INSTALLATION RESTORATION PROGRAM

***FINAL* REPORT**

FORMER LANDFILL (LF03) SURFACE SOIL INVESTIGATION REPORT

CAPE ROMANZOF LRRS, ALASKA

FEBRUARY 8, 2005

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LIST OF ACRONYMS

AAC	Alaska Administrative Code
AC&W	Aircraft Control and Warning Site
ADEC	Alaska Department of Environmental Conservation
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CES	Civil Engineering Squadron
DRO	Diesel-Range Organics
EPA	Environmental Protection Agency
GPS	Global Positioning System
IDW	Investigative Derived Waste
IRP	Installation Restoration Program
LF03	Former Landfill No. 2
LRRS	Long Range Radar System
LTM	Long-Term Monitoring
MAR	Minimally Attended Radar Site
mg/kg	Milligrams per Kilogram
MNA	Monitored Natural Attenuation
PAH	Polynuclear Aromatic Hydrocarbon
Paug-Vik	Paug-Vik Development Corporation
PCBs	Polychlorinated Biphenyls
RBC	Risk Based Concentration
TPH	Total Petroleum Hydrocarbon
USAF	United State Air Force
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WACS	White Alice Communication System
µg/kg	Micrograms per Kilogram

1 INTRODUCTION

Paug-Vik Development Corporation (Paug-Vik) performed a soil investigation at the former landfill site (LF03) at Cape Romanzof Long Range Radar Station (LRRS) in 2004 for the 611th Civil Engineer Squadron (611 CES) at Elmendorf Air Force Base, Alaska. The primary purpose of the study was to investigate polychlorinated biphenyls (PCB) concentrations in soil downgradient of the landfill and to inspect the landfill cap in conjunction with long term monitoring consistent with the requirements of the *Record of Decision for Interim Remedial Action at Sites: Spill Site SS023, Spill Site SS015, and Landfill Site LF003* (611 CES, March 2002). This project was performed under an Indefinite Delivery Indefinite Quantity contract with the Department of Interior, Minerals Management Service, GovWorks Contract No. 1435-04-03-CT-71697, under Delivery Order No. 34980.

1.1 EXECUTIVE SUMMARY

PCB contamination was documented in soils along Seep 1, a seep emanating from the northwest corner of the landfill. PCB soil contamination above the cleanup level of 1 milligram per kilogram (1 mg/kg) was noted over 600 feet downgradient from the landfill. PCB concentrations are generally higher closer to the landfill and decrease downgradient, as the seep approaches Fowler Creek. While PCBs were detected in one of the four soil samples taken at the confluence of the seep and Fowler Creek, concentrations did not exceed cleanup values. Sediment and surface water sampling of Fowler Creek downgradient of LF03 is recommended to assess potential impacts to that water body.

Inspection of the landfill cap found that while the liner was visible in several places, no rips or tears were present. Three significant seeps emanating from the landfill were noted, indicating that water is actively entering the former landfill, despite the cap. Prevention of water infiltration is recommended.

1.2 BACKGROUND

Cape Romanzof LRRS is located in western Alaska on a small peninsula that extends into the Bering Sea, approximately 560 miles west of Anchorage, 165 miles northwest of Bethel, and 170 miles southeast of Nome (Figure 1-1). The installation consists of 4,900

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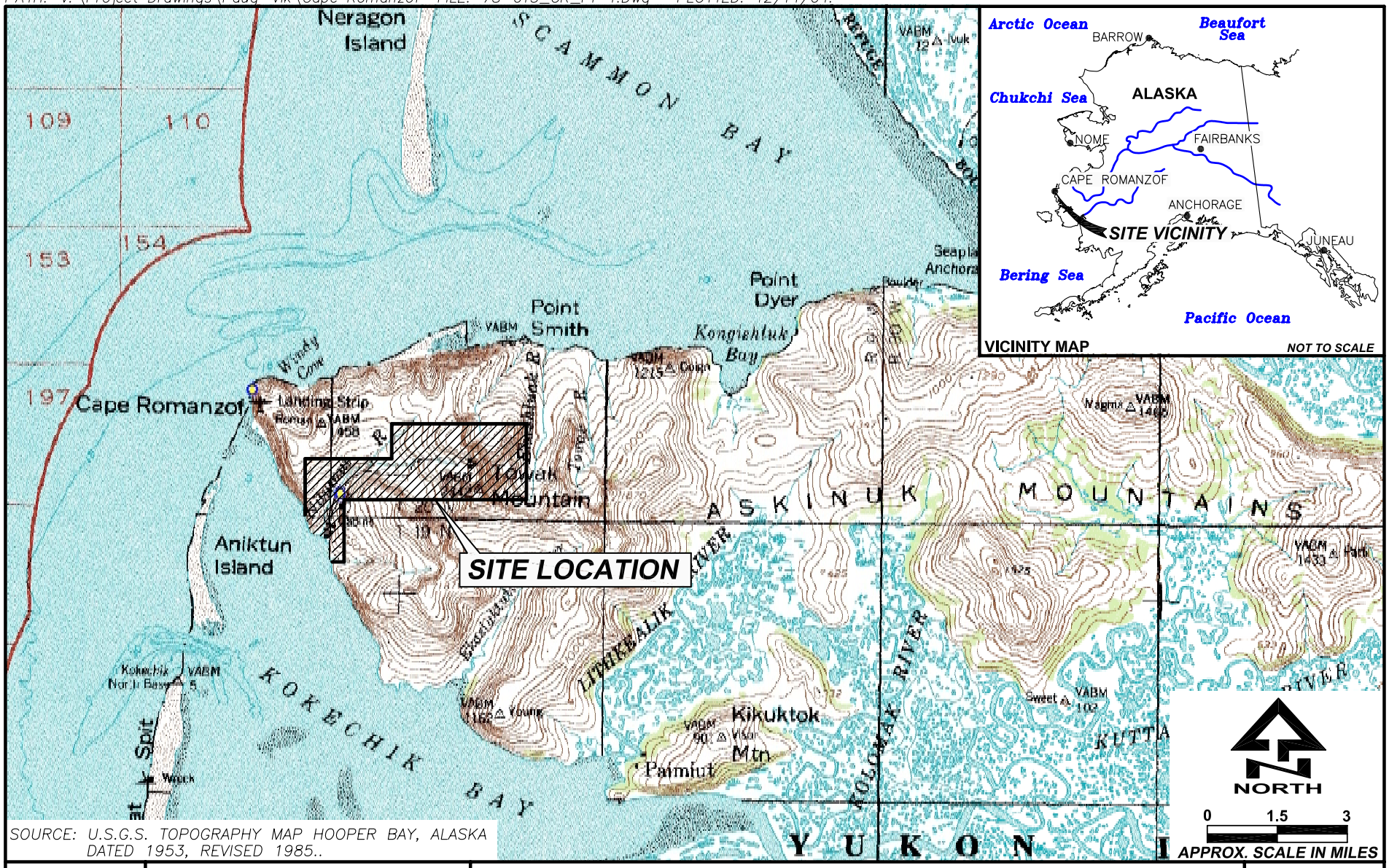

SOURCE: U.S.G.S. TOPOGRAPHY MAP HOOPER BAY, ALASKA DATED 1953, REVISED 1985..

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ELMENDORF AFB, ALASKA

SITE LOCATION MAP

FORMER LANDFILL (LF03)
SURFACE SOIL INVESTIGATION
Cape Romanzof, Alaska

FIGURE
1-1

acres of land within the Yukon-Kuskokwim Delta National Wildlife Refuge. Installation facilities are divided into two main activity areas: The Lower Camp where the main camp facilities (housing, power plant, and bulk fuel storage area) are located, and the Upper Camp where the Long Range Radar equipment is located (Figure 1-2).

The nearest local communities are Scammon Bay and Hooper Bay, located about 15 miles east and south of the installation, respectively. There are no roads connecting the Cape Romanzof installation to these communities. Cape Romanzof LRRS was one of the ten original aircraft control and warning (AC&W) sites in the Alaska Air Defense System. Construction of the installation was completed in 1952 and operations began in 1953. The White Alice Communication System (WACS) facility was installed in 1958, and replaced the initial communication and warning system. As technologies improved, the communications systems were upgraded eventually allowing the station to become a Minimally Attended Radar Site (MAR). By 1977, technological advances and significant reduction in site personnel allowed the Air Force to turn over operational support of the installation to independent contractors. The current site operations contractor is ARCTEC.

Approximately six contractor personnel currently live at the installation year-round. In the summer, the number of people living at the site can significantly increase (up to 30 people) when contractors and government agencies (e.g., Alaska Department of Fish and Game and U.S. Department of the Interior Fish and Wildlife Service) are conducting studies and performing work at the site.

The former landfill (LF03) is located approximately one mile west of the residential dome at the Lower Camp, south of the access road between the Lower Camp and the airstrip. The landfill area covers approximately 43,800 square feet (ft^2). Until the mid 1970s, the landfill reportedly received garbage, rubbish, wood, metal, plastic, construction and demolition debris, shop wastes, and incinerator ash.

In 1989 and 1991, site investigations documented the area surrounding the landfill as having large amounts of exposed wood, metal, and plastic debris. Several areas of stained soil and several points of oily effluent were noted on top of and adjacent to the landfill, respectively. Two drainages adjacent to the landfill were receiving surface flow and effluent flow from the landfill. Several seeps were observed to emanate from the landfill surface, and appeared to flow for up to 100 feet before reentering the landfill.

In 1989, four monitoring wells were installed in the landfill. Investigations conducted in 1989 and 1990 indicated that soil and surface water downgradient of the landfill were contaminated with petroleum and PCBs.

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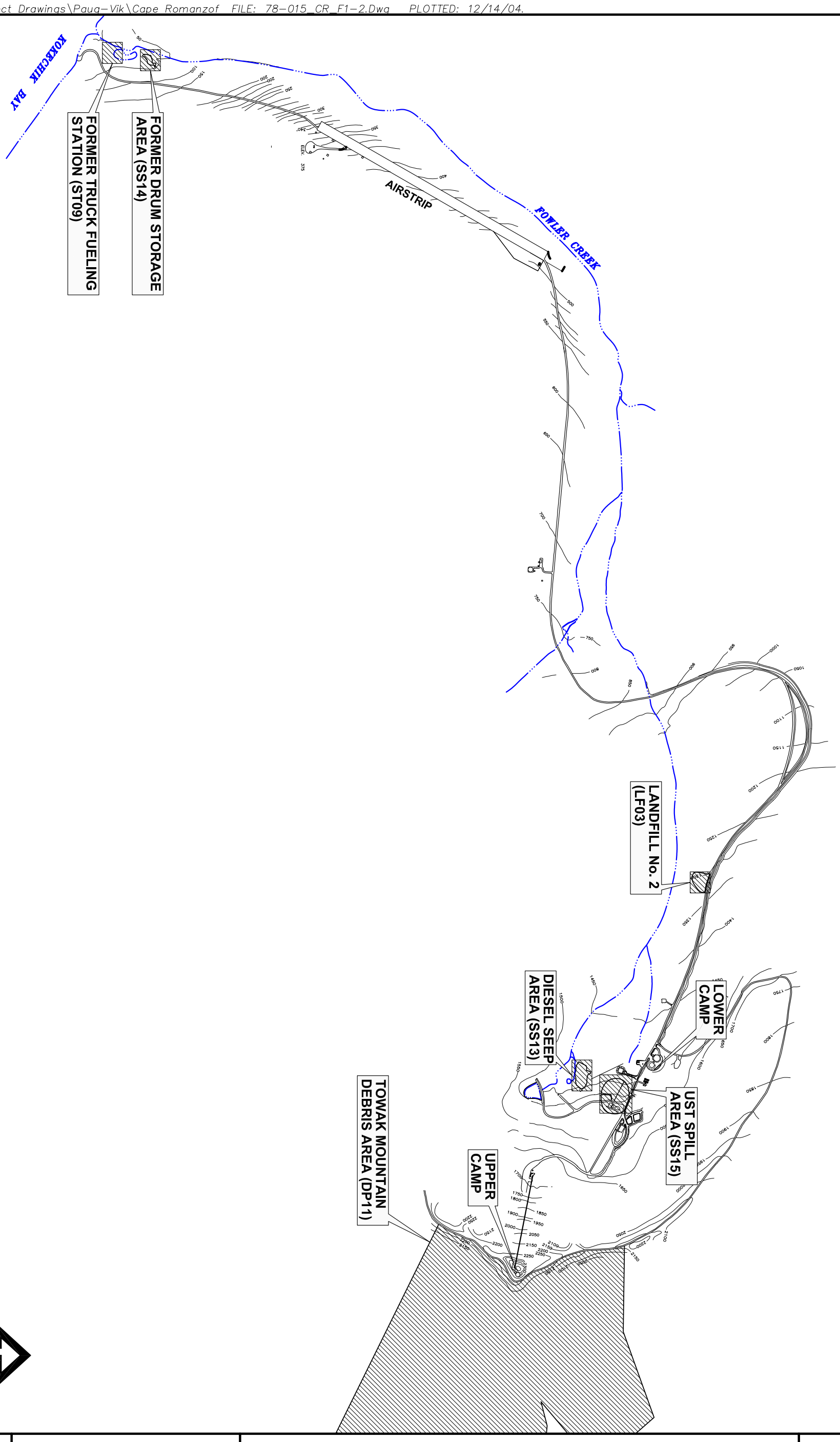

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ELMENDORF AFB, ALASKA

INSTALLATION LAYOUT AND OVERVIEW

FORMER LANDFILL (LF03)
SURFACE SOIL INVESTIGATION
Cape Romanzof, Alaska

FIGURE

1-2

In 1993 and 1994, the 611 CES collected debris from the periphery of the landfill, diverted a drainage at the toe of the landfill, and covered the landfill with a cap. The cap was comprised of an impermeable hypalon membrane overlain with geotextile fabric between sand and layers of pit run material. The cap was designed to prevent the infiltration of surface water that could produce contaminated leachate. Two monitoring wells installed in 1989 (#3, #4) were abandoned during the installation of the landfill cap. Re-vegetation was undertaken after observations indicated the contaminated effluent seeps had dried up. PCB concentrations in surface soil down gradient from the landfill (up to 40 feet) ranged from several micrograms per kilogram (µg/kg) to several hundred µg/kg.

In 1996, Harding Lawson installed seven monitoring wells around LF03. Soil, sediment, groundwater, and surface water samples were collected and analyzed. Results indicated that surface water and sediment downgradient of the landfill contained PCBs and diesel range organics (DRO). Harding Lawson continued monitoring the site in 1997 and results indicated that levels of benzene and chloromethane exceeded the Environmental Protection Agency (EPA) risk based concentrations (RBCs) in two monitoring wells. DRO was detected in all samples with concentrations ranging from 13.1 milligrams per kilogram (mg/kg) to 371 mg/kg. Trace amounts of pesticides were detected in one sediment sample.

In 1998, personnel of the 611 CES collected 50 soil samples in order to ascertain the extent of PCB and petroleum hydrocarbon contamination adjacent to LF03. Low level, widespread petroleum hydrocarbon contamination was documented in 1998. One sample site, SD2, had a PCB concentration of 180 mg/kg. All other soil samples analyzed for PCBs were below the Alaska Department of Environmental Conservation (ADEC) cleanup level at the time (10 mg/kg). Repair of the perimeter of the landfill cap was recommended in 1998. Long term monitoring was continued in 1999 and 2000 (BNCI, 2000 and BNCI, 2001). Two groundwater samples from the monitoring wells contained minor amounts of DRO. Sediment and groundwater samples indicated the presence of petroleum hydrocarbons above RBCs, and one sediment sample contained DRO and benzene concentrations above ADEC cleanup levels. PCBs were not detected in the surface water or sediment samples (BNCI, 2000 and BNCI, 2001).

PCB-contaminated soil adjacent to the capped landfill was investigated during a 2003 field effort (USAF, 2004). During this field effort, the landfill cap was inspected and deemed to be in serviceable condition, although the edges of the membrane were visible along the margins. A sediment sample was taken from the area that had previously exhibited PCB contamination (location SD2) and from a location approximately 120 feet

west and down slope of SD2. Sediment samples collected at SD2 and the down slope location contained PCB concentrations of 60 to 395 mg/kg, respectively. Observations at the site indicate that the PCBs are being deposited via a small seep that surfaces at the toe of the landfill. Recommendations from the 2003 field effort included detailed mapping of the seep, further sediment sampling along the seep area, and compilation of data to define an area for sediment removal.

1.3 PROJECT OBJECTIVES

The objectives of the 2004 soil sampling investigation are to:

- Identify and close any data gaps in the 1998 study conducted by the 611 CES.
- Assess the overall condition of the landfill cap.

2 INVESTIGATION APPROACH AND METHODOLOGY

In order to delineate the extent of PCB contamination at LF03, the following steps were taken during the field effort:

- Established a 10-foot sampling grid centered on the previously identified PCB hotspot (SD2).
- Field screened soil samples for PCBs using a qualitative immunoassay method.
- Collected laboratory samples to confirm the extent of PCB contamination.
- Performed a reconnaissance of the landfill area and visually observed the condition of the landfill cap.

2.1 CLEANUP LEVELS LANDFILL NO. 2 (LF03)

Cleanup levels for the soils deposited from the seep emanating from the former landfill (LF03) at Cape Romanzof were determined using regulatory cleanup levels established in 18 AAC 75; Method 2 Soil Cleanup Levels, Table B1. The analytical results were compared to soil cleanup levels because the seep can be considered a surface water body that is not present for at least half the year. The cleanup level for PCBs in soil at the former landfill (LF03) is 1 mg/kg, based on ADEC Method Two Soil Cleanup Levels (18 AAC 75 Table B1) and the "unrestricted land use" requirements (ADEC, 2003).

2.2 GRID SAMPLING

Using a hand held measuring tape, a sample grid was established around the sediment sample location SD2, the previously identified PCB hotspot. Grid points were established at ten and twenty foot distances from SD2. These sample locations were named to reflect their relative location using the following four character naming system:

- First character: Direction north or south from SD2 that the sample was collected.
- Second character: Distance in ten-foot increments north or south from SD2 that the sample was collected.
- Third character: Direction east or west from SD2 that the sample was collected.
- Fourth character: Distance in ten-foot increments east or west from SD2 that the sample was collected.
- For simplicity, characters with a distance of zero were omitted.

For example, the screening sample N2E1 would be located 20 feet north and 10 feet east of sediment sample SD2. The sample E2 would be 20 feet east of SD2.

2.3 FIELD SCREENING

Twenty-nine field-screening samples were collected and analyzed using the RPA-I™ RaPID Photometric Analyzer. The analyzer is used to screen for PCBs by immunoassay Method 4020, as described in the Paug-Vik 2004 Work Plan. Screening samples were collected with a disposable plastic scoop, and stored in plastic sample bags prior to analysis.

2.4 SURFACE SOIL SAMPLING

Surface soil samples were collected based on field screening results. Soil samples were collected using disposable plastic scoops. The soil was placed in approved precleaned laboratory containers, and then shipped to the laboratory for analysis of PCBs by EPA Method SW8082. Sampling locations were marked with flags labeled "PDC 2004" and the sample name. Locations were recorded in field sketches and when possible, global positioning system (GPS) coordinates were determined.

2.5 LANDFILL CAP INSPECTION

Visual inspection and documentation of the soil cap condition over the entire extent of the LF03 area was conducted. Field observations were documented through a combination of field notes, site sketches, and photographs.

2.6 INVESTIGATION-DERIVED WASTE HANDLING

The Investigation-Derived Waste (IDW) consisted of two separate waste streams.

- Soil screening samples collected at the seep feeding through SD2.
- IDW generated during sample collection and screening process such as sample bags, scoops, or test tubes.

Soil used for screening purposes was returned to its collection point after screening was conducted. IDW generated from the collection and screening process was in turn composited and field-screened. All screening results indicated the IDW was non-hazardous. The waste was then disposed of and treated by the on site incinerator.

2.7 DEVIATIONS FROM THE WORK PLAN

Due to topographical irregularities in the steep terrain at LF03, satellite reception for the handheld GPS unit was not always available. Because of this, GPS coordinates could not be collected for locations SS-08, SS-09, SS-18, or SD2. GPS coordinates were not taken for any of the grid sample locations, as the distance between the samples (10 feet) was not within the stated accuracy of the GPS unit (+/- 20 feet).

3 INVESTIGATION RESULTS

Field work at this site was performed from June 11 to June 22, 2004. An additional site reconnaissance was performed on August 31, 2004. Site photographs are presented in Appendix A. Field notes are located in Appendix B. Appendix C presents analytical results. Appendix D contains the Quality Assurance Report. Complete laboratory data reports can be found in Appendix E.

3.1 FIELD OBSERVATIONS

The LF03 area is composed mainly of large boulders and talus. Very little soil is present in the LF03 area. Soil present on site consisted mainly of gravel and sandy gravel, except near surface water flow areas. Soils in these areas were composed of silt and silty sand. Sampled soils ranged from damp to wet.

The boulder field downgradient of the landfill (and near SD2) appeared to be a region of seasonal outwash. A seep was noted emanating from the northwest corner of the landfill and was present near the SD2 area. From the boulder field, the seep flowed downgradient, both above and below the ground surface. The apparent course of the seep was flagged during the 2004 field effort, and presented in photograph 2 (Appendix A).

3.2 FIELD SCREENING RESULTS

Twenty-one samples were taken from the grid area established around SD2. Field screening results are displayed on Figure 3-1. Of the 21 samples, 17 samples had no detectable concentrations of PCBs. Three samples had concentrations of PCBs above the field screening detection limit (0.5 mg/kg), but below the ADEC cleanup level of 1 mg/kg. One sample, SD2 (the formerly identified PCB hotspot), showed a PCB concentration of over 10 mg/kg.

Detectable concentrations of PCBs were noted to be along a seep path, emanating from the northwest corner of the landfill.

Based on these results, seven additional field-screening samples were taken downgradient of SD2 and along the seep path. These additional samples were denoted with the prefix "SS-," to differentiate these samples from the samples taken from the grid areas. Field screening results for the downgradient sample locations are presented on Figure 3-2. Detectable concentrations of PCBs (above 0.5 mg/kg) were noted up to 600 feet downgradient from SD2.

3.3 SAMPLE LOCATION COORDINATES

Sample locations are provided on Figure 3-3. GPS Coordinates are presented in Table 1.

Figure 3-1: Field screening results from the gridded area around SD-2

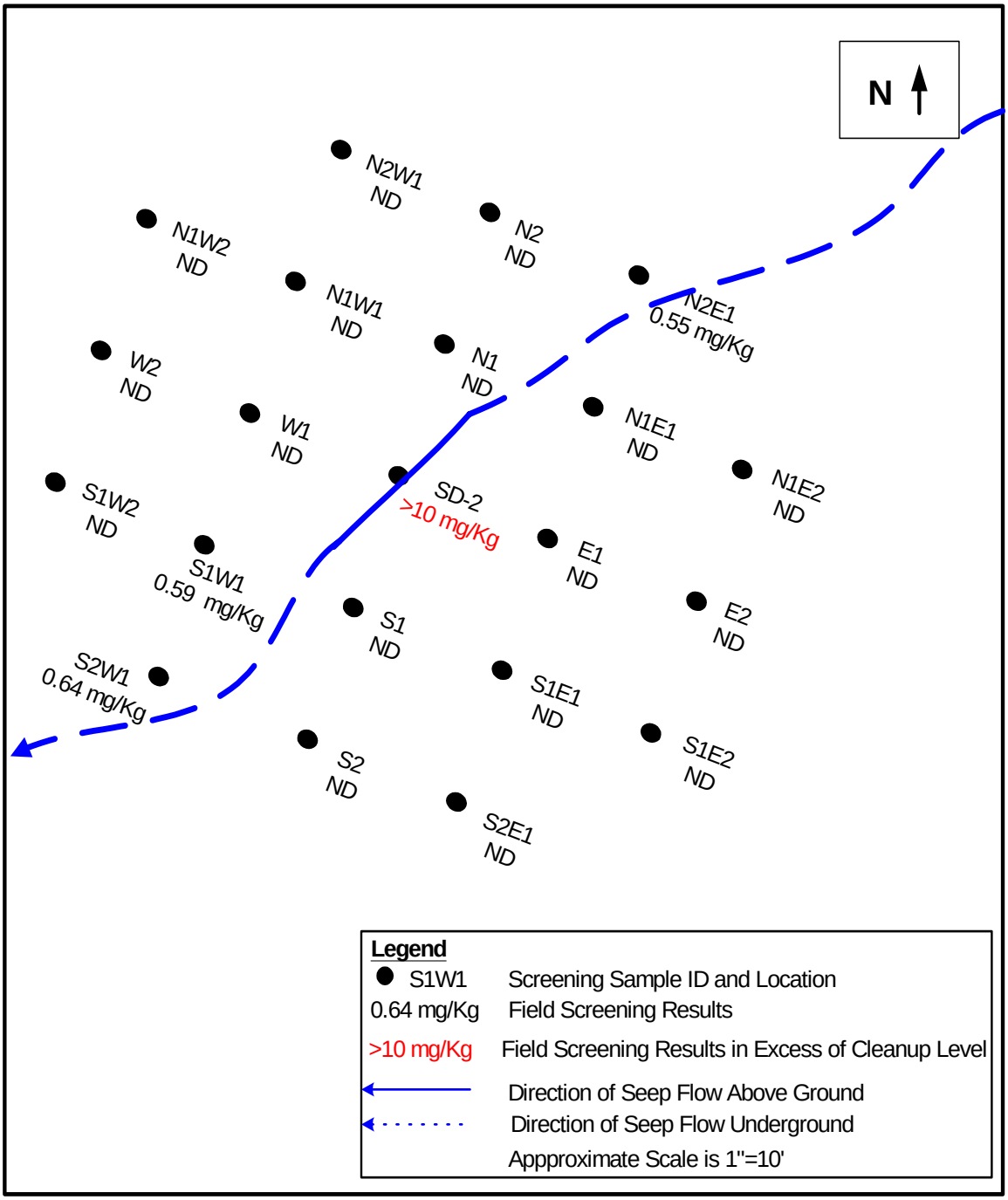
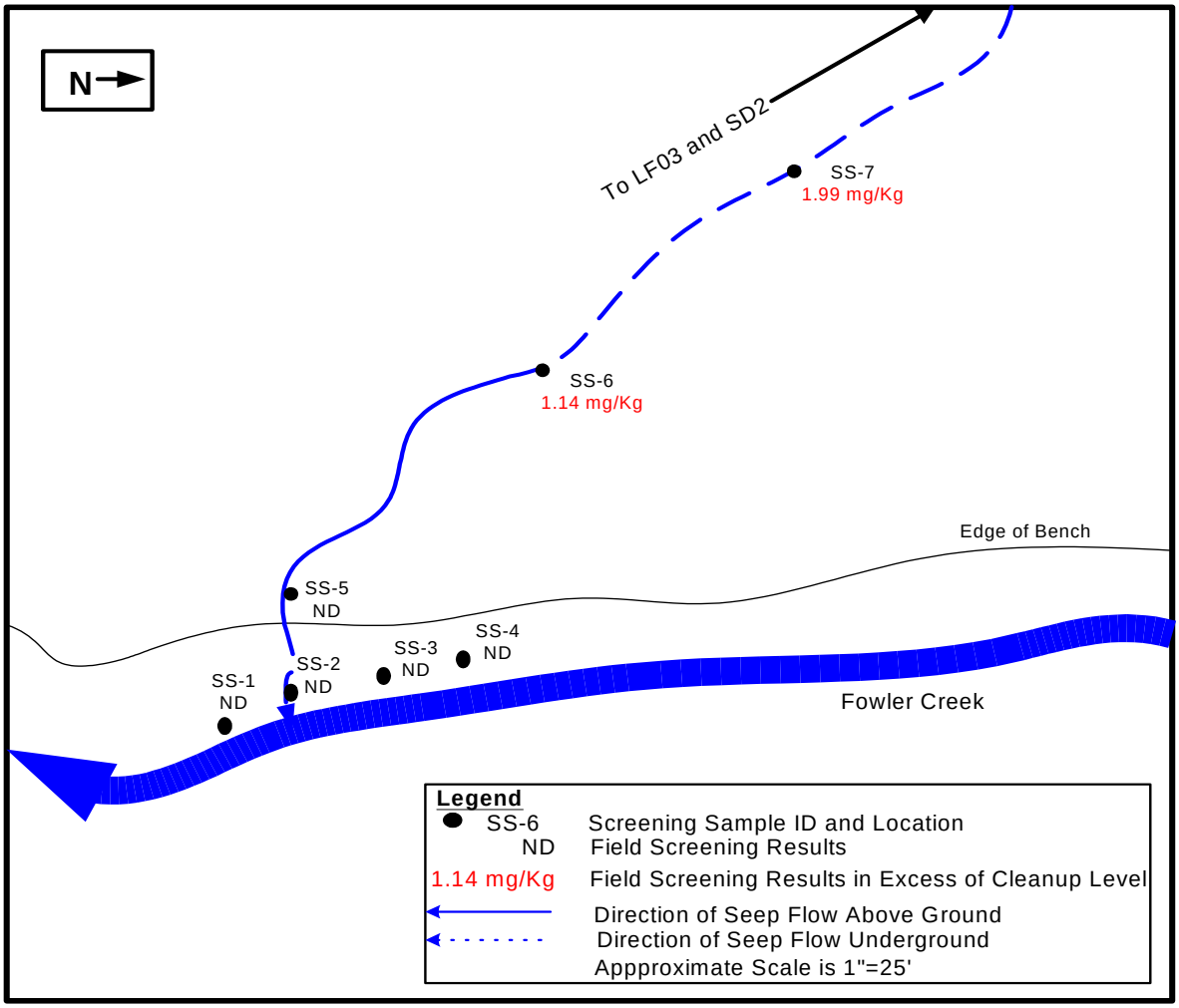


Figure 3-2: Field screening results from the lower seep area



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ACCESS ROAD

CMW-3
ND

MW-2

MW-1
ND

SS12
0.344

SS11
ND

SS13
0.0706

SD-2
153
SW-2
0.0709

SS14
1.76

CMW-5

LANDFILL
(LF03)

LIKELY PATH OF SEEP THROUGH
BOULDER FIELD (DASHED WHERE
FLOWS ABOVEGROUND)

SEEP

SS18
195

SS10
2.37

SS17
1.14

SS15
ND

SS16
ND

SS07
4.99

SD-3
ND
SW-3
ND

CMW-2
ND

CMW-4
ND

CMW-3
ND

SD-1
ND
SW-1
ND

SS06
1.41

SS08
1.94

SS09
3.12

CMW-7
ND

CMW-6
ND

SS05
0.655

SEEP

CREEK

CREEK

FOWLER CREEK

SS01
ND

SS02
ND

SS03
0.457

SS04
ND

LEGEND

- MONITORING WELL SAMPLE LOCATIONS WITH PCBs RESULTS IN mg/L
- SURFACE SOIL SAMPLE LOCATIONS WITH PCBs RESULTS IN mg/Kg
- SURFACE WATER/SEDIMENT SAMPLE LOCATIONS WITH PCBs RESULTS IN mg/L
- SCREENING LOCATIONS

PCBs POLYCHLORINATED BIPHENYLS

ND NOT DETECTED

NOTE:
BOLD/RED TEXT INDICATES AN EXCEEDANCE OF CLEANUP LEVELS.

NORTH

0 50 100

APPROX. SCALE IN FEET

FIGURE 3-3

SAMPLE LOCATION MAP

FORMER LANDFILL (LF03)
SURFACE SOIL NVESTIGATION
Cape Romanzof, Alaska

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Table 3-1: GPS Coordinates for LF03 Soil Sampling

Soil Sampling Site	Northing	Westing
SS-01	61.79094444	165.98355
SS-02	61.79108333	165.9839722
SS-03	61.79119444	165.9835
SS-04	61.79119444	165.9827222
SS-05	61.79122222	165.98175
SS-06	61.79138889	165.9833889
SS-07	61.79147222	165.9825278

3.4 SOIL SAMPLING ANALYTICAL RESULTS

Based on the field-screening results, 18 soil samples were collected for laboratory analysis. Nine verification samples were taken from the grid area, 5 samples were taken along the seep course downgradient from the SD2, and 4 samples were taken from seep deposits immediately above Fowler Creek. While the seep course is intermittently underground, the seep reappears at the surface near Fowler Creek and drops down a steep embankment towards the creek. The seep appeared to have had several historic channels near this confluence with Fowler Creek. The four samples taken in this area were taken to ensure that locations both up- and down-gradient of former channels were sampled.

Analytical results are displayed in Figures 3-4 and 3-5. Nine of the 18 samples had PCB concentrations above the ADEC cleanup level of 1.0 mg/kg. Araclor-1260 was the only PCB compound detected during the investigation.

Concentrations of PCB-1260 are consistently above the cleanup level in samples taken along the seep flow path. PCB concentrations are generally higher closer to the landfill and decrease down gradient. The highest concentration of PCB was noted in sample SS-18, just downgradient from SD2, with a concentration of 195 mg/kg. SS-18 was collected west and down slope of SD2 in the approximate location of where PCBs at previously been detected at a concentration of 395 mg/Kg.

No samples taken from the Fowler Creek area were above the cleanup level.

Figure 3-4: Analytical results from the gridded area around SD-2

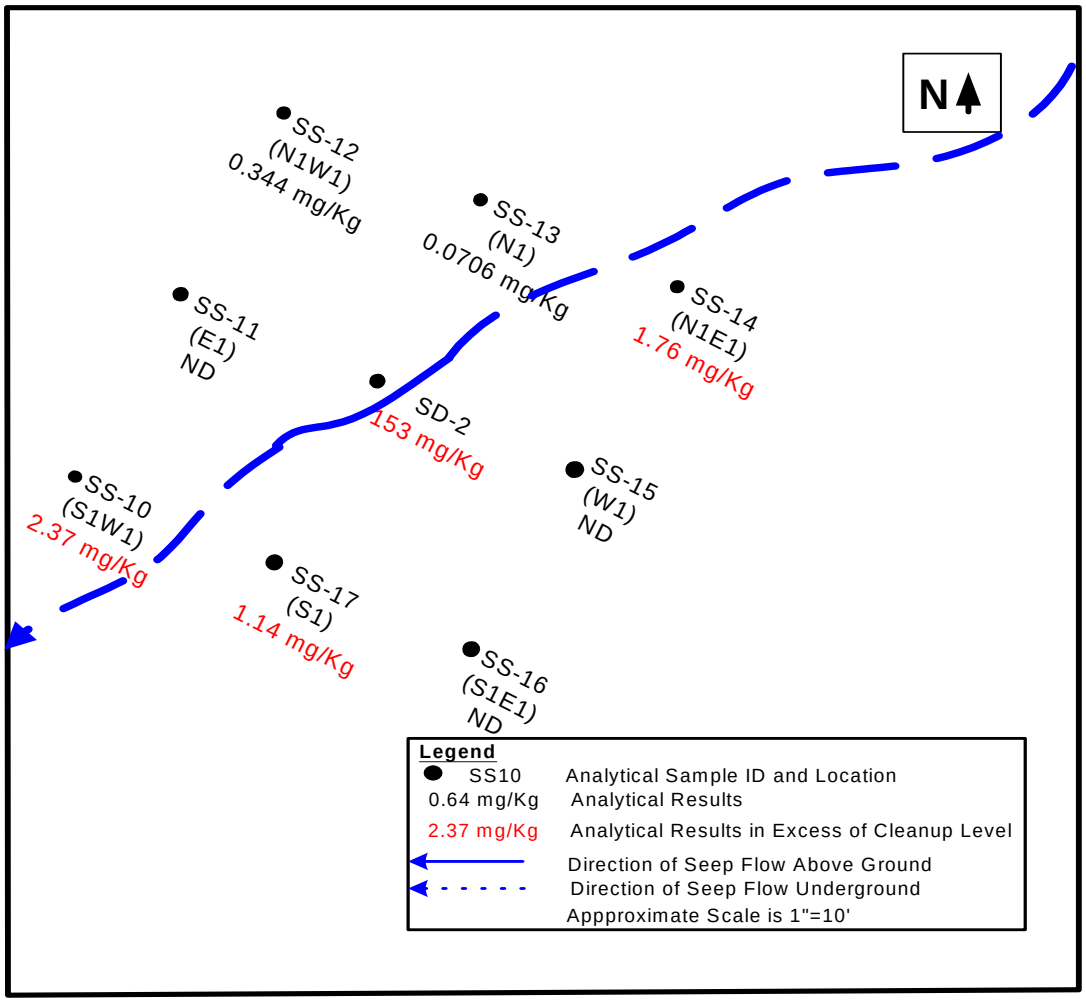
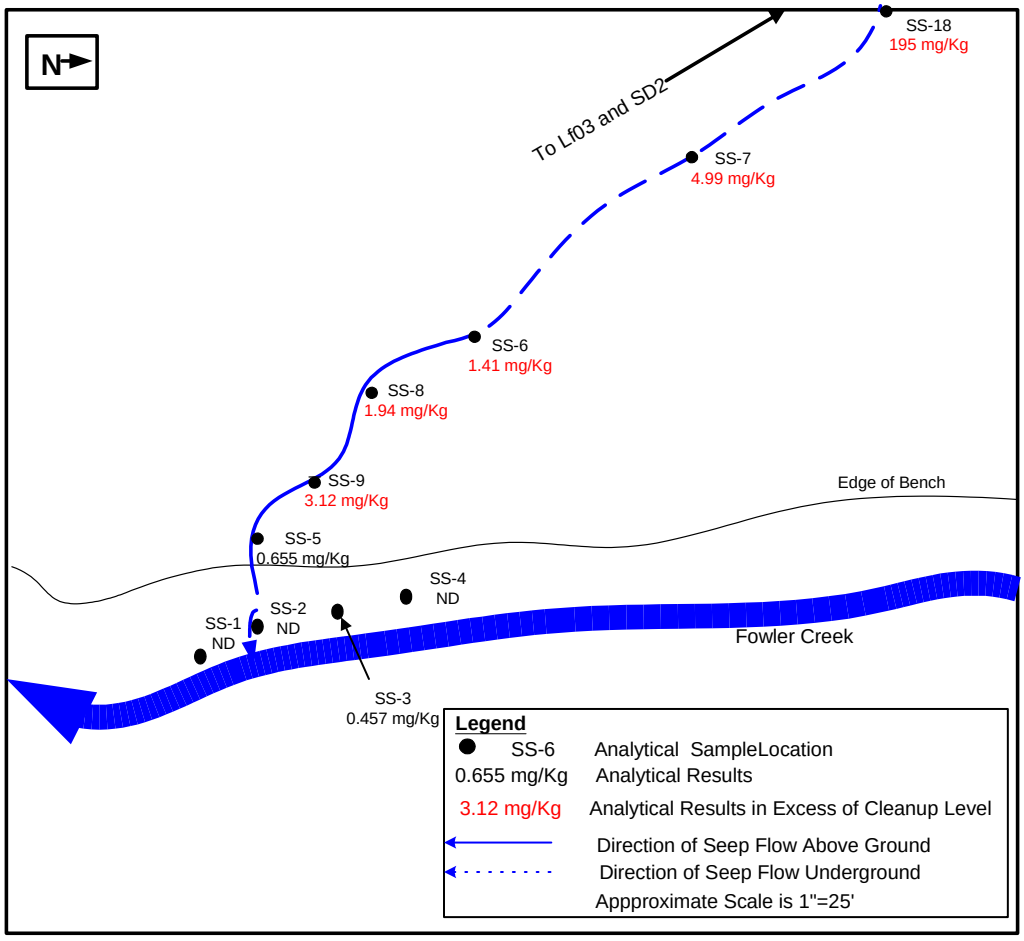


Figure 3-5: Analytical results from the lower seep area



It should be noted that field screening results and analytical results differed slightly. Table 3-2 shows the differences between the field screening and analytical results.

Table 3-2: Field Screening and Analytical Result Comparison

Soil Sampling Location	Field Screening Result (mg/kg)	Analytical Result (mg/kg)
N1W1	ND	0.334
W1	ND	0.0706
N1E1	ND	1.76
W1	ND	ND
SD2	>10	153
E1	ND	ND
S1W1	0.54	2.37
S1	ND	1.14
S1E1	ND	ND
SS-1	ND	ND
SS-2	ND	ND
SS-3	ND	0.457
SS-4	ND	ND
SS-5	ND	0.655
SS-6	1.14	1.41
SS-7	1.99	4.99

Notes:
Field screening detection limits ranged from 0.5 to 10 mg/kg.

Analytical results tended to be higher than field screening results, as would be expected due to differences in analytical techniques. Field screening methods (with detection range from 0.5 to 10 mg/kg) were calculated on a wet-weight basis. Analytical results are calculated on a dry-weight basis. Results from a dry-weight analysis would theoretically be higher than wet-weight analysis, by a factor determined by the percent solids. Heterogeneity of soils could also be a contributing factor to the difference.

3.5 LANDFILL CAP INSPECTION RESULTS

A thorough landfill cap inspection was conducted during the sampling event. Three seeps appear to be flowing out of the capped landfill area. The seeps are shown on Figure 3-6, and in photographs 2, 15-18 (Appendix A). The seeps are described below:

- Seep 1 flows from the northwest corner of the landfill (near the access road) downgradient through the PCB sampling grid area. Pieces of the landfill liner were observed at this site.

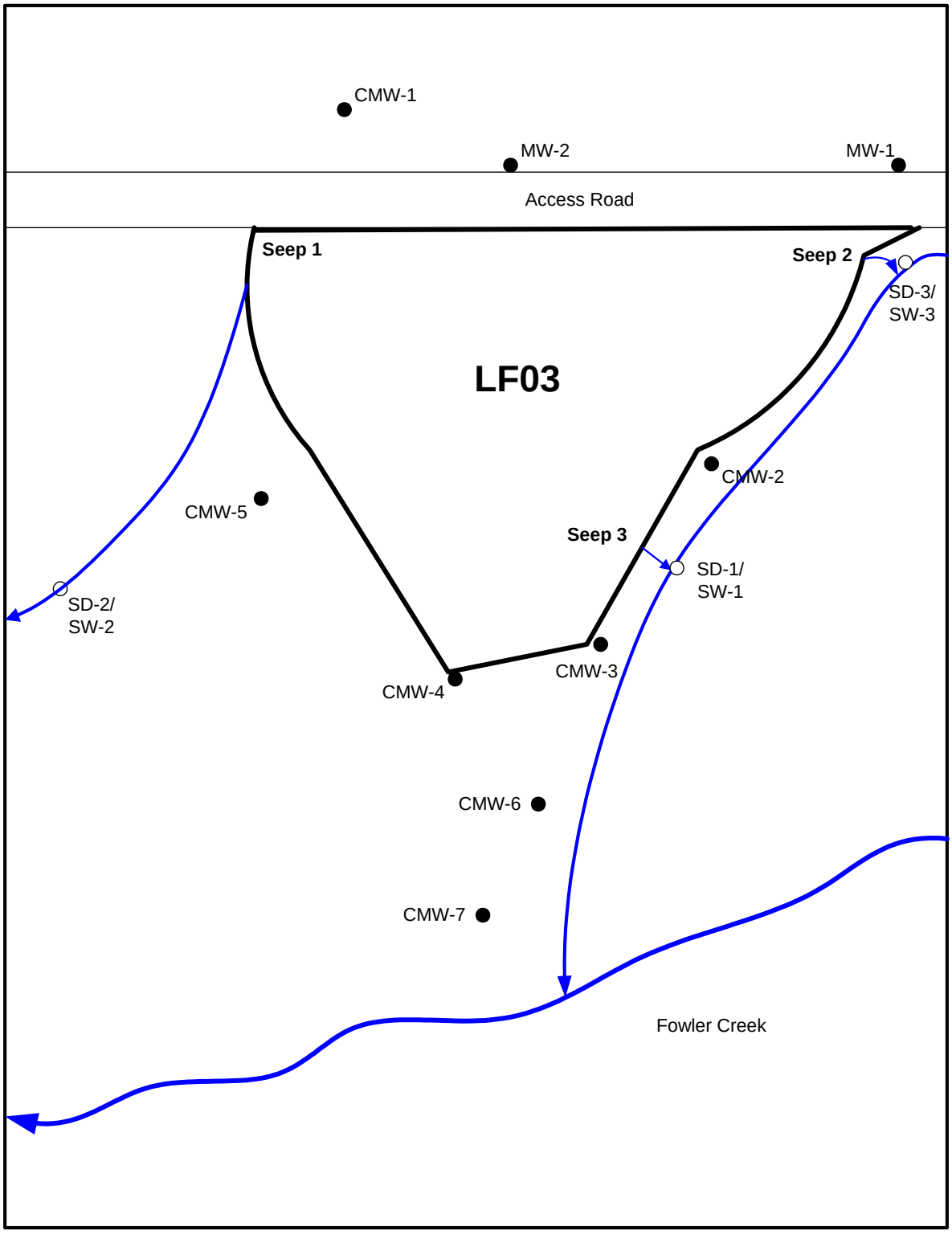
- Seep 2 originates from the northeast corner of the landfill and quickly joins Fowler Creek. Orange soil staining was observed near this seep. Surface water and sediment samples were taken from this area (SD-3 and SW-3) under a different project (Paug-Vik, 2004).
- Seep 3 emanates from the landfill at its toe between monitoring wells CMW-2 and CMW-3. This area was also sampled in the Paug-Vik 2004 Cape Romanzof long term monitoring (LTM) effort (SD-1 and SW-1). In June, obvious orange staining existed, but the seep itself was dry. During the August visit, water was freely flowing and a sheen was noted.

Results of samples SD-1/SW-1 and SD-3/SW-3 will be reported under in the 2004 Cape Romanzof Monitored Natural Attenuation and LTM report (Paug-Vik). No DRO, PCBs, PAHs, or BTEX were detected above laboratory reporting limits in these samples.

The landfill liner was exposed in several places, both around the top and at the toe of the landfill, during the June 2004 field visit. While the liner was exposed at places, no liner rips or tears were noted. During the reconnaissance in August 2004, it was noted that a layer of soil from a decommissioned biocell was added to the top of the landfill by the 611 CES. While the new soil covered exposed areas at the top of the landfill, the liner was still exposed at areas near the toe of the landfill.

Various amounts of non-hazardous waste such as metal scrap and assorted household waste were visible in the region downhill of the landfills toe (Photographs 19 and 20, Appendix A).

Figure 3-6: Seep Locations at LF03



4 CONCLUSIONS

4.1 SOIL SAMPLING

Field screening was conducted in a 10-foot spaced grid around SD2, a formerly identified PCB-hotspot. Araclor-1260 was detected along the course of the seep emanating from the northwest corner of the landfill (Seep 1). Additional sampling was downgradient of the grid area to determine if PCB-contaminated soil existed further down the seep course. The seep travels through a boulder-filled talus slope and empties into Fowler Creek.

Both field screening and analytical results show that PCB contamination is present along the course of the seep emanating from the northwest corner of the landfill (Seep 1) and contamination extends past the formerly identified hotspot (SD2) and towards Fowler Creek. PCB concentrations above the ADEC cleanup levels of 1 ppm are present along the seep course to within approximately 250 feet of Fowler Creek.

Four soil samples were taken along the seep channels immediately upgradient of Fowler Creek. Three of the four samples had no detectable concentrations of PCBs, while SS-3 had concentrations of PCB-1260 at 0.457 mg/kg.

Values of PCBs in soil varied from non-detectable to 195 mg/kg. Field screening values were slightly lower than analytical results. This difference is likely due, in part, to differences in methods (dry-weight versus wet-weight), and as a result of the heterogeneous nature of soil samples.

4.2 LANDFILL CAP OBSERVATIONS

Three seeps were observed emanating from the toe of the landfill. One seep (Seep 1) appears to be have transported PCB-contaminated soil downgradient. The other two seeps (Seep 2 and Seep 3) show signs of soil staining and sheen, but analytical results show no detectable contamination of DRO, PCBs, polynuclear aromatic hydrocarbons (PAHS), or benzene, toluene, ethylbenzene, and xylenes (BTEX).

The landfill liner was exposed in several places, both around the top and at the toe of the landfill during the June 2004 field visit, but appeared to be intact. Soil has subsequently been added to the top of the landfill by the 611 CES, but the landfill liner was still exposed at the toe during the August 2004 inspection.

Various amounts of non-hazardous waste such as metal scrap and assorted household waste were visible in the region downhill of the landfills toe.

The landfill cap appears to be intact and no direct precipitation is likely entering the landfill through the cap. However, the three seeps noted during the investigation indicate

that water is still entering (and exiting) the landfill area. Furthermore, one seep (Seep 1) appears to be have transported PCB-1260 downgradient towards Fowler Creek.

Water is likely entering the landfill via subsurface routes. While the landfill is covered with in impermeable cap, it is possible that there is no liner below or aquitard upgradient of the landfill. The entire area surrounding LF03 is composed of boulders and talus slopes, and easily supports migration of water. It is likely that water is flowing through the talus and can enter the landfill by traveling under the road, upgradient of the landfill. In periods of higher groundwater regimes, water could also enter the landfill from below.

5 RECOMMENDATIONS

PCB contamination exists in soils along Seep 1. Contamination appears to extend over 600 feet downgradient of the landfill and towards Fowler Creek.

Soils taken in the immediate vicinity of Fowler Creek did not have PCB concentrations above the ADEC cleanup levels. We recommend verification sampling both upgradient and further downgradient from the seep confluence with Fowler Creek, to confirm that Fowler Creek has not been significantly impacted.

Cleanup of PCB soil at this site could be logistically complicated. Because of the presence of large boulders onsite, cleanup strategies could involve excavators, hand operated suction devices, construction of sediment trapping devices, and extensive manual labor. Accurate estimates of the contamination extent will help keep costs lower and disturbance to the site to a minimum. We recommend that all future sampling be clearly marked with flagging and GPS sample coordinates to assist in future cleanup efforts.

As evidenced by the three seep emerging from the landfill toe, water is still entering the landfill, despite the landfill cap. Future efforts to prevent water from entering the landfill is recommended, as these efforts may prevent further migration of PCBs downgradient towards Fowler Creek. Possible efforts to prevent infiltration of water could include:

- Divert drainage ditch upgradient of road.
- Build impermeable water device layers upgradient of landfill.
- Constuct a bottom liner for landfill.

6 REFERENCES

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APPENDIX A
Field Photographs

APPENDIX B
Field Notes and Sketches

APPENDIX C

Analytical Data Table

APPENDIX D

Quality Assurance Report

APPENDIX E

Complete Analytical Data Packages

On file at the 611th