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July 26, 2019

Mr. Peter Campbell
Environmental Program Specialist
Alaska Department of Environmental Conservation
43335 Kalifornsky Beach Road, Suite 11
Soldotna, Alaska 99669

Re: 2019 Site Investigation and Monitoring Workplans
Swanson River P&S Yard and Compressor Plant 10 Projects, Swanson River Field, Sterling, Alaska

Mr. Campbell,

Chevron Environmental Management Company's (CEMC) is submitting the following documents associated the CEMC's ongoing environmental efforts at the Swanson River P&S Yard and Compressor Plant 10:

- *2019 Work Plan, Work Plan for 2019 Activities at Swanson River Field Compressor Plant 10* dated July 24, 2019
- *2019 Work Plan, Work Plan for 2019 Activities at Swanson River Field Pipe and Supply Yard* dated July 24, 2019

These documents were prepared by Stantec Consulting Services, Inc. (Stantec) on behalf of CEMC to describe investigation and monitoring activities planned for the respective project sites during calendar year 2019.

Should you have any questions regarding these workplans, please do not hesitate to contact me by phone at 832-854-5630 or via e-mail at kegan.boyer@chevron.com.

Sincerely,

Kegan W. Boyer, P.G.
Environmental Project Manager

cc w/enc: Ms. Sharon Yarawsky, Bureau of Land Management
Ms. Lynnda Kahn, US Fish & Wildlife Service
Mr. Craig Wilson, Stantec

Stantec

2019 Work Plan

Work Plan for 2019 Activities at Swanson River Field Pipe and Supply Yard

July 24, 2019

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
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Revision	Description	Author		Quality Check		Independent Review	
1	Draft	CHW	7/22/19	THM	7/23/19	AMS	7/23/19

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Prepared by ______________________________
(signature)

Craig Wilson

Reviewed by ______________________________
(signature)

Anna Skinner

Approved by ______________________________
(signature)

Tom Madsen

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Acronyms

°C	degree Celsius
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AECOM	AECOM Technical Services, Inc.
bgs	below ground surface
BLM	Bureau of Land Management
BTEX	benzene, toluene, ethylbenzene, and xylenes
CEMC	Chevron Environmental Management Company
COBC	Compliance Order by Consent
CoC	chain-of-custody
D	deep
DL	detection limit
DO	dissolved oxygen
DTW	depth-to-water
EPA	United States Environmental Protection Agency
GTS	groundwater treatment system
HASP	Health and Safety Plan
HHS	heated head space
Hilcorp	Hilcorp Alaska, LLC
LF	landfarm
LOQ	limit of quantitation
mg/kg	milligram per kilogram
mg/L	milligram per liter
MS	matrix spike
MSD	matrix spike duplicate
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
PVC	polyvinyl chloride
QAPP	Quality Assurance Program Plan
QC	quality control
RPD	relative percent difference
S	shallow
SRF	Swanson River Field
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 is supplemental to the 2018 remediation work plan developed by AECOM Technical Services, Inc. (AECOM) and submitted to Alaska Department of Environmental Conservation (ADEC) by CEMC (AECOM 2018).

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 2017b) and the *ADEC Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites* (ADEC 2017c). The sampling procedures described in this work plan were developed in accordance with ADEC's *Field Sampling Guidance* (ADEC 2017d) and relevant industry standards.

1.1 PROJECT OBJECTIVES

AECOM completed groundwater and surface water sampling in May 2019. The remaining 2019 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. Repair and restart the air sparge system located on site.

3. Removal of surplus equipment and debris from the project site.

4. Complete a comprehensive evaluation of 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 SCHEDULE

The proposed project timetable for completion of this work plan is as follows:

Date	Activity
29 July – 02 August 2019	Field sampling activities in support of COBC requirements.
26 – 30 August 2019	Replacement of air sparge system compressor and restart of air sparge system.
September 2019	Field sampling activities in support of COBC requirements and removal of surplus equipment from the project site.
November 2019	Complete data evaluation and alternatives analysis and recommend approach to progress site to closure.
December 2019	Meet with ADEC, USFWS, and the Bureau of Land Management (BLM) to discuss proposed investigation and remediation activities for 2020 to progress the site to closure.
January 2020	Submit the 2019 Annual Report and the 2020 Work Plan.

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 details.

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 aquifer. An aquitard consisting of silt, silty clay, and silty sand is present throughout the area, underlying the sand and gravel aquifer. 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 aquifer 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 aquifer 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 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., remediated landfarm 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).

2019 WORK PLAN

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 2015e; 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 2017a).

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). 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 2015d), and the *Final Groundwater Monitoring Program Work Plan* (AECOM 2015b).

Groundwater analytical results from direct-push wells installed in Swanson River Road during the 2013 subsurface investigation activities indicated that total xylene was detected in 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 and described in the *2013 Subsurface Investigation Report* (AECOM 2013) and 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., landfarm 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 2015c). 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 landfarm 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. The 2017 Draft Annual Groundwater and Wetland Monitoring Report September analytical results indicated 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.

- Ethylbenzene-impacted groundwater in exceedance of ethylbenzene cleanup standards is present in the remediated landfarm 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 temporary wells and piezometers were installed in 2018. The temporary wells were added 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 purpose of the piezometers was to fill data gaps that related to the lateral extent of xylene in groundwater in the area outside 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. This work plan includes re-activating the air sparge system.

2.4 CONTAMINANTS OF POTENTIAL CONCERN

Table 1 lists the known site contaminants addressed in this work plan and their COBC cleanup levels.

Table 1 Site Contaminants and Cleanup Levels

Contaminant of Potential Concern	Benzene	Toluene	Ethylbenzene	Xylene
Groundwater COBC Cleanup Level (mg/L)	Not listed	0.50	0.48	0.20
Soil COBC Cleanup Level (milligrams per kilogram [mg/kg])	2.0	4.5	15.0	1.5

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.

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 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 the stakeholders that a more conservative interim cleanup goal of 9.3 mg/kg would be used when screening soils.

3.0 AIR SPARGE SYSTEM REPAIR

The air sparge system air compressor is currently inoperable. Stantec will replace the inoperable air compressor with a new air compressor, and the air sparge system will then be restarted and tested.

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 is planned after repair. Different programming cycles will be tested 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. 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.

4.0 SAMPLING PLAN

AECOM conducted the first of three groundwater and wetland monitoring events in May 2019, and Stantec will conduct the two remaining monitoring events in July and September. Table 2 provides a summary of sampling locations and analysis.

Table 2 Sampling Schedule

Sample Identification	Location	Analysis
MW-1	Western side of landfarm (LF), outside of slurry wall, western side of Swanson River Road	BTEX, geochemical parameters, direct read dissolved oxygen (DO)
MW-2	Northwestern corner of LF, inside of slurry wall	BTEX
MW-3	Northwestern corner of LF, immediately outside of slurry wall	BTEX
MW-141	Southern side of LF, inside of slurry wall	BTEX
TW-1	Western side of LF, outside and immediately west of 2005 slurry wall, source area well	BTEX, direct read DO
TW-2	West side of LF, outside and immediately west of 2005 slurry wall, source area well	BTEX, direct read DO
TW-3	Western side of LF, outside and immediately west of 2005 slurry wall, source area well	BTEX, Direct read DO
TW-4R	Eastern side of LF, inside of slurry wall	BTEX, geochemical parameters, direct read DO
TW-5	Eastern side of LF, inside of slurry wall	BTEX, direct read DO
TW-6	LF area, inside of slurry wall	BTEX, direct read DO
TW-7	LF area, inside of slurry wall, within excavation area, 160 feet east of sheet pile wall, between Cell 1 and Cell 2	BTEX, direct read DO
TW-8	LF area, inside of slurry wall, within excavation area, 375 feet east of sheet pile wall, between Cell 3 and Cell 4	BTEX, direct read DO
TW-9	LF area, inside of slurry wall, within excavation area, 375 feet east of sheet pile wall, within Cell 5	BTEX
TW-10	Outside of 2002 slurry wall, northern side of LF area	BTEX
TW-11	Spruce forest outside of 2002 slurry wall on eastern side and downgradient of LF area	BTEX
TW-12	Spruce forest outside of 2002 slurry wall on eastern side and downgradient of LF area	BTEX, geochemical parameters, direct read DO
TW-13	Spruce forest outside of 2002 slurry wall on eastern side and downgradient of LF area	BTEX
TW-14	Topographically downgradient/cross gradient of LF area, furthest upgradient well in wetland area	BTEX, geochemical parameters, total Iron (Fe), direct read DO
TW-15	Topographically downgradient of LF area, downgradient of W-1P	BTEX, SIM PAH[a], geochemical parameters, total Fe, direct read DO

Sampling Plan

Sample Identification	Location	Analysis
TW-16	Topographically downgradient of LF area, furthest downgradient well in wetland area	BTEX, SIM PAH[a], geochemical parameters, total Fe, direct read DO
TW-17D	East of 2005 slurry wall, in LF area, immediately downgradient of TW-1	BTEX, direct read DO
TW-17S	East of 2005 slurry wall, in LF area, immediately downgradient of TW-1	BTEX, direct read DO
TW-18D	East of 2005 slurry wall, in LF area, immediately downgradient of TW-2	BTEX, direct read DO
TW-18S	East of 2005 slurry wall, in LF area, immediately downgradient of TW-2	BTEX, direct read DO
TW-19D	East of 2005 slurry wall, in LF area, immediately downgradient of TW-3	BTEX, direct read DO
TW-19S	East of 2005 slurry wall, in LF area, immediately downgradient of TW-3	BTEX, direct read DO
W-1P	Wetland	BTEX, SIM PAH[a,] geochemical parameters, direct read DO
W-1E	Wetland	SIM PAH[a]
W-3	Wetland, furthest downgradient creek surface water	SIM PAH[a]
W-4	Wetland, creek surface water east and northeast of LF area, upstream of W-1P	SIM PAH[a]
W-5	Wetland, creek surface water immediately east of LF area, upstream of W-1P	SIM PAH[a]
W-6	Wetland, creek surface water immediately east of LF area, downstream of W-1P	SIM PAH[a]
W-7	Wetland, creek surface water east and southeast of LF area, downstream of W-1P	SIM PAH[a]
W-8	Wetland, creek surface water east of LF area between TW-13 and W-1P	SIM PAH[a]
FSS-1	Seasonal seep present in May 2017 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	BTEX
FSS-2	Seasonal seep present in May 2017 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	BTEX
PSW-1	Ponded surface water at the east end of the remediated LF area, at the interface between the remediated LF and ponded water surface	BTEX [b]
PSW-2	Ponded surface LF at the east end of the remediated LF area, at the interface between the ponded water and the eastern berm	BTEX [b]
PZ 1 through PZ 19	Between TW-13 and W-1P	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	NA	not applicable
DO	dissolved oxygen	SIM PAH	Single ion monitoring polyaromatic hydrocarbon
Fe	iron	TBD	to be determined
LF	landfarm	Total Fe	total iron

4.1 TARGET ANALYTES

Table 3 provides a listing of the target analytes for each sampling event in this work plan.

Table 3 Target Analytes by Location

Location	Parameter / Method	Field Samples	Field Duplicates	Matrix Spike	Matrix Spike Duplicate	Trip Blanks
MW-1, MW-2, MW-3, MW-141, TW-1, TW-2, TW-3, TW-4R, TW-5, TW-6, TW-7, TW-8, TW-9, TW-10, TW-11, TW-12, TW-13, TW-14, TW-15, TW-16, TW-17D, TW-17S, TW-18D, TW-18S, TW-19D, TW-19S, W-1P, FSS-1, FSS-2, PSW-1, PSW-2	BTEX / EPA SW8021	31	4	2	2	3
PZ-1 through PZ-19	BTEX / EPA SW8021	19	2	1	1	1
TW-15 TW-16 W-1P W-1E, W-3, W-4, W-5, W-6, W-7, W-8	SIM PAH / EPA Method 8270D	10	1	1	1	—
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	Alkalinity SM21 2320B	7	1	1	1	—
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	Conductivity SM 21 2510B	7	1	1	1	—
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	pH SM 4500H+	7	1	1	1	
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	Nitrate / Nitrite SM 21 4500NO3-F	7	1	1	1	—
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	Sulfate EPA Method SW9056A	7	1	1	1	—
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	Methane EPA Method RSK 175	7	1	1	1	—
MW-1, TW-4R, TW-12, TW-14, TW-15, TW-16, W-1P	Dissolved Iron EPA Method 200.8, field filtered	7	1	1	1	—

Location	Parameter / Method	Field Samples	Field Duplicates	Matrix Spike	Matrix Spike Duplicate	Trip Blanks
TW-14, TW-15, TW-16	Total Iron EPA Method 200.8	3	1	1	1	—
MW-1, TW-1, TW-2, TW-3, TW-4R, TW-5, TW-6, TW-7, TW-8, TW-12, TW-14, TW-15, TW-16, TW-17D, TW-17S, TW-18D, TW-18S, TW-19D, TW-19S, W-1P	Direct Read DO	20	—	—	—	—

Table 3 Notes:

BTEX	benzene, toluene, ethylbenzene, and xylenes	PSW	Ponded Surface Water
DO	dissolved oxygen	SIM PAH	Single ion monitoring polyaromatic hydrocarbon
EPA	United States Environmental Protection Agency	SM	Standard Method
FSS	Forest Seep Sample	—	not applicable

4.2 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. A restroom is located at Hilcorp's main office.

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.

4.3 SAMPLE COLLECTION METHODS

Groundwater and wetland monitoring events will generally follow the procedures and sampling schemes laid out in the *2017 Groundwater and Wetland Monitoring Work Plan* (AECOM 2017b), Addendum to the *2017 Groundwater and Wetland Monitoring Work Plan* (AECOM 2017a), and *2018 Groundwater and*

Sampling Plan

Wetland Monitoring Work Plan Addendum (AECOM 2018). Sampling will be conducted using approved low flow sampling techniques (EPA).

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.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

5.1 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 4, 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 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 4 Quality Control Requirements

Sampling Event	Parameter	Number of Primary Samples	Equipment Blank (EB) Samples	Total Number of Samples
July, September	BTEX	50	1 per pump per day	50 + 6 Dup + 4 EB + 6 MS/MSD
	PAH	10	NA	10 + 1 Dup + 2 MS/MSD
	Nitrate / Nitrite	7	NA	7 + 1 Dup + 2 MS/MSD
	Dissolved (ferrous) Fe	7	NA	7 + 1 Dup + 2 MS/MSD
	Total Fe	3	NA	3 + 1 Dup + 2 MS/MSD
	Sulfate	7	NA	7 + 1 Dup + 2 MS/MSD
	Alkalinity	7	NA	7 + 1 Dup + 2 MS/MSD
	pH	7	NA	7 + 1 Dup + 2 MS/MSD
	Conductivity	7	NA	7 + 1 Dup + 2 MS/MSD
	Methane	7	NA	7 + 1 Dup + 2 MS/MSD
	Dissolved Oxygen	20	NA	NA

Table 4 Notes: Dup = duplicate sample;
MS/MSD = matrix spike/matrix spike duplicate;
EB = equipment blank
NA = not applicable

5.2 SAMPLE CONTAINERS, HOLD TIMES, AND PRESERVATION

Table 5 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 5 Sample Containers, Preservation, and Hold Times

Analytical Parameter	Analytical Method	Holding Time (days)	Containers	Preservation
BTEX	8021	14	40 mL VOA vials	pH<2, HCl; Cool to 0-6˚C
PAH	8270D	7	250 mL amber glass	Cool to 0-6˚C
Alkalinity	SM21 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

5.3 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.

5.4 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).

5.5 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.

5.6 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).

6.0 INVESTIGATION DERIVED WASTE MANAGEMENT

Investigation-derived waste includes 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.

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 for disposal at the Kenai Peninsula Borough Landfill.

7.0 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 2019. 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.

8.0 REFERENCES

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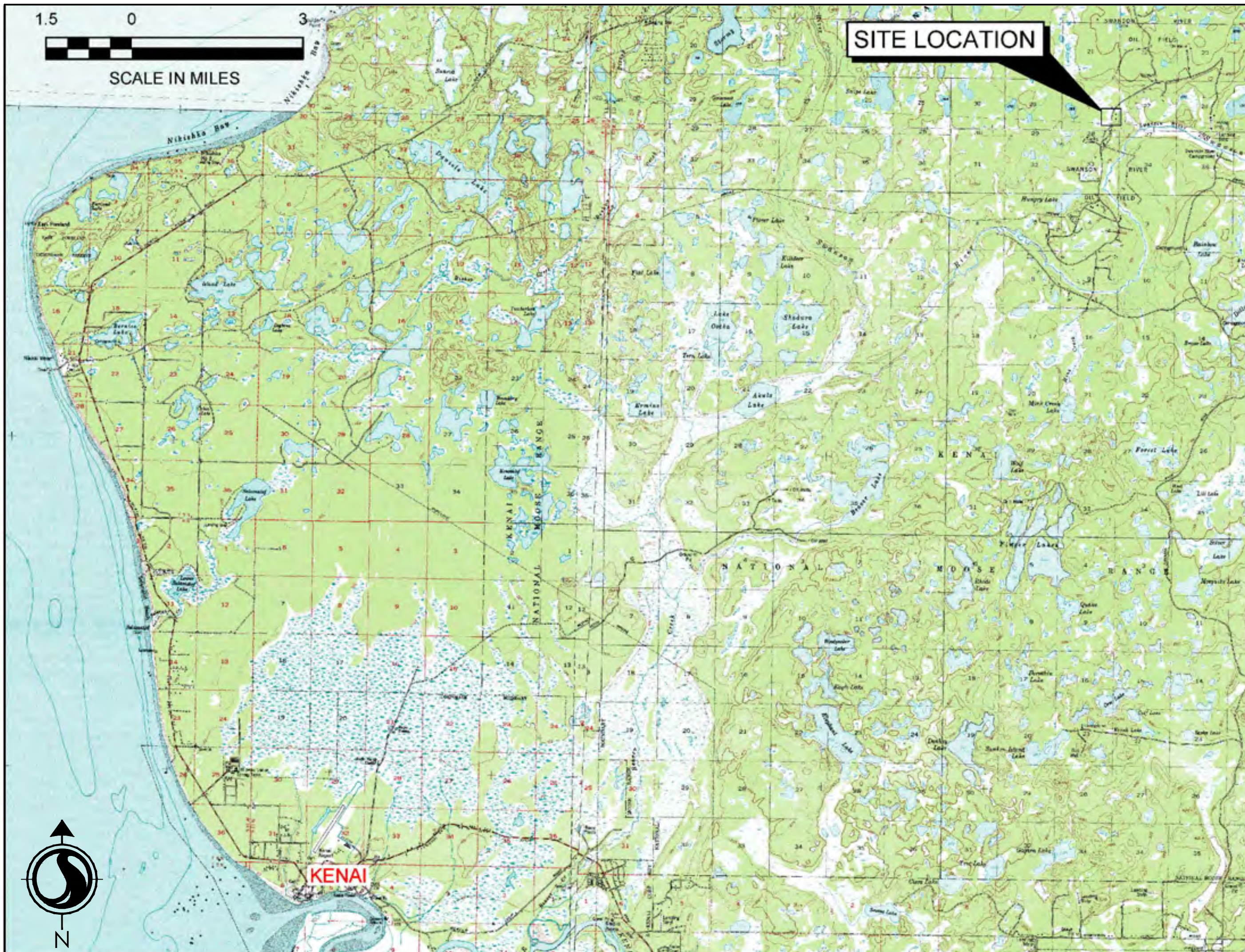
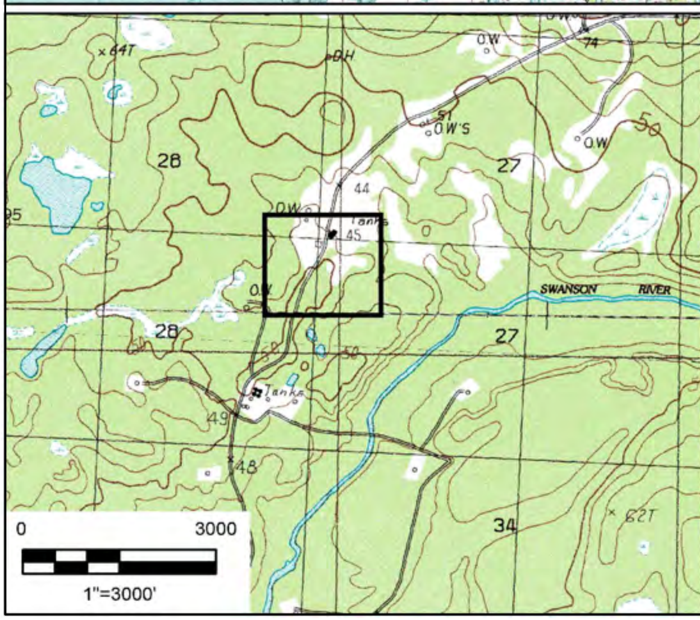
FIGURES





Stantec

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

SITE LOCATION MAP

FIGURE: 1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
203721236	JRO	AS	TM	07/23/19

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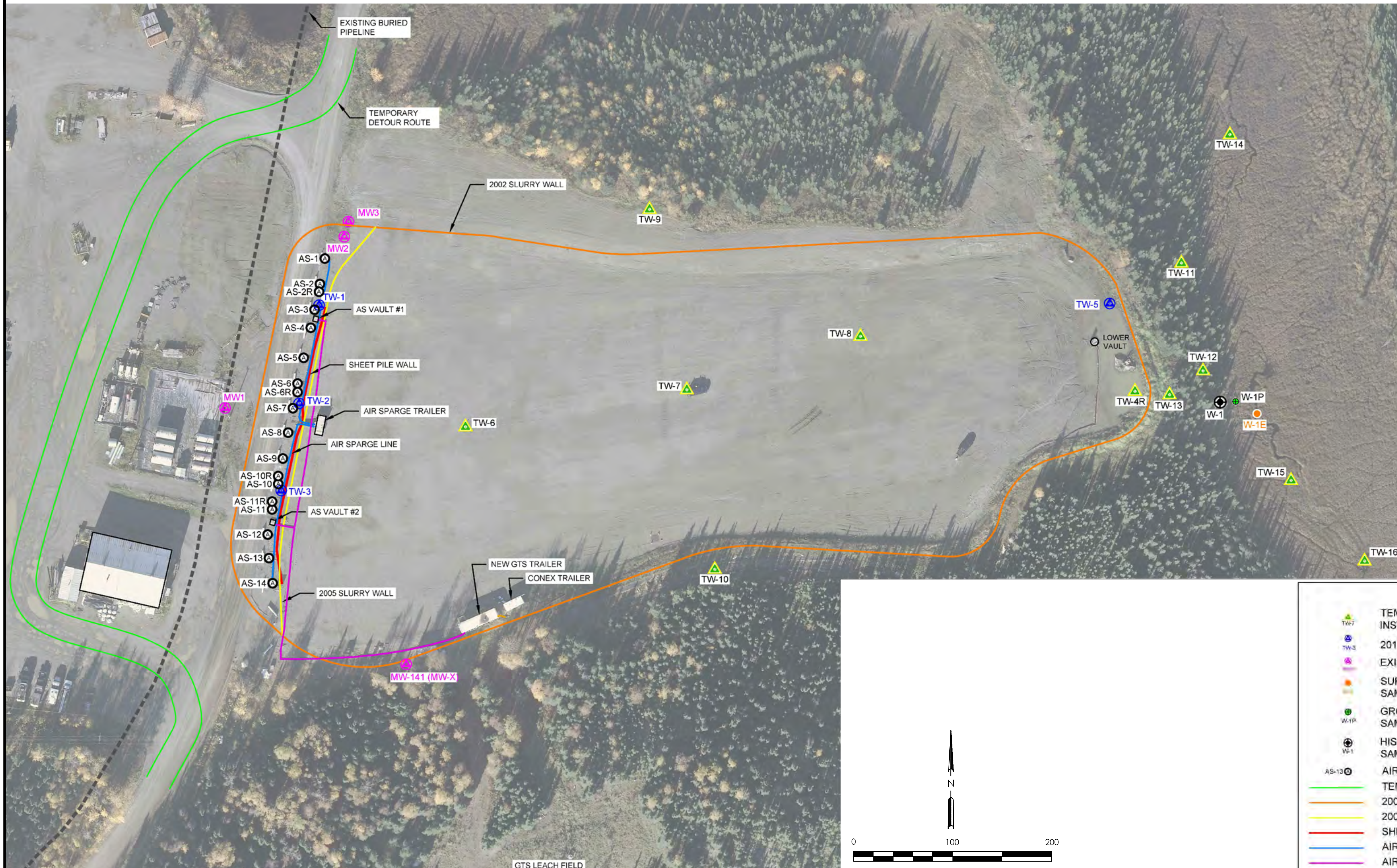

LEGEND

- TEMPORARY WELL INSTALLED IN 2016
- 2014 TEMPORARY WELL
- EXISTING MONITORING WELL
- SURFACE WATER SAMPLE LOCATION
- GROUNDWATER SEEP SAMPLE LOCATION
- HISTORIC SURFACE WATER SAMPLE LOCATION
- AIR SPARGE WELL
- TEMPORARY DETOUR ROUTE
- 2002 SLURRY WALL
- 2005 SLURRY WALL
- SHEET PILE WALL
- AIR SPARGE LINE
- AIR SPARGE TRENCH WATER RETURN LINE
- EXISTING BURIED PIPELINE

N

0 100 200

APPROXIMATE SCALE IN FEET

Stantec	FOR: CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY P&S YARD, SWANSON RIVER FIELD STERLING, ALASKA	SITE FEATURES	FIGURE: 2
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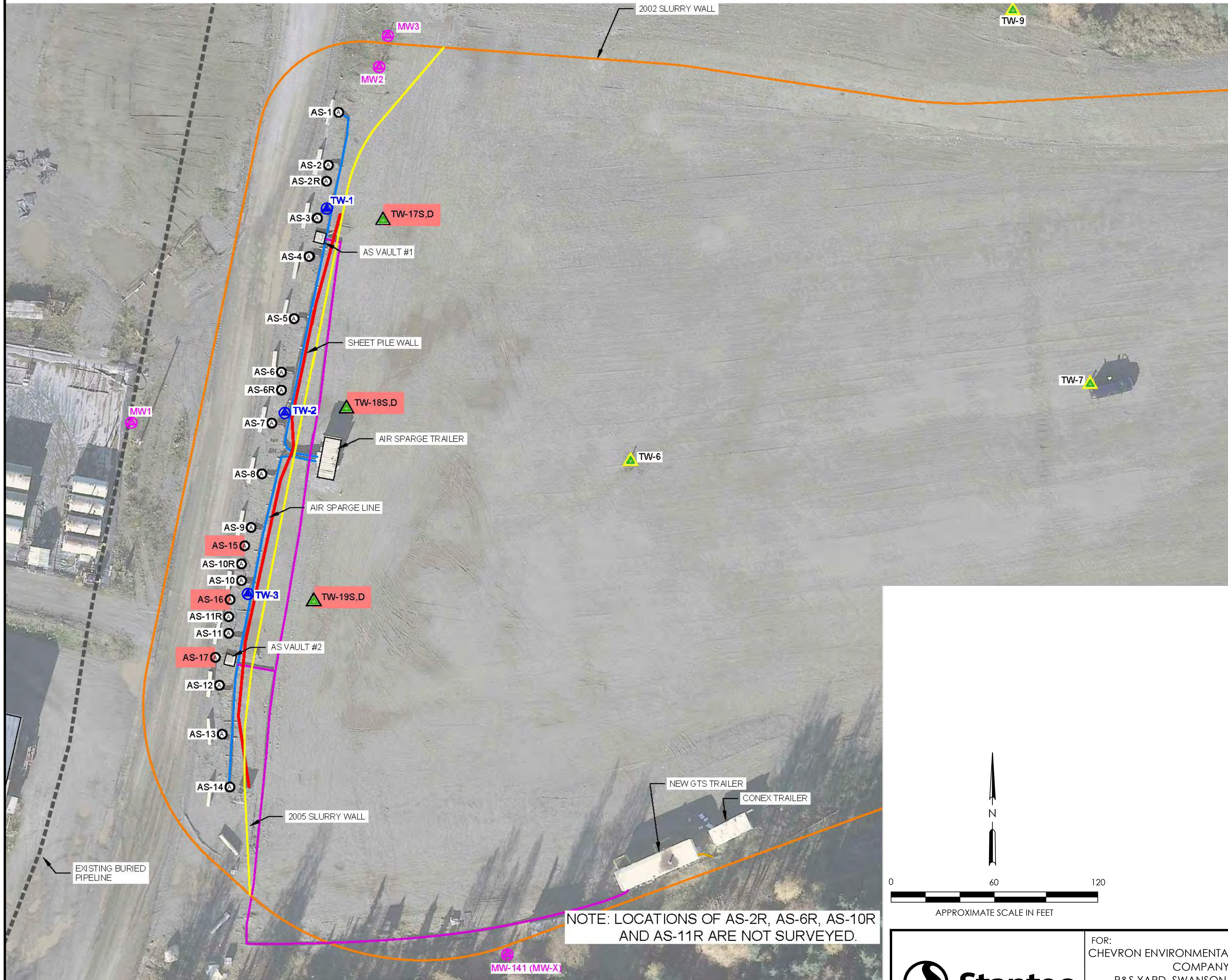

LEGEND

TW-19S,D	TEMPORARY WELL NESTED S = SHALLOW, D = DEEP
AS-16	AIR SPARGE WELL
TW-7	2016 TEMPORARY WELL
TW-3	2014 TEMPORARY WELL
MW1	EXISTING MONITORING WELL
AS-13	EXISTING AIR SPARGE WELL
	2002 SLURRY WALL
	2005 SLURRY WALL
	SHEET PILE WALL
	AIR SPARGE LINE
	AIR SPARGE TRENCH WATER RETURN LINE
	EXISTING BURIED PIPELINE

Stantec

FOR:		AIR SPARGE SYSTEM		FIGURE: 3
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY P&S YARD, SWANSON RIVER FIELD STERLING, ALASKA				
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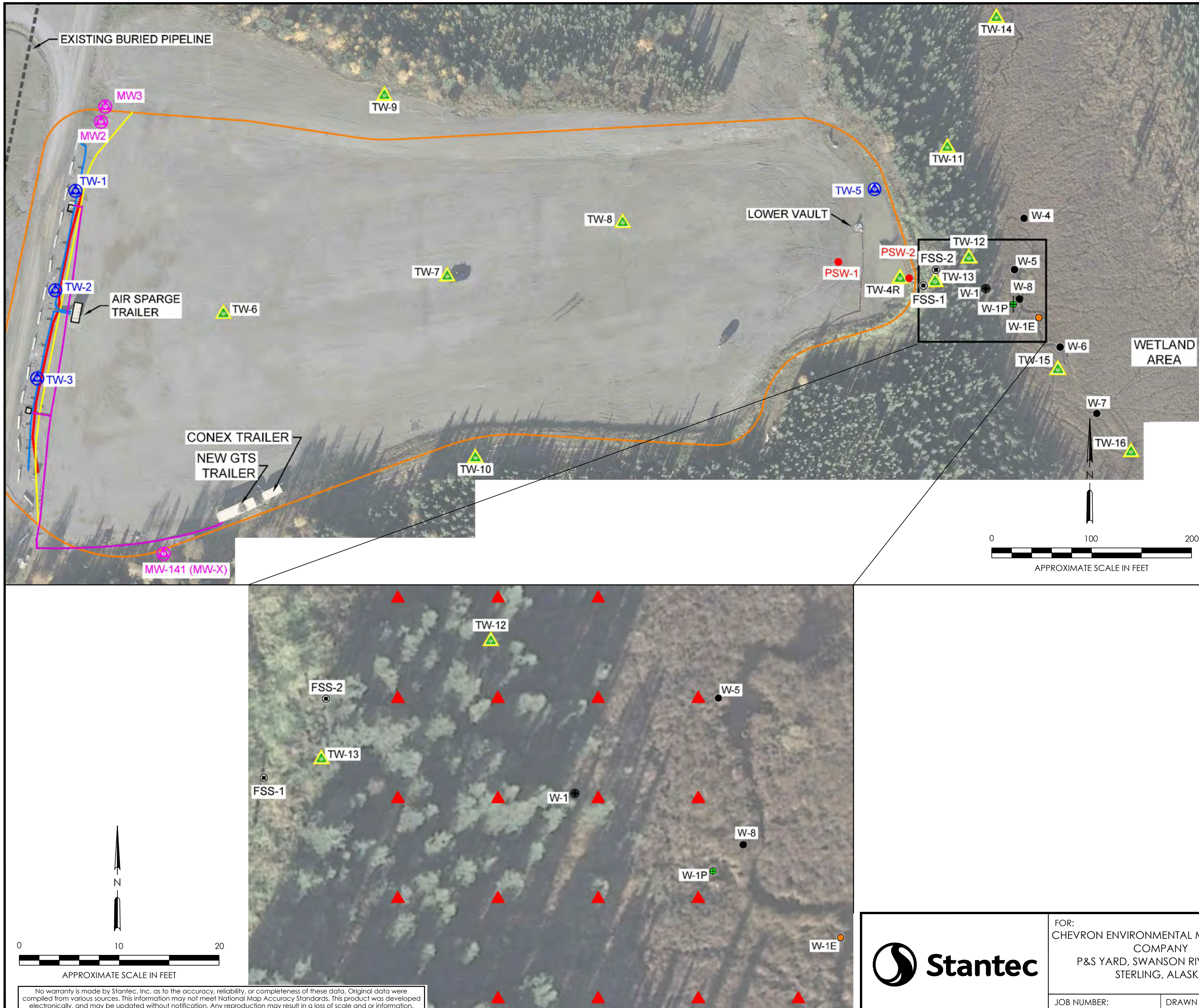

LEGEND

- TEMPORARY PIEZOMETER
- TW-7 — 2016 TEMPORARY WELL
- TW-3 — 2014 TEMPORARY WELL
- MW1 — EXISTING MONITORING WELL
- W-1P — GROUNDWATER SAMPLE
- W-1E — 2005 TO CURRENT SURFACE WATER SAMPLE
- W-1 — HISTORIC SURFACE WATER SAMPLE (PRIOR TO 2005)
- W-4 — SURFACE WATER SAMPLE
- FSS-1 — FOREST SEEP SAMPLE
- PSW-1 — PONDED SURFACE WATER SAMPLE
- 2002 SLURRY WALL
- 2005 SLURRY WALL
- SHEET PILE WALL
- AIR SPARGE LINE
- AIR SPARGE TRENCH WATER RETURN LINE
- EXISTING BURIED PIPELINE

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FOR: CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY P&S YARD, SWANSON RIVER FIELD STERLING, ALASKA		TEMPORARY PIEZOMETER LOCATIONS		FIGURE: 4
JOB NUMBER: 203721236	DRAWN BY: JRO	CHECKED BY: AS	APPROVED BY: TM	DATE: 07/23/19