC cleanup level exceedances identified.

- 10K-Gallon Diesel UST: 3 of 10 analytical sampling locations from two 70-ft long trenches excavated between 10 and 12.5 ft bgs exceeded the ADEC cleanup level for DRO (260 to 360 mg/kg). One sample was submitted for an expanded analytical suite that contained benzo(a)pyrene (2 mg/kg) above the ADEC cleanup level.

- Composite Building: 8 of 30 analytical sampling locations from 31 test pits excavated around the perimeter of the former footprint to depths between 1 and 3 ft bgs exceeded the ADEC cleanup level for DRO (260 to 4,900 mg/kg). 2 of 4

samples submitted for an expanded analytical suite also contained benzo[a]pyrene (4.5 to 5.1 mg/kg) in excess of ADEC cleanup levels.

- Soil Stockpile: Five test pits were excavated to 5 ft bgs with seven soil samples submitted for laboratory analysis. Both samples submitted for VOC exceeded the ADEC cleanup level for TCE (0.11 to 0.16 mg/kg); one of which was also submitted for expanded analytical suite that did not identify further ADEC cleanup level exceedances. DRO and PCBs were not detected at any of five additional sampling locations collected for a limited suite of analysis.

Resource Conservation and Recovery Act (RCRA) metals were also analyzed from soil samples collected at each area of concern, results of which are discussed below following recommendations that further sampling be conducted and incorporated into a background study.

In 2006, supplemental sampling activities were conducted at seven of the above-mentioned areas of concern to calculate background metals concentrations for arsenic (11 mg/kg) and chromium (57 mg/kg). Results indicated that arsenic and chromium are present in site soils at naturally occurring concentrations. Soil samples also were collected to determine the presence of trivalent versus hexavalent chromium. With the exception of the Fuel Filling Station (0.3 mg/kg), all sample results were non-detect for hexavalent chromium.

Based on the 2005 and 2006 data, further excavation and/or site characterization was recommended for the following six areas of concern related to the former AC&W main complex: North Fuel AST and Thermal Treatment Site, South Fuel AST, North Dome Tower, South Dome Tower, Composite Building, and the Soil Stockpile.

2.3.5 Feasibility Study and Decision Document (2007-2008)

Historical data for 13 individual DoD-use sites was compiled and presented in a combined FS to assess potential remedial alternatives for the Unalakleet AFS FUDS (USACE 2008). Following evaluation through established U.S. Environmental Protection Agency (EPA) guidance, Site 25 – Main Aircraft Control and Warning Station Complex, remained as one of six sites requiring further action based on known chemical contaminants and affected environmental media. According to the FS, the amount of impacted soil remaining at the former AC&W main complex was estimated to be 630 yd^3 as distributed within the following seven areas of concern (former facilities/areas):

- Composite Building: DRO and/or PAHs at eight locations; approximately 80 yd^3
- Transformer Staging Area: PAHs and/or DRO, TCE at three locations; approximately 3 yd^3
- 10K-Gallon Diesel UST: DRO and/or PAHs at three locations; approximately 20 yd^3

- North Dome Tower: DRO and/or PAHs at nine locations; approximately 50 yd^3
- Soil Stockpile: TCE at one location; approximately 1 yd^3
- South Fuel AST: DRO at six locations; approximately 380 yd^3
- North Fuel AST and Thermal Treatment Site: DRO and/or PAHs at six locations; approximately 95 yd^3

The reported contaminants of concern remaining in site soils above ADEC soil criteria included:

- PAHs – benzo(a)pyrene (between 5.1 and 18 mg/kg); dibenzo(a,h)anthracene (between 1.1 and 2.8 mg/kg); benzo(a)anthracene (between 8.2 and 16 mg/kg); and indeno(1,2,3-cd)pyrene (maximum concentration of 11 mg/kg)
- VOCs – TCE at a maximum concentration of 0.16 mg/kg
- TPH – DRO at a maximum concentration of 7,230 mg/kg

Based on initial screening of technologies, five remedial action alternatives were retained for detailed evaluation with respect to their effectiveness, implementability, and relative cost in order to meet the identified remedial action objective for the site (i.e., to prevent exposure to soil exceeding the chemical-specific cleanup levels). The five alternatives retained for detailed evaluation included: (1) No Action; (2) Natural Attenuation/Long-Term Monitoring; (3) Institutional Controls; (4) Thermal Desorption; (5) Excavation and Off-site Treatment/Disposal.

Through the 2008 DD, Alternative 5 - Excavation and Off-site Treatment/Disposal was selected as the remedial action to remove onsite contamination and eliminate future risk to humans and the environment. Accordingly, 630 yd^3 of impacted soils were identified for excavation and offsite shipment via barge to a permitted facility for treatment and/or disposal. Although not previously identified in the FS, DDT-impacted soils identified at the North Fuel AST and Thermal Treatment Site would also be excavated because it was co-located within the DRO-impacted soil. Confirmation sampling from the sidewalls of the excavation at this location included analysis for DDT.

2.3.6 Post-DD Remedial Actions (2010-2013)

The following is a summary of post-DD remedial activities specific to the former AC&W main complex.

In 2010, remedial action at the Unalakleet AFS FUDS was conducted between June and October in accordance with the Final DD; which included the planned excavation and disposal of approximately 630 yd^3 of COC-impacted soils (USACE 2013). However, soil quantities requiring removal were found to be higher than originally estimated. By the conclusion of the 2010 remedial action, approximately 1,075 yd^3 of soil were excavated, manifested, transported out-of-state, and disposed of and/or treated at approved facilities.

In addition, eight drinking water wells from a newly developed residential area, located approximately 1 ½-mile west-southwest of the site, were sampled and found not to contain site-related COCs. Based on discussions with ADEC, these groundwater wells were designated as points of compliance.

An addendum to the Remedial Action Work Plan was prepared and served as the planning document for continuing fieldwork in 2011. The initial activities focused on gathering data to better assess the nature and extent of contamination. To this end, approximately 183 test pits were excavated with soil samples collected for laboratory analysis. Following evaluation of the additional data, approximately 861 yd^3 of additional soil with TCE, PAHs, lead, and pesticides was excavated, screened, manifested, shipped off site, and properly disposed of (USACE 2013). Data collected in 2011 indicated that the extent of soil impacted with PAHs was larger than previously estimated.

The extent and magnitude of soil impacted with TCE was also found to be larger than indicated by previous data, raising concern that the highly mobile contaminants could be migrating off site. As a result, numerous seep and surface water samples were collected from down-slope locations identified approximately ½-mile northwest and ¼-mile southeast from the former AC&W main complex in attempts to demonstrate[2] that should groundwater be affected through the migration of site contaminants, any such contaminants would not likely migrate to a potential source of drinking water. TCE and its biodegradation products (cis-1,2-dichloroethene and vinyl chloride) were not found in any of the samples collected, indicating that these chemicals had not migrated to those locations.

Between June and August of 2012, remedial investigation/removal activities continued to address TCE and PAH impacted soil (USACE 2013). During these efforts, approximately 1,960 yd^3 of TCE impacted soil was excavated[3], manifested, transported out of state, and disposed of at approved facilities. Uneven bedrock depths ranging from 1.5 to greater than 20 ft bgs were reached at all but two locations with confirmation samples collected from excavation sidewalls. Excavation floor samples were also collected at the two locations that did not reach bedrock. Confirmation sample results indicated that the soil in the excavated areas contained TCE concentrations ranging from non-detect (ND) to 12.5 mg/kg. To better define the extent of the TCE, a series of step out test pits were also excavated with analytical samples collected for TCE and PAHs.

A total of 81 test pits were dug to variable depths using either an excavator or shovel. Samples analyzed for TCE were from approximately 1 ft above the bedrock surface, whereas those analyzed for PAHs were selected from the surface interval (i.e., 0 to 2 ft bgs). Thirty-six (36) TCE and 71 PAH samples were ultimately collected for laboratory analysis during this effort, four of which were also submitted for DRO analyses. TCE was

[2] A draft groundwater use determination was previously prepared in accordance with 18 AAC 75.350 to show that any groundwater beneath the site should not be considered a drinking water source. To date, ADEC has yet to concur with the data interpretation contained within that determination. Characterization of groundwater beneath the site was initiated under the current RI during the 2015 field season as reported herein.

[3] Assuming a similar soil density of 1.5 tons per yd^3 as cited in previous reports; reported volume within the reference document was provided only in tons (2,938.71).

confirmed above the ADEC criterion in eight step-out test pits, at concentrations ranging from 0.0202 mg/kg to 0.752 mg/kg, reaffirming that the extent was significantly larger than previously reported. The data indicated that TCE is likely well defined to the west and south, but not to the east of the former Composite Building or further north. Benzo(a)pyrene was detected above the ADEC cleanup level in 19 of the step-out test pits at concentrations ranging from 0.609 mg/kg to 71.8 mg/kg. PAHs were identified in the fill material covering the former Composite Building and to the north, east, and south of the building. PAHs were also found along the western and southern areas of the former AC&W main complex. Based on historical DoD uses, PCB analysis was performed on selected soil samples. Results indicated that only one (at a concentration of 1.319 mg/kg) of the 71 samples submitted for analysis exceeded the ADEC cleanup level of 1 mg/kg. This sample was collected from the presumed treated fill placed above the former Composite Building foundation.

Site data collected following the selected remedial action provided a more thorough understanding of the extent of TCE and PAH impacted soils. However, large volumes of each remained in soil at concentrations above the cleanup levels as set forth in the DD. DRO impacted soils remained at a number of locations, but the areas were relatively small and isolated when compared to the extent of TCE and PAHs impacted soils.

The single detection of hexavalent chromium that was observed in 2006 at the fuel filling station was no longer considered a contaminant of concern at the site due to extensive remedial actions that occurred across this area in 2010. For this reason, hexavalent chromium was not included as a part of the subsequent Supplementary Remedial Investigation.

2.3.7 Supplemental Remedial Investigation (2016)

The objective of the 2016 Remedial Investigation (RI) was to fill data gaps identified in 2009 that remained (USACE 2016). An improved understanding of the nature and extent of the COCs was used to update the conceptual site model (CSM) and develop alternative cleanup levels for an updated feasibility study (FS). The extent of remaining impacted soil at the site was determined by comparing all available data from previous investigations and data acquired from the 2016 RI field effort (Figure 3).

A total of 85 soil borings (including step-out borings) were advanced across the site and both surface and subsurface samples of overburden material were collected for laboratory analyses. An additional five samples were collected from well borings at the overburden-bedrock interface. These samples were collected from targeted depths based on previous sampling efforts and submitted for select analyses as part of the site-wide investigation to fill data gaps for delineation of COCs (VOCs, PAHs, PCBs, and DRO) in soil. The number of borings and samples were as follows:

- VOCs: A total of 77 surface and subsurface soil samples from 41 locations.
- PAHs: A total of 92 surface and subsurface soil samples from 50 locations.

- DRO: A total of 58 surface and subsurface soil samples from 33 locations.
- PCBs: A total of 61 surface and subsurface soil samples from 37 locations.

The soil investigation also included multi-incremental sampling to evaluate whether impacted soil identified/treated during historical remedial efforts may have been placed as cover material over the landfill and as general fill over the footprint of the former Composite Building. Furthermore, background soil sampling outside of source areas was conducted to evaluate total organic carbon (TOC) for development of alternate cleanup levels (ADEC Method Three).

It was determined that TCE in soil above the cleanup level of 0.044 mg/kg is predominantly present over the western portion of the former Composite Building footprint (Figure 3). Isolated discontinuous hot-spot locations have also been identified along a 2011 excavation located between the former radar buildings and in a test pit located further southwest. These exceedances are present in shallow soil extending to bedrock (refusal) at most locations; however, have been well delineated over the majority of the Site. The maximum remaining in-place concentration of TCE (1.64 mg/kg) is from an excavation bottom sample collected in fractured bedrock as part of the 2011 remedial effort (USACE 2013).

PAH impacts are widespread in surface soils across the Site and are typically associated with elevated benzo(a)pyrene (Figure 3). The highest concentrations of benzo(a)pyrene are found in the vicinity of the former Composite Building. Benzo(a)pyrene detections of up to 92.9 and 75.3 mg/kg have been identified near the eastern and southern sides of the former Composite Building footprint during past investigations, and up to 80 mg/kg to the north near the landfill as found during the 2016 RI. Soil results show that benzo(a)pyrene is the lone analyte detected above the corresponding cleanup level (1.5 mg/kg) within the southern portion of the landfill. Most of these areas are well defined including PAH impacts at the northwest and southeast landfill extents which appear to be co-mingled with site-wide impacts from outside the landfill.

DRO impacts in Site soil above the cleanup level of 3,800 mg/kg are present at three small isolated locations. Concentrations range from 4,890 mg/kg adjacent to a previous excavation near the western side of the former Composite Building to 7,450 mg/kg near the former fueling station (Figure 3). Each of these discontinuous hot spots is well defined by surrounding soil data.

Low level PCBs (Aroclor 1260) were detected in soil from seven RI boring locations; none of which exceed the cleanup level of 1.0 mg/kg. Three of these borings were near a known prior exceedance within the footprint of the former Composite Building, defining the limited extent of this isolated impact. Multi-Incremental (MI) samples from the landfill cover material were collected and submitted for analysis of PCBs and dioxins, whereas those collected at the former Composite Building were analyzed for dioxins only. The 2016 RI sample results indicate that all detected PCBs (including Total PCBs) and total toxic equivalents calculated from low-level dioxin/furan detections were below respective

cleanup level and 1/10th of the cleanup level. The results do not preclude the lone PCB sample exceedance at location 25-TP071 (USACE 2013).

Groundwater and surface water were evaluated during the 2016 RI. Six boreholes were advanced through bedrock to install six groundwater monitoring wells around the perimeter of the former AC&W main complex footprint. Groundwater was limited to bedrock fractures at highly variable depths ranging from as shallow as 32 feet (~20 feet into bedrock) along the northwestern perimeter of the Site to greater than 400 feet (~390 feet into bedrock) near the southern perimeter. All wells were sampled for VOCs in addition to DRO in shallower wells. Surface water was collected from ten nearby downslope seep locations and analyze for VOCs. The seeps correlated in elevation to the maximum monitoring well depth. The groundwater characterization demonstrated that that COCs present in soil have not migrated to groundwater at levels in excess of risk-based screening criteria. None of the sampled seep locations reported compounds above 1/10th of groundwater cleanup levels. Furthermore, groundwater in deep fracture zones was observed to be under positive hydraulic pressure base on observed water level responses and is not considered to be hydraulically connected to shallow soils above.

2.3.8 Feasibility Study (2018)

The primary purpose of the feasibility study (FS) was to identify soil technologies/process options, develop remedial alternatives and evaluate them against the criteria specified in the NCP. The FS incorporated the remedial action objectives (RAOs) presented in Section 2.9. Technologies retained from the screening process are presented in Section 2.11 and were further evaluated based on the nine evaluation criteria specified by the NCP (40 CFR Part 300) and the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (U.S. EPA 1988). The evaluation criteria and comparative analysis amongst alternatives are presented in Section 2.12, and encompass statutory requirements, technical considerations, institutional considerations, and cost.

Cleanup levels presented in the FS incorporated ADEC Method Three alternate soil cleanup levels (ACLs) based on the 18 AAC 75, November 6, 2016 limits. More recent cleanup level revisions established in 18 AAC 75, as amended through September 29, 2018, have since been incorporated in this DD based on less stringent soil cleanup levels associated with some PAH compounds. Cleanup level revisions resulted in a reduced extent of impacted soil requiring remedial action under each alternative.

2.4 Scope and Role of the Proposed Remedial Action

This section describes the scope and role of the current proposed remedial action relative to the overall cleanup plan and objective for this property. Since being initiated in 1990, USACE has defined and addressed five (5) projects for this property.

- Project 01: Building Demolition and Debris Removal
- Project 02: Containerized Hazardous or Toxic Waste Removal
- Project 03: Contaminated Soil (12 sites)
- Project 04: Ordnance Explosive Sites (Military Munitions Response Program)

- Project 05: AC&W Site 25

Projects 01 through 04 have since achieved “response complete” and have been closed. The first two projects (01 and 02) primarily addressed building demolition/debris removal (BD/DR) and the removal of containerized wastes. Project 04 was initiated for the purpose of investigating the potential for presence of military munitions. No evidence was found, and the project was subsequently closed. Projects 03 and 05 were defined to address environmental contaminants remaining on the property. Project 03 successfully addressed and closed twelve (12) identified sites. The remaining project (05) represents the current proposed remedial action to address the environmental concerns remaining at Site 25. Project 05 is intended to conclude all remedial activities for this property.

2.5 Enforcement History

RI and remedial work at the Unalakleet AFS AC&W Main Complex project has been carried out under the DERP FUDS program. There have been no enforcement activities or notices of violation pertaining to the DoD activities at the AC&W Main Complex FUDS.

2.6 Community Relations Activities

The following recent documents were made available to the public with corresponding release dates are:

- Remedial Investigation Report: December 9, 2016.
- Feasibility Study Report: January 3, 2019.
- Proposed Plan: August 2019.

The reports can be found in the Administrative Record file at USACE Alaska District on Joint Base Elmendorf-Richardson (JBER) and the Information Repository maintained at the Native Village of Unalakleet Community Building.

Public participation has been an important component of the CERCLA process at the Site. A public meeting was conducted on February 25, 2016 at the Native Village of Unalakleet Community Building to communicate the results of the 2016 RI and tentative timelines associated with future project developments (i.e., FS Report).

A second public meeting was conducted prior to the release of the final FS Report on June 12, 2017 at the Native Village of Unalakleet Community Building. The public hearing communicated the FS results and solicited public input regarding the evaluation and selection process of alternative remedial strategies. Representatives from USACE and ADEC were available to answer questions about the project and the remedial alternative selection process.

The Proposed Plan was released to the public on August 16, 2019 and a third public meeting was held on January 15, 2020 at the Native Village of Unalakleet Community Building to present the Proposed Plan. These events were advertised on various dates in

The Nome Nugget. Representatives from USACE, and ADEC were available at the public meeting to answer questions about the project and the remedial alternatives. USACE also used this meeting to again solicit community input. USACE's response to the comments received during the comment period (August 16, 2019 to January 22, 2020) is included in the Responsiveness Summary, which is part of this DD. The ADEC provided comments on the PP and this DD during document development, and as part of the ongoing coordination between USACE and Unalakleet community stakeholders. These comments were considered and addressed in finalizing both the Proposed Plan and this Decision Document.

2.7 Site Characteristics

This section provides an overview of the Site, including geology, hydrology, climate, and ecological resources.

2.7.1 Climate

Unalakleet has a subarctic climate with considerable maritime influence when Norton Sound is ice free, usually between May and October. Average monthly temperatures range from -4 to 61 degrees Fahrenheit (°F), with an average yearly temperature of 27 °F. Average annual precipitation in Unalakleet is low (15.6 inches), ranging from 0.5 inches in February to 3.0 inches in August. Snowfall generally from October through May averages 38 inches annually.

Unalakleet receives approximately 13 inches of precipitation annually, of which approximately 9.1 inches falls as rain and the remainder falls as snow. Due to its location at the top of a hill, a significant amount of the precipitation that does fall as snow may blow away leaving little melt water. Much of the remaining precipitation is likely lost to evaporation or evapotranspiration. The above conditions, along with wind and low levels of humidity, likely leave little water remaining to infiltrate into Site soils.

2.7.2 Topography

The former AC&W Site was built on a hilltop that was blasted to create a flat building area. The hilltop was originally at an elevation of 705 feet and was blasted down to an elevation of approximately 681 to 684 feet. In some areas, up to 15 feet of bedrock was removed to install subsurface utilities and USTs. Hill slopes in the area are typically less than 12 percent (USACE 2013b).

2.7.3 Geology

The Unalakleet River basin is underlain by sedimentary bedrock consisting of greywacke, shale, grit, and conglomerate. The coarser rocks form rubble-covered ridges and hills, while shale underlies the slopes and valleys. The bedrock is tightly folded and is overturned in places along fold axes that trend northeast. Large faults traverse the basin, both along the trend of the fold axes and across the trend of the folding. Fluvial deposits of silt, sand, gravel, and cobbles are found in streambeds, floodplains, and terraces (Sloan et al. 1982-83).

The Unalakleet River runs along a major regional fault, the Kaltag Fault. The geology along the river includes unconsolidated fluvial and floodplain deposits of silt and sand. North of the Unalakleet River, the bedrock geology consists of volcanic greywacke and mudstone of lower Cretaceous age. The deposits range from fine-grained to conglomeratic. The best exposures are in the cliffs north of Unalakleet, where a series of steeply dipping (55º to 85º) northeast-trending folds have been mapped (Patton and Moll-Stalcup 1996).

The general stratigraphy at the Site consists of a few feet of organics, soil and/or engineered fill over a few feet of highly weathered, and variably dipping bedrock underlain by fractured more competent bedrock. Soils are relatively homogenous and consist of well to poorly graded coarse-grained sands, gravels, and cobbles within a variable matrix of finer grained materials, including silts estimated at between 5 percent and 12 percent. The coarser fractions consist of sub-angular gravels to angular cobbles, which are predominantly weathered and fresh (blasted) bedrock rubble. The above overburden soils overlie fractured greywacke and mudstone bedrock.

Bedrock encountered at the Site consists of weathered and fractured mudstone, siltstone, and sandstone with flat to slightly east dipping orientations as observed during Site development (test pit logs from 1958 “As-Built” drawings). Review of photos from previous Site removal activities indicate primary bedding of the shallow bedrock to be to the west at highly variable angles and crossed by secondary fracture sets. Light to moderate fracturing (of variable depth and thicknesses) was observed through down-hole video efforts of open boreholes prior to installation of monitoring wells constructed in 2015.

2.7.4 Hydrogeology and Surface Water

The Unalakleet region is underlain by permafrost and low permeability bedrock with regional groundwater recharge and discharge most predominant in areas of unfrozen alluvium found under and adjacent to streams. In this setting, groundwater is recharged by surface water from “losing stream” sections and valley floors and/or as rainfall that percolates through surface soils and down into weathered and fractured bedrock from area hilltops. Groundwater is also discharged through seeps where water-bearing fractures extend to the ground surface (USACE 2013a).

Two seep clusters have been identified and previously sampled downgradient of the Site to the northwest and southeast. Water from the seeps in the northwestern direction flows into a series of small streams that merge as they flow downhill; whereas, water from the seeps to the southeast flows into a single stream. Sampling during a 2011 event indicated that flow was strong at each of the seeps during each of three visits. Field parameters were collected and indicate that the water has low levels of salts (low specific conductivity and low conductivity), high levels of dissolved oxygen (DO), high oxygen reduction potential (ORP), and exhibits near-neutral pH levels. These factors suggest that groundwater upgradient of these seeps have not been impacted by chemical subject to rapid biodegradation under aerobic conditions. The temperature of many of the seep samples was just above the freezing point (USACE 2013b).

Little historical data about the aquifer characteristics beneath the Site is available; however, groundwater is believed to flow toward prominent surface water drainage features (i.e., downslope creek tributaries) (USACE 2011). In 2015, exploratory borings were advanced through bedrock to locate water-bearing fractures for collection of groundwater samples. Six monitoring wells were ultimately installed along the perimeters of the former AC&W Site. Water was encountered at four of the locations in fractures at depths ranging from 32 feet (approximately 20 feet into bedrock) along the northwestern perimeter of the Site to greater than 400 feet (approximately 390 feet into bedrock) near the southern boundary. Groundwater was not encountered to a depth reaching 410 feet below ground surface (bgs) along the eastern boundary. Two additional monitoring wells were set within “weeping” fracture zones as identified during a down-hole video within the two deep exploratory borings advanced within the eastern half of the Site. These zones ultimately provided water following well completion but were had very poor yield and may have existed temporarily as remnants of melted permafrost.

Groundwater encountered in the deep fracture at the southern portion of the Site was under significant hydraulic pressure and immediately rose to an equilibrated level greater than 60 feet. This condition would suggest that deeper fracture zones, those with the ability to carry and discharge potentially sourced groundwater from the Site to previously identified points of compliance (i.e., downgradient seeps, surface waters, domestic wells) are not hydraulically connected with shallow soils above.

The nearest anadromous streams are the Unalakleet River (approximately three miles to the south) and Powers Creek (over two miles to the northwest). Both are unlikely to be affected by impacted soils identified from former activities at the Site. No other anadromous streams are identified in the area.

2.7.5 Ecological Setting

The Site is located in an upland area of the Nulato Foothills, which is within the Interior Forested Lowlands and Uplands sub-region of the Northwest Ecoregion of Alaska. No aquatic habitat is present at or near the Site. The Site has been previously disturbed by demolition of structures and investigation activities, and is in a state of recovery, characterized by grasses and scrub-shrub vegetation, with a sparse distribution of young trees primarily covering the landfill and former Composite Building footprint (Figure 2-2). Previous remedial (excavation) activities have left about one-third of the Site cleared of vegetation, resulting in minimal ecological habitat in these areas. Surrounding (undisturbed) habitat of the Nulato Foothills is sparsely forested, with spruce, paper birch, aspen, alder, native willow, and balsam poplar trees. Ground cover vegetation includes shrubs, grass, flowers, berries, lichen, and moss. Drainage areas are characterized by tall grasses, and muskeg occurs in low-lying areas (USACE 2011).

The Site is located about three miles inland from the village of Unalakleet, which lies along the coast adjacent to Norton Sound and only upland terrestrial species are expected at the Site. Although not specifically observed at the former AC&W Site, a variety of land mammals inhabit the Unalakleet area, including brown bear, black bear,

moose, caribou, gray wolf, red fox, lynx, muskrat, beaver, porcupine, otter, marten, ground squirrel, tree squirrel, wolverine, weasel, and hare.

Marine mammals inhabiting Norton Sound include Pacific walrus, bearded seal, ringed seal, spotted seal, fur seal, Steller sea lions, harbor seals, bowhead whales, beluga whales, gray whales, and orca whales. Several waterfowl and shorebird species migrate to the area for breeding during the summer months. Seabirds, raptors, perching birds, and songbirds are common (USACE 2011). Several species of fish are found in the Unalakleet River and its tributaries, including king salmon, silver salmon, chum salmon, pink salmon, arctic grayling, Dolly Varden trout, whitefish, burbot, arctic char, Alaska blackfish, and stickleback (USACE 2011). The nearest anadromous streams are the Unalakleet River (approximately three miles to the south) and Powers Creek (over two miles to the northwest). Both are unlikely to be affected by residual contamination identified from former activities at the Site. No other anadromous streams are identified in the area.

Many species of plants, animals, and fish are used as subsistence resources. Salmon are commercially harvested in the Unalakleet River and Norton Sound (USACE 2003).

2.8 Nature and Extent of Contamination

The nature and extent of the soil impacts at the Unalakleet AC&W Main Complex site is summarized in this section. CERCLA and POL COCs are discussed separately. The descriptions in the following paragraphs are based on information presented in the 2008 FS report, 2013 Remedial Action report, 2010 Site Investigation Report, 2016 RI report and associated Addenda, and 2018 FS report.

Environmental impacts at the Site are associated with historical military activities at the former AC&W main complex, which contained buildings, disposal areas, transformers/ capacitors, drum storage areas, generators, ASTs/USTs and associated piping, and other infrastructure. Remaining impacted media above action levels is limited to soil. Remaining compounds requiring remedial action include TCE, DRO, PCBs, and PAHs as shown in Figure 5.

2.8.1 CERCLA Site Characterization

TCE in soil above the cleanup level of 0.044 mg/kg exists near the eastern portion of the Composite Building footprint. Isolated discontinuous hot-spot locations have also been identified along a 2011 excavation located between the former radar buildings and in a test pit located further southwest. Impacts are present in shallow soil extending to bedrock at most locations. They have been well delineated over the majority of the site. The maximum concentration of TCE (1.65 mg/kg) was detected in an excavation bottom sample collected in fractured bedrock as part of a 2011 remedial effort.

Soil samples have been extensively tested for PCBs at the site. While occasional low concentrations were detected (Aroclor 1260), only a single sample exceeded the cleanup level of 1 mg/kg, with a maximum concentration of 1.319 mg/kg.

Groundwater was not found above bedrock in the excavations and test pits completed during previous investigations. Deep exploratory borings were advanced through bedrock to locate water-bearing fractures for collection of groundwater samples. Water was encountered in fractures ranging from as shallow as 32 feet deep (~20 feet into bedrock) along the northwestern perimeter of the Site to greater than 400 feet deep (~390 feet into bedrock) near the southern perimeter. No COCs were detected.

Downgradient surface seeps and a culvert outfall beneath North River Road were also sampled as part of the groundwater investigation, and no COCs were detected.

2.8.2 POL Site Characterization under DERP authority

PAH impacts are widespread in surface soils across the site and are always associated with elevated benzo(a)pyrene, with the highest concentrations found in the vicinity of the former Composite Building. Benzo(a)pyrene detections of up to 92.9 and 75.3 mg/kg have been identified near the eastern and southern sides of the former Composite Building footprint during past investigations, and up to 80 mg/kg to the north near the landfill as found during the recent 2015 RI. Most of these areas are well defined; however, soil impacts at limited areas east and south of the main plume over the former Composite Building could not be fully delineated due to steep terrain.

DRO impacted soil is present at three small isolated locations at concentrations ranging from 4,890 mg/kg adjacent a previous excavation near the western side of the former Composite Building to 7,450 mg/kg near the former fueling station. Each of these discontinuous hot spots is well defined by surrounding soil data.

Groundwater and seep investigation have demonstrated that POLs have not migrated to groundwater at levels in excess of risk-based screening criteria.

2.9 Current and Potential Future Land and Resource Uses

The Site is owned by the Unalakleet Native Corporation (BLM 2017). The current use of the vacant Site and surrounding land is limited to occasional site visitors, recreational users, and subsistence gathering. Present users may access the site using motorized vehicles via road, or by foot. Groundwater is not currently used. The reasonably anticipated future land use of the project area would continue to be recreational, based on discussion with Unalakleet Native Corporation stakeholders. There are no plans to develop the site; however, workers and residents were identified as possible future receptors for CSM evaluation purposes.

2.10 Summary of Site Risks

The USACE conducted a Human Health Risk Assessment and Screening-level Ecological Risk Assessment for the Site to evaluate the potential risks to human and ecological receptors based on potential exposures to contaminants originating from the site. The risk assessments are presented in detail in the RI/FS and are summarized in this section.

2.10.1 Identification of Chemicals of Concern (COCs)

The 2016 Remedial Investigation (RI) report evaluated the extent of remaining COCs based on historical data and soil and groundwater data acquired from the 2015 RI field effort (USACE 2016). PALs or screening criteria for soils included ADEC Method Two Tables B1 and B2 for the "under 40-inch" zone (18 AAC 75.341) and as adjusted through the ADEC Method Three approach under 18 AAC 74.340(e) and (f).

In November 2016 ADEC Division of Spill Prevention and Response – Contaminated Sites Program promulgated revisions to cleanup levels; therefore, analyte detections were compared to both the old and new 18 AAC 75limits. Cleanup levels presented in the FS incorporated ADEC Method Three alternate soil cleanup levels (ACLs) based on the 18 AAC 75, November 6, 2016.

Alternate soil cleanup levels (ACLs) were determined based on a calculated site-specific value (i.e., average) for TOC (1.55%). ADEC Method Three criteria incorporated the most conservative cleanup levels presented in Tables B1 (CERCLA contaminants) and B2 (petroleum hydrocarbons) of Title 18 of the AAC, Chapter 75 (18 AAC 75.341), for the "Under 40-Inch" precipitation zone (ADEC 2018).

For groundwater, Table C Groundwater cleanup levels (18 AAC 75.345) were used for comparison. After completion of the December 2018 Feasibility Study report (*Final)*, ADEC revised cleanup levels under 18 AAC 75 (ADEC 2018). The ADEC cleanup levels established in 18 AAC 75, as amended through October 27, 2018 were used to re-evaluate Site cleanup levels regarding COCs and their respective PALs. The evaluation resulted in updated revisions to Site cleanup levels using the same RI/FS criteria (i.e., ADEC Method Three criteria and Cumulative Risk Evaluation), of which are incorporated in this Decision Document.

CERCLA

As part of the 2016 RI, constituents in soil exceeding human health regulatory standards (Method Two cleanup levels) were established as COCs for the Site (USACE 2016. The maximum concentrations of each COC detected in remaining in-place soil are shown in Table 2.1.

Table 2.1: Maximum CERCLA Concentrations of Contaminants Detected in Soil

Chemical	Maximum Concentration (mg/kg)	Most Stringent ADEC Method Two Soil Cleanup Level (2021) (mg/kg)
Arsenic, Inorganic	21.8	0.20 (MTGW)
Lead and Compounds	371	400 (HH)
Trichloroethylene	12.5	0.011 (MTGW)
Polychlorinated Biphenyls	1.319	1 (HH)

Notes: 18 AAC 75 Oil and Other Hazardous Substances Pollution Control, June 24, 2021. HH – Table B1. Method Two Soil Cleanup Levels Table, Under 40 Inch Zone, Human Health. mg/kg – milligrams per kilogram. Metals (arsenic and lead) are background concentrations. MTGW - Migration to Groundwater. Table B1. Method Two Soil Cleanup Levels Table, Under 40 Inch Zone. Metals were found to be background concentrations and were discarded from further consideration.

POLs

POL COCs consisted of DRO and PAHs and are limited to soil. The maximum concentrations of each POL COC detected in remaining in-place soil are shown in Table 2.2.

Table 2.2: Maximum Concentrations Detected in Soil

Chemical	Maximum Concentration (mg/kg)	Most Stringent ADEC Method Two Soil Cleanup Level (2021) (mg/kg)
DRO	7,450	250 (MTGW)
PAHs		
Benz[a]anthracene	92	0.70 (MGTW)
Benzo[a]pyrene	80	1.5 (HH)
Benzo[b]fluoranthene	80	15 (HH)
Benzo[k]fluoranthene	31	150 (HH)
Chrysene	110	600 (MTGW)
Dibenzo[a,h]anthracene	12	1.5 (HH)
Fluoranthene	173	590 (MTGW)
Fluorene	56	36 (MTGW)
Indeno[1,2,3-cd]pyrene	41	15 (HH)
Methylnaphthalene, 1-	19.6	0.41 (MTGW)
Methylnaphthalene, 2-	25.7	1.3 (MTGW)
Naphthalene	95	0.038 (MTGW)
Pyrene	220	87 (MTGW)

Notes: 18 AAC 75 Oil and Other Hazardous Substances Pollution Control, June 24, 2021.
HH – Table B1. Method Two Soil Cleanup Levels Table, Under 40 Inch Zone, Human Health. mg/kg – milligrams per kilogram.
MTGW - Migration to Groundwater. Table B1. Method Two Soil Cleanup Levels Table, Under 40 Inch Zone.

All analytes detected in seep and groundwater samples were reevaluated and compared to updated 18 AAC 75.345, Table C regulatory cleanup levels (ADEC 2018). With the exception of DRO, none exceeded 1/10th of the cleanup levels. Low levels of DRO were detected below the PAL. Characterization of groundwater beneath and downgradient of the AC&W main complex has demonstrated that COCs present in soil have not migrated to groundwater at concentrations higher than risk-based screening criteria. The quality of the analytical data collected during the recent RI was reviewed by a third-party validator who determined that samples were successfully analyzed and acceptable for project use (USACE 2016).

2.10.2 Conceptual Site Model Overview

Human Health and Ecological Conceptual Site Models (CSM) were developed during the RI and are included as Attachment A. Potential human receptors were determined based on current and reasonably foreseeable site land use. Future human receptors include potential residents, commercial or industrial workers, and construction workers. Completed exposure pathways for current and future receptors included dermal absorption or incidental ingestion of contaminants in soil and groundwater, inhalation of outdoor air and fugitive dusts, and ingestion of wild foods.

2.10.3 Human Health Risk

A human health risk evaluation was conducted as part of the 2016 RI. Cumulative risk estimates were calculated following 18 AAC 75 Method Three guidance. Cumulative risk calculations incorporated maximum concentrations for all "in-place" individual compounds in excess of risk-based screening levels (RBSLs) from across the site. The RBSLs were evaluated for appropriate input and historical data from locations subsequently excavated were omitted. Two scenarios were evaluated based on 18 AAC 75, November 6, 2016 ADEC criteria for a child receptor under an Unlimited Use/Unrestricted Exposure (UU/UE) using the State's online calculator. Scenario 1 provided a baseline using site concentrations for current site conditions; whereas Scenario 2 demonstrated the likely impact on cumulative risk following a hypothetical soil removal effort to meet proposed ACLs at the time of the 2016 RI. Results of the 2016 RI cumulative risk evaluation are presented in Table 2.3 below.

Table 2.3: 2016 RI Cumulative Risk Output Summary

Individual Pathway Component	HI/Total Risk Result		Risk Reduction Factor (with Hypothetical Soil Removal)
	Scenario 1	Scenario 2	
Noncarcinogenic HI Child	**2.465**	0.326	*8*
Ingestion HI Child	*0.986*	*0.239*	*4*
Inhalation (Volatiles) HI Child	***1.343***	*0.062*	*22*
Inhalation (Particulates) HI Child	*0.001*	*0.000*	*2*
Dermal HI Child	*0.135*	*0.024*	*6*
Carcinogenic Risk	**5.60E-03**	**4.68E-05**	*120*
Ingestion Risk	***4.20E-03***	***3.64E-05***	*115*
Inhalation (Volatiles) Risk	***1.42E-05***	*1.95E-07*	*73*
Inhalation (Particulates) Risk	*9.26E-08*	*9.31E-09*	*10*
Dermal Risk	***1.40E-03***	***1.01E-05***	*139*

Notes: Values shown in **red-bold font with yellow highlighting** exceed an HI of 1 and/or demonstrate that a cumulative risk exists AND is outside of the upper EPA risk range. Values shown in **red-bold font** demonstrate that a cumulative risk exists but is within the established EPA risk range. Source: USACE 2016

Similar scenarios were considered for evaluation based on 18 AAC 75, October 27, 2018 ADEC criteria using the State's online calculator and ACL revisions for maximum detections. Summarized cumulative risk outputs based on adopted cleanup levels are presented below in Table 2.4.

Table 2.4: 2018 Cumulative Risk Output Summary			
Individual Pathway Component	**HI/Total Risk Result**		**Risk Reduction Factor (with Hypothetical Soil Removal)**
	Scenario 1	**Scenario 2**	
Noncarcinogenic HI Child	***5.55***	*0.107*	*52*
Ingestion HI Child	***3.31***	*0.073*	*45*
Inhalation (Volatiles) HI Child	***1.32***	*0.023*	*57*
Inhalation (Particulates) HI Child	*0.022*	*0.000262*	*83*
Dermal HI Child	*0.908*	*0.010*	*90*
Carcinogenic Risk	***7.81E-04***	***1.05E-05***	*74*
Ingestion Risk	*5.76E-04*	*7.85E-06*	*73*
Inhalation (Volatiles) Risk	*1.38E-05*	*6.15E-08*	*225*
Inhalation (Particulates) Risk	*3.90E-08*	*5.12E-10*	*76*
Dermal Risk	*1.91E-04*	*2.64E-06*	*72*

Notes: Values shown in **red-bold font with yellow highlighting** exceed an HI of 1 and/or demonstrate that a cumulative risk exists AND is outside of the upper EPA risk range. Values shown in **red-bold font** demonstrate that a cumulative risk exists but is within the established EPA risk range. Revisions to ACLs for maximum detections (Tables 2.1 and 2.2) at the AC&W Site using updated regulations (ADEC 2018) continue to support that risk would be reduced to an acceptable level.

2.10.4 Ecological Risk

An ecological conceptual site model (CSM) was developed as part of the 2016 RI to determine the need for an ecological risk assessment (Attachment A). Potential ecological receptors include vegetation, invertebrates, birds, and mammals. The ecoscoping process determined that no further ecological evaluation was recommended. The ecological CSM determined that quality habitat is limited under current conditions as the AC&W main complex area is in a state of recovery due to past disturbance. The Site is not located within a park, preserve, or wildlife refuge. Any complete ecological exposure pathways associated with the Site were considered insignificant. Groundwater is not readily available and collected data show that groundwater (where sampled) from site monitoring wells and offsite seep locations met regulatory standards. Additionally, there is no aquatic habitat or critical habitat designated or observed at the site.

2.10.5 Imminent and Substantial Endangerment Finding for POL under DERP

The POLs at the site were investigated to determine if they pose an ISE to human health or the environment under DERP. To make this determination, the concentrations of petroleum compounds were compared to Alaska's Site Cleanup Rules (18 AAC 75 Article 3) which are considered indicative of when an ISE to the public health or welfare or the environment exists. The RI results indicate DRO and PAH concentrations exceed ADEC cleanup levels and that a complete exposure pathway exists.

2.10.6 Basis for Response Action

The DoD is authorized to carry out a program of environmental restoration at former military sites pursuant to The Defense Environmental Restoration Account, 10 USC §2701 et seq., which authorizes the DERP program. Under this Program, FUDS are

defined as real property that was owned by, leased by, or otherwise possessed by the United States and under the jurisdiction of the Secretary of Defense and that was transferred from DoD control prior to 17 October 1986. Investigations completed AC&W Main Complex Site verified contaminated soil presents an unacceptable risk to human health and the environment. The response action selected in this DD is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

2.11 Remedial Action Objectives and Cleanup Objectives

Remedial action objectives (RAOs) are goals specific to media for protecting human health and the environment. The RAOs for contaminants are based on evaluation of applicable or relevant and appropriate requirements (ARARs), present and future land use considerations, conditions, and limitations of available remedial technologies. The following RAOs were identified to address soil contamination at the AC&W Main Complex FUDS:

- Prevent unacceptable risk to human health and the environment from exposure to COCs in excess of their respective cleanup levels in the surface and subsurface soil (see Table 2-5);

- Achieve source control to address potential migration of TCE from soil to shallow fractured bedrock environment;

- Use treatment techniques for remedy whenever practicable; and,

- Meet Site closure requirements for “cleanup complete” or “cleanup complete with institutional controls (ICs)” per Alaska Department of Environmental Conservation (ADEC) guidance (ADEC 2016). The status “cleanup complete” and “cleanup complete with ICs” is similar to “unlimited use and unrestricted exposure” (UU/UE) and remedy action with land use controls (LUCs), respectively. However, the “cleanup complete” status is awarded by ADEC when efforts to reduce hazardous substance contamination have achieved the most stringent levels established in state regulation, or the possibility of human exposure to residual contamination is highly unlikely.

2.11.1 CERCLA Soil Cleanup Levels

Cleanup levels presented in the FS incorporated ADEC Method Three alternate soil cleanup levels (ACLs) based on the 18 AAC 75, November 6, 2016 limits. Since that document was published, ADEC has promulgated revised Method Two cleanup levels per 18 AAC 75, as amended through October 27, 2018 which were used to reevaluate ADEC Method Three ACLs for COCs at the Site.

The revised ACLs for CERCLA compounds are incorporated in this DD and are summarized in Table 2.5.

Table 2.5: Revised CERCLA Soil Cleanup Levels at AC&W Site			
COC	ADEC Method Three Alternative Cleanup Level (mg/kg)		Cleanup Level (mg/kg)
	Human Health (Under 40-inch Zone)	Migration to Groundwater	
PCBs	3.1	NA	1[1]
Trichloroethylene (TCE)	9.6	0.044	0.044

[1]The TSCA cleanup level for PCB remediation waste (bulk) is more stringent than the ADEC Method Three Alternative Cleanup Level of 3.1 mg/kg and therefore identified as the chemical specific cleanup level. COC – Contaminant of Concern.
mg/kg - milligrams per kilogram

2.11.2 ARARs

Chemical-specific ARARs are media-specific laws and requirements that regulate the release to the environment of materials that possess certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limitations for specific chemicals. When a specific chemical is subject to more than one discharge or exposure limit, the more stringent of the requirements is used. The chemical-specific ARARs identified for the AC&W Site are presented in Table 2-6.

Table 2-6: Chemical-Specific ARARs

Topic	COC	Regulation / Requirements Citation		Comment
		Federal	State	
Soil Cleanup	PCBs	TSCA (40 CFR§ 761.61 (a)(4)(i)(A).) (Applicable)	18 AAC 75.341 Table B1 "under 40-inch" zone, cleanup level for PCBs at 1.0 mg/kg.	TSCA regulates PCBs at concentration of 50 ppm or greater. Soil containing PCBs equal or less than 50 ppm may be considered as TSCA remediation waste depending on the date of release and source concentration.
	TCE		18 AAC 75.340 (a)(3), Method 3 calculated cleanup level for TCE at 0.044 mg/kg.	The TSCA cleanup level for PCB remediation waste (bulk) as cited in Table 2.5 (see footnote 1) is more stringent than the ADEC Method Three Alternative Cleanup Level of 3.1 ppm and therefore identified as the applicable chemical-specific ARAR. These state regulations provide soil cleanup levels for CERCLA constituents and provide the basis for the site cleanup levels. ADEC Method Three Alternative Cleanup Level for TCE was calculated using the site-specific value for Total Organic Carbon (TOC) (0.0155 g/g), residential occupancy, under 40 inches of rainfall, migration to groundwater. There are no Federal regulations for petroleum in soil, and no risk assessment was conducted. CERCLA does not regulate petroleum impacted soils.

Notes:
ADEC = Alaska Department of Environmental Conservation
CFR = Code of Federal Regulations
PCBs = polychlorinated biphenyls
TCE = trichloroethylene
TSCA = Toxic Substances Control Act
ARAR = applicable or relevant and appropriate requirement
COC= contaminants of concern
ppm = parts per million

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. Table 2-7 presents the potential action-specific ARARs for the AC&W Site.

Table 2-7: Action-Specific ARARs

Topic	Standard or Requirement	Regulation / Requirements Citation		Comment
		Federal	State[1]	
Soil storage and disposal		N/A	18 AAC 75 370(a)	May not blend contaminated soil with uncontaminated soil. Must segregate contaminated soil based on the intended cleanup alternatives; and the specific hazardous substance present; Must store contaminated soil 100 feet or more from surface water, a private water system, or a fresh water supply system that uses groundwater for a use designated in 18 AAC 70.020(a)(1)(A) and 18 AAC 70.050(2); Must store contaminated soils 200 feet or more from a water source serving a community water system, a non-transient non-community water system, or a transient non-community water system, as defined in 18 AAC 80.1990; Must place contaminated soil on a liner or on or within another impermeable surface that prevents soil and groundwater beneath the liner from becoming contaminated. Must place petroleum-contaminated soil on a liner that meets the minimum specifications for the testing methods outlined by ADEC 18 AAC 75 Table D.
Soil storage			18 AAC 60.010(a)(3) and (4)	A person may not store accumulated solid waste in a manner that causes a health hazard and/or polluted run-off water.

Notes:
AAC = Alaska Administrative Code
ARAR = applicable or relevant and appropriate requirement
CFR = code of federal regulations
N/A = not applicable
PCBs = polychlorinated biphenyls
TCE = trichloroethylene
TCLP = toxicity characteristics leaching procedure
TSCA = Toxic Substances Control Act
mg/L = milligrams per liter

[1] = Although not considered ARARs, the requirements of 18 AAC 60.015, 75.340, .341(c), .355, .360, .370, and.375 will be incorporated into future planning documents as applicable to the selected alternative.

2.11.3 POL Cleanup Objectives

Alaska regulations provide methods to establish soil cleanup levels for petroleum hydrocarbons under Alaska Administrative Code (18 AAC 75), which are indicative of contamination posing an ISE to public health, welfare, or the environment. Table 2.8 shows cleanup levels for POLs.

Table 2.8: Revised POL Soil Cleanup Levels at AC&W Site

COC	ADEC Method Three Alternative Cleanup Level (mg/kg)		Cleanup Level (mg/kg)
	Human Health (Under 40-inch Zone)	Migration to Groundwater	
Benzo(a)anthracene	15	11	11
Benzo(b)fluoranthene	15	310	15
Benzo(k)fluoranthene	150	3,000	150
Benzo(a)pyrene	1.5	30	1.5
Chrysene	1,500	9,200	1,500
Dibenzo(a,h)anthracene	1.5	98	1.5
Indeno(1,2,3-c,d)pyrene	15	1,000	15
Naphthalene	110	0.52	0.52
Pyrene	2,300	1,300	1,300
DRO (total)	10,300	3,800	3,800

COC – Contaminant of Concern. mg/kg - milligrams per kilogram. ADEC Method Three Alternative Cleanup Level was calculated using the site-specific value for Total Organic Carbon (TOC) (0.0155 g/g), residential occupancy, under 40 inches of rainfall, migration to groundwater.

2.12 Description of CERCLA Contaminant Remedial Alternatives

As applicable to each of the five remedial alternatives evaluated as part of the 2018 FS, remedial costs and contaminant volume estimates have been revised and are incorporated in this DD based on soil cleanup level revisions. The five remedial alternatives evaluated as part of the 2018 FS include the following:

- Alternative 1: No Action
- Alternative 2: Hot Spot Excavation and Phytoremediation
- Alternative 3: Capping and Land Use Controls (LUCs)
- Alternative 4: Limited Excavation/Off-site Disposal, Capping and LUCs
- Alternative 5: Excavation and Off-site Disposal

2.12.1 Alternative 1: No Further Action

Estimated Capital Costs: $0
Estimated Annual Operations and Maintenance Costs: $0
Estimated Construction Timeframe: None

Estimated Time to Achieve RAOs: Indefinite

Evaluation of the No Action alternative is required by CERCLA to provide a baseline against which the benefits of other alternatives can be gauged. Under the No Action alternative, the AC&W Site would be left in its current state with no activities to control or mitigate exposure to COCs present at the Site. Although long term natural attenuation processes may reduce contaminants in soil over time, investigations at the Site have determined that COCs are present at concentrations that may be detrimental to human health and the environment.

2.12.2 Alternative 2: Hot Spot Excavation and Phytoremediation

Estimated Costs: $4.15 million (2019)
Estimated Construction Timeframe: 1 Year
Estimated Time to Achieve RAOs: 20 years

This alternative would include the discrete excavation and removal of an estimated 2,504 yd^3 of soil to remove TCE contaminated soil above cleanup levels at depths greater than four feet that may otherwise persist below the established root zone of phytoremediation treatment. Figure 4 depicts examples of hotspot excavation and phytoremediation. A majority of this soil is very close to cleanup levels. This soil would be spread on the surface and phytoremediated. Approximately 250 yd^3 of the most impacted soil would be removed from the site for off-site disposal.

Approximately 40 yd^3 of soil would be excavated from one localized hot spot of PCB contaminated soil above cleanup levels (Figure 5). All PCB impacted soils would be disposed of off-site. Remaining shallow soils above cleanup levels would be phytoremediated by planting and cultivating non-invasive species in prepared beds. The areas and extents of phytoremediation are also depicted in Figure 5.

Site access would be restricted through LUCs including, but not limited to, vehicle barriers and associated signage to protect the phytoremediation treatment area for the estimated 20-year duration of treatment. The barriers would remain in-place until performance monitoring results demonstrate that RAOs are achieved, or other actions considered warranted based on the five-year review. Additional LUCs restricting digging, and other construction activities would limit future construction worker exposure of COCs in soil.

Excavation activities under this alternative would be conducted during the one-year construction time frame in addition to most of the phytoremediation components. Estimates also include annual performance monitoring, four five-year reviews, and anticipated site closeout reporting upon completion of the 20-year performance monitoring period. Upon completion, no soil monitoring or five-year reviews would be required if RAOs are achieved. The ADEC would likely grant a *"Cleanup Complete Status"* for site closure, with appropriate LUCs regarding soil and groundwater.

It should be noted that initial estimates for this remedial solution were a 10-year time frame and a cost near $2.4 million. The 20-year time frame is included here to account for the additional uncertainties of phytoremediation.

2.12.3 Alternative 3: Capping and LUCs

Estimated Costs: $3.93 million (2017)
Estimated Construction Timeframe: 1-2 Years
Estimated Time to Achieve RAOs: Long Term (30-year estimate for monitoring and maintenance of LUCs with potential for extended duration).

This alternative would include installation of a low-permeability cap over the entire surface covering the contaminated soil with COCs above cleanup levels. Site access would be restricted through LUCs including, but not limited to, vehicle barriers and associated signage. Routine long-term monitoring and maintenance would be required in addition to multiple (five) five-year reviews. This alternative would not reduce COC concentrations to meet chemical specific ARARs, but it would attain an equivalent standard of performance by preventing exposure to soil with COC concentrations in excess of soil cleanup levels. An ARAR waiver would be justified for the soil above cleanup levels under this approach. The cost estimate is based on 30 years of monitoring and maintenance; however, this could extend beyond the estimation period. The ADEC would likely grant a *"Cleanup Complete Status with LUCs"* for site closure.

The cap and LUCs would be implemented during the first year of construction; however, lack of local equipment and materials could extend the construction season another year. Capping with continued inspection and maintenance would isolate COCs in soil and eliminate human exposure through dermal contact, inhalation, and ingestion of impacted soil. Capping would also prevent infiltration of precipitation and surface water run-off into the impacted soil and therefore control downward migration of TCE, if any that may eventually reach shallow fractured bedrock environment. LUCs would limit future construction worker exposure of COCs in soil by restricting digging and other construction activities. Capping would prevent ecological receptors such as birds and mammals from penetrating the impacted soil.

Site preparations such as clearing, grubbing, subgrade compaction, and finish grading would be conducted prior to cap placement. Regrading would be performed to eliminate surface ponding and adjust slopes to route surface run-off and precipitation away from the capped waste. Estimates include placement of a 40 Mil high density polyethylene liner cap over a prepared foundation layer. An overlying protection layer and uppermost surface layer would be placed above the liner. The foundation and protection layers consisting of low permeability clay and imported fill would be compacted in 6-inch lifts. The surface layer consisting of loam or topsoil would be seeded to promote vegetative cover. Access would be restricted through installation of fencing and posted signage.

Routine Site inspection and maintenance would identify and repair any deficiencies (e.g., top cover, ponding, signage) to ensure the cap's long-term integrity and performance. No degradation monitoring would be performed. Five-year reviews would be conducted to evaluate the integrity of the cover, evaluate impacts from any changed Site conditions, and assess the continued protectiveness of the remedial action.

2.12.4 Alternative 4: Limited Excavation/Off-site Disposal, Capping and LUCs

Estimated Costs: $8.08 million (2019)
Estimated Construction Timeframe: 1-2 years (for LUCs)
Estimated Time to Achieve RAOs: Long Term (30-year estimate for monitoring and maintenance of LUCs with potential for extended duration).

This alternative consists of limited excavation and off-site disposal pertaining to TCE - contaminated soil with capping to address the remaining soil contamination above cleanup levels at the AC&W Site. Routine long-term maintenance and restricted site access through ICs would be required in addition to multiple (five) five-year reviews. This alternative would comply with the chemical specific ARARs for a majority of TCE contaminated soil excavated; however, a waiver would be justified for the remaining other contaminants in soil above cleanup levels that would attain an equivalent standard of performance by preventing exposure to soil with contamination level above cleanup levels. The cost estimate is based on 30 years of monitoring and maintenance; however, this could extend beyond the estimation period. The ADEC would likely grant a *"Cleanup Complete Status with LUCs"* for site closure.

Excavation, cap installation, and LUCs would be implemented during the first year of construction; however, lack of local equipment and materials could extend the construction season another year. Approximately 6,315 yd^3 of TCE contaminated soil would be excavated from select locations from the AC&W Site that the eastern edge of former Composite Building and south of the North Radar Building. Excavation of hotspots would be completed using heavy equipment. Confirmation samples would be collected from the sidewalls and bottom of the excavated areas followed by placement of clean fill obtained locally. Impacted soils would be consolidated for off-site transport and disposal via barge transport.

Cap construction, maintenance, monitoring, and LUCs described under Alternative 4 would generally be the same as those described for Alternative 3; however, the capped footprint would be comparatively smaller.

2.12.5 Alternative 5: Excavation and Off-site Disposal

Estimated Costs: $14.11 million (2019)
Estimated Construction Timeframe: 1-2 years (or more)
Estimated Time to Achieve RAOs: 1-2 years (based on Construction Completion)

This alternative consists of excavation and off-site of the entire footprint of the soil containing COCs above their respective cleanup levels. The volume of excavated soil would be approximately 17,635 yds^3. Excavation would be performed at variable depths based on the historical and 2016 RI sampling results. Confirmation samples would be collected from the sidewalls and bottom of the excavated areas followed by placement of clean fill obtained locally or other source pending availability. The excavation would be backfilled with clean fill obtained locally or in Anchorage, Alaska.

Excavation activities under this alternative are estimated to be completed in one construction year; however, this could take two or more years due to seasonal construction limitations, and limited availability for marine transportation services. No five-year reviews would be conducted based on the estimated 1-2 year estimated construction timeframe. A closeout report would be prepared after post excavation confirmation sample results determine that ROAs have been achieved. The ADEC would likely grant a *"Cleanup Complete Status"* for site closure.

2.13 Description of POL Remedial Alternatives under DERP

Because the POLs are partially co-located with impacts from CERCLA COCs, and the remedial methods considered under CERCLA are also applicable to the POLs, the remedial actions considered are the same.

2.13.1 Alternative 1: No Action

Under the No Action alternative, the AC&W Site would be left in its current state with no activities to control or mitigate exposure to POLs at the Site. The long-term natural attenuation processes will reduce soil impacts over time, however, investigations at the Site have determined that POLs are present at concentrations that may be detrimental to human health and the environment.

2.13.2 Alternative 2: Phytoremediation

Phytoremediation will be used to address the POLs in shallow soils. The remedy would involve planting native willows and other suitable vegetation such as native grasses at the Site and fertilizing till they take root. The plant roots would absorb and process the POLs, removing them from the soil.

DRO impacted soils (approximately 58 yd^3) are all less than 4 feet in depth and would remain on site for phytoremediation.

Approximately 1,300 yd^3 of PAHs impacted soils would be excavated and spread on the surface for phytoremediation.

2.13.3 Alternative 3: Capping and LUCs

This would include installation of a low-permeability cap placed over the entire surface covering approximately 1.4 acres of DRO and PAH impacted soils that poses an imminent and substantial endangerment. Capping would involve site preparation such as clearing and grubbing, compaction of subgrade and regrading prior to placement of a cap. Regrading would be performed to eliminate surface ponding and adjust slopes to route surface run-off and precipitation away from the contaminated soil. Depending on the site-specific reuse of the site, capping may consist of a soil barrier, or asphalt paving, or other low-permeable material meeting the performance objectives. The type of capping would be finalized in the design phase.

2.13.4 Alternative 4: Excavation and Off-site Disposal

This consists of excavation and off-site disposal of the entire footprint of the DRO and PAH impacted soil. The volume of excavated soil is estimated to be approximately 11,293 yd^3. Soil removed from the areas of contamination would be backfilled with clean fill.

2.14 Comparative Analysis of Alternatives

2.14.1 CERCLA

The Feasibility Study provided a detailed analysis of the remedial alternatives developed to address contaminated soil at the Site. For PCBs and TCE, the remedial alternatives were evaluated based on the nine evaluation criteria established under CERCLA. Each alternative must meet the threshold criteria of overall protection of human health and the environment and compliance with ARARs for CERCLA-regulated compounds. Five balancing criteria are used to analyze the alternatives: long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost. Two additional modifying criteria, state acceptance and community acceptance, were evaluated based on public comments on the PP.

Overall Protection of Human Health and the Environment

- **Alternative 1 - No Further Action** is not protective of human health and the environment. This Alternative is therefore discarded from further consideration.

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** protects human health and the environment. Excavation would remove COCs in deeper soil and PCBs in shallow soil, and long-term phytoremediation is expected to degrade remaining COCs in shallow soils.

- **Alternative 3 - Capping and LUCs** protects human health and the environment. Capping would control exposure pathways and reduce mobility; however, LUCs would be required to ensure protectiveness.

- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** protects human health and the environment. Selective excavation of TCE above cleanup levels would achieve maximum source control for this contaminant, and capping would be comparable to Alternative 3 for remaining contaminants.

- **Alternative 5 - Excavation and Off-site Disposal** protects human health and the environment and provides maximum protection through direct removal of COCs above cleanup levels.

Compliance with Applicable or Relevant and Appropriate Requirements

CERCLA Section 121(d) and NCP § 399.430(f)(1)(ii)(B) require onsite remedial actions to at least achieve federal environmental ARARs, or more stringent state environmental ARARs, upon completion of the remedial action, unless such ARARs are waived under CERCLA Section 121(d)(4). Evaluation of this criterion addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other federal and State environmental statutes or provides a basis for invoking a waiver.

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** complies with ARARs.
- **Alternative 3 - Capping and LUCs** would not comply with ARARs but both would meet performance objectives and require an ARAR waiver.
- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** would not comply with ARARs but both would meet performance objectives and require an ARAR waiver.
- **Alternative 5 - Excavation and Off-site Disposal** complies with ARARs.

Long-Term Effectiveness and Permanence

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** degrades and permanently removes COCs from the Site over time (e.g., 20-year estimate).
- **Alternative 3 - Capping and LUCs** controls long-term exposure and COC migration but requires maintenance and effective LUCs to preserve the integrity of the cap.
- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** is the same as Alternative 3; however, TCE contaminated soil would be removed from the Site.
- **Alternative 5 - Excavation and Off-site Disposal** permanently removes COCs from the Site in the shortest period of time.

Reduction of Toxicity, Mobility, or Volume

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** incorporates phytoremediation that reduces the toxicity, mobility, and volume of COCs through in-situ treatment.
- **Alternative 3 - Capping and LUCs** reduces the mobility of COCs, but there is no anticipated reduction in toxicity and volume.

- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** is the same as Alternative 3; however, excavation of TCE impacted soil would result in a direct reduction in toxicity, mobility, and volume of this compound.

- **Alternative 5 - Excavation and Off-site Disposal** soil removal reduces toxicity, mobility, and volume of COCs at the Site.

Short-Term Effectiveness

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** has a minimal short-term risk during construction and operation based on the least amount of direct soil removal amongst alternatives requiring excavation; and minimal preparations are required for phytoremediation implementation.

- **Alternative 3 - Capping and LUCs** has moderate short-term risks due to construction activities associated with surface cap construction.

- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** has relatively high short-term risks based on greater volumes of TCE impacted soil requiring excavation, handling, and transportation; however, moderate short-term risks are associated with the cap construction component.

- **Alternative 5 - Excavation and Off-site Disposal** has the greatest potential to impact visitors and workers based on the greatest volume of impacted soil requiring excavation, handling, and transportation.

Implementability

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** is implementable and employs a simple technology (i.e., phytoremediation) that requires minimal equipment and resources that are available locally. The presence of native willow vegetation at the Site is a good indicator for suitable plant species cultivation.

- **Alternative 3 - Capping and LUCs** is implementable but requires marine transportation services for equipment not available locally and administrative IC acceptance amongst stakeholders.

- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** is implementable but requires marine transportation services for equipment not available locally; transportation of excavation soil and administrative IC acceptance amongst stakeholders.

- **Alternative 5 - Excavation and Off-site Disposal** is implementable but poses the greatest logistical constraints regarding excavation, handling, and subsequent disposal of the greatest soil volumes amongst alternatives in a remote location.

Cost (2017)

- **Alternative 2 - Hot Spot Excavation and Phytoremediation** is a lower cost action alternatives at $4.15 million. This cost is considered equivalent to Alternative 2 and may be much less depending on the rate of phytoremediation.

- **Alternative 3 - Capping and LUCs** is the least expensive amongst action alternatives $3.93 million.

- **Alternative 4 - Limited Excavation/Off-site Disposal, Capping and LUCs** is the second most expensive amongst action alternatives at $8.08 million.

- **Alternative 5 - Excavation and Off-site Disposal** is the most expensive amongst action alternatives at $14.11 million. This is more than three times the cheapest alternative.

State/Support Agency Acceptance

This criterion evaluates whether the State of Alaska agrees with the analysis and recommendations resulting from the field investigations and the PP. ADEC has indicated a preference for Alternatives that fully remove or degrade COCs at the site. These would be Alternatives 2 (Hot Spot Excavation and Phytoremediation) and 5 (Excavation and Off-site Disposal).

The ADEC requested consideration of multiple sections of Alaska regulations as ARARs including 18 AAC 60 and 18 AAC 75. USACE has determined that some of these state regulations are not ARARs. The proposed ARARs and USACE's rationale for not considering them ARARs are discussed below:

- 18 AAC 60.010(a)(3) and (4): require that solid waste not be stored in a manner that causes a health hazard and/or polluted runoff. This regulation is not applicable to any of the alternatives because waste covered by this regulation is not being stored on site. As such, it does not meet the definition of an ARAR.
- 18 AAC 60.015: requires that contaminated waste be covered during transport and any spills occurring during transport be promptly picked up. This is not a cleanup standard, standard of control, or requirement that specifically addresses a CERCLA hazardous substance, pollutant, or contaminant; remedial action; or remedial location. This regulation does not impact how the remediation would happen, and therefore is not an ARAR. As a best management practice, USACE would cover loads during transportation.
- 18 AAC 75.340(k): provides direction on calculating cumulative risk under 18 AAC 75.325(g). A risk calculation is not a cleanup standard or a standard of control. Accordingly, this is not an ARAR.
- 18 AAC 75.355(b): requires that required sampling and analysis is conducted or supervised by a qualified environmental professional. This is not a cleanup standard, standard of control, or requirement that specifically addresses a

CERCLA hazardous substance, pollutant, or contaminant; remedial action; or remedial location. This regulation does not impact how the remediation would happen, and therefore is not an ARAR. As a best management practice, USACE uses qualified environmental personnel to conduct sampling and analysis.

- 18 AAC 75.355(d): Deals with POL contamination. CERCLA Section 101(14) specifically excludes petroleum from the definitions of hazardous substance and pollutant or contaminant. Accordingly, this is not an ARAR.
- 18 AAC 75.355(e): requires use of a DEC-approved lab. This is not a cleanup standard, standard of control, or requirement that specifically addresses a CERCLA hazardous substance, pollutant, or contaminant; remedial action; or remedial location. This regulation does not impact how the remediation would happen, and therefore is not an ARAR. As a best management practice, USACE utilizes ADEC-approved labs.
- 18 AAC 75.360: requires that the site cleanup is conducted or supervised by a qualified environmental professional. This is not a cleanup standard, standard of control, or requirement that specifically addresses a CERCLA hazardous substance, pollutant, or contaminant; remedial action; or remedial location. This regulation does not impact how the remediation would happen, and therefore is not an ARAR. As a best management practice, USACE ensures that the cleanup is conducted or supervised by a qualified environmental professional.

Although not considered ARARs, the requirements of 18 AAC 60.015, 18 AAC 75.340(k), and 355(b)(d)(e) will be incorporated into future planning documents as applicable.

Community Acceptance

The preferred alternative in the Proposed Plan was Alternative 2 (Hot Spot Excavation and Phytoremediation). The only comments received on the Proposed Plan were in concurrence with Alternative 2. The community expressed no preference for any alternative other than Alternative 2 and expressed no reservations about Alternative 2.

2.14.2 POLs

POL remedial alternatives were evaluated considering the following factors: Achievement of POL cleanup objectives, effectiveness, implementability, and cost. Of the five alternatives, only the POL Alternative 1: No Action Alternative was found to be unacceptable.

POL Alternatives 2, 3, 4, and 5 were found to be equally effective, implementable, and achieved remedial objectives. The cost of POL Alternative 2: Phytoremediation distinguished it as preferable to Alternatives 4 and 5, and degradation of the COCs over time distinguished it from Alternative 3.

2.15 Selected Remedy

2.15.1 Summary of Rationale for the Selected Remedy

The threshold criteria are: (1) providing for overall protection of human health and the environment and (2) compliance with ARARs. Alternative 1 was removed from further consideration since it met neither of the threshold criteria.

The selected remedy best balances the primary balancing criteria. These were: (1) long-term effectiveness and permanence, (2) reduction of toxicity, mobility or volume, (3) short-term effectiveness, (4) implementability and (5) cost.

2.15.2 Description of the Selected Remedy

The Selected Remedy is **Alternative 2 (Hot Spot Excavation and Phytoremediation).**

The Selected Remedy consists of two primary components that include excavation of hot spots and planting of non-invasive species to promote degradation of COCs (PAHs) through phytoremediation.

Excavation activities under this alternative would be conducted during the one-year construction time frame in addition to most of the phytoremediation component.

Excavation of hotspots would be completed using heavy equipment during the one-year construction timeframe. This would include the selective excavation of an estimated 2,504 yd^3 of soil to remove TCE impacted soils at depths greater than four feet, and 40 yd^3 of soil to remove PCB impacted soil. The TCE impacted soils would be segregated based on prior RI data. Confirmation samples would be collected from the sidewalls and bottom of the excavated areas followed by placement of clean fill obtained locally. Impacted soils would be consolidated separately for off-site transport and disposal via barge.

Phytoremediation would likely incorporate native willows as a primary species for soil remediation at the AC&W Site because it is native, adapted to survive in arctic environment, fast growing, and helps to facilitate treatment of COCs through phytovolatilization, rhizosphere degradation and enhanced microbial community. In addition, the AC&W Site is currently vegetated with diamond willow and likely to support other locally sourced species of willows. The COCs are primarily confined to surface and shallow subsurface soils.

No field study would be performed to evaluate the phytoremediation component since short term results would provide minimal benefit due to the time necessary for species establishment. However, pre-treatment sampling would be conducted to evaluate soil nutrients to formulate fertilizer recommendations to optimize soil conditions for phytoremediation. The evaluation would include pH, soil organic matter (SOM), cation exchange capacity (CEC), available nitrogen (N), and extractable phosphorus (P), potassium (K), and trace metals (Mn, Zn, B, Cu, Fe, Al, S, Ca, Mg, and Na). Species selection (e.g.,) grasses, native willow, would be compatible with City of Unalakleet requirements.

In addition, the Site was last sampled in 2015. Native plants have naturally revegetated many areas of the site. While 5 years is a relatively short time frame, some additional surface sampling may be performed in re-vegetated areas to estimate COC degradation during this time frame, and further adjust the timeframe for site closure. A remedial action work plan will be prepared/approved that will provide an approach to assessing need for soil amendments. Fertilizers and soil amendments would be applied as identified to promote plant nutrient capacity. Soil amendments such as peat moss or aged compost can be blended which would also improve aeration and enhance rhizodegradation of COCs.

Cuttings (e.g., native willows) would be planted directly into the soil beds, and grass seed applied using broadcasting methods to promote uniform application. The target planting depth of cuttings would be 10-12 inches, leaving 4-6 inches above the ground surface. Maintenance activities would be greatest during the first year of construction to promote root zone establishment and seed germination through watering as necessary. Minimal maintenance is anticipated thereafter but may include additional watering or application of fertilizer to augment soil nutrients.

A vehicle barrier and associated signage would serve as LUCs for the phytoremediation treatment area for the estimated 20-year duration of treatment. The barriers would remain in-place until performance monitoring results demonstrate that RAOs are achieved, or other actions considered warranted based on the five-year review.

Performance monitoring would be conducted every 5 years. This would include a baseline sampling event upon completion of the first construction year. Although soil samples would be collected from an estimated average depth of 4 ft. to evaluate soil contaminant degradation trends over time, depths and locations would likely vary based on established root zones and sample control point trends. Five-year reviews would be conducted for this alternative until the RAOs are met. A site closeout report would be prepared once RAOs are met. The Selected Remedy is anticipated to achieve UU/UE that would correspond with an ADEC *"Cleanup Complete Status"* for site closure.

2.15.3 Summary of the Selected Remedy Costs

The costs for the selected remedy are shown in Table 2.9:

Table 2.9: Costs for the Selected Remedy

Year	Cost (2017 Dollars)	Work Included
1	$47,500	Work Plan, and Site Closeout Documentation Reporting
2	$0	Variable (interim) start date pending seasonal work window
3	$2,395,000	Excavation, Off-site Disposal, and Phytoremediation
4	$90,300	Performance Monitoring and Maintenance
5	$90,300	Performance Monitoring and Maintenance
6	$90,300	Performance Monitoring and Maintenance
7	$90,300	Performance Monitoring and Maintenance

8	132,000	Performance Monitoring, Maintenance, Five Year Review Reporting
9	$90,300	Performance Monitoring and Maintenance
10	$90,300	Performance Monitoring and Maintenance
11	$90,300	Performance Monitoring and Maintenance
12	$90,300	Performance Monitoring and Maintenance
13	$132,000	Performance Monitoring, Maintenance, Five Year Review Reporting
14	$90,300	Performance Monitoring and Maintenance
15	$90,300	Performance Monitoring and Maintenance
16	$90,300	Performance Monitoring and Maintenance
17	$90,300	Performance Monitoring and Maintenance
18	$90,300	Performance Monitoring and Maintenance
19	$90,300	Performance Monitoring and Maintenance
20	$90,300	Performance Monitoring and Maintenance
Subtotal	**$4,061,000**	
	$88,000	Escalation (2.7% Cumulative Inflation from 2017 to 2019)
TOTAL	**$4,150,000**	

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a DD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

The full cost estimate table for the selected remedy can be found in Attachment B.

2.15.4 Expected Outcomes of the Selected Remedy

CERCLA

Upon achievement of cleanup levels and RAOs, the Selected Remedy is anticipated to achieve UU/UE that would correspond with an ADEC *"Cleanup Complete Status"* for site closure. This is expected to occur after 20 years of phytoremediation. Cleanup standards for PCBs are based on the most stringent default cleanup level of 1 mg/kg. The cleanup levels for the other Site COCs are based upon the most conservative calculated ADEC Method Three Alternative Cleanup Level for the respective exposure pathways shown below:

Table 2.10: Soil Cleanup Levels for CERCLA COCs at AC&W Site

COC	Cleanup Level (mg/kg)	Basis for Cleanup Level
PCBs	1	TSCA Remediation Waste (bulk)
Trichloroethylene (TCE)	0.044	ADEC Method Three MTGW

COC – Contaminant of Concern. mg/kg – milligrams per kilogram. MTGW – Migration to Groundwater. TSCA – Toxic Substance Control Act (40 CFR§ 761.61 (a)(4)(i)(A).)

POLs

The cleanup levels for the other Site COCs are based upon the most conservative calculated ADEC Method Three Alternative Cleanup Level for the respective exposure pathways shown below:

Table 2.11: Soil Cleanup Levels for POLs at AC&W Site

COC	Cleanup Level (mg/kg)	Basis for Cleanup Level
Benzo(a)anthracene	11	ADEC Method Three MTGW
Benzo(b)fluoranthene	15	ADEC Method Three HH
Benzo(k)fluoranthene	150	ADEC Method Three HH
Benzo(a)pyrene	1.5	ADEC Method Three HH
Chrysene	1,500	ADEC Method Three HH
Dibenzo(a,h)anthracene	1.5	ADEC Method Three HH
Indeno(1,2,3-c,d)pyrene	15	ADEC Method Three HH
Naphthalene	0.52	ADEC Method Three MTGW
Pyrene	1,300	ADEC Method Three MTGW
DRO (total)	3,800	ADEC Method Three MTGW

COC – Contaminant of Concern. HH – Human Health (Under 40-inch Zone). mg/kg – milligrams per kilogram. MTGW – Migration to Groundwater. TSCA – Toxic Substance Control Act (40 CFR§ 761.61 (a)(4)(i)(A).)

2.15.5 Statutory Determinations

CERCLA

Under CERCLA §121 and the NCP, selected remedies shall: be protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

Protection of Human Health and the Environment

The Selected Remedy, Alternative 2, will protect human health and the environment through the excavation and disposal of TCE-contaminated soil at depths below the established root zone of phytoremediation treatment. PCB contaminated soil above cleanup levels at one discrete location would also be excavated since they are not considered suitable for phytoremediation treatment. The remaining compounds would progressively degrade to below cleanup levels through continued phytoremediation treatment.

Installation of a vehicle barrier with signage around the treatment area would restrict access. The barrier and signs would limit potential exposure to contaminants in soil via incidental ingestion, inhalation, and dermal exposure over the course of phytoremediation treatment. Site restrictions would remain in-place for an estimated duration of 20 years, or until performance monitoring results demonstrate that RAOs are achieved.

No adverse cross-media impacts are expected based on the results of investigative studies performed at the Site and the nature of the selected remedy.

Compliance with Applicable or Relevant and Appropriate Requirements
The Selected Remedy of Hot Spot Excavation and Phytoremediation complies with ARARs. TCE in deeper soils and PCB contaminated soils above cleanup levels would be directly removed through excavation and the remaining COCs in shallow soils treated through phytoremediation until cleanup levels are achieved.

Table 2.12: ARARs Applied to Selected Remedy

Topic/ Alternative	Contaminants of concern	Regulation / Requirements Citation	Description
Chemical Specific			
Soil Excavation/ Alternative 2	PCBs 1 mg/kg	TSCA (40 CFR§ 761.61 (a)(4)(i)(A).)	These regulations provide soil cleanup levels for CERCLA constituents and provide the basis for the site cleanup levels.
	TCE 0.044 mg/kg	18 AAC 75.340 (a)(3), Method 3	ADEC Method Three Alternative Cleanup Level was calculated using the site-specific value for Total Organic Carbon (TOC) (0.0155 g/g), residential occupancy, under 40 inches of rainfall, migration to groundwater.
Action Specific			
Soil storage and disposal/ Alternative 2	TCE and PCBs	18 AAC 75.370(a)(1),(3),(5) and (6)	For alternatives that include excavation of TCE and PCB-contaminated soils and potential onsite storage or soil stockpiles. For example, not mixing clean and dirty soils, storage of TCE or PCB contaminated soils on a liner and covering soil stockpiles.

Cost-Effectiveness
In the lead agency's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short- term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this selected remedy was determined to be proportional to its costs and hence this remedy represents a reasonable value for the money to be spent.

The estimated cost of the Selected Remedy is $4.15 million. Alternative 3 and Alternative 4 both incorporate isolation through capping, necessitating an ARAR compliance waiver for either alternative. Although excavation and off-site disposal under Alternative 5 provides the maximum protection of human health and the environment; ARAR compliance; and long-term effectiveness and permanence, it is comparatively less favorable than the Selected Remedy regarding the reduction in toxicity mobility and volume through treatment or removal; short-term effectiveness; implementability; and cost. USACE believes that the Selected Remedy's provides adequate protection of human health and the environment and is cost-effective.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

USACE has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the project. Of those alternatives that are protective of human health and the environment and comply with ARARs, USACE has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element.

The Selected Remedy achieves a permanent solution to soil contaminants at the Site through selective excavation and off-site disposal of PCB and deep TCE soil contamination, and degradation of contaminants in shallow *in situ* soil through phytoremediation until cleanup levels are achieved.

Preference for Treatment as a Principal Element

By treating the predominant volume of impacted soil above cleanup levels through phytoremediation, the Selected Remedy incorporates treatment technologies by removing COCs through enhanced *in situ* degradation. By utilizing treatment as a remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

Five-Year Review Requirements

Since the Selected Remedy is estimated to achieve UU/UE over a 20-year treatment period, a CERCLA policy review will be performed every five years, as required by DoD and FUDS policy. Additional five-year reviews will be required if RAOs and cleanup levels to allow for UU/UE takes longer.

POLs

The following sections discuss how the Selected Remedy will address POL contamination.

Protection of Human Health and the Environment

The Selected Remedy, Alternative 2, will protect human health and the environment as the remaining compounds would progressively degrade to below cleanup levels through continued phytoremediation treatment. Installation of a vehicle barrier with signage around the treatment area would restrict access. Site restrictions would remain in-place for an

estimated duration of 20 years, or until performance monitoring results demonstrate that RAOs are achieved, which will be conducted in conjunction with the CERCLA policy review. No adverse cross-media impacts are expected based on the results of investigative studies performed at the Site and the nature of the selected remedy.

Cleanup Objectives
The Selected Remedy of Hot Spot Excavation and Phytoremediation will achieve relevant ADEC cleanup levels regarding POL contamination, thus remediating the imminent and substantial endangerment.

2.16 Documentation of Significant Changes

The Proposed Plan for the project was released for public comment on August 16, 2019. The Proposed Plan Identified Alternative 2 (Hot Spot Excavation and Phytoremediation) as the Preferred Alternative for soil remediation. USACE reviewed all written and verbal comments submitted during the public comment period, and the preferred alternative has not changed.

Part 3: Responsiveness Summary

This Responsiveness Summary provides responses to comments received by the US Army Corps of Engineers regarding the Proposed Plan for the Aircraft Control and Warning Main Complex Site, Unalakleet, Alaska. ADEC and the Unalakleet Native Corporation provided comments on the Proposed Plan and this Decision Document during document development as part of the ongoing coordination between USACE and these stakeholders. These comments were addressed in finalizing the documents.

3.1 Public Involvement

The Proposed Plan was released to the public on 16 August 2019. The public comment period on the Proposed Plan ended on 22 January 2020. The unusually long comment period was due to the public meeting being rescheduled from 11 September 2019 to 15 January 2020 due to limited lodging availability in Unalakleet. The public meeting held in Unalakleet on 15 January 2020 included representatives from USACE, Unalakleet Native Corporation, and the ADEC to discuss the Proposed Plan. A transcript of the public meeting is included in the Administrative Record for this project. USACE has given full consideration to all comments received.

Opportunity to solicit of comments on the Proposed Plan were made available through direct communication by participants attending the PP meeting at the Native Village of Unalakleet Community Building, mail, email, or phone. The only comments received were during the public meeting.

3.2 Comments and Responses

Comment 1: Dennis Towarak – What are the quantities of contamination in the area?

COE Response: TCE soil is about 6,300 yd^3, PAHs is 2,500 yd^3 and 40 yd^3 of PCB and a couple hundred yd^3 of diesel contaminated soil. The estimate for PCBs based on a single sample. It may be less than that. Most of the soil volume is the surface soils; that is where the PAHs are observed to be concentrated.

Comment 2: Lynda Towarak - It says in the notes the soil has been excavated, thermally treated on site, and buried at the Marteck landfill. Where is that located?

COE Response: Landfill is located on the map. The Marteck landfill is mostly filled with building debris. There's a cell that has asbestos debris.

Comment 3: Lynda Towarak - Is there potential for the water to drain down into the Brown subdivision? There are multiple wells there; has that been checked?

COE Response: Five wells were installed at the site and sampled. COCs were not detected. We also sampled all the seeps we could find at the base of the hill. No COCs were detected. Eight drinking water wells from the nearest residential area, located approximately 1 ½-mile west-southwest of the site, were also sampled and found not to

contain site-related COCs.

Comment 4: Lynda Towarak - Do you prioritize the different sites in Alaska? How do you decide which is the most contaminated and which needs the most remediation?

COE Response: We work with ADEC to determine which sites have the most risk and need to be cleaned up. Cost comes into consideration as well when determining priority, as well as how many people are at risk of exposure. A site near a village has a higher priority than a more remote site. We also look at what, if anything, can be done to reduce risk.

Comment 5: Melanie Sagound identified areas near the White Alice site that have not been tested.

COE Response: Not everything has been cleaned up thoroughly. COE agrees this other unrelated site is something that needs to be investigated and requests that any other contaminated sites be brought to their attention.

Comment 6: Lynda Towarak - When you remove the contaminated soil and gravel, where do you take it?

COE Response: It will be barged to the lower 48. There are hazardous waste landfills there. Some may be treated.

Comment 7: Dennis Towarak - There are state standards and federal standards on the size of material. Will you be sorting and then shipping it out or just packaging it and shipping it out?

COE Response: Probably sort out the larger rocks and take just the soil.

Comment 8: Lynda Towarak - There is a big cost difference. $2.55 million vs $14.11 million. Can the state afford it? Are they paying for it?

COE Response: The federal government is paying for it. The state just sets cleanup levels. If you get above a certain concentration, that's when you must clean it up.

Comment 9: Lynda Towarak - Are we below the contamination level? Except for those hot spots?

COE Response: We have a cleanup level based on the site-specific conditions. Right now, we have concentrations above that level, so this remedy is to bring all the concentrations below the clean-up level. Outside of these areas, the contamination levels are already below the cleanup levels.

Comment 10: Lynda Towarak – Who decided to consider a cap? It doesn't solve the problem. It just covers the problem.

COE Response: The CERCLA process involves considering every alternative that could work or be a solution. That includes capping.

Comment 11: John Henry Jr. - Have you looked at fungi remediation?

COE Response: The fungi roots don't go as deep as willows. It is usually more of a land farming remediation than a phytoremediation remediation.

Comment 12: Mark Johnson - Can you explain the difference between high and low? For instance, short term effectiveness is high on Alternative 2 and low on Alternative 5. What is the difference? What does that mean? (on the chart that compares alternatives against criteria)

COE Response: In the short term, during implementation of the remedy, the workers are more protected during Alternative 2, but not as well protected in Alternative 5. In Alternatives 2, 4, and 5, especially 2 and 5, the contamination is gone. In the long term, those alternatives are very effective, as compared to Alternative 3, where you'll still have those contaminants underground.

Comment 13: Lynda Towarak - Is the village corporation involved in the decision?

COE Response: The corporation is being advised now and agrees with selecting Alternative 2. The COE will only work on a site if the land owner agrees with it. The COE needs to get right of entry to work on their land.

Comment 14: Mark Johnson - One of the concerns is if Alternative 5 was chosen, it might mean it would take longer to get acceptance from the federal government so it might be another 10-20 years due to the higher cost.

COE Response: It is always easier to get funding for less expensive options.

Comment 15: Lynda Towarak – Is ADEC okay with this plan?

COE Response: ADEC is comfortable with the work that's been done and how much we've lowered the risk and uncertainties in risk. It looks like the site model is such that remediation will occur without a lot of additional work.

Comment 16: John Henry Jr. – Will there be fences for site control?

COE Response: No, we aren't proposing fencing because there is not a risk for occasional visitors or people walking on the site. We propose signs asking people not to cut down any trees and bollards to prevent vehicles from running over the vegetation.

Comment 17: Concerns about state and federal administration changes. Have changes to laws made cleanup levels lower or higher? Are state budget cuts impacting

project?

COE Response - No, over time the clean-up levels have become more stringent as we get more information. In some cases, cleanup levels have gotten higher, but that is because new science has shown the compounds to be less toxic than previously thought.

Comment 18: Lynda Towarak – Do different toxins degrade over time and at different rates? Which one is the longest?

COE Response: Yes. Different compounds degrade at different rates. Complex molecules degrade slower than simple ones.

Comment 19: Lynda Towarak – Is the main concern for the long period of degradation of PCBs and TCE at the site?

COE Response - Yes. TCE does degrade, but much slower than PAHs or DRO. PCBs have negligible degradation rates.

Part 4: References

40 Code of Federal Regulations (CFR) 300. National Oil and Hazardous Substances Pollution Contingency Plan. Available at: http://ecfr.gov.

Alaska Department of Environmental Conservation (ADEC). 2008. Cumulative Risk Guidance. Division of Spill Prevention and Response, Contaminated Sites Program. 9 June.

———. 2014. Method Three & Cumulative Risk Calculator. Contaminated Sites Program. Available at: http://dec.alaska.gov/applications/spar/webcalc/index.htm.

_____. 2016. Fact Sheet: The Cleanup Process. April. Available at: http://dec.alaska.gov/spar/Contaminated Sites/ADEC Cleanup Process.pdf.

_____. 2021. 18 AAC 75 Oil and Other Hazardous Substances Pollution Control Public, June 24, , 2021.

_____. 2019. ADEC Online Cleanup Levels Calculator, February 2019.

BLM (U.S. Department of the Interior, Bureau of Land Management). 2017. Spatial Data Management System. Accessed July 12, 2017. https://sdms.ak.blm.gov/scanned_images_temp/PA_5020040462_07122017153311.pdf#toolbar=1&navpanes=1&pagemode=thumbs

USACE (United States Army Corps of Engineers. 1989. Findings and Determination of Eligibility (FDE) Report: Unalakleet Air Force Station. Project No. FlOAK000036.

———. 2001. Final Remedial Action Report DERP, Unalakleet and North River Sites.

———. 2002. Site Investigation Report Formerly Used Defense Sites Unalakleet, Alaska. February.

———. 2003a. Draft Preliminary Assessment Report Unalakleet Air Force Station Unalakleet, Alaska. Prepared by Weston Solutions Inc. February.

———. 2003b. Engineering Evaluation and Cost Analysis Removal Action at Formerly Use Defense Sites Unalakleet, Alaska. November. Alaska. Prepared by Weston Solutions, Inc. February.

———. 2004. Formerly Used Defense Sites (FUDS) Program Policy Regulation No. 200-3-1

———. 2006. Barrel Removal, Contaminated Soil Removal, and Site Characterization Report Unalakleet, Alaska. Prepared by Jacobs Engineering Group Inc. July.

———. 2007. Removal Action and Site Characterization Report Unalakleet, Alaska. Prepared by Jacobs Engineering Group Inc. June.

———. 2008. Final Feasibility Study, F10AK003603, HTRW, Unalakleet Air Force Station, Unalakleet, AK. Prepared by ENSR Corporation. October. F10AK003603_04.09_0500_a

———. 2009. Final Decision Document Unalakleet Air Force Station Formerly Used Defense Site. Prepared by AECOM Technical Services, Inc. June. F10AK003603_05.09_0500_a

———. 2013. Final 2012 Remedial Action Report and Supplemental Remedial Investigation Report for Site 25. Prepared by Bethel Services Inc. June. F10AK003603_07.08_0004_p

———. 2016. Final Remedial Investigation Report. Unalakleet Air Force Station Formerly Used Defense Site. Aircraft Control and Warning Main Complex, Unalakleet, Alaska. Prepared by AECOM Technical Services, Inc. December. F10AK003605_03.10_0500_a

———. 2018. Final Feasibility Study, Unalakleet Air Force Station, Formerly Used Defense Site, Aircraft Control and Warning Main Complex, (F10AK003605), Unalakleet Alaska. F10AK003605_04.09_0001_a

_____. 2019. Technical Memorandum for Record. Amendment of the Remedial Investigation Report dated December 2016 and the Feasibility Study Report dated December 2018 to Incorporate Updated Risk Calculations and Discussion, Unalakleet Air Force Station Formerly Used Defense Site Aircraft Control and Warning Main Complex, Unalakleet Alaska. F10AK003605_04.09_0002_a

———. 2020. Final proposed Plan, Unalakleet Air Force Station, Formerly Used Defense Site, Aircraft Control and Warning Main Complex, (F10AK003605), Unalakleet Alaska. F10AK003605_04.10_0001_a

Figures

Figure 1: Site Overview

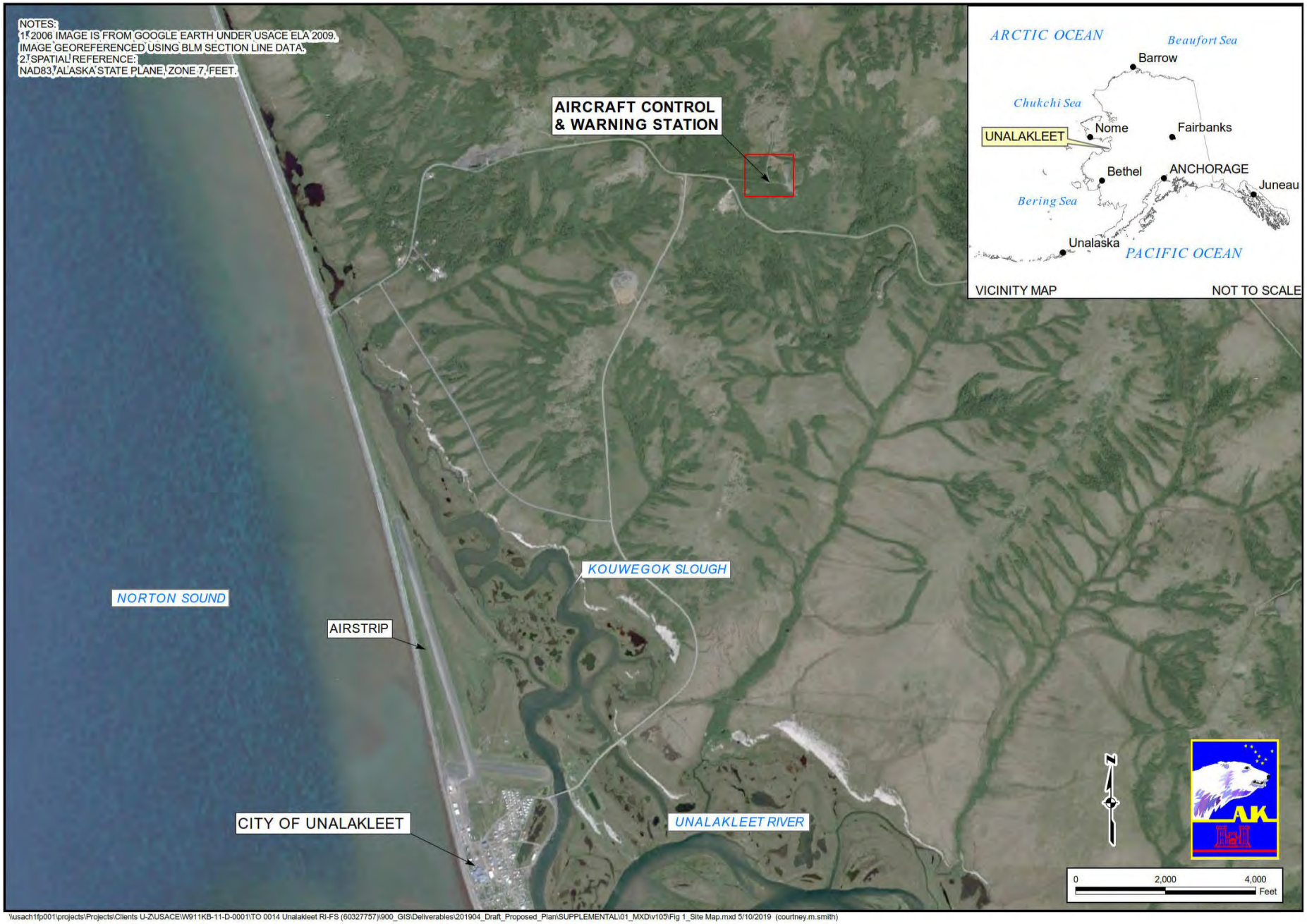


Figure 2: Former Site Features

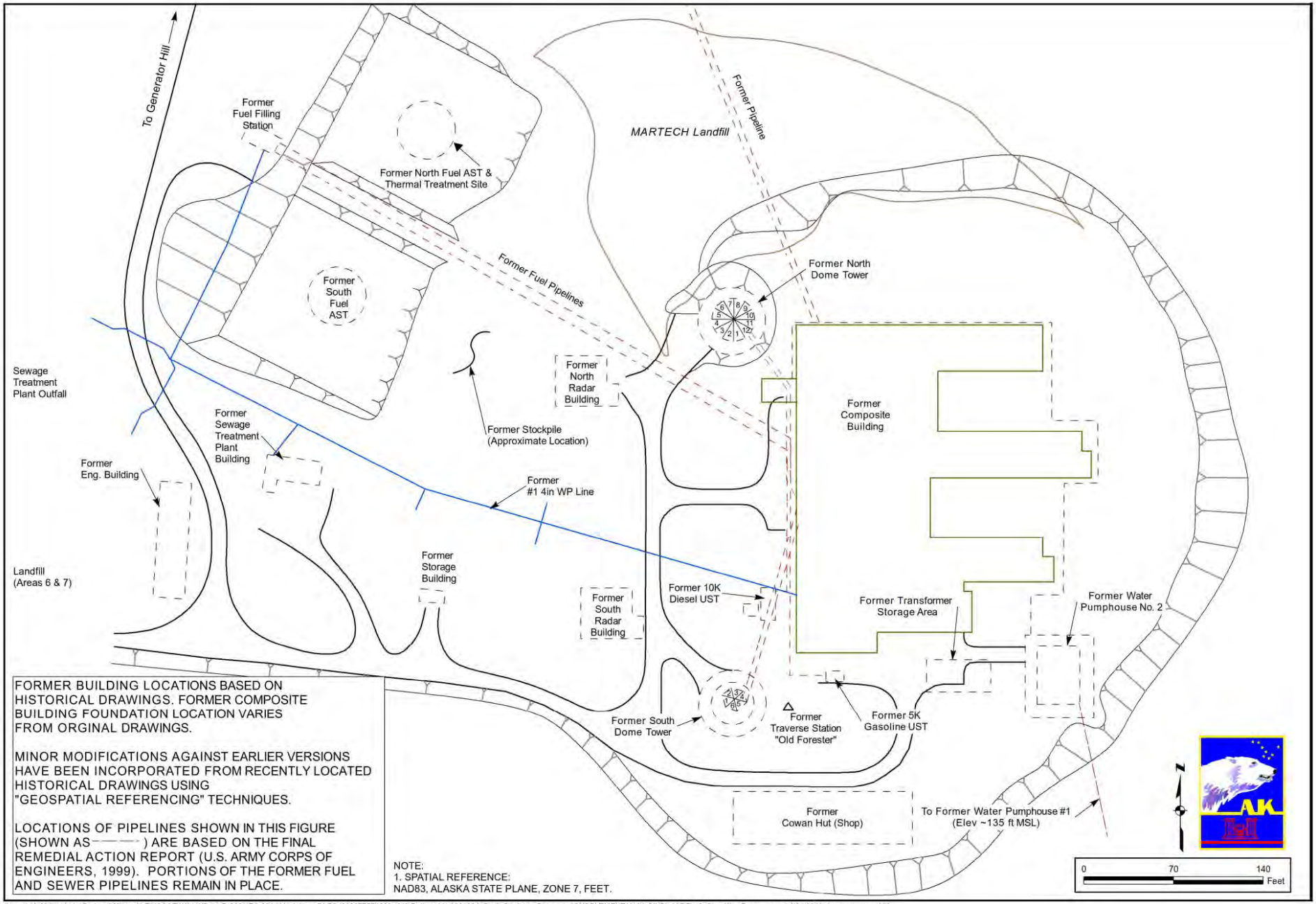


Figure 3: Extent of Contamination Above Cleanup Levels

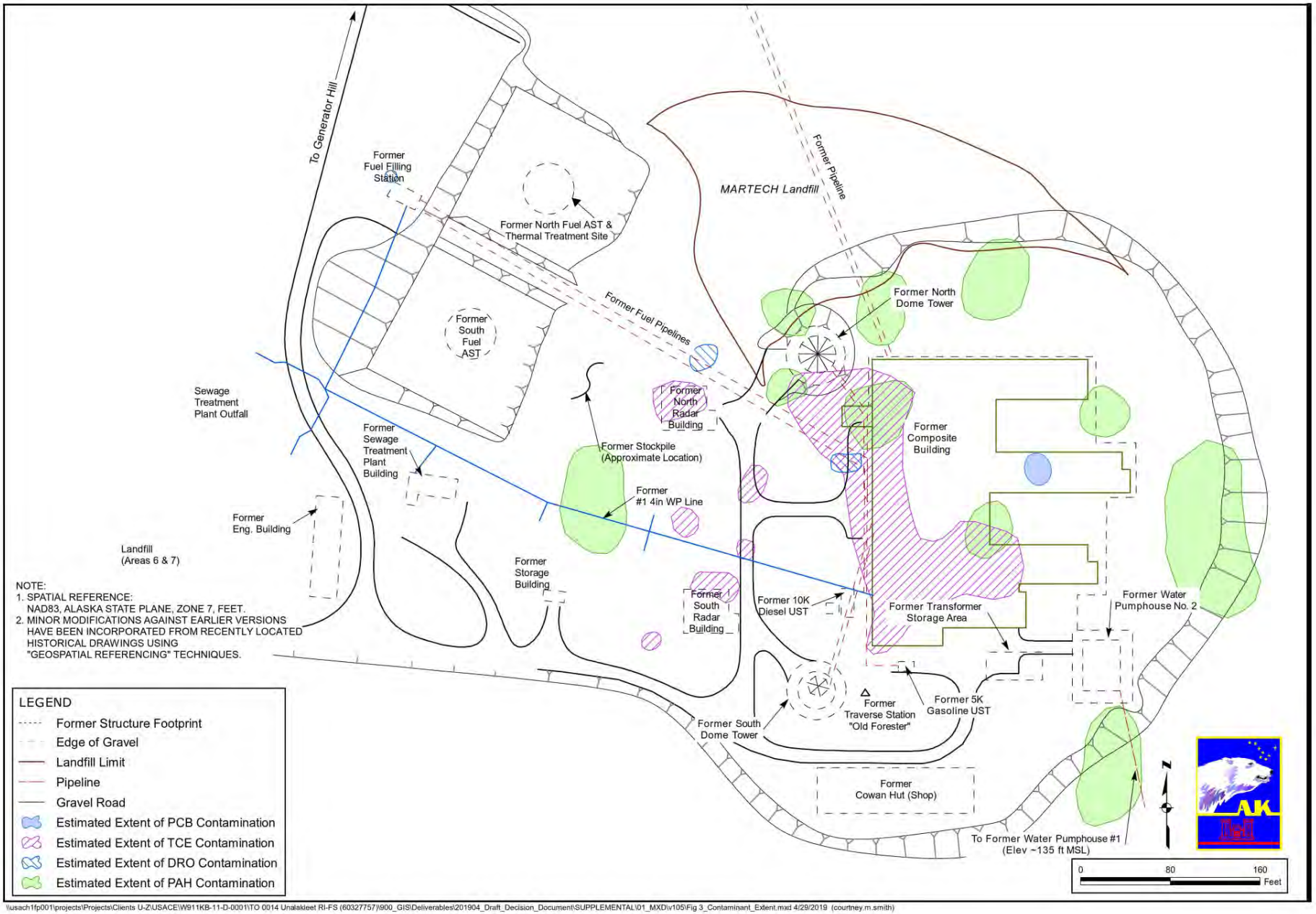
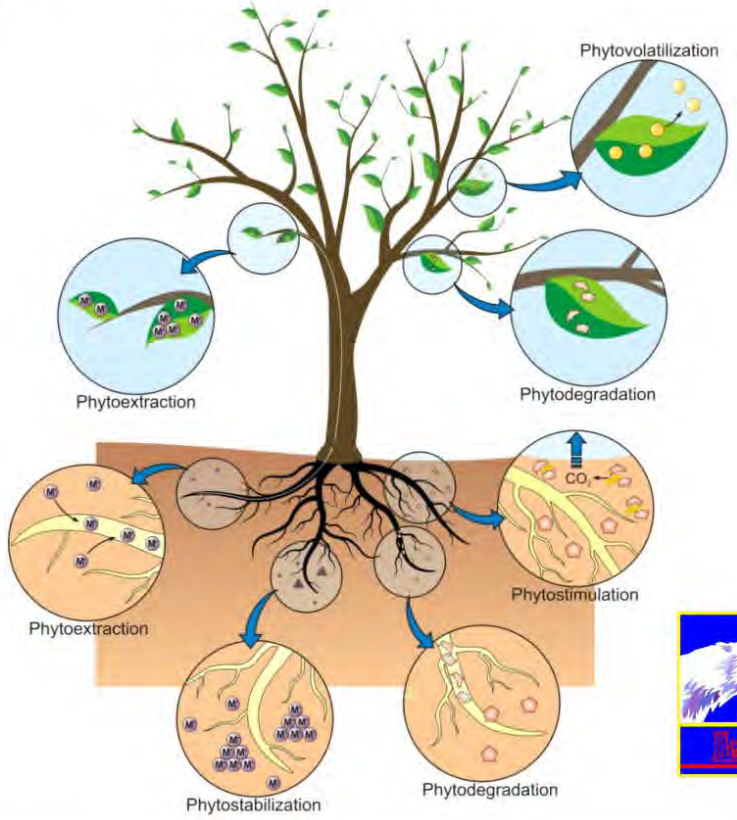


Figure 4: **Alternative 2 Hot Spot Excavation and Phytoremediation Example**

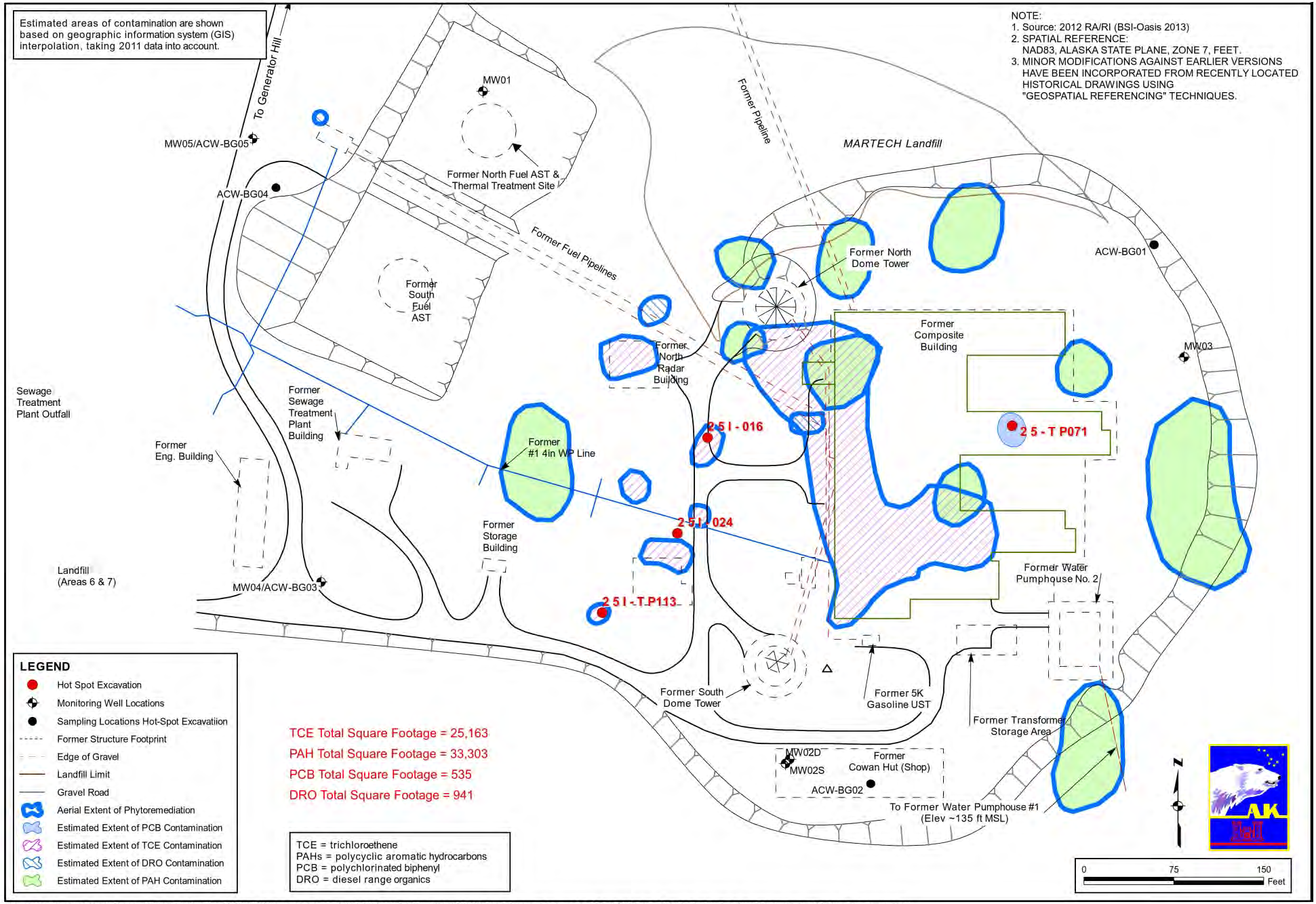
Hot spot excavation would be limited to a few locations Waste treatment or disposal would depend on waste characterization.

Planting of suitable vegetation to promote degradation. Arctic willow/fescue grass appear to be suitable.



\\usach1fp001\projects\Projects\Clients U-Z\USACE\W911KB-11-D-0001\TO 0014 Unalakleet RI-FS (60327757)\900_GIS\Deliverables\201904_Draft_Decision_Document\SUPPLEMENTAL\01_MXD\v105\Fig 4_Alternative2Hotspot.mxd 4/24/2019 (courtney.m.smith)

Figure 5: Alternative 2 Hot Spot Excavation and Phytoremediation Location



\\usach1fp001\projects\Projects\Clients U-Z\USACE\W911KB-11-D-0001\TO 0014 Unalakleet RI-FS (60327757)\900_GIS\Deliverables\201904_Draft_Decision_Document\SUPPLEMENTAL\01_MXD\v105\Fig 5_Alt2_HotSpot_Phyto_Loc.mxd 4/29/2019 (courtney.m.smith)

Attachment A
Human Health and Ecological Conceptual Site Models

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Unalakleet AFS FUDS- Site 25 AC&W Station

Completed By: AECOM

Date Completed: 04 January 2016

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1) *Check the media that could be directly affected by the release.*

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.*

Media	Transport Mechanisms	check
☑ Surface Soil (0-2 ft bgs)	Direct release to surface soil	check soil
	☑ Migration to subsurface	check soil
	☑ Migration to groundwater	check groundwater
	☑ Volatilization	check air
	☐ Runoff or erosion	check surface water
	☑ Uptake by plants or animals	check biota
	☐ Other (list):	
☑ Subsurface Soil (2-15 ft bgs)	Direct release to subsurface soil	check soil
	☑ Migration to groundwater	check groundwater
	☑ Volatilization	check air
	☐ Uptake by plants or animals	check biota
	☐ Other (list):	
☐ Ground-water	Direct release to groundwater	check groundwater
	☐ Volatilization	check air
	☐ Flow to surface water body	check surface water
	☐ Flow to sediment	check sediment
	☐ Uptake by plants or animals	check biota
	☐ Other (list):	
☐ Surface Water	Direct release to surface water	check surface water
	☐ Volatilization	check air
	☐ Sedimentation	check sediment
	☐ Uptake by plants or animals	check biota
	☐ Other (list):	
☐ Sediment	Direct release to sediment	check sediment
	☐ Resuspension, runoff, or erosion	check surface water
	☐ Uptake by plants or animals	check biota
	☐ Other (list):	

(3) *Check all exposure media identified in (2).*

(4) *Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5) *Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.*

Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ soil	☑ Incidental Soil Ingestion	F	F	C/F	F	C/F	C/F	C/F
	☑ Dermal Absorption of Contaminants from Soil	F	F	C/F	F	C/F	C/F	C/F
	☐ Inhalation of Fugitive Dust							
☑ groundwater	☑ Ingestion of Groundwater	F	F	C/F	F	C/F	C/F	C/F
	☑ Dermal Absorption of Contaminants in Groundwater	F	F	C/F	F	C/F	C/F	C/F
	☑ Inhalation of Volatile Compounds in Tap Water	F	F					
☑ air	☑ Inhalation of Outdoor Air	F	F	C/F	F	C/F	C/F	
	☑ Inhalation of Indoor Air	F	F					
	☑ Inhalation of Fugitive Dust	F	F	C/F	F	C/F	C/F	
☐ surface water	☐ Ingestion of Surface Water							
	☐ Dermal Absorption of Contaminants in Surface Water							
	☐ Inhalation of Volatile Compounds in Tap Water							
☐ sediment	☐ Direct Contact with Sediment							
☑ biota	☑ Ingestion of Wild or Farmed Foods	F	F	C/F	F	C/F	C/F	C/F

This page intentionally left blank

Print Form

Human Health Conceptual Site Model
Scoping Form

Site Name: Unalakleet AFS FUDS - AC&W Main Complex

File Number: F10AK0036-05

Completed by: AECOM

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☒ ASTs
- ☒ Dispensers/fuel loading racks
- ☒ Drums
- ☒ Vehicles
- ☒ Landfills
- ☒ Transformers
- ☐ Other:

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☒ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☒ Air
- ☐ Sediment
- ☒ Groundwater
- ☐ Surface water
- ☒ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☒ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☒ Subsistence harvester (i.e. gathers wild foods)
- ☒ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

Surface (0-2 feet bgs) soil has been directly impacted from various sources. Primary chemicals of concern are trichloroethene (TCE), diesel-range organics (DRO), polycyclic aromatic hydrocarbons (PAH), and polychlorinated biphenyl (PCBs).

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

PAHs and PCBs are some of the primary chemicals of concern.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

This pathway is considered complete; however COPCs detected in samples collected from recently installed on-site groundwater monitoring wells and off-site seep locations do not exceed 1/10th of the project action levels.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☐

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Sampling of groundwater seeps downgradient of the former AC&W complex have not detected COPCs in excess of 1/10th the project action levels. Surface water has not been identified on-site.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Complete

Comments:

Ingestion of wild foods for subsistence purposes could be a potential exposure pathway for site visitors, trespassers, recreational users, subsistence harvesters and subsistence consumers, and residents. Another investigation determined that ingestion of subsistence vegetation is an insignificant pathway.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

TCE is a primary chemical of concern.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

This pathway is only considered complete should a future building be constructed on-site.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are assumed to be protective of this pathway.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Groundwater data obtained during the RI indicate COPCs in groundwater do not exceed 1/10th of project action levels. There is currently no residential water use (i.e., showering, laundering, dish washing, etc.) and no potable water wells are present on or around the Site.

Groundwater seeps were identified downgradient of the former AC&W main complex and off-site. Samples collected from these locations, both recent and historical, do not contain COPOCS in excess of 1/10th the project action levels. No surface water has been identified on-site.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are assumed to be protective of this pathway.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

No residential water use (showering, laundering, and dish washing) is present or anticipated on-site. There are no COPCs in groundwater that exceed 1/10th of project action levels.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.
- Chromium is present in soil that can be dispersed as dust particles of any size.

Generally, DEC direct contact soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because it is assumed most dust particles are incidentally ingested instead of inhaled to the lower lungs. The inhalation pathway only needs to be evaluated when very small dust particles are present (e.g., along a dirt roadway or where dusts are a nuisance). This is not true in the case of chromium. Site specific cleanup levels will need to be calculated in the event that inhalation of dust containing chromium is a complete pathway at a site.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

A typical lithological profile at the site consists of a few feet of organics, sand, silt, and clay; and a few feet of weathered schist underlain by fractured schist bedrock.

Non-volatile compounds (PAHs) have been detected above PALs in surface soil (0-2 ft) and may be present in the top 2 cm of the soil column. Chromium is not a chemical of concern for the site.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

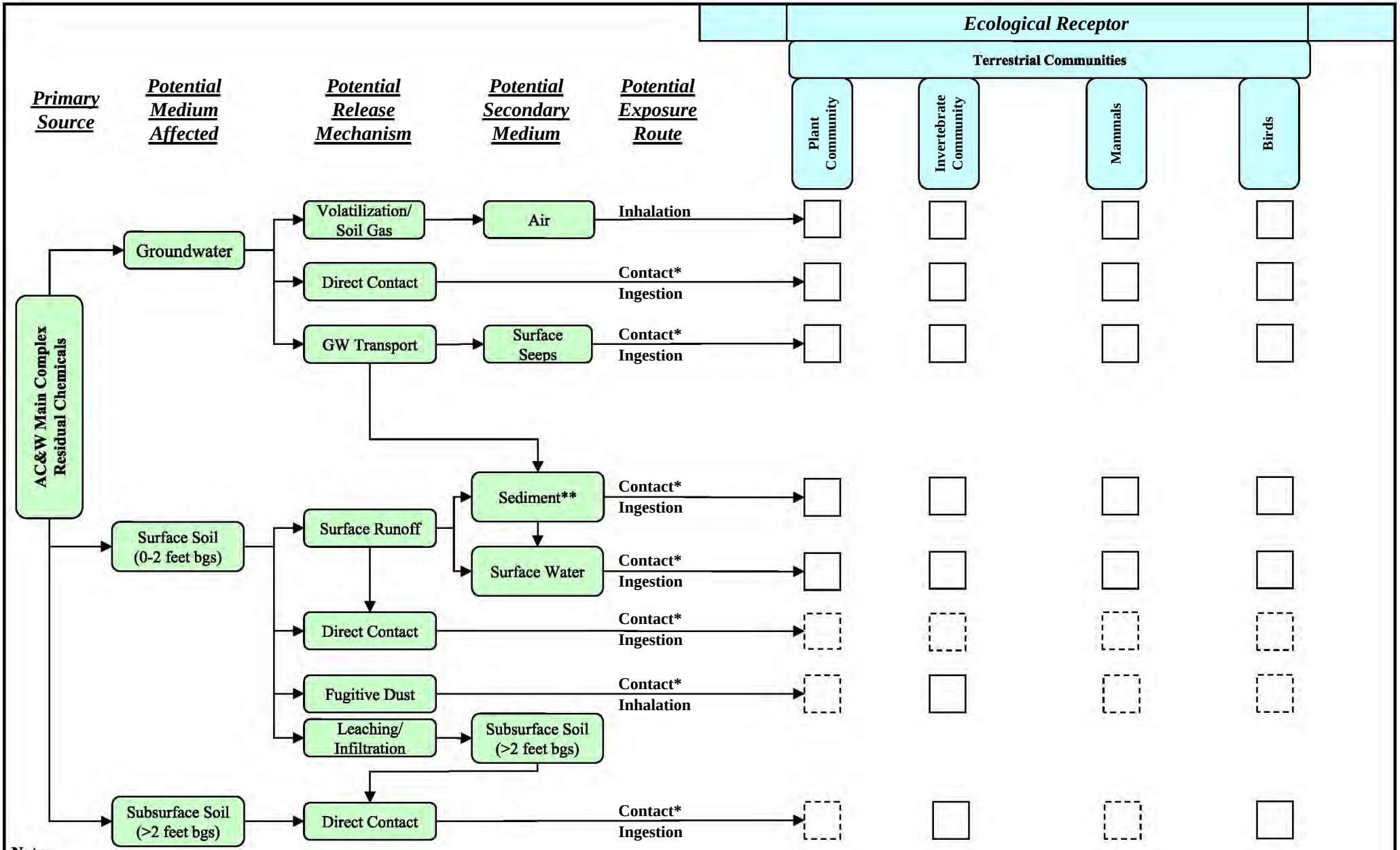
Check the box if further evaluation of this pathway is needed: ☐

Comments:

No sediment is present at the site.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

This page intentionally left blank



Notes:

- Incomplete Exposure Pathway
- Complete but Insignificant Exposure
- Complete and Significant Exposure

Soil horizons per ADEC CSM Guidance (ADEC 2010). The shallow interval (0-2 ft bgs) encompasses the biologically active zone relevant for most ecological exposures (i.e., 1 ft. bgs, per Anderson et al., 2010)

*Contact includes uptake directly from indicated medium for community level receptors; dermal contact is considered insignificant for ecological receptors. Uptake for wildlife assumes direct contact (ingestion of medium) and uptake via biota in diet.

Pathways identified as incomplete and complete but insignificant will be reevaluated pending review of information collected for the Remedial Investigation (RI).

AECOM

RI Report, Unalakleet AFS FUDS-AC&W Main Complex Unalakleet, Alaska	Revised Ecological Conceptual Site Model
DATE: 04 January 2016	Appendix K.2

This page intentionally left blank

ADEC Ecoscoping Form

Site Name:	**Unalakleet AFS FUDS –AC&W Main Complex**
Completed by:	**AECOM Technical Services, Inc.**
Date:	**04 January 2016**

Instructions: Follow the italicized instructions in each section below. "Off-ramps," where the evaluation ends before completing all of the sections, can be taken when indicated by the instructions. Comment boxes should be used to help support your answers.

Note: this is a preliminary evaluation. This scoping form will be updated following site visits.

1. Direct Visual Impacts and Acute Toxicity

Are direct impacts that may result from the site contaminants evident, or is acute toxicity from high contaminant concentrations suspected? C*heck the appropriate box.*

☐ Yes – *describe observations below and evaluate all of the remaining sections without taking any off-ramps.*
☒ No – *go to next section.*

Comments: No visually impacted areas (soil staining) are evident at the AC&W main complex. While impacts have been measured in soil, no evidence of acute toxicity to vegetation or wildlife is observed at the Site.

2. Receptor-Pathway Interactions

Check each terrestrial and aquatic pathways that could occur at the site.

Terrestrial Pathway Interactions

☐ Exposure to water-borne contaminants as a result of wading or swimming in contaminated waters or ingesting contaminated water
☐ Contaminant uptake in terrestrial plants whose roots are in contact with contaminated surface water
☐ Contaminant migration via saturated or unsaturated groundwater zones and discharge at upland "seep" locations (not associated with a wetland or water body)
☐ Contaminant uptake by terrestrial plants whose roots are in contact with groundwater present within the root zone
☒ Particulates deposited on plants directly or from rain splash
☒ Contaminants dissolved into moisture in the soil, making them available to roots
☒ Incidental ingestion and/or exposure while animals grub for food, burrow or groom
☒ Inhalation of fugitive dust or vapors disturbed by foraging or burrowing activities

☒ Bioaccumulatives (see the *Policy Guidance on Developing Conceptual Site Models*) taken up by soil invertebrates, which are in turn eaten by higher food chain organisms
☐ Other site-specific exposure pathways

Aquatic Pathway Interactions

☐ Contaminated surface runoff migration to water bodies through swales, drainage ditches, or overland flow
☐ Aquatic receptors exposed through osmotic exchange, respiration, or ventilation of surface waters
☐ Contaminant migration via saturated or unsaturated groundwater zones and discharge at "seep" locations along banks or directly to surface water
☐ Deposition into sediments from upwelling of contaminated groundwater
☐ Aquatic receptors may be exposed directly to contaminated sediments through foraging or burrowing, or indirectly exposed due to osmotic exchange, respiration, or ventilation of sediment pore water.
☐ Aquatic plants rooted in contaminated sediments
☐ Bioaccumulatives (see the *Policy Guidance on Developing Conceptual Site Models*) taken up by sediment invertebrates, which are in turn eaten by higher food chain organisms
☐ Other site-specific exposure pathways

If any of the above boxes are checked go on to the next section. If none are checked, end the evaluation and check the box below.

☐ ***OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY***

Comments:

The AC&W main complex is located in an upland area of the Nulato Foothills northeast of Unalakleet. The foothills are sparsely forested, with spruce, paper birch, aspen, alder, willow, and balsam poplar trees. Ground cover vegetation includes shrubs, grass, flowers, berries, lichen, and moss. Drainage areas are characterized by tall grasses, and muskeg occurs in low-lying areas (BSI-Oasis 2011).

While some of the above habitat characteristics are present at the Site, they are limited under current conditions. Approximately one-third of the site has been cleared of vegetation as a result of remedial action and is characterized by compact ground/fill material. The area of the Site with vegetative cover provides marginal habitat that is in a state of recovery due to past disturbance/compact soil. These areas are characterized by presence of grasses and scrub-shrub with sparse distribution of young trees, primarily covering the Martech Landfill and former Composite Building footprint.

Surface soil contamination, including bioaccumulative compounds, has been identified at the AC&W main complex. DDT was detected at several locations at the Site but at low concentrations. PCBs have been detected in surface soil as well, but also at low

concentrations and in a very limited area delineated by samples where PCBs were not detected.
No aquatic habitat is present on or adjacent to the Site. Groundwater may seasonally discharge to distant (off site) seeps; however the likelihood of potential impacts at these locations is low given the change in elevation vertically (approx. 350-400 ft) between the top of the site to downgradient seep locations, as well as the long lateral distance (about one mile) groundwater travels before discharging at the seeps. Also, current data do not indicate impacts in groundwater above regulatory standards.

3. Habitat

Check all that may apply. See Ecoscoping Guidance for additional help.

- ☐ Habitat that could be affected by the contamination supports valued species (i.e., species that are regulated, used for subsistence, have ceremonial importance, have commercial value, or provide recreational opportunity)
- ☐ Critical habitat or anadromous stream in an area that could be affected by the contamination
- ☐ Habitat that is important to the region that could be affected by the contamination
- ☐ Contamination is in a park, preserve, or wildlife refuge

If any of the above boxes are checked go on to the next scoping factor. If none are checked, end the evaluation and check the box below.

☒ ***OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY***

Comments:

The lack of quality ecological habitat at present and localized nature of existing soil impacts precludes the need for an ecological risk assessment based on current information. At present, ecological habitat is limited at the Site and the presence of wildlife is expected to be incidental, especially given that richer undisturbed upland habitat is present nearby. A variety of terrestrial mammals inhabit the Unalakleet area and species that could inhabit forest areas near the Site does include game animals (bear, moose and caribou). Other non-game species (e.g., gray wolf, red fox, lynx, porcupine, marten/weasel, ground squirrel, tree squirrel, wolverine, and hare) also occur regionally.

With consideration for future conditions, where full recovery of the Site would occur, current impacts (if left in place) are localized and exposure to wildlife via soil/biota would be expected to be insignificant.

The Site is managed by the Unalakleet Native Corporation and is located on US Bureau of Land Management (BLM) land. There are no state or federal preserves, parks or refuges at or near the AC&W main complex and no critical habitats (which generally includes large congregations of animal, plant, and water resources) are designated in the area.

The nearest anadromous stream is the Unalakleet river location approximately 3 miles away from the Site and is unlikely to be affected by the AC&W main complex. No other anadromous streams are identified in the area.

Based on current information, the conclusion that no further ecological evaluation is warranted at this time will be revisited pending review of information obtained for the RI.

4. Contaminant Quantity

Check all that may apply. See Ecoscoping Guidance for additional help.

- ☐ Endangered-, threatened-, or species of special concern are present
- ☐ The aquatic environment is or could be affected
- ☐ Non-petroleum contaminants may be present, or the total area of petroleum contaminated surface soil exceeds one-half acre

If any of the above boxes are checked go on to the next scoping factor. If none are checked, end the evaluation and check the box below.

☐ ***OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY***

Comments:

5. Toxicity Determination

Check all that apply.

- ☐ Bioaccumulative chemicals are present (see *Policy Guidance on Developing Conceptual Site Models*)
- ☐ Contaminants exceed benchmark levels (see the Ecological Benchmark Tool in RAIS, available at: http://rais.ornl.gov/tools/eco_search.php)

If either box is checked complete a detailed Ecological Conceptual Site Model (see DEC's Conceptual Site Model Guidance) and submit it with the form to you DEC Project Manager. If neither box is checked, check the box below and submit this form to your DEC Project Manager.

☐ ***OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY***

Comments:

Attachment B
Selected Remedy Cost Estimate

WBS-ECES Report
(with Markups)

System:

RACER Version: RACER® Version 11.4.63.0
Database Location: C:\Users\HasanN1\Documents\RACER 11.4\RACER.mdb

Folder:

Folder Name: Unalakleet Feasibility Study

Project:

ID: Revised Soil Remediation
Name: AC&W site, Unalakleet AC&W site, Alaska
Category: None

Location
State / Country: ALASKA
City: ALASKA STATE AVERAGE

Location Modifier	Default	User	Reason for changes
	2.170	2.170	

Options
Database: Modified System Costs
Cost Database Date: 2017
Report Option: Fiscal

Description

As part of FS, costs are estimated for remedial alternatives for soil remediation at Unalakleet AFS Aircraft Control and Warning (AC&W) Main Station Complex. The alternatives are:
•Alternative 1: No Action
•Alternative 2: Hot Spot Excavation and Phytoremediation
•Alternative 3: Capping and ICs
•Alternative 4: Limited Excavation/Off-site Disposal, Capping and ICs
•Alternative 5: Excavation and Off-site Disposal

WBS-ECES Report
(with Markups)

Site:

ID: Alternative 2
Name: Hot spot Excavation and Phytoremediation
Type: None

Media/Waste Type

Primary: Soil
Secondary: N/A

Contaminant

Primary: Multi-Contaminant
Secondary: None

Phase Names

Pre-Study
Study
Design
Removal/Interim Action
Remedial Action
Operations & Maintenance
Long Term Monitoring
Site Closeout

Documentation

Description: Unalakleet is located in northwest Alaska within the Unalakleet River basin, approximately 148 miles southeast of Nome and 395 miles northwest of Anchorage, at the base of the Nulato Hills. COCs above PRGs are present in the soil at Aircraft Control and Warning Main Complex, Unalakleet, Alaska. Contamination is confined to surface and shallow subsurface soil.

Hot spot excavation and phytoremediation alternative is considered in the Detailed Evaluation

Support Team: Paul Dworian, Project Manager.

References: USACE. 2016. Final Remedial Investigation Report Unalakleet Air Force Station Formerly Used Defense Site Aircraft Control and Warning Complex, Unalakleet, Alaska. December

Estimator Information

Estimator Name: Naseem Hasan
Estimator Title: Senior Engineer
Agency/Org./Office: AECOM
Business Address: 6200 S Quebec Street
Greenwood Village, CO. 80111
Telephone Number: 303-740-3821
Email Address: Naseem.Hasan@aecom.com
Estimate Prepared Date: 02/23/2017

Estimator Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 02/23/2017

Reviewer Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Phytoremediation
Description: Phytoremediation will be implemented using trees and grass. It is assumed that phytoremediation would be completed in 10 years.
Approach: In Situ
Start Date: January, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Phytoremediation	True	100	0
Professional Labor Management	False	0	0
Five-Year Review	True	100	0
PERFORMANCE MONITORING	True	100	0
Clear and Grub	True	100	0

Total Marked-up Cost: $2,194,402.10

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.07	INVESTIGATIONS AND MONITORING/SAMPLE COLLECTION		
4.07.00	INVESTIGATIONS AND MONITORING/SAMPLE COLLECTION	PERFORMANCE MONITORING	$1,176,099
4.21	IN SITU BIOLOGICAL TREATMENT		
4.21.09	Phytoremediation	Phytoremediation	$693,497
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Professional Labor Management	$131,071
4.05	SITE WORK		
4.05.03	Clear and Grub	Clear and Grub	$110,221
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.03	Regulatory Interaction	Five-Year Review	$83,514
			$2,194,402
Phase Total		$2,194,402	

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Excavation and Off-site Disposal
Description: New Phase

Approach: Ex Situ
Start Date: January, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Excavation	True	100	0
Residual Waste Management	True	100	0

Total Marked-up Cost: $307,091.72

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription				Marked Up Costs
4.				
4.19	SOLIDS/SOILS CONTAINMENT (e.g., Capping/Barrier) COLLECTION OR CONTROL			
4.19.01	Contaminated Soil Collection (Excavation)		Excavation	$35,259
4.33	DISPOSAL			
4.33.90	Other	Residual Waste	$271,833 Management	
				$307,092
Phase Total			$307,092	

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Site Closeout
Phase Name: Site closeout Documentation
Description: New Phase

Approach: Ex Situ
Start Date: February, 2027
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate

Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Site Close-Out Documentation	True	100	0

Total Marked-up Cost: $47,472.61

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Site Close-Out Documentation	$50,986
			$50,986
Phase Total			$50,986
ECES WBS Total:			**2,552,480**

WBS-ECES Report
(with Markups)

System:

RACER Version: RACER® Version 11.4.63.0
Database Location: C:\Users\HasanN1\Documents\RACER 11.4\RACER.mdb

Folder:

Folder Name: Unalakleet Feasibility Study

Project:

ID: Revised Soil Remediation
Name: AC&W site, Unalakleet AC&W site, Alaska
Category: None

Location
State / Country: ALASKA
City: ALASKA STATE AVERAGE

Location Modifier	Default	User	Reason for changes
	2.170	2.170	

Options
Database: Modified System Costs
Cost Database Date: 2017
Report Option: Fiscal

Description

As part of FS, costs are estimated for remedial alternatives for soil remediation at Unalakleet AFS Aircraft Control and Warning (AC&W) Main Station Complex. The alternatives are:
•Alternative 1: No Action
•Alternative 2: Hot Spot Excavation and Phytoremediation
•Alternative 3: Capping and ICs
•Alternative 4: Limited Excavation/Off-site Disposal, Capping and ICs
•Alternative 5: Excavation and Off-site Disposal

WBS-ECES Report
(with Markups)

Site:

ID: Alternative 3
Name: Capping and Institutional Controls
Type: None

Media/Waste Type
Primary: Soil
Secondary: N/A

Contaminant
Primary: Multi-Contaminant
Secondary: None

Phase Names

Pre-Study
Study
Design
Removal/Interim Action
Remedial Action
Operations & Maintenance
Long Term Monitoring
Site Closeout

Documentation
Description: Unalakleet is located in northwest Alaska within the Unalakleet River basin, approximately 148 miles southeast of Nome and 395 miles northwest of Anchorage, at the base of the Nulato Hills. COCs above PRGs are present in the soil at Aircraft Control and Warning Main Complex, Unalakleet, Alaska. Contamination is confined to surface and shallow subsurface soil.

Capping/ICs is considered in the Detailed Evaluation
Support Team: Paul Dworian, Project Manager
References: USACE. 2016. Final Remedial Investigation Report Unalakleet Air Force Station Formerly Used Defense Site Aircraft Control and Warning Complex,Unalakleet,Alaska. December.

Estimator Information
Estimator Name: Naseem Hasan
Estimator Title: Senior Engineer
Agency/Org./Office: AECOM
Business Address: 6200 S. Quebec
Greenwood Village, CO. 80111
Telephone Number: 303-740-3821
Email Address: Naseem.Hasan@aecom.com
Estimate Prepared Date: 02/23/2017

Estimator Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 02/24/2017

Reviewer Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: capping
Description: Aprproximately 1.6 acres of contaminated surface soil will be capped. Site preparation includes clearing and grubbing.
Approach: In Situ
Start Date: January, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Capping	True	100	0
Clear and Grub	True	100	0
Professional Labor Management	False	0	0
Fencing	True	100	0

Total Marked-up Cost: $1,528,407.89

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.26	EX SITU PHYSICAL TREATMENT		
4.26.23	Granular Activated Carbon Adsorption- Liquid	Capping	$875,106
4.05	SITE WORK		
4.05.03	Clear and Grub	Clear and Grub	$110,221
4.05.14	Fencing Fencing	$403,939	
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Professional Labor Management	$139,142
			$1,528,408
Phase Total		$1,528,408	

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Operations & Maintenance
Phase Name: capping maintenance, ICs and 5-yr reviews
Description: Capping O&M includes periodic inspection and repair of the cap for 30-year period.. Five-year reviews and ICs (Adminstrative Land Use Controls) will also be performed for 30 years.
Approach: Ex Situ
Start Date: January, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Operations and Maintenance	True	100	0
Five-Year Review	True	100	0
ADMINISTRATIVE LAND USE CONTROLS	True	100	0

Total Marked-up Cost: $2,400,550.37

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.04	Institutional Controls	ADMINISTRATIVE LAND USE CONTROLS	$1,904,122
4.02.03	Regulatory Interaction	Five-Year Review	$250,543
4.02.01	Project Management/Support/Administration	Operations and Maintenance	$245,886
			$2,400,550
Phase Total		$2,400,550	
ECES WBS Total:		**3,928,958**	

WBS-ECES Report
(with Markups)

System:

RACER Version: RACER® Version 11.4.63.0
Database Location: C:\Users\HasanN1\Documents\RACER 11.4\RACER.mdb

Folder:

Folder Name: Unalakleet Feasibility Study

Project:

ID: Revised Soil Remediation
Name: AC&W site, Unalakleet AC&W site, Alaska
Category: None

Location
State / Country: ALASKA
City: ALASKA STATE AVERAGE

Location Modifier	Default	User	Reason for changes
	2.170	2.170	

Options
Database: Modified System Costs
Cost Database Date: 2017
Report Option: Fiscal

Description

As part of FS, costs are estimated for remedial alternatives for soil remediation at Unalakleet AFS Aircraft Control and Warning (AC&W) Main Station Complex. The alternatives are:
•Alternative 1: No Action
•Alternative 2: Hot Spot Excavation and Phytoremediation
•Alternative 3: Capping and ICs
•Alternative 4: Limited Excavation/Off-site Disposal, Capping and ICs
•Alternative 5: Excavation and Off-site Disposal

WBS-ECES Report
(with Markups)

Site:

ID: Alternative 4
Name: Limited Excavation,/Off-site Disposal, Capping, ICs
Type: None

Media/Waste Type
Primary: Soil
Secondary: N/A

Contaminant
Primary: Multi-Contaminant
Secondary: None

Phase Names

Pre-Study
Study
Design
Removal/Interim Action
Remedial Action
Operations & Maintenance
Long Term Monitoring
Site Closeout

Documentation
Description: Unalakleet is located in northwest Alaska within the Unalakleet River basin, approximately 148 miles southeast of Nome and 395 miles northwest of Anchorage, at the base of the Nulato Hills. COCs above PRGs are present in the soil at Aircraft Control and Warning Main Complex, Unalakleet, Alaska. Contamination is confined to surface and shallow subsurface soil.

Limited Excavation/ Off-site Disposal, Capping and ICs alternative is considered in the Detailed Evaluation.
Support Team: Paul Dworian, Project Manager.
References: USACE. 2016. Final Remedial Investigation Report Unalakleet Air Force Station Formerly Used Defense Site Aircraft Control and Warning Complex, Unalakleet, Alaska. December

Estimator Information
Estimator Name: Naseem Hasan
Estimator Title: Senior Engineer
Agency/Org./Office: AECOM
Business Address: 5600 S. Quebec St
Greenwood Village, CO 80111
Telephone Number: 303-740-3821
Email Address: Naseem.Hasan@aecom.com
Estimate Prepared Date: 02/24/2017

Estimator Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 03/02/2017

Reviewer Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: Limited Excavation/Off-site Disposal, Capping and ICs
Description: Approximately 5,000 cubic yards of TCE contaminated soil would be excavated from select locations from the AC&W site. The remaining 1.1 acre of the contaminated soil surface would be capped. ICs and five-year reviews will be continued for 30 years.
Approach: Ex Situ
Start Date: January, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Excavation	True	100	0
Residual Waste Management	True	100	0
Capping	True	100	0
Professional Labor Management	False	0	0
Clear and Grub	True	100	0

Total Marked-up Cost: $5,386,027.38

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Professional Labor Management	$680,342
4.33	DISPOSAL		
4.33.90	Other Residual Waste	$3,584,151 Management	
4.26	EX SITU PHYSICAL TREATMENT		
4.26.23	Granular Activated Carbon Adsorption- Liquid	Capping	$601,951
4.05	SITE WORK		
4.05.03	Clear and Grub	Clear and Grub	$77,507
4.19	SOLIDS/SOILS CONTAINMENT (e.g., Capping/Barrier) COLLECTION OR CONTROL		
4.19.01	Contaminated Soil Collection (Excavation)	Excavation	$442,076
			$5,386,027
Phase Total		$5,386,027	

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Operations & Maintenance
Phase Name: capping O&M
Description: Cap maintenance, five-year reviews and ICs will be continued for 30 years.
Approach: Ex Situ
Start Date: July, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Operations and Maintenance	True	100	0
Five-Year Review	True	100	0
ADMINISTRATIVE LAND USE CONTROLS	True	100	0

Total Marked-up Cost: $2,696,313.18

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Operations and Maintenance	$1,682,153
4.02.04	Institutional Controls	ADMINISTRATIVE LAND USE CONTROLS	$763,617
4.02.03	Regulatory Interaction	Five-Year Review	$250,543
			$2,696,313
Phase Total		$2,696,313	
ECES WBS Total:		**8,082,341**	

WBS-ECES Report
(with Markups)

System:

RACER Version: RACER® Version 11.4.63.0
Database Location: C:\Users\HasanN1\Documents\RACER 11.4\RACER.mdb

Folder:

Folder Name: Unalakleet Feasibility Study

Project:

ID: Revised Soil Remediation
Name: AC&W site, Unalakleet AC&W site, Alaska
Category: None

Location
State / Country: ALASKA
City: ALASKA STATE AVERAGE

Location Modifier	Default	User	Reason for changes
	2.170	2.170	

Options
Database: Modified System Costs
Cost Database Date: 2017
Report Option: Fiscal

Description

As part of FS, costs are estimated for remedial alternatives for soil remediation at Unalakleet AFS Aircraft Control and Warning (AC&W) Main Station Complex. The alternatives are:
•Alternative 1: No Action
•Alternative 2: Hot Spot Excavation and Phytoremediation
•Alternative 3: Capping and ICs
•Alternative 4: Limited Excavation/Off-site Disposal, Capping and ICs
•Alternative 5: Excavation and Off-site Disposal

WBS-ECES Report
(with Markups)

Site:

ID: Alternative 5
Name: Excavation and Off-site Disposal
Type: None

Media/Waste Type
Primary: Soil
Secondary: N/A

Contaminant
Primary: Multi-Contaminant
Secondary: None

Phase Names

Pre-Study
Study
Design
Removal/Interim Action
Remedial Action
Operations & Maintenance
Long Term Monitoring
Site Closeout

Documentation
Description: Unalakleet is located in northwest Alaska within the Unalakleet River basin, approximately 148 miles southeast of Nome and 395 miles northwest of Anchorage, at the base of the Nulato Hills. COCs above PRGs are present in the soil at Aircraft Control and Warning Main Complex, Unalakleet, Alaska. Contamination is confined to surface and shallow subsurface soil.

Excavation and Off-site Disposal is considered in the Detailed Evaluation
Support Team: Paul Dworian, Project Manager.
References: Final Remedial investigation Report. Unalakleet Air Force Station Formerly Used Defense Site Aircraft Control and Warning Main Complex, Unalakleet, Alaska.

Estimator Information
Estimator Name: Naseem Hasan
Estimator Title: Senior Engineer
Agency/Org./Office: AECOM
Business Address: 6200 S. Quebec Street
Greenwood Village, CO. 80111
Telephone Number: 303-740-3821
Email Address: Naseem.Hasan@aecom.com
Estimate Prepared Date: 12/27/2018

Estimator Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Reviewer Information

Reviewer Name:
Reviewer Title:
Agency/Org./Office:
Business Address:
Telephone Number:
Email Address:
Date Reviewed: 12/31/2018

Reviewer Signature: _____ **Date:** _____

WBS-ECES Report
(with Markups)

Phase Documentation:

Phase Type: Remedial Action
Phase Name: excavation and off-site disposal
Description: Alternative 5: 8,952 CY of contaminated soil would be excavated and disposed off-site.
Approach: Ex Situ
Start Date: January, 2019
Labor Rate Group: System Labor Rate
Analysis Rate Group: System Analysis Rate
Phase Markup Template: System Defaults

Technology Markups	Markup	% Prime	% Sub.
Excavation	True	100	0
Residual Waste Management	True	100	0
Site Close-Out Documentation	True	100	0
Clear and Grub	True	100	0
Professional Labor Management	False	0	0

Total Marked-up Cost: $14,107,199.73

Technologies:

WBS-ECES Report
(with Markups)

GroupDescription			Marked Up Costs
4.			
4.19	SOLIDS/SOILS CONTAINMENT (e.g., Capping/Barrier) COLLECTION OR CONTROL		
4.19.01	Contaminated Soil Collection (Excavation)	Excavation	$862,755
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Professional Labor Management	$1,268,137
4.33	DISPOSAL		
4.33.90	Other Residual Waste	$11,818,614 Management	
4.02	PROJECT MANAGEMENT & SUPPORT (Operable Unit/Solid Waste Management Unit)		
4.02.01	Project Management/Support/Administration	Site Close-Out Documentation	$50,986
4.05	SITE WORK		
4.05.03	Clear and Grub	Clear and Grub	$110,221
			$14,110,713
Phase Total		$14,110,713	
ECES WBS Total:		**14,110,713**	