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June 9, 2020

Mr. Peter Campbell, Project Manager
Alaska Department of Environmental Conservation / SPAR / CSP
43335 Kalifornsky Beach Road, Suite 11
Soldotna, AK 99669-8250

Re: Work Plan for 2020 Activities at Swanson River Field Pipe and Supply Yard
ADEC File Number: 2334.38.017
ADEC Hazard ID Number: 452

Dear whom it concerns,

Please find enclosed for your files, copies of the following revised work plan.

- Work Plan for 2020 Activities at Swanson River Field Pipe and Supply Yard

The submittal was prepared by Stantec on behalf of Chevron Environmental Management Company (CEMC).

Please do not hesitate to contact Craig Wilson (907 266-1128) and/or Tom Madsen (801 743-4924) with Stantec or myself at 832-854-5601 should you have any questions.

Sincerely,

Jason Michelson

Jason Michelson

Encl. Work Plan for 2020 Activities at Swanson River Field Pipe and Supply Yard

2020 Work Plan

Work Plan for 2020 Activities at Swanson River Field Pipe and Supply Yard

June 8, 2020

Prepared for:

Chevron Environmental Management Company

Prepared by:

Stantec Consulting Services, Inc.
725 East Fireweed Lane, Suite 200
Anchorage, AK 99503-2245

ADEC File Number: 2334.38.017
ADEC Hazard ID Number: 452

Revision	Description	Author		Quality Check		Independent Review	
1	Draft	CHW	2/25/20	THM	2/29/20	AWA	2/28/20
2	Rev. 1	CHW	6/3/20	THM	6/8/20		

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Prepared by ______________________________
(signature)

Craig Wilson

Reviewed by ______________________________
(signature)

Ally Auffermann

Approved by ______________________________
(signature)

Tom Madsen

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Acronyms

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AECOM	AECOM Technical Services, Inc.
AS	Alaska Statutes
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CEMC	Chevron Environmental Management Company
COBC	Compliance Order by Consent
CoC	chain-of-custody
Coffman	Coffman Engineers
DO	dissolved oxygen
EM	electromagnetic
EPA	United States Environmental Protection Agency
Fe	iron
GPR	Ground penetrating radar
GPS	Global Positioning System
GTS	groundwater treatment system
HASP	Health and Safety Plan
HHS	heated head space
Hilcorp	Hilcorp Alaska, LLC
LOQ	limit of quantitation
mg/kg	milligram per kilogram
mg/L	milligram per liter
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
ND	non-detect
OBC	Order by Consent
O&M	Operation and Maintenance
OilRisk	OilRisk Consultants
P&S	Pipe and Supply
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
PRA	Previously Remediated Area
PVC	polyvinyl chloride
QAPP	Quality Assurance Program Plan
QC	quality control
SRF	Swanson River Field
Stantec	Stantec Consulting Services Inc.
SW	Solid Waste
TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
UOCC	Union Oil Company of California
USFWS	United States Fish and Wildlife Service
µg/L	micrograms per liter

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this work plan on behalf of Chevron Environmental Management Company (CEMC) in support of investigation and remedial efforts at a xylene remediation project site located at the Pipe and Supply (P&S) Yard, Swanson River Field (SRF), Sterling, Alaska (**Figure 1**). The groundwater and surface water exhibiting xylene and ethylbenzene impacts are presumed to be the result of a xylene and ethylbenzene release associated with an aboveground 1,000-barrel storage tank in 1988.

This work plan was prepared in compliance with Title 18 of the Alaska Administrative Code (AAC), Chapter 75, Section 355 (18 AAC 75.355; ADEC 2018) and the *ADEC Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites* (ADEC 2017b). The sampling procedures described in this work plan were developed in accordance with ADEC's *Field Sampling Guidance* (ADEC 2019) and relevant industry standards, with modifications as required due to the State of Alaska Health Mandates authorized under the Public Health Disaster Emergency Declaration signed by Governor Mike Dunleavy on March 11, 2020..

1.1 PROJECT OBJECTIVES

2020 project objectives for the P&S Yard described in this work plan are:

1. Conduct groundwater and surface water sampling and monitoring in accordance with ADEC requirements, in support of Amendment 5, dated 25 March 1991, to the Compliance Order by Consent (COBC) for the Swanson River Oil Field issued by the U. S. Fish and Wildlife Service (USFWS) on 06 August 1985.
2. Install temporary monitoring wells in the previously remediated area to gain a better understanding of the groundwater and contaminant movement in that area.
3. Conduct soil sampling in the wetlands area to determine the concentration of contaminants in the peat and to inform decisions involving active remediation of the area.
4. Continue operations and maintenance activities on the air sparge system located on site.
5. Complete removal of surplus equipment and debris from the project site.
6. Evaluate data collected to date, identify remaining data gaps, and develop remedial alternatives and a recommended approach to progress the site to closure.

1.2 PROJECT TEAM AND SCHEDULE

1.2.1 Project Team

The Stantec team member roles and responsibilities are listed in **Table 1**. Additional personnel and subcontractors will be utilized as needed to achieve the work plan goals.

Table 1 Project Team

Name / Position	Role
Tom Madsen Project Manager	Manages and oversees project scope, schedule, and budget. Supports project technical lead in project design, sample collection, and scientific approach.
Michael Zidek Managing Principal	Manages resources and supports project technical lead in review of deliverables, project design, sample collection, and scientific approach, and coordinates field team members to ensure that field goals are being met.
Craig Wilson Project Technical Lead	Manages development of deliverables and completion of field work to ensure that field goals are being met; relays information to CEMC Project Manager; ensures that project requirements are being met; assists in design questions; coordinates job safety briefings and tailgate safety meetings; and oversees general project status.
Roxanne Russell, EIT Project Staff	Assist in field operations and collection of samples. Supports all activities required for project completion, including sample preparation, decontamination, sample collection, packing and transport, as well as QA/QC related tasks; informs Project Manager of project status.
Austin Badger Project Staff	Assist in field operations and collection of samples. Supports all activities required for project completion, including sample preparation, decontamination, sample collection, packing and transport, as well as QA/QC related tasks; informs Project Manager of project status.
John Marshall Project Staff and Site Safety Officer	Assist in field operations and collection of samples. Supports all activities required for project completion, including sample preparation, decontamination, sample collection, packing and transport, as well as quality assurance/quality control (QA/QC) related tasks; informs Project Manager of project status; organizes and oversees tailgate safety meetings and job safety briefings; and ensures QA/QC goals are met.

1.2.2 Project Schedule

Table 2 presents the proposed project schedule for 2020 activities. The final schedule will be adjusted as necessary to meet state health mandates and other emergency orders.

Table 2 Proposed 2020 Project Schedule

Month	Activity
May - November	Monthly O&M of air sparge system
June	COBC Sampling and Monitoring Well Installation in the Previously Remediated Area
September	COBC Sampling and groundwater sampling in the Previously Remediated Area
November	Soil sampling of seep/wetland area and groundwater sampling in the Previously Remediated Area

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 SITE LOCATION AND OWNERSHIP

The P&S Yard site is located within the SRF, an oil and gas production facility within the boundaries of the Kenai National Wildlife Refuge. The SRF is approximately 50 miles southwest of Anchorage, and 15 miles northeast of Kenai, Alaska. The site is located within the western half of the west half of Section 27, and within the eastern half of the east half of Section 28, Township 8 North, Range 9 West, Seward Meridian. See **Figure 1** for additional location details. Current site features are shown on **Figure 2**.

Union Oil Company of California (UOCC), an indirect wholly owned subsidiary of Chevron Corporation, is the former leaseholder and operator of the SRF (including the P&S Yard). In 2011, UOCC sold the SRF assets along with other Cook Inlet assets, to Hilcorp Alaska, LLC (Hilcorp). However, UOCC retained contractual obligation to remediate xylene-impacted soils and groundwater at the P&S Yard site to the extent that the agencies grant closure, or a statement of no further corrective action necessary is issued. This remediation effort is being managed by CEMC on behalf of UOCC.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

Since 1988, numerous investigations and remediation activities have been implemented at the site. Soil and hydrogeologic conditions have been interpreted from these investigations and activities. In general, the soils at the P&S Yard consist of 2 to 3 feet of silty sand, or silt overlaying a predominantly sand-and-gravel water-bearing zone. An aquitard consisting of silt, silty clay, and silty sand is present throughout the area, underlying the sand and gravel water-bearing zone. The aquitard is located from approximately 2 feet below ground surface (bgs) in the vicinity of the wetlands located east of the site, to 15 feet bgs at the western end of the site. The water-bearing zone soils are interpreted to be primarily of glacio-fluvial origin, and the aquitard is composed of ground moraine or glaciolacustrine sediments (CH2M Hill 2008). The sand-and-gravel water-bearing zone contains scattered cobbles and boulders, thin lenses of coarse sand and/or pea gravel (that may act as preferential flow pathways), and some fine-grained silt layers (CH2M Hill 2008). During the historical landfarm and backfilling activities, coarser materials consisting of gravel larger than ¾ inches were used for backfill at the bottom of the excavation above the aquitard within the installed slurry wall (i.e., previous remediated area).

2.3 SUMMARY OF PAST FIELD EFFORTS

A xylene release was discovered in 1988 at the P&S Yard, originating from a former aboveground 1,000-barrel storage tank located on the eastern side of Swanson River Road. The contaminant groundwater plume extended from the tank to the downgradient seeps located approximately 750 feet east of the tank. Cleanup levels were established in Amendment 5 of the 1991 USFWS COBC (USFWS 1991). The COBC establishes soil and groundwater cleanup goals for benzene, toluene, ethylbenzene, and xylenes (BTEX) at the P&S Yard site (as discussed in Section 2.3.1 below).

Site Description and Background

Several remedial technologies were utilized in the 1990s and are summarized in the 1998 Site Summary Report compiled by GeoEngineers for UOCC (GeoEngineers 1998). Soil remediation consisting of excavation, soil screening, landfarming and backfilling began in 2010 and concluded in 2016. Details regarding soil remediation activities are summarized in numerous remediation reports (Weston Solutions [Weston], Coffman Engineers [Coffman] and OilRisk Consultants [OilRisk] 2011a; Weston, Coffman and OilRisk 2011b; Weston and Coffman 2013; AECOM 2014a; AECOM 2015d; and AECOM 2016). Concurrent with remediation activities, subsurface soil and groundwater investigations occurred to fill data gaps and to guide remediation efforts. Details regarding subsurface investigation results are summarized in three reports (AECOM 2013; AECOM 2014b; and AECOM 2017). In addition, a complete description of the project background and the approach and methodology for developing the interim cleanup level for the site is provided in UOCC's *Interim Soil Cleanup Level Analysis* (OilRisk 2010), the *2015 Remediation Work Plan* (AECOM 2015c), and the *Final Groundwater Monitoring Program Work Plan* (AECOM 2015a).

A groundwater interception trench system and groundwater treatment system (GTS) were installed initially in 1991 to intercept and treat impacted groundwater. The GTS system aeration trailer and leach field were upgraded in 2009. The interception trench system was systematically decommissioned and removed from west to east when landfarm soil excavation activities progressed between 2012 and 2015.

To contain the contaminant plume and control groundwater inflow, a soil-bentonite slurry wall was installed around the perimeter of the P&S Yard site in 2002, and a second slurry and sheet pile wall located adjacent to and just east of Swanson River Road was installed in 2005 (**Figure 2**).

Groundwater analytical results from direct-push temporary well points installed in Swanson River Road during the 2013 subsurface investigation activities indicated that total xylene was detected in grab groundwater samples at concentrations ranging from 0.026 milligrams per liter (mg/L) to 99.7 mg/L. Ethylbenzene was detected in groundwater samples at concentrations ranging from 0.008 mg/L to 32.9 mg/L. Benzene was not detected above the laboratory reporting limits in the groundwater samples collected during the assessment (AECOM 2013).

In 2014, three soil borings were drilled and completed as temporary wells between Swanson River Road and the 2005 slurry/sheet pile wall to more accurately delineate xylene-impacted soil and groundwater encountered in that area, as reported in the *2013 Subsurface Investigation Report* (AECOM 2013). The purpose of collecting this additional data was to evaluate alternatives for remediation of the Swanson River Road area. The 2014 investigation and total xylene analytical results from the soil borings drilled immediately east of Swanson River Road indicated that soil between 4.5 and 8.5 feet bgs (at SB 5 completed as TW-2 and SB-6 completed as TW-3) exceeds the interim soil cleanup level for total xylene (AECOM 2014b). Groundwater was encountered between 3 and 4 feet bgs in this area. Groundwater analytical results in 2014 from temporary monitoring wells (TW-1, TW-2, and TW-3), located immediately east of the Swanson River Road, indicate that total dissolved-phase xylene concentrations ranged from 20.3 mg/L to 45.5 mg/L.

A multiyear remedial effort consisting of excavation, soil screening, landfarming, and backfilling of xylene-impacted soil from within the 2002 slurry wall (i.e., previously remediated area) was conducted from 2010 through 2016. Landfarming technology was accomplished via excavating xylene-impacted soil down to the aquitard. Soil was stockpiled and mechanically screened utilizing a screening plant to remove rocks larger than ¾ inches in diameter. Rocks exceeding ¾ inches in diameter were later used for backfill at the bottom of the excavation above the aquitard. The screened material less than ¾ inches was stockpiled and staged for landfarming. Landfarming operations were conducted daily in the summer months with weather permitting, utilizing a spader deployed from a farm tractor. After soil screening and laboratory sample analytical results indicated that landfarm soil did not exceed soil screening levels, remediated soil was backfilled into the excavation moving west to east. Active soil remediation consisting of excavating, excavation dewatering, soil screening, and landfarming was completed at the conclusion of the 2015 field season. The landfarm excavation backfilling and final landfarm surface grading were completed in 2016.

The results of the 2005, 2013, and 2014 assessment activities indicated that xylene-impacted soil and groundwater existed along the eastern portion of Swanson River Road. Due to various health and safety risks, logistical challenges of closing Swanson River Road, and engineering limitations, excavation was eliminated as a potential remedial alternative for this area. In-situ air sparging was selected as a viable remedial technology. Data collected from a 1996 air sparge pilot test conducted at the site, along with the boring logs from the 2013 and 2014 subsurface investigations, indicated lithological conditions conducive to successful remediation of soil and groundwater by in-situ air sparging (GeoEngineers 1996; AECOM 2014a and 2014b). Regulatory approval for air sparging was obtained in 2014.

In 2015, AECOM installed an air sparge well network consisting of 14 air sparge wells (AS-1 through AS-14) on the eastern shoulder of Swanson River Road to address xylene-impacted soil and groundwater remaining in an isolated pocket between the 2002 and 2005 slurry walls beneath Swanson River Road on the western end of the site (AECOM 2015b). The air sparge network was turned on in November 2015 and was discontinued on November 1, 2016 for rebound testing and in conjunction with the groundwater treatment system shutdown.

In 2016, AECOM installed a total of 12 temporary wells to enhance the post-remediation groundwater monitoring well network. Six temporary wells (TW-11 through TW-16) on the eastern end of the site and in the wetlands were installed during February 2016 when the wetland was frozen and could support a drill rig without causing damage to the wetland surface. The remaining six temporary wells within and around the previously remediated area area (TW-4R, TW-6 through TW-10) were installed in June 2016. Four additional wells were drilled and completed as air sparge replacement wells in June 2016 (AS-2R, AS-6R, AS-10R, and AS-11R) with ADEC approval to replace four air sparge wells that had lost their seals (AS-2, AS-6, AS-10, and AS-11, respectively). **Figure 2** shows site features, slurry walls, remediation components and historic sample locations.

Twice yearly groundwater and wetland monitoring has been performed at the site since June 2016. Analytical results indicate that:

- Xylene and ethylbenzene-impacted groundwater in exceedance of cleanup standards is present between the 2002 slurry wall and the 2005 slurry/sheet pile walls in temporary wells TW-2 and TW-3 installed immediately east of Swanson River Road, but not TW-1.

- Ethylbenzene-impacted groundwater in exceedance of ethylbenzene cleanup standards is present in the previously remediated area temporary wells TW-6, TW-7 and TW-8 and xylene-impacted groundwater in exceedance of xylene cleanup standard is present in TW-6 and TW-7.
- Xylene-impacted groundwater in exceedance of xylene cleanup standard of 0.019 mg/L is present immediately downgradient of the eastern portion of the 2002 slurry wall in temporary well TW-13.
- W-1P has surface water quality exceedances for total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH).

Additional wells and temporary piezometers were installed in 2018. Five wells (TW-17, TW-18D, TW-18S, TW-19D, and TW-19S) were added in the previously remediated area to facilitate monitoring of potentially petroleum hydrocarbon-impacted groundwater immediately downgradient of the AS system. Wells TW-18S/D and TW-19S/D were installed as nested pairs to collect additional BTEX concentration data at the top of the aquitard (deep wells) and at the top of the water table (shallow wells). The deeper well of the nested pairs were constructed so they could be potentially converted to AS wells, if needed. The purpose of the temporary piezometers was to fill data gaps that related to the lateral extent of xylene in groundwater in the area outside and to the east of the 2002 slurry wall between TW-13 and W-1P.

The air sparging system was reactivated in 2018 with modified programming to vary the on-off cycles of each air sparge well to optimize xylene attenuation. Past analytical results from TW-1, TW-2 and TW-3 indicated that the air sparge system was effectively reducing xylene concentrations between the slurry walls. In early 2019, equipment issues with the system compressor forced a shutdown of the system. A new air compressor was installed in August 2019 and the air sparge system was restarted in October 2019.

2.4 CONTAMINANTS OF POTENTIAL CONCERN

Table 3 lists the known site contaminants addressed in this work plan and the cleanup levels specified in the COBC. Cleanup levels are specified in the COBC, except that the wetland area must meet ADEC water quality standards (ADEC 2018a).

Table 3 Site Contaminants and Cleanup Levels

Contaminant of Potential Concern	Benzene	Toluene	Ethylbenzene	Xylene	TAH	TAqH
Groundwater COBC Cleanup Level	Not listed	0.50 mg/L	0.48 mg/L	0.20 mg/L	NA	NA
Soil COBC Cleanup Level	2.0 mg/kg	4.5 mg/kg	15.0 mg/kg	1.5 mg/kg	NA	NA
Alaska Water Quality Standard (18 AAC 70) Note: Only applicable to wetland area	NA	NA	NA	NA	100 mg/L	150 mg/L

The COBC (USFWS 1991) requires sampling for benzene but does not list a groundwater cleanup level. Benzene monitoring levels will be compared to ADEC groundwater cleanup levels (ADEC 2018) for reference purposes only.

2.5 REMEDIAL APPROACH SELECTION AND INTERIM SOIL CLEANUP LEVEL

To achieve the soil and water cleanup goals established in the COBC (USFWS 1991), several remedial technologies were attempted in the 1990s, including soil venting, air sparging, and aboveground bio-piles. Landfarming with an agricultural disk was found to be most effective at reducing xylene concentrations in the soil. Considerable remediation has been completed in with in the slurry wall boundaries east of the AS system.

However, because of the desired expedited timeline for treating the soil, landfarming was not considered practical for achieving the COBC soil cleanup level of 1.5 mg/kg for total xylenes. Long-term monitoring results indicated that higher soil concentrations would be protective of groundwater (OilRisk 2008). Since previous work at the site indicated that soil concentrations below 30 mg/kg could be achieved via landfarming (OilRisk 1999), UOCC proposed development of an interim soil cleanup level that would result in leachate concentrations of xylenes below the established COBC groundwater cleanup level of 0.2 mg/L. A complete description of the approach and methodology for developing the interim cleanup level is provided in UOCC's *Interim Soil Cleanup Level Analysis* (OilRisk 2010). Samples were analyzed for xylenes in both soil and liquid leachate, and the pairs of results were fitted to a log-log regression relationship. The lower 90-percent confidence interval of the mean, 24.7 mg/kg, was proposed as the interim soil cleanup level for xylenes. This 2010 interim cleanup value ensured that for a given volume of soil, the mean leachate concentration would be below the groundwater cleanup level of 0.2 mg/L, with 90-percent confidence level. All ADEC and stakeholder approved P&S Yard Remedial Work Plans developed between 2010 and 2014 that identified a total xylene concentration of 24.7 mg/kg as the interim cleanup goal for soil. In 2015, after soil excavation activities began, it was determined by ADEC and the stakeholders that a more conservative interim cleanup goal of 9.3 mg/kg would be used when screening soils.

Current remediation activities are centered on reducing the xylene levels along the roadside in the vicinity of wells TW-2 and TW-3, utilizing the air sparge system. Future activities, determined by the results of the wetlands soil sampling, are anticipated to include remediation of xylene impacted peats in the wetland area.

3.0 WETLANDS SOIL SAMPLING

Soil samples will be collected from the seep/wetlands area to the east of the slurry wall, in the vicinity of W-1 and W-1P, to confirm the lateral extent, and evaluate the vertical delineation of the xylene impacted peats in the seep/wetlands area. Proposed sampling locations are shown on **Figure 3**. Pending freeze up, the sampling will occur in November 2020 to take advantage of the low winter water table and frozen ground for access. The results of the sampling will be used to inform future decisions regarding remediation in that area.

Based on the previous extent of investigation in the seep/wetlands area and knowledge of past use of the area, site clearance of the upper 5 feet of the borings will not be required prior to direct push activities. Utility clearance procedures will be limited to a State-required one-call. A USFWS special use permit and a notice of intent to be covered under an Army Corps of Engineers national general permit will be required before field work begins.

3.1 SOIL SAMPLING METHODS

It is anticipated that up to 24 soil borings will be advanced by direct push, with the actual number being determined by field conditions. The borings will be advanced through the peat layer to the underlying sediment, anticipated to be 8 feet or less bgs, based upon 2005 probing of the area. Borings will be advanced using a small GeoProbe® direct push rig, utilizing a Macro-Core® MC5 soil system for sample collection. The MC5 system uses 2.25 inch outside diameter tooling. Any thawed peat is expected to collapse on itself after sampling. If boring holes do not collapse after sampling, they will be filled with local organic material mixed with sand and bentonite chips.

Section 7 of this work plan provides details of the soil sample analytical methods associated with this activity.

4.0 AIR SPARGE SYSTEM OPERATION & MAINTENANCE

The air sparge system air compressor was restarted in October 2019, utilizing the pulsed operation schedule from September 2018 until March 2019 when the system went offline for repair. Pulsed operation of the air sparge system was shown to be effective in attenuating xylene concentrations during previous operation of the system, and similar operation has been continued after repairs were completed and the system placed back online in October 2019.

Different programming cycles will be tested in 2020 to find the optimum combination of air sparge wells and air pressures to target xylene attenuation at the south end of the air sparge line where xylene concentrations continue to exceed cleanup standards without incurring groundwater mounding or movement to the north end of the system. It is anticipated that the system will be run at a very low air flow volume across the entire air sparge network so that groundwater mounding does not occur.

4.1 MONNIT SYSTEM INSTALLATION

A Monnit® remote monitoring system, or equivalent, will be installed to allow remote auditing of system operation. At a minimum, the features of the remote monitoring system consist of verifying the operation status (i.e., on/off) of the AS system.

5.0 COBC MONITORING

Two sampling events, in May and September, will be conducted in support of the monitoring requirements of the COBC (USFWS). Section 7 of this work plan provides further details of this activity.

6.0 MONITORING WELL INSTALLATION IN PREVIOUSLY REMEDIATED AREA

Temporary monitoring wells will be installed at up to 9 locations (**Figure 4**) to gain a better understanding of the hydrogeology of the area, the lateral delineation of xylene impacts around TW-7 and TW-6, and the attenuation of the residual xylene in the area. The existing monitoring wells within the previously remediated area were installed in 2014 (TW-5), 2016 (TW-4R, TW-6, TW-7, TW-8) and 2018 (TW-17, TW-18S, TW-18D, TW-19S, TW-19D). TW-18D and TW-19D were completed with short screens (<2 feet) to preferentially sample at the aquitard, the other wells were completed with 5-10 foot screens set to intercept the groundwater table.

Table 4 lists the proposed temporary monitoring wells, and they are shown on **Figure 4**. Proposed wells TW-6D and TW-7D will be completed with short screens, similar to existing wells TW-18D and TW-19D, to preferentially sample at the aquitard near existing wells TW-6 and TW-7. The comparison of data from these wells with wells TW-6 and TW-7 will contribute to understanding whether there is a preferential pathway along the aquitard. Five wells would be completed with longer screens to sample across the groundwater surface and be centered in remediation cells 3, 4, and 5 on either side of the permeable collection trench that was installed as part of the groundwater treatment system. The last well would be located in the unremediated area between remediation cell 5 and existing wells TW-4R and TW-5, to determine if there is a gradual diminishment of xylene concentrations between the remediated cells and wells TW-4R and TW-5 or if there is a barrier to contaminant flow.

Table 4 Proposed Temporary Monitoring Wells

Proposed Well	Location	Estimated Depth (ft)	Screened Interval (ft)
TW-6D	Near TW-6	17	15-17
TW-7D	Near TW-7	14	12-14
TW-20	Equidistant between TW-6, TW-7, & TW-9	14	4-14
TW-21	Near buried boulders and the old service road	15	5-15
TW-22	Equidistant between TW-7, TW-8, & TW-9	14	4-14
TW-23	Center of south side of cell #4	14	4-14
TW-24	Midway between TW-8 and TW-9 at limit of excavation	12	3-12
TW-25	Along old GTS pipeline alignment - pipeline removed 12/2009	12	3-12
TW-26	In line with TW-8 & TW-4R, just east of 1992 interception trench	12	3-12

6.1 WELL DESIGN AND INSTALLATION

Up to 9 temporary monitoring wells will be installed using direct push technology, utilizing DT45 tooling and a Geoprobe 7822DT or equivalent. The wells will be completed with 2-inch polyvinyl chloride (PVC) tubing 0.010-inch machine slotted screens, 12/20 sand pack, bentonite solids for sealing and stick-up over-casings.

The borings will be advanced using direct push technology, the borings will be logged, and sampling intervals will be screened using a portable photoionization detector (PID). Borehole locations will be surveyed by GPS and vertical elevations will be determined by laser level.

6.1.1 Borehole Clearance

Borehole clearance will be conducted in accordance with CEMC and Hilcorp requirements. Utility clearance will be conducted in accordance with Alaska Statutes (AS) Title 42, Section 30 (Alaska 811 Digline System). Technicians will also complete a sweep of the planned well installation locations with ground penetrating radar (GPR) and perform an electromagnetic (EM) survey.

6.2 GROUNDWATER SAMPLE COLLECTION

Groundwater samples will be collected in September and November, in conjunction with other activities at the site, using the procedures described in Section 7. The samples will be submitted for analysis of BTEX using EPA Method 8260C.

6.3 SOIL SAMPLE COLLECTION

Up to two soil samples will be collected from each boring during well construction, one in the vadose zone at the interval with the highest PID reading, and one at the soil/groundwater interface, using the procedures described in Section 7. The samples will be analyzed for BTEX using EPA Method 8260C/5035A.

7.0 SAMPLING PLAN

2020 sampling will encompass three goals:

1. Monitoring levels of xylene concentrations within the site for compliance to COBC standards.
2. Sampling the wetlands area to the east of the site for compliance to Alaska water quality standards, and to evaluate xylene impacts in soil/peat.
3. Groundwater sampling of the previously remediated area.

Sampling within the site will include BTEX sampling (EPA Method 8260C), along with direct read measurements of conductivity, pH, and dissolved oxygen. Sampling within the wetlands area will include TAH (EPA Method 624.1) and TAqH (EPA Method 610) for surface water, and BTEX (EPA Method 8260C/5035A) for soil and groundwater.

Table 5 provides a summary of sampling locations and analysis.

Table 5 Sampling Schedule

Sample Identification	Location	Frequency	Analysis
MW-1	Western side of previously remediated area (PRA), outside of slurry wall, western side of Swanson River Road	Annual	BTEX, direct read dissolved oxygen (DO), geochemical parameters
TW-1	Western side of PRA, outside and immediately west of 2005 slurry wall, source area well	Monthly	BTEX, direct read DO
TW-2	West side of PRA, outside and immediately west of 2005 slurry wall, source area well	Monthly	BTEX, direct read DO
TW-3	Western side of PRA, outside and immediately west of 2005 slurry wall, source area well	Monthly	BTEX, Direct read DO
TW-4R	Eastern side of PRA, inside of slurry wall	Semi-annual	BTEX, direct read DO, geochemical parameters
TW-5	Eastern side of PRA, inside of slurry wall	Semi-annual	BTEX, direct read DO
TW-6	PRA area, inside of slurry wall	Semi-annual	BTEX, direct read DO
TW-7	PRA area, inside of slurry wall, within excavation area, 160 feet east of sheet pile wall, between Cell 1 and Cell 2	Semi-annual	BTEX, direct read DO
TW-8	PRA area, inside of slurry wall, within excavation area, 375 feet east of sheet pile wall, between Cell 3 and Cell 4	Semi-annual	BTEX, direct read DO
TW-12	Spruce forest outside of 2002 slurry wall on eastern side and downgradient of PRA area	Semi-annual	BTEX, direct read DO, geochemical parameters

Sampling Plan

Sample Identification	Location	Frequency	Analysis
TW-13	Spruce forest outside of 2002 slurry wall on eastern side and downgradient of PRA area	Semi-annual	BTEX, direct read DO
TW-17D	East of 2005 slurry wall, in PRA area, immediately downgradient of TW-1	Semi-annual	BTEX, direct read DO
TW-17S	East of 2005 slurry wall, in PRA area, immediately downgradient of TW-1	Semi-annual	BTEX, direct read DO
TW-18D	East of 2005 slurry wall, in PRA area, immediately downgradient of TW-2	Semi-annual	BTEX, direct read DO
TW-18S	East of 2005 slurry wall, in PRA area, immediately downgradient of TW-2	Semi-annual	BTEX, direct read DO
TW-19D	East of 2005 slurry wall, in PRA area, immediately downgradient of TW-3	Semi-annual	BTEX, direct read DO
TW-19S	East of 2005 slurry wall, in PRA area, immediately downgradient of TW-3	Semi-annual	BTEX, direct read DO
W-1P	Wetland	Semi-annual	BTEX, direct read DO, geochemical parameters, TAH, TAqH
FSS-1	Seasonal seep located immediately downgradient and east of the eastern edge of the slurry wall berm. Seep is located at toe of slurry wall between the berm and the forest in the vicinity of TW-13	Semi-annual	BTEX
FSS-2	Seasonal seep located immediately downgradient and east of the eastern edge of the 2002 slurry wall berm. Seep is located at toe of 2002 slurry wall between the berm and the forest in the vicinity of TW-13	Semi-annual	BTEX
PSW-1	Ponded surface water at the east end of the remediated PRA area, at the interface between the remediated PRA and ponded water surface	Semi-annual	BTEX [b]
PSW-2	Ponded surface water at the east end of the remediated PRA area, at the interface between the ponded water and the eastern berm	Semi-annual	BTEX [b]
PZ 1 through PZ 19	Between TW-13 and W-1P	Semi-annual	BTEX
Wetlands	Soil samples from seep/wetlands area (see Section 3)	Once	BTEX,
Wetlands	Surface water samples from seep/wetlands area (see Section 3)	Semi-annual	TAH, TAqH
PRA	Groundwater sampling (see Section 6)	Twice	BTEX

Table 2 Notes:

- Geochemical parameters are nitrate / nitrite, dissolved Fe (ferrous Fe), sulfate, alkalinity, pH, conductivity, and methane.
- [a] Per ADEC letter (2017a), Sampling for hydrocarbons should be included for the downgradient wetland monitoring wells and creek samples, at least on an interim basis, in order to determine if they are present at concentrations exceeding 15 micrograms per liter.

- [b] Per ADEC letter (2017a), If no ponded water is present at both of these locations at the time of sampling, and the dewatering system is not in operation, then one static water sample will be collected from the lower vault for analyses of BTEX by SW8021.

BTEX	benzene, toluene, ethylbenzene, and xylenes	PRA	previously remediated area
DO	dissolved oxygen	SIM PAH	Single ion monitoring polyaromatic hydrocarbon

Semi-annual monitoring will be conducted in the July and September timeframes, and monthly sampling of the monitoring wells in the AS area (TW-1, TW-2, and TW-3) may be reduced during the winter season if environmental conditions preclude effective sampling.

7.1 TARGET ANALYTES

Table 6 provides a listing of the target analytes for each sampling event in this work plan.

Table 6 Target Analytes by Location

Location	Parameter / Method	Field Samples	Field Duplicates	Matrix Spike	Matrix Spike Duplicate	Trip Blanks
MW-1, TW-1, TW-2, TW-3, TW-4R, TW-5, TW-6, TW-7, TW-8, TW-12, TW-13, TW-17D, TW-17S, TW-18D, TW-18S, TW-19D, TW-19S, W-1P, FSS-1, FSS-2, PSW-1, PSW-2	BTEX / EPA 8260C	22	3	2	2	3
PZ-1 through PZ-19	BTEX / EPA 8260C	19	2	1	1	1
MW-1, TW-4R, TW-12, W-1P	Alkalinity SM21 2320B	4	—	—	—	—
MW-1, TW-4R, TW-12, W-1P	Conductivity SM 21 2510B	4	—	—	—	—
MW-1, TW-4R, TW-12, W-1P	pH SM 4500H+	4	—	--	--	—
MW-1, TW-4R, TW-12, W-1P	Nitrate / Nitrite SM 21 4500NO3-F	4	—	—	--—	—
MW-1, TW-4R, TW-12, W-1P	Sulfate EPA Method SW9056A	4	—	--—	--	—
MW-1, TW-4R, TW-12, W-1P	Methane EPA Method RSK 175	4	—	—	—	—
MW-1, TW-4R, TW-12, W-1P	Dissolved Iron EPA Method 200.8, field filtered	4	—	—	—	—
MW-1, TW-1, TW-2, TW-3, TW-4R, TW-5, TW-6, TW-7, TW-8, TW-12, TW-17D, TW-17S, TW-18D, TW-18S, TW-19D, TW-19S, W-1P	Direct Read DO	17	—	—	—	—
Wetlands soil sampling	BTEX / EPA 8260C	48	5	4	4	3
Wetlands groundwater sampling	TAH / EPA 624.1	26	3	—	—	—
Wetlands groundwater sampling	TAqH / EPA 610	26	3	—	—	—
PRA groundwater sampling	BTEX / EPA 8260C	18	2	1	1	2
PRA soil sampling	BTEX / EPA 8260C	18	2	1	1	2

Table 3 Notes:

BTEX	benzene, toluene, ethylbenzene, and xylenes	PSW	Ponded Surface Water

DO	dissolved oxygen	TAH	Total Aromatic Hydrocarbons
EPA	U. S. Environmental Protection Agency	TAqH	Total Aqueous Hydrocarbons
FSS	Forest Seep Sample	SM	Standard Method
PRA	Previously Remediated Area	—	not applicable

7.2 SITE CONTROL

SRF is a Hilcorp-controlled facility. Any person entering the field is required to sign in and sign out at Hilcorp's main office. Any contractor new to the site will be required to attend a Hilcorp site-specific field orientation, which takes approximately one hour to complete.

Access to the P&S Yard xylene site will be controlled during remedial efforts. The site is surrounded on three sides by woods, and on the fourth side Jersey barriers prohibit vehicle access except where absent at the P&S Yard access road (driveway). Traffic cones are present across the P&S Yard driveway to further limit access. During remedial efforts access is restricted to remediation personnel and support personnel only. All visitors are required to check in at the P&S Yard GTS trailer. On-site personnel will monitor access during daily activities so that all visitors to the site are briefed about daily site activities prior to entering the area.

The GTS trailer will be used for safety meetings, office space, break room capacity, tool and material storage, and general site supervision use. Restrooms are located at Hilcorp's main office and at Plant 10.

Any heavy equipment or drilling equipment exposed to impacted soil will be staged inside the slurry wall containment and will be decontaminated prior to removal from the site. A specific equipment decontamination area may be constructed on site as needed. Decontamination fluids will be collected in 55-gallon drums and disposed of by a waste disposal subcontractor.

7.3 SAMPLE COLLECTION METHODS

7.3.1 Groundwater

Groundwater samples will be conducted using a peristaltic pump and approved low flow sampling techniques. A direct read down-hole optical dissolved oxygen (DO) meter will be used prior and post purging and sampling at locations identified in **Table 2**. Water samples will be collected directly from the end of the peristaltic tubing into sample containers supplied by the laboratory. Water quality parameters will be collected during purging and recorded on field forms. Wells will be sampled after water quality parameters stabilize for three successive readings. If water quality parameters do not stabilize, a minimum of four well casing volumes will be removed, and then the well will be immediately sampled.

7.3.2 Surface Water

Surface water samples will be collected by submerging a dedicated vial into the surface water, and the water will be decanted into sample containers supplied by the laboratory. Water quality measurements will be collected after the collection of the laboratory sample by submerging the water quality probe into the surface water after sample collection.

7.3.3 Soil

Field screened soil samples will be collected from direct push cores. Field screening will be conducted by partially filling (one-third to one-half) a re-sealable plastic bag with the soil and warming the sample soil to a minimum of 40 degrees Fahrenheit. Soils will be warmed for at least 10 minutes but no longer than 1 hour. The bag will be agitated for 15 seconds at the beginning and end of the headspace development period to assist volatilization. After headspace development, a PID will be used to measure relative organic vapors, and the result will be recorded on the soil boring logs.

Samples for laboratory analyses will be collected from the direct push cores. For each volatile soil sample, approximately 50 grams of soil was placed in a pre-tared, 4-ounce, amber-glass jar using a dedicated stainless-steel spoon and field-preserved in 25 milliliters of methanol. An additional unpreserved volume of soil will be collected with each volatile soil sample for percent-solid analysis. Sample containers will be immediately labeled and placed in a cooler with ice.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

8.1 QUALITY CONTROL SAMPLES

Quality control (QC) samples will be collected to assess potential errors introduced during sample collection, handling, and analyses. As part of the field Quality Assurance / Quality Control (QA/QC) program, field duplicate samples, trip blanks, and extra sample volume for matrix spike/matrix spike duplicate (MS/MSD) procedures will be collected.

QC samples, summarized in **Table 7**, will be collected to assess potential errors introduced during sample collection, handling, and analyses. In summary, QC samples will include:

1. One trip blank for each cooler containing BTEX samples,
2. One duplicate field sample for every 10 samples collected per laboratory analysis,
3. One equipment blank per submersible pump per day, and
4. Additional sample volumes for MS/MSD analysis for water samples at a rate of one per 20 samples collected per requested laboratory analysis.

Table 7 Quality Control Requirements

Sampling Event	Parameter	Number of Primary Samples	Equipment Blank (EB) Samples	Total Number of Samples
May, July, September	BTEX	41	1 per pump per day	41 + 5 Dup + 4 EB + 4 MS/MSD
	Nitrate / Nitrite	4	NA	NA
	Dissolved (ferrous) Fe	4	NA	NA
	Total Fe	3	NA	NA
	Sulfate	4	NA	NA
	Alkalinity	4	NA	NA
	pH	4	NA	NA
	Conductivity	4	NA	NA
	Methane	4	NA	NA
	Dissolved Oxygen	17	NA	NA

Table 4 Notes: Dup = duplicate sample;
MS/MSD = matrix spike/matrix spike duplicate;
EB = equipment blank

8.2 SAMPLE CONTAINERS, HOLD TIMES, AND PRESERVATION

Table 8 summarizes the sample containers, preservation, and holding times required for each analytical method by which samples will be collected. Field personnel designated by the analytical laboratory.

Table 8 Sample Containers, Preservation, and Hold Times

Analytical Parameter	Analytical Method	Holding Time (days)	Containers	Preservation
BTEX	EPA 8260C	14	40 mL VOA vials	pH<2, HCl; Cool to 0-6˚C
TAH	EPA 624.1 / 602	14	40 mL VOA vials	pH 4-5, HCl; Cool to 0-6˚C
TAqH	EPA 625 / 610	7	250 mL amber glass	Cool to 0-4˚C
Alkalinity	SM 21 2320B	14	250 mL HDPE	Cool to 0-6˚C
Conductivity	SM 21 2510B	28	125 mL HDPE	Cool to 0-6˚C
pH	SM 4500H+	15 minutes	125 mL HDPE	Cool to 0-6˚C
Nitrate / Nitrite	SM 21 4500NO3-F	28	125 mL HDPE	pH<2, H2SO4; Cool to 0-6˚C
Sulfate	EPA Method SW9056A	28	125 mL HDPE	Cool to 0-6˚C
Methane	EPA Method RSK 175	14	40 mL VOA vials	pH<2, HCl; Cool to 0-6˚C
Dissolved Iron	SM 3500-Fe	24 hours	250 mL amber glass	Field filtered; pH<2, HCl; Cool to 0-6˚C
Total Iron	EPA Method 200.8	24 hours	250 mL amber glass	Cool to 0-6˚C

8.3 FIELD DOCUMENTATION

Field documentation will include sample identification labels, photographs, laboratory analysis requests, and permanently bound field logs. A field logbook will be maintained by the field team lead to record a detailed description of all field activities and samples collected.

8.4 SAMPLE LABELING

Each sample container will be sealed and labeled immediately after collection. Sample labels will be completed using waterproof ink and will be affixed firmly to the sample containers. A sample code will be assigned to each sample as an identification number to track collected samples. The sample label will provide the following information: sample identification number; date and time of collection; analysis required; and preservation method used. Field duplicate samples will be submitted as blind duplicates – that is they will be consecutively numbered and will not be identified on the chain-of-custody (CoC) as being duplicates (but the fact that they are duplicates will be recorded in the field logbook).

8.5 CHAIN-OF-CUSTODY AND SAMPLE PACKAGING

A CoC record will be completed and shipped with the samples. Proper sample custody is maintained through adherence to the procedures listed below:

1. If the samples are not hand delivered, a minimum of one custody seal will be placed over the lid/cooler edge and secured with clear packaging tape.
2. A CoC record must accompany the coolers in which the samples are packed. When transferring samples, the individuals relinquishing and receiving the coolers must sign, date, and note the time on the CoC record. This record documents sample custody transfer.

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. Adherence to the following sample package requirements is essential:

1. Sample container lids must never be mixed. All lids must remain with their original container.
2. Environmental samples must be cooled to 0 to 6 ˚C and packed to maintain this temperate to preserve many chemical constituents. All coolers will contain a temperature blank that the laboratory will use to document sample temperatures.
3. Any remaining space in the cooler should be filled with inert packing material.

8.6 DATA REDUCTION, VALIDATION AND REPORTING

Validation and review of all analytical data will be performed by a qualified professional experienced in data validation and review procedures. All data will be validated and reviewed in accordance with appropriate EPA procedural guidance documents and ADEC regulatory guidance documents. The reference documents include *EPA Functional Guidelines for Organic Data Review* (EPA 2008), and *ADEC Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling, Technical Memorandum* (ADEC 2017a).

9.0 INVESTIGATION DERIVED WASTE MANAGEMENT

Investigation-derived waste includes soil cuttings, well purge water from water sampling, personal protective equipment (PPE) such as nitrile gloves, and dedicated sampling equipment including polyethylene bailers, peristaltic pump tubing, and paper towels.

Soil boring can potentially generate soil investigation-derived waste. Soil cuttings generated from the soil borings will be field screened as specified in ADEC guidance (ADEC 2019). Soil cuttings will be considered clean unless heated head space (HHS) screening exceeds the ADEC interim cleanup goal of 9.3 ppm. If HHS screening does not exceed 9.3 ppm, the soils will be placed back in the borehole from which they were generated. If soils are encountered that exhibit by elevated HHS results exceeding the 9.3 ppm HHS screening level, soil cuttings will be drummed in open-topped 55-gallon drums for off-site disposal at an ADEC approved waste disposal facility.

All well purge water will be collected in 5-gallon buckets that will be transported, labeled and stored inside of the P&S Yard groundwater treatment system trailer until laboratory analytical results are received. If analytical results indicate that concentrations of BTEX is below ADEC cleanup levels the water will be disposed of as non-regulated water. If BTEX concentrations exceed ADEC cleanup levels, then the water will be transported and disposed of as regulated waste at a permitted facility.

Personal protective equipment such as nitrile gloves and dedicated sampling equipment, including tubing and paper towels used to decontaminate the oil-water interface probe, will be disposed with general solid waste at Plant 10 for disposal at the Kenai Peninsula Borough Landfill.

10.0 REMOVAL OF SURPLUS EQUIPMENT AND SUPPLIES

Over the course of the project surplus equipment and supplies have accumulated at the project site. Removal and disposal of the accumulated equipment and supplies that are no longer useful to the project will be accomplished in the fall of 2020. Based on their use and condition, the removed equipment/supplies are considered suitable for disposal as general solid waste at the Kenai Peninsula Borough Landfill.

11.0 REFERENCES

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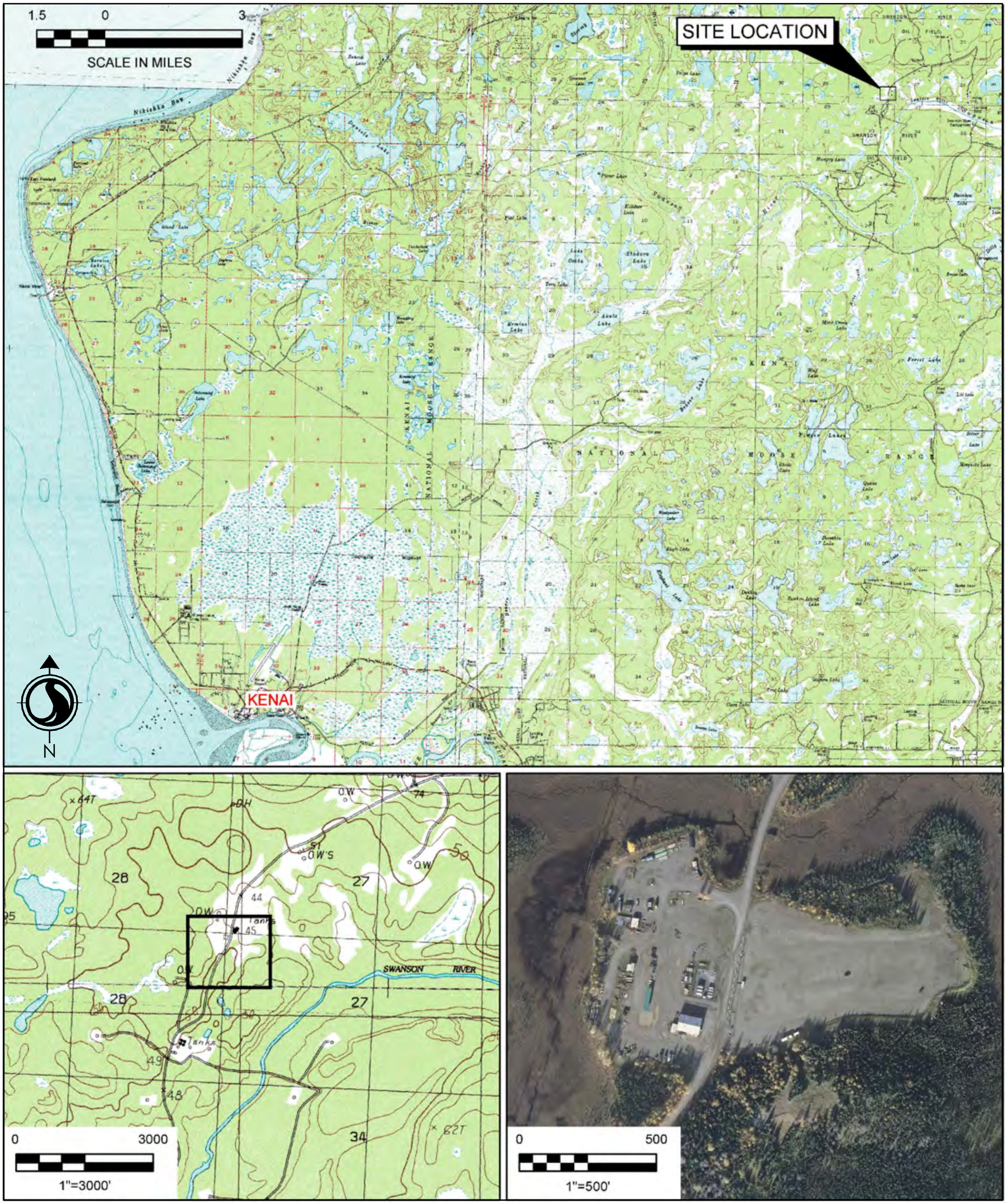
FIGURES

Figure 1 Site Location Map

Figure 2 Site Features

Figure 3 Wetlands Sampling Locations

Figure 4 Previously Remediated Area Monitoring Well Locations



Stantec

FOR:
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
P&S YARD, SWANSON RIVER FIELD
STERLING, ALASKA

SITE LOCATION MAP

FIGURE: 1

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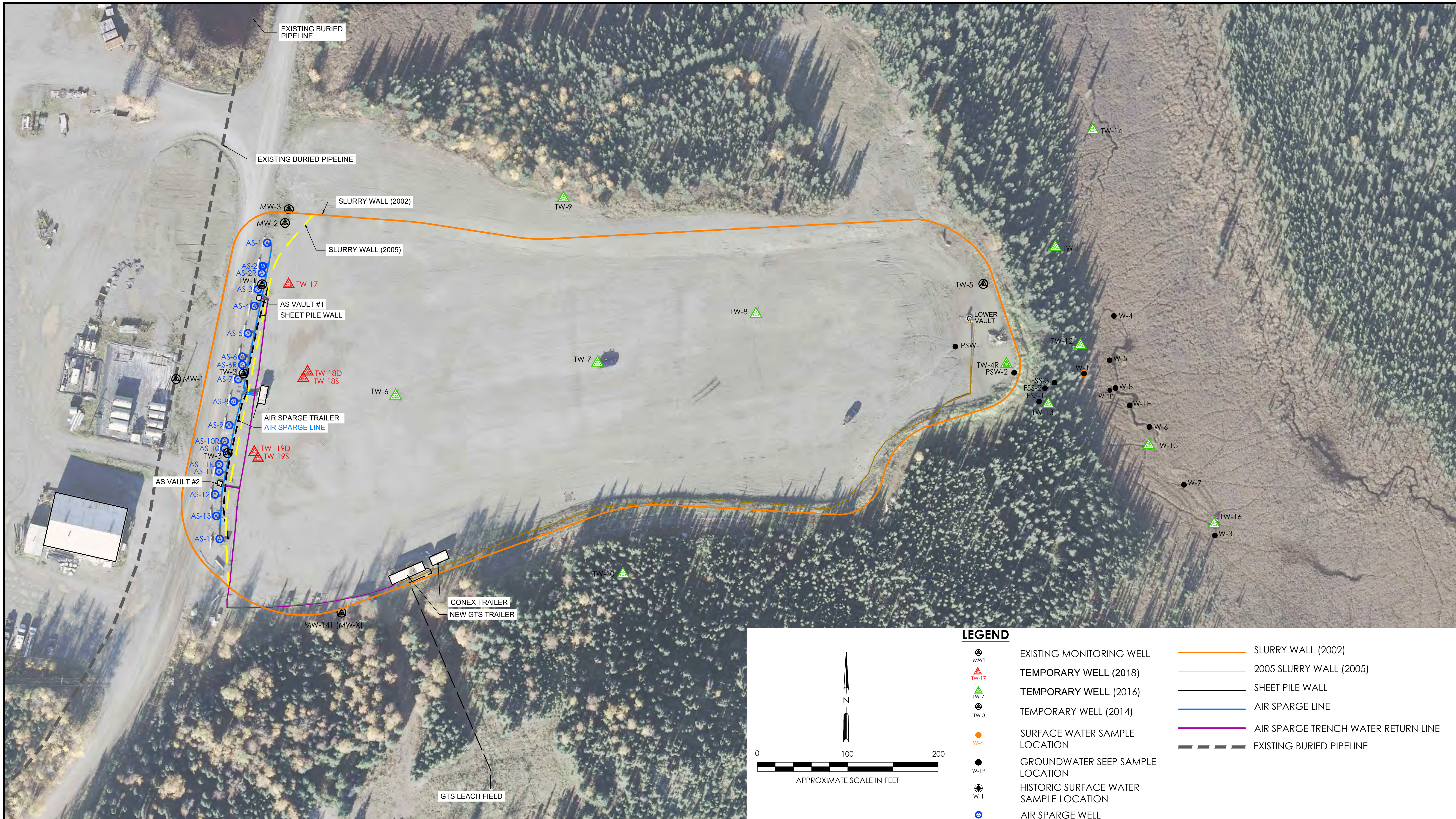

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FOR:
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
P&S YARD, SWANSON RIVER FIELD
STERLING, ALASKA

SITE FEATURES

FIGURE: 2

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
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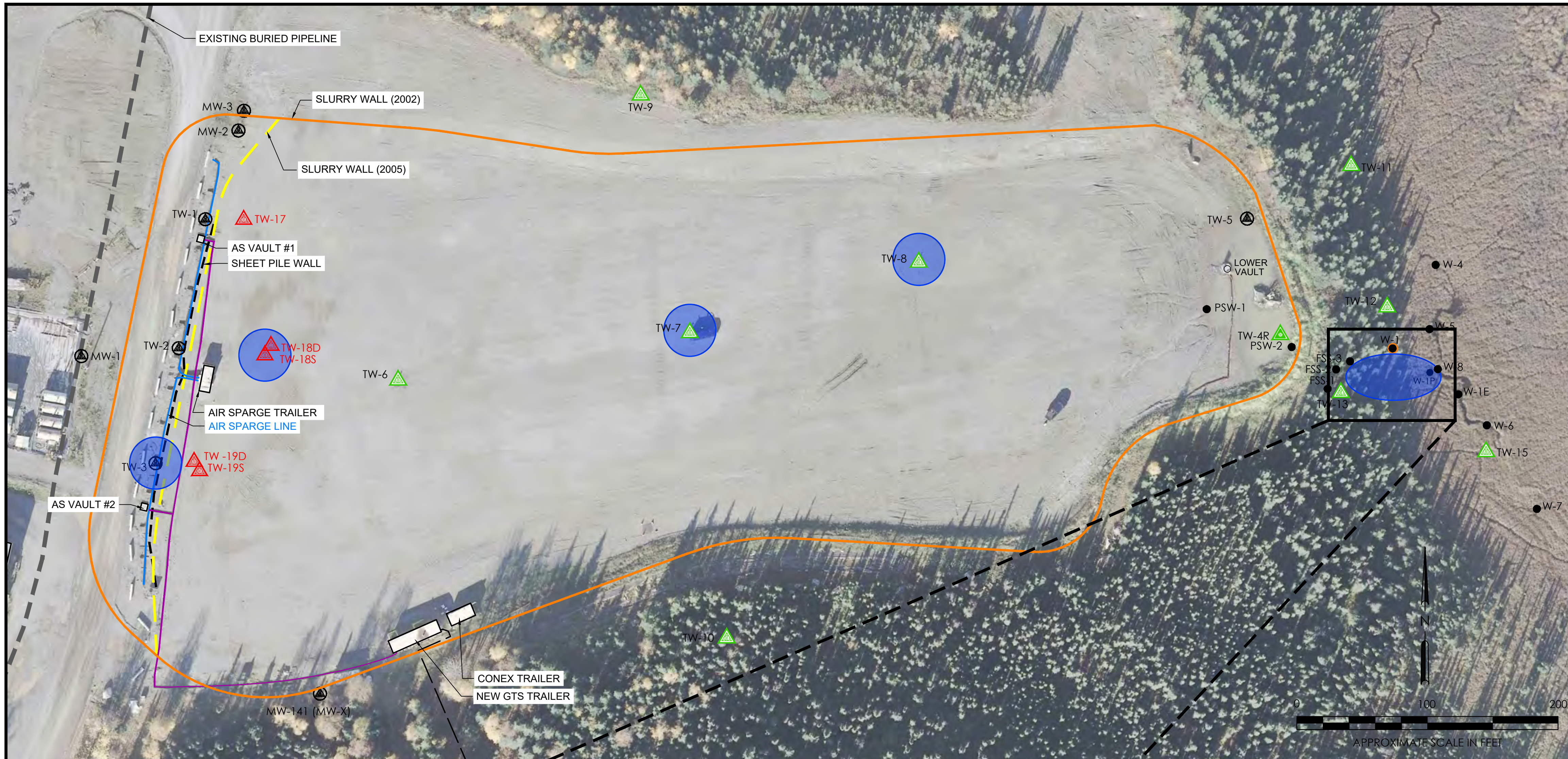

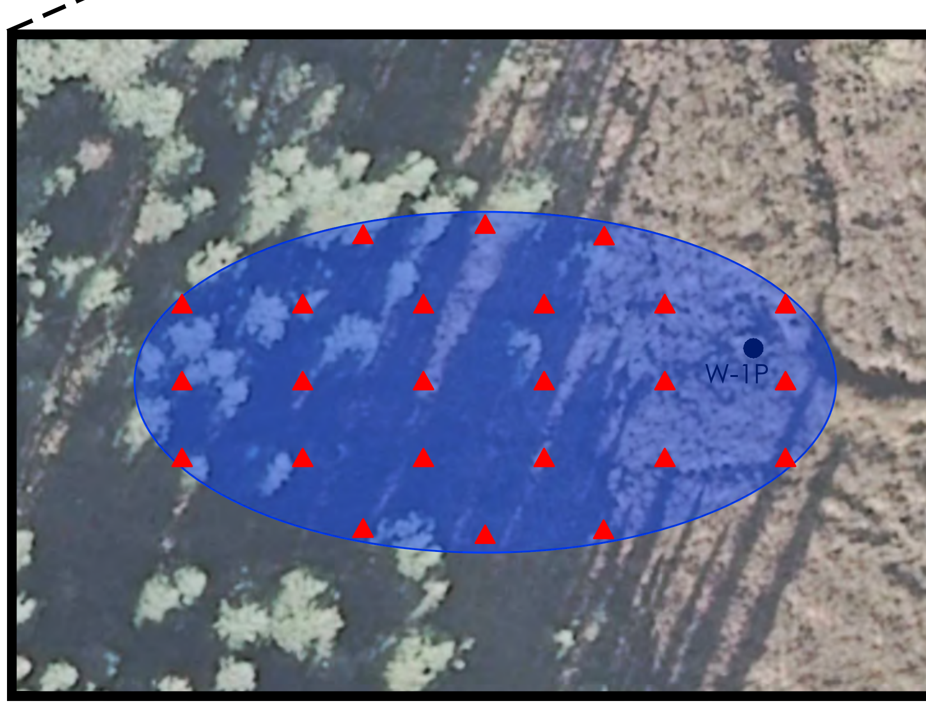

DETAIIL VIEW
SEEP / WETLANDS AREA

N
0 20 40
APPROXIMATE SCALE IN FEET

LEGEND

- TOTAL XYLENE CONCENTRATION x >0.2 mg/L
- SOIIL BORING LOCATIONS
- EXISTING MONITORING WELL (MW1)
- TEMPORARY WELL (2018) (TW-17)
- TEMPORARY WELL (2016) (TW-7)
- TEMPORARY WELL (2014) (TW-3)
- SURFACE WATER SAMPLE LOCATION (W-4)
- GROUNDWATER SEEP SAMPLE LOCATION (W-1P)
- HISTORIC SURFACE WATER SAMPLE LOCATION (W-1)
- AIR SPARGE WELL (AS-13)
- SLURRY WALL (2002)
- 2005 SLURRY WALL (2005)
- SHEET PILE WALL
- AIR SPARGE LINE
- AIR SPARGE TRENCH WATER RETURN LINE
- EXISTING BURIED PIPELINE

Stantec	FOR: CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY P&S YARD, SWANSON RIVER FIELD STERLING, ALASKA	WETLANDS SAMPLING LOCATIONS	FIGURE: 3
JOB NUMBER: 203721236	DRAWN BY: CCL	CHECKED BY: AS	APPROVED BY: TM	DATE: 3/5/2020

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LEGEND

- MW1 — EXISTING MONITORING WELL
- TW-17 — TEMPORARY WELL (2018)
- TW-7 — TEMPORARY WELL (2016)
- TW-3 — TEMPORARY WELL (2014)
- W-4 — SURFACE WATER SAMPLE LOCATION
- W-1P — GROUNDWATER SEEP SAMPLE LOCATION
- W-1 — HISTORIC SURFACE WATER SAMPLE LOCATION
- AS-13 — AIR SPARGE WELL
- TW-6D — PROPOSED MONITORING WELL

Stantec	FOR: CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY P&S YARD, SWANSON RIVER FIELD STERLING, ALASKA		PREVIOUSLY REMEDIATED AREA MONITORING WELL LOCATIONS	FIGURE: 4
	JOB NUMBER: 203721236	DRAWN BY: JRO	CHECKED BY: MS / APPROVED BY: TM	DATE: 06/04/2020

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