Alaska Department of Environmental Conservation

Reuse & Redevelopment Program

Brownfield Assessment

Lot 1, Block 1
Prospect Creek Airport

Environmental Management Plan

Dalton Highway Milepost 137, Alaska

Submitted to:
Department of Environmental Conservation
Reuse & Redevelopment Program

By:
OASIS Environmental, Inc
March 25, 2010

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ACRONYMS AND ABBREVIATIONS

ADOT&PF……Alaska Department of Transportation and Public Facilities
APSC .... Alyeska Pipeline Service Company
bgs .... Below ground surface
BLM............... Bureau of Land Management
BTEX............. Benzene, toluene, ethylbenzene, and xylenes
COPC............ Contaminant of potential concern
CSM .... Conceptual site model
CSP............... Contaminated Sites Program
DEC............... Alaska Department of Environmental Conservation
DRO .... Diesel-range organics
EMP .... Environmental management plan
EPA............... US Environmental Protection Agency
ESA............... Environmental Site Assessment
GRO .... Gasoline-range organics
IC................... Institutional Control
mg/kg .... Milligrams per kilogram
OASIS .... OASIS Environmental, Inc.
PAH............... Polyaromatic hyrdrocarbon
POL............... Petroleum, oil, and lubricant
PRP............... Potential responsible party
R&R............... Reuse & Redevelopment Program
RRO .... Residual-range organics
SCL .... Soil cleanup levels

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1. INTRODUCTION

1.1. Purpose

The purpose of this report is to provide the Alaska Department of Environmental Conservation (DEC) with an environmental management plan (EMP) for Lot 1, Block 1 of the Prospect Creek Airport apron area. The EMP identifies site chronology, data gaps, and potentially responsible parties and provides recommendations for filling data gaps and potential remediation alternatives.

1.2. Objectives

The objectives of this EMP are to organize all of the available information about the Prospect Creek site and to identify the actions required to restore this property for reuse in the future. The site is listed on the DEC contaminated sites database, and thus, the state has not been able to lease the lot. In addition, prospective tenants fear assuming potential site liabilities from the historical spills.

1.3. Scope of Services

OASIS Environmental, Inc. (OASIS) completed the following tasks to accomplish the project objectives:

- Participated in a Stakeholder Scoping and Planning Meeting
- Reviewed historical records and aerial photographs of the site
- Organized information to communicate site history and chronology
- Prepared this report with findings, conclusions, and recommendations

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2. COMMUNITY OVERVIEW AND INFORMATION

2.1. Community General Information

2.1.1. Location

Lot 1, Block 1 is located on the Prospect Creek Airport apron area. The site is located directly northeast of Alyeska Pipeline Service Company's (APSC) Pump Station #5 and east of Milepost 137 on the Dalton Highway (Figure 1). The land is owned by the Bureau of Land Management (BLM) and is managed by the Alaska Department of Transportation and Public Facilities (ADOT&PF). The site is located at 66.4846 degrees north latitude, 150.3837 degrees west longitude, Section 99, Township 23 North, Range 14 West, Fairbanks Meridian, Alaska.

Prospect Creek is in a very remote part of Alaska, situated near the Kanuti and Yukon Flats wildlife reserves and the Gates of the Arctic National Park. The airport is reached by road by going through Pump Station #5. Pump Station #5 is approximately 0.25 miles southwest of the airport apron area.

During construction of the Trans Alaska Pipeline, a temporary camp was established 2.5 miles southwest of the Prospect Creek airstrip. The camp facilities were limited to housing and facilities to support the workers that helped construct the pipeline. Upon completion of the pipeline in 1977, most of the camp was broken down and little remained except for a few buildings and the airstrip.

The area was temporarily populated again in 1992 during an effort to replace bridges along the nearby Dalton Highway. Engineers, construction workers, and their families lived in the area, presumably in temporary housing, during this effort. Currently there are no permanent residents at the Prospect Creek Airport.

2.2. Community Involvement

The site is not located within a community. It is adjacent to a remote airstrip near APSC's Pump Station #5 and across the highway from the ADOT&PF Jim River Maintenance Camp. The population potentially exposed to residual contamination this site are APSC personnel at Pump Station #5, ADOT&PF personnel, and users of the Prospect Creek Airport.

The nearest established community is Coldfoot, Alaska, about 30 miles to the northeast. According to the U.S. Census Bureau survey from the 2000 census, the population of Coldfoot is 13 people.

2.2.1. Community Concerns

This site is not surrounded by a community of residents. Concerned stakeholders are BLM as the landowner, ADOT&PF as the leaseholder, historic tenants of the site, and APSC as the leaseholder of the adjacent lot. Casual users of the Prospect Creek Airport are not likely to have concerns about the site.

2.2.2. Stakeholder Meeting Summary

The scoping meeting was held at the ADOT&PF offices in Fairbanks on July 6, 2009. Krista Webb of OASIS participated by teleconference. Participants were Krista Webb of OASIS, Penny Adler and Sam Myers of ADOT&PF, and Deb Williams and John Carnahan of DEC.

Topics of discussion are listed below:

- Previous uses of the site, lease history, and current status
- The role of APSC and the possibility that they stored fuel on Lease Lot 1
- Data gaps and potential sources of data
- The objectives of the EMP (to identify data gaps and potentially responsible parties and make recommendations for filling data gaps)

Action items from the meeting are listed below:

- Krista Webb prepared text for a letter describing APSC spill information and requesting more information. Deb Williams modified appropriately and sent this text to Pete Nagel at APSC. Alyeska responded with a letter dated August 19, 2009. This response and further communications are summarized in Section 5.1
- ADOT&PF provided the lease chronology.

2.2.3. Proposed Community Development and Land Reuse

At present, the parcel is listed as a contaminated site. The ADOT&PF has had difficulty leasing the site due to environmental conditions because the contamination makes the parcel unattractive to tenants. . A baseline assessment would make it possible to indemnify tenants from past contamination. If leased, Lot 1 could be used to provide storage or airport support services.

2.2.4. Interviews and Input

No interviews have been conducted outside of the stakeholders meeting on July 6, 2009.

3. PROPERTY/SITE OVERVIEW

3.1. Geologic Setting

The terrain around Prospect Creek is hilly to mountainous, with low-lying areas along the Jim River. It is typically underlain by discontinuous permafrost. Several feet of fine- to coarse-grained glacial outwash deposits overlie the subsurface permafrost at the site. The Phase I/II Environmental Site Assessment (ESA) performed by Nortech in 1999**Error! Bookmark not defined.** states that the depth to groundwater at the site is unknown, but it was estimated to be between approximately 12 and 15 feet below ground surface (bgs). The report states that the normal groundwater gradient in this area appears to be toward the Jim River, trending in a southwesterly direction away from the site.

According to the 1999 Phase I/II ESA[1], the surface of the subject property is almost totally open and appears to drain away from the tank containment area in a southerly direction. On the northeast side of the apron, one of the small local streams passed through a culvert from a southeast to northeast direction. That small stream ran to the south and southeast of the property. There is also a small lake approximately 50 feet from the north side of the apron (Figure 2). Surface water flow around the site is likely a result of contouring of the area for construction of the airport and apron.

There is no on-site water well at Prospect Creek Airport. The nearest well is across the Dalton Highway at the ADOT&PF Jim River Maintenance Camp, approximately 0.8 miles northeast of the apron area (closer to Jim River).

Geologic records show occurrences of tungsten minerals and bismuth in a quartz vein along Prospect Creek, but these resources have not yet been extracted, presumably due to the extremely remote location.

3.2. Property Use

Site history and property use were evaluated by looking at 42 digital documents obtained from the DEC and ADOT&PF files. Source documents are listed with a summary of the information provided and the digital file name in Appendix A. Information sources and the digital file names are cited as footnotes in this EMP. For illustration, specific graphics from these files have been included as figures in this report.

3.2.1. Historical Use

Historically, Lot 1, Block 1 has primarily been used as a fuel storage and dispensing area.

[1] Phase I/II Environmental Site Assessment prepared by Nortech for Northern Air Fuel (digital file: Prospect PI.pdf)

3.2.2. Current Use

Lot 1, Block 1 at Prospect Creek Airport is currently unoccupied. The state has been unable to sublease the lot because it is listed in the DEC contaminated sites database.

3.3. Ownership Information

The ADOT&PF leases the airstrip, Blocks 1 and 2, and the apron area from the BLM (Figure 3). Contact information for ADOT&PF is provided below:

State of Alaska
Transportation and Public Facilities
Northern Region Maintenance and Operations – Highway/Aviation
2301 Peger Road, MS-2550
Fairbanks, AK 99709
Contact: Sam Meyers (907) 451-5291

The last leaseholder of Lot 1, Block 1 was:

Mr. and Mrs. Dan Klaes
2453 Homestead
North Pole, AK 99705
(907) 488-7919 Bettles: (907) 692-5111

Block 2 is still leased by APSC.

3.4. Leasing/Ownership Records Review

Two leases associated with the airport were identified from ADOT&PF files: the BLM leased the airstrip to the State of Alaska on November 1, 1974[2], and the lease between ADOT&PF and Dan and Lynda Klaes (for Lot 1, Block 1) was entered into on July 10, 1986[3].

The text of a lease history memo from ADOT&PF files[4] with associated notes is provided below:

11/1/74	*State leases from federal government (BLM)*
81-83	*Northwest Gas Pipeline operated a fuel station*
5/1/81-10/31/81	*Matomco*
12/15/81	*Tanana Fuel/Coghill leased from 12/81-4/26/82 (Verification)*
7/10/86	*Klaes Lease*
8/11/87-12/21/87	*Nenana fuel/Coghill (not in same area as Klaes lease, associated with Brooks fuel)*
5/14/95	*APC report of Sheen, Brooks fuel notified, no report*

[2] Lease between BLM and ADOT&PF (digital file: Nov74_Lease.pdf)
[3] Lease between Klaes and ADOT&PF (digital file: Jul86_Lease.pdf)
[4] Lease history memo from ADOT&PF (digital file: DECSPILLPROSPECT.pdf)

8/6/95	*APSC report of sheen, (3rd party APSC responded with sorbents)*

Based on these records, past leaseholders of Lot 1, Block 1 and the surrounding areas were the following:

- Alyeska Pipeline Service Company
- Northwest Gas Pipeline
- Matomco
- Tanana Fuel
- Coghill
- Dan and Lynda Klaes (in conjunction with Petro Star, Big State Logistics, and Brooks Fuel)
- Nenana Fuel

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4. SITE RECONNAISSANCE

No site reconnaissance or sampling was performed as part of the scope of work for this EMP.

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5. ENVIRONMENTAL REVIEW AND SUMMARY OF FINDINGS

5.1. Historical Environmental Review

The Prospect Creek site was reportedly undeveloped until the installation of the Trans Alaska Pipeline in the early 1970s. The Dalton Highway was built from 1971 to 1977 to access the oilfields at Prudhoe Bay, Alaska. Prospect Creek Airport was built to bring supplies for the construction of the highway, pipeline, and pump stations.

Prospect Creek Airport was first leased by ADOT&PF from the BLM in 1974[2]. Lot 1, Block 1, is located on the southwest portion of the Prospect Creek Airport apron area and encompasses approximately 27,000 square feet (Figure 3).

Aerial photographs and as-built diagrams suggest that APSC maintained a fuel storage area near or on Lot 1, Block 1[5] [6] (in the SW corner of the pad, figures show it directly adjacent to the apron, but it may have overlapped with Lot 1) (Figures 3 & 4). The *Prospect Creek Airport Oil Spill Investigation* performed by John Janssen of Oil Spill Technology[7] provided a database printout of the APSC Summary of Spills over 100 gallons. Five spills listed were relevant to Prospect Creek Airport (Table 1). Alyeska was contacted by the ADEC regarding these spills on July 9, 2009[8]. They confirmed the location of each of these spills on August 19, 2009[9]. Details are provided in Table 1.

TABLE 1. RELEVANT PROSPECT CREEK AIRPORT SPILLS

Date	Substance	Amount (gallons)	Reason	Alyeska Confirmation August 19, 2009
7/25/70	Diesel	20,000	Bear Damaged Bladder	Spill at Prospect Camp, not airport
4/3/74	Diesel	206	Truck Rolled	Occurred on road near Prospect Camp, not airport
11/17/74	Diesel	200	Truck Rolled	Occurred 20 miles north of Prospect Camp.
4/2/75	Diesel	2,000	Tanker Overturned	Occurred 1,500 feet north of Jim River Bridge
7/16/79	Gasoline	1,600	Ruptured Fuel Bladder	Confirmed 11/13/09 that units are gallons, to containment, picked up with vacuum truck.

There were two additional spills dated January 26, 1976, listed in the APSC spill summary—40,000- and 100,000-gallon bladder releases. The 40,000 and 100,000 gallon releases were confirmed to be at Prospect Camp, not the airport[10].

The Oil Spill Investigation[7] includes an APSC *Hazardous Substance Release Reporting* form for the 1979, 1,600-**barrel** gasoline spill. In addition, there is a DEC *Reported Oil or Hazardous Material Discharge* form for the same date regarding the 1,600-**gallon**

[5] Alyeska Aerial photographs from 1969-2001 (digital file: Aerial Photos PS5 1969-2007.pdf)
[6] Prospect Creek Airport as-built diagrams dated 1974 (digital file: 2000 Prospect Oil Spill Investigtion.pdf)
[7] February 2000 Prospect Airport Oil Spill Investigation, Oil Spill Technology (digital file: 2000 Prospect Oil Spill Investigation.pdf)
8 070909 Letter to Alyeska requesting info on historical releases
9 081909 Alyeska response for spills at Prospect Airport
[10] Internal ADOT&PF Memo discussing Alyeska spill summary database output (digital file: APR03_Memo.pdf)

release of gasoline at the Prospect Creek Airport from an old patched fuel bladder (note discrepancy between units, barrels vs. gallons). The spill occurred during the removal of a gasoline storage bladder when "the end ruptured." The location of the historical gasoline release may have been in the former APSC fuel storage area, which overlapped Lot 1, Block 1[5] (see Figures 3 and 4). Both forms state that the release was within a lined berm and that it was pumped with a vacuum truck and placed into the sump at Pump Station #5. The APSC form states that the petroleum, oil, and lubricant (POL) berm was to be demobed, backfilled, and restored. A July letter from APSC to DEC (received by DEC on August 2, 1979) states that the Final Report for the July 16, 1979 "1,600 bbls gasoline" discharge was submitted. This spill is not listed in the DEC spill database.

APSC did not respond about this spill in their letter dated August 19, 2009. They were contacted by e-mail on November 13, 2009 regarding this discrepancy and provided documentation (official telex report) confirming that their internal form was mistyped as barrels and that the gasoline release was 1,600 gallons[11].

From 1981 to 1983, three tenants operated at the airport: Northwest Gas Pipeline operated a fuel station, and lease records show tenants as Matomco and Tanana Fuel/Coghill[4]. ADOT&PF could not track down the location of these tenants to confirm whether these leaseholders were present on Lot 1 or elsewhere on Block 1.

A letter to Petro Star, Inc. prepared by Travis/Peterson Environmental Consulting, Inc.[12] provides an interpretation of several aerial photographs and anecdotal history for Lot 1. The letter anecdotally confirms that Northwest Gas Pipeline had a vehicle shop and refueling station from 1981 to 1983. This facility was comprised of a connex office, a circular shop, and two supply and tool storage units. Aerial photographs from 1985[13] (see Photograph Set 1) show a circular building, a connex, and a lined fuel pit. The letter author recalls: 1) refueling his truck from a dispenser that was located next to the shop, thus, an underground pipe had to carry the fuel from the bulk fuel storage across from the office; 2) in the photograph, the dispenser is visible next to the office; and 3) that the bulk storage area was lined and that only unleaded gasoline was available.

This site was leased by Dan and Lynda Klaes from July of 1986 through August of 2000 to store fuel to be shipped to Bettles[3].

A June 7, 1994, internal ADOT&PF memo[14] concerning haul road airports states that the Lot 1, Block 1 lease with Dan and Lynda Klaes expired on August 1, 1994, and that the new lease application had been received. The memo states that the site appeared clean on inspection and that "everything except diked tanks and camper were removed from lot."

The Klaes were the operators who leased the site, and Big State Logistics transported fuel to the site by land from Petro Star, Inc. (the suppler). Brooks Fuel delivered the fuel

[11] 2009 correspondence regarding 1600 gallon gasoline spill
[12] Travis/Peterson report (digital file: DECSPILLPROSPECT.pdf)
[13] Photographs of airport apron (digital file: Jul85_Pictures.pdf)
[14] ADOT&PF memo concerning haul road airports (digital file: Jun94_memo.pdf)

to Bettles by air. Big State Logistics was responsible for “site maintenance and upkeep.” The cost of maintenance, upkeep, and cleanup was split equally between these four entities.

A letter dated March 27, 1995[15], from Big State Logistics to Becky Iles of ADOT&PF described general cleanup activities at the site, not response to a specific spill. A crew was on-site in September 1994 to do an on-site inspection, clean up any spilled fuel or oil, and improve the dike around the fuel storage tanks. The containment pit was skimmed with absorbents and cleaned. The liner was inspected and two patches were applied. The retaining walls were improved. Seven yards of contaminated gravel were removed from the ramp, transported to Fairbanks, and thermoremediated. No confirmation samples are documented and no photographs of this activity were identified.

A photograph was submitted to ADOT&PF in 1996 by the Klaes[16] showing paint and upgrades (See Photograph 2). The liner in the fuel pit is visible. ADOT&PF files contain a description of lease improvements by the Klaes’ to Lot 1[17]. Two 15,000-gallon fuel tanks were placed inside the 50-by-50-foot diked area. The dike consisted of a gravel berm approximately 3 feet high and 4 feet wide at the base. The pit was lined with a commercially made liner. Outlets on tanks had lockable valves with camlock-type fittings. Flammable/No Smoking signs were posted.

In 1999, a Phase I/II ESA**Error! Bookmark not defined.** was performed by Nortech. Nortech deemed the site as having a high potential for significant environmental contamination. At the time of this site investigation, there were two 10,000-gallon tanks in a large secondary containment area, a highway fuel tanker holding aviation gas, and a small connex storing propane and unleaded gasoline (Figure 5)

Environmental concerns identified by the ESA were as follows:

- The inadequate fuel handling practices noted, or inferred, by multiple spills and surficial fuel stains around the pump house and around the fuel tanks, an impression that was confirmed by laboratory results.
- The presence of a submerged 55-gallon drum in an adjoining stream.
- The presence of sheen on surface water surrounding the airport apron.
- The presence of large quantities of fuel not stored inside secondary containment facilities (the highway tanker outside the containment berm).
- An unknown fluid inside a partially filled 55-gallon drum and stains on the ground around it.

The potential source area was identified as subsurface soil beneath the pad in areas where tanks and piping were located.

[15] March 1995 Letter from Big State Logistics to ADOT&PF (digital file: Mar96_Letter.pdf *incorrect date in file name noted. Letter is dated 1995)*
[16] Photograph of Lot 1 showing paint and improvements (digital file: Jul96_Photo.pdf)
[17] Lease improvements (digital file: May91_Improvement.pdf)

Nortech collected and analyzed surface soil samples for AK 101 (gasoline-range organics [GRO]), AK 102 (diesel-range organics [DRO]), AK 103 (residual-range organics [RRO]), and benzene, toluene, ethylbenzene, and xylenes (BTEX). Results are provided in Table 2. Sample locations from the Nortech report**Error! Bookmark not defined.** are provided in Figure 6.

The high DRO results in Samples PC-2 and PC-3 were collected near the location of the pump and hose for aircraft fueling outside the dike and liner. The highest GRO sample concentrations were collected by the fuel tanker, outside the dike and liner.

TABLE 2. 1999 NORTECH PHASE I/II ESA RESULTS

Surface Soil Sample	DRO mg/kg	GRO mg/kg	Benzene mg/kg
PC-1	829	3.7	0.00698U
PC-2	35700	118	0.0893U
PC-3	26500	166	0.113U
PC-4	1690	4.96	0.00812U
PC-5	5660	214	0.0648
PC-6	13	1.77	0.00887U

mg/kg – Milligrams per kilogram

Photographs taken by ADOT&PF on July 1, 1999[18] (See Photograph Set 3), show tears in the liner, open containers, numerous leaks from pipes, active leaking from pipe connections, and stained soil.

DEC spill reports show that Big State Logistics went to the site to clean up contaminated soil based on the Phase I/II ESA findings. The Cleanup Plan[19] stated that Big State Logistics intended to excavate and remove all stained gravel, move the cleaned pump house to the lined area, inspect and repair the liner, replace the tanks with double-walled tanks, and replace all plumbing so that it was within the containment.

While at the site, the Big State Logistics operator accidentally overfilled a tank and released approximately 1,000 gallons of diesel[20] [21]. Spill reports indicate that the release was within the lined containment. A vacuum truck was mobilized from APSC Pump Station #5 to pick up the fuel. Two thousand four hundred gallons of fuel and oily water were recovered and relinquished to APSC[22]. No contaminated soil was excavated as part of remediation of this spill.

A letter dated August 4, 1999, from Big State Logistics[23] states that John Jannsen was contracted to take confirmation samples. Big State Logistics intended to remove and replace the pit liner, clean under the liner, move the pump house inside the containment

[18] Photographs taken by Darren Mulkey of ADOT&PF (digital files: Jul99_Pictures.pdf, Jul99_Pictures2.pdf, and Jul99_Pictures3.pdf)
[19] Big State Logistics Cleanup Plan (digital file: DECSPILLPROSPECT.pdf)
[20] DEC Spill Summary report record for spill number 99309921003 (digital file: DECSPILLPROSPECT.pdf)
[21] Original spill report form for spill number 99309921003 (digital file: DECSPILLPROSPECT.pdf)
[22] Alyeska memo/contract relinquishing rights to fuel (digital file: DECSPILLPROSPECT.pdf)
[23] Letter describing amendments to cleanup plan (digital file: DECSPILLPROSPECT.pdf)

pit, and replace the tanks. It also intended to replace the tanks with double-walled tanks, but not at that time.

On September 23, 1999, ADOT&PF sent a letter[24] to the Klaes requesting a cleanup plan and building permit applications for excavation and removal of gravel and installation of new tanks, liner, gravel, and other items involved. No cleanup plan or building permit applications were identified in the ADOT&PF files.

The *Prospect Airport Oil Spill Investigation*[7] contained data presumed to be confirmation samples from the excavation. These samples were collected September 13 and October 11, 1999. The exact location of the release is not documented. Samples appear to have been taken outside the excavation area, near where pumps and fuel dispensing took place. DRO ranged from 893 mg/kg to 5,950 mg/kg. GRO ranged from 6.65 mg/kg to 47.84 mg/kg. It was impossible to determine exact sample locations or the depth below grade of the samples based on the data and figures presented in this report. However, samples were collected surrounding the excavation. Samples were collected from test holes; however, depth below grade of the samples were not provided in the report.

A memo dated May 22, 2000[25], describes the 1,000-gallon Big State Logistics spill, notes the numerous drips and leaks and evidence of poor fuel-handling practices, and states that current potential responsible parties (PRPs) (Klaes, Petro Star, Big State Logistics, and Brooks Fuel) were notified. When the consortium of PRPs undertook removing the tanks and liner and excavating contaminated soil, an additional liner was discovered several feet (exact amount not given) below grade, indicating earlier use of the site for fuel storage. The memo author states that "based on the fact that there were multiple users over time all of which were potential spillers and no good evidence existed to indicate that any one of them was responsible for residual contamination, the case was transferred to ADEC Contaminated Sites."

On August 2, 2000, Linda Butts of the BLM sent a letter[26] describing a compliance examination performed at the site. The letter indicated that there was still stockpiled contaminated soil, 55-gallon drums with holes, stained areas within the leasehold, old liner fabric and excavations with potential contamination, and a large fuel tank sitting near the excavation. The BLM asked what progress was being made towards restoration of the area.

The ADOT&PF responded to the BLM on August 18, 2000[27], stating that the site was listed as a contaminated site by DEC. Stockpiled soils were scheduled to be thermoremediated by Big State Logistics. When a burn machine was delivered, the large fuel tank and drums were to be hauled to Fairbanks. One pile of soil remained. Three piles of clean gravel were to be used to cover burn-treated gravel. The letter author, Pamela Lewis, stated that the lease to Dan and Lynda Klaes expired on August 1, 2000, and the ADOT&PF would not be leasing the site again until DEC released it from its

[24] 9/23/99 letter from ADOT&PF to Klaes (digital file: Sp99_Letter.pdf)
[25] Summary memo from DEC files, author anonymous (digital file: DECSPILLPROSPECT.pdf)
[26] Letter from BLM to ADOT&PF (digital file: Aug_00Letter&Pics.pdf)
[27] Letter to BLM from ADOT&PF (digital file: Aug00-Letter.pdf)

contaminated sites listing. In November 2009, ADOT&PF confirmed that the lot technically could be leased, but that it is unattractive due to potential contamination. There is difficulty leasing the lot due to environmental conditions. Future tenants could be indemnified from past contamination, but leasing cannot do that without a baseline assessment.

An October 11, 2000, letter from ADOT&PF to the BLM[28] noted that contaminated soil remediation efforts had been delayed, but that the fuel tanks and drums had been removed.

A July 11, 2001, e-mail from the BLM to ADOT&PF[29] stated that the site had been visited on July 4, 2001 and appeared to have been remediated. All stockpiled soils and gravel were removed, and the area was smooth and graded. No solid waste was present except for scraps of black liner. No other confirmation of this cleanup was identified in the historical files.

There have been no tenants on Lot 1 since the Klaes lease ended in 2000.

5.1.1. Block 2

APSC has occupied Block 2 on the apron since the airport was first constructed. Block 2 is directly adjacent to Block 1 on the north to northeast and has four buildings. The largest metal building, the one nearest Block 1, is a warm storage building. According to the site assessment performed by Nortech in 1999[1], the building was not in use and APSC intended to replace it. Some staining on the dirt floor in the building was identified in the northeast corner of the building. APSC planned to clean up the staining before the new building was erected. The other buildings on-site included a control tower, a garage, and a generator building. According to ADOT&PF lease records dated March 19, 1993[30], two aboveground storage tanks were present on Block 2: a 1,500-gallon generator diesel storage tank and a 10,000-gallon JP-4 aviation gas storage tank.

5.1.2. Apron Area

The area near the southeast corner of the site has been leased at least three times for short periods for the purpose of fuel storage. The leases were for 120 days. This area is now being used by the general public to store and transfer material at the road/aviation node on a short-term basis.

5.1.3. Regulatory Background

The following guidance documents and regulations have been used to develop a regulatory framework for this project:

- DEC, *18 AAC 75, Oil and Other Hazardous Substances Pollution Control*, as amended through October 9, 2008
- DEC, *Underground Storage Tanks Procedure Manual*, January 30, 2003

[28] Letter to BLM from ADOT&PF (digital file: Oct00_Letter.pdf)
[29] Email from BLM to ADOT&PF (digital file: July01_Email.pdf)
[30] Alyeska Material Inventory (digital file: May93_Inventory.pdf)

- DEC, *Conceptual Site Model Policy Guidance*, November 2005

The site was put on the DEC Contaminated Sites list because subsurface contamination and a liner of unknown origin were identified during excavation. The entry text for this site in the Contaminated Sites Database is provided below:

> *Multiple large petroleum stained areas observed on the property were confirmed by soil analysis results above Method 2 cleanup levels for DRO in 5 out of 6 samples, the highest result reaching 35,700 mg/kg. Estimated quantity of spill is 50 gallons[31]. Fuel storage practices include 2 10,000 gallon ASTs with breached containment liners and a highway tanker and connex that contain large amounts of fuel with no containment. Phase I and II Preliminary Assessment Report identified visible petroleum sheen on all of the streams around the airport apron. The Klaes Lot 1 Block 1 lease agreement Number ADA-70194 was issued 7/30/1986 by ADOT&PF Division of Maintenance and Operations Airport Leasing Fairbanks 907-451-2217. Spill Number 99303318801 Spill date 7/7/1999. This site was transferred from PERP - File No. 330.02.162.*

5.2. Potential Source Areas

5.2.1. Subsurface Soil and Groundwater

The long history of fuel storage and fuel leaks, as well as the discovery of subsurface contaminated soil under a liner of unknown origin, indicate that there is potential for a significant volume of fuel-contaminated subsurface soil. There is also potential for fuel-contaminated groundwater.

5.2.2. Surface Water and Sediment

The Nortech Phase I/II ESA[1] states that there was sheen on nearby surface water. Petroleum hydrocarbons potentially present in subsurface contaminated soil may have leached via groundwater to surrounding surface water and sediment.

5.2.3. Surface Soil

Records indicate that the stained surface soil on Lot 1 has been removed and that contamination on Lot 1 may be limited to subsurface soil, under the old liner.

5.3. Cleanup Criteria

5.3.1. Potential Contaminants of Concern

The contaminants of potential concern (COPCs) associated with this project include:

- BTEX

[31] This estimate is contradicted by an email form Darren Mulkey (ADOT&PF) to Linda Butts (BLM) saying that the pollution incident in the case file was likely long-term leaks from fuel tank piping. It became a spill incident because holes in the liner were identified. However, the volume of the release is unknown.

- GRO
- DRO
- RRO
- Polycyclic aromatic hydrocarbons (PAHs)
- Lead

5.3.2. Soil/Water Regulatory Cleanup Requirements

DEC's Method Two cleanup levels are the applicable soil cleanup levels (SCLs), as described in 18 AAC 75.341. Results are compared to SCLs for the "Under 40 Inch Zone" presented in Tables B1 and B2 of 18 AAC 75. SCLs are based upon the most restrictive benchmark for the either the migration to groundwater pathway, inhalation pathway, or ingestion pathway.

Applicable groundwater cleanup levels are presented in Table C of 18 AAC 75. Table 3 presents the applicable soil and groundwater cleanup levels for this project.

TABLE 3. UNDER 40 INCH ZONE CLEANUP LEVELS

Analyte	Soil Cleanup Level (mg/kg)	Groundwater Cleanup Level (mg/L)
Benzene	0.02	0.005
Toluene	5.4	1.0
Ethylbenzene	5.5	0.7
Xylenes	78	10
GRO	300	2.2
DRO	250	1.5
RRO	10,000	1.1
Benzo(a)pyrene	1	0.0002
Lead	400	0.015

The possibility that "Arctic Zone" soil cleanup levels (Table 4) could be appropriate for this site was investigated by comparing site latitude and permafrost data to Arctic Zone cleanup level requirements. The "Arctic Zone" is defined in 18 AAC 75.990 as an area north of latitude 68 degrees north; areas south of that latitude will be considered an "Arctic Zone" on a site-specific basis, based on demonstration that the site is underlain by continuous permafrost. The Prospect Creek Airport is located at 66 degrees North latitude and is at 1,099 feet above mean sea level. Permafrost data for this vicinity was obtained from the National Snow and Ice Data Center[32] (Figure 7). Figure 7 shows that the site is in an area of "Discontinuous permafrost extent with medium ground ice content and thick overburden." The airport is approximately 1 mile from the Jim River and its associated thaw bulb. Therefore, available information suggests that Arctic Zone cleanup levels are not appropriate for this site.

32 Brown, J., O.J. Ferrians, Jr., J.A. Heginbottom, and E.S. Melnikov. 1998, revised February 2001. Circum-arctic map of permafrost and ground ice conditions. Boulder, CO: National Snow and Ice Data Center/World Data Center for Glaciology. Digital media.

However, if the permafrost at the site was continuous, the migration to groundwater pathway would not be complete and applicable SCLs would be based on the ingestion pathway for bulk hydrocarbons and benzo(a)pyrene and the outdoor inhalation pathway for individual analytes.

TABLE 4. ARCTIC ZONE SOIL CLEANUP LEVELS

Analyte	Arctic Zone Soil Cleanup Level (mg/kg)
Benzene	17[i]
Toluene	220[i]
Ethylbenzene	110[i]
Xylenes	63[i]
GRO	1,400[d]
DRO	12,500[d]
RRO	13,700[d]
Benzo(a)pyrene	0.66[d]
Lead	400

Notes:
[i] Based on the outdoor inhalation pathway
[d] Based on direct contact with soil

5.3.3. Non-Regulated Cleanup Criteria

Non-regulated cleanup criteria, including tanks, drums, structures, and solid waste, have been removed from Lot 1, Block 1. An e-mail from the BLM to ADOT&PT dated July 11, 2001[29], states that there are no stockpiled gravels or structures remaining; however, there were some scraps of liner blowing around.

5.4. Conceptual Site Model

A conceptual site model (CSM) for Lot 1, Block 1 at the Prospect Creek Airport has been prepared. The CSM scoping and graphic forms are provided in Appendix B. The CSM identifies all potential sources of contamination (soil, groundwater, surface water, leachate, air, etc.), release mechanisms, and receptor routes. It also identifies all potential pathways (including secondary pathways) and the media and receptors associated with each of these pathways.

5.4.1. Exposure Pathways Determination

Exposure pathways that were considered complete or potentially complete in the preliminary CSM are discussed in this section. Potential receptors for this site include site workers, trespassers, and construction workers. The site is a remote airstrip on land leased by ADOT&PF from the BLM; therefore, no future residents are expected.

Incidental Soil Ingestion: Incidental ingestion of soil at Prospect Creek Airport is a complete pathway if contaminants are present in surface soil at concentrations greater than cleanup levels. However, data suggest that stained surface soil was removed and remaining contamination is limited to subsurface soil. The incidental soil ingestion pathway is complete for future construction workers but not for any current receptors.

Dermal Contact with Soil: The dermal contact with soil pathway is considered complete if permeable soil contaminants (PAHs) are present at concentrations greater than cleanup levels. Samples have not been analyzed for PAHs; however, PAHs are potentially present in weathered fuel-contaminated soil. Surface soil is not expected to be contaminated. Only future construction workers are expected to be exposed to subsurface soil. The dermal contact with soil pathway may be complete for future construction workers.

Inhalation of Fugitive Dust: Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles;
- Dust particles are less than 10 micrometers (PM10). This size can be inhaled and would be of concern for determining if this pathway is complete.

Generally DEC soil ingestion cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway except for chromium. Furthermore, contaminated surface soil at this site has been removed. Contaminated soil is limited to subsurface so this pathway is not likely to be complete.

Ingestion of Groundwater: Permafrost at the site is discontinuous; therefore, contamination is potentially present in the shallow groundwater. No groundwater samples have been collected.

Groundwater is not a current drinking water source, because it is not used for a private or public drinking water system; it is not within the zone of contribution of an active private or public drinking water system; and it is not within a recharge area for a private or public drinking water well, wellhead protection area, or sole-source aquifer. There are no wells in the vicinity of Lot 1, so this pathway is not complete for current workers and casual users of the site.

According to 18 AAC 75.350, DEC can determine that groundwater is not a reasonably expected potential future source of drinking water based on an evaluation of:

1. the availability of the groundwater as a drinking water source, including depth to groundwater, the storativity and transmissivity of the aquifer, the presence of permafrost, and other relevant information;
2. actual or potential quality of the groundwater, including organic and inorganic substances, and if it is affected by background, saltwater intrusion, and known or existing areawide contamination;
3. the existence and enforceability of institutional controls described in 18 AAC 75.375 or municipal ordinances or comprehensive plans that prohibit or limit access to the groundwater for use as drinking water;

4. land use of the site and neighboring property, using the factors in the US Environmental Protection Agency's (EPA's) Land Use in the CERCLA Remedy Selection Process, adopted by reference in 18 AAC 75.340;
5. the need for a drinking water source and the availability of an alternative source.

If DEC makes a determination that groundwater is not a reasonably expected source of drinking water based on the reasons listed or the presence of discontinuous permafrost, ingestion of groundwater is not considered a future complete pathway. If this determination is not made, then ingestion of groundwater is a future complete pathway.

Inhalation of Indoor and Outdoor Air: Benzene was not detected at elevated concentrations in the Phase I/II ESA[1] surface soil samples. The nature of the subsurface contaminated soil found under the buried liner is uncharacterized. If volatile contaminants are present in soil or groundwater, the inhalation of outdoor air pathway may be complete for future workers and construction workers and current and future site visitors. If a building were constructed in the future, future workers may be exposed to volatile contaminants potentially present in indoor air.

Ingestion and Dermal Contact with Surface Water: Surface water is unlikely to be considered a potential drinking water source.

5.5. General Environmental Overview

Lot 1, Block 1 and immediate vicinity have been used for fuel storage since the early 1970s. Direct evidence is available to show that there have been at least two major releases at the site or immediately adjacent to the site: 1) the APSC 1,600-barrel (or gallon) gasoline bladder release and 2) the Big State Logistics 1,000-gallon diesel spill. Reports state that both these spills were within lined containment areas and were cleaned up with a vacuum truck.

Records show that potentially seven separate entities may have been storing or dispensing fuel on or in the immediate vicinity of Lot 1, Block 1:

1. Alyeska Pipeline Service Company
2. Northwest Gas Pipeline
3. Matomco
4. Tanana Fuel
5. Coghill
6. Dan and Lynda Klaes (in conjunction with Petro Star, Big State Logistics, and Brooks Fuel)
7. Nenana Fuel

At least one of these companies was responsible for covering with clean gravel and grading over a liner that was covering subsurface contaminated soil. The nature, volume, and extent of contaminated subsurface soil under this liner are not known.

Soil staining and photographic evidence (see Photograph Set 3) suggests that fuel handling practices at the site were poor and that drips and leaks were common. The

Klaes and Big State Logistics excavated and cleaned the surface soil and liner associated with their operations and covered the area with clean gravel. No solid waste remains.

Sheen was identified in the surrounding surface water**Error! Bookmark not defined.**, suggesting that surface water and sediment may be contaminated. The cause of this sheen is not known. Note that evidence exists to suggest that APSC routinely sprayed oil on the runway and ramps to decrease dust[1].

The CSM shows that complete exposure pathways are limited to future construction workers with the possible exception of inhalation of outdoor air. Based on the toxicity and volatility of the potential contaminants, this pathway is unlikely to pose a health risk to current receptors at the site. Thus, the site is not expected to pose a risk or health hazard to current human receptors at the site (temporary visitors or workers).

6. RECOMMENDED ACTIONS/OPINION

6.1. Data Gaps

After completion of the records review, OASIS identified the following data gaps:

- **Responsible party:** A liner covering subsurface contaminated soil was discovered during excavation of contaminated soil from the 1,000 gallon 1999 release by Big State Logistics. The volume of contaminated soil and the responsible party for the liner are unknown. Other tenants prior to the Klaes (Northwest Gas Pipeline, Matomco, Tanana Fuel, Coghill, and Nenana Fuel) stored and dispensed fuel. It is not known who put clean gravel over the liner covering contaminated soil. Sample data and soil staining suggest fuel handling practices by all tenants were poor.

  Stockpiled contaminated soil was scheduled to be thermoremediated by United Soil Recycling[27]. This remediation was delayed due to vehicles parked in the vicinity when the equipment was delivered[28] An e-mail from ADOT&PF to BLM states that the stockpiled soil was removed[29] and assumed to have been remediated, but no records are available to confirm that soil was treated and replaced.

  The 1976 aerial photograph[5] (Figure 4) indicates that APSC had a large fuel bladder adjacent to and possibly partly on Lot 1. Available records regarding the APSC 1,600- gasoline spill indicate that the release was within containment and picked up by a vacuum truck. However, it is possible gasoline was released through tears in the liner, and no confirmation samples exist to corroborate that soil was not contaminated.

- **Distribution of contaminated soil:** Aerial photographs indicate where fuel containers, piping, and dispensers were located. However, enough data gaps exist to make it impossible to identify exactly where subsurface contaminated soil may be located without sampling. The extent of subsurface contamination cannot be determined without field screening or sampling.

- **Presence and quantity of petroleum hydrocarbons:** The 1999 Phase I/II ESA[1] states that an unknown quantity of fuel-impacted soils are present at the lease lot. According to that report, the extent of contamination appears to be significant. Records identify significant gasoline and diesel spills and indicate that there were long-term drips and leaks. ADOT&PF correspondence[29] indicates that the surface soil contamination sampled in the 1999 Nortech Phase I/II ESA[1] was removed. Confirmation samples in the 2000 Oil Spill Investigation[7] show DRO ranging from 893 mg/kg to 5,950 mg/kg (versus the 250 mg/kg migration to groundwater cleanup level) and GRO ranging from 6.65 mg/kg to 47.84 mg/kg (versus the 300 mg/kg migration to groundwater cleanup level). The depth below ground surface of collected samples is not provided in the report.

  No groundwater samples have been collected to confirm whether fuel contamination is present in groundwater.

- **Volume of subsurface contaminated soil:** The depth, extent, and volume of contaminated soil under the old liner are not known. Estimating from a photograph dated July 1996[16] (See Photograph 2) and Figure 3, the square liner was approximately 500 square feet.
- **Presence of petroleum hydrocarbons in surrounding environment:** The 1999 Phase I/II ESA[1] states that all of the surface waters around the apron have a visible sheen present. However, the cause of this sheen is not known. Anecdotal evidence suggests that the runway, ramps, and apron were regularly sprayed with oil to reduce dust. Runoff from the oiled runway and ramp may have caused sheen in the surrounding surface water.

6.2. General Overall Environmental Actions

The goal for this site is to enable the safe reuse of the property such that it can be leased in the future. To be removed from the CSP Contaminated Sites list, it must be "closed," defined as "Cleanup Complete" or "Cleanup Complete with Institutional Controls." As of July 2009, Cleanup Complete determinations and requirements for Institutional Controls (ICs) are based on current and future potential exposure pathways at the site. For a site to be evaluated for closure, a list of conditions must be met *unless* the CSP makes a determination under 18 AAC 75.325 that the discharge or release does not pose a threat to human health, safety, welfare, or the environment. The list of closure conditions, status of the site, and recommendations for action are presented in Table 5.

TABLE 5. CLOSURE CONDITIONS AND RECOMMENDATIONS

Cleanup Complete Conditions	Status	Recommendation
Free product must be recovered to the maximum extent practicable (18 AAC 75.325(f)(1)(B)).	Presence of free product is unknown; however, based on the anecdotal evidence regarding fuel handling practices[18] and the photographs showing rips in the liner and active leaks, the presence of free product is likely.	Evaluate the potential for free product to be present at the site. Major releases were in lined containment areas. Subsurface contamination is expected to be the result of long-term poor fuel handling practices. Since there is a reasonable potential for free product to be present, field screening and soil borings are recommended in areas of greatest potential contamination.
Surface soil staining must be evaluated and cleaned up (18 AAC 75.325(f)(1)(E)).	Surface soil staining has reportedly been removed and clean gravel has been placed on the site.	No action needed.
Cumulative risk standards must be achieved (18 AAC 75.325(g)).	Based on limited exposure to subsurface soil and short term exposure to outdoor air, cumulative risk standards are achieved for current receptors.	Maximum detected concentrations of DRO and GRO[7] remaining in surface soil are likely below SCLs for direct exposure to current receptors. Collect subsurface samples to determine whether

Cleanup Complete Conditions	Status	Recommendation
	Subsurface soil has not been sampled, so cumulative risk is not quantified for future construction workers or future workers inhaling outdoor or indoor air.	concentrations are below SCLs for future construction workers or future workers inhaling outdoor or indoor air.
Approved groundwater cleanup levels must be achieved at the approved point of compliance (18 AAC 75.345(e)), unless DEC makes a determination that residual groundwater contamination cannot be feasibly or practicably addressed and does not pose a threat to human health, safety, or welfare, or to the environment.	Requires DEC groundwater determination.	DEC make groundwater use determination or collect groundwater samples to assess groundwater conditions.
Potential future exposure to residual contamination at levels that do not allow for unrestricted site use must be managed through the use of ICs (18 AAC 75.375(a)).	Residual contamination levels are unknown. Site is located adjacent to an airstrip and an APSC pump station.	Collect soil samples to determine residual contamination levels. Identify potential ICs and communicate with ADOT&PF to determine if ICs are feasible.
Approved soil cleanup levels must be achieved unless DEC makes a determination that residual soil contamination above approved soil cleanup levels cannot be feasibly or practicably addressed due to the presence of infrastructure or other extenuating factors and does not pose an unacceptable risk to human health, safety, or welfare, or to the environment.	Unknown.	Collect soil samples or determine if there are extenuating factors precluding collection of soil samples and remedial action to clean up soil.
Groundwater contaminant plumes must be steady state or shrinking, and concentrations of the hazardous substances within the plume must show a decreasing trend (18 AAC 75.380(c)(2)).	Unknown.	Collect groundwater samples to identify whether groundwater is contaminated and if so, implement a groundwater monitoring program.
Residual contamination must not cause a violation of 18 AAC 70 water quality standards.	Unknown.	Collect surface water samples around the pad.

In some instances, the CSP may base a Cleanup Compete determination on the results of an exposure pathway assessment alone if the CSP determines that under 18 AAC 75.325(d)(1) the discharge or release does not pose a threat to human health, safety, or welfare, or to the environment and requires no (further) cleanup action. This determination requires Unit-Manager approval.

If DEC determines that there is not enough data or too much uncertainty regarding contamination and exposure to implement a Cleanup Complete with Institutional Controls closure determination, additional sampling to close data gaps is necessary. Recommended sampling is discussed in Section 6.3.

6.3. Recommended Investigation Activities

6.3.1. Surface Soil

No action is necessary for surface soil on the pad at Lot 1.

6.3.2. Subsurface Soil and Groundwater

Subsurface soil sample collection is recommended to characterize contamination remaining at the site. Sampling can be used to identify the nature (what substances at what concentrations) and extent (both vertical and horizontal) of contamination and estimate the volume of contaminated soil.

If present at the site, groundwater should also be sampled to confirm the depth to groundwater, verify whether free product is present, identify the groundwater flow direction and gradient, and determine the nature and extent of potential groundwater contamination. Samples should also be collected to evaluate natural attenuation of the potential groundwater plume and to start the process of evaluating groundwater plume stability (i.e., whether the groundwater plume is considered stable, or not increasing, due to natural attenuation processes limiting the downgradient extent of groundwater contamination).

A direct-push drilling rig is recommended to cost-effectively advance soil borings and install temporary groundwater monitoring wells while minimizing investigation-derived waste. Historical research suggested groundwater may be present at a depth of approximately 12 feet bgs at this site, so soil boring/monitoring well depths are anticipated to range between approximately 10 and 20 feet bgs.

Approximately 20 to 30 soil borings and four to six temporary groundwater monitoring wells are recommended to evaluate conditions at the site. Soil borings should be advanced to investigate conditions within the former containment area, outside the former containment area, and along the site boundaries to investigate the potential for contamination from the adjacent apron to have impacted Lot 1 and also to investigate the possibility that contamination from Lot 1 has extended off-site. Temporary groundwater monitoring wells should be installed and sampled in the areas of highest contamination (as indicated by field screening), along with upgradient, cross-gradient, and downgradient locations (as determined using best professional judgment in the field).

Field screening, using a headspace photo ionization detector (PID) followed by a Petroflag® test should be used to determine potential source areas of contamination, to guide subsurface sample collection, and to evaluate the need for and recommended locations of temporary groundwater monitoring wells.

Soil samples for laboratory analysis should be collected from areas exhibiting the highest field-screening results. The following analyses are recommended for soil and groundwater samples:

- BTEX;
- GRO,

- DRO,
- RRO (soil only);
- VOCs (specifically ethylene dibromide);
- Lead; and
- PAHs (two soil and groundwater samples with the highest field-screening results only)

In addition, groundwater samples should be collected for natural attenuation parameters (dissolved oxygen, oxidation-reduction potential, pH, and conductivity by field measurements and nitrate, total organic carbon, and sulfate by laboratory analysis). Dissolved iron should be analyzed by field instrumentation or by a laboratory.

Soil and groundwater results should be compared to 18 AAC 75 Table B (for soil) and Table C (for groundwater) cleanup levels to delineate the nature and extent of soil and groundwater contamination.

If groundwater contamination is encountered, a periodic monitoring program may be required to evaluate plume stability over time.

6.3.3. Surface Water and Sediments

Surface water and sediment samples should be collected in the tundra on ponded water around the vicinityof Lot 1 (southwest corner of Block 1) to see if surface water quality has been affected.

Approximately three to five surface water/sediment pairs should be collected and compared to 18 AAC 70 water quality criteria.

6.3.4. Available Resources–Community or Region-Specific Information

6.3.4.1. Equipment

Based on site location and information from past remediation efforts, all sampling and remediation equipment and manpower will need to be transported to the site.

6.3.4.2. Labor

No resident labor is available in the vicinity of the site.

6.3.4.3. Resource Leveraging Opportunities

No resource leveraging opportunities are identified at this time.

6.4. General Outline of Remedial Requirements

Potential remedial actions at the site cannot be evaluated in detail until the nature and extent of contamination has been delineated as recommended in the Section 6.2 of this report.

In general, potential remedial alternatives for addressing petroleum contamination in soil are listed below:

- No action (only applicable if there is no residual petroleum contamination above 18 AAC 75 Table B cleanup levels).

- ICs only (if there is no unacceptable risk to current or future receptors from subsurface soil contamination migration to groundwater from leaching precipitation).
- Excavation and ex-situ (on-site or off-site) treatment of contaminated soil. Ex-situ treatment options are listed below:
  - Low-temperature thermal desorption: a remedial technology that uses heat to physically separate petroleum hydrocarbons from excavated soils. In some cases, the thermal desorption also causes some of the constituents to completely or partially decompose. The vaporized hydrocarbons are generally treated in a secondary treatment unit prior to discharge to the environment. Thermal desorption facilities may either be mobile, which can be operated directly on-site, or stationary, which require transportation of contaminated soil to the treatment facility. Contaminated soils are excavated and transported to stationary facilities; mobile units can be operated directly on-site.
  - Hot air vapor extraction (HAVE): a remedial technology that involves creating a pile of the contaminated soils interspersed with both pipe vent and hot air distribution pipes. The pile is then covered and the piping ducts are connected to the HAVE system, which uses a burner and blower to raise the temperature of the impacted soils. The fuel source is either diesel or natural gas.
  - Landfarming: a remedial technology that involves constructing one or more lined and bermed landfarm cells, then loading the cells with the stockpiled soils to a depth of about 18 inches. A backhoe or mounted tiller is used for periodic tilling/mixing of soils. Biodegradation over one to several years reduces the soil's contaminant concentrations.
  - Biocells: a remedial technology that, similarly to landfarming, involves construction of one or more lined and bermed bioremediation cells. Excavated soils are mixed with soil amendments (if necessary) and some form of aeration to enhance biodegradation. The treatment cell is generally underlain by an impermeable liner, contains an air distribution system buried under the soil, and is usually covered with plastic to control runoff, evaporation, and volatilization and to promote solar heating.
- In-situ treatment of contaminated soil by bioventing.
  - Bioventing: a process of stimulating the natural in-situ biodegradation of contaminants in soil by providing air or oxygen to existing soil microorganisms. Bioventing uses low air flow rates to provide only enough oxygen to sustain microbial activity in the vadose zone. Oxygen is most commonly supplied through direct air injection into residual contamination in soil. In addition to degradation of adsorbed fuel residuals, volatile compounds are biodegraded as vapors move slowly through biologically active soil. Factors that may limit the applicability and effectiveness of the process include: (1) low permeability soils (reduce bioventing performance); (2) monitoring of off-gases at the soil surface may be required;

and (3) low soil moisture content, which may be caused by bioventing, limits biodegradation.

In general, potential remedial alternatives for addressing petroleum contamination in groundwater are listed below:

- No action (only applicable if there is no residual petroleum contamination above 18 AAC 75 Table C cleanup levels).
- ICs only (if there is no unacceptable risk to current or future receptors from groundwater contamination, and the groundwater plume is either not present or stable).
- Monitored natural attenuation by allowing natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials to reduce contaminant concentrations to acceptable levels. Consideration of this option usually requires modeling and evaluation of contaminant degradation rates and pathways and predicting contaminant concentration at downgradient receptor points, especially when the plume is still expanding/migrating. The primary objective of site modeling is to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations below regulatory standards or risk-based levels before potential exposure pathways are completed. In addition, long-term monitoring must be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting cleanup objectives.

Other remedial alternatives exist for addressing volatile contamination in soil and groundwater (i.e., soil vapor extraction/air sparging). However, it is not considered likely that these alternatives would be feasible for this site due to high power requirements (difficult at a remote site) and a low likelihood that a significant volatile fraction remains from these approximately 30-year old releases.

6.5. General Cost Estimate Information

The potential cost for collecting additional data at this site would be between $60,000 and $90,000. This estimate is based on the assumptions listed below:

- Direct-push drilling rig would be transported to the site.
- Drilling and site investigation would take five days (plus travel time).
- Approximately 30 soil and groundwater samples would be collected for laboratory analysis.
- Detailed reporting of the nature and extent of soil and groundwater contamination and potential remedial alternatives would be performed.

Costs for remediating potentially contaminated soil and groundwater cannot be estimated until the volume of contaminated soil is quantified and groundwater is sampled to determine if fuel contamination is present.

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7. CONCLUSIONS

The Prospect Creek Airport apron Lot 1, Block 1 (the site) has been used for fuel dispensing and storage since the airstrip was developed in the early 1980s. In addition to the last leaseholders (Dan and Lynda Klaes) and the adjacent lot leaseholder (APSC), at least five other tenants stored and transferred fuel at the site. In 2000, subsurface soil contamination and an old liner were discovered while cleaning up a 1,000-gallon diesel release. Because the responsible party could not be identified, the site was put on the DEC Contaminated Sites list.

Evidence suggests that there have been many leaks and drips and general poor housekeeping at the site. There have been two significant documented spills on or adjacent to the site.

1. APSC records show a 1,600-gallon release of gasoline on July 16, 1979 from a ripped fuel storage bladder, to lined containment.
2. Big State Logistics released approximately 1,000 gallons of diesel to a lined containment area in 1999.

Surface contamination was reportedly removed in 2000, so remaining contamination is limited to subsurface soil and possibly groundwater. The degree and extent of contamination in soil and groundwater are not known.

Complete exposure pathways for current land use are limited to inhalation of outdoor air for workers and site visitors, and additional potentially complete exposure pathways for future land use include direct contact with subsurface contamination for construction workers. If a building is constructed at the site, inhalation of indoor air for future workers and visitors would become a complete pathway. As stated in the previous paragraph, the nature and extent of contamination are unknown, so the potential risk to current and future receptors cannot be quantified with the existing information. The data gaps are detailed in Section 6.1, and recommendations for filling the data gaps are provided in Table 5 and Section 6.2. Alternatively, DEC may make a determination that adequate information about complete exposure pathways are available and make a closure determination.

In order to identify whether remedial action is necessary to achieve site closure and evaluate feasible remedial options, subsurface soil, groundwater, surface water, and sediment samples should be collected. These data will determine the nature and extent of subsurface soil contamination, whether free product is present, and identify the presence and location of a potential contamination plume. Data collection will also verify whether contamination has migrated to surrounding surface water and confirm the presence and depth of any permafrost. Additional data collection is anticipated to cost between $60,000 and $90,000.

Once additional data are collected, DEC may make a determination of Cleanup Complete or Cleanup Complete with ICs or decide that a remedial alternative must be selected.

Potential remedial alternatives for contaminated subsurface soil and groundwater are discussed in general terms in Section 6.4.

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FIGURES

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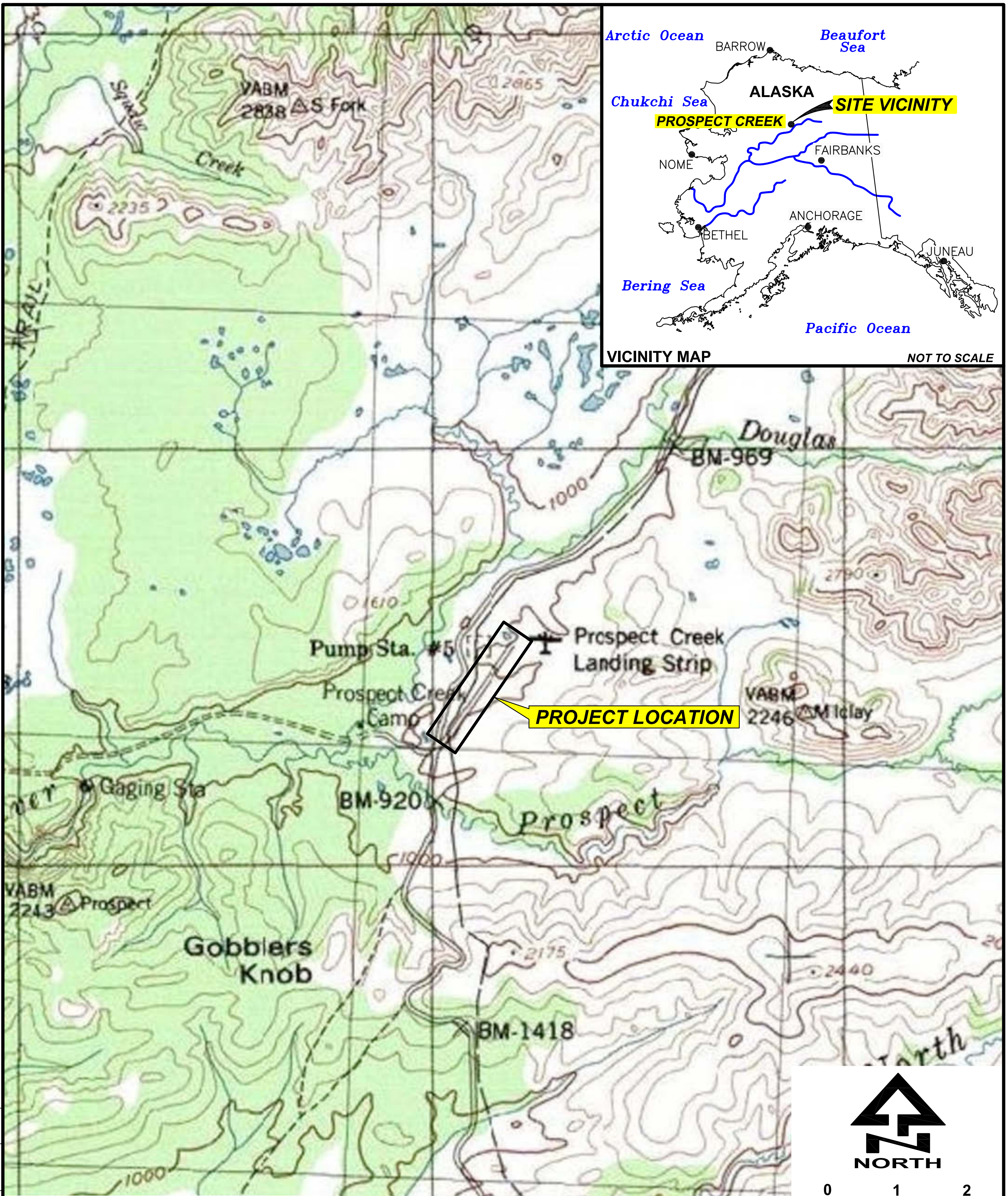

SOURCE: NATIONAL GEOGRAPHIC TOPO SOFTWARE PROGRAM 2007.

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DATE: AUGUST 2009
CHKD: K.G.W.
DRAWN: C.E.H
PROJ. No.: 14–163
825 W. 8th Ave., Anchorage, AK 99501, (907) 258–4880

SITE LOCATION MAP

ENVIRONMENTAL MANAGEMENT PLAN
PROSPECT CREEK AIRPORT
Prospect Creek, Alaska

FIGURE
1

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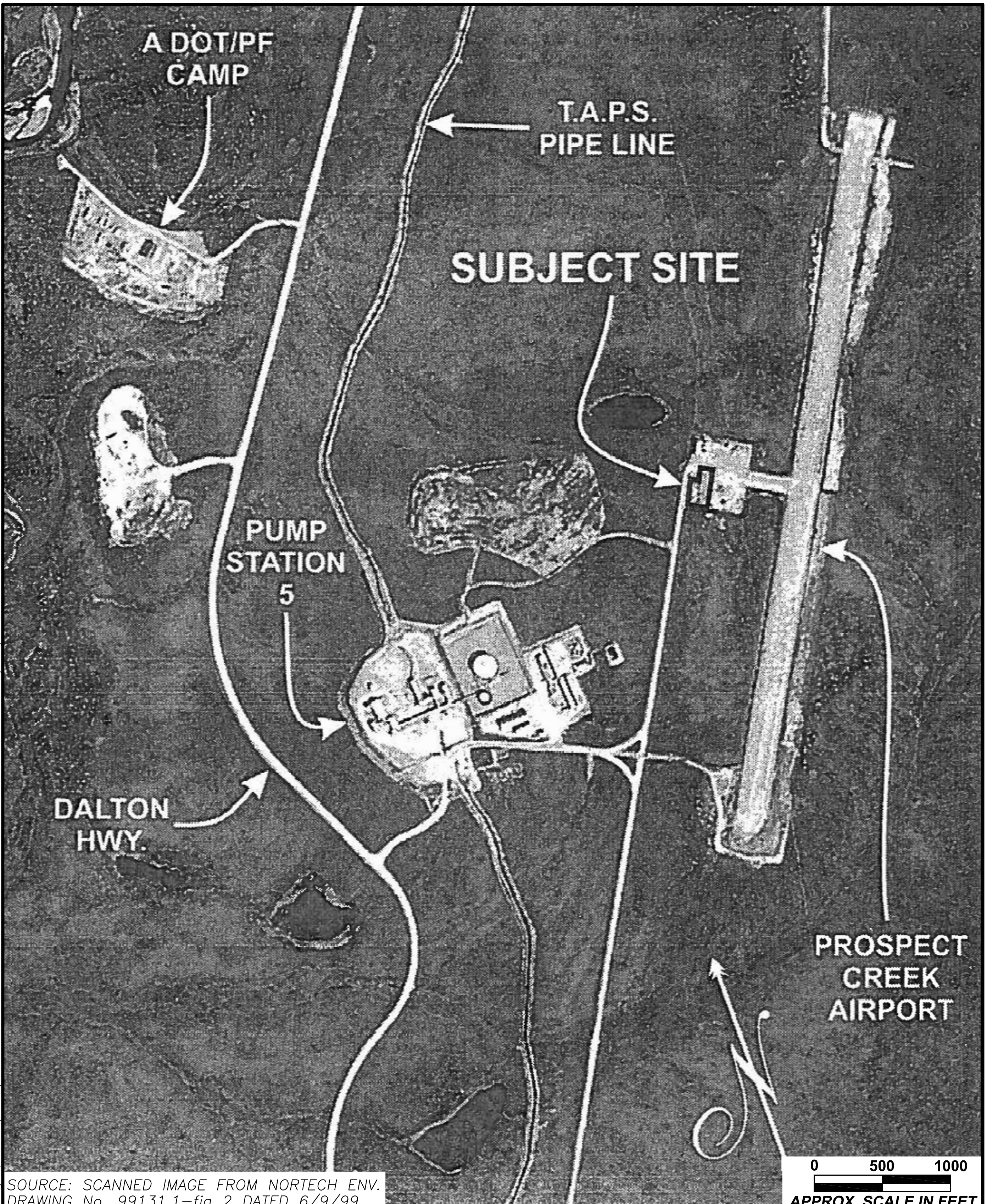

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SITE AND SURROUNDING AREA SCHEMATIC (1979 AERIAL FROM NORTECH PHASE I/II ESA)

ENVIRONMENTAL MANAGEMENT PLAN
PROSPECT CREEK AIRPORT
Prospect Creek, Alaska

FIGURE 2

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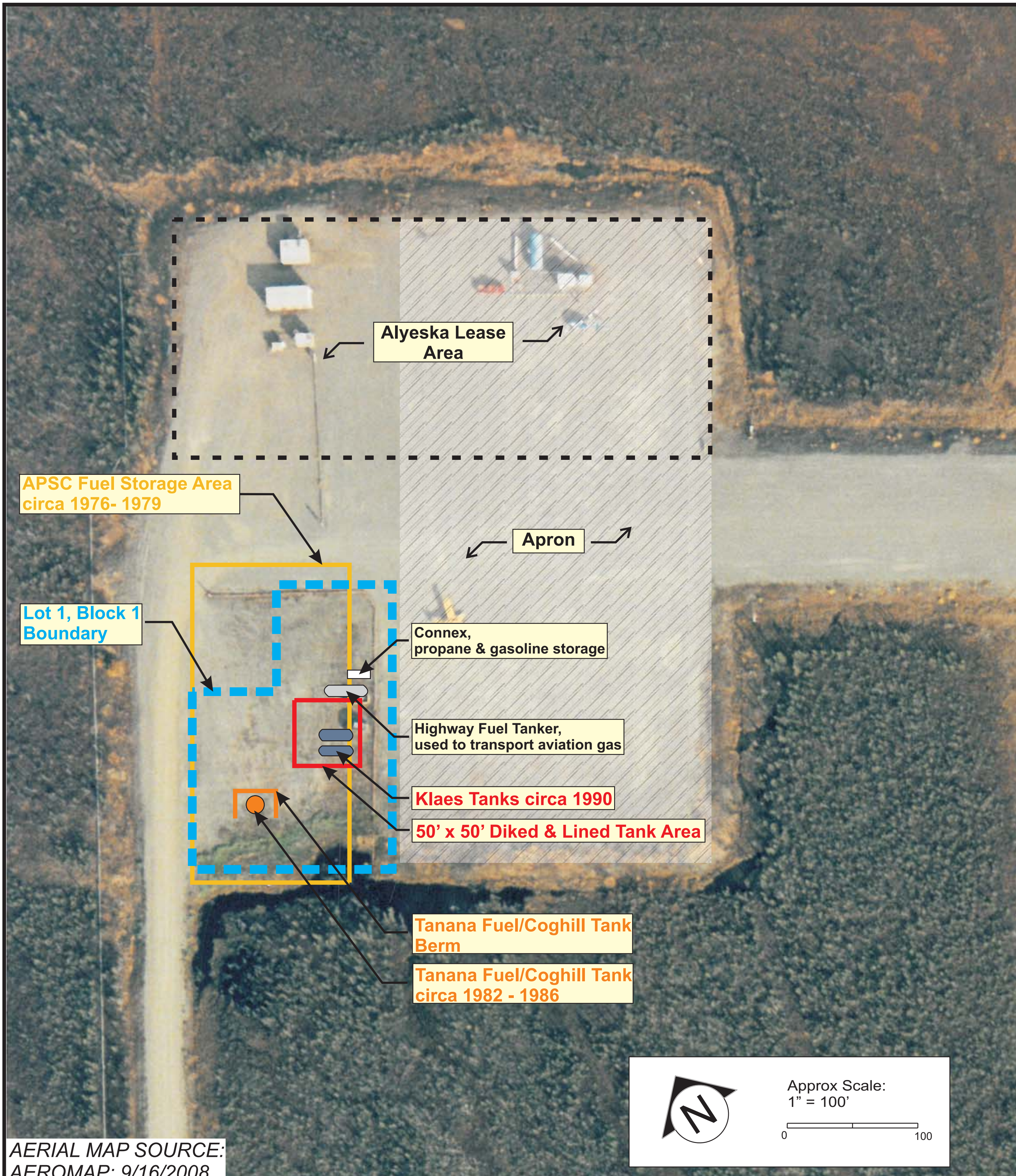

AERIAL MAP SOURCE:
AEROMAP; 9/16/2008

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DATE: 26-OCT-09
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DRAWN: JAS

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ANCHORAGE, AK 99504

Figure 3: Lot 1, Block 1

ENVIRONMENTAL MANAGEMENT PLAN
PROSPECT CREEK AIRPORT
Prospect Creek, Alaska

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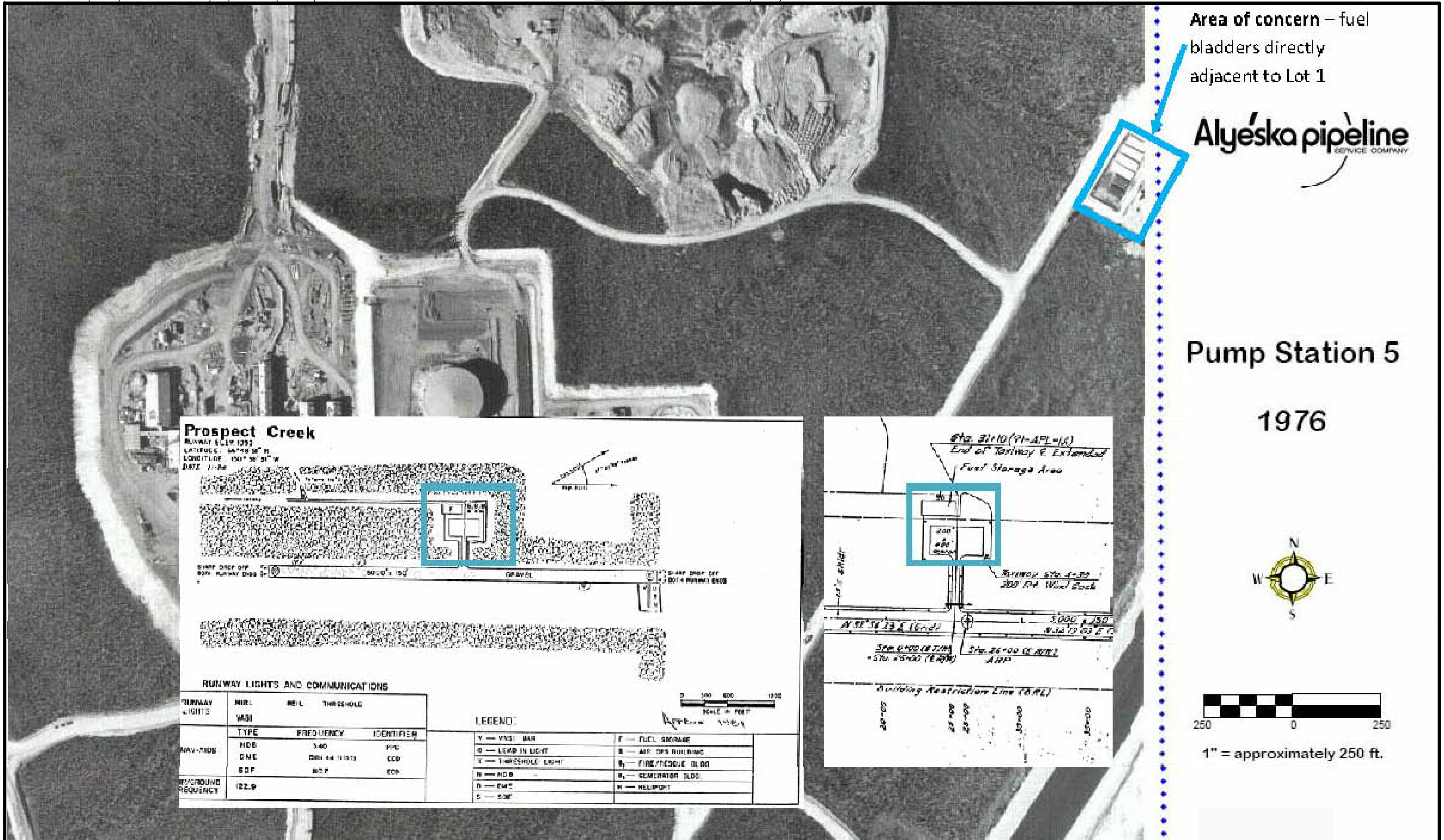

As-built diagrams were taken from *2000 Prospect Oil Spill Investigation*, Oil Spill Technology

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DRAWN: C.E.H.
PROJ. No.: 14-163
825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

1976 APSC FUEL STORAGE

ENVIRONMENTAL MANAGEMENT PLAN
PROSPECT CREEK AIRPORT
Prospect Creek, Alaska

FIGURE 4

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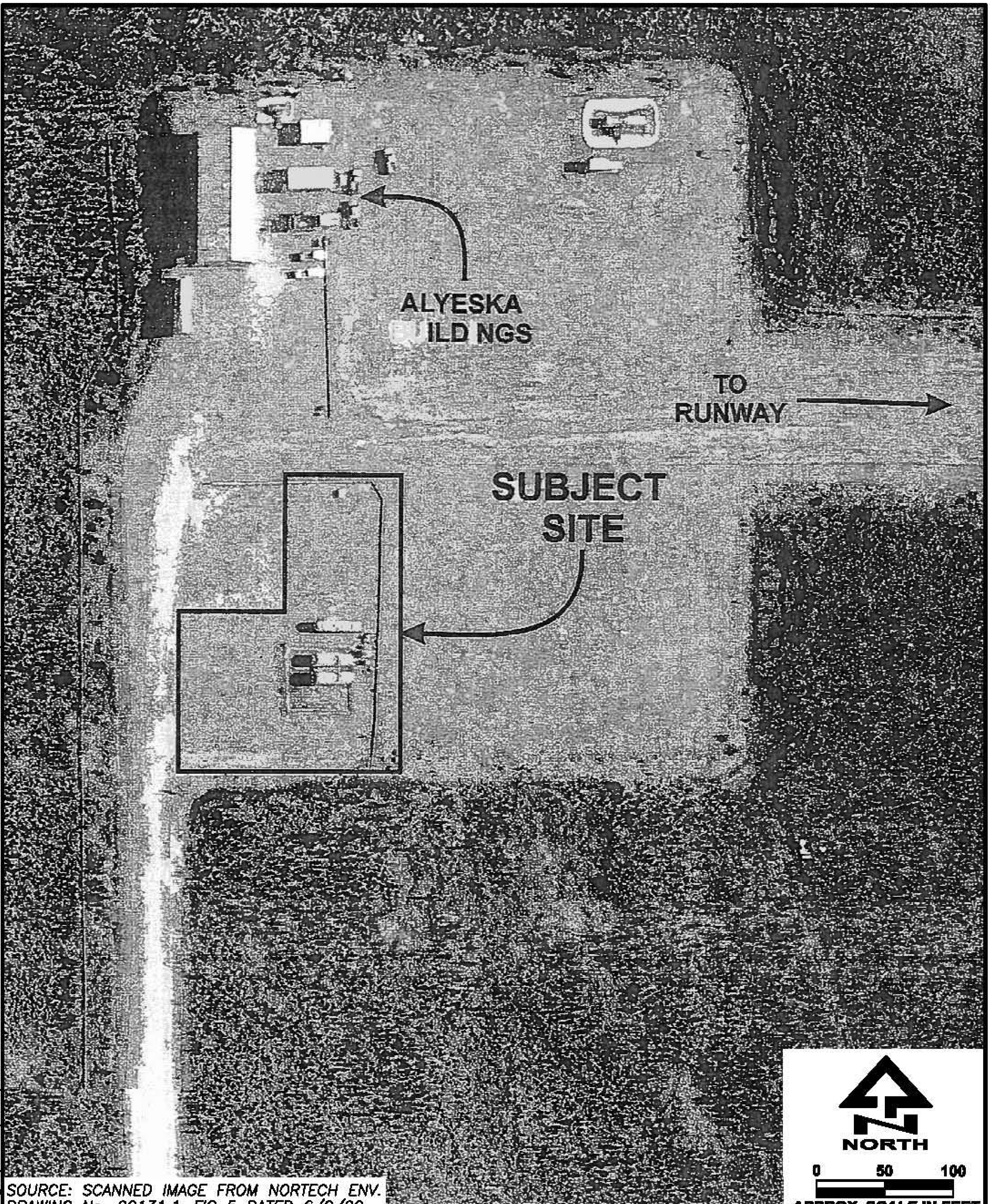
PATH: V:\Project Drawings\ADEC\Prospect Ck FILE: 14-163-PC-EMP-F2_6.DWG PLOTTED: 8/24/09.



SOURCE: SCANNED IMAGE FROM NORTECH ENV. DRAWING No. 99131.1-FIG 5 DATED 6/9/99.

oasis ENVIRONMENTAL	DATE: AUGUST 2009 CHKD: K.G.W. DRAWN: C.E.H. PROJ. No.: 14-163 825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880	**1996 AERIAL PHOTOGRAPH (SITE PLAN OF KLAES FACILITY)** ENVIRONMENTAL MANAGEMENT PLAN PROSPECT CREEK AIRPORT Prospect Creek, Alaska	FIGURE 5

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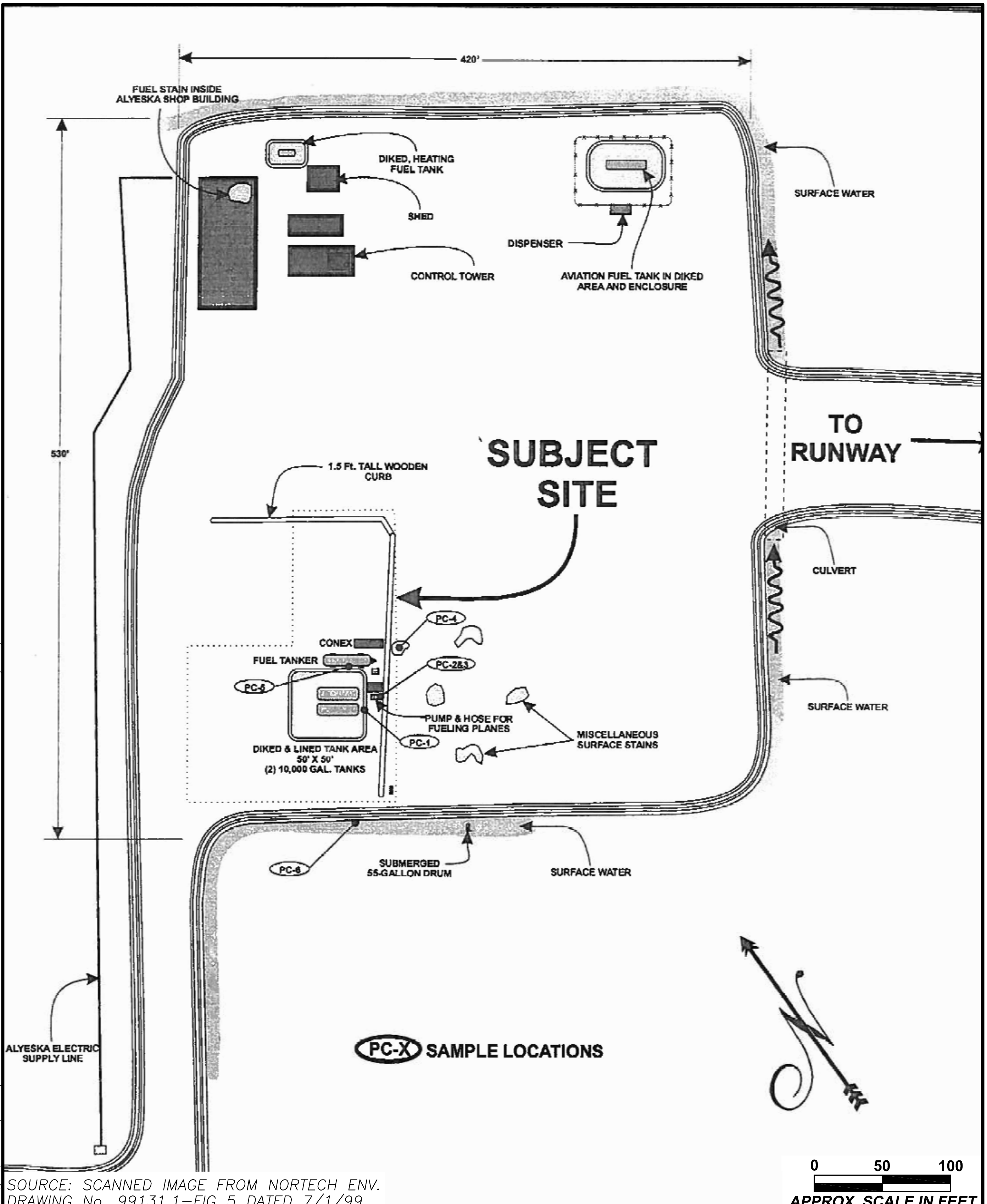

SOURCE: SCANNED IMAGE FROM NORTECH ENV. DRAWING No. 99131.1-FIG 5 DATED 7/1/99.

oasis ENVIRONMENTAL

DATE: AUGUST 2009
CHKD: K.G.W.
DRAWN: C.E.H.
PROJ. No.: 14-163

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

NORTECH PHASE I/II ESA SAMPLE LOCATION MAP

ENVIRONMENTAL MANAGEMENT PLAN
PROSPECT CREEK AIRPORT
Prospect Creek, Alaska

FIGURE 6

PATH: V:\Project Drawings\ADEC\Prospect Ck FILE: 14-163-PC-EMP-F2_6.DWG PLOTTED: 8/24/09.

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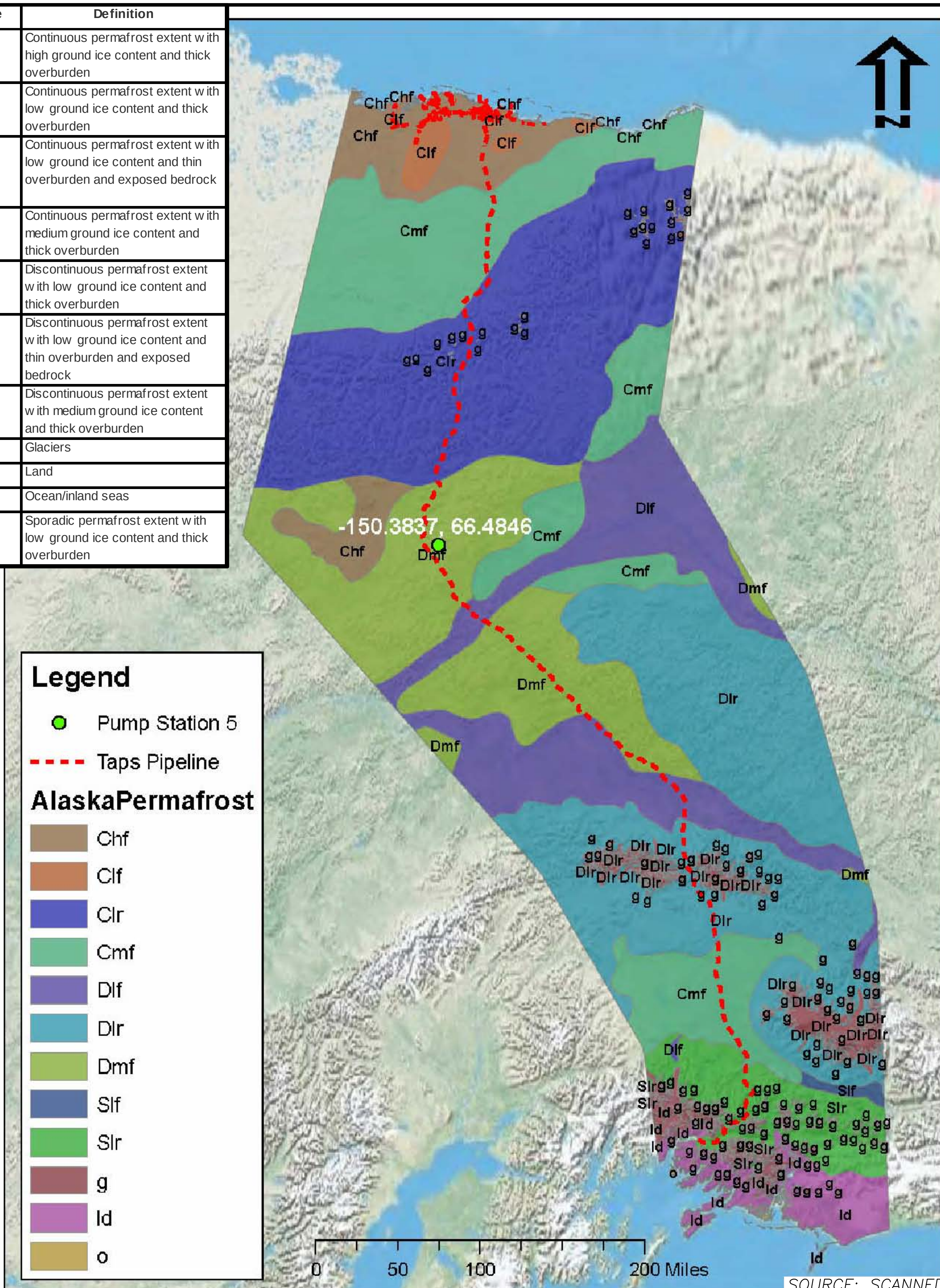
Value	Definition
chf	Continuous permafrost extent with high ground ice content and thick overburden
clf	Continuous permafrost extent with low ground ice content and thick overburden
clr	Continuous permafrost extent with low ground ice content and thin overburden and exposed bedrock
cmf	Continuous permafrost extent with medium ground ice content and thick overburden
dlf	Discontinuous permafrost extent with low ground ice content and thick overburden
dlr	Discontinuous permafrost extent with low ground ice content and thin overburden and exposed bedrock
dmf	Discontinuous permafrost extent with medium ground ice content and thick overburden
g	Glaciers
ld	Land
o	Ocean/inland seas
slf	Sporadic permafrost extent with low ground ice content and thick overburden



SOURCE: SCANNED IMAGE FILE/DATE UNKNOWN.

PATH: V:\Project Drawings\ADEC\Prospect Ck FILE: 14-163-PC-EMP-F2_6.DWG PLOTTED: 8/24/09.

oasis ENVIRONMENTAL

DATE: AUGUST 2009
CHKD: K.G.W.
DRAWN: C.E.H.
PROJ. No.: 14-163

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

PERMAFROST MAP IN VICINITY OF PS 5

ENVIRONMENTAL MANAGEMENT PLAN
PROSPECT CREEK AIRPORT
Prospect Creek, Alaska

FIGURE

7

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PHOTOGRAPHS

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Photograph Set 1

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Prospect Creek Airport 7/31/85
By: Barsalou

Fuel Pit

Fuel Pit

Prospect Creek Airport 7/31/85

By: Barsalou

Photograph 2

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Bettles Lodge & Air Service

serving the Arctic Traveler since 1950

BJ

July 29, 1996

RECEIVED
JUL 31 1996
AIRPORT LEASING

Alaska DOT- Leasing
2301 Peger Rd.
Fairbanks, AK 99709

Lease # 70872 was painted and upgraded during the summer of 1995.

Attached is a photograph of the Fuel Pit at Prospect Lot 1 Block 1 on July 1996.

P.O. Box 27 Bettles, Alaska 99726 (907)692-5111 FAX (907)692-5655

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Photograph Set 3

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Hoses (2) on ramp.

open containers

Various Tears in Liner

Darren Mulkey, DOT&PF Env. Coordinator
July, 1999
Prospect Creek Airport
ADA-70872

open container almost full!

Leaks - open containers

possible spray(?) of pump house.

Various leaks

Darren Mulkey, DOT+PF Env. Coordinator

July, 1999

Prospect Creek Airport

ADA-70872



Several pictures "to catch an active leak"

Success

Darren Mulkey, DOT&PF Environ. Coordinator

July, 1999

Prospect Creek Airport

ADA-70872



APPENDIX A

Footnote Source Documents

Provided on Compact Disk

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APPENDIX B

Conceptual Site Model Scoping Forms

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HUMAN HEALTH CONCEPTUAL SITE MODEL

Site: Prospect Creek Block 1, Lot 1

Completed By: Krista Webb, OASIS

Date Completed: August 10, 2009

Follow the directions below. Do not consider engineering or land use controls when describing pathways.

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

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Briefly list other mechanisms or reference the report for details.*

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

(4) *Check exposure pathways that are complete or need further evaluation. The pathways identified must agree with Sections 2 and 3 of the CSM Scoping Form.*

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

Media / Transport Mechanisms

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

Exposure Media / Exposure Pathways / Current & Future Receptors

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

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Human Health Conceptual Site Model
Scoping Form

Site Name: ______________________________

File Number: ______________________________

Completed by: ______________________________

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

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

1. *General Information:*

Sources *(check potential sources at the site)*

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

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

- ☑ Spills
- ☐ Leaks
- ☑ Direct discharge
- ☑ Burning
- ☐ Other: ____________

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

- ☑ Surface soil (0-2 feet bgs*)
- ☐ Subsurface Soil (>2 feet bgs)
- ☑ Air
- ☑ Groundwater
- ☐ Surface water
- ☐ Other: ____________

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

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

* bgs – below ground surface

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

a) Direct Contact –

1 Incidental Soil Ingestion

Is soil contaminated anywhere between 0 and 15 feet bgs? ☑

Do people use the site or is there a chance they will use the site in the future? ☑

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

2 Dermal Absorption of Contaminants from Soil

Is soil contaminated anywhere between 0 and 15 feet bgs? ☑

Do people use the site or is there a chance they will use the site in the future? ☑

Can the soil contaminants permeate the skin? (Contaminants listed below, or within the groups listed below, should be evaluated for dermal absorption). ☐

Arsenic	Lindane
Cadmium	PAHs
Chlordane	Pentachlorophenol
2,4-dichlorophenoxyacetic acid	PCBs
Dioxins	SVOCs
DDT	

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

b) Ingestion –

1 Ingestion of Groundwater

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

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

If both the boxes are checked, label this pathway complete: ____________________

2 **Ingestion of Surface Water**

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

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

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

3 **Ingestion of Wild Foods**

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

Do the site contaminants have the potential to bioaccumulate (*see* Appendix A)? ☐

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. the top 6 feet of soil, in groundwater that **could be** connected to surface water, etc.) ☐

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

c) Inhalation

1 **Inhalation of Outdoor Air**

Is soil contaminated anywhere between 0 and 15 feet bgs? ☑

Do people use the site or is there a chance they will use the site in the future? ☑

Are the contaminants in soil volatile (*See Appendix B*)? ☑

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

2 **Inhalation of Indoor Air**

Are occupied buildings on the site or reasonably expected to be placed on the site in an area that could be affected by contaminant vapors? (i.e., within 100 feet, horizontally or vertically, of the contaminated soil or groundwater, <u>or</u> subject to "preferential pathways" that promote easy airflow, like utility conduits or rock fractures) ☑

Are volatile compounds present in soil or groundwater (*See Appendix C*)? ☑

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

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

Dermal Exposure to Contaminants in Groundwater and Surface Water

Exposure from this pathway may need to be assessed only in cases where DEC water-quality or drinking-water standards are not being applied as cleanup levels. Examples of conditions that may warrant further investigation include:

- Climate permits recreational use of waters for swimming,
- Climate permits exposure to groundwater during activities, such as construction, without protective clothing, or
- Groundwater or surface water is used for household purposes.

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

Comments:

Inhalation of Volatile Compounds in Household Water

Exposure from this pathway may need to be assessed only in cases where DEC water-quality or drinking-water standards are not being applied as cleanup levels. Examples of conditions that may warrant further investigation include:

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

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

Comments:

Inhalation of Fugitive Dust

Generally DEC soil ingestion cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway, although this is not true in the case of chromium. Examples of conditions that may warrant further investigation include:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers. This size can be inhaled and would be of concern for determining if this pathway is complete.

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

Comments:

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during recreational or some types of subsistence activities. People then incidentally **ingest** sediment from normal hand-to-mouth activities. In addition, **dermal absorption of contaminants** may be of concern if people come in contact with sediment and the contaminants are able to permeate the skin (see dermal exposure to soil section). This type of exposure is rare but it should be investigated if:

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

ADEC soil ingestion cleanup levels are protective of direct contact with sediment. If they are determined to be over-protective for sediment exposure at a particular site, other screening levels could be adopted or developed.

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

Comments:

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

APPENDIX A

BIOACCUMULATIVE COMPOUNDS

Table A-1: List of Compounds of Potential Concern for Bioaccumulation

Organic compounds are identified as bioaccumulative if they have a BCF equal to or greater than 1,000 or a log K_{ow} greater than 3.5. Inorganic compounds are identified as bioaccumulative if they are listed as such by EPA (2000). Those compounds in Table X of 18 AAC 75.345 that are bioaccumulative, based on the definition above, are listed below.

Aldrin	DDT	Lead
Arsenic	Dibenzo(a,h)anthracene	Mercury
Benzo(a)anthracene	Dieldrin	Methoxychlor
Benzo(a)pyrene	Dioxin	Nickel
Benzo(b)fluoranthene	Endrin	PCBs
Benzo(k)fluoranthene	Fluoranthene	
Cadmium	Heptachlor	Pyrene
Chlordane	Heptachlor epoxide	Selenium
Chrysene	Hexachlorobenzene	Silver
Copper	Hexachlorocyclopentadiene	Toxaphene
DDD	Indeno(1,2,3-c,d)pyrene	Zinc
DDE		

Because BCF values can relatively easily be measured or estimated, the BCF is frequently used to determine the potential for a chemical to bioaccumulate. A compound with a BCF greater than 1,000 is considered to bioaccumulate in tissue (EPA 2004b).

For inorganic compounds, the BCF approach has not been shown to be effective in estimating the compound's ability to bioaccumulate. Information available, either through scientific literature or site-specific data, regarding the bioaccumulative potential of an inorganic site contaminant should be used to determine if the pathway is complete.

The list was developed by including organic compounds that either have a BCF equal to or greater than 1,000 or a log K_{ow} greater than 3.5 and inorganic compounds that are listed by the United States Environmental Protection Agency (EPA) as being bioaccumulative (EPA 2000). The BCF can also be estimated from a chemical's physical and chemical properties. A chemical's octanol-water partitioning coefficient (K_{ow}) along with defined regression equations can be used to estimate the BCF. EPA's Persistent, Bioaccumulative, and Toxic (PBT) Profiler (EPA 2004) can be used to estimate the BCF using the K_{ow} and linear regressions presented by Meylan et al. (1996). The PBT Profiler is located at http://www.pbtprofiler.net/. For compounds not found in the PBT Profiler, DEC recommends using a log K_{ow} greater than 3.5 to determine if a compound is bioaccumulative.

APPENDIX B

VOLATILE COMPOUNDS

Table B-1: List of Volatile Compounds of Potential Concern
Common volatile contaminants of concern at contaminated sites. A chemical is defined as volatile if the Henry's Law constant is 1 x 10^{-5} atm-m^3/mol or greater and the molecular weight less than 200 g/mole (g/mole; EPA 2004a). Those compounds in Table X of 18 AAC 75.345 that are volatile, based on the definition above, are listed below.

Acenaphthene	1,4-dichlorobenzene	Pyrene
Acetone	1,1-dichloroethane	Styrene
Anthracene	1,2-dichloroethane	1,1,2,2-tetrachloroethane
Benzene	1,1-dichloroethylene	Tetrachloroethylene
Bis(2-chlorethyl)ether	Cis-1,2-dichloroethylene	Toluene
Bromodichloromethane	Trans-1,2-dichloroethylene	1,2,4-trichlorobenzene
Carbon disulfide	1,2-dichloropropane	1,1,1-trichloroethane
Carbon tetrachloride	1,3-dichloropropane	1,1,2-trichloroethane
Chlorobenzene	Ethylbenzene	Trichloroethylene
Chlorodibromomethane	Fluorene	Vinyl acetate
Chloroform	Methyl bromide	Vinyl chloride
2-chlorophenol	Methylene chloride	Xylenes
Cyanide	Naphthalene	GRO
1,2-dichlorobenzene	Nitrobenzene	DRO

APPENDIX C

COMPOUNDS OF CONCERN FOR VAPOR MIGRATION

Table C-1: List of Compounds of Potential Concern for the Vapor Migration

A chemical is considered sufficiently toxic if the vapor concentration of the pure component poses an incremental lifetime cancer risk greater than 10-6 or a non-cancer hazard index greater than 1. A chemical is considered sufficiently volatile if it's Henry's Law constant is 1 x 10^{-5} atm-m^3/mol or greater.

Acenaphthene	Dibenzofuran	Hexachlorobenzene
Acetaldehyde	1,2-Dibromo-3-chloropropane	Hexachlorocyclopentadiene
Acetone	1,2-Dibromoethane (EDB)	Hexachloroethane
Acetonitrile	1,3-Dichlorobenzene	Hexane
Acetophenone	1,2-Dichlorobenzene	Hydrogen cyanide
Acrolein	1,4-Dichlorobenzene	Isobutanol
Acrylonitrile	2-Nitropropane	Mercury (elemental)
Aldrin	N-Nitroso-di-n-butylamine	Methacrylonitrile
alpha-HCH (alpha-BHC)	n-Propylbenzene	Methoxychlor
Benzaldehyde	o-Nitrotoluene	Methyl acetate
Benzene	o-Xylene	Methyl acrylate
Benzo(b)fluoranthene	p-Xylene	Methyl bromide
Benzylchloride	Pyrene	Methyl chloride chloromethane)
beta-Chloronaphthalene	sec-Butylbenzene	Methylcyclohexane
Biphenyl	Styrene	Methylene bromide
Bis(2-chloroethyl)ether	tert-Butylbenzene	Methylene chloride
Bis(2-chloroisopropyl)ether	1,1,1,2-Tetrachloroethane	Methylethylketone (2-butanone)
Bis(chloromethyl)ether	1,1,2,2-Tetrachloroethane	Methylisobutylketone
Bromodichloromethane	Tetrachloroethylene	Methylmethacrylate
Bromoform	Dichlorodifluoromethane	2-Methylnaphthalene
1,3-Butadiene	1,1-Dichloroethane	MTBE
Carbon disulfide	1,2-Dichloroethane	m-Xylene
Carbon tetrachloride	1,1-Dichloroethylene	Naphthalene
Chlordane	1,2-Dichloropropane	n-Butylbenzene
2-Chloro-1,3-butadiene (chloroprene)	1,3-Dichloropropene	Nitrobenzene
Chlorobenzene	Dieldrin	Toluene
1-Chlorobutane	Endosulfan	trans-1,2-Dichloroethylene
Chlorodibromomethane	Epichlorohydrin	1,1,2-Trichloro-1,2,2-trifluoroethane
Chlorodifluoromethane	Ethyl ether	1,2,4-Trichlorobenzene
Chloroethane (ethyl chloride)	Ethylacetate	1,1,2-Trichloroethane
Chloroform	Ethylbenzene	1,1,1-Trichloroethane
2-Chlorophenol	Ethylene oxide	Trichloroethylene
2-Chloropropane	Ethylmethacrylate	Trichlorofluoromethane
Chrysene	Fluorene	1,2,3-Trichloropropane
cis-1,2-Dichloroethylene	Furan	1,2,4-Trimethylbenzene
Crotonaldehyde (2-butenal)	Gamma-HCH (Lindane)	1,3,5-Trimethylbenzene
Cumene	Heptachlor	Vinyl acetate
DDE	Hexachloro-1,3-butadiene	Vinyl chloride (chloroethene)

Source: EPA 2002.