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**KWIGILLINGOK SITE RECONNAISSANCE
AND RECOMMENDATION REPORT
KWIGILLINGOK, ALASKA
FINAL**

Prepared for:

**ADEC Aboveground Storage Tank Program
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-5207**

Contract No. 18-5001-10

Prepared by:

**Bristol Environmental & Engineering Services Corporation
2000 W. International Airport Road, #C-1
Anchorage, Alaska 99502
(907) 563-0013**

Project No. 21069

January 2001

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NOTE: A video has been submitted as part of this report. The video format is MPEG compact disk.

1.0 INTRODUCTION

This document presents the results of a site reconnaissance performed at the village of Kwigillingok, Alaska. The site reconnaissance was performed by Bristol Environmental and Engineering Services, Incorporated (Bristol) at the request of the Alaska Department of Environmental Conservation (ADEC). ADEC had identified several bulk fuel facilities in this village. The potential exists for soil and groundwater contamination resulting from potential leaks or spills from these aboveground storage tank (AST's) or associated piping. Contamination may consist of diesel (heating fuel) or gasoline. Fuel leaks from piping and valves at various fuel facilities were identified in Kwigillingok during a 1998 site assessment.

The objective of this reconnaissance was to gather preliminary information on historic fuel releases and abandoned bulk oil storage sites. The results presented in this report are based on background information provided by ADEC, interviews, and a site visit from October 25 through October 27, 2000.

The information from the site reconnaissance is used to evaluate the potential for contamination at the site and to recommend any further site investigation that may be necessary. The recommendations are based on the condition of the site and the potential impact of the contamination. A site conceptual model was developed to evaluate the potential effect of the contamination on human health and the environment and to provide a basis for making recommendations for any further investigations.

2.0 PURPOSE

The purpose of the site reconnaissance at the village of Kwigillingok was to gather preliminary information on historic fuel releases and abandoned bulk oil storage sites. The information obtained during the reconnaissance is used to develop recommendations for any further site investigation.

As part of the information-gathering process, the following activities were performed:

- Conducted interviews with a local authority that would have knowledge of past spills and tank locations.
- Determined what heavy equipment, both village owned and privately owned, may be available on site, should it need to be used for remediation at the village.
- Sketched, videotaped and photographed all sites in the village where a reconnaissance was performed. Sites where reconnaissance was performed were then located on aerial photographs.
- Conducted sampling at sites identified by ADEC. At each site, sub-surface soil samples were collected using a hand auger, and field-screened for the presence of petroleum contaminants. If field observation or screening indicated the presence of contamination, at least one sample from that site (bulk fuel oil storage site, or piping location) was collected and submitted for laboratory analysis.

3.0 SITE FINDINGS

ADEC initially identified six bulk fuel facilities, and one additional private residential site to be evaluated during the site reconnaissance at Kwigillingok. As identified by ADEC, the six bulk fuel facility names and operators are:

Site 1 – Kwigillingok School, Lower Kuskokwim School District (LKSD)

Site 2 – Kwig Incorporated, Washeteria

Site 3 – Old BIA School, LKSD

Site 4 – Kwig Incorporated & Kwigillingok Village Council, Powerhouse and Retail Sales

Site 5 – Alaska Army National Guard, Armory

Site 6 – Kwig Incorporated, Storage

The owner and location of the one private residential site was not identified by ADEC. One additional site was identified in the field for reconnaissance.

The site reconnaissance was performed in Kwigillingok (Figure 1) on October 25, 26 and 27, 2000. At each of the Kwigillingok sites where a site reconnaissance was performed (Figure 2), photographs (Appendix A), field notes (Appendix B) and video were taken, soil samples were collected for field screening using a photo-ionization detector (PID) and potential laboratory analysis (Appendix C), and site sketches were drawn. The video taken from each site has been placed, in MPEG format, on a compact disk (CD) and is submitted as a separate attachment to this report. On the CD, a separate file has been made for each site where video was taken.

Soil samples were collected and initially analyzed as described in the approved work plan dated October 11, 2000, and titled *Final Site Reconnaissance Work Plan for the Villages of Tuntutuliak and Kwigillingok, Alaska*. Soil samples, as identified in their respective tables throughout this report, were re-analyzed for diesel-range organics (DRO) following silica-gel cleanup by the laboratory. Silica-gel cleanup is a laboratory method used to remove a portion of the biogenic material (peat, for instance) from the sample. The samples collected at Kwigillingok contained a relatively high amount of biogenic material, which could potentially cause the DRO results to be artificially high. Biogenic compounds are found in organic matter and plant oils, and can be produced as part of the natural decaying process. Conventional analysis does not differentiate between various forms of carbon. Consequently, the resulting DRO concentration estimates could include naturally occurring biogenic compounds that elute in the DRO range. While performing a silica-gel cleanup is able to remove some of the biogenic interference, it cannot remove all of the interference. Re-analyzing samples following silica-gel cleanup does, however, provide a more accurate and specific detection of petroleum contaminants in the sample.

Each of the sites identified by ADEC for reconnaissance, as well as the additional site identified in the field, is presented below. Conclusions and recommendations for each of these sites are in Section 4.

3.1 Site 1 – Kwigillingok School, LKSD

Site 1 will be referred to as the “school” throughout this report. Two ASTs are located at this site (photograph 1 and 2, Appendix A). These ASTs are the same two ASTs that were at the site during the 1998 site assessment. Using a hand auger, seven soil samples were collected for photo-ionization detector (PID) screening and potential submittal for laboratory analysis for DRO (method AK 102), benzene, toluene, ethylbenzene and xylenes (BTEX, method AK 101) and gasoline-range organics (GRO, method AK 101).

Samples were collected from up to three different 6-inch intervals, depending upon the estimated depth to groundwater. The location of the soil samples, as well as the PID results and depths of the samples are shown on Figure 3.

The following observations were made at the school tank farm:

- *Soil staining observed:* None.
- *Sheen on water observed:* None.
- *Soil description:* Peat was encountered from ground surface to the total depth of the boring. The exceptions are for boring locations 2 and 5. At location 2, peat was encountered to approximately 12 inches, then peat with gray silt from 12 inches to the bottom of the boring (18 inches). At location 5, a mixture of gravel, silt and sand, with some peat, was encountered from ground surface to the bottom of the boring (6 inches).
- *Depth to water table observed in soil borings:* Approximately 2 to 18 inches below ground surface.
- *Estimated direction of surface water and groundwater flow:* South, toward a nearby lagoon. Although the surface water and groundwater would generally be expected to flow southward, this direction may change because of the relatively flat topography and influence of seasonal flooding or rainfall.

The area surrounding the tank farm is marshy, with areas of standing water. The only area where firm ground was found is where the tanks are located.

PID readings from all boring locations were zero. The following table shows the depths of each boring:

BORING LOCATION	PID READING (units)	SOIL SAMPLE INTERVAL (inches)
1	0	0-6/6-12
2	0	0-6/6-12/12-18
3	0	0-6/6-12/12-18
4	0	0-6
5	0	0-6
6	0	0-6
7	0	0-6/6-12

Because no contamination was detected using the PID, and no visual signs of contamination were observed, no soil samples from this site were submitted for laboratory analysis.

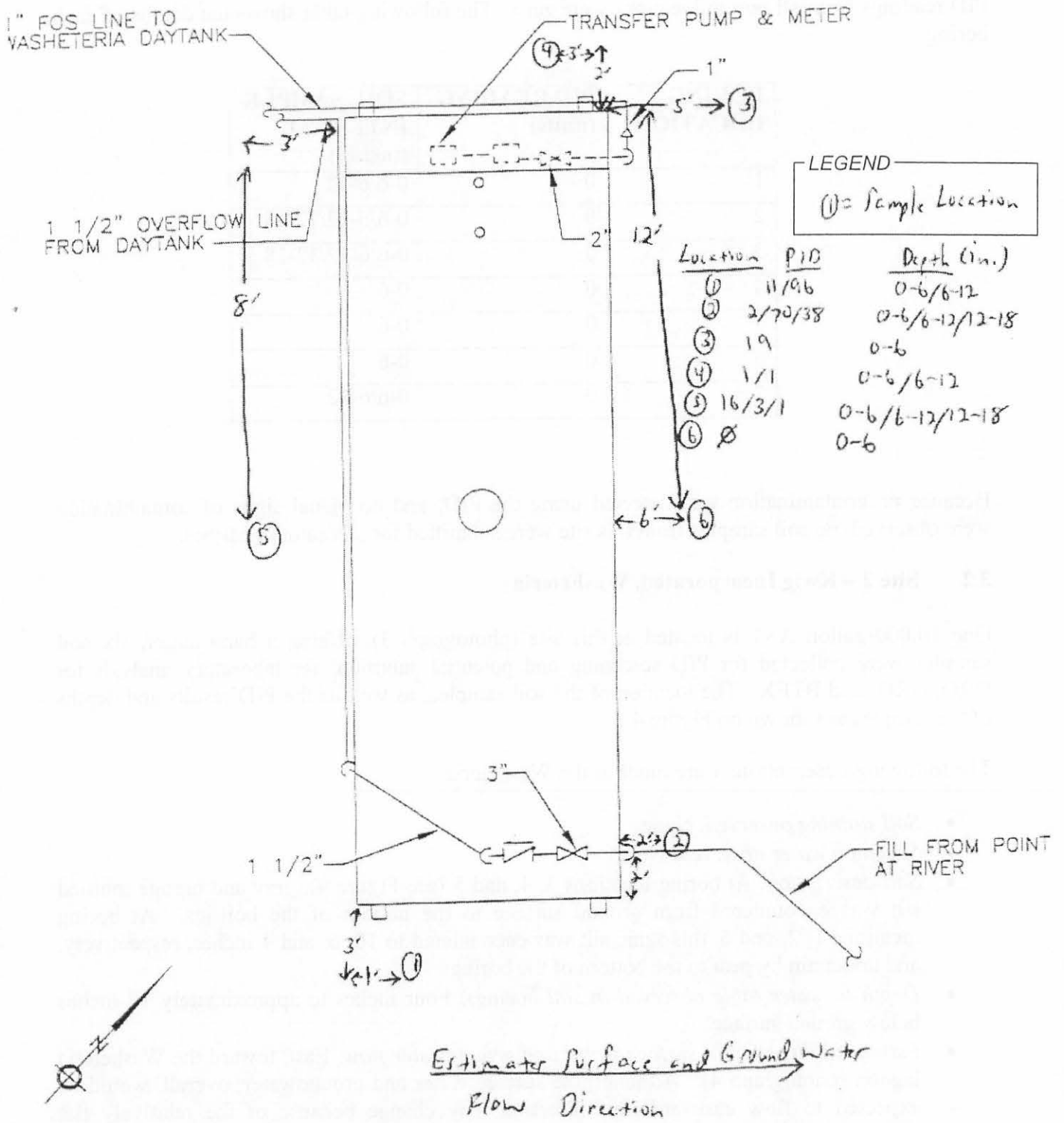
3.2 Site 2 – Kwig Incorporated, Washeteria

One 10,000-gallon AST is located at this site (photograph 3). Using a hand auger, six soil samples were collected for PID screening and potential submittal for laboratory analysis for DRO, GRO, and BTEX. The location of the soil samples, as well as the PID results and depths of the samples are shown on Figure 4.

The following observations were made at the Washeteria:

- *Soil staining observed:* None.
- *Sheen on water observed:* None.
- *Soil description:* At boring locations 3, 4, and 5 (see Figure 4), gray and orange mottled silt was encountered from ground surface to the bottom of the borings. At boring locations 1, 2, and 6, this same silt was encountered to 10, 6, and 4 inches, respectively, and underlain by peat to the bottom of the borings.
- *Depth to water table observed in soil borings:* Four inches to approximately 18 inches below ground surface.
- *Estimated direction of surface water and groundwater flow:* East, toward the Washeteria lagoon (photograph 4). Although the surface water and groundwater, overall, would be expected to flow eastward, this direction may change because of the relatively flat topography and influence of seasonal flooding or rainfall.

I:\Jobs\21069 ADEC-Kwigillingok Site Recon\Figures\Fig 4 - Site 2.dwg, Layout1, 01/15/01 11:05:29 AM



Modified from 1996 State of Alaska, Department of Community and Regional Affairs, Division of Enenergy figure. Not to Scale

BRISTOL Environmental & Engineering Services Corporation Contract No: 18-5001-10	Site 2 - Kwigillingok Incorporated, Washeteria - Field Drawing Kwigillingok, Alaska	Date: January 2001	Figure 4
		Drawn By: CJL Checked By: JSR	Project No: 21069

The area surrounding the tank farm is marshy, with areas of standing water. The only area where firm ground was found is the area where the tank and Washeteria building are located.

Soil samples were collected from six areas surrounding the tank. All soil samples were screened with a PID, and readings ranged from zero to 96 units. The soil sample with the PID reading of 96 units, collected from location number 1 at the southeast corner of the tank farm (Figure 4), was submitted to the laboratory for analysis. An identification of KSITE2-SL (Kwigillingok **SITE 2, SoIL**) was assigned to this sample. The soil sample collected from boring location 6 was analyzed in the field using a PetroFlag hydrocarbon test kit for soils. Results for this sample are given in units of parts per million (ppm), and are for total petroleum hydrocarbons (TPH). It should be noted that soils with a high concentration of organics, such as the case at this site, may result in false positives or sample results that are biased high when analyzed with the PetroFlag system. The same is true for DRO results obtained from the laboratory. PID readings, sample intervals, and their associated soil boring locations are shown on the following table:

BORING LOCATION	PID READING (units)	SOIL SAMPLE INTERVAL (inches)
1	11/96*	0-6/6-12
2	2/70/38	0-6/6-12/12-18
3	19	0-6
4	1/1	0-6/6-12
5	16/3/1	0-6/6-12/12-18
6	0	0-6

* Submitted for laboratory analysis

Analytical results for soil sample KSITE2-SL collected from the 6 to 12-inch interval from boring location 1, as well as the PetroFlag results for the 0 to 6-inch interval for boring location 6 are shown in the following table:

Boring Location	DRO (mg/kg)	GRO (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES (mg/kg)	TOTAL BTEX (mg/kg)	PETRO-FLAG, TPH (ppm)
1	392	19	ND (0.015)	ND (0.06)	ND (0.06)	0.255	0.255	na
1	212*	na	na	na	na	na	na	na
6	na	na	na	na	na	na	na	49

* = Results following silica-gel cleanup of sample and re-analysis

ND (0.015) = Not detected above quantification limit (quantification limit given)

na = Not applicable

According to Mr. Willie Atti, vice president of the local tribal council, most of the drinking water in the village is obtained from rainwater. The only other source of drinking water is the Washeteria, which obtains water from a lake located approximately two miles east of the Washeteria.

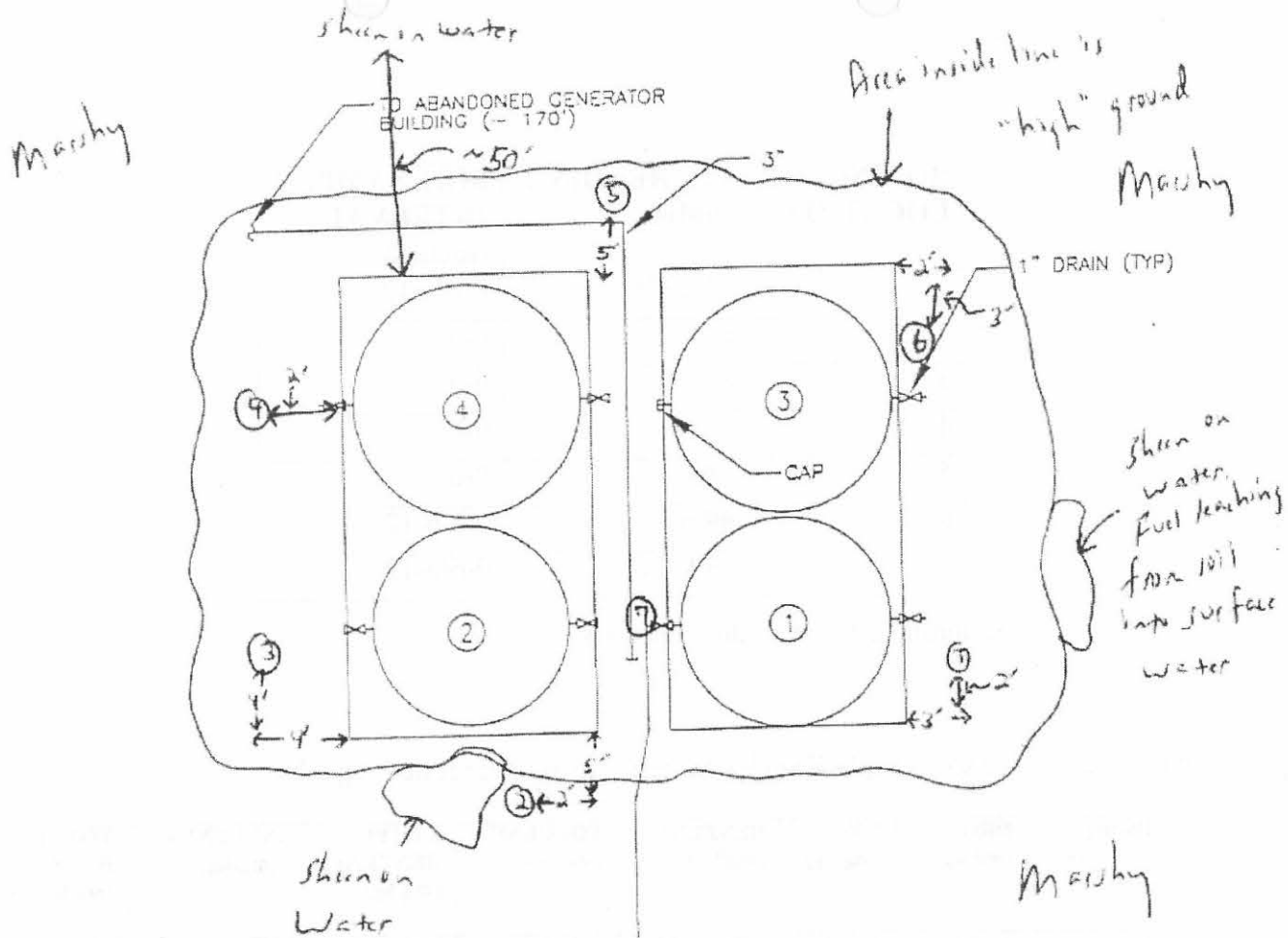
3.3 Site 3 – Old BIA School, LKSD

Four ASTs are located at this site (photograph 5). Using a hand auger, seven soil samples were collected for PID screening and potential submittal for laboratory analysis for DRO, GRO, and BTEX. The location of the soil samples, as well as the PID results and depths of the samples, are shown on Figure 5.

The following observations were made at the Old BIA School tank farm:

- *Soil staining observed:* The only area of firm ground observed at this site was the mound on which the tanks are located. The area surrounding this mound was marshy with standing water. Staining on the ground surrounding the tanks is extensive (photographs 5, 6, 7, and 8), and extends from the tanks to the mound/surface water interface. Staining was also extensive on the timber foundation, although this discoloration may be creosote from treating the wood.
- *Sheen on water observed:* A sheen was observed in several places on the surface water surrounding the tanks. The sheen was especially noticeable at the mound/surface water interface. At that location, the sheen could be seen from the interface extending in a direction outward from the mound (photograph 6 and 7), as the fuel appeared to be seeping into the surface water.
- *Soil description:* Peat was encountered from ground surface to the bottom of each boring.
- *Depth to water table observed in soil borings:* From ground surface to 12 inches.
- *Estimated direction of surface water and groundwater flow:* East, toward the Kwigillingok River, located approximately 400 feet from the tank farm (photograph 8). Although the surface water and groundwater would generally be expected to flow eastward, this direction may change because of the relatively flat topography and influence of seasonal flooding or rainfall.

Six soil samples were collected from six areas on the tank mound. All soil samples were screened with a PID, and readings ranged from 3 to 237 units. The soil sample with the PID reading of 237 units, collected from boring location number 1 at the southeast corner of the mound, was submitted to the laboratory for analysis. An identification of KSITE3-SL (Kwigillingok **SITE 3**, **SoiL**) was assigned to this sample. PID readings, sample intervals, and their associated soil boring locations are shown on the following table:



Marshy

Estimated Surface & Ground Water
Flow Direction →



LEGEND

① = Sample Location

Location	PID	Depth (in.)
①	91/237	0-6/6-12
②	6	0-6
③	83	0-6
④	3	0-6
⑤	28	0-6
⑥	49/61	0-6/6-12
⑦	39/122	0-6/6-12 FROM FILL POINT AT RIVER

Modified from 1996 State of Alaska, Department of
Community and Regional Affairs, Division of Energy figure.
Not to Scale

BRISTOL Environmental & Engineering Services Corporation Contract No: 18-5001-10	Site 3 - Old BIA School, LKSD - Field Drawing Kwigillingok, Alaska	Date:	Figure 5
		January 2001	
		Drawn By: CJL	Project No:
		Checked By: JSR	21069

BORING LOCATION	PID READING (units)	SOIL SAMPLE INTERVAL (inches)
1	91/237*	0-6/6-12
2	6	0-6
3	83	0-6
4	3	0-6
5	28	0-6
6	49/61	0-6/6-12
7	139/122	0-6/6-12

* Submitted for laboratory analysis

Analytical results for soil sample KSITE3-SL are shown in the following table:

Boring Location	DRO (mg/kg)	GRO (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES (mg/kg)	TOTAL BTEX (mg/kg)
1	16,700	1,810	ND (0.407)	ND (1.63)	5.36	25.82	31.18

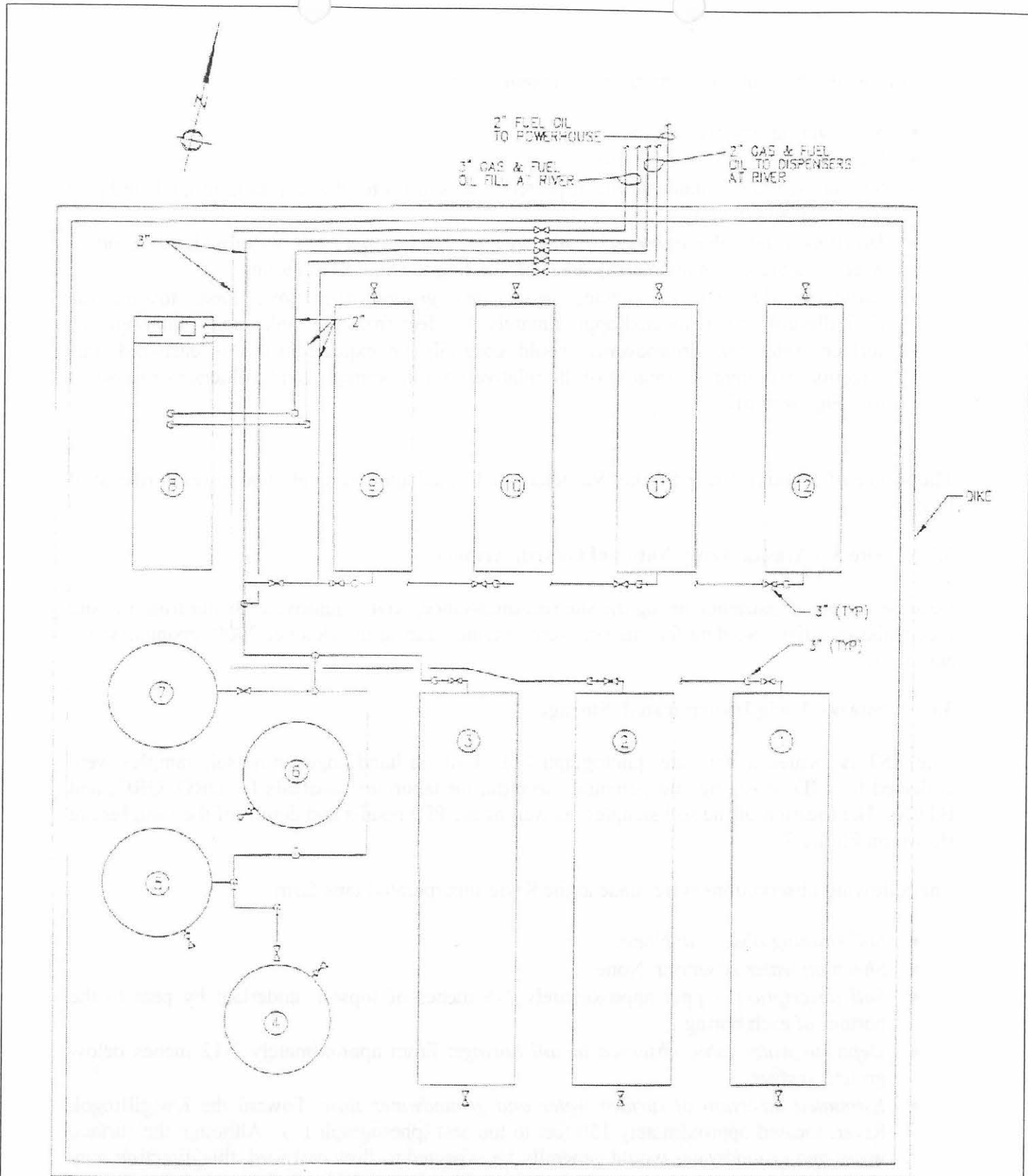
ND (0.407) = Not detected above quantification limit (quantification limit given)

The source of drinking water for the Washeteria is located approximately two miles northeast of this site.

3.4 Site 4 – Kwig Incorporated & Kwigillingok Village Council, Powerhouse and Retail Sales

This consolidated tank farm (see Figure 6) is new and consists of twelve ASTs ranging in capacity from 4,300 gallons to 23,500 gallons. The fuel is used for storage, supply, and dispensing of gasoline and diesel fuel to the village residents and to supply diesel for the powerhouse. Because of time constraints during the site reconnaissance and the age of the tank farm, ADEC did not require that soil samples be collected at this site. However, a visual site inspection was performed and video and photographs of the site were taken (photographs 9 and 10).

E:\Jobs\210669_ADEC-Kwigillingok Site Recon\Figures\Fig 6 - Site Layout.layout, 01/15/01 11:09:08 AM



Modified from 1996 State of Alaska, Department of
Community and Regional Affairs, Division of Energy figure.
Not to Scale

BRISTOL Environmental & Engineering Services Corporation Contract No: 18-5001-10	Site 4 - Kwigillingok Incorporated and Kwigillingok Village Council, Powerhouse and Retail Sales Kwigillingok, Alaska	Date: January 2001	Figure 6
		Drawn By: CJL Checked By: JSR	Project No: 21069

The following observations were made at the tank farm:

- *Soil staining observed:* None.
- *Sheen on water observed:* None.
- *Soil description:* Unknown, but suspected to be soil fill for the tank farm mound, and peat for the surrounding area.
- *Depth to water table observed in soil borings:* No borings were performed, but standing water was present in the marshy area surrounding the tank farm mound.
- *Estimated direction of surface water and groundwater flow:* East, toward the Kwigillingok River, located approximately 400 feet from the tank farm. Although the surface water and groundwater would generally be expected to flow eastward, this direction may change because of the relatively flat topography and influence of seasonal flooding or rainfall.

The source of drinking water for the Washeteria is located approximately two miles northeast of this site.

3.5 Site 5 – Alaska Army National Guard, Armory

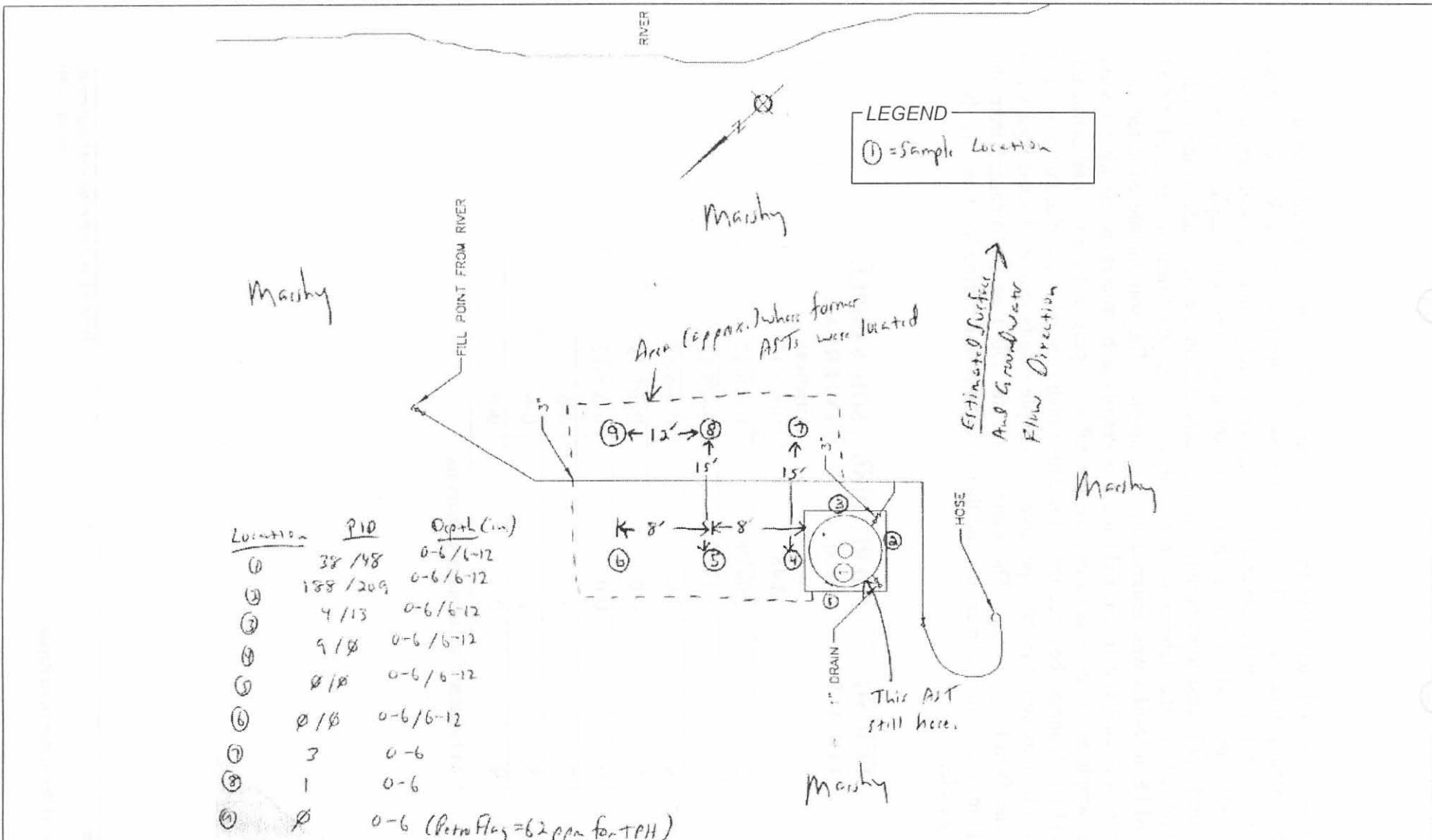
Because of time constraints during the site reconnaissance, ADEC removed the site from the site reconnaissance list. No data for this site were obtained during the October 2000 reconnaissance activities.

3.6 Site 6 – Kwig Incorporated, Storage

One AST is located at this site (photograph 11). Using a hand auger, nine soil samples were collected for PID screening and potential submittal for laboratory analysis for DRO, GRO, and BTEX. The location of the soil samples, as well as the PID results and depths of the samples are shown on Figure 7.

The following observations were made at the Kwig Incorporated tank farm:

- *Soil staining observed:* None.
- *Sheen on water observed:* None.
- *Soil description:* Upper approximately 1-6 inches of topsoil, underlain by peat to the bottom of each boring.
- *Depth to water table observed in soil borings:* From approximately 2-12 inches below ground surface.
- *Estimated direction of surface water and groundwater flow:* Toward the Kwigillingok River, located approximately 150 feet to the east (photograph 11). Although the surface water and groundwater would generally be expected to flow eastward, this direction may change because of the relatively flat topography and influence of seasonal flooding or rainfall.



Modified from 1996 State of Alaska, Department of Community and Regional Affairs, Division of Energy figure. Not to Scale

BRISTOL Environmental & Engineering Services Corporation Contract No: 18-5001-10	Site 6 - Kwigillingok Incorporated, Storage - Field Drawing Kwigillingok, Alaska	Date: January 2001	Figure 7
		Drawn By: CJL Checked By: JSR	Project No: 21069

Nine soil samples were collected from this site. The samples were collected from the area surrounding the existing tank, as well as the areas where the previous tanks were located (photograph 12), as evidenced by burlap and torn visqueen on the ground. All soil samples were screened with a PID, and readings ranged from 0 to 209 units. The soil sample with the PID reading of 209 units, collected from boring location number 2 on the west side of the existing tank, was submitted to the laboratory for analysis. An identification of KSITE6-SL (Kwigillingok **SITE 6, SoiL**) was assigned to this sample. The soil sample collected from boring location 6 was analyzed in the field using a PetroFlag hydrocarbon test kit for soils. Results for this sample are given in units of parts per million (ppm), and are for total petroleum hydrocarbons (TPH). It should be noted that soils with a high concentration of organics, such as the case at this site, may result in false positives or sample results that are biased high when analyzed with the PetroFlag system. The same is true for DRO results obtained from the laboratory. PID readings, sample intervals, and their associated soil boring locations are shown on the following table:

BORING LOCATION	PID READING (units)	SOIL SAMPLE INTERVAL (inches)
1	38/48	0-6/6-12
2	188/209*	0-6/6-12
3	4/13	0-6/6-12
4	9/0	0-6/6-12
5	0/0	0-6/6-12
6	0/0	0-6/6-12
7	3	0-6
8	1	0-6
9	0	0-6

* Submitted for laboratory analysis

Analytical results for soil sample KSITE6-SL collected from the 6 to 12-inch interval from boring location 2, as well as the PetroFlag results for the 0 to 6-inch interval for boring location 9 are shown in the following table:

Boring Location	DRO (mg/kg)	GRO (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES (mg/kg)	TOTAL BTEX (mg/kg)	PETRO-FLAG, TPH (ppm)
2	62,900	209	ND (0.102)	ND (0.407)	2.79	23.4	26.19	na
2	57,900*	na	na	na	na	na	na	na
9	na	Na	na	na	na	na	na	62

* = Results following silica-gel cleanup of sample and re-analysis

ND (0.102) = Not detected above quantification limit (quantification limit given)

na = Not applicable

The source of drinking water for the Washeteria is located approximately two miles northeast of this site.

3.7 Residential Site

The residential site identified by ADEC for site reconnaissance could not be located. Mr. Willie Atti, Vice President of the local tribal council, did not know of such a site in Kwigillingok.

3.8 Additional Reconnaissance Area (Pipeline spill)

A site reconnaissance was performed at one site not identified by ADEC. This site, located along the boardwalk approximately mid-way between the school and the Washeteria, was the site of a fuel pipeline spill (photograph 13).

During the time that the site reconnaissance was being performed at Kwigillingok, Mr. Willi Atti asked if the pipeline spill that occurred the previous year was going to be investigated during the reconnaissance activities. Following Mr. Atti's inquiry, ADEC was contacted and subsequently instructed that the site reconnaissance at the village include the pipeline spill.

According to information obtained from the ADEC Prevention and Emergency Response Program internet site, the Central Alaska Response Team (CART) was notified at 4:30 PM on Friday, September 10th, 1999, of an estimated 1,000-gallon diesel fuel spill from the pipeline leading to the Washeteria's 8,000-gallon fuel tank. Diesel fuel was delivered by river barge during the night of September 9th and apparently the fuel leaked from the pipeline while filling the fuel tank. The fuel soaked into nearby tundra and was contained in a low-lying area. Locals noticed the spill mid-day on September 10th and began immediate cleanup. A CART responder, stationed in Bethel, flew to the site September 15, 1999 to investigate the spill and determine the effectiveness of cleanup by local responders. A split in a pipeline flange at a connection caused the spill, presumably due to corrosion. Based on the Washeteria fuel tank readings before and after the barge delivery, the amount of fuel that was spilled was revised down from 1,000 gallons

to 384 gallons. Reportedly, 250 gallons were recovered and placed back into the tank. According to the report, the Kuskokwim River, located one-half mile away, was not threatened.

Under the Future Plans and Recommendations section of the report, the CART staff was to continue monitoring the cleanup through coordination with the responsible party (RP). It was stated that the RP planned to deactivate the pipeline and replace it.

Mr. Bob Dreyer, ADEC, was listed at the end of the report as the person to contact for additional information. Bristol contacted Mr. Dreyer on November 1, 2000, to inquire about the status of the cleanup. Mr. Dreyer stated that Mr. Bob Carlson of ADEC in Bethel traveled to the site twice to oversee cleanup and that ADEC considered the site cleaned.

On October 27, 2000, Bristol conducted a reconnaissance at the spill site. Using a hand auger, six soil samples were collected for PID screening and potential submittal for laboratory analysis for DRO, GRO, and BTEX. The location of the soil samples, as well as the PID results and depths of the samples are shown on Figure 8.

The following observations were made at the spill site:

- *Soil staining observed:* Extensive staining was observed throughout the spill area, especially in the low-lying areas north of the boardwalk (see Figure 8 and photograph 14). Staining was also visible south of the boardwalk, along the length of the section of pipeline that was replaced since the spill. Staining was not present on the areas of "high ground" in the area.
- *Sheen on water observed:* A sheen was not visible on the surface water. However, in low-lying areas of extensive staining of peat and/or grass where water was present, a sheen on the water surface was created when the peat or grass was pushed down into the water by hand.
- *Soil description:* Peat was encountered from ground surface to the bottom of each boring.
- *Depth to water table observed in soil borings:* From ground surface to approximately 6 inches below ground surface.
- *Estimated direction of surface water and groundwater flow:* North, toward the Washeteria lagoon (photograph 14).

Except for areas of high ground, the area was marshy with areas of standing water. Two booms were still in place downgradient from the source of the spill, between the source and the Washeteria lagoon (photograph 16). A 55-gallon drum marked "spill kit" (photographs 13 and 14) was still at the site and was approximately 2/3 full of what appeared to be fuel or fuel/water mixture from the cleanup efforts. Fuel odor was present throughout the area. On the south side of the boardwalk (photograph 15), an indentation was present on the ground from where the section of the old metal fuel line used to be. The new fuel line was seen adjacent to the old fuel line.

Soil samples were collected from six areas in the vicinity of the spill. All soil samples were screened with a PID, and readings ranged from 0 to 234 units. The soil sample with the PID reading of 234 units, collected from location number 5, was submitted to the laboratory for analysis. An identification of KSPILL-SL (**K**wigillingok **S**PILL, **S**oi**L**) was assigned to this sample. PID readings, sample intervals, and their associated soil boring locations are shown on the following table:

BORING LOCATION	PID READING (units)	SOIL SAMPLE INTERVAL (inches)
1	113	0-6
2	163	0-6
3	0	0-6
4	17	0-6
5	234*	0-6
6	109	0-6

* Submitted for laboratory analysis

Analytical results for soil sample KSPILL-SL collected from boring location 5 are shown in the following table:

Boring Location	DRO (mg/kg)	GRO (mg/kg)	BENZENE (mg/kg)	TOLUENE (mg/kg)	ETHYL-BENZENE (mg/kg)	XYLENES (mg/kg)	TOTAL BTEX (mg/kg)
5	90,700	480	ND (0.199)	1.91	1.58	22.9	26.39

ND (0.199) = Not detected above quantification limit (quantification limit given)

The source of drinking water for the Washeteria is located approximately two miles east of this site.

4.0 CONCLUSIONS AND RECOMMENDATIONS

For each site in this report where additional investigation is recommended, a preliminary site conceptual model is presented. The intent of this model is to show potential contaminant sources (e.g., soil, surface soil, surface water, groundwater) and receptors, such as vegetation or humans. These models are used to guide future investigative activities. For example, if contamination is suspected to be migrating from the source area (e.g., soil beneath leaking ASTs) into surface water where aquatic organisms such as fish may be affected, collection of surface water samples downgradient from the source area may be warranted. Based on the models presented in this report, general recommendations and rationale for future sample locations and media types are presented. Should ADEC determine that future investigative activities are warranted for a site, a detailed work plan showing proposed sample locations, media types, analytical methods and rationale will be developed.

Cleanup levels for the following sites are based on Method Two, Tables B1 and B2, from 18 AAC 75, as amended through October 28, 2000. Based on the fact that groundwater is not a current or potential future source of drinking water due to its salinity, the Method Two cleanup levels presented below are recommended. These levels are based on the Method Two, Under 40-Inch Zone ingestion pathway. Inhalation is not considered a primary exposure pathway due to the age climatic conditions at the site, including persistent, dispersive winds. The Method Two cleanup levels are:

- **GRO** – 1,400 mg/kg
- **DRO** – 10,250 mg/kg
- **Benzene** – 290 mg/kg
- **Toluene** – 20,300 mg/kg
- **Ethylbenzene** – 10,000 mg/kg
- **Xylenes** – 203,000 mg/kg

4.1 Site 1 – Kwigillingok School, LKSD

No signs of spills were visible at this site, and PID readings indicated no detectable fuel contamination in the soil surrounding the tank farm. No additional investigative activities are recommended at this site.

4.2 Site 2 – Kwig Incorporated, Washeteria

The highest PID reading of the six soil samples collected at this site was 96 units, and laboratory analysis of this sample indicates the presence of DRO, GRO, and xylenes at concentrations of 212 mg/kg (following silica-gel cleanup), 19 mg/kg and 0.255 mg/kg, respectively. No additional investigative activities are recommended at this site.

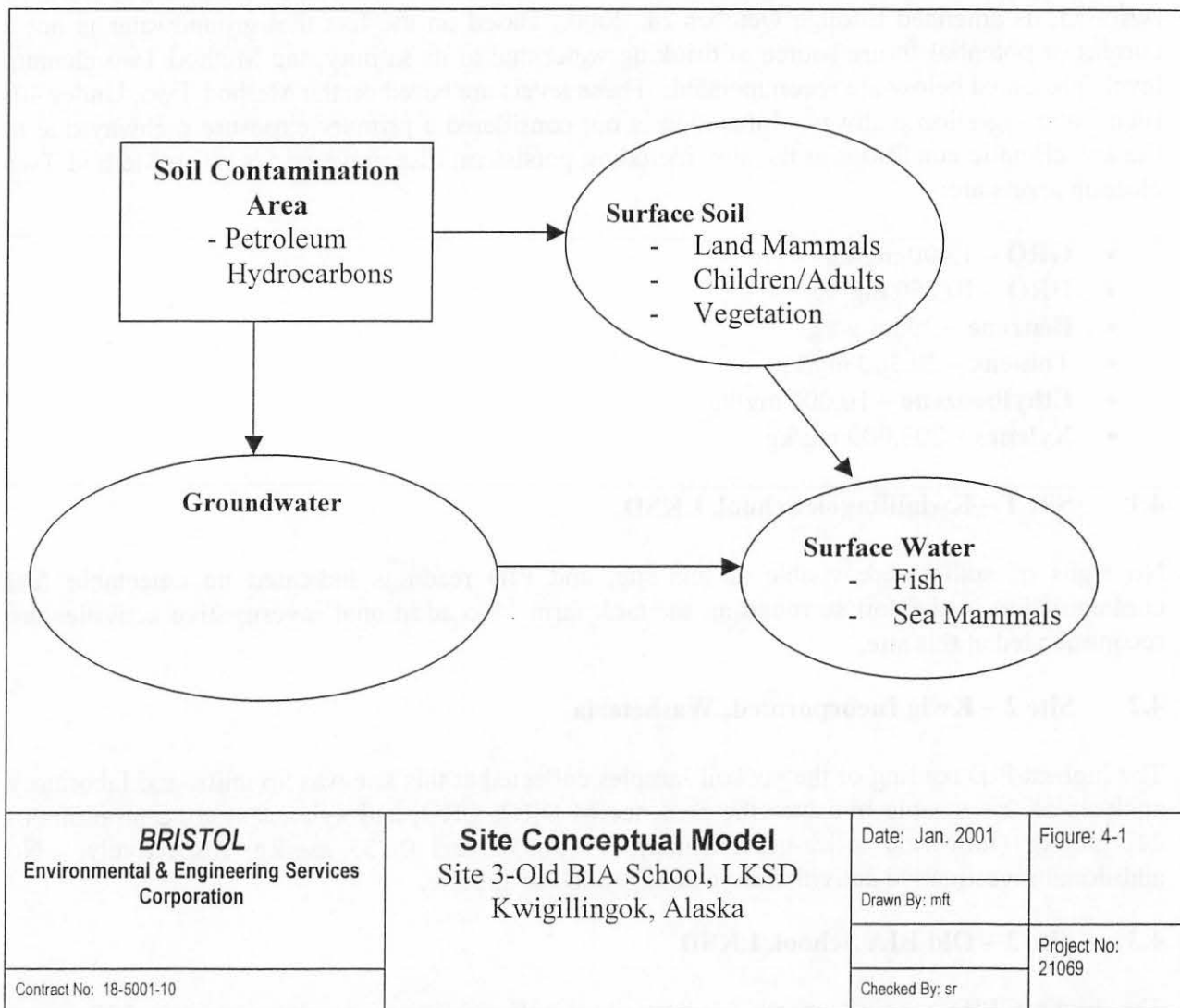
4.3 Site 3 – Old BIA School, LKSD

The highest PID reading of the seven soil samples collected at this site was 237 units. Laboratory analysis of this sample indicates the presence of DRO, GRO, ethylbenzene and

xylenes. Concentrations of DRO (16,700 mg/kg) and GRO (1,810 mg/kg) were detected at elevated concentrations and at concentrations exceeding the cleanup level for ingestion. The site was visibly stained with petroleum, and a sheen was visible on the surface water.

Given the concentration of contaminants detected in the soil sample, elevated PID readings, presence of soil staining and surface water sheen, and the proximity of the site to the Kwigillingok River, additional investigative activities are recommended at this site. These activities include collecting and analyzing groundwater, surface soil and surface water samples for DRO, GRO and BTEX. The location and rationale for collecting and analyzing these samples are presented in Table 4-1.

Based on data collected during the site reconnaissance, the conceptual model (Figure 4-1) showing potential contaminant sources and receptors has been developed.



Based on the site conceptual model shown above, the following types of samples, general sample locations and rationale, are presented:

Table 4-1

Sample Media	Location	Rationale
Groundwater	<ul style="list-style-type: none"> • Area surrounding suspected source area, especially between suspected source area and Kwigillingok River. 	<ul style="list-style-type: none"> • Groundwater possibly migrating to surface water surrounding tank farm.
Surface Soil	<ul style="list-style-type: none"> • On mounded area (high ground) of tank farm. 	<ul style="list-style-type: none"> • Contaminants possibly leaching from soil into groundwater and surface water.
	<ul style="list-style-type: none"> • Area surrounding tank farm. 	<ul style="list-style-type: none"> • Determine contaminant concentrations that potential receptors may be exposed to. • Define lateral extent of contamination for purpose of potential remedial activities.
Surface Water	<ul style="list-style-type: none"> • Downgradient from suspected source area. 	<ul style="list-style-type: none"> • Determine if contaminants are migrating toward Kwigillingok River.
	<ul style="list-style-type: none"> • Area surrounding tank farm. 	<ul style="list-style-type: none"> • Determine contaminant concentrations that potential receptors may be exposed to.
	<ul style="list-style-type: none"> • Kwigillingok River. 	<ul style="list-style-type: none"> • Determine contaminant concentrations that potential receptors may be exposed to.

4.4 Site 4 – Kwig Incorporated & Kwigillingok Village Council, Powerhouse and Retail Sales

No signs of spills were visible at this site, and no further investigation is recommended.

4.5 Site 5 – Alaska Army National Guard, Armory

ADEC removed this site from the list of sites to be visited. Therefore, no recommendations are appropriate for this report.

4.6 Site 6 – Kwig Incorporated, Storage

The highest PID reading of the seven soil samples collected at this site was 209 units. Laboratory analysis of this sample indicates the presence of DRO, GRO, ethylbenzene and xylenes. While concentrations of GRO, ethylbenzene and xylenes are relatively low, DRO (57,900 mg/kg following silica-gel cleanup) was detected at a concentration exceeding the cleanup level for ingestion.

Given the concentration of contaminants detected in the soil sample, elevated PID readings, and the proximity of the site to the Kwigillingok River, additional investigative activities are recommended at this site.

The site conceptual model (Figure 4-1) for Site 3 also applies to this site. Also applying to this site is the information in Table 4-1 for Site 3 showing the types of samples, general sample locations and rationale for recommended future sampling.

4.7 Residential Site

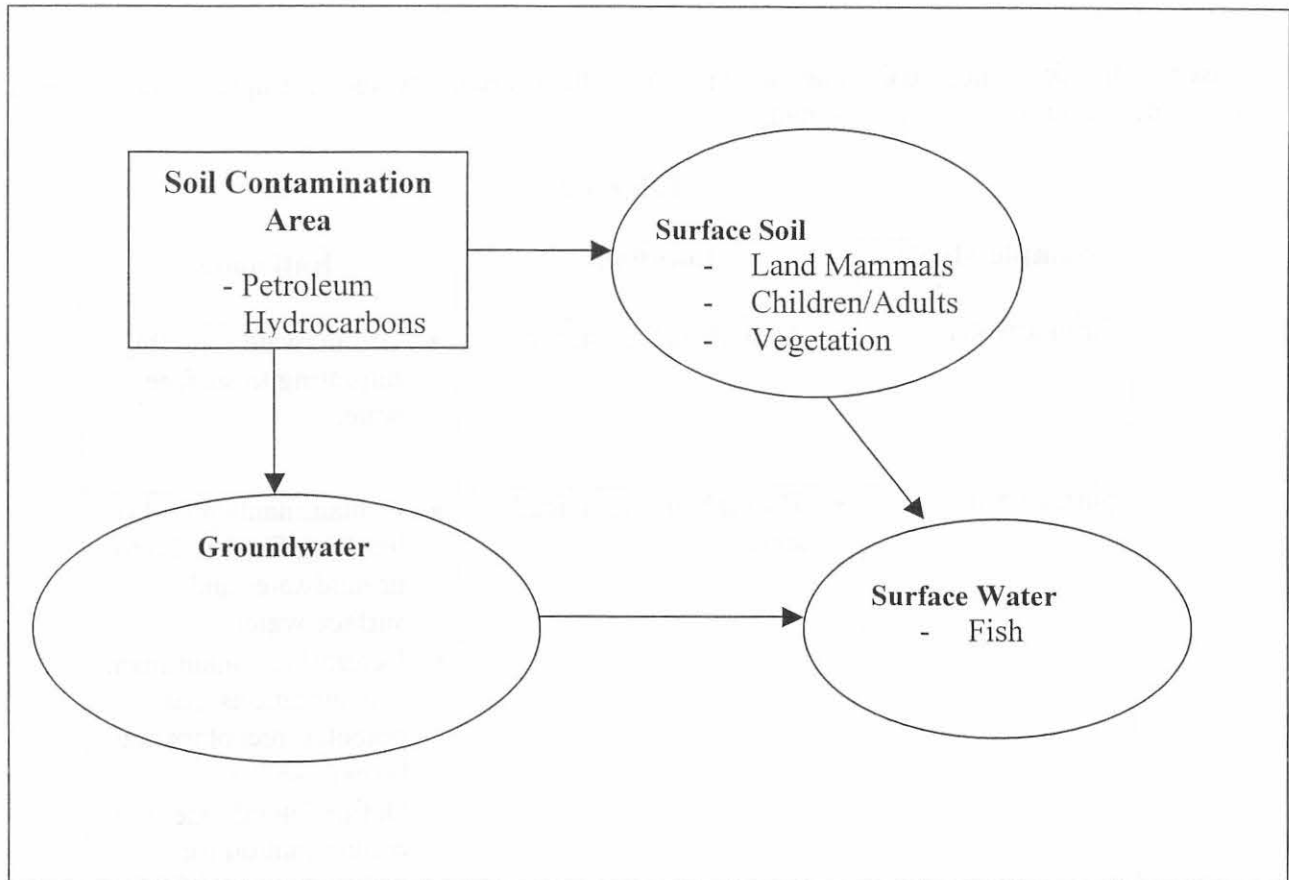
This site could not be identified or located. Therefore, no recommendations are appropriate for this report.

4.8 Additional Reconnaissance Area (Pipeline spill)

The highest PID reading of the seven soil samples collected at this site was 234. Laboratory analysis of this sample indicates the presence of DRO, GRO, toluene, ethylbenzene and xylenes. While concentrations of toluene, ethylbenzene and xylenes are relatively low, DRO (90,700 mg/kg) was detected at concentrations exceeding the cleanup level for ingestion. The site was visibly stained with petroleum.

Given the concentration of contaminants detected in the soil sample, elevated PID readings and the presence of soil staining, additional investigative activities are recommended at this site. These activities include collecting and analyzing groundwater, surface soil and surface water samples for DRO, GRO and BTEX. The location and rationale for collecting and analyzing these samples are presented in Table 4-2.

Based on data collected during the site reconnaissance, the conceptual model (Figure 4-2) showing potential contaminant sources and receptors has been developed.



BRISTOL Environmental & Engineering Services Corporation	Site Conceptual Model Pipeline Spill Kwigillingok, Alaska	Date: Jan. 2001	Figure: 4-2
		Drawn By: mft	
Contract No: 18-5001-10		Checked By: sr	Project No: 21071

Based on the site conceptual model shown above, the following types of samples, general sample locations and rationale, are presented:

Table 4-2

Sample Media	Location	Rationale
Groundwater	<ul style="list-style-type: none"> • Area of surface staining. 	<ul style="list-style-type: none"> • Groundwater possibly migrating to surface water.
Surface Soil	<ul style="list-style-type: none"> • Throughout the stained area. 	<ul style="list-style-type: none"> • Contaminants possibly leaching from soil into groundwater and surface water. • Determine contaminant concentrations that potential receptors may be exposed to. • Define lateral extent of contamination for purpose of potential remedial activities.
Surface Water	<ul style="list-style-type: none"> • Downgradient from source area. 	<ul style="list-style-type: none"> • Determine if contaminants are migrating toward Washeteria lagoon. • Determine contaminant concentrations that potential receptors may be exposed to.
	Kwigillingok River	<ul style="list-style-type: none"> • Determine contaminant concentrations that potential receptors may be exposed to.

APPENDIX A
SITE PHOTOGRAPHS



Village: Kwigillingok
ADEC Site Number: 1
Site Name: Kwigillingok School, LKSD
Direction: NW
Description: Two ASTs at the school's tank farm.

Photo 1



Village: Kwigillingok
ADEC Site Number: 1
Site Name: Kwigillingok School, LKSD
Direction: W
Description: South side of tank farm.

Photo 2



Village: Kwigillingok
ADEC Site Number: 2
Site Name: Kwig Incorporated, Washeteria
Direction: NE
Description: 10,000-gallon AST on east side of the Washeteria.

Photo 3



Village: Kwigillingok
ADEC Site Number: 2
Site Name: Kwig Incorporated, Washeteria
Direction: E
Description: North end of the AST. The Washeteria lagoon is in the background.

Photo 4



Village: Kwigillingok
ADEC Site Number: 3
Site Name: Old BIA School, LKSD
Direction: N

Photo 5

Description: Four ASTs at the tank farm. Note black staining surrounding the tanks. The Kwigillingok River is approximately 400 feet to the east (right).



Village: Kwigillingok
ADEC Site Number: 3
Site Name: Old BIA School, LKSD
Direction: W

Photo 6

Description: On the south side of the tanks. The plastic bag marks the location of auger location number 2. Note the sheen on the water along the right side of the photo where the water meets the tank farm mound.



Village: Kwigillingok
ADEC Site Number: 3
Site Name: Old BIA School, LKSD
Direction: N

Photo 7

Description: On the east side of the tanks. Note the black staining on the surface of the tank farm mound. A sheen can be seen on the water where the mound meets the water.



Village: Kwigillingok
ADEC Site Number: 3
Site Name: Old BIA School, LKSD
Direction: E

Photo 8

Description: On the south side of the tanks, looking toward the Kwigillingok River. Note the black staining near the tanks. A sheen is visible on the water adjacent to the tanks.



Village: Kwigillingok Photo 9
ADEC Site Number: 4
Site Name: Kwig Incorporated & Kwigillingok Village Council, Powerhouse
and Retail Sales
Direction: SE
Description: Tank farm. The Kwigillingok River is located approximately 400
feet east of the tank farm.



Village: Kwigillingok Photo 10
ADEC Site Number: 4
Site Name: Kwig Incorporated & Kwigillingok Village Council, Powerhouse and
Retail Sales
Direction: E
Description: The floor of the tank farm. No spills or leaks are visible.



Village: Kwigillingok
ADEC Site Number: 6
Site Name: Kwig Incorporated, Storage
Direction: E

Photo 11

Description: AST located on the south end of the former tank farm. The Kwigillingok River is seen approximately 150 feet beyond the tank.



Village: Kwigillingok
ADEC Site Number: 6
Site Name: Kwig Incorporated, Storage
Direction: S

Photo 12

Description: Three boring locations are marked with plastic bags. From foreground to background are boring locations 9, 8 and 7. The ground surface is covered with burlap and visqueen.



Village: Kwigillingok
Site Name: Pipeline Spill
Direction: SW

Photo 13

Description: The main area of the 1999 pipeline spill. Black surface staining is visible on both sides of the boardwalk. A spill kit drum is visible to the right of the boardwalk.



Village: Kwigillingok
Site Name: Pipeline Spill
Direction: W

Photo 14

Description: View from the boardwalk. The spill kit drum is visible on the left. The line running through the stained area is a water line. In the low-lying area of staining beyond and to the right of the drum that is on its side, a sheen on the water was created when the vegetation (mostly peat) was disturbed. The Washeteria lagoon is visible in the background.



Village: Kwigillingok
Site Name: Pipeline Spill
Direction: SW

Photo 15

Description: The former metal fuel pipeline is seen to the right of the new fuel pipeline. A depression can be seen where a section of the former pipeline was removed. Black surface staining is present throughout this low-lying area.

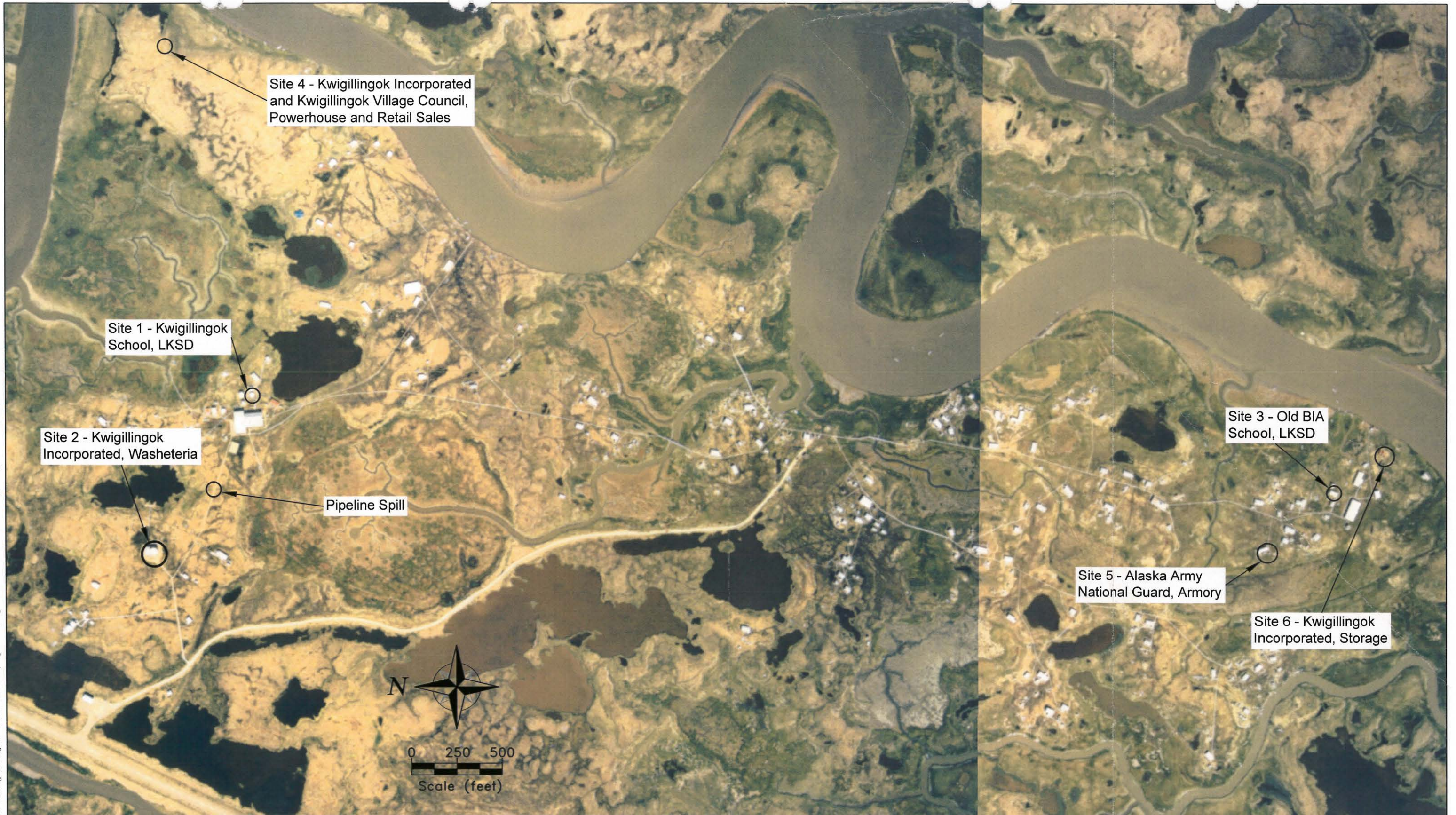


Village: Kwigillingok
Site Name: Pipeline Spill
Direction: NW

Photo 16

Description: Two booms (left and right of the drum) are still in place from the fuel recovery effort in 1999. This low-lying area leads to the Washeteria lagoon.

F:\Jobs\21069_ADEC-Kwigillingok Site Recon\Figures\Fig 2 - Aerial Photo.dwg, Layout1, 01/15/01 10:59:47 AM



BRISTOL
 Environmental & Engineering
 Services Corporation

Contract No: 18-5001-10

Specific Site Locations
 Kwigillingok, Alaska

Date:
 December 2000

Drawn By:
 CJL

Checked By:
 JSR

Figure 2

Project No:
 21069

APPENDIX B

FIELD NOTES

25 Oct. 00

1700 Arrive Kwig. No one needs me. Walk to village to find Willie Atti.

1730 Find Mr. Atti at store, I request Ywheeler contact village to very spread out and will take long time if have to walk & carry equipment to each site. Mr. Atti says can't take Ywheeler off boardwalk, so may not get to use one. Mr. Atti calls school to get me place to stay. No answer. Take me to get my gear at airstrip. Stop by school & find teacher, get room. Mr. Atti arrives at work at ~1600. Will see him tomorrow to discuss site location & transportation. End of day.

1830

26 Oct 00

0900 Call Dan Bedford to express concern of possibly not being able to finish site visits/sampling before Fri. (10/27) evening flight to Anchorage. I'm told no flights (Plan Air or GAA) to or from Kwig. on weekends. Concern is that sites are on opposite ends of village & need 4-wheeler to make better time. Tollyby Willis Atti that can't drive 4-wheeler to all places because can't drive off boardwalk, boardwalk ends (too narrow) before get to some sites. Dan will check to see if can get cheater out of Kwig, understand if have to. Call Lin back later.

1000 Talk to Mr. Atti. He wants site just on a gravel phone I have but not cell on radio for need of 4-wheeler rental for \$50/day. I walk to airstrip to see if rest of my gear (gear in from Tunti Atti in) Call Tunti. Should be in on tonight's flight. Also, Mr. Atti told me of pipeline

26 Oct-00

spill that they need to be investigated.
 I Call Dan Benfield. Tell him I probably would be able to get Y-wheeler. Also, that I will collect samples at pipeline spill, Dan says don't need to do rework at Army. Also, but at Site #4 (new tank farm) unless Mr. Atti knows of a spill there. Dan puts me in touch with Bethel APCC re: to work in possible checker out of here Saturday if can't finish work by Friday.
 1230 At Site #6 (New, Inc Storage) One vertical AST here.
 No visual signs of spills. Grassy, meadow.
 Collect soil samples from 9 locations (See Figure)
 Location Depth (in) PID
 1 0-6" / 6-12" 38 / 48
 2 0-6" / 6-12" 188 / 209 TO LAB
 3 0-6" / 6-12" 4 / 13 TO KJTE6-JL
 4 0-6" / 6-12" 9 / 16
 5 0-6" / 6-12" 8 / 16
 6 0-6" / 6-12" 8 / 16
 7 0-6" 3
 8 0-6" 1
 9 0-6" 0 (Petrolog = 62 ppm)

26 Oct-00

loc. 1
 Samples 1 through 4 surround the one remaining AST. Sample locations 5 through 9 where previous ASTs appear to have been, as evidenced by buckup dividers on ground & indications on ground.
 Camera #2. Photos 1-4 from loc. 1.
 Photos Direction Subject Time
 5 E AST 1345
 6 N-NE Sample location 5, old AST loc. 1347
 7 S Sample loc. 7, 8 & 9 1348
 8 NE Drainage for area 1350
 9 NE S. side of AST 1355
 Drainage appears to be toward the East toward river. Top 2-6" of ground is topsoil, underlain by peat. Groundwater from ~2 or so inches below ground surface in burials to approx. 12" bgs. Area around this will vary seasonally.
 SAMPLE TO LAB is from location 2, 6-12" depth. ID is KJTE6-JL
 Sample time = 1300 hrs site 6

26 Oct 00

At Old BIA school, SITE 3
 4 vertical ASTs on high ground, surrounded by marsh, standing water in most places. Severe (extensive) fuel staining on ground surrounding ASTs. Also, sheen on water in many places surrounding ASTs.
 Soil borings from 7 locations (see fig. next).

Location	Depth (in)	PID
1	0-6/6-12	91/237
2	0-6	TO LAB
3	0-6	TO KSITE3-SL
4	0-6	3
5	0-6	28
6	0-6/6-12	49/61
7	0-6/6-12	139/122

Diarrhage appears to be toward river to east. Peat from surface to groundwater probably deeper. Groundwater from surface to ~12" bgs in borings.
 SAMPLE TO Lab from location #1, 6-12" bgs. ID is KSITE3-SL.
 time 1430.

28 Oct 00

To Washeteria, approx. 1.2 miles from Old BIA school ASTs.
 At Washeteria

One horizontal AST in skids. No visible signs of leakage AST on slope that leads from Washeteria down to marshy area and beyond to washeteria legume to the east. Drainage to the east. Soil borings from 6 locations (see figure).

Location	Depth (in)	PID
1	0-6/6-12	11/96
2	0-6/6-12/12-18	70/38/18
3	0-6	TO LAB
4	0-6/6-12	TO LAB
5	0-6/6-12/12-18	16/3/1
6	0-6	∅ (Petroleum log = Y9)

All borings to groundwater. At location 3, 4, 5, silt from surface to bottom of boring. Silt is mottled gray to orange/brown. Location 1, 2 & 6 same silt to 10", 6", & 4", respectively, then silt beneath groundwater in borings from 4" to ~18" bgs.

26 Oct 00

Photos - note - Brown vld BBA SITE.

- Photo Direction Subject Time
- 10 N AST Pancake 1500
- 11 N " " 1500
- 12 N " " 1500
- 13 W S. side of tanks, west end. 1502
- Shen on surface water sample
- location #2 seen
- 14 N Up through middle of tanks, sample 1505
- location #7 in foreground
- 15 E Toward river, on south side of ASTs 1506
- 16 S Water on N. end of tanks, chain 1507
- 17 S East end. ~~1508~~
- 18 NN ~12' east of ASTs. Shen in water 1510
- 19185 Along E. end of tanks. Stained ground. 1502
- Shen in water

Wachetia Photos

- 20th NE AST 1715
- 21st E N. end of AST. Sea standing water. 1716
- Wachetia lagoon in background 1716
- 22nd N E. side of AST. Lagoon overnight (cutting photo) 1718
- 23rd N E. side, S. end sample location #2. 1718

26 Oct 00

Wachetia sample from location #1,
6-12" interval,
ID is KSITE-2-5L time 1700

1730 Remaining gear from Tuntalick arrives
at Lewis, airstrip.

1800 Over

1830 Run petrifilms on ~~at~~ Lewis Dns.
Storage, loc. 4. Sec p. 4 for results

Label, wrap samples collected today.

1930 End of day.

JK

27 Oct 00

0900 Talk to principal of school (Cathleen) about how I might move my equipment from school to airstrip for my departing flight this afternoon. She said she'll have a janitor move it for me. Have it ready by 4 PM. Pay here for lodging \$25/night, plus \$3 more (total \$53) because she didn't have enough change.

1000 Talk to Willie Atoti about pipeline spill, location of the site in village (residential) on ADFC's list that has the eleven storage tanks. Also, about any spills at the new tank farm (site #4).

PIPELINE

- 17 Spill in ~ June, 1999
- 2) Reported to State
- 3) Volume unknown to Mr Atoti, but William Itkerek of Kwig Power Co. may know. Mr Itkerek not in town now to ask.

27 Oct 00

Residential ADFC Site

Mr Atoti said he'd been thinking about who it could be, and said it must be in some other village.

Site #4 Spills

Mr Atoti said site is new, and he doesn't know of any spills.

He also said that the one remaining ADFC at Kwig Inic Storage (SITE #6) is empty and no longer used.

D cell Asner (ADFC in Bethel) to tell her I shouldn't need checks from Kwig to Bethel this weekend.

E cell Feb (CTE) to confirm hold times for samples. Minimum hold time is 2 wks, so bringing them in Monday will be fine.

1045 At the school tank farm.

1145 Light snow cover. Did a walk through of this site Oct. 26 and saw no signs of spills.

27 Oct 60

Soil borings from 7 locations (see fig.)

Location	Depth (in)	PIO
1	0-6/6-12	Ø/Ø
2	0-6/6-12/12-18	Ø/Ø/Ø
3	0-6/6-12/12-18	Ø/Ø/Ø
4	0-6	Ø
5	0-6	Ø
6	0-6	Ø
7	0-6/6-12	Ø/Ø

No samples to lab

Drainage direction appears to be toward the east.

Groundwater from (in borings) approx 2' to 18" below ground surface. Mostly steep where ground is raised for tank farm

Rest from surface (about 1" topsoil) to total depth, except location 2 & 5. At loc 2, gray silt w/ peat encountered at ~12" depth. At loc 5, mixture of gravel, silt & sand with some peat. Fill.

JK

27 Oct 60

Photo	Direction	Subject	Dates
2723	NW	ASTs	1200
2724	W	South of ASTs	1210
2725	S	Between ASTs, toward lagoon	1211
2726	W	N.E. corner of dike	1215

1300 At fuel pipeline spill site. Along boardwalk, between shaft & wastewater.

Extensive area of staining, especially in low-lying areas (see figure).

Soil borings from 6 locations.

Location Depth (in) PIO

1	0-6	113
2	0-6	163
3	0-6	Ø
4	0-6	17
5	0-6	234 ← To 1st. TO KSPILL-SE
6	0-6	109

Two burners still in place from last year's spill. Spill kit (w/ 35 gal of fuel) on site. Can seen south side of boardwalk where old iron pipe has been replaced. North of location 6, push on stained surface (peat in water) and

JK

27 Oct 00

27 Oct 00

create sheet on the staining water
 Fuel odor throughout area.
 Stained areas extend further east in
 along pipeline, but these areas not
 sampled (i.e. lateral extent not defined)
 Camera #3

Photo Direction Subject Time
 7 SE Overall photo 1505
 8 Tank farm floor. Clean 1507
 9 SW W side of tank farm 1508
 10 NW Overall photo 1510
 11 E Sight at tank farm 1515

Photo Direction Subject Time
 1 SW spill area. Sample loc. 1, 2, 3 on left. 1400
 2 NW spill area. Spill kit 1401
 3 SW Overall view 1402
 4 W Staining on east side. Sample loc. #6 1410
 5 W Two beams 1420
 6 W West end of old fuel line. 1422

Leave to park for de-mo
 Take more photos of pipeline spill site on way
 to airstrip. Snow has melted and now have
 better views of spill area.

Photo Direction Subject Time
 12 SW New piping left, spill kit on right. Black staining. 1630
 13 W Staining on north side of boardwalk. Water line, washeteria center background. 1630
 14 NW Staining on inside of boardwalk. See areas of "high ground" shown of fig. Washeteria again on right, background. 1630

Ground water from surface to ~ 6' in borings.
 Pent in all samples.
 1430 TO new tank farm (site #4).
 No samples to be collected. Only photo of
 sides, plus visual inspection

[Handwritten signature]

27 0400
1700 Leave on EPO Twin otter to
Bethel then Anchorage.
2130 Arrive Anchorage.
2200 End of day.

11

APPENDIX C

LABORATORY RESULTS



CT&E Environmental Services Inc.

Laboratory Division

Laboratory Analysis Report

200 W. Potter Drive
Anchorage, AK 99518-1605
Tel: (907) 562-2343
Fax: (907) 561-5301
Web: <http://www.cteesi.com>

Scott Ruth
Bristol Environmental
2000 W Intl Airport Rd, Ste C1
Anchorage, AK 995021117

Work Order: 1006763
Tunt & Kwig Recon.
Client: Bristol Environmental
Report Date: January 03, 2001

Enclosed are the analytical results associated with the above workorder.

As required by the state of Alaska and the USEPA, a formal Quality Assurance/Quality Control Program is maintained by CT&E. A copy of our Quality Control Manual that outlines this program is available at your request.

Except as specifically noted, all statements and data in this report are in conformance to the provisions set forth in our Quality Assurance Program Plan.

If you have any questions regarding this report or if we can be of any other assistance, please call your CT&E Project Manager at (907) 562-2343.

The following descriptors may be found on your report which will serve to further qualify the data.

- U Indicates the analyte was analyzed for but not detected.
- J Indicates an estimated value that falls below PQL, but is greater than the MDL.
- B Indicates the analyte is found in the blank associated with the sample.
- * The analyte has exceeded allowable limits.
- GT Greater Than
- D Secondary Dilution
- LT Less Than
- ! Surrogate out of range

SGS Member of the SGS Group (Societe Generale de Surveillance)

200 W. Potter Drive, Anchorage, AK 99518-1605 — Tel: (907) 562-2343 Fax: (907) 561-5301
3180 Peger Road, Fairbanks, AK 99709-5471 — Tel: (907) 474-8656 Fax: (907) 474-9685



CT&E Environmental Services Inc.

CT&E Ref.# 1006763008
 Client Name Bristol Environmental
 Project Name/# Tunt & Kwig Recon.
 Client Sample ID KSITE2-SL
 Matrix Soil/Solid
 Ordered By

Client PO#
 Printed Date/Time 12/19/2000 11:16
 Collected Date/Time 10/26/2000 17:00
 Received Date/Time 10/30/2000 12:45
 Technical Director Stephen C. Ede

Released By *Michael Rieley*

Sample Remarks:

DRO/RRO - Pattern consistent with weathered middle distillate.
 GRO/BTEX - Surrogate recovery is biased high due to matrix interference. Results not affected.
 Corrected Report: DRO Silica Gel added.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Solids								
Total Solids	73.9		%	SM20 2540G			10/31/00	JCO
Volatile Fuels Department								
Gasoline Range Organics	19.4	2.97	mg/Kg	AK101/8021B		10/26/00	11/07/00	MAF
Benzene	0.0149 U	0.0149	mg/Kg	AK101/8021B		10/26/00	11/07/00	MAH
Toluene	0.0595 U	0.0595	mg/Kg	AK101/8021B		10/26/00	11/07/00	MAH
Ethylbenzene	0.0595 U	0.0595	mg/Kg	AK101/8021B		10/26/00	11/07/00	MAH
P & M -Xylene	0.190	0.0595	mg/Kg	AK101/8021B		10/26/00	11/07/00	MAH
o-Xylene	0.0654	0.0595	mg/Kg	AK101/8021B		10/26/00	11/07/00	MAH
Surrogates								
1,4-Difluorobenzene <Surr>	82.5		%	AK101/8021B	60-120	10/26/00	11/07/00	MAH
4-Bromofluorobenzene <Surr>	171	!	%	AK101/8021B	50-150	10/26/00	11/07/00	MAH
Semivolatile Organic Fuels Department								
Diesel Range Organics	392	21.4	mg/Kg	AK102 DRO		10/31/00	11/01/00	MCM
DRO Silica Gel	212	158	mg/Kg	AK102 SILICA GEL		11/22/00	11/27/00	MCM
Surrogates								
5a Androstane <surr>	120		%	AK102 DRO	50-150	10/31/00	11/01/00	MCM
5a Androstane <surr>	87.5		%	AK102 SILICA GEL	50-150	11/22/00	11/27/00	MCM



CT&E Ref.# 1006763007
 Client Name Bristol Environmental
 Project Name/# Tunt & Kwig Recon.
 Client Sample ID KSITE3-SL
 Matrix Soil/Solid
 Ordered By

Client PO#
 Printed Date/Time 01/03/2001 13:32
 Collected Date/Time 10/26/2000 14:30
 Received Date/Time 10/30/2000 12:45
 Technical Director Stephen C. Ede

Released By *Michael Kelly*

Sample Remarks:

DRO/RRO - Pattern consistent with weathered middle distillate.
 GRO/BTEX - Surrogate recovery is biased high due to matrix interference. Results not affected.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Solids								
Total Solids	14.9		%	SM20 2540G			10/31/00	JCO
Volatile Fuels Department								
Gasoline Range Organics	1810	81.4	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Benzene	0.407 U	0.407	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Toluene	1.63 U	1.63	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Ethylbenzene	5.36	1.63	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
p- & m-Xylene	19.8	1.63	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
o-Xylene	6.02	1.63	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Surrogates								
1,4-Difluorobenzene <Surr>	90.8		%	AK101/8021B	60-120	10/26/00	11/08/00	MAH
4-Bromofluorobenzene <Surr>	1530	!	%	AK101/8021B	50-150	10/26/00	11/08/00	MAH
Semivolatile Organic Fuels Department								
Diesel Range Organics	16700	194	mg/Kg	AK102 DRO		10/31/00	11/01/00	MCM
Surrogates								
Androstane <surr>	114		%	AK102 DRO	50-150	10/31/00	11/01/00	MCM



CT&E Environmental Services Inc.

CT&E Ref.# 1006763006
 Client Name Bristol Environmental
 Project Name/# Tunt & Kwig Recon.
 Client Sample ID KSITE6-SL
 Matrix Soil/Solid
 Ordered By

Client PO#
 Printed Date/Time 12/19/2000 11:16
 Collected Date/Time 10/26/2000 13:00
 Received Date/Time 10/30/2000 12:45
 Technical Director Stephen C. Ede

Released By *Michael R. Riley*

Sample Remarks:

DRO/RRO - Pattern consistent with weathered middle distillate.
 DRO/RRO - Surrogate recoveries outside controls due to matrix interference and/or sample dilution.
 GRO/BTEX - Surrogate recovery is biased high due to matrix interference. Results not affected.
 Corrected Report: DRO Silica Gel added.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Solids								
Total Solids	24.3		%	SM20 2540G			10/31/00	JCC
Volatile Fuels Department								
Gasoline Range Organics	209	20.4	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Benzene	0.102 U	0.102	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Toluene	0.407 U	0.407	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Ethylbenzene	2.79	0.407	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
P & M -Xylene	11.7	0.407	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
o-Xylene	11.7	0.407	mg/Kg	AK101/8021B		10/26/00	11/08/00	MAH
Surrogates								
1,4-Difluorobenzene <Surr>	90.4		%	AK101/8021B	60-120	10/26/00	11/08/00	MAH
4-Bromofluorobenzene <Surr>	164	!	%	AK101/8021B	50-150	10/26/00	11/08/00	MAH
Semivolatile Organic Fuels Department								
Diesel Range Organics	62900	984	mg/Kg	AK102 DRO		10/31/00	11/02/00	MCM
DRO Silica Gel	57900	739	mg/Kg	AK102 SILICA GEL		11/22/00	11/27/00	MCM
Surrogates								
5a Androstane <surr>	937	!	%	AK102 DRO	50-150	10/31/00	11/02/00	MCM
5a Androstane <surr>	599	!	%	AK102 SILICA GEL	50-150	11/22/00	11/27/00	MCM



CT&E Ref.# 1006763009
 Client Name Bristol Environmental
 Project Name/# Tunt & Kwig Recon.
 Client Sample ID KSPILL-SL
 Matrix Soil/Solid
 Ordered By

Client PO#
 Printed Date/Time 01/03/2001 13:32
 Collected Date/Time 10/27/2000 13:45
 Received Date/Time 10/30/2000 12:45
 Technical Director Stephen C. Ede
 Released By *Michael R. Riedel*

Sample Remarks:

DRO/RRO - Pattern consistent with weathered middle distillate.
 GRO/BTEX - Surrogate recovery is biased high due to matrix interference. Results not affected.

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Solids								
Total Solids	9.25		%	SM20 2540G			10/31/00	JCO
Volatile Fuels Department								
Gasoline Range Organics	480	39.7	mg/Kg	AK101/8021B		10/27/00	11/07/00	MAH
Benzene	0.199 U	0.199	mg/Kg	AK101/8021B		10/27/00	11/07/00	MAH
Toluene	1.91	0.795	mg/Kg	AK101/8021B		10/27/00	11/07/00	MAH
Ethylbenzene	1.58	0.795	mg/Kg	AK101/8021B		10/27/00	11/07/00	MAH
p & m -Xylene	12.9	0.795	mg/Kg	AK101/8021B		10/27/00	11/07/00	MAH
o-Xylene	10.0	0.795	mg/Kg	AK101/8021B		10/27/00	11/07/00	MAH
Surrogates								
1,4-Difluorobenzene <Surr>	90		%	AK101/8021B	60-120	10/27/00	11/07/00	MAH
4-Bromofluorobenzene <Surr>	311	!	%	AK101/8021B	50-150	10/27/00	11/07/00	MAH
Semivolatile Organic Fuels Department								
Diesel Range Organics	90700	2070	mg/Kg	AK102 DRO		10/31/00	11/02/00	MCM
Surrogates								
Androstane <surr>	130		%	AK102 DRO	50-150	10/31/00	11/02/00	MCM



CT&E Ref.# 1006763010
 Client Name Bristol Environmental
 Project Name/# Tunt & Kwig Recon.
 Client Sample ID TB
 Matrix Soil/Solid
 Ordered By

Client PO#
 Printed Date/Time 01/03/2001 13:32
 Collected Date/Time
 Received Date/Time 10/30/2000 12:45
 Technical Director Stephen C. Ede

Released By *Michael R. Riley*

Sample Remarks:

Parameter	Results	PQL	Units	Method	Allowable Limits	Prep Date	Analysis Date	Init
Solids								
Total Solids	100		%	SM20 2540G			10/31/00	JC
Volatile Fuels Department								
Gasoline Range Organics	2.56 U	2.56	mg/Kg	AK101/8021B			11/07/00	MAH
Benzene	0.0128 U	0.0128	mg/Kg	AK101/8021B			11/07/00	MAH
Toluene	0.0511 U	0.0511	mg/Kg	AK101/8021B			11/07/00	MAH
Ethylbenzene	0.0511 U	0.0511	mg/Kg	AK101/8021B			11/07/00	MAH
P & M -Xylene	0.0511 U	0.0511	mg/Kg	AK101/8021B			11/07/00	MAH
o-Xylene	0.0511 U	0.0511	mg/Kg	AK101/8021B			11/07/00	MAH
Surrogates								
1,4-Difluorobenzene <Surr>	83.1		%	AK101/8021B	60-120		11/07/00	MAH
4-Bromofluorobenzene <Surr>	66.9		%	AK101/8021B	50-150		11/07/00	MAH



CT&E Environmental Services Inc.

SAMPLE RECEIPT FORM

1006763

CT&E WO#:

Due Date:

Received Date/Time:

Cooler Temperature:

Sample Condition:

Matrix of each Sample:

2 " "

" "

" "

2 Trip Blank MS/MSD

Additional Sample Remarks:

AK101s/ _____ 8260s field pres'd?

Field-filtered for dissolved _____?

Lab-filter for dissolved _____?

Ref Lab required? _____

Notes: _____

of each Container Received:

_____ 950 ml amber unpres'd

_____ 950 ml amber w/ HCl

_____ 500 ml amber w/ H2SO4

_____ 1L cubies unpres'd

_____ 1L cubies w/ HNO3

_____ 1L cubies w/ H2SO4

_____ 1L cubies w/ NaOH + ZnAc

_____ 120 ml coli bottles

_____ 60 ml Nalg

9 8 oz amber unpres'd

_____ 4 oz amber unpres'd

10 4 oz w/ septa w/ MeOH

_____ 40 ml vials w/ HCl

_____ Other (specify) _____

_____ Other (specify) _____

#/Log In Proofed by: Are 10/30/00

Yes

No

Are samples **RUSH**, priority, or *within 72 hrs* of **hold time**?

If yes, have you done *e-mail notification*?

Are samples *within 24 hrs* of **hold time** or **due date**?

If yes, have you *spoken with* Supervisor?

Are there any **problems** (e.g., ids, analyses)?

Were samples preserved correctly and pH verified?

Has Project Manager been notified of problems?

Is this an ACOE/AFCEE/ADEC project?

Will a **data package** be required?

If this is for PWS, provide **PWSID**.

Is there a **quote** for this project?

Will **courier** charges apply?

Completed by (sign): [Signature] (print): [Name]

*** The following *must* be completed for *all* ACOE & AFCEE projects: ***

Yes

No

Notes:

Is cooler temperature 4 + C?

thermometer used: _____

Was there an airbill, etc? note #:

Was cooler sealed with custody seals?

#/where? _____

Were seals intact upon arrival?

Was there a COC with cooler?

Was the COC filled out properly?

Did the COC indicate ACOE/AFCEE project?

Did the COC and samples correspond?

Were samples screened with Geiger counter?

Were all samples packed to prevent breakage?

packing material: _____

Were all samples unbroken and clearly labelled?

Were all samples sealed in separate plastic bags?

Were all bottles for volatiles free of headspace?

Were correct container/sample sizes submitted?

Was client notified of problems? (specify below)

Individual contacted: _____

Date & Time: _____ Phone/Fax #: _____

APPENDIX D

CHAIN-OF-CUSTODY SHEET

CHAIN OF CUSTODY RECORD

1006763



CT&E Environmental Services Inc.
 Laboratory Division

1 CLIENT: *Bristol Environmental*

CONTACT: *Slott & Ruth* PHONE NO: *907 563-0013*

PROJECT: *Tunt & Kwig Reconn.* SITE:

REPORTS TO: *Slott & Ruth* FAX NO: *907 563-6713*

INVOICE TO: *Slott & Ruth* P.O. NUMBER: *Slott &*

CT&E Reference: _____ PAGE *1* OF *1*

LAB NO.	SAMPLE IDENTIFICATION	DATE	TIME	MATRIX	CONTAINERS	SAMPLE TYPE	Preservatives Used	Analysis Required	REMARKS									
									C = COMP	G = GRAB								
1	TPPAST2-SL	10-24-00	1730	soil	2	G	1	1	<div style="position: absolute; top: 0; left: 0; width: 100%; height: 100%; pointer-events: none;"> DRO (AK102) GRAB (BTR) (AK101) </div>									
2	TW2-SL	10-24-00	1500	nil	2	G	1	1										
3	TPPTF8-SL	10-24-00	1600	soil	2	G	1	1										
4	TPPAST10-SL	10-24-00	1800	soil	2	G	1	1										
5	TRES4-SL	10-25-00	1430	soil	2	G	1	1										
6	KSITE6-SL	10-26-00	1300	soil	2	G	1	1										
7	KSITE3-SL	10-26-00	1430	soil	2	G	1	1										
8	KSITE2-SL	10-26-00	1700	soil	2	G	1	1										
9	KSPILL-SL	10-27-00	1345	soil	2	G	1	1										
10	TB (tip & tank)	NA	NA	NA	1		1	1										

5 Collected/Relinquished By: (1) *Slott & Ruth* Date *10/21/00* Time *1230* Received By:

Relinquished By: (2) Date _____ Time _____ Received By: _____

Relinquished By: (3) Date _____ Time _____ Received By: _____

Relinquished By: (4) Date *10/30/00* Time *1245* Received For Laboratory By: *[Signature]*

4 Shipping Carrier: _____ Samples Received Cold? (Circle) YES NO

Shipping Ticket No: _____ Temperature °C: *1.8*

Data Deliverables Required: _____ Chain of Custody Seal: (Circle) INTACT BROKEN ABSENT

Level I Level II Level III

Requested Turnaround Time and Special Instructions: _____

APPENDIX E

LIST OF LOCAL RESOURCES AND AUTHORITIES

LOCAL EQUIPMENT RESOURCES

According to Mr. Willie Atti, Vice President of the Kwigillingok Tribal Council, all operational heavy equipment (backhoes, loaders, etc.) in Kwigillingok are owned by Osborne Construction. Osborne Construction is currently working on a sewer project which is projected to be completed within the next two years. At the completion of the sewer project, the equipment will likely be removed from the village. It is not known at this time if any of the equipment would be available for use for projects (e.g. remediation) other than the current sewer project. The village owns a dozer and loader, but this equipment is not currently in operating condition

LOCAL AUTHORITIES

- 1) Willi Atti, Kwigillingok Traditional Council Vice President (907-588-8112)
- 2) William Igkurak, Kwig Power Company Manager (907-588-8626)
- 3) Oscar Evon, Tribal Administrator (907-588-8114)
- 4) Tommy Andrew, Village of Kwigillingok President (907-588-8114)

APPENDIX F

SUMMARY OF BILLABLE HOURS FOR PERSONNEL AND EQUIPMENT, EMPLOYEE TRAVEL

The following is a summary of billable field hours (includes travel time) for personnel and equipment rental:

Field hours for Bristol geologist: 26.5

Photoionization Detector: 2 days

Camcorder: 2 days

Hand Auger: 2 days

Global Positioning Satellite (GPS) Unit: 2 days

APPENDIX G

**TRANSCRIPTS OF MEETINGS WITH VILLAGE
AUTHORITIES**

25 Oct. 00

1700 Arrive Kwig. No one meets me. Walk to village to find Willie Atti.

1730 Find Mr. Atti at store. I request 4-wheeler rental since village is very spread out and will take long time if have to walk carry equipment to each site. Mr. Atti says can't take 4-wheelers off boardwalk, so may not get to use one. Mr. Atti calls school to get me place to stay. No answer. Take me to get my gear at airstrip. Stop by school & find teacher, get room. Mr. Atti arrives at work at 1800. Will see him tomorrow to discuss site location & transportation.

1830 5-0-0 day.

11

26 Oct. 00

0900 Call Dan Benfield to express concern of possibly not being able to finish site visits/sampling before Fri. (10/4/27) evening flight to Anchorage. I'm told no flights (Pina Air or EAA) to or from Kwig. on weekends. Concern is that sites are on opposite ends of village & need 4-wheeler to make better time. Tolly Willie Atti that can't drive 4-wheeler to all places because can't drive off boardwalk, boardwalk ends (too narrow) before get to some sites. Dan will check to see if can get charter out of Kwig, and let if have to. Call him back later.

1000 Talk to Mr. Atti. He needs site lease on a aerial photo I have. But out call on radio for need of 4-wheeler rental for 8-10 day. I walk to airstrip to see if rest of my gear can be in from Tent. Atti in call. Tent. Should be in on tonight's flight. Also, Mr. Atti told me of pipeline]

26 Oct 00

[spill that they need to be investigated.
I call Dan Benfield. Tell him I probably would be able to get 4 wheelers. Also, that will collect samples at pipeline spill. Dan says don't need to do recon at Army. Also, met at Site #4 (new tank farm) where Mr. Atti knows of a spill there. Dan puts me in touch with Bethel APCC re: to work in possible checker out of here Saturday if can't finish work by Friday.

1:30 At Site #6 (Kewy Inc. Storage)

One vertical AST here.

No visual signs of spills here, nearby.

Collect soil samples from 9 locations (See Figure)

Location Depth (in.) PID

1 0-6" / 6-12" 38 / 48

2 0-6" / 6-12" 188 / 209

3 0-6" / 6-12" 4 / 13

4 0-6" / 6-12" 9 / 0

5 0-6" / 6-12" 0 / 0

6 0-6" / 6-12" 0 / 0

7 0-6" 3

8 0-6" 1

9 0-6" 0 (Petrolog = 62 ppm)

TO LAB
TO KITE6-5L

26 Oct 00

loc. 1
Samples 1 through 4 surround the one remaining AST. Sample locations 5 through 9 where previous ASTs appear to have been, as evidenced by buckup disjunctures on ground & indentations on ground.
Camera #2. Photos 1-4 from that.

Photo Direction Subject

5 E AST time 1345

6 NNE Sample location 5, 6, old AST loc. 1347

7 S Sample loc. 7, 8, 9 1348

8 NE Drainage for area 1350

9 NE S. side of AST 1355

Drainage appears to be toward the East toward river. Top 2-6" of ground is topsoil, underlain by peat. Groundwater from ~2 or so inches below ground surface is brought to approx. 12" bgr. Area flooded, so this will vary seasonally.

MAPLET TO LAB is from location 2,

6-12" depth. ID is KSITE6-5L

Sample time = 1300

Kwis rated will

27 Oct 00

0900 Talk to principal of school (Kathleen) about how I might move my equipment from school to airstrip for my departing flight this afternoon. She said she'll have a janitor move it for me. Have it ready by 4 PM. Pay here for lodging, \$25/night, plus \$3 more (total \$53) because she didn't have enough change.

1000

Talk to Willie Atti about pipeline spill, location of the site in village (residential) on ADCC's list that has the eleven storage tanks. Also, about any spills at the new tank farm (site #4).

PIPELINE

- 1) Spill in ~ June, 1989
- 2) Reported to State
- 3) Volume unknown to Mr. Atti, but William Itkarak of Kwig Power Co. may know. Mr. Itkarak not in town now to ask.

27 Oct 00

Residential ADCC Site

Mr. Atti said he'd been thinking about who it could be, and said it must be in some other village.

Site #4 Spills

Mr. Atti said site is new, and he doesn't know of any spills.

He also said that the one remaining ADCC at Kwig Inc Storage (SIH#6) is empty and no longer used.

I call Agnes (ADCC in Bethel) to tell her I shouldn't need checker from Kwig. to Bethel this weekend.

I call Lab (CTE) to confirm hold times for samples. Minimum hold time is 2 wks, so bringing them in Monday will be fine.

1045 At the school tank farm.

Light snow cover. Did a walk through of this site Oct. 26 and saw no signs of spills.

APPENDIX H

SUMMARY OF INJURIES, ACCIDENTS AND INCIDENTS

Number of Injuries Sustained: 0
Number of Accidents: 0
Number of Incidents: 0
Number of Lost Time Accidents: 0