FINAL
FEASIBILITY STUDY
FORT BABCOCK
FORMERLY USED DEFENSE SITE
(F10AK035304)
SITKA, ALASKA

Prepared for:

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

Contract: W911KB-17-D-0018
Task Order: W911KB18F0019

December 2018

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ACRONYMS AND ABBREVIATIONS

%	percent
°F	degrees Fahrenheit
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ACL	alternate cleanup level
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
CSM	conceptual site model
DERP	Defense Environmental Restoration Program
DRO	diesel range organics
EF	exposure frequency
EPA	United States Environmental Protection Agency
FS	feasibility study
ft	foot/feet
ft^2	square feet
FUDS	formerly used defense site
gal	gallon
GRA	general response action
GRO	gasoline range organics
ISCO	in-situ chemical oxidation
LUC	land use control
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
NCP	National Contingency Plan

NOAA	National Oceanic and Atmospheric Administration
No.	Number
O&M	operation and maintenance
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
POL	petroleum, oil, and lubricants
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RRO	residual range organics
SQuiRT	NOAA Screening Quick Reference Table
SVOC	semivolatile organic compound
TAH/TAqH	total aromatic hydrocarbons/total aqueous hydrocarbons
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
U.S.	United States
USACE-AK	United States Army Corps of Engineers, Alaska District
USFS	United States Forest Service
UU/UE	unlimited use and unrestricted exposure
VEG	Vapor Energy Generator
VOC	volatile organic compound
WQS	Alaska Water Quality Standards

EXECUTIVE SUMMARY

The United States (U.S.) Army Corps of Engineers, Alaska District has conducted a feasibility study (FS) for the Fort Babcock formerly used defense site (FUDS) in Sitka, Alaska (F10AK035304). This FS was conducted following the U.S. Environmental Protection Agency's (EPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988).

The purpose of this FS was to develop remedial alternatives to address polychlorinated biphenyl (PCB) contamination at the Power Plant sub-site at the Fort Babcock FUDS. The alternatives developed to address PCB contamination at the Power Plant include:

- *PCB Alternative 1 – No Action:* No remedial action would occur and PCB contaminated soil would remain onsite.
- *PCB Alternative 2 – Ex-situ Vapor Energy Generator (VEG):* PCB contaminated soil would be excavated and stockpiled onsite for VEG treatment. The excavation would be backfilled with the clean, treated soil.
- *PCB Alternative 3 – Excavation and Offsite Disposal:* Contaminated soil exceeding 50 milligrams per kilogram (mg/kg) would be removed and disposed of at an approved Subtitle C landfill (hazardous waste), and the remaining soil exceeding the 1 mg/kg cleanup level would be removed and disposed of at an approved Subtitle D landfill. The excavation would be backfilled with clean fill material.

Since a petroleum, oil, and lubricants (POL) remedial action may occur in conjunction with the PCB remedial action at the Power Plant, remedial alternatives were developed to address Alaska Department of Environmental Conservation (ADEC) regulated POL contamination at the Fuel Storage Area and Tar Drum Area sub-sites. A streamlined screening and development process was used to develop four POL alternatives:

- *POL Alternative 1 – No Action:* No remedial action would occur and POL contaminated soil would remain onsite.
- *POL Alternative 2 – In-situ Mixing:* A binding agent (likely Portland Cement) would be used to solidify and stabilize the contaminated soil in place.
- *POL Alternative 3 – Ex-situ VEG:* POL contaminated soil would be excavated and stockpiled onsite for VEG treatment. The excavation would be backfilled with the clean, treated soil.
- *POL Alternative 4 – Excavation with Offsite Disposal:* Contaminated soil above the cleanup level would be completely removed and disposed of at an approved Subtitle D landfill. The excavation would be backfilled with clean fill material.
- *POL Alternative 5 – Excavation with Offsite Low Temperature Thermal Desorption:* Contaminated soil above the cleanup level would be completely removed and thermally desorbed at an approved facility. The excavation would be backfilled with clean fill material.

The rankings and costs associated with each alternative are summarized in Table E-1.

Table E-1: Alternative Ranking Summaries and Costs

Alternative Ranking Summary for the Power Plant Sub-site Following the CERCLA Process			
	PCB Alternative 1	**PCB Alternative 2**	**PCB Alternative 3**
Criteria	**No Action**	**Ex-situ Vapor Energy Generator**	**Excavation with Offsite Disposal**
Overall Protection of Human Health and the Environment	Fail	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass
Long-term Effectiveness and Permanence	Very Low	Very High	Very High
Reduction of Toxicity, Mobility, and Volume through Treatment	Very Low	Very High	Very Low
Short-term Effectiveness	Very Low	Low	Low
Implementability	Very High	Medium	High
Cost	None	$2,428,000	$1,894,000

Alternative Ranking Summary for the Fuel Storage Area and Tar Drum Area Sub-sites Following the ADEC Process					
	POL Alternative 1	**POL Alternative 2**	**POL Alternative 3**	**POL Alternative 4**	**POL Alternative 5**
Criteria	**No Action**	**In-situ Mixing**	**Ex-situ Vapor Energy Generator**	**Excavation with Offsite Disposal**	**Excavation with Offsite Low Temperature Thermal Desorption**
Overall Protection of Potential Receptors/ Achieves Cleanup Levels	Fail	Pass	Pass	Pass	Pass
Effectiveness	Very Low	High	Very High	Very High	Very High
Implementability	Very High	Medium	Medium	Medium	Medium
Cost	None	$1,176,000	$1,868,000	$1,213,000	$1,323,000

ADEC Alaska Department of Environmental Conservation
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
LUC land use control
PCB Polychlorinated Biphenyl
POL Petroleum, oils, and lubricants

1.0 INTRODUCTION

The United States (U.S.) Army Corps of Engineers, Alaska District (USACE-AK) has conducted a feasibility study (FS) for the Fort Babcock formerly used defense site (FUDS) in Sitka, Alaska (F10AK035304).

This FS presents an evaluation of remedial alternatives to address polychlorinated biphenyl (PCB) contaminated soils. The Defense Environmental Restoration Program (DERP) Manual states that response actions taken to address releases of hazardous substances or pollutants shall be carried out pursuant to Section 9620 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The term "hazardous substance" is defined under CERCLA §101(14) to include toxic substances listed under several other environmental statues. PCBs are listed as a hazardous substance and are subject to the requirements under CERCLA.

Since petroleum, oil, and lubricant (POL) contamination is anticipated to be addressed in conjunction with the PCB remedial action, remedial alternatives for POL-contaminated sub-sites were included in this FS. CERCLA §101(14) excludes petroleum from its covered substances, so it may not be used to address certain releases of POL. The DERP Manual allows POL releases to be addressed under other applicable authorities consistent with DERP. POL are regulated under the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Program and 18 Alaska Administrative Code (AAC) 75, which generally follow an abbreviated and streamlined version of the CERCLA process for completing a FS or selecting a cleanup remedy, thus a streamlined process was used to screen technologies and develop/evaluate alternatives.

1.1 Purpose

The purpose and objectives of the FS include the following:

- Summarize previous investigations.
- Present the conceptual site model (CSM) and identify the exposure routes and receptors.
- Identify chemicals of concern (COCs).
- Identify applicable or relevant and appropriate requirements (ARARs).
- Develop remedial action objectives (RAOs).
- Develop remedial alternatives to address PCB-contaminated soil.
  - Identify and screen remedial technologies.
  - Develop remedial alternatives.
  - Conduct a detailed analysis of alternatives based on the nine criteria identified in the National Contingency Plan (NCP).
  - Compare the alternatives based on the detailed analysis.
  - Estimate costs for each alternative.
- Develop remedial alternatives to address POL-contaminated soil.
  - Identify and screen remedial technologies.

- Develop remedial alternatives.
- Conduct an analysis of alternatives.
- Compare the alternatives based on the detailed analysis.
- Estimate costs for each alternative.

1.2 Report Organization

This FS is organized into seven sections:

- Section 1.0 presents an introduction and overview of the report.
- Section 2.0 provides the site history and a summary of previous investigations.
- Section 3.0 presents the ARARs and RAOs.
- Section 4.0 presents the screening of remedial technologies, development of alternatives and a comparative analysis of those alternatives for the Power Plant sub-site, which contains PCBs.
- Section 5.0 presents cleanup levels, technology screening, and remedial alternative development process for the Fuel Storage Area and Tar Drum sub-sites, which contain ADEC-regulated POLs.
- Section 6.0 presents the FS conclusions.
- Section 7.0 lists the references used during the FS preparation.

1.3 Site Overview and Description

Fort Babcock is located approximately 11 miles west of Sitka, Alaska at Shoals Point on the southeast corner of Kruzof Island (Figure 1-1). Sitka Sound separates Kruzof Island from the community of Sitka and access to Fort Babcock is limited to marine vessels, recreational sea kayakers, small fixed-wing aircraft, and helicopters (if a landing area can be identified).

1.3.1 Site History

In the 1930s, the U.S. War Department developed “Plan Orange,” in response to the possibility of war in the Pacific. Alaska was recognized as part of a strategic defense triangle. Facilities established as part of the “Sitka Naval Air Station” in 1939 were the first wartime construction in Alaska. After the bombing of Pearl Harbor, in Hawaii, on 7 December 1941, and the bombing of Dutch Harbor, in Alaska, on 3 June 1942, military activity at Sitka increased.

On 9 June 1942, a Harbor Defense Plan to support the Sitka Naval Operating Base, as part of the U.S. Army Coastal Defenses, was initiated and called for three modern 200 series 6-inch gun batteries to be constructed on Kruzof Island (Battery 290), Biorka Island (Battery 291), and Makhnati Island (Battery 292).

The U.S. War Department acquired 4,070 acres on Kruzof Island for Fort Babcock by Executive Order 8877, dated 29 August 1941. At Fort Babcock, planned construction of one fixed, 6-inch gun battery (Battery 290) and additional support facilities were initiated, but stopped before completion in 1944 when the Sitka Naval Operating Base was decommissioned, as the focus of the war in Alaska shifted to the Aleutian Islands. Constructed facilities that were completed included a 7,500-square-foot (ft^2) concrete bunker (magazine and fire control station); observation tower; water tank; diesel fuel storage tanks; Quonset huts; a power plant; maintenance shops; wood-frame buildings utilized for troop quarters, administration, and supply/equipment storage; and a 220- by 40-foot (ft) dock at Shoals Point (USACE-AK 2014).

1.3.2 Land Ownership and Use

Fort Babcock is owned by the U.S. Forest Service (USFS). The island is generally uninhabited and current land use is predominately un-guided recreation (e.g., sight-seeing, hiking, camping, hunting) permitted by the USFS. The USFS Land Management Plan designates the area, including the FUDS, as a Special Interest Area due to unique geologic values of the Mt. Edgecumbe Geological Area. According to the USFS, the Special Interest Area designation prohibits residential land use. In addition, there is a very low probability that the designation would change in the future based on the geologic attributes of the area.

During Phase I remedial investigation (RI) fieldwork, which lasted approximately three weeks, field personnel encountered approximately 15 people traveling to the island for hiking and camping, all attempting to use the trail near the Fuel Storage Area aboveground storage tank (AST) as an entry point to the island's interior. One small recreational group was also encountered at the FUDS during the Phase II RI, an approximately four-week field effort. Approximately twice a week during the summer, a marine touring company lands watercraft on a beach near the Landfill Area and briefly unloads passengers to explore the area. The USFS maintains four recreational cabins on the island, with the nearest to the site located approximately 1 mile to the north (USACE-AK 2014).

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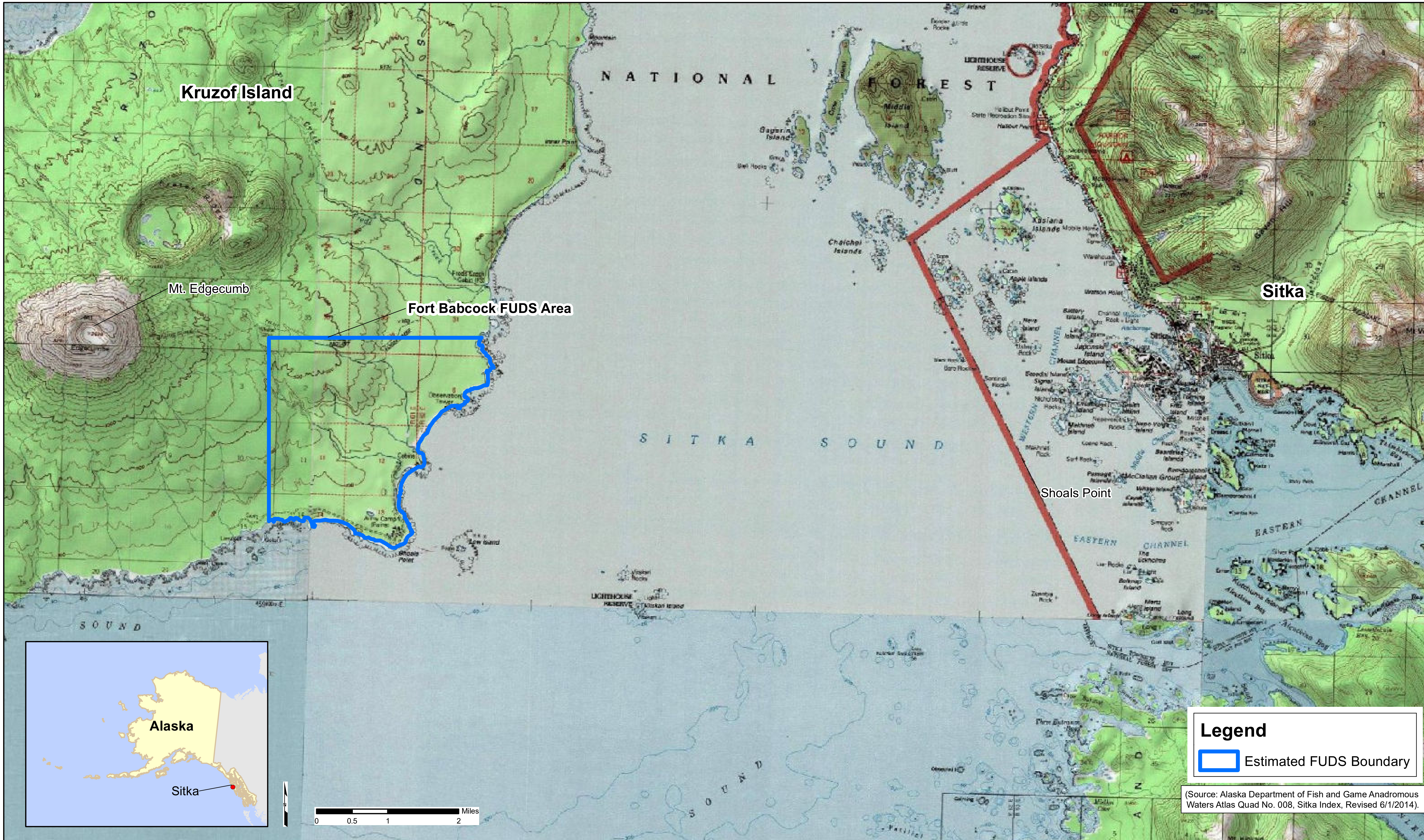

U.S.Army Engineer District, Alaska

Fort Babcock
Feasibility Study
Kruzof Island, Alaska

Date: 2/3/2018 | DRWN: lb | Revision: 0

Project Location Map

FIGURE 1-1

Path: C:\Users\lbeasley\Documents\ArcGIS\Packages\FIGURE 1-1_9BECC4B3-C191-4275-B54C-0A25CFD64043\v10\FIGURE 1-1.mxd

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2.0 PREVIOUS INVESTIGATIONS AND SITE CONDITIONS

Previous FUDS investigations, conducted between 1985 and 2017, are summarized in the following sections.

2.1 Initial Investigations

2.1.1 Site Inventory (1985)

USACE-AK conducted a site visit in 1985 in which the following features were inventoried: a concrete bunker (Battery 290), four collapsed timber structures, a collapsed timber bulkhead, 19 Quonset huts, a concrete crib, and two ASTs used for possible fuel storage. One AST (approximately 330 gallons [gal]) was located on the beach about 1,000 ft north of the Quonset huts, and the other (approximately 8,000 gal) was located 150 ft from a collapsed timber bulkhead. Both ASTs were sounded and presumed to be empty. It was speculated that leaks may have occurred from the riveted seams of the larger 8,000-gal AST. Soil and water samples were not collected and analyzed (USACE-AK 1986).

2.1.2 Site Investigation (1995)

USACE-AK returned to the site in 1995 and collected three soil samples near the 8,000-gal AST located adjacent to the timber bulkhead. The samples were analyzed for gasoline range organics (GRO) and diesel range organics (DRO). GRO was not detected. DRO was detected at a maximum concentration of 4,520 milligrams per kilogram (mg/kg), which exceeded the most stringent ADEC Method Two Migration to Groundwater cleanup level of 230 mg/kg, but was lower than the ingestion pathway (18 AAC 75) cleanup value of 8,250 mg/kg. In addition, the USACE-AK team visually searched for other COC sources. Physical evidence of contamination was not identified and therefore, additional sampling (e.g., for volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], pesticides, PCBs, metals, asbestos, and explosives) was not conducted at that time (USACE-AK 2010).

2.1.3 Site Visit (1998)

USACE-AK returned a third time, in 1998, for a site inventory, which also included an inspection of the 8,000-gal AST located near the timber bulkhead. Although the access hatch could not be opened, the field team observed liquid through a small opening at the top of the tank. The contents measured approximately 2 inches and appeared to be a mixture of water, rust, and vegetation with a slight diesel fuel odor. The field team did not find any evidence of stained soil, stressed vegetation, or pooled liquids in the area around the AST. No water or soil samples were collected for laboratory analysis (USACE-AK 2010). In addition to investigating the 8,000-gal AST, the former Battery 290 was inspected. There were no batteries, tanks, transformers, generators, or any other impacts in either Battery 290 or the immediate vicinity around the battery that would be a concern under the FUDS hazardous, toxic, or radioactive waste program.

2.1.4 Site Investigation (2010)

In 2010, USACE-AK collected one water sample from the 8,000-gal AST remaining at the site, as well as 12 analytical soil samples from 65 surface soil screening locations and 4 hand-borings installed in the immediate vicinity of the AST. According to the Site Investigation Report (USACE-AK 2010), the following contaminants exceeded the ADEC petroleum requirements:

- DRO was detected at a concentration of 5,880 mg/kg from one soil sample collected on the eastern downslope side of the AST. For comparison, the most stringent ADEC Method Two cleanup level for DRO is 230 mg/kg and the ingestion pathway cleanup level is 8,250 mg/kg.
- DRO and residual range organics (RRO) were detected in a sample of the AST's liquid contents at concentrations of 26.7 and 7.57 milligrams per liter (mg/L), respectively; both more than their respective ADEC Table C Groundwater cleanup levels of 1.5 mg/L and 1.1 mg/L.

As of August 2010, the AST was in relatively poor condition, with several holes in both ends of the tank. Piping was visible below the tank, but it, along with soils, was inaccessible with available equipment and not sampled. The piping appeared to extend from the tank to an unknown location, presumably near the shoreline. In addition, two empty tank cribs, an unknown length of associated piping, and seven rusted drums were discovered near the AST (USACE-AK 2010).

2.1.5 Pre-RI Site Visits (2012 and 2013)

USACE-AK conducted a site visit in May 2012 to evaluate logistical challenges associated with the Phase I RI activities and to investigate if additional FUDS eligible site features were present that should be incorporated in the RI. An archeological assessment was conducted as part of the site visit to assist with identifying a suitable location for a temporary camp and marine vessel landings. Previously identified features were observed in similar condition to those described in the 2010 Site Investigation Report (USACE-AK 2010). Small streams were observed 150 ft north and 30 ft south of the AST. Additional features identified in the field included a historical septic tank (Septic Tank #1) and a drum carcass with gray/black, semi-hardened, tar-like material (Tar Drum Area). Additionally, during the Phase I RI field event, a former dump site (Landfill Area) was identified (Figure 2-1).

After the Phase I RI was completed, additional sub-sites were identified using historical engineering drawings and considered for further investigation during the Phase II RI. These sub-sites included a second septic tank (Septic Tank #2), Power Plant, Pump House, and a fuel tank at the former location of Lava Point Base End Station. Each sub-site listed above was visually assessed during the Phase II RI site visit completed in May 2013. A manhole (Manhole #1) near Septic Tank #1, Septic Tank #2 and two associated septic tank traps (Trap #1 and Trap #2), the Power Plant, and the Pump House were located (Figure 2-1). Although the Pump House and remnants of the buildings associated with the former Lava Point Base End Station were located, no evidence of contamination or contaminant sources was found. Based on potential contaminant sources, the remaining sub-sites assessed during the May 2013 site visit were incorporated into the Phase II RI.

2.2 Remedial Investigation – Phase I (2012), Phase II (2013), Addendum I Technical Memorandum (2015), and Addendum II Technical Memorandum (2017)

USACE-AK conducted a RI to determine the nature and extent of contamination at the Fort Babcock FUDS (USACE-AK 2013 and 2014). During the RI, the ADEC Method Two and Table C cleanup levels were utilized and applied as screening criteria to determine the nature and extent of contamination, prior to the development of alternate cleanup levels for nickel, DRO, RRO, benzo(a)pyrene, and benzo(b)fluoranthene based on the Method 3 calculator. The RI was completed in two phases. During the Phase I RI, in 2012, several features at the Fuel Storage Area sub-site were investigated, including the 8,000-gal AST, suspected former fuel tank cribs, aboveground and buried piping, and drums. Additionally, the Landfill Area, Tar Drum Area, and a former septic tank (Septic Tank #1) were investigated. As part of Phase II RI, three new sub-sites identified during the 2013 site visit (Septic Tank #2, Manhole #1, and the Power Plant) were evaluated; and data gaps at the Landfill, Fuel Storage, and Tar Drum Areas were addressed (Figure 2-1). RI activities included magnetic surveys to identify metallic debris; temporary well point installation; soil boring advancement; field screening; and collection of soil, sediment, surface water, groundwater, concrete, and tile wipe samples for laboratory analysis. Site-specific total organic carbon data were also collected at the Landfill, Power Plant, Fuel Storage Area, and Tar Drum Area sub-sites and used to calculate Method Three residential cleanup levels using the ADEC online calculator.

The screening criteria presented in the Phase II RI (USACE-AK 2014) were protective of a residential land use scenario that would allow for unrestricted use and unrestricted exposure at the site. However, a residential scenario is not a current or anticipated future land use given the USFS Special Interest Area Designation of the area which prohibits residential use. As such, a Phase II RI Addendum I Technical Memorandum was prepared in 2015 to calculate cleanup levels protective of a recreational land use scenario (USACE-AK 2015). ADEC Method Three recreational cleanup levels were developed for all COCs (nickel, DRO, RRO, benzo(a)pyrene, and benzo(b)fluoranthene) that exceeded residential cleanup levels, with the exception of lead and PCBs. For lead and PCBs, the ADEC commercial/industrial cleanup level and Method Two human health cleanup level was applied, respectively, since a Method Four risk assessment was not completed. In addition to presenting recreational cleanup levels, a modified CSM and a "350 Determination" for groundwater use were provided. Based on the modified CSM, the surface water and sediment exposure pathways were considered insignificant and do not require further evaluation. Groundwater pathways were considered incomplete, supported by the "350 Determination." In their letter dated 26 May 2015 approving Phase II Addendum I (USACE-AK 2015), ADEC agreed groundwater at Fort Babcock is not a current or reasonably expected future drinking source. Insignificant and incomplete pathways do not require risk or hazard evaluation; therefore, recreational cleanup levels have not been developed for these media.

A Phase II RI Addendum II Technical Memorandum was prepared in 2017 by USACE to recalculate the proposed cleanup levels based on the updated ADEC 2016 cleanup levels presented in 18 AAC 75 (USACE-AK 2017). Following the approach presented in the Phase II RI Addendum I, ADEC Method Three recreational cleanup levels were developed for all COCs (nickel, DRO, RRO, benzo(a)pyrene, and benzo(b)fluoranthene) except lead and PCBs. The calculated cleanup levels for DRO and RRO were above the ADEC Maximum Allowable values for these constituents. Therefore, the ADEC Maximum Allowable concentrations for DRO and RRO were applied as cleanup levels in accordance with 18 AAC 75.341(j)(3). For lead and PCBs, the ADEC commercial/industrial cleanup level and Method Two human health cleanup level were applied, respectively, since a Method Four risk assessment was not completed. In their letter dated 17 October 2017 approving the Phase II RI Addendum II (USACE-AK 2017), ADEC agreed with this methodology and approved the recreational cleanup levels (Table 2-1). The recreational cleanup levels for nickel, benzo(a)pyrene, and benzo(b)fluoranthene were substantially higher than the maximum concentrations measured at any of the sites, so these compounds were no longer considered COCs. Additionally, since data collected at the Power Plant area during the Phase II RI (USACE-AK 2014) were not sufficient to evaluate risk to human health and the environment, the Phase II RI Addendum II was prepared to address the extent of the PCB contamination in soil.

The following subsections summarize the RI results by location and present the applicable cleanup levels (Table 2-1).

2.2.1 Landfill Area

The historical landfill is directly adjacent to the northern terminus of the historical road, approximately 250 ft south of a horseshoe bend at the mouth of a nearby, unnamed stream, and approximately 120 ft northwest of the intertidal zone (Figure 2-1). During the Phase I and II RIs, a visual survey, magnetic survey, and soil sample collection were conducted at the Landfill Area (USACE-AK 2013 and 2014). Two locations of metallic debris were identified within the western and eastern landfill areas, containing an estimated debris volume of approximately 788 cubic yards.

Soil samples collected during the Phase II RI were analyzed for DRO, RRO, GRO, VOCs, polynuclear aromatic hydrocarbons (PAHs), target metals, PCBs, and hexavalent chromium. Samples collected during the Phase I RI were analyzed for a more limited analyte list. Only two isolated metals: lead and nickel, were detected at concentrations above the ADEC residential cleanup levels. The nickel concentration (115 mg/kg) collected 5.5 to 6.0 ft below ground surface (bgs) exceeded the ADEC residential migration to groundwater cleanup level; however, a soil sample collected at a depth below the sample that showed an exceedance indicated that the nickel is vertically bound. Furthermore, metals contamination is not likely to migrate and based on the “350 Determination”, groundwater in the area will not be used as a drinking water source. Lead in soil (668 mg/kg) collected 1.5 to 2.0 ft bgs at one location exceeded the ADEC Method Two human health cleanup level. Both the nickel and lead concentrations were below the recreational cleanup levels (800 mg/kg for lead and 40,071 mg/kg for nickel) presented in the Phase II RI Addendum II Technical Memorandum and are not considered COCs under a recreational land use scenario, indicating that this sub-site does not pose an unacceptable risk to human health or the environment (USACE-AK 2017). Two temporary well points were installed within the landfill at 15.0 ft and 9.1 ft bgs, respectively, but groundwater samples were not collected because groundwater was not encountered (USACE-AK 2014).

2.2.2 Fuel Storage Area

The Fuel Storage Area consists of a former military docking and refueling area located south of the Landfill (Figure 2-1). Existing features observed during the RI field efforts included an 8,000-gal AST, empty tank cribs, piping and drum remnants, gravel pad, and timbers from a former pier (Figure 2-2). During the Phase I and Phase II RIs, magnetic surveys were conducted to determine the extent of buried piping. A total of 49 ft of piping was identified (USACE-AK 2013 and 2014).

Soil, groundwater, sediment, and surface water samples were collected to evaluate POL contamination associated with Fuel Storage Area sub-site. Samples were analyzed for DRO and RRO, with select samples analyzed for GRO and benzene, toluene, ethylbenzene, and xylenes (BTEX). DRO was detected above the recreational cleanup level at maximum concentrations of 38,000 mg/kg at the 8,000-gal AST and 130,000 mg/kg at the Eastern Piping Area (USACE-AK 2014). Based on the Phase II RI Addendum II Technical Memorandum, the estimated DRO-impacted soil volume exceeding the recreational cleanup level at this sub-site is 82 cubic yards (Figure 2-3; USACE-AK 2017). Since DRO exceeded the recreational cleanup level, this sub-site may require remedial action under the ADEC Contaminated Sites Program.

At the Western Piping Area, DRO was detected above the residential cleanup level at a maximum concentration of 1,600 mg/kg but was below the recreational cleanup level applied to the site (USACE-AK 2014, 2015, and 2017). As such, the Western Piping Area was removed as a feature of concern in the Phase II RI Addendum I Technical Memorandum (USACE-AK 2015). Sediment and surface water samples collected from the stream south of the 8,000-gal AST had concentrations below the Alaska Water Quality Standards (WQS) for surface water, and National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) screening levels for sediment. Additionally, sediment concentrations were also below the ADEC Method Two inhalation and ingestion soil cleanup levels. One groundwater sample collected from a temporary well point at the 8,000-gal AST contained DRO at 2.0 mg/L, which is above the ADEC Table C cleanup level of 1.5 mg/L. A groundwater sample collected from a temporary well point installed in the gravel pad area had an RRO concentration of 1.2 mg/L, which is above the Table C cleanup level (1.1 mg/L). Based on the “350 Determination,” groundwater pathways are considered incomplete, so groundwater does not require further evaluation. No other constituents were detected above the applicable cleanup level for tested media (USACE-AK 2014).

2.2.3 Manhole #1

A concrete vault with a manhole (Manhole #1) is located north of Septic Tank #1 and was observed along with a marine outfall pipe during the May 2013 site visit (Figure 2-1). According to a historical map, this feature was part of a sewer system that serviced barracks and possibly a mess hall that ultimately discharged to the Sound. During the RI, soil, sediment, surface water, and groundwater samples were collected at Manhole #1 and analyzed for DRO, RRO, GRO, BTEX, PAHs, and target metals. Additionally, PCBs (soil, groundwater, and sediment), hexavalent chromium (soil), and total aromatic hydrocarbons/total aqueous hydrocarbons (TAH/TAqH [surface water]) were analyzed for select media. All tested media had COC concentrations below the respective proposed cleanup levels, indicating that this sub-site does not pose unreasonable risk to human health or the environment. Material in Manhole #1 was analyzed for PCBs, toxicity characteristic leaching procedure (TCLP) VOCs/SVOCs/metals, and ignitability. Results indicated the material was not characteristic of Resource Conservation and Recovery Act (RCRA) or Toxic Substances Control Act (TSCA) waste (USACE-AK 2014). Therefore, this material does not pose unacceptable risk to human health or the environment.

2.2.4 Septic Tank #1

Septic Tank #1 is constructed of a 4.5-ft-wide concrete basin with structural wood remnants and is located in an ephemeral stream (Figure 2-1). According to a historical map, this septic system serviced a mess hall. During the Phase I RI, surface water and sediment samples were collected from a small ephemeral stream adjoining the historical Septic Tank #1. The samples were analyzed for GRO, DRO, RRO, PAHs, BTEX, and metals. Additionally, the sediment samples were analyzed for PCBs, and the surface water samples were analyzed for TAH/TAqH. Surface water samples had concentrations of tested constituents below the WQS. Several PAHs were detected in sediment at concentrations above the ADEC-recommended NOAA SQuiRT screening levels (USACE-AK 2013). When compared to the ADEC Method Two to be considered (TBC) cleanup level, which are based on the residential soil human health cleanup level, only one location (a small 5- by 5-ft area within Septic Tank #1) had PAH concentrations above these criteria. Additionally, this location contained RRO above the ADEC Method Two TBC cleanup level. PAH and RRO concentrations downstream of this location were below both ADEC Method Two and NOAA SQuiRT values, indicating a lack of PAH and RRO migration. The PAHs and RRO specific to Septic Tank #1 sediment are, therefore, localized, of small extent, and stable (USACE-AK 2014). The limited and stagnant nature of the Septic Tank #1 ephemeral stream indicates recreational activities (e.g., filtering water for drinking) are likely not occurring at this location, or at least not at a high frequency. Therefore, direct contact with sediment is considered an insignificant pathway and there is no unacceptable risk associated with the sediment at the Septic Tank #1 Area (USACE-AK 2015).

2.2.5 Tar Drum Area

The Tar Drum Area is located approximately ¼-mile southeast of the Fuel Storage Area, approximately 80 ft downgradient of the Power Plant Area (Figure 2-1). An area of approximately 50 ft^2 showed signs of distressed vegetation in that large trees, moss, ground cover, and ferns were absent in this area. The impacted area had a silver/gray sheen on the surface and a black/gray tar-like material near dilapidated drum remnants. Two unique drums were identified from the remnants; however, due to the high level of corrosion, additional drums may have potentially existed.

During the Phase I and II RIs, soil and groundwater samples were collected at the Tar Drum Area. Soil samples collected during the Phase II RI were analyzed for GRO, DRO, RRO, PAHs, PCBs, VOCs, target metals, and hexavalent chromium. DRO and RRO were detected at maximum concentrations of 46,000 mg/kg and 36,000 mg/kg, respectively. These concentrations are above the residential cleanup levels and the ADEC Maximum Allowable concentrations (12,500 mg/kg for DRO and 22,000 mg/kg for RRO), which were applied as the recreational cleanup levels, in accordance with 18 AAC 75.340(j)(3) (USACE-AK 2014). Since

POL in soil exceed the recreational cleanup levels, this sub-site may require remedial action under the ADEC Contaminated Sites Program. Based on the Phase II RI Addendum I Technical Memorandum, the estimated volume of POL-impacted soil above recreational cleanup levels is 15 cubic yards (Figure 2-3). Additionally, approximately 1 cubic yard of tar-like material was identified in surface soil and analyzed for TCLP metals, SVOCs, VOCs, and ignitability. The material was characterized as a RCRA hazardous waste, based on ignitability rate of burning, according to 40 Code of Federal Regulations (CFR) 261.21(a)(2) (USACE-AK 2013). In addition to the tar-like material and soil contamination, an area of approximately 50 ft^2 contained distressed vegetation.

In addition to POL contamination, benzo(a)pyrene was detected in soil at 1.9 mg/kg, which is above the residential cleanup level, but below the recreational cleanup level (4 mg/kg). Therefore, this PAH was removed as a COC in the Phase II RI Addendum I Technical Memorandum under a recreational land use scenario (USACE-AK 2015).

Groundwater samples were collected from temporary well points located upgradient, within, and downgradient of the contaminant source area. The samples were analyzed for PCBs, GRO, DRO, RRO, PAHs, VOCs, and target metals. The COCs detected in groundwater were below the ADEC Table C cleanup levels (USACE-AK 2014).

2.2.6 Power Plant Area

The Power Plant Area is located approximately 80 ft west and upgradient of the Tar Drum Area (Figure 2-1). A concrete foundation with suspected generator mounts and scattered building debris (siding, tile, and other collapsed building remnants) are all that remain of the former power plant. During the RI, the concrete foundation and building debris were covered in detritus/soil, which sustained growth for small diameter trees, brush, and moss. Soil, surface water, groundwater, concrete, and tile wipe samples were collected at the Power Plant Area. Soil and groundwater samples were analyzed for DRO, RRO, GRO, BTEX, and PAHs. Additionally, target metals and PCBs (surface soil and groundwater), and hexavalent chromium (surface soil) were analyzed for select media. The concrete and tile wipe samples were analyzed for PCBs. Based on the environmental data collected during the Phase II RI, PCB-contaminated surface soil was present at the former Power Plant. Specifically, two sample locations, each with an estimated concentration of 1.8 mg/kg, exceeded the applicable ADEC cleanup level of 1 mg/kg (Method Two human health; USACE-AK 2014). The PCB exceedances were detected along the west side of the former building and in a depression to the north of the building. PCBs were detected in all concrete samples and in one tile wipe sample collected from the former Power Plant Building. Total PCB concentrations in the concrete samples were all below the 40 CFR concrete criterion of 1 mg/kg; the tile wipe sample concentration within the concrete foundation fell below the 40 CFR criterion of 10 micrograms/wipe (40 CFR 761.125(c)(2)(i)) (USACE-AK 2014). PCBs and arsenic were also detected at concentrations above the Table C cleanup levels in one groundwater sample; however, the elevated concentrations were discounted as a result of soil sloughing into the temporary well boring which caused high turbidity in the water sample, and the results are not considered representative of actual groundwater conditions. No other constituents were detected above the applicable ADEC cleanup levels (USACE-AK 2014).

PCB data collected during the Phase II RI efforts were not sufficient to evaluate risk to human health and the environment. As a result, additional soil samples were collected by USACE staff during June 2016 and analyzed for PCBs. The 2016 sampling results indicated PCB levels at six sample locations that would be designated PCB-contaminated, TSCA regulated waste (i.e. above 50 mg/kg); PCB levels at 13 locations were between 1 mg/kg and 50 mg/kg exceeding the ADEC cleanup level of 1 mg/kg (40 CFR 761.61(a)(5)(i)(B)(2)) (Figure 2-4; USACE-AK 2017). Additionally, the maximum concentration detected during the 2016 sampling event was 9,300 mg/kg (USACE-AK 2017). Given the relatively high PCB concentrations in surface soil at the Power Plant site, the risk to human health from exposure to PCB-contaminated soil is considered high enough to warrant action without performing a detailed human health risk assessment. The objective of the cleanup response would be to reduce PCB concentrations in soil to below 1 mg/kg, which is expected to effectively reduce human health and ecological risk to acceptable levels (USACE-AK 2017). The volumes of soil contaminated with PCBs above 50 mg/kg and between 1 mg/kg and 50 mg/kg requiring remedial action are estimated to be approximately 156 and 403 cubic yards, respectively. These volumes of soil were conservatively estimated in the Phase II RI Addendum II, based on the measured depth to water of 6.24 ft bgs (USACE-AK 2017).

2.2.7 Septic Tank #2

A second former septic tank (Septic Tank #2) is located south of the Power Plant Area (Figure 2-1). Two open concrete boxes associated with the former septic tank were identified as Trap #1 and Trap #2 on the historical map. Pooled water within the former septic tank, as observed during the RI, likely derived from both precipitation and groundwater seeps. A small stream flowed from the former septic tank pool, spread out in a low, wet area downgradient of the septic tank, and continued subterranean before reaching the beach. During the RI, soil, sediment, surface water, and groundwater samples were collected at Septic Tank #2 and analyzed for DRO, RRO, GRO, BTEX, PAHs, and target metals. Additionally, PCBs (soil and sediment), hexavalent chromium (soil), and TAH/TAqH (surface water) were analyzed for select media. Material within two traps associated with Septic Tank #2 was analyzed for PCBs, TCLP VOCs/SVOCs/metals, and ignitability, with results not characteristic of RCRA or TSCA waste. Several sediment samples contained PAHs and metals (mercury) at concentrations above the SQuiRT threshold effect level screening levels. However, the concentrations were below the ADEC Method Two TBC cleanup level. Soil, surface water, and groundwater samples were all below the screening or applicable proposed cleanup levels. Based on the RI, Septic Tank #2 features do not pose unacceptable risk to human health or the environment (USACE-AK 2014).

2.3 Evaluation of Site Risks

This section details the updated CSM that was presented in the Phase II RI Addendum I Technical Memorandum and presents the potential site risks (USACE-AK 2015).

2.3.1 Human Health Conceptual Site Model

A human health CSM has been developed in accordance with Federal guidelines under CERCLA and ADEC *Policy Guidance on Developing Conceptual Site Models* (ADEC 2010). Current land use is predominantly un-guided recreation (e.g., sight-seeing, hiking, camping, hunting) permitted by the land owner, USFS. The USFS Land Management Plan designates the area, including the FUDS, as a Special Interest Area due to unique geologic values of the Mt. Edgecumbe Geological Area. According to the USFS, the Special Interest Area designation prohibits residential land use. In addition, there is a very low probability that the designation would change in the future, based on the remoteness and geologic attributes of the area. Although the reasonably anticipated future land use of the FUDS would remain the same as current land use, an unrestricted future land use scenario was initially assumed during the RI for conservative screening purposes. The CSM presented in the Phase II RI Addendum I was updated to reflect the anticipated future land use (recreational). The pathways and receptors that are potentially complete, or where likely exposure exists, are summarized below:

- *Recreational User/Site Visitor (current/future):* The most likely current and future human receptors include recreationists (e.g., hikers, hunters). Adults and children are both included as recreationists and site visitor receptors. Soil pathways include incidental ingestion and dermal absorption. Recreationists and site visitors may ingest edible vegetation during time at the site. Since bioaccumulative compounds were present at the Power Plant and Landfill Areas (e.g., PCBs), ingestion of wild foods is considered a complete pathway for this receptor. While possibly complete, the ingestion of wild foods pathway is considered insignificant based on expected minimal ecological exposure indicated through the Phase II RI ecological scoping process (USACE-AK 2014).

  Ingestion of groundwater was retained as a potential future pathway during the RI as a conservative measure. The USFS designates the land encompassing the FUDS as a Special Interest Area. There are no plans to change this designation or allow seasonal or full-time occupancy of the island where a drinking water system would be necessary. It is unreasonable to include groundwater pathways for the limited recreational use of the area since receptor interactions with groundwater are not and will not be occurring. Further support for the FUDS area being neither a current nor reasonably anticipated future drinking water source is provided in the “350 Determination” outlined in the Phase II RI Addendum Technical Memorandum. Additionally, RI data show groundwater-to-surface water interactions do not yield any COC in surface water above the WQS.

  Exposure to surface water is considered to be a potentially complete, but insignificant pathway. All tested surface water show COC concentrations below the WQS. Sediment contact is a possible concern at the stream adjacent to Septic Tank #1, where multiple PAHs and RRO above ADEC Method Two cleanup levels were encountered in sediment. The limited and stagnant nature of this stream[1] indicates recreational activities (e.g., filtering water for drinking) are likely not occurring at this location, or at least not at a high frequency. Therefore, direct contact with sediment is considered an insignificant pathway. The absence of suitable fish habitat at the ephemeral streams associated with Septic Tanks #1[1] and #2, and the small/shallow footprint of perennial South and North Streams associated with the Fuel Storage Area, precludes the human consumption of aquatic organisms from streams located in these areas. Therefore, the ingestion of aquatic organisms (i.e., wild foods pathway) is considered to be an incomplete pathway.

[1] The stream associated with Septic Tank #1 was observed to be dry during the 2013 RI and when water was present, was stagnant and fetid from accumulation of detritus in the pooled area of the historical septic tank.

- *Subsistence Harvester/Consumers (current/future):* Subsistence harvesters are assumed to have the same exposure and pathways as recreationists and site visitors. Additionally, subsistence harvesters and their families are commonly also subsistence consumers, who could be exposed to bioaccumulative compounds through the ingestion of wild foods pathway. However, the Phase II RI ecological scoping process indicated ecological exposure to contaminants is insignificant based on habitat and areal distribution of impacts. Therefore, human exposure through the ingestion of wild foods is also considered insignificant. Subsistence terrestrial foods include mink, deer, brown bear, mushrooms, berries, and fern. The range a subsistence hunter and/or gatherer covers and the terrestrial wildlife that is hunted for food is likely much greater than the impacted FUDS. Subsistence avian foods include duck, goose, and tern. Again, the home range of these animals would be much larger than the impacted FUDS locations, and the heavily forested conditions of the sub-sites typically do not provide habitat for many of these species. Subsistence marine foods include salmon, halibut, lingcod, rockfish, herring, shellfish, crab, and seaweed. RI results indicated the marine environment has not been impacted by contaminants and exposure from marine foods is not expected. As mentioned above, the absence of a habitat supportive of fish populations in the freshwater ephemeral streams associated with FUDS contamination precludes human consumption of aquatic organisms from these areas.
- For all potential receptors, volatiles inhalation in ambient air is considered a complete pathway, although exposure is likely minor due to rapid dilution and atmospheric mixing. In addition, the petroleum product releases at the sub-sites occurred over 70 years ago and are heavily weathered, so few volatiles remain. However, naphthalene was detected above 1/10th of the 2016 ADEC human health cleanup level at one surface soil location, so this pathway was retained for further risk evaluation. Inhalation of fugitive dust is considered an incomplete pathway for all receptors due to the wet climate and abundant vegetative ground cover in the form of mosses and underbrush.

2.3.2 Potential Human Health Risks

Since the current and anticipated future land use is recreational, the exposure frequency (EF) used to calculate cumulative risk for nickel, DRO, RRO, benzo(a)pyrene, and benzo(b)fluoranthene was changed from the residential default value of 330 days per year (for Over 40 Inch Zone) to 14 days per year (USACE-AK 2015). Fourteen days per year is considered more reasonable and representative of the time a recreational user would be in contact with contaminated soil at the FUDS. In this scenario, an adult or child recreational user would need to be camping at, or spending the majority of time at, one or more of the contaminated surface soil locations for a period of 14 days every year for up to 30 years before potential adverse effects might occur. Cumulative risk was calculated for a pre-remediation scenario using the 2016 PCB data. Using an EF of 14 days, the cancer risk exceeds the NCP acceptable cancer risk range (1×10^{-4} to 1×10^{-6}) with a cancer risk of 6 in 10,000 (6×10^{-4}). The risk is driven by PCBs.

Cumulative risk was also calculated for a post-remediation scenario after the cleanup levels are applied. After remediation, the cumulative risk remaining at the site meets the NCP and ADEC risk criteria.

2.3.3 Ecological Scoping

An ecological CSM has been developed in accordance with ADEC *Ecoscoping Guidance* (ADEC 2012). The CSM provides a general overview of the potential exposure pathways and ecological receptors to assess environmental risk on a site-wide basis. The generic ecological CSM indicates that complete and significant exposure for ecological receptors is not expected. “Off-ramps” were identified for each of the sub-sites (Landfill Area, Fuel Storage Area, Manhole #1, Septic Tank #1, Tar Drum Area, Power Plant Area, and Septic Tank #2 and associated features); indicating further evaluation of risk to the environment is not warranted.

In all instances, “off-ramps” were taken for Item 3 of the ecoscoping form (Habitat). There are no critical habitats (which generally includes large congregations of animal, plant, and water resources) designated or observed on the island. Kruzof Island (managed by the USFS) provides habitat for eagles, which possess cultural significance to local [Native American] people, and black-tailed deer, which are hunted throughout the island (for subsistence and recreation). Although Kruzof Island is located within the Tongass National Forest, the FUDS areas do no occur within a park, preserve, or wildlife refuge, as defined by the ADEC. The investigated FUDS are located adjacent to the beach area, but are well above the high tide zone and, with the possible exception of shore birds that may occupy and forage in open (unforested) areas along, and adjacent to, the beach/shoreline (none of which are directly in contaminated areas), do not provide suitable habitat for marine receptors. Although deer and/or bear and other wildlife may use or traverse the FUDS, the overall sub-site footprints are small in relation to the foraging ranges of even small prey animals (e.g., mice), and review of soil data indicate that chemical impacts are localized and associated with only a few individual point locations. Exposure, while potentially complete, is, therefore, expected to be insignificant (USACE-AK 2015).

2.4 Chemicals of Concern

Specified features and locations at the RI sub-sites associated with the Fort Babcock FUDS were evaluated for the following analytes: DRO, RRO, GRO, VOCs (BTEX only at some areas), PAHs, Target Metals, hexavalent chromium, and PCBs. Not all analytes were evaluated at all locations and/or depths; rather, the sampling strategy was dependent on the sub-site feature and apparent source being investigated. The Power Plant sub-site contains PCB-contaminated soil at concentrations above the ADEC Method Two residential cleanup level, which in this case, is applied as the recreational cleanup level (USACE-AK 2017). Additionally, PCB concentrations at six sample locations are designated PCB-contaminated, TSCA regulated waste (i.e. above 50 mg/kg). The Landfill contained metals and the Tar Drum Area contained PAHs (CERCLA process) at concentrations above the ADEC Method Two residential cleanup level, but below the applicable recreational cleanup levels and are therefore not considered for remedial action under the current and future recreational land use scenario. The Fuel Storage Area and Tar Drum Area soils contained POL (Non-CERCLA, ADEC process) concentrations greater than the recreational cleanup levels. Table 2-1 includes approved recreational cleanup levels and estimated contaminated soil volumes after the recreational cleanup levels were applied to each sub-site (USACE-AK 2017).

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Table 2-1: COCs, Cleanup Levels, Maximum Concentrations, and Estimated Contaminated Soil Volumes

Sub-site	COC	CERCLA or Non-CERCLA Process	Approved Recreational Cleanup Level (mg/kg)	Maximum Concentration (mg/kg)	Estimated Volume of Soil (cubic yards)	Estimated Volume Assumptions
Fuel Storage Area	DRO	Non-CERCLA	12,500 [a]	**130,000**	82	Soils exceeding the recreational cleanup level = 2 ft bgs over 990 ft² and 3 ft bgs over 75 ft².
Tar Drum Area	DRO	Non-CERCLA	12,500 [a]	**46,000**	15	Soils exceeding the recreational cleanup level = 1.5 ft bgs over 264 ft².
	RRO		22,000 [b]	**36,000**		
Power Plant Area	PCBs	CERCLA	1 [c]	**9,300**	559	Soils exceeding the recreational cleanup level = 6.24 ft bgs over 2417 ft².

Notes:
Bold Shaded indicates concentration exceeds applicable recreational cleanup level.
ACL alternate cleanup level
bgs below ground surface
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
COC chemical of concern
DRO diesel range organics
ft foot or feet
ft^2 square feet
mg/kg milligram(s) per kilogram
PCB polychlorinated biphenyl
RRO residual range organics
[a] Calculated DRO Method Three ACL (195,643 mg/kg) greater than ADEC Maximum Allowable (12,500 mg/kg) – Maximum Allowable (12,500 mg/kg) proposed and approved by ADEC in a letter to the USACE dated 12 October 2017.
[b] Calculated RRO Method Three ACL (195,643 mg/kg) greater than ADEC Maximum Allowable (22,000 mg/kg) – Maximum Allowable (22,000 mg/kg) proposed and approved by ADEC in a letter to the USACE dated 12 October 2017.
[c] ADEC Method Four required for the determination of ACL for PCBs; Method 4 not performed. ADEC 2016 Human Health level of 1 mg/kg PCBs proposed and approved by ADEC in a letter to the USACE dated 12 October 2017.

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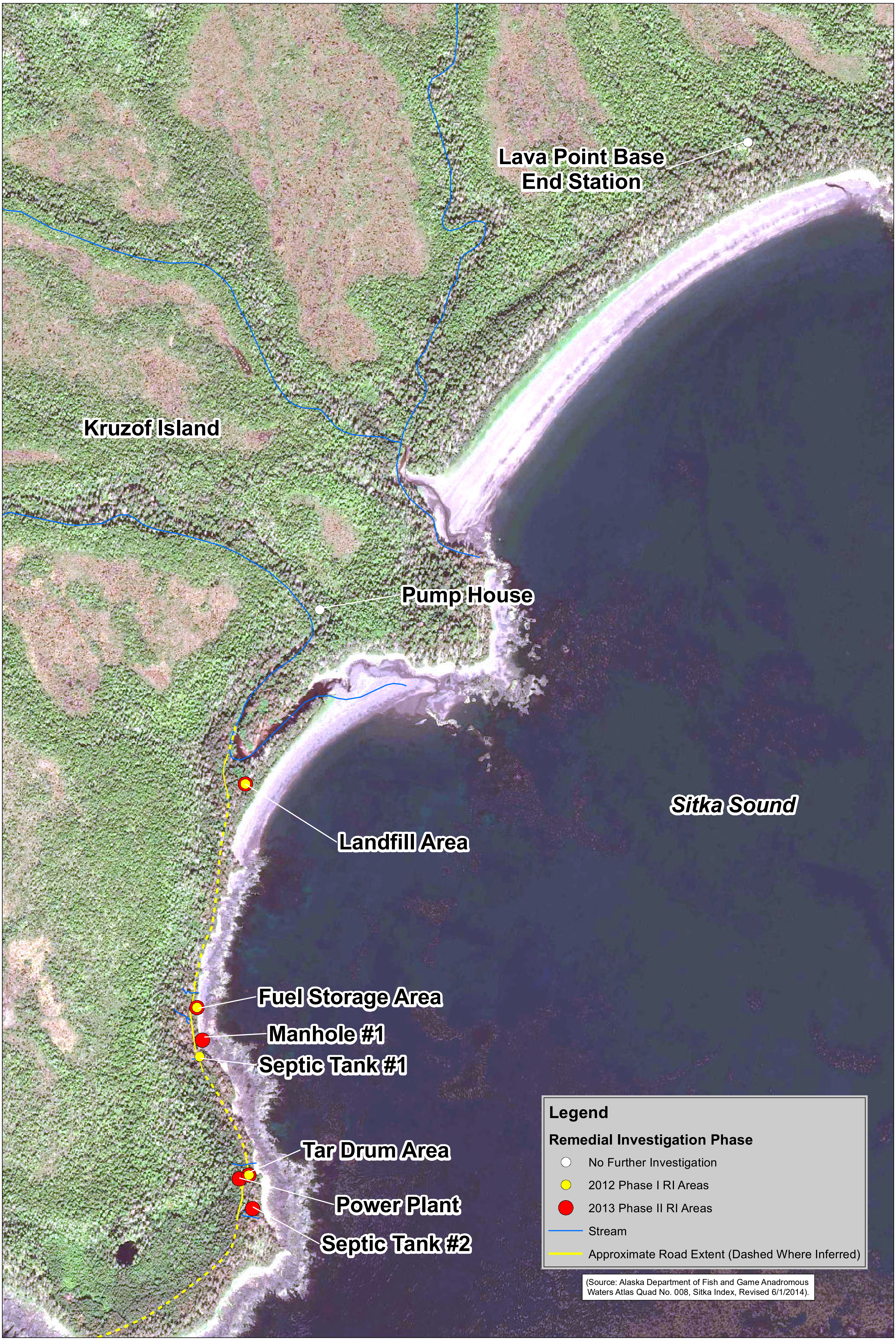

U.S.Army Engineer District, Alaska

Feet
0 250 500 1,000

Fort Babcock
Feasibility Study
Kruzof Island, Alaska

Sub-sites Investigated During the Phase I/II Remedial Investigation

Date: 2/3/2018 | DRWN:lb | Revision: 0

FIGURE 2-1

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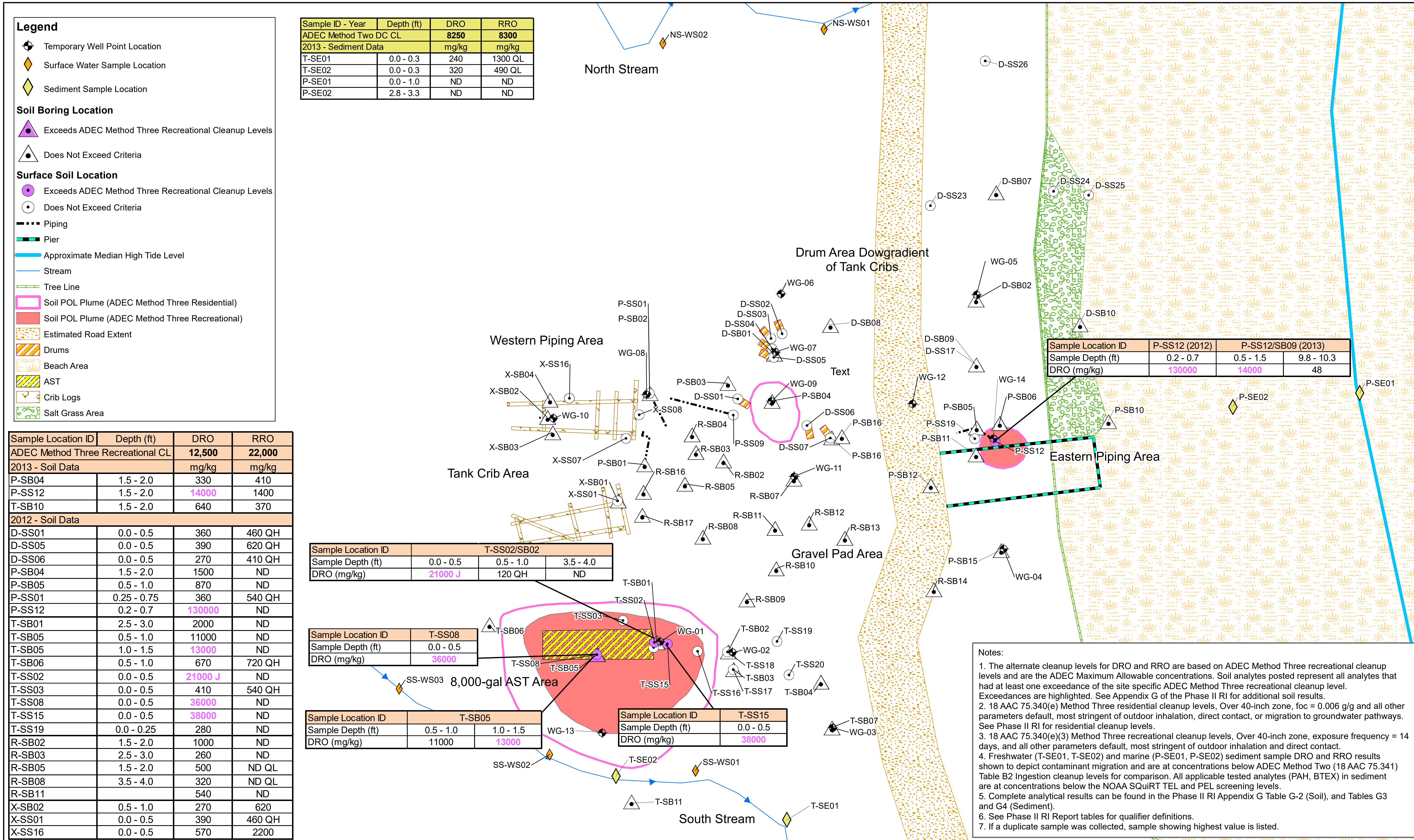

Sample ID - Year	Depth (ft)	DRO	RRO
ADEC Method Two DC CL		**8250**	**8300**
2013 - Sediment Data		mg/kg	mg/kg
T-SE01	0.0 - 0.3	240	1300 QL
T-SE02	0.0 - 0.3	320	490 QL
P-SE01	0.0 - 1.0	ND	ND
P-SE02	2.8 - 3.3	ND	ND

Sample Location ID	Depth (ft)	DRO	RRO
ADEC Method Three Recreational CL		**12,500**	**22,000**
2013 - Soil Data		mg/kg	mg/kg
P-SB04	1.5 - 2.0	330	410
P-SS12	1.5 - 2.0	14000	1400
T-SB10	1.5 - 2.0	640	370
2012 - Soil Data			
D-SS01	0.0 - 0.5	360	460 QH
D-SS05	0.0 - 0.5	390	620 QH
D-SS06	0.0 - 0.5	270	410 QH
P-SB04	1.5 - 2.0	1500	ND
P-SB05	0.5 - 1.0	870	ND
P-SS01	0.25 - 0.75	360	540 QH
P-SS12	0.2 - 0.7	130000	ND
T-SB01	2.5 - 3.0	2000	ND
T-SB05	0.5 - 1.0	11000	ND
T-SB05	1.0 - 1.5	13000	ND
T-SB06	0.5 - 1.0	670	720 QH
T-SS02	0.0 - 0.5	21000 J	ND
T-SS03	0.0 - 0.5	410	540 QH
T-SS08	0.0 - 0.5	36000	ND
T-SS15	0.0 - 0.5	38000	ND
T-SS19	0.0 - 0.25	280	ND
R-SB02	1.5 - 2.0	1000	ND
R-SB03	2.5 - 3.0	260	ND
R-SB05	1.5 - 2.0	500	ND QL
R-SB08	3.5 - 4.0	320	ND QL
R-SB11		540	ND
X-SB02	0.5 - 1.0	270	620
X-SS01	0.0 - 0.5	390	460 QH
X-SS16	0.0 - 0.5	570	2200

Sample Location ID	P-SS12 (2012)	P-SS12/SB09 (2013)	
Sample Depth (ft)	0.2 - 0.7	0.5 - 1.5	9.8 - 10.3
DRO (mg/kg)	130000	14000	48

Sample Location ID	T-SS02/SB02		
Sample Depth (ft)	0.0 - 0.5	0.5 - 1.0	3.5 - 4.0
DRO (mg/kg)	21000 J	120 QH	ND

Sample Location ID	T-SS08
Sample Depth (ft)	0.0 - 0.5
DRO (mg/kg)	36000

Sample Location ID	T-SB05	
Sample Depth (ft)	0.5 - 1.0	1.0 - 1.5
DRO (mg/kg)	11000	13000

Sample Location ID	T-SS15
Sample Depth (ft)	0.0 - 0.5
DRO (mg/kg)	38000

Notes:

1. The alternate cleanup levels for DRO and RRO are based on ADEC Method Three recreational cleanup levels and are the ADEC Maximum Allowable concentrations. Soil analytes posted represent all analytes that had at least one exceedance of the site specific ADEC Method Three recreational cleanup level. Exceedances are highlighted. See Appendix G of the Phase II RI for additional soil results.
2. 18 AAC 75.340(e) Method Three residential cleanup levels, Over 40-inch zone, foc = 0.006 g/g and all other parameters default, most stringent of outdoor inhalation, direct contact, or migration to groundwater pathways. See Phase II RI for residential cleanup levels.
3. 18 AAC 75.340(e)(3) Method Three recreational cleanup levels, Over 40-inch zone, exposure frequency = 14 days, and all other parameters default, most stringent of outdoor inhalation and direct contact.
4. Freshwater (T-SE01, T-SE02) and marine (P-SE01, P-SE02) sediment sample DRO and RRO results shown to depict contaminant migration and are at concentrations below ADEC Method Two (18 AAC 75.341) Table B2 Ingestion cleanup levels for comparison. All applicable tested analytes (PAH, BTEX) in sediment are at concentrations below the NOAA SQuiRT TEL and PEL screening levels.
5. Complete analytical results can be found in the Phase II RI Appendix G Table G-2 (Soil), and Tables G3 and G4 (Sediment).
6. See Phase II RI Report tables for qualifier definitions.
7. If a duplicate sample was collected, sample showing highest value is listed.

Path: C:\Users\lbeasley\Documents\ArcGIS\Packages\FIGURE 2-3_C44BEBFF-D655-4521-AAFE-ACD9AA79DF17\v10\FIGURE 2-3.mxd

U.S.Army Engineer District, Alaska

Surveyed by: O'Neil Surveying and Engineering
Date: August to September 2012 and September to October 2013
Horizontal Datum: NAD 83 Alaska State Plane Zone 1 Feet
Vertical Datum: NAVD 88

Fort Babcock
Feasibility Study
Kruzof Island, Alaska

Fuel Storage Area POL Impacted Soils

Date: 2/3/2018 | DRWN:lb | Revision: 0

FIGURE 2-2

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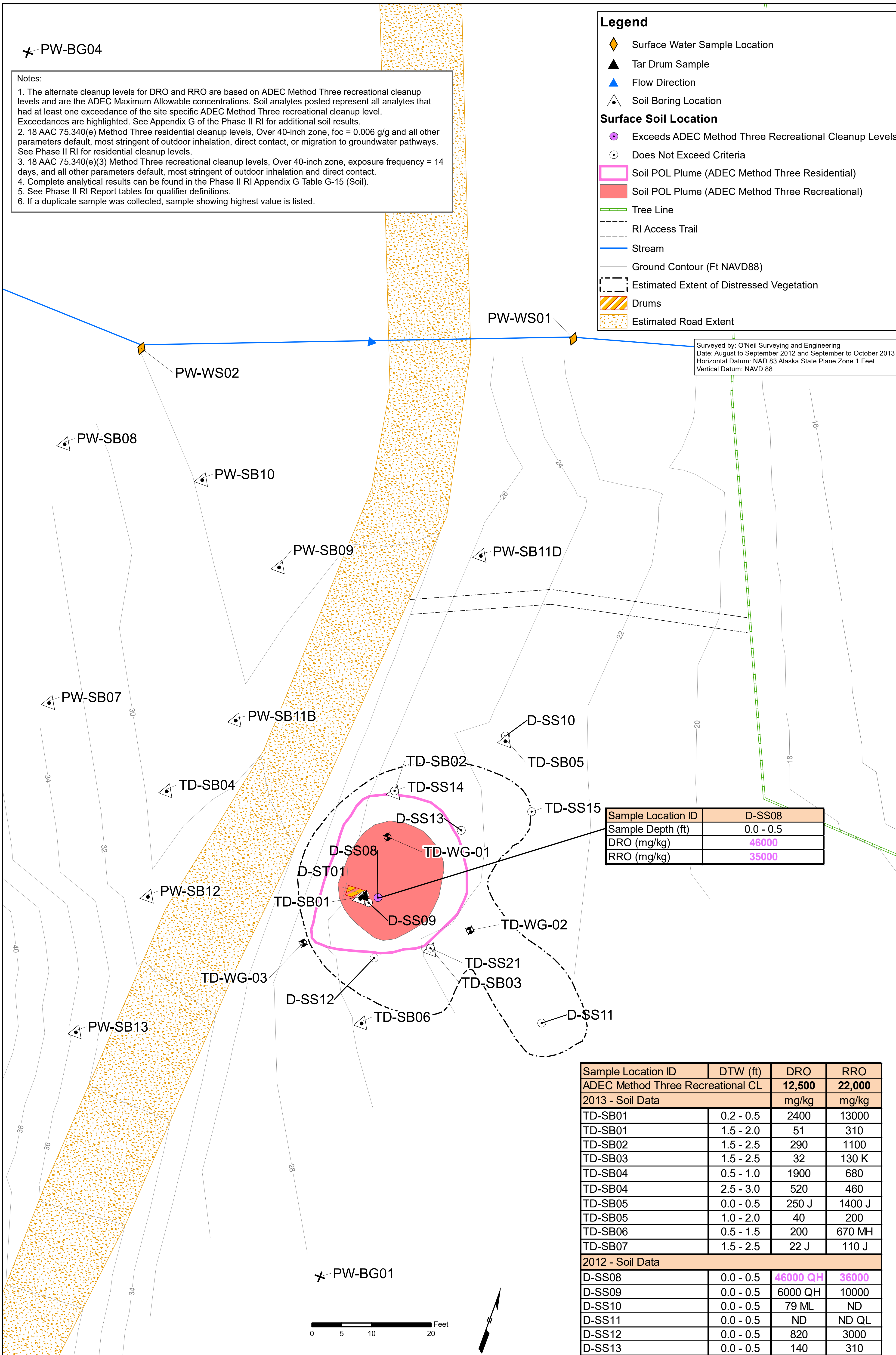

Notes:

1. The alternate cleanup levels for DRO and RRO are based on ADEC Method Three recreational cleanup levels and are the ADEC Maximum Allowable concentrations. Soil analytes posted represent all analytes that had at least one exceedance of the site specific ADEC Method Three recreational cleanup level. Exceedances are highlighted. See Appendix G of the Phase II RI for additional soil results.
2. 18 AAC 75.340(e) Method Three residential cleanup levels, Over 40-inch zone, foc = 0.006 g/g and all other parameters default, most stringent of outdoor inhalation, direct contact, or migration to groundwater pathways. See Phase II RI for residential cleanup levels.
3. 18 AAC 75.340(e)(3) Method Three recreational cleanup levels, Over 40-inch zone, exposure frequency = 14 days, and all other parameters default, most stringent of outdoor inhalation and direct contact.
4. Complete analytical results can be found in the Phase II RI Appendix G Table G-15 (Soil).
5. See Phase II RI Report tables for qualifier definitions.
6. If a duplicate sample was collected, sample showing highest value is listed.

Sample Location ID	DTW (ft)	DRO	RRO
ADEC Method Three Recreational CL		12,500	22,000
2013 - Soil Data		mg/kg	mg/kg
TD-SB01	0.2 - 0.5	2400	13000
TD-SB01	1.5 - 2.0	51	310
TD-SB02	1.5 - 2.5	290	1100
TD-SB03	1.5 - 2.5	32	130 K
TD-SB04	0.5 - 1.0	1900	680
TD-SB04	2.5 - 3.0	520	460
TD-SB05	0.0 - 0.5	250 J	1400 J
TD-SB05	1.0 - 2.0	40	200
TD-SB06	0.5 - 1.5	200	670 MH
TD-SB07	1.5 - 2.5	22 J	110 J
2012 - Soil Data			
D-SS08	0.0 - 0.5	46000 QH	36000
D-SS09	0.0 - 0.5	6000 QH	10000
D-SS10	0.0 - 0.5	79 ML	ND
D-SS11	0.0 - 0.5	ND	ND QL
D-SS12	0.0 - 0.5	820	3000
D-SS13	0.0 - 0.5	140	310

Path: C:\Users\lbeasley\Documents\ArcGIS\Packages\FIGURE 2-4_F1DEE15F-1428-4BDF-8572-BC1050858DE1\v10\FIGURE 2-4.mxd

U.S.Army Engineer District, Alaska

Fort Babcock
Feasibility Study
Kruzof Island, Alaska

Tar Drum Area POL Impacted Soils

Date: 2/3/2018 | DRWN:lb | Revision: 0

FIGURE 2-3

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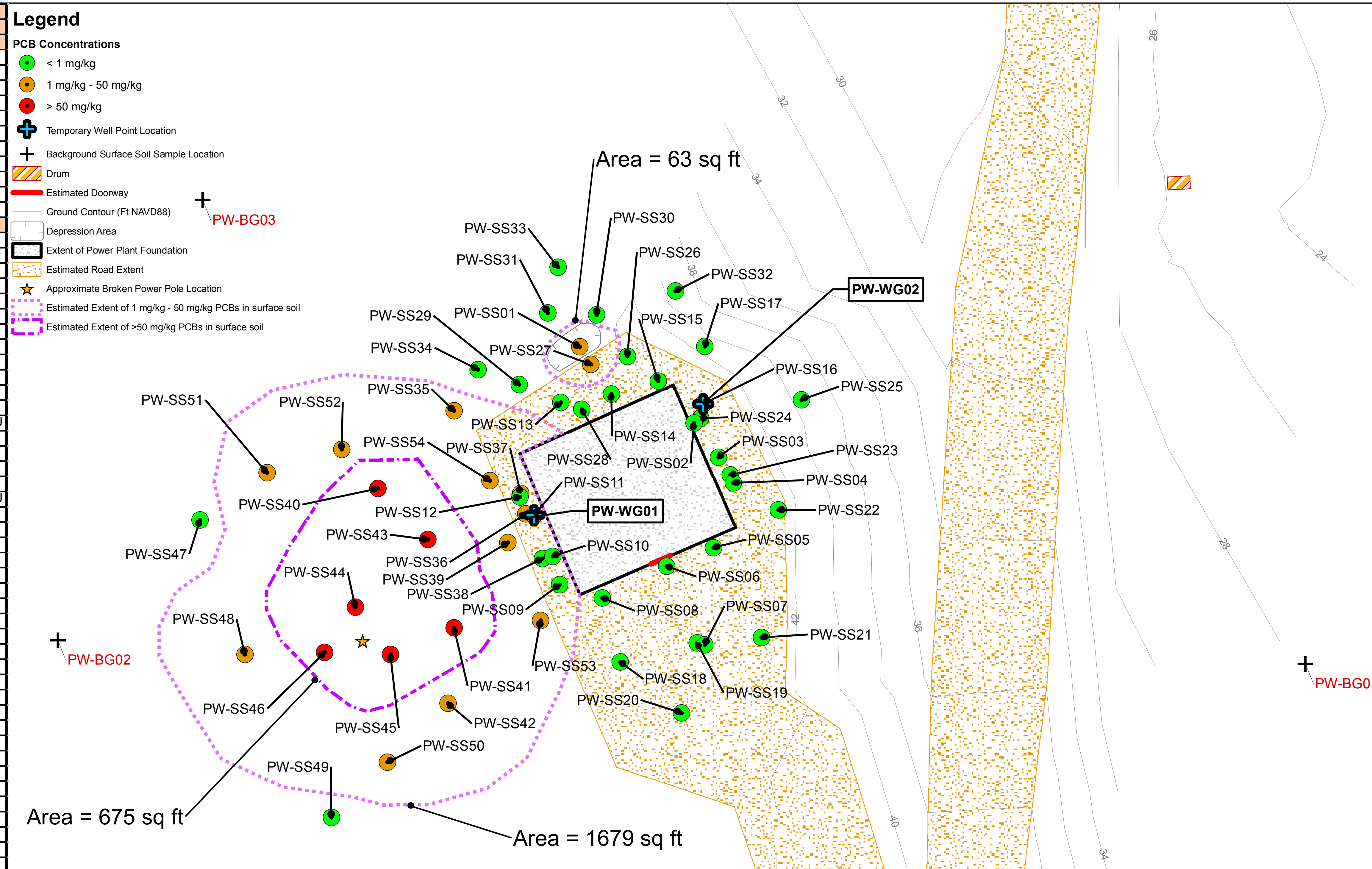
Sample ID - Year	Depth (ft)	DRO	RRO	PCBs
ADEC Method Three *Residential* CL		**12,500**	**22,000**	**1**
2013 - Soil Data		mg/kg	mg/kg	mg/kg
PW-SS01-0.5-1.5-13	0.5 - 1.5	120	96 J	1.8 J
PW-SS02-0.5-1.5-13	0.5 - 1.5	170 QL	65 J	0.015 J
PW-SS06-0.5-1.5-13	0.5 - 1.5	4.9 QL	26 J	0.12 J
PW-SS060-0.5-1.5-13	0.5 - 1.5	5.7 J	33 J	0.087 J
PW-SS07-0.5-1.5-13	0.5 - 1.5	19 J	76 J	0.48 J
PW-SS08-0.5-1.5-13	0.5 - 1.5	8.2 J	70 J	0.47 J
PW-SS11-0.5-1.5-13	0.5 - 1.5	3.7 J	9.9 J	1.8 J
PW-SS15-0.5-1.5-13	0.5 - 1.5	2.0 J	5.8 J	ND
PW-SS16-0.5-1.5-13	0.5 - 1.5	ND	5.3 J	ND
PW-SS16-3.0-3.5-13	3.0 - 3.5	440	1200	0.97 J
PW-SS17-0.5-1.0-13	0.5 - 1.0	98	270	ND
2016 - Soil Data				
PW-SS18-0.5-1.5-16	0.5 - 1.5	--	--	0.201
PW-SS19-0.5-1.5-16	0.5 - 1.5	--	--	0.0510 J
PW-SS20-0.5-1.5-16	0.5 - 1.5	--	--	0.114
PW-SS21-0.5-1.5-16	0.5 - 1.5	--	--	0.186
PW-SS22-0.5-1.5-16	0.5 - 1.5	--	--	ND
PW-SS23-0.5-1.5-16	0.5 - 1.5	--	--	ND
PW-SS24-0.5-1.5-16	0.5 - 1.5	--	--	ND
PW-SS25-0.5-1.5-16	0.5 - 1.5	--	--	ND
PW-SS26-0.5-1.5-16	0.5 - 1.5	--	--	ND
PW-SS260-0.5-1.5-16	0.5 - 1.5	--	--	ND
PW-SS27-0.5-1.5-16	0.5 - 1.5	--	--	3.25
PW-SS28-0.5-1.5-16	0.5 - 1.5	--	--	.0380 J
PW-SS29-0.5-1.5-16	0.5 - 1.5	--	--	0.0534 J
PW-SS30-0.5-1.5-16	0.5 - 1.5	--	--	0.111
PW-SS31-0.5-1.5-16	0.5 - 1.5	--	--	0.35
PW-SS32-0.5-1.5-16	0.5 - 1.5	--	--	0.275
PW-SS33-0.5-1.5-16	0.5 - 1.5	--	--	0.257
PW-SS34-0.5-1.5-16	0.5 - 1.5	--	--	0.0766 J
PW-SS35-0.5-1.5-16	0.5 - 1.5	--	--	4.52
PW-SS36-0.5-1.5-16	0.5 - 1.5	--	--	1.27
PW-SS360-0.5-1.5-16	0.5 - 1.5	--	--	1.7
PW-SS37-0.5-1.5-16	0.5 - 1.5	--	--	4.64
PW-SS38-0.5-1.5-16	0.5 - 1.5	--	--	0.42
PW-SS39-0.5-1.5-16	0.5 - 1.5	--	--	3.38
PW-SS40-0.5-1.5-16	0.5 - 1.5	--	--	36.6
PW-SS40-3.5-4.5-16	3.5 - 4.5	--	--	57.8
PW-SS41-0.5-1.5-16	0.5 - 1.5	--	--	5660
PW-SS42-0.5-1.5-16	0.5 - 1.5	--	--	2.87
PW-SS420-0.5-1.5-16	0.5 - 1.5	--	--	3.53
PW-SS43-0.5-1.5-16	0.5 - 1.5	--	--	76.6
PW-SS44-0.5-1.5-16	0.5 - 1.5	--	--	8770
PW-SS45-0.5-1.5-16	0.5 - 1.5	--	--	9300
PW-SS46-0.5-1.5-16	0.5 - 1.5	--	--	6960
PW-SS47-0.5-1.5-16	0.5 - 1.5	--	--	0.581
PW-SS48-0.5-1.5-16	0.5 - 1.5	--	--	17
PW-SS49-0.5-1.5-16	0.5 - 1.5	--	--	0.383
PW-SS50-0.5-1.5-16	0.5 - 1.5	--	--	2.05
PW-SS51-0.5-1.5-16	0.5 - 1.5	--	--	1.04
PW-SS52-0.5-1.5-16	0.5 - 1.5	--	--	1.47
PW-SS53-0.5-1.5-16	0.5 - 1.5	--	--	21.2
PW-SS530-0.5-1.5-16	0.5 - 1.5	--	--	27.3
PW-SS54-0.5-1.5-16	0.5 - 1.5	--	--	32.8



Notes:
1. Data shown was collected by AECOM and USACE and reported in the Phase II RI dated September 2013 and this Phase II RI Addendum.
2. Soil PCB results are compared to the ADEC 2016 Table B1 Method 2 Human Health cleanup level in the over 40- inch zone.
3. Complete analytical results are reported in mg/kg and can be found in Appendix I Table I-17 (Soil) of the Phase 2 RI report and the tables of this Phase II RI Addendum.
4. See Phase II RI Addendum report Table 2 for qualifier definitions.
5. The highest PCB concentration was selected to be depicted for duplicate pairs.

2013 site features and sample locations were surveyed by O'Neil Surveying and Engineering which is based in Sitka, Alaska.
Date: August to September 2012 and September to October 2013
Horizontal Datum: NAD 83 Alaska State Plane Zone 1 Feet
Vertical Datum: NAVD 88
2016 sample locations were measured using swing-ties relative to Power Plant Foundation surveyed during 2013.

Feet
0 10 20

N

Date: 2/3/2018

Fort Babcock
Phase II Remedial Investigation Report Addendum 2
Kruzof Island, Alaska

U.S. ARMY CORPS OF ENGINEERS ALASKA DISTRICT

Power Plant PCB Impacted Soils

FIGURE 2-4

X:\Projects\Ft_Babcock\Fort_Babcock\1_MXD\MXD_TEMPLATE\Dales_Edites_September_2016\FIGURE_MAR_16th_Edits_RJ.mxd

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Table 2-1: COCs, Cleanup Levels, Maximum Concentrations, and Estimated Contaminated Soil Volumes

Sub-site	COC	CERCLA or Non-CERCLA Process	Approved Recreational Cleanup Level (mg/kg)	Maximum Concentration (mg/kg)	Estimated Volume of Soil (cubic yards)	Estimated Volume Assumptions
Fuel Storage Area	DRO	Non-CERCLA	12,500 [a]	**130,000**	82	Soils exceeding the recreational cleanup level = 2 ft bgs over 990 ft² and 3 ft bgs over 75 ft².
Tar Drum Area	DRO	Non-CERCLA	12,500 [a]	**46,000**	15	Soils exceeding the recreational cleanup level = 1.5 ft bgs over 264 ft².
	RRO		22,000 [b]	**36,000**		
Power Plant Area	PCBs	CERCLA	1 [c]	**9,300**	559	Soils exceeding the recreational cleanup level = 6.24 ft bgs over 2417 ft².

Notes:
Bold Shaded indicates concentration exceeds applicable recreational cleanup level.
ACL alternate cleanup level
bgs below ground surface
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
COC chemical of concern
DRO diesel range organics
ft foot or feet
ft² square feet
mg/kg milligram(s) per kilogram
PCB polychlorinated biphenyl
RRO residual range organics
[a] Calculated DRO Method Three ACL (195,643 mg/kg) greater than ADEC Maximum Allowable (12,500 mg/kg) – Maximum Allowable (12,500 mg/kg) proposed and approved by ADEC in a letter to the USACE dated 12 October 2017.
[b] Calculated RRO Method Three ACL (195,643 mg/kg) greater than ADEC Maximum Allowable (22,000 mg/kg) – Maximum Allowable (22,000 mg/kg) proposed and approved by ADEC in a letter to the USACE dated 12 October 2017.
[c] ADEC Method Four required for the determination of ACL for PCBs; Method 4 not performed. ADEC 2016 Human Health level of 1 mg/kg PCBs proposed and approved by ADEC in a letter to the USACE dated 12 October 2017.

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3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND REMEDIAL ACTION OBJECTIVES

3.1 Applicable or Relevant and Appropriate Requirements

One of the objectives of the CERCLA process is to ensure that remedial response actions comply with the environmental laws that are ARARs. These ARARs are identified on a site-specific basis. In general, the identification process involves comparing a number of site-specific factors with the statutory or regulatory requirements of the relevant environmental laws. The ARARs identified for the Power Plant site soil, with PCBs as the sole COC requiring remedial response actions under CERCLA, are discussed below. The POL contaminated sub-sites are not regulated under CERCLA and are further discussed in Section 5. Although not considered ARARs, the requirements of 18 AAC 70.010, 18 AAC 75.325(g), .370(a)(2), and .355(b) will be incorporated into future planning documents as applicable to the selected alternative.

3.1.1 Chemical-Specific ARARs

Chemical-specific ARARs include those requirements that regulate the release to, or presence in, the environment for materials possessing 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 ARAR is presented in Table 3-1.

Table 3-1: Chemical-specific ARARs

Chemical-Specific ARARs			
Topic	**Chemical of Concern**	**Regulation/Requirements Citation**	**Description**
Soil cleanup	PCBs	Alaska Oil and Hazardous Substances Pollution Control Regulations [18 AAC 75.341(c) Table B1 PCB cleanup level]	These state regulations provide soil cleanup levels for CERCLA constituents and provide the basis for the site cleanup level of 1 mg/kg.

AAC Alaska Administrative Code
ARAR applicable or relevant and appropriate requirement
CFR Code of Federal Regulations
mg/kg milligram(s) per kilogram
PCB polychlorinated biphenyl

3.1.2 Location-specific ARARs

Location-specific ARARs are restrictions placed on the constituent concentrations or activities that may be conducted because the site is in a special location, such as a floodplain, wetland, historic place, or fragile ecosystem or habitat. No such location-specific ARARs were identified for the project site.

3.1.3 Action-specific ARARs

Action-specific ARARs are technology- or activity-based requirements. By definition, action-specific ARARs depend on the proposed remedial actions. Action-specific ARARs do not in themselves determine the remedial alternative; rather, they indicate how an alternative must be conducted. No such action-specific ARARs were identified for the project site.

3.2 RAOs

RAOs are media-specific goals that are protective of human health and the environment. RAOs include the COC, exposure routes, and the acceptable cleanup level (EPA 1988). The RAO for the PCB-contaminated soil at the Power Plant sub-site is to minimize or prevent direct human contact, outdoor inhalation, and ingestion of soil more than the approved recreational cleanup level of 1.0 mg/kg total PCBs. No RAOs are required for the other sub-sites and their associated contamination (i.e. PAHs, metals) because the concentrations fall below the appropriate recreational cleanup levels, which is consistent with the current and anticipated future use of the site.

4.0 SUB-SITES FOLLOWING THE CERCLA PROCESS: LANDFILL, SEPTIC TANK #1, TAR DRUM AREA, AND POWER PLANT

Contamination remains at the Landfill (metals), Septic Tank #1 (PAHs), Tar Drum Area (PAHs), and Power Plant (PCBs) at concentrations above the residential cleanup levels that allow for unlimited use and unrestricted exposure. The Power Plant sub-site contains PCB-contaminated soil at concentrations above the residential cleanup level, which in this case, is applied as the recreational cleanup level (Table 2-1).

The current and reasonably anticipated future land use of Fort Babcock FUDS is recreational, with likely current and future human receptors being hikers, hunters, and site visitors. As part of the RI, cleanup levels were developed based on the recreational land use of the sub-sites. The contaminant concentrations at the Landfill (metals), Septic Tank #1 (PAHs), and Tar Drum Area (PAHs) are present below the recreational land use cleanup levels, and as such, no remedial or further actions are required for the protection of human health under the current and future land use setting. Remedial action alternatives were developed to address PCB contamination in soil at levels above the recreational cleanup level of 1 mg/kg at the Power Plant site, approximately 559 cubic yards (Table 2-1).

4.1 Sub-site Requiring PCB Remedial Action Following the CERCLA Process: Power Plant

This section introduces the processes involved in identifying and screening appropriate technology options for completing the RAO under CERCLA. The regulatory requirements and RAO were identified and developed above in Section 3.

4.1.1 General Response Actions

General response actions (GRAs) are media-specific response actions that address the RAOs. GRAs include a variety of measures to reduce contaminant concentrations or exposure to contaminated media. The technologies/process options under the GRAs that are potentially applicable to the PCB-contaminated soils at the Power Plant include:

- Land use controls (LUCs)
- Containment
- Excavation (common component for ex-situ treatment)
- Treatment, including thermal desorption, incineration, and chemical dehalogenation
- Disposal including, offsite and onsite (monofill)
- In-situ mixing.

4.1.2 Identification and Screening of Remedial Technologies/Process Options

Specific remedial technologies and process options associated with each GRA were identified and screened using the following three criteria:

- *Effectiveness:* The ability of a technology or process to contain, reduce, or remove contaminants from the soil and achieve the site-specific RAOs.

- *Implementability:* The technical and administrative feasibility of implementing a particular remedial technology based on sub-site conditions.
- *Cost:* Capital and operation and maintenance (O&M) costs for implementing a particular technology. During the screening process, costs are based on engineering judgment and/or previous experience at the sub-site, rather than detailed cost estimates.

For preliminary screening purposes, the effectiveness, implementability, and cost of each technology/process option were ranked on a scale of high, medium, and low. Technologies with higher scores for effectiveness and implementability and lower scores for cost were retained for remedial alternative development. Technologies with lower effectiveness and implementability scores and higher costs were eliminated. Table 4-1 describes each technology and process option; provides a description and ranking for the technology's effectiveness, implementability, and cost; and indicates whether the technology was retained for development or alternatives or eliminated.

Table 4-1: Screening of Technology/Process Options for PCB-Contaminated Soils

Technology/Process	Technology Description	Effectiveness	Implementability	Cost	Screening Rationale	Screening Result
LUCs	LUCs may include institutional controls (dig restrictions and land use restrictions) and engineering controls (signs) restricting access to contaminated areas.	LOW A LUC restricting land use to recreational already exists at this site, set by USFS based on the land designation. Additional institutional controls (dig restrictions) and engineering controls (signs, fences) could be implemented, but these are contingent upon land owner approval (USFS). LUCs alone would not effectively protect current receptors. Additionally, enforcement and maintenance would be difficult due to the site's remote location. PCB concentrations would not be reduced below the recreational cleanup level; thus the RAO would not be met.	MEDIUM Institutional and engineering controls could only be implemented at the site with land owner approval (USFS).	LOW Low construction costs associated with installing signs. Moderate long-term monitoring and maintenance costs. Long-term maintenance, monitoring, and 5-year reviews would be required for an assumed 30-year period.	LUCs could effectively eliminate exposure pathways associated with the contaminated soil, but are contingent upon land owner approval. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable. Because a full ecological risk assessment was not completed, leaving contamination in place is not considered viable.	Eliminated
In-situ containment/capping	Capping involves covering contaminated soil with clean, relatively impermeable fill material, such as clay. The soil cap is typically vegetated to reduce surface erosion potential. Caps in non-residential areas are usually 2-3 ft thick to prevent contact with contaminated surface soils.	LOW Capping may isolate soil contamination by creating a barrier of clean soil between the potential receptors and the underlying layer of contaminated soil. However, under 40 CFR 761.61(a)(4)(i)(B) capping is not permitted for concentrations above 100 parts per million. PCB concentrations would not be reduced below the recreational cleanup level, thus the RAO would not be met. Long-term effectiveness is dependent on proper cap maintenance.	LOW-MEDIUM Capping would require heavy equipment access, including vegetation clearing and access road construction. In addition, fill material would need to be transported to the site to construct the cap. Fill material sources in the Sitka area are limited. Additional sampling may be necessary to fully delineate the outer boundary of PCB contamination requiring capping. Capping may not be compatible with current and future land use and would depend on land owner (USFS) approval. Furthermore, LUCs, long-term monitoring, and maintenance would be required to ensure cap integrity is maintained over time.	HIGH Initially high construction and fill material transport costs. Road repair/construction work would be required to provide site access. In addition, there would be moderate, long-term monitoring and cap maintenance costs. Long-term maintenance, monitoring, and 5-year reviews would be required for an assumed 30-year period.	Capping is a method of containment that may be protective of site receptors. Long-term effectiveness is dependent on proper maintenance. Capping does not treat or reduce PCB concentrations, and under 40 CFR 761.61(a)(4)(i)(B) is not permitted for the concentrations of PCBs at the site. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable. Because a full ecological risk assessment was not completed, leaving contamination in place is not considered viable.	Eliminated
In-situ mixing	In-situ mixing is a chemical and/or physical process that uses a binding agent to reduce the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms. Common binders include Portland cement and pozzolans.	MEDIUM-LOW In-situ mixing does not treat PCB contamination; rather, it is a containment method. PCB concentrations would not be reduced below the recreational cleanup level; thus the RAO would not be met. This technology isolates receptors by solidifying surface contamination and immobilizing it.	MEDIUM In-situ mixing requires heavy equipment access, including vegetation clearing and access road construction. In addition, material would need to be transported to the site to perform the mixing. Additional sampling may be necessary to fully delineate the outer boundary of PCB contamination requiring stabilization. This process requires access to fresh water which would involve permitting with the land owner to utilize nearby water sources.	HIGH Initial construction costs would be high. Equipment and binding material would be barged to the site. Road repair/construction work would be required to provide site access. Long-term maintenance, monitoring, and 5-year reviews would be required for an assumed 30-year period.	In-situ mixing is protective of site receptors, however the technology does not treat or reduce PCB concentrations. The RAO would not be met. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable. Because a full ecological risk assessment was not completed, leaving contamination in place is not considered viable.	Eliminated
Ex-situ Vapor Energy Generator (VEG)	Remove contaminated soil, stockpile onsite, and remediate using VEG technology. The VEG process uses a highly efficient, patented vapor generator to thermally treat soils, while eliminating emissions through the use of vapor collection and filters. The technology also utilizes the vapors generated through thermal treatment of soils to serve as fuel for operation of the system.	HIGH VEG remediation has been proven effective in treating PCB contaminated soil at the concentrations found onsite. The process generates non-hazardous discharge liquid which will be thermally oxidized/vaporized onsite, eliminating the need for offsite disposal or transportation.	LOW-MEDIUM VEG remediation requires heavy equipment access, including vegetation clearing and access road construction. Additionally, the VEG unit, a filtration system, generator, and propane tank would need to be transported to the site from Seattle. The VEG process is slowed by rain and excess moisture.	HIGH Initial construction costs would be high. Equipment would be barged to the site. Road repair/construction work would be required to provide site access. The VEG process typically takes several weeks and can be slowed by excess moisture or rain which will increase costs. There are no long-term O&M costs.	VEG is an effective method for treating PCBs and the RAO would be met.	Retained
Ex-situ containment (onsite monofill)	Remove contaminated soil and place in lined and covered onsite monofill.	LOW Placing contaminated soil in an onsite monofill effectively isolates receptors by removing surface contamination and containing it. Long-term effectiveness is dependent on proper maintenance. Placing soils into a monofill does not treat the PCB contamination; rather, it is a containment method. PCB concentrations would not be reduced below the recreational cleanup level; thus the RAO would not be met.	LOW Fill material would need to be transported to the site to construct the monofill. Fill material sources in the Sitka area are limited. The site has shallow bedrock, which may prevent excavating the monofill to the appropriate depth. Furthermore, there are many streams and surface water drainages in the area, which would limit the available area for monofill construction.	HIGH Initial construction costs would be high. Equipment and fill material would be barged to the site. Road repair/construction work would be required to provide site access. Long-term maintenance, monitoring, and 5-year reviews would be required for an assumed 30-year period.	Monofill containment is protective of receptors, although the technology does not treat or reduce PCB concentrations. Long-term effectiveness is dependent on proper monitoring and maintenance. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable.	Eliminated
Excavation with offsite thermal desorption	Thermal desorption is a physical separation process with subsequent destruction of contaminants in the emission control treatment system.	MEDIUM Ex-situ thermal desorption has been proven effective in treating organic contaminated (including PCBs) soil. Contaminant destruction efficiencies in the afterburners of thermal desorption units are reportedly greater than 95%. Since treatment would occur off-site, the technology is protective of receptors at Fort Babcock. However, potentially toxic waste streams may be generated during treatment and must be processed and properly disposed.	LOW-MEDIUM Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge. Off-gas treatment may require further assessment for by-products such as dioxins and furans. Fill material sources in the Sitka area are limited.	HIGH Initially high cost for excavation and offsite transport due to remote nature of Fort Babcock site. Road repair/construction work would be required to provide site access. There are no long-term O&M costs.	Technology is not cost-effective for treatment of soil from remote sites.	Eliminated

Technology/Process	Technology Description	Effectiveness	Implementability	Cost	Screening Rationale	Screening Result
Excavation with offsite disposal to a permitted facility	Remove contaminated soil and transport to a permitted PCB landfill. Chemical landfills have relatively impermeable soils, or a synthetic membrane liner and are constructed a minimum of 50 ft above the high groundwater level. Chemical landfills typically have leachate collection systems and monitoring wells to evaluate potential groundwater impacts. PCB-contaminated soil is managed within the landfill to prevent human and ecological exposure.	HIGH Landfill disposal does not effectively treat PCB contamination; rather, it is a disposal and containment method. Since the PCB-contaminated soils would be removed and disposed of off-site, the technology is protective of receptors at Fort Babcock.	HIGH Excavation at the site would require heavy equipment access, including vegetation clearing and access road construction. Excavated material would require offsite transport by barge. No landfills in Alaska accept soil with PCBs above 1 mg/kg. Soil would be segregated based on the TSCA designation and sent to either a Subtitle C landfill or Subtitle D landfill, dependent upon the PCB concentrations. A Subtitle C landfill that accepts this waste is located in Oregon. A Subtitle D landfill that accepts this waste is located in Washington. It is feasible to excavate, transport, and dispose of PCB-contaminated soil at these facilities. Fill sources in the Sitka area are limited.	MEDIUM-HIGH Landfill disposal is relatively inexpensive compared to treatment technologies. The upfront excavation and transportation costs are high due to the remote nature of Fort Babcock. Road repair/construction work would be required to provide site access. There are no long-term O&M costs.	Offsite landfill disposal is a method of containment that is protective of site receptors and meets the RAO, although it does not treat the PCBs.	Retained
Excavation with offsite incineration	Incineration can be used to destroy PCBs in soil using high temperatures (usually above 1,400°F) in combination with oxygen to volatilize, combust, and destroy organic compounds.	LOW The EPA has approved incineration as an effective treatment for PCBs at high concentrations (above 50 mg/kg). Trial burn results indicate incineration can remove high level concentrations to parts per billion or parts per trillion levels. The technology has a destruction and removal efficiency of 99.9999% for high level PCBs. The most effective treatment is achieved when petroleum is also present in the soil, which is not the case at the former Power Plant at Fort Babcock. However, the technology has not been approved for treatment of low-level PCBs, such as those present at Fort Babcock (i.e. below 50 mg/kg). The technology is not limited by soil volume and is effective across a wide range of soil types. Since treatment would occur off-site, the technology is protective of receptors at Fort Babcock. However, potentially toxic waste streams may be generated during incineration (ash, water, and air emissions) at the offsite facility.	LOW-MEDIUM Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge. The incineration treatment technology is available with several commercially permitted PCB incineration facilities located across the country (TX, OK, LA, and UT), although none are located on the west coast. A portable unit is also available and could be mobilized from California to Sitka. This may require a treatability study to evaluate effectiveness for low-level PCBs prior to implementation. Fill material sources in the Sitka area are limited.	HIGH Initially high cost for excavation and offsite transport due to remote nature of Fort Babcock site. Incineration cost typically depends on the volume of soil treated. Road repair/construction work would be required to provide site access. There are no long-term O&M costs.	Technology is not cost-effective for treatment of soil from remote sites.	Eliminated
Excavation with offsite chemical dehalogenation	Chemical dehalogenation uses chemical reagents to destroy or transform PCB congeners to less toxic substances to allow for disposal or reuse of contaminated soil. Four chemical dehalogenation processes have been identified, including Base Catalyzed Decomposition, Zero Valent Iron, Solvated Electron Technology, and Gas Phase Chemical Reduction.	LOW The technology has effectively treated some PCB congeners, but it has not been shown to treat all PCB congeners. Efficiencies of 99.9999% or greater have been achieved using this technology. The technology may require upfront processes prior to dehalogenation, such as thermal desorption, solvent extraction, or soil washing/extraction. Residual wastes generated during front end treatment must be properly treated and disposed of, including off-gas. The technology is not limited by soil volume. However, high moisture content, particle size, clay content, and pH can adversely affect the treatment. In addition, the technology's effectiveness can be reduced if metals are present in the soil. Since treatment would occur off-site, the technology is protective of receptors at Fort Babcock. However, potentially toxic waste streams may be generated during treatment and must be processed and properly disposed.	LOW-MEDIUM Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge. The dehalogenation treatment technology is available with several commercially permitted PCB chemical dehalogenation facilities located across the country (WV, GA, IN, OK, and KS), although none are located on the west coast. This may require a treatability study to determine technology's effectiveness in treating the specific congeners present at Fort Babcock. Fill material sources in the Sitka area are limited.	HIGH Initially high cost for excavation, offsite transport, and treatment at dehalogenation facility. Road repair/construction work would be required to provide site access. There are no long-term O&M costs.	Technology is not effective in treating all PCB congeners. Furthermore, front end treatment may be required, generating potentially toxic residuals that must be properly treated and disposed.	Eliminated

%	percent
°F	degrees Fahrenheit
EPA	United States Environmental Protection Agency
ft	foot or feet
GA	Georgia
IN	Indiana
KS	Kansas
LA	Louisiana
LUC	land use control
mg/kg	milligram(s) per kilogram
O&M	operation and maintenance
OK	Oklahoma
PCB	polychlorinated biphenyl
TX	Texas
UT	Utah
USFS	United States Forest Service
VEG	Vapor Energy Generator
WV	West Virginia

4.1.3 Development of Alternatives

Based on the screening evaluation presented in Table 4-1 no action, ex-situ Vapor Energy Generator (VEG), and excavation with offsite disposal were retained for development of alternatives.

4.1.3.1 PCB Alternative 1 – No Action

PCB Alternative 1 is the no action alternative. Under this alternative, contaminated soil would remain in place and remedial actions would not be implemented. The no action alternative is retained to provide a comparative baseline for the evaluation of other alternatives.

4.1.3.2 PCB Alternative 2 – Ex-situ Vapor Energy Generator

PCB Alternative 2 involves the excavation, stockpiling, and in-pile treatment of PCB-contaminated soil above the cleanup level using a VEG (Figure 4-1). The excavation would be backfilled with the clean, treated soil. Since the PBC contamination would be reduced to below the residential cleanup level under this alternative, all exposure pathways would present an acceptable level of risk and the site would meet unlimited use and unrestricted exposure (UU/UE).

There are several site-specific conditions that impact the implementation and costs associated with this alternative. Because of the remote and undeveloped nature of the site, heavy construction equipment, VEG treatment equipment, associated materials, and field personnel would be transported from Sitka to Kruzof Island using marine vessels. A shallow draft landing craft and personnel transport vessel would be needed, and the landing site for equipment and personnel would be along the beach located northeast of the Landfill Area. The availability of heavy construction equipment can be limited in Sitka. As such, it may be necessary to transport these items on a barge from Seattle to Sitka. Once the equipment/materials are transported to Kruzof Island, vegetation clearing and access road construction would be required to obtain access to the Power Plant sub-site. A new access road would be constructed from the beach landing area to a northern point along the existing road. From there, the existing road will be utilized wherever feasible, with vegetation removal and improvements made as needed. All tree and other vegetation cutting outside of the FUDS property would require approval from the USFS. Since there are no facilities located on Kruzof Island, a remote field camp would be constructed for field personnel near the beach landing area.

PCB-contaminated soil would be excavated and stockpiled onsite. Temporary construction fencing and signs would be used to secure the open excavation and treatment stockpiles. A field test would be performed to determine the optimal VEG operation temperature to achieve treatment based on moisture content and soil type. Once the parameters were determined, the VEG process would occur. This process requires a water source, so a nearby water source would need to be permitted for use during construction. During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup level (1 mg/kg). Excavation would continue until PCB concentrations in remaining soil are below the cleanup level. The excavation would be backfilled with the treated soil following VEG remediation. The treated soils would be sampled prior to backfilling to ensure PCB concentrations are below the cleanup level. Site restoration and repair would occur following construction completion, restoring all stream flows and disturbed areas to their pre-remediation conditions as feasibly possible. No additional reviews will be required at the Power Plant sub-site after remediation.

4.1.3.3 PCB Alternative 3 – Excavation with Offsite Disposal

PCB Alternative 3 is the complete removal of PCB-contaminated soil above the cleanup level and offsite waste disposal (Figure 4-1). In accordance with TSCA disposal requirements (40 CFR. 761.61(a)(5)) waste soil would be segregated by PCB content (above or below 50 mg/kg) and transported to an appropriate landfill. The excavation will be backfilled with clean and certified material sourced from Sitka. Since the PBC contamination would be reduced to below the residential cleanup level under this alternative, all exposure pathways would present an acceptable level of risk and the site would meet UU/UE.

There are several site-specific conditions that impact the implementation and costs associated with this alternative. Because of the remote and undeveloped nature of the site, heavy construction equipment, backfill material, and field personnel would be transported from Sitka to Kruzof Island using marine vessels. A shallow draft landing craft and personnel transport vessel would be needed, and the landing site for equipment and personnel would be along the beach located northeast of the Landfill Area. The availability of heavy construction equipment can be limited in Sitka. As such, it may be necessary to transport these items on a barge from Seattle to Sitka. Once the equipment/materials are transported to Kruzof Island, vegetation clearing and access road construction would be required to obtain access to the Power Plant sub-site. A new access road would be constructed from the beach landing area to a northern point along the existing road. From there, the existing road will be utilized wherever feasible, with vegetation removal and improvements made as needed. All tree and other vegetation cutting outside of the FUDS property would require approval from the USFS. Since there are no facilities located on Kruzof Island, a remote field camp would be constructed for field personnel near the beach landing area.

During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup level (1 mg/kg). Excavation would continue until PCB concentrations in remaining soil are below the cleanup level. The excavation will be backfilled with USFS approved weed and invasive-species free fill material obtained in Sitka. The excavated soil would be segregated based on the TSCA designation, containerized in Super Sacks®, and transported to Sitka on the shallow draft landing craft. Once in Sitka, the waste soil would be loaded onto shipping containers for transport to the appropriate landfill; soil with PCB concentrations at or above 50 mg/kg would be transported to an approved Subtitle C landfill in Arlington, Oregon, while soil with PCB concentrations below 50 mg/kg would be transported to an approved Subtitle D landfill in Seattle, Washington. Site restoration and repair would occur following construction completion, restoring all stream flows and disturbed areas to their pre-remediation conditions as feasibly possible. No additional reviews will be required at the Power Plant sub-site after remediation.

4.1.4 Detailed Evaluation of Remedial Alternatives

Each alternative was evaluated using the nine NCP criteria listed in 40 CFR 300.430(e)(a)(iii). The nine criteria are divided into three categories, including threshold criteria, primary balancing criteria, and modifying criteria and are described in Table 4-2.

Table 4-2: NCP Alternative Evaluation Criteria

Criterion	How the Criterion is Applied
Threshold Criteria	
1. Overall Protection of Human Health and the Environment	Used to evaluate whether an alternative eliminates, reduces, or controls site risks such that no unacceptable risk to human or ecological receptors remains.
2. Compliance with ARARs	Used to determine if an alternative meets federal, state, and local ARARs.
Primary Balancing Criteria	
3. Long-term Effectiveness and Permanence	Used to evaluate the potential risk remaining at the site after the alternative is implemented. Also used to assess the reliability of controls used during alternative implementation.
4. Reduction in Toxicity, Mobility, or Volume through Treatment	Used to evaluate whether the technology permanently and significantly reduces the toxicity, mobility, or volume of the contaminant.
5. Short-term Effectiveness	Used to evaluate if the alternative is protective of site workers, the community, and the environment; and to determine how long the technology will take to achieve the RAOs.
6. Implementability	Used to determine the technical feasibility of implementing the alternative. Implementability includes the availability of goods and services required to implement the technology, the ease of executing construction, and the reliability of the alternative to provide an effective reduction in contamination.
7. Cost	Used to evaluate the engineering, construction, and O&M costs associated with implementing the technology.
Modifying Criteria	
8. Regulatory Agency Acceptance	Used to assess technical and administrative issues and concerns that the ADEC may have about the alternative.
9. Community Acceptance	Used to evaluate the issues and concerns that the public may have about the alternative.

ADEC Alaska Department of Environmental Conservation
ARAR applicable or relevant and appropriate requirement
NCP National Contingency Plan
O&M operations and maintenance

The two threshold criteria, protection of human health and the environment, and compliance with ARARs, were evaluated on a pass/fail basis. The balancing criteria, with the exception of cost, were assessed using a five-tiered scale of very low, low, medium, high, and very high. Very low is the least favorable rating and very high is the most favorable rating. Cost is presented as a monetary value. The modifying criteria will be addressed in the Decision Document once comments to the RI/FS and Proposed Plan have been received. Table 4-3 provides the assigned rankings and associated descriptions for each alternative.

4.1.5 Cost

Generally, the cost for each alternative is calculated from estimates of first year capital and long-term O&M costs. Capital costs include the purchase or rental of equipment, labor, and materials necessary to implement the alternative, as well as the required engineering, project management, cost accounting, and other services such as testing and monitoring. Annual O&M costs for each alternative include operating labor, maintenance materials and labor, auxiliary materials, and energy, where applicable. Due to the remote nature of the site, local estimates were obtained where available to ensure the cost estimates were as accurate as possible, and contingency was added. Government administrative costs were also estimated. Cost estimates were developed using EPA Guidance for FS Cost Estimates. Detailed cost estimate information and assumptions are provided in Appendix A.

Table 4-3: Comparison of Remedial Action Alternatives for Sub-sites Following the CERCLA Process

NCP Criteria	Ranking Scale	PCB Alternative 1 No Action	PCB Alternative 2 Ex-situ Vapor Energy Generator (VEG)	PCB Alternative 3 Excavation with Offsite Disposal
Overall Protection of Human Health and the Environment	Pass if protective of human health and the environment. Fail if not protective.	FAIL Does not address PCB contamination currently in place. Is not protective of human health risks.	PASS Provides protection of human health and the environment by treating contaminated soil exceeding the cleanup level at the site. Effectively isolates potential receptors from the contamination.	PASS Provides protection of human health and the environment by removing contamination exceeding the cleanup level from the site. Effectively isolates potential receptors from the contamination.
Compliance with ARARs	Pass if alternative complies with all ARARs. Fail if alternative does not comply with ARARs.	FAIL Does not comply with the identified ARARs. Contamination will persist at concentrations above the recreational cleanup level.	PASS Complies with the identified ARARs.	PASS Complies with the identified ARARs.
Long-term Effectiveness and Permanence	Very high if highly effective. Very low if not effective.	VERY LOW Not effective. Contamination will persist.	VERY HIGH Effective and permanent because all contaminated soil above the cleanup level is treated at the Power Plant site.	VERY HIGH Effective and permanent because all contaminated soil above the cleanup level is removed from the Power Plant site and disposed of at offsite disposal facilities designed to landfill PCB-contaminated soil.
Reduction of Toxicity, Mobility, and Volume through Treatment	Very high if reduces all contaminants. Very low if no reduction.	VERY LOW No reduction in PCBs through treatment.	VERY HIGH Reduces toxicity, mobility, and volume through treatment.	LOW Does not reduce toxicity, mobility, or volume through treatment. However, contaminated media will be removed and disposed of offsite, which reduces the onsite toxicity, mobility, and volume.
Short-term Effectiveness	Very high if highly effective. Very low if not effective.	VERY LOW Not protective of the community or environment. RAO will not be met.	LOW VEG process requires excavation and treatment time and will cause some short-term disturbance of contaminated soil during the removal action. Protective measures and careful handling would be required. Although the Sitka area's high precipitation typically mitigates airborne particulate material, the excavation could potentially generate contaminated dust and particulates. All construction activities would be performed in accordance with the Site Safety and Health Plan. Potential worker and site user exposure to contaminated dust would be minimized through dust control measures.	LOW Can be implemented quickly but will cause some short-term disturbance of contaminated soil during the removal action. Protective measures and careful handling would be required. Although the Sitka area's high precipitation typically mitigates airborne particulate material, the excavation could potentially generate contaminated dust and particulates. All construction activities would be performed in accordance with the Site Safety and Health Plan. Potential worker and site user exposure to contaminated dust would be minimized through dust control measures.
Implementability	Very high if highly feasible and available. Very low if not feasible and available.	VERY HIGH No Action is highly feasible and can easily be implemented.	MEDIUM This alternative is technically feasible and can be implemented. This process requires access to fresh water which would involve permitting with the land owner (USFS) to utilize nearby water sources. Because the site is remote and uninhabited, it requires special logistical considerations, such as a shallow draft landing craft for equipment delivery and a camp for personnel.	HIGH This alternative is technically feasible and can be implemented. Because the site is remote and uninhabited, it requires special logistical considerations, such as a shallow draft landing craft for equipment delivery, soil transport off-site by shallow draft landing craft to designated PCB disposal facilities based on the specific concentrations, and a camp for personnel.
Cost	Estimated cost in dollars. Detailed costs and assumptions are provided in APPENDIX A.	$0 Since no action is implemented under this alternative, there is no associated cost.	$2,428,000 General Cost Assumptions (See Appendix A for details) • Heavy equipment and VEG equipment transport to Sitka by barge and Kruzof Island by shallow draft landing craft • Personnel transport on marine vessel • Remote field camp construction and operation • Access road vegetation clearing and construction • Contaminated soil excavation and stockpile • Perform bench scale testing • Permitting for use of nearby water source during process • Perform in-pile VEG remediation • Backfill of excavation with treated soil • Confirmation sample collection • Repair and restoration of the site	$1,894,000 General Cost Assumptions (See Appendix A for details) • Heavy equipment transport to Sitka by barge and Kruzof Island by shallow draft landing craft • Backfill material transport to Kruzof Island by shallow draft landing craft • Personnel transport on marine vessel • Remote field camp construction and operation • Access road vegetation clearing and construction • Contaminated soil excavation • Confirmation sample collection • Offsite transport to appropriate disposal facility via shallow draft landing craft and shipping containers • Backfill of excavation with clean soil from Sitka • Repair and restoration of the site
Regulatory Agency Acceptance	These evaluation criteria will be addressed in the Decision Document once comments to the RI/FS and Proposed Plan have been received.			
Community Acceptance				

ARAR applicable or relevant and appropriate requirement
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
FS Feasibility Study
LUC land use control
NCP National Contingency Plan
PCB polychlorinated biphenyl
POL petroleum, oil, and lubricants
RI Remedial Investigation
USFS United States Forest Service
VEG Vapor Energy Generator

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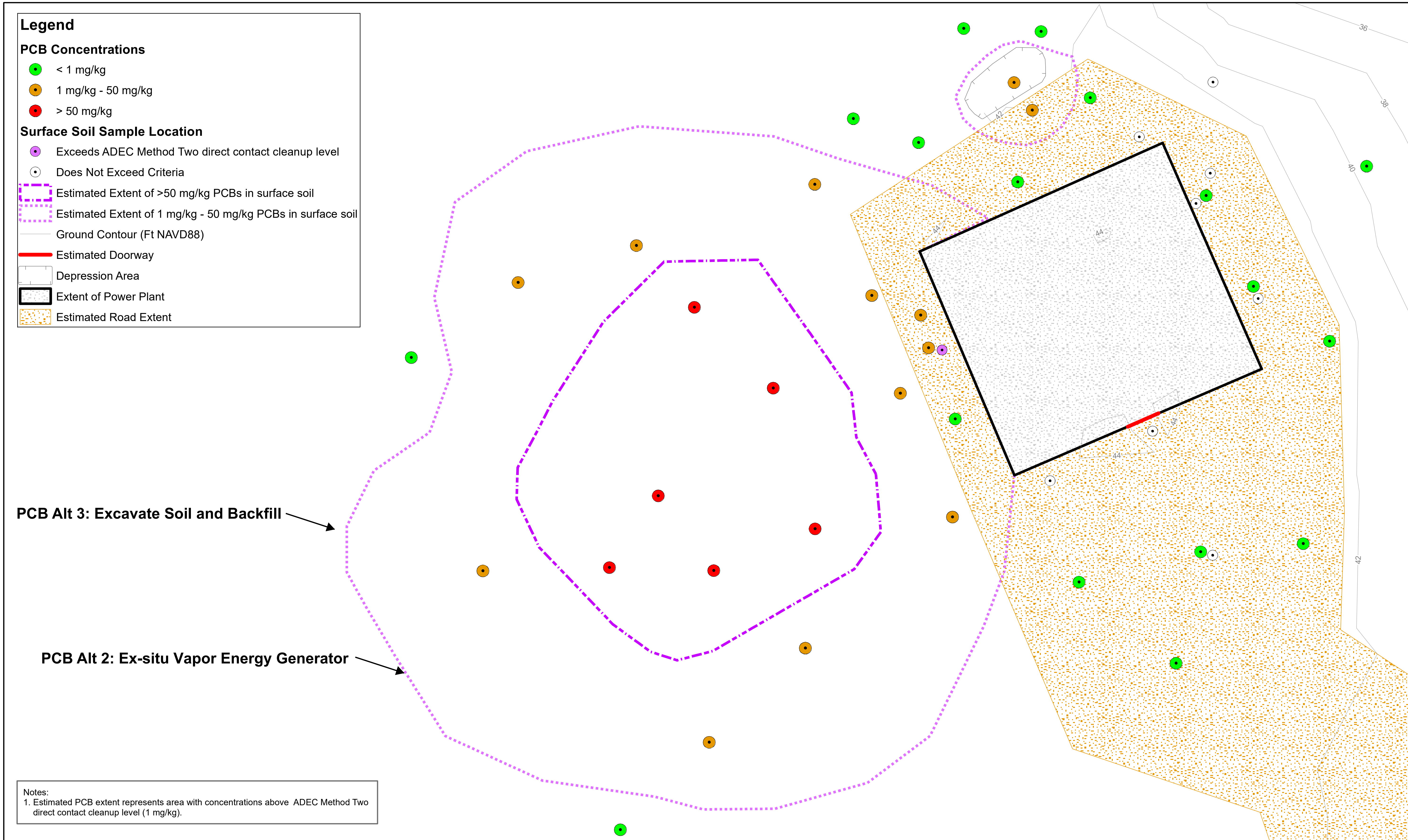

Path: C:\Users\lbeasley\Documents\ArcGIS\Packages\FIGURE 4-1_E214C851-0716-4552-BBC3-DECA090D2452\v10\FIGURE 4-1.mxd

U.S.Army Engineer District, Alaska

0 5 10 20 Feet

N

Surveyed by: O'Neil Surveying and Engineering
Date: August to September 2012 and September to October 2013
Horizontal Datum: NAD 83 Alaska State Plane Zone 1 Feet
Vertical Datum: NAVD 88

Fort Babcock Feasibility Study Kruzof Island, Alaska			Power Plant PCB Remedial Alternative 2 and 3
Date: 2/3/2018	DRWN:lb	Revision: 0	FIGURE 4-1

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5.0 PETROLEUM HYDROCARBON SUB-SITES REGULATED BY THE ADEC CONTAMINATED SITES PROGRAM: FUEL STORAGE AREA AND TAR DRUM AREA

POL contamination (DRO and/or RRO) was detected in soil at the Fuel Storage Area and Tar Drum Area at concentrations above the residential cleanup levels that allow for unlimited use and unrestricted exposure. The Fuel Storage Area and Tar Drum Area sub-sites also contain DRO- and/or RRO-contaminated soil at concentrations above the recreational cleanup levels (Table 2-1). The cleanup levels were established since the current and reasonably anticipated future land use of Fort Babcock FUDS is recreational. Remedial action alternatives were developed to address DRO- and RRO-contaminated soil at levels above the recreational cleanup levels at the Fuel Storage Area and Tar Drum Area sub-sites, approximately 82 cubic yards and 15 cubic yards, respectively (Table 2-1).

Removal and disposal of material within the Septic Tank #2 traps and Manhole #1 are included in the remedial action alternatives since removal of this material may occur during the remedial action at the Fuel Storage Area and Tar Drum Area sub-sites.

5.1 Septic Tank #2 Traps and Manhole #1 Vault

The Septic Tank #2 traps and Manhole #1 vault contain approximately 7 cubic ft of potential waste material collectively. During the Phase II RI (USACE-AK 2014), this material was sampled and analyzed using the TCLP. The results were compared to 40 CFR §761.60 for PCBs; 40 CFR §261.24 for TCLP VOCs, TCLP SVOCs, and TCLP metals; and 40 CFR §261.21 for ignitability to determine whether disposal as a hazardous material is required. The TCLP results meet the EPA criteria for non-hazardous waste. USACE intends to remove and dispose of this material to eliminate possible threats from any potential future migration scenarios that could pose risk to human health or the environment (USACE-AK 2014). Since the removal and disposal of this material may occur during the remedial action at the Fuel Storage Area and Tar Drum Area sub-sites, the associated costs are included in Table 5-2 and Appendix A.

5.2 Sub-sites Requiring POL Remedial Action Following the ADEC Process: Fuel Storage Area and Tar Drum Area

This section introduces the processes involved in identifying and screening appropriate technology options for completing the RAOs. POLs are regulated under ADEC Contaminated Sites Program and 18 AAC 75 (excluded from CERCLA), which generally follows an abbreviated and streamlined version of the CERCLA process for completing a FS or selecting a cleanup remedy.

The regulatory requirements defined by ADEC include the reduction of COCs to a level at which the human health risk does not exceed the cancer risk management standard of 1 in 100,000 (1×10^{-5}) and a noncarcinogenic risk standard or HI of 1.0, as defined in 18 AAC 75.325(h). The overall risk may be reduced by lowering the contaminant levels and/or the exposure routes. The cumulative risk remaining in a post-remediation scenario after the recreational cleanup levels are applied meets the ADEC risk management criteria (USACE-AK 2017). Thus, the RAO for the POL-contaminated soil at the Fuel Storage Area and Tar Drum Area sub-sites is to minimize or prevent direct human contact, outdoor inhalation, and ingestion of soil at concentrations higher than the approved recreational cleanup levels of 12,500 mg/kg for DRO and 22,000 mg/kg for RRO.

For the Fuel Storage Area and Tar Drum Area, media-specific remedial action alternatives were developed to address the DRO- and/or RRO-contaminated soil at concentrations above the recreational cleanup levels (Table 2-1). Since the RAO entails addressing contamination to meet recreational cleanup levels, contamination may remain in place above residential soil cleanup levels and if so, institutional controls would be required. Institutional controls in the form of LUCs are already in place through the USFS's Tongass Land and Resource Management Plan which restricts land use to recreational at Fort Babcock. The ADEC institutional control guidance states "Land management plans may be utilized to provide notice of contamination or restrict specific activities." Therefore, no further intuitional controls are necessary to protect recreational users from POL contamination below the recreational cleanup levels.

The Tar Drum Area contains approximately 1 cubic yard of tar-like material identified in the surface soil. During the Phase I RI, this material was sampled and analyzed using the TCLP (USACE-AK 2013). The results were compared to CFR 40 CFR §761.60 for PCBs; 40 CFR §261.24 for TCLP VOCs, TCLP SVOCs, and TCLP metals; and 40 CFR §261.21 for ignitability to determine whether disposal as a hazardous material is required. The material was characterized as a RCRA hazardous waste, based on ignitability rate of burning, according to 40 CFR 261.21(a)(2) (USACE-AK 2013). Because of the tar-like nature of this material and the small quantity, it will not be included in the remedial action alternative screening as many viable options for the DRO- and RRO-contaminated soils will not address this material. Instead, the removal and disposal of this material will be included in each alternative, with the associated costs included in Table 5-3 and Appendix A.

5.2.1 Identification and Screening of Remedial Technologies and Process Options

Remedial technologies and process options for remediating POL-contaminated soils were identified and screened using the effectiveness, implementability, and cost criteria outlined in Section 4.1.2. For preliminary screening purposes, the effectiveness, implementability, and cost of each technology/process option were ranked on a scale of high, medium, and low. Technologies with higher effectiveness and implementability scores and lower costs were retained for remedial alternative development, while technologies with low effectiveness and implementability were eliminated. Table 5-1 describes each technology and process option; provides a description and ranking for the technology's effectiveness, implementability, and cost; and indicates whether the technology was retained or eliminated from consideration.

Table 5-1: Screening of Technology/Process Options for POL Contaminated Soils

Technology/Process	Technology Description	Effectiveness	Implementability	Cost	Screening Rationale	Screening Result
LUCs	LUCs may include institutional controls (dig restrictions and land use restrictions) and engineering controls (signs) restricting access to contaminated areas.	LOW A LUC restricting land use to recreational already exists at this site, set by USFS based on the land designation. Additional institutional controls (dig restrictions) and engineering controls (signs, fences) could be implemented, but these are contingent upon land owner approval (USFS). LUCs alone would not effectively protect current receptors. Additionally, enforcement and maintenance would be difficult due to the site's remote location. POL concentrations would not be reduced below the recreational cleanup level, thus the RAO would not be met.	MEDIUM Institutional and engineering controls could only be implemented at the site with land owner approval (USFS).	LOW Initial low construction costs associated with sign installation. Moderate long-term monitoring and maintenance costs.	LUCs could effectively eliminate exposure pathways associated with the contaminated soil but are contingent upon land owner approval. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable.	Eliminated
In-situ containment/capping	Capping involves covering contaminated soil with a low-impermeability surface, such as clay. Capping can reduce contaminant migration by decreasing the area exposed to leaching, and it provides a barrier between contaminated soils and receptors. The soil cap is typically vegetated to reduce surface erosion potential. Caps in non-residential areas are usually 2-3 ft thick to prevent contact with contaminated surface soils.	LOW-MEDIUM DRO/RRO contamination is present at the Fuel Storage Area and Tar Drum Area at concentrations above the ADEC maximum allowable and inhalation cleanup levels. However, the POLs remaining at the site are highly weathered and exposure to volatiles is unlikely due to rapid dilution and atmospheric mixing. Thus, the inhalation of volatiles in ambient air is considered a complete but insignificant pathway. Since inhalation is considered insignificant, capping technology would effectively isolate receptors from the completed ingestion and dermal absorption pathways. Capping does not treat POL contamination; rather, it is a containment method. POL concentrations would not be reduced below the recreational cleanup level, thus the RAO would not be met.	LOW-MEDIUM Capping would require heavy equipment access, including vegetation clearing and access road construction. In addition, cap material would need to be transported to the site. Cap material sources in the Sitka area are limited. Furthermore, LUCs, long-term monitoring, and maintenance would be required to ensure cap integrity is maintained over time. Capping may not be compatible with current and future land use and would depend on land owner (USFS) approval.	HIGH Initially high construction costs. In addition, moderate, long-term monitoring and cap maintenance costs.	Capping is a method of containment that would isolate receptors for the ingestion and dermal absorption pathways. Capping does not treat DRO/RRO contamination. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable.	Eliminated
In-situ chemical oxidation (ISCO) with amendments	ISCO involves treating contaminated soil in place using oxidizing chemicals (permanganate, persulfate, hydrogen peroxide, or ozone) to transform contaminants into less toxic substances. Oxidants can be applied to surface soils, directly injected underground, or placed in trenches with excavation equipment. Catalysts, such as iron, can be used to speed up chemical reactions.	LOW-MEDIUM ISCO technology has been used to destroy volatile and semivolatile contaminants in-situ. ISCO technology is most commonly applied to remediating groundwater, although it can be used to treat soil contamination. The degree of effectiveness is dependent on lithology, natural oxidant demand, the persistence of the oxidant, and achieving effective contact between the oxidizer and contamination. This technology may be effective for treating DRO at the Fuel Storage Area. However, it would not be effective for treating the thick, tarlike substance at the Tar Drum Area.	LOW Applying ISCO at the site would require vegetation clearing and access road construction. ISCO can take anywhere from a few months to a few years to clean up site soils. Cleanup takes longer at sites with large source areas, soils or rock that do not allow the oxidant to spread quickly and evenly, and in areas where contaminants are trapped in clay layers or fractures. This process requires access to fresh water which would involve permitting with the land owner to utilize nearby water sources. ISCO will also likely require multiple chemical applications over time. Because this site is remote and only accessible by water, it may be difficult to implement this technology over a longer-time period (months or years). This may require bench-scale and pilot studies to determine effectiveness under site conditions.	HIGH Initially high cost associated with transporting construction equipment, materials, and chemical oxidizers to the site. To access the site, vegetation clearing and access road construction would be required. Furthermore, oxidizing chemical costs range from $0.75 per pound to $5.95 per pound, depending on the type of oxidizer used. Chemical oxidation would require long-term monitoring and will likely require multiple chemical applications. Confirmation sampling would be required after treatment to confirm the technology was effective. If additional chemical applications are required and the treatment extends over a few years, it may be cost prohibitive to use this technology. Periodic reviews and monitoring will be required until site cleanup is attained.	ISCO technology can effectively treat POL contamination in soil, but due to limited access to water and the need for multiple applications, it may be difficult to implement due to the remote nature of Fort Babcock.	Eliminated
In-situ mixing	In-situ mixing is a chemical and/or physical process that uses a binding agent to reduce the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms. Common binders include Portland cement and pozzolans.	MEDIUM This technology isolates receptors by solidifying surface contamination and immobilizing it. In-situ mixing does not treat POL contamination; rather, it is a containment method. POL concentrations would not be reduced below the recreational cleanup level; thus the RAO would not be met.	MEDIUM In-situ mixing requires heavy equipment access, including vegetation clearing and access road construction. In addition, material would need to be transported to the site to perform the mixing. This process requires access to fresh water which would involve permitting with the land owner to utilize nearby water sources. In-situ mixing may not be compatible with current and future land use and would depend on land owner (USFS) approval.	MEDIUM-HIGH Initial construction costs would be high. Equipment and binding material would be barged to the site. Road repair/construction work would be required to provide site access. Moderate, long-term monitoring and maintenance costs.	In-situ mixing is protective of site receptors, although the technology does not treat or reduce POL concentrations. This technology would eliminate contaminant migration through solidification. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable.	Retained

Technology/Process	**Technology Description**	**Effectiveness**	**Implementability**	**Cost**	**Screening Rationale**	**Screening Result**
Ex-situ landfarming	Landfarming involves spreading contaminated soils in a thin layer no more than 18 inches thick and stimulating aerobic microbial activity by aerating the soils (tilling). Amendments, including the addition of minerals and nutrients, can be added to enhance treatment.	MEDIUM Excavation and onsite landfarming is an effective treatment for organic constituents with slow biodegradation rates, such as DRO. The technology effectively isolates site receptors from the contaminated soil. Furthermore, landfarming can effectively treat POL contamination in soil, reducing concentrations up to 95%. It should be noted that this technology is less effective for soils with total petroleum hydrocarbon (TPH) concentrations above 50,000 mg/kg. DRO concentrations at the Fuel Storage Area are up to 130,000 mg/kg.	LOW-MEDIUM Excavation at the site would require vegetation clearing and access road construction. Landfarming has a relatively long-treatment time, typically ranging from 6 months to 2 years. This treatment time can be affected by wet or cold conditions. Furthermore, there are many streams and surface water drainages in the area that would inhibit landfarm construction. This process requires access to fresh water which would involve permitting with the land owner to utilize nearby water sources. Because the excavation would extend to the water table, fill material would need to be transported to the site. Fill material sources in the Sitka area are limited. This may require bench-scale and pilot studies to determine effectiveness under site conditions.	HIGH The upfront excavation and landfarming costs are high due to the remote nature of Fort Babcock. Moderate soil treatment costs would be incurred. Long-term O&M costs associated with maintenance and testing. Backfill would need to be barged to the site.	Landfarming can effectively treat POL contamination in soil, but due to limited access to water and the need for ongoing maintenance, it may be difficult to implement due to the remote nature of Fort Babcock. Technology is not cost-effective for treatment of soil from remote sites.	Eliminated
Ex-situ VEG	Remove contaminated soil, stockpile onsite, and remediate using VEG technology. The VEG process uses a highly efficient, patented vapor generator to thermally treat soils, while eliminating emissions through the use of vapor collection and filters. The technology also utilizes the vapors generated through thermal treatment of soils to serve as fuel for operation of the system.	HIGH VEG remediation has been proven effective in treating POL-contaminated soil at the concentrations found onsite.	LOW-MEDIUM VEG remediation requires heavy equipment access, including vegetation clearing and access road construction. Additionally, the VEG unit, a filtration system, generator, and propane tank would need to be transported to the site from Seattle. The VEG process is slowed by rain and excess moisture.	HIGH Initial construction costs would be high. Equipment would be barged to the site. Road repair/construction work would be required to provide site access. The VEG process typically takes several weeks and can be slowed by excess moisture or rain which will increase costs. There are no long-term O&M costs.	VEG is an effective method for treating POL contaminated soils and the RAO would be met.	Retained
Ex-situ containment (onsite monofill)	Remove contaminated soil and place in lined and covered onsite monofill.	MEDIUM Placing contaminated soil in an onsite monofill effectively isolates receptors by removing surface contamination and containing it, thereby eliminating ingestion and inhalation risks. Long-term effectiveness is dependent on proper maintenance. Placing soils into a monofill does not treat the POL contamination; rather, it is a containment method. POL concentrations would not be reduced below the recreational cleanup level, thus the RAO would not be met.	LOW-MEDIUM Monofill construction would require heavy equipment access, including vegetation clearing and access road construction. In addition, fill material would need to be transported to the site for the monofill cover. Fill material sources in the Sitka area are limited. The site has shallow bedrock, which may prevent excavating the monofill to the appropriate depth. Furthermore, there are many streams and surface water drainages in the area that would inhibit monofill construction. Constructing an onsite monofill may be incompatible with current and future land use and would require landowner (USFS) approval. LUCs, long-term monitoring, and maintenance would be required.	HIGH Initial construction costs would be high. Equipment and fill material would be barged to the site. Road repair/construction work would be required to provide site access. Moderate, long-term monitoring and landfill maintenance costs. Backfill would need to be barged to the site.	Monofill containment is protective of receptors and eliminates the ingestion and dermal absorption pathways. The technology does not treat POL, although biodegradation may occur within the monofill over time. Long-term effectiveness is dependent on proper monitoring and maintenance. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable.	Eliminated
Excavation with offsite disposal to a permitted facility	Remove contaminated soil and transport to a landfill permitted to accept POL waste.	HIGH Landfill disposal does not effectively treat POL contamination, although biodegradation within the landfill may occur over time. Since the POL-contaminated soils will be removed and disposed of off-site, the technology is protective of receptors at Fort Babcock. This technology could be applied to both the Fuel Storage Area and the Tar Drum Area.	HIGH Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge to a landfill permitted to accept POL-contaminated soil. Several landfills in Alaska, and many landfills in the Lower 48 States, accept POL-contaminated soil. Because the excavation would extend to the water table, fill material would need to be transported to the site. Fill material sources in the Sitka area are limited.	HIGH The upfront excavation and transportation costs are high due to the remote nature of Fort Babcock. There are no long-term operation or maintenance costs. Backfill would need to be barged to the site.	Offsite landfill disposal is a method of containment that is protective of site receptors, although it does not treat the POL constituents in the soil. This technology would handle the tarlike substance present at the Tar Drum Area.	Retained
Excavation with offsite landfarming	Remove contaminated soil and transport to a permitted landfarming facility for treatment. Landfarming involves spreading contaminated soils in a thin layer no more than 18 inches thick and stimulating aerobic microbial activity by aerating the soils (tilling). Amendments, including the addition of minerals and nutrients, can be added to enhance treatment.	MEDIUM Excavation and offsite landfarming is an effective treatment for organic constituents with slow biodegradation rates, such as DRO. The technology effectively isolates site receptors from the contaminated soil. Furthermore, landfarming can effectively treat POL contamination in soil, reducing concentrations up to 95%. It should be noted that this technology is less effective for soils with TPH concentrations above 50,000 mg/kg. DRO concentrations at the Fuel Storage Area are up to 130,000 mg/kg.	MEDIUM Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge to a landfarming facility. Landfarming has a relatively long-treatment time, typically ranging from 6 months to 2 years. This treatment time can be affected by wet or cold conditions. Because the excavation would extend to the water table, fill material would need to be transported to the site. Fill material sources in the Sitka area are limited.	HIGH The upfront excavation and transportation costs are high due to the remote nature of Fort Babcock. Moderate soil treatment costs would be incurred. There are no long-term O&M costs associated with offsite landfarming. Backfill would need to be barged to the site.	Offsite landfarming is protective of site receptors, and it can substantially reduce POL concentrations in soil, although it is less effective for soils with TPH concentrations above 50,000 mg/kg. Technology is not cost-effective for treatment of soil from remote sites.	Eliminated

Technology/Process	Technology Description	Effectiveness	Implementability	Cost	Screening Rationale	Screening Result
Excavation with offsite incineration	Remove contaminated soil and transport to a permitted incineration facility for treatment. Incineration is the process of burning wastes/contaminated soil materials at high temperatures to volatilize the contaminants and destroy them. The off-gases are then passed through an air pollution control system to remove particulates and acidic gases.	MEDIUM This technology effectively isolates site receptors from the contaminated soil. Furthermore, incineration destroys POL in soil allowing the soil to be reused or recycled. The EPA requires that incinerators destroy 99.99% of chemicals.	MEDIUM Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge to an incineration facility. Incineration is considered a conventional technology. Since the quantity of contaminated soil at Fort Babcock is relatively small, incineration would likely be completed in a short time period (weeks). Because the excavation would extend to the water table, fill material would need to be transported to the site. Fill material sources in the Sitka area are limited.	HIGH The upfront excavation and transportation costs are high due to the remote nature of Fort Babcock. High soil treatment costs would be incurred. There are no long-term O&M costs associated with offsite incineration. Backfill would need to be barged to the site.	Technology is not cost-effective for treatment of soil from remote sites.	Eliminated
Excavation with offsite low temperature thermal desorption	Remove contaminated soil and transport to a permitted offsite thermal desorption facility. Thermal desorption is the process of separating organic contaminants from soil by heating the material in a thermal desorber. SVOCs, including DRO and coal tar, can be volatilized but require higher temperature treatment.	HIGH This technology effectively isolates site receptors from the contaminated soil. Furthermore, thermal desorption destroys POL contamination, allowing the soil to be reused/recycled.	HIGH Excavation at the site would require vegetation clearing and access road construction. Excavated material would require offsite transport by barge. Since the quantity of contaminated soil at Fort Babcock is relatively small, thermal desorption would likely be completed in a short time period. A typical thermal desorber can treat 25 tons of soil per hour. Large rocks and other debris must be removed prior to treatment. Because the excavation would extend to the water table, fill material would need to be transported to the site. Fill material sources in the Sitka area are limited.	HIGH The upfront excavation and transportation costs are high due to the remote nature of Fort Babcock. Moderate soil treatment costs would be incurred. There are no long-term O&M costs. Backfill would need to be barged to the site.	Offsite thermal desorption effectively isolates site receptors and destroys POL contamination in soil.	Retained

%	percent
DRO	diesel range organics
ISCO	in-situ chemical oxidation
LUC	land use control
mg/kg	milligram(s) per kilogram
O&M	operations and maintenance
POL	petroleum, oil, and lubricants
SVOC	semi-volatile organic compounds
TPH	total petroleum hydrocarbon
USFS	United States Forest Service
VEG	Vapor Energy Generator

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5.2.2 Development of Alternatives

Based on the screening evaluation presented in Table 5-1, no action, in-situ mixing, VEG, excavation with offsite landfill disposal, and excavation with offsite low temperature thermal desorption were retained for the development of alternatives and are discussed in detail below.

5.2.2.1 POL Alternative 1 – No Action

POL Alternative 1 is the no action alternative. Under this alternative, POL-contaminated soil would remain in place and remedial actions would not be implemented. The no action alternative is retained to provide a comparative baseline for the evaluation of other alternatives.

5.2.2.2 POL Alternative 2 – In-Situ Mixing

POL Alternative 2 uses a process known as in-situ mixing. Portland Cement is spread and mixed into the contaminated soil, which effectively encapsulates the waste to form a solid material and protects potential receptors from the contaminated soil (soil above recreational cleanup level and surface soil staining in accordance with 18 AAC 75.325 [f][1][E]). Under this alternative, the contaminated soil would be left in place (Figure 5-1 and Figure 5-2). Vegetation will not regrow in these areas due to the soil solidification.

There are several site-specific conditions that impact the implementation and costs associated with this alternative. Because of the remote and undeveloped nature of the site, heavy construction equipment and field personnel would be transported from Sitka to Kruzof Island using marine vessels. A shallow draft landing craft and personnel transport vessel would be needed, and the landing site for equipment and personnel would be along the beach located northeast of the Landfill Area. The availability of heavy construction equipment can be limited in Sitka. As such, it may be necessary to transport these items on a barge from Seattle to Sitka. Once the equipment is transported to Kruzof Island, vegetation clearing and access road construction would be required to obtain access to the Fuel Storage Area and Tar Drum Area sub-sites. A new access road would be constructed from the beach landing area to a northern point along the existing road. From there, the existing road will be utilized wherever feasible, with vegetation removal and improvements made as needed. All tree and other vegetation cutting outside of the FUDS property would require approval from the USFS. Since there are no facilities located on Kruzof Island, a remote field camp would be constructed for field personnel near the beach landing area.

Prior to in-situ mixing, the 8,000-gal AST would be moved outside of the construction area to access the contaminated material. A field test would be performed to determine the proper reagent addition necessary to produce a solid, homogeneous mix that will minimize leaching. Based on available literature and similar projects, a 7% cement to soil ratio would be assumed. During in-situ mixing, Portland Cement would be spread and mixed into the contaminated soil. This process requires a water source, so a nearby water source would need to be permitted for use during construction. Confirmation sampling will be required to confirm that all contaminated soils with concentrations above the recreational cleanup levels were solidified using Portland Cement. The non-hazardous waste from the Septic Tank #2 traps and Manhole #1 vault, as well as the 1 cubic yard of hazardous tar-like material from the Tar Drum area, will be containerized in a Super Sack and transported to Sitka on the shallow draft landing craft. Once in Sitka, the waste material will be loaded onto shipping containers for transport to the appropriate landfill. Site restoration and repair would occur following construction completion, restoring all stream flows and disturbed areas to their natural conditions as feasibly possible, including replacing the AST to its original location. No additional reviews will be required at the sub-sites after remediation.

5.2.2.3 POL Alternative 3 – Ex-situ Vapor Energy Generator

POL Alternative 3 involves the excavation, stockpiling, and in-pile treatment of POL-contaminated soil (soil above recreational cleanup level and surface soil staining in accordance with 18 AAC 75.325 [f][1][E]) using a VEG (Figure 5-1 and Figure 5-2). The excavation would be backfilled with the clean, treated soil.

There are several site-specific conditions that impact the implementation and costs associated with this alternative. Because of the remote and undeveloped nature of the site, heavy construction equipment, VEG treatment equipment, associated materials, and field personnel would be transported from Sitka to Kruzof Island using marine vessels. A shallow draft landing craft and personnel transport vessel would be needed, and the landing site for equipment and personnel would be along the beach located northeast of the Landfill Area. The availability of heavy construction equipment can be limited in Sitka. As such, it may be necessary to transport these items on a barge from Seattle to Sitka. Once the equipment/materials are transported to Kruzof Island, vegetation clearing and access road construction would be required to obtain access to the Fuel Storage Area and Tar Drum Area sub-sites. A new access road would be constructed from the beach landing area to a northern point along the existing road. From there, the existing road will be utilized wherever feasible, with vegetation removal and improvements made as needed. All tree and other vegetation cutting outside of the FUDS property would require approval from the USFS. Since there are no facilities located on Kruzof Island, a remote field camp would be constructed for field personnel near the beach landing area.

Prior to excavation, the 8,000-gal AST would be moved outside of the construction area to access the contaminated soil. POL-contaminated soil would be excavated and stockpiled onsite. Temporary construction fencing and signs would be used to secure the open excavation and treatment stockpiles. A field test would be performed to determine the optimal VEG operation temperature to achieve treatment based on moisture content and soil type. Once the parameters were determined, the VEG process would occur. This process requires a water source, so a nearby water source would need to be permitted for use during construction. During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup levels. Excavation would continue until concentrations in remaining soil are below the cleanup levels. The excavation would be backfilled with the treated soil following VEG remediation. The treated soils would be sampled prior to backfilling to ensure POL concentrations are below the cleanup levels. The non-hazardous waste from the Septic Tank #2 traps and Manhole #1 vault, as well as the 1 cubic yard of hazardous tar-like material from the Tar Drum area, will be containerized in a Super Sack and transported to Sitka on the shallow draft landing craft. Once in Sitka, the waste material will be loaded onto shipping containers for transport to the appropriate landfill. Site restoration and repair would occur following construction completion, restoring all stream flows and disturbed areas to their pre-remediation conditions as feasibly possible, including replacing the AST to its original location. No additional reviews will be required at the sub-sites after remediation.

5.2.2.4 POL Alternative 4 – Excavation with Offsite Disposal

POL Alternative 4 is the complete removal of POL contaminated soil above the cleanup level with offsite waste disposal (Figure 5-1 and Figure 5-2). Additionally, this alternative assumes that all surface soil staining at the Tar Drum Area will be removed for offsite disposal based on 18 AAC 45.325 (f)(1)(E), which states: to the maximum extent practicable, perform a cleanup of surface soil staining attributable to a hazardous substance. Wastes would be transported to an approved POL-disposal facility. The excavations would be shallow (maximum of 3 ft); however, because of the shallow groundwater table, the excavations would be backfilled with clean soil sourced from Sitka.

There are several site-specific conditions that may impact the implementation and costs associated with this alternative. Because of the remote and undeveloped nature of the site, heavy construction equipment, backfill material, and field personnel would be transported from Sitka to Kruzof Island using marine vessels. A shallow draft landing craft and personnel transport vessel are needed, and the landing site for equipment and personnel would be along the beach located northeast of the Landfill Area. The availability of heavy construction equipment and large quantities of backfill material can be limited in Sitka. As such, it may be necessary to transport these items on a barge from Seattle to Sitka. Once the equipment is transported to Kruzof Island, vegetation clearing and access road construction would be required to obtain access to the Fuel Storage Area and Tar Drum Area sub-sites. A new access road would be constructed from the beach landing area to a northern point along the existing road. From there, the existing road will be utilized wherever feasible, with vegetation removal and improvements made as needed. All tree and other vegetation cutting outside of the FUDS property would require approval from the USFS. Since there are no facilities located on Kruzof Island, a remote field camp would be constructed for field personnel near the beach landing area.

Prior to excavation, the 8,000-gal AST would be moved outside of the construction area to access the contaminated soil. During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup levels. Excavation would continue until concentrations in remaining soil are below the cleanup levels. The excavation will be backfilled with USFS approved weed and invasive-species free fill material obtained in Sitka. The excavated soil, the non-hazardous waste from the Septic Tank #2 traps and Manhole #1 vault, and the 1 cubic yard of hazardous tar-like material from the Tar Drum area will be containerized in Super Sacks and transported to Sitka on the shallow draft landing craft. Once in Sitka, the waste material will be loaded onto shipping containers for transport to the appropriate landfill. Site restoration and repair will occur following construction completion, restoring all stream flows and disturbed areas to their pre-remediation conditions as feasibly possible, including replacing the AST to its original location. No additional reviews will be required at the sub-sites after remediation.

5.2.2.5 POL Alternative 5 – Excavation with Offsite Low Temperature Thermal Desorption

POL Alternative 5 is the complete removal of POL contaminated soil present above the cleanup level with offsite thermal desorption at an approved facility (Figure 5-1 and Figure 5-2). Additionally, this alternative assumes that all surface soil staining at the Tar Drum Area will be removed for offsite disposal based on 18 AAC 45.325 (f)(1)(E), which states: to the maximum extent practicable, perform a cleanup of surface soil staining attributable to a hazardous substance. Wastes would be transported to an approved POL-thermal desorption facility. The excavations would be shallow (maximum of 3 ft); however, because of the shallow groundwater table, the excavations would be backfilled with clean soil sourced from Sitka.

There are several site-specific conditions that may impact the implementation and costs associated with this alternative. Because of the remote and undeveloped nature of the site, heavy construction equipment, backfill material, and field personnel would be transported from Sitka to Kruzof Island using marine vessels. A shallow draft landing craft and personnel transport vessel are needed, and the landing site for equipment and personnel would be along the beach located northeast of the Landfill Area. The availability of heavy construction equipment and large quantities of backfill material can be limited in Sitka. As such, it may be necessary to transport these items on a barge from Seattle to Sitka. Once the equipment is transported to Kruzof Island, vegetation clearing and access road construction would be required to obtain access to the Fuel Storage Area and Tar Drum Area sub-sites. A new access road would be constructed from the beach landing area to a northern point along the existing road. From there, the existing road will be utilized wherever feasible, with vegetation removal and improvements made as needed. All tree and other vegetation cutting outside of the FUDS property would require approval from the USFS. Since there are no facilities located on Kruzof Island, a remote field camp would be constructed for field personnel near the beach landing area.

Prior to excavation, the 8,000-gal AST would be moved outside of the construction area to access the contaminated soil. During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup levels. Excavation would continue until concentrations in remaining soil are below the cleanup levels. The excavation will be backfilled with USFS approved weed and invasive-species free fill material obtained in Sitka. The excavated soil, the non-hazardous waste from the Septic Tank #2 traps and Manhole #1 vault, and the 1 cubic yard of hazardous tar-like material from the Tar Drum area will be containerized in Super Sacks and transported to Sitka on the shallow draft landing craft. Once in Sitka, the waste material will be loaded onto shipping containers for transport to the appropriate facility or landfill. Site restoration and repair will occur following construction completion, restoring all stream flows and disturbed areas to their pre-remediation conditions as feasibly possible, including replacing the AST to its original location. No additional reviews will be required at the sub-sites after remediation.

5.2.3 Comparative Analysis of Remedial Alternatives

Each remedial alternative was evaluated using an abbreviated evaluation criteria list[2] that includes the following: 1) overall protection of potential receptors/achieves cleanup levels; 2) effectiveness; 3) implementability; and 4) cost. Costs were developed as presented in Section 4.1.5. The threshold criteria of protection of human health and the environment was evaluated on a pass/fail basis. The remaining criteria, with the exception of cost, were assessed using a five-tiered scale of very low, low, medium, high, and very high. Very low is the least favorable rating and very high is the most favorable rating. Cost is reported as a monetary value. Table 5-2 provides the assigned rankings and associated descriptions for each alternative.

[2] Since POLs are regulated by the ADEC, a simplified list of evaluation criteria was used to evaluate each alternative.

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Table 5-2: Comparison of Remedial Alternatives for Petroleum Hydrocarbon Sub-Sites Regulated by the ADEC Contaminated Sites Program

Evaluation Criteria	**Ranking Scale**	**POL Alternative 1** **No Action**	**POL Alternative 2** **In-situ Mixing**	**POL Alternative 3** **Ex-situ Vapor Energy Generator (VEG)**	**POL Alternative 4** **Excavation with Offsite Disposal**	**POL Alternative 5** **Excavation with Low Temperature Thermal Desorption**
Overall Protection of Potential Receptors/Achieves Cleanup Levels	Pass if protective of potential site receptors. Fail if not protective.	FAIL Does not address POL contamination currently in place or current exposure pathways. Is not protective of human health risks.	PASS POL contamination would remain on site. However, provides protection of potential receptors by solidifying contaminants in place, removing exposure pathways, and isolating potential receptors from contaminated media.	PASS Provides protection of human health and the environment by treating contaminated soil exceeding the cleanup level at the site. Effectively isolates potential receptors from the contamination.	PASS Contaminated soil above the recreational cleanup level would be removed from the site, which is protective of potential receptors.	PASS Contaminated soil above the recreational cleanup level would be removed from the site, which is protective of potential receptors.
Effectiveness	Very high if highly effective. Very low if not effective.	VERY LOW Not effective. Contamination will persist in the long-term, although POLs may eventually naturally attenuate.	HIGH Although this alternative would not reduce POL concentrations to meet the cleanup levels, it would attain an equivalent standard of performance by preventing exposure and migration to soil contamination in excess of the soil clean-up level.	VERY HIGH Contaminant concentrations would be reduced in the short- and long-term because contaminated media above the cleanup level will be treated at the site.	VERY HIGH Contaminant concentrations would be reduced in the short- and long-term because contaminated media above the cleanup level will be removed from the site and placed in a specially designed, constructed, and monitored disposal facility designed to receive POL waste.	VERY HIGH Contaminant concentrations would be reduced in the short- and long-term because contaminated media above the cleanup level will be removed from the site and treated at an approved facility designed to thermally desorb POL waste.
Implementability	Very high if highly feasible and available. Very low if not feasible and available.	VERY HIGH No action is highly feasible and can easily be implemented.	MEDIUM This alternative is technically feasible; however, implementation may be difficult. This process requires access to fresh water which would involve permitting with the land owner (USFS) to utilize nearby water sources. Because the site is remote and uninhabited, it requires special logistical considerations, such as a shallow draft landing craft for equipment transport to the site, and a camp for personnel. The land owner (USFS) has expressed that leaving contamination in place and untreated may not be desirable.	MEDIUM This alternative is technically feasible and can be implemented. This process requires access to fresh water which would involve permitting with the land owner (USFS) to utilize nearby water sources. Because the site is remote and uninhabited, it requires special logistical considerations, such as a shallow draft landing craft for equipment delivery and a camp for personnel.	MEDIUM This alternative is technically feasible and can be implemented. Because the site is remote and uninhabited, it requires special logistical considerations, such as a shallow draft landing craft for equipment transport and soil transport off-site, and a camp for personnel.	MEDIUM This alternative is technically feasible and can be implemented. Because the site is remote and uninhabited, it requires special logistical considerations, such as a shallow draft landing craft for equipment transport and soil transport off-site, and a camp for personnel.
Cost	Estimated cost in dollars. Detailed costs and assumptions are provided in APPENDIX A.	$0 Since no action is implemented under this alternative, there is no associated cost.	$1,176,000 General Cost Assumptions (See Appendix A for details) • Heavy equipment transport to Sitka by barge and Kruzof Island by shallow draft landing craft • In-situ mixing material transport to Sitka by barge and Kruzof Island by shallow draft landing craft • Personnel transport on marine vessel • Remote field camp construction and operation • Access road vegetation clearing and construction • Move 8,000-gal AST • Permitting for use of nearby water source during construction • Perform in-situ mixing • Confirmation sample collection • Removal and disposal of Septic Tank #2 traps and Manhole #1 non-hazardous waste material • Removal and disposal of Tar Drum Area tar-like hazardous waste • Periodic review reporting • Repair and restoration of the site	$1,868,000 General Cost Assumptions (See Appendix A for details) • Heavy equipment and VEG equipment transport to Sitka by barge and Kruzof Island by shallow draft landing craft • Personnel transport on marine vessel • Remote field camp construction and operation • Access road vegetation clearing and construction • Move 8,000-gal AST • Contaminated soil excavation and stockpile • Perform bench scale testing • Permitting for use of nearby water source during process • Perform in-pile VEG remediation • Backfill of excavation with treated soil • Confirmation sample collection • Removal and disposal of Septic Tank #2 traps and Manhole #1 non-hazardous waste • Removal and disposal of Tar Drum Area tar-like hazardous waste • Repair and restoration of the site	$1,213,000 General Cost Assumptions (See Appendix A for details) • Heavy equipment transport to Sitka by barge and Kruzof Island by shallow draft landing craft • Backfill material transport to Kruzof Island by shallow draft landing craft • Personnel transport on marine vessel • Remote field camp construction and operation • Access road vegetation clearing and construction • Move 8,000-gal AST • Contaminated soil excavation • Confirmation sample collection • Removal and disposal of Septic Tank #2 traps and Manhole #1 non-hazardous waste • Removal and disposal of Tar Drum Area tar-like hazardous waste • Offsite transport to approved POL-disposal facility via shallow draft landing craft and shipping containers • Backfill of excavation with clean soil from Sitka • Repair and restoration of the site	$1,323,000 General Cost Assumptions (See Appendix A for details) • Heavy equipment transport to Sitka by barge and Kruzof Island by shallow draft landing craft • Backfill material transport to Kruzof Island by shallow draft landing craft • Personnel transport on marine vessel • Remote field camp construction and operation • Access road vegetation clearing and construction • Move 8,000-gal AST • Contaminated soil excavation • Confirmation sample collection • Removal and disposal of Septic Tank #2 traps and Manhole #1 non-hazardous waste • Removal and disposal of Tar Drum Area tar-like hazardous waste • Offsite transport to approved POL-thermal desorption facility via shallow draft landing craft and shipping containers • Backfill of excavation with clean soil from Sitka • Repair and restoration of the site

ADEC Alaska Department of Environmental Conservation
AST above-ground storage tank
LUC land use control
POL petroleum, oil, and lubricants
USFS United States Forest Service
VEG Vapor Energy Generator

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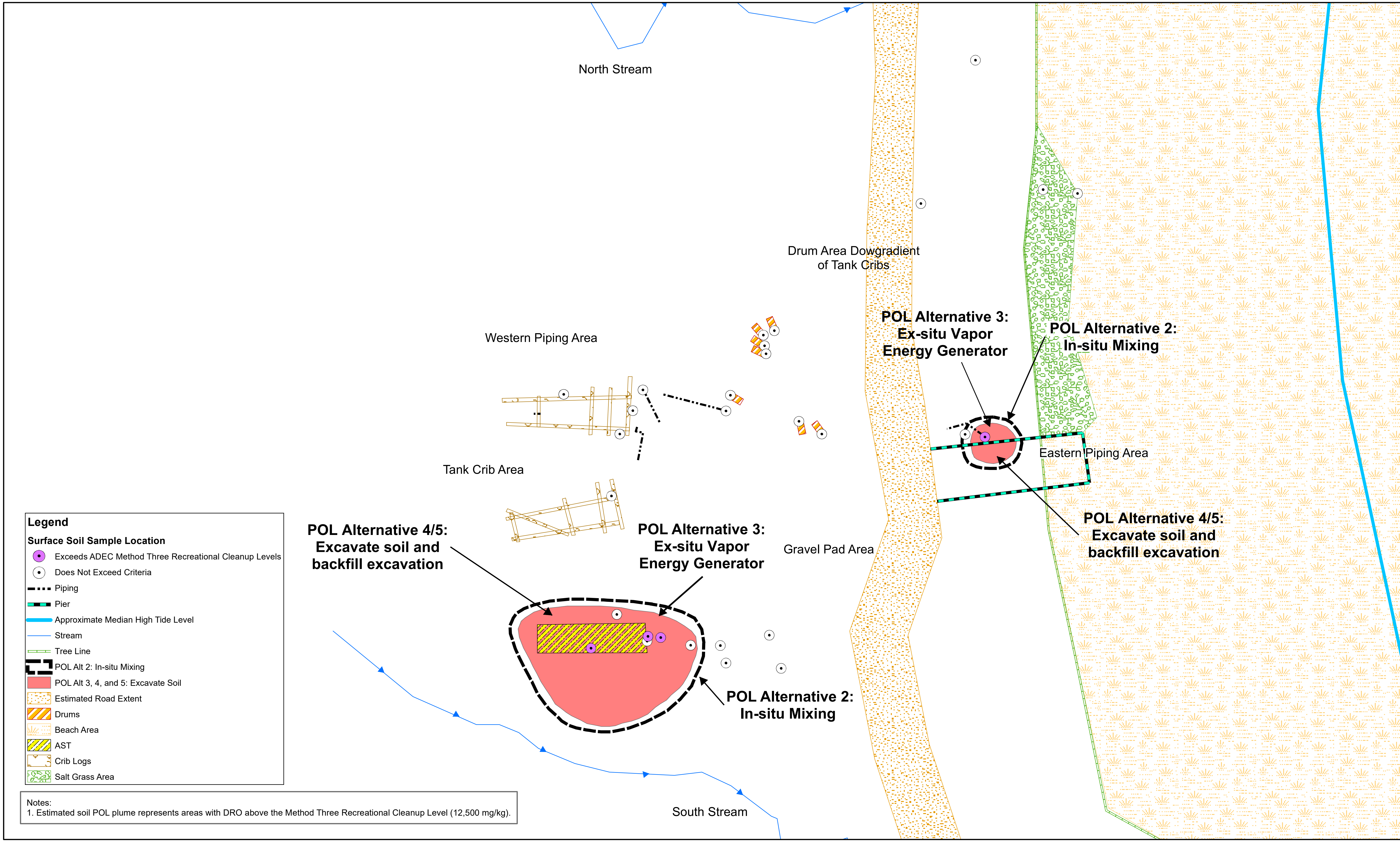

U.S.Army Engineer District, Alaska

Surveyed by: O'Neil Surveying and Engineering
Date: August to September 2012 and September to October 2013
Horizontal Datum: NAD 83 Alaska State Plane Zone 1 Feet
Vertical Datum: NAVD 88

Fort Babcock Feasibility Study Kruzof Island, Alaska			Fuel Storage Area POL Remedial Alternatives 2, 3, 4, and 5
Date: 2/3/2018	DRWN:lb	Revision: 0	FIGURE 5-1

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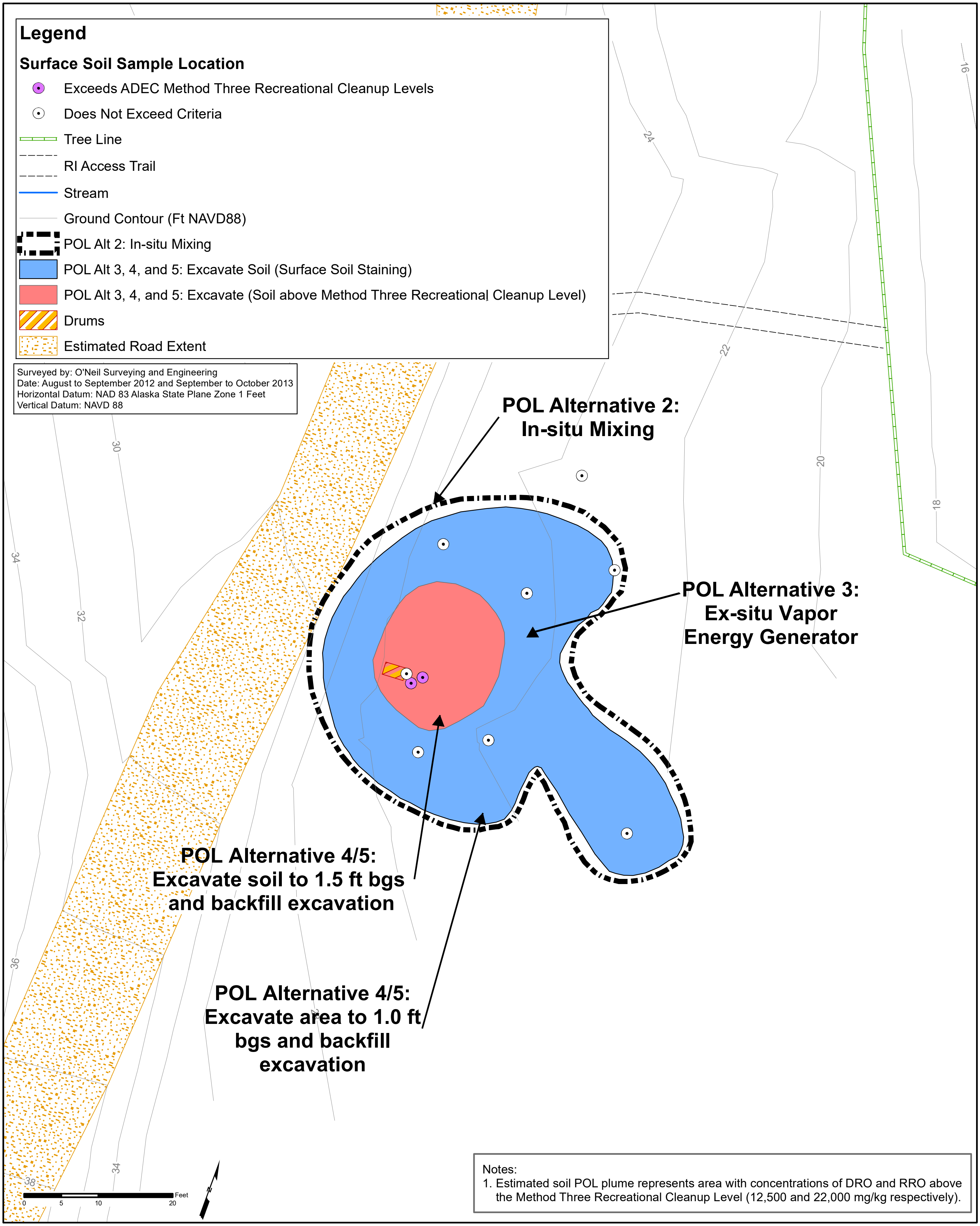

Path: C:\Users\lbeasley\Documents\ArcGIS\Packages\FIGURE 5-2_BB067D60-098D-467B-BAA7-2E7F0E7E4C8E\v101\FIGURE 5-2.mxd

U.S.Army Engineer District, Alaska

Fort Babcock
Feasibility Study
Kruzof Island, Alaska

Tar Drum Area POL Remedial Alternatives 2, 3, 4, and 5

Date: 2/3/2018	DRWN:lb	Revision: 0	FIGURE 5-2

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6.0 CONCLUSION

The Power Plant sub-site contains PCB-contaminated soil at concentrations above the residential cleanup level of 1 mg/kg, which in this case is also applied as the recreational cleanup level (Table 2-1). Remedial technologies were screened and three alternatives developed to address the contaminated soil. These alternatives include PCB Alternative 1 – No Action, PCB Alternative 2 – Ex-situ VEG, and PCB Alternative 3 – Excavation and Offsite Disposal. The rankings and costs associated with each alternative are summarized in Table 6-1.

The Landfill and Tar Drum areas contain metals- and PAH-contaminated soils (respectively) below the applicable recreational cleanup levels but above the Method Two residential cleanup levels. Additionally, Septic Tank #1 sediment, considered a potentially complete but insignificant exposure pathway under recreational land use, contained PAH and RRO soil contamination above the Method Two TBC. Based on the current and anticipated future land use (i.e. recreational), no remedial or further action at these sub-sites is required.

The Fuel Storage Area and Tar Drum area contain POL-contaminated soils at concentrations above the recreational cleanup levels. Although POL remedial actions are not required to follow the CERCLA process, a POL remedial action following state POL cleanup requirements may be conducted in conjunction with the CERCLA remedial action at the Power Plant; therefore, remedial alternatives were developed to address POLs as part of this FS. The tar-like material at the Tar Drum area was excluded from the development of the remedial alternatives; instead, tar removal and disposal costs were included in each alternative. The costs for removing material in Septic Tank #2 traps and the Manhole #1 vault were also included in the POL alternatives, since these sites may be evaluated for removal during the POL remedial action. A streamlined screening and development process was used to develop five alternatives, including POL Alternative 1 – No Action, POL Alternative 2 – In-situ Mixing, POL Alternative 3 – Ex-situ VEG, POL Alternative 4 – Excavation with Offsite Disposal, and POL Alternative 5 – Excavation with Low Temperature Thermal Desorption. The rankings and costs associated with each alternative are summarized in Table 6-1.

The costs developed in Table 6-1 for each of the alternatives considered within this FS are inclusive and standalone for comparison purposes. For example, mobilization and personnel transport via marine vessel is included in each alternative. However, utilizing construction sequencing and timing, some of these items may be combined or truncated to reduce the overall cost of the chosen alternatives.

Table 6-1: Alternative Ranking Summaries and Costs

Alternative Ranking Summary for the Power Plant Sub-site Following the CERCLA Process

Criteria	PCB Alternative 1 No Action	PCB Alternative 2 Ex-situ Vapor Energy Generator	PCB Alternative 3 Excavation with Offsite Disposal
Overall Protection of Human Health and the Environment	Fail	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass
Long-term Effectiveness and Permanence	Very Low	Very High	Very High
Reduction of Toxicity, Mobility, and Volume through Treatment	Very Low	Very High	Very Low
Short-term Effectiveness	Very Low	Low	Low
Implementability	Very High	Medium	High
Cost	None	$2,428,000	$1,894,000

Alternative Ranking Summary for the Fuel Storage Area and Tar Drum Area Sub-sites Following the ADEC Process

Criteria	POL Alternative 1 No Action	POL Alternative 2 In-situ Mixing	POL Alternative 3 Ex-situ Vapor Energy Generator	POL Alternative 4 Excavation with Offsite Disposal	POL Alternative 5 Excavation with Offsite Low Temperature Thermal Desorption
Overall Protection of Potential Receptors/Achieves Cleanup Levels	Fail	Pass	Pass	Pass	Pass
Effectiveness	Very Low	High	Very High	Very High	Very High
Implementability	Very High	Medium	Medium	Medium	Medium
Cost	None	$1,176,000	$1,868,000	$1,213,000	$1,323,000

ADEC Alaska Department of Environmental Conservation
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
LUC land use control
PCB Polychlorinated Biphenyl
POL Petroleum, oils, and lubricants

7.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2010. *Policy Guidance on Developing Conceptual Site Models.* Division of Spill Prevention and Response, Contaminated Sites Program. October.

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APPENDIX A:
COST ESTIMATES

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APPENDIX A.1
Sub-Sites Following the CERCLA Process, PCB Alternative 2
Ex-situ Vapor Energy Generator

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PCB Alternative 2		LOCATION	Total Cost		$2,428,000
Alternative 2 involves using a Vapor Energy Generator (VEG) to thermally treat the soil above ground in-pile.		Kruzof Island, AK	Implementation Time:	66	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost
Implementation Costs					
Mobilization/Demobilization					
Airfare (Anchroage to Sitka Roundtrip)	Alaska Airlines	6	ea	$ 500	$3,000
Barge Equipment & Supplies (Seattle, WA to Sitka, AK Roundtrip)	Lynden Maritime	1	LS	$ 32,167	$32,167
Boat Travel- Personnel/Resupply (Sitka to Kruzof Island 6 Pack Charter assuming 6 round trips at 2 hours each)	Seamarine, LLC.	12	hr	$ 185.00	$2,220
Boat Travel- Landing Craft for Equipment and Supplies (Kruzof Island to Sitka)	Sea Level Transport	6	day	$ 3,000.00	$18,000
Surveying					
Topographical Survey - Pre-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Topographical Survey - Post-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	4	ea	$ 500.00	$2,000
Per Diem					
Sitka-Mt. Edgecumbe Rate x 2 people @ $280/day	Dept. of Defense	8	day	$ 560.00	$4,480
Site Preparation					
Remote Camp Setup (includes cook,camp manager, mob/demobe to Sitka, and setup/operation on site. Equipment and staff would mobilized on landing craft to Kruzof Island)	Taiga Ventures	1	LS	$ 262,453	$262,453
EMT III/Paramedic (Includes supplies and airfare to Sitka)	Beacon	66	day	$ 805	$53,130
Implementation					
Road Building, Excavate, Mix and Compact, and Restoration					
Excavator (1 Month Rental)	Star Rentals, Seattle, WA	2	month	$ 3,900	$7,800
Front End Loader (1 Month Rental)	Star Rentals, Seattle, WA	2	month	$ 4,000	$8,000
Fuel and other engine fluids (10% of Machinery Cost)	Professional est	1	LS	$ 1,580	$1,580
Borrow Mat'l for Road (Weed-free Common Borrow with 5 mile haul to Landing Craft. 1 mile road by 10 feet wide by 1 foot thick.)	Professional est	1,956	cy	$ 60.00	$117,333
Misc. Supplies (plywood, silt fence, pumps, signage, geotextile liner, etc.)	Professional est	1	ea	$ 8,000	$8,000
Temporary Culvert (18-inch x 20 feet HDPE)	Lowes	10	ea	$ 321.00	$3,210
VEG Treatment: Above Ground In-Pile Heating					
Including Excavation, Backfilling, Labor, Materials, and Mobe/Demobe to Seattle.	Endpoint Inc.	1	LS	$ 650,000	$650,000
Sampling					
Sampling Equipment	Professional est	1	ea	$ 1,000	$1,000
Shipping Samples	Professional est	1	LS	$ 500	$500
Laboratory Fee for PCB Analysis with Rush Delivery	SGS Anchorage	28	ea	$ 85	$2,380
Offloading and Transportation to Landfill in Arlington, OR					
WM Rate for Offloading, Transportation, and Disposal (Regulated Waste)	Waste Management	2	ton	$ 185.00	$370
Analytical Team					
Field Manager (10hr days for the duration of implementation period)	Professional est	660	hr	$ 140	$92,400
Field Technician (10hr days for the duration of implementation period)	Professional est	660	hr	$ 100	$66,000
Remediation Crew					
Superintendent (10hr days for the duration of implementation period)	Professional est	660	hr	$ 200	$132,000
Operating Engineers (10hr days for the duration of implementation period)	Professional est	660	hr	$ 150	$99,000
Laborers x 1 (10hr days for the duration of implementation period)	Professional est	660	hr	$ 90	$59,400
Per Diem					
Sitka-Mt. Edgecumbe Rate x 6 people at $98/day (M&IE only)	Dept. of Defense	66	day	$ 588	$38,808
Reporting					
Final Construction Report	Professional est	1	ea	$ 75,000	$75,000
Project Close-Out Report	Professional est	1	ea	$ 40,000	$40,000
Sub-Total Implementation Costs					**$1,818,632**
Bid Bond (1%)					**$18,186**
7.5% Governement Administration					**$136,397**
10% Professional/Technical Services					**$181,863**
15% Contingency					**$272,795**
Total Cost					**$2,428,000**

PCB Alternative 2		LOCATION	Total Cost		$2,428,000
Alternative 2 involves using a Vapor Energy Generator (VEG) to thermally treat the soil above ground in-pile.		Kruzof Island, AK	Implementation Time:	66	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost

Assumptions

Working condition is safety level:	D			
Labor productivity	82%			
Equipment productivity	100%			
Number of people on site (per diem calc.) not including surveyors	6			
Total soil volume to be mixed	97	cy		
% cement to soil mixed	7%			
Location factor[1]	1.238	Ketchikan, Alaska		
Daily transport from Sitka travel time (roundtrip)	2	hours	1 hour each way	
Clearing and grubbing area (includes road)	1	acre		
Time to clear and grub per Acre[1]	0.385	acre/day	31 11 10.10 0260	with labor productivity (above) applied
Total time to clear and grub	3	days[2]		
Temporary road construction area	4987	sy		
Time to construct temp. road per sy[1]	586	sy/day	01 55 23.50 0050	with labor productivity (above) applied
Total time to construct road	9	days[2]		
Total time for site restoration	3	days[2]		
VEG Treatment: Above Ground In-Pile Heating	42	days[2]	Endpoint Inc.	
Number of landing craft trips (Equipment)	4	Trips		
Time per landing craft trip	3	hours	1 hour each way and 1 hour unload time.	
Time for landing craft trips (Equipment)	2	days[2]		
Landing craft relocation time (removed from total crew time)	4	days[2]	Landing craft located in Auke Bay, AK. Assumes two separate round trips of 2 days each and no standby time.	
Total landing craft time	6	days[2]		
Number of days added for weather contingency	7	days[2]		
Total implementation time	66	days[2]		
Sample cost (SGS Anchorage PCB analysis with rush delivery)	$85			
Surface area to be treated:	2,417	sf		
One sample per	100	sf		
Number of samples	25	ea		
Additional 3 samples per site (1 site)	3	ea		
Total number of samples	28	ea		

Assumes machinery is not available in Sitka, AK. Most efficient cost option is barging from Seattle, WA.

Quantity of soil estimates and associated area estimates come from the Final Technical Memorandum for the Phase II Remedial Investigation (RI) Report, Addendum 2 for the Summary of Polychlorinated Biphenyl (PCB) Soil and Groundwater Sample Results from the Former Power Plant, and Comparison of RI Data with 2016 Alaska Department of Conservation (ADEC) Updated Cleanup Levels dated 5

Assumes water and approved permits will be available on site for VEG process.

Assumes Survey Crew (2 people) would need 2 travel days and 2 working days so 4 days of per diem assumed.

Lynden Transportation would deliver machinery and containers from Seattle. Cheaper than from Anchorage.

Fuel charge is assumed to be 10% of the total equipment rental fee (not including boats/barges which fuel is included).

Assumes fieldwork can be accomplished with one loader and one excavator. Two of each (backups) are assumed to be brought on-site even though the backups could be stored in Sitka if a staging area was

Assumes crew, equipment, and vessels are available for the duration of the project.

Notes

cy cubic yards

sy square yards

References:

1 Source is 2018 CostWorks, RS Means

2 Day is assumed to be a 10 hour work day

APPENDIX A.2
Sub-Sites Following the CERCLA Process, PCB Alternative 3
Excavation with Offsite Disposal

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PCB Alternative 3		LOCATION	Total Cost		$1,894,000
Alternative 3 involves excavating approximately 559 cy (159 cy TSCA regulated) soil and barging the soil to the appropriate landfill for disposal in either Seattle, WA (non regulated soil) or Arlington, OR (regulated soil).		Kruzof Island, AK	Implementation Time:	49	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost
Implementation Costs					
Mobilization/Demobilization					
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	6	ea	$ 500.00	$3,000
Barge Equipment & Supplies (Seattle, WA to Sitka, AK Roundtrip)	Lynden Maritime	1	LS	$ 32,167	$32,167
Boat Travel- Personnel/Resupply (Sitka to Kruzof Island 6 Pack Charter assuming 6 round trips at 2 hours each)	Seamarine, LLC.	12	hr	$ 185.00	$2,220
Boat Travel- Landing Craft for Equipment, Supplies (Kruzof Island to Sitka)	Sea Level Transport	9	day	$ 3,000.00	$27,000
Surveying					
Topographical Survey - Pre-Construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Topographical Survey - Post-Construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	4	ea	$ 500.00	$2,000
Per Diem					
Sitka-Mt. Edgecumbe Rate x 2 people	Dept. of Defense	8	day	$ 560.00	$4,480
Site Preparation					
Remote Camp Setup (includes cook,camp manager, mob/demobe to Sitka, and setup/operation on site. Equipment and staff would mobilized on landing craft to Kruzof Island)	Taiga Ventures	1	LS	$ 236,953	$236,953
EMT III/Paramedic (Includes supplies and airfare to Sitka)	Beacon	49	day	$ 805	$39,445
Implementation					
Clearing, Road Building, Excavation, Hauling material to Landing Craft, Restoration					
Excavator (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 2,170	$13,020
Front End Loader (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 2,667	$16,000
Fork Lift (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 972	$5,830
Fuel and other engine fluids (10% of Machinery Cost)	Professional est	1	LS	$ 3,485	$3,485
Borrow Mat'l for Road (Weed-free Common Borrow with 5 mile haul to Landing Craft. 1 mile road by 10 feet wide by 1 foot thick.)	Professional est	1,956	cy	$ 60.00	$117,333
Construction Supplies					
Supersacks- 1 cy each, lined. For borrow material and waste material	BagCorp	1,124	ea	$ 20.00	$22,480
Borrow Mat'l (Weed-free Common Borrow) (with 5 mile haul to Landing Craft)	Professional est	517	cy	$ 60.00	$31,034
Weed-free Top Soil (with 5 mile haul Landing Craft)	Professional est	45	cy	$ 75.00	$3,357
Misc. Supplies (plywood, silt fence, geotextile liner etc.)	Professional est	1	LS	$ 8,000	$8,000
Temporary Culvert (18-inch x 20 feet HDPE)	Lowes	10	ea	$ 321.00	$3,210
Transportation of Material from Kruzof Island to Sitka					
Boat Travel- Landing Craft for Material transport	Sea Level Transport	5	day	$ 3,000.00	$15,000
Transportation of Material to Seattle, WA					
TSCA Regulated Waste (>50 ppm PCBs) (239 Tons)	Lynden Maritime	1	LS	$ 99,336	$99,336
Non-regulated Waste (<50 ppm PCBs) (605 Tons)	Lynden Maritime	1	LS	$ 124,461	$124,461
Offloading and Transportation to Landfill in Arlington, OR					
WM Rate for Offloading, Transportation, and Disposal (Regulated Waste)	Waste Management	239	ton	$ 185.00	$44,123
Offloading and Transportation to Landfill in Seattle, WA					
WM Rate for Offloading, Transportation, and Disposal	Waste Management	605	ton	$ 75.00	$45,338
Sampling				.	
Sampling Equipment	Professional est	1	ea	$ 1,000.00	$1,000
Shipping Samples	Professional est	1	LS	$ 500	$500
Laboratory Fee for PCB Analysis with Rush Delivery	SGS Anchorage	28	ea	$ 85	$2,380
Analytical Team					
Field Manager (10hr days for the duration of implementation period)	Professional est	490	hr	$ 140.00	$68,600
Field Technician (10hr days for the duration of implementation period)	Professional est	490	hr	$ 100.00	$49,000
Remediation Crew					
Superintendent (10hr days for the duration of implementation period)	Professional est	490	hr	$ 200.00	$98,000
Operating Engineers (10hr days for the duration of implementation period)	Professional est	490	hr	$ 150.00	$73,500
Laborers x 1 (10hr days for the duration of implementation period)	Professional est	490	hr	$ 90.00	$44,100
Per Diem					
Sitka-Mt. Edgecumbe Rate x 6 people at $98/day (M&IE only)	Dept. of Defense	49	day	$ 588.00	$28,812
Reporting					
Final Construction Report	Professional est	1	ea	$ 75,000	$75,000
Project Close-Out Report	Professional est	1	ea	$ 40,000	$40,000
Sub-Total Implementation Costs					**$1,418,563**
Sub-Total					**$1,418,563**
Bid Bond (1%)					**$14,186**
7.5% Governement Administration					**$106,392**
10% Professional/Technical Services					**$141,856**
15% Contingency					**$212,784**
Total Cost				**$1,894,000**	

PCB Alternative 3	LOCATION	Total Cost		$1,894,000
Alternative 3 involves excavating approximately 559 cy (159 cy TSCA regulated) soil and barging the soil to the appropriate landfill for disposal in either Seattle, WA (non regulated soil) or Arlington, OR (regulated soil).	Kruzof Island, AK	Implementation Time:	49	Days
		Post Remediation Monitoring:	n/a	

Description	Data Source	Quantities: Quantity Amount	Quantity Unit	Combined Unit Costs: Unit Cost	Option Total Cost

Assumptions

Description	Value	Unit	Notes		
Working condition is safety level:	D				
Labor productivity	82%				
Equipment productivity	100%				
Number of people on site (per diem calc.) not including surveyors	6				
Total soil volume to be removed	562	cy	TSCA Regulated:	159	cy
Density of soil	1.5	ton/cy			
Weight of soil to be removed	843	tons			
Location factor[1]	1.238	Ketchikan, Alaska			
Daily transport from Sitka travel time (roundtrip)	2	hours	1 hour each way		
Clearing and grubbing area (includes road)	1	acre			
Time to clear and grub per Acre1	0.385	acre/day	31 11 10.10 0260	with labor productivity (above) applied	
Total time to clear and grub	3	days[2]			
Temporary road construction area	4987	sy			
Time to construct temp. road per sy1	586	sy/day	01 55 23.50 0050	with labor productivity (above) applied	
Total time to construct road	9	days[2]			
Total time for site restoration	3	days[2]			
Excavation and loading into super sacks through hopper	540	cy/day	01 55 23.50 0050	with labor productivity (above) applied	
Time to excavate, mix, and backfill	2	days[2]			
Number of super sacks per trip hauled to landing craft	2	ea			
Speed of loader	5	mph			
Distance of road	0.85	miles	Google Earth Estimate		
Time per haul trip (roundtrip)	0.34	hrs			
Number of loader trips	281	ea	1 Cy Super Sacks		
Time for hauling material to landing craft	10	days[2]			
Landing craft super sacks per trip (17' x 45' deck with deck crane arm)	85	ea			
Number of landing craft trips (material)	7	trips	Assumes backfill material brought on return trip		
Number of landing craft trips (equipment)	4	trips			
Time per landing craft trip	4	hours	1 hour each way and 2 hour unload time.		
Landing craft relocation time (removed from total crew time)	4	days[2]	Landing craft located in Auke Bay, AK. Assumes two separate round trips of 2 days each and no standby time.		
Total landing craft time	9	days[2]			
Multiple Rounds of PCB Confirmation Sampling Days	10	days[2]			
Number of days added for weather contingency	7	days[2]			
Total implementation time (crew hour calcs.) incl. weather contingency	49	days[2]			
Sample cost (SGS Anchorage PCB analysis with rush delivery)	$85				
Surface area to be treated:	2,417	sf			
One sample per	100	sf			
Number of samples	25	ea			
Additional 3 samples per site (1 site)	3	ea			
Total number of samples	28	ea			

Assumes sequence of on-site events would accommodate confirmation sampling by sending samples via boat to Sitka, flight to anchorage, delivered to SGS with results returned in 24 hours (SGS).

Quantity of soil estimates and associated area estimates come from the Final Technical Memorandum for the Phase II Remedial Investigation (RI) Report, Addendum 2 for the Summary of Polychlorinated Biphenyl (PCB) Soil and Groundwater Sample Results from the Former Power Plant, and Comparison of RI Data with 2016 Alaska Department of Conservation (ADEC) Updated Cleanup Levels dated 5 October 2017.

Assumes existing road is completely overgrown and unusable. A complete clearing and grubbing and road building required.

Assumes Survey Crew (2 people) would need 2 travel days and 2 working days so 4 days of per diem assumed.

Lynden Transportation would deliver machinery and containers from Seattle. Cheaper than from Anchorage.

Lynden Transportation would be in Sitka to receive the 1 cy super sacks a forklift to load the sacks (2 high) into 20-foot long shipping containers for transport.

Lynden Transportation would deliver containers to Waste Management offload facility in Seattle and dispose of contents.

Borrow Material (fill and topsoil) would be available and sourced from Sitka.

Fuel charge is assumed to be 10% of the total equipment rental fee (not including boats/barges which fuel is included).

Assumes fieldwork can be accomplished with one loader and one excavator. Two of each are assumed to be brought on-site even though the backups could be stored in Sitka if a staging area was determined.

Assumes machinery is not available in Sitka, AK. Cheapest option is barging from Seattle, WA.

Assumes crew, equipment, and vessels are available for the duration of the project.

Notes

cy cubic yards
sy square yards

References:

1 Source is 2018 CostWorks, RS Means
2 Day is assumed to be a 10 hour work day

APPENDIX A.3
Petroleum Hydrocarbon ADEC Regulated Sub-Sites, POL Alternative 2
In-situ Mixing

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POL Alternative 2		LOCATION	Total Cost		$1,176,000
Alternative 2 involves in situ solidification/stabilization using shallow in place mixing with Portland Cement. Including long-term operation and maintenace of land use controls (LUCs).		Kruzof Island, AK	Implementation Time:	26	Days
			Post Remediation Monitoring:	30	years
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost
Implementation Costs					
Mobilization/Demobilization					
Airfare (Anchroage to Sitka Roundtrip)	Alaska Airlines	6	ea	$ 500	$3,000
Barge Equipment & Supplies (Seattle, WA to Sitka, AK Roundtrip)	Lynden Maritime	1	LS	$ 32,167	$32,167
Boat Travel- Personnel/Resupply (Sitka to Kruzof Island 6 Pack Charter assuming 6 round trips at 2 hours each)	Seamarine, LLC.	12	hr	$ 185.00	$2,220
Boat Travel- Landing Craft for Equipment and Supplies (Kruzof Island to Sitka)	Sea Level Transport	6	day	$ 3,000.00	$18,000
Surveying					
Topographical Survey - Pre-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Topographical Survey - Post-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	4	ea	$ 500.00	$2,000
Per Diem					
Sitka-Mt. Edgecumbe Rate x 2 people @ $280/day	Dept. of Defense	8	day	$ 560.00	$4,480
Site Preparation					
Remote Camp Setup (includes cook,camp manager, mob/demobe to Sitka, and setup/operation on site. Equipment and staff would mobilized on landing craft to Kruzof Island)	Taiga Ventures	1	LS	$ 202,453	$202,453
EMT III/Paramedic (Includes supplies and airfare to Sitka)	Beacon	26	day	$ 805	$20,930
Implementation					
Treatment Study					
Determine the proper cement to soil ratio for adequate in-situ stabilization	Professional est	1	LS	$ 100,000	$100,000
Road Building, Excavate, Mix and Compact, and Restoration					
Excavator (1 Month Rental)	Star Rentals, Seattle, WA	1	month	$ 3,900	$3,900
Front End Loader (1 Month Rental)	Star Rentals, Seattle, WA	1	month	$ 3,275	$3,275
Fuel and other engine fluids (10% of Machinery Cost)	Professional est	1	LS	$ 718	$718
Borrow Mat'l for Road (Weed-free Common Borrow with 5 mile haul to Landing Craft. 1 mile road by 10 feet wide by 1 foot thick.)	Professional est	1,956	cy	$ 60.00	$117,333
Construction Supplies					
Portland Cement (90 lb Bags at 7% cement to soil. Shipped with equipment)	Home Depot	147	ea	$ 15	$2,205
Misc. Supplies (plywood, silt fence, pumps, signage, geotextile liner, etc.)	Professional est	1	ea	$ 8,000	$8,000
Temporary Culvert (18-inch x 20 feet HDPE)	Lowes	10	ea	$ 321.00	$3,210
Transportation of Tar-like Substance and contaminated material unfit for in-situ stabilizaation (root balls) to Seattle (1 cy)					
TSCA Regulated Waste (1 CY)	Lynden Maritime	1	LS	$ 8,396	$8,396
Offloading and Transportation to Landfill in Arlington, OR					
WM Rate for Offloading, Transportation, and Disposal (Regulated Waste)	Waste Management	2	ton	$ 185.00	$370
Sampling					
Sampling Equipment	Professional est	1	ea	$ 1,000	$1,000
Shipping Samples	Professional est	1	LS	$ 500	$500
Laboratory Fee for POL Analysis with Rush Delivery	SGS Anchorage	10	ea	$ 85	$850
Analytical Team					
Field Manager (10hr days for the duration of implementation period)	Professional est	260	hr	$ 140	$36,400
Field Technician (10hr days for the duration of implementation period)	Professional est	260	hr	$ 100	$26,000
Remediation Crew					
Superintendent (10hr days for the duration of implementation period)	Professional est	260	hr	$ 200	$52,000
Operating Engineers (10hr days for the duration of implementation period)	Professional est	260	hr	$ 150	$39,000
Laborers x 1 (10hr days for the duration of implementation period)	Professional est	260	hr	$ 90	$23,400
Per Diem					
Sitka-Mt. Edgecumbe Rate x 6 people at $98/day (M&IE only)	Dept. of Defense	26	day	$ 588	$15,288
Reporting					
Final Construction Report	Professional est	1	ea	$ 75,000	$75,000
Project Close-Out Report	Professional est	1	ea	$ 40,000	$40,000
Sub-Total Implementation Costs					**$880,495**
Bid Bond (1%)					**$8,805**
7.5% Governement Administration					**$66,037**
10% Professional/Technical Services					**$88,050**
15% Contingency					**$132,074**
Total Cost					**$1,176,000**

POL Alternative 2		LOCATION	Total Cost		$1,176,000
Alternative 2 involves in situ solidification/stabilization using shallow in place mixing with Portland Cement. Including long-term operation and maintenace of land use controls (LUCs).		Kruzof Island, AK	Implementation Time:	26	Days
			Post Remediation Monitoring:	30	years
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost

Assumptions

Working condition is safety level:	D			
Labor productivity	82%			
Equipment productivity	100%			
Number of people on site (per diem calc.) not including surveyors	6			
Total soil volume to be mixed	97	cy		
% cement to soil mixed	7%			
Location factor[1]	1.238	Ketchikan, Alaska		
Daily transport from Sitka travel time (roundtrip)	2	hours	1 hour each way	
Clearing and grubbing area (includes road)	1	acre		
Time to clear and grub per Acre[1]	0.385	acre/day	31 11 10.10 0260	with labor productivity (above) applied
Total time to clear and grub	3	days[2]		
Temporary road construction area	4987	sy		
Time to construct temp. road per sy[1]	586	sy/day	01 55 23.50 0050	with labor productivity (above) applied
Total time to construct road	9	days[2]		
Total time for site restoration	3	days[2]		
Excavation, mixing, and backfill[1]	540	cy/day	01 55 23.50 0050	with labor productivity (above) applied
Time to excavate, mix, and backfill	2	days[2]		
Number of landing craft trips (Equipment)	4	Trips		
Time per landing craft trip	3	hours	1 hour each way and 1 hour unload time.	
Time for landing craft trips (Equipment)	2	days[2]		
Landing craft relocation time (removed from total crew time)	4	days[2]	Landing craft located in Auke Bay, AK. Assumes two separate round trips of 2 days each and no standby time.	
Total landing craft time	6	days[2]		
Number of days added for weather contingency	7	days[2]		
Total implementation time (crew hour calcs.)	26	days[2]		
Sample cost (SGS Anchorage for RRO and DRO)	$85			
Surface area to be treated:	339	sf		
One sample per	100	sf		
Number of samples	4	ea		
Additional 3 samples per site (2 sites)	6	ea		
Total number of samples	10	ea		

Assumes machinery is not available in Sitka, AK. Most efficient cost option is barging from Seattle, WA.

Quantity of soil estimates and associated area estimates come from the Final Technical Memorandum for the Phase II Remedial Investigation (RI) Report, Addendum 2 for the Summary of Polychlorinated Biphenyl (PCB) Soil and Groundwater Sample Results from the Former Power Plant, and Comparison of RI Data with 2016 Alaska Department of Conservation (ADEC) Updated Cleanup Levels dated 5

Assumes non-hazardous waste (approximately 7 cf) from Septic Tank #2 traps and Manhole #1 vault will be removed and disposed of at an approved Subtitle D landfill (Seattle, WA). Due to the relatively small volume of soil, this cost will be covered under the contingency.

Assumes water and approved permits will be available on site for cement mixing.

Assumes Survey Crew (2 people) would need 2 travel days and 2 working days so 4 days of per diem assumed.

Lynden Transportation would deliver machinery and containers from Seattle. Cheaper than from Anchorage.

The cement-to-soil ratio is based on a the report by Geo-Con, Inc. titled "In Situ Soil Stabilization of a Former MGP Site" located at http://www.containment.fsu.edu/cd/content/pdf/252.pdf. This percent is approximate and a field test should be performed to determine the actual cement-to-soil ratio needed for adequate solidification.

Fuel charge is assumed to be 10% of the total equipment rental fee (not including boats/barges which fuel is included).

Assumes maintenance to insure LUCs are funtioning as designed will be performed by the United States Forest Service (USFS) Sitka Ranger District

Assumes fieldwork can be accomplished with one loader and one excavator. Two of each (backups) are assumed to be brought on-site even though the backups could be stored in Sitka if a staging area was

Costs associated with removal and replacement of 8,000-gallon AST are included in site clearing and restoration, respectively.

Assumes crew, equipment, and vessels are available for the duration of the project.

Notes

cy cubic yards
sy square yards

References:

1 Source is 2018 CostWorks, RS Means
2 Day is assumed to be a 10 hour work day

APPENDIX A.4
Petroleum Hydrocarbon ADEC Regulated Sub-Sites, POL Alternative 3
Ex-situ Vapor Energy Generator

POL Alternative 3		LOCATION	Total Cost		$1,868,000
Alternative 3 involves using a Vapor Energy Generator (VEG) to thermally treat the soil above ground in-pile.		Kruzof Island, AK	Implementation Time:	66	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost
Implementation Costs					
Mobilization/Demobilization					
Airfare (Anchroage to Sitka Roundtrip)	Alaska Airlines	6	ea	$ 500	$3,000
Barge Equipment & Supplies (Seattle, WA to Sitka, AK Roundtrip)	Lynden Maritime	1	LS	$ 32,167	$32,167
Boat Travel- Personnel/Resupply (Sitka to Kruzof Island 6 Pack Charter assuming 6 round trips at 2 hours each)	Seamarine, LLC.	12	hr	$ 185.00	$2,220
Boat Travel- Landing Craft for Equipment and Supplies (Kruzof Island to Sitka)	Sea Level Transport	6	day	$ 3,000.00	$18,000
Surveying					
Topographical Survey - Pre-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Topographical Survey - Post-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	4	ea	$ 500.00	$2,000
Per Diem					
Sitka-Mt. Edgecumbe Rate x 2 people @ $280/day	Dept. of Defense	8	day	$ 560.00	$4,480
Site Preparation					
Remote Camp Setup (includes cook,camp manager, mob/demobe to Sitka, and setup/operation on site. Equipment and staff would mobilized on landing craft to Kruzof Island)	Taiga Ventures	1	LS	$ 262,453	$262,453
EMT III/Paramedic (Includes supplies and airfare to Sitka)	Beacon	66	day	$ 805	$53,130
Implementation					
Road Building, Excavate, Mix and Compact, and Restoration					
Excavator (2 Month Rental)	Star Rentals, Seattle, WA	2	month	$ 3,900	$7,800
Front End Loader (2 Month Rental)	Star Rentals, Seattle, WA	2	month	$ 3,275	$6,550
Fuel and other engine fluids (10% of Machinery Cost)	Professional est	1	ea	$ 1,435	$1,435
Borrow Mat'l for Road (Weed-free Common Borrow with 5 mile haul to Landing Craft. 1 mile road by 10 feet wide by 1 foot thick.)	Professional est	1,956	cy	$ 60	$117,333
Misc. Supplies (plywood, silt fence, pumps, signage, geotextile liner, etc.)	Professional est	1	ea	$ 8,000	$8,000
Temporary Culvert (18-inch x 20 feet HDPE)	Lowes	10	ea	$ 321.00	$3,210
VEG Treatment: Above Ground In-Pile Heating					
Including Excavation, Backfilling, Labor, Materials, and Mobe/Demobe to Seattle.	Endpoint Inc.	1	LS	$ 225,000	$225,000
Sampling					
Sampling Equipment	Professional est	1	ea	$ 1,000	$1,000
Shipping Samples	Professional est	1	LS	$ 500	$500
Laboratory Fee for POL Analysis with Rush Delivery	SGS Anchorage	10	ea	$ 85	$850
Transportation of Tar-like Substance and contaminated material unfit for VEG treatment (root balls) to Seattle (1 cy)					
TSCA Regulated Waste (1 CY)	Lynden Maritime	1	LS	$ 8,396	$8,396
Offloading and Transportation to Landfill in Arlington, OR					
WM Rate for Offloading, Transportation, and Disposal (Regulated Waste)	Waste Management	2	ton	$ 185.00	$370
Analytical Team					
Field Manager (10hr days for the duration of implementation period)	Professional est	660	hr	$ 140	$92,400
Field Technician (10hr days for the duration of implementation period)	Professional est	660	hr	$ 100	$66,000
Remediation Crew					
Superintendent (10hr days for the duration of implementation period)	Professional est	660	hr	$ 200	$132,000
Operating Engineers (10hr days for the duration of implementation period)	Professional est	660	hr	$ 150	$99,000
Laborers x 1 (10hr days for the duration of implementation period)	Professional est	660	hr	$ 90	$59,400
Per Diem					
Sitka-Mt. Edgecumbe Rate x 6 people at $98/day (M&IE only)	Dept. of Defense	66	day	$ 588	$38,808
Reporting					
Final Construction Report	Professional est	1	ea	$ 75,000	$75,000
Project Close-Out Report	Professional est	1	ea	$ 40,000	$40,000
Sub-Total Implementation Costs					**$1,398,903**
Bid Bond (1%)					**$13,989**
7.5% Governement Administration					**$104,918**
10% Professional/Technical Services					**$139,890**
15% Contingency					**$209,835**
Total Costs					**$1,868,000**

POL Alternative 3		LOCATION	Total Cost		$1,868,000
Alternative 3 involves using a Vapor Energy Generator (VEG) to thermally treat the soil above ground in-pile.		Kruzof Island, AK	Implementation Time:	66	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost

Assumptions

Working condition is safety level:	D			
Labor productivity	82%			
Equipment productivity	100%			
Number of people on site (per diem calc.) not including surveyors	6			
Total soil volume to be mixed	97	cy		
% cement to soil mixed	7%			
Location factor[1]	1.238	Ketchikan, Alaska		
Daily transport from Sitka travel time (roundtrip)	2	hours	1 hour each way	
Clearing and grubbing area (includes road)	1	acre		
Time to clear and grub per Acre[1]	0.385	acre/day	31 11 10.10 0260	with labor productivity (above) applied
Total time to clear and grub	3	days[2]		
Temporary road construction area	4987	sy		
Time to construct temp. road per sy[1]	586	sy/day	01 55 23.50 0050	with labor productivity (above) applied
Total time to construct road	9	days[2]		
Total time for site restoration	3	days[2]		
VEG Treatment: Above Ground In-Pile Heating	42	days[2]	Endpoint Inc.	
Number of landing craft trips (Equipment)	4	Trips		
Time per landing craft trip	3	hours	1 hour each way and 1 hour unload time.	
Time for landing craft trips (Equipment)	2	days[2]		
Landing craft relocation time (removed from total crew time)	4	days[2]	Landing craft located in Auke Bay, AK. Assumes two separate round trips of 2 days each and no standby time.	
Total landing craft time	6	days[2]		
Number of days added for weather contingency	7	days[2]		
Total implementation time (crew hour calcs.)	66	days[2]		
Sample cost (SGS Anchorage for RRO and DRO)	$85			
Surface area to be treated:	339	sf		
One sample per	100	sf		
Number of samples	4	ea		
Additional 3 samples per site (2 sites)	6	ea		
Total number of samples	10	ea		

Assumes machinery is not available in Sitka, AK. Most efficient cost option is barging from Seattle, WA.

Quantity of soil estimates and associated area estimates come from the Final Technical Memorandum for the Phase II Remedial Investigation (RI) Report, Addendum 2 for the Summary of Polychlorinated Biphenyl (PCB) Soil and Groundwater Sample Results from the Former Power Plant, and Comparison of RI Data with 2016 Alaska Department of Conservation (ADEC) Updated Cleanup Levels dated 5

Assumes non-hazardous waste (approximately 7 cf) from Septic Tank #2 traps and Manhole #1 vault will be removed and disposed of at an approved Subtitle D landfill (Seattle, WA). Due to the relatively small volume of soil, this cost will be covered under the contingency.

Assumes water and approved permits will be available on site for cement mixing.

Assumes Survey Crew (2 people) would need 2 travel days and 2 working days so 4 days of per diem assumed.

Lynden Transportation would deliver machinery and containers from Seattle. Cheaper than from Anchorage.

Fuel charge is assumed to be 10% of the total equipment rental fee (not including boats/barges which fuel is included).

Assumes fieldwork can be accomplished with one loader and one excavator. Two of each (backups) are assumed to be brought on-site even though the backups could be stored in Sitka if a staging area was

Costs associated with removal and replacement of 8,000-gallon AST are included in site clearing and restoration, respectively.

Assumes crew, equipment, and vessels are available for the duration of the project.

Notes

cy cubic yards

sy square yards

References:

1 Source is 2018 CostWorks, RS Means

2 Day is assumed to be a 10 hour work day

APPENDIX A.5
Petroleum Hydrocarbon ADEC Regulated Sub-Sites, POL Alternative 4
Excavation with Offsite Disposal

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POL Alternative 4		LOCATION	Total Cost		$1,213,000
Alternative 4 involves excavating approximately 97 cy of contaminated soil for removal and disposal at a landfill located in Seattle, Wa.		Kruzof Island, AK	Implementation Time:	28	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost
Implementation Costs					
Mobilization/Demobilization					
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	6	ea	$ 500.00	$3,000
Barge Equipment & Supplies (Seattle, WA to Sitka, AK Roundtrip)	Lynden Maritime	1	LS	$ 32,167	$32,167
Boat Travel- Personnel/Resupply (Sitka to Kruzof Island 6 Pack Charter assuming 6 round trips at 2 hours each)	Seamarine, LLC.	12	hr	$ 185.00	$2,220
Boat Travel- Landing Craft for Equipment, Supplies (Kruzof Island to Sitka)	Sea Level Transport	7	day	$ 3,000.00	$21,000
Surveying					
Topographical Survey - Pre-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Topographical Survey - Post-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	4	ea	$ 500.00	$2,000
Per Diem					
Sitka-Mt. Edgecumbe Rate x 2 people @ $280/day	Dept. of Defense	8	day	$ 560.00	$4,480
Site Preparation					
Remote Camp Setup (includes cook,camp manager, mob/demobe to Sitka, and setup/operation on site. Equipment and staff would mobilized on landing craft to Kruzof Island)	Taiga Ventures	1	LS	$ 205,453	$205,453
EMT III/Paramedic (Includes supplies and airfare to Sitka)	Beacon	28	day	$ 805	$22,540
Implementation					
Clearing, Road Building, Excavation, Hauling material to Landing Craft, and Restoration					
Excavator (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 2,170	$13,020
Front End Loader (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 2,667	$16,000
Fork Lift (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 972	$5,830
Fuel and other engine fluids (10% of Machinery Cost)	Professional est	1	LS	$ 3,485	$3,485
Borrow Mat'l for Road (Weed-free Common Borrow with 5 mile haul to Landing Craft. 1 mile road by 10 feet wide by 1 foot thick.)	Professional est	1,956	cy	$ 60.00	$117,333
Construction Supplies					
Supersacks- 1 cy each, lined. For borrow material and waste material	BagCorp	194	ea	$ 20.00	$3,880
Borrow Mat'l (Weed-free Common Borrow) (with 5 mile haul to Landing Craft)	Professional est	91	cy	$ 60.00	$5,443
Weed-free Top Soil (with 5 mile haul Landing Craft)	Professional est	6	cy	$ 75.00	$471
Misc. Supplies (plywood, silt fence, geotextile liner etc.)	Professional est	1	LS	$ 8,000	$8,000
Temporary Culvert (18-inch x 20 feet HDPE)	Lowes	10	ea	$ 321.00	$3,210
Transportation of Material from Kruzof Island to Sitka					
Boat Travel- Landing Craft for Material transport	Sea Level Transport	5	day	$ 3,000.00	$15,000
Transportation of Material to Seattle, WA					
Non-regulated Waste (~150 Tons) and Regulated Tar-like Material (2 ton)	Lynden Maritime	1	LS	$ 50,744	$50,744
Offloading and Transportation to Landfill in Seattle, WA					
WM Rate for Offloading, Transportation, and Disposal	Waste Management	146	ton	$ 75.00	$10,913
Sampling					
Sampling Equipment	Professional est	1	LS	$ 1,000	$1,000
Shipping Samples	Professional est	1	LS	$ 500	$500
Laboratory Fee for POL Analysis with Rush Delivery	SGS Anchorage	6	ea	$ 85	$543
Analytical Team					
Field Manager (10hr days for the duration of implementation period)	Professional est	280	hr	$ 140.00	$39,200
Field Technician (10hr days for the duration of implementation period)	Professional est	280	hr	$ 100.00	$28,000
Remediation Crew					
Superintendent (10hr days for the duration of implementation period)	Professional est	280	hr	$ 200.00	$56,000
Operating Engineers (10hr days for the duration of implementation period)	Professional est	280	hr	$ 150.00	$42,000
Laborers x 1 (10hr days for the duration of implementation period)	Professional est	280	hr	$ 90.00	$25,200
Per Diem					
Sitka-Mt. Edgecumbe Rate x 6 people at $98/day (M&IE only)	Dept. of Defense	28	day	$ 588.00	$16,464
Reporting					
Final Construction Report	Professional est	1	ea	$ 75,000	$75,000
Project Close-Out Report	Professional est	1	ea	$ 40,000	$40,000
Sub-Total Implementation Costs					**$908,496**
Bid Bond (1%)					$9,085
7.5% Governement Administration					**$68,137**
10% Professional/Technical Services					**$90,849.59**
15% Contingency					**$136,274.38**
Total Cost					**$1,213,000**

POL Alternative 4

POL Alternative 4	LOCATION	Total Cost	$1,213,000
Alternative 4 involves excavating approximately 97 cy of contaminated soil for removal and disposal at a landfill located in Seattle, Wa.	Kruzof Island, AK	Implementation Time: 28 Days Post Remediation Monitoring: n/a	

Description	Data Source	Quantities: Quantity Amount	Quantities: Quantity Unit	Combined Unit Costs: Unit Cost	Option Total Cost

Assumptions

Working condition is safety level:	D			
Labor productivity	82%			
Equipment productivity	100%			
Number of people on site (per diem calc.) not including surveyors	6			
Total soil volume to be removed	97	cy		
Density of soil	1.5	ton/cy		
Weight of soil to be removed	145.5	tons		
Location factor[1]	1.238	Ketchikan, Alaska		
Daily transport from Sitka travel time (roundtrip)	2	hours	1 hour each way	
Clearing and grubbing Area (includes road)	1	acre		
Time to clear and grub per Acre[1]	0.385	acre/day	31 11 10.10 0260	with labor productivity (above) applied
Total time to clear and grub	3	days[2]		
Temporary road construction area	4987	sy		
Time to construct temp. road per sy[1]	586	sy/day	01 55 23.50 0050	with labor productivity (above) applied
Total time to construct road	9	days[2]		
Total time for site restoration	3	days[2]		
Excavation and loading into super sacks through hopper	540	cy/day	01 55 23.50 0050	with labor productivity (above) applied
Time to excavate and backfill	1	days[2]		
Number of super sacks per trip hauled to landing craft	2	ea		
Speed of loader	5	mph		
Distance of road	0.85	miles	Google Earth Estimate	
Time per haul trip (roundtrip)	0.34	hrs		
Number of loader trips	49	ea	1 Cy Super Sacks	
Time for hauling material to landing craft	2	days[2]		
Landing craft super sacks per trip (17' x 45' deck with deck crane arm)	85	ea		
Number of landing craft trips (material)	1	trips	Assumes backfill material brought on return trip	
Number of landing craft trips (Equipment)	4	trips		
Time per landing craft trip	4	hours	1 hour each way and 1 hour unload time.	
Landing craft relocation time (removed from total crew time)	4	days[2]	Landing craft located in Auke Bay, AK. Assumes two separate round trips	
Total landing craft time	7	days[2]		
Number of days added for weather contingency	7	days[2]		
Total implementation time (crew hour calcs.)	28	days[2]		
Sample cost (SGS Anchorage POL analysis with rush delivery)	$85			
Surface area to be treated:	339	sf		
One sample per	100	sf		
Number of samples	3	ea		
Additional 3 samples per site (1 site)	3	ea		
Total number of samples	6	ea		

Assuming sequence of on-site events would accommodate confirmation sampling by sending samples via boat to Sitka, flight to anchorage, delivered to SGS with results returned in 24 hours (SGS).

Quantity of soil estimates and associated area estimates come from the Final Technical Memorandum for the Phase II Remedial Investigation (RI) Report, Addendum 2 for the Summary of Polychlorinated Biphenyl (PCB) Soil and Groundwater Sample Results from the Former Power Plant, and Comparison of RI Data with 2016 Alaska Department of Conservation (ADEC) Updated Cleanup Levels dated 5 October 2017.

Assumes non-hazardous waste (approximately 7 cf) from Septic Tank #2 traps and Manhole #1 vault will be removed and disposed of at an approved Subtitle D landfill (Seattle, WA). Due to the relatively small volume of soil, this cost will be covered under the contingency.

Assumes Survey Crew (2 people) would need 2 travel days and 2 working days so 4 days of per diem assumed.

Lynden Transportation would deliver machinery and containers from Seattle. More cost effective than obtaining from Anchorage.

Lynden Transportation would be in Sitka to receive the 1 cy super sacks and a forklift to load the sacks (2 high) into 20-foot long shipping containers for transport.

Lynden Transportation would deliver containers to Waste Management offload facility in Seattle and dispose of contents.

Borrow Material (fill and topsoil) would be available and sourced from Sitka.

Fuel charge is assumed to be 10% of the total equipment rental fee (not including boats/barges which fuel is included).

Assumes fieldwork can be accomplished with one loader and one excavator. Two of each are assumed to be brought on-site even though the backups could be stored in Sitka if a staging area was determined.

Assumes machinery is not available in Sitka, AK. Most cost effective option is barging from Seattle, WA.

Costs associated with removal and replacement of 8,000-gallon AST are included in site clearing and restoration, respectively.

Assumes crew, equipment, and vessels are available for the duration of the project.

Notes

cy cubic yards
sy square yards

References

1 Source is 2018 CostWorks, RS Means
2 Day is assumed to be a 10 hour work day

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APPENDIX A.6
Petroleum Hydrocarbon ADEC Regulated Sub-Sites, POL Alternative 5
Excavation with Offsite Low Temperature Thermal Desorption

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POL Alternative 5		LOCATION	Total Cost		$1,323,000
Alternative 5 involves excavating approximately 97 cy of contaminated soil for removal and hauled to Arlington, OR Subtitle D facility for Thermal Desorption Treatment.		Kruzof Island, AK	Implementation Time:	28	Days
			Post Remediation Monitoring:	n/a	
		Quantities		Combined Unit Costs	
Description	Data Source	Quantity Amount	Quantity Unit	Unit Cost	Option Total Cost
Implementation Costs					
Mobilization/Demobilization					
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	6	ea	$ 500.00	$3,000
Barge Equipment & Supplies (Seattle, WA to Sitka, AK Roundtrip)	Lynden Maritime	1	LS	$ 32,167	$32,167
Boat Travel- Personnel/Resupply (Sitka to Kruzof Island 6 Pack Charter assuming 6 round trips at 2 hours each)	Seamarine, LLC.	12	hr	$ 185.00	$2,220
Boat Travel- Landing Craft for Equipment, Supplies (Kruzof Island to Sitka)	Sea Level Transport	7	day	$ 3,000.00	$21,000
Surveying					
Topographical Survey - Pre-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Topographical Survey - Post-construction (2 people x 4 days including travel days)	Professional est	80	hr	$ 240.00	$19,200
Airfare (Anchorage to Sitka Roundtrip)	Alaska Airlines	4	ea	$ 500.00	$2,000
Per Diem					
Sitka-Mt. Edgecumbe Rate x 2 people @ $280/day	Dept. of Defense	8	day	$ 560.00	$4,480
Site Preparation					
Remote Camp Setup (includes cook,camp manager, mob/demobe to Sitka, and setup/operation on site. Equipment and staff would mobilized on landing craft to Kruzof Island)	Taiga Ventures	1	LS	$ 205,453	$205,453
EMT III/Paramedic (Includes supplies and airfare to Sitka)	Beacon	28	day	$ 805	$22,540
Implementation					
Clearing, Road Building, Excavation, Hauling material to Landing Craft, and Restoration					
Excavator (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 2,170	$13,020
Front End Loader (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 2,667	$16,000
Fork Lift (6 week rental) x2	Star Rentals, Seattle, WA	6	wk	$ 972	$5,830
Fuel and other engine fluids (10% of Machinery Cost)	Professional est	1	LS	$ 3,485	$3,485
Borrow Mat'l for Road (Weed-free Common Borrow with 5 mile haul to Landing Craft. 1 mile road by 10 feet wide by 1 foot thick.)	Professional est	1,956	cy	$ 60.00	$117,333
Construction Supplies					
Supersacks- 1 cy each, lined. For borrow material and waste material	BagCorp	194	ea	$ 20.00	$3,880
Borrow Mat'l (Weed-free Common Borrow) (with 5 mile haul to Landing Craft)	Professional est	91	cy	$ 60.00	$5,443
Weed-free Top Soil (with 5 mile haul Landing Craft)	Professional est	6	cy	$ 75.00	$471
Misc. Supplies (plywood, silt fence, geotextile liner etc.)	Professional est	1	LS	$ 8,000	$8,000
Temporary Culvert (18-inch x 20 feet HDPE)	Lowes	10	ea	$ 321.00	$3,210
Transportation of Material from Kruzof Island to Sitka					
Boat Travel- Landing Craft for Material transport	Sea Level Transport	5	day	$ 3,000.00	$15,000
Transportation of Material to Seattle, WA					
Non-regulated Waste (~150 Tons) and Regulated Tar-like Material (2 ton)	Lynden Maritime	1	LS	$ 50,744	$50,744
Offloading and Transportation to Landfill in Arlington, OR					
WM Rate for Offloading and Transportation of 20-foot Shipping Containers (Regulated Waste	Waste Management	12	ea	$ 1,300.00	$15,600
Thermal Desorption Treatment	Waste Management	146	ton	$ 530.00	$77,115
Sampling				.	
Sampling Equipment	Professional est	1	LS	$ 1,000	$1,000
Shipping Samples	Professional est	1	LS	$ 500	$500
Laboratory Fee for POL Analysis with Rush Delivery	SGS Anchorage	6	ea	$ 85	$543
Analytical Team					
Field Manager (10hr days for the duration of implementation period)	Professional est	280	hr	$ 140.00	$39,200
Field Technician (10hr days for the duration of implementation period)	Professional est	280	hr	$ 100.00	$28,000
Remediation Crew					
Superintendent (10hr days for the duration of implementation period)	Professional est	280	hr	$ 200.00	$56,000
Operating Engineers (10hr days for the duration of implementation period)	Professional est	280	hr	$ 150.00	$42,000
Laborers x 1 (10hr days for the duration of implementation period)	Professional est	280	hr	$ 90.00	$25,200
Per Diem					
Sitka-Mt. Edgecumbe Rate x 6 people at $98/day (M&IE only)	Dept. of Defense	28	day	$ 588.00	$16,464
Reporting					
Final Construction Report	Professional est	1	ea	$ 75,000	$75,000
Project Close-Out Report	Professional est	1	ea	$ 40,000	$40,000
Sub-Total Implementation Costs					**$990,298**
Bid Bond (1%)					$9,903
7.5% Governement Administration					**$74,272**
10% Professional/Technical Services					**$99,029.84**
15% Contingency					**$148,544.76**
Total Cost					**$1,323,000**

POL Alternative 5	LOCATION	Total Cost		$1,323,000
Alternative 5 involves excavating approximately 97 cy of contaminated soil for removal and hauled to Arlington, OR Subtitle D facility for Thermal Desorption Treatment.	Kruzof Island, AK	Implementation Time:	28	Days
		Post Remediation Monitoring:	n/a	

Description	Data Source	Quantities: Quantity Amount	Quantities: Quantity Unit	Combined Unit Costs: Unit Cost	Option Total Cost
Assumptions					
Working condition is safety level:	D				
Labor productivity	82%				
Equipment productivity	100%				
Number of people on site (per diem calc.) not including surveyors	6				
Total soil volume to be removed	97	cy			
Density of soil	1.5	ton/cy			
Weight of soil to be removed	145.5	tons			
Location factor[1]	1.238	Ketchikan, Alaska			
Daily transport from Sitka travel time (roundtrip)	2	hours	1 hour each way		
Clearing and grubbing Area (includes road)	1	acre			
Time to clear and grub per Acre[1]	0.385	acre/day	31 11 10.10 0260	with labor productivity (above) applied	
Total time to clear and grub	3	days[2]			
Temporary road construction area	4987	sy			
Time to construct temp. road per sy[1]	586	sy/day	01 55 23.50 0050	with labor productivity (above) applied	
Total time to construct road	9	days[2]			
Total time for site restoration	3	days[2]			
Excavation and loading into super sacks through hopper	540	cy/day	01 55 23.50 0050	with labor productivity (above) applied	
Time to excavate and backfill	1	days[2]			
Number of super sacks per trip hauled to landing craft	2	ea			
Speed of loader	5	mph			
Distance of road	0.85	miles	Google Earth Estimate		
Time per haul trip (roundtrip)	0.34	hrs			
Number of loader trips	49	ea	1 Cy Super Sacks		
Time for hauling material to landing craft	2	days[2]			
Landing craft super sacks per trip (17' x 45' deck with deck crane arm)	85	ea			
Number of landing craft trips (material)	1	trips	Assumes backfill material brought on return trip		
Number of landing craft trips (Equipment)	4	trips			
Time per landing craft trip	4	hours	1 hour each way and 1 hour unload time.		
Landing craft relocation time	4	days[2]	Landing craft located in Auke Bay, AK. Assumes two separate round trips		
Total landing craft time	7	days[2]			
Number of days added for weather contingency	7	days[2]			
Total implementation time (crew hour calcs.)	28	days[2]			
Sample cost (SGS Anchorage POL analysis with rush delivery)	$85				
Surface area to be treated:	339	sf			
One sample per	100	sf			
Number of samples	3	ea			
Additional 3 samples per site (1 site)	3	ea			
Total number of samples	6	ea			

Assuming sequence of on-site events would accommodate confirmation sampling by sending samples via boat to Sitka, flight to anchorage, delivered to SGS with results returned in 24 hours (SGS).

Quantity of soil estimates and associated area estimates come from the Final Technical Memorandum for the Phase II Remedial Investigation (RI) Report, Addendum 2 for the Summary of Polychlorinated Biphenyl (PCB) Soil and Groundwater Sample Results from the Former Power Plant, and Comparison of RI Data with 2016 Alaska Department of Conservation (ADEC) Updated Cleanup Levels dated 5 October 2017.

Assumes non-hazardous waste (approximately 7 cf) from Septic Tank #2 traps and Manhole #1 vault will be removed and disposed of at an approved Subtitle D landfill (Seattle, WA). Due to the relatively small volume of soil, this cost will be covered under the contingency.

Assumes Survey Crew (2 people) would need 2 travel days and 2 working days so 4 days of per diem assumed.

Lynden Transportation would deliver machinery and containers from Seattle. More cost effective than obtaining from Anchorage.

Lynden Transportation would be in Sitka to receive the 1 cy super sacks and a forklift to load the sacks (2 high) into 20-foot long shipping containers for transport.

Lynden Transportation would deliver containers to Waste Management offload facility in Seattle and dispose of contents.

Borrow Material (fill and topsoil) would be available and sourced from Sitka.

Fuel charge is assumed to be 10% of the total equipment rental fee (not including boats/barges which fuel is included).

Assumes fieldwork can be accomplished with one loader and one excavator. Two of each are assumed to be brought on-site even though the backups could be stored in Sitka if a staging area was determined.

Assumes machinery is not available in Sitka, AK. Most cost effective option is barging from Seattle, WA.

Costs associated with removal and replacement of 8,000-gallon AST are included in site clearing and restoration, respectively.

Assumes crew, equipment, and vessels are available for the duration of the project.

Notes

cy cubic yards
sy square yards

References

1 Source is 2018 CostWorks, RS Means
2 Day is assumed to be a 10 hour work day

APPENDIX B:
RESPONSE TO COMMENTS

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THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Environmental Conservation
DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
555 Cordova Street
Anchorage, AK 99501
Main: 907-334-5939
Fax: 907-269-7687
www.dec.alaska.gov

File No.: 1525.38.046

November 21, 2018

Beth Astley
USACE, Alaska District
PO Box 6898
JBER, AK 99506-0898

Re: Review of "**Final Feasibility Study, Fort Babcock Formerly Used Defense Site, Sitka, Alaska" Dated November 2018**

Dear Ms. Astley:

The Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Program has reviewed the "Final Feasibility Study, Fort Babcock Formerly Used Defense Site (F10AK035304), Sitka Alaska" dated November 2018, as well as the responses ADEC's July 2018 comments on the draft version of the document. ADEC disagrees with responses to Comments 8, 9, 10, and 11, as documented in the enclosed comment matrix, and maintains that the state regulations cited in these comments are substantive requirements that need to be included in the "applicable or relevant and appropriate requirements" (ARARs) section of this document. If ADEC and the U.S Army Corps are unable to come to an agreement regarding these ARARS, please ensure that the state's request to include these regulations as ARARs is documented by including the enclosed response matrix as an appendix to the final feasibility study.

Additionally, while reviewing the revised document, ADEC noted that the Toxic Substance Control Act and Clean Water Act have been removed from the ARARs section. ADEC disagrees with the removal of these ARARs and believes that these federal regulations are pertinent to remedial action work to be conducted at the Fort Babcock site, and should be included in the ARARs section of the feasibility study.

If you have any questions regarding this letter, please contact me at (907) 269-0298 or sammi.castle@alaska.gov.

Sincerely,

Sammi Castle

Sammi Castle
Environmental Program Specialist

Enclosure: 2018 Feasibility Study Comment Matrix

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	SITE: Fort Babcock FUDS DOCUMENT (title/date): Draft Feasibility Study, Fort Babcock Formerly Used Defense Site, Sitka, Alaska, June 2018 REVIEWER (name/date): Sammi Castle, July 2018			
Item No.	**Page No., Section or Para.**	**COMMENTS**	**RESPONSE**	**ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)**
1	Overview	Text refers to 'Method Two direct contact' levels, however ADEC's updated regulations do not contain direct contact cleanup levels. Please correct text throughout this document to indicate the current Method Two cleanup level that is being referenced (human health, migration to groundwater, ingestion, or inhalation). In addition, the text is inconsistent when referencing ADEC's Method Two and Table C cleanup levels. In some instances text refers to Method Two and Table C as cleanup levels and in other instances as screening levels. ADEC's Method Two and Table C levels are cleanup levels and should be referred to as such to avoid confusion. Please correct all references to Method Two and Table C throughout the document.	The Method Two cleanup levels referenced in the document were clarified to indicate human health cleanup levels. The text was revised to reference the Method Two and Table C levels as cleanup levels. However, it should be noted that for the purposes of the RI, they were considered screening levels. The Method Two and Table C cleanup levels were used as screening levels to determine nature and extent of contamination, prior to the development of alternate cleanup levels for nickel, DRO, RRO, benzo(a)pyrene, and benzo(b)fluoranthene based on the Method 3 calculator.	Agree.
2	Executive Summary	POL Alternative 3 states: 'PCB contaminated soil would be..' Should state: 'POL contaminated soil would be…'	The text was revised to "POL contaminated soil would be…"	Agree.
3	Page 2-5, First paragraph, Third sentence	Text states: "…DRO was detected above the ADEC Method Three residential and recreational screening criteria..". Please correct text to state: "…DRO was detected above the ADEC Method Three recreational cleanup level...".	The text was revised to "DRO was detected above the recreational cleanup level..."	Agree.
4	Page 2-6, Section 2.2.5 Second paragraph	Text states that ADEC Maximum Allowable concentrations "were applied as the Method Three recreational cleanup levels, in accordance with 18 AAC 75.341(j)(3)." This reference is incorrect. Text should reference 18 AAC 75.340(j)(3).	The reference in the text was updated to 18 AAC 75.340(j)(3).	Agree.
5	Page 2-7, Second paragraph	The Method Three recreational cleanup level for benzo(a)pyrene is stated as being 9 mg/kg. The alternative cleanup level for benzo(a)pyrene was changed to 4 mg/kg in the 2017 Phase II RI Report Addendum II. Please update the cleanup level used in this paragraph, or clarify that the 9 mg/kg cleanup level was a previously used cleanup level.	The text was updated to reflect the alternate cleanup level 4 mg/kg.	Agree.
6	Page 2-8, First paragraph	Text states the estimated volumes of PCB-contaminated soil requiring remedial action as 156 and 403 cubic yards. How has the estimated volume of PCB-contaminated soil been calculated when the vertical extent of PCB contamination is unknown?	The estimated volume of PCB-contaminated soil was calculated in the Phase II RI Addendum II (USACE-AK 2017) using a conservative estimate that soil would be removed to the water table, based on the depth to water of 6.24 feet bgs measured in the field. The single subsurface soil sample collected in 2016 indicated PCB-	Agree.

Item No.	Page No., Section or Para.	COMMENTS	RESPONSE	ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
			contaminated soils existed up to a depth of 4.5 feet bgs. The text was revised to reflect the source of these soil volumes.	
7	Page 2-10, Section 2.3.2	Please ensure that cumulative risk post-remediation meets ADEC cumulative risk standards; ADEC will be unable to close the site without institutional controls if it exceeds the cumulative risk standards in 18 AAC 75.325(g) or 18 AAC 78.600(d).	USACE will ensure that cumulative risk post-remediation meets ADEC cumulative risk standards per 18 AAC 75.325(g) for the sites considered in this FS. The text was revised to "Cumulative risk was calculated for a pre-remediation scenario using the 2016 PCB data. No further action sites were excluded from this analysis._Using an EF of 14 days, the cancer risk exceeds the NCP acceptable cancer risk range (1×10^{-4} to 1×10^{-6}) with a cancer risk of 6 in 10,000 (6×10^{-4}). The risk is driven by PCBs. Cumulative risk was also calculated for a post-remediation scenario after the cleanup levels are applied. After remediation, the cumulative risk remaining at the site meets the NCP and ADEC risk criteria."	Agree.
7a	Table 2-1		Although no comment was made regarding Table 2-1, a clarification change was made as a result of Comment 27. Lead and benzo(a)pyrene were removed from the table because the maximum site concentrations are below the previously approved recreational cleanup levels of 800 mg/kg and 4 mg/kg, respectively. The Table 2-1 footnotes were updated for clarification. The notes on Figures 2-2 and 2-3 were also updated for consistency.	Agree.
8	Page 3-1, Table 3-1	For chemical-specific ARARs, it should be noted that in accordance with 18 AAC 75.325(g), a responsible person shall ensure that, after completing site cleanup, the risk from hazardous substances does not exceed a cumulative carcinogenic risk standard of 1 in 100,000 across all exposure pathways and does not exceed a cumulative noncarcinogenic risk standard at a hazard index of one, reported to one significant figure, across all exposure pathways.	See response to comment 7, above. The cited requirement is not a substantive requirement that is specific to a CERCLA hazardous substance. The following statement will be added to this section, "Although not considered ARARs, the requirements of 18 AAC 70.010, 18 AAC 75.325(g), .370(a)(2), and .355(b) will be incorporated into future planning documents as applicable to the selected alternative."	Disagree.
9	Page 3-2, Section 3.1.2	For location-specific ARARs, in accordance with 18 AAC 75.370(a)(2), contaminated soil must be stored 100 feet or more from surface water.	The cited requirement is not a substantive requirement that is specific to a CERCLA hazardous substance. Please see response to Comment 8.	Disagree.
10	Page 3-2, Table 3-2	For action-specific ARARs, in accordance with 18 AAC 75.355(b), the collection, interpretation, and reporting of data,	The cited requirement is not a substantive requirement that is specific to a CERCLA hazardous substance. Please see response to Comment 8.	Disagree.

Item No.	Page No., Section or Para.	COMMENTS	RESPONSE	ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		and the required sampling and analysis is to be conducted or supervised by a qualified environmental professional.		
11	Page 3-2, Table 3-2	For action-specific ARARs, in accordance with 18 AAC 70.010, a person may not conduct an operation that causes or contributes to a violation of the water quality standards.	The cited requirement is not a substantive requirement that is specific to a CERCLA hazardous substance. Please see response to Comment 8.	Disagree.
12	Page 4-3, Table 4-1, Process #6, Implement ability	For Implementability of 'Excavation with offsite disposal to a permitted facility', text states that it is feasible to excavate and dispose of PCB-contaminated soil at a Subtitle D landfill located in Oregon. It should be noted in this section that PCB-contaminated soil would be transported to two landfills, a Subtitle C and Subtitle D, dependent upon the PCB concentrations.	The text was revised to "Soil would be segregated based on the TSCA designation and sent to either a Subtitle C landfill or Subtitle D landfill, dependent upon the PCB concentrations. A Subtitle C landfill that accepts this waste is located in Oregon. A Subtitle D landfill that accepts this waste is located in Washington. It is feasible to excavate, transport, and dispose of PCB-contaminated soil at these facilities."	Agree.
13	Page 4-5 & 4-6, Sections 4.1.3.2 & 4.1.3.3, Third paragraphs	For PCB Alternatives 2 and 3, text states that 'Following excavation, samples would be collected to confirm that contaminated soil was removed and residual contamination does not remain above the cleanup level (1 mg/kg)." If the initial excavation effort does not remove all contaminated soils above 1 mg/kg, will excavation efforts continue until only soils below the cleanup level are left in place? If so, please add language to these sections to clarify this.	The text was revised to "During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup level (1 mg/kg). Excavation would continue until concentrations in remaining soil are below the cleanup level."	Agree.
14	Page 4-5, Section 4.1.3.2	PCB Alternative 2: VEG treated soil would need to be sampled prior to backfilling the excavation to ensure PCB concentrations are below 1 mg/kg. Please add language to paragraph three to indicate this. Please describe temporary controls (e.g. signs, fences, etc.) to be implemented during VEG treatment to keep recreational visitors from falling in the excavation or coming in contact with PCB-contaminated soil while it is being treated.	The text was revised to "The excavation would be backfilled with the treated soil following VEG remediation. The treated soils would be sampled prior to backfilling to ensure PCB concentrations are below the cleanup level." The text was revised to "PCB-contaminated soil would be excavated and stockpiled onsite. Temporary construction fencing and signs would be used to secure the open excavation and treatment stockpiles."	Agree.
15	Page 4-11, Figure 4-1	This figure is inconsistent with Figure 2-4, which illustrates 13 locations for PCB concentrations between 1 mg/kg – 50 mg/kg, as depicted by the presence of an orange circle. This figure only depicts 12 locations between 1 mg/kg – 50 mg/kg with orange circles.	The figure was updated to display the missing PCB location.	Agree.

SITE: Fort Babcock FUDS
DOCUMENT (title/date): Draft Feasibility Study, Fort Babcock Formerly Used Defense Site, Sitka, Alaska, June 2018
REVIEWER (name/date): Sammi Castle, July 2018

Item No.	Page No., Section or Para.	COMMENTS	RESPONSE	ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
16	Page 5-2, Second paragraph	Text states: 'Therefore, no further institutional controls are necessary to protect residential users..'. Replace "residential" with "recreational."	The text was revised as requested.	Agree.
17	Page 5-7, Section 5.2.2	The first sentence of this paragraph gives an 'Error! Reference source not found' message. Please correct this sentence to include the appropriate reference.	The text was revised to include the appropriate reference to Table 5-1.	Agree.
18	Page 5-8, Section 5.2.2.3	The first sentence of this section states: 'POL Alternative 2…'. Text should state: 'POL Alternative 3…'.	The text was revised as requested.	Agree.
19	Page 5-8, 5-9 & 5-10, Sections 5.2.2.3, 5.2.2.4 & 5.2.2.5	For POL Alternatives 3, 4, and 5, text states: 'Following excavation, samples would be collected to confirm that contaminated soil was removed and residual contamination does not remain above cleanup levels.' If the initial excavation effort does not remove all contaminated soil above applicable cleanup levels, will excavation efforts continue until only soil below cleanup levels is left in place? If so, please add language to these sections to clarify this.	The text was revised to "During excavation, samples would be collected to confirm that contaminated soil was removed, and residual contamination does not remain above the cleanup levels. Excavation would continue until concentrations in remaining soil are below the cleanup levels."	Agree.
20	Page 5-8, Section 5.2.2.3, Third paragraph	Prior to excavation, the 8,000-gallon AST would need to be moved outside the construction area. Please include language stating this. VEG treated soil would need to be sampled prior to backfilling the excavation to ensure POL concentrations are below cleanup levels. Please add language to indicate this. Please describe temporary controls (e.g. signs, fences, etc.) to be implemented during VEG treatment to keep recreational visitors from falling in the excavation or coming in contact with POL-contaminated soil while it is being treated.	The text was revised to state that the AST will be moved outside of the construction area prior to excavation and put back to its original location during site restoration. The text was revised to read "The excavation would be backfilled with the treated soil following VEG remediation. The treated soils would be sampled prior to backfilling to ensure POL concentrations are below the cleanup levels." The text was revised to "POL-contaminated soil would be excavated and stockpiled onsite. Temporary construction fencing and signs would be used to secure the open excavation and treatment stockpiles."	Agree.
21	Page 5-9, Section 5.2.2.5	The first sentence of this section states: 'POL Alternative 4…'. Text should state: 'POL Alternative 5…'.	The text was revised as requested.	Agree.
22	Page 5-11, Table 5-2	For alternatives where waste will be left onsite, contamination is expected to remain above cleanup levels, or the alternate cleanup level is dependent on a recreational land use, land use	USACE has been coordinating closely with the landowner (USFS) throughout the RI/FS process. Please refer to the letter USFS submitted to ADEC dated September 10, 2018, which describes their	Agree.

Item No.	Page No., Section or Para.	COMMENTS	RESPONSE	ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		controls/institutional controls will be required and must be included as part of the remedy consideration. Landowner concurrence is required for the implementation of institutional controls.	concurrence with alternate cleanup levels based on a recreational scenario, and the institutional controls that will ensure the selected remedy remains protective.	
23	Page 5-11, Table 5-2	For POL Alternative 3, bulleted items in the 'Cost' box does not include moving the 8,000-gallon AST. Please add.	The text was revised to state that the AST will be moved outside of the construction area prior to excavation and put back to its original location during site restoration.	Agree.
24	Page 6-1, Section 6.0, Second paragraph	First sentence of this paragraph states that contaminated soils at the Landfill and Tar Drum areas are 'below the applicable Method Three recreational cleanup levels but above the Method Three residential cleanup levels.' Should this be corrected to say 'below the applicable Method Three recreational cleanup levels but above the Method Two residential cleanup levels'?	The text was revised to "Method Two residential cleanup levels."	Agree.
25	Page 6-1, Section 6.0, Second paragraph	Text in this paragraph states that Septic Tank #1 sediment is considered an incomplete pathway. Sediment at Septic Tank #1 is considered a potentially complete but insignificant pathway. Please correct.	The text was revised as requested.	Agree.
26		Please provide ADEC with written landowner approval of the alternative cleanup levels proposed for use at this site.	Please refer to the letter USFS submitted to ADEC dated September 10, 2018, which describes their concurrence with the proposed alternate cleanup levels for the site.	Agree.
27		Please provide ADEC with written documentation from the landowner describing site use limitations and access control at the site. Since the alternative cleanup levels were developed based on the assumption that recreational visitors are at the site 14 days or less a year, ADEC needs to know how that 14 day limit will be maintained. Is the landowner willing to put a notice of environmental contamination on the land? How will the USACE and the landowner ensure any institutional controls are adequately documented and run with the land? If the land use ever changes from recreational to industrial or residential, the site will need to be reassessed.	Please refer to the letter USFS submitted to ADEC dated September 10, 2018. The letter references at least four types of controls which likely limit recreational access to 14 days, which include: 1) the 2016 Tongass Land and Management Plan, which designates the site as a Special Use Area that is not compatible with residential or industrial use; 2) Forest Order 10-05-00-11-01, which prohibits camping for more than 30 days within a six-month period; 3) the regular presence of guided visitors, which serves as a deterrent to users seeking longer term, isolated camping opportunities; and 4) USFS commitment to notify permit holders utilizing the Fort Babcock area of the remaining environmental contamination post-remediation. The only alternate cleanup level that was developed using a 14 day Exposure Frequency (EF) was benzo(a)pyrene (Bzap). The	Agree. Please provide worksheets for recalculation of benzo(a)pyrene alternative cleanup level for 60 day exposure frequency in the final work plan.

SITE: Fort Babcock FUDS
DOCUMENT (title/date): Draft Feasibility Study, Fort Babcock Formerly Used Defense Site, Sitka, Alaska, June 2018
REVIEWER (name/date): Sammi Castle, July 2018

Item No.	Page No., Section or Para.	COMMENTS	RESPONSE	ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
			alternate cleanup levels for DRO and RRO are based on the Maximum Allowable concentrations from Method 2. The alternate cleanup level for PCBs is based on the Method 2 residential value. The alternate cleanup level for lead is based on the commercial/industrial cleanup level. The Bzap alternate cleanup level of 4 mg/kg was recalculated using a 60-day EF and the 2018 Method 2 Human Health cleanup level of 1.2 mg/kg for Bzap. The resulting revised recreational cleanup level was 7 mg/kg for Bzap. Both 7 mg/kg Bzap and 4 mg/kg Bzap are substantially higher than the maximum concentration of 1.9 mg/kg Bzap observed at the Tar Drum Area. Assuming the site is restored to levels safe for recreational use based on the Decision Document, and the project is subsequently closed, the project closure determination may be reviewed and modified in the future if any new information becomes available which indicates the presence of eligible and accessible contamination that may cause a risk to human health or the environment.	

USDA United States Department of Agriculture | Forest Service | Tongass National Forest Alaska Region | Sitka Ranger District 2108 Halibut Point Road Sitka, AK 99835 907-747-6671

File Code: 7410
Date: July 6, 2018

Beth Astley
Project Manager
Formerly Used Defense Site Program
U.S. Army Corps of Engineers
Alaska District
P.O. Box 6898
JBER, Alaska 99506-0898

Dear Ms. Astley,

Thank you for the opportunity to review the Draft Feasibility Study for the Fort Babcock Formerly Used Defense Site (FUDS). I am pleased with the steps the Army Corps of Engineers is taking toward remedying the site contamination. I can support all of the retained alternatives which take action to remediate the Polychlorinated Biphenyl (PCB) and Petroleum, oil, and lubricant (POL) contamination.

As a land steward, I prefer the Vapor Energy Generator (VEG) method of remedy, as it addresses contamination at Fort Babcock without increasing contamination at another location. This method has a lower risk of introducing invasive plants via fill material. The Feasibility Study does not address the risk of transporting contaminated soils over the ocean and public roads. The risk of transportation mishaps is reduced by treating and leaving the soil on site. While the onsite treatment alternatives are more expensive and would require clearing a greater land area, I believe that they offer the most responsible remedy. Additionally, the cost of the off-site disposal alternatives will increase when the previously noted spreadsheet errors are corrected and the actual cost of weed free fill material is determined.

I understand that the project details will be clarified following the selection of a proposed action. I look forward to seeing how these concerns are addressed by the proposed action:

1. Precautions must be taken to ensure that invasive plants are not introduced to National Forest System lands. This includes washing construction equipment and only using weed free borrow and soil materials. Grass seeding with a specific native seed mixture is an effective way to control erosion from disturbed soil. My staff can provide you with our Best Management Practices (BMPs).
2. Steps should be taken to minimize the visual impact following project completion. This should be considered when designing the beach/upland interface section of the road.
3. The Forest Service would like to be consulted when planning landscape modifications outside of the original roadbed and when determining steps to rehabilitate the site.

I again want to emphasize my support of the US Army Corps of Engineers' efforts to responsibly remove contaminants at Formerly Used Defense Sites on National Forest System lands.

Sincerely,

PERRY EDWARDS
District Ranger

cc: Julie Creed

USDA United States Department of Agriculture | Forest Service | Tongass National Forest Alaska Region | Sitka Ranger District 2108 Halibut Point Road Sitka, AK 99835 907-747-6671

File Code: 2720
Date: September 10, 2018

Sammi Castle
Environmental Program Specialist
Alaska Department of Environmental Conservation
Division of Spill Prevention and Response
Contaminated Sites Program
555 Cordova Street
Anchorage, AK 99501

Dear Ms. Castle,

I concur with the alternative cleanup levels developed for the Formerly Used Defense Site (FUDS) at Fort Babcock, based on recreational land use. Fort Babcock, located on Kruzof Island, is accessed by boat. Most visitors to the site arrive with Forest Service authorized guides and stay for a few hours. Less frequently, visitors arrive by private vessel for recreation activities, including overnight camping. Landing and anchorage opportunities are limited and require calm ocean conditions. Sitka is the closest location to purchase supplies.

The 2016 Tongass Land and Resource Management Plan (Forest Plan) designates the site as a Special Interest Area due to its unique geological features. This Land Use Designation is not compatible with residential or industrial use. There is no indication that this designation will change in the foreseeable future.

Shoals Point is designated as a Large Group Area in the Shoreline II Outfitter/Guide Record of Decision. This allows permitting Outfitter/Guides for groups of up to 75 people. The area is visited by authorized guides that spend a few hours on site. This regular presence of guided visitors is a deterrent to users seeking longer term, isolated camping opportunities.

Forest Order 10-05-00-11-01 prohibits camping for more than 30 days during any 6-month period on National Forest System lands. The above mentioned limitations make it unlikely someone would be in the FUDS for more than 14 days in any 365 day period.

The Forest Plan is the institutional control that ensures residential and industrial use would not occur at Fort Babcock. The site conditions will be recorded in the Forest Service's Land Status Record System database. This information will run with the land and inform future management decisions. I do not support signing the area. I do agree to notify permit holders, whose authorized use includes the Fort Babcock area, of remaining contamination levels post-remediation.

Sincerely,

PERRY EDWARDS
District Ranger

cc: Beth Astley, Julie Creed