

# Groundwater Monitoring Work Plan

1655 Highway 101

Coos Bay, Oregon 97420

HydroCon Project Number: 2021-083-001

DEQ LUST No.: 06-16-0741, 06-15-1789 and 06-91-0096

Prepared for:

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Attachment B – Standard Operating Procedures

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Groundwater Sample Collection Form  
Field Report Form

# **Subsurface Site Investigation Work Plan**

**Coos Bay Pacific Pride**

**1655 Highway 101**

**Coos Bay, OR 97420**

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HydroCon Project No: 2021-083-001

*Prepared by:*

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## 1.0 INTRODUCTION

This work plan (Work Plan) has been prepared by HydroCon Environmental, LLC (HCE) on behalf of CECO, Inc., (CECO) to describe sampling procedures and methods for performing groundwater monitoring and hydrogeologic assessment at 1655 Highway 101 in Coos Bay, Oregon (the Site; Figures 1 and 2). The Site is associated with Department of Environmental Quality (DEQ) leaking underground storage tank (LUST) numbers 06-16-0741, 06-15-1789 and 06-91-0096. The proposed scope of work is based on previous site investigation which identified the presence of elevated petroleum concentrations in soil and groundwater at the site as well as sheen that has been historically observed in a surface water drainage ditch to the east of the Site.

The work plan includes requirements for groundwater and surface water sampling and analysis. The plan includes sampling methodology and locations, analytical testing, documentation, and quality assurance/quality control.

Supporting documentation that is found in the attachments includes the Standard Operating Procedures (SOPs) and field forms that will be used during the investigation.

## 2.0 BACKGROUND INFORMATION

The following section provides a summary of the Site location and description, geologic setting, and historical land use at the Site.

### 2.1 Site Description

The subject property is utilized as a Pacific Pride Cardlock. Two (2) 6,000-gallon registered underground storage tanks (USTs), and one (1) 10,000-gallon above ground storage tank (AST) supply gasoline and diesel fuel to multiple cardlock operated dispensers, located beneath a canopy in the central portion of the property. The Oregon DEQ currently identifies the subject property as the Coos Bay Pac-Pride II (UST Facility ID 10858). The Site has two (2) active and one (1) closed LUST files associated with it as listed above.

### 2.2 Regulatory History

The following section summarizes the regulatory history of the Site and is based on the site history described in BB&A Environmental (BB&A) *Work Plan for Mitigating Surface Water Impact*<sup>1</sup>. A detailed site history is presented in that plan.

In September 1991, an underground release of diesel was discovered during the decommissioning of an underground piping system associated with a 10,000 gallon above ground storage tank (AST). In response, DEQ issued LUST 06-91-0096 which was closed in April 2003. The piping system and approximately 900 to 1000 cubic yards (CYs) of soil with elevated levels of petroleum hydrocarbons

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<sup>1</sup> BB&A, 2016. *Work Plan for Mitigating Surface Water Impact, Coos Bay Pac-Pride II (Former Davis Oil Inc. Cardlock, 62590 S. Highway 101, Coos Bay, OR. August 31, 2016.*

were removed from the impacted area by Industrial Petroleum Equipment Company (IPE). In addition to the removal of piping and impacted soils, approximately 70 to 80 gallons of separate-phase product (diesel) and approximately 15 gallons of “sludge” were removed from the excavation area. After cleanup activities were performed, new underground storage tanks (USTs) were placed in the excavated area.

Assessment of residual contamination in soil and groundwater (including the installation of an observation well within the previously excavated area) was subsequently conducted by BB&A in October 1991. Results showed residual concentrations in soil above target cleanup levels at the time.

Subsequent groundwater sampling of observation wells OB-SE and OB-SW from 1991 to 1993, identified low levels of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds as well as naphthalene. No polycyclic aromatic hydrocarbons (PAHs) were detected.

Additional characterization of residual diesel in soil and groundwater was conducted by BB&A in August of 2002. Investigation consisted of advancing six borings (P-1 through P-6) and soil/groundwater sampling and analysis. Diesel was identified at depths ranging from six to seven feet below ground surface (bgs) in P-1, P-2, and P-3 at concentrations of 4700, 3900, and 5500 mg/kg, respectively. Diesel concentrations were not detected in samples from borings P-4 through P-6. Additionally, a grab groundwater sample collected from P-2 showed low concentrations of BTEX compounds and various PAHs. The historical boring locations are shown on Figure 2. Based on the results, BB&A estimated that approximately 1,681 CYs of petroleum-containing soil (PCS) remained. The estimated remaining PCS is shown on BB&A’s Figure 3 in Attachment A<sup>2</sup>. As shown on the figure, gasoline, diesel, and oil range hydrocarbons were detected in the residual soil with diesel being the primary component of residual petroleum.

On November 18, 2015, DEQ observed a sheen on water within a drainage ditch adjacent and east of the facility. The ditch receives water from the Site, in addition to several other sites to the north, south, and west, which are hydraulically connected to the ditch.

On May 17, 2016, a spill bucket associated with an onsite dispenser released a limited amount of gasoline, resulting in the removal of approximately 1.45 tons of PCS. No PCS was left in-place.

On September 5, 2017, DEQ again observed sheen in the drainage ditch. The specific source of the sheen has not been determined, however, is unlikely associated with the limited spill buck release as the release was limited, and the sheen had been observed prior to the release. The proposed investigation is to assist in identifying the source of the sheen.

In December 2021, HCE advanced seven borings (HC01 through HC07) at the Site to depths of 15 feet bgs. Boring locations are shown on Figure 2. Grab soil and groundwater samples were collected from

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<sup>2</sup> BB&A, 2016. *Work Plan for Mitigating Surface Water Impact, Coos Bay Pac-Pride II (Former Davis Oil Inc. Cardlock, 62590 S. Highway 101, Coos Bay, OR.* August 31, 2016.

each location and three of the borings (HC01, HC02, and HC04) were converted to monitoring wells (MW01, MW02, and MW03, respectively). An additional groundwater sample was collected from an onsite tank basin observation well (OBS-NE-W). Grab soil sample analytical results showed concentrations of diesel-range petroleum hydrocarbons (DRPH) in four samples (HC03-6, HC04-5, HC06-6, and HC07-6) above RBCs for occupational and/or construction worker direct contact. Additionally, analytical results show groundwater concentrations of DRPH, gasoline-range petroleum hydrocarbons (GRPH), and/or volatile organic compounds (VOCs) above the occupational direct contact RBC and at least one ecological RBC in every sample with the exception of HC05-W. Concentrations of PAHs in groundwater exceeded at least one ecological RBC in every sample with the exception of HC02-W and HC05-W.

### **2.3 Local Geology and Hydrogeology**

The property is bordered by a seasonal creek (Brainard Creek) and Linton Avenue to the north, Highway 101 and Isthmus Slough on the east, and Carlisle Street to the south. Land use in the vicinity is primarily commercial with intermixed residential. The Site lies in an area of historically filled wetlands. Portions of the Site are subject to tidal flooding during heavy winter storms and tidal surges. The water table beneath the Site is shallow and tidally influenced.

The Site is located within the Coast range of the Pacific Border physiographic province. The Site is located along the north bank of the Isthmus Slough at an approximate elevation of 10 feet above mean sea level (MSL). Precipitation occurs mainly in the form of rain with an average of 56.82 inches per year. The geology of the Site has been determined by research of available published data and observations from bore hole cuttings during drilling at the Site. The Site is underlain by approximately five (5) to eight (8) feet of sands and silty sands overlying a black, silty clay deposit. The geology of the Site corresponds locally to the Coaledo Formation. Depth to groundwater ranges from 2.5 to seven (7) feet bgs as measured during the collection of groundwater samples from the tank pit observation well (various BB&A groundwater monitoring events 1991 to 1993). Groundwater during the recent December 2022 site investigation ranged from 2.5 to 6.8 feet bgs. The water table at the site reportedly fluctuates daily and is greatly influenced by the tides due to the proximity of the Site to the Isthmus Slough. Based on the topography of the area, groundwater beneath the Site is presumed to flow east northeast.

## **3.0 PROPOSED SCOPE OF WORK**

The proposed scope of work is based on discussions between DEQ, CECO, and HydroCon as well as the results of the recent December 2022 site investigation.

### **3.1 Preparatory Activities**

**Health and safety.** HCE will update the site-specific Health and Safety Plan to guide field safety protocols, in accordance with rules established by the Occupational Safety and Health Administration (OSHA).

### **3.2 Field Work**

Field operations will be performed in accordance with the Site's Health and Safety Plan. Sampling will be conducted in accordance with SOPs in Attachment B. Proposed field activities are described below.

**Survey.** Onsite monitoring wells MW01 through MW03 will be surveyed for horizontal location, ground elevation, and top-of-casing (TOC) elevation by a licensed surveyor. In addition, at least one control point established adjacent to the drainage ditch will be surveyed in order to track surface water height. Results will be used to establish groundwater depths relative to surface water, as well as any fluctuations from tidal effects.

**Quarterly groundwater monitoring.** Onsite monitoring wells MW01 through MW03 will be monitored on a quarterly basis for one year. Each event will consist of the following activities:

- **Ditch observations** – Throughout each event, conditions in the drainage ditches will be observed and documented. Particular attention will be paid to the presence of any sheen, the character of the sheen, surface water elevation/depth, tidal stage, and any other relevant information.
- **Groundwater gauging** – Prior to monitoring, well caps will be removed and water levels in each well will be allowed to equilibrate for at least 15 minutes. After equilibration, each well will be checked for the presence of light non-aqueous phase hydrocarbon (LNAPL) using either an oil/water interface probe, hydrocarbon detecting paste/tape, or other appropriate method. If LNAPL is detected, the product thickness will be measured and recorded after which the depth to groundwater will be measured and recorded. If LNAPL is detected, groundwater will not be sampled and if feasible, a sample of the product will be collected for potential fingerprinting analysis. After product sampling, LNAPL will be removed to the extent practicable using a bailer. Wells containing LNAPL will be checked multiple times throughout the field sampling day to check if LNAPL has recharged after removal. Any recharged LNAPL will be measured and removed.
- **Groundwater sampling** – If LNAPL is not detected, groundwater will be purged and sampled using low flow methodology as described in SOP 11 (Attachment B). Prior to groundwater sampling, the wells will be purged using a low-flow peristaltic pump equipped with a new length of LDPE tubing attached to a new length of silicone tubing. The tubing intake will be placed approximately 2 to 3 feet below the surface of the groundwater or mid-screen in each well. During purging, water quality will be monitored using a multi-parameter water quality meter equipped with a flow-through cell. The water quality parameters monitored will include temperature, pH, specific conductance, dissolved oxygen, turbidity, and oxidation-reduction potential. The wells will be purged until all six water quality parameters stabilize or the minimum parameter subset of pH, specific conductance, temperature, and turbidity and/or dissolved

oxygen stabilize. Efforts will be made to remove any suspended sediment to the extent practicable. After purging, groundwater from each well will be transferred into clean, laboratory-provided sample bottles and stored at approximately 4-degrees Celsius before being transported to the analytical laboratory under chain-of-custody protocol. Groundwater samples will be analyzed for the following:

- GRPH by Northwest Method NWTPH-Gx;
  - DRPH and oil-range petroleum hydrocarbons (ORPH) by Northwest Method NWTPH-Dx;
  - Volatile organic compounds (VOCs) by EPA Method 826B; and
  - Polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270.
- Tidal sampling schedule – It should be noted that at least one of the groundwater sampling events (expected to be April 2022 and possibly July 2022) will include two discrete rounds of sampling occurring within one 24-hour period. One of the rounds will be conducted during high/flood tide, and one will occur during low/ebb tide. The events will include samples from groundwater monitoring wells,

**Surface water sampling.** It is possible that surface water samples may be collected during one or more events depending on field conditions. Up to 3 surface water samples may be collected from drainage ditches. In addition, groundwater elevations as well as surface water elevations will be measured concurrent with sampling. If collected, the samples will be collected as grab samples and any relevant field observations will be noted (e.g., sheen, sediment, etc.).

**Quality control samples.** In addition to investigative samples, Quality Assurance/Quality Control (QA/QC) samples will be collected for laboratory analysis. These will include blind duplicates and trip blanks. QA/QC samples applicable are described below.

- Blind Duplicate – A duplicate sample collected in conjunction with a primary sample. The duplicate will be named differently and results will be compared with the results of the primary sample. The relative percent difference (RPD) will be reviewed to assess laboratory repeatability.
- Trip Blank – A trip blank will be prepared by the laboratory to evaluate the presence of contamination (volatiles) during transit, from sample bottles, or from laboratory conditions. Each 40 ml bottle is filled with lab-grade deionized water in the laboratory, preserved as required, and returned to the laboratory for analysis in the same shipping container with the soil and groundwater samples. The Trip Blank sample will be analyzed for BTEX using EPA Method 8260D. No VOCs should be detected in the sample.

**Sample containers.** Groundwater samples will be collected in the containers described below. We have assumed that one groundwater sample will be collected from each well and one duplicate sample

will be collected (total of 4 samples). Additionally, a trip blank will be analyzed for VOCs. Surface water samples (if collected) will also be analyzed for the same analytical suite.

Laboratory analysis	Method	Sample Containers (per round)		
		Three 40ml VOAs (HCl preserved)	1L Amber Glass (HCl preserved)	1L Amber Glass (unpreserved)
GRPH and VOCs	NWTPH-Gx and EPA Method 8260D	8 (11 <sup>1</sup> )	--	--
DRPH	NWTPH-Dx	--	7 (10 <sup>1</sup> )	--
PAHs	EPA Method 8270	--	--	7 (10 <sup>1</sup> )

*Notes:*

*HCl = hydrochloric acid; mL = milliliter;*

*VOA = volatile organic analysis*

<sup>1</sup> = number of containers if up to three surface water samples are also collected.

### 3.3 Field Forms

HCE will document field activity with the following forms found in Attachment C:

- Groundwater sample collection forms will be used to document sample information and observations and measurements made during groundwater sampling.
- Field reports will be used to document field activity, decision making, communication and other relevant topics during each day of the field work.
- Chain-of-custody forms will be filled out to direct the analytical requirements for soil and groundwater samples collected at the Site.

### 3.4 Packaging and Shipping

All samples shall be packaged and transported to Apex Labs of Tigard, Oregon as required by the laboratory.

A chain-of-custody (COC) form will be completed with all required information and accompany all samples (see attachments for form). The COC provides a record of the transfer of sample custody from the field sampler to the laboratory. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC form.

### 3.5 Management of Investigation Derived Waste

Investigation derived waste (IDW) in the form of water will be generated. Each media will be contained in separate labeled drums and temporarily stored on-site pending waste profiling and acceptance into a

licensed disposal facility. Solid waste, (used gloves, garbage, disposable equipment, etc.) will be placed in plastic garbage bags and disposed of in a dumpster.

## 4.0 REPORTING

Field activities, sampling methodology, results, risk screening (using DEQ-established human health and ecological risk based concentrations), and conclusions/recommendations will be summarized and reported in a subsurface site investigation report. In addition, the report will include the following:

- Field forms of well development and groundwater sampling.
- Tabulated analytical results, figures showing sampling locations with posted laboratory results, and a narrative discussion of investigation methods and results.

The report will be prepared in draft and final form. The draft report will be submitted to DEQ for review and comment prior to being finalized.

## 5.0 SCHEDULE

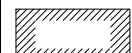
We anticipate that the first event work can proceed in April 2022. Subsequent events will be completed on a quarterly basis.

## FIGURES

C:\Users\Lindsey\Desktop\HydroCon\TEMP\PHASE 1 Figures\2021-083\2021-083 Carson Oil.dwg



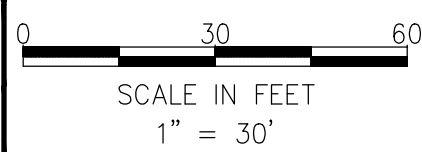
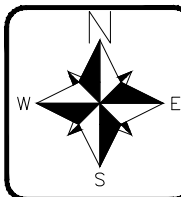
**LEGEND**

 FUEL ISLAND CANOPY

 SOIL BORING LOCATION (BB&A 10/1991)

 SOIL BORING LOCATION (BB&A 8/2002)

 SOIL BORING LOCATION (PNE)



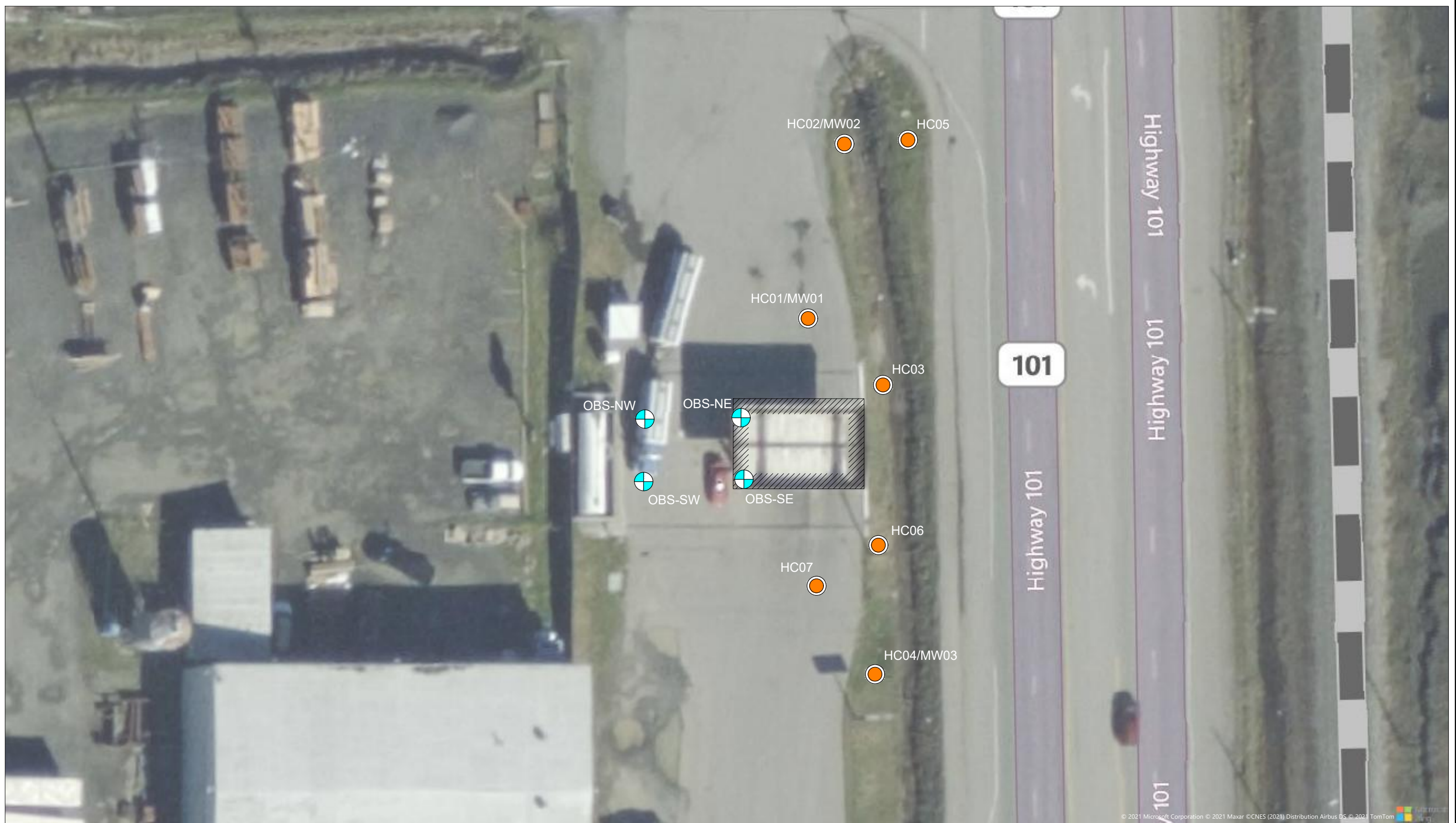
314 W 15th Street, Suite 300, Vancouver, Washington 98660  
Phone 360.703.6079 Fax 360.703.6086

DATE: 10-15-2021  
DWN: LC  
CHK: CS  
APPROVED: CS  
PRJ. MGR: CS  
PROJECT NO:  
2021-083

**FIGURE 2**  
HISTORICAL SOIL BORINGS  
COOS BAY PAC PRIDE  
1655 US-101  
COOS BAY, OREGON  
97420




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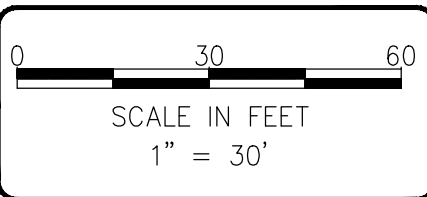
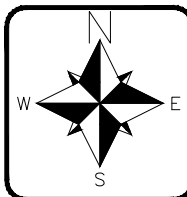
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**LEGEND**

-  FUEL ISLAND CANOPY BORING/
-  OBSERVATION WELL
-  MONITORING WELL LOCATIONS




314 W 15th Street, Suite 300, Vancouver, Washington 98660  
Phone 360.703.6079 Fax 360.703.6086

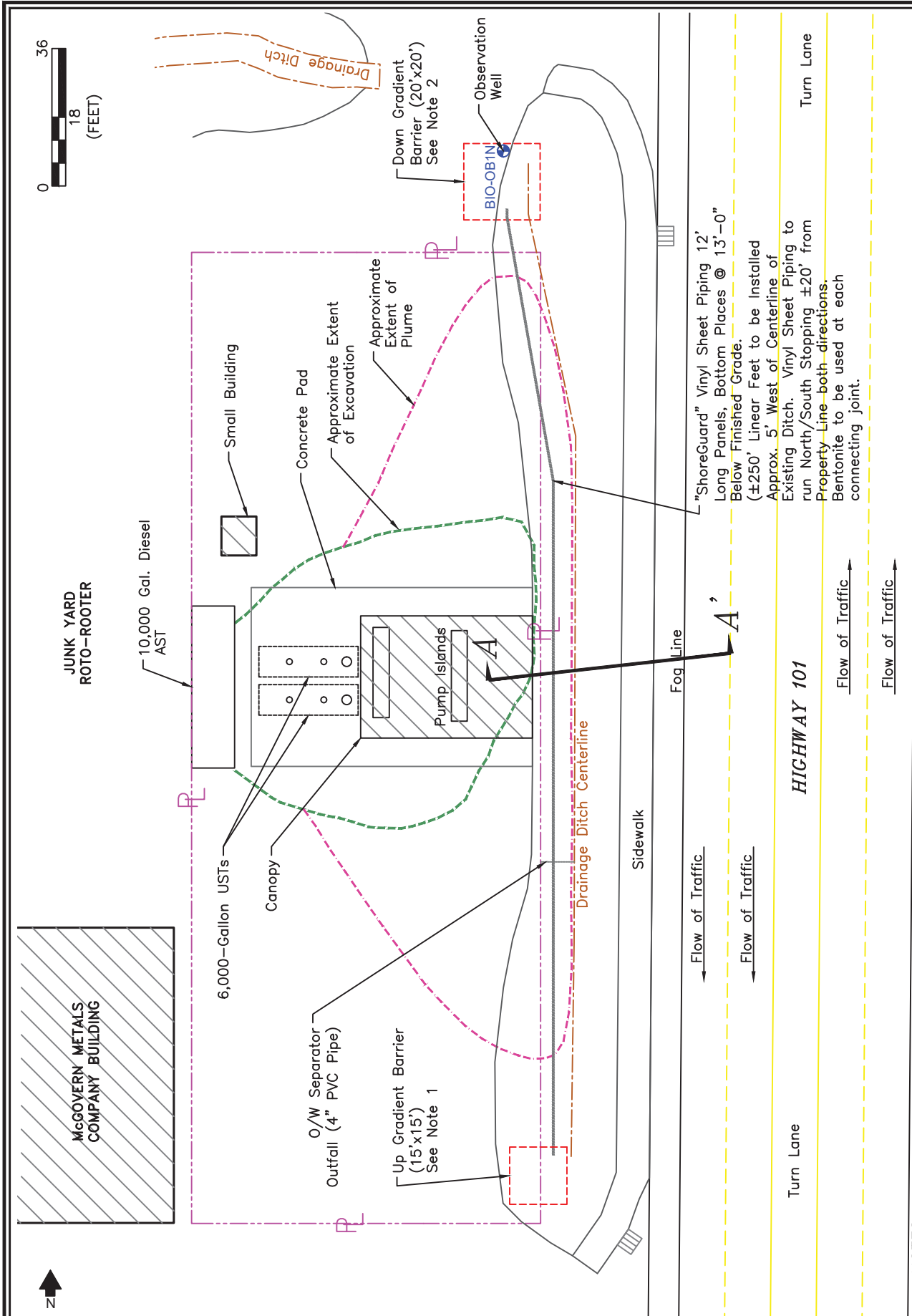
DATE: 12-21-21  
DWN: LC  
CHK: CS  
APPROVED: CS  
PRJ. MGR: CS  
PROJECT NO:  
2021-083

**FIGURE 3**  
SUBSURFACE INVESTIGATION BORING LOCATIONS  
COOS BAY PAC PRIDE  
1655 US-101  
COOS BAY, OREGON  
97420

**ATTACHMENT A**  
**BB&A FIGURES**

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3. BOS-200 and Bacteria Concentrate will be applied in multiple batches and spray applies to up gradient and down gradient barrier in lifts (3'-4', 4'-5', 5'-6', 6'-7' & 7'-8'). between one (1) and three (3) feet BLS mix in gypsum (Supplemental Sulfate). BOS-200, Gypsum, and Bacteria Concentrate in water will be sprayed on the material into each lift as soil is mechanically mixed with an excavator. Install Observation Well BIO-OB1N.

2. Up Gradient Barrier (Near GP-7):  
 DRO (Soil) - GP4-GP2:  
 GW Flow Direction: North/East  
 Barrier Excavation Size: ~20'x20' (400sq.ft.)  
 BOS-200 Application: 2,000 Pounds  
 Supplemental Sulfate: 700 Pounds  
 Bacteria Concentrate: 1.5/3.5 = 5.0 Gallons

1. Up Gradient Barrier (Near GP-4):  
 DRO (Soil) - GP4-GP2:  
 GW Flow Direction: North/East  
 Barrier Excavation Size: ~15'x15' (225sq.ft.)  
 BOS-200 Application: 600 Pounds  
 Supplemental Sulfate: 300 Pounds

**NOTES:**

1. Up Gradient Barrier (Near GP-4):  
 DRO (Soil) - GP4-GP2:  
 GW Flow Direction: North/East  
 Barrier Excavation Size: ~15'x15' (225sq.ft.)  
 BOS-200 Application: 600 Pounds  
 Supplemental Sulfate: 300 Pounds
2. Up Gradient Barrier (Near GP-7):  
 DRO (Soil) - GP4-GP2:  
 GW Flow Direction: North/East  
 Barrier Excavation Size: ~20'x20' (400sq.ft.)  
 BOS-200 Application: 2,000 Pounds  
 Supplemental Sulfate: 700 Pounds  
 Bacteria Concentrate: 1.5/3.5 = 5.0 Gallons
3. BOS-200 and Bacteria Concentrate will be applied in multiple batches and spray applies to up gradient and down gradient barrier in lifts (3'-4', 4'-5', 5'-6', 6'-7' & 7'-8'). between one (1) and three (3) feet BLS mix in gypsum (Supplemental Sulfate). BOS-200, Gypsum, and Bacteria Concentrate in water will be sprayed on the material into each lift as soil is mechanically mixed with an excavator. Install Observation Well BIO-OB1N.



**EUGENE OFFICE**  
 32986 Roberts Ct.  
 Coburg, OR  
 ph: 541.484.9484

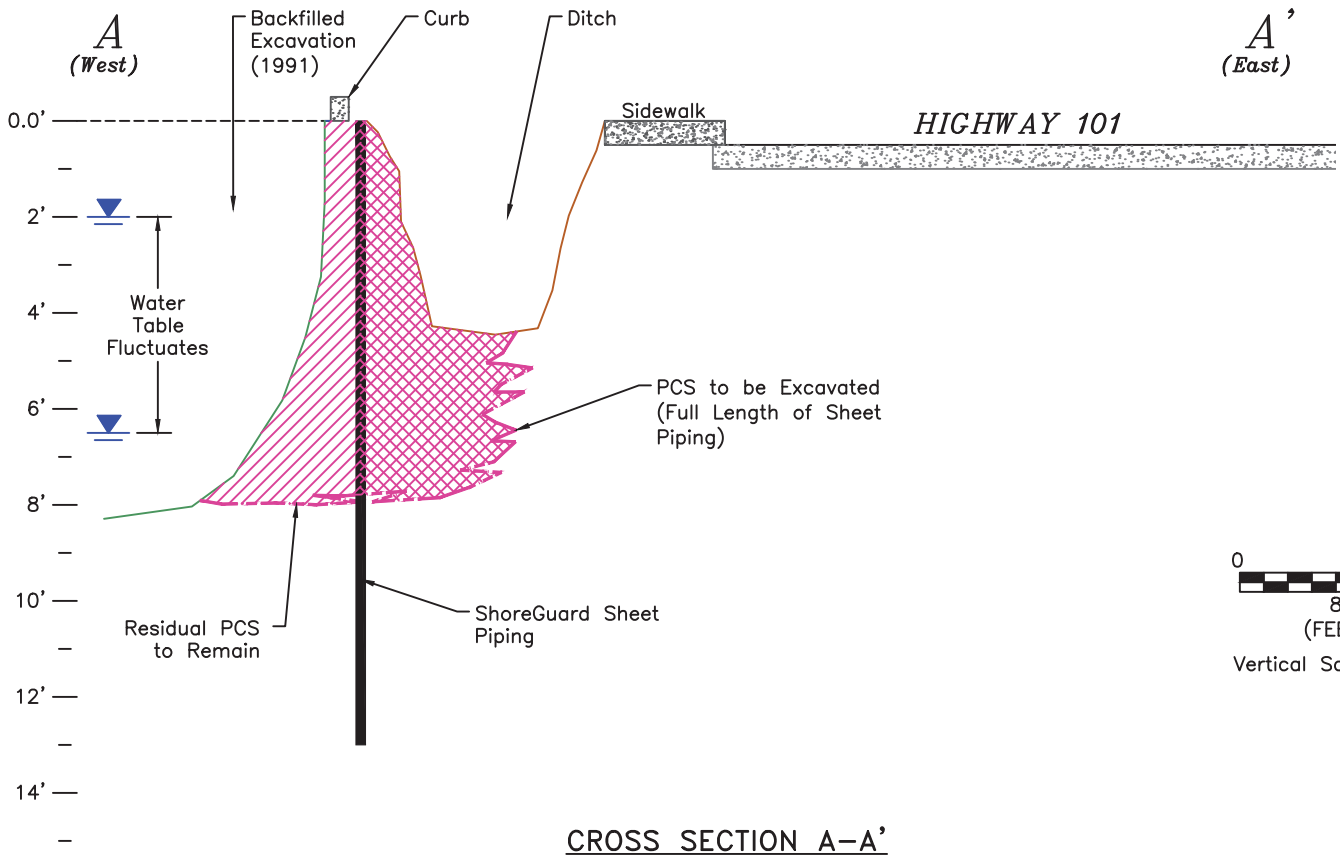
**PORTLAND OFFICE**  
 25195 SW Parkway Ave., #207  
 Wilsonville, OR  
 ph: 503.570.9484

www.BBAENV.COM

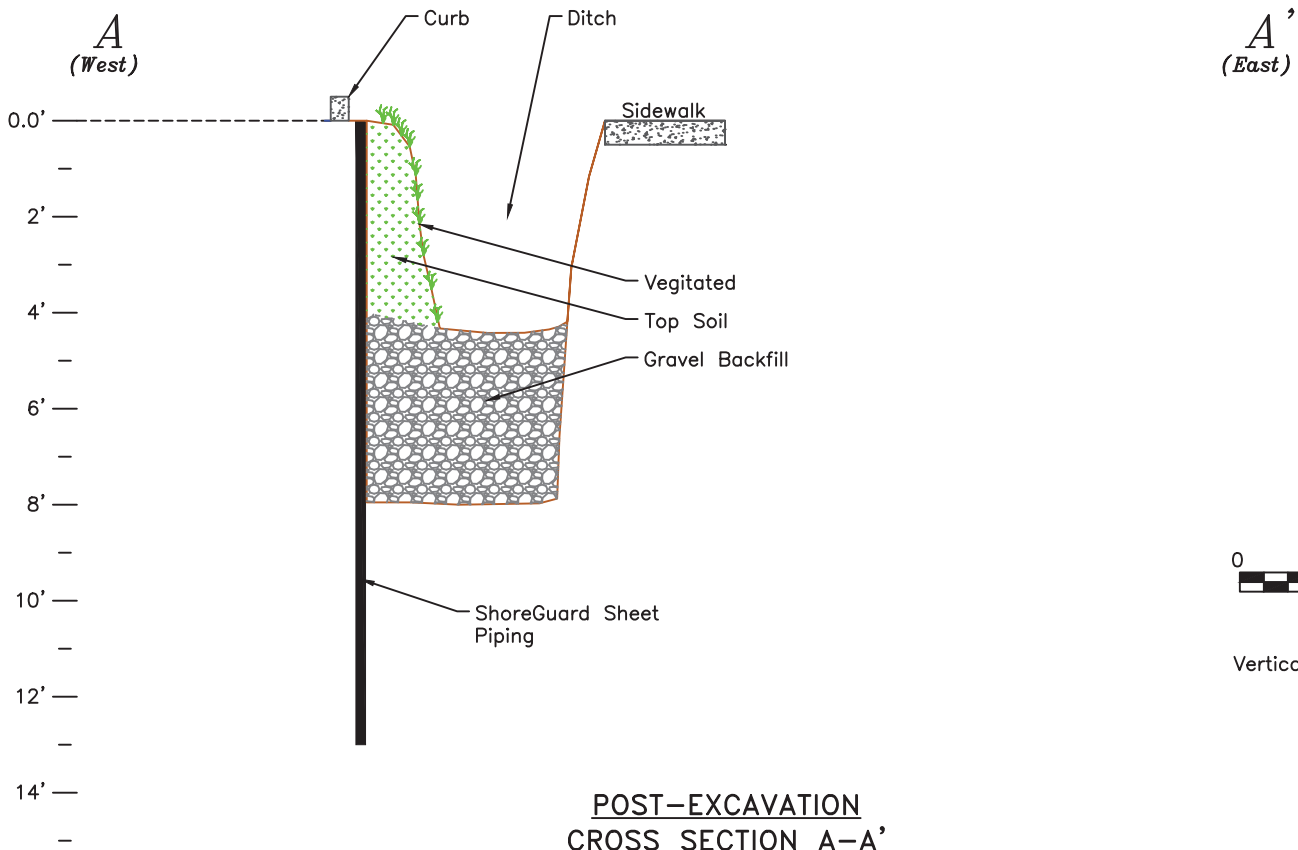
**SITE PLAN SHOWING GRADIENT BARRIER**  
**COOS BAY PAC-PRIDE II (Former Davis Oil, Inc. Cardlock)**  
**62590 S. HIGHWAY 101, COOS BAY, OREGON**

PROJECT CODE: PNE01MAG.16UC	DATE: 08/31/16	SCALE: AS SHOWN	DRAWN: K.D.DESIGNS	CHECKED: RANDALL BOESE
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FIGURE #:  
4



**CROSS SECTION A-A'**



**POST-EXCAVATION  
CROSS SECTION A-A'**



**EUGENE OFFICE**  
32986 Roberts Ct.  
Coburg, OR  
ph: 541.484.9484

**PORTLAND OFFICE**  
25195 SW Parkway Ave., #207  
Wilsonville, OR  
ph: 503.570.9484

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**A-A' GEOLOGIC CROSS SECTION**  
**COOS BAY PAC-PRIDE II (Former Davis Oil, Inc. Cardlock)**  
**62590 S. HIGHWAY 101, COOS BAY, OREGON**

<b>PROJECT CODE:</b> PNE01MAG.16UC	<b>DATE:</b> 08/31/16	<b>SCALE:</b> AS SHOWN	<b>DRAWN:</b> K.D.DESIGNS	<b>CHECKED:</b> RANDALL BOESE
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**FIGURE #:**  
**5**

**ATTACHMENT B**  
**STANDARD OPERATING PROCEDURES**

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## STANDARD OPERATING PROCEDURE SOP - 11

### LOW-FLOW PERISTALTIC PUMP GROUNDWATER SAMPLING

#### 1.0 General

This standard operating procedure is designed to assist the technician in taking representative groundwater samples from monitoring wells. Groundwater samples will be collected using low-flow (minimal drawdown) purging and sampling methods as discussed in U.S. EPA, Ground Water Issue, Publication Number EPA/540/S-95/504, July 1996 by Puls, R.W. and M.J. Barcelona - "Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells."

The sampler's objective is to purge and sample the well so that the water that is discharged from the pump, and subsequently collected, is representative of the formation water from the aquifer's identified zone of interest.

#### 1.1 Initial Pump Flow Test Procedures

Measure and record the Static Water Level (SWL) on field data sheet following the procedures outlined in SOP 9.

The appropriate tubing type (Teflon, HDPE, PVC, polyethylene, etc.) should be preselected based on the analytes of interest.

The mid-point of the saturated screen length is used by convention as the location of the tubing intake. Site specific work plans may change the location of sample intake depth in order to sample from the highest yielding zone within the screened interval. In wells with a fully saturated screen length over 10 feet, testing should be performed if possible during development to determine highest water yielding zone within screened interval.

After tubing installation and confirmation that the SWL has returned to its original level (as determined prior to tubing installation), the peristaltic pump should be started at a discharge rate less than 0.5 liters per minute (0.13 gal/min) without any In-Line Flow Cell connected. The water level in the well casing must be monitored continuously for any change from the original measurement. If significant drawdown is observed, the pump's flow rate should be reduced until the SWL drawdown stabilizes. Total drawdown from the initial (static) water level should not exceed 0.3 feet. In any case, the water level in the well should not be lowered below the top of the screen/intake zone of the well.

Once the specific well's optimum flow rate has been determined and documented, connect the In-Line Flow Cell system (if available) to be used to the well discharge and determine the control settings required to achieve the well's determined optimum flow rate with the In-Line Flow Cell connected (due to the system's back-pressure, the flow rate will be decreased by 10 to 20 percent).

## 1.2 Purge and Sampling Events

Prior to the initiation of purging a well, the SWL will be measured and documented. The peristaltic pump will be started utilizing its documented control settings and its flow rate will be confirmed by volumetric discharge measurement with the In-Line Flow Cell connected. If necessary, any minor modifications to the control settings to achieve the well's optimum flow rate will be documented on the appropriate field form. When the optimum pump flow rate has been established, the SWL drawdown has stabilized within the required range, and at least one pump system volume (down well extraction tubing, pump head tubing, and discharge tubing volume) has been purged, begin taking field measurements for pH, temperature (T), conductivity (Ec), oxygen reduction potential (ORP), dissolved oxygen (DO), and turbidity (TU) using an in-line flow cell or if unavailable individual water quality meters. All water chemistry field measurements will be documented on the appropriate field form. Measurements should be taken every three to five minutes until stabilization has been achieved. Stabilization is achieved after all parameters have stabilized for three consecutive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or dissolved oxygen. Three consecutive measurements indicating stability should be within:

Temperature	± 3% of reading (min ± 0.2° C)
pH	± 0.1 units, min
Conductance	± 3% of reading
Dissolved Oxygen	± 10% of reading
Redox	± 10 mV
Turbidity	± 10% NTU or <10 NTU

When water quality parameters have stabilized, and there has been no change in the stabilized SWL (i.e., no continuous drawdown), sample collection may begin.

## 1.3 Field Procedures

A summary of field procedures used to collect groundwater samples using a peristaltic pump is provided below.

- Calibrate all field instruments at the start of each day following the instrument manufacturer's instructions. Record calibration data on field form.
- Prior to use at each well, decontaminate all instruments that will be lowered in the well (electronic water level indicator and/or oil/water interface probe) by washing with phosphate-free detergent, rinsing with potable water, and rinsing with deionized water.
- Make notes in the appropriate field form documenting condition of the well and activity in the vicinity of the well.
- Measure the depth to water from the surveyed reference mark on the wellhead and record the measurement on the appropriate field form. Lock the water level meter in place so that the level can be monitored during purging and sampling.
- Place a new length of disposable sampling tubing into the well casing so that the tip of the tubing is located at appropriate sampling depth within the well screen.
- Place a new length of silicone tubing into the peristaltic pump head fixture.
- Connect the sample tubing to the influent end of the silicone tubing in the peristaltic pump head fixture.
- Place a new length of disposable sample tubing to the effluent end of the silicone tubing on the peristaltic pump and secure to drain the water purged from the well into the collection container (i.e., 5 gallon bucket).
- Start the peristaltic pump. Set the pump controller settings to the appropriate settings for the specific well. Confirm the flow rate is equal to the well's established optimum flow rate. Modify as necessary (documenting any required modifications).
- Monitor the water level and confirm that the SWL drawdown has stabilized within the well's allowable limits.
- Remove the pump discharge tubing.
- Connect the pump discharge tubing to the In-Line flow cells "IN" fitting.
- Connect the Flow Cell's "OUT" line and secure to drain the water purged from the well into the collection container (i.e., 5 gallon bucket).
- After purging the first system volume (down well sampling tubing, pump head silicone tubing, and discharge tubing volume) record the water quality field measurements every three to five minutes until all parameters have stabilized within their allowable ranges for at least three consecutive measurements. Begin sampling after stabilization has been achieved.
- Disconnect the flow cell and tubing from the pump discharge line before collecting samples. Decrease the pump rate to 100 milliliters per minute or less by lowering the pump controller's setting prior to collecting samples for volatiles. Place the samples in a chilled cooler with enough blue ice or ice to keep the temperature at 4 degrees Centigrade.
- Once samples for volatiles have been collected, re-establish pump flow rate to the original purge flow rate by inputting the documented controller settings for the well without the In-Line Flow Cell connected, and collect remaining samples.
- Consolidate purge water into a labeled 55-gallon drum(s).

- Remove and decontaminate the electronic water level indicator with phosphate-free detergent, rinsing with potable water and rinsing with deionized water.
- Disconnect and dispose the sample and silicone tubing used to collect the sample.
- Secure the peristaltic pump in the portable pump carrying case.
- Place the wellhead cover on the well and secure with a lock.
- Move equipment to next well to be sampled and repeat.
- At the end of each day clean and decontaminate the In-Line Flow Cell with phosphate-free detergent, rinsing with potable water, and rinsing with deionized water.
- Make a photocopy of all completed field forms. The copies should be retained on site. The original forms will be kept in the HC's project file.

#### **1.4 Equipment List**

The following equipment is needed to conduct low flow purging and sampling:

- Peristaltic pump equipped with a flow controller.
- Appropriate amount of disposable sample tubing to collect groundwater samples from each well at the site.
- In-Line Flow Cell and meter(s) with connection fittings and tubing to measure water quality.
- Water quality meters as backup in-case of in-line flow cell malfunction.
- Photoionization detector (PID).
- Electronic Water Level Indicator Probe.
- Laboratory-prepared sample containers appropriate for the analytical requirements.
- Field documentation forms.
- Measuring cup.
- Five gallon bucket(s) for containerizing purge water.
- Stopwatch.
- Cleaning and decontamination supplies.

**ATTACHMENT C**  
**FIELD FORMS**

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