

October 21, 2019

Janine Boyette  
Alyeska Pipeline Service Company  
R&R Subject Matter Expert  
PO Box 196660  
3700 Centerpoint Drive  
MS507  
Anchorage, Alaska 99519-6660

**Re: PS04 Deadleg Excavation Site Conceptual Site Model**

Dear Ms. Boyette,

This memorandum provides a Conceptual Site Model (CSM) for Alyeska Pipeline Service Company's (APSC's) Pump Station 4 (PS04) Deadleg Excavation site requested by the Alaska Department of Environmental Conservation (ADEC). The CSM was developed to qualitatively assess the risk to human and ecological receptors from petroleum hydrocarbons documented to be present along the deadleg pipe in shot rock fill immediately north of the Manifold Building hallway at PS04.

The purpose of this work is to develop a CSM to evaluate sources, exposure routes, and potential human and ecological receptors to petroleum hydrocarbon impact associated with the PS04 1993 deadleg pipe excavation. Development of the CSM was consistent with Alaska Department of Environmental Conservation's (ADEC's) *Guidance on Developing Conceptual Site Models*, January 2017 (ADEC, 2017). An ADEC eco-scoping form was completed for the site to evaluate whether a full ecological CSM was warranted.

**SITE SETTING AND LITHOLOGY**

PS04 is located 0.5 miles off the Dalton Highway, 144 miles south of Prudhoe Bay, at the base of the northern slope of the Brooks Range (Figure 1). The Pump Station is situated at the south end of a north-south oriented valley, bounded by the Brooks Range to the south and associated foothills to the east and west. PS04 is positioned on top of an elevated knoll with the topography in the immediate vicinity relatively flat in all directions (Figure 2). The deadleg pipe excavation was located at north eastern corner of the manifold building, approximately 200 feet (ft) from the Permanent Living Quarters building (Figure 3).

The pump station was constructed on a prominent rock outcrop that was blasted and leveled during pipeline construction. The bedrock is generally within 1 foot of the ground surface at the station with the exception of the main pipe corridor, which was blasted-out and filled with sand and gravel. Limestone bedrock was encountered at a depth of 1 to 12 feet below ground surface during the fuel island closure investigation completed in 1991 (American North, 1992). The terrain surrounding PS04 consists of localized pothole type lakes and permafrost and tundra features (EMCON, 1997).

Suprapermafrost groundwater or meltwater was encountered at approximately 11 ft bgs at the silty sand and gravel bedrock interface, during previous site activities in 1991 near the mainline pipe. The source of groundwater recharge is unknown; though it is likely the aquifer is perched on the bedrock surface because the pump station rises above the surrounding topography. The direction of groundwater flow beneath PS04 is unknown (EMCON, 1997).

## **SITE BACKGROUND AND PRIOR INVESTIGATIONS**

In August 1993 during a corrosion investigation excavation of the dead leg pipe at PS04, crude oil staining was noted in shot rock fill and on accumulated groundwater at the base of a 12-foot deep excavation north of the manifold building (Figure 3). On August 31, 1993, one water sample, EWS-1, was collected in duplicate from the base of the excavation for analysis of benzene, toluene, ethylbenzene, total xylenes, and total petroleum hydrocarbons. Benzene concentrations were 0.0033 milligrams per liter (mg/L) in the primary sample and 0.0030 mg/L in the duplicate. Both results were below ADEC cleanup levels. Total petroleum hydrocarbon concentrations ranged from 119 mg/L in EWS-1 to 271 mg/L in the duplicate quality control sample. Soil samples were not collected due to the size of the fractured rock media used as fill. The source of the contamination was suspected to be a May 5, 1984 spill of 210-gallons of crude oil due to an O-ring failure on the pig launcher in the Manifold Building. Based on the findings, further investigation work at this site was planned for 1994 (EMCON, 1993).

A search of the ADEC Contaminated Sites database under File Number 330.38.020 indicated that further investigation work had not been conducted and the site has remained dormant since 1993 (ADEC, 2019).

## **CSM DEVELOPMENT**

This CSM was developed to qualitatively assess the risk to human receptors from petroleum hydrocarbons in soil and suprapermafrost groundwater at the PS04 Deadleg Excavation site. This CSM is based upon site observations and groundwater data collected in 1993 and current Site conditions. The CSM describes the potential exposure scenarios for current and future site receptors; and was prepared in accordance with the ADEC *Guidance on Developing Conceptual Site Models* (ADEC, 2017) using the ADEC Human Health Conceptual Site Model Scoping Form, which is included as Appendix A. The ADEC Human Health Conceptual Site Model Graphic Form was used to summarize the results of the checklist and is included as Appendix B. An ADEC Ecoscoping Form was completed using the ADEC Ecoscoping Guidance to evaluate whether development of a full ecological CSM was warranted (ADEC, 2014). The Ecoscoping Form is included as Appendix C.

## **IMPACTED MEDIA**

Impacted media at the site is the environmental substance with which a contaminant is in contact (ADEC, 2017). Analytical results from 1993 were reviewed in order to determine what media have been impacted as a result of Site activities. Limited data are available from 1993 as the original response only included sampling of suprapermafrost groundwater at the base of an excavation. Soils could not be sampled due to the size of the shot-rock fill matrix. Visual staining observed on fill at the base of the excavation, approximately 12-feet below ground surface, indicated fill had been, or was, in contact with crude oil. For the purpose of developing this CSM, contaminant concentrations are assumed to be unchanged since the

time the samples were collected. Analytical data used to support this CSM are presented in the Background Section of this report.

### **Surface Water**

The nearest permanent surface water bodies are pothole lakes and the Atigun River, which are approximately 0.2 miles and 0.6 miles from the Site, respectively. For this CSM, surface water is not considered an impacted medium.

No surface water samples have been collected from the Site.

### **Sediment**

A direct discharge from the Site would not directly affect sediment associated with the nearest permanent surface water. Therefore, for this CSM, sediment is not considered an impacted medium.

No sediment samples have been collected from this Site.

## **TRANSPORT MECHANISMS AND EXPOSURE MEDIA**

Three transport mechanisms were identified as possible, resulting in the identification of three exposure media. The exposure media for this site include soil, ground water (suprapermafrost meltwater), and air. Possible transport mechanisms and exposure media are depicted on the ADEC Human Health Conceptual Site Model Graphic Form (Appendix B).

## **EXPOSURE PATHWAYS**

Each potential exposure pathway was evaluated using the ADEC Human Health Conceptual Site Model Scoping Form (Appendix A). Based on this evaluation, four potentially complete exposure pathways were identified. These pathways include incidental soil ingestion, dermal absorption of contaminants from soil, inhalation of outdoor air, and inhalation of indoor air. The determination of complete or incomplete exposure pathways is explained in the following sections.

### **Complete or Potentially Complete Exposure Pathways**

The direct contact exposure pathway via incidental soil ingestion is considered complete because soil contamination is present to a depth of 15 feet bgs. The Site is currently used by human receptors and is expected to be used by human receptors in the future. The significance of this pathway reduced due to on-site excavation controls and site access controls present at the PS04 facility.

The dermal absorption of contaminants from soil pathway is considered complete because soil contamination is present to a depth of 15 feet bgs and crude oil is comprised of compounds evaluated for dermal exposure. The Site is currently used by human receptors and is expected to be used by human receptors in the future. The significance of this pathway reduced due to on-site excavation controls and site access controls present at the PS04 facility.

The inhalation of outdoor air exposure pathway is considered complete because of the presence of volatile contaminants in soil between 0 feet and 15 feet bgs and the current and future use of the site by human receptors. Volatile contaminants that make this a complete exposure pathway include BTEX. The significance of this pathway reduced due to the depth of contamination and BTEX concentrations below 18 AAC 75, Table C, cleanup levels in suprapermafrost meltwater samples collected in 1993.

The inhalation of indoor air exposure pathway is considered complete due to the presence of occupied buildings on the Site, and because volatile contaminants are present in the soil. The presence BTEX in soil makes this a complete exposure pathway. The significance of this pathway reduced due to the depth of contamination and BTEX concentrations below 18 AAC 75, Table C, cleanup levels in suprapermafrost meltwater samples collected in 1993.

### **Incomplete Exposure Pathways**

The remaining exposure pathways were determined to be incomplete based on site-specific data, features, or other pertinent information in accordance with the ADEC Human Health Conceptual Site Model Scoping Form (Appendix A). These remaining pathways are discussed briefly below.

The ingestion of groundwater pathway is considered incomplete because the suprapermafrost meltwater at the Site is not used as a drinking water source. The site is located on a bedrock knoll with only a thin layer of suprapermafrost groundwater found above the bedrock. The drinking water well at PS04 is located over 2,000 feet west of the pump station adjacent to a tundra pond. The well was advanced through 100 feet of permafrost soil before encountering a producing aquifer used as a drinking water source (PS04 drinking water well log – Appendix D).

The ingestion of surface water pathway is not complete because the nearest permanent surface water is 0.2 miles away and is not expected to have been impacted by Site activities. In addition, surface water is not used as a source of drinking water.

The ingestion of wild foods pathway is not complete because the Site is industrial with controlled access and not expected to be used for hunting, fishing, or harvesting of wild food. Nearby undeveloped areas are not expected to have been impacted by Site activities.

The following pathways are not considered complete; dermal absorption of contaminants in ground water and surface water, and the inhalation of volatile compounds in tap water.

The inhalation of fugitive dust is not complete because ADEC Method Two soil cleanup levels are protective of this pathway for Site contaminants and near-surface soils are not contaminated.

The direct contact with sediment pathway is not considered complete because the nearest sediments are not expected to be impacted and no known activities would result in exposure via this pathway.

## CURRENT AND FUTURE RECEPTORS

The Site is currently industrial and, as such, the following human receptors are considered to be potentially exposed to site contaminants (both currently and in the future):

- Commercial or industrial workers,
- Site visitors, and
- Construction workers.

## ECOSCOPIING FORM COMPLETION

Appendix C presents the completed Ecoscoping Form for the site. No terrestrial or aquatic exposure routes were identified as complete and no further ecological evaluation was necessary.

## CONCLUSIONS

The findings of the human health CSM indicate that there are exposure pathways to potential receptors, which include: commercial/industrial workers, construction workers, and site visitors. The four exposure pathways are: 1) incidental soil ingestion, 2) dermal absorption of contaminants from soil, 3) inhalation of outdoor air, and 4) inhalation of indoor air.

The incidental soil ingestion and dermal absorption of contaminants from soil pathways are mitigated by Site access controls, the work permitting process, and protective clothing required by APSC personnel if onsite work could result in contact with contaminated soil. The inhalation of outdoor air and indoor air pathways, while complete, are viewed as insignificant due to the depth of contamination and low concentrations of VOCs, below 18 AAC 75, Table C, cleanup levels, found in suprapermafrost meltwater.

No terrestrial or aquatic exposure routes were identified and development of an Ecological CSM was not warranted.

Please call if you have any questions regarding this work.

Sincerely,

**SLR International Corporation**



Carl Benson  
Principal Scientist



for Scott Rose  
Principal Geologist

## References

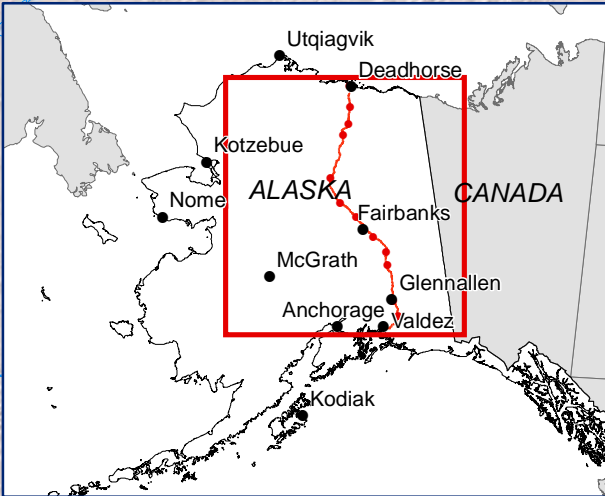
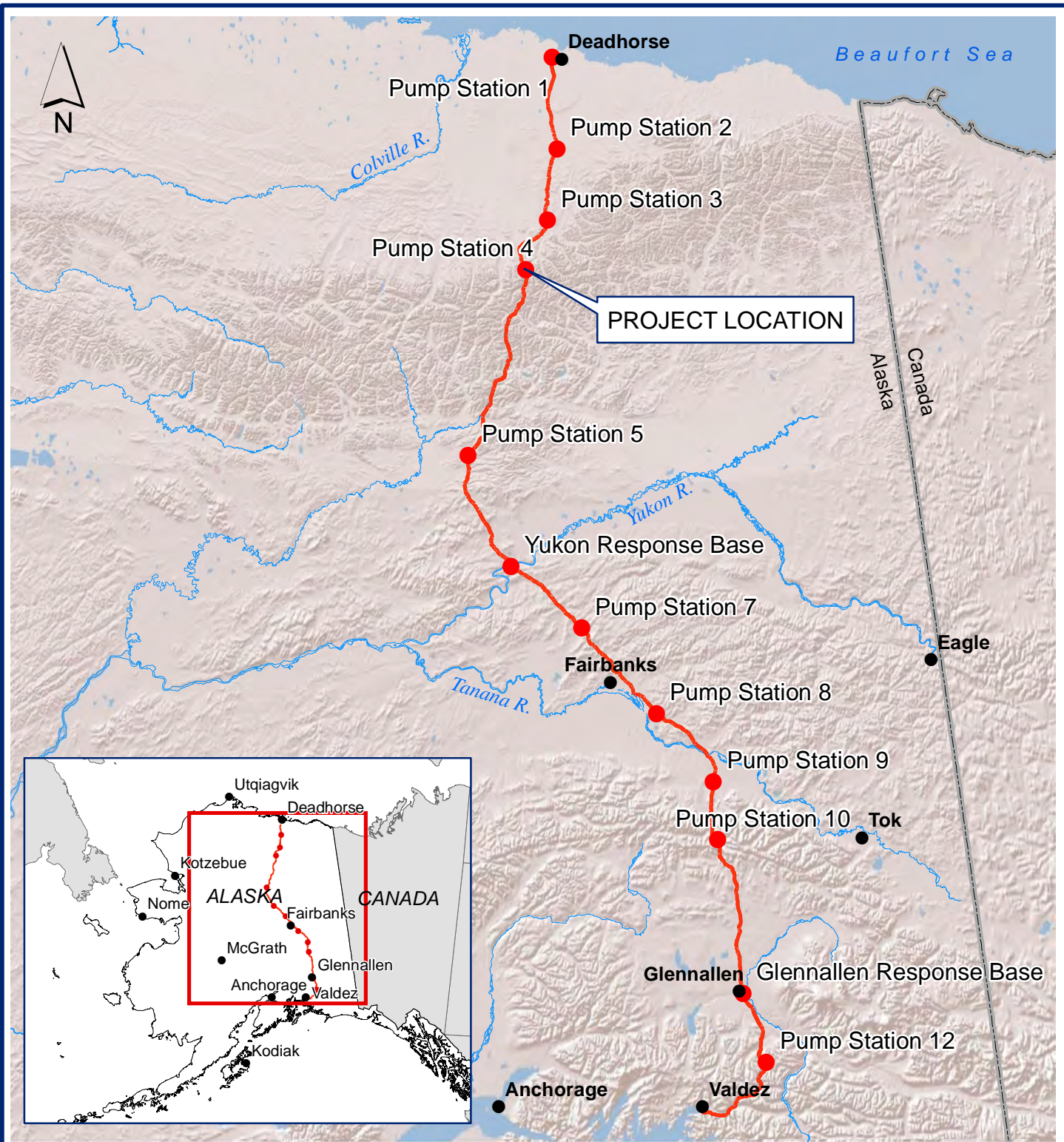
Alaska Department of Environmental Conservation (ADEC), 2017. Guidance on Developing Conceptual Site Models, January.

ADEC, 2014. Ecoscoping Guidance, A tool for Developing an Ecological Conceptual Site Model. March.  
ADEC, 2019. Contaminated Sites Database Search  
<https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/167> . June.  
America North, Inc. 1992, Fuel Island Excavation Closure Report. February.  
EMCON Alaska, Inc. 1997. MLT Sump Contamination Assessment. December.

Enc: Figure 1 – Site Location Map  
Figure 2 – Site Vicinity Map  
Figure 3 – Site Detail  
Appendix A - Human Health Conceptual Site Model Scoping Form  
Appendix B - Human Health Conceptual Site Model Graphic Form  
Appendix C – Ecoscoping Form  
Appendix D – Pump Station 4 Well Log

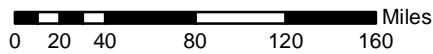
cc Grant Lidren, ADEC





**Legend**

- City
- Pump Station
- Trans Alaska Pipeline



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY.  
ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.



Site  
 ALYESKA PIPELINE SERVICE COMPANY  
 PUMP STATION 4  
 PIPELINE MILEPOST 144

Report  
 PUMP STATION 4  
 DEADLEG EXCAVATION CSM REPORT

Drawing  
 SITE LOCATION MAP

Drawing July 2019  
 File Name F1 PS04 RPT\_19.mxd

Scale As Shown  
 Project No. 105.01288.19038

Fig. No. 1





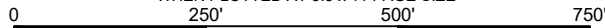
**DEADLEG  
EXCAVATION**



**PUMP STATION  
NORTH**

SCALE: 1" = 250'

WHEN PLOTTED AT 8.5 x 11 PAGE SIZE



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.



Site  
**ALYESKA PIPELINE SERVICE COMPANY  
 PUMP STATION 4  
 PIPELINE MILEPOST 144**

Report  
**PUMP STATION 4  
 DEADLEG EXCAVATION CSM REPORT**

Drawing  
**DEADLEG EXCAVATION VICINITY MAP**

Date July 2019

Scale 1" = 250 Feet

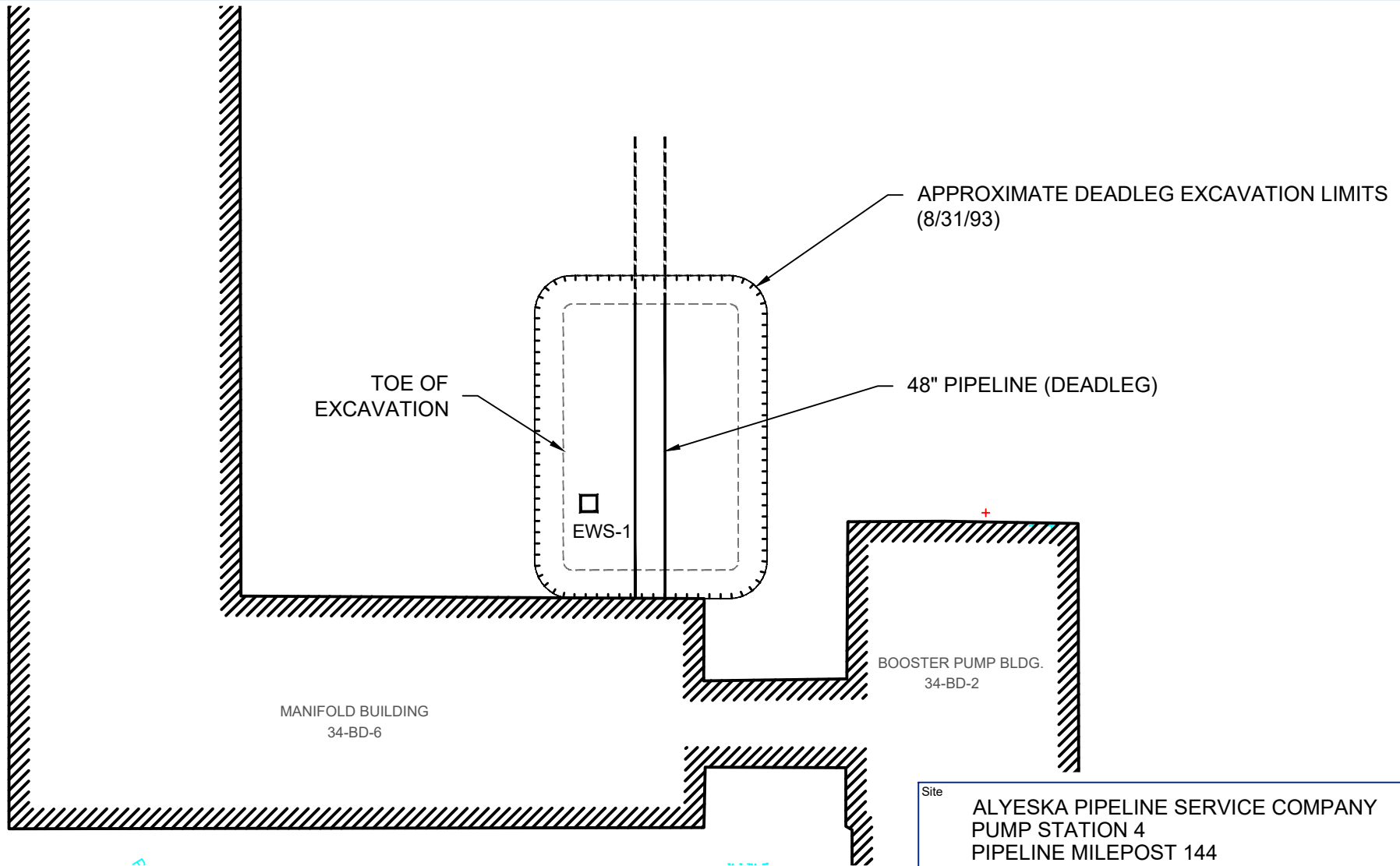
Fig. No.

File Name F2-3 PS04 Deadleg RPT\_19


Project No. 105.01288.19038

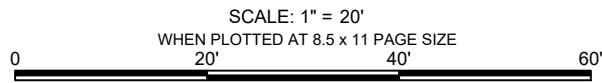
**2**





REFERENCE: AMERICA NORTH / EMCON, INC., WATER SAMPLE REPORT PUMP STATION #4 DEADLEG EXCAVATION, FIGURE 1, OCTOBER 1993

EWS-1  LOCATION OF MELTWATER SAMPLE COLLECTED ON AUGUST 31, 1993



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

Site  
**ALYESKA PIPELINE SERVICE COMPANY  
 PUMP STATION 4  
 PIPELINE MILEPOST 144**

Report  
**PUMP STATION 4  
 DEADLEG EXCAVATION CSM REPORT**

Drawing  
**SITE DIAGRAM**

Date July 2019

Scale 1" = 20 Feet

Fig. No.

File Name F2-3 PS04 Deadleg RPT\_19

Project No. 105.01288.19038



# Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

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, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

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

## 1. General Information:

**Sources** (*check potential sources at the site*)

- |  |  |
|--|--|
| <input type="checkbox"/> USTs                          | <input type="checkbox"/> Vehicles                    |
| <input type="checkbox"/> ASTs                          | <input type="checkbox"/> Landfills                   |
| <input type="checkbox"/> Dispensers/fuel loading racks | <input type="checkbox"/> Transformers                |
| <input type="checkbox"/> Drums                         | <input type="checkbox"/> Other: <input type="text"/> |

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

- |                                 |  |
|---------------------------------|--|
| <input type="checkbox"/> Spills | <input type="checkbox"/> Direct discharge            |
| <input type="checkbox"/> Leaks  | <input type="checkbox"/> Burning                     |
|                                 | <input type="checkbox"/> Other: <input type="text"/> |

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

- |  |  |
|--|--|
| <input type="checkbox"/> Surface soil (0-2 feet bgs*)  | <input type="checkbox"/> Groundwater                 |
| <input type="checkbox"/> Subsurface soil (>2 feet bgs) | <input type="checkbox"/> Surface water               |
| <input type="checkbox"/> Air                           | <input type="checkbox"/> Biota                       |
| <input type="checkbox"/> Sediment                      | <input type="checkbox"/> Other: <input type="text"/> |

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

- |  |  |
|--|--|
| <input type="checkbox"/> Residents (adult or child)                      | <input type="checkbox"/> Site visitor                |
| <input type="checkbox"/> Commercial or industrial worker                 | <input type="checkbox"/> Trespasser                  |
| <input type="checkbox"/> Construction worker                             | <input type="checkbox"/> Recreational user           |
| <input type="checkbox"/> Subsistence harvester (i.e. gathers wild foods) | <input type="checkbox"/> Farmer                      |
| <input type="checkbox"/> Subsistence consumer (i.e. eats wild foods)     | <input type="checkbox"/> Other: <input type="text"/> |

\* 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

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.)

*If the box is checked, label this pathway complete:*

Comments:

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.)

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)?

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

Comments:

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 DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350.

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

Comments:



## 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:*

Comments:

## 3. Ingestion of Wild and Farmed Foods

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

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)?

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.)

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

Comments:

### c) Inhalation-

#### 1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.)

Are the contaminants in soil volatile (see Appendix D in the guidance document)?

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

Comments:

## 2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminated soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures)

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)?

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

Comments:

**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**

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

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

Comments:

**Inhalation of Volatile Compounds in Tap Water**

Inhalation of volatile compounds in tap water may be a complete pathway if:

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

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

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

Comments:



## 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 (Particulate Matter - PM<sub>10</sub>). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

*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 some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

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

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

*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.)*

# HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: \_\_\_\_\_  
 \_\_\_\_\_

Completed By: \_\_\_\_\_

Date Completed: \_\_\_\_\_

**Instructions:** Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.

(1) Media	(2) Transport Mechanisms
<input type="checkbox"/> Surface Soil (0-2 ft bgs)	<input type="checkbox"/> Direct release to surface soil <i>check soil</i>
	<input type="checkbox"/> Migration to subsurface <i>check soil</i>
	<input type="checkbox"/> Migration to groundwater <i>check groundwater</i>
	<input type="checkbox"/> Volatilization <i>check air</i>
	<input type="checkbox"/> Runoff or erosion <i>check surface water</i>
	<input type="checkbox"/> Uptake by plants or animals <i>check biota</i>
<input type="checkbox"/> Other (list): _____	
<input type="checkbox"/> Subsurface Soil (2-15 ft bgs)	<input type="checkbox"/> Direct release to subsurface soil <i>check soil</i>
	<input type="checkbox"/> Migration to groundwater <i>check groundwater</i>
	<input type="checkbox"/> Volatilization <i>check air</i>
	<input type="checkbox"/> Uptake by plants or animals <i>check biota</i>
<input type="checkbox"/> Other (list): _____	
<input type="checkbox"/> Ground-water	<input type="checkbox"/> Direct release to groundwater <i>check groundwater</i>
	<input type="checkbox"/> Volatilization <i>check air</i>
	<input type="checkbox"/> Flow to surface water body <i>check surface water</i>
	<input type="checkbox"/> Flow to sediment <i>check sediment</i>
	<input type="checkbox"/> Uptake by plants or animals <i>check biota</i>
<input type="checkbox"/> Other (list): _____	
<input type="checkbox"/> Surface Water	<input type="checkbox"/> Direct release to surface water <i>check surface water</i>
	<input type="checkbox"/> Volatilization <i>check air</i>
	<input type="checkbox"/> Sedimentation <i>check sediment</i>
	<input type="checkbox"/> Uptake by plants or animals <i>check biota</i>
	<input type="checkbox"/> Other (list): _____
<input type="checkbox"/> Sediment	<input type="checkbox"/> Direct release to sediment <i>check sediment</i>
	<input type="checkbox"/> Resuspension, runoff, or erosion <i>check surface water</i>
	<input type="checkbox"/> Uptake by plants or animals <i>check biota</i>
	<input type="checkbox"/> Other (list): _____

(3) Exposure Media	(4) Exposure Pathway/Route	(5) Current & Future Receptors						
		Residents (adults or children)	Commercial or Industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
<input type="checkbox"/> soil	<input type="checkbox"/> Incidental Soil Ingestion							
	<input type="checkbox"/> Dermal Absorption of Contaminants from Soil							
	<input type="checkbox"/> Inhalation of Fugitive Dust							
<input type="checkbox"/> groundwater	<input type="checkbox"/> Ingestion of Groundwater							
	<input type="checkbox"/> Dermal Absorption of Contaminants in Groundwater							
	<input type="checkbox"/> Inhalation of Volatile Compounds in Tap Water							
<input type="checkbox"/> air	<input type="checkbox"/> Inhalation of Outdoor Air							
	<input type="checkbox"/> Inhalation of Indoor Air							
	<input type="checkbox"/> Inhalation of Fugitive Dust							
<input type="checkbox"/> surface water	<input type="checkbox"/> Ingestion of Surface Water							
	<input type="checkbox"/> Dermal Absorption of Contaminants in Surface Water							
	<input type="checkbox"/> Inhalation of Volatile Compounds in Tap Water							
<input type="checkbox"/> sediment	<input type="checkbox"/> Direct Contact with Sediment							
<input type="checkbox"/> biota	<input type="checkbox"/> Ingestion of Wild or Farmed Foods							



## Appendix C: Blank Ecoscoping Form

**Site Name:** Pump Station 4 Deadleg Excavation

**Completed by:** Carl Benson

**Date:** July 18, 2019

*Instructions: Follow the italicized instructions in each section below. “Off-ramps,” where the evaluation ends before completing all of the sections, can be taken when indicated by the instructions. Comment boxes should be used to help support your answers.*

### 1. Direct Visual Impacts and Acute Toxicity

Are direct impacts that may result from the site contaminants evident, or is acute toxicity from high contaminant concentrations suspected? *Check the appropriate box.*

- Yes – *Describe observations below and evaluate all of the remaining sections without taking any off-ramps.*
- No – *Go to next section.*

Comments:

### 2. Terrestrial and Aquatic Exposure Routes

*Check each terrestrial and aquatic route that could occur at the site.*

#### Terrestrial Exposure Routes

- Exposure to water-borne contaminants as a result of wading or swimming in contaminated waters or ingesting contaminated water.
- Contaminant uptake in terrestrial plants whose roots are in contact with contaminated surface water.
- Contaminant migration via saturated or unsaturated groundwater zones and discharge at upland “seep” locations (not associated with a wetland or waterbody).
- Contaminant uptake by terrestrial plants whose roots are in contact with soil moisture or groundwater present within the root zone (generally no more than 4 feet below ground surface).
- Particulates deposited on plants directly or from rain splash.
- Incidental ingestion and/or exposure while animals grub for food, burrow (up to 2 feet for small animals or 6 feet for large animals), or groom.

- Inhalation of fugitive dust or vapors disturbed by foraging or burrowing activities.
- Bioaccumulatives (other than PAHs, which bioaccumulate more readily in aquatic environments) taken up by soil invertebrates, which are in turn eaten by higher food chain organisms (see the *Policy Guidance on Developing Conceptual Site Models*).
- Other site-specific exposure pathways.

Aquatic Exposure Routes

- Contaminated surface runoff migration to water bodies through swales, drainage ditches, or overland flow.
- Aquatic receptors exposed through osmotic exchange, respiration, or ventilation of surface waters.
- Contaminant migration via saturated or unsaturated groundwater zones and discharge at “seep” locations along banks or directly to surface water.
- Deposition into sediments from upwelling of contaminated groundwater.
- Aquatic receptors may be exposed directly to contaminated sediments through foraging or burrowing, or indirectly exposed due to osmotic exchange, respiration, or ventilation of sediment pore water.
- Aquatic plants rooted in contaminated sediments.
- Bioaccumulatives (see the *Policy Guidance on Developing Conceptual Site Models*) taken up by sediment invertebrates, which are in turn eaten by higher food chain organisms.
- Other site-specific exposure pathways.

*If any of the above boxes are checked, go on to the next section. If none are checked, end the evaluation and check the box below.*

OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

**3. Habitat**

*Check all that may apply. See *Ecoscoping Guidance* for additional help.*

- Habitat that could be affected by the contamination supports valued species (i.e., species that are regulated, used for subsistence, have ceremonial importance, have commercial value, or provide recreational opportunity).
- Critical habitat or anadromous stream in an area that could be affected by the contamination.
- Habitat that is important to the region that could be affected by the contamination.

- Contamination is in a park, preserve, or wildlife refuge.

*If any of the above boxes are checked, go on to the next scoping factor. If none are checked, end the evaluation and check the box below.*

- OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

#### **4. Contaminant Quantity**

*Check all that may apply. See Ecoscoping Guidance for additional help.*

- Endangered or threatened species are present.
- The aquatic environment is or could be affected.
- Non-petroleum contaminants may be present, or the total area of petroleum-contaminated surface soil exceeds one-half acre.

*If any of the above boxes are checked, go on to the next scoping factor. If none are checked, end the evaluation and check the box below.*

- OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

#### **5. Toxicity Determination**

*Check all that apply.*

- Bioaccumulative chemicals are present (see *Policy Guidance on Developing Conceptual Site Models*).
- Contaminants exceed benchmark levels (see the Ecological Benchmark Tool in RAIS, available at: [http://rais.ornl.gov/tools/eco\\_search.php](http://rais.ornl.gov/tools/eco_search.php)).



*If either box is checked, complete a detailed Ecological Conceptual Site Model (see DEC's Policy Guidance on Developing Conceptual Site Models) and submit it with the form to your DEC project manager.*

*If neither box is checked, check the box below and submit this form to your DEC project manager.*

OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

PUMP STATION 4 WATER WELL  
5-23-94

Page 1

Ellipsoid = CLARKE 1866 / N.A.D. 1927  
Projection = Alaska Zone 4 / Transverse Mercator

	PT#	NORTH	EAST	ELEV
		5272494.000	584416.000	
CONVERGENCE	MEAN RADIUS	GRID SCALE	COMB. SCALE	PROJECTION
0 34'58"	20977678.361	0.9999080974	0.9999080974	AK Zone 4
		LATITUDE		LONGITUDE
		N 68 25'19.78998"		W 149 22'23.82933"

T.12S., R.12E., SEC. 8, NE 1/4, NW 1/4

MEMORANDUM

JOHN FERRER

TO  F. R. Fisher	SUBJECT  Boring Logs P.S. #4 Water Well (OCRP-397)	
FROM  J. C. Harle <i>J.C. Harle</i>	DATE  December 15, 1978	FILE NO.  EAM-13527

Attached are the boring logs for the new water well at Pump Station 4 (OCRP-397). These logs are for submittal to ADEC to secure final operating permit.

As-built drawings for the well are being completed and will be furnished to you for submission to the ADEC by January 17, 1979.

If you have any questions, please contact R. C. Harris at Ext. 8139.

*R. RCH*  
JCH/EPU/RCH:mkw

Attachments

- cc: R. D. Boorman
- G. E. Heywood
- K. M. Peacock
- E. P. Ulbricht

# BORING LOG

WELL No. 7

HOLE Ø  
TYPE DRILLING  
RIG  
WATER LEVEL

18"  
AUGRE TO 5' Casing  
ADDITION - STAR 72, m: w DRL.  
SURF. ENCOUNTERED @ 143'

DATE 9/25 & 10/2-10/7/78  
WEATHER CLEAR  
TEMP. COLD - 10°F 5x wire for S.  
PAGE 1 OF 5

DEPTH	DRILL RATE	FRZ.	SOILSAMP. SYM.	ISAMP. TYPE	DESCRIPTION	COMMENTS
1			0.0	AUGRE CUT	9-25-78 Drill 5' and 3" minus ROAD BED MATERIAL	DEL w/ 18" AUGRE TO 5' on 9-25-78 STOP ON BOULDER WHICH CAN'T REMOVED OR REFRAM
5	0900 1300 2 1/4 hr			AUG	ORGANICS; PEAT, ROOTS, WOODY DEBRIS ml, SILT w/ GRAVEL; BE, 15% vis. ICE, brush-grey 10-2-78 BOULDER 5-6 1/2' IN SIDEWALL NO RETURNS	BEGIN w/ CABLE TOOL 10-2-78 2500' TOOL
10	1500 1815 2 1/4 hr			BAIL	ml, SILT w/ GRAVEL, BE 20% VISIBLE ICE (AS PODS 1/8 TO 3/8") BRUSH-GREY, NON-CALL 10-4-78	2500 BIT BIT 17" BAILING w/ 10' SAND PUMP. DAL ~ 3' AHEAD OF CASING
15	1000 1030			BAIL	ml, SANDY SILT w/ ~5% 1/2" ROUNDED GRAVEL, BE, VIS ICE XLS, brush-grey SAND fn grained, ROUNDS TO SUBCOUNT, PREDOMINANTLY QTZ. SAND ~20% of sample	ICE DOWN @ 55 1/4 ft
20	1230 2 1/4 hr 1430			BAIL	ml, SANDY SILT, AS ABOVE BUT w/ ONLY OCCASIONAL GRAVELS & 10-15% VIS. ICE PODS (1/4-3/8"). NO CALL	1st joint down @ 1320
25	8 1/4 hr			BAIL	ml, SILT w/ SOME SAND, BE OCCASIONAL ICE XLS., GREY SAND VERY FN, ROUNDED, <7% NON-CALL.	DRIVE 1st 2 1/4 (19-21), C&C FILL DURING DEL TO 25'
30	1515 1700 1.5 1/2 hr			BAIL	ml, SILT w/ OCCASIONAL MINUTE ICE XLS., B.E., NON-CALL, GREY	SHUT DOWN FOR DINNER BEN 2 1/2 hr DEL
35	2245 4.8 1/2 hr			BAIL	ml, SILT w/ SMALL % SAND & OCCASIONAL GRAU., B.E., NO VISIBLE ICE GRAU. ANG-POSSIBLE LH CHIPS (DALL SAYS HAS HIT NO RKS.) NON-CALL, GREY	DALL'S NOTES: NO ICE ON BIT THIS RUN DALLS SPENT 10.5 RUNNING C&C. BROKE BIT 10-5. RAN C&C 10-6; REMOVED BIT 10-6. SHIFT CHANGE
40	2400 1445 1800			BAIL	10-7-78 ml, SILT w/ 5-10% SAND AND OCCASIONAL 1/4" ROUNDED GRAVEL, B.N., NO VISIBLE ICE, BRUSH-GREY. VERY DRY CALL (APPEARS TO BE REACTING w/ vt sand grains)	

LOGGED BY: R. HARRIS



# BORING LOG

HOLE Ø  
TYPE DRILLING  
RIG  
WATER LEVEL

18"  
CABLE TOOL  
STAR 72 M.W.DAL.  
Ø, ENCOUNTERED @ 145'

WELL No. 7  
DATE 10/7-10/10/78  
WEATHER CLOUDY  
+ 8°F Calm  
PAGE 2 OF 5

DEPTH	DRILL RATE	FRZ.	SOILSAMP. SYM.	SAMP. TYPE	DESCRIPTION	COMMENTS
41	.754/hr 1-45 2200 0015			BAIL	m1, SILT w/ SAND; OCCASIONAL GRAVEL, B.N. BRNISH GRAY. SAND 10 TO 15%, U.F. TO COARSE, RVE MEDIUM, SUB-10-875 ANG. TO SUBANG. GRAU F. TO 1/2" AU 1/4"; COMPOSED OF F. GRAINED SS OR SLTST, NON-CALL (AS IS THE SAND)	DAL STEADY, OCC. RKS. ENCOUNTERED  THE CGG HAS BEEN FALLING BY ITS OWN WEIGHT NO. DRIVING IS NECESSARY
45	.754/hr 0400 0515 0645 0930			BAIL	m1, SAME AS ABOVE	
50	.754/hr 1100 1245			BAIL	m1, SILT w/ SOME SAND, B.N. BRNISH GRAY. SAND U.P. TO COARSE, RVE FINE, MOSTLY SUBROUND, NON-CALL. SAND 5 TO 10%	
55	.754/hr 1700 2215 2345 0100			BAIL	m1, SILT w/ SOME SAND AND CLAY, B.N. BRNISH-GRAY, NON-CALL. SAND ~10%, CLAY ~5% 1/8" THREADS, SLIGHTLY COHESIVE WHEN DRY. SAND U.P. TO COARSE, AU FINE.  MUCH OF COARSE SAND; THE OCCASIONAL GRAVELS APPEAR TO BE RL. CHIPS RATHER THAN THE IN-SITU (ROUNDED) PARTICLES	REPAIR BIT 1700-2115 HARDFACE BIT 2345-0100
60	1.254/hr 0500 0630					
65	1.254/hr 1100 1515			BAIL	m1, CLAYEY SILT w/ SAND, B.N. BRNISH GRAY CLAY ~10-15%, SAND ~5%, U.F. TO MEDIUM, SUBANG TO EVE ROUND, COMPOSED OF U.F. SS. OR SLTST.  1/8" THREADS, SL. COHESION	HARDFACE BIT 1100-1350 (In/out for back DRILLING HARDER THAN LAST 15')
70	1.4/hr 2130 2230 0045 0145			BAIL	m1, CLAYEY SILT w/ SAND, AS ABOVE EXCEPT CLAY FRACTION INCREASING TO ~15%	DRIVE CGG 60/ft BENT IN CGG. THAT CAUGHT BIT, ROLLED INTO CGG; CAUSING BIT. DOWN TIME 8 HRS
75	1.254/hr 0630 1430 1800 1845				ROCK CHIPS w/ CLAYEY SILT. CHIPS TO 2" INCORPORATED IN CLAYEY SILT. ROCK TYPE VC SS MED GRAY SAND FRACTION 15%  LITH CHANGE, DESCRIPTION NEXT PAGE	BGN DEL EASIER
80						

# DORING LOG

HOLE Ø  
TYPE DRILLING  
RIG  
WATER LEVEL

18" (to 106') : 16"  
CARL TOOL  
STAR 72. MSLW  
Ø: ENCOUNTERED 0.143'

WELL No. 7  
DATE 10/10 - 10/14  
WEATHER (10/10) Lt Snow  
+1°F, 2x from N.  
PAGE 3 OF 5

DEPTH	DRILL DATE	FRZ?	SOILS SAMP. SYM. TYPE	DESCRIPTION	COMMENTS
81	1.8 FT / HR 2215 2230		BAIL	SM, SILTY SAND w/ some clay, B.E. ICE RICH, VISIBLE ICE POODS TO 2/3" ICE 20%; SAND UP TO MED, SUBSAND TO SUBANGULAR, 60% OF SAND, NON-CALC. THAW UNSTABLE	DEL. RATE INCREASE
85	6.7 FT / HR 2315 2315		CHUCKS ON TOP OF DEL BIT	Ml, SANDY SILT, B.E, ICE RICH. VISIBLE ICE POODS TO 2/3" ICE 250%, ≈ 40 P.C.F. SAND UP TO M, SUBSAND TO SUBANG, 15% OF SAND, LT BANISH-GREY, NON-CALC. THAW UNSTABLE	HARD SIZED SAND, UNDISTURBED
90	4 FT / HR 0030 1100			10-10-78 10-13-78 NO SAMPLE REPRESENTATIVE BECAUSE OF SLOP FROM CSC. OPERATION	— SHIFT CHANGE RL STOOD IN CSC BEGIN PILING CSC 10/11-10/12
95	1130		BAIL	Ml, SILT w/ some sand, B.E. ICE RICH - VISIBLE ICE POOD TO 3/8" ICE ≈ 50%. SAND UP TO F, SUBSAND TO SUBANG, 210% SAND, BANISH-GREY, NON-CALC	
100	1.8 FT / HR 1845 1845 1.6 FT / HR 2000 2235		WRING FROM TOP OF BIT	CONTACT CL- SILTY CLAY, THAWED, SOFT, STICKY, BORDERLINE HIGH PLASTICITY. THREADS TO 1/16", NON-CALC, BANISH-GREY	DEL CHARACTERISTICS CHANGING. DEL PAUL TOP @ 101' FINDS CLAY ON TOP OF BIT
105	3 FT / HR 2330 0230		BIT CUTTING	CL-CH SILTY CLAY-THAWED, SOFT, STICKY, PLASTICITY HIGH, THREADS TO < 1/16" NON-CALC, BANISH-GREY	← 105.30' BTH 18' CSC FM CL. • L7' STICK UP BETW 16" HOLE
110	0.15 FT / HR 1.5 FT / HR				DEL COMMENTS THAT FORMATION IS VERY STICKY
115	0.730 0.130 0.900 1300 1.4 FT / HR		BIT CUTTING	CL- SILTY CLAY, THAWED, SOFT, STICKY, MOD PLASTICITY, THREADS TO < 1/16", NON-CALC, BANISH-GREY A ROCK 4" x 4" x 2" ALSO CAME UP ON BIT. METACRYLITE - F. L. A. IN LT GAY, ROUNDED, CYLIC (THE WELL)	QUANTAL HOLE TRY INTO STOP SAUBERLING. DOES NOT HOLD. FILL HOLE w/ H <sub>2</sub> O
120					— DEL NOTES THAT P.M. IS DEL A LITTLE DIFF.

LOGGED BY: R. HARRIS

# DORING LOG

HOLE Ø  
TYPE DRILLING  
RIG  
WATER LEVEL

16" to 142.10" below  
Cable Tool  
Star 72 miw  
Ø: ENCOUNTERED @ 143'

WELL No. 7  
DATE 10/14-  
WEATHER CLEAR  
+8°F, Calm (10-14-78)  
PAGE 4 OF 5

DEPTH	DRILL RATE	FRZ.	SOILSAMP. SYM.	SAMP. TYPE	DESCRIPTION	COMMENTS
121	16:30 16:45 2.4% HR			BIT CUTTING	CL GRAVELY SILTY CLAY w/SOME SAND, THAWED, SOFT TO STIFF (CUTTINGS DISTURBED), COARSE FRACTION < 50%; GRAVEL 1/2 TO 1; RND TO SUBRND, OBLONG, FR. 25 OR GREATER. SAND V.F. H. COARSE, SUBRND, 210% of SAND. CLAY-SOFT, LOW PLAS., THREADS TO 1/16" NON-CALL, BUSH-GRAY, 100 PLF	DOL SMOOTH & STEADY. DOL W/ HOLE FULL OF WATER
125	18:00 18:45 2.8% HR			BIT CUTTING	SAME AS ABOVE GRADATIONAL CONTACT	DRILL COMMENT DOL SLOWER & STEADYER W/ W
130	20:00 HR			BIT CUTTING	CL SILTY CLAY w/ 1-2% SAND & OCL. GRAVEL. STIFF TO VERY STIFF, LOW PLAS., THREADS TO 1/16", NON-CALL BUSH-GRAY, 100 PLF	
135	22:30 22:45 4.0% HR			BIT CUTTING	CL SILTY CLAY w/ TRACE SAND, STIFF, LOW PLAS., THREADS TO 1/16" NON-CALL, BUSH-GRAY 100 PLF	
140	24:00 01:00 2.7% HR			BIT CUTTING	CL SILTY CLAY w/ TRACE F. SAND, STIFF, MOD PLAS. THREADS TO 1/16", NON-CALL, BUSH-GRAY, 100 PLF	
142	03:00 19:30			BIT CUTTING CIRCU CUTTINGS	CL SILTY CLAY w/ TRACE F. SAND, STIFF, MOD PLAS. THREADS TO 1/16", NON-CALL, BUSH-GRAY, 100 PLF. CONTACT?	UNDERFRAME TO 142 ← Btm 16" HOLE ALSO DRILLED CEMENT PLUG 8" IN 10" HOLE DEL. W/ CIRCULATION WATER
143	1 FT HR				SP-SAND, MED TO COARSE, WELL ROUNDED TO SUBRND, OCL PLATES OR QTZ, W/ SAND 30 FEET FROM SURF. PRE-DOMINANTLY DARK GRAY SILTST. 2-2% QTZ GRAINS. OCL SILT PIECES. PRE-DOMINANT RETURNS (85%) ARE GRAY CEMENT; AN OCL PIECE OF ASPHALT ROOFING COMPOUND FROM INSULATION WORK	CIRCULATING PIPE 30 IMPOSSIBLE TO TELL FOR SURE WHAT DOL IN. FIRST INDICATIONS OF WATER @ 143 CONSIDER @ 144
144	21:30 2:30 2.0% HR			CIRCU CUTTINGS	SW SAND, FINE TO COARSE, WELL ROUNDED TO SUBRND, SPREADING TO PLATES, FAIR SORTING (AV. COARSE). PRE-DOMINANTLY DARK GRAY SILTST. 50% OF RETURNS ALL CEMENT THIS SAND IS GENERALLY COARSER THAN THE SAND @ 143-144 SOME SILT IS GETTING THROUGH THE SAMPLE SCREEN. IT IS PROBABLY WATER FOR THE SAND BUT IMPOSSIBLE TO GET %.	FR FT 3/4-1.5 gm EVEN UNDER WEIGHT OF 250 <sup>g</sup> AL GEL 200 <sup>g</sup> BASITE TO CONTROL WATER @ 144 USE 300 <sup>g</sup> MORE BASITE + 2 1/2" DOL THOL FLOW STOP 3/4 gm
146	22:30 01:00				10-21	

LOGGED BY R. HARRIS

# BORING LOG

HOLE Ø  
TYPE DRILLING  
RIG  
WATER LEVEL

10" ± 8" (FROM 155' TO T.O.)  
COST TOP W/CLAY TO 155'  
STAR 7E  
SURF FIRST ELEV @ 143'

WELL No. 7  
DATE 10/21 - 10/26  
WEATHER COLD, CLEAR  
TO CLOUDY - 10 TO -15°  
PAGE 5 OF 5

DEPTH	DRILL RATE	FRZ.	SOILSAMP. SYM.	TYPE	DESCRIPTION	COMMENTS
146	0100				10-21	
147	1.37% /hr			CIRC CUTTING	SANDY SILT W/CLAY, 30:60 W/10% CLAY BAND-LAY, O.C. GRAVEL; 2" & L' COLL	DELS. HARDER
148	0230				~100 P.P., HARD (2x DENSE) HIGH CALCARIUS; SAND IS MED TO COARSE, ROUNDED TO ANG, SPHERICAL TO PLATES, FAIR SORTING. GRAVEL FOLLOWS SAME WIDE RANGE. PROBABLE FINE GRANULAR FRACTION COMPOSED OF 10% QZ, 30 LT; O.C. SILTY MUDSTONE GRAINS, W/ O.C. LIMESTONE GRAINS.	DELS. HARDER THESE CALCULINES WAS LOST W/ BR CONDITIONS FROM BALL SAMPLING @ 157' GAINING WATER @ 20 GAL/HR
150					6" BOULDER; 3' LODES OF LIMESTONE, CONGLOMERATE, AND QUARTZITE (QZTQ) FILL IN HOLE SOMEWHERE BTW. 145' & 155'	
152				CIRC. CUTTING	SANDY SILT W/CLAY AND OCCASIONAL GRAVEL AS ABOVE EXCEPT SAND IS GENERALLY COARSE.	GAINING WATER @ 20 GAL/MIN LOSSING WATER SLOWLY DELS COMMENT, "DRINK LINE BOAT"
154	0245 0245 20% /hr 1015 0730 30% /hr 1100 2100				SILTY SAND W/CLAY; O.C. GRAVEL SAND UP TO COARSE AND TO ANGULAR. CONTACT	DELS COMMENT, "DRINK LINE BOAT"
156	70% /hr			BAIL	10-24 SANDY LIMESTONE, D.C. GLEY, V. WELL INDUCATED, EXTREMELY HARD V. FINE SL., SAND V. FINE, ANG. TO SUB-ANG, COMPOSED OF QZ, IF CAL. SL. 20% SAND, 15% - 200, REST LINT SL.	WELL BLEW OUT FLOW @ 75 GPM BTM @ 156'
158	2400 0115 50% /hr				10-25 156-157' LZ IS SO HARD THAT RETURN ARE ALL FN SAND SIZE PARTICLES, 157'-160' MANY 1/2" - 1" CHUNKS (RANDOM ANGULAR)	TOP 6" SLR. BTM 6" COG POSITIVE ZONE @ 157' - 160'
160	0330 0330 54% /hr 0530 0530 10% /hr				10-26 SANDY LIMESTONE, AS ABOVE, EXCEPT BREAKING UP INTO 1" PIECES.	VERY HARD BALL DELS COMMENT
165	0800 0800 37% /hr 1015 1200 47% /hr 2115			BAIL	SANDY LIMESTONE, AS ABOVE, CUTTINGS ALL MED. SAND SIZE WITH O.C. 1/2" OR 1" PIECE.	DELS. HARD GALZ BASED, T.O. IN HOLE 2130 RETURNS 2245
170	47% /hr 1030				10-26 T.D. 171'	BTM 6" S.R.