SUBMITTED TO:

Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska 99501

BY:

Shannon & Wilson, Inc.
5430 Fairbanks Street, Suite 3
Anchorage, Alaska 99518

(907)561-2120
www.shannonwilson.com

SITE CHARACTERIZATION REPORT

DOT&PF Statewide PFAS
ANC Fire Training Pit

ANCHORAGE INTERNATIONAL AIRPORT, ANCHORAGE, ALASKA; ADEC FILE NO. 2100.38.028.26, HAZARD ID: 414

February 2024
Shannon & Wilson No: 108906-003

SHANNON & WILSON

PAGE INTENTIONALLY LEFT BLANK FOR DOUBLE-SIDED PRINTING

Submitted To: Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, Alaska 99501
Attn: Mr. Bill O'Connell

Subject: SITE CHARACTERIZATION REPORT, DOT&PF STATEWIDE PFAS ANC FIRE TRAINING PIT , ANCHORAGE INTERNATIONAL AIRPORT, ANCHORAGE, ALASKA; ADEC FILE NO. 2100.38.028.26, HAZARD ID: 414

This report presents the results of Shannon & Wilson's site characterization activities conducted at the Ted Stevens Anchorage International Airport (ANC) Fire Training Pit in Anchorage, Alaska. Shannon & Wilson participated in this project as a consultant for the Alaska Department of Environmental Conservation (ADEC). Our scope of services was specified in our November 2022, *DOT&PF Statewide PFAS ANC Fire Training Pit Site Characterization Work Plan.* The project was performed under our Alaska Department of Transportation and Public Facilities (ADOT&PF) Per- and Polyfluoroalkyl Substance (PFAS) Related Environmental & Engineering Services Term Contract PSA No. 25-19-1-013. Authorization to proceed with the project was received on November 9, 2022 with Notice to Proceed Number P15-2.

If you have any questions or comments regarding this report, please contact Dan McMahon or the undersigned at (907) 561-2120.

Sincerely,

SHANNON & WILSON, INC.

Alec Rizzo
Environmental Staff

Dan P. McMahon, PMP
Vice President

CONTENTS

CONTENTS

Tables

Figures

Appendices

ACRONYMS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AFFF	Aqueous film forming foam
AK	Alaska Method
ANC	Ted Stevens Anchorage International Airport
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CSM	Conceptual site model
DO	Dissolved Oxygen
DRO	Diesel range organics
DQO	Data quality objective
EPA	Environmental Protection Agency
Eurofins	Eurofins TestAmerica
FBI	Federal Bureau of Investigation
GAC	Granulated activated carbon
Geotek	Geotek Alaska Inc.
GRO	Gasoline range organics
HDPE	High-density polyethylene
IDW	Investigation derived waste
LCS/LCSD	Laboratory control sample/laboratory control sample duplicate
LDRCs	Laboratory data review checklists
LOQ	Limit of quantitation
Mammoth	Mammoth Consulting, LLC
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
MOA	Municipality of Anchorage
MS/MSD	Matrix spike/matrix spike duplicate
MWs	Groundwater monitoring wells
NGSD-29	National Geodetic Vertical Datum of 1929
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
OWS	Oil/water separator
PAHs	Polynuclear aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PFAS	Per- and Polyfluoroalkyl Substances
PFC	Perfluorinated compounds
PFOA	Perfluorooctanoic acid

PFOS	Perfluorooctanesulfonic acid
pg/g	Picogram per gram
PPE	Personal protective equipment
PVC	Polyvinyl chloride
QEP	Qualified environmental professional
QSM	Quality Systems Manual
RPD	Relative percent difference
RRO	Residual range organics
SGS	SGS North America Inc.
VOCs	Volatile organic compounds

1 INTRODUCTION

Shannon & Wilson is pleased to submit this report presenting the results of the site characterization activities performed at the former fire training pit site, located south of Runway 6R at the Ted Stevens Anchorage International Airport (ANC) in Anchorage, Alaska. The site is an Alaska Department of Environmental Conservation (ADEC) contaminated site, and is identified as "AIA Fire Training Pit," under File No. 2100.38.028.26 and Hazard ID 414. A vicinity map is included as Figure 1.

1.1 Purpose and Objectives

The project objectives were to sample surface soil, subsurface soil, sediment, surface water, and groundwater to further evaluate the extent of per- and polyfluoroalkyl substances (PFAS) and petroleum-related contamination in the vicinity of the fire training area. The information primarily will be used to evaluate the fate and transport of PFAS resulting from the use of aqueous film forming foam (AFFF).

1.1.1 Site Location and Boundaries

The ANC fire training area is located south of Runway 6R and Airport Maintenance Road (Figure 1). A lined fire training pit is located on the southeast portion of the facility. The geographic coordinates of the ANC fire training area are latitude 61.1658, longitude -150.0079. Liquid which accumulates in the fire training pit discharges via buried piping to a lined aeration/settling pond to the northwest. The aeration/settling pond discharges to an oil/water separator (OWS), which subsequently discharges via a culvert to a drainage ditch, which parallels Airport Maintenance Road. Surface water in the drainage ditch flows approximately 4,200 feet west, until it is diverted north approximately 2,200 feet beneath Runway 7R and Taxiway K, until is diverted west where it ultimately discharges into the Cook Inlet. According to ANC, the fire training pit and OWS effluents are currently closed, preventing the discharge of water to the drainage ditch.

An aircraft mockup, which was used for fire training exercises is located north of the fire training pit. A shooting range and a building used by the Federal Bureau of Investigations (FBI) are located to the west of the fire training pit.

The project area also includes the area south of the fire training area, which encompasses approximately 100 acres. This area is primarily vegetated and is bound by Raspberry Road to the south, South Airport to the east, and vegetated land to the west.

1.2 Geology

The ANC is located in the western portion of Anchorage, along the eastern shore of Upper Cook Inlet. The Anchorage area consists primarily of broad outwash plains, flood plains, stream terraces, and tidal plains. Most landforms in the area have been influenced by glaciations and many are mantled by loess deposits. Soil parent materials include sandy and gravelly glacial outwash, and loamy and gravelly glacial drift. The tidal plains along Cook Inlet consist of silty and clayey sediments. Poorly drained bogs and fens occupy broad depressions and occur throughout the ANC.

Sediments known as the Bootlegger Cove formation underlie most of the area at depths between 0 and 200 feet below ground surface (bgs). These sediments are mostly silt with up to 5 percent clay minerals. During development of the ANC area beginning in the 1950s, low-lying lands were drained and filled for commercial and residential use. The ANC is located in a natural lowland area with elevations generally less than 200 feet above mean sea level and containing numerous lakes and muskegs. (DOT&PF, 2020).

1.3 Groundwater

According to the August 2004 *Final Airport-Wide Risk Management Plan* prepared by Shaw Environmental, Inc., three distinct water bearing zones are present within the ANC. A deep aquifer, greater than 150 feet bgs, an upper aquifer from 50 feet to 70 feet bgs, and a series of shallow discontinuous aquifers that in some locations reach the ground surface. Groundwater flow direction varies throughout the ANC relative to topography and proximity to lakes, but it generally flows to the northwest toward Cook Inlet (USGS, 1995; DOT&PF, 2020).

2 BACKGROUND

In 1970 the fire training facility was constructed. Between 1970 and 1989 fire training was conducted in unlined depressions and other areas at the site. AFFF was used during the fire training exercises. Until 1984, burned liquids included waste oil, fuel, waste solvents, and alcohol, which were stored onsite in drums and tanks. After 1984, fuel was purchased for use during the training exercises. In 1990, the fire training facility was upgraded to include a lined fire training area and a wastewater treatment system, which included a lined aeration/settling pond and an OWS. Reportedly, the fire training pit was last used for firefighting training in 2018.

The ADEC Contaminated Sites Program published groundwater-cleanup levels of 0.400 micrograms per liter (μg/L) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) in November 2016. Prior to the publication of these levels, there were no state-level cleanup levels established for PFAS. On October 2, 2019, ADEC published a Technical Memorandum amending the April 9, 2019 Technical Memorandum to include additional PFAS analytes to the testing requirements. Current ADEC soil cleanup levels are 0.0030 micrograms per kilogram (mg/kg) for PFOS and 0.0017 mg/kg for PFOA.

2.1 Previous Investigations

The ADEC opened the "AIA Fire Training Pit" contaminated site in 1988 (ADEC File Number 2100.38.028.26, Hazard ID 414). Between 1984 and 1991 site characterization and cleanup activities were conducted at the site. Three groundwater monitoring wells were installed at the site in 1989. During these activities, petroleum-impacted soil and groundwater was identified at the site. In addition, a soil sample collected in 1984 contained a concentration of polychlorinated biphenyls (PCBs) exceeding the ADEC cleanup level. In 1996, an additional well was installed northwest of the new fire training pit.

The site was granted "Conditional Closure" by the ADEC in 2006. At this time, it was noted that contaminated soil remained at the site. As a condition of closure, the ADEC required long-term groundwater monitoring of the on-site monitoring wells. The wells were periodically sampled for gasoline range organics (GRO); diesel range organics (DRO); and benzene, toluene, ethylbenzene, and xylenes (BTEX) through 2012. Surface water samples were also periodically collected from a drainage ditch located north of the fire training area. During several of the events the surface water samples contained concentrations of DRO exceeding the ADEC Table C cleanup levels. By 2012 the concentrations of GRO, DRO, and BTEX were less than the ADEC Table C cleanup levels in the samples collected from the monitoring wells. In 2013 the wells were decommissioned and the ADEC removed the Institutional Controls, which required groundwater sampling.

In 2016, the ADEC requested that ANC conduct an airport-wide perfluorinated compounds (PFC) investigation. As part of these requested activities, Monitoring Well MW-04 was installed west of the OWS. Samples collected from the wells contained concentrations of PFOA and PFOS less than the applicable action levels. In 2020, a sample collected from water which had accumulated in the fire training pit contained concentrations of PFAS compounds. In April 2022, the ADEC re-opened the contaminated site due to "an unacceptable risk due to the presence of PFAS contamination".

According to the ADEC's Division of Spill Prevention and Response, three reported spills have occurred at the site. Each of the spills is listed as "Case Closed, No Further Action". The spills include:

- The "TSAIA Firefighting Training Pit AFFF" spill (Spill No. 19239914201) occurred on May 22, 2019. According to the Spill Notification Form, approximately 50 gallons of AFFF/water was released to the fire training pit while testing firefighting equipment. It was estimated that the release consisted of 3 percent AFFF and 97 percent water.
- The "AK DOT Firefighting Truck AFFF Release" spill (Spill No. 20239910001) occurred on April 10, 2020. Reportedly, the AFFF system of an ANC response truck accidentally charged. As a result, approximately 4,200 gallons of water mixed with 10 gallons of ANSULITE 3% FREEZE PROTECTED AFFF Foam Concentrate. The truck contents were discharged to the fire training pit.
- The "TSAIA Crash Truck AFFF Release" spill (Spill No. 20239922701) occurred on August 13, 2020, when the AFFF system of an ANC response truck accidentally charged. Reportedly, approximately 4,200 gallons of water mixed with 10 gallons of ANSULITE 3% FREEZE PROTECTED AFFF Foam Concentrate. The truck contents were discharged to the fire training pit.

3 PROJECT ACTIVITIES

The project activities consisted of advancing soil borings, installing groundwater monitoring wells (MWs), collecting surface water, sediment, soil, and groundwater samples, laboratory analysis of samples, and disposal of investigation-derived waste (IDW). The site characterization activities were performed in accordance with the conditions of our DOT&PF Professional Services Agreement Number 25-19-1-013 *Per- and Polyfluoroalkyl Substance Related Environmental & Engineering Services*, 18 Alaska Administrative Code (AAC) 75, and the ADEC *Field Sampling Guidance*.

Shannon & Wilson provided Qualified Environmental Professionals (QEP), as defined by 18 AAC 75.333, to conduct and document the field work. Geotek Alaska Inc. (Geotek) provided the equipment and personnel to advance the borings and install the groundwater monitoring wells. The analytical soil and groundwater samples were submitted to SGS North America Inc. (SGS) and Eurofins TestAmerica (Eurofins) for laboratory analysis. US Ecology disposed of the IDW for the project. Mammoth Consulting LLC (Mammoth) surveyed the locations of the borings and monitoring wells. Site photographs and copies of field notes are included in Appendices A and B, respectively. Boring logs are provided in Appendix C. It should be noted that the field notes presented in Appendix B are provided for informational purposes only. Tables 1 through 6, and the boring logs presented in Appendix C, represent our interpretation of the field data and take precedence over the field notes.

The following borings and monitoring wells were outlined in our work plan and were completed as part of the 2023 site characterization activities:

- Three borings completed as monitoring wells (Borings/Wells SB1/B1MW, SB2/B2MW, and SB3/B3MW) were installed in the vicinity of the ANC fire training area, and completed in the shallow aquifer;
- Two soil borings (Borings SB4 and SB5) were advanced to approximately 32 feet bgs in the vicinity of the ANC fire training area;
- One soil boring (Boring SB6) was advanced to the shallow aquifer, southeast of the ANC fire training area;
- Two soil borings were completed as temporary MWs (Borings SB8/B8TMW and SB9/B9TMW) and were installed south/southeast of the ANC fire training area, and completed at the shallow aquifer; and
- One boring completed as a MW (Boring/Well SB11/B11MW) was installed southeast of the ANC fire training area, and completed within the deeper aquifer.

In addition to sampling the borings and newly installed monitoring wells, a pre-existing monitoring well (Well MW-04) located to the west of the OWS was sampled (Figure 2). Five surface water (Samples SW-1 through SW-5) and sediment (Samples SD-1 through SD-5) samples were collected from the drainage ditch located west/northwest of the ANC fire training area. A surface water sample (Sample SW-6) and a sediment sample (Sample SD-6) was collected from the fire training pit. In addition, surface water samples (Sample SW-7 and SW-8) were collected from the aeration/settling pond and a pond located south of the ANC fire training area, respectively. The surface water and sediment sample locations are shown on Figure 3.

3.1 Work Plan Modifications

The project was conducted in general accordance with our ADEC-approved work plan dated November 2022 except for the following scope changes. The scope changes were implemented due to conditions encountered in the field and were approved by the ADEC prior to conducting the modified work.

- Monitoring B3MW could not be developed or sampled due to the lack of water column encountered in the well;
- Boring SB6 was completed as Temporary Monitoring Well TMW6;
- Boring SB10 was not advanced;
- Boring/Temporary Monitoring Well SB7/TMW7 was not advanced/installed; and
- Borings SB12 and SB13 were advanced south of the fire training pit and completed as Wells B12MW and B13MW in the shallow aquifer.

3.2 Soil Borings and Sampling

Shannon & Wilson scheduled utility locates using the Alaska Digline prior to drilling activities. GeoTek advanced the soil borings at each subsurface location (Figure 2). A Geoprobe direct-push drill rig was used to advance Borings SB1 through SB6, SB8, SB9, SB12, and SB13. Borings SB4 and SB5 were terminated at 32 feet bgs. Borings SB1 through SB5 were advanced in February 2023 and Borings SB6, SB8, SB9, SB12, and SB13 were advanced in August 2023. Soil borings completed as MWs or temporary MWs were terminated approximately 5 feet below the groundwater table to install the MWs or temporary MWs.

In July 2023, a Geoprobe Sonic 8140LS drill rig was used to advance Boring SB11, which was completed as Well B11MW. The sonic head advanced 4-inch and 6-inch diameter heavy duty rods, equipped with a drill bit, through an application of down pressure, rotation, and sonic vibration sent to the bit through the sonic rods. Once advanced 10 feet, the lead rod was retracted from the ground and the sample was extruded in a bag by vibrating it out with the sonic head. PFAS-free water was used when getting the tools back to sample depth to assist with keeping any borehole collapse from slowing down tool advancement. This process was repeated in 10-foot increments. The water generated during the drilling process was discharged to the ground surface adjacent to the boring.

In accordance with our work plan, analytical soil samples were collected from Borings SB1, SB2, SB3, SB6, SB8, and SB9 from 0 to 2 feet bgs, 10 to 12 feet bgs, 20 to 22 feet bgs, 50 to 52 feet bgs, and the soil/groundwater interface. Analytical soil samples were also collected from 0 to 2 feet bgs, 10 to 12 feet bgs, 20 to 22 feet bgs, and 30 to 32 feet bgs in Borings SB4 and SB5. In addition, soil samples were collected from the “shallow” and “deep” soil/water interfaces in Boring SB11.

The soil samples tested for volatile constituents were collected using methanol preservation. In accordance with the method, at least 25 grams of soil was quickly placed into a laboratory supplied 4-ounce jar that had been pre-weighed. Afterward, 25 milliliters of reagent grade methanol were added to submerge the soil. The methanol extracts the hydrocarbons from the soil at the time of sampling, thereby reducing the possible loss of volatile constituents prior to sample analysis. The sample jars for non-volatile analyses were collected after the volatile analysis jars. All samples were transferred to the appropriate laboratory supplied jars using decontaminated stainless-steel spoons, and transferred to the laboratory in coolers with ice packs using chain-of-custody procedures.

3.3 Monitoring Well Installation, Development, and Sampling

The MWs were installed as described in the ADEC *Monitoring Well Guidance* (2013) and our work plan. The wells were constructed with two-inch inside-diameter schedule 40 polyvinyl chloride (PVC) material and have a 10-foot section of 0.010-inch pre-packed screen and threaded end caps. The filter pack around the screened intervals is 20/40 rounded silica sand and extends at least 2 feet above the top of the screen. The grout seal above the sand pack is at least five feet of bentonite chips, hydrated in place. For the Well B11MW within the "deeper" aquifer, the grout seal extended approximately 5 feet above the shallow aquifer to prevent potential cross contamination of the "deeper" aquifer from the shallow aquifer. Drill cuttings were placed above the grout seal.

Excess drill cuttings generated while drilling Borings SB6, SB8, SB9, SB11, SB12, and SB13 were landspread adjacent to the borings. Excess drill cutting generated while drilling Borings SB1 through SB5 were containerized and handled in accordance with Section 3.8.

Wells B1MW, B2MW, B12MW, and B13MW were completed as stick-up wells within steel monuments. At the request of ANC, Well B3MW was completed with a flushmount protective casing. Protective bollards were placed around Wells B1MW, B2MW, B12MW, and B13MW.

Shannon & Wilson field staff developed the wells to remove sediment and to allow for hydraulic connection to the aquifer prior to collecting groundwater samples. To allow time for annular-seal materials to set, development occurred no sooner than 24 hours after installation was complete. The monitoring wells were developed using a submersible pump or Waterra (Well B11MW) and a combination of surging and purging. During the development of the wells, water quality parameters (temperature, specific conductivity, pH, oxidation reduction potential [ORP], dissolved oxygen [DO] and/or turbidity), and purge volume were collected to evaluate the effectiveness of the development process. The water quality instruments were calibrated prior to use, using the manufacturer's instructions. The non-disposable equipment that comes into contact with groundwater was decontaminated prior to use with a non-phosphate detergent wash, a tap water rinse, and a distilled-water rinse. Monitoring Wells B1MW, B2MW, B3MW, B12MW, and B13MW purged dry during development. Development was considered complete for each well after of three hours of effort. Monitoring well B3MW could not be developed due to the lack of water column encountered in the well. Development water was treated and disposed of in accordance with Section 3.8. Well construction and installation information were recorded on the Monitoring Well Construction Details form and are presented in Table 2.

The newly installed wells were allowed to recharge to 80 percent of the original water volume before sample collection. Water samples were obtained from the screened portion of the well using a either a submersible pump or Waterra with dedicated disposable tubing. Analytical samples were collected by transferring water directly from the pump tubing into the laboratory supplied containers. The sample jars were filled in decreasing order of volatility.

In addition to the newly installed monitoring wells, pre-existing Well MW-04 was sampled. Groundwater samples were collected using a low-flow sampling method. The submersible pump was placed within 2 feet of the surface of the groundwater column or within the screened portion of the well. The pump rate was adjusted with a goal of limiting the sustained water drawdown to a maximum of 0.3 foot. During the purging process, field personnel monitored water quality parameters and purge volume. Purging was considered complete when at least one well volume was removed, and water quality parameters stabilized. Water quality parameters were considered stabilized when three consecutive measurements collected 3 to 5 minutes apart indicate that at least four of the five parameters were within the following tolerance ranges: pH within 0.1 unit, temperature within 3 percent, conductivity within 3 percent, and turbidity within 10 percent or less than 10 nephelometric turbidity units (NTU).

3.4 Temporary Monitoring Well Installation and Sampling

Borings SB6, SB8, and SB9 were completed as temporary MWs B6TMW, B8TMW, and B9TMW, respectively. The temporary MWs were constructed of 1-inch nominal inside diameter 40 PVC pipe with threaded connections. The lower portion of the wells consisted of an approximately 10-foot section of 0.010-inch slotted well screen. The screen extended approximately 5-feet below the soil/groundwater interface. The temporary wells were left undisturbed for at least 1 hour to allow groundwater to accumulate. Prior to sampling, depth-to-water, with respect to the ground surface, was measured with an electronic water level indicator. Grab groundwater samples were collected with disposable polyethylene bailers from the temporary wells.

Following sampling, the temporary wells were removed and the hole was backfilled with a combination of drill cuttings and bentonite chips above the groundwater table to two feet bgs, and topped with pea gravel.

3.5 Surface Water Sampling

Surface water samples were collected from the drainage ditch (SW1 through SW5) that parallels Airport Maintenance Road, the aeration/settling pond (Sample SW7), and the surface water body south of the fire training area (Sample SW8). The approximate locations of the surface warer samples are shown on Figure 3. Shannon & Wilson collected the surface water samples at least 48 hours after precipitation to prevent potential dilution effects. Samples were collected once disturbed solids settled to the bottom or have moved down stream. A clean, PFAS-free disposable sample container was used to collect the surface water sample and then transferred in laboratory provided high-density polyethylene (HDPE) bottles.

3.6 Sediment Sampling

Sediment samples were collected at the locations of surface water samples SW1 through SW6. The approximate locations of the sediment samples are shown on Figure 3. Shannon & Wilson collected the sediment samples using a shovel, collecting soil beneath the vegetation layer, if present. Shannon & Wilson drained away excess water from the sample and placed the remaining solid material in a laboratory-provided sampling container.

3.7 Professional Survey

The horizontal and vertical locations of MWs B1MW, B2MW, B3MW, B11MW, B12MW, B13MW, and pre-existing Well MW-04 were surveyed by Mammoth. In addition, the horizontal locations of Borings SB4, SB5, SB6, SB8, and SB9 were surveyed. The survey was conducted by Mammoth on August 28, 2023. Horizontal locations are in Alaska State Plane coordinates, Zone 4, North American Datum of 1983; and elevations are based on the National Geodetic Vertical Datum of 1929 (NGSD-29), Municipality of Anchorage (MOA) 1972 adjusted. Elevations were measured at the ground surface, the top of the well monuments, and at the top of the monitoring well casings, to a resolution of 0.01 feet. A copy of the survey is provided in Appendix D.

3.8 Investigation-Derived Waste Disposal

IDW consisted of soil cuttings, decontamination and purge water, personal protective equipment (PPE), and disposable sampling equipment. PPE and disposable sampling equipment were collected into plastic garbage bags and disposed of as general municipal waste. The soil cuttings from Borings SB1 through SB5 were containerized in 18 labeled 55-gallon drums and were disposed of by US Ecology on October 5, 2023. The disposal documents are provided in Appendix E.

Drilling equipment was decontaminated on site by Geotek in a lined decontamination area which was constructed onsite. Purge water and decontamination fluids used to clean drill tooling and sampling equipment were inspected for a petroleum sheen. Since no sheen was noted, the fluids were treated with a granulated activated carbon (GAC) system containing six GAC filters capable of treating petroleum hydrocarbons and PFAS constituents and discharged to the ground surface within the site boundaries and a minimum of 100 feet away from drinking water wells and surface water. An effluent sample was collected following treatment of all potentially contaminated purge and development water. Analytical results of the effluent system are provided in Section 6.

Other investigation-derived waste including non-reusable equipment such as nitrile gloves, sample tubing, and temporary well casings were disposed of at the Anchorage Regional Landfill.

4 LABORATORY ANALYSES

Each PFAS sample was submitted to Eurofins and analyzed for PFAS by Quality Systems Manual (QSM) 5.3 Table B-15. Soil samples collected from Borings SB1 through SB5 at 0 to 2 feet bgs and 10 to 12 feet bgs were also analyzed for GRO by Alaska Method (AK) 101, DRO by AK 102, residual range organics (RRO) by AK 103, volatile organic compounds (VOCs) by environmental protection agency (EPA) Method 8260D, polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270D SIM, PCBs by EPA Method 8082, and dioxins by EPA Method 8290A. The samples were submitted to the laboratories using chain-of-custody procedures.

5 SUBSURFACE CONDITIONS

The subsurface soil at the site generally consists of sand with varying amounts of gravel, and silt to silt with varying amounts of sand and gravel. For borings advanced in the vicinity of the fire training area, the shallow groundwater aquifer was encountered at approximately 65 feet bgs (Borings SB3 and SB12) to 75 feet bgs (Boring SB6). For borings advanced south of fire training area (SB8, SB9, and SB11), the shallow groundwater aquifer was encountered at approximately 38 feet bgs in Boring SB8, 112 feet bgs in Boring SB9, and 107 feet bgs in Boring SB11. The deeper groundwater aquifer was encountered in Boring SB11 at approximately 130 feet bgs. The measured static depth to water in the Wells B1MW, B2MW, B3MW, B12MW, and B13MW ranged from 63.32 feet bgs in Well B12MW to 68.90 feet bgs in Well B3MW.

Groundwater elevations were calculated for the groundwater monitoring wells (Wells B1MW, B2MW, B3MW, B12MW, and B13MW) completed in the shallow groundwater aquifer, using the groundwater measurements collected on September 11, 2023 and the results of Mammoth's survey conducted on August 28, 2023. The calculated groundwater elevations ranged from 24.47 to 27.91 feet and were inconsistent across the site. As a result, the site's groundwater gradient was not calculated. As shown on Figure 4, groundwater flow direction is generally west, with variations to the northwest and south/southwest.

6 DISCUSSION OF ANALYTICAL RESULTS

The analytical results were compared to ADEC cleanup levels presented in the October 2023, 18 AAC 75 regulations. The applicable soil criteria consist of the most stringent ADEC Method Two cleanup levels listed in Tables B1 and B2 of 18 AAC 75.341, for the "over 40-inch (precipitation) zone". Groundwater cleanup levels are established in Table C of 18 AAC 75.345. The sediment and surface water results were compared to the soil and groundwater cleanup levels, respectively. The applicable cleanup levels are listed in Tables 3 through 6. The laboratory reports and Laboratory Data Review Checklists (LDRCs) are included in Appendix F.

6.1 Soil Samples

6.1.1 Non-PFAS Compounds

Non-PFAS analytes were tested in samples collected from Borings SB1 through SB5. The sample collected from Boring SB3 from 10.0 to 12.0 feet bgs contained concentrations of GRO (maximum 531 J+ mg/kg), DRO (maximum 1,420 mg/kg), benzene (maximum 0.0851 J mg/kg), ethylbenzene (maximum 3.22 mg/kg), total xylenes (maximum 10.2 mg/kg), 1,2,4-trimethylbenzene (maximum 14.5 mg/kg), 1,3,5-trimethylbenzene (maximum 5.91 mg/kg), naphthalene (maximum 7.94 mg/kg), 1-methylnaphthalene (maximum 6.45 mg/kg), and 2-methylnaphthalene (maximum 9.67 mg/kg) exceeding the ADEC Method Two cleanup levels of 300 mg/kg, 250 mg/kg, 0.022 mg/kg, 0.13 mg/kg, 1.5 mg/kg, 0.61 mg/kg, 0.66 mg/kg, 0.038 mg/kg, 0.41 mg/kg, and 1.3 mg/kg, respectively. Dioxins (0.04 picograms per gram [pg/g]) were detected in a sample collected from Boring SB3 from 0.0 to 2.0 feet bgs at a concentration less than the ADEC Method Two cleanup level of 3.9 pg/g. The remaining tested analytes were either not detected or were detected at concentrations less than the ADEC Method Two cleanup levels. The analytical soil results are presented in Table 3.

6.1.2 PFAS

Apart from Boring SB9, each boring contained detectable concentrations of PFAS. The concentrations of PFOA detected in Borings SB1 (maximum 0.130 mg/kg), SB2 (0.049 mg/kg), SB3 (maximum 0.039 mg/kg), SB4 (maximum 0.019 mg/kg), SB5 (maximum 0.032 mg/kg) are greater than the ADEC Method Two cleanup level of 0.0017 mg/kg. The concentrations of PFOS detected in Borings SB1 (maximum 0.260 mg/kg), SB2 (maximum 0.490 mg/kg), SB3 (maximum 0.170 mg/kg), SB4 (maximum 0.074 mg/kg), and SB5 (maximum 0.330 mg/kg) are greater than the ADEC Method Two cleanup level of 0.0030 mg/kg. PFOS and PFOA were either not detected or were detected at concentrations less than the ADEC Method Two cleanup levels in the remaining samples. There were also detectable concentrations of 10 additional PFAS constituents in at least one sample. These analytes do not have ADEC Method Two cleanup levels. The analytical soil results are presented in Table 3.

6.2 Groundwater Samples

6.2.1 Non-PFAS Compounds

Non-PFAS analytes were tested in the samples collected from Wells B1MW and B2MW. DRO (1,610 B µg/L) and RRO (1,120 B µg/L) were detected in Sample B1MW at concentrations exceeding the ADEC Table C cleanup levels of 1,500 µg/L and 1,100 µg/L, respectively. In addition, chloromethane and ten PAH analytes were detected in at least one sample at concentrations less than the ADEC Table C cleanup levels. The remaining analytes were not detected. The analytical groundwater results are presented in Table 4.

6.2.2 PFAS

The samples collected from each monitoring well and temporary monitoring well had detectable concentrations of PFAS analytes. Sample B1MW contained concentrations of PFOA (5.1 µg/L) and PFOS (1.2 µg/L) greater than the ADEC Table C cleanup levels of 0.400 µg/L. The PFOS and PFOA detections in the remaining water samples were either not detected or were detected at concentrations less than the ADEC Table C cleanup levels. There were detectable concentrations of eight additional PFAS constituents in at least one sample. These analytes do not have ADEC Table C cleanup levels. The effluent GAC sample contained a detectable concentration of perfluorohexanoic acid (0.00050 J µg/L). This analyte does not have an ADEC Table C cleanup level. The analytical groundwater results are presented in Table 4.

6.3 Surface Water Samples

Each surface water sample contained detectable concentrations of PFAS. Samples SW6 (13.0 µg/L) and SW7 (14.0 µg/L) contained concentrations of PFOA greater than the ADEC Table C groundwater cleanup level of 0.400 µg/L. Samples SW1 (1.2 µg/L), SW2 (1.1 µg/L), SW3 (0.860 µg/L), SW4 (0.850 µg/L), SW5 (maximum 0.520 µg/L), SW6 (130.0 µg/L), and SW7 (97.0 µg/L) contained concentrations of PFOS greater than the ADEC Table C cleanup level of 0.400 µg/L. The remaining PFOS and PFOA detections were reported at concentrations less than the ADEC Table C groundwater cleanup levels. There were also detectable concentrations of six additional PFAS constituents in each surface water sample. These analytes do not have ADEC Table C groundwater cleanup levels. The analytical surface water results are presented in Table 5.

6.4 Sediment Samples

Each sediment sample contained detectable concentrations of PFAS. Sample SD6 (0.016 J+ mg/kg) contained a concentration of PFOA greater than the ADEC Method Two soil cleanup level of 0.0017 mg/kg. Samples SD1 (0.049 J+ mg/kg), SD2 (0.022 J+ mg/kg), SD3 (0.0076 J+ mg/kg), SD4 (0.019 J+ mg/kg), SD5 (maximum 0.033 J+ mg/kg), and SD6 (1.2 J+ mg/kg) contained concentrations of PFOS greater than the ADEC Method Two soil cleanup level of 0.0030 mg/kg. The remaining PFOS and PFOA detections were reported at concentrations less than the ADEC Method Two soil cleanup levels. There were also detectable concentrations of nine additional PFAS constituents in at least one sample. These analytes do not have ADEC Method Two soil cleanup levels. The analytical sediment results are presented in Table 6.

6.5 Quality Assurance Summary

The project laboratory follows on-going quality assurance/quality control procedures to evaluate conformance to applicable ADEC data quality objectives (DQOs). Internal laboratory controls to assess data quality for this project include surrogates, method blanks, matrix spike/matrix spike duplicates (MS/MSD), and laboratory control sample/laboratory control sample duplicates (LCS/LCSD) to assess precision, accuracy, and matrix bias. If a DQO was not met, the project laboratory provides a brief narrative concerning the problem in the case narrative of their laboratory reports (see Appendix F).

Field quality control samples included two trip blanks, five field duplicate soil sample sets, three field duplicate groundwater sample sets, one field duplicate surface water sample set, one field duplicate sediment sample set, six equipment blanks, and seven field blanks. Laboratory-prepared soil and water trip blank samples accompanied the project sample bottles from the laboratory to the site during sampling activities and back again to SGS. The soil and water trip blanks did not contain detectable concentrations of GRO or VOCs. Trip blanks check for sample-contamination issues during the sample collection process.

Although less than the limit of quantitation (LOQ), samples are flagged "B" in Table 3 when the reported sample concentration is within 10x the reported method blank concentration. GRO in Samples SB1S1, SB1S2, SB2S1, SB2S2, SB3S1, SB4S1, SB4S2, SB5S1, SB5S2, FB1, and TB1 were reported at levels less than the LOQ; therefore, the sample concentrations are reported as non-detect at the LOQ and flagged "B" in Table 3. The remaining GRO concentrations are greater than 10 times the blank concentration, therefore the results are reported at the detected concentration.

DRO in Samples SB1S1, SB2S2, SB4S2, SB5S2 were reported at levels less than the LOQ; therefore, the sample concentrations are reported as non-detect at the LOQ and flagged "B" in Table 3. The concentration of DRO detected in Sample SB3S1 is greater than the LOQ but less than 5 times the blank concentration, therefore the results are flagged "B" and reported as non-detect at the detected concentration. The concentrations of DRO detected in Samples SB1S2, SB2S1, and SB5S1 are within 5 and 10 times the blank concentration, therefore the results are flagged "B" and reported at the detected concentration. The remaining DRO concentrations are greater than 10 times the blank concentration, therefore the results are reported at the detected concentration.

An estimated concentration of perfluorohexanoic acid was detected in the project soil method blank. Although less than the LOQ, samples are flagged "B" in Table 3 when the reported sample concentration is within 10x the reported method blank concentration. The concentration of perfluorohexanoic acid in Sample SB11S1 was less than the LOQ; therefore, the results are reported as non-detect at the LOQ and flagged "B" in Table 3.

An estimated concentration of PFOS (0.000124 mg/kg) was detected in a project soil method blank. In addition, an estimated concentration of hexafluoropropylene oxide dimer acid (0.00157 µg/L) was detected in a project groundwater method blank. Although less than the LOQ, samples are flagged "B" in Table 3 when the reported sample concentration is within 10x the reported method blank concentration. The concentration of PFOS in Samples SB6S1, SB12S3, and SB13S3 are less than 5 times the method blank detection; therefore, the sample concentrations are "B" flagged in Table 3 and reported as non-detect at the reported concentration. The concentration of PFOS in Sample SB13S1 is greater than 5 times the method blank detection, but less than 10 times the method blank detection; therefore, the sample concentration is "B" flagged in Table 3 at the reported concentration. The concentration of PFOS in Sample SB12S1 is greater than 10 times the method blank detection. Therefore, the analytical results are considered unaffected by the method blank detection and the result is reported at the detected value. For the groundwater method blank, hexafluoropropylene oxide dimer acid was not detected in the affected sample. Therefore, flagging is not required.

Although less than the LOQs, estimated concentrations of DRO (0.491 J μg/L) and RRO (0.284 J μg/L) were detected in the method blanks. Although less than the LOQ, samples are flagged "B" in Table 3 when the reported sample concentration is within 10x the reported method blank concentration. The concentrations of DRO and RRO detected in all project samples are greater than the LOQ but less than 5 times the blank concentration, therefore the results are flagged "B" and reported as non-detect at the detected concentration in Table 4.

An estimated concentration of 4,8-Dioxa-3H-perfluorononanoic acid (0.552 J μg/L) was detected in the project groundwater method blank. Although less than the LOQ, samples are flagged "B" in Table 4 when the reported sample concentration is within 10x the reported method blank concentration. The analyte was not detected in the project sample; therefore, no flagging is required.

The project laboratory indicated several MS/MSD, LCS/LCSD, and surrogate accuracy/precision QC failures in the laboratory reports. The affected results are either flagged "J+" in Tables 3, 4, and 6 to represent a potential high bias.

The relative percent difference (RPD) between the project sample and associated duplicate results is a measure of precision affected by matrix heterogeneity, sampling technique, and laboratory analyses. The ADEC recommends an RPD of less than 50 percent for duplicate soil samples and 30% for duplicate groundwater samples. The RPDs for duplicate sample set B2MW/B12MW for benzo(a)anthracene, benzo(a)pyrene, benzo[b]fluoranthene, chrysene, and pyrene were greater than QC criteria and are flagged "E" in Table 3. The remaining duplicate sample sets were within QC criteria.

Duplicate Samples B2MW/B12MW and B11MW were analyzed outside of the analytical method hold time. In addition, Sample B11MW arrived at the laboratory outside of QC criteria for temperature. Although these errors occurred, Shannon & Wilson does not believe it grossly affects the data.

Shannon & Wilson conducted a limited data assessment to review the laboratory's compliance with precision, accuracy, sensitivity, and completeness to the data quality objectives. Shannon & Wilson reviewed the SGS data deliverables and completed the ADEC's Laboratory Data Review Checklist for each data package, which is included in Appendix F. No non-conformances that would adversely affect the data quality or usability of the data were noted.

7 CONCEPTUAL SITE MODEL

The following conceptual site model (CSM) was prepared to identify known and potential exposure pathways at the site. The CSM was developed using the ADEC's guidance CSM Scoping Form and Graphic Form, which are included as Appendix G.

7.1 Description of Potential Receptors

The CSM considers commercial/industrial workers, site visitors, and construction workers to be current and/or future potential receptors.

7.2 Potential Exposure Pathways

Discussions of the potential exposure pathways are provided below. The narrative includes descriptions of site-specific considerations that increase or decrease the viability of each pathway at the site. Potential human exposure pathways include direct contact of soil, ingestion of groundwater, inhalation of indoor and outdoor air, dermal exposure of contaminants in groundwater and surface water, direct contact with contaminated sediment, and inhalation of fugitive dust.

Note this CSM reflects only the known, documented contaminants of concern, and should be revised as warranted if additional site assessments are conducted to address data gaps regarding the nature and/or extent of impacted media.

7.2.1 Soil

Incidental ingestion, dermal absorption of contaminants from soil, and inhalation of fugitive dust are considered potential current and future exposure pathways for soil. Concentrations of GRO, DRO, benzene, ethylbenzene, xylenes, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, PFOS, and/or PFOA were detected in soil samples exceeding ADEC Method Two cleanup levels. Potential receptors include current and/or future commercial/industrial workers, site visitors, and construction workers.

7.2.2 Groundwater

Concentrations of DRO, RRO, PFOS and PFOA were detected in Well B1MW at concentrations exceeding the ADEC Table C cleanup criteria. The remaining analytes were either reported at concentrations below the ADEC cleanup criteria or were reported as non-detect. It is noted that ANC does not permit the installation of drinking water wells at the airport. ADEC regulation stipulates groundwater must be considered a future potential drinking water source; therefore, ingestion and dermal absorption of groundwater are considered potentially complete exposure pathways for future commercial/industrial workers, site visitors, trespassers, and/or construction workers. In 2001, the ADEC approved a "Section 350 Determination" for the upper unconfined aquifer at ANC in the airside and commercial zones, which includes the majority of the ANC property. The "Section 350 Determination" establishes that the groundwater at ANC is not a current or future drinking water source.

7.2.3 Surface Water, Sediment, and Biota

Based on 2023 analytical results, surface water and sediment within the project area is impacted with PFAS contaminants. Apart from surface water Sample SW8, PFAS contaminants exceeding the ADEC cleanup criteria were encountered at each surface water/sediment sample location. Potential receptors include commercial/industrial workers, site visitors, and/or construction workers.

In addition, due to the bioaccumulative risk of PFAS, biota is considered a potential pathway for exposure. Our site assessment activities are not designed to assess the biota exposure pathway. However, we understand the State of Alaska is conducting sampling at various PFAS sites to investigate this pathway.

8 CONCLUSIONS

The project consisted of advancing soil borings, installing six groundwater monitoring wells, installing three temporary monitoring wells and collecting analytical soil, groundwater, sediment, and surface water samples.

Results of the characterization efforts identified GRO, DRO, benzene, ethylbenzene, total xylenes, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene contamination exceeding the ADEC Method Two cleanup levels in Boring SB3. In addition, concentrations of PFOS and PFOA exceeding ADEC Method Two cleanup levels were reported in soil samples from Borings SB1, SB2, SB3, SB4, and SB5.

DRO, RRO, PFOS, and PFOA were detected in groundwater Sample B1MW at concentrations exceeding the ADEC Table C cleanup levels. The remaining petroleum analytes, PFOS, and PFOA detections in Wells B2MW, B11MW, B12MW, and B13MW, and Temporary Wells B6TMW, B8TMW, and B9TMW, were either reported at concentrations below the ADEC Table C cleanup level or reported as non-detect.

The samples collected from each surface water/sediment sample location had detectable concentrations of PFAS. Surface water Samples SW1, SW2, SW3, SW4, SW5, SW6, and SW7 had concentrations of PFOA and/or PFOS greater than the ADEC Table C cleanup level. Sediment Samples SD1, SD2, SD3, SD4, SD5, and SD6 had concentrations of PFOA and/or PFOS greater than the ADEC Method Two cleanup level.

9 RECOMMENDATIONS

Based on the results of the site characterization efforts we recommend the following actions.

- Decommission the fire training pit and associated infrastructure to prevent further releases from the contaminated water and sediment present within the system.
- Collect additional subsurface soil and groundwater samples to delineate the extent of PFAS-impacted soil and groundwater.
- Conduct further characterization of the drainage ditches between the OWS discharge and the Cook Inlet.
- Collect periodic groundwater samples from the existing groundwater monitoring wells.
- Decommission any groundwater monitoring wells which are deemed unnecessary.

10 REFERENCES

Alaska Department of Environmental Conservation (ADEC), 2023a, 18 AAC 75, Oil and Other Hazardous Substances Pollution Control: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, October, available: http://dec.alaska.gov/commish/regulations/.

Alaska Department of Environmental Conservation (ADEC), 2023b, 18 AAC 75.345, Groundwater Cleanup Levels: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, Section 341, October, available: http://dec.alaska.gov/commish/regulations/.

Alaska Department of Environmental Conservation (ADEC), 2023c, 18 AAC 75.341, Soil Cleanup Levels: Juneau, Alaska, Alaska Administrative Code (AAC), Title 18, Chapter 75, Section 341, October, available: http://dec.alaska.gov/commish/regulations/.

Alaska Department of Transportation & Public Factifies (DOT&PF), 2020, Anchorage International Airport, Airport Wide Characterization Report, Testing for Per-fluorinated Compounds (PFAS analytes), Anchorage International Airport: Report prepared by DOT&PF, Anchorage, Alaska, February 2020.

Shaw Environmental, Inc., 2004, Final Airport-Wide Risk Management Plan, Ted Stevens Anchorage International Airport: Report prepared by Shaw Environmental, Inc., Anchorage, Alaska, August 2004.

U.S. Geology Survey (USGS), 1995, Overview of Environmental and Hydrologic Conditions at Three Federal Aviation Administration Facilities Near Anchorage International Airport, Anchorage, Alaska: Report prepared by USGS, Anchorage, Alaska, 1995.

11 CLOSURE/LIMITATIONS

This report is prepared for the exclusive use of our client and their representatives in the study of this site. The findings presented within this report are based on the limited research, sampling, and analyses that were conducted. They should not be construed as definite conclusions regarding the site's soil or groundwater quality. As a result, the sampling, analyses, and data interpretations can provide you with only our professional judgment as to the environmental characteristics of this site, and in no way guarantee that an agency or its staff will reach the same conclusions as Shannon & Wilson, Inc. The data presented in this report should be considered representative of the time of our release investigation activities. Changes in site conditions can occur over time, due to natural forces or human activity. In addition, changes in government codes, regulations, or laws may occur. Because of such changes beyond our control, our observations and interpretations may need to be revised.

You are advised that various state and federal agencies (ADEC, EPA, etc.) may require the reporting of this information. Shannon & Wilson does not assume the responsibility for reporting these findings and therefore has not, and will not, disclose the results of this study unless specifically requested and authorized by ADEC, or as required by law.

Shannon & Wilson has prepared the information in Appendix H, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our report.

IMPORTANT INFORMATION

Appendix H

Important Information

About Your Geotechnical/ Environmental Report

IMPORTANT INFORMATION

ENVIRONMENTAL SITE ASSESSMENTS/EVALUATIONS ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

This report was prepared to meet the needs you specified with respect to your specific site and your risk management preferences. Unless indicated otherwise, we prepared your report expressly for you and for the purposes you indicated. No one other than you should use this report for any purpose without first conferring with us. No one is authorized to use this report for any purpose other than that originally contemplated without our prior written consent.

The findings and conclusions documented in this site assessment/evaluation have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in this area. The conclusions presented are based on interpretation of information currently available to us and are made within the operational scope, budget, and schedule constraints of this project. No warranty, express or implied, is made.

OUR REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

Our environmental site assessment is based on several factors and may include (but not be limited to) reviewing public documents to chronicle site ownership for the past 30, 40, or more years; investigating the site's regulatory history to learn about permits granted or citations issued; determining prior uses of the site and those adjacent to it; reviewing available topographic and real estate maps, historical aerial photos, geologic information, and hydrologic data; reviewing readily available published information about surface and subsurface conditions; reviewing federal and state lists of known and potentially contaminated sites; evaluating the potential for naturally occurring hazards; and interviewing public officials, owners/operators, and/or adjacent owners with respect to local concerns and environmental conditions.

Except as noted within the text of the report, no sampling or quantitative laboratory testing was performed by us as part of this site assessment. Where such analyses were conducted by an outside laboratory, Shannon & Wilson relied upon the data provided and did not conduct an independent evaluation regarding the reliability of the data.

CONDITIONS CAN CHANGE.

Site conditions, both surface and subsurface, may be affected as a result of natural processes or human influence. An environmental site assessment/evaluation is based on conditions that existed at the time of the evaluation. Because so many aspects of a historical review rely on third-party information, most consultants will refuse to certify (warrant) that a site is free of contaminants, as it is impossible to know with absolute certainty if such a condition exists. Contaminants may be present in areas that were not surveyed or sampled or may migrate to areas that showed no signs of contamination at the time they were studied.

Unless your consultant indicates otherwise, your report should not be construed to represent geotechnical subsurface conditions at or adjacent to the site and does not provide sufficient information for construction-related activities. Your report also should not be used following floods, earthquakes, or other acts of nature; if the size or configuration of the site is altered; if the location of the site is modified; or if there is a change of ownership and/or use of the property.

INCIDENTAL DAMAGE MAY OCCUR DURING SAMPLING ACTIVITIES.

Incidental damage to a facility may occur during sampling activities. Asbestos and lead-based paint sampling often require destructive sampling of pipe insulation, floor tile, walls, doors, ceiling tile, roofing, and other building materials. Shannon & Wilson does not provide for paint repair. Limited repair of asbestos sample locations is provided. However, Shannon & Wilson neither warranties repairs made by our field personnel, nor are we held liable for injuries or damages as a result of those repairs. If you desire a specific form of repair, such as those provided by a licensed roofing contractor, you need to request the specific repair at the time of the proposal. The owner is responsible for repair methods that are not specified in the proposal.

READ RESPONSIBILITY CLAUSES CAREFULLY.

Environmental site assessments/evaluations are less exact than other design disciplines because they are based extensively on judgment and opinion and there may not have been any (or very limited) investigation of actual subsurface conditions. Wholly unwarranted claims have been lodged against consultants. To limit this exposure, 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 responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses may appear in this report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

Consultants cannot accept responsibility for problems that may develop if they are not consulted after factors considered in their reports have changed or conditions at the site have changed. Therefore, it is incumbent upon you to notify your consultant of any factors that may have changed prior to submission of the final assessment/evaluation.

An assessment/evaluation of a site helps reduce your risk but does not eliminate it. Even the most rigorous professional assessment may fail to identify all existing conditions.

ONE OF THE OBLIGATIONS OF YOUR CONSULTANT IS TO PROTECT THE SAFETY, HEALTH, PROPERTY, AND WELFARE OF THE PUBLIC.

If our environmental site assessment/evaluation discloses the existence of conditions that may endanger the safety, health, property, or welfare of the public, we may be obligated under rules of professional conduct, statutory law, or common law to notify you and others of these conditions.

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