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FINAL

CONTAMINATED MEDIA MANAGEMENT PLAN

Cordova Airport Combined Maintenance Facility

CORDOVA, ALASKA

August 2021

Shannon & Wilson No: 103311-012

SHANNON & WILSON

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Submitted To: PDC Inc. Engineers
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Attn: William Hrinko

Subject: FINAL CONTAMINATED MEDIA MANAGEMENT PLAN, CORDOVA AIRPORT COMBINED MAINTENANCE FACILITY, CORDOVA, ALASKA

This Management Plan describe field activities to be conducted during the construction phase of Cordova Airport Snow Removal Equipment Building (SREB) replacement project.

Our Scope of Services to prepare this plan was specified on our proposal dated June 9, 2021 and approved by Amendment 8 of our professional services agreement.

Sincerely,

SHANNON & WILSON, INC.

Rachel Willis
Environmental Scientist

Mark Lockwood (Christopher Darrah for Mark Lockwood)
Senior Associate

RLW:MSL:CBD/rlw

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ACRONYMS

AAC	Alaska Administrative Code
ARFF	Aircraft Rescue and Fire Fighting Building
bgs	below ground surface
°C	degrees Celsius
CAA	Civil Aeronautics Administration
CDV	Merle K. Smith Airport
CMMP	Contaminated Media Management Plan
COC	chain of custody
COPC	contaminant of potential concern
CSM	Conceptual Site Model
CUL	Cleanup Level
CV	coefficient of variance
cy	cubic yard
DEC	Alaska Department of Environmental Conservation
DOT&PF	Alaska Department of Transportation & Public Facilities
DRO	diesel range organics
DU	decision unit
EPA	US Environmental Protection Agency
°F	Fahrenheit
FAA	Federal Aviation Administration
GRO	gasoline range organics
HOT	heating oil tank
IDA	isotope dilution analyte
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology and Regulatory Council
LDRC	Laboratory Data Review Checklist
LHA	Lifetime Health Advisory Level
LOQ	limit of quantitation
mL	milliliters
MS	matrix spike
PAH	polynuclear aromatic hydrocarbons
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PID	photoionization detector
ppm	parts per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control

ACRONYMS

QEP	Qualified Environmental Professional
RCRA	Resource Conservation and Recovery Act
RL	reporting limits
RPD	relative percent difference
RRO	residual range organics
RSD	relative standard deviation
SD	standard deviation
SDWA	Safe Drinking Water Act
SGS	SGS North America, Inc.
SREB	Snow Removal Equipment Building
SVOC	semi-volatile organic compounds
TestAmerica	Eurofins TestAmerica Laboratories, Sacramento
TCLP	Toxicity Characteristic Leaching Procedure
μ	arithmetic mean
UIC	Underground Injection Control
VOC	volatile organic compound

1 INTRODUCTION

This Contaminated Media Management Plan (CMMP) describes our approach for managing disturbed contaminated materials during construction activities at the Merle K. (Mudhole) Smith Airport (CDV) in Cordova, Alaska (Figure 1). We understand it is Alaska Department of Transportation and Public Facilities (DOT&PF) intent to require the build contractor to adhere to this agency-approved CMMP by including it in the build specifications. We understand that Shannon & Wilson, Inc. (Shannon & Wilson) will implement the CMMP during the demolition and construction phase.

Shannon & Wilson prepared this CMMP in general accordance with Alaska Department of Environmental Conservation's (DEC) March 2017 *Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites* and DEC's October 2019 *Field Sampling Guidance* document.

2 PROJECT SUMMARY

We understand the DOT&PF plans to demolish the existing Airport Rescue and Fire Fighting building (ARFF) and construct a combined ARFF and Snow Removal Equipment Building (SREB) in a portion of the old ARFF footprint (Figure 2).

The CDV was owned and operated by the Federal Aviation Administration (FAA) and Civil Aeronautics Administration (CAA) until 1966, when property ownership transferred to the State of Alaska. During the 1940's, the property was used as a camp and storage for fuel, aircraft, and ammunition; later additions included control towers, airplane hangars, and multiple underground fuel tanks. Most facilities from the FAA and CAA ownership era have been removed from the site. The DEC Contaminated Sites database lists five FAA locations within 500 feet of the ARFF related to excavation of multiple gasoline and heating oil tanks in 1994. The sites are listed as "cleanup complete" or "cleanup complete with institutional controls" (DEC File Number 2215.38.001; Hazard IDs 2604, 2079, 2078, 1853, and 2081). We do not anticipate these sites will affect this project.

The CDV ARFF is an active contaminated site registered under the DEC File Number 2215.38.035 with Hazard ID 27304 for an unknown release relating to petroleum compounds in the soil and PFAS in the soil and groundwater. As such, any disturbance to the potentially impacted onsite material must meet all DEC requirements and regulations for handling, transport, and treatment/disposal.

DEC site characterization regulations are presented in 18 Alaska Administrative Code (AAC) 75.335. While this project is not intended to be a site characterization or cleanup project, we are using these regulations as a guide for the screening, sampling, and handling of potentially contaminated soil encountered during excavation.

2.1 Project Objective and Scope

The project objective is to properly manage environmental media disturbed by project activities. Soil stockpiling requirements for petroleum-contaminated soil will be determined by field screening during excavation. Areas of suspected PFAS contamination and previously untested areas will be stockpiled regardless of field screening results. Analytical sampling will be performed to determine disposal options for contaminated media generated during construction. If dewatering is required during construction, the contractor should obtain an Excavation Dewatering General Permit.

The scope of this effort includes:

- Field screening soil excavated from the construction footprint;
- Excavating the buried heating oil tank (HOT);
- Segregating soil excavated during construction;
- Sampling stockpiled soil and asphalt and at the limits of excavations; and
- Closing/removing two Class V Industrial Injection Wells in accordance with the Safe Drinking Water Act (SDWA) Underground Injection Control (UIC) regulations.

2.2 Construction Plans

We understand that the demolition areas include:

- demolition of the existing ARFF;
- excavation and removal of the buried HOT;
- removal of two floor drain vault injection well structures (CR-ARFF-1 and CR-ARFF-2);
- excavation and removal of the ARFF septic tank, piping, and appurtenances;
- excavations to grade and expand the driveway south of the SREB and create a new driveway north of the SREB; and
- excavation of utility lines to connect the test wells, leach field, and other utilities to the proposed and existing structures.

The proposed demolition areas are shown on Figures 2 and 3. The anticipated excavation depth will vary. We understand that excavation may extend to or beneath the groundwater table at select locations, which may require dewatering. Excavation plans are provided in Appendix A; these plans are included for reference only. The contractor should use the most recent plans from DOT&PF to guide excavation. We understand that 5,000 to 6,000 cubic yards of potentially contaminated soil will be removed during construction activities and DOT&PF will require the contractor to stockpile all excavated soil relating to the SREB project. We understand that DOT&PF will direct work based on our recommendations and the contractor will be responsible for performing the services described in this CMMP.

2.3 Project Team

Chris Darrah is Shannon & Wilson's Principal-in-Charge. Mark Lockwood is Shannon & Wilson's Project Manager (PM) and site safety officer, coordinating Shannon & Wilson's field activities and maintaining safe work practices. Rachel Willis will be the assistant PM who will undertake many of the day-to-day project roles and project quality assurance. This approach provides value to DOT&PF in that very senior staff are not undertaking all the PM tasks yet DOT&PF benefits from the years of experience and expertise. It also provides you with a knowledgeable backup person. Tiffany Green will provide assistance with the Class V Industrial Injection Well closure and coordinate with DOT&PF and regulatory agencies. Shannon & Wilson's project team also includes other State of Alaska Qualified Environmental Professionals to support the various field and reporting tasks. The project team and their responsibilities are summarized in Exhibit 2-1 below.

Exhibit 2-1: Project Team

Affiliation	Responsibility	Representative	Contact Number
DOT&PF	Owner	Lauren Staft, PE	(907) 451-5424
	Regional POC, Environmental	Sam Myers	(907) 451-5291
	Statewide PFAS POC	Sammy Cummings	(907) 888-5671
PDC, Inc. Engineers	Client	William Hrinko, PE	(907) 452-1414
DEC	Regulatory agency POC	Bill O'Connell Michael Hooper	(907) 269-3057 (907) 388-4314
Shannon & Wilson	Principal-in-charge	Chris Darrah, CPG, CPESC	(907) 458-3143
	Project Manager	Mark Lockwood	(907) 458-3142
	Assistant PM	Rachel Willis	(907) 458-3123
	Injection Well Closure	Tiffany Green	(907) 799-4140
Eurofins TestAmerica, Sacramento	PFAS analytical laboratory services	David Alltucker	(916) 374-4383
SGS North America, Inc.	Analytical laboratory services	Jennifer Dawkins	(907) 474-8656

2.4 Project Schedule

Once DEC approval is received for the proposed scope of services outlined in this CMMP and the US Environmental Protection Agency (EPA) approves proposed IW closure activities, Shannon & Wilson will coordinate with the demolition and excavation contractor to conduct screening and sampling. The project will go out for contractor bid in 2022; the construction schedule will be established once the contract has been issued.

Laboratory analysis will be requested on a standard 14-day turn-around time. After field work is complete, a report will be prepared documenting the results of the sampling event. The report will include a summary of field observations, analytical results with a discussion of data quality, photo documentation, figures showing sample locations, description of deviations from the approved CMMP, if any, and conclusions and recommendations. The report will also include an updated conceptual site model.

3 SITE DESCRIPTION

The following subsections provide a site and project description.

3.1 Site Description

The CDV is located east of the community of Cordova, Alaska at Mile 13 of the Copper River Highway (60.4933 North, 145.4683 West). Cordova is located at the southeastern end of the Prince William Sound in the Gulf of Alaska near the mouth of the Copper River. The airport is located within Section 7 and 18, Township 16 South, Range 1 West, and Section 12, Township 16 South, Range 2 West, Copper River Meridian. Access to the community is only by air and water, as no roads connect Cordova to other communities in Alaska.

The CDV is located south of the Chugach Mountains on the Copper River Delta area. The delta is a wide, flat plain formed by the progressive accumulation of sediments transported and deposited by numerous glacial rivers from areas inland. The subsurface consists of alluvial, glacial, and marine deposits, with bedrock estimated at 125 feet below ground surface (bgs). Several small streams and ponds are within the CDV property, and groundwater is present between 7 to 10 feet bgs. Regional groundwater surrounding the CDV is expected to flow to the southwest, however, local groundwater may vary seasonally. The site-specific groundwater direction at the ARFF is unknown. A discussion of the CDV aquifers and geotechnical explorations can be found in our September 2020 *Draft Well Evaluation Report, Cordova Airport SREB/ARFF, Cordova, Alaska* and our September 2020 Draft Geotechnical Data Report, Cordova Airport SREB/ARFF, Cordova, Alaska, respectively.

The ARFF has two distinct functional spaces—a garage and apartment quarters. The garage houses the airport's fire and rescue response truck and vehicle and firefighting maintenance supplies. The ARFF is served by a single well, located approximately 20 feet southwest of the garage. The well is approximately 60 feet deep, with shallow ground water at approximately 7 feet bgs.

4 SUMMARY OF KNOWN CONTAMINATION

This section summarizes previous site investigations at the CDV.

4.1 2020 Field Activities

In July 2020, Shannon and Wilson conducted a hazardous building materials assessment and field screening and sampling from geotechnical soil borings and surface soil within the demolition footprint.

Analytical results from soil sampling show DEC Cleanup Level (CUL) exceedances for multiple analytes surrounding the existing ARFF (Figure 2). Fuel-related contaminants were detected in surface soil samples in the vicinity of the out-of-use buried HOT. Perfluorooctanesulfonic acid (PFOS) was reported to be present in all but one of the soil samples collected from the borings and surface. PFOS was reported above CUL in one surface-soil sample and two soil boring samples.

During the hazardous building materials assessment, Shannon & Wilson observed Class V Industrial Injection Well floor drains in the ARFF garage. Upon completion of the site assessment, on behalf of the DOT&PF, we reported the discovered contamination to the DEC (DEC File Number 2215.38.035).

4.2 2021 Site Characterization Activities

In March 2021, Shannon and Wilson completed additional site characterization within the construction footprint. The scope of work for the 2021 site characterization included:

- advancing and sampling 17 borings within the demolition and construction footprint and vicinity;
- installing three temporary well points and four groundwater monitoring wells;
- sampling surface soil and surface water in low-lying areas surrounding the SREB footprint;
- characterizing soil impacted by effluent from two Class V Industrial Injection Wells in advance of closure with the EPA;

- conducting a limited water supply well search to identify wells that may be affected by migrating contamination; and
- sampling identified water supply wells for per- and polyfluoroalkyl substances (PFAS).

PFOS was detected in 13 of the 17 soil borings and exceeded DEC CULs at six boing locations. Vinyl chloride was detected above DEC CULs at one location north of the existing ARFF. Figure 2 summarizes soil sample analytical results, and injection well results are summarized in Section 4.3.

We did not find fuel-related contaminants or DEC CUL exceedances for PFAS compounds in groundwater samples; however, PFOS and perfluorooctanoic acid (PFOA) were detected above the EPA Lifetime Health Advisory Level (LHA) in samples collected from one temporary well point located southeast of the ARFF. A discussion of the 2021 Site Characterization results can be found in our May 2021 *Cordova Airport Combined Maintenance Facility Final 2021 Site Characterization Report*.

4.3 Class V Industrial Injection Well Characterization

The CR-ARFF-1 and CR-ARFF-2 injection well floor drains were constructed with an 8-inch removable drain cover and 2-inch diameter pipe spanning the thickness of the concrete floor, from surface to four inches bgs. Below the concrete was a void approximately 1 to 2-feet in diameter and extending to 6 feet bgs. We assume the void is a concrete pipe 24-inches in diameter, as described in the 1974 plan detail provided in the *Injection Well Closure Work Plan* (March 2021). Sand and gravel were present below the void. Detailed field drawings and descriptions of the floor drain can be found in the May 2021 *Cordova Airport Combined Maintenance Facility Final 2021 Site Characterization Report*.

We advanced one boring in each injection well floor drain and collected two analytical samples from each boring, including the endpoint (soil at the base of the concrete vault) from 6.0 to 7.5 feet bgs and the groundwater interface from 7.5 to approximately 8.5 feet bgs. Samples were submitted for analysis of gasoline range organics (GRO), diesel range organics (DRO), residual range organics (RRO), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, PFAS, ethylene glycol, ammonia, and polycyclic aromatic hydrocarbons (PAHs). DEC CUL exceedances in soil from the injection well borings are summarized in the Exhibit 4-1.

DOT&PF submitted a Class V Well Pre-Closure Notification (form 7520-17) on February 10, 2021 notifying EPA of the intent to close. The Class V Well Pre-Closure Notification has been updated to reflect current information and will be submitted in conjunction with this CMMP.

Exhibit 4-1: Injection Well Soil DEC Cleanup Level Exceedances from March 2021

Analyte	Cleanup Level	Units	CR-ARFF-1		CR-ARFF-2	
			SBIW19-1 (6.0-7.5 ft)	*SBIW19-2* (7.5-8.5 ft)	*SBIW20-1†* (6.0-7.5 ft)	*SBIW20-2* (7.5-8.7 ft)
DRO	230	mg/kg	1,030	28.1	5,540 J*	59.0
RRO	9,700	mg/kg	5,180	ND	20,600 J*	139
Naphthalene	0.038	mg/kg	0.0887 J	ND	ND	ND
Arsenic	0.2	mg/kg	3.46 J	4.37	3.45	4.59
PFOS	3	µg/kg	11,000 J*	170	5,000 J*	120
PFOA	1.7	µg/kg	1,500 J*	1.5	7.3 J*	0.55

NOTES: DEC Soil-Cleanup Levels are from 18 AAC 75.341 *Table B1. Method Two- Soil Cleanup Levels (Over 40-Inch Zone)* and *Table B2. Method Two - Over 40 Inch Zone - Migration to Groundwater*. DEC CUL exceedances are highlighted in red.

J Estimated concentration, detected less than the limit of quantitation. Flag applied by the laboratory.

J* Estimated concentration due to quality control failures. Flag applied by Shannon & Wilson, Inc. (*)

† Field duplicate sample collected; highest concentration from the pair is reported.

J* Estimated concentration due to quality control failures. Flag applied by Shannon & Wilson, Inc.

DRO = diesel range organics; ft = feet; mg/kg = milligrams per kilogram; ND = analyte not detected; PFOA = perfluorooctanoic acid; PFOS = perfluorooctanesulfonic acid; RRO = residual range organics.

5 CONTAMINANTS OF POTENTIAL CONCERN AND REGULATORY LEVELS

The primary contaminants of potential concern (COPCs) for soil are PFAS (specifically PFOS and PFOA), GRO, DRO, RRO, VOCs, and PAHs.

COPCs for the Class V Industrial Injection Well closure and site characterization include PFOS, PFOA, GRO, DRO, RRO, VOCs, PAHs, SVOCs, and a subset of Resource Conservation and Recovery Act (RCRA) metals (see Exhibit 5-1 for a list of metals). In addition, a representative subset of soil samples will be collected and held for Toxicity Characteristic Leaching Procedure (TCLP) analysis pending metals results. The TCLP results, if needed, will be used to characterize soil for appropriate disposal under Federal and State regulations.

Cordova has an annual average precipitation of 92 inches per year (Western Region Climate Center). To evaluate analytical data, soil results will be compared to 18 Alaska Administrative Code (AAC) 75.341 *Table B1 Method Two—Migration to Groundwater* and *Table B2, Method Two—Over 40-Inch Zone—Migration to Groundwater*. The current DEC CULs and analytical reporting limits for these site COPCs are summarized below in Exhibit 5-1.

Exhibit 5-1: Soil COPCs and Laboratory Reporting Limits

Method	Analyte	Soil Cleanup Level[a] (mg/kg)	Laboratory Reporting Limit[b] (mg/kg)
PFAS Analytes			
537.1 or 537.1M[c]	PFOS	0.003	0.0002
	PFOA	0.0017	0.0005
AK101	GRO	260	1.25
AK102	DRO	230	10
AK103	RRO	9,700	50
Volatile Organic Compounds			
EPA 8260	multiple	analyte dependent	
PAH Analytes			
EPA 8270D-SIM	multiple	analyte dependent	
SVOC Analytes[d]			
EPA 8270D	multiple	analyte dependent	
RCRA Metal Analytes			
EPA 6020B	Arsenic	0.2	0.31
	Barium	2,100	0.094
	Cadmium	9.1	0.062
	Chromium	100,000	0.13
	Lead	400[e]	0.062
	Mercury	0.36	0.01
	Selenium	6.9	0.31
	Silver	11	0.15

Notes:

a. 18 AAC 75 *Table B2. Method Two - Petroleum Hydrocarbon Soil Cleanup Levels – Over 40-Inch Zone - Migration to Groundwater* or *Table B1. Method Two - Soil Cleanup Levels Table - Migration to Groundwater*.

b. February 2020 LODs from SGS North America, Inc. for petroleum and PAH analyses. February 2020 RLs from Eurofins TestAmerica, Sacramento for PFAS analyses.

c. All available PFAS analytes will be requested for analytical reports. However, only PFOS and PFOA have a DEC drinking water action level or cleanup levels and are reported in this table.

d. Samples analyzed for SVOC analytes will only include injection well end-point samples.

e. 18 AAC 75.341 *Table B1 Method Two – Soil Cleanup Levels Table (Human Health – over 40-Inch Zone)*.

DRO = diesel range organics; EPA = U.S. Environmental Protection Agency; GRO = gasoline range organics; mg/kg = milligram per kilogram; µg/L = microgram per liter; PAH = polynuclear aromatic hydrocarbons; PFAS = per- and polyfluoroalkyl substances; PFOA = perfluorooctanoic acid PFOS = perfluorooctanesulfonic acid; RRO = residual range organics; SIM = selective ion monitoring; SVOC = semi-volatile organic compounds

6 UPDATED CONCEPTUAL SITE MODEL

A conceptual site model (CSM) describes potential pathways between a contaminant source and possible receptors (i.e., people, animals, and plants) and is used to determine who may be at risk of exposure to those contaminants. A DEC Human Health CSM Graphic Form and Human Health CSM Scoping Form was updated based on our understanding of site conditions in July 2021. These forms are included in Appendix B of this Work Plan Addendum.

Very little is known about potential PFAS-affected media. The CSM will be revised and presented in the final report following receipt of analytical data. Potentially affected media include contaminated soil, groundwater, and surface water. Potential human exposure pathways include:

- incidental soil, groundwater, or surface water ingestion;
- dermal absorption of contaminants from soil, groundwater, or surface water;
- ingestion of fugitive dust; and
- ingestion of ground water (i.e., water supply wells).

We have not included wild or farmed foods or direct contact of contaminants in sediment as the scope of our CSM is limited to the vicinity of the future SREB and not a CSM for the entire CDV.

7 FIELD SAMPLING PLAN

7.1 Rationale

The purpose of the soil sampling and analysis described herein is to characterize the excavated soil for the purpose of determining disposal options and to document contaminant concentrations remaining at the limits of excavation. The following is our proposed approach for environmental screening, soil sampling, testing, and reporting.

The excavation area will be divided into sub-10,000 square feet decision units (DUs), shown in Figure 3. The DUs are categorized based on the likelihood for PFAS- or fuel-related contamination to reduce mixing PFAS-contaminated soil with non-PFAS-contaminated soil. We will sample the limits of the excavation and stockpile using incremental sampling methodology (ISM) sampling techniques for non-visually contaminated soil. When petroleum-related or other visually contamination soil is encountered, we will separately stockpile the soil and conduct additional discrete sampling for COPCs. Specific sampling requirements outside of the ISM and discrete sampling for the injection well, HOT, and leach field are described in subsequent sections.

An ISM sample is a composite of a representative number of subsamples, known as increments. ISM sampling is an appropriate tool for our approach to characterizing PFAS since there are no field-screening tools for PFAS. ISM samples provide a statistically defensible mean analyte concentration within a given area or bulk quantity of material. Each decision unit will have one ISM PFAS sample to represent the contamination remaining in place at base of excavation, and one or more ISM PFAS samples to characterize the PFAS concentration of each 300 cubic yard stockpile.

ISM samples are more robust and representative than typical composite samples because the entire DU is subdivided into units of units of equivalent surface area and/or volume. An increment of equivalent mass is collected from each of these subunits, so that every portion of the entire DU is represented equally within the final composite sample. To meet the strict criteria of a representative and reproducible ISM sample result, the sample collection process will adhere to Interstate Technology and Regulatory Council's (ITRC) October 2020 *Incremental Sampling Methodology (ISM) Update Technical/Regulatory Guidance*. Further discussion of ISM is in Appendix D.

We suspect that petroleum-related contamination will be limited to small surface spills and soil surrounding the injection well based on previous site visits. During excavation, we will field screen soil for petroleum contamination using a handheld photoionization detector (PID). When we encounter elevated PID readings, we will stockpile elevated PID readings separately from non-elevated PID soil from the same decision unit.

The contractor will stockpile all excavated soil according to criteria established in Section 7.2. The contractor will only excavate soil depths required for design needs, with exception of the two Class V Industrial Injection Wells, HOT and leach field, where excavation of contaminated soil will proceed until visual signs of contamination have been removed or until the groundwater interface is reached. Field forms to be used during sampling are included in Appendix C.

Upon reaching the limits of excavation of each DU, we will field screen the base and sidewalls. If we do not observe elevated PID readings, we will collect analytical samples for analysis of PFAS from the base and sidewalls using ISM and DEC's *Field Sampling Guidance* Table 2B criteria, respectively. If PID readings from the base and sidewalls are elevated, then we will collect additional discrete samples for analysis of petroleum related COPCs.

For waste characterization purposes, the QEP will collect samples from each DU stockpile using ISM *Ex-Situ* Method for analysis of PFAS. In the petroleum contaminated stockpile(s), the QEP will collect discrete samples in accordance with DEC's *Field Sampling Guidance* Table 2A criteria for analysis of petroleum related COPCs and PFAS.

7.2 Excavation Area Descriptions

For the purpose of this CMMP, the QEP will segregate soils based on the decision unit and type of contamination. The DUs are shown in Figure 3 and are delineated based on surface area and contamination potential. Soil from each DU will be in one stockpile, with exception for DUs with deep excavation depths where multiple 300 cubic yard stockpiles will be required. The excavation areas are summarized in Exhibit 7-1.

Prior to removing asphalt, the QEP will sample the asphalt according to Section 7.7. Asphalt and visually contaminated soil (e.g., injection well soil and structures, leach field, fuel-stained soil) will be stockpiled separately from soil in the DU that is not visually contaminated. However, soil with petroleum contamination from surface spills or related to the HOT may be stockpiled together with similar contaminated soil from other DU areas.

Exhibit 7-1: Excavation Area Summary

Excavation Area	Surface Area (square feet)	Excavation Depth (feet)	Volume (cubic yards)	Number of Stockpiles	Notes
A	9,000	1	350	1	Existing gravel and asphalt.
B	5,500	1	200	1	Existing gravel.
C	6,000	1	250	1	Unknown soil & media; asphalt.
D	9,500	5	1,800	6	ARFF garage and surroundings; contains buried HOT; new facility footprint.
E	8,000	5	1,500	5	Existing gravel area; new facility footprint.
F	8,000	1	300	1	Leach field.
G	7,000	1	250	1	Existing gravel/grass.
H_1 & H_2	7,000	1	250	1	Existing asphalt and gravel.
I	5,000	5	900	3	New facility footprint.

Notes:
Quantities for surface area, excavation depths, and volumes are estimated.

7.3 Contaminated Media Descriptions

From each DU, the QEP will segregate soils in the following categories: *Unknown, Visually Contaminated*, *Injection Well*, *Asphalt*, *and Leach field*. These categories are defined below.

- ***Unknown***: No visible stains, no smells of fuels or other volatiles, headspace field-screening results less than 20 ppm.

- ***Visually Contaminated*:** Soil with visible stains, odor of fuel or other volatiles, and/or headspace field-screening results above 20 parts per million (ppm).
- ***Injection Well***: This includes all soil and structures related to the Class V Industrial Injection Wells.
- ***Asphalt***: All asphalt removed during demolition will be stockpiled and characterized for waste disposal.
- ***Leach field***: Soil excavated from below the leach pipes will be stockpiled separately from other stockpiled materials.

We anticipate that majority of the excavated soil from each DU will be categorized as *Unknown*. The types of contaminated media and sampling procedures for the stockpiles and limits of excavation are summarized in Exhibit 7.2.

Exhibit 7-2: Types of Contaminated Media

Unknown	
Stockpiles	300 CY stockpiles; sampled in accordance with ISM *ex situ*.
Limits of Exc. Base	ISM *in situ* sampling per each DU.
Limits of Exc. Sidewalls	Discrete sampling in accordance with DEC's *FSG* Table 2B.
Analytes	PFAS
Visually Contaminated Soil	
Stockpiles	300 CY stockpiles; discrete sampling in accordance with DEC's *FSG* Table 2A.
Limits of Excavation	Discrete sampling in accordance with DEC's FSG Table 2B.
Analytes	GRO, DRO, RRO, VOCs, PAH (10%), and PFAS
Injection Well Soil and Media	
Stockpiles	300 CY stockpiles; discrete sampling in accordance with DEC's *FSG* Table 2A.
Limits of Excavation	Discrete sampling in accordance with DEC's *FSG* Table 2B; Sample base of each IW floor drain vault (end-point sample).
Analytes	GRO, DRO, RRO, VOCs, and PFAS End-Point samples from each IW also analyzed for SVOCs, total metals, and PAH (10%)
Asphalt	
Pre-stockpile	Discrete sampling of asphalt surface in accordance with DEC's *FSG* Table 2B (modified).
Analytes	PFAS
Leach Field Soil and Media	
Stockpiles	300 CY stockpiles; PID < 20 ppm, sampled in accordance with ISM; PID > 20, additional discrete sampling in accordance with DEC's *FSG* Table 2A.
Limits of Excavation	ISM *in situ* sampling per each stockpile decision unit.
Analytes	PID < 20 ppm, PFAS only PID > 20 ppm, GRO, DRO, RRO, VOCs, PAH (10%)

Notes: CY = cubic yards; FSG = *Field Sampling Guidance* (2019); ISM = incremental sampling methodology

7.4 Field Screening Procedures

We will use a hand-held MiniRae® 3000 PID manufactured by RAE Systems (or equivalent PID) with a 10.6 eV lamp to detect petroleum compounds. The PID measures total volatile compounds present as vapors, which is a semi-quantitative indication of hydrocarbons present. The MiniRae provides a three-second response time up to 15,000 ppm. We will calibrate the PID daily, or more often as needed, to a 100-ppm isobutylene standard according to the manufacturer's instructions. Shannon & Wilson's QEPs are trained and experienced in the calibration, operation, routine maintenance, and troubleshooting of the PID, as well as interpreting PID results.

We will collect a headspace sample a minimum of 1 for every 10 cubic yards, or approximately every 5 to 10 excavator bucket scoops of material removed. The QEP will retrieve headspace samples using a clean, stainless-steel spoon from freshly uncovered soil and place the soil in a clean, resealable plastic bag, filling it one-third to one-half full and quickly sealing it closed. We will maintain the headspace samples within our custody and screen the headspace samples within one hour of collection.

The QEP will allow the headspace to develop in the bag by warming it to at least 40 degrees Fahrenheit (°F) for 10 minutes to one hour and shaking the bag for 15 seconds at the beginning and end of the period to assist volatilization. We will open the bag just enough to allow insertion of the PID probe about one-half the headspace depth, taking care to avoid uptake of water droplets and soil particles. We will record the maximum PID reading obtained, noting any erratic meter response at high organic-vapor concentrations or conditions of elevated headspace moisture.

Based on field screening results and location of the excavation, the QEP will segregate the soil into the *Visually Contaminated* or the associated DU stockpile. *Injection Well* and *Leach Field* soil will be stockpiled separately. We will not field screen asphalt samples.

7.5 Limits of Excavation Field Screening and Sampling

We will field screen the limits of excavation base and sidewalls at the frequency required by DEC's *Field Sampling Guidance*, Table 2B (Exhibit 7-3). The QEP will retrieve headspace samples from the limits of excavation using a clean, stainless-steel spoon from freshly uncovered soil using the procedure described in Section 7.4. If PID readings are below 20 ppm, the QEP will collect samples for PFAS only using ISM as described in Section 7.5.2. If PID readings are above 20 ppm, samples will be collected for fuel related COPCs as described in Section 7.5.3.

7.5.1 Non-Visually Contaminated Soil Sample Collection

The limits of excavation base for each DU will be sampled in accordance with ISM in-situ sampling. Each excavation area DU will correspond to one or more stockpile DUs to estimate contamination removed and remaining in place. Each DU will be divided into 30 representative grid cells. We will systematically collect an equal quantity of soil using a standardized tool, such as a Terra Core Sampler™ to collect each subsample, known as an increment, from each grid cell. Once collected, the increments will be deposited and homogenized in a clean sealable bag or other PFAS-free container for transport. The homogenized sample will be subsampled upon arrival to the laboratory for analysis of PFAS using EPA Method 537.1 (modified). A full description of ISM sampling is provided in Appendix D.

The sidewalls of the *Unknown* excavation areas will be sampled according to DEC's Field Sampling Guidance, Table 2B (Exhibit 7.3).

Exhibit 7-3: Table 2B. Surface/Excavation Base and Excavation Sidewall Soil Sample Collection Guide

Base or Sidewalls	Surface Area (square feet)	Number of Screening Samples	Associated Number of Laboratory Samples
Base	0-50	5	1
	51-124	5	2
	125-250	1 per 25 ft^2	2
	More than 250	10 plus 1 per additional 100 ft^2.	2 samples, plus one sample for each additional 250 sf, or portion thereof.
Sidewalls	Any	For each excavation sidewall, 1 per 10 square feet (depth and length), or portion thereof, with field screening sample collection focused on soil horizon(s) demonstrated as most likely to be contaminated.*	Minimum 1 per each sidewall plus one additional sample for each sidewall areas over 250 total square feet (depth and length), or portion thereof at the highest field screening reading in all soil horizons.*

1 * Field screening samples and laboratory samples are to be collected within a soil horizon at the area most likely to be contaminated, such as on top of confining layers, at the base of more porous layers, at the groundwater interface, or along any other preferential pathways identified in the field. Sidewalls of 2 feet or less in depth must have field screening and laboratory samples collected in accordance with Table 2B.

7.5.2 Visually Contaminated Soil Sample Collection

If the QEP observes PID readings greater than 20 ppm within the limits of excavation, we will collect additional samples using discrete methodology. In areas where there is visual contamination and areas related to the injection well removal, the frequency of field screening samples will follow Table 2B of the 2019 DEC *Field Sampling Guidance* (Exhibit 7-3). The QEP will field screen and collect analytical soil samples from freshly uncovered soil from the locations with the highest field-screening results or from areas likely to be contaminated.

We will submit samples for the following analyses and methods: Method AK101 for GRO, Method AK102 for DRO, Method AK103 for RRO, EPA Method 8260D for VOCs, EPA Method 537.1 (modified) for PFAS, and EPA Method 8270D-SIM for PAHs. PAH samples will be collected for 10-percent of analytical samples only.

7.6 Injection Well Sampling

The U.S. EPA issued conditional approval of the March 2021 *Final Cordova Airport Combined Maintenance Facility Site Characterization Work Plan* on March 2, 2021 with the condition that DOT&PF submit a plan for demolition that satisfies the remaining elements contained in the Guidance for Underground Injection Control Class V Well Closures in EPA Region 10 for review and approval by EPA. The following sections describe demolition and analytical sampling activities related to the closure of the Class V Industrial Injection Wells.

Upon demolition of the ARFF structure, the contractor will expose the injection well system and remove the floor drain structural components. Any liquid or semi-solid material within the injection well will be pumped into 55-gallon drums using a pneumatic vacuum after collecting an effluent sample. The contractor will excavate all visually contaminated soil and stockpile separately from soil within the same DU area. The structural components from the injection well will be stockpiled in the containment area.

We will field screen and collect analytical samples from the injection well stockpile and limits of excavation according to DEC's *Field Sampling Guidance* Table 2B (Exhibit 7-3). The QEP will collect one sample will be collected at the depth of discharge (base of IW floor drain vault) for each injection well to serve as the end-point sample. The end-point sample will be submitted for the following analyses and methods: Method AK101 for GRO, Method AK102 for DRO, Method AK103 for RRO, EPA Method 8260D for VOCs, EPA Method 8260D-SIM for SVOCs, Method 6020A for RCRA Total Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), EPA Method 537.1 (modified) for PFAS, and EPA Method 8270D-SIM for PAHs. One PAH sample will be taken from the end-point location with the highest PID reading. We will collect a subset of soil samples for TCLP analysis of metals to be submitted to the laboratory and held pending results of total metals analysis. If any effluent is present in the injection well, we will collect a sample for analysis of GRO, DRO, RRO, VOCs, PAH, and RCRA Total Metals prior to containerizing the effluent.

7.7 Asphalt Sampling

Previous site characterization investigations were limited to gravel surfaces surrounding the ARFF due to utilities and airport operations. It is unknown if the asphalt surrounding the ARFF has been contaminated by PFAS. Prior to asphalt excavation, a QEP will collect multiple discrete surface samples of the asphalt on the south of the ARFF garage. We estimate there is 10,000 square feet of between the ARFF garage and runway apron; therefore, we will collect 10 analytical samples for PFAS to characterize the surface of the asphalt for excavation and disposal. If the asphalt is contaminated with PFAS, we suspect that the contamination is limited to the surface of the asphalt. If sampling and waste characterization occurs after excavation, or asphalt is sampled via coring methods, the asphalt samples could be diluted.

The QEP will collect one PFAS sample per 1,000 square feet. The QEP will partition the asphalt into 20 grid squares of approximately 1,000 square feet each. Samples will be collected from degraded pavement or the lowest elevation within each gird square. If the pavement is not degraded and appears entirely level, the samples will be collected from the center of each square. The sampler will grind the uppermost one-half inch to inch of the asphalt surface using a rotary hammer or similar tool. They will fill sample jar with ground asphalt using a stainless-steel spoon. The drill bit, spoon, and any equipment that comes into contact with the sample will be decontaminated before and between locations.

The asphalt analytical results will be used to determine asphalt management during excavation. Asphalt with PFOS and PFOA below DEC CULs may be contained on an unlined stockpile, whereas asphalt with PFOS and PFOA above DEC CUL will be stockpiled on a liner, as described in Section 9.

7.8 HOT Excavation

A 3,000-gallon buried HOT is present along the eastern side of the ARFF garage in DU Area D (Figure 3). The QEP will conduct field screening during the fuel storage tank removal and document any residual odors, spills, signs of contamination, or damage to the tank. Soil surrounding the HOT with PID readings less than 20 ppm will be stockpiled with non-visually contaminated soil from DU Area D. Soil with elevated PID readings (i.e., greater than 20 ppm) will be stockpiled in the *Visually Contaminated* soil stockpiles.

The QEP will collect a minimum of two samples below the tank from highest PID result or areas most likely to be contaminated for analysis of GRO, DRO, RRO, VOCs, PFAS, and PAH.

7.9 Septic Tank and Leach Field

The existing septic tank and leach field (DU Area F) are to be removed and replaced with classified fill. Soil above the leach pipes will be added to the associated DU Area F stockpile. Soil removed from below the leach field piping will be stockpiled separately, in the *Leach Field* stockpile, from other stockpiled materials within the DU. During excavation of the leach field, the QEP will conduct field screening at the frequency described in Section 7.3 and collect ISM samples for PFAS as described in Section 7.9.2. If PID readings are above 20 ppm, the QEP will also collect stockpile samples for analysis of GRO, DRO, RRO, VOCs, and PAH according to Exhibit 7-4. If elevated PID readings are not observed, no additional samples will be collected.

7.10 Stockpiled Soil and Other Media

7.10.1 Pre- and Post-Stockpile Sampling

The proposed stockpile location is shown in Figures 1 and 4. Prior to construction of the stockpiles, we will field screen and sample the native material below the stockpiles. We will collect 10 field screening samples from each 50-foot by 50-foot stockpile footprint. Shannon & Wilson's QEP will observe the surface soil for signs of staining. If PID readings are greater than 20 ppm, we will collect two discrete samples from the stockpile base area and submit for analysis of GRO, DRO, RRO, VOCs, and PAHs; additionally, we will collect an *in-situ* ISM sample for analysis of PFAS from each stockpile footprint. If PID readings are below 20 ppm, then we will sample the base of the stockpile using *in-situ* ISM for PFAS.

The procedures for *in-situ* ISM are included in Appendix D. Each stockpile footprint will be a decision unit. We will collect 30 subsamples, known as increments, at a calculated frequency from the grided stockpile footprint. The QEP will use a standardized tool, such as a Terra Core Sampler™ to collect each subsample. Once collected, the increments will be deposited and homogenized in a clean sealable bag or other PFAS-free container for transport. The homogenized sample will be subsampled upon arrival to the laboratory.

Upon completion of excavation, receipt of analytical results, and transport of the stockpiled materials, we will sample the native material below the stockpile according to the same pre-stockpile procedure described above.

7.10.2 Stockpile Characterization Sampling

Upon completion or during containment activities, the QEP will collect waste characterization samples using either discrete sampling or ICM *ex-situ*.

7.10.2.1 Method One: Discrete Sampling

The DEC's *Field Sampling Guidance* Table 2A is a preferred method for characterizing petroleum contaminated soil or soils that are clearly contaminated. The QEP will collect analytical soil samples from freshly uncovered soil from the stockpiles with the highest field-screening results, where possible.

The stockpiles designated as *Visually Contaminated* and *Injection Well* soil and media will be sampled with the discrete sampling method, as described above. Stockpile soil samples will be submitted for the following analyses and analytes: Method AK101 for GRO, Method AK102 for DRO, Method AK103 for RRO, EPA Method 8260D for VOCs, EPA Method 8270D-SIM for PAHs (for 10-percent of samples collected), and EPA Method 537.1 (modified) for PFAS.

Exhibit 7-4: Table 2A. Excavated Soil Sample Collection Guide

By Volume (cubic yards)	Number of Screening Samples	Associated Number of Laboratory Samples
0 - 10	5	1
11 - 50	5	2
51 - 100	1 per 10 cy	3
More than 100	1 per 10 cy, or as the CSP determines necessary.	3 samples, plus one (1) sample for each additional 200 cubic yards, or portion thereof or as the CSP determines necessary.

2 The Table is appropriate for characterizing the levels of petroleum contamination in soil suitable for management onsite subject to 18 AAC 75.325 (i) or for transport to a treatment or disposal facility. Consult with CSP for determining the appropriate numbers of field screening and laboratory soil samples for characterizing maximum petroleum concentrations in soil for on-site treatment.

7.10.2.2 Method Two: ISM Ex-Situ

A detailed sampling rationale for ISM, description of the *ex-situ* sampling, and associated calculations are included in Appendix D. Soil from each DU that is not visually contaminated will be stockpiled in 300 cubic yard stockpiles. Each excavation area will have one or more associated stockpiles. During excavation, the QEP will collect 30 subsamples, known as increments, at a calculated frequency directly from the excavator scoop. The QEP will use a standardized tool, such as a Terra Core Sampler™ to collect each subsample. Once collected, the increments will be deposited and homogenized in a clean sealable bag or other PFAS-free container for transport. The homogenized sample will be subsampled upon arrival to the laboratory.

Once the soil is contained in a stockpile, additional sampling will not occur, as the ISM homogenized sample will be used to characterize the contents of the stockpile. The stockpiles will be analyzed with EPA Method 537.1 (modified) for PFAS.

8 SAMPLING PROCEDURES

8.1 Soil Sampling

We will wear a new pair of disposable nitrile gloves during the collection and handling of each soil sample to prevent cross-contamination. For discrete soil samples, we will collect each sample using a clean, stainless-steel spoon. We will collect grab samples from each sampling location and will not collect samples as composites or homogenize the samples. We will collect soil samples into laboratory-provided containers in order of decreasing volatility (i.e., VOCs/GRO, DRO, PAH, PFAS).

We will collect soil samples for GRO and VOC analysis with the following procedure:

- Using a clean, stainless-steel spoon, place approximately 50 grams of soil into the pre-weighed, 4-ounce amber-glass sample jar provided by the laboratory.
- Carefully add 25 milliliters (mL) of methanol to the jar.
- Use a clean paper towel to remove soil from the threads of the sample containers and caps, as needed.
- Use waterproof ink to complete the sample label attached to the jar by the laboratory (do not place a label, tape, or other material on the sample jar).
- Seal the jar and place into the sample cooler with frozen ice-substitute.

We will collect soil samples for non-volatile analyses by completely filling the laboratory supplied jars. Sample depths, field-screening results, and encountered soils will be recorded on our standard sample collection log (Appendix C).

ISM increment subsamples for PFAS will be collected using a standardized tool, such as a Terra Core Sampler™. Each increment subsample will be added to a sealable plastic bag provided by the laboratory. Collecting inequal soil from one or more subunits will bias the results, giving more weight to those subunits. Once collected, the increments should be deposited and homogenized in a clean sealable bag or other PFAS-free container for transport to the laboratory. We will target a bulk sample mass of one or two kilograms per ISM sample. The sample will be double-bagged prior to shipment to the laboratory.

8.2 Special Considerations for PFAS Sampling

Because PFAS is found in numerous everyday items, the following special precautions will be taken during sampling activities:

- No use of Teflon®-containing materials (e.g., Teflon® tubing, bailers, tape, sample container lid liners, or plumbing paste).

- No Tyvek® clothing will be worn on-site.
- Clothes treated with stain-, flame-, or rain-resistant coatings will be avoided or go through several washings prior to use on-site.
- No Post-It® notes will be brought on-site.
- No fast-food wrappers, disposable cups, or microwave popcorn will be brought on-site.
- After handling the above items, field personnel will wash their hands thoroughly with soap and water prior to sampling activities.
- No use of foil.
- No use of chemical (blue) ice packs.
- Change nitrile gloves between each sample location.
- No preservative, other than chilling is required for PFAS analysis.
- Label jars using permanent, waterproof ink.

8.3 Analytical Laboratories and Methods

We will submit samples for analysis of GRO, DRO, RRO, VOCs, PAH, SVOCs, and RCRA metals to SGS North America, Inc. (SGS) in Anchorage, Alaska. SGS is a DEC-approved laboratory with National Environmental Laboratory Accreditation Program validation. Discrete and ISM PFAS soil samples will be submitted to Eurofins TestAmerica (TestAmerica) of Sacramento, California. Based on the DEC Technical Memorandum issued on October 2, 2019, PFAS analysis will report the 18 PFAS compounds defined in the EPA Method 537.1. Other analytical samples will be submitted for the analyses listed in Exhibit 8-1. We will request a standard turnaround time of 14 days.

8.4 Sample Containers, Preservation, and Holding Times

Prior to field sampling efforts, Shannon & Wilson will request the necessary sample containers from SGS and TestAmerica. Sample containers, preservation requirements, and holding times for the analyses are shown in Exhibit 8-1.

8.5 Sample Custody, Storage, and Shipping

Prior to the delivery to the laboratory, soil samples will be in the custody of Shannon & Wilson. During field activities, the field representative will store the samples in a cooler with adequate quantities of frozen ice-substitute to maintain samples at 0 °C to 6 °C.

The field representative will complete chain of custody (COC) records to document sample possession from the point of collection to the time of receipt by the laboratory's sample control center. Shannon & Wilson will keep a copy of the COC record to allow sample accountability between field and laboratory.

Shannon & Wilson will deliver samples to the analytical laboratory with time to allow for the laboratory to extract the samples within the holding time requirements of the test method. The field representative will pack the samples in a hard-plastic cooler with bubble wrap and enough ice substitute to maintain samples between 0 °C to 6 °C during travel. The field representative will pack a temperature blanks with the samples in each cooler, carefully tape the cooler shut, and affix dated and signed custody seals across the front of the hinged cooler lid. Samples will be transported to the laboratory from Cordova, Alaska to SGS in Anchorage, Alaska or TestAmerica in Sacramento, California using Alaska Air Cargo's Goldstreak service.

Exhibit 8-1: Soil Sample Containers, Preservation, and Holding Times

Analyte	Method	Container and Sample Volume	Preservation	Holding Time
PFAS	EPA 537.1 or 537.1M	Discrete:1 x 250 mL polycarbonate ISM: 1 x gal sized plastic bag	0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
GRO	AK101	Pre-weighed 4-oz amber glass jar with septa	25mL MeOH 0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
DRO	AK102	4-oz amber glass jar	0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
RRO	AK103	4-oz amber glass jar	0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
VOCs	EPA 8260D	Pre-weighed 4-oz amber glass jar with septa	25mL MeOH 0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
PAHs	EPA 8270D SIM	4-oz amber glass jar	0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
SVOCs	EPA 8270D	4-oz amber glass jar	0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction
Metals	EPA 6020B	4-oz amber glass jar	0 °C to 6 °C	180 days

°C = degrees Celsius; DRO = diesel range organics; EPA = U.S. Environmental Protection Agency; GRO = gasoline range organics; HDPE - high density polyethylene; ISM = incremental sampling methodology; mL = milliliter, MeOH = methanol; oz = ounce; PAH = polynuclear aromatic hydrocarbons; PFAS = per- and polyfluoroalkyl substances; RRO = residual range organics; SIM = selective ion monitoring, SVOC= semi-volatile organic compound; VOC = volatile organic compound

8.6 Equipment Decontamination

All reusable equipment introduced into sample collection must be decontaminated prior to use and reuse. Decontamination procedures will be as follows:

- non-phosphate detergent wash;
- tap water rinse; and
- distilled-water rinse.

Decontamination fluids will be containerized in drums or buckets until receipt of analytical results.

9 CONTAMINATED SOIL MANAGEMENT AND DISPOSAL

This section describes the management and disposal of excavated soil at the CDV.

9.1 Containment of Excavated Material

All stored material will be managed in accordance with 18 AAC 75.370. Stockpiles will be located on DOT&PF property as shown in Figure 1. The following procedure should be followed:

- Prior to installing the stockpile liner, the base of the stockpile location should be sampled for CPOCs listed in Section 5.0.
- Stockpiles should be stored at least 100 feet from surface water, a private or public water system, or a fresh water supply system.
- Stockpiles should be stored at least 200 feet from a water source servicing a public water system.
- Stockpiles should be constructed on an impermeable, reinforced 20-mil polyethylene liner meeting the specifications of Table D in 18 AAC 75.370 for onsite long-term storage for greater than 180 days (Exhibit 9-1).
- Stockpiles should be covered with at least a 10-mil reinforced polyethylene liner meeting the specifications of 18 AAC 75.370, with the edge of the cover lapped over the bottom liner and weights along perimeter edges to protect the stockpile from weather (Exhibit 9-1).
- The equipment operator will load excavated soil into a truck or suitable container for transport of contaminated soil between the excavation area to stockpile area.

- Loaded truck boxes should be covered during transport to the stockpile location. Excess soil should be removed from the trucks to avoid distributing contamination.
- During active excavation and transport of contaminated materials to the stockpile area, the stockpile area should be inspected daily. Once the stockpile has been sampled for the COPCs, they should be inspected every two weeks to ensure the cover remains intact and any liquid leachate derived from the soil is contained.
- Inspections should include date and time of the inspection, notes (accidental tears, runoff, etc.) and photographs. Inspection records should be made available to DEC upon request. DEC should be notified if stockpile conditions change due to weather, tampering, etc.
- Trucks and excavator buckets should be free from residual soil in between transport from the excavation to the truck and truck to stockpile. The truck and bucket should undergo dry decontamination, such as sweeping the bucket scoop with a broom, after contact with soil that is visibly contaminated.
- The containment area should be enclosed with fencing and adequately marked to prevent tampering or unauthorized movement. The perimeter of the containment area should be marked with traffic safety cones or safety fencing and include two Public Health and Safety signs on each side. The signs should be weatherproofed and include contaminant of concern, point of contact for the contractor and DOT&PF (name and number), and generation start date.

Exhibit 9-1: Bottom Liner Specifications from 18 AAC 75.370 Table D

Method	Coated Fabric	Extruded Fabric
Long-term storage of petroleum-contaminated soils (180 days to two years)		
Cold Crack (ASTM D 2136-02(2012), updated 2012)	-60°Fahrenheit	-60°Fahrenheit
Black carbon content (ASTM D 1603-12, updated May 2012)	two percent or greater	two percent or greater
Tensile strength (ASTM D 751-06(2011), updated 2011)	300 pounds (warp)	N/A
Mullen burst (ASTM D 751-06(2011), updated May 2011)	500 pounds per square inch (psi)	N/A
One inch tensile strength (ASTM D 882-12, updated August 2012)	N/A	45 pounds (warp)
One inch elongation MD (machine direction)	N/A	625 percent
Nominal thickness	20 mil	20 mil
Oil resistance (ASTM D 471-12a, updated December 2012)	No signs of deteriorate and more than 80 percent retention of tensile and seam strength after immersion for 30 days at 73°F	No signs of deterioration and more than 80 percent retention of tensile and seam strength after immersion for 30 days at 73°F

9.2 Soil Management

Upon receipt of the laboratory analytical sample results, stockpiled soil will be classified based on the following criteria:

- Uncontaminated Soil: Soil that does not exceed DEC soil CULs may be used as unclassified fill material. These soils will be transported to an alternate, non-environmentally sensitive reuse area.
- Contaminated Soil: The contractor must obtain approval from DEC before moving or disposing of soil subject to the site cleanup rules listed in 18 AAC 75.

The QEP will record all pertinent information regarding the location(s) of contaminated soil, response actions, screening and contaminant concentration data, soil disposition, etc. and provide the information in a report to DOT&PF.

9.3 Soil Disposal

DOT&PF is currently researching alternatives for treatment/disposal of the contaminated soil and asphalt generated during this project.

10 FIELD DOCUMENTATION

We will use field log sheets to document field information, including the following:

- Sampling team member(s)
- Weather and other salient observations
- Documentation of instrument calibration
- Location of activity and site conditions
- Site sketches and field measurements
- Documentation of project progress
- Daily estimated volumes of soil excavated and/or dewatering volumes
- Estimated volumes of soil stockpiles
- PID screening results of potentially impacted excavated soil
- Changes to sampling protocol
- Sample identification, date, and time
- Site photographs
- Location of sampling points and GPS coordinates (if used)

We will prepare field activity reports for each day we are in the field. Samples of our standard field forms are included in Appendix D.

11 QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) presents the quality assurance (QA) and QC activities designed to achieve data quality goals for this project. The QAPP is intended to guide activities during assessment and review of resulting data. Shannon & Wilson will be responsible for conducting data reduction, evaluation, and reporting under this QAPP.

QA is defined as the total integrated program for assuring reliability of screening and measuring data. QC is defined as the routine use of procedures to effectively achieve defined goals and standards for sampling and analysis. The following sections describe specific procedures to be followed during sampling at each site, so sampling and documentation are effective, laboratory data are usable, and the information acquired is of high quality and reliable.

11.1 Quality Assurance Objectives

For measurement data, the QA objective is to assure environmental-monitoring data are of known and acceptable quality. For analytical data, the objective is to meet acceptable QA standards of precision, accuracy, representativeness, comparability, and completeness. These terms are defined below:

- Precision: is a measure of agreement among replicate or duplicate results of the same analyte. The laboratory objective for precision is to equal or exceed the precision demonstrated for similar samples and shall be within the established control limits for the methods as published by the EPA. Precision will be measured as the relative percent difference (RPD) between project and duplicate samples.
- Accuracy: is a measure of bias in a measurement system. Accuracy will be expressed as the percent recovery of an analyte from a surrogate or matrix spike (MS) sample, or a standard reference material. The laboratory objective for accuracy is to equal or exceed accuracy demonstrated for these analytical methods on similar samples and shall be within the established control limits for the methods as published by the EPA.
- Representativeness: is a quality characteristic attributable to the type and number of samples to be taken to be representative of the medium/environment (e.g., soil or water). Sample locations will be selected in the field to be representative of the soils or water at that location, within the constraints of sample-location guidelines in the regulations.

- Comparability: is a qualitative parameter expressing the confidence with which one data set can be compared to another. The sampling method employed, methods used for the transfer of samples to the analytical laboratory, and analytical techniques implemented at the laboratory shall be performed in a uniform manner.
- Completeness: is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. The objective of completeness is to generate an adequate database to successfully achieve the goals of the investigation.

Numeric QA objectives for the primary COPCs are presented in Exhibit 11-1 below. The rationale for the QA program is to obtain data that are representative of environmental conditions at the project site. Comparability among samples will be maintained by consistency in sampling procedures, sample-preservation methods, analytical methods, and data-reporting units. Analytical reporting-limit goals for this project will be less than the applicable DEC cleanup and/or action levels.

11.2 Field Quality Control Samples

The field QA/QC program for this project includes the collection of the following QA/QC samples, as described below.

11.2.1 Field Duplicate Samples

Duplicate samples will be collected at a minimum rate of 10% of the samples submitted per analysis, i.e., a minimum of one per every 10 field samples for each matrix sampled, and for each target analyte. If possible, duplicates will be collected from locations most likely to be contaminated based on PID results, field observations, and/or site-specific information, as applicable, since calculation of duplicate precision is not possible for samples with contaminants below detection limits. Duplicates will be assigned a separate sample number and submit them “blind” to the laboratory. Duplicate sample results will be used to test the comparability of analytical data.

QC field duplicate samples will be collected from the same location and using the same procedure as the primary sample. Two complete sets of sample containers will be filled, and the field duplicate samples will be submitted using a unique, “blind” identifier to the laboratory. The duplicate location and identifier will be identified on the sampling log (Appendix B). Duplicates will be analyzed using the same analytical method used for the primary sample.

Field duplicate and triplicate samples will be collected for 10-percent of ISM PFAS samples. See Section 4 of Appendix D for a description of QA/QC procedures for ISM samples.

Exhibit 11-1: Quality Assurance Objectives for Analytical Samples

Analyte	Method	Matrix	Precision	Accuracy	Completeness
PFAS	EPA 537.1	Soil	±50%	(analyte dependent)	85%
GRO	AK101	Soil	±50%	60-120%	85%
DRO	AK102	Soil	±50%	60-120%	85%
RRO	AK103	Soil	±50%	60-120%	85%
VOCs	EPA 8260D	Soil	±50%	(analyte dependent)	85%
PAHs	EPA 8270D-SIM	Soil	±50%	(analyte dependent)	85%
SVOCs	EPA 8270D	Soil	±50%	(analyte dependent)	85%
Metals	EPA 6020B	Soil	±50%	(analyte dependent)	85%

Notes:

COPC = contaminant of potential concern; DRO = diesel range organics; EPA = U.S. Environmental Protection Agency; GRO = gasoline range organics; PAH = polynuclear aromatic hydrocarbons; PFAS = per- and polyfluoroalkyl substances; RRO = residual range organics; SIM = selective ion monitoring; SVOC = semi-volatile organic compound; VOC = volatile organic compound

11.2.2 Trip Blank Samples

Trip blank samples are used to detect and quantify potential volatile analyte cross-contamination between samples or contamination originating from an outside source. Where additional volatile COPCs have been identified, trip blanks will be required. The laboratory will create one trip blank set for each matrix (soil, water, etc.) for the volatile analyses. Field personnel will transport trip blanks to the sampling location and return them to the laboratory in the same cooler as their associated project samples. The laboratory will analyze the trip blank for volatile parameters using the same analytical method as project samples. The concentration of any volatile artifacts found in the trip blank will be noted and compared to the project-sample results.

11.2.3 Equipment Blank Samples

Field staff will not be using reusable sampling equipment so equipment blank samples will not be collected.

11.2.4 Temperature Blank Samples

Temperature blanks enable the receiving laboratory to estimate the samples' temperature on their arrival at the laboratory. Each sample cooler will be submitted to the laboratory with a temperature blank. Temperature blanks will consist of a jar filled with water and packed with the other samples in each cooler. Artificial ice will be added as necessary to maintain an interior cooler temperature within the range of 0 °C to 6 °C. The water temperature in the blank will be measured at the laboratory upon arrival. The laboratory will document sample and cooler conditions, including temperature, and whether any sample containers are broken.

11.3 Laboratory Quality Control Samples

The analytical laboratory will perform QC measurements to determine the precision and accuracy of the entire measurement system, including initial and continuing calibration checks, analysis of method blanks, analysis of spiked samples, duplicate analyses, and evaluation of surrogate and/or isotope dilution analyte (IDA) recoveries.

11.4 Laboratory Data Deliverables

Analytical data obtained will be reviewed and validated by conducting what the EPA refers to as a Stage 2a Validation (EPA 2009). Accordingly, Shannon & Wilson will request Stage 2a laboratory data deliverables and electronic data deliverables. These deliverables generally include the following items:

- A Cover Sheet, Table of Contents, and Laboratory Case Narrative;
- Sample results forms, COC and supporting records, and laboratory receipt checklist; and
- QC data and QC acceptance criteria linked to corresponding field samples (e.g. method blanks, matrix duplicates, surrogates, etc.).

12 DATA REDUCTION, EVALUATION, AND REPORTING

The laboratory supervisor or other responsible party will validate the laboratory tests and include evaluation for precision and accuracy of the data set. The laboratory QC officer or other responsible party will review and sign analytical data before release. Data reporting will be included in the laboratory reports submitted to Shannon & Wilson. Individual laboratory reports will be included with our final report.

We will check analytical data generated by the laboratory for precision, accuracy, and completeness and complete a DEC laboratory data-review checklist (LDRC) for each analytical laboratory report received. After we have reviewed the analytical data, we will prepare a site assessment report in which we document field activities, summarize soil sampling results, and evaluate those results in the context of ADEC cleanup levels.

To evaluate analytical data, we will compare soil-sample analytical results to migration-to-groundwater cleanup levels for the "Over 40 Inch Zone" listed in 18 AAC 75.341[c] and [d].

Qualified Shannon & Wilson personnel will review field data, including sample descriptions and pertinent observations, during preparation of the report. We will provide a discussion of sample results, deviations from the work plan, and recommendations for additional investigation or corrective action, as appropriate. Our report will include tabulated analytical results, figures depicting sample locations, scanned field notes, laboratory data reports, completed DEC LDRC, and copies of COC records.

13 REFERENCES

Alaska Department of Environmental Conservation (DEC), 2021, 18 AAC 75, Oil and Other Hazardous Substances Pollution Control: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, January available: http://dec.alaska.gov/commish/regulations/.

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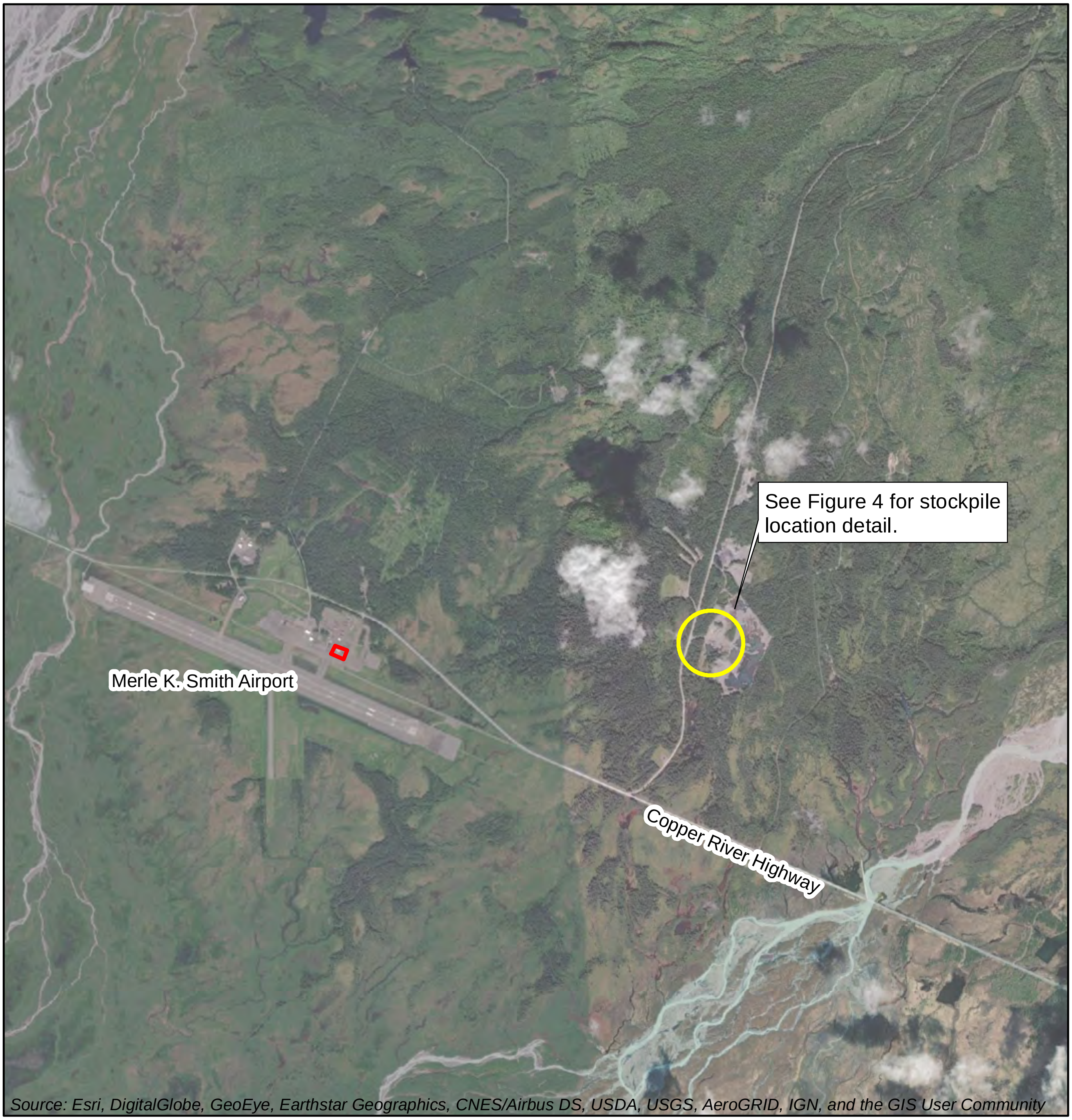
Alaska Department of Environmental Conservation (DEC), 2017, Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites: Juneau, Alaska, DEC Division of Spill Prevention and Response, Contaminated Sites Program, March, available: http://dec.alaska.gov/spar/csp/guidance_forms/csguidance.htm.

Interstate Technology and Regulatory Council, 2020, Incremental Sampling Methodology (ISM) Update, October, available https://itrcweb.org/teams/projects/incremental-sampling-methodology.

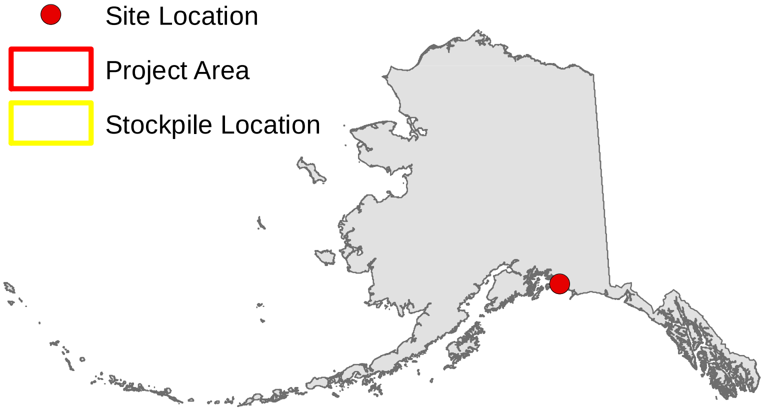
Shannon & Wilson, Inc., 2020, Cordova Airport Combined Maintenance Facility Hazardous Materials Assessment Report: Report prepared by Shannon & Wilson, Inc., Fairbanks, 103311-001, for PDC Engineers, Inc., Fairbanks, Alaska. June 2021.

Shannon & Wilson, Inc. 2021 Cordova Airport Combined Maintenance Facility, 2021 Site Characterization Report: Report: Report prepared by Shannon & Wilson, Inc., Fairbanks, 103311-009, for PDC Engineers, Inc., Fairbanks, Alaska. May 2021.



LEGEND

- Site Location
- Project Area
- Stockpile Location



0 5,000 10,000

Feet

N

Cordova Airport Combined Maintenance Facility
Contaminated Media Management Plan
Cordova, Alaska

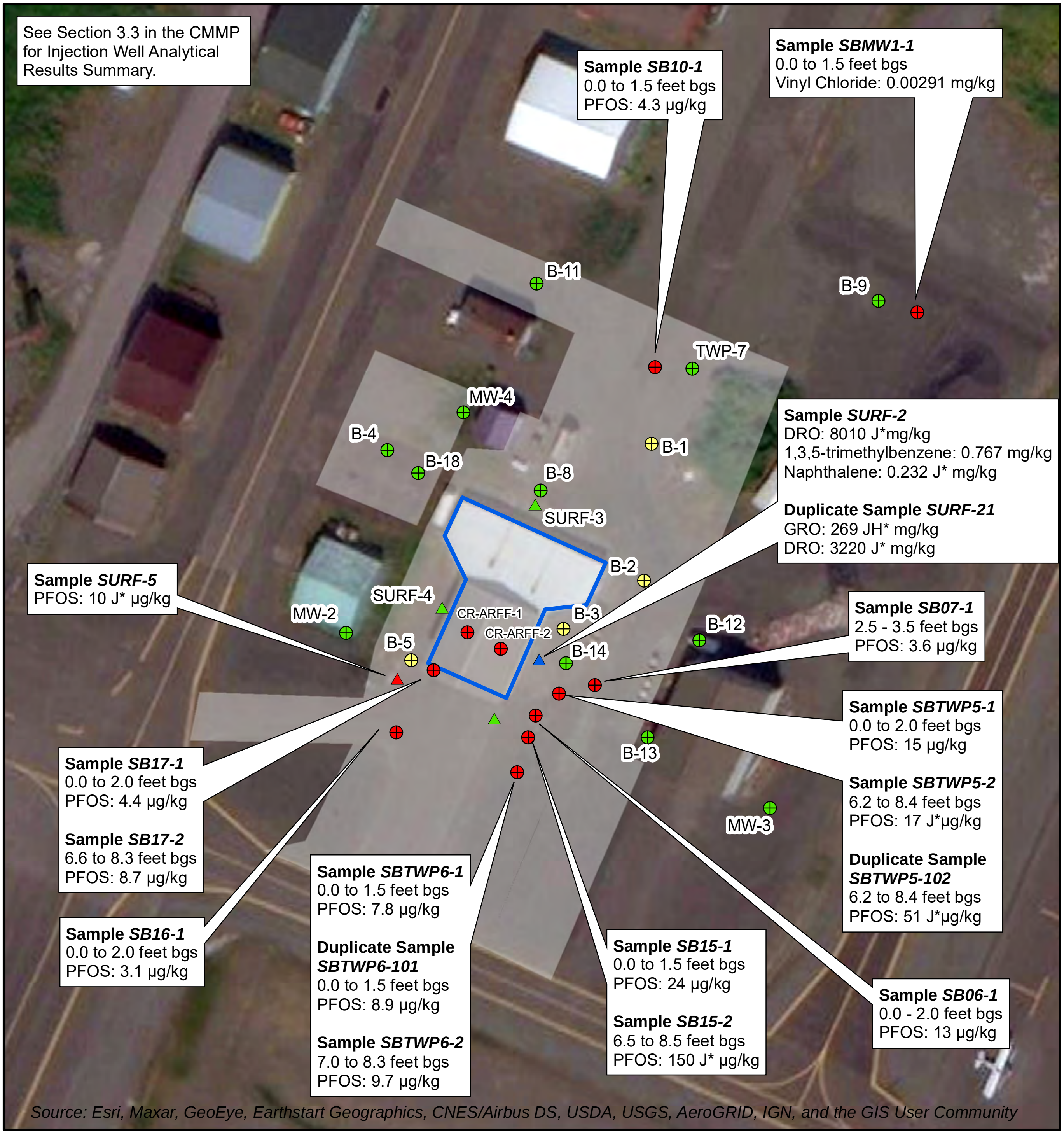
CORDOVA AIRPORT VICINITY MAP

August 2021

103311-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1



LEGEND

- Soil boring results exceeding CUL
- Soil boring results below CUL
- Soil boring results below CUL; PFAS unknown
- Surface soil results below CUL
- Surface soil results exceeding CUL
- Surface soil results exceeding CUL; PFAS unknown
- Aircraft Rescue and Fire Fighting (ARFF) building
- Planned Excavation Areas

0 50 100

Feet

N

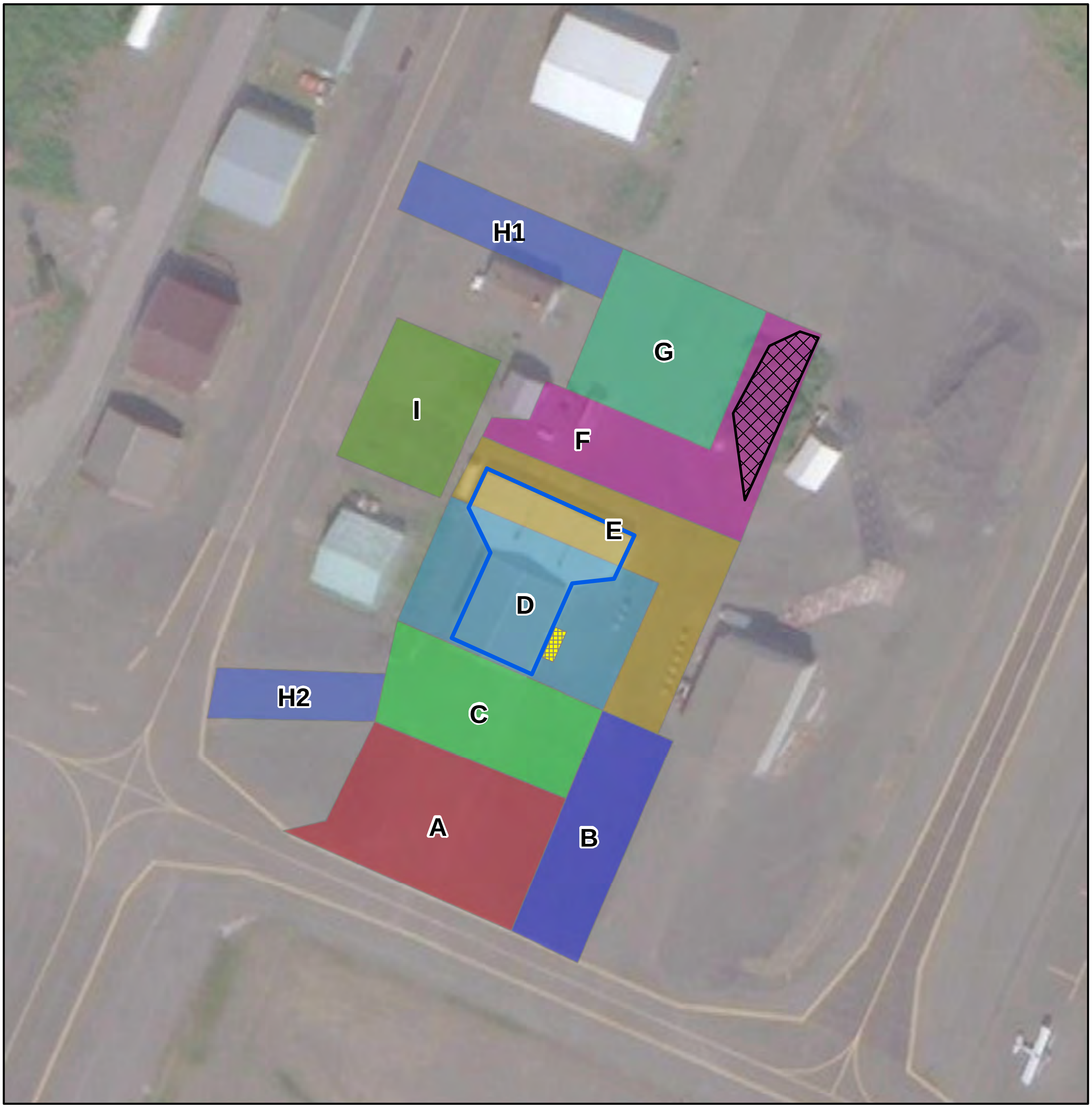
Cordova Airport Combined Maintenance Facility
Contaminated Media Management Plan
Cordova, Alaska

2020 AND 2021
SOIL EXCEEDANCES

August 2021 | 103311-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 2



Source: Esri, Maxar, GeoEye, Earthstart Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

0 50 100

Feet

LEGEND

- Aircraft Rescue and Fire Fighting (ARFF) building
- Excavation Decision Units (various colors)
- Underground Heating Oil Tank
- Septic and Leach Field

N

Cordova Airport Combined Maintenance Facility
Contaminated Media Management Plan
Cordova, Alaska

SITE MAP WITH EXCAVATION AREAS

August 2021

103311-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 3

Aerial photo provided by ADOT&PF - July 18, 2021
Sheridan Glacier Gravel Pit

0 500
Feet

Legend

Proposed stockpile location

N

Cordova Airport Combined Maintenance Facility
Contaminated Media Management Plan
Cordova, Alaska

PROPOSED STOCKPILE AREA

August 2021 103311-012

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 4

APPENDIX A: EXCAVATION PLAN

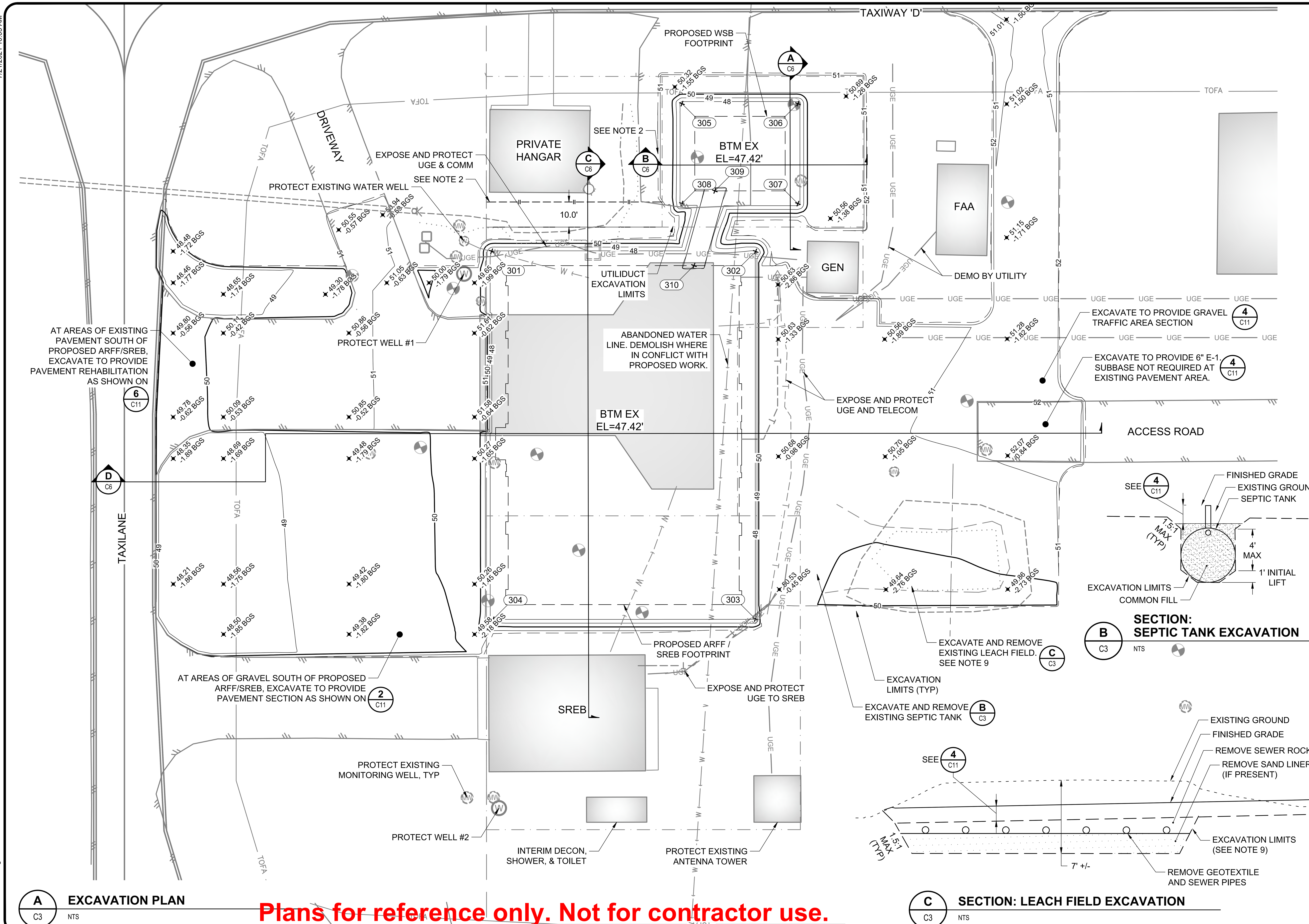
Appendix A

Excavation Plan

From Final Check Set Dated July 21, 2021

CONTENTS

- Sheet C3, Excavation Plan
- Sheet C6, Site Sections



B C3 **SECTION: SEPTIC TANK EXCAVATION** NTS

A C3 **EXCAVATION PLAN** NTS

Plans for reference only. Not for contractor use.

C C3 **SECTION: LEACH FIELD EXCAVATION** NTS

NOTES:

1. CONTRACTOR SHALL LOCATE ALL UNDERGROUND UTILITIES BEFORE BEGINNING WORK. RELOCATION OF BURIED POWER AND COMMUNICATION MAY BE REQUIRED FOR FOUNDATION CONSTRUCTION.
2. EXCAVATION, EQUIPMENT, MATERIALS, AND TEMPORARY SPOILAGE PILES SHALL NOT ENCROACH PRIVATE HANGAR LOT FOR THE DURATION OF THE PROJECT EXCEPT WITHIN EASEMENT. PROPERTY LINE AND EASEMENT SHALL BE CLEARLY MARKED, AND CONTRACTOR SHALL PROVIDE MEANS TO PROTECT ADJACENT PROPERTY FROM DISTURBANCE.
3. PROPOSED EXCAVATION AT PROPOSED ARFF/SREB FOOTPRINT IS BASED UPON DEPTH TO REMOVE EXISTING ARFF FOUNDATION, AND TO PROVIDE BUILDING PAD OF HOMOGENOUS COMPOSITION. EXCAVATION DEPTH IN TRAFFIC AREAS IS BASED UPON DEPTH OF TYPICAL PAVEMENT SECTIONS SHOWN IN DETAILS 2, 4 & 6 ON SHEET C11 RELATIVE TO FINISHED GRADE. DEPTHS SHOWN ARE FROM EXISTING GROUND.
4. SEE SHEET C6 FOR EXCAVATION SECTIONS.
5. EXCAVATION FOR EXISTING SEWER AND LEACH FIELD DEMOLITION, FUEL TANK DEMOLITION, PROPOSED RAW WATER PIPE TRENCHING, PROPOSED FUEL PIPE TRENCHING, PROPOSED SANITARY SEWER PIPE AND TANK TRENCHING INTENTIONALLY NOT SHOWN FOR CLARITY. SEE SECTIONS THIS SHEET DETAILING RELATIVE DEPTH OF EXCAVATION AND BACKFILL MATERIAL REQUIREMENTS.
6. FIELD SCREENING AND ANALYTICAL SAMPLING WILL BE REQUIRED DURING THE EXCAVATION. THE DEPARTMENT HAS RETAINED SHANNON & WILSON, INC. TO SERVE AS AN APPROVED QUALIFIED ENVIROMENTAL PROFESSIONALS (QEPS) RESPONSIBLE FOR FIELD SCREENING, COLLECTING ANALYTICAL SAMPLES, DETERMINING STOCKPILING REQUIREMENTS, AND DOCUMENTING THOSE ACTIVITIES.
7. THE CONTRACTOR SHALL ASSIST THE QEPS AS REQUIRED DURING THE EXCAVATION AS THEY FOLLOW THE SCOPE OF WORK AS DETAILED IN THE CONTAMINATED MEDIA MANAGEMENT. THE CONTRACTOR'S PLAN FOR SOIL EXCAVATION SHALL ACCOUNT FOR QEP ACTIVITIES DURING EXCAVATION WHILE THE QEP FIELD SCREENS, DETERMINES STOCKPILING REQUIREMENTS, AND COLLECTS ANALYTICAL SAMPLES.
8. BECAUSE CONTAMINATED SOILS EXIST WITHIN THE PROJECT AREA, THE CONTRACTOR SHALL MAINTAIN CONTROL OF ALL EXCAVATED MATERIALS FROM EROSION AND SEDIMENT TRANSPORT. CONTAMINATED SOILS GENERATED FROM SITE EXCAVATION MAY BE TEMPORARILY STOCKPILED ONSITE UNDER THE DIRECTION OF THE QEP.
9. EXISTING LEACH FIELD DIMENSIONS AND DEPTH ARE UNKNOWN. PRIOR TO REMOVAL OF EXISTING DRAINFIELD, THE SYSTEM MUST BE ALLOWED A DRYING OUT PERIOD OF SIXTY (60) DAYS TO ENSURE THAT NO LIQUID SEWAGE EFFLUENT IS PRESENT. ALL MATERIAL IN CONTACT WITH EFFLUENT SHALL BE HAULED OFF AND STOCKPILED IN A LOCATION THAT MINIMIZES HUMAN EXPOSURE TO ALLOW PATHOGEN DIE-OFF. EXCAVATION LIMITS SHALL BE TO THE INTERFACE BETWEEN MEDIA AND ADJACENT INSITU SOILS AND EXCAVATION DEPTH SHALL BE TO THE BOTTOM OF MEDIA OR ELEVATION NECESSARY TO CONSTRUCT GRAVEL TRAFFIC AREA SECTION, WHICHEVER IS DEEPER.
10. BACKHAULING OF CLEAN PROJECT MATERIALS ARE ALLOWED ONLY IF ALL REMNANTS OF EXCAVATION MATERIALS HAVE BEEN CLEANED OUT PRIOR TO LOADING.

7/21/2021 10:03 AM

BASIS OF SCALE FOR FULL SIZE 22X34 DRAWINGS 1"

PLANS DEVELOPED BY: PDC, INC., CERTIFICATE OF AUTHORIZATION NUMBER: AECC605, 1028 AURORA DRIVE, FAIRBANKS, AK 99709, (907) 452-1414
P:\2018\18243FB-Cordova_M&O\C\C2001cnst-18243FB.dwg

DESIGN	DES
DRAWN	HRB
CHECKED	KLH

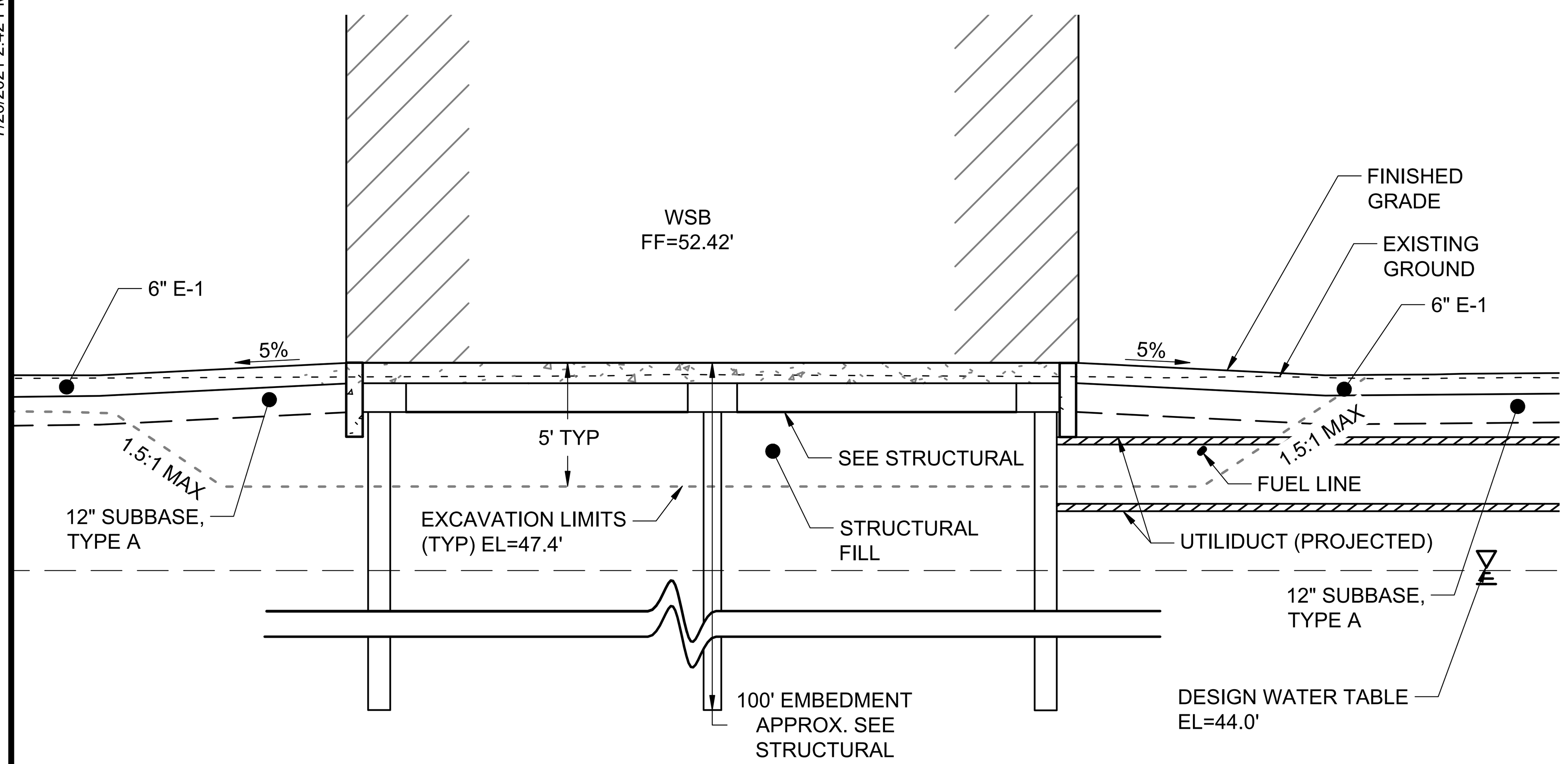
STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
NORTHERN REGION-DESIGN AND CONSTRUCTION-AVIATION

FINAL CHECK SET
DATE: 07/21/2021

BY	DATE	REVISIONS

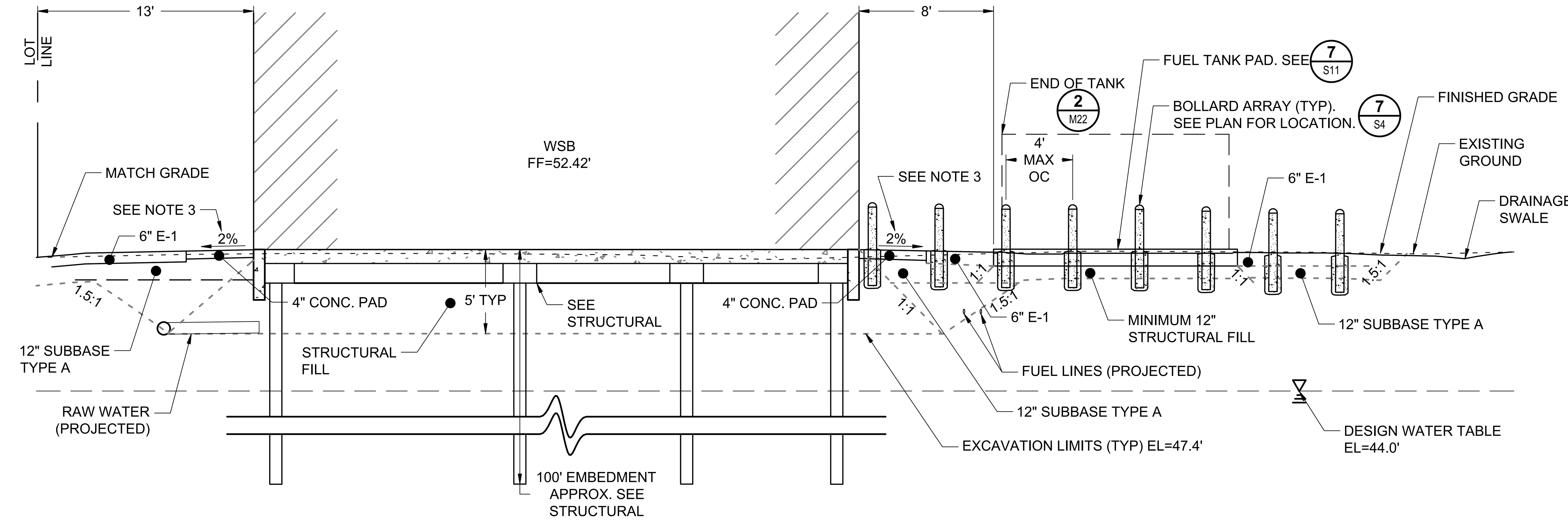
CORDOVA AIRPORT
ARFF & SREB REPLACEMENT
AIP 3-02-0067-XXX-2022 / Z768760000
EXCAVATION PLAN

SHEET C3 OF TBD



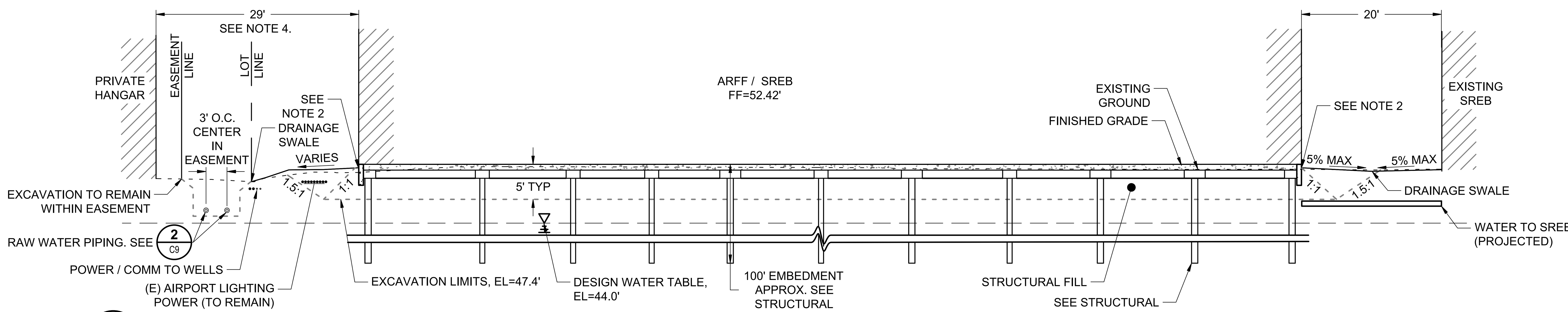
A C6 **TYPICAL SECTION WEST TO EAST**

NTS



B C6 **TYPICAL SECTION SOUTH TO NORTH**

NTS



C C6 **TYPICAL SECTION WEST TO EAST**

NTS

SECTION NOTES:

1. BASED UPON ADNR WELL LOG 25837, GROUNDWATER IS APPROXIMATELY 6-10 FEET BELOW EXISTING GROUND. DEWATERING MAY BE REQUIRED. CONSULT WITH ADEC PM (MICHAEL HOOPER 907-451-4174) BEFORE DEWATERING ACTIVITIES.
2. FINISH GRADE ALONG EAST AND WEST SIDES OF THE ARFF/SREB IS 6 INCHES BELOW FINISH FLOOR ELEVATION. SEE DETAIL 7/A20.
3. FINISHED GRADE IS SLOPED AT 2.0% FROM THE MAN DOORS AND 5.0% FOR 10 FEET ELSEWHERE.
4. SEE SHEET C8 FOR ADDITIONAL UTILITY INFORMATION.

D C6 **TYPICAL SECTION SOUTH TO NORTH**

NTS

Plans for reference only. Not for contractor use.

DESIGN	DES
DRAWN	HRB
CHECKED	KLH

STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

NORTHERN REGION-DESIGN AND CONSTRUCTION-AVIATION

FINAL CHECK SET

DATE: 07/21/2021

BY	DATE	REVISIONS

CORDOVA AIRPORT

ARFF & SREB REPLACEMENT

AIP 3-02-0067-XXX-2022 / Z768760000

SITE SECTIONS

SHEET C6 OF TBD

7/20/2021 2:42 PM
BASIS OF SCALE FOR FULL SIZE 22X34 DRAWINGS 1"
PLANS DEVELOPED BY: PDC, INC., CERTIFICATE OF AUTHORIZATION NUMBER: AECC605, 1028 AURORA DRIVE, FAIRBANKS, AK 99709, (907) 452-1414
P:\2018\18243FB-Cordova_M&O\C\C3001cnst-18243FB.dwg

APPENDIX B: CONCEPTUAL SITE MODEL

Appendix B

Conceptual Site Model

CSM

CONTENTS

- DEC CSM Scoping Form
- DEC CSM Graphic Form

Print Form

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

Site Name: Aircraft Rescue and Fire Fighting Building, Cordova Airport, Cordova AK

File Number: n/a

Completed by: Rachel Willis. Updated 4/16/2021.

Introduction
The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

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

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☒ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☒ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Aqueous film forming foam (AFFF)

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

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

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

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☒ Air
- ☐ Sediment
- ☒ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other:

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

- ☐ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☐ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

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

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

Comments:

Soil samples contained concentrations of GRO, DRO, 1,3,5-trimethylbenzene, naphthalene, and PFOS above DEC CUL. Contamination may be brought to the surface during construction activities.

2. Dermal Absorption of Contaminants from Soil

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

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

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

Comments:

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the ground-water is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

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

Comments:

Water for the airport structures is provided by an existing well. Contaminants do not exceed regulatory levels in groundwater, but soil contaminants may migrate to groundwater in the future.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☒

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☒

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

Comments:

Our well search identified multiple water supply wells near the ARFF building. PFAS was not present exceeding EPA lifetime health advisory levels in two wells sampled, but soil contaminants may migrate to groundwater in the future. We suspect contamination is limited to the top-most water aquifer.

3. Ingestion of Wild and Farmed Foods

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

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

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

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

Comments:

We suspect that the contamination has not spread beyond the airport property boundary. The airport property is developed and restricted-access.

c) Inhalation-

1. Inhalation of Outdoor Air

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

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

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

Comments:

Volatile contaminants of potential concern include constituents of heating oil. Excavation activities could unearth the contaminated soil, which would affect outdoor air quality.

2. Inhalation of Indoor Air

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

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

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

Comments:

Contaminants are present below the ARFF in the floor drain substrate.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

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

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

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

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

Comments:

Dermal exposure to PFAS contaminants may occur during construction excavation.

Inhalation of Volatile Compounds in Tap Water

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

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

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

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

Comments:

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- o Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- o Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

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

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

Comments:

One surface soil sample collected from localized surface soil staining has results above cleanup level for multiple fuel and volatile compound. PFAS was found above CUL in multiple surface soil samples. These particles may be dispersed in the wind.

Direct Contact with Sediment

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

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

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

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

Comments:

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Aircraft Rescue and Fire Fighting Building, Cordova Airport

Completed By: Rachel Willis

Date Completed: Updated 2/2/2021,

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

(1) *Check the media that could be directly affected by the release.*

(2) *For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.*

(3) *Check all exposure media identified in (2).*

(4) *Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5) *Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.*

Media / Transport Mechanisms

☑ Surface Soil (0-2 ft bgs)

- Direct release to surface soil — check soil
- ☑ Migration to subsurface — check soil
- ☑ Migration to groundwater — check groundwater
- ☑ Volatilization — check air
- ☑ Runoff or erosion — check surface water
- ☐ Uptake by plants or animals — check biota
- ☐ Other (list): ______

☑ Subsurface Soil (2-15 ft bgs)

- Direct release to subsurface soil — check soil
- ☑ Migration to groundwater — check groundwater
- ☑ Volatilization — check air
- ☐ Uptake by plants or animals — check biota
- ☐ Other (list): ______

☑ Ground-water

- Direct release to groundwater — check groundwater
- ☐ Volatilization — check air
- ☐ Flow to surface water body — check surface water
- ☐ Flow to sediment — check sediment
- ☐ Uptake by plants or animals — check biota
- ☐ Other (list): ______

☐ Surface Water

- Direct release to surface water — check surface water
- ☐ Volatilization — check air
- ☐ Sedimentation — check sediment
- ☐ Uptake by plants or animals — check biota
- ☐ Other (list): ______

☐ Sediment

- Direct release to sediment — check sediment
- ☐ Resuspension, runoff, or erosion — check surface water
- ☐ Uptake by plants or animals — check biota
- ☐ Other (list): ______

Exposure Media / Exposure Pathway/Route / Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ soil	☑ Incidental Soil Ingestion		C/F	C/F	F			
	☑ Dermal Absorption of Contaminants from Soil		C/F	C/F	F			
	☑ Inhalation of Fugitive Dust		F	F	F			
☑ groundwater	☑ Ingestion of Groundwater		C/F	C/F	F			
	☑ Dermal Absorption of Contaminants in Groundwater		C/F	C/F	F			
	☑ Inhalation of Volatile Compounds in Tap Water		F	F	F			
☑ air	☑ Inhalation of Outdoor Air		C/F	C/F	C/F			
	☑ Inhalation of Indoor Air		C/F	C/F	C/F			
	☑ Inhalation of Fugitive Dust		C/F	C/F	C/F			
☑ surface water	☑ Ingestion of Surface Water		C/F	C/F	C/F			
	☑ Dermal Absorption of Contaminants in Surface Water		C/F	C/F	C/F			
	☐ Inhalation of Volatile Compounds in Tap Water							
☐ sediment	☐ Direct Contact with Sediment							
☐ biota	☐ Ingestion of Wild or Farmed Foods							

APPENDIX C: FIELD FORMS

Appendix C
Field Forms

CONTENTS

SAMPLE COLLECTION LOG

Project Number: Location: Page of

Date:

Sampler:

Sample Number	Location	Sample Time	Depth Interval (ft)		Matrix Type	Sampling Method	Sample Type	PID Reading	Analyses
			top	bottom					

Matrix Type

AR	Air
GW	Groundwater
PR	Product
SB	Subsurf. soil
SE	Sediment
SG	Sludge
SS	Surface soil
SW	Surface water
WR	Water

Sampling Method

B	Bailer/Coliwas
D	Drill cuttings
G	Grab sampling
H	Hand auger
L	Tube liner
P	Pump (liquid)
SS	Split spoon
T	Shelby tube
V	Vacuum (gas)
W	Wipe sampling

Sample Type

ES	Environmental sample
ER	Equipment rinsate
FB	Field blank
FD	Field duplicate
FM	Field measurement
FR	Field replicate
MD	Matrix spike duplicate
MS	Matrix spike duplicate
TB	Trip blank

FIELD ACTIVITIES DAILY LOG

Date ______________
Sheet _____ of _____
Project No. ______________

Project Name: ______________________________
Field activity subject: ______________________________
Description of daily activities and events: ______________________________

Visitors on site: ______________________________

Changes from plans/specifications and other special orders and important decisions:

Weather conditions: ______________________________

Important telephone calls: ______________________________

Personnel on site: ______________________________
Signature: Date:

Page____ of____

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CHAIN-OF-CUSTODY RECORD

Laboratory________________
Attn:________________

400 N. 34th Street, Suite 100
Seattle, WA 98103
(206) 632-8020

2043 Westport Center Drive
St. Louis, MO 63146-3564
(314) 699-9660

303 Wellsian Way
Richland, WA 99352
(509) 946-6309

2355 Hill Road
Fairbanks, AK 99709
(907) 479-0600

5430 Fairbanks Street, Suite 3
Anchorage, AK 99518
(907) 561-2120

2255 S.W. Canyon Road
Portland, OR 97201-2498
(503) 223-6147

1200 17th Street, Suite 1024
Denver, Co 80202
(303) 825-3800

Analysis Parameters/Sample Container Description
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Comp.	Grab							Total Number of Containers	Remarks/Matrix

Project Information	Sample Receipt	
Project Number:	Total Number of Containers	
Project Name:	COC Seals/Intact? Y/N/NA	
Contact:	Received Good Cond./Cold	
Ongoing Project? Yes ☐ No ☐	Delivery Method:	
Sampler:	(attach shipping bill, if any)	

Instructions
Requested Turnaround Time:
Special Instructions:

Relinquished By: 1.	Relinquished By: 2.	Relinquished By: 3.
Signature: Time:______	Signature: Time:______	Signature: Time:______
Printed Name: Date:______	Printed Name: Date:______	Printed Name: Date:______
Company:	Company:	Company:

Received By: 1.	Received By: 2.	Received By: 3.
Signature: Time:______	Signature: Time:______	Signature: Time:______
Printed Name: Date:______	Printed Name: Date:______	Printed Name: Date:______
Company:	Company:	Company:

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report
Yellow - w/shipment - for consignee files
Pink - Shannon & Wilson - Job File

F-19-91/UR

No. 30000

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

DAILY SAFETY MEETING LOG

JOB NAME:	JOB NO:	BORING NO:

LOCATION: ______________________ DATE: / / TIME: :

SUBCONTRACTOR: ______________________ S&W REP: __________ S&W PM: __________

WORK DESCRIPTION: ______________________

CHECK APPLICABLE HAZARDS: Heavy Equipment ☐, Vehicles ☐, Overhead ☐, Tools ☐, Temperature ☐, Lifting ☐ (Use Mechanical Means Instead), Site Housekeeping ☐ (Clear Walkways to Prevent Slips, Trips, Falls), Awkward Work Area ☐, Public ☐, Security ☐, Plants ☐, Animals ☐, Noise ☐, Vibration ☐, Dust ☐, Radiation ☐, UV exposure ☐, Repetitive Motion ☐, Suspected Contamination ☐, Chemical Exposure ☐, Flammable/Explosive ☐

OTHER HAZARDS: ______________________

EQUIPMENT ON SITE: ______________________

DOCUMENTATION:	Present	PPE:	Present
SSHSP On Site?	☐	Boots - Safety Toe / Other	☐
Hospital Map On Site?	☐	Safety Glasses	☐
Fall Protection Plan On Site?	☐	Vest - Class II / Class III	☐
Respiratory Protection Plan On Site?	☐	Hard Hat	☐
Confined Space Entry Plan On Site?	☐	Ear - Plugs / Muffs / Both	☐
Traffic Control Plan?	☐	Gloves - Type: __________	☐
Other Plan? __________	☐	Face Shield	☐
Current Fit Test?	☐	Respirator	☐

Cards/Certs Required? *List Below* Other PPE? *List Below*

Hazards & Controls Discussed? ☐ Need to Update SSHSP? ☐

My signature below confirms that the above hazards, controls and plans have been discussed and that I understand them.

PRINT NAME	SIGNATURE	COMPANY	HAS ALL CARDS	PPE On?
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

APPENDIX D: INCREMENTAL SAMPLING METHODOLOGY

Appendix D

Incremental Sampling Methodology

ISM

CONTENTS

Exhibits and Equations

Enclosure

A.1 INTRODUCTION

The purpose of an ISM sample is to report statistically defensible mean analyte concentrations within a given area or bulk quantity of material, known as a decision unit (DU). To meet the strict criteria of a representative and reproducible ISM sample result, the sample collection process must adhere to Interstate Technology and Regulatory Council's (ITRC) guidance October 2020 *Incremental Sampling Methodology (ISM) Update Technical/Regulatory Guidance*.

An ISM sample is a composite of a representative number of subsamples referred to as increments. ISM samples are more robust and representative than a typical composite sample because the entire DU is subdivided into units of equivalent surface area and/or volume. An increment of equivalent mass is collected from each of these subunits, such that every portion of the entire DU is represented equally within the final composite. The location from which the increments are collected within the subunits is determined through some form of random selection to remove procedural bias. Replicate ISM samples are collected at a rate of 20 percent of the overall project ISM samples, or at minimum of one set per area of concern. Replicates are collected to analyze the precision of the method and to calculate 95 percent upper confidence limits (95% UCLs) for the target analytes.

Prior to any ISM sampling effort, the number of DUs must be determined. For stockpiles, maximum DU volume is typically capped at 500 to 750 cubic yards (cy). We understand the quantity of material at the CDV is approximately 6,000 cy and stockpiles will be capped at approximately 300 cy; therefore, we estimate a minimum of 21 DU stockpiles with three sets of replicate ISM samples. The excavation area is broken into nine areas of 10,000 square feet or less, where the limits of excavation will be sampled using ISM methodology.

Two potential processes are described below to perform ISM sampling on the stockpiles and limits of excavation in such a way as to conform to ITRC guidance. These two methodologies are detailed in the following sections.

A.2 IN-SITU METHOD

The in-situ method can be performed on the base of the limits of excavation or on a stockpile with defined dimensions and uniform depth. A grid is physically staked out on the surface of the stockpile or within the limits of excavation and random selection is used to determine increment sample locations within the grid cells.

A.2.1 Grid Creation and Sample Collection

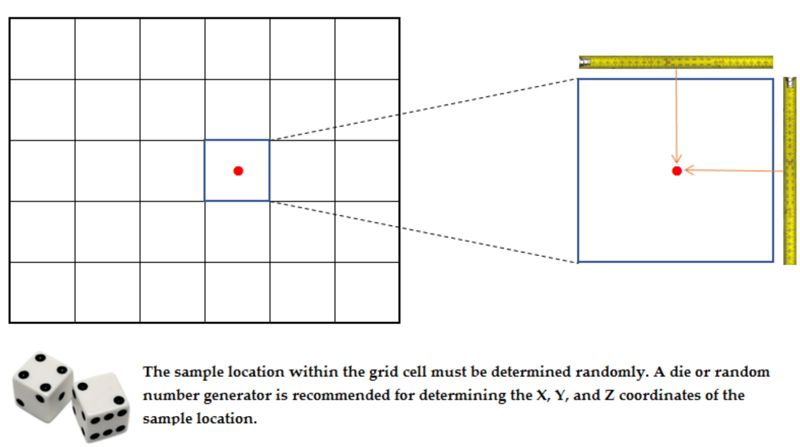
Before sampling can commence, the DU must be subdivided into a grid of equally sized cells. The number of these cells is variable, but DEC and ITRC guidance state that 30 grid cells should be considered a minimum for a representative sample. The total area encapsulated by each grid cell is at the discretion of the environmental professional, but should provide sufficient resolution to capture the spatial variability of the DU. The following formula (Equation 1) may be used to estimate the dimensions of each grid cell:

Equation 1: Grid Cell Dimension Estimation

Equation	Variable and Definition	
$X = \sqrt{\frac{A}{N}}$	X	Length and width dimensions of the resulting grid cell
	A	Total area of the DU
	N	Total number of desired grid cells

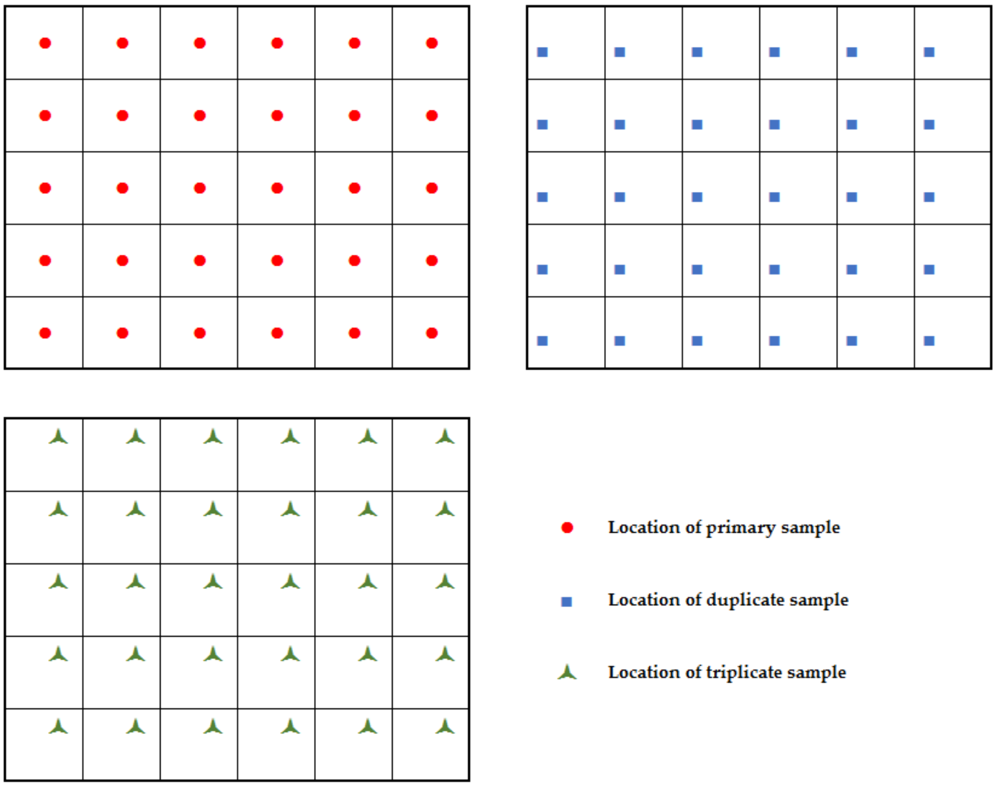
When performing the sampling, the environmental professional must systematically collect a quantity of soil of equivalent volume from each grid cell within the DU. The location of these sample points within the grid cells must be determined randomly. The recommended method by which to accomplish this is to lay a tape measure along the X and Y axis of a grid cell. A die or random number generator can then be used to ascertain random values which correspond to units on the tape measures (Exhibit 1).

Exhibit 1: Random Sample Location Determination



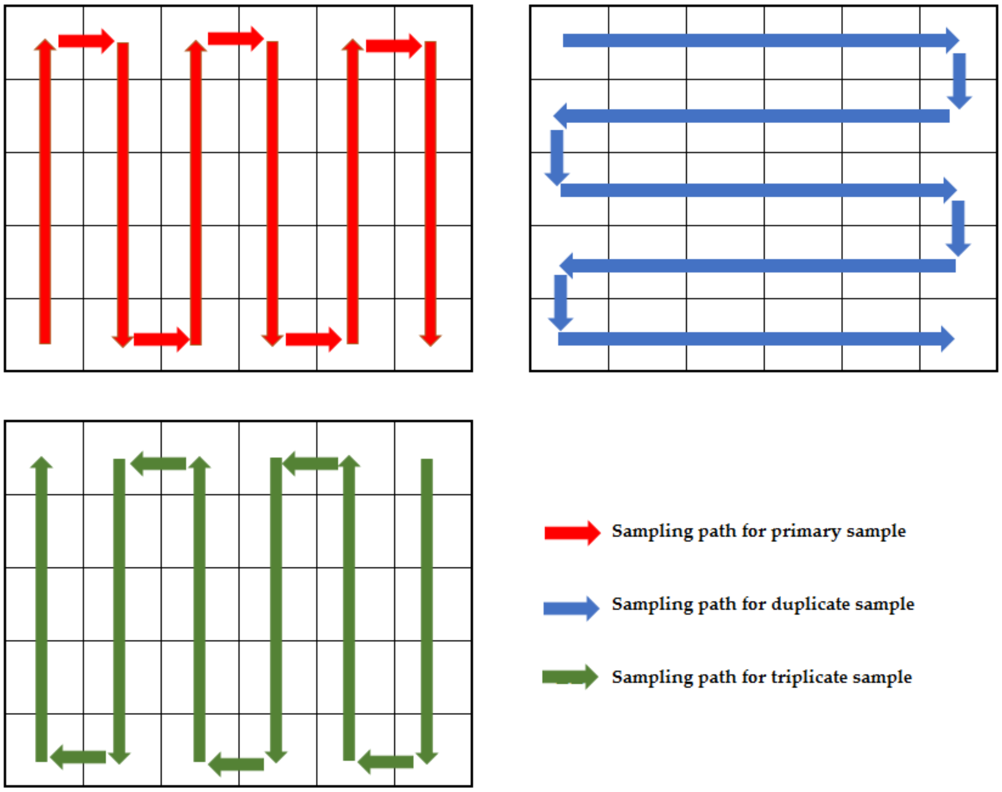
Once the random sample location has been determined within the grid cell, that same location is used when sampling all remaining grid cells within the DU. This process may be repeated for replicate samples, such that a new random location is determined for each of the three replicates (Exhibit 2).

Exhibit 2: Random Sampling Locations for Replicate Samples



The systematic order in which the grid cells are sampled should be different for each of the replicate ISM samples (Exhibit 3). While all grid cells within the DU will be sampled during each process, changing the order in which they are sampled reduces procedural bias.

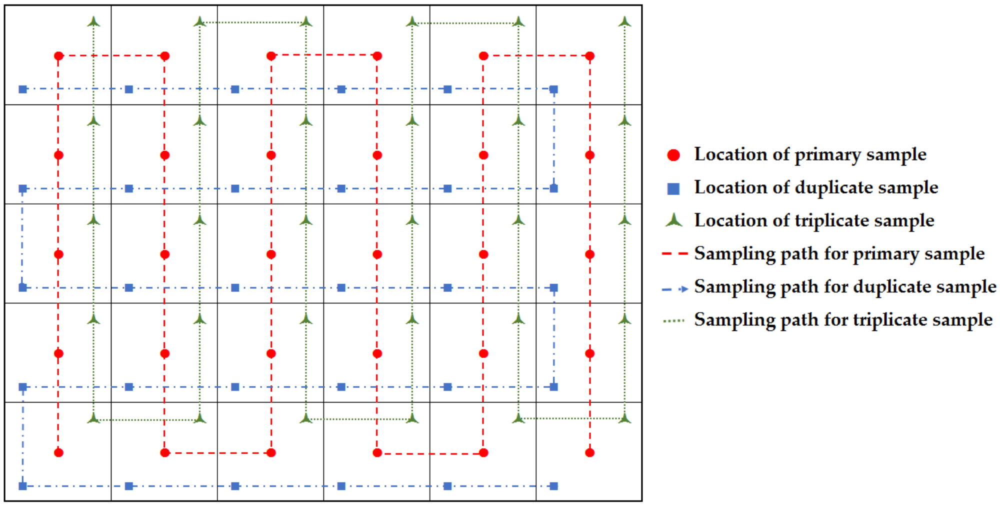
Exhibit 3: Systematic approach to sampling grid cells



The increments collected from each grid cell should be composited with the increments from all other grid cells for that replicate sample for that DU. The end result should be a single unique container for each replicate sample.

By collecting soil from unique locations within the grid cells for each of the replicate samples, the total amount of DU surface area coverage is enhanced and the ability of the method to account for spatial variability can be assessed (Exhibit 4).

Exhibit 4: DU coverage after triplicate samples are collected



The frequency of replicate sample collection is determined by the number of DUs being sampled, and through consultation with the DEC.

This method of sampling requires additional time for the environmental professional(s) to design an appropriate grid and physically establish it in the field. It is beneficial for there to be at least two personnel onsite to measure and mark out the grid and to aid with collection of the replicate samples. The benefit of this method is a more systematic and reproducible approach to sample collection.

For a stockpile with a depth greater than 2 feet, the ISM process would need to be completed for each layer. We note the ITRC document requires 1-foot layers; however, we are proposing 2 foot layers for this project.

A.3 EX-SITU SAMPLING

The ex-situ method has the benefit of expediency but requires an excavator/backhoe operator to be onsite to facilitate sampling. The method involves shifting the stockpile horizontally and collecting ISM increments at regular intervals based on the known volume of the excavator/backhoe bucket.

To perform this method, an accurate estimate of stockpile volume is needed. The total volume of the DU is divided by the number of required increments. The result is then divided by the bucket size of the excavator/backhoe to determine the frequency of increment collection. Randomization is not needed via this method because the material is already randomized through the scooping action of the excavator/backhoe. An example of sampling frequency is provided below.

A.3.1 Assumptions

Maximum DU Volume is 300-cy

30 increments are required per DU and ISM sample

Excavator bucket size is 0.5-cy

A.3.2 Calculations

(300 cubic yards)/(30 increments) = 1 increment per 10 cubic yards

(10 cubic yards) / (0.5 cubic yards per scoop) = 1 increment collected per 20 scoops

There are fundamental sources of error in this method due to inconsistency in scoop sizes and/or poor estimations of overall DU volume. However, when care is taken to be consistent throughout the process the analytical results can still be representative.

A.4 INCREMENT COLLECTION

When collecting increment samples, it is important to collect roughly the same quantity from each subunit of the total area/volume of the DU. Because the analytical results will represent the mean analyte concentrations for the entire DU, each grid cell must be represented equally in the composite sample. To ensure an equal volume of soil is collected from each subunit, the environmental professional should use a standardized tool, such as a Terra Core Sampler™ when collecting increments. Collecting inequal soil from one or more subunits will bias the results, giving more weight to those portions of the DU. Once collected, the increments should be deposited and homogenized in a clean bucket, large sealable bag, or other PFAS-free container for transport. We will target a bulk sample mass of one to two kilograms per ISM sample. The sample will be subsampled by the laboratory.

A.5 SAMPLE REPRESENTATIVENESS AND REPORTING

Replicate samples are collected so a relative standard deviation (RSD) and 95% UCL may be calculated upon receipt of the analytical results. The RSD, represented as a percentage, is used to determine the amount of agreement between replicate results. The RSD is calculated via the following formula (Equations 2-4):

Equation 2: Relative Standard Deviation

Equation	Variable and Definition	
$RSD(\%) = \frac{SD}{\mu} \times 100$	RSD	Relative standard deviation
	SD	Standard deviation
	μ	Arithmetic mean of sample results for a target analyte

Where standard deviation (SD) is defined as:

Equation 3: Standard Deviation

Equation	Variable and Definition	
$SD = \sqrt{\frac{\sum \lvert x - \mu \rvert^2}{N - 1}}$	SD	Standard deviation
	x	Result for a target analyte for which the SD is to be calculated
	μ	Arithmetic mean of the data set for the target analyte
	N	Number of results in the data set for the target analyte

And the arithmetic mean (μ) is defined as:

Equation 4: Arithmetic Mean

Equation	Variable and Definition	
$\mu = \frac{1}{N}\sum_{i=1}^{N} x_i$	μ	Arithmetic mean of the data set for the target analyte
	N	Number of results in the data set for the target analyte
	x	Result for a target analyte for which the mean is to be calculated

DEC requires the RSD be 30% or less before the data can be considered sufficiently precise. If the RSD is greater than 30%, DEC considers the representativeness of the sample to be questionable. The RSD may be elevated differently when the detected analyte concentrations are near or below the limit of quantitation (LOQ) or relevant reporting limits (RLs). In these situations, the data must be evaluated on a case-by-case basis.

The 95% UCL is a value derived from the results of the three replicate samples for each target analyte. This value represents a statistically derived concentration for a target analyte for which there is a 95% probability that the true mean analyte concentration does not exceed within the given DU. The 95% UCL for each analyte should be compared to the applicable regulatory limits during reporting. The method by which the 95% UCL is derived is based on whether the concentrations of target analytes are assumed to be normally distributed or skewed within the soil mass. This assumption can be made by calculating the coefficient of variance (CV). The CV is calculated via the following formula (Equation 5):

Equation 5: Coefficient of Variance

Equation		Variable and Definition
$CV = \frac{SD}{\mu}$	CV	Coefficient of variance
	SD	Standard deviation
	μ	Arithmetic mean of sample results for a target analyte

Typically, if the CV for a given analyte is found to be between 0 and 1.5, then that analyte is assumed to be normally distributed within the sample. Conversely, if the CV is between 1.5 and 3.0, the distribution of that analyte within the sample can be assumed to be skewed. A CV greater than 3.0 would imply a heavily skewed distribution.

For an analyte exhibiting a normal distribution, the 95% UCL should be calculated using the one-sided Student's t-factor. This is accomplished via the following formula (Equation 6):

Equation 6: 95% Upper Confidence Limit Using Student's T-Factor

Equation		Variable and Definition
$95\%\ UCL = \mu + \frac{(t \times SD)}{\sqrt{N}}$	μ	Arithmetic mean of the data set for the target analyte
	N	Number of results in the data set for the target analyte
	t	95% one-sided t-distribution factor (e.g. for N=3, t=2.92)
	SD	Standard deviation

For an analyte exhibiting a skewed distribution, the 95% UCL should be calculated using the Chebyshev's theorem. This is accomplished via the following formula (Equation 7):

Equation 7: 95% Upper Confidence Limit Using Chebyshev's Theorem

Equation		Variable and Definition
$95\%\ UCL = \mu + \sqrt{(1/\alpha) - 1} \times \frac{SD}{\sqrt{N}}$	μ	Arithmetic mean of the data set for the target analyte
	N	Number of results in the data set for the target analyte
	1 - α	Decision confidence level (*α = 5% or 0.05)*
	SD	Standard deviation

Assuming a Type 1 error tolerance of 5%, the expression $\sqrt{\left(\frac{1}{\alpha}\right) - 1}$ is simplified to the constant 4.36 for computational purposes.

By either method, replicate data sets that contain one or two non-detect results we will substitute the laboratory's most sensitive detection limit (normally the method detection limit [MDL] or detection limit [DL]) for the non-detect result during RSD and 95% UCL calculations.

IMPORTANT INFORMATION

Important Information

About Your Environmental Report

IMPORTANT INFORMATION

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

IMPORTANT INFORMATION

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for

IMPORTANT INFORMATION

another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland