SUMMARY REPORT
Phase III Remedial Investigation
Northeast Cape, St. Lawrence Island, Alaska

FINAL

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ARAR	applicable or relevant and appropriate requirements
AST	aboveground storage tank
BDDR	building demolition and debris removal
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CON/HTW	containerized hazardous or toxic waste
cy	cubic yards
DERP	Defense Environmental Restoration Program
DRO	diesel range organics
FUDS	Formerly Used Defense Sites
GRO	gasoline range organics
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOC	Main Operations Complex
MW	monitoring well
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PL	Public Law
POL	petroleum, oil, and lubricants
RBCL	risk-based cleanup level
RI	Remedial Investigation
RRO	residual range organics
SARA	Superfund Amendments and Reauthorization Act
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USAED	United States Army Engineer District, Alaska
USC	United States Code
VOC	volatile organic compounds
WACS	White Alice Communications System
WP	well point
°F	degrees Fahrenheit

1.0 INTRODUCTION

Pursuant to Contract No. DACA85-98-D-0007, the United States Army Engineer District, Alaska (USAED), contracted with MWH, formerly Montgomery Watson, to perform Phase III Remedial Investigation (RI) activities at Northeast Cape, St. Lawrence Island, Alaska. The RI was conducted according to the guidelines of the Defense Environmental Restoration Program (DERP) of the United States Department of Defense. This document presents the findings of the Phase III RI performed for selected sites at Northeast Cape.

This Summary Report (Report) consists of a text volume and two volumes of appendices, as described below. The text includes the following four sections.

- Section 1 Introduction – Presents a project description, including a summary of data objectives and regulatory criteria and a brief history of operations and previous investigations at Northeast Cape.
- Section 2 Investigation Objectives, Activities, and Results – Presents brief site descriptions and environmental data collected during the investigation.
- Section 3 Conclusions and Recommendations – Includes a summary of investigation results from 2001 and 2002, and recommendations for future site work.
- Section 4 References – Lists the documents cited in this report.

Volume I of the appendices includes:

- Appendix A Field Notes and Field Note Forms
- Appendix B Sample Plan Checklist, Chain-of-Custody Forms, and Lab Receipts
- Appendix C Field Photographs
- Appendix D Analytical Data Tables

Volume II of the appendices includes:

- Appendix E Chemical Data Quality Review
- Appendix F Quality Assurance/Quality Control Report
- Appendix G USACE Trip Report – Biological Sampling
- Appendix H Site Survey Data
- Appendix I Geotechnical Lab Test Report
- Appendix J Environment and Natural Resources Institute Taxonomic Report (Plant Report)
- Appendix K Estimate of Contaminated Soil Volume

1.1 PROJECT OBJECTIVES AND ACTIVITIES

There were two reasons why the Phase III RI was necessary. The first was that the extent of contamination had not been adequately defined during previous investigations for risk assessments and feasibility studies at some sites. The second was that the White Alice

Communications System (WACS) became eligible for investigation and cleanup under the DERP-Formerly Used Defense Sites (FUDS) program. Although the Northeast Cape WACS had been investigated in the past, additional data is needed to evaluate the installation.

The focus of the 2001-2002 Phase III RI fieldwork was to collect sufficient soil, sediment, surface water, groundwater, fish tissue, and plant tissue samples at selected Northeast Cape installation sites to achieve the following:

- Evaluate the volume, including depth and areal extent, of contaminated soil/sediment at Sites 6, 13, 15, 19, 21, 22, 27, 28, 29, 31, 32, 33, and 34.
- Investigate the presence or absence of contamination at Sites 3, 4, 7, 16, 22, 24, and 26.
- Assess whether Sites 7 and 9 meet Alaska Department of Environmental Conservation (ADEC) criteria for landfill closure.
- Characterize background concentrations of organic and inorganic analytes in gravel soil, tundra soil, sediment, and groundwater.
- Perform hydrologic characterization studies for Sites 3, 4, 6, 7, 9, 28, and the Main Operations Complex (MOC – Sites 13, 15, 19, 20, and 27).
- Evaluate background concentrations of various site contaminants in fish and plants.
- Gather data to be used in the Human Health and Ecological Risk Assessment

At the request of the USAED, alternate cleanup levels or risk-based cleanup levels (RBCLs) are not proposed in this Report.

1.2 REGULATORY SETTING

Work was performed under the DERP-FUDS program. Authority for DERP-FUDS is derived from the following legislation:

- The Comprehensive Environmental Restoration Compensation, and Liability Act of 1980 (CERCLA), Public Law (PL) 96-510, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, PL-99-499 (codified as 42 United States Code [USC] 9601-9675)
- Environmental Restoration Program, 10 USC 2701-2707

The Phase III RI for Northeast Cape is being performed following the CERCLA process and procedures. In accordance with CERCLA, the Alaska State Oil and Other Hazardous Substance Pollution Control Regulations (18 Alaska Administrative Code [AAC] 75) that govern the cleanup of contaminated sites in Alaska were identified as Applicable and Relevant or Appropriate Requirements (ARARs) for Northeast Cape. The following regulations and standards are relevant to the characterization and cleanup of the Northeast Cape installation:

- **Soil Cleanup Criteria –** 18 AAC 75 provides four options for determining appropriate soil cleanup criteria. In earlier phases of the investigation, Method 1 criteria were used to support recommendations for no further action where contaminant concentrations in soil fell below the Method 1 ADEC matrix levels for petroleum and Table B2 levels for petroleum constituents. For sites where petroleum concentrations exceeded Method 1 levels, the

cumulative risk was assessed in accordance with Method 2 procedures. If the cumulative risk exceeds the Method 2 criteria, site-specific information and risk assessment data are used to develop cleanup criteria in accordance with the Method 4 procedures for site-specific risk assessment. Once negotiated and accepted, the RBCLs will be used in the Feasibility Study to identify and evaluate remedial options.

- **Groundwater Cleanup Criteria** – Numerical cleanup criteria for groundwater that is a future or future potential drinking water source are identified in 18 AAC 75.345, Table C. Additionally, 18 AAC 75.345 requires that groundwater that is closely hydraulically connected to surface water may not cause a violation of the water quality standards in 18 AAC 70 for surface water or sediment. Additional modifying conditions are identified.

  At this time, ADEC considers the groundwater at Northeast Cape to be a reasonably expected potential future drinking water source.
- **Surface Water and Sediment Cleanup Criteria** – 18 AAC 75.345 identifies the water quality criteria in 18 AAC 70 as applicable when evaluating surface water and sediment cleanup criteria

Cleanup of soil, groundwater, surface water, and sediments is performed in order to protect public health and the environment. Cleanup of these media to established standards is designed to result in the reduction of site contaminants in vegetation, fish, and wildlife.

ADEC is involved in the review and approval of all work plans, site work, and reports for the installation.

1.3 SITE DESCRIPTION

Northeast Cape is approximately 9 miles west of the northeastern cape of St. Lawrence Island, between Kitnagak Bay to the northeast and Kangighsak Point to the northwest. The Kinipaghulghat Mountains bound the southern portion of the site. St. Lawrence Island is located in the Bering Sea near the territorial waters of Russia, approximately 135 air miles southwest of Nome. Northeast Cape is accessible by boat, aircraft, or all terrain vehicle (Figures 1-1 and 1-2).

Northeast Cape was used by the military from the early 1950s until 1975. The surveyed location is 63°19'60" North, 168°58'26" West. Individual sites at Northeast Cape are shown on Figure 1-3. A summary of environmental issues identified in various media at the sites included in the Phase III RI is presented in Table 1-1.

1.4 SITE HISTORY AND PREVIOUS INVESTIGATIONS

Site history and previous investigation information provided in this Report have been summarized from previous Northeast Cape documents. Documents providing results of field investigations, chemical sampling and analyses, and quality assurance/quality control activities performed during previous investigations include:

- Removal Action Report for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program Northwest Area, White Alice Site, Northeast Cape, St. Lawrence Island, Alaska. URS Corporation. May 1991.

Table 1-1
Northeast Cape FUDS Summary of Environmental Issues at Phase III RI Sites

Site	Source(s) of Contamination	Contamination Confirmed?[1]	Contaminant(s) of Concern[2]	Contaminated Media[3]	Status[4]
3 – Fuel Line Corridor and Pumphouse	Former ASTs, former fuel line,	Yes	DRO, RRO	Soil, groundwater	HHRA, ERA
	ACM, LBP (removed)	No	Asbestos, lead	NA	Removed
4 – Subsistence Fishing and Hunting Camp	Former abandoned vehicles, former ASTs	Yes	DRO, RRO	Soil, groundwater	HHRA, ERA, BD/DR
6 – Cargo Beach Road Drum Field	1,500 former POL drums, battery	Yes	DRO, RRO, metals	Soil, sediment	HHRA, ERA, BD/DR
7 – Cargo Beach Road Landfill	Former drums, batteries; current, exposed landfilled materials	Yes	DRO, RRO, PCBs, metals	Soil	HHRA, ERA, BD/DR
		Yes	RRO, metals	Groundwater	HHRA, ERA
9 – Housing and Operations Landfill	Landfilled materials	Yes	DRO, RRO, metals	Tundra soil, sediment, groundwater	HHRA, ERA, BD/DR
13 – Heat and Electrical Power Building	Former diesel USTs and ASTs, transformers, generators, piping	Yes	DRO, GRO, PAHs	Soil, groundwater	HHRA[5], HSR
	ACM, LBP (scheduled for removal 2003/2004)	Yes	Asbestos, lead	Building and/or surface materials	BD/DR
14 – Emergency Power/Operations Building	Former AST and transformers	Yes	PCBs	Soil	HSR
	ACM, LBP	Yes	Asbestos, lead	Building and/or surface materials	BD/DR
15 – Buried Fuel Line Spill Area	Diesel release from fuel line	Yes	DRO, RRO	Soil, groundwater	HHRA[5] pending confirmation sampling results (Foster Wheeler)
16 – Paint and Dope Storage Building	Abandoned containers, former AST	Yes	None	Soil	HHRA[5]
		Yes	None	Groundwater	HHRA[5]
	ACM, LBP (removed)	No	Asbestos, lead	NA	Removed

Table 1-1
Northeast Cape FUDS Summary of Environmental Issues at Phase III RI Sites
(continued)

Site	Source(s) of Contamination	Contamination Confirmed?[1]	Contaminant(s) of Concern[2]	Contaminated Media[3]	Status[4]
19 – Auto Maintenance and Storage Facilities	Former ASTs, smudge pots, aircraft washing powder Work and storage areas	Yes	DRO, GRO, chromium	Soil, groundwater	HHRA[5], HSR, CON, HTW BD/DR scheduled 2003/2004
	ACM, LBP	Yes	Asbestos, lead	Building and/or surface materials	BD/DR
21 – Wastewater Treatment Facility	Wastewater treatment effluent	Yes	DRO, metals	Tundra soil	HHRA, ERA
	ACM, LBP (scheduled for removal 2003/2004)	Yes	Asbestos, lead	Building and/or surface materials	BD/DR
22 – Water Wells and Water Supply Building	Former diesel engine, UST, AST; cans of asbestos cement,	Yes	RRO	Soil, groundwater	HHRA, ERA
	ACM, LBP (removed)	No	Asbestos, lead	NA	Removed
24 – Receiver Building Area	Buried and scattered drums	Yes	DRO, metals	Soil, groundwater	Removed
	ACM, LBP (removed)	No	Asbestos, lead	NA	Removed
26 – Former Construction Camp Area (Well #4)	Unknown	No	None	None	NFA
27 – Diesel Fuel Pump Island	Diesel release from a former fuel pump and fuel line, buried drums	Yes	DRO, GRO, benzene	Soil, groundwater	HHRA[5]
28 – Drainage Basin	Sites 10-20, 27	Yes	DRO, RRO, PAHs, metals	Soil, sediment, surface water, groundwater	HHRA, ERA
		Yes	PCB, PAHs, metals	Fish, plants	HHRA, ERA
29 – Suqitughneq River	Upgradient sites, especially Site 28	Yes	DRO, metals	Sediment	HHRA, ERA
		Yes	PCBs, metals	Fish	HHRA, ERA

Table 1-1
Northeast Cape FUDS Summary of Environmental Issues at Phase III RI Sites
(continued)

Site	Source(s) of Contamination	Contamination Confirmed?[1]	Contaminant(s) of Concern[2]	Contaminated Media[3]	Status[4]
30 -- Background	None	Not applicable	None	None	Not applicable
31 – White Alice Site	Former transformers, ASTs	Yes	DRO, RRO, PCBs	Soil	HHRA, ERA
	ACM, LBP	Yes	Asbestos, lead	Building and/or surface materials	BD/DR scheduled 2003/2004
32 – Lower Tram Terminal	Former transformers, AST, tram cables	Yes	DRO	Soil	HHRA, ERA
	ACM, LBP (scheduled for removal 2003/2004)	Yes	Asbestos, lead	Building and/or surface materials	BD/DR scheduled 2003/2004
33 – Upper Tram Terminal	Tram cables	Yes	DRO	Soil	HHRA, ERA
	ACM, LBP (scheduled for removal 2003/2004)	Yes	Asbestos, lead	Building and/or surface materials	BD/DR scheduled 2003/2004
34 – Upper Camp	Former drum dump, transformer, AST	Yes	DRO	Soil	HHRA, ERA
	ACM, LBP (scheduled 2003/2004)	Yes	Asbestos, lead	Building and/or surface materials	BD/DR scheduled 2003/2004

Key:

[1]Contamination attributable to a military source in soil, sediment, surface water, or groundwater found at concentrations exceeding Tier I screening criteria. Building materials and surface coatings on building materials are listed if they contain regulated levels of ACM, LBP, or PCBs.
[2]Consists of environmental issues remaining after pre-Phase III RI removal actions (i.e., remaining as of December 31, 2002).
[3]Building materials and surface coatings on building materials are listed if they contain regulated levels of ACM, LBP, or PCBs.
[4]The activities listed in the status column include work performed during 2000 through 2002, and risk assessment activities.
[5]Ecological risk assessment is not planned because the habitat value is considered too low to warrant quantitative ecological risk assessment.

ACM	= asbestos-containing material	LBP	= lead-based paint
AST	= aboveground storage tank	NA	= not applicable
BDDR	= building demolition and debris removal[6]	NFA	= no further action
CON-HTR	= containerized hazardous, toxic waste	PAHs	= polynuclear aromatic hydrocarbons
DRO	= diesel range organics	PCBs	= polychlorinated biphenyls
ERA	= environmental risk assessment[7]	POL	= petroleum, oil, and lubricants
FUDS	= formerly used defense site	RI	= Remedial Investigation
GRO	= gasoline range organics	RRO	= residual range organics
HHRA	= included in human health risk assessment	UST	= underground storage tank
HSR	= Hot-spot removal[8]	VOC	= volatile organic compound

[6]BDDR includes removing debris not associated with building demolition (tanks, drums, etc.) and HSR; no risk assessment activities are planned for contaminants slated for BD/DR
[7]ERA included in environmental risk assessment
[8]HAS; consists of excavating and removing limited areas of stained soil; no risk assessment activities are planned for HSR contaminants.

- Final Report, Site Inspection for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program Northwest Area, White Alice Site, Northeast Cape, St. Lawrence Island, Alaska. Shannon & Wilson. May 1991.
- Preliminary Assessment Report, Naval Ocean Systems Center Special Areas, Alaska. Naval Energy and Environmental Support Activity. July 1991.
- Revised Site Inspection Final Report, White Alice Site, Northeast Cape, St. Lawrence Island, Alaska. URS Corporation. April 1992.
- Site Inventory, Northeast Cape, St. Lawrence Island, Alaska. Ecology and Environment. December 1992.
- Chemical Data Acquisition Plan, Site Inventory Update, Northeast Cape, St. Lawrence Island, Alaska. Ecology & Environment. February 1993.
- Remedial Investigation, Northeast Cape, St. Lawrence Island, Alaska. Montgomery Watson. January 1995.
- Building Demolition and Debris Removal Technical Memorandum, Northeast Cape, St. Lawrence Island, Alaska. Montgomery Watson. January 10, 1995.
- Remedial Action Alternatives Technical Memorandum, Northeast Cape, St. Lawrence Island, Alaska. Montgomery Watson. November 1995.
- Engineering Evaluation/Cost Analysis, Northeast Cape, Alaska. Montgomery Watson. April 1996.
- St. Lawrence Island Investigation HTW Activities Summary. Montgomery Watson. September 18, 1997.
- Phase II Remedial Investigation, Northeast Cape, St. Lawrence Island, Alaska. Montgomery Watson. August 1999.
- Phase II Remedial Investigation Report Addendum, 1999 Fieldwork, Northeast Cape, Alaska. Montgomery Watson. June 2000.
- Building Composite Sampling and Asbestos Survey Technical Memorandum, Northeast Cape, Alaska. Montgomery Watson. December 2000.
- Work Plan, Phase III Remedial Investigation, Northeast Cape, St. Lawrence Island, Alaska. Final. Montgomery Watson. August 2001.
- Biological Sampling Plan. 2001 Phase III Remedial Investigation. Northeast Cape, St. Lawrence Island, Alaska. Montgomery Watson. August 2001.
- Site Characterization Technical Memorandum. 2002 Phase III Remedial Investigation, Sites 13, 15, 19, 22, and 27. Northeast Cape, St. Lawrence Island, Alaska. MWH. October 2002.

RIs have been conducted at Northeast Cape since 1994. During the Phase I RI, sampling results from the investigated sites were compared to conservative benchmark criteria to identify sites at which further evaluation would be necessary. Several sites were removed from further consideration because contamination was not present, was present at concentrations below benchmark criteria, or site-specific criteria showed no elevated risk to human health or the environment.

Phase II RI work was conducted at Northeast Cape sites to fill data gaps identified during review of Phase I RI work, to support assessment of remedial alternatives, and to support future work at the site. Phase II RI work included posting danger signs, cutting wire, conducting radiological and asbestos surveys, environmental sampling, evaluating gravel borrow areas, removing containerized hazardous or toxic wastes (CON/HTW), identifying polychlorinated biphenyls (PCBs) and lead in paint and building materials, and performing ecological sampling and assessment.

Work performed during the 2000 field season at Northeast Cape included building demolition and debris removal (BD/DR), removal of CON/HTW, and sampling building materials as reported in a Technical Memorandum dated December 2000 (Montgomery Watson, 2000b).

Phase III field work performed in 2001 and 2002 and detailed in this Report included sampling surface water, groundwater, sediment, surface and subsurface soils, vegetation, and fish. Phase III RI work was intended to fill data gaps, confirm previous results, and provide data for updated Human Health and Ecological Risk Assessments.

1.5 ENVIRONMENTAL SETTING

The physical setting at Northeast Cape is described in this section. The information presented was summarized from the detailed site setting information provided in the Phase I RI Report (Montgomery Watson, 1995), Phase II RI Report Addendum (Montgomery Watson, 2000a), and Preliminary Conceptual Site Model, St. Lawrence Island, Alaska Northeast Cape FUDS (USACHPPM, 2001).

1.5.1 Climate

St. Lawrence Island has a cool, moist, subarctic maritime climate with some continental influences during winter, when much of the Bering Sea is capped with pack ice. Winds and fog are common; precipitation occurs approximately 300 days per year as light rain, mist, or snow. Annual snowfall is about 80 inches per year. Annual precipitation is about 16 inches per year, and more than half falls as light rain between June and September. Summer temperatures average between 48 and 34 degrees Fahrenheit (°F), with a record high of 65°F. Winter temperatures range from minus 2°F to 10°F, with an extreme low of -30°F (URS, 1985). Freeze-up normally occurs in October or November, and break-up normally occurs in June.

The wind is generally from a northerly to northeasterly direction from September to June, and southwesterly in July and August. Winds exceeding 10 knots occur 70 percent of the time, and average 20 knots in winter months. The average wind speed is 18 miles per hour (USKH, 1993). Gusts in the Northeast Cape area have been measured as high as 110 miles per hour.

1.5.2 Topography

The site consists mainly of flat coastal plains, which gradually turn into rolling tundra towards the base of the Kinipaghulghat Mountains. The Kinipaghulghat Mountains rise abruptly to a maximum elevation of approximately 1,800 feet above sea level about 2 miles south of the

installation. Most of the installation is at an elevation of 20 to 80 feet above mean sea level. The White Alice area is located in an upland area near the Kinipaghulghat Mountains.

1.5.3 Geology

St. Lawrence Island consists of isolated bedrock highlands of igneous, metamorphic, and older sedimentary rocks surrounded by unconsolidated surficial deposits overlying a relatively shallow erosional bedrock surface. In the immediate installation vicinity, shallow unconsolidated surficial materials overlie quartz monzonitic rocks of the Kinipaghulghat Pluton (Patton and Csejtey, 1980). The Pluton forms the mountainous area south of the installation, which includes Kangukhsam Mountain. Immediately south of the installation, an unnamed drainage in the Kinipaghulghat Pluton has created an erosional valley and alluvial fan of unconsolidated sediments. The primary areas of this investigation are located on this alluvial fan, which progrades north from the mountain front toward the Bering Sea. Granitic bedrock materials are exposed at the coast north of the installation at Kitnagak Bay, suggesting that quartz monzonitic bedrock underlies the unconsolidated materials at a relatively shallow depth on a wave-cut erosional platform.

The unconsolidated alluvial materials exhibit a soil profile in areas that have not been disturbed by man. In general, native soil stratigraphy at the site is characterized by silts near the surface, overlying more sand-dominated soils at depth. The silt may contain varying quantities of clay/sand/gravel, and range from zero to 10 feet in thickness. The silt is dark brown to dark green, and sometimes exhibits a mottled texture. In some areas, the silt exhibits an aqua green or blue color. Dark brown silts are observed in outcrops. The sand at depth contains varying degrees of silt/gravel/cobbles and may vary from 2 to greater than 20 feet thick. These deeper, coarse-grained materials are generally unsorted and are likely to be of glaciofluvial origin. The depth to bedrock at the installation is unknown.

1.5.4 Background Concentrations of Naturally-Occurring Constituents

The presence of naturally occurring inorganics, such as metals, is well documented in soils in Alaska, especially in areas with a volcanic origin such as St. Lawrence Island. Metals such as arsenic, chromium, and lead are present in areas that have had little or no human presence throughout the state. Samples at Northeast Cape collected to characterize background were designated 'Site 30' and are discussed in greater detail in Section 2.1.15. A statistical evaluation of background concentrations at Northeast Cape is currently underway and will be used in the Risk Assessment as well as the Feasibility Study in order to determine the contribution of naturally-occurring inorganic materials at the installation.

1.5.5 Hydrogeology

Because of the relatively remote and undeveloped nature of St. Lawrence Island, there is little data on the regional groundwater regime. The primary aquifer at the Northeast Cape installation is the unconsolidated alluvial material and fractured bedrock that underlies all of the installation, and may transmit large quantities of groundwater periodically or throughout the year.

Select regions of the bedrock, such as the extensive talus field (broken blocks of rock) at the tramway and upper camp extending off of Kinipaghulghat Mountain, are likely capable of transmitting large volumes of groundwater. It is also likely that runoff from the bedrock mountain also permeates into the highly fractured rubble and associated fractures that form the talus along the mountain flank and thereby contributes to the groundwater budget of the overlying glacial deposits. Surface and groundwater drainage from the Kinipaghulghat Mountain may well be an important source of shallow and deeper groundwater to the downgradient sites at the Northeast Cape.

The mountainous area south of the installation provides an ideal recharge area for the unconsolidated materials, providing runoff from rain and snowmelt during the summer months. Based on the topography and geology of the installation, the regional, deep groundwater flow direction is expected to be from the mountainous recharge area south of the installation, flowing north and eventually discharging to the Bering Sea.

The facilities at Northeast Cape apparently used deep groundwater as a water supply. There were four production wells at Sites 22 and 26, designated Wells 1 through 4 (E&E, 1993a). Production wells used to supply the installation were drilled to a depth of 50 to 70 feet before reaching fractured, granitic bedrock capable of transmitting enough water to supply the camp.

According to a report by the U.S. Army Engineer District, Alaska titled "Report of Foundations and Materials Investigations Airmen's Dormitory Northeast Cape AFS" (August 12, 1963), a 70 foot water supply well (Water Supply Well No. 4) was drilled adjacent to the southerly side of the Water Storage Building at an elevation of 99 feet above sea level. (Note this water well appears to be labeled Well No. 1 on as-built drawings). Water Supply Well No. 4 encountered overburden to a depth of 39 feet, and bedrock granite or granodiorite below this depth. The aquifers are fracture zones in bedrock at depths of 51 to 56 feet and 62 to 65 feet. No visible frozen formations were reported during the drilling. Water in limited amounts occurred in the overburden at a depth of 30.5 feet.

In addition, during the drilling of Water Supply Well No. 5 (a 68-ft water well just inside the northerly corner of the Lower Tramway Terminal addition, approximately 392 feet elevation) overburden was encountered to a depth of 33 feet and bedrock granite or granodiorite below this depth. The overburden is logged as a mixture of silt, sand, gravel, and boulders. The aquifers are again fracture zones in bedrock at depths of 55-57 feet and 64-65 feet, similar to Water Supply Well No. 4. Water in limited amounts was encountered in the overburden at a depth of 16 to 18 feet. No visibly frozen formations were reported during the drilling.

The bedrock aquifer may be connected to the confined overburden aquifer hinted at by a boring near the Suqi River. According to Corps of Engineers maps (dated 10 November 1950) at a drill hole (DH-53) immediately west of Cargo Beach Road and adjacent to the Suqitughneq, artesian water (estimated flow 4 gal/min over top of casing) was encountered beneath a hard, packed silt layer at 18-20 feet below ground surface. This boring was located at an elevation of 38.2 feet above sea level, and extended to a depth of 35 feet.

Groundwater was encountered in the Main Complex potable water wells between 22 and 30 feet below the top of the steel casing in July 2001, when they were decommissioned. Little is known

about the capacity, construction characteristics, or method of abandonment of these wells. A driller's log is available for one of the wells, indicating "coarse sand (water)" at a depth of 9 to 28 feet, underlying silty surficial deposits, and clean gravel and sand from a depth of 28 to 32 feet.

The use of four wells and accompanying storage tanks may indicate that groundwater was not always available in the same quantities throughout the year. Evidence of artesian flow was observed in a soil boring near the Suqitughneq River, which indicates that some areas may be overlain by impermeable layers such as permafrost or hardpan silts.

There is insufficient data to determine whether this deep aquifer is continuous or not throughout the Northeast Cape area. It is suspected that the deep groundwater consists of pockets of groundwater interspersed within an intermittent permafrost layer.

At the installation, shallow subsurface water has been observed intermittently across the installation to a depth of 15 feet over the course of the investigations conducted during the past 8 years. The shallow, intermittent subsurface water is suspected to consist of seasonally-thawed water within the active layer of the shallow soils that is intermittent both spatially and temporally.

At present, there is insufficient information to determine whether the shallow intermittent subsurface water is hydraulically connected to the deep groundwater. A key factor influencing the flow of groundwater at the installation is the existence of permafrost and frozen soils, which can render the unconsolidated materials effectively impermeable. The United States Geological Survey has classified St. Lawrence Island as an area of "moderately thick to thin permafrost." Although the depth of permafrost at St. Lawrence Island is unknown, the base of permafrost on the mainland at Nome (135 air miles to the northeast) is estimated to be at a depth 120 feet (Ferrians, 1965). The deeper unconsolidated deposits at the installation are probably permanently frozen, and the shallow soils observed during this investigation represent the active layer where soils are thawed only during portions of the year. Frozen soils are expected to have a profound effect in retarding groundwater flow both vertically and horizontally during most of the year.

1.5.6 Hydrology

Other than the Bering Sea north of the Northeast Cape facility, surface water in the vicinity of the installation consists of marshy areas, small streams, and small- to moderate-sized lakes that are often ephemeral. Surface water generally flows from the highland area south of the installation in a northward direction. Small ephemeral surface-water bodies are common throughout the area. The primary stream drainage in the area is fed by runoff from the prominent drainage of the Kinipaghulghat Mountain valley south of the installation. In late 1999, this was determined to be the Suqitughneq River. This stream drainage is fed by several smaller tributaries as it flows north to Kitnagak Point. The smaller tributaries originate from two small, unnamed lakes (Figure 1-3).

During the period of field work for the Phase I RI (July and August of 1994), it was noted that surface water flow was highly dynamic, changing significantly over the course of a few days

(Montgomery Watson, 1995b). For example, it was noted that streamflow in the major drainage south of the installation varied significantly, from several hundred gallons per minute during warm days, to no flow during relatively cold periods lasting more than a day (the runoff was primarily snowmelt from higher elevations). In other locations, small lakes and marshy areas created by recent snowmelt were observed to dry up and/or change shape over the course of a few days or weeks.

Over the course of the Phase I, II and III RIs, the only consistent surface water observed at the installation is the Suqitughneq River, it's tributaries, and some of the larger lakes. The remaining "lakes" and marshy areas are ephemeral and may not be capable of consistently supporting aquatic life (e.g., fish). For clarity, these areas are identified in this Report as ephemeral ponds.

Phase III RI fieldwork performed in 2002 found the Northeast Cape study area drier than had previously been observed. Ephemeral ponds and drainages were dry and the Suqitughneq River level was very low, compared to previous years.

1.6 DEMOGRAPHY AND LAND USE

The Village of Savoonga is approximately 60 miles northwest of Northeast Cape and has a population of 643 people, as reported in the 2000 United States Census. There are currently no permanent residents at the Northeast Cape installation, however subsistence hunting, gathering, and fishing occurs in the vicinity. A local fish camp near Cargo Beach is inhabited during the summer by residents of Savoonga and Gambell.

1.7 ECOLOGY, WILDLIFE AND ENDANGERED SPECIES

The Northeast Cape area supports habitat for a variety of seabirds, waterfowl, and mammals that either breed in or migrate through the area. The ocean surrounding the Northeast Cape area is used for subsistence hunting of walrus, seal, sea birds, fish (e.g., halibut), whales and polar bear. Additionally, Arctic fox, cross fox, and reindeer inhabit the area.

1.7.1 Vegetation

Vegetation in the Northeast Cape area is classified as alpine tundra. This type of vegetation is predominantly white mountain avens, mat forming herbs, grasses, and sedges. Shrubs include bearberry, dwarf birch, narrow leaf Labrador tea, willow, heaths, and cassiopes. The Northeast Cape Site consists of many low-lying areas featuring lakes, bogs, and poorly-drained soils. In these areas, vegetation is typically classified as wet tundra, which is dominated by heaths, sedges, mosses, lichens, and cotton grass (URS, 1985).

1.7.2 Birds

The only breeding seabird colony known to exist at the Northeast Cape installation consists of 60 glaucous gulls on Seevookhan Mountain. This colony, cataloged as 93-19 by the United States Fish and Wildlife Service Catalog of Alaskan Seabird Colonies, is the most current known

estimate of breeding seabirds in the area. Several other species of birds have been sighted in the vicinity of the installation, including common ravens, snow bunting, whistling swans, Lapland longspurs, sandhill cranes, and sea gulls (URS, 1985).

1.7.3 Mammals

Large mammals are generally not abundant on St. Lawrence Island. However, polar bear can be seen on the island year round, especially when the ice pack is near shore. Grizzly bear have been reported on the island, but are rarely seen. A population of several hundred reindeer can also be found on the island. Arctic fox, red fox, cross fox, and several small mammal species (tundra shrew, Arctic ground squirrel, Greenland collared lemming, red-backed vole, and tundra vole) also reside on the island (URS, 1985).

Marine mammals are present in the vicinity of Northeast Cape as seasonal migrants in the offshore and near-shore marine waters, at haul-out sites, and in association with the advancing and retreating pack ice. However, there are no haul-out areas within the installation. During the summer, walrus, sea lions, and spotted seals may be present in the offshore waters. During the ice season, ringed seals, bearded seals, walrus, and spotted seals can be found in near-shore and offshore leads and open water. Whale species that can be seen near the installation include bowhead, gray, minke, killer, and beluga (USKH, 1993).

1.7.4 Fish

There are ten primary species of fish that reside in the streams and lagoons of St. Lawrence Island. These include blackfish, nine-spined stickleback, grayling, Dolly Varden, and whitefish. Five of the six species of Pacific Salmon occur around the island. According to Savoonga natives, the Suqitughneq River (Figure 1-3) once supported large fish populations (including sockeye and silver salmon), but the stream no longer supports these populations. This is perhaps due to a large diesel oil spill originating from Site 11 (Fuel Storage Tank Area) that entered one of the stream's tributaries in 1969. Juvenile and adult Dolly Varden have been observed along the length of the Suqitughneq River (URS, 1985).

1.7.5 Endangered Species

Endangered or threatened species of animals on St. Lawrence Island include the Spectacled Eider (endangered), the Steller's Eider (proposed threatened), and the Steller's sea lion (threatened). The prevalence of these animals at the Northeast Cape installation is unknown. Polar bears are not an endangered or threatened species; however, they are protected under the Marine Mammal Protection Act. Alaska Natives are exempt from this act, and are allowed to hunt polar bears for subsistence purposes or handcrafts, as long as the population is not depleted and the animals are not wasted. Vegetative species that have been proposed as threatened include Krause's Sorrel *(Rumex krausei)* and Chukchi Primrose *(Primula tschuktschorum).*

1.8 ARCHAEOLOGICAL, HISTORICAL, AND CULTURAL RESOURCES

The Northeast Cape installation was determined to be eligible for the National Register of Historic Places by the United States Army Corps of Engineers, along with all other WACS sites in Alaska. The State Historic Preservation Officer was informed of the federal undertaking at Northeast Cape in January 1999, and a memorandum of agreement covering mitigation for adverse effects of investigations and BD/DR at Northeast Cape was signed in July 1999.

In addition to the Cold War era buildings and structures at Northeast Cape, there are archaeological sites, cemeteries, and the fishing village at the end of the road. These sites were not disturbed by the investigations.

No artifacts or historic remains were collected from any sites.

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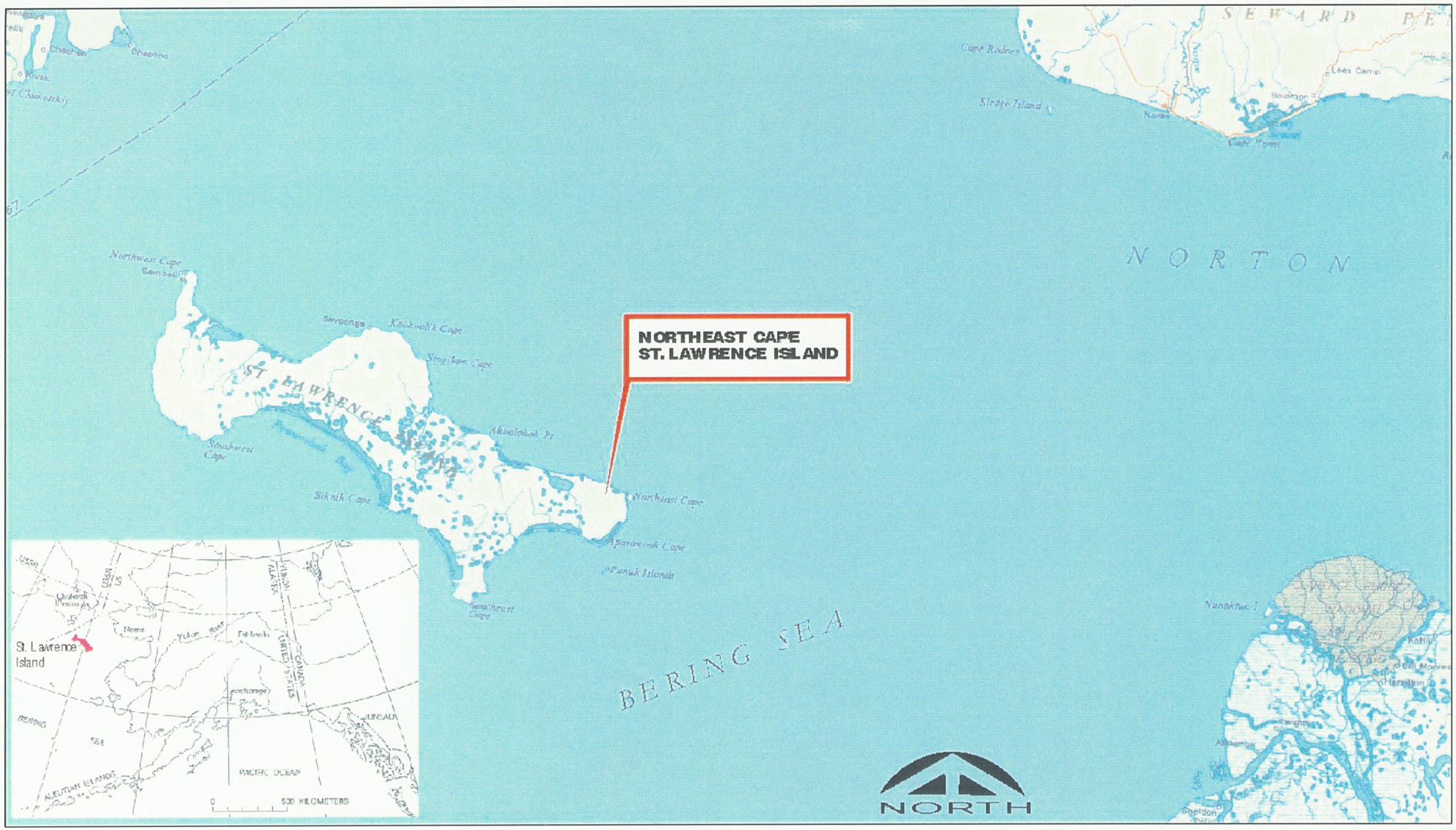

SOURCE: U.S. Geological Survey Reston, Virginia 22092, 1976 – St. Lawrence, Alaska N6265 – W16830 60x210
Surveyed 1948, Compiled 1957 Minor Revisions 1974 – Scale 1:250,000 Contour Interval 100'

MWH
Anchorage, Alaska

FIGURE 1-1

U. S ARMY ENGINEER DISTRICT, ALASKA – N. E CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

VICINITY MAP

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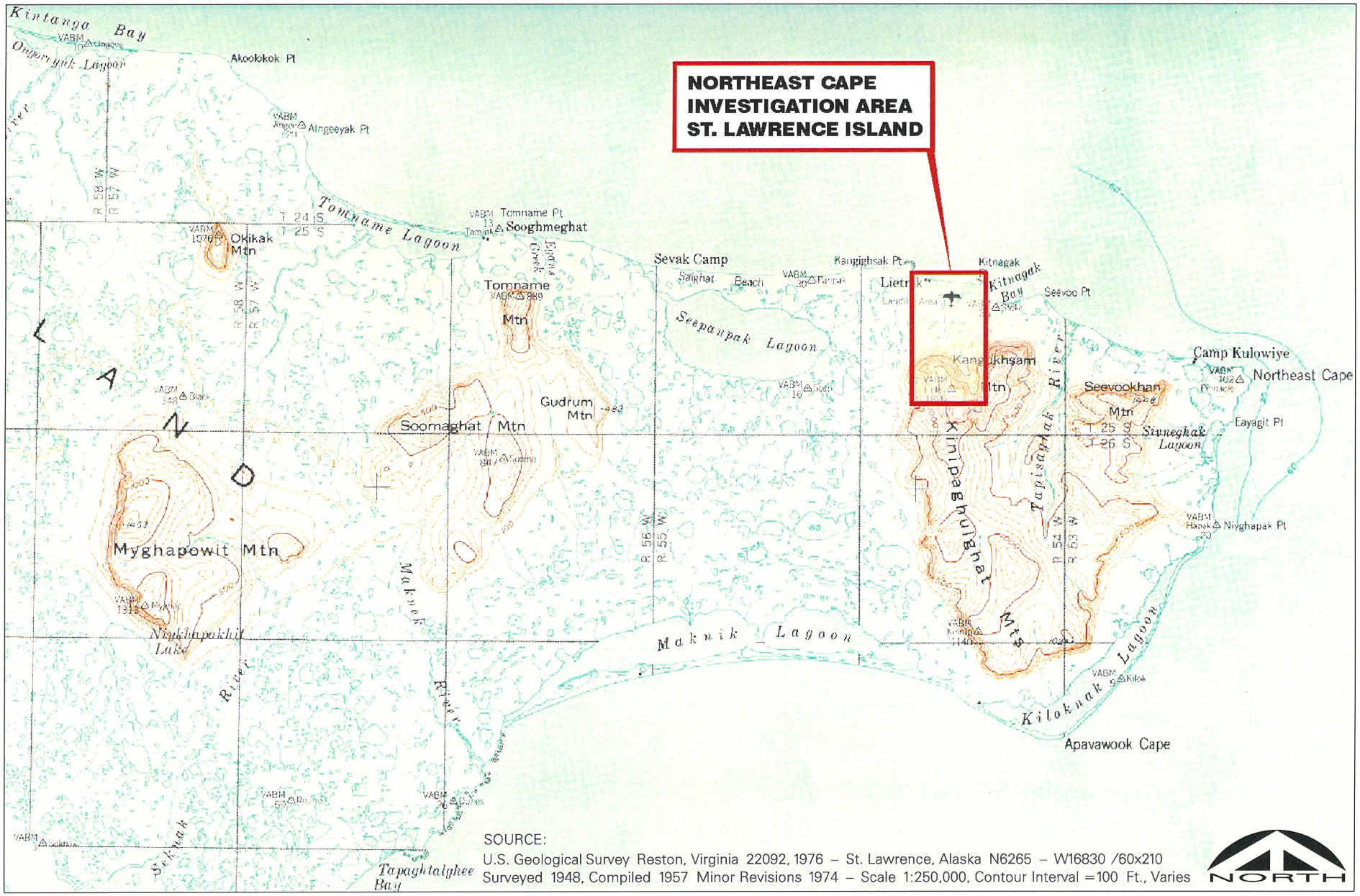

SOURCE:
U.S. Geological Survey Reston, Virginia 22092, 1976 – St. Lawrence, Alaska N6265 – W16830 /60x210
Surveyed 1948, Compiled 1957 Minor Revisions 1974 – Scale 1:250,000, Contour Interval =100 Ft., Varies

MWH
Anchorage, Alaska

FIGURE 1–2

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

LOCATION MAP

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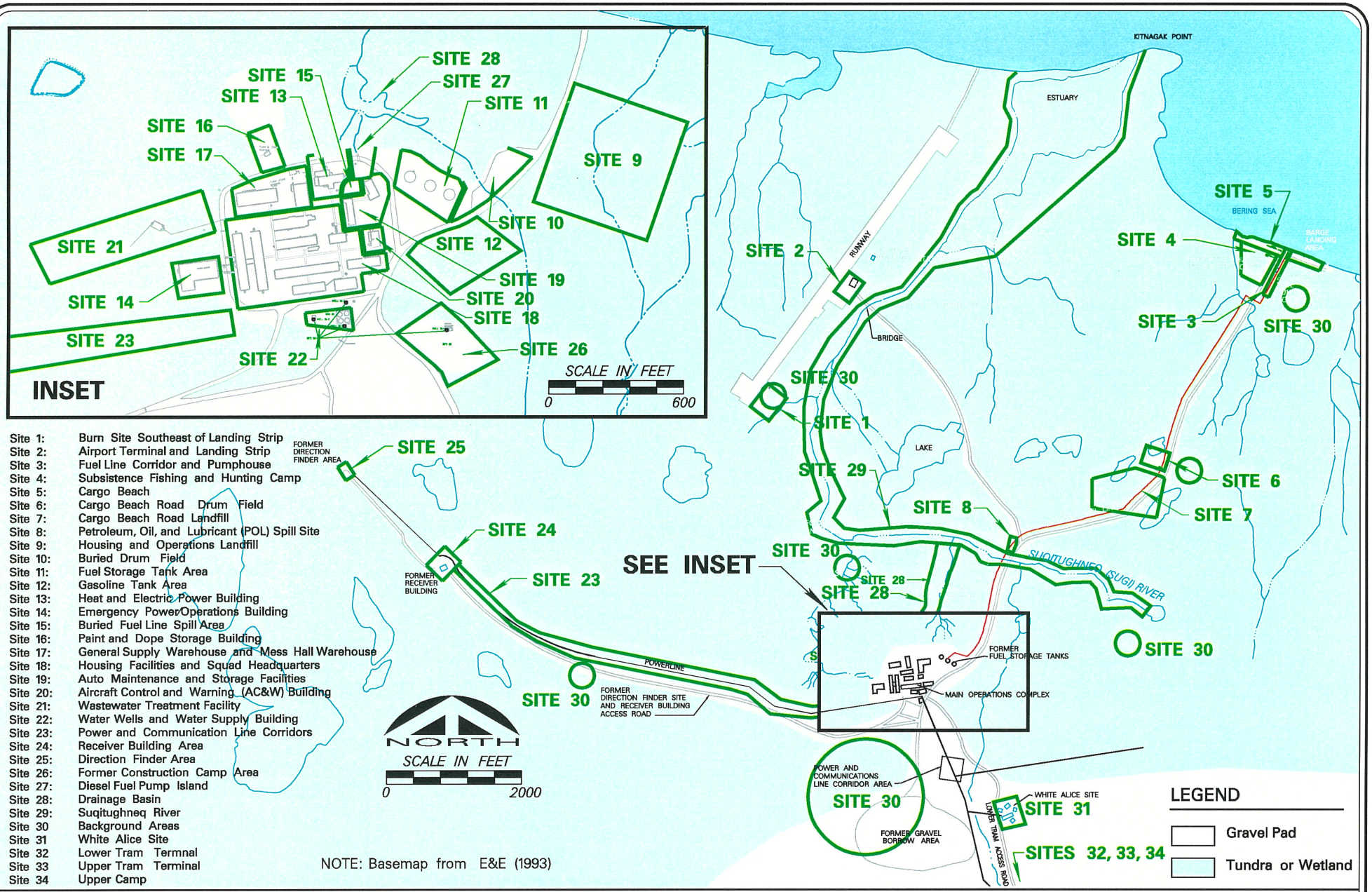


Site 1: Burn Site Southeast of Landing Strip
Site 2: Airport Terminal and Landing Strip
Site 3: Fuel Line Corridor and Pumphouse
Site 4: Subsistence Fishing and Hunting Camp
Site 5: Cargo Beach
Site 6: Cargo Beach Road Drum Field
Site 7: Cargo Beach Road Landfill
Site 8: Petroleum, Oil, and Lubricant (POL) Spill Site
Site 9: Housing and Operations Landfill
Site 10: Buried Drum Field
Site 11: Fuel Storage Tank Area
Site 12: Gasoline Tank Area
Site 13: Heat and Electric Power Building
Site 14: Emergency Power/Operations Building
Site 15: Buried Fuel Line Spill Area
Site 16: Paint and Dope Storage Building
Site 17: General Supply Warehouse and Mess Hall Warehouse
Site 18: Housing Facilities and Squad Headquarters
Site 19: Auto Maintenance and Storage Facilities
Site 20: Aircraft Control and Warning (AC&W) Building
Site 21: Wastewater Treatment Facility
Site 22: Water Wells and Water Supply Building
Site 23: Power and Communication Line Corridors
Site 24: Receiver Building Area
Site 25: Direction Finder Area
Site 26: Former Construction Camp Area
Site 27: Diesel Fuel Pump Island
Site 28: Drainage Basin
Site 29: Suqitughneq River
Site 30 Background Areas
Site 31 White Alice Site
Site 32 Lower Tram Termnal
Site 33 Upper Tram Terminal
Site 34 Upper Camp

NOTE: Basemap from E&E (1993)

MWH
Anchorage, Alaska

FIGURE 1–3
U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE MAP

2.0 INVESTIGATION OBJECTIVES, ACTIVITIES, AND RESULTS

All fieldwork at the Northeast Cape installation has complied with the provisions of Nationwide Permit No. 6 for Survey Activities, General Concurrence No. 24, of the Coastal Zone Management Plan, and Land Use Agreement No. DACA 85-9-98-41 between the USAED and the landowners. Except as noted, all fieldwork was performed in accordance with the Final Phase III Work Plan, (Montgomery Watson, 2001a), and the Biological Sampling Plan (BSP – Montgomery Watson, 2001b).

Sites investigated during the Phase III RI are listed in Table 2-1. Some sites are grouped for presentation and discussion in this Report.

Table 2-1
Northeast Cape Phase III RI Sites

Site Number	Site Description
Site 3	Fuel Line Corridor and Pumphouse
Site 4	Subsistence Fishing and Hunting Camp
Site 6	Cargo Beach Road Drum Field
Site 7	Cargo Beach Road Landfill
Site 9	Housing and Operations Landfill
Sites 13, 15, 19, 20 and 27 (Site 88)	Main Operations Complex
Site 14	Emergency Power/Operations Building
Site 16	Paint and Dope Storage Building
Site 21	Wastewater Treatment Facility
Site 22	Water Wells and Water Supply Building
Site 24	Receiver Building Area
Site 26	Former Construction Camp Area
Site 28	Drainage Basin
Site 29	Suqitughneq River
Site 30	Background Areas
Site 31	White Alice Site
Site 32	Lower Tram Terminal
Site 33	Upper Tram Terminal
Site 34	Upper Camp

Key:
RI = remedial investigation

2.1 ENVIRONMENTAL SAMPLING

This report describes the field activities and analytical results performed in 2001 and 2002 as part of the Phase III RI. Information on sites previously investigated and data from samples collected before 2001 may be found in the RI Report (Montgomery Watson 1995b), the Phase II RI Report (Montgomery Watson 1999), and other report addenda and technical memoranda listed in Section 1.4.

Environmental media sampled during the Phase III RI consisted of soil, sediment, surface water, groundwater, fish tissue, and plant tissue. For the purposes of the remedial investigation, the media was designated based on the condition of the sample location at the time of sampling. For example, a sample collected from an unsaturated soil is designated as soil. A soil sample collected from an area that was permanently or temporarily covered with water is designated as sediment. All water samples collected from standing or flowing water bodies were designated as surface water regardless of whether the water was ephemeral, or supported an aquatic community. All water samples collected from monitoring wells, well points or the former water supply wells were designated as groundwater.

This system of classification is suitable for the remedial investigation. However, it will be appropriate to reevaluate the media designations prior to using the data in the risk assessment, in order to assign media designations that can be used to accurately identify the risk pathways and receptors.

Unless otherwise stated, metals analyzed in environmental samples include: arsenic, aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

Brief site descriptions, objectives for the Phase III RI fieldwork, field activities performed, and a summary of analytical results are provided below. Environmental sampling locations are shown on Figures 2-1 through 2-29, located at the end of Section 2.

To provide a context for the remedial investigation results, laboratory results are compared to selected environmental benchmarks in Sections 2 and 3 of this report. Analytical data are compared to the most recent constituent-specific criteria provided in the State of Alaska's Oil and Other Hazardous Substances Pollution Control Regulations (18 AAC 75 as amended through January 30, 2003). Data from soil and sediment sampling are compared to 18 AAC 75.340 Method Two, Tables B1 and B2, under 40-inch zone, migration to groundwater pathway, referred to herein as 'Method Two'. Data from groundwater and surface water sampling are compared to 18 AAC 75.345 Table C. Cumulative risk calculations were not considered. In depth evaluation of the remedial investigation data, including identification and screening against relevant criteria will be performed and presented in the risk assessment.

Only analytes that exceeded the numerical single-constituent ADEC cleanup levels (18 AAC 75, Tables B1, B2, and C) in for one or more samples are listed in the report tables. A complete list of all analytical results from Phase III sampling is provided in Appendix D.

2.1.1 Site 3 – Fuel Line Corridor and Pumphouse

2.1.1.1 Background

Site 3, the Fuel Line Corridor and Pumphouse, is located at the northern edge of the project area. Site 3 contained a fuel pumphouse, two empty ASTs that were formerly used to store diesel fuel, and a 4-inch fuel line (Montgomery Watson, 1999). These were removed during 2000/2001 BD/DR activities. Previous investigations found 14 milligrams per liter (mg/L) diesel range organics (DRO) in shallow groundwater at the source area (Fuel Pumphouse) (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 3 were to confirm DRO contamination in shallow groundwater and define the extent of the contamination.

2.1.1.2 Groundwater Sampling

As stated in the Work Plan, three well points were installed to the maximum depth feasible, which in this case was 3 to 6 feet below ground surface (bgs) when bedrock was encountered. Each well was sampled to evaluate the extent of DRO-contaminated groundwater. Recharge in the well points was adequate for sample collection and the ground was saturated in this area. Well Point WP 3-2 was installed approximately 60 feet downgradient (north) of the suspected source area, WP 3-3 was installed approximately 70 feet downgradient (east) of the suspected source area, and WP 3-4 was installed between the gravel pad and a surface drainage to the east (Figure 2-1). Photos of well points are provided in Appendix C. Groundwater samples were collected from each well point and analyzed for DRO and residual range organics (RRO).

DRO concentrations ranged from 1.8 to 3.3 mg/L, exceeding the ADEC Table C groundwater cleanup level (Table 2-2). RRO concentrations ranged from 1.3 to 8.1 mg/L, also exceeding the Table C cleanup level.

Table 2-2
Site 3 Groundwater Results, Regulatory Exceedences

Sample Location	Sample Identification	DRO (mg/L)	RRO (mg/L)
WP 3-2	01NE03WP102	**3.3**	**1.3 VJ**
WP 3-3	01NE03WP103	**2.4**	**8.1 VJ**
WP 3-4	01NE03WP104	**1.8**	**6.3 VJ**
ADEC Table C Cleanup Level		1.5	1.1

Key:

Bold indicates concentration exceeds cleanup level.
ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
mg/L = milligrams per liter
RRO = residual range organics
VJ = estimated value
RRO = well point

2.1.2 Site 4 – Subsistence Fishing and Hunting Camp

2.1.2.1 Background

Site 4, the Subsistence Fishing and Hunting Camp, contains wood frame structures, abandoned vehicles, drums, and two abandoned aboveground storage tanks (ASTs) most of which was removed during the 2000/2001 BD/DR activities. Both ASTs reportedly were used for water storage. Previous investigations identified DRO in shallow groundwater at a concentration of 3.7 mg/L and DRO in soil at concentrations up to 5,300 milligrams per kilogram (mg/kg) (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 4 were to confirm DRO contamination in shallow groundwater and define the extent of the contamination.

2.1.2.2 Groundwater Sampling

As stated in the Work Plan, three well points were installed to the maximum depth feasible, which in this case was 3 to 6 feet below ground surface (bgs) when bedrock was encountered. Each well was sampled to evaluate the extent of DRO-contaminated groundwater.

The ground was saturated in this area and recharge in the well points was adequate for sample collection. Well Points WP 4-2, WP 4-3, and WP 4-4 were installed approximately 40, 80, and 40 feet downgradient (north) of the former oil drum storage area, respectively (Figure 2-2). Photos of well points are provided in Appendix C. Groundwater samples were collected from each well point and analyzed for DRO and RRO.

DRO concentrations ranged from 0.96 to 2.0 mg/L, exceeding the ADEC Table C groundwater cleanup level in the sample for WP4-3 (Table 2-3). RRO concentrations ranged from 2.6 to 6.5 mg/L, also exceeding the Table C cleanup level.

Table 2-3
Site 4 Groundwater Results, Regulatory Exceedences

Sample Location	Sample Identification	DRO (mg/L)	RRO (mg/L)
WP 4-2	01NE04WP102	1.4 VB	**6.5 VJ**
WP 4-3	01NE04WP103	**2.0 VB**	**5.4 VJ**
WP 4-4	01NE04WP104	0.96 VB	**2.6 VJ**
ADEC Table C Cleanup Level		1.5	1.1

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
mg/L = milligrams per liter
RRO = residual range organics
VB = analyte detected in sample and associated blank indicating a possible false-positive result
VJ = estimated value
WP = well point

2.1.3 Site 6 – Cargo Beach Road Drum Field

2.1.3.1 Background

During 2000-2001 BD/DR activities, all debris was removed from Site 6 including an empty 500-gallon AST, metal debris, and 1,500 drums. These drums are thought to have contained petroleum, oil, or lubricants (POL) that were used during installation operations then discarded when empty, although some may have contained some minor residual amounts of sludge or fluids. Previous investigations at the site identified DRO at concentrations of up to 102,000 mg/kg in soil and sediment, and up to 1.8 mg/L in shallow ephemeral surface water (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 6 were to refine the extent of DRO contamination in soil and groundwater.

2.1.3.2 Soil Sampling

Two test pits were excavated to bedrock within the stained soil area at Site 6 to evaluate the depth of contamination in the soil (Figure 2-3). Photos of test pits are provided in Appendix C. One soil sample was collected from the soil/bedrock interface at the bottom each test pit and analyzed for DRO, RRO, and total organic carbon (TOC) by a laboratory-specific standard method.

DRO concentrations were 2,000 mg/kg at 5.3 feet bgs in Test Pit 6-1 and 3,000 mg/kg at 5 feet bgs in Test Pit 6-2, exceeding the ADEC Method Two cleanup level in both samples (Table 2-4). RRO was not detected at concentrations exceeding the Method Two cleanup level. TOC was measured at 2.0 and 2.6 percent.

Two sediment samples were collected: SD116 and SD117 from two ephemeral ponds south and north, respectively, of the drum field (Figure 2-3). Photos of sample locations are provided in Appendix C. The sediment samples were analyzed for DRO, RRO, gasoline range organics (GRO), PCBs, metals, and benzene, toluene, ethylbenzene, and xylenes (BTEX).

Arsenic was detected in sample SD117 at 4.1 mg/kg, above the ADEC Method Two cleanup level (Table 2-4). No DRO, RRO, BTEX, or other metals were detected at concentrations exceeding Method Two cleanup levels. GRO and PCBs were not detected.

2.1.3.3 Shallow Groundwater and Surface Water Sampling

Well Point WP 6-1 was installed within the stained soil/former drum storage area of the pad to a depth of 3.2 feet bgs where bedrock was encountered. The well point did not yield any water. Well Point WP 6-2 was installed 3 to 6 feet bgs approximately 80 feet downgradient (north) of the pad. The sample collected from WP 6-2 was analyzed for DRO and RRO. Well Point WP 6-3 was installed 3 to 6 feet bgs near the southwestern edge of the stained soil area between two ephemeral surface water bodies (Figure 2-3). Photos of well points are provided in Appendix C.

Table 2-4
Site 6 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Arsenic	Beryllium	Cadmium	Chromium	Lead	Nickel	Thallium	Zinc
Soil (mg/kg)												
TP 6-1	01NE06TP101	5.3	**2,000**	3,400 VJ	NA	NA	NA	NA	NA	NA	NA	NA
TP 6-2	01NE06TP102	5.0	**3,000**	8,500 VJ	NA	NA	NA	NA	NA	NA	NA	NA
SD 117	01NE06SD117	0.5	40	220 VJ	**4.1**	0.8	ND (0.2)	13.9	15.0	9.0	ND (6.0)	29.8
ADEC Method Two Cleanup Level			250	11,000	2	42	5	26	400	87	NC	9,100
Groundwater (mg/L)												
WP 6-3	01NE06WP103	N/A	0.29 VB	ND (0.5)	ND(0.022)	**0.004**	**0.006**	**1.22**	**0.16**	**1.68**	**0.002**	**17.7**
ADEC Table C Cleanup Level			1.5	1.1	0.05	0.004	0.005	0.1	0.015	0.1	0.002	11.0

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
Ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
NA = not analyzed
NC = no cleanup level in 18 AAC 75 Table B
ND = analyte not detected. Method reporting limit shown in parenthesis
RRO = residual range organics
SD = sediment
TP = test pit
VB = analyte detected in sample and associated blank indicating a possible false-positive result
VJ = estimated value
WP = well point

The sample collected from WP 6-3 was analyzed for DRO, RRO, GRO, BTEX, PCBs, and metals.

DRO and RRO were not detected in the sample from WP 6-2. In the sample from WP 6-3, the following analytes were detected at concentrations that equaled or exceeded ADEC Table C cleanup levels: beryllium, cadmium, chromium, lead, nickel, thallium and zinc (Table 2-4).

Because WP 6-1 was dry, surface water sample SW116 was collected from an ephemeral surface water body north of the former drum field. A photo of the sample location is provided in Appendix C. This sample was analyzed for DRO and RRO. Neither was detected.

2.1.4 Site 7 – Cargo Beach Road Landfill

2.1.4.1 Background

This site contains an unpermitted solid waste landfill used from 1965 until 1974. In 2000, numerous exposed drums and metal debris were removed from the area southeast of Cargo Beach Road. Previous investigations found DRO concentrations up to 32,000 mg/kg in soil around the perimeter of the refuse (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 7 were to determine whether drums and surface debris have impacted surface soils and if the landfill qualifies for closure under ADEC's closure criteria as described in 18 AAC 60.390.

ADEC Class III landfill closure is based on the following criteria:

- Revegetation of the site
- Cover of 24 inches thickness or greater that promotes drainage
- Absence of surface runoff that could lead to erosion of the cover
- Survey and documentation of the landfill area
- Absence of groundwater or soil contamination

2.1.4.2 Landfill Inspection Activities

The landfill was inspected and areas of concern noted in field notes. Areas of concern consisted of exposed debris, unvegetated areas, eroded areas, and other signs that the landfill cover was inadequate.

The existing landfill cover was inspected for protruding debris, sinkholes, and evidence of erosion. Exposed Marston matting, empty drums, cable spools, stained soils, and miscellaneous debris were observed in the area southeast of Cargo Beach Road. The central portion of the landfill is currently being used as a staging area for debris-filled connexes destined for off-island removal. This area is unvegetated and free of debris.

In the area of the landfill northwest of Cargo Beach Road, eroded and sunken areas and pockets of exposed debris were observed along the northern toe of the landfill, with large concentrations

of debris at several locations. Site use by animals was evidenced by burrows, droppings, rodent skeletons, and the presence of active adult cross fox. Most of the vegetation is concentrated along the north side of the landfill. Vegetative cover is estimated at 80 percent.

The landfill cover was inspected for erosion. The site was relatively dry and some of the ephemeral ponds observed in the past had disappeared, so surface runoff pathways may not have been evident. Erosion appears to be concentrated on the southeast side of Cargo Beach Road due to a lack of vegetation.

The landfill boundary was surveyed to meet ADEC closure permit requirements. Survey information is provided in Appendix H.

2.1.4.3 Soil and Sediment Sampling

Three surface soil samples were collected from southeast of Cargo Beach Road at the former exposed drums and metal debris location (Figure 2-4). Sample SS127 was collected within the former drum/debris area, and Samples SS125 and SS126 were collected at the base of the southeastern toe of the landfill, approximately 75 feet downgradient of Sample SS127. Photos of sample locations are provided in Appendix C. Soil samples were analyzed for DRO, RRO, volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), PCBs, and metals.

The following analytes exceeded ADEC Method Two cleanup levels in sample SS127: DRO, arsenic, chromium, lead and PCB Aroclor™-1260 (Table 2-5). In sample SS125 arsenic, chromium and PCB Aroclor™-1260 exceeded Method Two values and in SS126, arsenic, chromium and lead.exceeded Method Two values. No other metals, DRO, RRO, VOCs, or PCBs were detected at concentrations exceeding Method Two cleanup levels in these surface soil samples.

Two sediment samples were collected from ephemeral surface water at the site to assess contaminant concentrations in sediment. These samples were co-located with surface water samples. Sample SD104 was collected from an ephemeral surface water body on the north-northwestern border of the landfill area. Sample SD105 was collected in the southeastern corner of the landfill area, across Cargo Beach Road from the main landfill area. Photos of sample locations are provided in Appendix C. Sediment samples were analyzed for DRO, RRO, VOCs, PAHs, PCBs, and metals.

DRO and arsenic were detected at concentrations exceeding the ADEC Method Two cleanup levels in both sediment samples (Table 2-5). No RRO, VOCs, PAHs, PCBs, or other metals were detected at concentrations exceeding Method Two cleanup levels.

2.1.4.4 Groundwater and Surface Water Sampling

Shallow groundwater and surface water are believed to be in close communication as evidenced by the lack of or abundance of both, depending on recent weather conditions. Shallow

Table 2-5
Site 7 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	PCB Aroclor™-1260	Arsenic	Chromium	Lead	Nickel
Soil (mg/kg)									
SS 125	01NE07SS125	0.5	150	620 VJ	**1.1**	**50**	**64**	350	37
SS 126	01NE07SS126	0.5	160	740 VJ	0.13	**17.3**	**75**	**460**	43
SS 127	01NE07SS127	0.5	**720**	3,600 VJ	**13**	**30**	**65**	**419**	57
SD 104	01NE07SD104	0.5	**1,400**	2,800 VJ	ND(0.079)	**3.3**	19	41	13
SD 105	01NE07SD105	0.5	**280**	1,700 VJ	ND(0.28)	**4.1**	5	20	5
ADEC Method Two Cleanup Level			250	11,000	1	2	26	400	87
Groundwater (mg/L)									
WP 7-1	01NE07WP101	N/A	0.66	**2.7 VJ**	ND(0.001)	**0.01**	**0.255**	**0.04**	**3.54**
WP 7-2	01NE07WP102	N/A	ND(0.25)	**1.1 VJ**	ND(0.001)	**0.004**	0.014	**0.017**	ND(0.01)
WP 7-3	01NE07WP103	N/A	0.39 VJ	**1.4 VJ**	ND(0.001)	**0.004**	0.014	0.006	ND(0.01)
ADEC Table C Cleanup Level			1.5	1.1	0.05	0.004	0.1	0.015	0.1

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
Ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
ND = analyte not detected. Method reporting limit shown in parenthesis
PCB = polychlorinated biphenyl
RRO = residual range organics
SD = sediment
SS = surface soil
VJ = estimated value
WP = well point

groundwater is inferred to flow topographically downgradient in a radial pattern mimicking the topography at the site.

To evaluate any impact to groundwater, three well points were installed 3 to 6 feet bgs downgradient of the landfill (Figure 2-4). WP 7-1 was installed near the western edge of the landfill area. WP 7-2 and WP 7-3 were installed 235 feet apart, approximately 125 and 165 feet, respectively, north of the north-northeastern border of the landfill area.

Despite being installed in saturated ground, these well points yielded very little water. WP7-1 required several days to produce the 3 to 4 liters of water required by the laboratory.

Groundwater samples were collected from each well point and were analyzed for DRO, RRO, GRO, VOCs, PAHs, PCBs, and metals.

DRO and GRO were below Table C cleanup levels in all three samples. RRO was detected in all three samples at concentrations ranging from 1.1 to 2.7 mg/L, equaling or exceeding the Table C cleanup level (Table 2-5). In the sample collected from WP 7-1, chromium, lead, and nickel were detected at concentrations that exceed Table C cleanup levels. The sample from WP 7-2 contained lead in exceedence of the Table C cleanup level. No PCBs, PAHs, or VOCs were detected in the samples, except acetone, which was detected below the Table C cleanup level in the sample from WP 7-1.

Two surface water samples were collected from ephemeral surface water bodies at the site to assess contaminant migration. At each of these locations a surface water and sediment samples were collected. Sample SW104 was collected from the ephemeral surface water on the north-northwestern border of the landfill area. Sample SW105 was collected in the southeastern corner of the landfill area, across Cargo Beach Road from the main landfill area. Photos of sample locations are provided in Appendix C. Surface water samples were analyzed for DRO, GRO, RRO, VOCs, PAHs, PCBs, and metals.

DRO, RRO, GRO, VOCs, PAHs, and PCBs were not detected at or above the method reporting limit. No metals were detected at concentrations exceeding Table C cleanup levels.

Therefore, it appears that localized areas of contamination may be present, but the extent is limited either by the quantity of contamination present or undetermined subsurface migration patterns.

2.1.5 Site 9 – Housing and Operations Landfill

2.1.5.1 Background

This site was used as a waste disposal location from 1952 until 1965. Previous investigations found DRO concentrations of up to 375 mg/kg in soil and up to 250 mg/kg in sediment (Montgomery Watson, 1999). DRO was also detected at concentrations of up to 11 mg/L in groundwater.

Objectives of Phase III RI fieldwork at Site 9 were to determine whether the landfill qualifies for closure under ADEC's closure criteria, and to delineate the extent of groundwater contamination.

ADEC Class III landfill closure is based on the following criteria:

- Revegetation of the site
- Cover of 24 inches thickness or greater that promotes drainage
- Absence of surface runoff that could lead to erosion of the cover
- Survey and documentation of the landfill area
- Absence of groundwater or soil contamination

2.1.5.2 Landfill Inspection Activities

The landfill was inspected and areas of concern noted. Areas of concern included exposed debris, unvegetated areas, eroded areas, and other signs that the landfill cover was inadequate.

The existing landfill cover was inspected for protruding debris, sinkholes, and evidence of erosion. Exposed debris was observed in piles around the site and partially submerged in surface water bodies, including ponds and streams.

The landfill area is largely vegetated, with only a small area lacking in vegetation directly on the surface of the former landfill. Vegetated area is estimated at 80 percent.

The landfill cap was inspected for erosion. Prominent surface drainages are present in the form of erosion pathways formed by run-off and standing surface water (Figure 2-5). Surface water runs through Site 9 in several locations, eventually entering the Suqitughneq River approximately ¼-mile to the north. Debris is exposed in some channels, suggesting that erosion could expose more debris, especially during high rainfall years or as the run-off changes course. Iron-stained sediment was observed in some of the run-off channels.

The landfill boundary was surveyed to meet ADEC closure permit requirements. Survey results are provided in Appendix H.

2.1.5.3 Sediment Sampling

To evaluate contamination in sediment, five sediment samples were collected: three from locations where surface water samples were collected and two from approximately 100 and 200 feet downgradient (north) of the landfill. Sediment samples were analyzed for DRO, RRO, VOCs, PAHs, PCBs, TOC, and metals.

In the three sediment samples co-located with surface water samples (SD107, SD108, and SD109), arsenic was detected above Method Two cleanup levels – ranging from 5.9 to 25.7 mg/kg (Table 2-6). Photos of sample location are provided in Appendix C. DRO was detected at concentrations at or above the Method Two cleanup level in Sample SD107. Toluene was detected at or above the Method Two cleanup level in Sample SD108. Concentrations of DRO, antimony, cadmium, chromium, lead, and nickel were detected above Method Two cleanup

Table 2-6
Site 9 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Arsenic	Antimony	Beryllium	Cadmium	Toluene	Chromium	Lead	Nickel
Soil and Sediment (mg/kg)												
SD 107	01NE09SD107	0.5	**320**	2,100 VJ	**8**	**ND(30)**	0.7	ND(1)	ND(0.22)	5	ND(10)	ND(6)
SD 108	01NE09SD108	0.5	84	520 VJ	**5.9**	**ND(20)**	2.0	ND(0.9)	**6**	22	27	10
SD 109	01NE09SD109	0.5	**510**	1,300 VJ	**25.7**	**250**	ND(1)	**7**	ND(0.081)	**42**	**630**	**110**
SD 113	01NE09SD113	0.5	**270**	1,400 VJ	**10**	**ND(30)**	3.8	1	ND(0.27)	19	100	13
SD 114	01NE09SD114	0.5	93	740 VJ	**6**	**ND(30)**	1.6	ND(1)	ND(0.44)	16	40	10
ADEC Method Two Cleanup Level			250	11,000	2	3.6	42	5	5.4	26	400	87
Groundwater (mg/L)												
MW 9-3	01NE09MW103	N/A	ND (0.25)	ND(0.5)	ND (0.005)	**0.12**	**0.014**	0.004	ND(0.001)	0.099	**0.3**	0.08
WP 9-2	01NE09WP102	N/A	0.93	**4.2**	0.012	ND(0.05)	**0.004**	0.002	ND(0.001)	0.075	**0.056**	**0.11**
ADEC Table C Cleanup Level			1.5	1.1	0.05	0.006	0.004	0.005	1	0.1	0.015	0.1

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
MW = monitoring well
N/A = not applicable
NA = not analyzed
ND = analyte not detected. Method reporting limit shown in parenthesis
RRO = residual range organics
SD = sediment
WP = well point

levels in Sample SD109. No other analytes were detected above Method Two cleanup levels, however, the method reporting limit for antimony was above the cleanup level in all soil samples. No PCBs were detected at or above the method reporting limit.

In Sample SD113, collected approximately 100 feet downgradient of the landfill, DRO and arsenic were detected above Method Two cleanup levels. TOC was measured at 28 percent. No PCBs or PAHs were detected at or above the method reporting limits. Acetone was detected at concentrations below the Method 2 cleanup level and no other VOCs were detected at or above the method reporting limits.

In Sample SD114, collected approximately 200 feet downgradient of the landfill, arsenic was detected above the Method Two cleanup level. TOC was measured at 18 percent. No PAHs, PCBs, or VOCs were detected.

2.1.5.4 Groundwater and Surface Water Sampling

Because past sampling results from monitoring wells at this site showed contamination in groundwater, planned activities included resampling of the existing Monitoring Well MW 9-2 and installation and sampling of new well points. Existing Monitoring Well MW 9-2 had been compromised due to weather, so a new well point was installed. The new well point was successfully installed, but yielded no water. In the absence of groundwater, a surface water sample was collected from an ephemeral surface water body at the site (Figure 2-5).

Installation and sampling of four additional well points, one at the location of MW 9-3 and three downgradient of the landfill, was also planned. WP 9-2 was successfully installed and sampled; the other three well points were successfully installed, but yielded no water. Attempts were made to install the well points in several locations, but shallow bedrock was encountered, which made installation unfeasible. Photos of MW 9-3 and WP 9-2 are provided in Appendix C. In the absence of groundwater, three surface water samples were collected from ephemeral surface water bodies adjacent to the planned locations of the well points. Groundwater and surface water samples were analyzed for DRO, RRO, GRO, VOCs, PAHs, PCBs, and metals.

The water sample from MW 9-3 contained concentrations of antimony, beryllium, and lead that exceeded Table C cleanup concentrations (Table 2-6). Sample WP-9-2 contained concentrations of RRO, beryllium, lead, and nickel that exceeded Table C cleanup levels. No other metals or petroleum hydrocarbons exceeded Table C values. PCBs, PAHs, and VOCs were not detected.

Three surface water samples co-located with sediment samples were collected. Samples SW108 and SW109 were upgradient and downgradient, respectively, from the run-off channel that flows through the landfill area. Photos of sample locations are provided in Appendix C. Sample SW108 was east of the standing water at the southeastern edge of the landfill. In the absence of groundwater, surface water samples SW110, SW111, and SW112 were also collected from locations on top of and downgradient of the landfill.

No metals were detected in surface water samples at concentrations exceeding Table C cleanup levels (Appendix D). No DRO, RRO, GRO, VOCs, PAHs, or PCBs were detected.

2.1.6 Sites 13, 15, 19, 20, and 27 – Main Operations Complex (Site 88)

2.1.6.1 Background

The MOC consists of Sites 13, 15, 19, 20, and 27, which includes the Heat and Electric Power Building, Buried Fuel Line Spill Areas, Auto Maintenance and Storage Facilities, Aircraft Control and Warning Building 103, and the Diesel Fuel Pump Island, respectively. These sites are similar because they are adjacent, have similar soil environments (gravel fill over native soil), have similar contaminant types (generally diesel and PCBs), and are a current source of contamination to the Drainage Basin (Site 28). For the purposes of sample identification, these sites were collectively called 'Site 88" during 2002 sampling.

The Aircraft Control and Warning Building 103 (Site 20) was removed in 2001. Sources of contamination at this site were limited to lead and asbestos-containing building materials; therefore, the site was not included in the original Phase III Work Plan. However, after review of figures and analytical data from 2002, contamination from an unidentified source was detected in Monitoring Well MW-10. In the absence of a known source, the upgradient site, Site 20 was added to the investigation.

Objectives of Phase III RI fieldwork at the MOC were to characterize the nature and extent of groundwater and subsurface soil contamination.

A total of 18 soil borings were advanced to the groundwater interface, 10 were completed as monitoring wells (Figure 2-6). Most of the soil borings and monitoring wells were installed at the northern end of the MOC, upgradient of the Drainage Basin (Site 28).

2.1.6.2 Soil Sampling

Each of the 18 soil borings (Figure 2-6) was continuously sampled at 2-foot intervals using a split-spoon. Field samples were then screened for volatile organic compounds using a photoionization detector (PID). The sample with the highest concentration of volatile organic compounds in the soil headspace and the sample located at the groundwater interface were collected as laboratory samples and analyzed for DRO, RRO, GRO, BTEX, PCBs, lead, zinc, chromium, and TOC. Photos of soil boring locations are provided in Appendix C.

DRO was detected in 24 of 36 soil samples at concentrations above the ADEC Method Two cleanup level, ranging from 380 to 51,000 mg/kg (Table 2-7). GRO and RRO were not detected above Method Two cleanup levels. Other analytes detected above Method Two cleanup levels include benzene (five samples), chromium (one sample), and naphthalene (two samples). TOC ranged from 0.04 to 16.5 percent. No PCBs were detected above the Method Two cleanup level. At this site, these soil samples included samples from near the surface to 26 feet bgs.

Lithologic cross-sections are presented in Figures 2-7 to 2-9. Soil classifications are based on field observations.

Geotechnical laboratory test reports are included in Appendix I.

Table 2-7
Sites 13, 15, 19, 20, and 27 (Site 88) Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	GRO	RRO	Benzene	Naphthalene	Chromium
Soil (mg/kg)								
MW 88-1	01NE88SB001	15.5-17.5	**5,000**	19	39 VJ	ND(0.012)	0.0022 VJ	6.5
MW 88-1	01NE88SB002	17.5-20	**1,400**	4.9	16	ND(0.011)	0.00038 VJ	4.38
MW 88-3	01NE88SB006	16-18	**3,700**	51	24	**ND(0.021) VJ**	1.5	13.1
MW 88-4	01NE88SB007	9-11	**12,000**	44	3,700	**0.047**	5.9 VHB	17.3
MW 88-4	01NE88SB008	11-13	**2,600**	54	16 VJ	ND(0.018)	2.3	3.73
MW 88-5	01NE88SB009	1-3	**380**	ND(2.8)	3,400	ND(0.012)	0.0041 VJ	**42.3**
MW 88-6	01NE88SB011	7-9	**3,100**	130 VHB	23 VJ	ND(0.012)	4.1	12.8
MW 88-6	01NE88SB012	11-13	**1,200**	83 VHB	30 VJ	ND(0.012)	1.1	8.3
MW 88-7	01NE88SB013	7-9	**12,000**	140 VHB	50 VJ	ND(0.012)	7.9	17
MW 88-7	01NE88SB014	11-13	**9,200**	130 VHB	54 VJ	ND(0.011)	8.4	11.6
MW 88-8	01NE88SB015	10-12	**5,200**	68 VHB	11 VJ	ND(0.018)	3.3	9.63
MW 88-8	01NE88SB016	14-16	**2,300**	73 VHB	7.4 VJ	ND(0.018)	2.3	8.34
MW 88-10	01NE88SB019	22-24	**1,400**	31	ND (110)	ND(0.015)	0.48	10
MW 88-10	01NE88SB020	24-26	**750**	19	ND (110)	ND(0.015)	0.11	4.8
SB 88-11	01NE88SB021	3-5	**13,000**	70	5,100	**0.12**	12	16.5
SB 88-11	01NE88SB022	7-9	**51,000**	99	6,000	**0.19**	**81**	23.7
SB 88-13	01NE88SB025	6-8	**430**	11 VJ	4,600	**0.37**	0.042	16.5
SB 88-14	01NE88SB027	2-4	**47,000**	220 VHB	3,000	0.019	**79**	22.7
SB 88-14	01NE88SB028	12-14	210	62	900	**0.024**	0.041	22.8
SB 88-16	01NE88SB031	6-8	**16,000**	110 VHB	33 VJ	ND(0.015)	**28**	15.6
SB 88-16	01NE88SB032	10-12	**4,200**	60 VHB	12 VJ	ND(0.017)	0.9 VLB	6.7
SB 88-17	01NE88SB033	8-10	**4,700**	130 VHB	450	ND(0.013)	12	18.2
SB 88-17	01NE88SB034	12-14	**4,300**	140 VHB	110 VJ	ND(0.012)	3.6	8.31
SB 88-18	01NE88SB035	8-10	**7,300**	100 VHB	24 VJ	0.018 VHB	10	14

Table 2-7
Sites 13, 15, 19, 20, and 27 (Site 88) Results, Regulatory Exceedences
(continued)

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	GRO	RRO	Benzene	Naphthalene	Chromium
SB 88-18	01NE88SB036	10-12	**4,000 VJ**	170 VHB	220	**0.062 VJ**	6.9 VJ	16.7 VJ
ADEC Method Two Cleanup Level			250	300	11,000	0.02	21	26
Groundwater (mg/L)								
MW 88-2	01NE88GW002	N/A	0.71	ND (0.05)	**1.3**	0.00092	NA	NA
MW 88-3	01NE88GW003	N/A	**34**	0.42	0.22	0.00057	NA	NA
MW 88-4	01NE88GW004	N/A	**72**	1.2	**1.9**	**0.03**	NA	NA
MW 88-5	01NE88GW005	N/A	**9.8**	**1.3**	**2.3**	**0.019**	NA	NA
MW 88-6	01NE88GW006	N/A	**69**	1.1	**2.1**	0.00074	NA	NA
MW 88-7	01NE88GW007	N/A	**6.1 VLB**	**1.5**	0.32	**0.014**	NA	NA
MW 88-8	01NE88GW008	N/A	**20**	0.52	0.18 VJ	0.00012 VJ	NA	NA
MW 88-10	01NE88GW010	N/A	**55**	0.12	**1.3**	0.0027	NA	NA
ADEC Table C Cleanup Level			1.5	1.3	1.1	0.005	0.07	0.1

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
GRO = gasoline range organics
GW = groundwater
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
MW = monitoring well
N/A = not applicable
NA = not analyzed
ND = analyte not detected. Method reporting limit shown in parenthesis
RRO = residual range organics
SB = soil boring
VHB = result biased high
VJ = estimated value
VLB = result is estimated with a low bias

2.1.6.3 Groundwater Sampling

Observed water levels throughout the Northeast Cape site in 2002 were much lower than in previous years, as evidenced by dry ephemeral ponds and streambeds and low water in the Suqitughneq River. Photos of Suqitughneq River showing the low water levels are provided in Appendix C. After installation and development of the monitoring wells, groundwater samples were collected from each well and analyzed for DRO, RRO, GRO, BTEX, alkalinity, sulfate, methane, ethane, and ethene. Most monitoring wells became dry during sampling as noted in field logs/forms found in Appendix A. Photos of monitoring wells are provided in Appendix C.

Concentrations of DRO were detected in seven of the 10 monitoring wells at concentrations that exceed the ADEC Table C cleanup level, ranging from 6.1 to 72 mg/L (Table 2-7). RRO was detected in four of 10 monitoring wells at concentrations that exceeded the ADEC Table C cleanup level, ranging from 1.3 to 2.3 mg/L. GRO was detected in two of 10 monitoring wells at concentrations that equaled or exceeded the ADEC Table C cleanup level. Benzene was detected in 3 of 10 monitoring wells at concentrations at or above the Table C cleanup level.

2.1.7 Site 14 – Emergency Power/Operations Building

The Emergency Power/Operations Building, which housed a transformer bank, was located at this site. The site also contained a 5,000-gallon AST formerly used for fuel on the southern perimeter (Figure 2-10). In 1998, total PCBs were detected in surface soil at a concentration of 1.5 mg/kg (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 14 were to determine the presence of PCB contamination in surface soil and, if present, to define the extent of the contamination.

In accordance with the Work Plan, a sampling grid was established at the site of suspected PCB contamination in accordance with the protocols described in 40 CFR 761, Subpart N. The sampling grid was three cells long by four cells wide. Each cell was a square measuring 10 feet by 10 feet. A surface soil sample was collected at 0 to 0.5 feet bgs from each grid location using a stainless steel spoon and screened for PCBs in the field using an immunoassay test kit. Photos of the sampling grid are provided in Appendix C. Field screening indicated the presence of PCBs above the detection level of 0.5 mg/kg in seven of 12 samples analyzed. The field screening results are in a unitless numeric colorimetric reading. Negative numbers indicate the presence of PCBs above the field-test-specific numerical criteria, which was 0.5 mg/kg total PCB (wet basis) for this investigation. Positive numbers indicate the absence of total PCBs above 0.5 mg/kg PCB (wet basis). The three soil samples with the highest negative numbers were submitted for laboratory analysis of PCBs to confirm the results obtained during field screening (Figure 2-10).

All three soil samples contained detectable concentrations of the PCB Aroclor™ 1260. The two samples with the highest negative field screening values contained PCBs above the Method Two cleanup level: SS101 at 3.6 mg/kg and SS102 at 19 mg/kg (Table 2-8).

Table 2-8
Site 14 Soil Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	Total PCBs by Immunoassay (colorimetric)	PCB Aroclor-1260 (mg/kg)
SS 101	01NE14SS101	0.5	-0.71	**3.6**
SS 102	01NE14SS102	0.5	-0.85	**19**
SS 103	01NE14SS103	0.5	-0.43	0.2
ADEC Method Two Cleanup Level				1.0

Key:
Bold indicates concentration exceeds cleanup level.
ADEC = Alaska Department of Environmental Conservation
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl

Based on these results, it appears that the field screening tests may result in some false-positive results. This is not uncommon.

2.1.8 Site 16 – Paint and Dope Storage Building

2.1.8.1 Background

Site 16 included a Paint and Dope Storage Building, which was a single-room, wood-frame building on the north side of the perimeter access road surrounding the housing and operations complex. One steel AST, presumed to be used for oiling roads, was located on the northern border of the site (Figure 2-11). During the 1994 investigation, PCBs were detected in surface soils at concentrations up to 1.4 mg/kg, and lead was detected in concentrations of up to 822 mg/kg (Montgomery Watson, 2000a). Also, bis-(2-ethylhexyl)phthalate was detected in one groundwater sample (Montgomery Watson, 2000a).

Objectives of Phase III RI fieldwork at Site 16 were to confirm PCB, pesticide, and lead contamination in soil, and bis-(2-ethylhexyl) phthalate contamination in groundwater.

2.1.8.2 Soil Sampling

The following surface soil samples were collected at Site 16 (Figure 2-11):

- 2001 Samples SS165 and SS167 were collected in the vicinity of the 1994 Sample SS159. PCBs and lead were previously detected in Sample SS159 at concentrations of 0.9 and 586 mg/kg, respectively.
- 2001 Samples SS166 and SS168 were collected the vicinity of 1994 Samples SS161 and SS163. PCBs were previously detected in Sample SS163 at a concentration of 1.4 mg/kg and lead was previously detected in Sample SS161 at a concentration of 822 mg/kg.

2001 Samples SS165 and SS166 were analyzed for PCBs and lead. After the initial sample collection, two additional samples (SS167 and SS168), were collected from the same locations and analyzed for pesticides. Photos of sample locations are provided in Appendix C.

No PCBs, pesticides, or lead were detected in the soil samples at concentrations exceeding Method Two cleanup levels (Appendix D).

2.1.8.3 Groundwater Sampling

Groundwater samples were collected from three existing monitoring wells at Site 16 and analyzed for PAHs. Photos of monitoring wells are provided in Appendix C. Bis-(2-ethylhexyl) phthalate was detected in two samples at concentrations below the Table C cleanup level, but was not detected in the sample from MW16-3. No other PAHs were detected above Table C cleanup levels (Appendix D).

2.1.9 Site 21 – Wastewater Treatment Facility

2.1.9.1 Background

Site 21 consists of the Wastewater Treatment System, no longer in operation, which served the Housing and Operations Complex. This facility was located west of the perimeter road and included two side-by-side concrete septic settling tanks (AST 21-1 and AST 21-2) that were approximately 15 feet wide by 50 feet long and 8 feet deep. These settling tanks discharged to a third tank (AST 21-3), perpendicular to ASTs 21-1 and 21-2. The tanks received wastewater from all buildings at the MOC. Effluent from AST 21-3 was discharged via an 8-inch insulated cast iron pipe to a wetland area approximately 450 feet to the west. Sludge samples collected from these tanks in 1999 contained PCBs at concentrations of up to 122 mg/kg, exceeding ADEC and federal regulatory limits (Montgomery Watson, 2000a).

Objectives of Phase III RI fieldwork at Site 21 were to confirm the presence of PCBs and define the extent of PCB contamination adjacent to the tanks and downgradient of the sewage outfall.

2.1.9.2 Soil and Sediment Sampling

In the area adjacent to the septic tanks, three co-located surface and subsurface soil samples were collected (Figure 2-12). Photos of sample locations are provided in Appendix C. One of these samples was collected to confirm PCB results near the location of 1994 Soil Sample SS168, where PCBs were detected at a concentration of 1.92 mg/kg. Two surface soil samples, SS172 and 173, were collected downgradient of the outfall pipe. Soil samples were analyzed for DRO, RRO, GRO, VOCs, PCBs, and metals.

DRO was detected in the surface and subsurface samples at SS/SB169 and SS/SB170, collected near the settling tanks, above the Method Two cleanup level (Table 2-9). Concentrations of DRO were also detected above the Method Two cleanup level in one surface sample located near the outfall pipe (SS173). Arsenic was detected above the Method Two cleanup level in all surface and subsurface samples, ranging from 3 to 14.7 mg/kg. Chromium was detected above

Table 2-9
Site 21 Soil Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO (mg/kg)	Arsenic (mg/kg)	Chromium (mg/kg)
SS/SB 169	01NE21SS169	0.5	**270**	**7.4**	4
SS/SB 169	01NE21SB169	1.5	**640**	**3.0**	**27.4**
SS/SB 170	01NE21SS170	0.5	**380**	**5.9**	2.2
SS/SB 170	01NE21SB170	1.5	**340**	**4.0**	20.5
SS/SB 171	01NE21SS171	0.5	94	**6.1**	**39.8**
SS/SB 171	01NE21SSB71	1.5	ND (5)	**4.3**	**41**
SS 172	01NE21SS172	0.5	140	**11.5**	25
SS 173	01NE21SS173	0.5	**300**	**4.5**	23.2
SW/SD 113	01NE21SD113	0.5	**310**	**12.1**	**36**
SW/SD 114	01NE21SD114	0.5	**310**	**14.7**	**50**
ADEC Method Two Cleanup Level			250	2.0	26

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
ND = analyte not detected. Method reporting limit shown in parenthesis
SB = soil boring
SD = sediment
SS = surface soil
SW = surface water
WP = well point

the Method Two cleanup level in two surface and one subsurface sample near the septic tanks. PCBs were detected below the Method Two cleanup level in two surface samples, one near the septic tanks and one near the outfall pipe. No other analytes were detected above Method Two cleanup levels.

Two sediment samples were collected; one from each location where a surface water sample was collected near the outfall pipe. Sediment samples were analyzed for DRO, RRO, VOCs, PCBs, and metals.

DRO, arsenic, and chromium were detected in both sediment samples above the Method Two cleanup levels. No other analytes were detected at concentrations exceeding Method Two cleanup levels (Table 2-9).

2.1.9.3 Surface Water Sampling

Two surface water samples were collected from an ephemeral water body downgradient of the outfall pipe. Photos of sample locations are provided in Appendix C. Surface water samples were analyzed for DRO, RRO, GRO, PCBs, and metals.

No DRO or metals were detected at concentrations exceeding Table C cleanup levels (Appendix D). No RRO, GRO, or PCBs were detected.

2.1.10 Site 22 – Water Wells and Water Supply Building

2.1.10.1 Background

Site 22, located adjacent to the MOC (Site 88), consisted of a pumphouse, three water supply wells, and the potable water storage building that held four 20-foot diameter, 26-foot high water tanks and associated piping. The pumphouse and tanks have been removed and the wells were decommissioned in accordance with ADEC procedures in 2001. The former water storage building also contained 150 1-gallon paint cans full of Asbestos Retort Cement and ten 50-pound bags of asbestos cement. All containerized waste has been removed. Only the stem walls of the Water Storage Building remain. The pumphouse contained a diesel-powered engine and pump that were apparently supplied with fuel from a UST located on south side of building. Soil and sediment samples collected in 1994 from areas around the diesel engine, pump, and UST showed areas where concentrations of DRO, antimony, and lead exceeded cleanup standards. Groundwater samples collected in 1994 contained no contaminants at concentrations above regulatory criteria.

The objective of Phase III RI fieldwork was to determine if fuel contamination or evidence of natural attenuation of fuel contamination was present in the potable water wells or soil.

2.1.10.2 Groundwater Sampling

Following removal of the water pumps installed with the system, the three water supply wells were sampled (Figure 2-13). Photos of well sampling are provided in Appendix C. Groundwater samples were analyzed for DRO, RRO, GRO, BTEX, and parameters that are used to evaluate the potential for natural attenuation (i.e., alkalinity, chloride, sulfate, nitrogen, sulfide, chemical oxygen demand, and some metals).

In water supply well 22-2, DRO and RRO were detected (Table 2-10); DRO was below the Table C cleanup level, RRO exceeded the Table C cleanup level. GRO and BTEX were not detected. No petroleum constituents were detected at the two other water supply wells at Site 22.

Table 2-10
Site 22 Groundwater Results, Regulatory Exceedences

Sample Location	Sample Identification	RRO (mg/L)	DRO (mg/L)
Well 22-2	01NE35GW102	**2.8**	1.4
ADEC Table C Cleanup Level		1.1	1.5

Key:
Bold indicates concentration exceeds cleanup level.
ADEC = Alaska Department of Environmental Conservation
GW = groundwater
mg/L = milligrams per liter
RRO = residual range organics

Natural attenuation parameters may be used to determine if natural attenuation of petroleum hydrocarbons is occurring in this area. This determination must be based upon baseline background conditions and the results of several sampling events. Though the wells at Site 22 were decommissioned in 2001, natural attenuation data can be used in the future if sampling from a similar depth occurs.

2.1.10.3 Soil Sampling

In 2002, two soil borings were advanced at Site 22 to evaluate the presence or absence of groundwater and to investigate possible soil contamination at this site (Figure 2-13). Both soil borings were located near a former utilidor north of the former water storage building that was a suspected potential conduit for fuel constituents, based on field observations of contamination inside the building during previous investigations. Photos of soil boring locations are provided in Appendix C. Soil samples were collected continuously from 2-foot intervals using a split-spoon and screened in the field using a PID. The sample with the highest volatile organic concentration in soil headspace as measured by the PID and the sample from the groundwater interface were submitted as laboratory samples and analyzed for DRO, RRO, GRO, BTEX, PCBs, lead, zinc, chromium and TOC.

Soil borings met refusal on a hard rock surface at 32 and 36 feet bgs. No groundwater was encountered. No analytes were detected at concentrations exceeding Method Two cleanup levels in soil samples.

2.1.11 Site 24 – Receiver Building Area

2.1.11.1 Background

The Receiver Building, located approximately 1.5 miles west of the Housing and Operations Complex, consisted of a reinforced concrete building on concrete pillars. All equipment associated with the building was removed and the building was burned; only the concrete shell remained, which is scheduled for removal in 2003-2004. Debris that may be associated with the Receiver Building was reported in an ephemeral surface water body adjacent to the site. The pad on which the building was constructed is likely to consist of approximately 1,000 empty, buried POL drums aligned in rows and covered with gravel. During the Phase II RI, DRO, lead, chromium, and the VOC cis-1,2-dichloroethene were detected at concentrations above soil cleanup standards in soil and sediment samples (Montgomery Watson, 2000a). However, the data was qualified by the laboratory as an estimate, biased high.

Objectives of Phase III RI fieldwork at Site 24 were to inventory the remaining debris and to investigate the presence or absence of contamination in sediment and surface water.

An inventory of the debris on the pad, in the surface water, and in the immediate vicinity of the site was performed and documented in field activity logbooks and with photographs.

2.1.11.2 Surface Water Sampling

One surface water sample was collected at the location of one of the sediment samples (SW114, Figure 2-14). Photos of sample locations are provided in Appendix C. The surface water sample was analyzed for DRO, RRO, GRO, VOCs, PCBs, and metals.

No metals were detected at concentrations exceeding Table C cleanup levels (Appendix D). No DRO, RRO, GRO, VOCs or PCBs were detected at or above the method detection limit.

2.1.11.3 Sediment Sampling

Two sediment samples were collected from suspected contaminated areas (adjacent to submerged debris and stained soil locatedat the edge of the pond. Sediment samples were analyzed for DRO, RRO, GRO, VOCs, PCBs, and metals. Photos of sample locations are provided in Appendix C.

DRO was detected in Sample SD114 above the Method Two cleanup level (Table 2-11). Arsenic and antimony were detected in both sediment samples above the Method Two cleanup level. GRO and PCBs were not detected. No other analytes were detected above Method Two cleanup levels.

Table 2-11
Site 24 Sediment Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)
SD 114	01NE24SD114	0.5	**4,600**	**70**	**11**
SD 115	01NE24SD115	0.5	100	**11**	**5.6**
ADEC Table C Cleanup Level			250	3.6	2.0

Key:
Bold indicates concentration exceeds cleanup level.
ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
Ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
SD = sediment

2.1.12 Site 26 – Former Construction Camp Area

2.1.12.1 Background

The former Construction Camp Area is located adjacent to the MOC. It consists of a flat gravel pad area and one former potable water well (No. 4), decommissioned in 2001 (Figure 2-13). No stained soil, structures, debris, or CON/HTW were observed and no fuel contamination was evident during a 1993 site inspection by Ecology and Environment.

The objective of Phase III RI fieldwork was to determine if fuel contamination was present in the potable water well.

2.1.12.2 Groundwater Sampling

The out-of-service water supply well was sampled following removal of the pumphouse by the cleanup contractor, Nugget Construction. There was no pump in the well. Photos of sample locations are provided in Appendix C. Groundwater samples were analyzed for DRO, RRO, GRO, VOCs, and parameters that are used to evaluate the potential for natural attenuation (i.e., alkalinity, chloride, sulfate, nitrogen, sulfide, chemical oxygen demand, and some metals).

No metals were detected at concentrations exceeding Table C cleanup levels (Appendix D). No DRO, RRO, GRO, or VOCs were detected.

2.1.13 Site 28 – Drainage Basin

2.1.13.1 Background

The Drainage Basin receives surface and subsurface flow from Site 10 (Buried Drum Field), Site 11 (Fuel Storage Tank Area), and Sites 13, 15, 19, 20, and 27 at the MOC (Figure 2-15). Diesel fuel releases from Tank 2 at Site 11 and from the Diesel Fuel Pump Island at Site 27 (within the MOC) have impacted the Drainage Basin, which flows to the Suqitughneq River. In addition, PCBs and other petroleum constituents from the Power Plant have entered the Drainage Basin. Surface soil, sediment, and surface water samples collected from the Drainage Basin indicated elevated concentrations of fuel components DRO, RRO and PAHs, metals and PCBs (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 28 were to:

- Refine understanding of the distribution of contaminated sediments within the Drainage Basin.
- Assess the contribution of upgradient sites to contamination found in the Drainage Basin.
- Assess the amount of discharge from the Drainage Basin entering the Suqitughneq River to assist in determining remedial alternatives.
- Evaluate concentrations of contaminants present in Drainage Basin vegetation consumed by subsistence users and reindeer and in resident Alaska Blackfish.

2.1.13.2 Surface Water and Sediment Sampling – Main Channel

To assist in characterizing the distribution of contaminants in the middle to lower Drainage Basin, three sets of cross sections were sampled within the main channel of the Drainage Basin (Figure 2-15). Cross section samples are numbered south to north or west to east, depending on orientation. Each set of cross sections consisted of two transects separated by approximately 100 feet. The first set was located near the confluence with the Suqitughneq River (cross sections [CS] 1 and CS 2) to evaluate contaminant flow into the river. The second set was located at a

large area of standing water near the headwaters at Sites 13 and 27 (CS 5 and CS 6). The last set was located approximately midway between the other sets of cross sections (CS 3 and CS 4). Cross sections extended to the high-water mark on either side of stream flow. At each cross section, surface sediment samples were collected from five different locations along the section perpendicular to stream flow. At each cross section, a subsurface sediment sample was collected 12 to 18 inches below the stream bottom to evaluate the depth of contaminated sediments at one of the five locations, for a total of 36 sediment samples. Photos of cross-sections and sample locations are provided in Appendix C. Sediment samples were analyzed for DRO, RRO, PAHs, PCBs, TOC, chromium, zinc, and lead.

One surface water sample was collected at the location of each set of cross sections for a total of three surface water samples. Surface water samples were analyzed for DRO, RRO, and PCBs.

DRO was detected in 29 surface and 3 subsurface sediment samples above the Method Two cleanup level from CS-1 through CS-6 in the main channel, ranging from 280 to 150,000 mg/kg (Table 2-12). Other analytes detected above Method Two cleanup levels include chromium (three samples), 2-methylnaphthalene (five samples), naphthalene (two samples) and RRO (one sample). TOC ranged from 0.55 to 49 percent (Appendix D). The highest level DRO concentration detected at Site 28 (150,000 mg/kg) was from Sample SD132, a sub-surface sample collected at CS-4, midway between the source area and the confluence with the Suqitughneq River.

In the three surface water samples collected, DRO was not detected above the Table C cleanup level; RRO and PCBs were not detected (Appendix D).

Contaminant contours for DRO, PCBs, and chromium at Site 28 are presented in Figures 2-16 through 2-18, respectively. The cross-hatched area identified as 'post release fill' on the figures is an area that is believed to have been filled after the primary fuel release from Site 10 and any contamination present is inferred to extend beneath this fill to the original bank. Contaminant contours were manually generated by extrapolating between sample locations.

2.1.13.3 Surface Water and Sediment Sampling – Outfall from the MOC

To assist in determining the contribution of contaminants from the MOC, and to characterize the extent of contamination, samples were collected across two sets of cross sections (CS-7:CS-8, and CS-9:CS-10) near the outfalls from the manhole that drains from Site 13 and the culvert that drains from Site 27 (Figure 2-15). At each cross section, surface and subsurface sediment samples were collected from three locations perpendicular to stream flow. The subsurface sediment sample was collected from approximately 2 feet below the ground surface to evaluate the depth of contaminated sediment. One subsurface sediment sample could not be collected at CS-9 due to the absence of unconsolidated material. At CS-10 one subsurface sample could not be collected due to refusal at 8 inches bgs. A surface sediment sample was collected at this location instead. A total of 23 sediment samples were collected from these four cross sections. Photos of cross-sections and sample locations are provided in Appendix C. Sediment samples were analyzed for DRO, RRO, PAHs, PCBs, TOC, chromium, zinc, and lead.

Table 2-12
Site 28 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Chromium	Lead	PCBs[1]	Naphthalene	2-methyl naphthalene
Sediment – Main Channel (mg/kg)									
CS-1	01NE28SD111	0.5	**640**	520 VJ	17	20	ND (0.21)	ND (0.037)	ND(0.037)
CS-1	01NE28SD112	1.5	**610**	1,800 VJ	23.7	14	ND (0.075)	ND (0.014)	0.039
CS-1	01NE28SD113	0.5	180	420 VJ	12	10	ND (0.26) VQQ	ND (0.045)	0.16
CS-1	01NE28SD114	0.5	**680**	3,200 VJ	20	10	ND (0.094)	0.33 VLB	1.4 VLB
CS-1	01NE28SD115	0.5	**360**	1,600 VJ	10	ND(10)	ND (0.23)	1.7	8.7
CS-1	01NE28SD116	0.5	**310**	1,500 VJ	25.7	9	ND (0.053)	0.11	0.21
CS-2	01NE28SD117	0.5	**1,500**	920 VJ	4.4	5	ND (0.061)	ND(0.091)	ND(0.091)
CS-2	01NE28SD118	1.5	**330**	430 VJ	19	9	ND (0.05)	ND(0.012)	ND(0.012)
CS-2	01NE28SD119	0.5	**36,000**	9,000 VJ	**39**	70	0.73	3.9	7.5
CS-2	01NE28SD120	0.5	**480 VLB**	1,000 VLB	13	ND(20)	ND (0.16)	1.6	6.6
CS-2	01NE28SD121	0.5	74	580 VJ	9	ND(10)	ND (0.18)	0.24	0.33
CS-2	01NE28SD122	0.5	**310 VLB**	910 VLB	ND(4)	ND(20)	ND (0.22)	0.024	0.022
CS-3	01NE28SD123	0.5	**1,600 VLB**	1,500 VLB	7	ND(9)	ND (0.24)	1.6	0.32
CS-3	01NE28SD124	0.5	**650**	2,000 VJ	19	ND(8)	ND (0.1)	4.8	7
CS-3	01NE28SD125	1.5	NA	880	18	7	ND (0.067)	3.7	6.5
CS-3	01NE28SD126	0.5	**5,200**	1,200 VJ	9	ND(10)	ND (0.2)	0.61	3.4
CS-3	01NE28SD127	0.5	**3,100**	300 VJ	12	ND(9)	ND (0.14)	3.4	33
CS-3	01NE28SD128	0.5	**15,000**	1,800 VJ	18	13	ND (0.18)	1.6	18
CS-4	01NE28SD129	0.5	**2,500**	660 VJ	5	ND(13)	ND (0.13)	7.4	4.1
CS-4	01NE28SD130	0.5	**14,000**	2,200 VJ	10	20	0.51	3.2	23
CS-4	01NE28SD131	0.5	**56,000**	9,900 VJ	18.6	21	0.3	6.4	33
CS-4	01NE28SD132	1.5	**150,000**	6,900 VJ	19	ND(20)	0.19	14	**53**

Table 2-12 (continued)
Site 28 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Chromium	Lead	PCBs[1]	Naphthalene	2-methyl naphthalene
Sediment – Main Channel (mg/kg) (cont.)									
CS-4	01NE28SD133	0.5	**4,900**	780 VJ	10	ND(9)	ND (0.15)	0.78	5.9
CS-4	01NE28SD134	0.5	**5,200**	ND(230) VQQ	22	ND(10)	ND (0.15)	1.8	26
CS-5	01NE28SD135	0.5	**1,100**	400 VJ	19.9	4	ND (0.045)	0.093	0.29
CS-5	01NE28SD136	0.5	**40,000**	**13,000 VJ**	**31**	64	0.35	**29**	**78**
CS-5	01NE28SD137	0.5	**560**	2,700 VJ	24	13	ND (0.06)	0.037	0.022
CS-5	01NE28SD138	1.5	170	1,200 VJ	24.6	13	ND (0.065)	ND(0.012)	ND(0.012)
CS-5	01NE28SD139	0.5	**520**	2,300 VJ	22	13	ND (0.078	0.043	0.032
CS-5	01NE28SD140	0.5	**6,900**	1,300 VJ	19	17	ND (0.11)	1.3	0.083
CS-6	01NE28SD141	0.5	**430**	2,200 VJ	21.7	10	ND (0.07)	0.45	0.29
CS-6	01NE28SD142	0.5	**280**	1,100 VJ	22	12	ND (0.078)	0.38	0.67
CS-6	01NE28SD143	0.5	**15,000**	2,300 VJ	**40**	75	ND (0.095)	**49**	**110**
CS-6	01NE28SD144	1.5	**6,700**	2,600 VJ	24	27	ND (0.078)	**34**	**94**
CS-6	01NE28SD145	0.5	**2,500**	3,000	24	17	ND (0.077)	12	32
CS-6	01NE28SD146	0.5	**66,000**	1,900 VJ	24	13	ND (0.095	**220**	**500**
ADEC Method Two Cleanup Level			250	11,000	26	400	1	21	43
Sediment – Outfall from Main Operations Complex (mg/kg)									
CS-7	01NE28SD147	0.5	**11,000**	1,200 VJ	20	24	ND (0.041)	1.2	5.2
CS-7	01NE28SD148	1.5	**14,000**	1,300 VJ	17	14	ND (0.082)	**27**	**59**
CS-7	01NE28SD149	0.5	**19,000**	1,900 VJ	**26.6**	82	0.41	3.2	18
CS-7	01NE28SD150	1.5	**4,600**	1,300 VJ	20.9	22	ND (0.047)	0.61	1
CS-7	01NE28SD151	0.5	**15,000**	1,000 VJ	19.4	21	ND (0.047)	5.6	29
CS-7	01NE28SD152	1.5	**5,700**	1,200 VJ	22.3	22	ND (0.054)	3.4	15
CS-8	01NE28SD153	0.5	**19,000**	2,400 VJ	13.2	32	0.244	1.6	8.9

Table 2-12 (continued)
Site 28 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Chromium	Lead	PCBs[1]	Naphthalene	2-methyl naphthalene
Sediment – Outfall from Main Operations Complex (mg/kg) (cont.)									
CS-8	01NE28SD154	1.5	**14,000**	2,000 VJ	17.1	30	0.252	2.8	18
CS-8	01NE28SD155	0.5	**88,000**	10,000 VJ	**649**	**4,590**	**2.52**	**160**	**440**
CS-8	01NE28SD156	1.5	**85,000**	**14,000 VJ**	19.9	113	0.75	**130**	**370**
CS-8	01NE28SD157	0.5	**15,000**	ND(2,000)VQQ	25.5	20	ND (0.047)	1	3
CS-8	01NE28SD158	1.5	**3,800**	1,300 VJ	8	12	0.048	18	38
CS-9	01NE28SD159	0.5	**58,000**	ND(10,000)VQQ	**28.2**	46	0.211	7.3	3
CS-9	01NE28SD160	1.5	**71,000**	2,000 VJ	24.5	28	0.063	16	3.4
CS-9	01NE28SD161	0.5	**75,000**	4,000 VJ	**26.8**	36	ND (0.052)	**54**	**260**
CS-9	01NE28SD163	0.5	**56,000**	4,000 VJ	21.4	28	0.253	9.5	2.7
CS-9	01NE28SD164	1.5	**59,000**	1,600 VJ	21.4	22	ND (0.047)	14	31
CS-10	01NE28SD165	0.5	120	620 VJ	**27.4**	61	0.151	ND(0.0088)	ND(0.0088)
CS-10	01NE28SD166	1.5	65	240 VJ	**30.1**	18	ND (0.044)	ND(0.0077)	ND(0.0071)
CS-10	01NE28SD167	0.5	**17,000**	10,000 VJ	**57.1**	219	**5.43 VLB**	ND(1.2)	ND(1.2)
CS-10	01NE28SD168	1.5	**8,200**	3,000 VJ	24.4	57	0.68	4.9	13
CS-10	01NE28SD169	0.5	**54,000**	6,300 VJ	**27.1**	48	0.435	9.9	38
CS-10	01NE28SD170	0.5	**60,000**	6,900 VJ	24.9	36	0.541	14	**51**
ADEC Method Two Cleanup Level			250	11,000	26	400	1	21	43
Sediment – Outfall from Sites 10 and 11 (mg/kg)									
CS-11	01NE28SD171	0.5	**2,200**	4,200 VJ	9	ND(20)	ND (0.25)	ND(0.045)	ND(0.045)
CS-11	01NE28SD172	0.5	**5,700**	360 VJ	156	30	ND (0.29) VQQ	ND(4.2)	ND(4.2)
CS-11	01NE28SD173	0.5	**1,600**	2,100 VJ	**29**	22	ND (0.12)	2	1.4
CS-11	01NE28SD174	1.5	**950**	2,000 VJ	**26.1**	14	ND (0.071)	0.33	0.66
CS-11	01NE28SD175	0.5	**280 VLB**	1,200 VJ	14	30	ND (0.18)	ND(0.033)	ND(0.033)

Table 2-12 (continued)
Site 28 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Chromium	Lead	PCBs[1]	Naphthalene	2-methyl naphthalene
CS-12	01NE28SD176	0.5	**790 VLB**	1,400 VJ	12	20	ND (0.29)	ND(0.052)	ND(0.052)
CS-12	01NE28SD177	0.5	**12,000**	1,200 VJ	20	39	ND (0.12)	ND(1.7)	ND(1.7)
CS-12	01NE28SD178	0.5	**45,000**	2,200 VJ	21	33	ND (0.11)	ND(3.1)	ND(3.1)
CS-12	01NE28SD179	0.5	**9,600**	1,300 VJ	14.4	24	ND (0.043)	ND(1.2)	ND(1.2)
CS-12	01NE28SD180	1.5	**8,900**	1,900 VJ	**31.3**	42	ND (0.074)	ND(1.1)	ND(1.1)
CS-12	01NE28SD181	0.5	**4,100**	1,700 VJ	19	30	ND (0.047)	ND(1.4)	ND(1.4)
CS-12	01NE28SD182	0.5	**1,400**	2,100 VJ	21	39	ND (0.11)	ND(0.068)	ND(0.068)
ADEC Method Two Cleanup Level			250	11,000	26	400		21	43
Surface Water (mg/L)									
CS-7	01NE28SW114	NA	**2.3**	ND(0.5) VQQ	NA	NA	ND (0.001)	NA	NA
ADEC Table C Cleanup Levels			1.5	1.1	0.005	0.015	0.0005	1.46	1.5

Key:

Bold indicates concentration exceeds cleanup level.
[1]PCBs include combination of Aroclors™–1242, -1254, and -1260
ADEC = Alaska Department of Environmental Conservation
CS = cross section
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not analyzed
ND = analyte not detected. Method reporting limit shown in parenthesis
RRO = residual range organics
SD = sediment
SW = surface water
VJ = estimated value
VLB = result is estimated with a low bias
VQQ = practical quantitation limit is estimated
WP = well point

One surface water sample was collected from each set of cross sections, for a total of two surface water samples. Surface water samples were analyzed for DRO, RRO, and PCBs.

DRO was detected in 12 surface and 9 subsurface samples above the Method Two cleanup level from CS 7 through CS-10 at the outfalls from the MOC, ranging from 4,600 to 88,000 mg/kg (Table 2-12). Other analytes detected above Method Two cleanup levels include: chromium (eight samples), lead (one sample), 2-methylnaphthalene (five samples), naphthalene (three samples), PCBs (two samples), and RRO (one sample). Sample SD155 had lead at 4,590 mg/kg and chromium at 649 mg/kg, the highest concentrations for these metals in the Drainage Basin. The only PCB exceedences were located in these cross sections. TOC ranged from 1.3 to 15 percent (Appendix D).

After the initial samples were collected in August 2001, additional surface and subsurface samples were collected in September 2001 and analyzed for pesticides. These additional samples were collected based on laboratory results from August 2001 sampling that showed possible pesticide peaks during PCB analysis. Five additional sediment samples, SD183 through SD187, were collected from CS-8, two at the surface and three subsurface. Two additional samples, SD188 and 189, were collected from the surface at either end of CS-11 and three surface samples, SD190 through SD192, were collected from the surface at CS-7, 9, and 10 at the center of the cross section. Sample locations SD183-187 correlate with samples SD153-158 and sample locations SD171 and 176 correlate to samples SD189 and 188. Samples SD190-192 do not directly correlate to previous sample locations.

The primary pesticide detected was 4,4'-DDD, which was detected in six of the eight samples below the Method Two cleanup level (Appendix D). Other pesticides detected include beta-BHC, Heptachlor, endosulfan sulfate, and Lindane.

In the two surface water samples, DRO was detected above the Table C cleanup level in Sample SW114; no RRO or PCBs were detected (Table 2-12).

2.1.13.4 Surface Water and Sediment Sampling – Outfall from Sites 10 and 11

To assist in determining the contribution of contaminants from Sites 10 and 11, and to characterize the extent of contamination, two cross sections were sampled (CS-11 and CS-12). The cross sections were located approximately 100 feet and 300 feet downgradient from the toe of the slope below Site 10 (Figures 1-3 and 2-1). At each cross section, surface sediment samples were collected from five locations perpendicular to flow. At each cross section, a subsurface sample was collected at one of the locations from approximately 2 feet bgs to evaluate the depth of contaminated sediments. A total of 12 sediment samples were collected from CS-11 and CS-12. Photos of cross-sections and sample locations are provided in Appendix C. Sediment samples were analyzed DRO, RRO, PAHs, PCBs, pesticides, TOC, chromium, zinc, and lead.

DRO was detected in all 10 surface and both subsurface sediment samples above the Method Two cleanup level, ranging from 280 to 45,000 mg/kg (Table 2-12). Chromium was detected in three samples above the Method Two cleanup level. TOC ranged from 3.4 to 43 percent (Appendix D).

Surface water sample 28SW11 was collected from CS-11 and analyzed for DRO, RRO, and PCBs. None of the analytes were detected above Table C cleanup levels.

After the initial samples were collected, two additional surface sediment samples were collected from either end of CS 11 and analyzed for pesticides (SD188 and SD189). These additional samples were collected based laboratory results from 2001 sampling that showed possible pesticide peaks during PCB analyses. No pesticides were detected in either sample.

2.1.13.5 Biological Sampling

To investigate contaminant concentrations in vegetation and fish, samples were collected throughout the Drainage Basin. Seventeen plant tissue samples representing 15 different species were collected from five areas within the Drainage Basin (Figure 2-19). Samples of three plant species were collected from a reference location upgradient of the Drainage Basin, on the east side of Cargo Beach Road.

Targeted plant species included berries and greens utilized as food sources for human consumption, and willows and lichens upon which reindeer graze (Table 2-13). A species of rye grass representing the dominant species in the Drainage Basin was also collected based on input from the ADEC. Whole plant samples, including roots, flowers, and fruits (except for berries which were analyzed separately), were collected and submitted for analysis as whole plant samples. Samples were accompanied by specific handling instructions such as "Plant roots are to be free from soil before sample preparation has begun". Sample handling instructions are included in Appendix B. The identity of the plants and their use as a subsistence food source was verified by Herman Toolie, Sr., a Native Elder from Savoonga. Each plant species was classified by an experienced taxonomist following sample collection. Plant tissue samples were submitted for analysis of PAHs, PCBs, and metals.

Selected analyte ranges detected in plant samples include the following:

- Arsenic – 0.06 to 2.38 mg/kg
- Chromium – 0.12 to 77.5 mg/kg
- Lead – 0.065 to 11.3 mg/kg
- PCB Aroclor™ 1254 – 0.0049 to 9.3 mg/kg
- PCB Aroclor™ 1260 – 0.0049 to 0.92 mg/kg

Plant sample PT5101 (Figure 2-19) had the highest concentrations of nearly all analytes in all samples. This genus of lichen, *Stereocaulon,* is consumed by reindeer. This result might be due to the absorption characteristics of lichen over their life span, or a highly localized point-source contamination.

Alaska blackfish were the only fish species targeted for sampling in the Drainage Basin (Figure 2-24) in order to assess toxicity and to compare with results from previous sampling. Three small Dolly Varden were caught in a trap in the lower reaches of the Drainage Basin and released. It has been observed that the input of the Drainage Basin to the Suqitughneq River is largely sub-surface in nature, as the amount of surface flow does not appear equal to the input

Table 2-13
Plant Sampling – Cross Reference to Field Identification, July 25, 2001

Plant Number	Purpose	Description	Native Name (Common Name)	Location	Reference Number	Sample Identification	Remarks[1]
1	R	Lichen, white fuzzy	Mulck	PT 5	PT 5-1	01 NE 28 PT 5 101	
2	R	Lichen, yellow	Mulck	PT 3	PT 3-2	01 NE 28 PT 3 101	
3	R	Lichen, white, straw like	Mulck	PT 3	PT 3-3	01 NE 28 PT 3 102	
4	R & H	Bush, low woody willow, green leaves	Ququnqaq or Uqfigaq (Chamiso's Willow)	PT 5	PT 5-4	01 NE 28 PT 5 106	Leaves eaten
5	R	Moss, green		PT 1	PT 1-5	01 NE 28 PT 1 101	
6	R	Moss, very bright green		PT 4	PT 4-6	01 NE 28 PT 4 101	
7	R	Flowers, pink	(Langsdorf's Lousewort)	PT 2	PT 2-7	01 NE 28 PT 2 101	
8	R	Flowers, blue	(Tall Jacob's Ladder)	PT 3	PT 3-8	01 NE 28 PT 3 103	
9	R	Flowers, yellow, daisy	(Lessing's Leopardbane)	PT 5	PT 5-9	01 NE 28 PT 5 102	
10	R	Lichen, black on rocks	Mulck	PT 5	PT 5-10	01 NE 28 PT 5 103	
11	H	Bush, very low willow, green leaves, fluffy flowers	(Diamond-leaf willow)	PT 2	PT 2-11	01 NE 28 PT 2 102	Leaves eaten
12	H	Greens, succulent	Nunivak (Leaf Roseroot)	PT 5	PT 5-12	01 NE 28 PT 5 104	
13	H	Greens, cactus-like	Kitmmik (White Arctic Mountain Heather)	PT 5	PT 5-13	01 NE 28 PT 5 105	Greens eaten
14	H	Flower, fuchsia	Angukaq	Not found			Leaves used
15	H	Greens, spinach-like, with red stack	Allqeggkaq	Not found			Leaves cooked, juice from stock (Napazio)
16	G	Grass, Rye 1		PT 1	PT 1-16	01 NE 28 PT 1 102	
17	G	Grass, Rye 2		PT 3	PT 3-17	01 NE 28 PT 3 104	
18	G	Grass, Rye 3		PT 4	PT 4-18	01 NE 28 PT 4 102	
19	RF	Lichen, white		PT 6	PT 6-19	01 NE 28 PT 6 101	RF to PT 5-1
20	RF	Bush, low woody willow, green leaves		PT 6	PT 6-20	01 NE 28 PT 6 102	RF to PT 5-4
21	RF	Greens, succulent		PT 6	PT 6-21	01 NE 28 PT 6 103	RF to PT 5-12
QC		QC Sample	See 01NE28PT104			01 NE 28 PT 5 204	
22	H	Berries, black	Kavlak	Unable to collect edible sample during field visits			
23	H	Berries, crow	Ququnghaq (Black Crowberry)	PT 5	PT 5-23	01 NE 28 PT 5 107	Sampled 8-20-01
24	H	Berries, salmon	Aqavzik	Unable to collect edible sample during field visits			
25	H	Greens, dry	Ahaqukak	Not found			Collected in dry river beds

Key:

[1]All samples submitted to laboratory for analysis of polynuclear aromatic hydrocarbons, polychlorinated biphenyls, and metals.

G = rye grass
H = human use
PT = plant tissue sample
QC = quality control sample
R = reindeer food
RF = reference sample

calculated in Section 2.1.14.3. This is especially evident during dry years. Therefore, it is believed that there are no subsistence resource fish species that use the Drainage Basin. Data from blackfish sampling was incorporated into the Ecological Risk Assessment, because they represent a possible food source for other ecological receptors in the area. Blackfish data were not incorporated into the Human Health Risk Assessment because they are not consumed by humans. Each blackfish tissue sample consisted of 6 to 10 individual fish from the same pool, which were composited to achieve the volume required for analysis. Fish tissue samples were submitted for analysis of PAHs, PCBs, metals, and total lipids.

Selected analyte ranges detected in blackfish samples include the following:

- Arsenic – 0.06 to 0.08 mg/kg
- Lead – 0.011 to 0.028 mg/kg
- PCB Aroclor™ 1260 – 0.06 to 0.14 mg/kg

Analysis of plant and blackfish tissue samples was performed to provide data for the Human Health and Ecological Risk Assessments. There are currently no ADEC-approved cleanup standards or toxicity benchmarks for these media. A detailed evaluation of plant and fish toxicity and their relation to human health will be included in the Northeast Cape Human Health and Ecological Risk Assessment, which will be released at a later date.

2.1.14 Site 29 – Suqitughneq River

2.1.14.1 Background

The Suqitughneq River receives flow from The East Tributary, the Drainage Basin (Site 28), and the West Tributary. Fish tissue samples collected from the Suqitughneq River in 1999 indicated elevated concentrations of PCBs (Montgomery Watson, 1999).

Objectives of Phase III RI fieldwork at Site 29 were to define the distribution of contaminated surface water and sediments within the Suqitughneq River and to determine concentrations of contaminants present in fish species consumed by subsistence users.

2.1.14.2 Surface Water and Sediment Sampling

Four cross sections were sampled within the Suqitughneq River. SC-1 was located in the vicinity of the 1996 Sample SW/SD-111, where 25,000 mg/kg DRO was detected in sediment (Figure 2-20) SC-2 through SC-4 were located in depositional areas and areas where fish might congregate such as pools and eddies. At each cross section, surface sediment samples were collected at three locations along a cross section perpendicular to the stream flow. Four additional surface sediment samples were also collected from the Suqitughneq River. SD-128 and SD-129 were from the lagoon estuary at the mouth of the Suqitughneq River, and SD-126 and SD127 were from upgradient of the East Tributary. Photos of cross-sections and sample locations are provided in Appendix C. Sediment samples were analyzed for DRO, RRO, PAHs, PCBs, chromium, zinc, and lead. One surface water sample was collected at the location of each cross section and analyzed for DRO, RRO, VOCs and PCBs.

DRO was detected in Samples SC-1 and SC-4 above the Method Two cleanup level, both downgradient of the Drainage Basin (Table 2-14). Arsenic was detected in the four additional sediment samples above the Method Two cleanup level along the entire length of the Suqitughneq River. No PCBs were detected.

Table 2-14
Site 29 Sediment Results, Regulatory Exceedences

Sample Location	Sample Identification	DRO (mg/kg)	Arsenic (mg/kg)
SC-1	01NE29SD114	**410**	NA
SC-4	01NE29SD124	**1,400**	NA
SD-126	01NE29SD126	240	**3.3**
SD-127	01NE29SD127	59	**5.7**
SD-128	01NE29SD128	180	**4.8**
SD-129	01NE29SD129	15	**2.8**
ADEC Method Two Cleanup Level		250	2.0

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
mg/kg = milligrams per kilogram
NA = not analyzed
SC = Suqitughneq River cross section
SD = sediment

In the four surface water samples, no metals were detected above Table C cleanup levels, and no DRO, RRO, VOCs, or PCBs were detected (Appendix D).

2.1.14.3 Contribution to Suqitughneq River

To determine the contribution made by the Drainage Basin to the Suqitughneq River, flow was measured at two locations along the Suqitughneq River in 2001 and 2002: one immediately upstream of the Drainage Basin confluence, and the second one immediately downstream of the confluence (Figure 2-21). Photos of streamflow measurement locations are provided in Appendix C.The flow was measured by profiling the cross sectional area of the streambed and measuring the average stream velocity. Stream cross sections and velocity and flow calculations are presented in Figures 2-22 and 2-23.

Profiling the streambed consisted of measuring the cross sectional area of the Suqitughneq River at the two selected locations. The velocity of flow was measured using a Flo-Mate™ Model 2000 Portable Flow Meter (manufactured by Marsh-McBirney, Inc.). The mean flow velocity was calculated using the ".2, .4, .8 Method" described in the Marsh-McBirney, Inc., *Open Channel Profiling Handbook.*

In August 2001, the stream discharge was 4.92 cubic feet per second (cfs) at the upgradient cross section. For the downgradient cross section, the stream discharge was 8.35 cfs. The difference

between these stream discharge numbers is 3.43 cfs, which is assumed to be the total contribution from the Drainage Basin. This measurement indicates the Drainage Basin contribution comprises 41 percent of total Suqitughneq River flow.

In August 2002, the stream discharge was 1.46 cfs at the upgradient cross section and 2.55 cfs for the downgradient cross section. The difference between these stream discharge numbers is 1.09 cfs, which is assumed to be the total contribution from the Drainage Basin. This measurement indicates the Drainage Basin contribution comprises 43 percent of total Suqitughneq River flow, similar to that found in 2001.

2.1.14.4 Biological Sampling

Fish samples were collected from the lagoon/estuary downstream of the Airport Road Bridge; this was the only location where anadromous Dolly Varden within the desired size range could be caught (Figure 2-24). Eight Dolly Varden were collected from the Suqitughneq River. The fish were submitted to the laboratory as frozen, whole fish samples. Because subsistence users consume fish heads, eggs, and filets, the fish were subdivided in the laboratory for analysis. Fish tissue samples were analyzed for PAHs, PCBs, selected metals, and total lipids.

Selected analyte ranges detected in Dolly Varden include the following:

- Egg Samples – PCB Aroclor™ 1254 (0.0077 to 0.013 mg/kg)
- Head Samples – PCB Aroclor™ 1254 (0.023 to 0.03 mg/kg) and lead (0.007 to 0.011 mg/kg)
- Fillet Samples – PCB Aroclor™ 1254 (0.0061 to 0.015 mg/kg) and lead (0.003 to 0.012 mg/kg)
- Remains – PCB Aroclor™ 1254 (0.015 to 0.018) and lead (0.003 to 0.007 mg/kg)

Analysis of fish tissue samples was performed to provide data for the Human Health Risk Assessment. There are currently no ADEC-approved cleanup standards or toxicity benchmarks for this media. A detailed evaluation of fish toxicity and its relation to human health will be included in the Northeast Cape Human Health and Ecological Risk Assessment, which will be released at a later date.

2.1.15 Site 30 – Background/Reference Areas

The presence of naturally occurring organic and inorganic materials is well documented throughout the state of Alaska. The volcanic nature of the geology of St. Lawrence Island suggests that many analytes, especially metals, detected during investigations at St. Lawrence Island may represent ambient concentrations of these analytes and are not associated with any human activity on the island. For the purposes of characterization, all analytes are compared to regulatory criteria regardless of background concentrations. Samples identified as background or reference during Phase III investigation are believed to represent biological and environmental media that have either not been impacted or have been minimally impacted by site activities. These samples, however, do not represent a comprehensive, statistically generated analysis of background conditions at the installation.

Samples were collected from several locations at Northeast Cape during previous investigations. Seven tundra soil samples, one background gravel soil sample, five co-located surface water and sediment sample sets, and one background groundwater sample were collected during previous site investigation work (Montgomery Watson, 1999).

The objectives of the Phase III field work in the background areas at Northeast Cape were to collect additional soil, sediment, groundwater, plant tissue, and fish tissue samples for evaluating the installation data (Figure 2-25).

Because the soil within many of the Northeast Cape gravel pads has been contaminated, reference gravel soil sample SS102 was collected from 12 to 18 inches bgs at the gravel borrow area, used as the source for building pads and covering landfills. Concentrations of selected analytes detected in this sample are presented in Table 2-15.

Two background tundra soil samples and one background sediment sample were collected. Soil Sample SS101 was collected approximately 150 feet from the southwest end of the runway and Soil Sample SS103 was collected from south of the roadbed to the west of the majority of the installation buildings. Sediment Sample SD101 was collected from the west tributary of the Suqitughneq River. Photos of sample locations are provided in Appendix C. Sediment samples were analyzed for DRO, RRO, PAHs, and metals. Concentrations of selected analytes detected in these samples are presented in Table 2-15.

Table 2-15
Site 30, Concentrations of Selected Analytes in Reference Samples

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO	RRO	Arsenic	Chromium	Lead
Soil (mg/kg)							
SS101	01NE30SS101	1.5	390	2,300	5.3	31	15
SS102[1]	01NE30SS102	0.5	11	21	4.4	52.1	28
SS103	01NE30SS103	0.5	170	1,200	ND(2)	ND(3)	ND(10)
SD101	01NE30SD101	0.5	84	270	19.8	30	59
Groundwater (mg/L)							
WP101	01NE30WP101	N/A	2.0	6.9	0.007	0.03	0.007
WP102	01NE30WP102	N/A	ND(0.25)	ND(0.5)VQQ	0.003	0.003	0.002

Key:
[1]Gravel sample collected 12 to 18 inches below ground surface.
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
N/A = not applicable
RRO = residual range organics
SD = sediment
SS = surface soil
VQQ = practical quantitation limit is estimated
WP = well point

Two well points were installed and sampled to assess shallow groundwater conditions away from site activities. Both were installed east of Cargo Beach Road: WP101 due south of Site 3 and WP102 between the road and the Suqitughneq River. Photos of well points are provided in Appendix C.Groundwater samples were analyzed for DRO, GRO, RRO, PAHs, VOCs, and metals. Concentrations of selected analytes detected in these samples are presented in Table 2-15.

Reference vegetation samples PT6101, PT6102, and PT6103 were collected from an area upgradient of the drainage basin on the east side of Cargo Beach Road (Figure 2-19). Plant samples were analyzed for PAHs, PCBs, and metals. Reference plant samples contained concentrations of metals, PAHs, and PCBs similar to those found in primary samples (Appendix D).

Background fish samples were collected from the Tapisaghak River, approximately 3 miles east of the Suqitughneq River. Four Dolly Varden and two pink salmon were collected (Figure 2-24). Although pink salmon were not a targeted species, they were inadvertently caught along with the Dolly Varden and submitted for laboratory analysis. Samples were separated into eggs, head, fillet, and remains as the primary samples were. Fish tissue samples were analyzed for PAHs, PCBs, and metals. Background fish samples contained concentrations of metals and PCBs similar to those found in primary samples (Appendix D).

Analysis of plant and fish tissue samples was performed to provide data for the Human Health and Ecological Risk Assessments. There are currently no ADEC-approved cleanup standards or toxicity benchmarks for these media. A detailed evaluation of plant and fish toxicity and their relation to human health will be included in the Northeast Cape Human Health and Ecological Risk Assessment, which will be released at a later date.

2.1.16 Site 31 – White Alice Site

2.1.16.1 Background

The White Alice Site is located at the base of Mt. Kangukhsam. The site consists of an array of four antennae, the Main Electronics Center (Building 1001), the Automobile Maintenance Shop (Building 1055), a storage shed, and seven ASTs (six outside and one inside Building 1001 – Figure 2-26). An ephemeral stream called the East Tributary drains from Sites 31 and 32 to the Suqitughneq River (Figure 1-3). Previous work at this site included a tank survey, asbestos survey and sampling effort, and removal of hazardous waste. PCBs were detected on the concrete transformer pad located adjacent to Building 1001 and in soil surrounding the concrete transformer pad at concentrations of up to 1.7 mg/kg (URS, 1992).

Objectives of Phase III RI fieldwork at the White Alice Site were to confirm the detection of PCBs in surface soils during previous investigations, characterize the extent of PCB contamination, identify any soil contamination associated with the diesel fuel stored in ASTs at the antennae and POL storage area, and evaluate whether contaminants have migrated to the East Tributary.

2.1.16.2 Surface Soil Sampling for PCB at the Transformer Pad

Twelve surface soil samples were collected from around a previously existing grid at the concrete transformer pad at Building 1001 and field-screened for PCBs using an immunoassay test kit. The sampling grid was three cells long by six cells wide. Each cell was 10 feet squared. Of the 12 screening samples, ten indicated the presence of PCBs above the action level of 0.5 mg/kg. Four surface soil samples, SS101 through SS104, were collected from the areas with the highest immunoassay test results for laboratory analysis for DRO, RRO, PCBs, and pesticides. Photos of sample locations are provided in Appendix C.

DRO and RRO were detected below Method Two cleanup levels in each of the four surface soil samples (Figure 2-26). The PCB Aroclor™ 1260 was detected in all four surface soil samples at concentrations above the Method Two cleanup level. No other PCBs or pesticides were detected.

2.1.16.3 AST and POL Storage Area Soil Sampling

At each of the four fuel ASTs located adjacent to the four antennae, two co-located surface and subsurface soil sample were collected (Figure 2-26). Photos of sample locations are provided in Appendix C. Subsurface soil samples were collected from 2 feet bgs. Surface and subsurface soil samples were analyzed for DRO and RRO.

At Antennae 1, 2, and 3, DRO was detected in all surface and subsurface samples (SS105 to SS110) at concentrations above the Method Two cleanup level, ranging from 310 to 3,400 mg/kg (Table 2-16). RRO was not detected in any soil samples collected at Antennae 1, 2, and 3. At Antenna 4, DRO and RRO were detected in both surface and subsurface samples (SS111 and SS112) at concentrations below the Method Two cleanup level.

Eight soil samples were collected near the ASTs in the POL storage area/tank impoundment. Two co-located surface and subsurface soil samples were collected (SS113 through SS120) at each of four locations (Figure 2-26). Photos of sample locations are provided in Appendix C. Soil samples were analyzed for DRO and RRO.

DRO was detected in all surface and subsurface samples SS113 through SS120 above the Method Two cleanup level, ranging from 380 to 3,000 mg/kg. RRO was detected in subsurface sample SS120 at the Method Two cleanup level (Table 2-16).

Reference surface soil sample SS125 was collected from an area upgradient of the White Alice Site believed to be unaffected by site activities and analyzed for DRO and RRO. DRO was detected at 64 mg/kg and RRO was detected at 210 mg/kg. PCBs were not detected.

2.1.16.4 Surface Water Sampling

Surface water samples SW101 and SW102 were collected from the East Tributary at locations downgradient from the White Alice Site (Figures 2-26 and 2-27). Photos of sample locations are provided in Appendix C. Surface water samples were analyzed for DRO, RRO, VOCs, PAHs, and metals.

Table 2-16
Site 31 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO (mg/kg)	RRO (mg/kg)	Total PCBs by Immunoassay (colorimetric)	PCB Aroclor™ 1260 (mg/kg)
SS101	01NE31SS101	0.5	11	33	-0.31	**6.7**
SS102	01NE31SS102	0.5	25	95	+0.14	**4.7**
SS103	01NE31SS103	0.5	18	62	-0.46	**4.1**
SS104	01NE31SS104	0.5	49	140	+0.01	**4.4**
SS105	01NE31SS105	0.5	**3,400**	ND(500)VQQ	NA	NA
SS106	01NE31SS106	1.5	**620**	ND(100)VQQ	NA	NA
SS107	01NE31SS107	0.5	**690**	ND(100)VQQ	NA	NA
SS108	01NE31SS108	1.5	**550**	ND(50)VQQ	NA	NA
SS109	01NE31SS109	0.5	**470**	ND(50)VQQ	NA	NA
SS110	01NE31SS110	1.5	**310**	ND(40)VQQ	NA	NA
SS113	01NE31SS113	0.5	**640**	ND(100)VQQ	NA	NA
SS114	01NE31SS114	1.5	**1,600**	ND(200)VQQ	NA	NA
SS115	01NE31SS115	0.5	**380**	ND(40)VQQ	NA	NA
SS116	01NE31SS116	1.5	**1,200**	ND(200)VQQ	NA	NA
SS117	01NE31SS117	0.5	**2,100**	ND(200)VQQ	NA	NA
SS118	01NE31SS118	1.5	**3,000**	ND(200)VQQ	NA	NA
SS119	01NE31SS119	0.5	**1,600**	7,800 VJ	NA	NA
SS120	01NE31SS120	1.5	**2,100**	**11,000**	NA	NA
SS123	01NE31SS123	0.5	240	1,300 VJ	NA	**22**
ADEC Method Two Cleanup Level			250	11,000	None	1

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
NA = not analyzed
ND = analyte not detected. Method reporting limit shown in parenthesis
PCB = Polychlorinated biphenyl
RRO = residual range organics
SD = sediment
SS = surface soil
VQQ = practical quantitation limit is estimated

No metals were detected above Table C cleanup levels, and no DRO, RRO, VOCs, or PAHs were detected (Appendix D).

2.1.16.5 Sampling Areas of Suspected Contamination

Two additional surface soil samples were collected from suspected contaminated areas at Site 31 (Figure 2-26). Sample SS124 was collected from immediately downgradient of the outfall pipe from the tank impoundment. Sample SS123 was collected from immediately downgradient of an outfall pipe from Building 1001, possibly a sewage outfall. Photos of sample locations are provided in Appendix C. Surface soil samples were analyzed for DRO, RRO, GRO, VOCs, PCBs, and pesticides.

The PCB Aroclor™ 1260 was detected in Sample SS123 at 22 mg/kg, above the Method Two cleanup level (Table 2-16). DRO and RRO were not detected above Method Two cleanup levels, and no other PCBs, GRO, or pesticides were detected

2.1.17 Site 32 – Lower Tram Terminal

2.1.17.1 Background

The Lower Tram Terminal is located south of the White Alice Site at the northern base of Mt. Kangukhsam. The site consists of a Tram Terminal Building, Substation Transformer Bank No. 2, three ASTs (two inside and one outside the Tram Terminal Building), a water well, and an Anchor Pit (Figure 2-27). The East Tributary drains from Sites 31 and 32 to the Suqitughneq River. Previous investigations identified PCB contamination in the concrete transformer pad at the Transformer Bank, but PCBs were not detected in soil surrounding the concrete pad (URS, 1992).

Objectives of Phase III RI fieldwork at the Lower Tram Terminal were to establish the presence or absence of soil contamination associated with the exterior diesel AST and oiling of tram cables, and to inspect the area for any visual signs of contamination, such as stained soil, distressed vegetation, septic system outfalls, or transformer pads.

2.1.17.2 Soil Sampling

Co-located surface and subsurface soil samples (SS101 and SS102) were collected from an area of heavy soil staining beneath the valve at the exterior AST (Figure 2-27). Photos of sample locations are provided in Appendix C.Soil samples were analyzed for DRO and RRO.

DRO was detected above the Method Two cleanup level in both the surface and subsurface samples (Table 2-17). RRO was not detected.

Surface soil samples SS103 through SS105 were collected from the area immediately outside the tram bay (Figure 2-27). These sample locations were determined in the field based on soil staining that was interpreted as evidence of oil dripping from the tram cables. Photos of sample locations are provided in Appendix C. Stained areas were discontinuous and appeared heavier toward the north (downhill) portion of the tram bay area. Soil samples were analyzed for DRO, RRO, PCBs, and pesticides.

Table 2-17
Site 32 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO (mg/kg)
SS101	01NE32SS101	0.5	**7,600**
SS102	01NE32SS102	1.5	**13,000**
SS104	01NE32SS104	0.5	**600**
SS105	01NE32SS105	0.5	**1,000**
SS122	01NE31SS122	0.5	**11,000**
ADEC Method Two Cleanup Level			250

Key:

Bold indicates concentration exceeds cleanup level.

ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
SS = surface soil

DRO was detected in two of the three surface soil samples at concentrations above the Method Two cleanup level (Table 2-17). No PCBs or RRO were detected above Method Two cleanup levels, and no pesticides were detected.

Two additional surface soil samples were collected from suspected contaminated areas at Site 32 (Figure 2-27). Sample SS122 was collected from the Anchor Pit. Sample SS121 was collected from an area with stained soil and distressed vegetation located approximately 50 feet downgradient of the concrete pad at Substation Transformer Bank No. 2. Photos of sample locations are provided in Appendix C. These samples were erroneously identified as having come from Site 31. Surface soil samples were analyzed for DRO, RRO, GRO, VOCs, PCBs, and pesticides.

DRO was detected in the Anchor Pit soil sample 31SS122 at a concentration above the Method Two cleanup level (Table 2-17). No RRO, GRO, or VOCs were detected above Method Two cleanup levels, and no PCBs or pesticides were detected.

2.1.18 Site 33 – Upper Tram Terminal

A tramway links the Lower Tram Terminal Building to the Upper Tram Building, which is located on top of Mt. Kangukhsam. The site consists of a Tram Terminal Building connected to the Upper Camp by an Enclosed Track Man-lift. Previous work at this site included a tank survey, asbestos survey and sampling effort, and removal of hazardous materials (URS, 1992).

Objectives of the Phase III RI fieldwork at Site 33 were to identify any soil contamination associated with oiling of tram cables.

Three surface soil samples were collected from stained soil areas immediately outside the tram bay (Figure 2-28) and analyzed for DRO, RRO, and PCBs.

DRO exceeded the Method Two cleanup level in surface soil sample SS103. (Table 2-18). RRO was below the Method Two cleanup level, and no PCBs were detected.

Table 2-18
Site 33 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO (mg/kg)
SS103	01NE33SS104	0.5	**660**
ADEC Method Two Cleanup Level			250

Key:
Bold indicates concentration exceeds cleanup level.
ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
SS = surface soil

2.1.19 Site 34 – Upper Camp

2.1.19.1 Background

The Upper Camp is located at the top of Mt. Kangukhsam. Upper Camp structures are connected to the Upper Tram Terminal Building by an Enclosed Track Man-lift and consist of a Substation Transformer Pad, one fuel AST, one water AST, a Radome (Building 221), and the Upper Quarters Building (Building 124 – Figure 2-29). Previous work at this site included a tank survey, asbestos survey and sampling effort, and removal of hazardous materials. Over 600 drums were removed from an abandoned drum field at this site where total petroleum hydrocarbons (TPH) were detected in soil samples collected from the abandoned drum field. PCBs were also detected in the concrete transformer pad and in soil surrounding the pad at concentrations of up to 1.4 mg/kg (URS, 1992).

Objectives of Phase III RI fieldwork at the Upper Camp were to confirm the concentrations of PCBs detected in soil during previous investigations and characterize the extent of contamination, identify any soil contamination associated with the diesel fuel stored in the AST, resample areas with the highest TPH concentrations from previous investigations and analyses using current analytical methods, and collect and analyze surface soil samples from areas suspected of contamination.

2.1.19.2 Surface Soil Sampling for PCBs

The sampling grid laid out during previous sampling was located and four surface soil samples were collected from previously sampled hot spots around the concrete transformer pad at the

Substation Transformer Pad (Figure 2-29) and field-screened for PCBs using an immunoassay test kit. The soil sample with the highest immunoassay test result (SS104) was submitted for laboratory analysis of PCBs. Field screening indicated no PCBs were present above the action level of 0.5 mg/kg in any of the samples. However, laboratory analysis did detect PCBs in the sample submitted. Photos of sample locations are provided in Appendix C.

PCBs were detected above the Method Two cleanup level in Sample SS104 (Appendix D).

2.1.19.3 Soil Sampling for DRO

Two co-located soil samples were collected at the fuel AST; Sample SS105 from the surface and Sample SS106 from soil approximately 2 feet bgs. The samples were collected at a stained soil area beneath the tank valve (Figure 2-29). Photos of sample locations are provided in Appendix C. Soil samples were analyzed for DRO and RRO.

DRO was detected in both the surface and subsurface soil samples above the Method Two cleanup level (Table 2-19); RRO was not detected above the Method Two cleanup level.

Table 2-19
Site 34 Results, Regulatory Exceedences

Sample Location	Sample Identification	Sample Depth (ft. bgs)	DRO (mg/kg)	Total PCBs by Immunoassay (colorimetric)	PCBs (mg/kg)
SS104	01NE34SS104	0.5	NA	+0.23	**1.06**
SS105	01NE34SS105	0.5	**980**	NA	NA
SS106	01NE34SS106	1.5	**1,100**	NA	NA
SS109	01NE34SS109	0.5	**300**	NA	0.213
ADEC Method Two Cleanup Level			250	None	1

Key:
Bold indicates concentration exceeds cleanup level.
ADEC = Alaska Department of Environmental Conservation
DRO = diesel range organics
ft. bgs = feet below ground surface
mg/kg = milligrams per kilogram
NA = not analyzed
PCBs = polychlorinated biphenyls
SS = surface soil

Surface soil samples SS101, SS102, and SS111 were collected from previous sampling locations at the abandoned drum field (Figure 2-29). Sample locations were limited due to the lack of surface soil. Surface soil samples were analyzed for DRO, RRO, PAHs, and PCBs. DRO and RRO were not detected above the Method Two cleanup level, and no PAHs or PCBs were detected.

Background surface soil sample SS103 was collected south of the former abandoned drum field (Figure 2-29) and analyzed for DRO, RRO, PAHS, and PCBs. DRO and RRO were not detected above the Method Two cleanup level, and no PAHs or PCBs were detected.

2.1.19.4 Sampling Areas with Suspected Contamination

Additional surface soil samples SS107 through SS110 were collected from areas downgradient of an outfall pipe from Building 124 (possibly a sewage outfall – Figure 2-29). Photos of sample locations are provided in Appendix C. These surface soil samples were analyzed for DRO, RRO, PCBs, and TOC.

DRO was detected above the Method Two cleanup level in Sample SS109; no other analytes were detected above Method Two cleanup levels (Table 2-19).

2.2 INVESTIGATIVE-DERIVED WASTE

Project waste consisted of four waste streams:

- Purge water from developing and purging monitoring wells
- Decontamination water from cleaning non-disposable equipment
- Soil cuttings from borehole drilling
- Disposable protective clothing, supplies, and sampling equipment

2.2.1 Purge Water

In 2001, purge water was added to the water waste stream of the BD/DR contractor for treatment/disposal. In 2002, purge water was filtered through a granular activated carbon filter and discharged to the ground surface.

2.2.2 Decontamination Water

In 2001, decontamination water was added to the water waste stream of the BD/DR contractor for treatment/disposal. In 2002, decontamination water was filtered through a granular activated carbon filter and discharged to the ground surface.

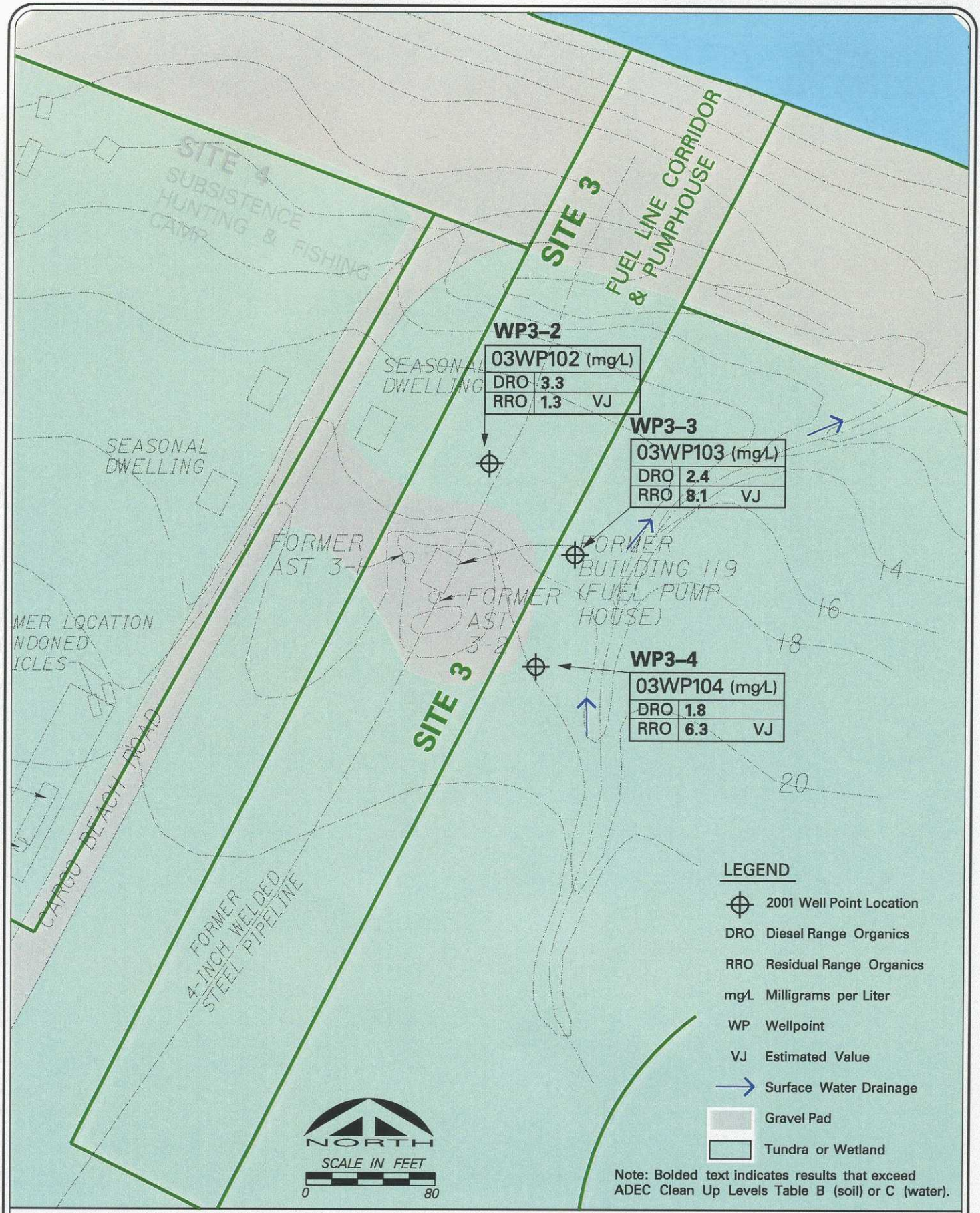
A carbon generator declaration is included in Appendix A.

2.2.3 Soil Cuttings

Soil cuttings from borehole drilling were placed on plastic sheeting until borehole drilling was completed, then the cuttings were returned to the borehole. For monitoring wells, the soil cuttings were spread at the surface.

2.2.4 Disposable Protective Clothing, Supplies, and Sampling Equipment

Based on previous data collected at the site, disposable protective clothing, supplies, and sampling equipment were designated as non-hazardous. These items were bagged and shipped to Anchorage, Alaska, for disposal as solid waste.



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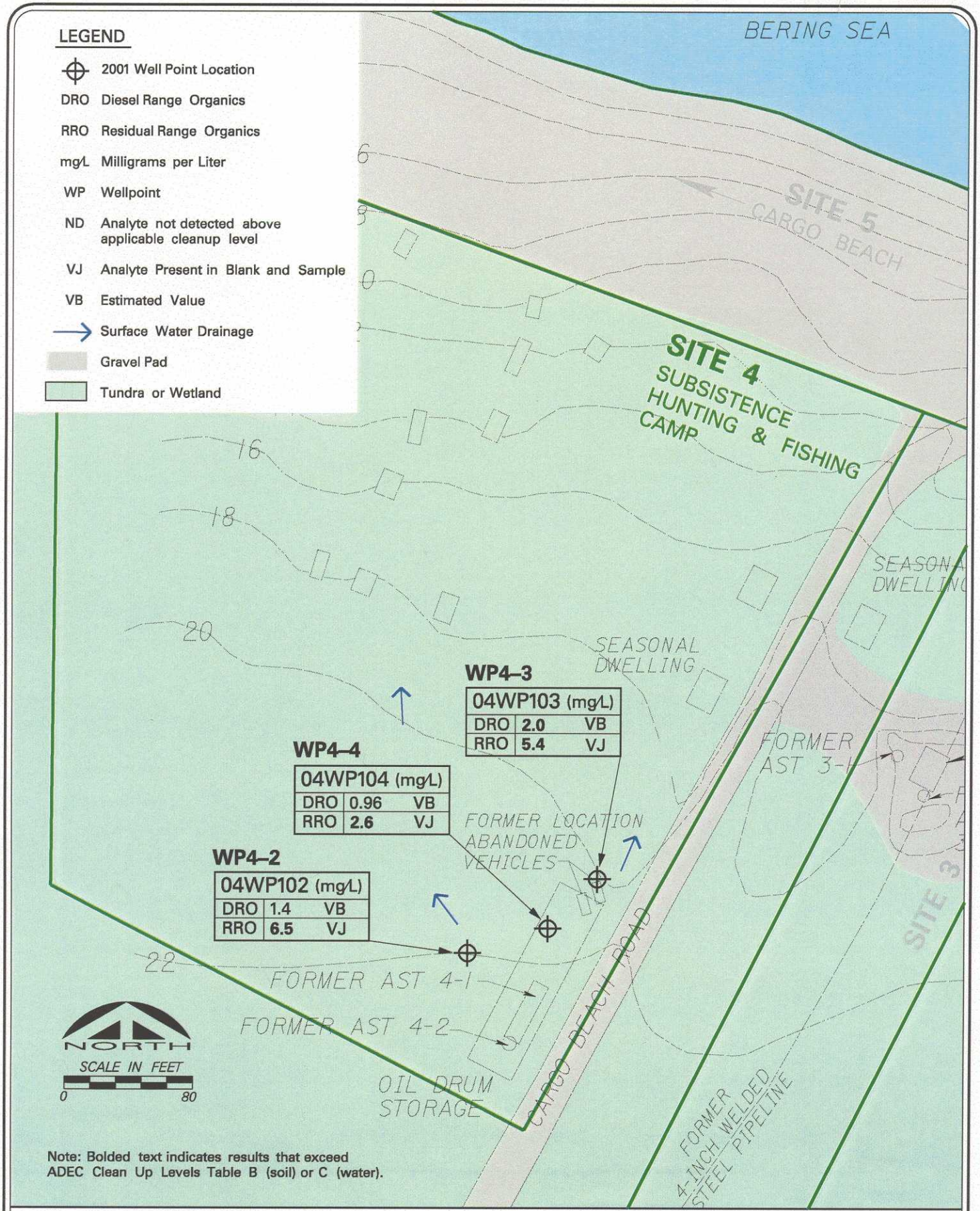
Anchorage, Alaska

FIGURE 2-1

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 3 – FUEL LINE CORRIDOR AND PUMPHOUSE
2001 SAMPLING LOCATIONS & SELECTED RESULTS



Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

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FIGURE 2–2

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 4 – SUBSISTENCE HUNTING AND FISHING CAMP
2001 SAMPLING LOCATIONS & SELECTED RESULTS

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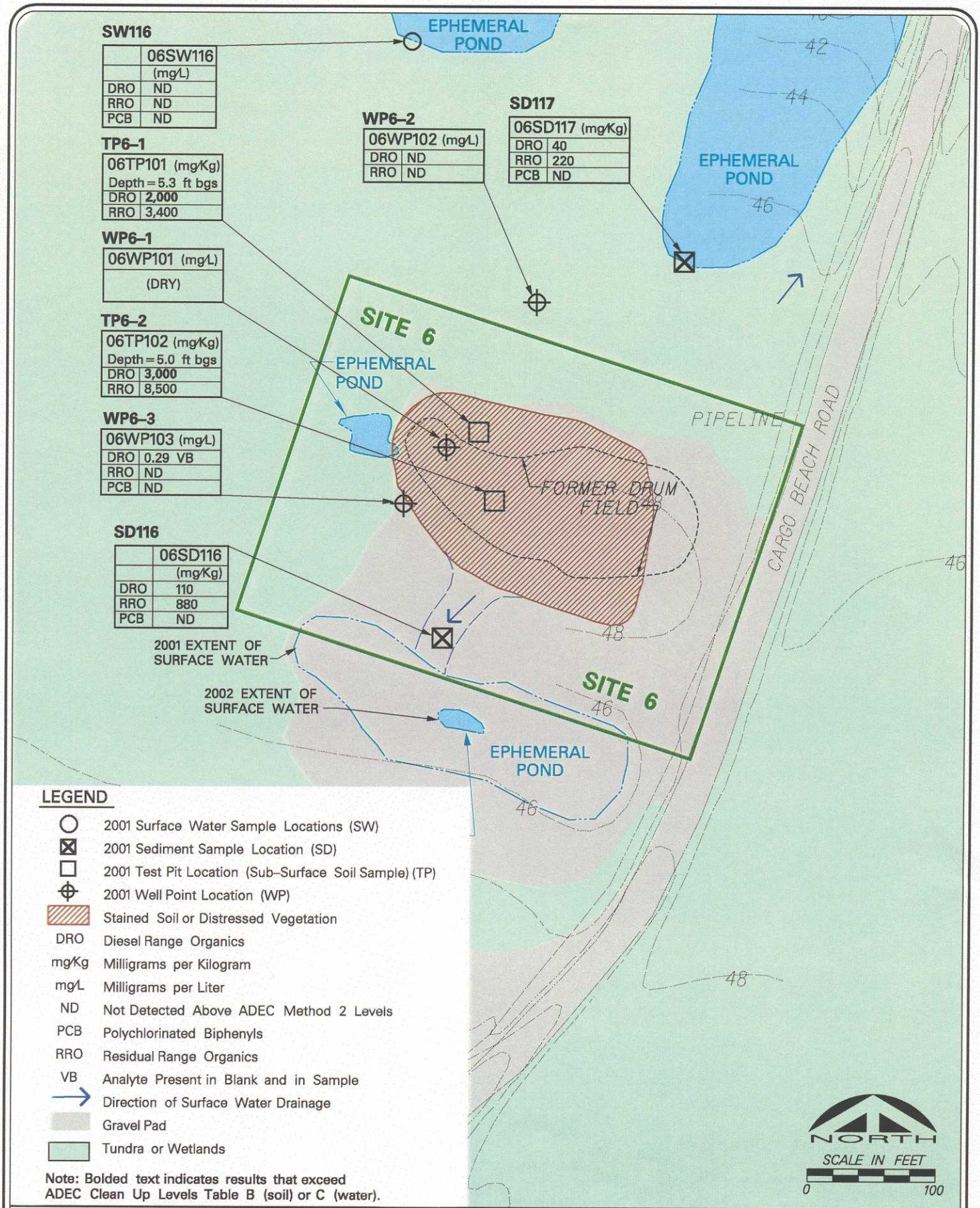

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FIGURE 2–3

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 6 – CARGO BEACH ROAD DRUM FIELD
2001 SAMPLING LOCATIONS & SELECTED RESULTS

LEGEND

- 2001 Surface Soil Sample Location (SS)
- 2001 Surface Water/Sediment Sample Location (SW/SD)
- 2001 Well Point Location (WP)
- Exposed Material (2001)
- DRO Diesel Range Organics
- mg/Kg Milligrams per Kilogram
- mg/L Milligrams per Liter
- ND Not Detected
- PCB Polychlorinated Biphenyls
- RRP Residual Range Organics
- VJ Estimated Value
- Gravel Pad
- Tundra or Wetland

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

SW/SD104

07SW/SD104	(mg/L)	(mg/Kg)
DRO	ND	**1,400**
RRO	ND	**2,800**
PCB	ND	ND

WP7–2

07WP102 (mg/L)		
DRO	ND	
RRO	**1.1**	VJ
PCB	ND	

WP7–3

07WP103 (mg/L)	
DRO	0.39
RRO	**1.4**
PCB	ND

WP7–1

07WP101 (mg/L)		
DRO	0.66	
RRO	**2.7**	VJ
PCB	ND	

SS127

07SS127 (mg/Kg)	
DRO	**720**
RRO	**3,600**
PCB	**13**

SS125

07SS125 (mg/Kg)	
DRO	150
RRO	620
PCB	**1.1**

SS126

07SS126 (mg/Kg)	
DRO	160
RRO	740
PCB	0.13

SW/SD105

	07SW105 (mg/L)	07SD105 (mg/Kg)
DRO	ND	**280**
RRO	ND	1,700
PCB	ND	ND

EPHEMERAL POND

1999 EXTENT OF SURFACE WATER

2001 EXTENT OF SURFACE WATER

1994 EXTENT OF SURFACE WATER

SITE 6

SITE 7

CONNEX STAGING AREA (2001–2003)

CARGO BEACH ROAD

LANDFILL SURVEY BOUNDARY (2001)

EXPOSED LANDFILL MATERIAL (2001)

2002 EXTENT OF SURFACE WATER

NORTH

SCALE IN FEET

0 100

NOTES

Base maps were digitized from various as–built drawings provided by the Corps of Engineers.

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FIGURE 2–4

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 7 – CARGO BEACH ROAD LANDFILL
2001 SAMPLING LOCATIONS & SELECTED RESULTS

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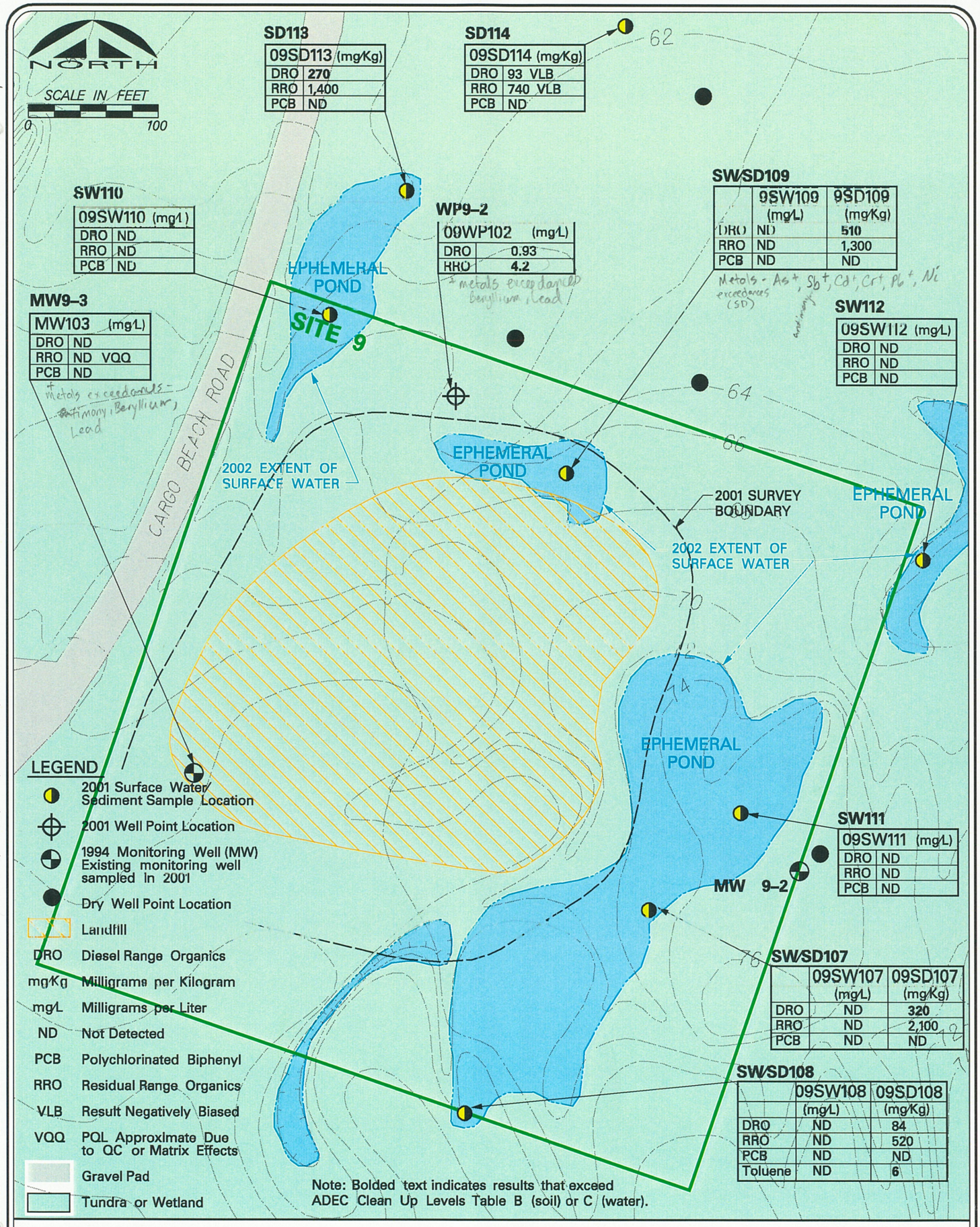

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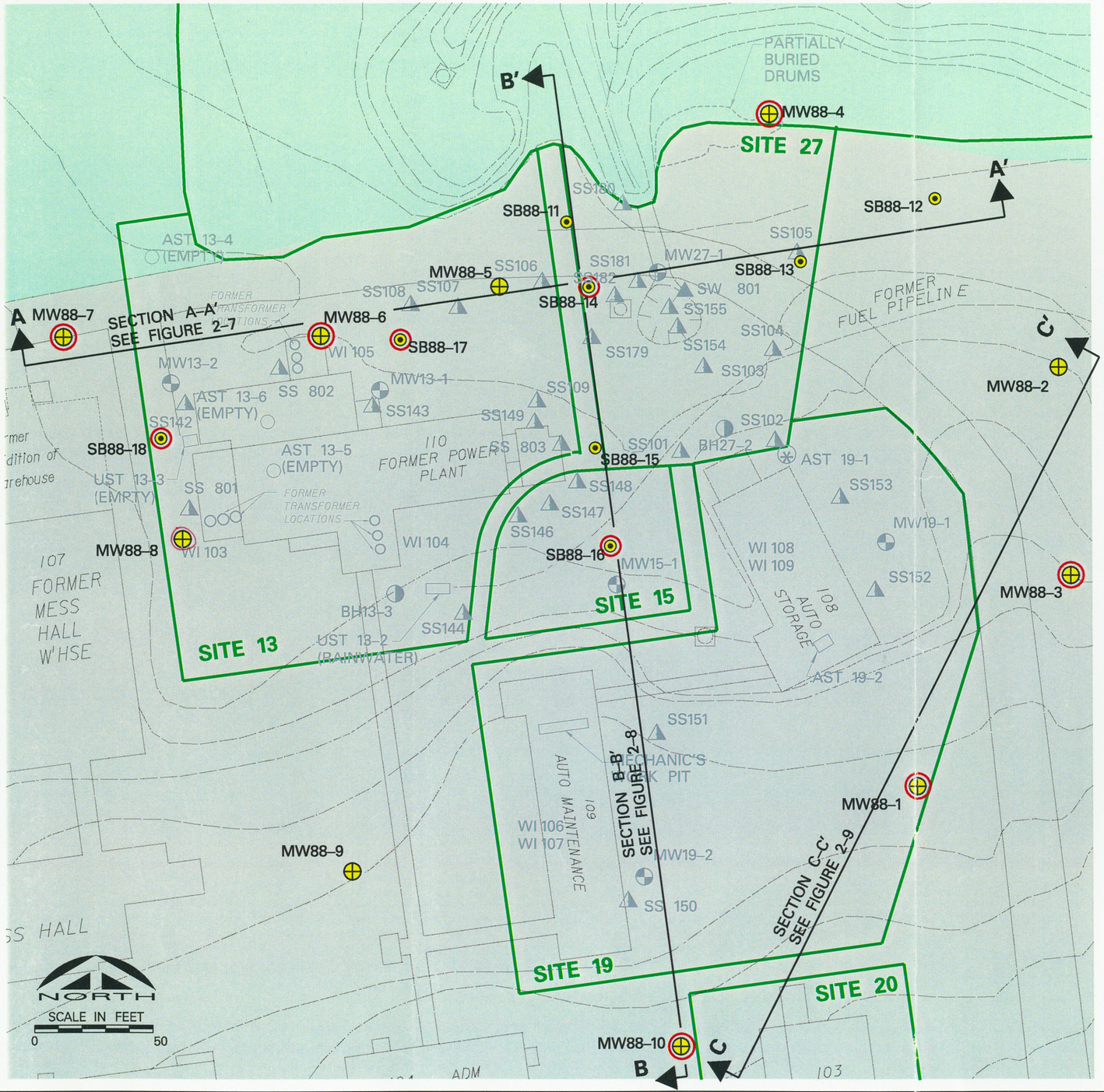
FIGURE 2–5

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 9 – HOUSING & OPERATIONS LANDFILL
2001 SAMPLING LOCATIONS & SELECTED RESULTS



SOILS RESULTS

Soil Sample Location	Sample (feet bgs)	GRO (mg/Kg)	DRO (mg/Kg)	RRO (mg/Kg)	Benzene (mg/Kg)	Toluene (mg/Kg)	o-Xylene (mg/Kg)	m & p- Xylene (mg/Kg)	Naphthalene (mg/Kg)	Chromium (mg/Kg)
MW 88-1	15.5-17.5	19	**5000**	39 VJ	ND (0.012)	ND (0.027)	ND (0.027)	ND (0.027)	0.0022 VJ	6.5
MW 88-1	17.5-20	4.9	**1400**	16 VJ	ND (0.011)	ND (0.025)	ND (0.025)	ND (0.025)	0.00038 VJ	4.38
MW 88-2	8-10	ND (3)	ND (12)	6 VJ	ND (0.014)	ND (0.035)	ND (0.035)	ND (0.035)	0.001 VJ	16.1
MW 88-2	10-12	ND (3.6)	ND (11)	7.1 VJ	ND (0.015)	ND (0.037)	ND (0.037)	ND (0.037)	0.00056 VJ	8
MW 88-3	4-6	ND (6)	7.6 VJ	120 VJ	ND (0.023)	ND (0.058)	ND (0.058)	ND (0.058)	0.00081 VJ	22.3
MW 88-3	16-18	51	**3700**	24 VJ	ND (0.021)	ND (0.051)	ND (0.051)	0.31 VJ	1.5	13.1
MW 88-4	9-11	44	**12000**	3700	**0.047**	0.083	0.89	1.6	5.9 VHB	17.3
MW 88-4	11-13	54 VHB	**2600**	16 VJ	ND (0.018)	ND (0.044)	0.01 VJ	0.29	2.3	3.73
MW 88-5	1-3	ND (2.8)	**380**	340	ND (0.012)	ND (0.025)	ND (0.025)	ND (0.025)	0.0041 VJ	**42.3**
MW 88-5	11-13	ND (4)	21	25 VJ	ND (0.014)	ND (0.034)	ND (0.034)	ND (0.034)	0.0037 VJ	4.5
MW 88-6	7-9	130 VHB	**3100**	23 VJ	ND (0.012)	ND (0.026)	0.044	0.44	4.1	12.8
MW 88-6	11-13	83 VHB	**1200**	30 VJ	ND (0.012)	ND (0.028)	0.013 VJ	0.15	1.1	8.3
MW 88-7	7-9	140 VHB	**12000**	55 VJ	ND (0.012)	ND (0.027)	0.13	1.5	7.9	17
MW 88-7	11-13	130 VHB	**9200**	54 VJ	ND (0.011)	ND (0.026)	0.38	2.2	8.4	11.6
MW 88-8	10-12	68 VHB	**5200**	11 VJ	ND (0.018)	ND (0.044)	ND (0.044)	0.17	3.3	9.63
MW 88-8	14-16	73 VHB	**2300**	7.4 VJ	ND (0.018)	ND (0.045)	ND (0.045)	0.18	2.3	8.34
MW 88-9	8-10	ND (3.5)	7 VJ	8.7 VJ	ND (0.015)	ND (0.036)	ND (0.036)	ND (0.036)	0.00045 VJ	7.04
MW 88-9	20-22	ND (4.8)	7.6 VJ	12 VJ	ND (0.016)	ND (0.038)	ND (0.038)	ND (0.038)	0.0019 VJ	12.5
MW 88-10	22-24	31	**1400**	ND (110)	ND (0.015)	ND (0.038)	ND (0.038)	ND (0.038)	0.48	10
MW 88-10	24-26	19	**750**	ND (110)	ND (0.015)	ND (0.038)	ND (0.038)	ND (0.038)	0.11	4.8
SB 88-11	3-5	70	**13000**	5100	**0.12**	3.2	2.7	5.1	12	16.5
SB 88-11	7-9	99	**51000**	6000	**0.19**	4.5	6.2	12	**81**	23.7
SB 88-12	4-6	ND (5.2)	190	150	ND (0.022)	ND (0.054)	ND (0.054)	ND (0.054)	0.0045 VJ	12.4
SB 88-12	10-12	ND (3.8)	20	33 VJ	ND (0.017)	ND (0.043)	ND (0.043)	ND (0.043)	0.0011 VJ	9.62
SB 88-13	6-8	11 VJ	**430**	4600	**0.37**	ND (0.18)	0.071 VJ	0.19	0.042	16.5
SB 88-13	14-16	ND (6.1)	77	420	ND (0.022)	ND (0.054)	ND (0.054)	ND (0.054)	0.0018 VJ	14.3
SB 88-14	2-4	220 VHB	**47000**	3000	0.019	0.036 VJ	1.7	0.71	**79**	22.7
SB 88-14	12-14	62	**210**	900	**0.24**	1.4	1.7	1.3	0.41	22.8
SB 88-15	10-12	ND (4.9)	33	150	ND (0.018)	ND (0.044)	0.01 VJ	ND (0.044)	0.016	23
SB 88-15	12-14	ND (4.4)	79	590	ND (0.021)	ND (0.052)	ND (0.052)	ND (0.052)	0.0047 VJ	23.4
SB 88-16	6-8	110 VHB	**16000**	33 VJ	ND (0.015)	0.032 VJ	0.015 VJ	1.8	28	15.6
SB 88-16	10-12	60 VHB	**4200**	12 VJ	ND (0.017)	ND (0.041)	ND (0.041)	0.043	0.9 VLB	6.7
SB 88-17	8-10	130 VHB	**4700**	450	ND (0.013)	0.05 VHB	1.5 VHB	4 VHB	12	18.2
SB 88-17	12-14	140 VHB	**4300**	110 VJ	ND (0.012)	ND (0.023)	0.34 VHB	3 VHB	3.6	8.31
SB 88-18	8-10	100 VHB	**7300**	24 VJ	0.018 VHB	0.018 VJ	0.019 VJ	0.95 VHB	10	14
SB 88-18	10-12	170 VHB	**4000 VJ**	220	**0.062 VJ**	0.041	1.3 VJ	4.4 VJ	6.9 VJ	16.7 VJ

Ethylbenzene results did not exceed ADEC Method 2

WATER RESULTS

Sample Location	GRO (mg/L)	DRO (mg/L)	RRO (mg/L)	Benzene (mg/L)	Ethylbenzene (mg/L)	Toluene (mg/L)	o-Xylene (mg/L)	m & p - Xylene (mg/L)
MW 88-1	0.024 VJ	1.2	0.43	0.00058	ND (0.0005)	0.00061 VB	0.00013 VJ	0.00022 VJ
MW 88-2	ND (0.05)	0.71	**1.3**	0.00092	0.00034 VJ	0.00036 VB	0.0001 VJ	0.00035 VJ
MW 88-3	0.42	**34**	0.22	0.00057	0.025	0.00024 VB	0.00008 VJ	0.022
MW 88-4	1.2	**72**	**1.9**	**0.03**	0.12	0.0032	0.007	0.085
MW 88-5	**1.3**	**9.8**	**2.3**	**0.019**	0.035	0.12	0.071	0.14
MW 88-6	1.1	**69**	**2.1**	0.00074	0.052	0.00019 VB	0.0038	0.055
MW 88-7	**1.5**	**6.1 VLB**	0.32	**0.014**	0.072	0.0012 VB	0.024	0.13
MW 88-8	0.52	**20**	0.18 VJ	0.00012 VJ	0.018	0.00011 VB	0.00064	0.016
MW 88-9	0.064	0.71	ND (0.2)	ND (0.0005)	ND (0.0005)	ND (0.0005)	ND (0.0005)	ND (0.0005)
MW 88-10	0.12	**55**	**1.3**	0.0027	0.0017	0.0014	0.00015 VJ	0.00079

KEY

DRO – diesel range organics
GRO – gasoline range organics
mg/Kg – milligrams per kilogram
mg/L – milligrams per liter
MW – monitoring well
ND – not detected
RRO – residual range organics
SB – soil boring
VB – analyte present in the blank and the sample
VHB – results positively biased
VJ – results negatively biased
VLB – estimated value
( ) – method reporting limit

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

LEGEND

- Monitoring Well/Soil Sample Location (2002)
- Borehole/Soil Sample Location (2002)
- Borehole (BH)
- Monitoring Well (MW)
- Surface Soil Sample (SS)
- Surface Water/Sediment Sample (SW/SD)
- Gravel Pad
- Tundra or Wetland
- Surface Water Drainage
- DRO Results Exceed ADEC Table B at Static Water Interface

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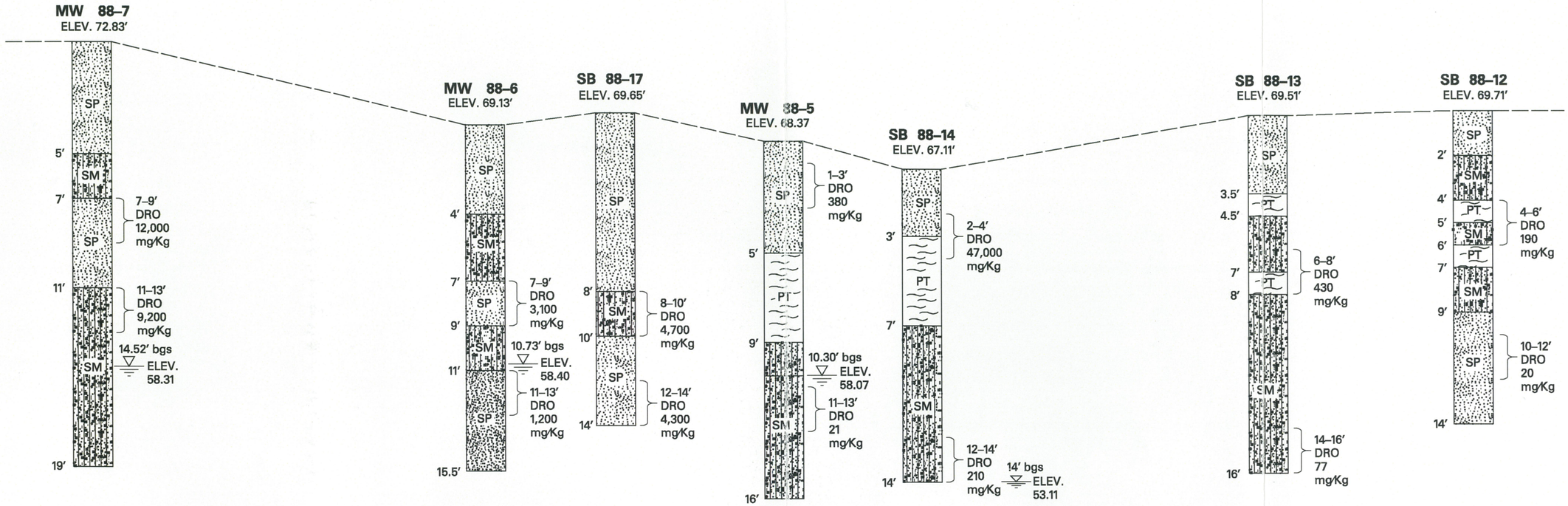
FIGURE 2-6

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 88 (SITES 13, 15, 19, 20, & 27) – MAIN OPERATIONS COMPLEX SAMPLING LOCATIONS & SELECTED RESULTS



SCALE:
HOR. 1″ = 30′
VER. 1″ = 5′

LEGEND

SB	Soil Boring Well
MW	Monitoring Well
7′–9′	Depth of Sample Below Grade Surface (bgs)
DRO	Diesel Range Organics
Elev.	Elevation
SP	Gravelly Sands
SM	Sand/Silt Mixtures
PT	Peat

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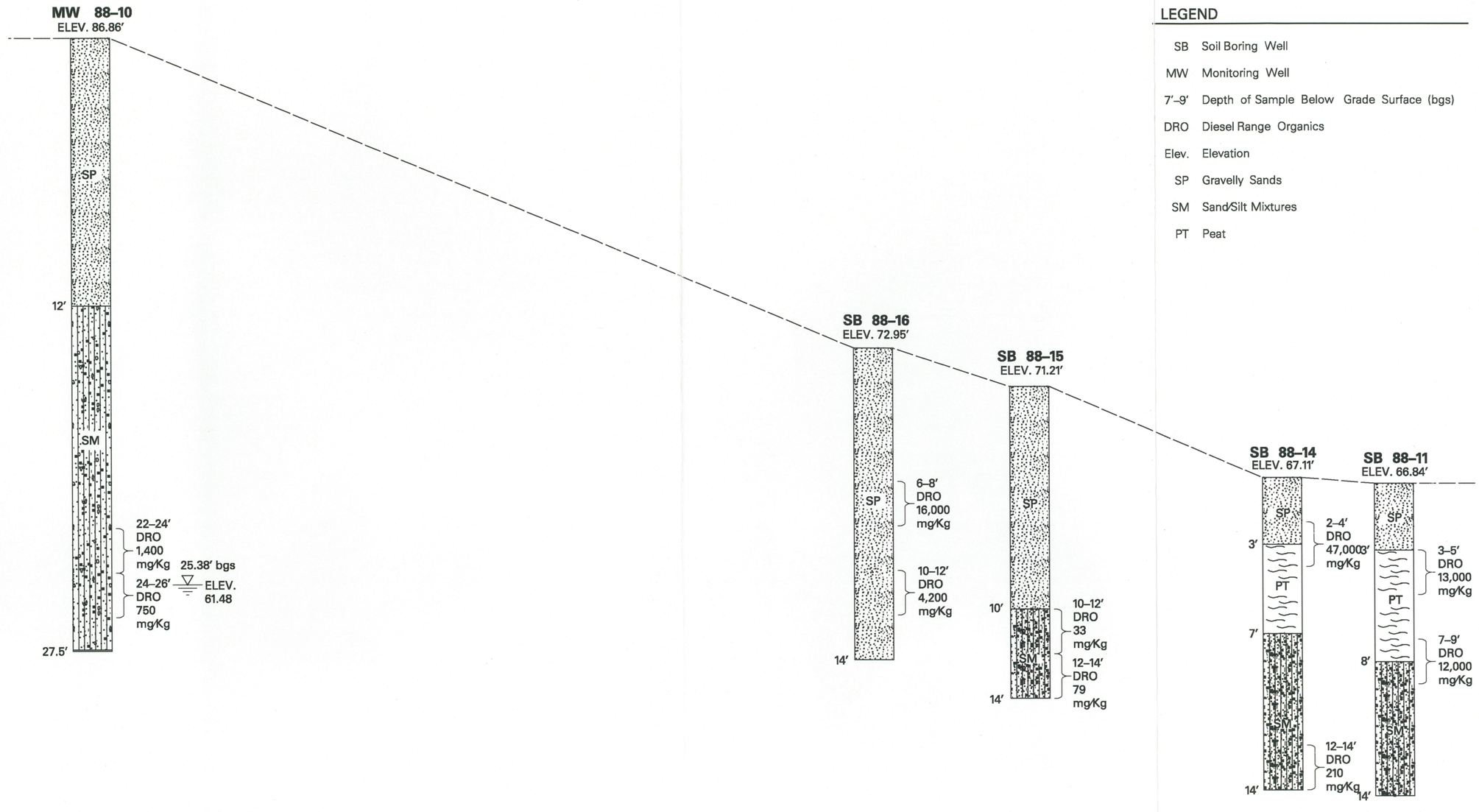
FIGURE 2–7
U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION
SITE 88 (SITES 13, 15, 19, 20, & 27) - MAIN OPERATIONS COMPLEX
SECTION A-A′



LEGEND

SB	Soil Boring Well
MW	Monitoring Well
7′–9′	Depth of Sample Below Grade Surface (bgs)
DRO	Diesel Range Organics
Elev.	Elevation
SP	Gravelly Sands
SM	Sand/Silt Mixtures
PT	Peat

SCALE:
HOR. 1″ = 30′
VER. 1″ = 5′

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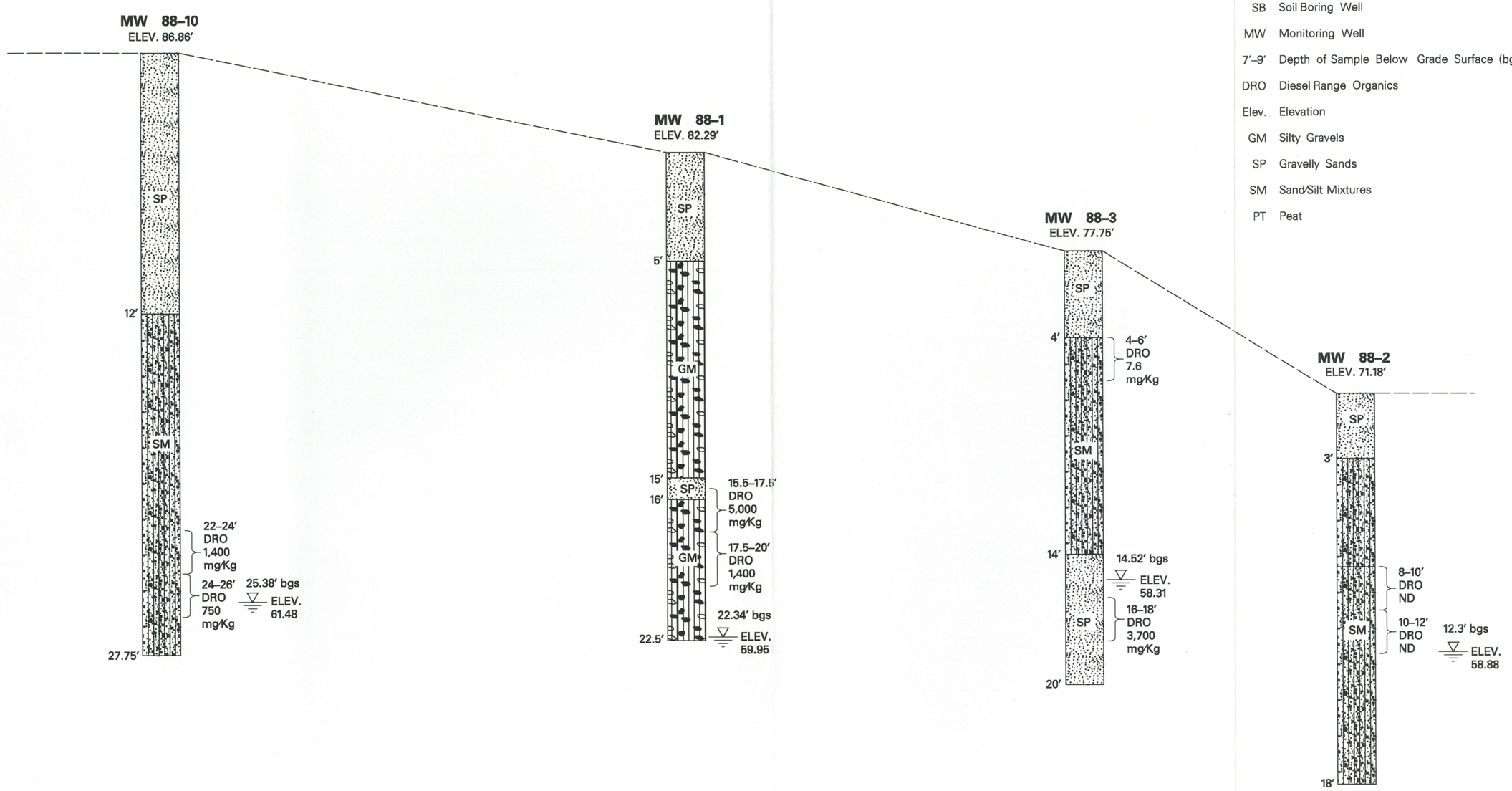
Anchorage, Alaska

FIGURE 2–8

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 88 (SITES 13, 15, 19, 20, & 27) – MAIN OPERATIONS COMPLEX SECTION B–B′



LEGEND

SB	Soil Boring Well
MW	Monitoring Well
7′–9′	Depth of Sample Below Grade Surface (bgs)
DRO	Diesel Range Organics
Elev.	Elevation
GM	Silty Gravels
SP	Gravelly Sands
SM	Sand/Silt Mixtures
PT	Peat

SCALE:
HOR. 1″ = 30′
VER. 1″ = 5′

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Anchorage, Alaska

FIGURE 2–9

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

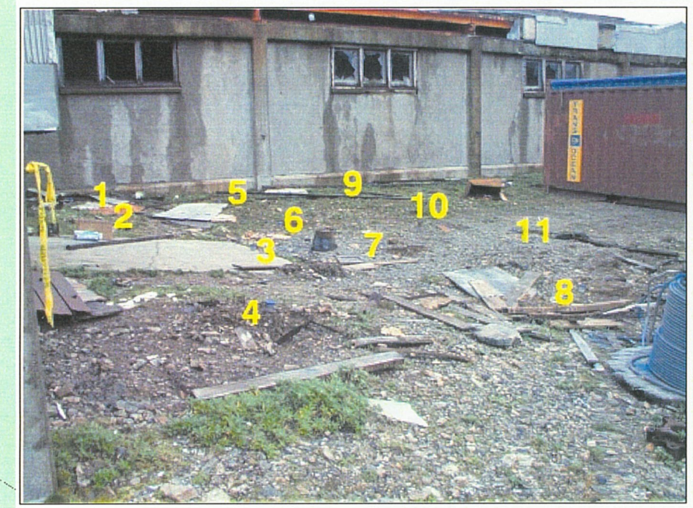
SITE 88 (SITES 13, 15, 19, 20, & 27) - MAIN OPERATIONS COMPLEX SECTION C-C′

TIME: 23-APR-2003 11:44 FILE: \\USANCIS-FILESRV\server\Cad\Proj\uscce\necape\02r1_ph3\report\FinalFinal\FIG2-10.DGN

NORTH

SCALE IN FEET

0 50



SITE 14 SCREENING GRID (10'X10' EACH)

SITE 14

FORMER BLDG. 98

SUBTERRANEAN ROOM

SUBTERRANEAN CORRIDOR

101, WEST DORMITORY

SS101

14SS101 (mg/Kg)	
PCB	**3.5**

SCREENING GRID

SS103

14SS103 (mg/Kg)	
PCB	0.2

SS102

14SS102 (mg/Kg)	
PCB	**19**

FORMER AST 18-I

FORMER TRANSFORMER LOCATIONS

LEGEND

- △ 2001 Sampling Locations
- mg/Kg Milligrams per Kilogram
- PCB Polychlorinated Biphenyl
- Gravel Pad
- Tundra or Wetlands
- Photo Orientation

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

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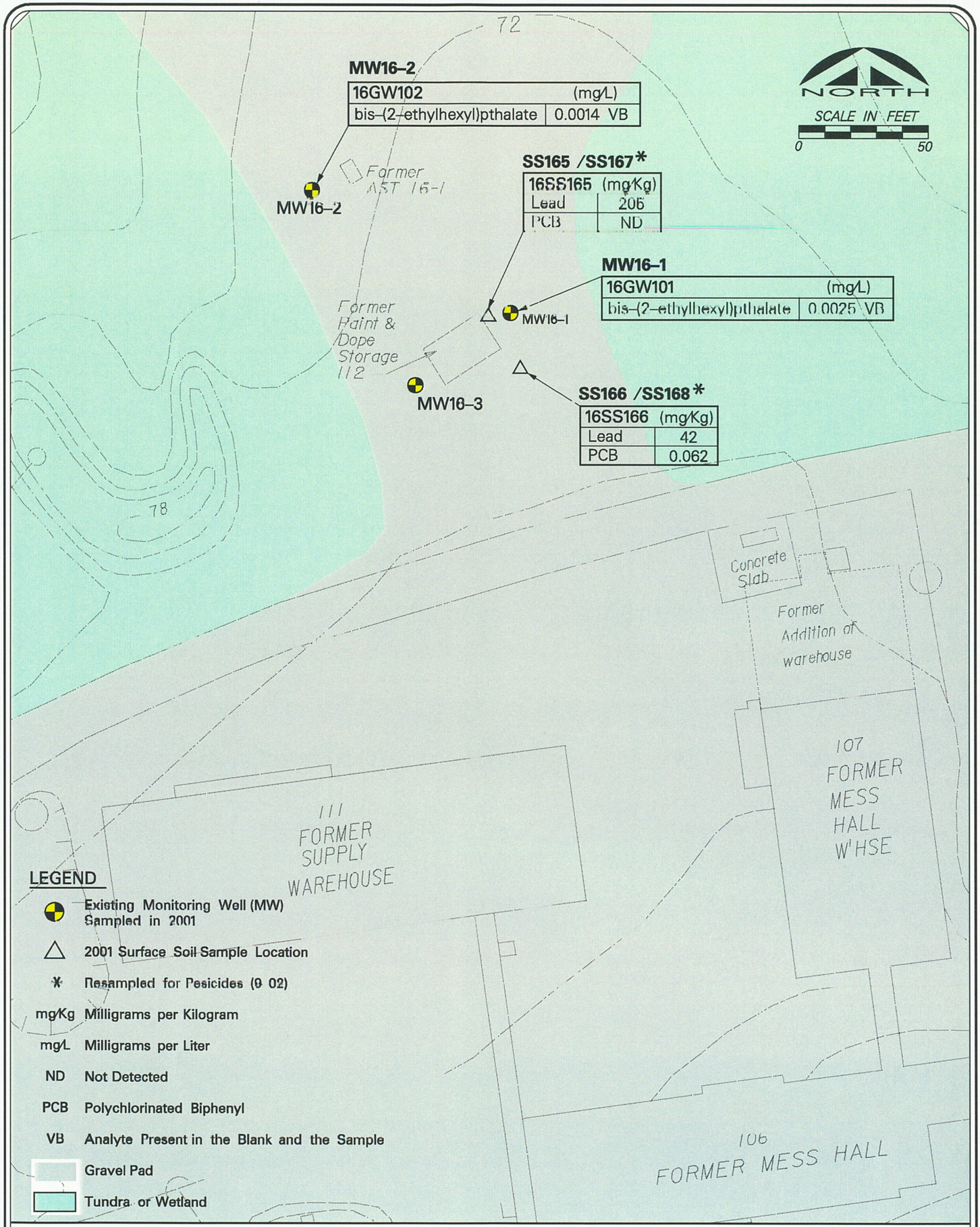
FIGURE 2-10

J. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 14 – EMERGENCY POWER/OPERATIONS BUILDING 2001 SAMPLING LOCATIONS & SELECTED RESULTS



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Anchorage, Alaska

FIGURE 2–11

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 16 – FORMER PAINT AND DOPE STORAGE BLDG.
2001 SAMPLING LOCATIONS & SELECTED RESULTS

LEGEND

- 2001 Surface Soil Sample Location (SS)
- 2001 Surface Soil/Subsurface Soil Sample Location (SS/SB)
- 2001 Surface Water/Sediment Sample Location (SW/SD)
- DRO Diesel Range Organics
- mg/Kg Milligrams per Kilogram
- mg/L Milligrams per Liter
- ND Not Detected
- PCB Polychlorinated Biphenyls
- RRO Residual Range Organics
- VQQ PQL Approximate Due to QC or Matrix Effects
- Gravel Pad
- Tundra or Wetland

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

SW/SD113

	21SW113	21SD113
	(mg/L)	(mg/Kg)
DRO	0.3	**310**
RRO	ND	2,000
AS	0.002	**12.1**
CR	ND	**36**
PCB	ND	ND

SS172

21SS172	(mg/Kg)
DRO	140
RRO	390
PCB	ND
AS	**11.5**

SW/SD114

	21SW114	21SD114
	(mg/L)	(mg/Kg)
DRO	ND VQQ	**310**
RRO	ND VQQ	2,000
PCB	ND	ND
AS	ND	**14.2**
CR	ND	**50**

SS/SB169

	21SS169	21SB169
	(mg/Kg)	(mg/Kg)
Depth	0–.5'	1.5–2.0'
DRO	**270**	**640**
RRO	2,800	3,700
PCB	ND	ND
AS	**7.4**	**3.0**
CR	ND	**27.4**

SS173

21SS173	(mg/Kg)
DRO	**300**
RRO	1,700
PCB	0.32
AS	**4.5**

SS/SB170

	21SS170	21SB170
	(mg/Kg)	(mg/Kg)
Depth	0–.5'	1.5–2'
DRO	**380**	**340**
RRO	2,200	2,300
PCB	0.29	ND
AS	**5.9**	**4.0**

SS/SB171

	21SS171	21SB171
	(mg/Kg)	(mg/Kg)
Depth	0–.5,	1.5–2.0'
DRO	94	ND
RRO	530	25
PCB	ND	ND
AS	**6.1**	**4.3**
CR	**39.8**	**41.0**

NORTH
SCALE IN FEET
0 100

SITE 21
AST 21–3
AST 21–2
AST 21–1
Conc. Sewer Box
Conc. Footing
Culvert
MH
Electric Relay
Concrete Slab
filler pipes & Vents
111 FORMER SUPPLY WAREHOUSE
Prefab Bldg
electric relay
98 FORMER EMERGENCY POWER & OPERATION BLDG.
SCREENING GRID
FORMER AST 18-1
P.P.
101. WEST DORMITORY
101. EAST DORMITORY
Former Power & Communication To Security B'ldg
BOG
40
42
44
46
48
50
52
54
56
58
60
62
64
66
70
80
84
86

NOTES

Base maps were digitized from various as–built drawings provided by the Corps of Engineers.

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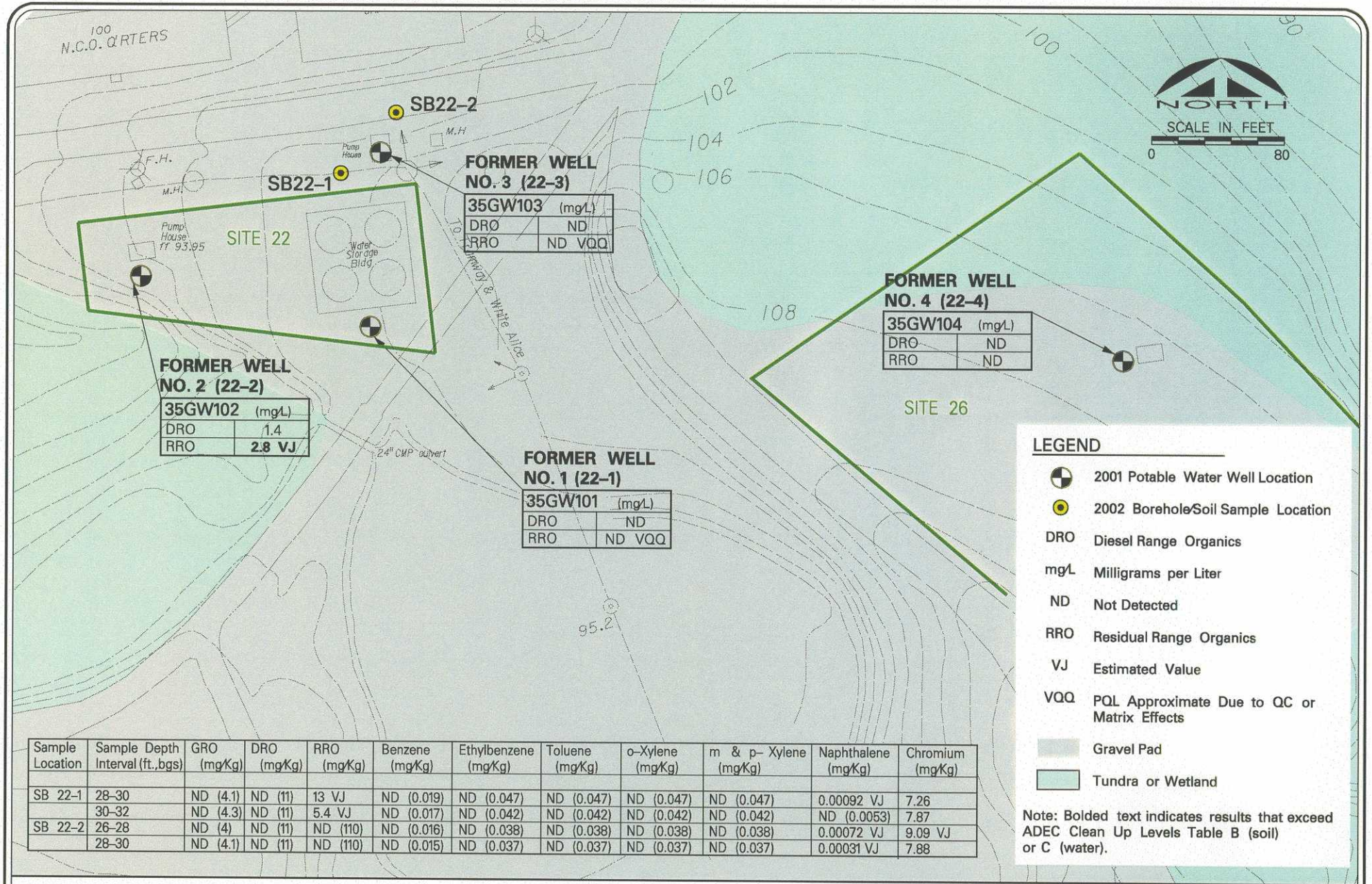
FIGURE 2–12

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 21 – WASTEWATER TREATMENT FACILITY
2001 SAMPLING LOCATIONS & SELECTED RESULTS

FILE: \\USANCIS-FILESRV\server\Cad\Proj\usace\necape\02r1_ph3\report\FinalFinal\FIG2-12.
TIME: 23-APR-20

TIME: 24-MAR-2003 15:03 FILE: \\Usancls-fileSrv\server\Cad\Proj\usace\necape\02rI_ph3\report\Final\FIG2-13.DGN



Sample Location	Sample Depth Interval (ft.,bgs)	GRO (mg/Kg)	DRO (mg/Kg)	RRO (mg/Kg)	Benzene (mg/Kg)	Ethylbenzene (mg/Kg)	Toluene (mg/Kg)	o-Xylene (mg/Kg)	m & p- Xylene (mg/Kg)	Naphthalene (mg/Kg)	Chromium (mg/Kg)
SB 22-1	28-30	ND (4.1)	ND (11)	13 VJ	ND (0.019)	ND (0.047)	ND (0.047)	ND (0.047)	ND (0.047)	0.00092 VJ	7.26
	30-32	ND (4.3)	ND (11)	5.4 VJ	ND (0.017)	ND (0.042)	ND (0.042)	ND (0.042)	ND (0.042)	ND (0.0053)	7.87
SB 22-2	26-28	ND (4)	ND (11)	ND (110)	ND (0.016)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	0.00072 VJ	9.09 VJ
	28-30	ND (4.1)	ND (11)	ND (110)	ND (0.015)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.037)	0.00031 VJ	7.88

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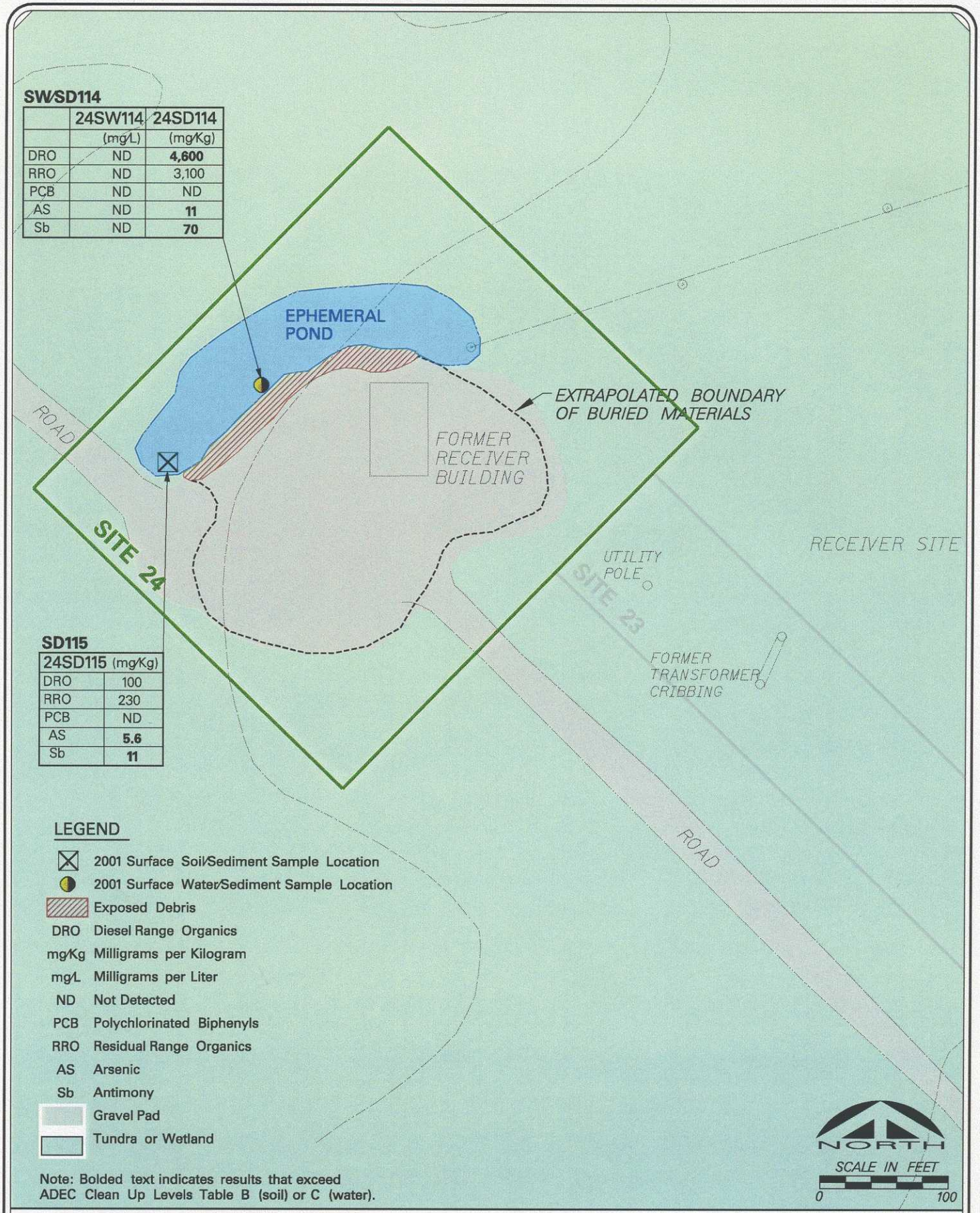
FIGURE 2-13

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITES 22 & 26 - WATER WELLS & WATER SUPPLY BLDG. 2001 SAMPLING LOCATIONS & SELECTED RESULTS



TIME: 24-MA... ...03 15:03 FILE: \\Uscncls-fileserv\server\Cad\Proj\usace\necape\02r1_ph3\report\Final\Fig02-14.dwg

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FIGURE 2–14

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 24 – RECEIVER BUILDING AREA
2001 SAMPLING LOCATIONS & SELECTED RESULTS

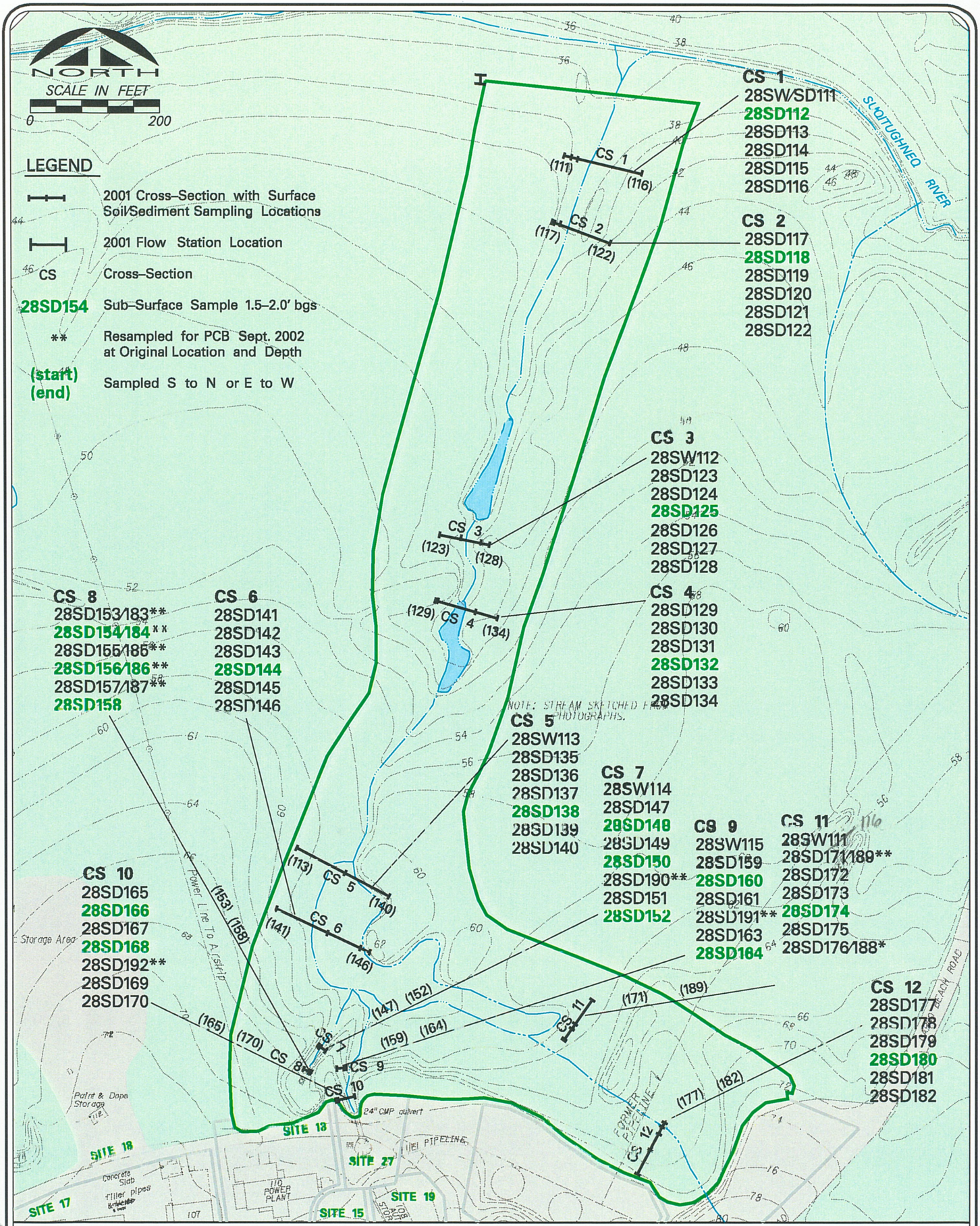

FIGURE 2–15

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 28 – DRAINAGE BASIN
2001 SAMPLING LOCATIONS

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FILE: \\USANCIS-FILESRV\server\Cad\Proj\usace\necape\02-1_ph3\report\FinalFinal\Fig2-15.DGN
TIME: 23-APR-03 11:45

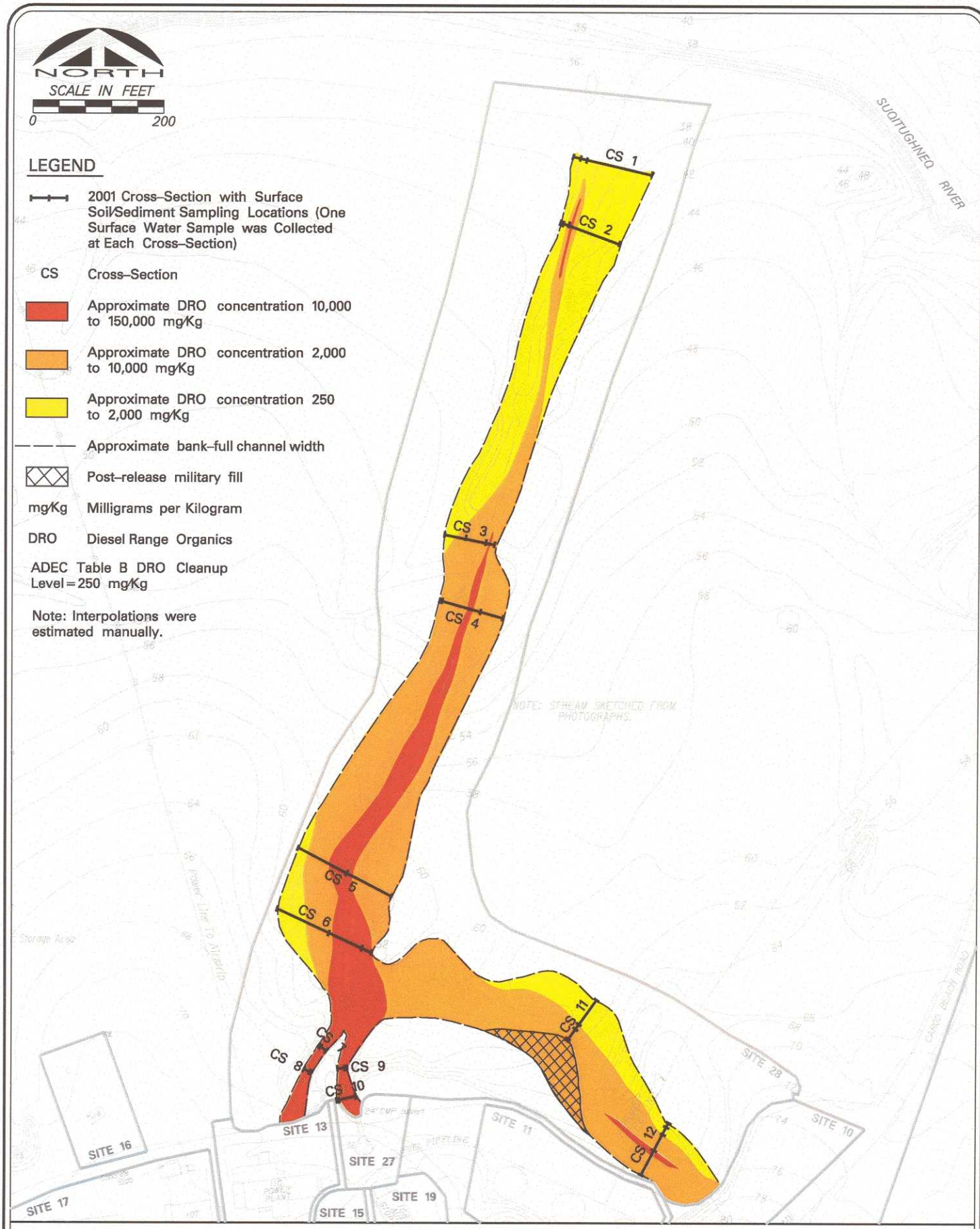

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FIGURE 2–16

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 28 – DRAINAGE BASIN 2001 DRO CONTOURS

TIME: 24-MA...03 15:37 FILE: \\Uscncls-fileserv\server\Cad\Proj\usace\necape\02ri_ph3\report\Final\fig2-16...dgn

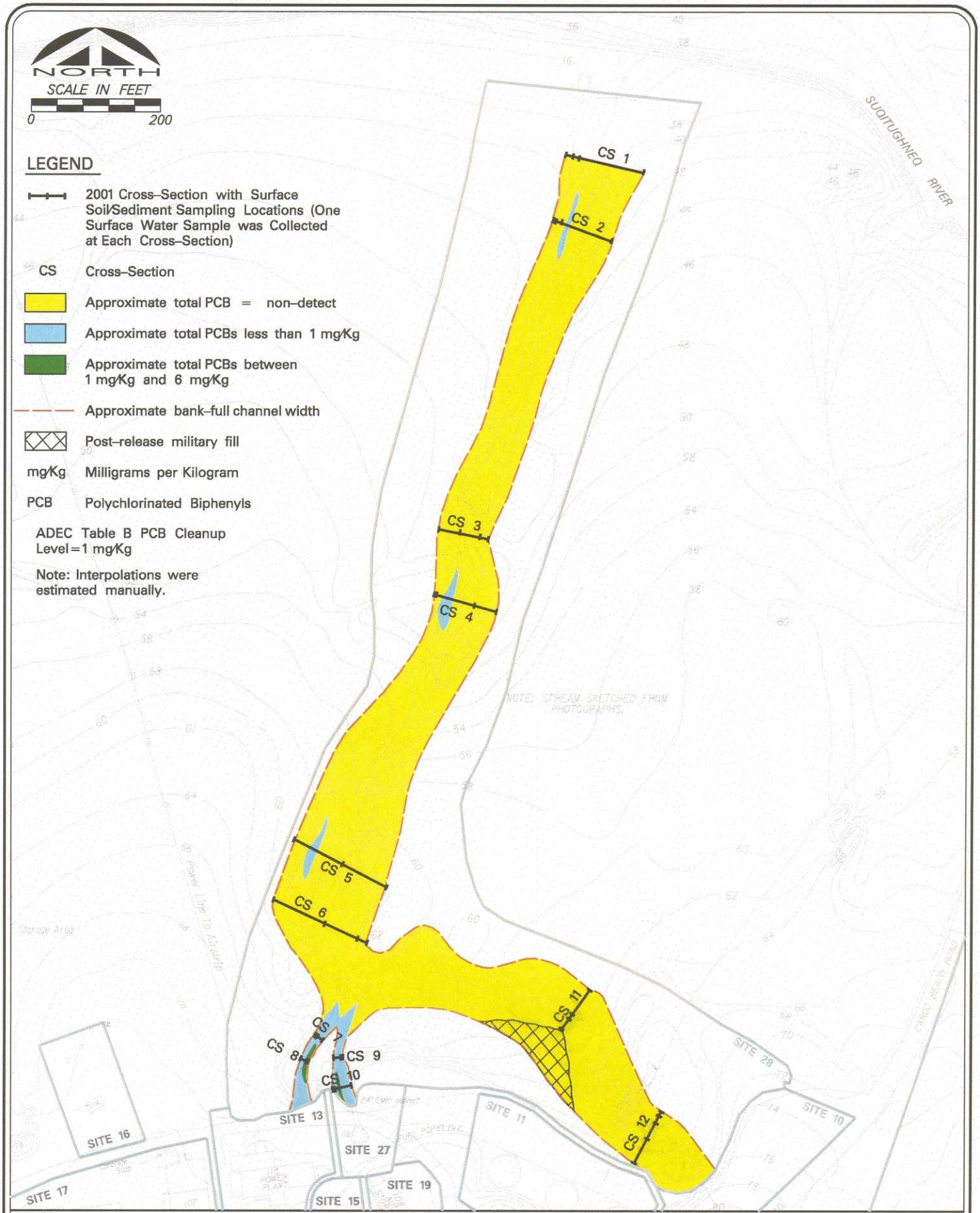

FIGURE 2-17

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 28 – DRAINAGE BASIN 2001 PCB CONTOURS

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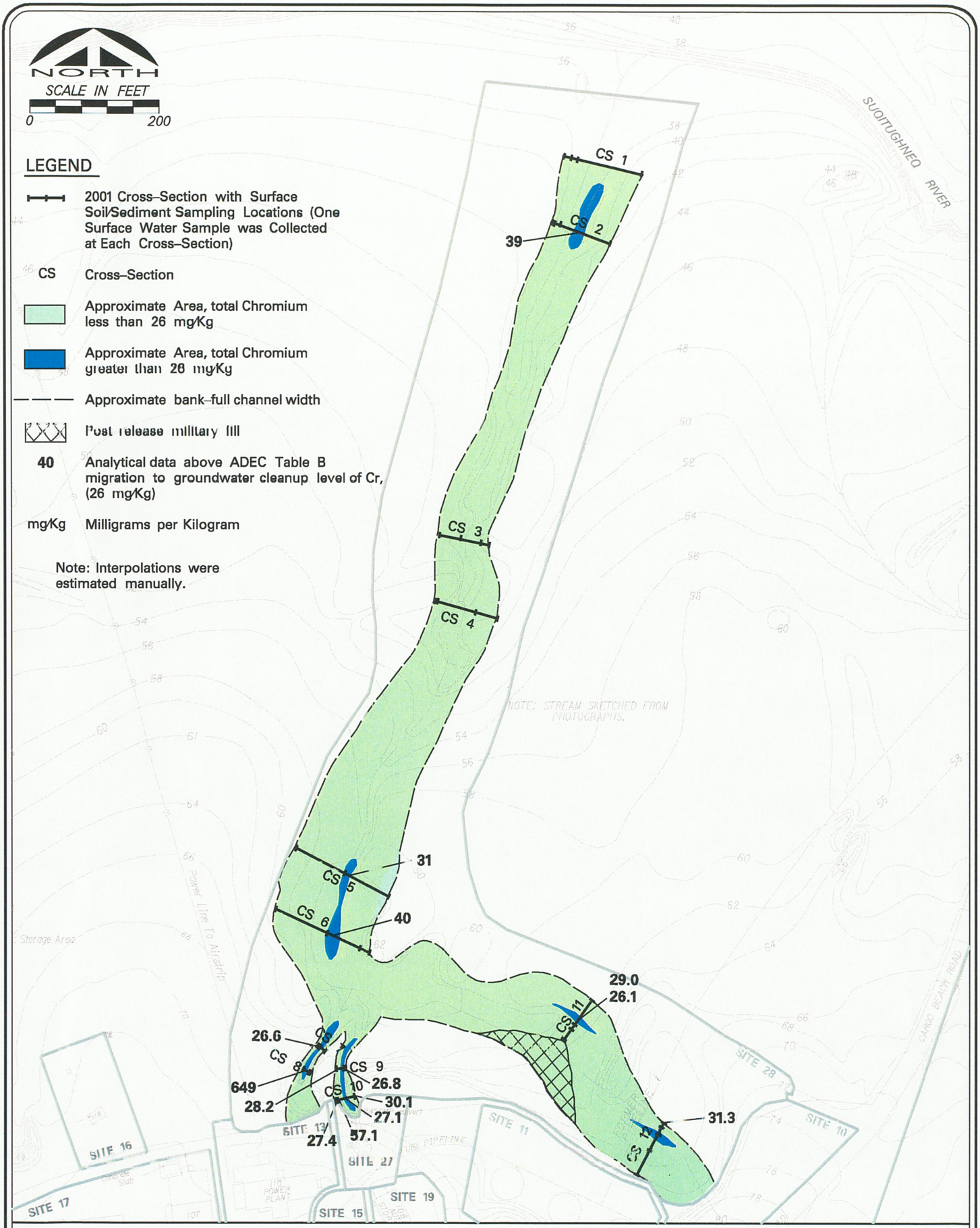
TIME: 24-MAR-03 15:38 FILE: \\Uscnc1-fileserv\server\Cad\Proj\usace\necape\02rl_ph3\report\Final\fig2-17.dgn



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TIME: 24-MAR-03 15:38

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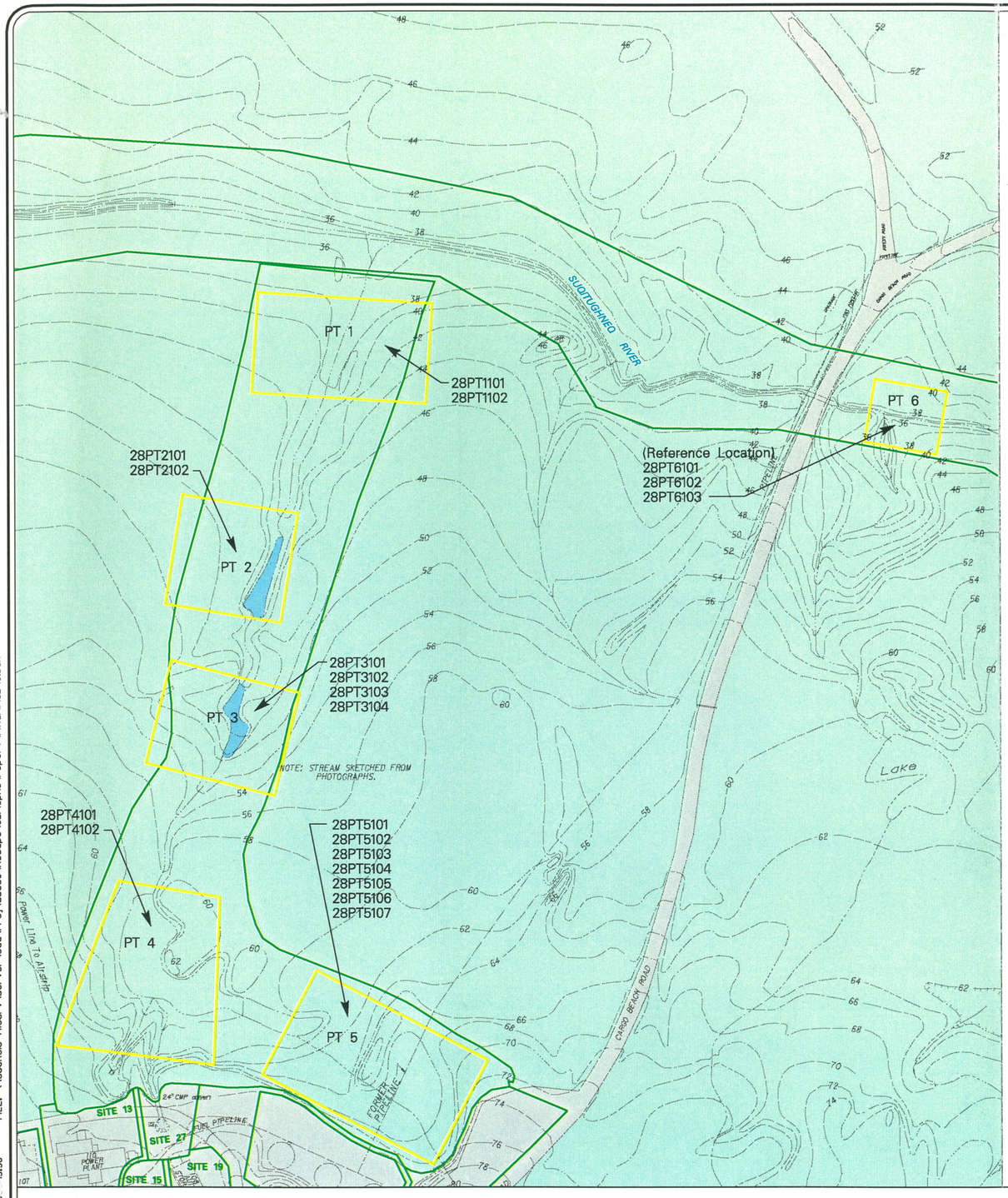
FIGURE 2–18

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 28 – DRAINAGE BASIN
2001 CHROMIUM CONTOURS



PLANT SAMPLING – CROSS REFERENCE TO FIELD IDENTIFICATION, JULY 25, 2001

Plant No.	Purpose	Description	Native Name (Common Name)	Location	Reference Number	Sample Identification	Remarks
1	R	Lichen, white fuzzy	Mulck	PT 5	PT 5–1	01 NE 28 PT 5 101	
2	R	Lichen, yellow	Mulck	PT 3	PT 3–2	01 NE 28 PT 3 101	
3	R	Lichen, white, straw like	Mulck	PT 3	PT 3–3	01 NE 28 PT 3 102	
4	R&H	Bush, low woody willow, green leaves	Qugunqaq or Uqfigaq (Chamiso's Willow)	PT 5	PT 5–4	01 NE 28 PT 5 106	Leaves eaten
5	R	Moss, green		PT 1	PT 1–5	01 NE 28 PT 1 101	
6	R	Moss, very bright green		PT 4	PT 4–6	01 NE 28 PT 4 101	
7	R	Flowers, pink	(Langsdorf's Lousewort)	PT 2	PT 2–7	01 NE 28 PT 2 101	
8	R	Flowers, blue	(Tall Jacob's Ladder)	PT 3	PT 3–8	01 NE 28 PT 3 103	
9	R	Flowers, yellow, daisy	(Lessing's Leopardbane)	PT 5	PT 5–9	01 NE 28 PT 5 102	
10	R	Lichen, black on rocks	Mulck	PT 5	PT 5–10	01 NE 28 PT 5 103	
11	H	Bush, very low willow, green leaves, fluffy flowers	(Diamond–leaf willow)	PT 2	PT 2–11	01 NE 28 PT 2 102	Leaves eaten
12	H	Greens, succulent	Nunivak (Leaf Roseroot)	PT 5	PT 5–12	01 NE 28 PT 5 104	
13	H	Greens, cactus–like	Kitmmik (White Arctic Mountain Heather)	PT 5	PT 5–13	01 NE 28 PT 5 105	Greens eaten
14	H	Flower, fuchsia	Auqukaq	Not found			Leaves used
15	H	Greens, spinach–like, with red stack	Allqeggkaq	Not found			Leaves cooked, juice from stock (Napazio)
16	G	Grass, Rye 1		PT 1	PT 1–16	01 NE 28 PT 1 102	
17	G	Grass, Rye 2		PT 3	PT 3–17	01 NE 28 PT 3 104	
18	G	Grass, Rye 3		PT 4	PT 4–18	01 NE 28 PT 4 102	
19	RF	Lichen, white		PT 6	PT 6–19	01 NE 28 PT 6 101	RF to PT 5–1
20	RF	Bush, low woody willow, green leaves		PT 6	PT 6–20	01 NE 28 PT 6 102	RF to PT 5–4
21	RF	Greens, succulent		PT 6	PT 6–21	01 NE 28 PT 6 103	RF to PT 5–12
QC		QC Sample	See 01NE28PT104			01 NE 28 PT 5 204	
22	H	Berries, black	Kavlak	Unable to collect edible sample during field visits			
23	H	Berries, crow	Ququnqhaq (Black Crowberry)	PT 5	PT 5–23	01 NE 28 PT 5 107	Sampled 8–20–01
24	H	Berries, salmon	Aqavzik	Unable to collect edible sample during field visits			

Key:
1 – All samples submitted to laboratory for analysis of polynuclear aromatic hydrocarbons, polychlorinated biphenyls, and metals.
RF – reference samples PT – plant tissue
G – grass QC – quality control
H – human use R – reindeer food

LEGEND

- Gravel Pad
- Tundra or Wetland
- 2001 Plant Tissue Sampling Location
- 28PT5101 2001 Sample Identification Number
- PT Plant Tissue

NORTH
SCALE IN FEET
0 240

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FIGURE 2–19
U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION
SITE 28 –DRAINAGE BASIN
2001 PLANT TISSUE SAMPLING LOCATIONS

FILE: \\Usancls-fileserv\server\Cad\Proj\usace\necape\02ri_ph3\report\Vfinal\FIG2-19.DGN
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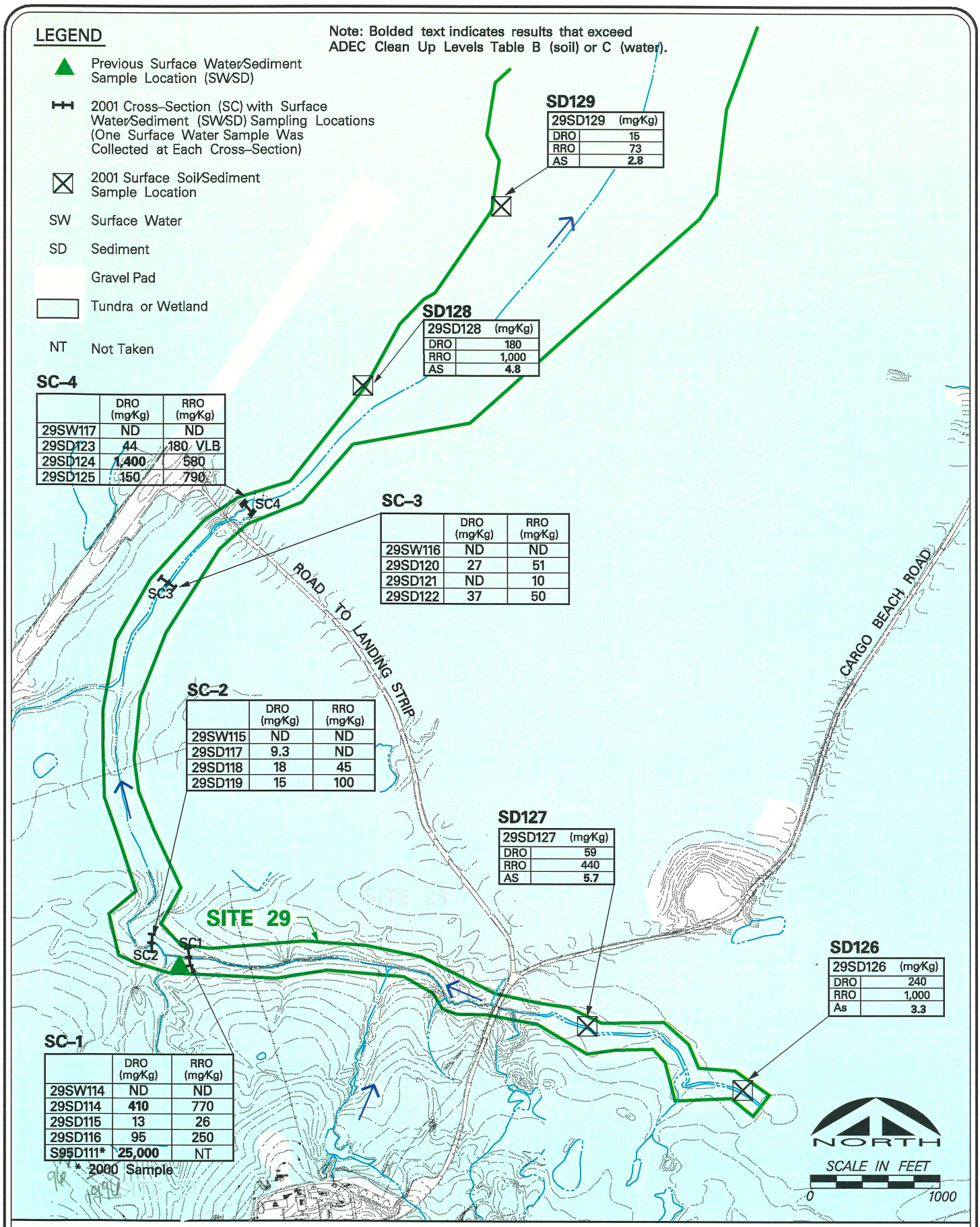

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TIME: 24-MAR 03 15:38

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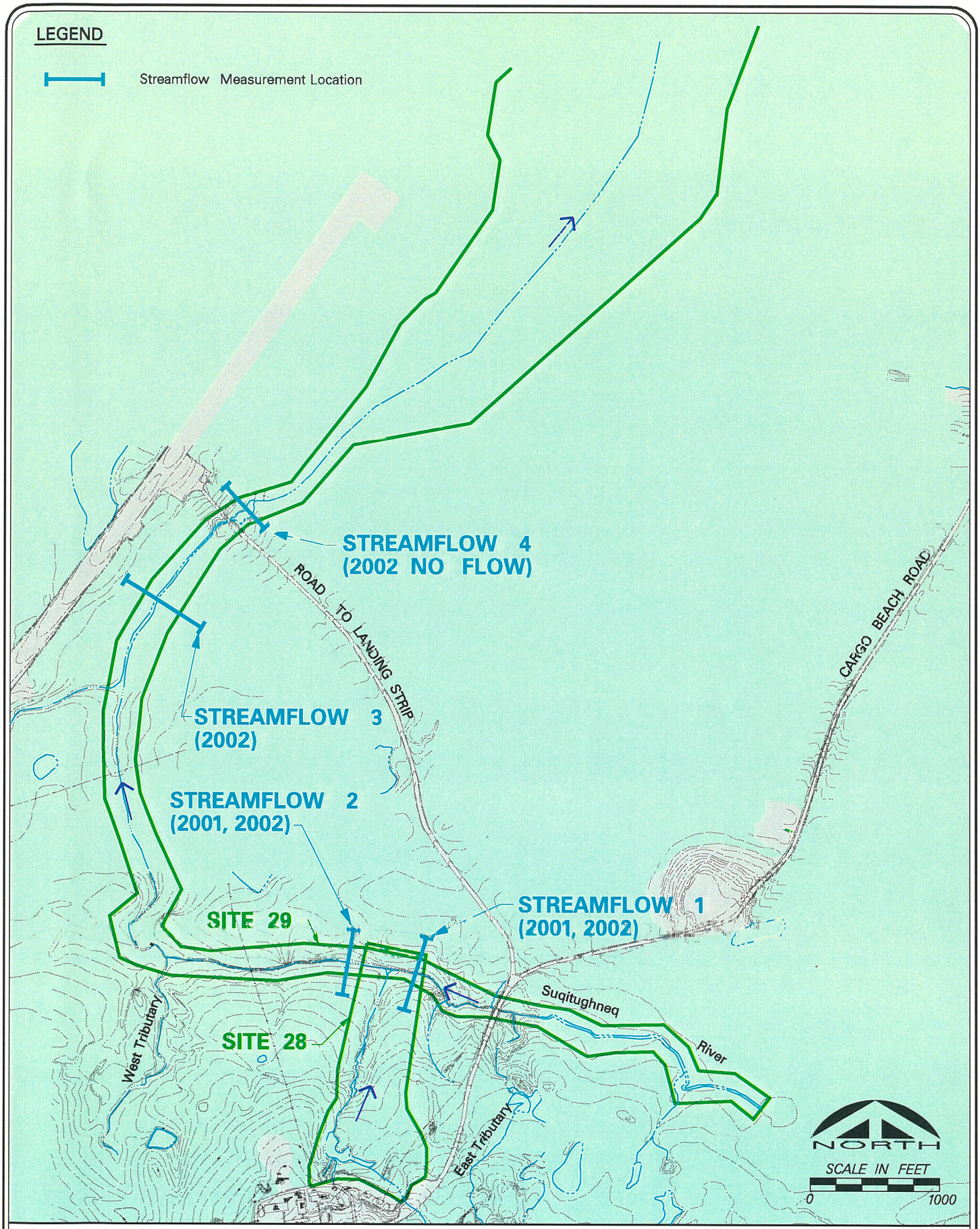
FIGURE 2–20

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 29 – SUQITUGHNEQ RIVER
2001 SAMPLING LOCATIONS & SELECTED RESULTS



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TIME: 24-MAR-03 15:39

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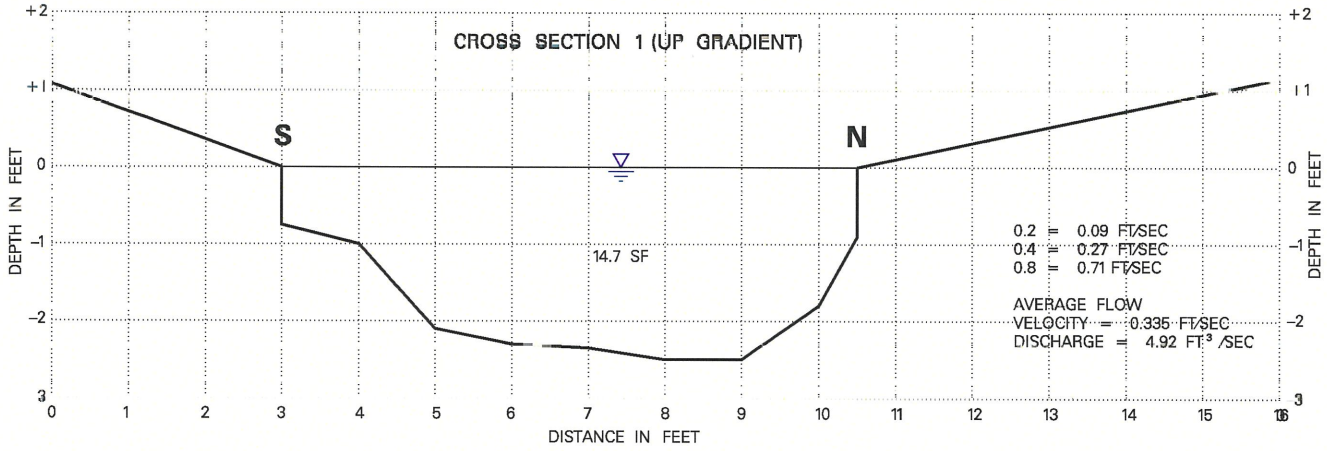
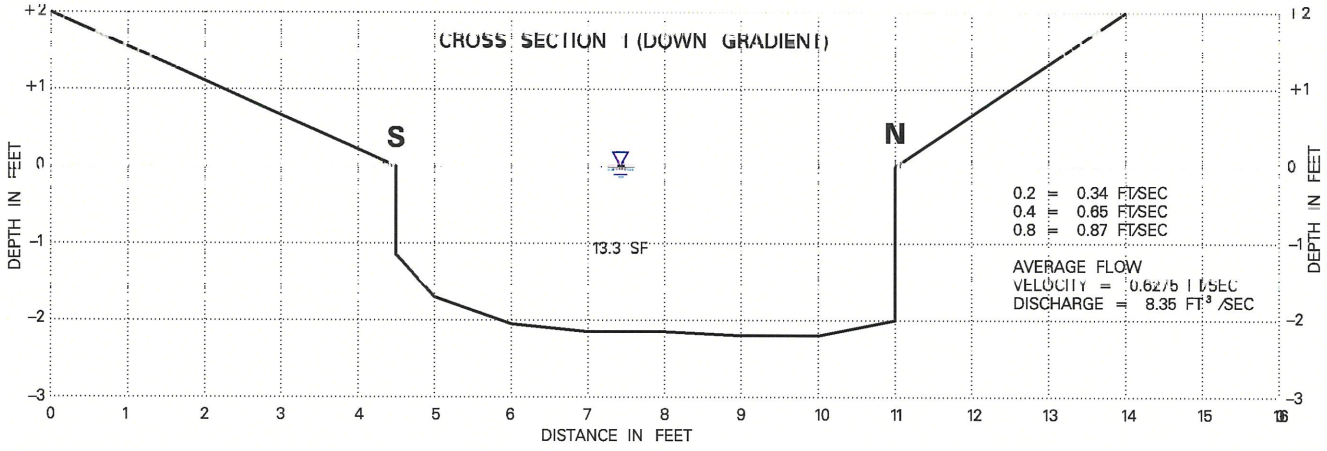
FIGURE 2–21

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 29 – SUQITUGHNEQ RIVER STREAMFLOW MEASUREMENT LOCATIONS



DRAINAGE BASIN DISCHARGE = 3.43 FT³/SEC



Marsh–McBirney Discharge Calculation

1. Identify the centerline of the channel.
2. Calculate positions on the centerline by:
   - 0.2 X depth
   - 0.4 X depth
   - 0.8 X depth
3. Measure velocity at the .2, .4, and .8 positions from the bottom using flowmeter.
4. Average the .2 and .8 velocities; average this value with the .8 velocity.
5. Multiply velocity (ft/sec) by area (ft2 /sec) to get discharge (ft3/sec)

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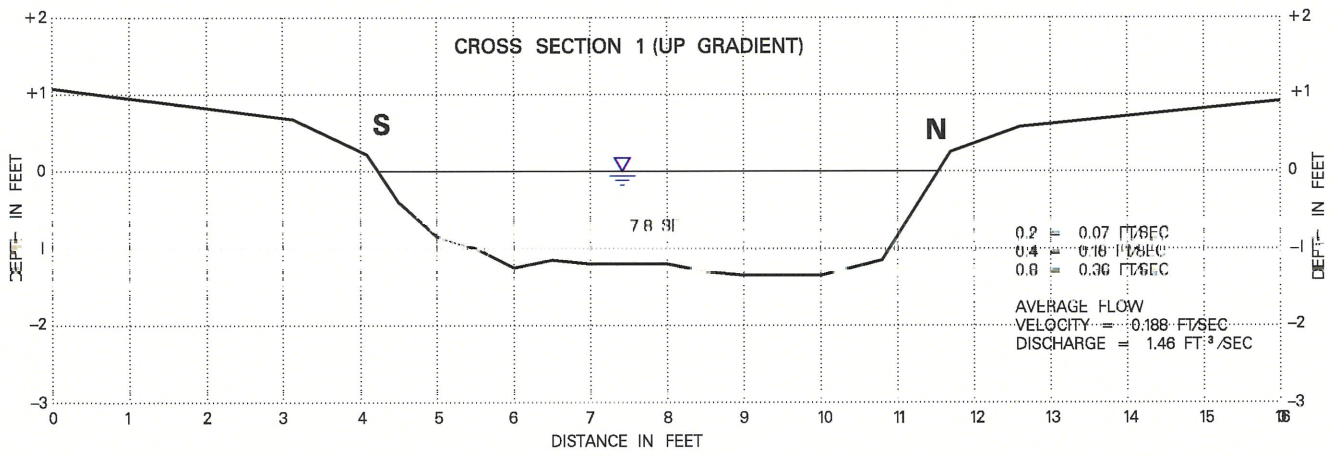
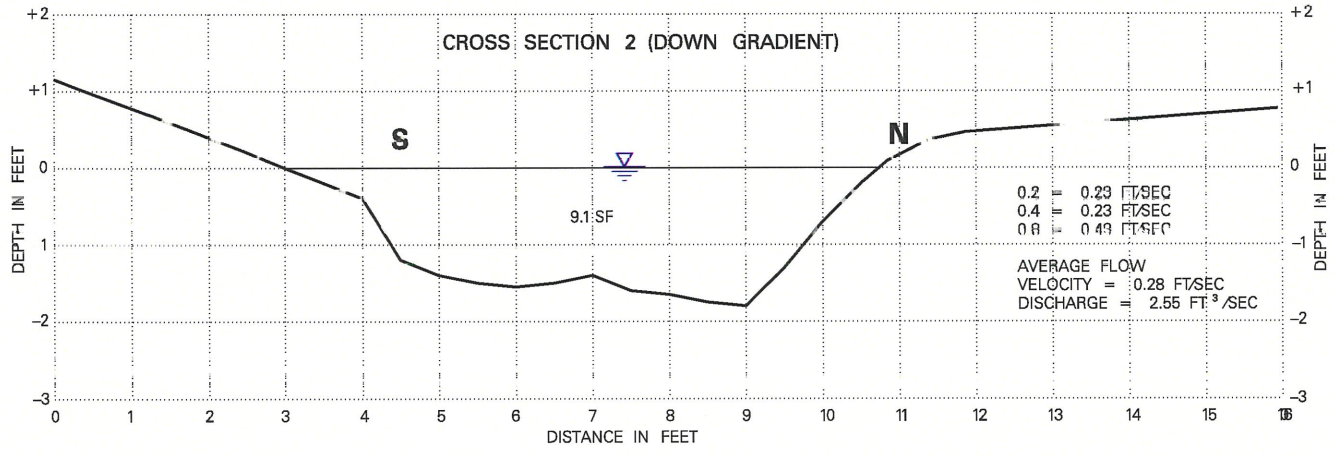
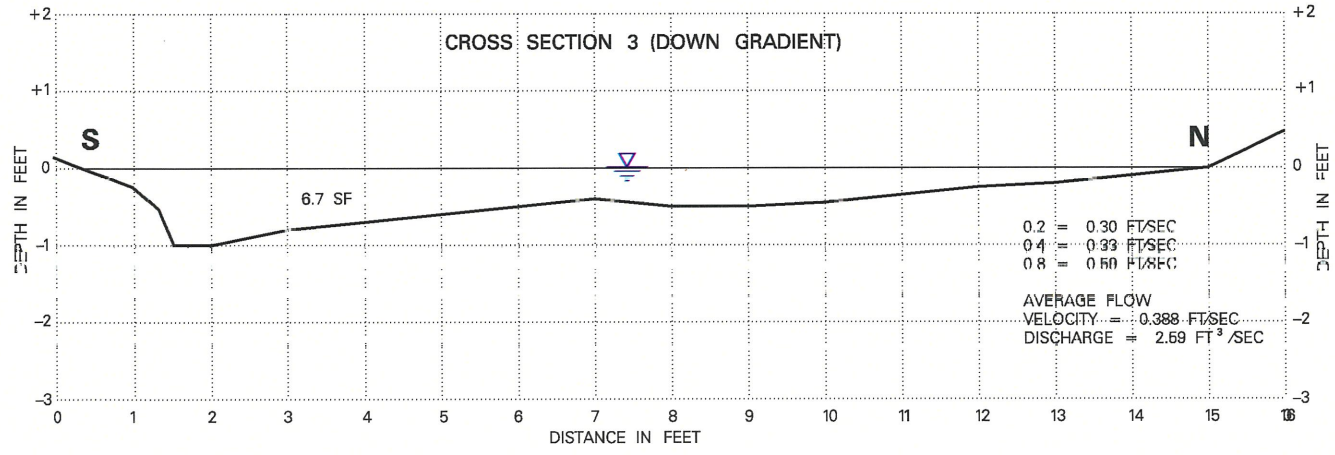
FIGURE 2–22

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 29 – SUQITUGHNEQ RIVER
2001 CALCULATION OF DRAINAGE BASIN DISCHARGE







Marsh–McBirney Discharge Calculation

1. Identify the centerline of the channel.
2. Calculate positions on the centerline by:
   - 0.2 X depth
   - 0.4 X depth
   - 0.8 X depth
3. Measure velocity at the .2, .4, and .8 positions from the bottom using flowmeter.
4. Average the .2 and .8 velocities; average this value with the .8 velocity.
5. Multiply velocity (ft/sec) by area (ft2 /sec) to get discharge (ft3/sec)

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FIGURE 2–23

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 29 – SUQITUGHNEQ RIVER
2002 CALCULATION OF DRAINAGE BASIN DISCHARGE

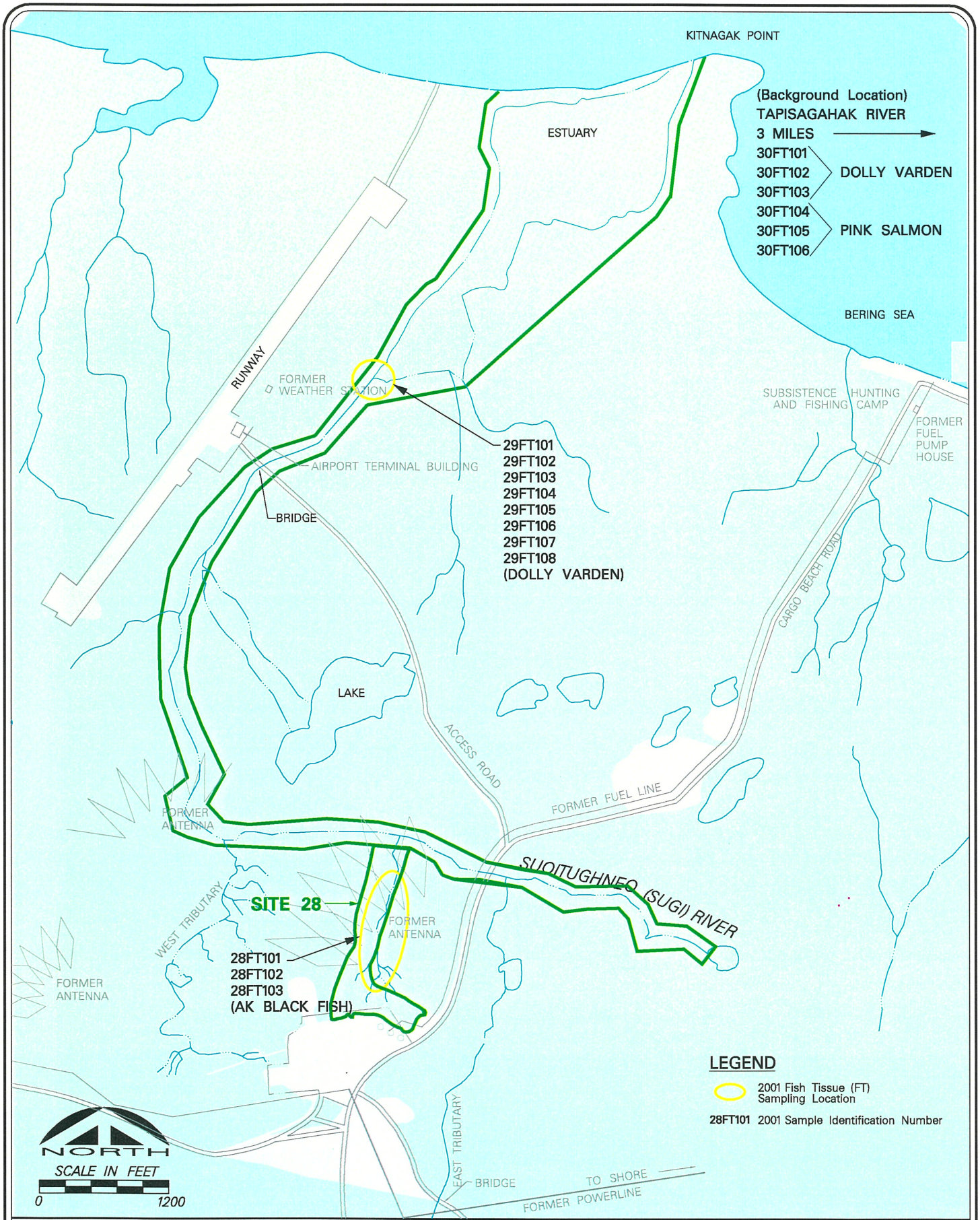

FIGURE 2–24

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 29 – SUQITUGHNEQ RIVER 2001 FISH TISSUE SAMPLING LOCATIONS

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TIME: 24-MAR .3 15:42 FILE: \\Usancls-fileSrv\server\Cad\Proj\usace\necape\02r1_ph3\report\Final\FIG2-2...

TIME: 24-MAR-2003 15:42 FILE: \\Usancls-filesrv\server\Cad\Proj\usace\necape\02ri_ph3\report\Final\FIG2-25.DGN

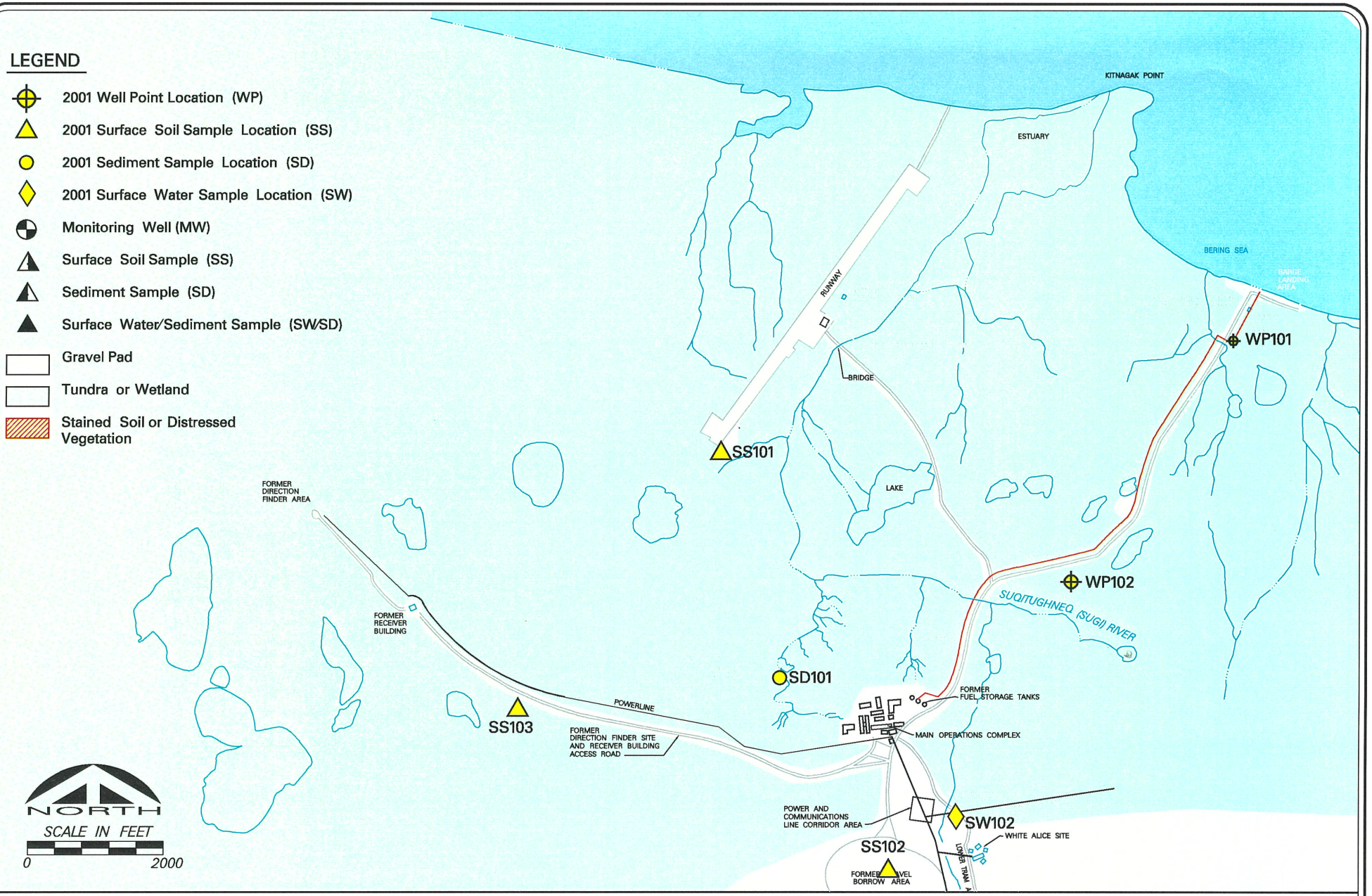

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FIGURE 2–25

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 30 – SOIL & WATER BACKGROUND AREAS
2001 SAMPLING LOCATIONS

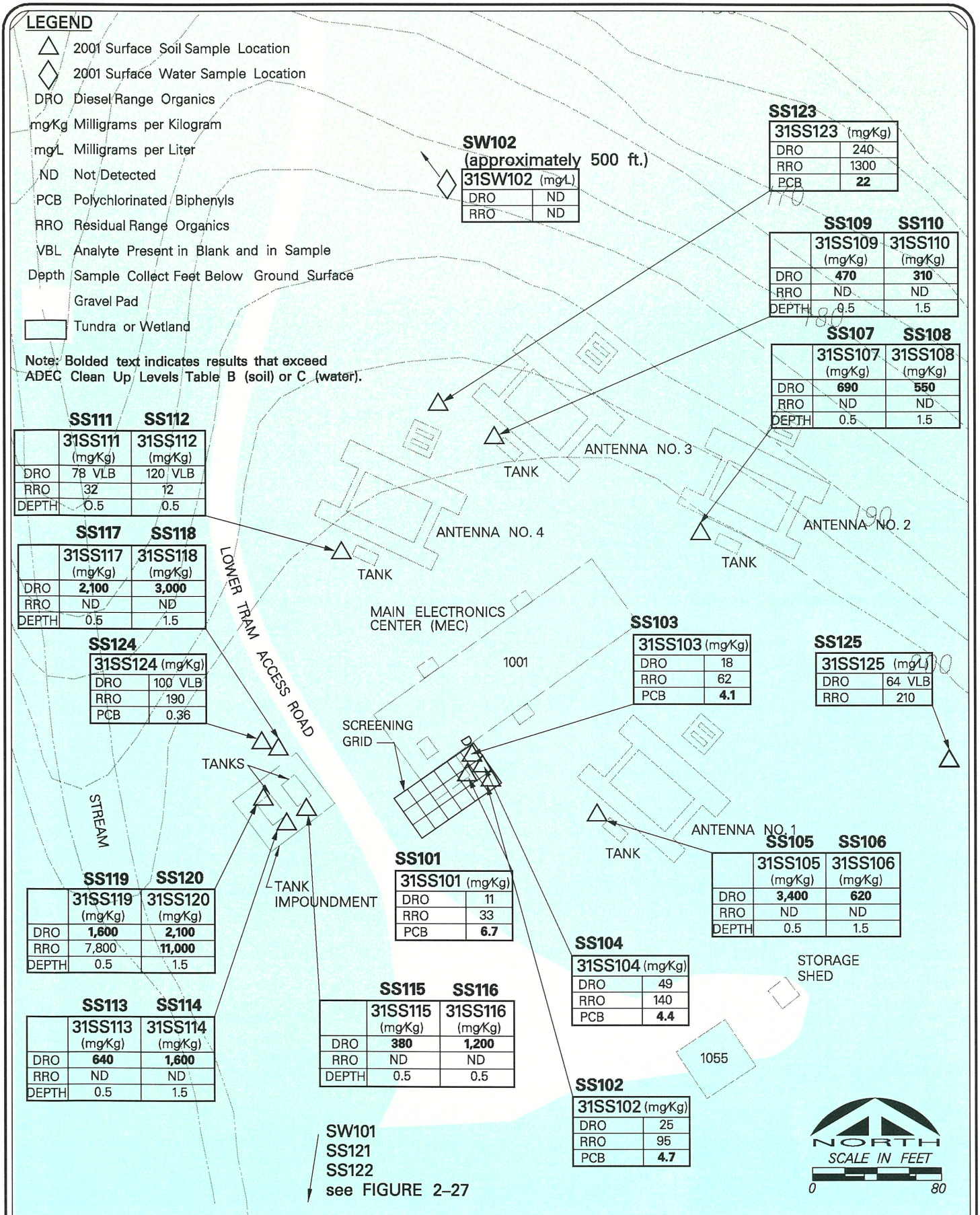

FIGURE 2–26

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 31 – WHITE ALICE SITE
2001 SAMPLING LOCATIONS & SELECTED RESULTS

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Anchorage, Alaska

TIME: 24-MA .3 15:43 FILE: \\Usancls-filesrv\server\Cad\Proj\usace\necape\02r1_ph3\report\Final\FIG2-2...

SW101

31SW101 (mg/Kg)	
DRO	ND
RRO	ND

SS121

31SS121 (mg/Kg)	
DRO	47
RRO	350
PCB	ND

SS122

31SS122 (mg/Kg)	
DRO	**11,000**
RRO	7,800
PCB	ND

SS105

32SS105 (mg/Kg)	
DRO	**1,000**
RRO	3,600
PCB	0.89

SS104

32SS104 (mg/Kg)	
DRO	**600**
RRO	1,200
PCB	0.16

SS103

32SS103 (mg/Kg)	
DRO	230
RRO	1,100
PCB	ND

SS101 SS102

	32SS101 (mg/Kg)	32SS102 (mg/Kg)
DRO	**7,600**	**13,000**
RRO	ND	ND
DEPTH	0.5	1.5

NORTH

SCALE IN FEET

0 30

SUBSTATION TRANSFORMER BANK NO. 2

WATER WELL

ANCHOR PIT

AST (WATER)

AST (FUEL)

AST

PIPING

LOWER TRAM TERMINAL BLDG.

TO UPPER CAMP

LEGEND

- 2001 Surface Soil Sample Location (SS)
- 2001 Surface Soil/Subsurface Soil Sample Location (SS/SB)
- 2001 Surface Water Sample Location (SW)
- DRO Diesel Range Organics
- mg/Kg Milligrams per Kilogram
- ND Not Detected
- PCB Polychlorinated Biphenyls
- RRO Residual Range Organics
- AST Above Ground Storage Tank
- Gravel Pad
- Tundra or Wetland

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

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FIGURE 2-27

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 32 – LOWER TRAM TERMINAL
2001 SAMPLING LOCATIONS & SELECTED RESULTS

TIME: 23-AP... J3 11:41 FILE: \\USANCIS-FILESRV\server\Cad\Proj\usace\necape\02rf_ph3\report\FinalFinal\Fi... 27.DGN

TIME: 24-MAR-2003 15:43 FILE: \\Usancls-filesrv\server\Cad\Proj\usace\necape\02ri_ph3\report\Final\FIG2-28.DGN

SITE 33 SAMPLING

SS103

33SS103 (mg/Kg)	
DRO	**660**
RRO	2,100 VJ
PCB	ND

TO LOWER TRAMWAY

SS101

33SS101 (mg/Kg)	
DRO	170
RRO	300
PCB	ND

SS102

33SS102 (mg/Kg)	
DRO	150
RRO	270
PCB	ND

UPPER TRAM BUILDING

ENCLOSED TRACK MAN-LIFT

LEGEND

- △ 2001 Surface Soil Sampling Location
- DRO Diesel Range Organics
- mg/Kg Milligrams per Kilogram
- ND Not Detected
- PCB Polychlorinated Biphenyls
- RRO Residual Range Organics
- Crushed Rock Fill
- Tundra or Wetland
- Photo Orientation

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

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FIGURE 2–28

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 33 – UPPER TRAM TERMINAL
2001 SAMPLING LOCATIONS & SELECTED RESULTS

TIME: 24-MAR-2003 15:44 FILE: \\Usancls-filesrv\server\Cad\Proj\usace\necape\02ri_ph3\report\Final\FIG2-29.DGN

LEGEND

- 2001 Surface Soil Sample Location
- 2001 Surface Soil/Subsurface Soil Sample Location
- DRO Diesel Range Organics
- mg/Kg Milligrams per Kilogram
- ND Not Detected
- PCB Polychlorinated Biphenyls
- RRO Residual Range Organics
- Gravel Pad
- Tundra or Wetland
- Photo Orientation

ENCLOSED TRACK MAN-LIFT

FORMER SUBSTATION TRANSFORMER BANK NO. 3

221 RADOME

UPPER QUARTERS BUILDING

124

150,000-GALLON WATER TANK

FUEL TANK

OUTFALL

SCREENING GRID

ROAD

TO LOWER CAMP

SS104

34SS104 (mg/Kg)	
PCB	1.06

SS111

34SS111 (mg/Kg)	
DRO	7.1
RRO	30
PCB	ND

SS101

34SS101 (mg/Kg)	
DRO	47
RRO	150
PCB	ND

SS102

34SS102 (mg/Kg)	
DRO	14
RRO	77
PCB	ND

SS103

34SS103 (mg/Kg)	
DRO	13
RRO	76
PCB	ND

SS106

34SS106 (mg/Kg)	
DRO	**1,100**
RRO	58
DEPTH	**1.5**

SS105

34SS105 (mg/Kg)	
DRO	**980**
RRO	ND VQQ
DEPTH	0.5'

SS107

34SS107 (mg/Kg)	
DRO	41
RRO	95
PCB	0.05

SS110

34SS110 (mg/Kg)	
DRO	230
RRO	620
PCB	0.23

SS109

34SS109 (mg/Kg)	
DRO	**300**
RRO	1,200
PCB	0.21

SS108

34SS108 (mg/Kg)	
DRO	220
RRO	280
PCB	0.36

SITE 34 SAMPLING

NORTH

SCALE IN FEET

0 80

Note: Bolded text indicates results that exceed ADEC Clean Up Levels Table B (soil) or C (water).

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FIGURE 2-29

U. S. ARMY ENGINEER DISTRICT, ALASKA – N. E. CAPE, ALASKA
2002 PHASE III REMEDIAL INVESTIGATION

SITE 34 – UPPER CAMP
2001 SAMPLING LOCATIONS & SELECTED RESULTS

3.0 CONCLUSIONS AND RECOMMENDATIONS

This section contains conclusions and makes recommendations based on Phase III RI activities. Estimates of contaminated soil volumes are based on Phase III investigation and sample analyses. Further refinement of contaminated soil volumes is expected based on possible alternate cleanup levels and feasibility study.

Estimates of volume of contaminated soil at various sites were prepared using sample data from Phase III sampling and from previous sampling events. Volume was calculated using the deepest Phase III sample location where analyses showed an exceedence of the ADEC Method Two DRO soil cleanup level of 250 mg/Kg. This depth was multiplied by the length and width of the area estimated to be contaminated, then converted to cubic yards. These are preliminary estimates of in situ soil volume only, and will be subject to further revision in the Feasibility Study.

3.1 SITE 3 – FUEL LINE CORRIDOR AND PUMPHOUSE

The shallow groundwater at Site 3 is contaminated with DRO and RRO at concentrations above ADEC Table C groundwater cleanup levels. The sources of this contamination are believed to be the former pumphouse located at the site and an accompanying fuel pipeline, and former diesel fuel ASTs.

Shallow groundwater at Site 3 has been observed to be ephemeral in nature; therefore, estimates of the areal extent of contamination would be highly speculative. Continued removal of contaminated soil at the site should reduce the amount of contamination in the groundwater and is recommended as a possible remedial action.

3.2 SITE 4 – SUBSISTENCE FISHING AND HUNTING CAMP

The shallow groundwater at Site 4 is contaminated with DRO and RRO at concentrations above ADEC Table C groundwater cleanup levels. The sources of this contamination are believed to be drums that were previously stored at the site.

Shallow groundwater at Site 4 has been observed to be ephemeral in nature; therefore, estimates of the areal extent of contamination would be highly speculative. Removal of contaminated soil at the site should reduce the amount of contamination in the groundwater and is recommended as a possible remedial action.

3.3 SITE 6 – CARGO BEACH ROAD DRUM FIELD

Soil at Site 6 is contaminated with DRO and arsenic and groundwater is contaminated with metals including arsenic, beryllium, cadmium, chromium, lead, nickel, thallium, and zinc, at concentrations above ADEC cleanup levels. Sources of this contamination are drums and ASTs that were formerly present at the site. Soil and groundwater contamination are closely related because, in the absence of ephemeral groundwater, contamination resides in the soil.

Well point 6-2 is the furthest downgradient sample to the north and was free from contamination in 2001 indicating no fuel contamination has migrated off site through shallow groundwater.

Samples collected from test pits excavated to a depth of 5.3 feet bgs indicate DRO contaminated soils above the ADEC Method Two cleanup level are present to that depth over an area of 35,000 square feet, for a total of approximately 7,000 cubic yards (cy) of in-situ DRO-contaminated soil. Calculation of volume of contaminated soil can be found in Appendix K. Contamination appears to extend to the bedrock surface, 5 to 6 feet bgs. Removal of contaminated soil at the site should reduce the amount of contamination in the groundwater and is recommended as a possible remedial action.

3.4 SITE 7 – CARGO BEACH ROAD LANDFILL

Soil at Site 7 is contaminated with DRO, PCBs and metals including arsenic, chromium, lead, and nickel at concentrations above ADEC cleanup levels. Groundwater at Site 7 is contaminated with RRO, chromium, lead, and nickel. Site contamination is attributed to materials dumped here while the site was used as a landfill, and materials stored at the landfill.

PCBs were only detected in soil samples collected from within the exposed debris mass on the southeastern side of Cargo Beach Road. This debris is believed to have been dumped here after the road was constructed and is not connected to the main portion of the landfill. This debris is scheduled for removal by Bristol in 2003.

The amount of RRO compared to DRO in groundwater samples collected from well points to the north and west of the landfill suggests degradation of hydrocarbons in groundwater or biogenic interference due to the prevalence of peaty material at the sample locations. Diesel fuel that has degraded over time may show a prevalence of RRO (C_{25}-C_{36}) over DRO (C_{10}-C_{25}) in samples due to the breakdown nature of the hydrocarbons.

The difficulty in obtaining samples from the well points indicates poor transmission of groundwater in the shallow zone. Even well points that were installed in saturated soil required several days to sample, suggesting the porewater is closely held within the active layer.

Large concentrations of debris are present at Site 7, primarily along the northwestern edge and on the southeastern toe of the landfill, which is exposed and eroding. Currently, the site does not qualify for closure under ADEC's landfill closure criteria as described in 18 AAC 60.390. To qualify for closure as a Class III landfill, the landfill would have to be capped by at least 24 inches of ADEC-approved material, graded to promote drainage, revegetated, and free from contamination.

3.5 SITE 9 – HOUSING AND OPERATIONS LANDFILL

Soil at Site 9 is contaminated with DRO and metals including arsenic, antimony, cadmium, chromium, lead, and nickel at concentrations above ADEC cleanup levels. Groundwater is contaminated with RRO, antimony, beryllium, lead, and nickel. Site contamination is attributed to materials dumped here when the site was used as a landfill, and materials stored at the landfill.

Several piles of debris are present on the ground and in water bodies around the site. On-site surface water pathways contribute to erosion of the landfill cap and transport of contaminants downgradient.

Site use at Site 9 appears to have varied during the years the installation was active. Figures and drawings from this time indicate this area as a storage area, as well as a debris dump.

Currently, Site 9 does not qualify for closure under ADEC's landfill closure criteria as described in 18 AAC 60.390. Further investigation of source areas is recommended to evaluate the remaining debris as a source of soil and groundwater contamination. To qualify for closure as a Class III landfill, the landfill would have to be capped by at least 24 inches of ADEC-approved material, graded to promote drainage, revegetated, and free from contamination.

3.6 SITES 13, 15, 19, 20, AND 27 – MAIN OPERATIONS COMPLEX (SITE 88)

Soil and groundwater at Site 88 is contaminated with petroleum hydrocarbons, benzene, naphthalene, and chromium. Contamination at this site might be attributed to various site activities such as the storage and use of fuels and lubricants at several locations. Site 20 was not originally included in the Phase III RI because no apparent source areas had previously been identified. Investigations in 2002, however, indicated that DRO contamination was present, so Site 20 was identified as a potential site.

Investigations conducted in 2002 indicate the presence of DRO in soil above the Method Two cleanup level at depths ranging from the surface to 26 feet bgs at Site 88. Gravel fill at Site 88 ranges from 1 to 3 feet thick around the edges to 10 to 14 feet thick near the center. DRO contamination appears to have infiltrated the native soil below the fill to a depth of at least 26 feet bgs in some areas. DRO concentrations above the ADEC Method Two cleanup level might be present in as much as 85,000 cy of in-situ soil at Site 88. Calculation of volume of contaminated soil can be found in Appendix K.

Installation of MW 88-10 at Site 20 in 2002 met with refusal at 27.5 feet bgs on a hard rock surface. No indication of contamination was evident until approximately 24 feet bgs, when a fuel odor was noticed by field personnel. The presence of contamination at this depth, along a hard rock surface, indicates that this surface may act as a collection and transport zone for upgradient contaminants. A closer review of possible upgradient source areas is recommended.

Detection of DRO in MW 88-10 and downgradient wells suggests a contaminant plume that extends from MW 88-10 downgradient towards the drainage basin. High concentrations of DRO in groundwater samples suggests a possible free-product source remains upgradient.

The results of investigations conducted during the 2002 fieldwork provide significant evidence of the effect of permafrost and/or frozen soils on shallow, perched groundwater lenses present throughout Site 88. The thickness of fill material has a significant impact on the thermal characteristics of the native soil. Soil borings, such as SB-11 and SB-12, placed near the edge of the gravel pad where the fill material is 1 to 3 feet thick, encountered frozen native soil at a depth of 3 feet bgs and extending to the bottom of the boring at 14 feet bgs. Whereas SB-14, located

approximately 50 feet away and upgradient of SB-11 and SB-12 in an area with 4 to 6 feet of fill, encountered no frozen soils between zero and 14 feet bgs, with groundwater located at 14 feet bgs.

Perhaps because of these areas of frozen soil, the availability of groundwater in monitoring wells varied greatly over a short distance. MW 88-6, near the edge of the fill, had very low recharge requiring several visits over many hours to recover one sample volume. In contrast, MW 88-7, located in approximately 12 feet of fill, had ample flow, allowing for well development and sampling the next day with little or no drawdown in the well.

The proximity of these borings to each other with their respective thermal characteristics suggests a significant transition from unfrozen to frozen soils in a relatively short distance. The presence of these frozen soils may impact the site in several ways:

- A vertical transition from unfrozen to frozen soil may act as a barrier to migration of water or contaminants downgradient, forcing groundwater above or around the frozen soil barrier.
- Horizontal layers of frozen soil may act as confining layers between the deep aquifer and the shallow, perched groundwater present throughout the complex.
- Horizontal layers of frozen soil may act as collection zones for groundwater or contaminants.
- The presence of fill likely creates a thaw bulb below the filled area, the size and shape of which mirrors the topography of the fill. This could account for discrepancies in water availability in some monitoring wells.

Lithologic cross-sections in Figures 2-7 through 2-9 show the depth to contamination in boreholes at the site, as well as groundwater elevations. Groundwater flow appears to mirror the surface topography, generally flowing downgradient to the Drainage Basin. Cross-sections also show the thickness of fill at various locations, represented by the 'SP' unit. The boundary between the fill and the native soil is approximate, as the fill was place on top of similar material.

Continued monitoring is recommended for Site 88.

3.7 SITE 14 – EMERGENCY POWER/OPERATIONS BUILDING

Soil contaminated with PCB Aroclor™-1260 is present at Site 14 near the location of a former transformer bank. Of the three samples with the highest immunoassay screening results, two had PCB concentrations above the Method Two cleanup level. The absence of PCBs above the cleanup limit in nearby samples suggests the contamination may be limited to a small area near the former transformer bank of approximately 10 cy. Calculation of the volume of contaminated soil can be found in Appendix K. Hot spot soil removal is recommended.

3.8 SITE 16 – PAINT AND DOPE STORAGE BUILDING

No contaminants were detected in soil or groundwater above ADEC Method 2 cleanup levels at Site 16. No further action is recommended.

3.9 SITE 21 – WASTEWATER TREATMENT FACILITY

Soil and sediment at Site 21 is contaminated with DRO, arsenic, and/or chromium at concentrations above ADEC Method Two cleanup levels. Sources of this contamination might be the concrete settling tanks, the pipeline, or other upgradient sources. Contaminated soil is found near the settling tanks, along the sewage pipeline, and near the pipeline outfall in a wetland area west of the Main Operations Complex.

DRO in soil exceeded the cleanup level in subsurface samples collected 1.5 to 2 feet bgs. Total depth of contamination is unknown, but may extend to the bedrock surface, 6 to 8 feet bgs.

Extrapolation between sample locations suggests that approximately 5,000 cy of in-situ soil may be contaminated with DRO above the cleanup level. Calculation of volume of contaminated soil can be found in Appendix K. Further evaluation through risk assessment is recommended.

3.10 SITE 22 – WATER WELLS AND WATER SUPPLY BUILDING

Groundwater at Site 22 contaminated with DRO and RRO was found in one of three potable wells sampled. An AST associated with this well is believed responsible for contamination in the well. This contamination appears very localized, since nearby wells downgradient were non-detect for petroleum hydrocarbons.

Removal of contaminated soil associated with this former AST is recommended as a way to remediate the groundwater in the area.

Two boreholes, 32 and 36 feet bgs, were drilled in 2002. No sign of contamination was noted by field personnel and no fuel contamination was detected. The boreholes stopped at 32 and 36 feet bgs, where they met refusal on a hard rock surface. This surface, similar to that found in MW 88-10 at Site 20, might act as a collection zone for contaminants, the absence of which indicates little or no contamination upgradient from these boreholes.

As of August 2002, the three potable wells had been decommissioned.

3.11 SITE 24 – RECEIVER BUILDING AREA

Sediment at Site 24 is contaminated with DRO, antimony, and arsenic above ADEC cleanup levels. Samples were collected from a debris-filled pond on the site. Removal of exposed debris is recommended as a way to remediate sediment contamination.

3.12 SITE 26 – FORMER CONSTRUCTION CAMP AREA

No contamination was found in the groundwater from the potable well formerly located at Site 26. As of August 2002, this well had been decommissioned. No further action is recommended.

3.13 SITE 28 – DRAINAGE BASIN

Sediment in the Drainage Basin is contaminated with DRO, RRO, chromium, lead, naphthalene, PCBs, and 2-methylnaphthalene at concentrations above ADEC cleanup levels. Sources of these contaminants are upgradient areas such as the MOC (Site 88) and Sites 10 and 11, where large fuel releases have occurred in the past. Data suggest approximately 30,000 cy of in-situ sediment contaminated with DRO above the Method Two cleanup level might be present at the site. Calculation of volume of contaminated soil can be found in Appendix K.

Contamination in the Drainage Basin appears most concentrated near the outfalls from the MOC, as shown on Figures 2-15 through 2-19. The highest concentrations of lead, chromium, PCBs, naphthalene, and 2-methylnaphthalene, plus high concentrations of DRO, were found in samples from these areas – suggesting that upgradient source areas continue to contribute contamination to the Drainage Basin. The only exceedence of the ADEC cleanup level for PCBs was in this area. Similarly, the only regulatory exceedence in a surface water sample was from this area.

Samples collected near the outfall from Sites 10 and 11, which contributed the largest known release to Site 28, have lower concentrations of DRO and chromium and no RRO, lead, naphthalene, or 2-methylnaphthalene. This suggests that these areas no longer contribute significant amounts of contamination to Site 28, and might have experienced some natural attenuation of petroleum hydrocarbons.

The main channel of the Drainage Basin is contaminated with DRO, RRO, naphthalene, and 2-methylnaphthalene. Samples from cross-sections nearest the Suqitughneq River show DRO and chromium above ADEC Method Two cleanup levels. Though present above cleanup levels, the concentration of contaminants here is generally less than at areas closer to the upgradient sources. This may indicate that, while some contamination is reaching the Suqitughneq River from the Drainage Basin, the highest concentrations remain near the source areas.

Removal of upgradient sources and hot spots is recommended.

Plant tissue samples collected from Site 28 were analyzed as whole plant samples (roots, leaves, stem, flowers, and non-berry fruits) per the Biological Sampling Plan (MWH, 2001a), whereas the whole plant is rarely consumed by humans or reindeer. The result of this is analytical data that does not appropriately represent the consumption patterns of subsistence users. Fleshy plant roots that remain in the ground all year would be much more likely to absorb and retain contaminants than the greens, leaves, or berries eaten by humans or reindeer. Collection and analysis of specific plant parts utilized as a food resource is recommended to appropriately gauge contaminant concentrations in subsistence plant resources.

Fish and plant samples collected from the Drainage Basin will provide data for the Human Health and Ecological Risk Assessment. Data from fish and plant sampling is included in Appendix D; however, interpretation of this data will be performed in the risk assessment.

3.14 SITE 29 – SUQITUGHNEQ RIVER

Sediment samples collected along the Suqitughneq River show DRO contamination unevenly distributed from below the Drainage Basin to the lagoon. Two samples had DRO above the cleanup level; however, these samples were widely spaced – indicating possible contamination along the length of the river below the Drainage Basin. Bends or pools in the river would act as collection zones for contaminants where the river slows, depositing contamination in specific locations. Data suggest approximately 6,000 cy of in-situ sediment contaminated with DRO above the Method Two cleanup level might be present at the site. Calculation of volume of contaminated sediment can be found in Appendix K.

Arsenic was detected above ADEC cleanup levels in sediment samples collected along the Suqitughneq River. No PCBs were detected in any water or sediment samples from the Suqitughneq River, and no other contaminants were detected in surface water samples.

Continued surface water and sediment monitoring is recommended.

Dolly Varden collected from the Suqitughneq River lagoon had detectable concentrations of contaminants such as metals and PCBs. Some samples had detectable concentrations of PAHs, whereas PAHs were not detected in background fish samples from the Tapisaghak River.

Fish collected from the Suqitughneq River lagoon will provide data for the Human Health and Ecological Risk Assessment. Data from fish sampling is included in Appendix D; however, interpretation of this data will be performed in the risk assessment.

3.15 SITE 30 – BACKGROUND AREAS

Samples collected from background areas in 2002 contained concentrations of contaminants similar to many other samples collected throughout the site. Some background samples were collected from areas that were less impacted than other sites. SS102 was collected from 1.5 feet bgs in the gravel borrow area, on the side of the mountain. This gravel soil sample contained arsenic, chromium, and lead at 4.4, 52.1, and 28 mg/kg, respectively. The volcanic nature of the material sampled and the location of the sample suggests that these concentrations of metals may best represent their ambient concentrations in the installation area.

Background fish samples collected from the Tapisaghak River had concentrations of metals and PCBs similar to those found in primary samples. Background fish samples, however, contained fewer PAHs than in primary samples.

Samples identified as background during the Phase III investigation are believed to represent biological and environmental media that have not been impacted or have been minimally impacted by site activities. These samples, however, do not represent a comprehensive, statistically generated analysis of background conditions at the installation.

3.16 SITE 31 – WHITE ALICE SITE

Soil at Site 31 is contaminated with DRO and PCBs above the ADEC Method Two cleanup levels. DRO contamination is concentrated near ASTs used to heat the antennae and provide fuel for the site activities. PCB contamination is concentrated near a former transformer pad and near an outfall pipe between Antennae 3 and 4.

DRO contamination associated with ASTs appears to be localized within tank impoundments and near tank valves. Assuming localized contamination at each of the tanks, and a PCB hotspot near a pipe outfall, a total of 235 cy of in-situ contaminated soil might be present site-wide. Approximately 10 cy of PCB-contaminated soil may be present near the former transfomer pad at Building 1001. Calculation of volume of contaminated soil can be found in Appendix K. Contaminated soil will be further evaluated in the Risk Assessment.

Surface water samples collected from the East Tributary show no signs of contamination.

Removal of contaminated soil hot spots is recommended.

3.17 SITE 32 – LOWER TRAM TERMINAL

Site 32 has DRO contamination above the ADEC Method Two cleanup level in three locations; near an AST, beneath the tram cables, and within the anchor pit. The approximate volume of DRO contaminated soil is 60 cy. Calculation of volume of contaminated soil can be found in Appendix K. Visual inspection of the area revealed no sign of contamination outside of the sample collection areas where petroleum products were stored and used. Removal of contaminated soil hot spots is recommended.

No PCBs were detected near the former transformer pad.

3.18 SITE 33 – UPPER TRAM TERMINAL

Site 33 contains DRO above the ADEC cleanup level at one location beneath the tram cables. The area sampled was rocky with thin soils and contamination appears limited to approximately 1 in-situ cy. Calculation of volume of contaminated soil can be found in Appendix K.

Feasibility of removal actions should be considered in the feasibility study.

3.19 SITE 34 – UPPER CAMP

Site 34 has DRO contamination above the cleanup level in several discreet locations; beneath an AST and near the outfall of a pipe downgradient of the tank. The area sampled was rocky with thin soils and contamination appears limited to approximately 20 in-situ cy. Calculation of volume of contaminated soil can be found in Appendix K.

Feasibility of removal actions should be considered in the feasibility study.

PCBs were detected above the cleanup level near the former transformer pad. Volume of PCB contaminated soil is minimal due to thin soils and is estimated at 2 cy.

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DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
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REPLY TO
ATTENTION OF:

September 11, 2003

Programs and Project Management Division
Civil Works Branch

Mr. Jeff Brownlee
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska 99501

Dear Mr. Brownlee:

As you are aware, the U.S. Army Corps of Engineers has received considerable commentary from the public regarding our cleanup investigations at the Northeast Cape Project. The majority of the critical commentary has come from the Alaska Community Action on Toxics (ACAT) and TAPP provider Dr. Ron Scrudato. The Corps is committed to putting forth an honest effort into fully cleaning up the former Department of Defense sites at NE Cape. In order to do that, we must have a defensible remedial investigation record.

To that end, we are sending you a table that summarizes comments we have received on our NE Cape Project that generally contend our investigation shows inadequate site characterization. This compilation of comments is arranged by site, and limited to those comments where the Corps disagrees with the action suggested by the comment. In order to proceed with cleanup efforts comfortably, we feel it is necessary to have concurrence from the State of Alaska that we have adequately investigated the site and can proceed with a Feasibility Study to devise a cleanup project. If the ADEC feels, upon evaluation of submitted comments, that more investigation is warranted, we would seek your advice in bringing the investigation up to ADEC standards.

I recognize we are not dealing with exact science here. In many instances site characterization involves a judgment call. I'm sure that if we were to do twice as much sampling, we would find some additional areas of contamination. Our mandate is to accomplish investigation/cleanup in accordance with regulations, and in a cost-efficient manner within the bounds of practicality. We know that additional sampling will occur as part of the confirmation process after site cleanup. But in some instances, it may certainly be more cost effective to know what you're dealing with before remedial actions take place.

The Corps is requesting that you review the enclosed summary table of comments and Corps responses. We are seeking concurrence on the Corps responses to these comments and any proposed course of action. If the ADEC feels that further investigation is warranted, we would consider additional sampling or other measures to satisfy regulatory guidance. I believe you mentioned at the last RAB Meeting that you were initiating a review of public comments on your own. We hope this table will assist you in that effort. It would be a great benefit to the project for you to provide guidance in the settlement of site concerns. If you would like to discuss any of the sites in question, we could set up a meeting, or you could call either Lisa Geist or me.

As always, I can be reached at (907) 753-2689, or e-mail me at carey.c.cossaboom@poa02.usace.army.mil.

Sincerely,

Carey Cossaboom
FUDS Project Manager

Enclosure

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Northeast Cape – Remedial Investigation Summary by Site

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Position
1 – Burn Site SE of Airstrip	Inadequate site characterization. No testing for potential contaminants of concern, including PCBs, dioxins, metals, and DRO. Soils should have been tested before the site was declared No Further Action (NFA). Runoff passing through this area moves directly into the Suqi, entering just upstream of the runway bridge. The area upstream of the runway bridge was declared a "stressed" site by the contractor ENRI (Environmental and Natural Resources Institute, University of Alaska Anchorage). They noted lower invertebrate taxa richness than was expected for physical and chemical stream conditions, and also noted high sediment toxicity as determined by bacterial assay.	Field checked by visual observations. No further action recommended.	During a July 1992 site visit by Ecology and Environment (E&E 1992), the field team investigated this site based on reports from the community that it was formerly used for the burning of fuel oil collected in absorbent materials. The field team found several slight depressions in the tundra between 100 and 300 feet east of the runway near its southern end. These depressions contained no debris, burn marks, soil staining, odor, sheen, or ash. Only a minor amount of debris was found scattered adjacent to and along the length of the airstrip. The field team concluded no further investigation was required. During the Phase I Remedial Investigation in 1994, Montgomery Watson found no physical indications, such as distressed vegetation or charred debris suggesting a burn area. Accordingly, Site 1 was not investigated further. Furthermore, we would not expect the burning of oil-saturated absorbent pads to produce dioxins or significant metals. The area investigated by ENRI and reported as "stressed" is located due east of the airport terminal, from 50 meters below to 200 meters above the airport road bridge crossing and appears to be approximately 2000 feet north (downgradient) of the reported Site 1 location. Based on the numerous field observations, we do not believe that soil testing is necessary. Sediment in the Suqi River has been tested downgradient of Site 1 (see cross section 3 from Phase III investigation) and the results do not show significant diesel or residual range organics contamination. No further action is recommended, based on the findings of prior phases of investigation at the site.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Position**
2 – Airport Terminal and Landing Strip	Inadequate site characterization. No attempt has been made to see if PCBs flush off runway into the Suqi River. Runoff would enter the Suqi both upstream and downstream of the runway bridge. When these locations were tested by ENRI, both were found to be stressed (low	Nugget Construction removed miscellaneous debris and a large fuel tank during an interim removal action (2000). Transformers had been previously removed. The Airport Terminal Building and	During the Phase I remedial investigation (1994), three soil samples were collected from Site 2. One sample was collected and analyzed for petroleum/ oil/lubricants (POLs including DRO, GRO, TRPH and BTEX), one sample was collected and analyzed for POLs and metals associated with spent engine lubricating oils, and one sample was collected and analyzed for PCBs. Arsenic, mercury and selenium were not analyzed for because these metals are not expected in lubricating oils. The chemical sampling plan for the Phase I investigation recommended analytical tests based on the most probable

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Position
3 – Fuel Line Corridor and Pumphouse	Inadequate site characterization. Aerial extent of groundwater contamination is unknown. Analytical results from Phase III investigation were limited to DRO and RRO. Need testing for other contaminants. Are other contaminants present or likely at this site? Why was the list of analytes restricted to these substances? What about solvents?	Nugget Construction removed 8,000 feet of pipeline, and partially removed the pumphouse building during 2000-2001. Nugget also excavated stained soils (12.6 Tons) from Site 3 in July 2001. Bristol Environmental demolished the remaining concrete sidewalls during 2003.	During the Phase I remedial investigation (1994), 5 samples were collected at Site 3, based on areas/sources of most likely contamination. Although solvents (we assume the concern is chlorinated solvents) may have been used in small quantities during maintenance procedures, use of large volumes is unlikely to have occurred. Since this site contained a fuel line and pumphouse, the targeted analytes in the initial investigation phase were: fuels, volatile organic compounds (VOCs), PCBs, and priority pollutant metals (excluding arsenic, mercury, and selenium because these metals are not expected to be present in spent lubricating oils). One location containing abandoned batteries was tested for the presence of lead. The surface soil samples were located as follows: one inside the pumphouse building, one in front of the entryway (near batteries), one below an abandoned engine block, and two below and downslope of the remaining ASTs. Two samples were analyzed for DRO, GRO, TRPH, BTEX, PCBs, and RCRA metals. One sample was analyzed for DRO, GRO, TRPH, and BTEX. One sample was analyzed for VOCs, and one sample was analyzed for total lead. Only DRO was retained as a contaminant of concern, because of surface soil contamination (SS101 with 3,760 mg/kg). Low levels of PCBs (0.290 to 0.750 mg/kg) and lead (27 to 119 mg/kg) were detected in surface soils, but below the ADEC Method 2 cleanup levels for residential exposure. During the Phase II investigation (1998), a well point was installed at Site 3 to evaluate possible migration of fuel contamination. One subsurface water sample was collected and analyzed for DRO, BTEX, and PAH. The detections of BTEX and PAH were below cleanup criteria, but DRO (14 mg/L) exceeded the ADEC groundwater cleanup level of 1.5 mg/L. Therefore, three additional well points were installed during the Phase III investigation (2001) to refine the extent of DRO contamination in the perched shallow groundwater. The target list of analytes was narrowed to DRO and RRO based on prior phases of the remedial investigation. The well points were intended to further delineate the extent of groundwater contamination by stepping out from previous locations of documented contamination. The groundwater samples contained DRO from 1.8 to 3.3 mg/L, and RRO from 1.3 to 8.1 mg/L. It appears that the extent of groundwater contamination which exceeds the ADEC Table C values may be greater than anticipated. However,

			The Bering Sea is located approximately 500 feet downgradient of well-point WP4-3. It is unlikely that shallow groundwater contributes a significant volume of water to the surface water interface with the Bering Sea. The well-points in this vicinity have not generated large amounts of water during sampling activities. Sampling of marine sediment and ecological receptors is not warranted. Site 4 will be evaluated in the risk assessment. The shallow groundwater will be considered a potential drinking water source, and the site retained for further evaluation of remedial alternatives in the feasibility study. However, we believe no further sampling is required at this time.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
5 – Cargo Beach	Inadequate site characterization. Despite obvious soil staining and cans of dielectric oil (probably contain PCBs), and recommendations from previous contractors that the area be extensively sampled, MWH has taken only three surface soil samples, all from the same location. Neither water samples nor product samples from drums have been taken.	Scattered 55-gallon drums were removed by Nugget Construction during 2000. The 9 cans of dielectric oil reported by URS (1986) have been removed according to E&E (1993).	URS (1986) conducted a preliminary reconnaissance of the site to develop material inventories for preparation of bid documents to implement cleanup of the site. A limited number of samples were collected during their investigation. Soil grab samples collected during their preliminary reconnaissance indicated that PCB contamination may be present. Two out of three samples collected from areas of stained soils contained PCBs at 1.1 and 1.6 ppm, respectively. A river sediment sample collected from the same vicinity did not contain detectable levels of PCBs. The URS report did indicate that full one-gallon containers of dielectric fluid were found in the area. However, subsequent investigation and site reconnaissance by E&E did not document the presence of these containers, thus it is assumed the containers were removed from the area. A large-scale cleanup contract was awarded in the late 1980's but subsequently terminated since an acceptable right of entry agreement could not be reached between the Corps and landowners. Further investigation was not pursued until 1992 when Ecology and Environment (E&E) re-inventoried the site and prepared a workplan, which Montgomery Watson implemented in 1994. The Corps of Engineers did not implement the recommendations made by URS (1986) regarding extensive sampling of the Cargo Beach area, due to FUDS eligibility restrictions. It is obvious that local use of this area has been ongoing since the military abandoned the site. Beneficial use of the area precludes FUDS eligibility. A small area (approximately 9 square feet) containing petroleum-stained soil was noted by E&E (1993) around drums near the western edge of the Cargo

at this level (0.002 mg/L) in groundwater from well point 6-3 in 2001.

Regarding beryllium, previous investigation results (1994) show it was detected in one primary and two quality assurance soil samples from Site 6 (ranging from 0.99 to 1.3 mg/kg), but at levels below the ADEC Method 2 Table B1 cleanup level of 42 mg/kg. Beryllium (0.02 mg/L) was also detected (at the method detection limit) in one groundwater sample from MW 6-1. However, beryllium was detected in the total water sample, not the dissolved fraction, suggesting that the detection resulted from suspended soil particles in the water. The ADEC groundwater cleanup level for beryllium is 0.004 mg/L. Beryllium was detected in a sample collected from well point 6-3 during the 2001 investigation at a concentration equal to the ADEC cleanup level.

The most recent sampling results (2001) for Site 6 indicated elevated concentrations of several metals in shallow groundwater adjacent to the known area of petroleum contamination (the west edge of the gravel pad). The following metals were detected at levels equal to or exceeding the ADEC Table C groundwater cleanup levels at well point 6-3:

Metal	*Concentration*	*ADEC cleanup level*
Beryllium	0.004 mg/L	0.004 mg/l
Cadmium	0.006 mg/L	0.005 mg/L
Chromium	1.22 mg/L	0.1 mg/L
Lead	0.16 mg/L	0.015 mg/L
Nickel	1.68 mg/L	0.1 mg/L
Thallium	0.002 mg/L	0.002 mg/L
Zinc	17.7 mg/L	11.0 mg/L

The most likely source of several detected metals, beryllium, cadmium, and thallium, is natural background. Historic disposal of materials at the drum field may have also contributed to the recent detections of several metals in groundwater. The elevated metals in groundwater do not appear linked to upgradient contamination migrating from Site 7, since two upgradient monitoring wells (WP7-1 and WP7-2) did not contain elevated concentrations of metals in groundwater. Exposed and scattered drums, and other miscellaneous debris were removed from Site 6 by Nugget Construction during 2000 and 2001.

Shallow subsurface water and adjacent surface waters have been sampled at Site 6. No additional groundwater sampling is planned at this time.

	contained >10 mg/kg PCBs; elevated mercury, lead and arsenic in surficial soil samples. It is therefore possible the buried materials are also contaminated. Additional soil sampling is needed to effectively characterize the extent of contamination within the buried materials at this site. All of the samples collected to date have been from the periphery of the site. There is no information on the deeper portions of the landfill. The nature and extent of contamination in the subsurface has not been adequately characterized. The lateral and vertical limits of PCB and trace metal contamination have not been defined. What are the sources of dioxins/furans? Concerned that the landfill will be closed, not removed. Concerned that contaminated soil and buried material will be left behind after drums removed.		feasibility study, based on the results of the Phase I, II and III remedial investigations and final risk assessment. Additional sampling is not planned at this time, and we believe the most logical approach is to remove an estimated quantity of PCB or metal contaminated soils based on existing sample results, and conduct post-excavation confirmation sampling. Elevated levels of arsenic, chromium, and lead were identified during the 2001 investigation, but these hotspots will be evaluated in the risk assessment to determine applicable site cleanup levels. Mercury concentrations in the soil/sediment samples ranged from ND (0.1 mg/kg) to 0.56 mg/kg, and did not exceed the ADEC Table B cleanup level of 1.4 mg/kg. The PCBs in soil located east of Cargo Beach Road did not result from landfill leachate, but rather from debris pushed off the edge of the road. Therefore, the feasibility study can proceed based on the existing information. Regarding characterization of deeper portions of the landfill, the Corps feels the delineation of deeper materials within the landfill footprint is impractical. It is standard industry practice to conduct sampling on the fringe of a landfill to determine if contaminants are migrating away from the site. Drilling boreholes through unknown buried materials would be hazardous and potentially damaging to the sampling equipment. The source of dioxins is unknown. Dioxins are a typical byproduct from the burning of chlorinated, combustible landfill materials. Dioxins are also distributed via atmospheric transport and deposited in remote locations across the globe. Dioxin/furans were detected at low levels in surface soil during the 1994 remedial investigation. Twelve soil samples were collected at Site 7. Surface soil sample 94NE07SS122, located on the east side of Cargo Beach Road, had the highest dioxin concentrations. The results were evaluated using the total dioxin toxic equivalency approach (TEQ) published by USEPA in 1987, the acceptable guidelines at the time of the 1994 investigation. However, since the Phase I remedial investigation was completed, updated dioxin toxic equivalency factors have been published by the World Health Organization (WHO 1997). Using the USEPA 1987 approach, surface soil sample SS122 had a TEQ of 1.87 parts per trillion (ppt), versus 6.37 ppt using the more recent WHO 1997 methodology. Another surface soil sample 94NE07SS124 (analyzed in duplicate/triplicate) contained a TEQ of 0.00 ppt (0.0071/0.0026 ppt) per USEPA 1987, versus 0.00082 ppt (0.072/0.027 ppt) using the more recent WHO 1997 methodology. The USEPA Region 3 Risk-Based Concentration for 2,3,7,8 TCDD in residential soil is 4.3 ppt.

			In response to concerns raised in a public meeting, a subsequent inspection of Site 8 was performed on August 5, 1996 and September 14, 1998 by a field team from Montgomery Watson. Mr. Eugene Toolie, who worked at Northeast Cape at the time the spill occurred and was responsible for the pipeline repair and cleanup efforts, accompanied the team. According to Mr. Toolie, a spill of approximately 500 gallons of diesel fuel occurred in 1973. Cleanup efforts were initiated shortly after the spill, consisting of spreading absorbent pads over the area. Mr. Toolie indicated that the cleanup efforts were relatively successful. The team observed a wetlands area about 40 feet wide and 60 feet long immediately downslope of the fuel line break site (below the road embankment). The wetlands area drains to the south to the Suqi River, which crosses under the road approximately 400 feet to the south of the spill area. Within the wetlands area and parallel to the road embankment lies a 10 foot by 3 foot surface water area with a diesel sheen and odor. The wetlands vegetation appeared healthy and choked with cottonweed grass. The diesel-contaminated area appeared localized, and there was no evidence that it flowed to the Suqi River, which was consistent with Mr. Toolie's recollections. No sampling was performed because the presence of diesel was readily observed in a small, localized area. The pipeline was removed by Nugget Construction during 2000-2001. Based on Nugget's Final Project Plans for the removal action, if soil staining was observed during or after removal of the pipeline, surface soil samples were to be collected and field screened. If the field screening results indicated the presence of petroleum hydrocarbons, then off-site laboratory samples would be collected from an estimated 3 locations. Nugget's contract was terminated for convenience before a removal action report detailing actual field activities was produced. At this time, the Corps is assuming that no soil samples were collected during removal of the fuel pipeline at Site 8. Areas downgradient of Site 8 have been investigated, including sediment and surface waters of the Suqitughneq River. No further action is recommended based on the results of prior phases of investigation.

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Response
10 – Buried Drum Field	Inadequate site characterization. No monitoring wells have been installed downgradient or circumferentially. Only one water sample has been taken. No testing has been done for arsenic. Concerns that drum field will not be completely removed. The recommendation appears to be that an area around one of the test pits (test pit #2, where a full drum was found) be dug up and clean fill placed on top, leaving the rest of the drum field as is. If buried, leaking drums remain, contents could flush into the Suqi drainage with heavy rains. PCB-impacted soils are located downgradient of Site 10, which could be the source area.	2 monitoring wells installed (1994).	The Phase I investigation (1994) included sampling of monitoring wells, boreholes, sediment, surface soils, and surface water. Samples were analyzed for VOCs (or BTEX), GRO, DRO, TRPH, PCBs, BNAs, and/or modified metals. A profile of the potential extent of fuel contamination was also generated using cross sections (see Figure 4-7-2, Phase I RI Report, 1995). During the 1994 investigation, two monitoring wells and two boreholes were installed downgradient of Site 10. Two monitoring wells were also installed at the adjacent Site 11. Numerous soil and sediment samples (25) were collected from the embankment at Site 10, Site 11, and the downgradient drainage basin area. Two surface water samples were collected immediately downgradient of the sites. In 1996, six additional surface soil samples were collected at Site 10 and analyzed for DRO and TRPH. The monitoring wells at Site 11 were re-sampled in 1998. According to the text of the Remedial Investigation Report (MW 1995), soil and water samples were analyzed for arsenic. However, the data presented in the Appendices only show one arsenic sample result, from MW 10-1 (0.039 mg/L As+). According to the Chemical Data Acquisition Plan (E&E 1993), modified priority pollutant metals were to be analyzed at Site 10, which excluded arsenic, mercury, and selenium. According to E&E (1992), only those metals associated with spent lubricating oils were recommended for sampling. Thus, arsenic, mercury, and selenium are excluded from the list of priority pollutant metals, since they were not expected to be present. In contrast, at Site 16 (Paint and Dope Storage Building), E&E (1992) recommended analyzing for all metals, including arsenic, mercury and selenium, based on the presence of various containers of potential contamination sources observed within the building. The downgradient PCB contamination observed in the Drainage Basin (Site 28) is most likely related to Site 11, which is also immediately upgradient of the sampling locations. The exact source of PCBs is unknown, but assumed to originate at the Main Complex. During the 1994 investigation, PCBs were not detected in surface soil samples collected from the embankment of Site 10. Note that Figure 5-8 of the Phase II RI Report (MW, 1999) shows elevated PCB detection limits for these surface soil samples (SS125-136). However, the data are erroneous because the method reporting limits (MRLs) for each

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Response
11- Fuel Storage Tanks	Inadequate site characterization. Despite reports that oil was burned off, there has been no testing for dioxins. Water has not been tested for PCBs or metals. No attempt to determine vertical extent of contamination.	The three above ground storage tanks were removed by Nugget Construction during 2000-2001.	During the Phase I investigation (1994), three surface water samples were analyzed for fuels, PCBs, modified priority pollutant metals, and base/neutral/ acid extractable organic compounds at locations downgradient of Site 11 in the Drainage Basin. PCBs were not detected in surface water immediately downgradient of Site 11 (SW109 non-detect with MRL of 0.0005 mg/L). However, PCBs were detected in surface water sample SW110 (halfway between Site 27 culvert and Suqi River) at 0.0016 mg/L (QA and QC split samples results were 0.0014 mg/L and ND 0.001 mg/L). This result was attributed to suspended sediments in the water. PCBs were not detected (ND 0.0005 mg/L) in surface water collected just upgradient of the Suqi River in the Drainage Basin (SW117), or from the lagoon at Kitnagak Point (SW116). Furthermore, groundwater from two monitoring wells at the adjacent Site 10 (downgradient or cross gradient of Site 11) was analyzed for fuels, PCBs and metals. PCBs were not detected in MW 10-1 or MW 10-4 (MRL of 0.0005 mg/L). Arsenic, chromium, copper, lead, nickel, and zinc were detected in MW 10-1, while only lead was detected in MW 10-4. Groundwater samples from monitoring wells MW 11-2 and MW 11-3 were not analyzed for PCBs or metals, only VOCs and fuels, based on the Chemical Data Acquisition Plan (E&E 1993) for the remedial investigation. The vertical extent of contamination was investigated with borehole samples at Sites 10 and 11 during the Phase I investigation. Three boreholes were drilled at Site 11, and 4 boreholes at Site 10. MW 11-3 was sampled to 11.5 ft. Surface water sampling results from 2001 were also non-detect for PCBs (MRL of 0.001 mg/L) in areas immediately downgradient of Sites 10 and 11. E&E 1993 did not recommend testing for dioxins at Site 11, since the primary chemical of concern was leaking fuels from the storage tanks. The Corps believes that additional sampling for dioxin is not warranted. Dioxins are not an expected byproduct of the burning of fuel or oils. A source of chlorine is necessary to produce dioxins from combustion activities. All data results will be analyzed in the risk assessment, and the drainage basin is recommended for further evaluation of remedial alternatives in the feasibility study. No further sampling is necessary, and we believe the feasibility study can proceed.

	that contaminate the drainage downstream are not identified or delineated. The Phase III document does not provide justification for the analytes selected. Note the concentration of DRO in MW88-7 is up to 12,000 mg/kg with more than 9,000 mg/kg identified at about 11-13 feet. The data indicate the depth of contamination extends to greater than 25 feet below the ground surface at the Main Complex. Samples were not collected below this depth and the vertical extent of the impacted soils and/or groundwater is therefore not known. Additional sampling required.		Concentrations of PCBs ranged from 0.32 to 1.02 mg/kg. The excavations were graded with surrounding soils. The Phase I investigation targeted potential fuel contamination only at the two USTs and day tank at the Power Plant building, PCB contamination associated with stained soil within the southwest transformer room, and wipe sampling of concrete floor slabs in the generator and other transformer rooms. Metals were not identified as potential contaminants of concern. The soils surrounding the nearby Auto Storage and Maintenance Buildings were investigated for metals, based on observations of a grease pit, oil-stained floor slabs, smudge pots, and a suspected antifreeze AST. Four surface soil samples were collected and two monitoring wells installed. The maximum concentrations of chromium (59 mg/kg), copper (65 mg/kg), and zinc (282 mg/kg) were initially identified as exceeding benchmark concentrations. However, comparison with current ADEC Method 2 cleanup levels for copper (4,060 mg/kg) and zinc (9,100 mg/kg) indicate these metals are not of concern. Further investigation was completed during the 2002 field season. Activities at the Main Complex (Sites 13, 15, 19, 22 and 27) included drilling 10 soil borings and 10 monitoring wells. Soils were analyzed for DRO/RRO/GRO, PCBs, BTEX, PAHs, lead/zinc/chromium, and total organic carbon. Groundwater was analyzed for DRO/RRO/GRO and BTEX. PCBs were not detected in the soil samples, thus PCBs would not be expected in the groundwater. The monitoring wells and soil borings were installed to delineate contamination at and above the groundwater interface. Frozen soil and bedrock were encountered at depths ranging from 14 feet to 36 feet below ground surface at several borings within the main complex. For example, MW 88-10 was drilled to a total depth of 27.5 feet when the auger met refusal at bedrock. DRO was detected at 750 mg/kg between 24-26 feet at this location. MW 88-10 is upgradient of MW 88-7, and approximately 14 feet higher in surface elevation. At Site 22, also upgradient of the MW 88-7, two soil borings were drilled to refusal, a total depth of 32 and 36 feet, where bedrock was encountered. Site 22 is about 11 feet higher in surface elevation than MW 88-10, and 25 feet higher than MW 88-7. Petroleum products were not detected at these locations. Permafrost or bedrock were also encountered at a depth of 17 feet at MW 88-4, located on the north edge of the main complex between the drainage culvert and the large fuel tanks. Frozen soils were encountered at SB 88-11 and 88-13 at 14 and 16 feet below ground surface. Therefore, the depth of contamination

			Additional sampling is not planned at this time, and we believe the most logical approach is to remove an estimated quantity of PCB-contaminated soils, and conduct post-excavation confirmation sampling. The feasibility study can proceed based on the existing information. Remedial alternatives for Site 14 will be evaluated in the feasibility study. The flooded area noted at Site 14 was a subterranean corridor connecting Building 98 and Building 101 (Site 18). The standing water was sampled for BTEX, TRPH and PCBs during the 1996 field activities. All results were non-detect. Based on the test results, ADEC gave verbal authorization to remove the water and discharge it to the ground surface (see page 2-17, MW 1999). Therefore, this flooded area has not contributed contamination to the adjacent wetlands area at Site 21.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
16 – Paint and Dope Storage Building	Inadequate site characterization. The lateral and vertical extent of lead, PCBs and DDT have not been delineated and the extent of contamination remains unknown. A broader range of herbicide/pesticide analyses is required. Other metals including arsenic and mercury were also not included in the list of analytes for this site during the 2001 investigation. Site 16 contained less than 0.2 mg/kg concentrations of DDD/DDT and less than 0.1 mg/kg concentrations of PCBs (1260). These data indicate DDT was used at the NEC at the time the military occupied the site. Is it possible DDT and its degradation products exist at other Main Complex sites? What was the determinant for selecting Site 16 for sample analysis of DDT products relative to some of the other impacted sites?	The building, AST and miscellaneous containerized wastes were removed by Nugget Construction during 2000-2001. Stained soils (2.56 tons) were also excavated by Nugget and placed in supersacks for off-site disposal.	The 2001 pesticide sampling was the result of a modification to the ongoing field activities. While reviewing the PCB sampling data results, the laboratory chemist reported that peaks in the chromatograms may indicate pesticide contamination. MWH informed the Corps of Engineers that Site 16 and Site 28 (cross sections 7-11) may have hits of pesticides, but they were unable to confirm given the existing samples. Thus, the Corps of Engineers directed MWH to collect 12 additional samples from these combined locations to confirm or refute the presence of pesticides. The levels detected at Site 16 were significantly less than ADEC Method 2 cleanup levels. For example, the soil cleanup level for DDT is 24 mg/kg, and the 2001 results ranged from 0.011 to 0.12 mg/kg. Therefore, further sampling is not warranted. In addition, a broad range of compounds were analyzed during the initial remedial investigation (1994). Soils and subsurface water around the AST, abandoned containers and building were sampled and analyzed for SVOC, VOC, PCBs, pesticides, and priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc). Pesticides were <u>not</u> identified as compounds of concern after the Phase I investigation. No pesticides were detected in the soil or groundwater samples. It is unknown exactly what type of pesticides were potentially stored or used at Northeast Cape. The most likely products used would be insecticides for the control of mosquitoes. For example, during remedial activities conducted by

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Response
17 – General Supply Warehouse and Mess Hall Warehouse	Inadequate site characterization.	Miscellaneous debris, containerized hazardous waste, and building structure were removed by Nugget Construction during the 2000-2001 field seasons. Bristol Environmental completed the building demolition during the 2003 field season.	During the Phase I investigation (1994), one surface soil sample was collected at Site 17, and analyzed for VOCs and base/neutral/acid extractable organic compounds (includes pesticides, PAHs). This sample was located adjacent to a leaking drum on the north end of Building 107 Mess Hall Warehouse. No chemicals were detected. A wipe sample of the concrete floor of Building 107 Mess Hall Warehouse was also collected and the results were ND for PCBs and base/neutral/acid compounds. Therefore, there was no reason to conduct further sampling to determine the horizontal and vertical extent of contamination at Site 17. It is unlikely this site would be contributing to PCB contamination of the surrounding tundra. There are no water sources on the gravel pad that could be sampled. More recent soil and groundwater sampling results (2001) at the Main Complex indicate that elevated concentrations of GRO and DRO are present to the north of Building 107 Mess Hall Warehouse. This sampling location (MW88-7) was intended to delineate the edge of the plume of contamination associated with the Power Plant Building, Diesel Fuel Pump Island, and other buildings to the east of Site 17. The unexpected sampling results indicate that fuel contamination associated with the Main Complex is more extensive than previously thought. (Note: During the 1994 investigation, a wipe sample of the concrete floor in Building 111 Supply Warehouse was also collected and contained 21 ug/100 cm^2 of PCB-1260 and 61,000 ug/100 cm^2 of bis (2-ethylhexyl) phthalate (a common plasticizer and laboratory contaminant). Building 111 has since been demolished and only the concrete floor slab remains. It is unknown if the wipe sample corresponded to a stained area of the floor. Thus, it is possible that PCBs in concrete may exceed the current standard of 1 ppm at this location.)
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
18 – Housing facilities and Squad Headquarters	Inadequate site characterization. This is a huge area with nine buildings and associated utilidors, but no sampling has been done. The utilidors could be a contaminant migration pathway.	Some buildings were removed by Nugget Construction during 2000 and 2001, the remaining buildings and utilidors were demolished by Bristol Environmental during 2003.	No further action from an HTRW perspective is recommended based on the results of prior phases of investigation. The remaining buildings and utilidors were demolished during the 2003 field season. The 9 original buildings were wood-frame construction on concrete or wood pillars. During the site inventory (1992), E&E suspected lead paint and asbestos-containing materials, such as insulation, tiles, and transite siding, which should be tested to determine proper disposal requirements. However, since no leaking containers,

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Response
19 – Auto Maintenance Building	Inadequate site characterization. Although it is very likely that an auto mechanics shop would have PCBs (from hydraulic, brake, and lube oils), no testing has been done for PCB contamination. Observation of mechanics work pit by independent observers noted that water levels in the pit tend to fluctuate; if water levels are high in metals and benzene, need to know where this pit drains to. Also need to know where floor drains drain to; 1993 reports note six drains, but later reports only note two drains?	The mechanics work pit was cleaned out by Nugget Construction during the 2000-2001 field seasons. Bristol Environmental demolished the buildings during 2003.	The original Site Inventory conducted by E&E (1992) did not recommend sampling for PCBs at Site 19. During the Phase I investigation (1994) groundwater, surface and subsurface soil samples were collected and analyzed for BTEX, DRO, GRO, TRPH, and metals. During the 2001 investigation, soil samples from boreholes surrounding Site 19 were collected and analyzed for PCBs. PCBs were not detected in any of the samples. The site inventory identified a grease pit in the northern section of Building 109 and notes that these types of pits commonly drain to an open drain field. This former grease pit was cleaned out by Nugget Construction as part of their work during the 2000/2001 field seasons. Based on site knowledge, building layouts, and construction of the gravel pad, the most likely area for discharge from this grease pit is the 24" culvert which is located immediately downgradient of the diesel fuel pump stand (Site 27) on the northern edge of the gravel pad and above the drainage basin (Site 28). A smaller drainpipe located just west of the culvert also discharges to the drainage basin and may have been connected to Building 109. Alternatively, the grease pit may connect to the utilidor system. Either way, discharge from the grease pit has been investigated such that numerous samples have been collected and analyzed for PCBs from the Drainage Basin (Site 28), as well as additional samples from the outlet of the Wastewater Treatment Tank (Site 21). PCB concentrations in sediment samples collected from the Drainage Basin have ranged from ND to 5.4 mg/kg. A sludge sample collected from within the wastewater tank contained total PCBs at 122 mg/kg. Sediment samples collected from the outfall of the wastewater treatment tank had ND levels of PCBs, and one surface soil sample contained 0.32 mg/kg of PCBs. Two surface soil samples collected near the tank itself contained PCBs at 1.92 mg/kg (4.2 m/kg duplicate) and 0.29 mg/kg. The gravel pad is constructed such that the high point is the southeast corner of the pad, and based on site topographic drawings, water flows in a northerly direction from the pad. The 1992 Site Inventory report by E&E does mention 6 floor drains in each Building (108 and 109), plus the grease pit in Building 109. The Phase I investigation (1994) does not contradict this observation, only states that two wipe samples were to be collected from each center floor drain.

	and should have included sampling and analysis for DDT compounds. Inadequate characterization of PCB distribution; what are sources of metals, toluene, xylene? Groundwater sampling should be conducted here and downgradient from the site.		limit for lead in tundra soils is 106 mg/kg. The soil/sediment samples collected in 1994 contained lead ranging from 6.1 to 96 mg/kg. The concentrations of lead in soil/sediment samples collected in 2001 ranged from ND (10) to 67 mg/kg. Therefore, the lead concentrations at Site 21 are not significant. Mercury was also detected in one surface soil sample (SS168) during the Phase I investigation (1994). This sample was analyzed in triplicate and the results were 5.6, 4.0 and 3.1 mg/kg, which exceeds the ADEC Table B cleanup level of 1.4 mg/kg. The other seven soil/sediment sampling results were all non-detect (at 0.1 mg/kg). Additional sampling was conducted in 2001, and mercury was detected in 4 out of 11 samples, at concentrations ranging from 0.07 to 0.25 mg/kg, which are below the ADEC Table B criteria. The 1994 detection of mercury appears to be localized. Concentrations of DRO, arsenic and chromium have been adequately delineated at Site 21. The detected levels of these compounds may also be partially attributed to natural background concentrations of organics and inorganics. Based on a recent statistical analysis, the ambient levels of metals in tundra soil at Northeast Cape were 7.8 mg/kg for arsenic and 48 mg/kg for chromium. Chromium has been detected above background levels at only two historical sampling locations – immediately under the outfall (93 mg/kg in 1994), and downgradient of the outfall (50 mg/kg in 2001). Arsenic has been detected at several locations above background levels, primarily around the outfall (21, 39, and 170 mg/kg in 1994) and downgradient of the outfall (11.5, 12.1, and 14.7 mg/kg in 2001). The only potentially elevated levels of arsenic near the wastewater tank were detected in 1994 (9.6 mg/kg). However, subsequent testing in 2001 indicated levels ranging from 4.3 to 5.9 mg/kg in this vicinity. DRO has been detected at consistent levels across Site 21, with the exception of one sample location (SS168) adjacent to the wastewater tank which contained 1,160 mg/kg (3,800 mg/kg in duplicate) in 1994. Additional sampling downgradient of this location in 2001 indicated DRO at 270 mg/kg in a surface sample (0-0.5 ft) and 640 mg/kg in a subsurface (1.5-2.0 ft) soil sample. Otherwise, DRO concentrations in the remaining samples ranged from 46 to 620 mg/kg in 1994 and from 94 to 380 mg/kg in 2001. The higher DRO concentrations are primarily associated with surface samples. For example, MW 21-2, located between the wastewater tank and the downgradient outfall, was sampled in 1994 to a depth of 4-6 feet and concentrations of DRO and TRPH were an order of magnitude lower (46 and 85 mg/kg, respectively) than

Site	Stakeholder Concerns	Actions Completed or Scheduled	Corps Response
22 – Water Storage Building	Nature and extent of contamination are not characterized. The potable wells should have been analyzed for trace metal contaminants found at the NEC including arsenic, lead, mercury and others to ensure this potential water supply is free of both organic and inorganic contaminants. It also would have been advisable to analyze the well water for pesticides since these contaminants are also known to be present at the Main Complex. What are sources of antimony, lead, DRO, RRO? Groundwater here is NOT potable in present state and should not be characterized as such.	The potable water wells were decommissioned in 2001 by Nugget Construction. The water storage tanks were also removed, and the building partially demolished (only three concrete stem walls remain). The UST 22-1 at the pumphouse for Well #2 was removed by Nugget Construction in July 2001. Soils associated with excavation of the UST, as well as a small area (0.25 tons) of stained soils inside the water storage tank building by the north wall were removed by Nugget during 2001. Bristol Environmental completed demolition of the concrete stem walls during the 2003 field season.	The wells were decommissioned in 2001 as part of an existing demolition contract and are no longer available for sampling. The main constituent found in the shallow groundwater is diesel fuel contamination, hence the deeper water supply wells were analyzed for fuel compounds only, to determine if any connection between the two aquifers existed. Arsenic, lead, mercury, and pesticides were not identified as potential chemicals of concern in groundwater. Possible sources of contamination for the detected DRO/RRO at former potable well #2 (PW-2) include a diesel-powered engine in the pumphouse, and a 500-gallon diesel underground storage tank adjacent to the pumphouse. The groundwater contamination identified in PW-2 may be due to leakage from the adjacent UST, leaks in the diesel pump system, or migration of contamination along the well casing. Since former potable wells #3 and 4 did not contain detectable contamination, it is possible the diesel and residual range organics in the deeper groundwater at Site 22 are localized due to the former UST. The UST was decommissioned by Nugget Construction in July 2001. Approximately 18 cubic yards (27 tons) of soil were removed during the tank excavation. Confirmation samples indicate elevated levels of DRO remain in the underlying soils, approximately 6 feet below grade. In 1994, a surface soil sample collected within the water storage tank building contained elevated levels of antimony (34 mg/kg), lead (497 mg/kg), DRO (2,640 mg/kg), and TRPH (5,920 mg/kg). This sample was located below a set of dilapidated stairs on the north side of the structure, downslope from a pile of debris. Possible sources of the detected compounds include asbestos retort cement, paint cans/debris, fuel spillage, or the building's utilidor connection. This small area of stained soil (0.25 tons) was excavated by Nugget during 2001. One confirmation sample (and QC duplicate) was collected from the bottom of the excavation and analyzed for GRO/DRO/RRO, BTEX, and lead. DRO was detected at 2,090 (1,730) mg/kg. RRO was detected at 3,660 (3,970) mg/kg. GRO was detected at 2.69 (2.59) mg/kg. Lead was detected at 4.93 (5.79) mg/kg. BTEX compounds were not detected. Migration of contamination from this particular location was further investigated in 2002 by the placement of two downgradient boreholes (drilled to refusal at 32 and 36 feet below ground surface) near the former utilidor corridor north of the building. Four soil samples were collected; two at the

			gravel pad, contained 280 mg/kg of lead. The downgradient sediment sample (SD113) only had 18 mg/kg of lead. Thus, lead contamination has been adequately delineated and appears localized. Chromium was detected in soils during the 1994 investigation at levels ranging from 4.7 to 58 mg/kg. Only 1 location exceeded the site-specific background level of 50 mg/kg for gravel soils. During the 2001 investigation, chromium was detected in the two sediment samples at 12.3 and 13 mg/kg, which do not exceed the background level for chromium of 34 mg/kg in sediment. Possible sources of contamination include scattered drums, misc. debris, and former equipment associated with the building. Ambient levels of inorganics in the environment may also be contributing to perceived contamination. Groundwater sampling was conducted during the Phase I remedial investigation (1994). Three monitoring wells were installed and water samples were collected and analyzed for TRPH, DRO, GRO, VOC, SVOC, PCB, pesticides, and metals. The ADEC Table C groundwater cleanup standard was only exceeded for total lead. However, the dissolved concentrations of lead were below the groundwater cleanup level. Thus, the source of the lead is likely soils entrained in the water column, and metals were excluded as contaminants of concern.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
26 – Potable Water Well	The sampling did not include trace metals such as mercury, lead, or arsenic that may affect using the water as a potable source. Natural attenuation geochemical data should be included in a follow up report. These data will be important in determining remedial alternatives for the impacted groundwater and soils.	The potable wells were decommissioned in 2001 by Nugget Construction.	The wells were decommissioned in 2001 and are no longer available for sampling. Metals were not identified as a contaminant of concern in the shallow groundwater at the site, thus they were not included in the deep groundwater analyses. The primary contaminant of concern in groundwater at the Main Complex is diesel fuel. The groundwater samples were analyzed for DRO/RRO/GRO, BTEX, and parameters used to evaluate the potential for natural attenuation (i.e. alkalinity, chloride, sulfate, nitrogen, sulfide, chemical oxygen demand, manganese and iron). No further sampling is planned.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
28 – Drainage Basin	In adequate site characterization. The list of analytes for surface water and sediment sampling should have included all	Remedial investigations – including sampling of soil, sediment, surface water, groundwater, plants, and	Sediment and surface water in the drainage basin were previously sampled during the Phase I investigation (1994). Samples were analyzed for BTEX, DRO, GRO, TRPH, BNAs, PCBs, and metals (antimony, beryllium, cadmium, chromium, copper, lead, nickel, silver, thallium, zinc). Pesticides (including

	What is the source of the dibenzofurans? Since this contaminant is found in the Drainage Basin, there must be an upgradient source(s). The depth of contamination determined by the 2001 field season results also indicates there is little understanding of the lateral and vertical extent of contamination within the Suqi drainage. For example, samples collected 18-24 inches below the land surface contained about 150,000 mg/kg DRO, more than 110 mg/kg lead, greater than 0.5 mg/kg PCBs and a range of organic and inorganic contaminants to a depth of 24 inches. This indicates there is little understanding of the vertical extent of contamination within the drainage basin. The extent of contamination in the subsurface is unknown. The extent of contamination is defined by the sampling protocols used to sample the soils and sediments within the Drainage Basin. For example, it is not known whether the soils and sediments found beyond the approximate bank-full channel are also contaminated since no samples were collected from areas that extend beyond the channel width. Sediments, and likely contaminants, are transported and deposited in the overbank area of the drainage during flooding and it is therefore likely contaminated sediments can also be found within the floodplain of the Drainage. In future characterization of the NEC, the lateral and vertical extent of contamination of the soils and sediments and associated waters should be determined to assess		[a] levels shown are the lowest of the inhalation/ingestion/migration to groundwater pathways [b] ingestion pathway [c] migration to groundwater pathway [d] inhalation pathway [e] cleanup level for endosulfan used as surrogate, since endosulfan sulfate is a metabolite and closely related compound The only pesticides detected above a default cleanup level were beta-BHC and gamma-BHC. These compounds will be evaluated in the human health risk assessment. The pesticides may be present due to several factors: low level residues from historical military use of pesticides, or atmospheric deposition. Furthermore, during the Phase I investigation (1994), samples from various sites including the Drainage Basin area (not yet identified as Site 28) were analyzed for BNAs (base/neutral/acid extractable organic compounds). This suite of compounds includes the pesticides DDD, DDE, DDT, aldrin, dieldrin, endrin aldehyde, heptachlor, delta-BHC, and gamma-BHC. BNAs were also analyzed for at Sites 0 (background), 6, 7, 9, 10, 11, 16, 17, 22, 23, 24, and 25. Pesticides were not identified as chemicals of concern at any site. It is very unlikely that the Agent Orange or 2- 4D were utilized at Northeast Cape. Agent Orange is a herbicide that was used heavily in Vietnam by the military, because it was principally effective against broad-left foliage, and caused defoliation of trees and shrubs. Agent Orange was primarily used in tropical climates. Given the arctic conditions on St. Lawrence Island, the lack of trees or shrub vegetation, it is highly unlikely that this herbicide would have been utilized at Northeast Cape. The most likely pesticides used at Northeast Cape would have been insecticides for the control of mosquitoes. For example, a 1-gallon container of diazinon was removed from the Main Electronics Bldg 1001 at the White Alice Site by contractors working for the U.S. Navy in 1992. However, recent sampling (2001) at both Site 31 and Site 32 did not detect any pesticide compounds in surface soil. Dibenzofuran is part of the suite of BNAs (SW8270) analyzed for at various sites across the Northeast Cape site during the 1994 investigation. It was <u>not</u> detected in any samples collected at Site 28. Dioxin/furans were not analyzed for at Site 28. Dioxin and furans are typically the result of incineration or combustion activities. They are also widespread in the environment due to global deposition. Low levels of dioxins/furans were detected at the landfills,

	sites also contained elevated arsenic in the surface sediments The presence of toluene also indicates the eastern tributary of the Suqi has been impacted by contaminant discharges to this section of the drainage basin. The nearest downstream sampling location in the Suqi River (2001) from the confluence of the Drainage Basin is located approximately 1500 feet downstream. These sampling location sediments (114, 115 and 116) contained relatively elevated PAHs, lead and DRO concentrations. The sediments from this site were not, however, analyzed for mercury, copper and other select trace metals.		Arsenic was also detected at 3.3 and 5.7 mg/kg in SD 126 and 127. A recent statistical analysis of ambient concentrations of inorganics at the Northeast Cape site indicates that the background upper tolerance limit for arsenic in tundra soils is 7.8 mg/kg. Thus, arsenic should not be considered elevated at these locations. Toluene was detected at 0.0074 and 0.0097 mg/kg in SD 126 and 127, and the results were qualified VB (analyte present in blank and sample). The ADEC Table B soil cleanup level for toluene is 5.4 mg/kg. The detected concentrations, if present, are orders of magnitude less than regulatory levels. The trace amounts of toluene in the easternmost sediment samples of Site 29 do not indicate an upgradient source of fuels, these levels may be due to aerial deposition of contaminants from a variety of sources. Prior phases of the remedial investigation included more extensive sampling of the drainage basin and Suqitughneq River. Sediment/surface water samples were previously collected in the vicinity of the Drainage Basin and Suqi River confluence. For example, in 1996, SW/SD 108 was collected just downgradient of the confluence (DRO 190 mg/kg), and SW/SD 107 (DRO 130 mg/kg) was collected immediately upgradient of the confluence. In 1998, samples SW/SD 803 and SW/SD 804 were collected immediately downgradient of the confluence and DRO was detected at 310 and 2,200 mg/kg, respectively. The Phase III remedial investigation was meant to build on those results and fill in perceived data gaps. Thus, the referenced samples (SD114, 115 and 116) were collected from a sediment cross-section (CS1) which was planned for the vicinity of previous sampling location SW/SD 111. This location was specifically targeted to verify the prior sampling results (25,000 mg/kg DRO in 1996) and determine the downgradient extent of contamination. The detected concentrations of DRO and RRO at cross section 1 should not be considered elevated. DRO ranged from 13 to 410 mg/kg, whereas RRO ranged from 26 to 770 mg/kg. Only one sediment sample exceeded the ADEC Table B soil cleanup level of 250 mg/kg DRO. The lead concentrations at SD114/115/116 ranged from 8 to 15 mg/kg, which should not be considered elevated. The sediment samples collected from each cross section in 2001 were only analyzed for the metals chromium/lead/zinc, based on previous investigation results which identified these compounds as chemicals of concern in the

	The lateral and vertical extent of the organic contaminants identified in the soils at Site 31 is undefined. Additional sampling and analyses are required to effectively characterize the contaminant distributions.		Additional sampling is not planned at this time, and we believe the most logical approach is to remove an estimated quantity of DRO or PCB contaminated soils based on existing sample results, and conduct post-excavation confirmation sampling. Therefore, the feasibility study can proceed based on the existing information, using basic assumptions regarding the lateral and vertical extent of contamination surrounding known point sources such as tank valves, piping, impoundments, and former transformer pads. The Corps agrees that further sampling may be necessary to accurately design future remedial actions. The additional information can then be evaluated in the proposed plans to determine if the FS recommendations should be changed.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
32 and 33 – Lower and Upper Tram Terminals	Inadequate site characterization. The limited number of samples collected at the sites is insufficient to determine the lateral and vertical extent of contamination and the sites remain poorly characterized. The contaminants identified at this site need to be better characterized to ensure against continuing downgradient contamination. Site samples were not analyzed for trace metals.	Bristol Environmental completed demolition of the buildings during the 2003 field season.	We do not believe testing for metals is warranted at Site 32. Trace metals were not identified as a chemical of potential concern in the approved workplan. The most reasonably expected contaminants of concern were selected for analysis, based on former site activities and potential sources of contamination. Sample locations were chosen based on proximity to potential sources (oiling of tram lines, anchor pit, AST), and field observations of suspected contaminated areas. Pesticides were also added to the analytical suite (at Site 32), based on input from stakeholders during the workplan review conference. No pesticides were detected in the samples. The Corps believes the data collected is sufficient to proceed with the feasibility study. Stained soils are obvious by the lower tram terminal building and in the anchor pit, therefore assumptions can be made regarding the full lateral and vertical extent of fuel contamination at this location. We believe the most logical approach is to remove an estimated quantity of DRO contaminated soils based on existing sample results, and conduct post-excavation confirmation sampling. If further sampling is conducted in the future, those results will be evaluated in the proposed plans, to determine if the recommendations of the feasibility study should be revised.
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
34 – Upper Camp, White Alice	Inadequate site characterization. Analysis of the soil samples was restricted to PCBs, DRO and RRO. Other analytes	Bristol Environmental completed demolition of the buildings during the 2003 field season.	We do not believe testing for other contaminants is warranted at Site 34. According to the approved workplan, the most reasonably expected contaminants of concern were selected for analysis, based on site conditions and potential sources of contamination (e.g. above ground storage tanks,

	does this indicate past uses of arsenate-based pesticides? A full investigation of the possibility of storage and/or use of arsenic-based chemical warfare agents has not been completed.		with natural levels of this metal in the substrate (igneous rock). In those locations where arsenic was detected at abnormally high levels, additional actions may be taken based on a site-specific risk assessment and feasibility study. The elevated levels may be the result of dumping boiler contents or other wastes. We have no indication that arsenate pesticides were utilized at Northeast Cape. Furthermore, a statistical analysis of ambient concentrations of inorganics at Northeast Cape, indicates that the background upper tolerance limit for arsenic is 7.8 mg/kg (tundra soils) and 11 mg/kg (gravel soils). We have researched the possible use of chemical warfare agents, and there is no evidence that such materials were ever stored or utilized at Northeast Cape (personal communication with John Wilder, Topographic Engineering Center, who conducted the Historical Aerial Photograph Time Sequence Analysis, including an extensive records review).
Site	**Stakeholder Concerns**	**Actions Completed or Scheduled**	**Corps Response**
General	An ecological/human health risk assessment cannot be done without extensive testing of plants, fish, and wildlife that people rely on for traditional foods. This would include voles, fox, reindeer, fish (freshwater, anadromous, and marine), freshwater and marine invertebrates, more extensive testing of plants (including marine species of nearshore algae), and seals.		The objective of the remedial investigation is to delineate the nature and extent of military sources of contamination at the site, to determine cleanup requirements. Testing of organisms such as fish and plants was conducted to better evaluate uptake of contaminants from known areas of contamination and assess the potential impacts to human health. A clear connection between site contamination and uptake by ecological receptors must be established before considering more extensive testing. The Corps believes extensive testing of plants, fish and wildlife is not warranted at this time.
General	The extent of contaminant migration into the Bering Sea must be comprehensively assessed before the ecological/human health risk assessment can even be contemplated. The Corps must assess the volume of contamination migrating through groundwater, the Suqi River and into the Bering Sea.		In the project area, the Suqi River is the primary drainage to the Bering Sea, however water and sediments from the mouth of the Suqi River have been tested and are well below cleanup levels. Sampling of marine sediment and ecological receptors is not warranted. The objective of site cleanup actions are to reduce future impacts. The cleanup levels for a site are determined to take the long-term effects into consideration. Therefore, cleanup levels are a much more straightforward approach than calculating mass or volume of contamination over a given period of time.
General	Passive samplers such as the semi-permeable membrane devices should be deployed to assess migration of PAHs and		Further sampling is not planned. However, future monitoring techniques could be investigated during the feasibility study or remedial design phases of the project.

	the remainder of the river system. These potential impacts need to be integrated into any complete assessment and evaluation of risk of the military sites located near NEC.		