United States Army
Corps of Engineers

Alaska District
PO Box 6898
Anchorage, AK
99506-6898

Feasibility Study

Gambell
St. Lawrence Island
Alaska

FINAL
February 2004

F10AK069603_04.09_0500_a
200-1e

Executive Summary

This Feasibility Study evaluates alternatives for potential future remedial actions at selected sites (4A, 4B, 6, 7, 8, and 12) in Gambell, Alaska. These sites were recommended for potential remedial action in the 2001 Supplemental Remedial Investigation (MWH, 2002) and the EE/CA (USACE, 2002). The Feasibility Study was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), using the standard evaluation criteria. The study provides information sufficient to support an informed risk management decision regarding the most appropriate remedy for each Gambell site. The Native Village of Gambell is located on St. Lawrence Island, in the western portion of the Bering Sea, approximately 200 air miles southwest of Nome, Alaska. During the 1950s, the military constructed and operated facilities in Gambell as part of a surveillance and intelligence-gathering network. The sites have undergone remedial investigation and prior removal actions. Petroleum and/or metals-contaminated soils were identified at Sites 4A, 4B, 6, 7, and 12. An evaluation of the site-specific exposure pathways indicated that ingestion of soils was the most relevant exposure pathway. The level of petroleum contamination in soils at Sites 4A, 4B, 6, 7, and 12 do not exceed ADEC cleanup levels based on the ingestion pathway. However, Site 12 has lead-contaminated soil, which exceeds the residential soil cleanup level. Debris that poses a physical hazard is present at Site 8 and Site D. The alternatives evaluated included: no-action; removal of debris only (Site 8 and D); off-island disposal of debris (Site 8 and D) and lead-contaminated soil (Site 12); and off-island disposal of debris (Site 8 and D) and in situ treatment of lead contaminated soil.

Table of Contents

List of Tables

List of Figures and Photographs

Appendix

List of Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADOTPF	Alaska Department of Transportation and Public Facilities
Alaska District	United States Army Engineer District, Alaska
ARAR	applicable and relevant or appropriate requirements
ATV	all-terrain vehicle
bgs	below ground surface
BIA	Bureau of Indian Affairs
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
DERP	Defense Environmental Restoration Program
DoD	United States Department of Defense
DRO	diesel range organics
E&E	Ecology & Environment
EE/CA	Engineering Evaluation / Cost Analysis
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
GRO	gasoline range organics
HTSA	Historical Time Sequence Analysis
MW	Montgomery Watson or monitoring wells
MWH	Montgomery Watson Harza
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NALEMP	Native American Lands Environmental Mitigation Program
NCP	National Contingency Plan
ND	non-detect
O&M	operations and maintenance
OE	ordnance and explosives
OSCI	Oil Spill Consultants, Inc.
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RRO	residual range organics
SARA	Superfund Amendments and Reauthorization Act
SB	soil boring
SPIP	Strategic Project Implementation Plan
TAL	Target Analyte List
TBC	to be considered
TEC	Topographic Engineering Center, USAED

TRPH	total recoverable petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USAF	United State Air Force
USEPA	United States Environmental Protection Agency
URS	URS Corporation
VOC	volatile organic compound

1. Introduction

The United States Army Corps of Engineers (USACE), Alaska District, has performed a Feasibility Study (FS) at several sites in Gambell, Alaska. These sites include 4A, 4B, 6, 7, 8 and 12. The Gambell site is a Formerly Used Defense Site (FUDS), and is not listed on the National Priorities List (NPL). This project was authorized by the Defense Environmental Restoration Program (DERP) of the United States Department of Defense (DoD), and was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.1 Purpose and Organization of Report

The FS report is intended to provide information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for the Gambell sites. The FS is based on data collected during previous investigations and will be used during preparation of the Proposed Plan and, following public comment on the Proposed Plan, the Record of Decision for the site remedy. The development of the FS follows guidance for conducting a feasibility study under CERCLA (USEPA, 1988), and alternatives were developed and evaluated using standard criteria.

The purpose of the FS is to develop remedial action objectives (RAOs); identify and screen general response actions, remedial technologies, and process options; and develop and evaluate remedial alternatives.

The FS report is organized as follows. Section 1.0, Introduction, presents the purpose and approach of the FS and a summary of previous investigations. Section 2.0, Identification and Screening of Remedial Technologies and Process Options, contains remedial action objectives; the identification of general response actions, remedial technologies and process options; and screening of remedial technologies and process options. Section 3.0, Development of Alternatives, is a summary of the development of each of the alternatives chosen for Gambell. Section 4.0, Analysis of Alternatives, includes a detailed analysis of alternatives; a comparative analysis of remedial alternatives; and conclusions. Section 5.0, References, contains a list of documents used in preparation of the FS. Appendix A contains applicable or relevant and appropriate requirements (ARARs).

1.2 Background Information

The site history and previous investigation information contained in this FS have been summarized from reports documenting previous investigation results from the Gambell area. More detailed site descriptions and background information, including results of field investigations, can be found in the documents listed below:

- Work Plan, 2001 Supplemental Remedial Investigation, Gambell, St. Lawrence Island, Alaska. MWH Americas, Inc., September 2001.

- Final Remedial Action Report for Debris Removal and Containerized Hazardous Waste and Toxic Waste Removal, Gambell, Alaska. Oil Spill Consultants, Inc., February 15, 2001.
- Final Strategic Project Implementation Plan, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, December 2000.
- GIS-Based Historical Time Sequence Analysis (Historical Photographic Analysis), Gambell Sites, St. Lawrence Island Alaska. United States Army Corps of Engineers, Engineer Research and Development Center, TEC, September 2000.
- Site 5 Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, 1999.
- Final Phase II Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, December 1998.
- Final Investigation of Geophysical Anomaly, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, December 1997.
- Remedial Action Alternatives Technical Memorandum, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, November 1995.
- Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, January 1995.
- Chemical Data Acquisition Plan, Site Inventory Update, Gambell, St. Lawrence Island, Alaska. Ecology & Environment (E&E), February 1993.
- Site Inventory Report, Gambell Formerly Used Defense Site, St. Lawrence Island, Alaska. E&E, December 1992.

1.2.1 Site Description

Gambell is located off the coast of western Alaska on the northwest tip of St. Lawrence Island, in the western portion of the Bering Sea, approximately 200 air miles southwest of Nome, Alaska, and 39 air miles from the Siberian Chukotsk Peninsula (Figure 1-1). The village of Gambell, at an elevation of approximately 30 feet above mean sea level, is situated on a gravel spit that projects northward and westward from the island (Figure 1-2). St. Lawrence Island is currently owned jointly by Sivuqaq, Inc., in Gambell, Alaska, and Savoonga Native Corporation in Savoonga, Alaska. Non-Native land on St. Lawrence Island is limited to state land used for airstrips and related facilities in Gambell and Savoonga (MW, 1995a).

The Village of Gambell is inhabited primarily by Native St. Lawrence Island Yupik people, who lead a subsistence-based lifestyle. The Gambell area supports habitat for a variety of seabirds, waterfowl, and mammals that either breed in or visit the area. The area surrounding the top of Sevuokuk Mountain, above the Village of Gambell, supports a large bird rookery. The birds and bird eggs serve as a subsistence food source for local inhabitants. The ocean surrounding the Gambell area is used extensively for subsistence hunting of whales, walrus, seals, sea birds, and fish.

1.2.2 Site History

Several phases of a release investigation and/or removal actions have been conducted at Gambell. URS Corporation (URS) conducted a file search and preliminary reconnaissance of the Gambell area in 1985. The site reconnaissance included an inventory of all materials left by the military and collection of a limited number of soil and water samples. In 1991 and 1992, Ecology and Environment, Inc. (E&E) conducted a more detailed site reconnaissance visit and interviewed individuals living at Gambell during the period of DoD occupation. E&E then prepared a Chemical Data Acquisition Plan for investigation of 18 areas of concern (sites) based on information gathered during the interviews and information reported in the URS document (E&E, 1993). Montgomery Watson (MW) implemented the Chemical Data Acquisition Plan in 1994 as part of a Phase I Remedial Investigation (RI). The objectives of the 1994 RI were to gather sufficient chemical, geophysical, and hydrological data to characterize the nature and extent of contamination at the sites.

A Phase II RI was conducted in 1996 to fill data gaps from the Phase I RI. The following sites were included in the RI: Site 1 (Area 1A and 1B), Site 2, Site 3, Site 4 (Area 4B and 4D), and Site 5. The investigation included collection of soil and groundwater samples to further delineate the extent of contamination, a debris reconnaissance, and a geophysical survey. All visible surface debris was removed from the island in 1997 (MW, 1997).

After the 1997 removal action, frost jacking forced additional debris to surface. During the 1999 field season, Oil Spill Consultants, Inc. (OSCI) performed cleanup activities at Gambell including Sites 2, 3, 4A, 4B, 5, 6, 7, 8, 10, 12, and 13. The fieldwork accomplished the removal of 26.8 tons of hazardous and non-hazardous containerized wastes such as asphalt drums, paint, generators, batteries, empty drums, and transformer carcasses; removal of 71 tons of exposed metal debris such as runway matting, cable, fuel tanks and equipment parts; and excavation of 72 tons of contaminated soil.

During 2000, under the Native American Lands Environmental Mitigation Program (NALEMP), the Native Village of Gambell conducted strategic project planning activities, including the completion of community questionnaires and geophysical surveys. Based upon the results of the geophysical surveys and questionnaires, several newly identified sites were targeted for further investigation (MW 2000).

In 2000 and 2001, the Army Engineering and Support Center (Huntsville) conducted extensive research and investigations to locate possible ordnance and explosives (OE) materials left behind by the military. At the request of the Huntsville office, the Topographic Engineering Center (TEC 2000) completed a review of historical aerial photos and other documentation as part of the ordnance investigation. The Historical Time Sequence Analysis (HTSA) combined data from historic aerial photographs with current maps of Gambell to identify and confirm areas of possible former military use. During the OE field surveys, very little OE was found, consisting primarily of highly weathered 30-caliber small arms ammunition at a beach burial pit southwest of Troutman Lake (Area D of Site 8).

A Supplemental Remedial Investigation was conducted by Montgomery Watson Harza (MWH 2002) during the 2001 field season, to investigate the nature and extent of contamination based on new information in the HTSA (TEC 2000), the NALEMP Strategic Project Implementation Plan (MW 2000), and the Final Remedial Action Report (OSCI 2001). The HTSA identified four new sites for investigation - Sites 25B, 26, 27, and 28. Additional soil and groundwater data was also collected at Sites 6, 7, 16, and 25A. The results of previous confirmation sampling data were verified for areas where contaminated soils had been removed - Sites 4A, 4B, 6, 8, and 12.

The Summary Report for the 2001 Supplemental RI recommended further action at the following sites: 4A, 4B, 6, 7, and 12. The recommended actions were removal of soil "hot spots" based on the presence of metals and/or fuel contamination. The Summary Report recommended "no action warranted" at the remaining sites: 8, 16, 18A, 24, 25A, 25B, 26, 27, and 28. However, the RI report did not give consideration to the small arms ammunition debris buried in the beach gravels at Area D within Site 8.

1.2.3 Nature and Extent of Contamination

The nature and extent of contamination or hazard debris at Sites 4A, 4B, 6, 7, 8, and 12 are described in the following sections. The descriptions are based on a review of previous investigation results.

1.2.3.1 Site 4A – Quonset Huts Near Former USAF Radar Site

Site 4A, located on Sevuokuk Mountain, formerly contained two Quonset huts (see Figure 1-2). During the 1994 RI, surface soil samples were collected from Site 4A and analyzed for fuel-related contaminants, PCBs, solvents, and dioxins. No contaminants were detected above method detection limits. In 1999, OSCI removed metal debris, drums, and 1,877 pounds (0.93 tons) of visibly stained soil from Site 4A. OSCI collected confirmation soil samples following the removal action. The soil samples were collected from within and outside the two Quonset hut footprints, following removal of the frames and contaminated soil. The confirmation samples contained DRO at concentrations of up to 1,310 mg/kg, arsenic concentrations from 1.6 to 8.3 mg/kg, chromium concentrations up to 422 mg/kg, and lead concentrations up to 311 mg/kg. There is no significant volume of contaminated soil remaining at Site 4A. Site 4A consists of large boulders on top of bedrock with small amounts of soil.

During 2001, supplemental investigation was done at Site 4A to verify the 1999 confirmation sampling results because the referenced latitude and longitude coordinates were not documented by OSCI. Thirty-six surface soil samples (nine each from four triangular grids) were collected and screened in the field using a photo-ionization detector (PID) and PetroFlag™ screening kits. The four triangular sampling grids were established using the approximate locations of the 1999 samples as the grid centerpoints. Four soil samples (one from each of the four grids with the highest field screening results) were submitted for laboratory analysis of GRO, DRO, RRO, and Resource Conservation and Recovery Act (RCRA) metals. Two samples corresponding to previous samples were analyzed for hexavalent chromium, because of the high total chromium results detected in the 1999 samples.

The 2001 sampling results confirmed the 1999 sampling results for arsenic. In 1999, arsenic concentrations ranged from 1.6 to 8.3 mg/kg; in 2001, arsenic concentrations ranged from 1.6 to 3.9 mg/kg. For both sets of samples, results generally exceeded the default ADEC Method 2 Migration to Groundwater arsenic cleanup level of 2 mg/kg. However, these observed concentrations may be due to naturally occurring levels of arsenic. Arsenic results generally exceeded 2 mg/kg at all soil-sampling locations (surface and subsurface) in the Gambell area during the 2001 Supplemental RI, as well as previous investigations. All arsenic sample results are for total arsenic. A background surface soil sample collected northeast of Site 4B had arsenic results of 1.3 and 2.0 mg/kg (duplicate).

High chromium levels (up to 422 mg/kg) identified during the 1999-sampling event were not confirmed by 2001 sample results (up to 12.1 mg/kg total chromium). The two 1999 sample locations with the highest chromium concentrations were resampled in 2001. The results were less than 12.1 mg/kg for total chromium and non-detect for hexavalent chromium. The ADEC Method 2 cleanup level for total chromium is 26 mg/kg.

The 1999 sampling results had lead concentrations of up to 311 mg/kg. The highest lead concentration detected in 2001 was 44 mg/kg. The Method 2 cleanup level for lead (400 mg/kg) was not exceeded in either sample set.

The 2001 sampling results for DRO confirmed the 1999 sampling results. DRO results from 1999 ranged from 15.3 to 1,310 mg/kg and in 2001 ranged from 7.2 to 970 mg/kg. None of the samples exceeded the Method 2 Ingestion cleanup level of 10,250 mg/kg. The 2001 sampling results for RRO did not match the 1999 sampling results. RRO results from 1999 ranged from 47.7 to 930 mg/kg and in 2001 ranged from 21 to 110 mg/kg. However, none of the RRO sample results exceeded the 11,000 mg/kg Method 2 ingestion cleanup level.

The Quonset hut frames were not sampled for lead paint or asbestos during the initial investigation. However, soil samples collected in 1994 around the fallen Quonset huts were non-detect for asbestos.

No other analytes were detected during the 2001 sampling event at concentrations exceeding the Method 2, under 40-inch zone, migration-to-groundwater cleanup levels.

1.2.3.2 Site 4B –Former USAF Radar Site

Site 4B, the Former United States Air Force (USAF) Site, is also located on Sevuokuk Mountain and covers an area approximately 375 feet by 500 feet (see Figure 1-2). This site housed buildings that burned and caused ordnance to explode and scatter debris. Analysis of soil samples collected during the Phase II RI, in 1995, showed elevated levels of metals and dioxins. Soil and debris removal actions were performed by OSCI in 1999.

The OSCI Site 4B map (OSCI Figure 6, shown in Appendix A) showed an area approximately 29 by 37 feet, partly covered by boulders, and with localized heavy staining and an oily substance. This area had 52 tons of soil excavated in 1999 to a depth of approximately 24 inches. Confirmation samples collected after the soil excavation showed DRO at concentrations ranging from non-detect to 13,900 mg/kg. The concentration of dioxins also decreased as a result of removing the soil. The OSCI report states that the concentration of dioxins dropped by 75%.

In 2001, supplemental RI fieldwork was done at Site 4B to verify the 1999 confirmation sampling results because the referenced latitude and longitude coordinates were not documented by OSCI. Thirty-six surface soil samples (nine each from the four triangular grids) were collected and screened in the field using a PID and PetroFlag™ screening kits. Four soil samples (one from each of the grids) with the highest field screening results were submitted for laboratory analysis of GRO, DRO, RRO, and RCRA metals.

The 2001 sample results confirmed the 1999 sample results for arsenic. In 1999, arsenic concentrations ranged from 0.604 to 1.57 mg/kg; in 2001, arsenic concentrations ranged from 1.4 to 4.3 mg/kg. For both sets of samples, results did not exceed the Method 2 arsenic ingestion cleanup level of 5.5 mg/kg. All arsenic results are for total arsenic.

The 1999 and 2001 lead sampling results at Site 4B did not agree. The highest lead concentrations were 396 and 96 mg/kg in 1999 and 2001, respectively. The Method 2 residential cleanup level for lead (400 mg/kg) was not exceeded in either sample set.

The 2001 sample results for DRO confirmed the results for the 1999 samples. High DRO concentrations in 2001 (10,000 and 2,000 mg/kg) corresponded to high DRO concentrations in 1999 (13,700 and 643 mg/kg). Only the 13,700 mg/kg detection in 1999 exceeded the Method 2 Ingestion cleanup level (10,250 mg/kg).

GRO sample results from 2001 contained two notable differences from the 1999 sample results. The 1999 sample 99GAM021SL had a GRO concentration of 34.7 mg/kg, but the corresponding 2001 sample had a GRO concentration of 310 mg/kg, slightly exceeding the Method 2 migration to groundwater cleanup level for GRO of 300 mg/kg. Furthermore, the 2001 result was flagged as biased low, indicating that the actual GRO concentration may have been higher than 310 mg/kg. In 1999, the GRO result for sample 99GAM023SL was non-detect (ND) (2.68 mg/kg), and the corresponding 2001 sample result was 240 mg/kg. Both results are below the Method 2 cleanup level.

No other analytes were detected in the 2001 samples at concentrations exceeding the Method 2, under 40-inch zone, migration-to-groundwater cleanup levels, including RRO.

1.2.3.3 Site 6 – Military Landfill

Site 6 is located north of Gambell High School and east of the new housing area (see Figure 1-2). This landfill was used to dispose of building materials, vehicles, machinery, drums, and miscellaneous debris. An investigation was performed in 1994. Exposed drums (7,897 pounds) and other metal debris (1,748 pounds) were removed in 1999 by OSCI. A confirmation soil sample (99GAM026SL) collected from the approximate center of the removed drum stockpile had low levels of RRO and arsenic; no other fuel-related contaminants, solvents, PCBs, or pesticides were detected.

In 2001, community concerns, aerial photos and prior investigation results prompted supplemental RI fieldwork at Site 6 to verify the 1999 confirmation sampling results and to further define the nature and extent of soil and groundwater contamination. To confirm the 1999 sampling results, nine surface soil samples from a triangular grid were collected and screened in the field using a PID and PetroFlag™ screening kits. The two soil samples with the highest field screening results were submitted for laboratory analysis of GRO, DRO, RRO, and RCRA metals.

To further define the nature and extent of soil contamination, five soil borings (three as scheduled in the work plan plus two discretionary boreholes) were advanced to frozen soil. Soil boring locations were selected, in part, by the locations of depressions identified from aerial photographs in the HTSA report. The two discretionary boreholes (SB6-12 and SB6-13) were placed to help delineate the extent of contamination suspected at borehole SB6-11. Boreholes were continuously split-spoon sampled, and each sample was field-screened using a PID. Soil samples were collected for laboratory analysis at the near-surface and at the near-bottom of each borehole, and from mid-borehole locations in two of the boreholes based on the highest PID readings. Samples were submitted for laboratory analysis of GRO, DRO, RRO, VOCs, and TAL metals.

Groundwater was not encountered in any of the five soil borings at Site 6 during the September 2001 sampling event. Groundwater was previously encountered in two of five soil borings installed in June 1994. Groundwater was measured at 8.0 feet bgs in SB6 and 8.0 feet bgs in SB8. All soil borings drilled in 1994 and 2001 were drilled to permafrost. Figure 3-1 in Appendix B shows the location of soil borings drilled at Site 6 in 1994 and 2001. The figure was originally prepared for the 1995 Remedial Investigation Report. The locations of soil borings drilled in 2001 have been added.

The 2001 surface soil grid sample results confirmed the 1999 sample results for arsenic. In 1999, arsenic was found at a concentration of 5.3 mg/kg; in 2001, arsenic concentrations ranged from 6 to 7.7 mg/kg. For both sets of samples, results exceeded the default Method 2 arsenic cleanup level of 2 mg/kg. Additionally, previously analyzed soil samples from various depths in all Site 6 boreholes exceeded Method 2 cleanup levels for arsenic, with concentrations ranging from 3.7 to 13.2 mg/kg. All arsenic results are for total arsenic.

In borehole SB6-10, the soil sample collected from 2 feet below ground surface (bgs) contained antimony, total chromium, and nickel at concentrations of 7.3, 59, and 120 mg/kg, respectively. These concentrations exceeded the Method 2 migration to groundwater cleanup levels for antimony (3.6 mg/kg), total chromium (26 mg/kg), and nickel (87 mg/kg). Unlike arsenic, these metals did not consistently exceed screening levels in other samples from the site, suggesting that the concentrations of antimony, total chromium, and nickel may be related to debris or former military activities.

DRO was found at a concentration of 1,200 mg/kg at 7 feet bgs in SB6-11. In SB6-12, the two DRO sample at 8 feet bgs had concentrations of 200 and 300 mg/kg. None of the results exceeded the Method 2 Ingestion cleanup level (10,250 mg/kg). SB6-9, SB6-10 and SB6-12 were drilled to 10 feet bgs, SB6-11 was drilled to 7.5 feet bgs, and SB6-13 was drilled to 6.8 feet bgs.

No other analytes were detected in the soil samples at concentrations exceeding the Method 2, under 40-inch zone, migration-to-groundwater cleanup levels.

1.2.3.4 Site 7 – Former Military Power Facility

The Former Military Power Facility was reportedly demolished and buried north of the present Gambell Municipal Building. The burial site of this former military facility comprises Site 7 (see Figure 1-2). Electrical transformers were also reportedly disposed at this site. Additionally, Gambell residents have reported that the military may have dumped partially full barrels of oil or other petroleum products on the ground near this site. During previous investigations, DRO was detected in shallow soils at concentrations up to 1,950 mg/kg. Benzene (19 micrograms per liter - µg/l in MW-24) and DRO (19.4 mg/l in MW-25) were detected in groundwater samples from Site 7 in 1994.

Five soil borings were drilled in 1994 and four were completed as monitoring wells. One of the three monitoring wells (MW26) was abandoned due to lack of water. The three soil borings were drilled in 2001 to 10, 7.2 and 6.2 feet bgs. Groundwater was not encountered in the soil borings drilled in 2001. All soil borings were drilled to permafrost in 1994 and 2001. Figure 3-1 in Appendix B shows the location of soil borings and monitoring wells installed at Site 7 in 1994 and 2001. The figure was originally prepared for the 1995 Remedial Investigation Report. The locations of soil borings drilled in 2001 have been added.

DRO was detected in soil samples collected while drilling MW-24, MW-25, and MW-26 in 1994. Generally the DRO concentrations were higher (180 to 1,840 mg/kg) in shallow (2.5 to 5 feet bgs) soils and lower (13 to 400 mg/kg) in deeper (10 to 14 feet bgs) soil samples. The same pattern was observed in soil samples collected from SB 7-20 in 2001. The DRO concentration was 710 mg/kg at 2 feet bgs and 160 mg/kg (duplicate was 460 mg/kg) at 7 feet bgs. None of the DRO results exceeded the Method 2 Ingestion cleanup level for DRO (10,250 mg/kg).

In 2001, supplemental RI fieldwork was done at Site 7 to further define the nature and extent of fuel and groundwater contamination, to determine the source of soil contamination, and to evaluate the presence of PCBs. To determine the nature and extent of soil contamination, three soil borings were advanced to frozen soil. Soil boring locations were selected, in part, by the locations of pits and buildings identified from 1955 aerial photographs in the HTSA report. Soil samples were collected for laboratory analysis at the near-surface and at the near-bottom of each borehole, and from mid-borehole locations in two of the boreholes. Samples were submitted for laboratory analysis of DRO, RRO, PCBs, and Target Analyte List metals.

The Site 7 borehole soil samples contained arsenic in concentrations ranging from 4.5 to 10.2 mg/kg in the 2001 Supplemental RI. Arsenic concentrations ranged from 1 to 4 mg/kg in the 1994 RI. The 1994 results are less than the ADEC Method 2 arsenic ingestion cleanup level of 5.5 mg/kg. Six of the eleven arsenic results in 2001 exceeded the ADEC Method 2 arsenic ingestion cleanup level of 5.5 mg/kg. All arsenic results are for total arsenic.

Because of community concerns, regarding a report that transformers had been buried at Site 7, PCB samples were collected during the 2001 RI. PCBs were not detected in these Site 7 samples. No other analytes were detected in the soil samples at concentrations exceeding the Method 2, under 40-inch zone, migration-to-groundwater cleanup levels.

1.2.3.5 Site 8 – West Beach/Army Landfill

Site 8 encompasses the area surrounding the airstrip from west beach (north of the airfield), east to the western edge of Troutman Lake, and south to the northern shore of Nayvaghaq Lake. The site has been investigated and all detected analytes were below ADEC Method 2 cleanup level, except for arsenic. Surface debris removed by OSCI in 1999 included scattered metal, small quantities of wood and concrete, drums containing tar, and an exposed layer of metal landing mat (Marston matting) approximately 30 feet wide and 4,500 feet long. Removal of the Marston matting was stopped because buried electrical lines interfered with the excavation. There is 1,820 lineal feet of metal landing mat remaining on site.

Small-arms ammunition rounds are located at Area D along the beach south of Troutman Lake. Approximately 800 rounds were removed from Area D in July 2000. The Final Gambell Site EE/CA (USACE, 2002) states that additional rounds remain in approximately 100 cubic yards of soil.

1.2.3.6 Site 12 – Nayvaghaq Lake Disposal Site

Site 12 is located north of Nayvaghaq Lake on the southwest side of an all-terrain vehicle (ATV) trail. The site is divided into a north area and a south area. The north area contained approximately 120 drums, battery remnants, and household refuse. The south area contained approximately 50 drums, 18 of which were found to be full of garbage.

The debris and drums were removed by OSCI in 1999. The OSCI report states that most of the drums at Site 12 were punctured and empty. All drums were empty or contained a few ounces of rainwater (OSCI, 2001).

Two monitoring wells were installed at the site in 1994. Permafrost was encountered in MW-17 and MW-18 at 5.5 and 6.0 feet bgs, respectively. Water was measured in MW-17 and MW-18 at 2.5 and 4.0 feet bgs, respectively. Samples collected in 1994 include one surface water sample from Nayvaghaq Lake, three surface soil samples, and two subsurface soil samples. The soil samples were analyzed for VOCs, GRO, DRO, TRPH, priority pollutant metals, and PCBs. Total Recoverable Petroleum Hydrocarbons (TRPH) were detected in the three surface soil samples at concentrations ranging from 22 to 75 mg/kg. The concentrations of metals detected in all soil samples were below background. No other analytes were detected in the soil samples. Groundwater and surface water samples were analyzed for VOCs, GRO, DRO, TRPH, PCBs, and priority pollutant metals. DRO was detected in the surface water sample at a concentration of 0.06 mg/L, below ADEC Table C levels. The only analytes detected in the groundwater were metals, which were below background. Background levels for groundwater and surface water were determined from a sample taken from MW-14 located at the base of Sevoukuk Mountain. The only other analytes detected in the surface water were metals, which were below background.

OSCI removed 798 pounds of metal debris, 8,702 pounds of HTW debris, and 7,237 pounds of stained soil during the 1999 fieldwork. Following the debris removal, confirmation soil samples were collected. The OSCI map of Site 12 (OSCI, 2001) showed confirmation sample locations 99GAM009, -010, and -011SL, which had concentrations of DRO and lead of up to 463 mg/kg and 562 mg/kg, respectively. Arsenic concentrations in these samples ranged from 3.06 to 6.02 mg/kg, and the highest total chromium concentration was 20 mg/kg in 1999. GRO was not detected at Site 12 in 1999.

In 2001, supplemental RI fieldwork was done at Site 12 to verify the 1999 confirmation sampling results. Because exact locations of the 1999 samples were not surveyed or permanently marked, triangular sampling grids were established using the approximate locations of the 1999 samples as the grid center points. The grids approximated the previous sample locations, which were not recorded. To confirm the 1999 sampling results, 27 surface soil samples (9 each from 3 triangular grids) were collected and screened in the field using a PID and PetroFlag™ screening kits. Locations and orientations of the triangular grids were decided in the field based on site observations. The four soil samples with the highest field screening results (the highest from each grid plus the next highest) were submitted for laboratory analysis of GRO, DRO, RRO, and RCRA metals.

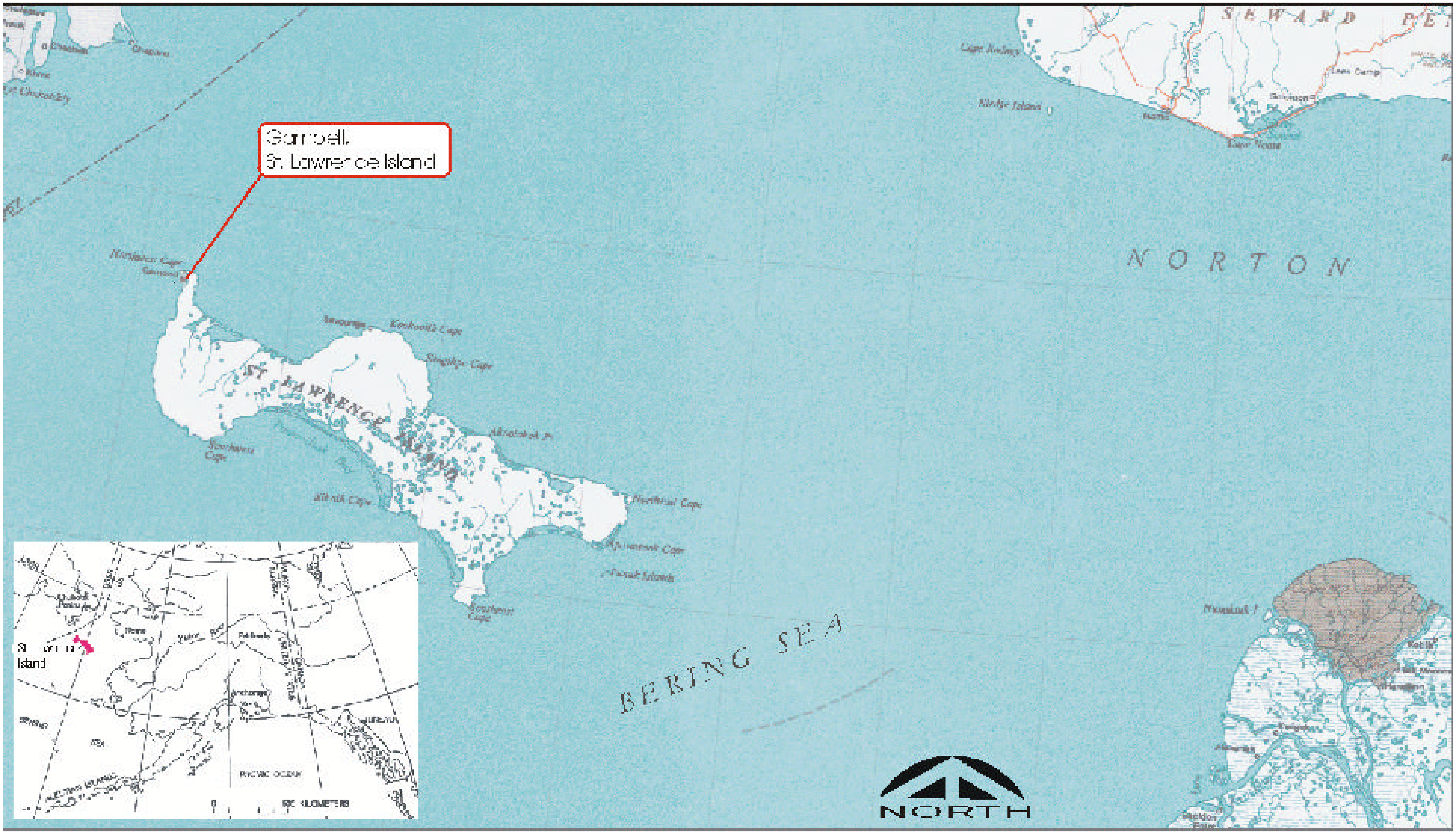
The 2001 sampling results confirmed the 1999 sampling results for arsenic. In 1999, arsenic concentrations ranged from 3.06 to 6.02 mg/kg; in 2001, arsenic concentrations ranged from 6.0 to 9.4 mg/kg. For both sets of samples, several results exceeded the arsenic ingestion cleanup level of 5.5 mg/kg.

The 1999 confirmation sampling results for total chromium were not corroborated by the 2001 sample results. In 1999, the highest total chromium concentration was 20 mg/kg versus 162 mg/kg in 2001. The 2001 results exceeded the ADEC Method 2 migration to groundwater cleanup level for total chromium (26 mg/kg)

The lead level (562 mg/kg) found during the 1999 sampling event was confirmed by the 2001 sampling results (7 mg/kg up to 1,530 mg/kg lead). For both sets of samples, results exceeded the residential lead cleanup level of 400 mg/kg.

DRO levels (up to 463 mg/kg) found during the 1999 sampling event were not confirmed by 2001 sampling results (up to 46 mg/kg DRO). None of the DRO results exceeded the Method 2 Ingestion cleanup level (10,250 mg/kg). The 2001 GRO results generally confirmed the 1999 GRO sample results. In 1999, GRO was not detected at Site 12; in 2001, GRO was not detected in the primary sample but was detected at the low concentration of 13 mg/kg in a duplicate surface soil sample.

No other analytes were detected in the 2001 samples at concentrations exceeding the Method 2, under 40-inch zone, migration-to-groundwater cleanup levels.



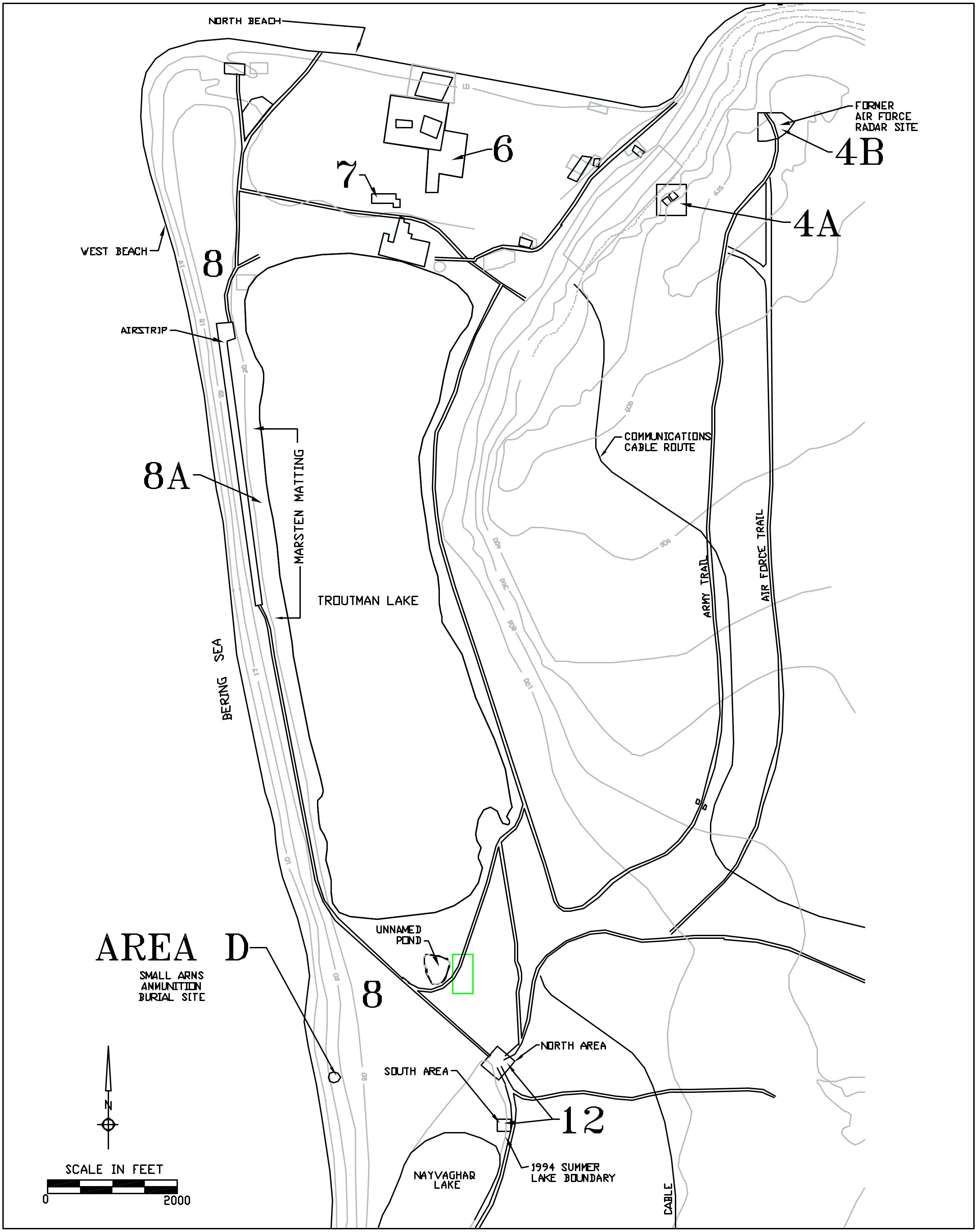
LOCATION MAP
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

SOURCE: U.S. Geological Survey
Reston, Virginia 22092, 1976
St. Lawrence, Alaska
N6265 - W16830 /60x210
Surveyed 1948, Compiled 1957
Minor Revisions 1974
Scale 1:250,000 Contour Interval 100'

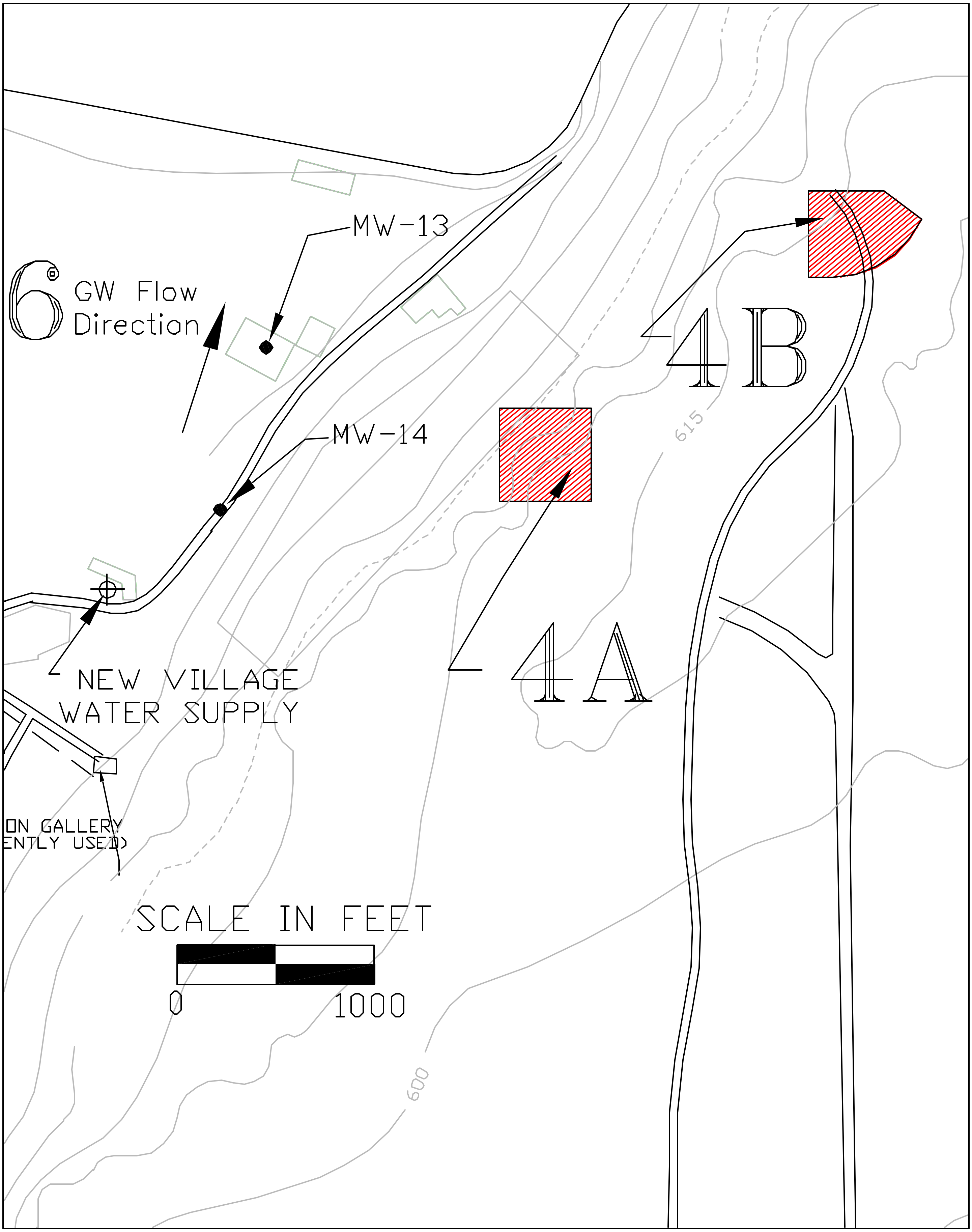
DATE: 31 OCTOBER 2003
FILE NAME: FG1-1R1.DWG
DWN BY: GNO RVW BY:
SCALE: NOT TO SCALE

FIGURE 1-1

U.S. ARMY
CORPS OF ENGINEERS
ALASKA DISTRICT



DATE: 31 OCT 2003		GAMBELL VICINITY MAP GAMBELL, ST. LAWRENCE ISLAND, ALASKA	FIGURE 1-2
FILE NAME: FG1-2R2.DWG			
DWN BY: GNO	RVW BY:		U.S. ARMY CORPS OF ENGINEERS ALASKA DISTRICT
SCALE: AS NOTED			



DATE: 04 FEB 2004	
FILE NAME: FG1-2R2.DWG	
DWN BY: GND	RVW BY:
SCALE: AS NOTED	

Location of Village Water Supply
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

FIGURE 1-3

U.S. ARMY
CORPS OF ENGINEERS
ALASKA DISTRICT

2. Identification and Screening of Technologies

This section identifies the remedial action objectives (RAOs), general response actions, technology types, and specific process options for each site. Identification of these elements was conducted following USEPA's Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (USEPA 1988).

Remedial action objectives are medium-specific (soil, groundwater, surface water, etc.) objectives for protecting human health and the environment. RAOs are discussed in Section 2.1. After RAOs have been established, Section 2.2 identifies the general response actions, technology types, and applicable process options for each site, including volumes and areas of media to be remediated. The various technologies and process options are then screened in Section 2.3.

2.1 Remedial Action Objectives

This section evaluates the applicable soil cleanup levels for each site. During the remedial investigation phase, concentrations of contaminants in soil were compared to the ADEC Method 2, Table B cleanup levels (under 40 inch zone, migration to groundwater cleanup pathway). The migration to groundwater pathway is typically selected for comparison purposes, since it is usually the most conservative cleanup value. The migration to groundwater pathway assumes that contaminants in soil are likely to impact a potential drinking water source. A site-specific evaluation of the exposure scenarios and pathways demonstrates that the migration of contaminants from each site to a drinking water source is unlikely to occur.

The sites evaluated in this Feasibility Study – 4A, 4B, 6, 7, 8, and 12 – do not contain groundwater that could potentially be used as a current or future source of drinking water. The sites located at the top of Sevuokuk Mountain – Sites 4A and 4B – are situated on a bedrock outcropping. Very little soil is found at the top of Sevuokuk Mountain and groundwater is expected to run off the side of the mountain or enter bedrock fractures. It is unlikely that groundwater from Sites 4A and 4B could impact the aquifer at the base of the mountain. Figure 1-3 shows the location of the village water supply well in relation to Sites 4A and 4B.

Sites 6 and 7 are located near the east end of the Village of Gambell. Groundwater encountered at these sites has been limited in quantity, and only sporadically detected. All soil borings were drilled to permafrost. In 1994, groundwater around Sites 6 and 7 was measured to flow north from Troutman Lake to the Bering Sea. Appendix B includes Figure 3-1 from the 1995 Remedial Investigation. Also included in Appendix B are Figures 3-2, 3-3, and 3-4, which show the cross-sections noted on Figure 3-1. The shallow groundwater, when present, is found on top of the permafrost and is within the active layer. The active layer is defined as the interval of soil that freezes and thaws each year. Soil below the active layer either remains frozen (permafrost) or unfrozen.

Groundwater found on top of permafrost is usually not considered drinking water. Monitoring wells installed in this area typically have low recovery. Groundwater was not encountered in any of the eight borings drilled at Sites 6 and 7 in 2001.

Site 12 is located south of Troutman Lake and north of Navaqaq Lake. The only groundwater encountered at this location in 1994 was at very shallow depths (2.5 and 4.0 feet bgs). No contaminants were detected in groundwater samples collected in 1994. Groundwater in this area is likely influenced by saltwater intrusion (brackish water of Nayvaghaq Lake). Field observations indicate the water is most likely melted porewater on top of an active permafrost layer, or surface water infiltration that is perched above the permafrost.

It is unlikely that groundwater from the gravel spit will be used as a source of drinking water. Groundwater in the gravels is often saline, sporadically distributed, difficult to recover in useable quantities, and located over permafrost. Drinking water wells installed in the gravel have been abandoned in the past. A recent article from the Nome Nugget had the following quote: "Our drinking water problem goes back to the 1930s and the old well dug by the BIA down by the old school which eventually went dry. Feasibility studies have more recently shown that we can obtain a better quality drinking water if we tap into Troutman Creek." The current drinking water source is located at the base of Sevoukuk Mountain (see Figure 1-3).

Therefore, the migration to groundwater pathway can be eliminated as a reasonable exposure route for all sites considered in this FS. The relevant ADEC cleanup levels are the Method 2, Table B, under 40-inch zone, ingestion or inhalation pathway. The ADEC Method 2 cleanup levels are also considered conservative compared to Method 3 or Method 4, which would likely result in higher cleanup levels. Further information is included below in the discussion of RAOs for each site.

The default ADEC Method 2 cleanup level for arsenic is 2 mg/kg (under 40 inch zone, migration to groundwater pathway). Arsenic has been detected at concentrations above this level in almost every soil sample analyzed throughout the remedial investigation (1994-2001) at Gambell. The presence of arsenic in soil/gravel at Gambell may be naturally occurring. Since the arsenic concentrations are consistent across the site, and do not appear associated with past military activity; arsenic is not considered a contaminant of concern which requires further remedial action.

2.1.1 Site 4A – Quonset Huts Near Former USAF Radar Site

The ADEC Method 2 ingestion cleanup level is appropriate and protective of human health at Site 4A. Groundwater at the site is not used for private or public drinking water. It is very unlikely that a drinking water well would be installed at Site 4A. This site is at the top of Sevoukuk Mountain (615 feet above sea level). Bedrock either outcrops here, or is very shallow, and the site abuts a steep natural slope. This geologic setting would likely require a very deep well to reach a groundwater aquifer.

Water resulting from rainfall or snowmelt at the site is an unlikely potential source of drinking water due to the accessibility of the site. Water potentially impacted by Site 4A contamination cannot reasonably be expected to be transported to the village water supply at the base of mountain farther to the south.

Water near Site 4A likely flows to the northwest, the direction of the slope at Site 4A (see Figure 1-3). Unconsolidated gravels at the base of the mountain constitute a discontinuous aquifer. The flow of groundwater along the base of Sevuokuk Mountain was assessed in 1994 and 1998, and found to flow to the north-northeast, away from the village water supply well. Site 4A is located roughly 1/2 mile northwest from the village water supply well. Monitoring wells MW-13 and MW-14 are located in the unconsolidated gravels near the area where groundwater from Site 4A would be expected to flow down the side of the mountain. MW-13 is located almost directly down slope from Site 4A. MW-14 is south of MW-13 (closer to the village water supply) and determined to be upgradient of MW-13. DRO was not detected in the most recent (1994) sampling results from MW-13 and MW-14. These two monitoring wells could function as sentry wells to the drinking water aquifer.

The Method 2, under 40-inch zone ingestion cleanup level for DRO is 10,250 mg/kg. The highest levels detected at Site 4A do not exceed the ingestion cleanup level. No further work is recommended for Site 4A.

2.1.2 Site 4B – Former USAF Radar Site

The ADEC Method 2 ingestion cleanup level is appropriate and protective of human health at Site 4B. Conditions at Site 4B are similar to those at Site 4A, with Site 4B being even further north, farther from the village water supply. Groundwater at the site is not used for a private or public drinking water system, or within the zone of contribution or recharge area for a private or public drinking water well. Groundwater at the site is not a reasonably expected potential source of drinking water due to the location of the site. It is very unlikely that a drinking water well will be installed at Site 4B. Groundwater potentially impacted by Site 4B is not reasonably expected to be transported to a groundwater source. Groundwater from Site 4B likely flows to the northwest, and into the Bering Sea (see Figure 1-3).

The Method 2, under 40-inch zone, ingestion, cleanup level for DRO is 10,250 mg/kg. The highest DRO concentration detected at Site 4B in 1999 was 13,700 mg/kg. The highest DRO concentration detected in 2001 was 10,000 mg/kg. The Method 2, under 40-inch zone, ingestion cleanup level for GRO is 1,400 mg/kg. The highest GRO detection was 310 mg/kg, which does not exceed the ingestion cleanup level. Because of the removal action that occurred in 1999, there is only a small amount of soil remaining at Site 4B. No further work is recommended for Site 4B.

2.1.3 Site 6 – Military Landfill

The Method 2 Ingestion cleanup level is appropriate and protective of human health at Site 6. Groundwater at the site is not used for a private or public drinking water system. Nor is it within the zone of contribution or recharge area for a private or public drinking water well. Groundwater was encountered in two out of three soil borings in 1994 and in none of the five soil borings drilled in 2001. Figure 1-3 shows where groundwater has been encountered and the estimated groundwater flow direction. Groundwater at the site is not a reasonably expected potential source of drinking water due to the limited quantity of groundwater at the site. It is very unlikely that a drinking water well will be installed at Site 6. Groundwater potentially impacted by Site 6 is not reasonably expected to be transported to another groundwater zone of contribution since groundwater at Site 6 would flow to the Bering Sea, 1200 feet north. Pore water samples were collected in 1994 from four soil borings at Site 6. The samples were analyzed for VOCs, GRO, DRO, TRPH, priority pollutant metals, and PCBs. DRO was the only analyte detected. The concentration of DRO ranged from 0.079 to 0.88 mg/L in three of the samples and was non-detect in the fourth. These concentrations do not exceed the ADEC Table C Groundwater Cleanup Level of 1.5 mg/L. Groundwater observed at Site 6 is found over permafrost and is not usually considered drinking water.

The media of concern at Site 6 are surface and subsurface soils. In borehole SB6-10, the soil sample collected from 2 feet below ground surface (bgs) contained antimony, total chromium, and nickel at concentrations of 7.3, 59, and 120 mg/kg, respectively. These concentrations are less than Method 2 ingestion cleanup levels for antimony (41 mg/kg), total chromium (300 mg/kg), and nickel (2000 mg/kg). Arsenic concentrations in subsurface soil samples collected in 2001, ranged from 3.7 to 13.2 mg/kg. 7 of the 14 arsenic results were less than the ADEC Method 2 ingestion cleanup level for arsenic (5.5 mg/kg).

DRO has not been detected at levels exceeding the Method 2 ingestion cleanup level (10,250 mg/kg) at Site 6.

Except for arsenic, no contaminants have been detected above ADEC Method 2 Ingestion Cleanup Levels. No further work is recommended for Site 6.

2.1.4 Site 7 – Former Military Power Facility

The Method 2 ingestion cleanup level is appropriate and protective of human health at Site 7. Groundwater at the site is not used for a private or public drinking water system, or within the zone of contribution or recharge area for a private or public drinking water well. Groundwater at the site is not a reasonably expected potential source of drinking water due to the limited quantity of groundwater. Groundwater was encountered in two out of five soil borings in 1994 and in none of the three soil borings drilled in 2001. It is unlikely that a drinking water well will be installed at Site 7. Groundwater observed at Site 7 is found over permafrost and is not considered drinking water. Groundwater potentially impacted by Site 7 is not reasonably expected to be transported to another groundwater source since groundwater at Site 7 would flow to the Bering Sea, 2000 feet north.

The media of concern for Site 7 is subsurface soil. DRO has not been detected at levels exceeding the Method 2 ingestion cleanup level (10,250 mg/kg) at Site 7. The Site 7 borehole soil samples contained arsenic in concentrations ranging from 4.5 to 10.2 mg/kg in the 2001 Supplemental RI. Arsenic concentrations ranged from 1 to 4 mg/kg in the 1994 RI. The 1994 results are less than the ADEC Method 2 arsenic ingestion cleanup level of 5.5 mg/kg. Six of the eleven arsenic results in 2001 exceeded the ADEC Method 2 arsenic ingestion cleanup level of 5.5 mg/kg.

Except for arsenic, no contaminants have been detected above ADEC Method 2 Ingestion Cleanup Levels. No further work is recommended for Site 7.

2.1.5 Site 8 – West Beach/Army Landfill

The media of concern at Site 8 is exposed debris, including Marsten matting and small caliber ammunition rounds.

The first remedial action objective at Site 8 is to complete the removal of Marsten matting along the east side of the runway. The OSCI Final Remedial Action Report (OSCI, 2001) notes that 1,820 lineal feet of Marsten matting remain.

The second remedial action objective at Site 8 is to remove small arms rounds from Area D along the beach south of Troutman Lake. Approximately 800 rounds were removed from Area D in July 2000. The Final Gambell Site EE/CA (USACE, 2002) states that additional rounds need to be removed from approximately 100 cubic yards of soil. The rounds will have to be sifted or hand-picked from the gravelly soils.

2.1.6 Site 12 – Nayvaghaq Lake Disposal Site

The ADEC Method 2 ingestion cleanup level is appropriate and protective of human health at Site 12. Groundwater at the site is not used for a private or public drinking water system, or within the zone of contribution or recharge area for a private or public drinking water well. Groundwater was observed in two monitoring wells installed in 1994, at 2.5 and 4 feet bgs. The site is located 100 to 200 feet west (cross gradient) of the Septic Disposal Area. It is very unlikely that a drinking water well will be installed at Site 12. Groundwater potentially impacted by Site 12 is not reasonably expected to be transported to another groundwater zone.

The media of concern at Site 12 is surface soil. The highest total chromium concentration detected in 1999 at Site 12 was 20 mg/kg; in 2001, total chromium concentrations ranged up to 162 mg/kg. The 2001 results were less the Method 2 Ingestion cleanup level for total chromium of 300 mg/kg. In 1999, arsenic concentrations ranged from 3.06 to 6.02 mg/kg; in 2001, arsenic concentrations ranged from 6.0 to 9.4 mg/kg. For both sets of samples, several results exceeded the arsenic ingestion cleanup level of 5.5 mg/kg.

The elevated lead level (562 mg/kg) found during the 1999 sampling event was confirmed by 2001 sample results (up to 1,530 mg/kg lead). For both sets of samples, results exceeded the residential lead cleanup level of 400 mg/kg.

Elevated DRO levels (up to 463 mg/kg) found during the 1999 sampling event were not confirmed by 2001 sample results (up to 46 mg/kg DRO). DRO has not been detected at levels exceeding the Method 2 Ingestion cleanup level (10,250 mg/kg) at Site 12.

Except for lead and arsenic, contaminants at Site 12 do not exceed the ADEC Method 2 Ingestion Cleanup Levels. Additional work will be required to address the elevated concentration of lead in the soil.

The following RAOs were developed for the Site 12:

1. Prevent surface soil from continuing to act as a source of lead contamination to human and ecological receptors.

2.2 Applicable or Relevant and Appropriate Requirements (ARARs)

A review of potential applicable or relevant and appropriate requirements (ARARs) and to be considered (TBCs) was performed to facilitate selecting remedial alternatives. ARARs are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations, established under federal or state law, that specifically address or regulate a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance associated with the planned remedial actions. If existing ARARs do not ensure protectiveness in all situations or site conditions, then advisories, criteria, or guidelines will be used as TBCs to set cleanup targets. ARARs and TBCs can be divided into three categories: (1) chemical-specific, (2) location-specific, and (3) action-specific.

This project is a remedial action to address specific risks and hazards at the Gambell site. The following text describes ARARs and TBCs that affect tasks to be conducted under the remedial action, as proposed.

2.2.1 Chemical-Specific ARARs and TBCs

Chemical-specific requirements are based on health or risk-based concentrations in environmental media (e.g. water or soil) for specific hazardous chemicals. These requirements may be used to set cleanup levels for the chemicals of concern in the designated media. The proposed chemical-specific action levels for contaminated soil are based on the State of Alaska Oil and Hazardous Substances Pollution Control regulations , 18 AAC 75, Tables B1 and B2 (see Table 2.2).

The Toxic Substances Control Act (TSCA) may also provide chemical specific action levels. TSCA is the primary Federal statute regulating the use of certain chemicals and substances, including asbestos, PCBs, radon and lead.

2.2.2 Location-specific ARARs and TBCs

Location-specific ARARs and TBCs are related to the geographical or physical position of the site. These requirements may limit the type of actions that can be implemented and may pose additional constraints on cleanup actions. No location-specific ARARs or TBCs were identified for the Gambell site. However, remedial actions must be coordinated with the local landowners, municipality, and tribal government.

2.2.3 Action-Specific ARARs and TBCs

Action-specific ARARs and TBCs are requirements that define acceptable treatment and disposal procedures for hazardous substances. ARARs and TBCs set general performance, design or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. Removal of the lead-contaminated soil must comply the requirements for identification and proper disposal of hazardous wastes under RCRA (see Table 2.2). The process for investigating contaminated sites, selecting remedial actions, and implementing remedial actions is defined in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by Superfund Amendments and Reauthorization Act, October 17, 1987.

2.3 Identification of General Response Actions, Remedial Technologies and Process Options

Sites 4A, 4B, 6, and 7 do not require additional response actions, therefore they are not evaluated further in this FS. Section 2.1 established RAOs for Sites 8 and 12. General response actions, remedial technologies, and process options are developed below for Sites 8 and 12.

General response actions include the following: no action, limited actions, containment, on-island treatment, and off-site treatment or disposal. Remedial technologies include types of actions (i.e., biological treatment, thermal treatment, and capping). Process options may include "specific types" of treatment. The general response actions, remedial technologies, and process options which meet the RAOs identified for Sites 8 and 12 are described in the following sections.

2.3.1 General Response Actions

The general response actions applicable to the Gambell sites are the following:

- No Action
- Limited Actions
- Containment

- On-Island Treatment
- Off-Site Disposal

2.3.2 Identification and Screening of Remedial Technologies

The remedial technologies identified for each general response action are shown on Table 2-1. The No Action general response action includes no remedial technologies. Three technologies were identified for the Limited Action general response action: site controls, institutional controls, and monitoring. One technology was identified for the Containment general response action: capping. Three technologies were identified for the On-Island Treatment general response action: physical, thermal, and biological treatment. Two technologies were identified for the Off-site Disposal general response option: off-island treatment and landfilling.

2.3.3 Evaluation of Technologies and Selection of Representative Technologies

This section presents an evaluation of the remedial technologies and process options identified in the previous section. The effectiveness, implementability, and relative cost of each remedial technology type and process option will be reviewed. The cost information at this stage is based on engineering judgment. Relative capital and operation and maintenance (O&M) costs are used rather than detailed estimates. The costs are presented in low, medium, and high terms relative to other process options in the same remedial technology type. This evaluation will provide a selection of remedial technologies and process options that will be considered for further evaluation. A summary of the process options that were retained or eliminated from further consideration is presented in Figure 2-1.

2.3.3.1 No Action

No Action is required for consideration in the FS process by the National Contingency Plan (NCP) as a baseline condition. The No Action option is retained for further evaluation. There are no capital costs associated with this option, and minimal costs for project closeout activities only.

2.3.3.2 Limited Actions

Limited Actions are designed to minimize exposure to hazardous materials and debris by restricting site access or land use. Three remedial technologies for institutional controls were screened: site controls, institutional controls, and long-term monitoring.

Site Controls

<u>Effectiveness</u>. Access restrictions (such as fencing) can prevent exposure to surface soil, exposed debris, and the small arms burial pit. Access restrictions would not prevent erosion or migration of contaminated soils.

Implementability and Cost. No implementability limitations have been identified for initiating access restrictions at Site 12. However, installation of fencing near the runway at Site 8 would require coordination with and approval from the landowner, the Alaska Department of Transportation and Public Facilities. Construction of fencing may adversely affect maintenance of airport lighting/navigation aids or snow removal activities. Installation of fencing around Area D would also impede snow machine travel during the winter, when obstacles are difficult to observe in poor weather conditions. The construction costs are relatively low.

Evaluation. Access restrictions are not retained for further evaluation, because they are not effective at reducing long term potential risk to human health, would likely meet with local opposition, and would require extensive coordination and permission from the ADOTPF.

Institutional Controls

Effectiveness. Use restrictions are potentially effective methods to prevent exposure by sensitive populations (for example, children) or to prevent chronic exposure to soils. Use restrictions, such as deed or zoning restrictions, could prevent ingestion of soil from the site by restricting specific site uses. For example, restrict future use of the area to non-residential use. Use restrictions would probably have little effect on preventing interaction with exposed debris near the airport and the west beach.

Implementability and Cost. One implementability limitation identified for use restrictions is the lack of a mechanism for recording and enforcing the restriction. The cost is relatively low.

Evaluation. Access restrictions are not retained for further evaluation, because they are not implementable and would likely meet with local opposition.

Monitoring/Natural Attenuation

Effectiveness. Soil sampling can be an effective technique for monitoring the progress of natural attenuation. However, soil-sampling results can vary significantly due to sample locations, and sampling and analytical methods. Monitoring is only applicable for contaminants that have the potential to naturally degrade over time. It is not likely that metals contamination in soil will measurably degrade over time. Monitoring/natural attenuation is not applicable to the exposed metal debris at Site 8 and the small arms ammunition at Area D.

Implementability and Cost. No implementability issues have been identified for soil sampling. Due to the long distance to the Gambell site, the cost for sampling is moderate.

Evaluation. Monitoring soil for metals is not retained for further evaluation due to the limited effectiveness of the process.

2.3.3.3 Containment

Containment is designed to limit exposure to hazardous materials by creating a barrier between the impacted soil or debris and potential receptors. The only remedial technology considered for containment is capping.

Capping

The process options are:

- Compacted Clay – Compacted clay covered with sand and gravel
- Synthetic liner – Synthetic membrane without secondary barrier

Effectiveness. Capping can be effective at minimizing exposure and minimizing the amount of surface water recharge to ground water at the site. Contaminants would remain on-site if this process option were selected.

Implementability and Cost. Significant implementability limitations and relatively high costs have been identified for capping. The severe weather conditions in Gambell, which increase the probability of damage from frost heaving and erosion, will impact the design considerations and construction costs. Yearly maintenance and monitoring costs to ensure a successful cap would result in relatively high costs for this technology. In addition, constructing a cap over exposed debris on the slope adjacent to the airfield would require coordination with and approval from the ADOTPF.

Evaluation. Containment is not retained for further evaluation, because of the high potential maintenance costs.

2.3.3.4 On-Island Treatment

Three on-island soil treatment technologies are considered: physical, thermal and biological treatment. Each of the process options listed requires excavating the soil for treatment. These technologies do not apply to the exposed metal debris at Site 8 or the small arms ammunition at Area D.

Physical/Chemical

The process options considered for the physical/chemical remedial technology are:

- Soil Solidification/Stabilization –Binders such as cement/ash, silicates, or pozzolans are added to the soil to physically limit the solubility or mobility of the metals.
- Chemical Stabilization – Chemicals are added to the soil to convert heavy metals into mineral crystals, lowering the leachability of the metals.

Effectiveness. Soil solidification/stabilization effectively immobilizes heavy metals by incorporating the contaminants into an inert matrix. Chemical stabilization chemically bonds the heavy metals into a mineral crystal.

Implementability and Cost. Implementability issues have been identified for physical treatment of the soil. It would be difficult and costly to implement a solidification/stabilization remediation system for a small quantity of soil at this remote site. The cost to mobilize the equipment and supplies necessary to implement physical stabilization, would be nearly the same as excavation and removal. Compared to physical binders, smaller amounts of chemical stabilizer would be required, reducing shipping costs.

Evaluation. Physical treatment of the soil in situ is not retained for further evaluation. Chemical stabilization of the soil is retained for further evaluation, because it appears to a potentially cost effective method for reducing the mobility of the contaminants.

Thermal

Thermal processes are not effective at reducing concentrations of, or destroying metals in contaminated soil. Thermal processes are not retained for further consideration because they are not applicable technologies for lead-contaminated soil.

Biological

Biological remediation would have no impact on the concentration of metals (lead) in the soil, and is not retained for further consideration.

2.3.3.5 Off-site Disposal

Two off-site disposal technologies are considered: landfilling and thermal treatment. Each of the process options listed requires excavating and transporting the soil and debris off-island for treatment or disposal.

Landfilling

The process option considered for the landfilling technology is:

- Landfilling – Dispose of scrap metal in an approved, off-island, solid waste landfill, dispose of metals-contaminated soil in an approved hazardous waste landfill.

Effectiveness. While landfilling would not remove contaminants from the soil, it is an effective method of disposal. Landfilling would permanently remove the exposed debris from the island.

Implementability and Cost. Landfilling is relatively difficult to implement for large volumes of soil or debris due to the challenge of shipping materials off-island. However, large volumes of soil are not expected based on current information, and the amount of debris is moderate. An additional challenge would be locating a landfill to take the lead-contaminated soil. Given the concentration of total lead in the soil, it is assumed the soil would require disposal at a hazardous waste landfill. There are no landfills permitted to accept RCRA wastes in Alaska. The scrap metal could also be taken to a recycler. The costs would be moderate.

Evaluation. Landfilling is retained for further evaluation.

Table 2-1
Gambell Technology Screening

Media	General Response Action	Technology Process Option	Site 8	Site 12
Technologies for Soil or Sediment	No Action	No Action	☑	☑
	Limited Actions	Site Controls	✖	✖
		Institutional Controls	✖	✖
		Monitoring/Natural Attenuation	✖	✖
	Containment	Capping	✖	✖
	On-Island Treatment	Solidification/Stabilization	✖	☑
		Thermal Treatment	✖	✖
		Biological	✖	✖
	Off-Island Action	Landfill Disposal	☑	☑

☑ - Retained for the development of alternatives

✖ - Eliminated from further consideration

TABLE 2-2. SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Standard, Requirement, or Criteria	Description	Comment
CHEMICAL-SPECIFIC		
Alaska Department of Environmental Conservation		
Oil and Hazardous Substances Pollution Control, as amended January 30, 2003, 18 AAC 75. Method 2, Tables B1 and B2, Under 40-Inch Zone, Ingestion Pathway	Establishes cleanup criteria for POL and non-POL contamination in soil. The Method 2, Table B1, Under 40-Inch Zone, Ingestion Pathway applies to this particular action for the identified chemicals of concern: DRO – 10,250 mg/kg RRO – 10,000 mg/kg GRO – 1,400 mg/kg Antimony – 41 mg/kg Chromium – 300 mg/kg Lead – 400 mg/kg Nickel – 2,000 mg/kg	May be relevant and appropriate to contaminated soils, for the identified chemicals of concern.
Toxic Substances Control Act, 15 U.S.C. s/s 2601 et seq (1976)	The Toxic Substances Control Act (TSCA) of 1976 was enacted by Congress to give EPA the ability to track the 75,000 industrial chemicals currently produced or imported into the US.	May be relevant and appropriate to contaminated soils, for the identified chemicals of concern.
Resource, Conservation and Recovery Act (RCRA). Identification and Listing of Hazardous Waste (40 CFR 261)	Establishes criteria for identification of materials as hazardous waste under RCRA.	To be considered potentially applicable to contaminated soil.
EPA Region 9 Preliminary Remediation Goals (PRGs)	Provides risk-based preliminary remediation goals for soil ingestion and inhalation under residential and industrial exposure scenarios. Also provides soil screening levels for migration to groundwater.	To be considered potentially applicable to contaminated soil.
EPA Region 3 Risk Based Concentrations (RBCs)	Provides risk-based concentrations for soil under residential and industrial exposure scenarios, fish, ambient air, and tap water. Also provides screening levels for migration to groundwater.	To be considered potentially applicable to contaminated soil.
ACTION-SPECIFIC		
Resource, Conservation and Recovery Act (RCRA)		
Identification and Listing of Hazardous Waste (40 CFR 261)	Establishes Criteria for identification of materials as hazardous waste under RCRA.	Lead-contaminated soil must be properly identified as a solid or hazardous waste.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), amended by Superfund Amendments and Reauthorization Act October 17, 1987. Title 42, Chapter 103	Establishes a process for investigating and addressing contaminated sites.	May be relevant and appropriate to contaminated soils, for the identified chemicals of concern.
LOCATION-SPECIFIC		
None identified	Remedial actions will require coordination with the local landowners, municipality, and tribal government.	Work activities near the airfield must be coordinated with the ADOTPF.

Figure 2-1
Technology Screening

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost	Comments
No Action	No Action	No Action	Does not reduce contaminant concentrations or prevent migration of contamination. Does not achieve RAOs in timely manner.	Easy to implement; however, state and community acceptance is unlikely.	No Cost	Required under CERCLA as a baseline against which remedial alternatives are compared. Because ADEC residential cleanup levels are exceeded, this is not a viable option for lead-contaminated soil.
Limited Action	Limited Action	Institutional Controls	Does not reduce contaminant concentrations or prevent contaminant migration. When used alone, does not achieve RAOs in a timely manner. Effectiveness at preventing future exposure depends on continued implementation.	State and community acceptance is unlikely, unless active treatment metals. Enforcement of the restrictions may be difficult without a local authority to implement.	Low	Eliminated from consideration due to implementability issues.
		Site Controls	Access restrictions (such as fencing) can prevent exposure to surface soil. Access restrictions do not reduce the volume or concentration of contaminants on site.	State and community acceptance is unlikely. Regular maintenance of a fence or other barrier would be expensive given the distance to the site.	Low	Eliminated from consideration due to implementability issues.
		Long-Term Monitoring	Long-term monitoring is not effective at removing or degrading contamination.	Easy to implement, however, state and community acceptance of monitoring alone is unlikely.	Moderate	Eliminated from consideration due to implementability issues.
Containment	Containment	Impermeable Cap	An impermeable cap would reduce the migration of soluble contaminants to groundwater. It would not remove or destroy contaminants.	Construction of an impermeable cap would require that large quantities of construction materials be brought to the site. This would include some materials not available in Gambell. The cap would need to be protected from vehicular traffic.	Moderate	Eliminated from consideration due to implementability issues.
On-site Treatment	Excavation	Excavation	All ex situ technologies rely on excavation to access contaminated soils. To be effective, excavation must be combined with treatment technologies.	Soil excavation is relatively easy to implement at Site 12.	Moderate	Retained for further consideration. Excavation may be combined with a variety of ex situ treatment technologies in the development of alternatives.
	Physical Treatment	Stabilization/ Solidification	Soil stabilization/solidification can be effective at immobilizing metals in soil.	Gambell is a remote location to ship, setup and operate a stabilization/solidification system.	High	Stabilization/solidification eliminated from further consideration due to implementability issues.
	Physical Treatment	Thermal Treatment	Thermal technologies can be effective at removing VOCs from soil and less effective at removing degraded diesel. Thermal remediation would have no impact on the concentration of metals in the soil.	Gambell is a remote location to ship, setup and operate a thermal treatment system.	High	Thermal treatment is eliminated from further consideration due to high concentrations of lead-contaminated soil.
	Chemical Treatment	Chemical Treatment	Chemical technologies can be effective at reducing the toxicity and mobility of contaminants.	Gambell is a remote location to apply a chemical treatment. The remoteness will result in higher costs and the extreme weather conditions will slow treatment.	Moderate	Retained for further consideration.
	Biological Treatment	Biological Treatment	Biological technologies are effective at removing degraded diesel fuel from soil. Biological remediation would have no impact on the concentration of metals in the soil.	Gambell is a remote location to setup and operate a biological treatment system. The remoteness will result in higher costs and the extreme weather conditions will slow treatment.	High	Eliminated from consideration due to implementability issues.
Off-site Disposal	Off-site Disposal	Landfilling	Effective for a variety of contaminants. If contaminants are not destroyed and are mixed with other wastes, could create additional liability for the Army.	Moderate difficulty to implement for small volumes of soil. Key implementability issues include transporting soil from remote location to RCRA-permitted landfill.	High	Retained for further consideration. Offsite disposal offers suitable location for metals-contaminated soil, and is particularly appropriate in dealing with small volumes of waste.

[shaded box] = Technology or process option eliminated from further consideration.

[white box] = Technology or process option retained for further consideration.

3. Development and Screening of Alternatives

In this section, general response actions and the process options chosen to represent the various technology types are combined to form alternatives for the Gambell sites. Alternatives were developed to represent a range of potential remedial actions.

The alternatives include:

- No action (Alternative 1);
- Removal of exposed debris only (Alternative 2); and
- Off-island disposal of exposed debris and contaminated soil (Alternative 3).
- In-situ treatment of contaminated soil and off-island disposal of exposed debris (Alternative 4).

3.1 Descriptions of Alternatives

The following sections describe the conceptual designs for these alternatives and the basis for the design approach. The conceptual designs of the alternatives presented in this section are based on the best available information at the time that this report was prepared.

3.1.1 Alternative 1 : No Action

The No Action Alternative involves no additional actions at the site. This alternative is required by the NCP.

3.1.2 Alternative 2 : Removal of Exposed Debris Only

The Removal of Exposed Debris Only Alternative includes removal of exposed debris, including Marsten matting from Site 8 and small caliber ammunition from Site D. No contaminated soil would be removed under this alternative. Metallic debris would be disposed off site.

3.1.3 Alternative 3: Off-Island Disposal

The Off-Island Disposal Alternative includes the following:

- Excavation of metals (lead) contaminated soil from Site 12.
- Removal of exposed debris, including marsten matting from Site 8 and small caliber ammunition from Site D.
- Off-island disposal of debris and metals-contaminated soil.

3.1.4 Alternative 4: In-situ Soil Treatment and Off-Island Disposal of Debris

The In-Situ Soil Treatment Alternative includes the following:

- In-situ chemical treatment of metals (lead) contaminated soil from site 12.
- Removal of exposed debris, including marsten matting from Site 8 and small caliber ammunition from Site D.
- Off-island disposal of debris and ammunition.

4. Detailed Analysis of Alternatives

This section provides the results of the evaluation for the alternatives developed for the Gambell Sites in Section 3.0. First the individual analysis of alternatives is presented using the seven evaluation criteria described in Section 4.1. A comparative analysis of alternatives is then presented using the same evaluation criteria.

4.1 Individual Analysis of Alternatives

This section presents an analysis of each of the alternatives by comparing them to seven specific criteria:

- Overall protection to human health and the environment
- Attainment of cleanup standards and compliance with applicable state and federal laws, and local requirements.
- Short-term effectiveness
- Long-term effectiveness
- Reduction of toxicity, mobility and volume through treatment
- Implementability
- Cost

These factors are described below:

Overall protection to human health and the environment. This assessment focuses on whether a specific alternative achieves adequate protection of human health and the environment, and describes how site risks are eliminated, reduced, or controlled through treatment or institutional controls.

Attainment of cleanup standards and compliance with applicable state and federal laws, and local requirements. This addresses the federal, state, and/or local requirements which are applicable or relevant and appropriate for a specific alternative and how the alternative meets these requirements.

Short-term effectiveness. Short-term effectiveness considers the protection of public health, worker health and the environment during the construction and implementation of a remedy until remedial action objections are met.

Long-term effectiveness. Long-term effectiveness considers the effectiveness of each alternative in maintaining protection of human health and the environment after response action objectives have been met. The magnitude of remaining risk from untreated soil or treatment residuals, if any, and the adequacy and reliability of controls for providing protection from residuals, are considered in this assessment.

Reduction of toxicity, mobility, and volume through treatment. This criterion considers the type and quantity of residuals that will remain following treatment, and the degree to which the treatment reduces the hazards posed by the site. Where possible, numerical comparisons before and after remediation are presented.

Implementability. The technical and administrative feasibility of each alternative is evaluated in this criterion. Technical feasibility includes the ability to construct the system used, the ability to operate and maintain the equipment, and the ability to monitor the effectiveness of operations. Administrative feasibility refers to the ability to obtain necessary permits and approvals from applicable regulatory agencies and the likelihood of favorable community response.

Cost. The capital cost associated with the development and construction, and the annual O&M costs of each alternative are evaluated in this step. The cost estimates are prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The actual cost of remediation depend on many variables, including volume of contaminated soil, concentration and total mass of contaminants treated, distance to contaminated site, cleanup levels, health and safety regulations, labor and equipment costs, and the final project scope. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper evaluation and adequate funding. Costs are expected to be within the range of accuracy typical of FS-level costs estimates (-30 to +50 percent).

4.1.1 Alternative 1 – No Action

Analysis of the No Action Alternative is required by the NCP. This alternative involves no further action at the site and is sometimes referred to as the “walk-away” alternative.

4.1.1.1 Evaluation

Overall protection. The No Action Alternative does not reduce the risk currently posed by the Gambell sites. The contaminant concentrations at Site 12 exceed regulatory limits, and may pose a significant risk to human health or the environment. The exposed debris would continue to pose a physical hazard to local residents.

Compliance with ARARs. The No Action Alternative does not comply with the identified ADEC soil cleanup levels for lead at Site 12, since there would be no reduction in the concentration or quantity of contaminants in soil at that site.

Short-term effectiveness. There are no short-term risks posed by the site or implementation of Alternative 1, since there are no actions included in this alternative.

Long-term effectiveness. The No Action Alternative does not reduce the long-term risks associated with the site.

Reduction of Toxicity, Mobility, or Volume. The No Action Alternative will not reduce the toxicity, mobility, or volume of contaminated soil. The No Action Alternative would not reduce the physical hazards associated with the exposed debris.

Implementability. No technical or administrative implementability issues have been identified for the No Action Alternative. This alternative will likely be met with local opposition.

Cost. The estimated cost for Alternative 1 is $39,700.

4.1.2 Alternative 2 – Removal of Exposed Debris Only

The Removal of Exposed Debris Only Alternative only includes removal of exposed debris from Site 8 and small caliber ammunition from Site D. Site 8 debris includes Marsten matting located along the eastside of the runway. Site D debris includes the beach ammunition dump located 1 1/3 miles south of the runway. Debris would be transported to an off-site landfill or sent to a recycling facility. There is no soil removal included with this alternative.

4.1.2.1 Evaluation

Overall protection. The Removal of Exposed Debris Only Alternative reduces the physical hazard posed by the debris. However, this Alternative does not reduce the potential risk associated with the lead-contaminated soils present at Site 12.

Compliance with ARARs. The Removal of Exposed Debris Only Alternative complies with ARARs by requiring disposal of the debris in an approved landfill. However, this alternative does not comply with identified ADEC soil cleanup levels at Site 12, since lead-contaminated soil is left in place.

Short-term effectiveness. There are no short-term risks posed by implementation of Alternative 1. Since there are no know chemical hazards in the areas where debris removal would occur, implementation of this alternative would be protective of public and worker health. A health and safety plan will be followed to ensure general safe working conditions.

Long-term effectiveness. The Removal of Exposed Debris Only Alternative effectively reduces the long-term physical hazard posed by the debris. Site 8 and Site D do not currently pose a chemical hazard. However, this alternative does not reduce the long-term risks associated with Site 12.

Reduction of Toxicity, Mobility, or Volume. The Removal of Exposed Debris Alternative will reduce the volume of exposed debris at Site 8 and Site D. This alternative will not reduce the toxicity, mobility, or volume of contaminated soil at Site 12.

Implementability. Implementation of this alternative will require coordination with the State of Alaska Department of Transportation and Public Facilities (DOTPF). Electrical wiring for the runway lights will need to be rerouted to allow removal of the Marsten matting. There may also be working hour restrictions due to runway operations. There may be difficultly encountered when trying to sift the .30 cal ammunition from the gravels. There should be no difficultly locating an approved off-site landfill or recycling facility once the debris is removed.

Cost. The estimated cost for Alternative 2 is $370,000.

4.1.3 Alternative 3 – Off-Island Disposal of Lead Contaminated Soil and Exposed Debris

The Off-Island Disposal Alternative includes excavation of metals-contaminated soil from Site 12, and removal of exposed debris from Site 8 and Site D. Site 12 contains soil contaminated with lead. Site 8 debris includes marsten matting located along the east side of the runway. Site D debris includes the beach ammunition dump located 1 1/3 miles south of the runway. Debris and contaminated soil would be transported to an off site landfill, or sent to a recycling facility.

4.1.3.1 Evaluation

Overall protection. Alternative 3 would remove the risk posed by Site 12 by excavating soil containing lead above regulatory concentrations. This alternative also reduces the physical hazard posed by the debris at Site 8 and Site D.

Compliance with ARARs. This alternative would reduce the level of contamination to meet ARARs that apply to the Gambell site. All contaminated soil and debris would be removed and properly disposed at an approved off-site landfill.

Short-term effectiveness. There is a potential for exposure to site workers while excavating, transporting and treating the contaminated soil. Following a health and safety plan and using appropriate personal protective equipment, would minimize exposure of site workers to contaminants. Additional measures would be taken to prevent exposure to residents entering the areas during implementation of the alternative. The short-term risks are manageable.

Long-term effectiveness. The residual risk posed by the site would be reduced by this alternative because the contaminated soil and exposed debris would be removed. Institutional controls would not be necessary since no soil with contaminants above regulator levels would remain on site.

Reduction of toxicity, mobility, and volume. The lead-contaminated soil would not be treated, so there would be no reduction in the toxicity, mobility or volume.

Implementability. Implementation of the debris removal portion of this alternative will require coordination with the State of Alaska Department of Transportation and Public Facilities (DOTPF). Electrical wiring for the runway lights will need to be rerouted to allow removal of the Marsten matting. There may also be working hour restrictions due to runway operations. There may be difficulty encountered when trying to sift the .30 cal ammunition from the gravels. There should be no difficulty locating an approved off-site landfill or recycling facility once the debris is removed. There should be no difficulty excavating or transporting the lead contaminated soil from Site 12. There should also be no difficulty locating an approved landfill for the contaminated soil.

Cost. The estimated cost for Alternative 3 is $418,200.

4.1.4 Alternative 4 – In-situ Treatment of Lead Contaminated Soil and Off-Island Disposal of Exposed Debris

The In-situ Treatment Alternative includes treatment of metals-contaminated soil from Site 12, and removal of exposed debris from Site 8 and Site D. Site 12 contains soil contaminated with lead. Site 8 debris includes marsten matting located along the east side of the runway. Site D debris includes the beach ammunition dump located 1 1/3 miles south of the runway. Debris would be transported to an off site landfill, or sent to a recycling facility. Soil at Site 12 would be treated to chemically bind the lead contamination into a compound, reducing the leachability of the metals.

4.1.4.1 Evaluation

Overall protection. Alternative 4 would reduce the risk posed by Site 12 by treating soil containing lead above regulatory concentrations. This alternative also reduces the physical hazard posed by the debris at Site 8 and Site D.

Compliance with ARARs. This alternative would not reduce the level of contamination and would not meet all ARARs that apply to the Gambell site. All debris would be removed and properly disposed at an approved off-site landfill.

Short-term effectiveness. There is a potential for exposure to site workers while treating the contaminated soil. Following a health and safety plan and using appropriate personal protective equipment, would minimize exposure of site workers to contaminants. Additional measures would be taken to prevent exposure to residents entering the areas during implementation of the alternative. The short-term risks are manageable.

Long-term effectiveness. The residual risk posed by the site would be reduced by this alternative because the leachability of the contaminants in soil would be reduced and exposed debris would be removed. Institutional controls would not be necessary since the leachability of contaminants in soil would be reduced.

Reduction of toxicity, mobility, and volume. The lead-contaminated soil would be treated in-situ, resulting in a reduction in the toxicity and mobility of the contaminants. The volume of the contaminated soil would not be reduced.

Implementability. Implementation of the debris removal portion of this alternative will require coordination with the State of Alaska Department of Transportation and Public Facilities (DOTPF). Electrical wiring for the runway lights will need to be rerouted to allow removal of the Marsten matting. There may also be working hour restrictions due to runway operations. There may be difficulty encountered when trying to sift the .30 cal ammunition from the gravels. There should be no difficulty locating an approved off-site landfill or recycling facility once the debris is removed.

There should be no difficulty applying chemical treatment to lead contaminated soil at Site 12. The lead contamination is not expected to extend more than 2 to 4 feet into the subsurface.

Cost. The estimated cost for Alternative 4 is $432,800.

4.2 Comparative Analysis

In this section of the FS, the alternatives developed in Chapter 3 and evaluated with respect to specific criteria in Section 4.1 are compared to one another to allow for selection of the remedial action at the Gambell sites.

4.2.1 Overall Protection of Human Health and the Environment

Alternatives 1 and 2 would not reduce the chemical risk posed to human health and the environment since no actions would be taken to address the lead-contaminated soil. Alternatives 2, 3, and 4 address the physical hazard posed by exposed debris. Alternative 3 would be most protective because the lead-contaminated soil would be permanently removed and disposed off-site. Alternative 4 would be less protective than Alternative 3, because the treated soil would remain in place.

4.2.2 Compliance with ARARs

Alternatives 1 and 2 would not reduce or remove lead contaminants in soil at Site 12 and would therefore not meet ARARs. Alternative 3 would comply with ARARs since the lead-contaminated soil would be removed from Site 12 and disposed off-island. Alternative 4 would not comply with ARARs, since the concentration of lead in soil would not be reduced. Additional tests would have to be performed on the soil following treatment to document the reduced leachability of the lead.

4.2.3 Short-Term Effectiveness

None of the alternatives represent an unacceptable risk to the community, workers or the environment during implementation.

4.2.4 Long-Term Effectiveness

Alternative 3 has the highest long-term effectiveness because this alternative has the highest potential to permanently remove the lead-contaminated soil. Alternatives 1 and 2 provide the least long-term effectiveness since neither includes action to reduce the amount of lead-contaminated soil. Alternative 4 has a long-term effectiveness that is less than Alternative 3 because Alternative 4 leaves the treated soil on-site. Alternative 4 has a long-term effectiveness that is greater than Alternatives 1 and 2, because Alternative 4 treats the lead contaminated soil in-situ.

4.2.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 and 2 do not reduce the toxicity, mobility, or volume of the lead-contaminated soil. Alternative 3 reduces the volume of contaminants left on site through removal. Alternative 4 reduces the mobility and toxicity of the lead, but not the volume.

4.2.6 Implementability

All of the alternatives can be implemented using commercially available services. Alternative 1 and 2 could be easily implemented and few technical challenges would be expected. Alternative 3 is more challenging. This alternative includes excavation and off-island disposal of the metals contaminated soil. Alternative 4 would be the most challenging to implement. Alternative 4 would require the application and mixing of a reagent with the lead contaminated soil.

4.2.7 Cost

Table 4-1 presents a summary of the total estimated costs for each of the alternatives. Alternative 1 has the lowest cost ($39,700) and Alternative 2 has the second lowest cost ($370,000). Alternative 4 has the highest costs ($432,800) and Alternative 3 has the second highest cost ($418,200). Overall, the additional cost to remove and dispose of the lead-contaminated soil is not significantly higher than Alternative 2 (Remove of Exposed Debris Only) and less than Alternative 4 (Treat Lead Contaminated Soil In-situ).

4.2.8 Preferred Alternative

Alternative 3 is the preferred alternative. Alternative 3 is less complex than Alternative 4 and will permanently reduce the risk posed by lead contaminated soil at Site 12. Alternative 4 may reduce the mobility and toxicity of the lead, but it will not reduce the volume of lead contaminated soil.

Table 4-1
Cost Comparison Summary

Alternatives	Actions	Categories	Costs
Alternative 1 - No Action	Project Close out	Project Close Out	Total: **$39,700**
Alternative 2 - Remove Exposed Debris Only	Off-site disposal of debris in landfill	Work Plans and Reports Mobilization/Demobilization Field Work Project Management	$53,400 $184,400 $117,600 $14,600 Total: **$370,000**
Alternative 3 - Remove Exposed Debris and Lead-Contaminated Soil	Off-site disposal of debris and soil in landfill	Work Plans and Reports Mobilization/Demobilization Field Work Project Management	$77,300 $192,100 $131,100 $17,700 Total: **$418,200**
Alternative 4 - Treat Lead-Contaminated Soil and Remove Exposed Debris	On-site treatment of soil and off-site disposal of debris	Work Plans and Reports Mobilization/Demobilization Field Work Project Management	$77,300 $192,100 $145,700 $17,700 Total: **$432,800**

Bibliography

Ecology and Environment, Inc. (E&E). 1992. Inventory Report, Gambell, Formerly Used Defense Site, St. Lawrence Island, Alaska. Contract No. DACA85-91-D-003. December.

E&E. 1992. Site Inventory Report, Gambell Formerly Used Defense Site, St. Lawrence Island, Alaska. December.

E&E. 1993. Chemical Data Acquisition Plan, Site Inventory Update, Gambell, St. Lawrence Island, Alaska. February.

Golder Associates Inc. (GAI). 1994. Final Report Geophysical Survey Investigation – St. Lawrence Island, Alaska, USA. November 3.

GAI. 1996. Geophysical Survey Investigation, Gambell, Alaska. August 22.

Montgomery Watson (MW). 1995a. Remedial Investigation, Gambell, St. Lawrence Island, Alaska. January.

MW. 1995b. Remedial Action Alternatives Technical Memorandum, Gambell, St. Lawrence Island, Alaska. November 6.

MW. 1995c. Building Demolition and Debris Removal Technical Memorandum, Gambell, St. Lawrence Island, Alaska. December 8.

MW. 1997. Investigation of Geophysical Anomaly, Gambell, St. Lawrence Island, Alaska. Final. December.

MW. 1998. Phase II Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Final. December.

MW. 1999a. Site 5 Remedial Investigation, Gambell, St. Lawrence Island, Alaska.

MW. 1999b. Final Investigation of Geophysical Anomaly, Gambell, St. Lawrence Island, Alaska. Final. December.

MW. 2000. Strategic Project Implementation Plan, Gambell, St. Lawrence Island, Alaska. Final. December.

MWH Americas, Inc. (MWH). 2002. Summary Report 2001 Supplemental Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Final. May.

Oil Spill Consultants, Inc. (OSCI). 2001. Remedial Action Report for Debris Removal and Containerized Hazardous Waste and Toxic Waste Removal, Gambell, Alaska. Final. February 15.

United States Army Corps of Engineers Engineer Research and Development Center, Topographic Engineering Center (TEC). 2000. GIS-Based Historical Time Sequence Analysis (Historical Photographic Analysis), Gambell Sites, St. Lawrence Island, Alaska. Final. September.

United States Army Corps of Engineers (USACE). 2002. Engineering Evaluation / Cost Analysis (EE/CA), Gambell sites, St. Lawrence Island, Alaska. Final. November.

United States Environmental Protection Agency (USEPA). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. EPA/540/G-89/004. Interim Final. October.

URS Corporation and Rittenhaus-Zeman & Associates (URS). 1985. Defense Environmental Restoration Program (DERP), Gambell, St. Lawrence Island, Alaska, Geotechnical, Geophysical, Soil, and Groundwater Quality Studies, Prepared for URS Engineers, W-4581. August.

Appendix A

SUMMARY SHEET

Activity	Cost
Alternative 1 - No Action	
Reporting	$23,700
Coordination	$13,000
Travel	$3,000
Total	$39,700
Alternative 2 - Debris Removal Only	
Planning and Pre-Mob Activities	$33,300
Mobilization	$88,000
Field Work	$117,600
Demobilization	$96,400
Reporting	$20,100
Project Management	$14,600
Total	$370,000
Alternative 3 - Contaminated Soil and Debris Removal	
Planning and Pre-Mob Activities	$47,400
Mobilization	$90,500
Field Work	$127,100
Demobilization	$101,600
Lab Samples	$4,000
Reporting	$29,900
Project Management	$17,700
Total	$418,200
Alternative 4 - Contaminated Soil Treatment and Debris Removal	
Planning and Pre-Mob Activities	$47,400
Mobilization	$90,500
Field Work	$141,700
Demobilization	$101,600
Lab Samples	$4,000
Reporting	$29,900
Project Management	$17,700
Total	$432,800

Item	Hours	Rate	Total
Prepare Draft Site Closeout Report			
Project Manager	20	$70.00	$1,400
Environmental Engineer	80	$70.00	$5,600
OE Technician III	20	$60.00	$1,200
Clerical	40	$29.75	$1,190
Prepare Responses to comments			
Project Manager	10	$70.00	$700
Environmental Engineer	20	$70.00	$1,400
OE Technician III	10	$60.00	$600
Clerical	10	$29.75	$298
Review Conference			
Project Manager	8	$70.00	$560
Environmental Engineer	8	$70.00	$560
Community Involvement Activities			
Project Manager	20	$70.00	$1,400
Environmental Engineer	20	$70.00	$1,400
Attend RAB meeting			
Project Manager	24	$70.00	$1,680
Environmental Engineer	24	$70.00	$1,680
Coordinate with Regulators			
Project Manager	40	$70.00	$2,800
Environmental Engineer	20	$70.00	$1,400
Prepare Final Site Closeout Report			
Project Manager	16	$70.00	$1,120
Environmental Engineer	40	$70.00	$2,800
OE Technician III	10	$60.00	$600
Clerical	20	$29.75	$595
		Subtotal	$28,983
Other Direct and Indirect Costs (15%)			$4,347
Travel Costs (2 persons)			$3,000
		Profit (10%)	$3,333
		Grand Total	$39,663
Round up to nearest hundred			**$39,700**

Item	Number	Unit	Rate	Total
Site D - Subsurface OE Clearance				
Work Plan and Health/Safety Plan				
Preparation	1	Lump Sum	$12,000.00	$12,000
Site 8 - Marsten Matting Debris Cleanup				
Prepare Draft Health and Safety Plan				
Environmental Engineer	4		$70.00	$280
Industrial Hygenist	40		$50.75	$2,030
Clerical	40		$29.75	$1,190
Prepare Draft Work Plan				
Environmental Engineer	20		$70.00	$1,400
Chemist	16		$59.50	$952
Clerical	20		$29.75	$595
Prepare Responses to comments				
Environmental Engineer	8		$70.00	$560
Industrial Hygenist	8		$50.75	$406
Chemist	8		$59.50	$476
Clerical	8		$29.75	$238
Review Conference				
Environmental Engineer	4		$70.00	$280
Industrial Hygenist	4		$50.75	$203
Chemist	4		$59.50	$238
Prepare Final Health and Safety Plan				
Environmental Engineer	2		$70.00	$140
Industrial Hygenist	20		$50.75	$1,015
Clerical	20		$29.75	$595
Subcontracting				
Scope of Work				
Environmental Engineer	4		$70.00	$280
Cost Estimator	1		$59.50	$60
Contract Specialist	0		$57.75	$0
Negotiations				
Environmental Engineer	4		$70.00	$280
Contract Specialist	4		$57.75	$231
Award				
Contract Specialist	4		$57.75	$231
Barging Sub				
Scope of Work				
Environmental Engineer	0		$70.00	$0
Cost Estimator	0		$59.50	$0
Contract Specialist	4		$57.75	$231
Negotiations				
Environmental Engineer	0		$70.00	$0
Contract Specialist	4		$57.75	$231
Award				
Contract Specialist	4		$57.75	$231
TDU Sub				
Scope of Work				
Environmental Engineer	4		$70.00	$280
Cost Estimator	0		$59.50	$0
Contract Specialist	0		$57.75	$0

Negotiations				
Environmental Engineer	0		$70.00	$0
Contract Specialist	4		$57.75	$231
Award				
Contract Specialist	4		$57.75	$231
Pre-construction Meeting				
Field Foreman	8		$77.00	$616
Environmental Engineer	8		$70.00	$560
			Subtotal	$26,291
	Other Direct and Indirect Costs (15%)			$3,944
			Profit (10%)	$3,023
			Grand Total	$33,257
		Round up to nearest hundred		**$33,300**
Site 12 - Lead Contaminated Soil Excavation				
Prepare Draft Sampling and Analysis Plan				
Environmental Engineer	8		$70.00	$560
Chemist	20		$59.50	$1,190
Clerical	20		$29.75	$595
Prepare Draft Work Plan				
Environmental Engineer	20		$70.00	$1,400
Chemist	16		$59.50	$952
Clerical	20		$29.75	$595
Prepare Responses to comments				
Environmental Engineer	8		$70.00	$560
Industrial Hygenist	8		$50.75	$406
Chemist	8		$59.50	$476
Clerical	8		$29.75	$238
Review Conference				
Environmental Engineer	4		$70.00	$280
Industrial Hygenist	4		$50.75	$203
Chemist	4		$59.50	$238
Prepare Final Work Plan				
Environmental Engineer	20		$70.00	$1,400
Chemist	8		$59.50	$476
Clerical	20		$29.75	$595
Laboratory Sub				
Scope of Work				
Chemist	4		$59.50	$238
Cost Estimator	1		$59.50	$60
Contract Specialist	1		$57.75	$58
Negotiations				
Chemist	4		$70.00	$280
Contract Specialist	2		$57.75	$116
Award				
Contract Specialist	4		$57.75	$231
			Subtotal	$11,146
	Other Direct and Indirect Costs (15%)			$1,672
			Profit (10%)	$1,282
			Grand Total	$14,099
		Round up to nearest hundred		**$14,100**

Item	Number	Unit	Unit Cost	Total Cost
Site D - Subsurface OE Clearance				
Labor (Travel and Construct Gravel Sieve in Anchorage)				
UXO Technician III	0*	Hours	$60.00	$0
Project Manager	0*	Hours	$70.00	$0
Supplies and Services				
Airfare (Roundtrip to Gambell from East Coast)	0*	Each	$2,400.00	$0
Per Diem (Lodging, Anchorage)	0*	Nights	$120.00	$0
Per Diem (3/4 Meals, Anchorage)	0*	Days	$51.00	$0
Per Diem (Meals, Anchorage)	0*	Days	$68.00	$0
Truck Rental (Anchorage)	0*	Days	$95.00	$0
Air Cargo (Gambell to Nome)	2400	Pounds	$1.38	$3,312
Air Cargo (Nome to Anchorage)	2400	Pounds	$0.87	$2,088
Site 8 - Marsten Matting Debris Cleanup				
Labor for Travel (all rates burdoned)				
Foreman/QC	12	Hours	$77.00	$924
Lgt Equipment Operator	12	Hours	$59.50	$714
Truck Driver	12	Hours	$50.75	$609
Supplies and Services				
Airfare (Roundtrip Anchorage to Gambell)	0*	Each	$878.50	$0
Per Diem (Gambell)	3	Man-Days	$153.00	$459
Barge Equipment from Site (reg. Schedule)				
Gambell to Anchorage	32000	Pounds	$0.3738	$11,962
Debris-filled Connexes (Gambell to Seattle)	150000	lbs	$0.3738	$56,070
			Total	**$76,138**
	Other Direct and Indirect Costs (15%)			$11,421
			Profit (10%)	$8,756
			Grand Total	$96,314
		Round up to nearest hundred		**$96,400**
Site 12 - Lead Contaminated Soil Excavation				
Labor for Travel (all rates burdoned)				
Chemist	12	Hours	$59.50	$714
Supplies and Services				
Airfare (Roundtrip Anchorage to Gambell)	0*	Each	$878.50	$0
Air Cargo (Gambell to Nome)	100	Pounds	$1.38	$138
Air Cargo (Nome to Anchorage)	100	Pounds	$0.87	$87
Per Diem (Gambell)	1	Man-Days	$153.00	$153
Soil-filled Connexes (Gambell to Seattle)	8000	lbs	$0.3738	$2,990
			Total	**$4,082**
	Other Direct and Indirect Costs (15%)			$612
			Profit (10%)	$469
			Grand Total	$5,164
		Round up to nearest hundred		**$5,200**
Site 12 - Lead Contaminated Soil Treatment				
Labor for Travel (all rates burdoned)				
Chemist	12	Hours	$59.50	$714

Supplies and Services				
Airfare (Roundtrip Anchorage to Gambell)	0*	Each	$878.50	$0
Air Cargo (Gambell to Nome)	100	Pounds	$1.38	$138
Air Cargo (Nome to Anchorage)	100	Pounds	$0.87	$87
Per Diem (Gambell)	1	Man-Days	$153.00	$153
			Total	**$1,092**
	Other Direct and Indirect Costs (15%)			$164
			Profit (10%)	$126
			Grand Total	$1,381
		Round up to nearest hundred		**$1,400**
* included in mobilization				

Item	Number	Unit	Unit Cost	Total Cost
Site D - Subsurface OE Clearance				
Labor (Travel and Construct Gravel Sieve in Anchorage)				
UXO Technician III	62	Hours	$60.00	$3,720
Project Manager	62	Hours	$70.00	$4,340
Supplies and Services				
Airfare (Roundtrip to Gambell from East Coast)	2	Each	$2,400.00	$4,800
Per Diem (Lodging, Anchorage)	8	Nights	$120.00	$960
Per Diem (3/4 Meals, Anchorage)	4	Days	$51.00	$204
Per Diem (Meals, Anchorage)	8	Days	$68.00	$544
Truck Rental (Anchorage)	4	Days	$95.00	$380
Air Cargo (Anchorage to Nome)	2400	Pounds	$0.87	$2,088
Air Cargo (Nome to Gambell)	2400	Pounds	$1.38	$3,312
Site 8 - Marsten Matting Debris Cleanup				
Labor for Travel (all rates burdoned)				
Foreman/QC	12	Hours	$77.00	$924
Lgt Equipment Operator	12	Hours	$59.50	$714
Truck Driver	12	Hours	$50.75	$609
Supplies and Services				
Airfare (Roundtrip Anchorage to Gambell)	3	Each	$878.50	$2,636
Barge Equipment/Connexes (Seattle to Gambell)	50000	Pounds	$0.5400	$27,000
Barge Equipment (Anchorage to Gambell)	32000	Pounds	$0.5400	$17,280
Per Diem (Gambell)	3	Man-Days	$153.00	$459
			Total	**$69,511**
	Other Direct and Indirect Costs (15%)			$10,427
			Profit (10%)	$7,994
			Grand Total	$87,931
	Round up to nearest hundred			**$88,000**
Site 12 - Lead Contaminated Soil Excavation				
Labor for Travel (all rates burdoned)				
Chemist	12	Hours	$59.50	$714
Supplies and Services				
Airfare (Roundtrip Anchorage to Gambell)	1	Each	$878.50	$879
Air Cargo (Anchorage to Nome)	100	Pounds	$0.87	$87
Air Cargo (Nome to Gambell)	100	Pounds	$1.38	$138
Per Diem (Gambell)	1	Man-Days	$153.00	$153
			Total	**$1,971**
	Other Direct and Indirect Costs (15%)			$296
			Profit (10%)	$227
			Grand Total	$2,493
	Round up to nearest hundred			**$2,500**

Item	Number	Unit	Unit Cost*	Total Cost
Site D - Subsurface OE Clearance				
Field Work				
UXO Technician III	50	Hours	$60.00	$3,000
Project Manager	50	Hours	$70.00	$3,500
Local Laborers (2)	100	Hours	$30.00	$3,000
Supplies and Services				
RTK GPS Equipment rental	2	Week	$2,100.00	$4,200
Metal Detector	2	Week	$100.00	$200
Gravel Sieve (materials)	1	Each	$16,000.00	$16,000
Back Hoe Rental (w/operator) - Local	50	Hours	$130.00	$6,500
Shipping Containers	10	Each	$30.00	$300
ATV rental	1	Week	$875.00	$875
PPE	4	Person	$20.00	$80
Ammunition Disposal Shipment (Gambell to Nome)	500	Pounds	$0.87	$435
Ammunition Disposal Shipment (Nome to Anchorage)	500	Pounds	$1.38	$690
Ammunition Disposal Fee	400	Pounds	$4.09	$1,636
Per Diem				
Per Diem (Lodging Gambell)	12	Nights	$85.00	$1,020
Per Diem (Meals, Gambell)	10	Days	$54.00	$540
Site 8 - Marsten Matting Debris Cleanup				
Unload Barge Materials in Gambell				
Laborer	2	Hours	$29.75	$60
Lgt Equipment Operator	2	Hours	$59.50	$119
Truck Driver	2	Hours	$50.75	$102
Field Work				
Foreman/QC	70	MH	$77.00	$5,390
Lgt Equipment Operator	70	MH	$59.50	$4,165
Truck Driver	70	MH	$50.75	$3,553
Laborers	140	MH	$29.75	$4,165
Load Connexes				
Lgt Equipment Operator	10	Hours	$59.50	$595
Truck Driver	10	Hours	$50.75	$508
Equipment				
Small Dump Truck (5 CY)	1	Month	$2,100.00	$2,100
Backhoe Loader (416 C or D)	1	Month	$4,000.00	$4,000
ATVs with Trailer (3)	42	days	$150.00	$6,300
Field screening equipment (Hanby Kit)	1	Each	$520.00	$520
Supersacks for contaminated soil	10	Each	$80.00	$800
Radios	4	Each	$100.00	$400
Disposable Camera	5	Each	$9.00	$45
Diesel Fuel for Equipment	700	Gal	$3.00	$2,100
Connex Rental for removal of debris and soil	150	Unit-Day	$4.00	$600
e Loader CAT 426C IT (w/connexes to load them on-site)	1	Month	$3,000.00	$3,000
Plastic Fencing, tarps, etc for winter storage	1	LS	$2,000.00	$2,000
Move Debris from Dock to Landfill in Seattle				
Truck Driver	10	MH	$50.75	$508
Landfill Tipping Fee				
	50	tons	$45.00	$2,250
Lodging and Per Diem for Workers				
Foreman/Operator/Truck Driver	21	Days	$153.00	$3,213

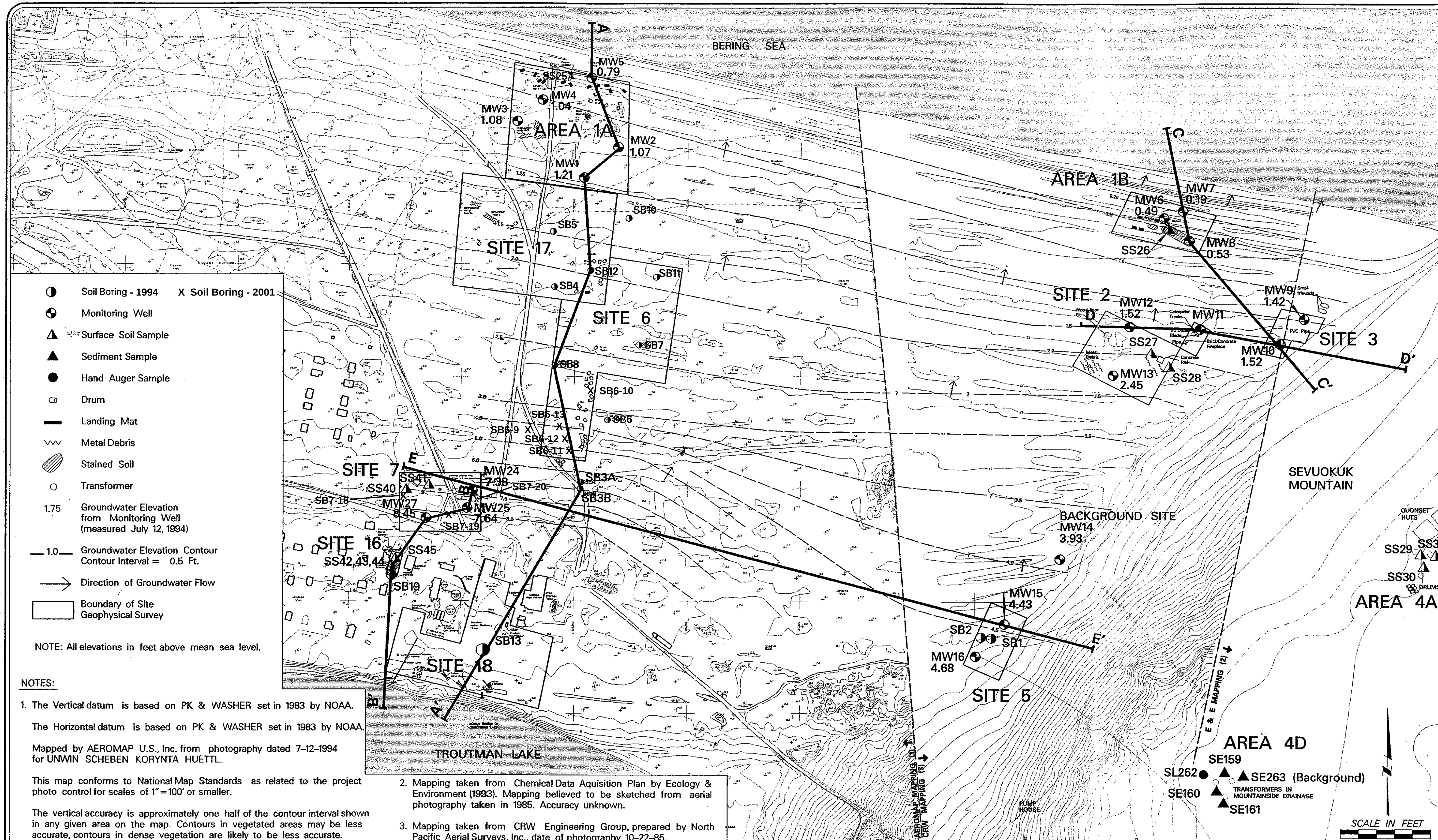
			Subtotal	$88,467
Small Tools/Consumables and PPE (5%)				$4,423
			Total	$92,890
Other Direct and Indirect Costs (15%)				$13,933
			Profit (10%)	$10,682
			Grand Total	$117,506
	Round up to nearest hundred			**$117,600**
Site 12 - Lead Contaminated Soil Excavation				
Field Work				
Foreman/QC	20	MH	$77.00	$1,540
Lgt Equipment Operator	20	MH	$59.50	$1,190
Truck Driver	20	MH	$50.75	$1,015
Laborers	20	MH	$29.75	$595
Chemist	20	MH	$59.50	$1,190
Move Soil to TDU from Dock to TDU in Seattle				
Truck Driver	4	MH	$50.75	$203
Landfill Tipping Fee				
	4	tons	$45.00	$180
Lodging and Per Diem for Workers				
Foreman/Operator/Truck Driver/Chemist	8	Days	$153.00	$1,224
			Subtotal	$7,137
Small Tools/Consumables and PPE (5%)				$357
			Total	$7,494
Other Direct and Indirect Costs (15%)				$1,124
			Profit (10%)	$862
			Grand Total	$9,480
	Round up to nearest hundred			**$9,500**
Site 12 - Lead Contaminated Soil Treatment				
Field Work				
Foreman/QC	40	MH	$77.00	$3,080
Lgt Equipment Operator	40	MH	$59.50	$2,380
Truck Driver	20	MH	$50.75	$1,015
Laborers	40	MH	$29.75	$1,190
Chemist	40	MH	$59.50	$2,380
Treatment Chemicals				
Treatment Chemicals	1	LS	$5,000.00	$5,000
Lodging and Per Diem for Workers				
Foreman/Operator/Truck Driver/Chemist	20	Days	$153.00	$3,060
			Subtotal	$18,105
Small Tools/Consumables and PPE (5%)				$905
			Total	$19,010
Other Direct and Indirect Costs (15%)				$2,852
			Profit (10%)	$2,186
			Grand Total	$24,048
	Round up to nearest hundred			**$24,100**
* Labor rates are all loaded.				

Test Method	Item	Number	Unit	Unit Cost	Total Cost
Project Samples					
8RCRA	8 RCRA Metals	10	Sample	$130.00	$1,300.00
AK102/103	DRO/RRO	10	Sample	$125.00	$1,250.00
lab	TOC	10	Sample	$60.00	$600.00
QA/QC Samples (10% of project samples)					
Test Method	**Item**	**Number**	**Unit**	**Unit Cost**	**Total Cost**
8RCRA	8 RCRA Metals	1	Sample	$130.00	$130.00
AK102/103	DRO/RRO	1	Sample	$125.00	$125.00
lab	TOC	1	Sample	$60.00	$60.00
	Total Samples	33			
	Cooler Shipping	2	Coolers	$250.00	$500.00
	Vermaculite	1	Bags	$17.00	$17.00
				Total	$3,982.00
				Round Up	**$4,000.00**
All per sample cost includes data review.					

Item	Hours	Rate	Total
Site D - Subsurface OE Clearance			
Prepare Draft Removal Action Report			
Project Manager	8	$70.00	$560
OE Technician III	40	$60.00	$2,400
Clerical	20	$29.75	$595
Site 8 - Marsten Matting Debris Cleanup			
Prepare Draft Removal Action Report			
Environmental Engineer	80	$70.00	$5,600
Industrial Hygenist	4	$50.75	$203
Clerical	40	$29.75	$1,190
Prepare Responses to comments			
Environmental Engineer	16	$70.00	$1,120
Industrial Hygenist	4	$50.75	$203
Clerical	8	$29.75	$238
Review Conference			
Environmental Engineer	4	$70.00	$280
Prepare Final Removal Action Report			
Environmental Engineer	40	$70.00	$2,800
Industrial Hygenist	2	$50.75	$102
Clerical	20	$29.75	$595
		Subtotal	$15,886
Other Direct and Indirect Costs (15%)			$2,383
		Profit (10%)	$1,827
		Grand Total	$20,095
Round up to nearest hundred			**$20,100**
Site 12 - Lead Contaminated Soil Excavation			
Prepare Draft Chemical Data Report			
Environmental Engineer	4	$70.00	$280
Chemist	40	$59.50	$2,380
Clerical	20	$29.75	$595
Prepare Responses to comments			
Chemist	16	$59.50	$952
Clerical	4	$29.75	$119
Review Conference			
Chemist	4	$59.50	$238
Prepare Final Chemical Data Report			
Environmental Engineer	2	$70.00	$140
Chemist	40	$59.50	$2,380
Clerical	20	$29.75	$595
		Subtotal	$7,679
Other Direct and Indirect Costs (15%)			$1,152
		Profit (10%)	$883
		Grand Total	$9,714
Round up to nearest hundred			**$9,800**

(6% of total hours for all phases)		
Phase	**Labor Hours for Phase**	**10%**
Planning and Pre-Mob Activities	383	38
Mobilization	160	16
Field Work	576	58
Demobilization	52	5
Reporting	286	29
	Total Project Management Hours	146
	PM Rate	$78.75
	Total	$11,473.88
	Other Direct and Indirect Costs (15%)	$1,721.08
	Profit (10%)	$1,319.50
	Grand Total	$14,514.45
	Round up to nearest hundred	**$14,600**
Phase	**Labor Hours for Phase**	**10%**
Planning and Pre-Mob Activities	212	13
Mobilization	12	1
Field Work	116	7
Demobilization	12	1
Reporting	150	9
	Total Project Management Hours	30
	PM Rate	$78.75
	Total	$2,371.95
	Other Direct and Indirect Costs (15%)	$355.79
	Profit (10%)	$272.77
	Grand Total	$3,000.52
	Round up to nearest hundred	**$3,100**

Appendix B



NOTES:

1. The Vertical datum is based on PK & WASHER set in 1983 by NOAA.

   The Horizontal datum is based on PK & WASHER set in 1983 by NOAA.

   Mapped by AEROMAP U.S., Inc. from photography dated 7-12-1994 for UNWIN SCHEBEN KORYNTA HUETTL.

   This map conforms to National Map Standards as related to the project photo control for scales of 1"=100' or smaller.

   The vertical accuracy is approximately one half of the contour interval shown in any given area on the map. Contours in vegetated areas may be less accurate, contours in dense vegetation are likely to be less accurate.

2. Mapping taken from Chemical Data Aquisition Plan by Ecology & Environment (1993). Mapping believed to be sketched from aerial photography taken in 1985. Accuracy unknown.

3. Mapping taken from CRW Engineering Group, prepared by North Pacific Aerial Surveys, Inc., date of photography 10-22-85.

FILE: /usr3/corps/gambell/fg3_1.dgn TIME: 26-JAN-1995 0:14 JOB No. 2198.0...

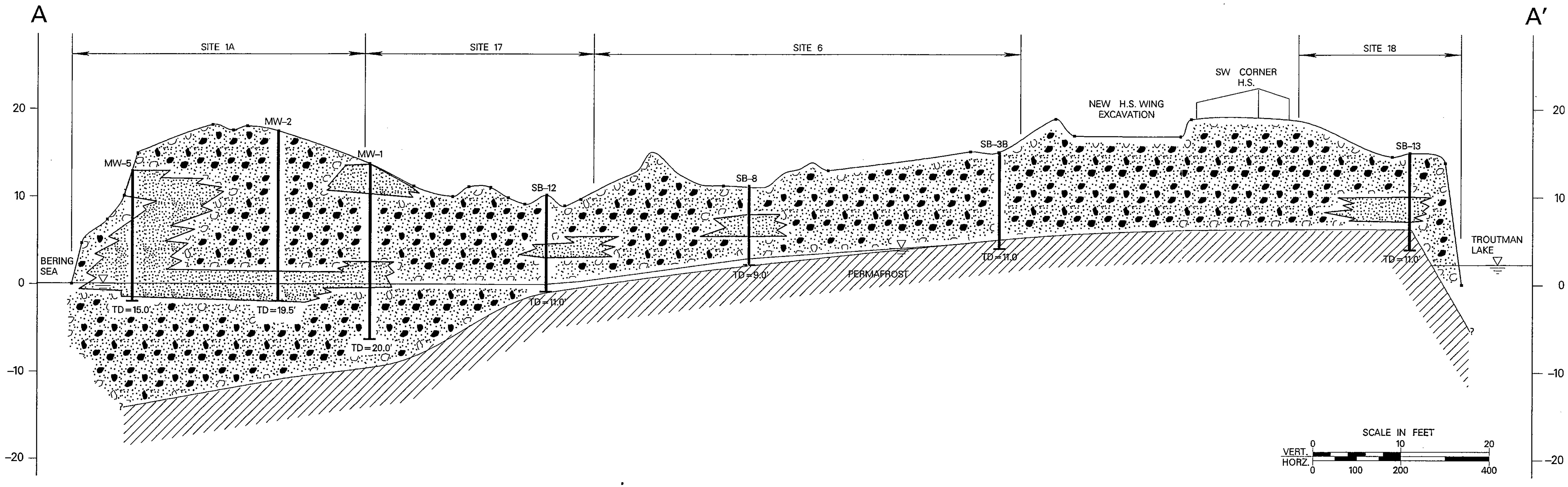
MONTGOMERY WATSON

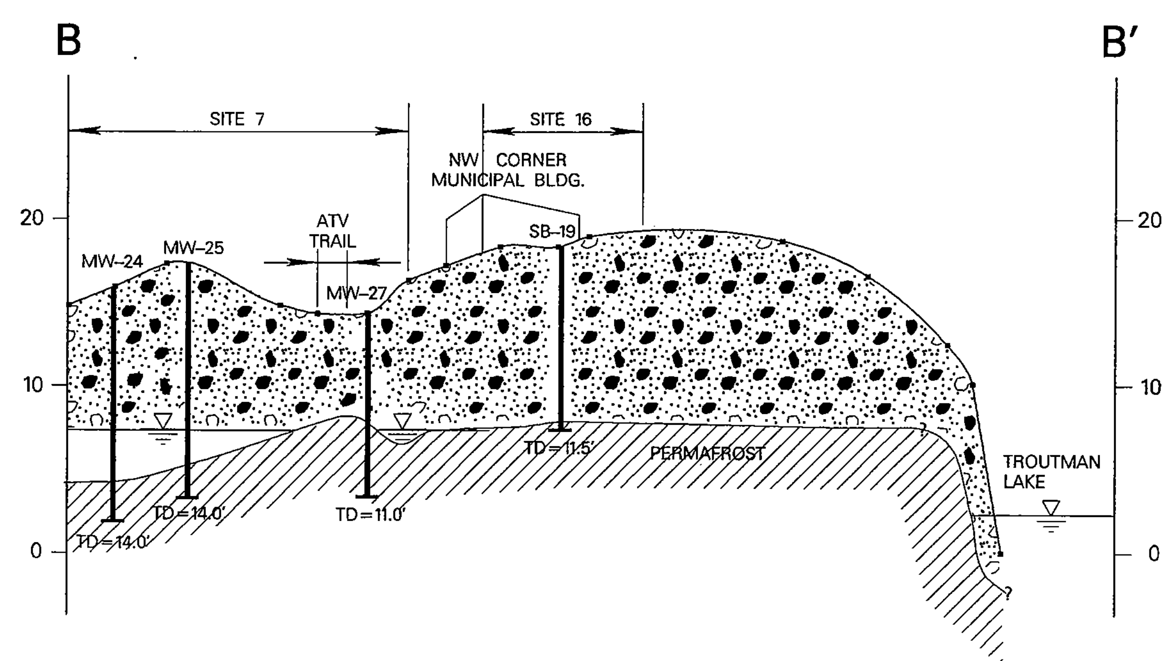
Anchorage, Alaska

FIGURE 3-1

ALASKA DISTRICT - CORPS OF ENGINEERS
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

GROUNDWATER CONTOURS AND CROSS SECTION LOCATIONS





SCALE IN FEET

VERT. 0 10 20

HORZ. 0 100 200 400

MW-27

SOIL BORING OR MONITORING WELL SHOWING TOTAL DEPTH

TD=11.0′

LEGEND

SP - POORLY GRADED SAND

GP - POORLY GRADED GRAVEL

PERMAFROST

WATER TABLE OR SURFACE WATER ELEVATION

FILE: /usr3/corps/gambell/fg3_2.dgn TIME: 26-JAN-1995 10:15 JOB No. 2198.02

MONTGOMERY WATSON

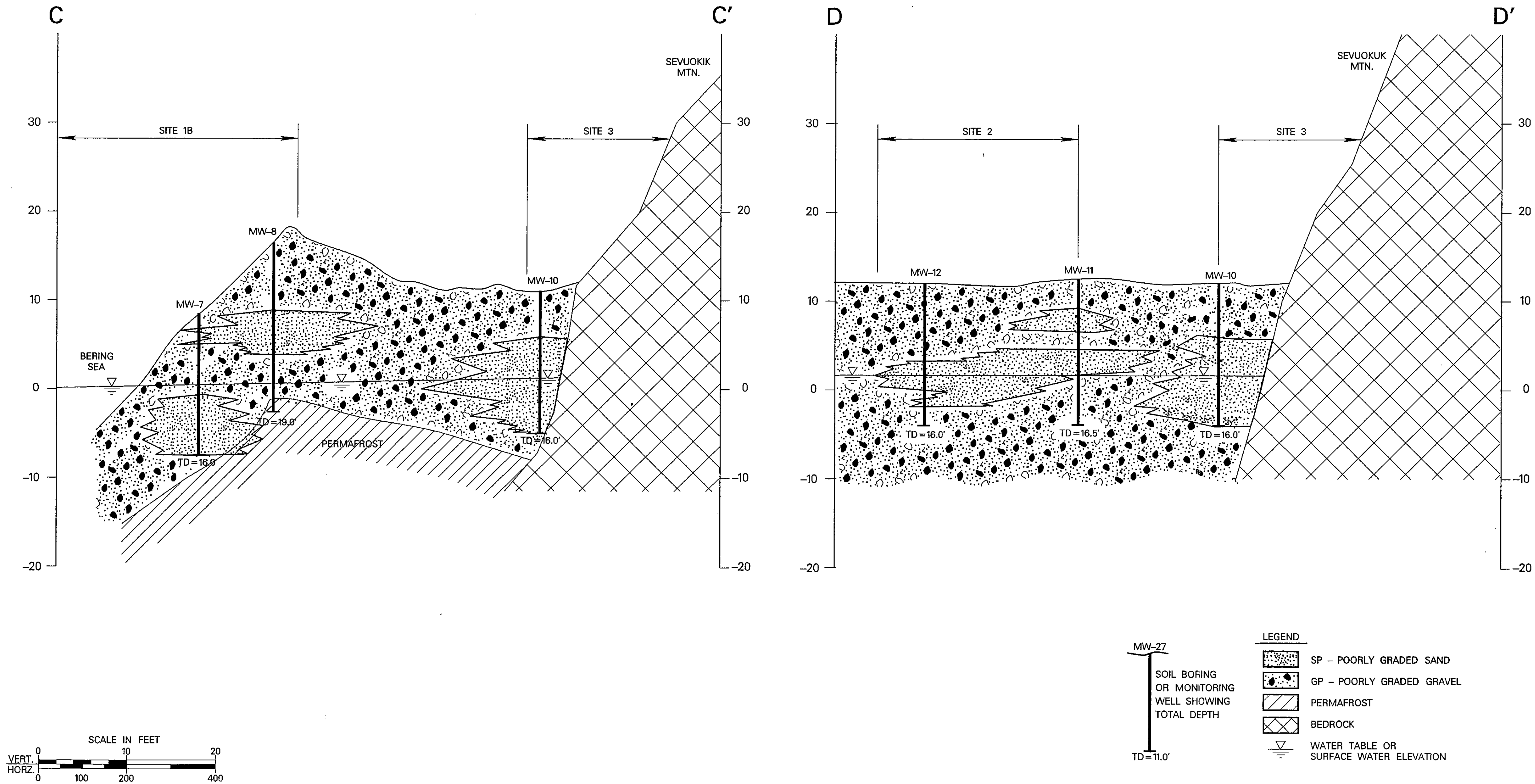
Anchorage, Alaska

FIGURE 3-2

ALASKA DISTRICT - CORPS OF ENGINEERS

GAMBELL, ST. LAWRENCE ISLAND, ALASKA

CROSS SECTIONS A-A′, B-B′ GAMBELL

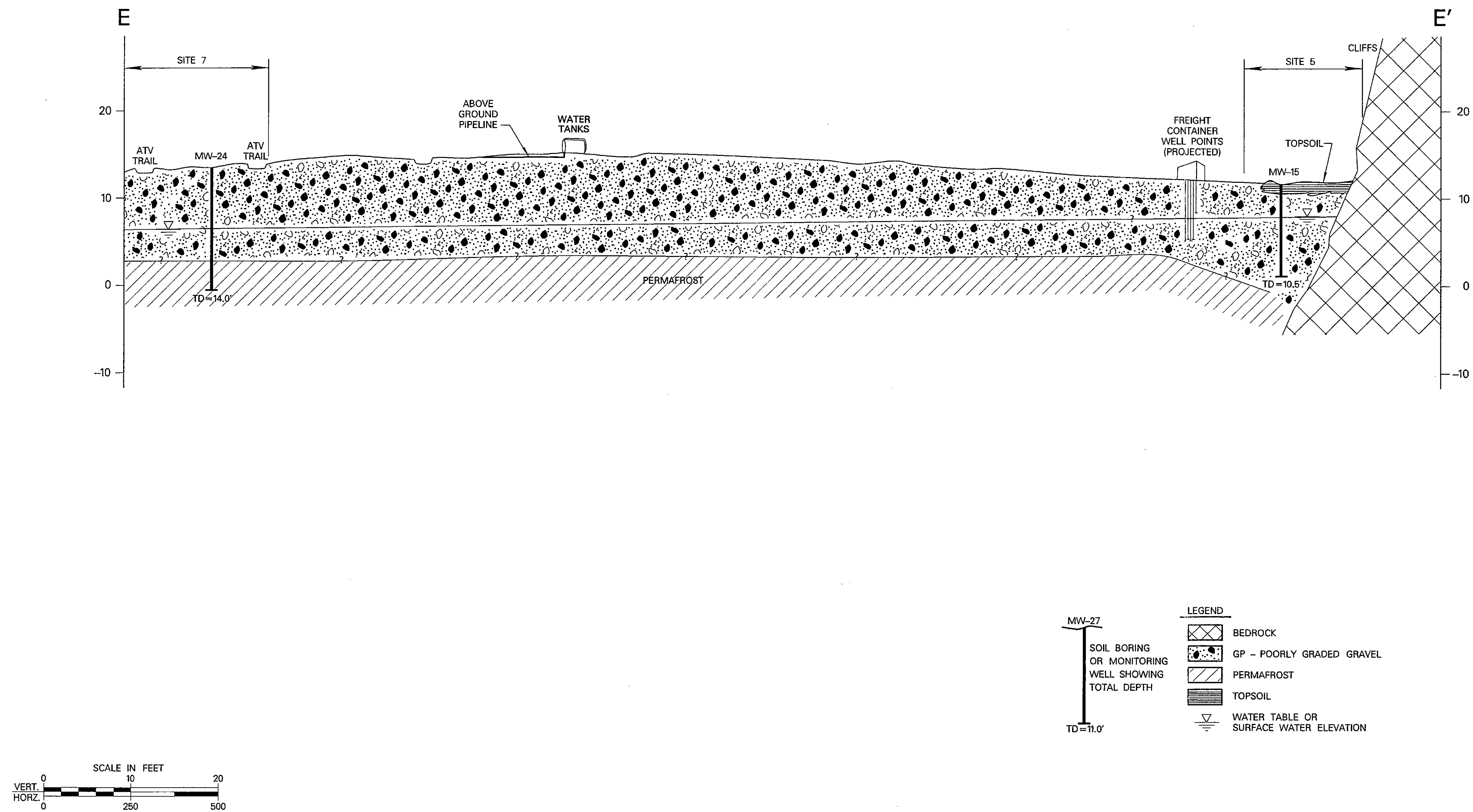


MONTGOMERY WATSON
Anchorage, Alaska

FIGURE 3-3

ALASKA DISTRICT - CORPS OF ENGINEERS
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

CROSS SECTIONS C-C', D-D'
GAMBELL



FILE: /usr3/corps/gambell/fg3_4.dgn TIME: 26-JAN-1995 10:20 JOB No. 2198.02...

MONTGOMERY WATSON

Anchorage, Alaska

FIGURE 3-4

ALASKA DISTRICT - CORPS OF ENGINEERS
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

CROSS SECTION E-E'
GAMBELL

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-6898

REPLY TO
ATTENTION OF:

April 19, 2004

Programs and Project Management Division
Civil Works Management Branch

«Title» «FirstName» «LastName»
«Company»
«Address1»
«City», «State» «PostalCode»

Dear «Title» «LastName»:

Three Final Reports were recently delivered to your local Information Repository. These reports are: 1) the Gambell NALEMP Removal Action Report submitted to the Corps by Montgomery Watson Harza (MWH); 2) the Gambell Feasibility Study for FUDS sites; and 3) the Final Human Health and Ecological Risk Assessment, Northeast Cape Installation, St. Lawrence Island, Alaska, submitted to the Corps by Montgomery Watson Harza (MWH). The NALEMP report describes the debris removal activities at Sites 6 and 7 that took place in Gambell last summer. The Feasibility Study evaluates alternatives for future remedial actions at selected sites in Gambell. The two-volume Risk Assessment at NE Cape is intended to evaluate potential impacts of site-related chemicals on public health and on the environment.

Since these reports are final, there is no formal review period. Nonetheless, the U.S. Army Corps of Engineers is interested to know whether you feel your previous comments have been fully addressed. Therefore, upon reading the document, if you believe the Corps has not satisfactorily responded to your concerns, please let me know. If you submitted written comments, a copy of your comments with a response is included. All comments will be supplied to the Information Repositories.

This letter has been furnished to the following RAB Members:

Mr. Alex Akeya
Ms. Peggy Akeya
Mr. Leonard Apangalook, Sr.
Mr. Paul Apangalook
Mr. Melvin Apassingok
Mr. Merle Apassingok
Mr. Jerome Apatiki
Ms. Lucy Apatiki
Mr. Jesse Gologergan

Ms. Linda Gologergan
Ms. Jeanette Iya
Ms. C. Jane Kava
Mr. Christopher Koonooka
Mr. Job Koonooka
Mr. Merlin Koonooka
Ms. June Martin
Ms. Pam Miller
Mr. George Noongwook
Mr. Conrad Oozeva
Mr. Jerry Reichlin
Mr. Paul Rookok, Sr.
Mr. Morris Toolie, Jr.
Ms. Viola Waghiyi
Mr. Kevin Zweifel

Call me at (907) 753-2689, or e-mail me at: carey.c.cossaboom@poa02.usace.army.mil, if you have any questions.

Sincerely,

Carey Cossaboom
Project Manager

G:\PM-P\FUDS Program\Carey\Gambell\RAB transmittal letter_3 Report Finals.doc
Merge with G:\PM-P\FUDS Program\Carey\NE Cape\RAB data source_Nov03

	Title	FirstName	LastName	Company	Address1	City	State	Comments	PostalCode
a.	Mr.	Alex	Akeya		P.O. Box 108	Savoonga	AK		99769
b.	Ms.	Peggy	Akeya		P.O. Box 192	Savoonga	AK		99769
c.	Mr.	Leonard	Apangalook, Sr.		P.O. Box 93	Gambell	AK		99742
d.	Mr.	Paul	Apangalook		General Delivery	Gambell	AK	Confirm mailing address	99742
e.	Mr.	Melvin	Apassingok		P.O. Box 91	Gambell	AK		99742
f.	Mr.	Merle	Apassingok		P.O. Box 182	Gambell	AK		99742
g.	Mr.	Jerome	Apatiki		P.O. Box 12	Gambell	AK		99742
h.	Ms.	Lucy	Apatiki		P.O. Box 138	Gambell	AK	ACAT	99742
i.	Mr.	Jeff	Brownlee	ADEC	555 Cordova St., 2nd Floor	Anchorage	AK		99501
j.	Mr.	Jesse	Gologergan		P.O. Box 105	Savoonga	AK	Confirm mailing address	99769
k.	Ms.	Linda	Gologergan		P.O. Box 1688	Nome	AK		99762
l.	Ms.	Jeanette	Iya	Savoonga IRA Building	P.O. Box 120	Savoonga	AK		99769
m.	Ms.	C. Jane	Kava		P.O. Box 154	Savoonga	AK	ACAT and Mayor of Savoonga	99769
n.	Mr.	Christopher	Koonooka		P.O. Box 123	Gambell	AK		99742
o.	Mr.	Job	Koonooka		P.O. Box 123	Gambell	AK		99742
p.	Mr.	Merlin	Koonooka		P.O. Box 67	Gambell	AK		99742
q.	Ms.	June	Martin	Alaska Community Action on Toxics	505 W. Northern Lights Blvd., #205	Anchorage	AK		99503
r.	Ms.	Pam	Miller	Alaska Community Action on Toxics	505 W. Northern Lights Blvd. #205	Anchorage	AK		99503
s.	Mr.	George	Noongwook		P.O. Box 81	Savoonga	AK		99769

REVIEW COMMENTS
Feasibility Study
Gambell, St. Lawrence Island, Alaska
DRAFT November 2003

REVIEWER
Morgan Apatiki
Resident
Gambell, Alaska 99742

ITEM	REF	COMMENTS
1.	1.2 Page 1 1.2.2 Page 4	The Work Plan, 2001 Supplemental Remedial Investigation, Gambell, St. Lawrence Island, Alaska. MWH Americas, Inc., September 2001, was not a complete performance, like the way it has been described in this work plan and from the locals perspectives stated in the following subsequent sections.
2.	1.2.3.1 Page 4 1.2.3.2 Page 5	Sites 4A and 4B had the oil drainages. Both had the intense smell of organics.
3.	1.2.3.3 Page 7	There are several things that happened during the MWH's soil borings in their proposed designated areas. 1. The Month of September was not appropriate to verify the 1999 analytical confirmation sampling results. It was the month of freezing level, at which time the frozen soils formed at 2 to 4 feet intervals below the subsurface. 2. The progress of the performances was impeded by obstructions of residential housings and mains of the community that had been built over the burial and contaminated-Sites. And obstructed by frozen soil. Most of the soil borings were conducted away from the proposed designated areas. Not all of the proposed 30 borehole, soil samplings were conducted.

ITEM	REF	COMMENTS
3.	Con't.	3. The groundwater level had degraded below the permafrost during the late month of September and elevated during fall season and come up to 4 feet below subsurface.
4.	1.2.3.4 Page 8	Site 7 is adjacent to Site 27, where massive oil spill occurs. The local eye-witness report states that the transformer fluids contained in metal 5 gallons containers were also spilled in this area. The construction crew member's report states that they had encountered saturated soil and organic on top of the permafrost about 10 to 12 feet below the subsurface. The soil boring conducted in this area was not to exceed no more than 7 feet below the subsurface. The investigative soil sampling performed by ACAT operation had found unidentified accumulation of petroleum products in this area. It was also identified and indicated in the NALEMP Project Work Plan. The above statements somehow could not be found and determined by Corps' Alaska District's Independent Contractors and Remedial Investigators.
5. GENERAL		Sites 8 and 12 are still new to the Feasibility Study and so are the rest of burial and contaminated Sites that are still intact and have never been determined hazardous. Locals are anticipated to this new reevaluation of the feasibility study.

REVIEW COMMENTS
GAMBELL FEASIBILITY STUDY

All sites in the Feasibility Study are used by residents and non residents alike. These sites are used, whether on occasion or by season, for subsistence activities. Some sites, like 4a and 4b, have ancient trails that lead to subsistence hunting areas. The trails are still utilized by the local residents and on occasion use the ground water for drinking.

1. Below 4a and 4b, there is evidence that the local residents of Gambell still utilize the ground water that runs off from Sevuokuk Mountain. There is a hose that captures the run off water and from this the residents haul water. The F.S. states that the ground water is an unlikely source of water. Some of the residents who haul water have no water and sewer in their homes and some just do not want tap water for their drinking water. These two sites pose a potential human health hazard to those that haul water from below these two sites.

2. The F.S. states that this site does not pose an acceptable risk to the community and that no further work is recommended for Site 6. This site is considered for future development, mainly homes for the growing population of Gambell. In the summer of 1999, OSCI removed the surface debris and in the summer of 2000, MWH removed some, not all, of the buried debris. According to the geophysical survey done by Golder Associates in the summer 2000, there still remains some buried debris at this site. This site should be considered for remedial actions in the future.

3. The area in Site 7 may be considered for future development. The F.S. recommends that no further work for this site. Although this site does not pose an unacceptable risk to the community, this site should be considered for long term monitoring.

4. Site 8 has a well established road and trail system and so receives a large amount of traffic. The F.S. states that 1,820 feet of matting still remain on this site. In the summer of 1999, OSCI removed approximately 4,500 feet of matting. The remaining matting was not removed because of buried electrical wiring. With proper supervision, the remaining matting could be removed. This remaining matting poses a real and present hazard to the large amount of traffic it receives. The F.S. also states that there is small arms rounds remaining in approximately 100 cubic yards of soil. These rounds, if exposed, pose a potential physical hazard as subsistence hunters use the area year round.

REVIEW COMMENTS
GAMBELL FEASIBILITY STUDY

5. The two areas in site 12 are utilized by subsistence hunters, especially in the spring. Water fowl and migratory birds are known to frequent the two areas in this site. The F.S. states that 3 surface soil samples were collected from Site 12 and that Total Recoverable Petroleum Hydrocarbons were detected at concentrations ranging from 22 to 75 mg/kg. DRO was also detected in the surface water at a concentration of 0.006 mg/L.

   2001 sample results for total chromium exceeded the 26 mg/kg level for ADEC Method 2 migration to ground water clean up level. Lead level found in 2001 samples results also exceeded the residential clean up level of 400 mg/kg. A Remedial Action Objective was made for this site which stated: Prevent surface soil from continuing to act as a source of lead contamination to human and ecological receptors. The lead contamination on this site poses as a real and present hazard to the community of Gambell.

Cossaboom, Carey C POA02

From: Rjscrudato@aol.com

Sent: Sunday, August 29, 2004 05:59 AM

To: Cossaboom, Carey C

Cc: Geist, Lisa K

Subject: Gambell Feasibility

Carey/Lisa:

I have previously commented on the Gambell feasibility study and those comments are attached.

One factor I believe requires attention is the frequency of monitoring that will be conducted at each of the Gambell sites in particular the groundwater monitoring wells related to the municipal water supply system.

I believe the "standard" monitoring protocol calls for a five year cycle; I suggest a far more frequent monitoring program be established, once per year, for select Gambell sites particularly for the areas in the vicinity of the municipal water supply infiltration gallery and the area near the school since there is incomplete understanding of the hydrology of those areas.

Morgan Apatiki also raised a valid issue and questioned whether there may be long term contaminant implications related to the variations in the permafrost and the effects of global warming relative to the future release and migration of contaminants as well as effects on the hydrology in the Gambell area as the permafrost is modified by climatic changes.

Look forward to seeing you on SLI on the 9th.

Ron Scrudato