INTERIM ACTION WORK PLAN—AOC 1

NORTHERN STATE MULTI SERVICE CENTER
SEDRO-WOOLLEY, WASHINGTON

AGREED ORDER NO. DE 16309
CLEANUP SITE ID: 10048

Prepared for
PORT OF SKAGIT
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The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

This digital seal certifies the signatory and document content.

08-24-2023

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ACRONYMS AND ABBREVIATIONS

AO	Agreed Order No. DE 16309
AOC 1	the former laundry building area of concern
bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
cVOC	chlorinated volatile organic compound
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
IAWP	interim action work plan
MFA	Maul Foster & Alongi, Inc.
PCE	tetrachloroethene
the Port	Port of Skagit
the Property	2070 Northern State Road in Sedro-Woolley, Washington
QAPP	quality assurance project plan
SAP	sampling and analysis plan
the Site	Northern State Multi Service Center
TCE	trichloroethene
WAC	Washington Administrative Code

1 INTRODUCTION

On behalf of the Port of Skagit (the Port), Maul Foster & Alongi, Inc. (MFA), has prepared this interim action work plan (IAWP) for the vapor intrusion mitigation at the former laundry building area of concern (AOC 1) at the Northern State Multi Service Center (former Northern State Hospital site) (the Site). This Site is located at the Sedro-Woolley Innovation for Tomorrow Center property at 2070 Northern State Road in Sedro-Woolley, Washington (the Property) (see Figure 1-1). The Site is listed with the Washington State Department of Ecology (Ecology) under facility site ID 65415931 and cleanup site ID 10048.

1.1 Regulatory Framework and Purpose

The Port entered into Agreed Order No. DE 16309 (AO) with Ecology which contemplates interim remedial actions at the Site. The scope of work for the AOC 1 interim action was revised from what was initially described in Exhibit B of the 2019 AO, due to an updated understanding of site geology and environmental conditions. Therefore, the AO will be amended to reflect these changes prior to the implementation of the interim actions described in this IAWP. The Port received a U.S. Environmental Protection Agency (EPA) cleanup grant to support interim cleanup actions at the Site, including the proposed interim remedial action for AOC 1. This IAWP was prepared consistent with the EPA requirements for interim cleanup action plan and engineering design reports.

During previous investigations on the Site, AOC 1 was identified based on the presence of chlorinated solvents and degradation products (i.e., chlorinated volatile organic compounds [cVOCs]) in soil, groundwater, and soil gas underlying and adjacent to the former laundry building (MFA 2015, 2018). The former laundry building is currently occupied by occupational tenants as instructional classrooms. There is no current indoor air risk; however, potential degradation of the building slab in the future could increase the risk of inhalation exposure by building occupants.

The proposed interim remedial action consists of installing an active sub-slab depressurization system to mitigate potential future inhalation exposure risk for occupants and visitors in the former laundry building.

This IAWP includes the following elements, consistent with the requirements of Washington Administrative Code (WAC) 173-340-400 and 173-340-380:

- General information on the facility, including a summary of information from the remedial investigation (see Section 2)
- Contaminant and contaminated-media characteristics and relevant cleanup standards applied to the Site (see Section 3)
- Identification of who will be responsible for the cleanup action during and following construction (see Section 4)

- The proposed interim remedial action (see Section 5)
- Appendices, including a health and safety plan (HASP) (see Appendix A) and a sampling and analysis plan (SAP) that incorporates quality assurance project plan (QAPP) elements, referred to as a SAP/QAPP for purposes of this report, consistent with EPA requirements (Appendix B)

2 PROPERTY BACKGROUND

2.1 Property Description

The approximately 220-acre Property is located at 2070 Northern State Road, in the northeast corner of Sedro-Woolley, Washington (Figure 1-1). The Property is bordered on the north, east, and south by the Northern State Recreation Area, a public open space owned and managed by Skagit County and historically associated with the Northern State Hospital. To the west, the Property is bordered by Fruitdale Road and residential properties.

The Property is in sections 7, 8, 17, and 18 of township 35 north and range 5 east of the Willamette Meridian, on a small plateau with a downward topographic slope toward the east, south, and southwest in the direction of the Skagit River in Skagit Valley. The Property currently comprises of more than 80 buildings and structures. Tenants occupy some of the buildings, but many are currently vacant.

The Property is currently owned and managed by the Port, with buildings leased to multiple tenants, including the Cascade Job Corps, for on-site housing and educational services; and the Pioneer Center North, as a drug and alcohol treatment facility with on-site housing. Historically, the Property was used as a self-sustaining treatment and residence facility for people with mental illness, and included on-site patient and staff housing, a powerhouse, maintenance shops, a laundry building, and a fueling station. The laundry building is currently occupied by the Cascade Job Corps and utilized for classroom instruction.

2.2 Property History

The Property was developed in 1909 and operated as a treatment and residence facility and hospital for people with mental illness until its closure in 1973. After the facility's closure, the 220-acre treatment and residential campus was transferred from the Washington State Department of Social and Health Services to the Washington State General Services Administration, which later became the Department of Enterprise Services. On July 1, 2018, the Port took title to the Property from Washington State.

The Northern State Hospital was designed to be self-sustaining and included on-site patient and staff housing, a dedicated water supply reservoir and an associated potable water treatment facility, a fueling station for on-site vehicles, maintenance and paint shops, and a laundry facility. During the construction of the hospital, much of the Property was logged, graded, drained, and terraced to

provide a suitable ground surface throughout the campus (Artifacts Consulting 2008). Many of the remaining buildings and structures associated with the former facility, as well as the campus landscape, are listed on the National Register of Historic Places. This includes the former laundry building that is subject to the proposed interim action described in this IAWP.

3 SITE CONDITIONS

3.1 Geology and Hydrogeology

According to the *Geologic Map of the Sedro-Woolley North and Lyman 7.5-minute Quadrangles, Western Skagit County, Washington*, the Property and vicinity are underlain by Quaternary glaciomarine drift (Dragovich et al. 1999). The glaciomarine deposits typically consist of "poorly sorted, poorly compacted diamicton consisting of silty, sandy, gravelly clay to clayey gravel; moderately well- to well-sorted sandy silt, sandy clay, clayey silt, and clay" (Dragovich et al. 1999). Geologic cross sections developed through interpretation of well log, geotechnical boring, and field information show approximately horizontally oriented, 100- to 130-foot-thick deposits of Quaternary glaciomarine drift in the vicinity of the Property (Dragovich et al. 1999).

Subsurface investigations in the vicinity of AOC 1 indicate that subsurface soil generally consists of silt and clay to approximately 14 feet below ground surface (bgs), underlain by interbedded silty sand, sand, and silt to 30 feet bgs, the maximum depth explored (see Appendix C). Water levels in monitoring wells in the vicinity of AOC 1 (MW09, MW10, MW11) measured during the remedial investigation on May 17, 2022, ranged between 4.87 to 6.17 feet below top of well casing (MFA 2022). Groundwater flow direction varies in this portion of the Site, but generally flows east toward Hansen Creek and southeast toward the Skagit River Valley (MFA 2022).

3.2 Environmental Conditions

AOC 1 includes the former laundry building and associated concentrations of chlorinated volatile organic compounds (cVOCs), including tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE), in soil, groundwater, and/or soil vapor (MFA 2022) (see Figure 3-1). While there are no records of dry-cleaning operations at the Site, the presence of PCE in soil, groundwater, and soil vapor in AOC 1 indicates that solvents containing PCE were likely used in the former laundry building. Given the lack of cVOCs detected in the monitoring wells both upgradient and downgradient of the PCE and TCE detections in groundwater, it is unlikely that impacts are migrating to nearby surface water in Hansen Creek. The absence of PCE detections or other breakdown products at any other historical sample location near the former laundry building suggests that the groundwater impacts likely are localized to an area in the direct vicinity of the northeast corner of the laundry building.

Laundry extractor machines and a trench drain are shown in the north portion of the building on the historical blueprint (see Appendix D). Given the consistent detections of PCE and/or TCE in soil,

groundwater, and soil vapor in this portion of the former laundry building, it is likely that the operation of these features is the source of the PCE in the area. This is supported by the absence of detections in groundwater west, northwest, southwest, and southeast of the former laundry building.

Multiple investigations were completed to assess the nature and extent of contamination in soil, groundwater, and soil vapor impacts (MFA 2014, 2015, 2018, 2022). Ambient (outdoor) air samples and indoor air samples were analyzed for cVOCs, including PCE and its breakdown products (i.e., TCE; cis-1,2-DCE; trans-1,2-DCE; and vinyl chloride [see Table 3-1]). Low detections of 1,2-DCE were identified in indoor and outdoor air samples collected during the April 2021 sampling event. Detections of 1,2-DCE were slightly higher in the outdoor sample than the indoor samples. No other cVOCs were detected in the analyzed indoor and outdoor air samples.

Sub-slab soil gas samples collected from permanent sub-slab sampling points SB01 and SB02 were analyzed for cVOCs (see Table 3-2 and Figure 3-1). PCE was detected in both sub-slab soil gas samples during sampling events in both April and July 2021. TCE was detected in sampling point SB01 during the July 2021 event and in sampling point SB02 during the April 2021 event. No other cVOCs were detected in the sub-slab soil gas samples. Sample results are summarized on Figure 3-1.

Preliminary cleanup standards for the Site were developed based on the conceptual site model presented in the draft remedial investigation report (see Figure 3-2) (MFA 2022). Chemicals of potential concern in soil vapor identified for AOC 1 include:

- 1,1-Dichloroethene
- 1,2-Dichloroethane
- Cis-1,2-Dichloroethene
- Tetrachloroethene
- Trans-1,2-Dichloroethene
- Trichloroethene
- Vinyl chloride

Associated screening levels for each chemical of potential concern are provided in Table 3-3.

4 PROJECT ORGANIZATION AND SCHEDULE

4.1 Project Organization

The following organization shall apply to the project:

- Regulator—Ecology
- Technical reviewer—EPA
- Owner—Port

- Engineer—MFA
- Site work contractor—to be determined

4.2 Schedule

An anticipated project schedule is provided in the table below. Installation of sub-slab depressurization system is dependent on contractor availability. No work will begin until EPA and Ecology approve the IAWP and the SAP/QAPP (attached to this IAWP).

Task	**Duration (weeks)**	**Anticipated Start Date**	**Anticipated Completion Date**
Finalize Interim Action Work Plan	18	May 5, 2023	September 7, 2023
Public Comment Period	4	July 17, 2023	August 16, 2023
Bid Process for Contractor Selection	4	September 30, 2023	October 31, 2023
Installation of Sub-Slab Depressurization System	2	January 21, 2024	February 2, 2024
First Quarterly Compliance Event	1	February 8, 2024	February 15, 2024
Draft Completion Report	12	February 28, 2024	May 30, 2024
Second Quarterly Compliance Event	1	May 15, 2024	May 22, 2024
Agency Reviews of Draft Completion Report	6	May 30, 2024	July 15, 2024
Final Completion Report	6	July 15, 2024	August 29, 2024
Third Quarterly Compliance Event	1	August 15, 2024	August 22, 2024
Fourth Quarterly Compliance Event	1	November 15, 2024	November 22, 2024
First Quarterly Performance Monitoring Event	1	February 2024 (pending Ecology approval)	

5 INTERIM REMEDIAL ACTION ENGINEERING DESIGN

The proposed interim remedial action consists of the installation of an active sub-slab depressurization system, creating a negative pressure gradient to mitigate the risk of chemicals of potential concern in sub-slab soil gas from entering indoor air in the former laundry building. Remedial action activities will be followed by compliance and performance monitoring events, as described in Section 5.4. The selected interim remedial action will address the following objective:

- Mitigation of inhalation exposure risk for occupants and visitors of the Property associated with concentrations of cVOCs above applicable MTCA cleanup levels.

Design elements of the remedial actions are described below. The SAP/QAPP presents sampling and analytical protocols for compliance monitoring (see Appendix B).

5.1 Preliminary Feasibility Assessment

Prior to selecting an interim remedial action, MFA conducted a sub-slab subgrade material investigation to assess whether the subgrade material would support vents in the sub-slab depressurization system to efficiently pull a vacuum. On December 21, 2021, MFA subcontracted Cut-All Concrete of Arlington, Washington, to drill a 6-inch concrete core into the slab of the laundry building to assess the conditions of subgrade material. The concrete slab was measured to be 5.75 inches thick just north of sub-slab vapor point SB01. Subgrade material underneath the slab consisted of gray, angular to subangular gravel with sand with increasing fines observed at depth. The material was loosely compacted from 0 to 3 inches but became denser with depth. Refusal with a small hand spade was hit at 4.5 to 5 inches below the slab. The hole was backfilled with crushed rock and sealed with fresh concrete at the end of the inspection.

Observations from the investigation suggest that the subgrade material will provide good sub-slab soil gas communication across the building slab. Subgrade material will be assessed during the installation of the proposed vent pipes, as described in section 5.3.2, to determine whether additional vent risers are necessary. Plans did not show any structural or foundation elements that would restrict the flow of sub-slab vapor around the building slab.

5.2 Site Preparation

A minimum of two days before vent installation the locations of subsurface utilities within 10 feet of the proposed vent riser locations will be identified by public and private utility locators. Access within the work area will be controlled during construction activities with work areas cleared of building occupants. Any additional site controls will be established in accordance with the site HASP found in Appendix A, and as determined by the construction contractor's HASP.

5.3 Sub-Slab Depressurization System

The sub-slab depressurization system design was developed using EPA (EPA 1993) and City of Los Angeles Department of Building and Safety (City of Los Angeles 2010) guidance. The system will consist of five 3-inch-diameter vertical vent pipes installed into the aggregate subgrade fill beneath the concrete building slab and connected to individual inline centrifugal fans. The centrifugal fans will create suction through the pipes and then vent collected soil gas through a riser pipe extending above the building roof. Details of the system design are described in this section.

An evaluation of potential emissions from the proposed system was conducted to assess whether the small quantity emission rates from WAC 173-460-150 will be met following installation of the sub-slab depressurization system at the Site. These calculations were performed using 2021 sub-slab soil gas data collected from the former laundry building. The emissions calculations determined that the concentrations of PCE and TCE underlying the slab would not exceed the small quantity emission rate threshold. As the calculated emissions rates are below the small quantity emissions rate from WAC 173-460-150, we do not anticipate that the sub-slab depressurization system will pose an environmental risk to ambient air quality. Additionally, air emission samples will be collected from the vent risers following installation of the system to verify emission rates as described in the SAP/QAPP (Appendix B).

Air emissions calculations are provided in Appendix E. The Northwest Clean Air Agency regulates emissions in Skagit County; however, there is a procedural exemption for an air discharge permit for the Site as the action (i.e., operation of the sub-slab depressurization system) is being conducted under an AO, in accordance with WAC 173-340-710(9)(b).

5.3.1 Treatment Area

The former laundry building encompasses approximately 14,000 square feet and is constructed on a slab-on-grade foundation. Based on the findings of the subsurface investigation and review of historical building plans, the subgrade material should provide good communication across the building footprint and is considered a single treatment area for the vent riser pipe placement and design.

5.3.2 Vent Riser Sizing, Number, and Placement

Typically, standard vent pipes for sub-slab vapor mitigation systems range between 1.5 and 4 inches in diameter (City of Los Angeles 2010). During a visual inspection of the building, MFA staff observed a dense network of ceiling utilities, including ducting, electrical conduits, water lines, and unidentified pipes. A 3-inch vent pipe size was selected to reduce the risk of conflicts with these utilities by limiting space needed for each vent pipe while balancing the total number of risers required to achieve an appropriate vacuum beneath the slab. For 3-inch pipes, City of Los Angeles guidance recommends one pipe be installed per 7,500 square feet of building footprint with a minimum of four vent riser pipes recommended (City of Los Angeles 2010). EPA guidance suggests that, for buildings with good sub-slab communication, two vent riser pipes is sufficient to achieve a vacuum across the slab. In order to ensure that the interim remedial action objective is achieved with consideration to the pipe

trench network that exists beneath the slab, five vent riser pipes will be installed at the proposed locations shown on Figure 5-1.

Vent locations were selected to do the following:

- Be equally spaced throughout the treatment area.
- Stay out of high-traffic portions of the building to limit noise disruptions to building tenants due to fan operation.
- Remain accessible to facility staff for quarterly inspection and maintenance.
- Avoid existing utilities and obstructions that run along the ceiling and roof of the building.

As discussed in Section 5.1, the subgrade material observed during an investigation may vary from subgrade material in other portions of the slab. MFA staff shall observe subgrade material during vent installation. For vent locations positioned along the existing piping trench area, extra care will be taken to ensure the integrity of the piping is maintained during installation of the vent riser. If observed conditions indicate that the material beneath slab may not have good communication, MFA will reevaluate the placement and number of vent risers to determine whether modifications to the design are necessary. Indicators of poor sub-slab communication may include the discovery of non-uniform dense subgrade material, a thin subgrade layer underlain by tight silts, or the presence of structural features which may block air flow between portions of the building footprint. Changes to the number of vents or location adjustments greater than 10 feet will be submitted to Ecology and EPA for review and approval prior to implementation.

5.3.3 Fan Selection and Flow Rate

Individual 4-inch FanTech FR Series Round Inline Exhaust fans or engineer-approved equivalent will be installed at each vent riser. The fan is pre-wired and can be connected into existing circuits in the building. A licensed electrician will evaluate the existing available tie in points, and wire new connections as necessary. Prior to construction, the contractor shall submit the final fan specifications for engineer approval. The industry standard for sub-slab depressurization systems with inline centrifugal fans ranges between 50 and 90 watts with a flow capacity of 125 to 270 cubic feet per minute at zero static pressure (EPA 1993). Due to the uncertainty in sub-slab conditions across the building, an 80-watt fan is proposed to provide a higher flow capacity and a wider range of operating conditions. Optimal fan operating conditions will be assessed once the system is turned on and initial pressure measurements are collected. Initial operating conditions for the fans will be determined based on the specific performance curve provided by the fan manufacturer. Vacuum at each vent riser and pressure differential at sub-slab vapor points will be measured once the system is turned on. Power in the fans may be adjusted along to performance curve to increase vacuum and flow rate as necessary. Weather conditions during system assessment impact the target vacuum conditions as they impact the pressure of indoor air. However, a minimum target vacuum of 0.025-0.035 inches across all measured points during mild weather conditions should be sufficient to maintain an appropriate pressure differential between the indoor air and sub-slab vapor (EPA 1993).

5.3.4 Vent Riser Detail

Exact pipe lengths and configurations will vary depending on the height of the roof, the bracing, and the utilities at the proposed riser location, but each vent riser will have the basic configuration shown in Figure 5-2. Where possible, vent riser pipes shall be routed to penetrate through the roof into existing decorative copulas on the building. Approximate locations of copulas and proposed pipe routing are shown in Figure 5-2. Actual pipe pathway may vary based on observed conditions during installation. If a pipe cannot be routed through a copula due to obstructions, distance, or technical infeasibility, the vent pipe shall be routed directly through the roof. Vent riser penetrations in the roof shall be a minimum of 10 feet away from or 3 feet above any windows, doors, or air intakes and extend through the vent flashing a minimum of 6 inches above the roof.

For each proposed vent location, a concrete core shall be removed for pipe installation. Concrete cores shall be no larger than one half inch greater in diameter than the diameter of the vent pipe. One of the riser locations is placed over a historic pipe trench. During construction, care will be taken to ensure that the slab penetration does not damage any existing utilities. To increase contact with soil gas, a small hole approximately 6 to 18 inches in radius shall be created by removing the subgrade material from the concrete core prior to the installation of the vent pipes. Material shall be removed using a shop vac, hand removal or other approved means. Sub-grade material is expected to consist of gravel with little to no fines. Any material removed from below the slab with measurable fines will be temporarily drummed on the Site, labeled, and sampled for characterization and disposal. Vent pipes will be placed so that the end penetrates just below the slab. The remaining void spaces shall be filled with ¾-inch or greater gravel lacking fines. Any gaps between the concrete slab and the vent pipe shall be sealed with an engineer-approved hydraulic cement or approved equivalent. Vent pipes shall be made of 3-inch schedule 40 PVC and equipped with a U-tube manometer installed at eye level that is easily accessible on the pipe. Pipes shall be secured to the wall with brackets or appropriate pipe supports and be run in as linear a manner as possible up to the roof penetration.

5.4 Post Installation Compliance Monitoring

Following installation of the sub-slab depressurization system, four quarters of compliance monitoring shall be conducted to evaluate the functionality of the system and establish baseline operating conditions. Sampling in the initial compliance monitoring events includes indoor air sampling, sub-slab pressure measurements, air emissions sampling from vent risers (two events, after start up of system and during an opposite season [e.g., wet and dry season]), and vent pipe vacuum monitoring. The first compliance monitoring event will occur after the sub-slab depressurization system has been operating for one week.

If results from the first compliance monitoring indicate the system is functioning within the proposed operating conditions, quarterly compliance monitoring will be implemented for the first year of system operation. After four quarters of monitoring, changes to the monitoring plan may be proposed based on an evaluation of data with Ecology and EPA. If monitoring results indicate the system is not functioning as designed, fan operating parameters may be adjusted, and the compliance monitoring process evaluated in coordination with Ecology and EPA. Modifications may be required if system adjustments do not yield desired results. These modifications may include modifications to the fan

size and/or additional vent locations. Any significant design changes will be approved by Ecology and/or EPA prior to implementation. Data from the first compliance monitoring event will be used to update the inspection flow chart used to determine if additional maintenance or actions are required.

5.4.1 Post Installation Air Sampling

Indoor air samples will be collected and analyzed for cVOCs to:

- Confirm that the installation process did not result in preferential pathways for vapor intrusion into the former laundry building,
- Confirm the effectiveness of the sub-slab depressurization system, and
- Confirm that indoor air quality was not impacted during system installation.

Samples will be collected from the two previously installed indoor air locations (INAIR01 and INAIR02) and a new location INAIR03 using a 6-liter stainless steel canister with an eight-hour flow controller. Sample canisters will be placed 3 to 5 feet above the ground to collect within the breathing zone. Field staff will record data before and after sample collection, including the sampling stop and start time, initial and final canister vacuum readings, and observations of conditions that may influence sampling results (i.e., the presence or use of volatile products, open or closed doors). Sampling results will be screened to the appropriate MTCA cleanup levels for indoor air (see Table 3-3). Indoor air sampling results will be incorporated into a completion report and subsequent quarterly progress reports as described in Section 5.6.

One ambient (outdoor) air sampler will be deployed outside and upwind of the building to capture other potential VOC sources for one eight-hour period during collection of the indoor air samples. Field staff will attempt to deploy the sampler in a location that is free of discernible ambient sources of VOCs. The ambient air sampling will be initiated approximately one to two hours before the start of indoor air sampling. MFA will place a 6-liter, stainless steel canister (Summa canister), with an eight-hour flow controller, outside the perimeter of the building and VOC-impacted areas. The sampler will be placed 3 to 5 feet above the ground. Atmospheric data (including wind speed and direction) data will be collected from the nearest U.S. weather station for the two days prior to and during sample collection events. The data will be reviewed to identify the upwind ambient air sample location. Sampling will be conducted on days with minimal precipitation, as feasible.

Work will be conducted in accordance with the site-specific HASP (Appendix A) and SAP/QAPP (Appendix B).

5.4.2 Sub-Slab Pressure Measurements

Sub-slab pressure differential measurements will be used to determine whether a vacuum is being generated across the slab. Field staff will use the existing two vapor pins (SB01 and SB02) and a new third location (SB03) to collect data on the pressure differential between the sub-slab and indoor air. The measured pressure differential, date, time, and sample location will be recorded in a field notebook. Work will be conducted in accordance with the site-specific HASP (Appendix A) and SAP/QAPP (Appendix B).

Under a constant fan operating condition, the pressure differential between the sub-slab and the indoor air is dependent on several factors including temperature, weather, indoor climate control operating conditions, and open doors or windows. The presence of a pressure differential where the indoor air pressure is greater than sub-slab vapor is indicative that the system is functioning as intended.

5.4.3 Vent Pipe Pressure Port Monitoring

Vacuum (pressure differential) measurements from each vent riser pipe will be used to confirm that the fans are functioning within the proposed operating conditions, and that each vent riser is properly sealed. Manometer readings at the vent riser are site-specific and will depend on the fan size and operating conditions. Readings at the vent riser are expected to be between 0.5 and 1.75 inches of water; however, readings outside of these parameters are not necessarily indicative of a system failure. A typical manometer reading for the vent risers will be established in the field once a vacuum is confirmed across the slab after the first compliance monitoring event in coordination with Ecology and EPA. Field staff will inspect the U-tube manometer on each vent riser and record the observed vacuum in a field notebook with the date, time, name of the vent riser, and manometer measurement. Work will be conducted in accordance with the site-specific HASP (Appendix A) and SAP/QAPP (Appendix B).

5.5 Post Installation Performance Monitoring and Maintenance

Following installation and once compliance monitoring is complete and regular operating conditions are established in concurrence with Ecology, Port staff will begin quarterly performance monitoring. Performance monitoring will be conducted concurrent with quarterly heating ventilation and air conditioning system inspections in the building and consist of inspecting the vent riser pipes to confirm fan operation. Port staff shall inspect the U-tube manometer and record the vacuum reading at each vent riser A quarterly inspection form will be provided to Port staff for consistency in recorded measurements and observations between events. Measurements recorded during the inspection shall be retained on site for at least five years and provided to Ecology in the quarterly progress reports required under the AO.

If the system does not pull a sufficient vacuum at any of the vent risers, as determined in the completion report indoor air samples shall be collected in accordance with Section 5.4.1 within 10 business days, and the system repaired within 30 days of the initial observation.

Figure 5-3 shows the steps for evaluating which samples are required based on the observations of the quarterly inspection. Performance monitoring shall continue on a quarterly basis. The system functionality and need shall be reassessed during the feasibility study or if there is indication that concentrations below the slab have been reduced below applicable soil vapor screening criteria protective of indoor air. Any modifications to the frequency of monitoring will be approved by Ecology prior to implementation.

5.6 Reporting

Following construction and the first post-construction compliance monitoring event, a completion report will be prepared in accordance with Exhibit B of the AO. The completion report will document the final system configuration and operating conditions. The completion report will include as built drawings, fan specifications and performance curves, pictures from installation, and compliance monitoring results.

During subsequent compliance and performance monitoring events, details of the monitoring events and data will be provided in quarterly progress reports or technical memorandums within 90 days of the event to Ecology.

LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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TABLES

Table 3-1
AOC 1: Indoor and Ambient (Outdoor) Air Analytical Results
Northern State Multi Service Center
Sedro-Woolley, Washington

Location:	MTCA Method B, Vapor Intrusion, Indoor Air[1]		INAIR01		INAIR02		OUTAIR01	
Sample Name:			INAIR01	INAIR01-072021	INAIR02	INAIR02-072021	OUTAIR01	OUTAIR01-072021
Collection Date:	Cancer	Noncancer	04/06/2021	07/20/2021	04/06/2021	07/20/2021	04/06/2021	07/20/2021
VOCs (ug/m^3)								
1,1-Dichloroethene	NV	91	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-Dichloroethane	0.096	3.2	0.069	0.04 U	0.069	0.04 U	0.073	0.04 U
cis-1,2-Dichloroethene	NV	18	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Tetrachloroethene	9.6	18	8.8 U	6.8 U	6.8 U	6.8 U	6.8 U	6.8 U
trans-1,2-Dichloroethene	NV	18	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Trichloroethene	0.33	0.91	0.14 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
Vinyl chloride	0.28	46	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U

Notes

Detections were compared to screening criteria and no exceedances were identified; non-detects (U) were not compared with screening criteria.

AOC = area of concern.

MTCA = Model Toxics Control Act.

NV = no value.

U = result is non-detect at the method reporting limit.

ug/m^3 = micrograms per cubic meter.

VOC = volatile organic compound.

Reference

[1]Ecology. 2023. *Cleanup Levels and Risk Calculation (CLARC) table.* Washington State Department of Ecology, Toxics Cleanup Program. January.

Table 3-2
AOC 1: Sub-Slab Soil Gas Analytical Results
Northern State Multi Service Center
Sedro-Woolley, Washington

Location:	MTCA Method B, Vapor Intrusion, Sub-Slab Soil Gas[1]		GP31	SB01		SB02	
Sample Name:	Cancer	Noncancer	GP31-BV-0.5	SB01	SB01-072021	SB02	SB02-072021
Collection Date:			04/22/2015	04/06/2021	07/20/2021	04/06/2021	07/20/2021
VOCs (ug/m^3)							
1,1-Dichloroethene	NV	3,000	0.62 U	2.3 U	2.3 U	2.3 U	2.3 U
1,2-Dichloroethane	3.2	110	--	0.24 U	0.24 U	0.23 U	0.23 U
cis-1,2-Dichloroethene	NV	610	0.62 U	2.3 U	2.3 U	2.3 U	2.3 U
Tetrachloroethene	320	610	100	120	1,100 J	45	130
trans-1,2-Dichloroethene	NV	610	0.62 U	2.3 U	2.3 U	2.3 U	2.3 U
Trichloroethene	11	30	0.84 U	0.63 U	1.5	0.69	0.62 U
Vinyl chloride	9.5	1,500	0.4 U	1.5 U	1.5 U	1.5 U	1.5 U

Notes

Shading (color key below) indicates values that exceed screening criteria; non-detects (U) were not compared with screening criteria.

MTCA Method B, Vapor Intrusion, Sub-Slab Soil Gas, Cancer

MTCA Method B, Vapor Intrusion, Sub-Slab Soil Gas, Noncancer

-- = not analyzed.

AOC = area of concern.

J = result is estimated.

MTCA = Model Toxics Control Act.

NV = no value.

U = result is non-detect at the method reporting limit.

ug/m^3 = micrograms per cubic meter.

VOC = volatile organic compound.

Reference

[1]Ecology. 2023. *Cleanup Levels and Risk Calculation (CLARC) table* . Washington State Department of Ecology, Toxics Cleanup Program. January.

Table 3-3
Sub-Slab Soil Gas and Air Screening Levels
Northern State Multi Service Center
Sedro-Woolley, Washington

Analyte	MTCA Method B, Vapor Intrusion, Indoor Air[1]		MTCA Method B, Vapor Intrusion, Sub-Slab Soil Gas[1]	
	Cancer	Noncancer	Cancer	Noncancer
VOCs (ug/m^3)				
1,1-Dichloroethene	NV	91	NV	3,000
1,2-Dichloroethane	0.096	3.2	3.2	110
cis-1,2-Dichloroethene	NV	18	NV	610
Tetrachloroethene	9.6	18	320	610
trans-1,2-Dichloroethene	NV	18	NV	610
Trichloroethene	0.33	0.91	11	30
Vinyl chloride	0.28	46	9.5	1,500

Notes

MTCA = Model Toxics Control Act.

NV = no value.

ug/m^3 = micrograms per cubic meter.

VOC = volatile organic compound.

Reference

[1]Ecology. 2023. *Cleanup Levels and Risk Calculation (CLARC) table*. Washington State Department of Ecology, Toxics Cleanup Program. January.

FIGURES

Path: X:\0624.04 Port of Skagit\18\Projects\Fig1-1 PropertyVicinity.mxd

TRACT A

Hansen Creek

Maintenance Building

Former Laundry Building

Powerhouse

POWERHOUSE DRIVE

DIV. 8

DIV. 9

Athletic Field

DIV. 5

TRACT C

TURNING POINT COURT

PLANTERS ROAD

Smith Hall

DIV. 6

Trevennen Building

Thompson Hall

Wilkes Hall

Valdez Hall

DIV. 7

HUB DRIVE

NORTHERN STATE ROAD

Denny Building

NORTH SOUND DRIVE

DIV. 2

Former Ward Building Area

DIV. 4

Douglas Building

Coleman Building

Brickyard Creek

DIV. 3

THOMPSON DRIVE

TRACT C

CHARLES JONES MEMORIAL CIRCLE

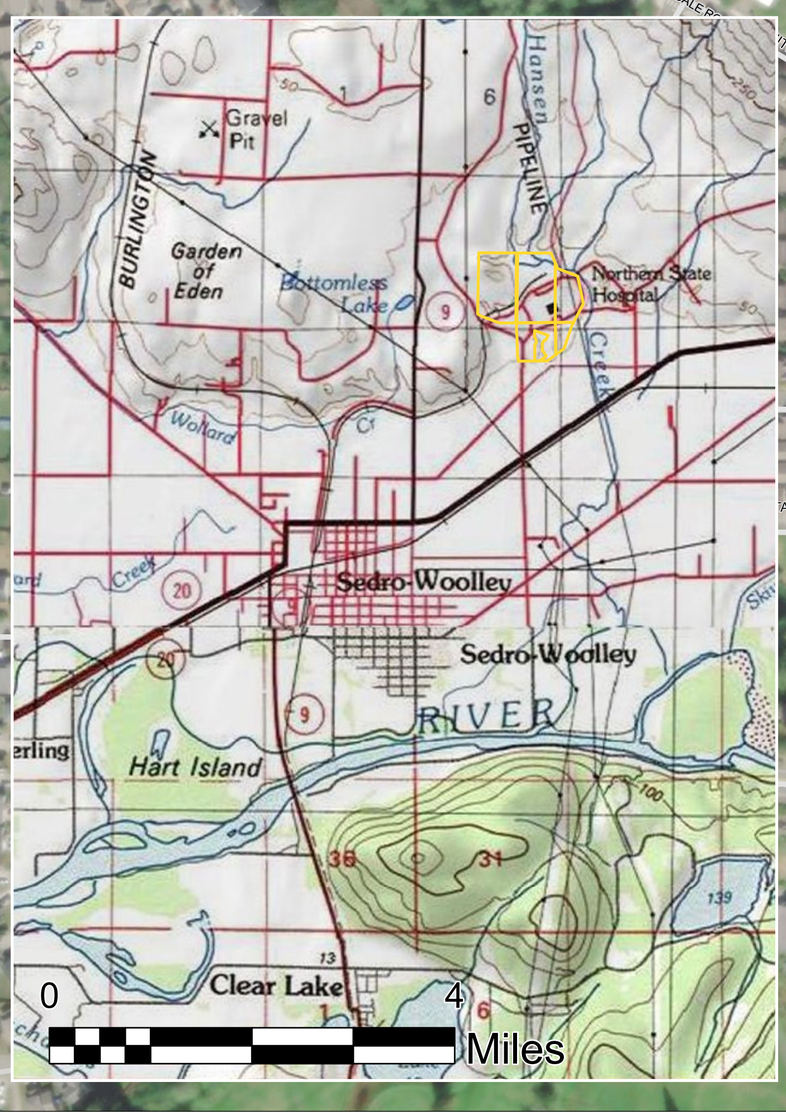
CHARLES JONES MEMORIAL CIRCLE

DIV. 1

FRUITDALE ROAD

TRACT B

STARFLOWER LANE



Source: Aerial photograph obtained from Esri ArcGIS Online; parcels and roads and streams data sets obtained from Skagit County; city limits data set obtained from City of Sedro-Woolley.

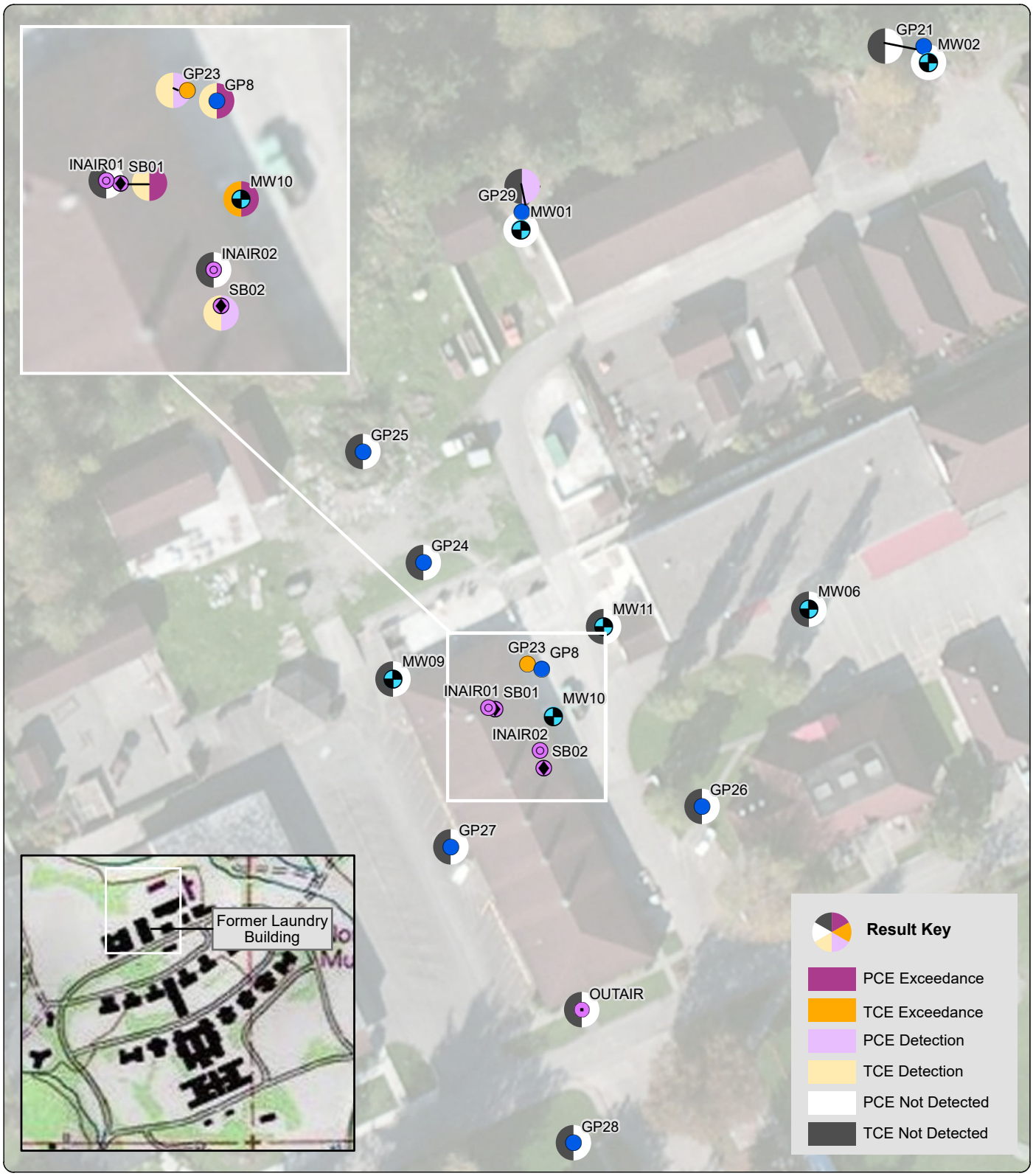
Legend

- Property Parcel and Parcel Name
- Northern State Recreational Area
- Sedro-Woolley City Limits (Post Annexation)
- Stream

Figure 1-1
Property Vicinity
Northern State Multi Service Center
Port of Skagit
Sedro-Woolley, Washington

0 500 1,000
Feet

Print Date: 6/7/2022
Approved By: cwise
Produced By: jroberts
Project: M0624.04.018



NOTES:
All features are approximate.
MW01 and MW02 were not analyzed for TCE because adjacent borings were non-detect.
Results were screened against their applicable Model Toxics Control Act Cleanup Levels (see Table 3-3).

AOC = area of concern.
PCE = tetrachloroethene.
TCE = trichloroethene.

Legend

- Soil Boring
- Groundwater Boring
- Monitoring Well (Soil and Groundwater)
- Indoor Air
- Outdoor Air
- Subslab Vapor

Source:
Aerial photograph was obtained from ArcGIS Online.

Figure 3-1
AOC 1: Former Laundry Building Results

Northern State Multi Service Center
Port of Skagit
Sedro-Woolley, Washington

0 60 120
Feet

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Path: X:\0624.04 Port of Skagit\18\Projects\Fig3-1_AOC1FormerLaundryBldgResults.mxd
Print Date: 5/3/2023
Approved By: cwise
Produced By: jroberts
Project: M0624.04.018

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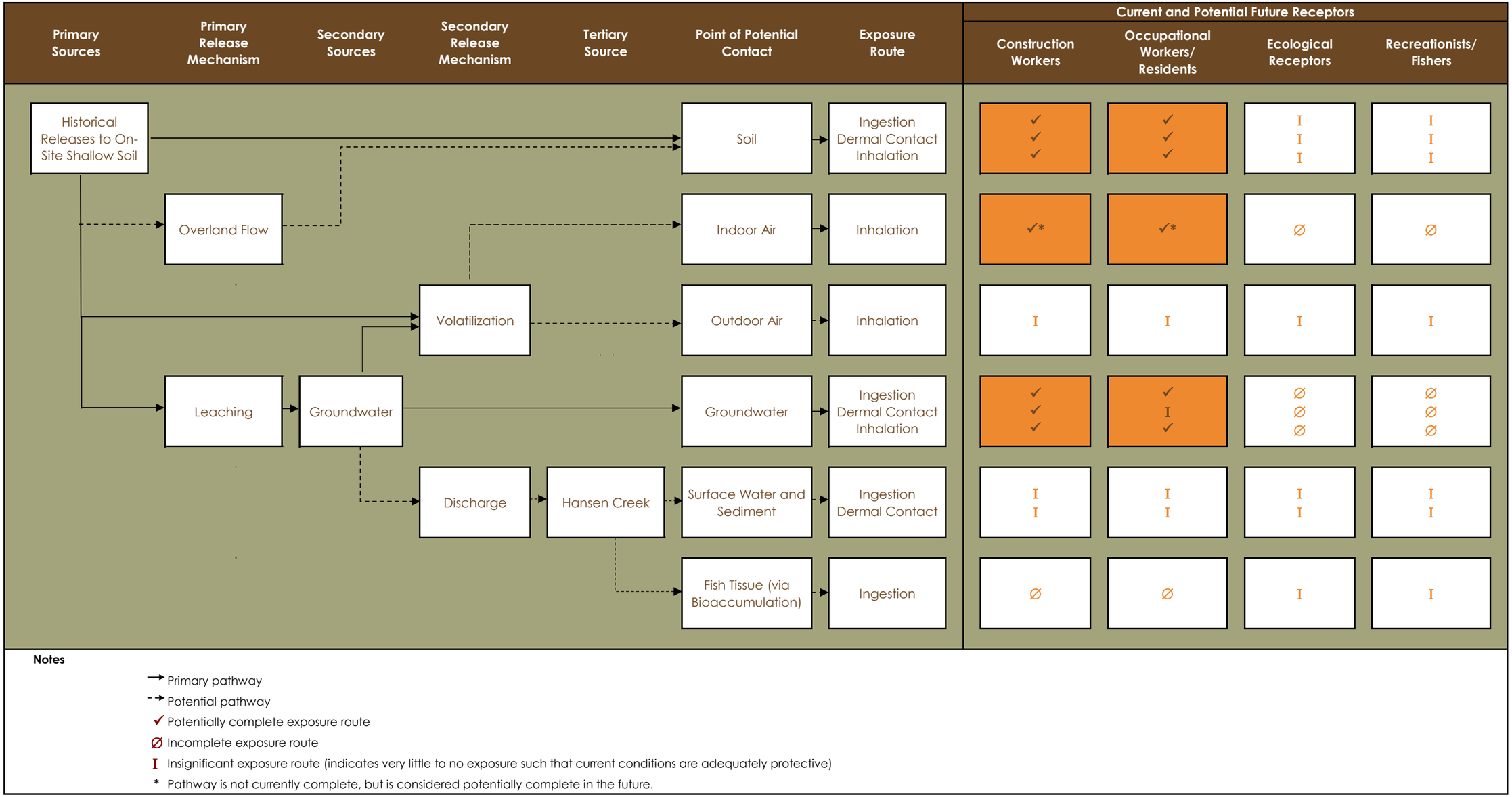
Figure 3-2
Conceptual Site Model
Northern State Multi Service Center
Sedro-Woolley, Washington



Notes

→ Primary pathway

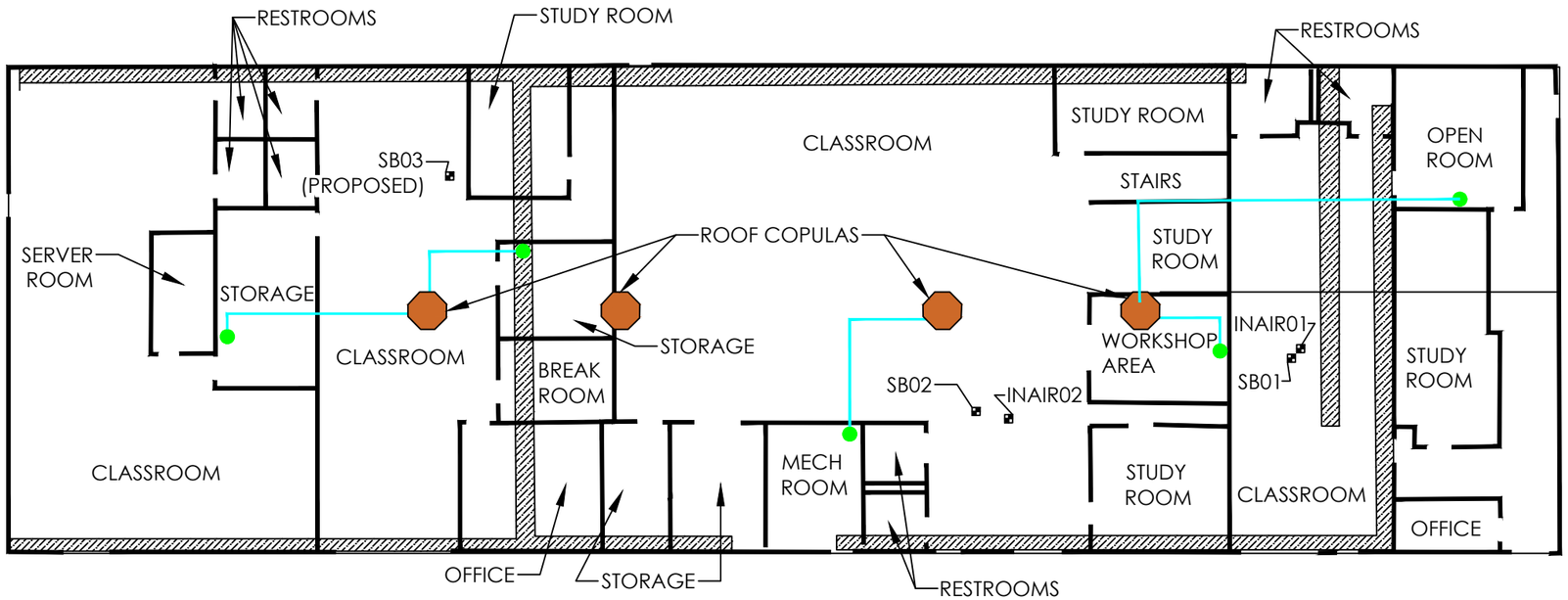
- → Potential pathway

✓ Potentially complete exposure route

∅ Incomplete exposure route

I Insignificant exposure route (indicates very little to no exposure such that current conditions are adequately protective)

* Pathway is not currently complete, but is considered potentially complete in the future.



LEGEND:

- BUILDING FOOTPRINT
- PROPOSED VENT LOCATION
- PROPOSED PIPE ROUTE
- PIPE TRENCH (APPRX.)

NOTES:

1. PIPE ROUTING IS APPROXIMATE. CONTRACTOR TO FIELD ROUTE VENT PIPE TO ACCOMMODATE OBSTRUCTIONS AND STRUCTURE.

DRAWING NOT TO SCALE

Figure 5-1
Sub-Slab Depressurization System Pipe Layout

Northern State Multi Service Center
Sedro-Woolley, WA

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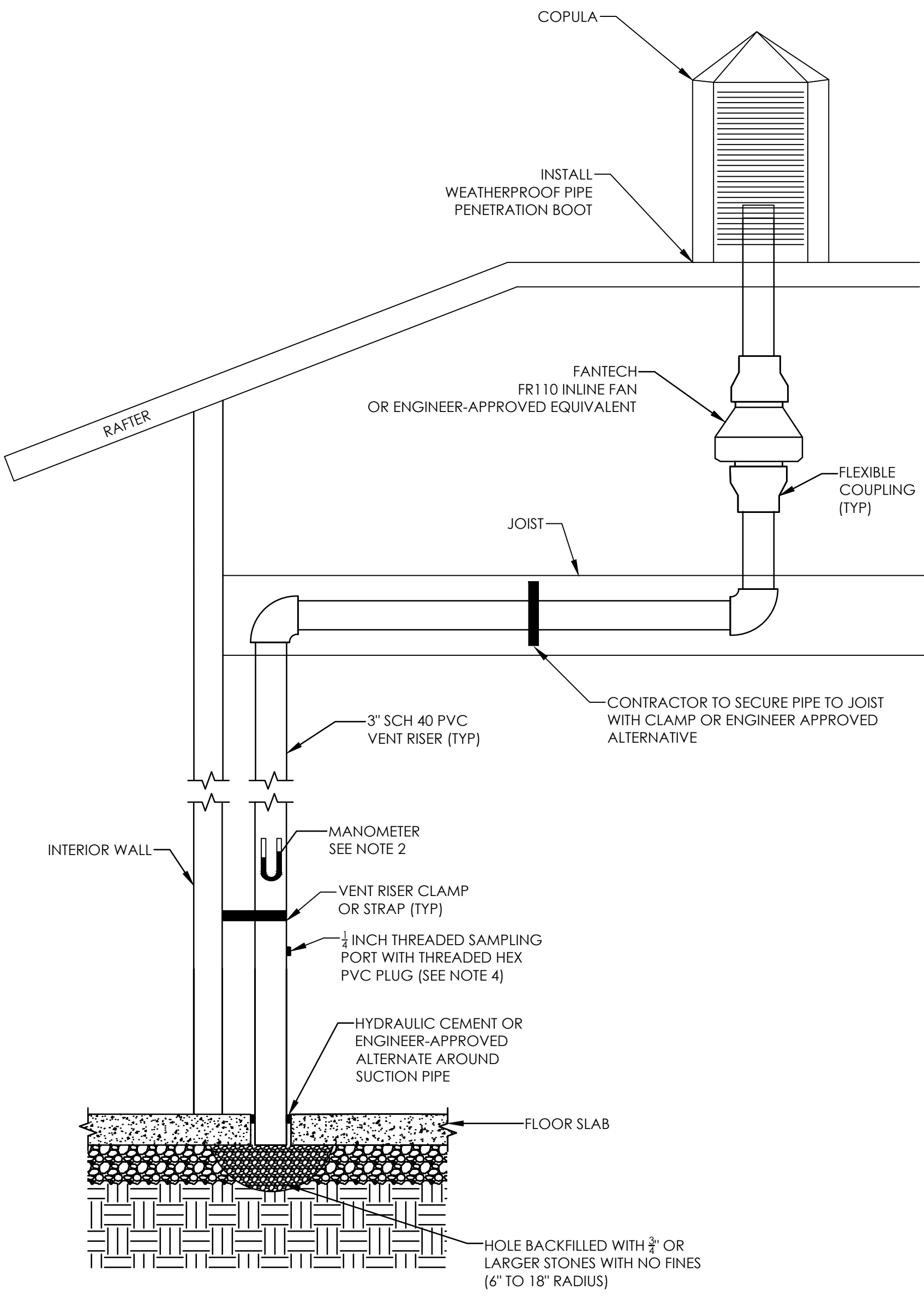

NOTES:

1. TERMINATION OF VENT RISER SHALL BE AS FOLLOWS:
   - 1.1. 10' MINIMUM AWAY FROM, OR AT LEAST 3' ABOVE ANY OPENABLE WINDOW, DOOR, OPENING OR AIR INTAKE, OR VENT SHAFT.
   - 1.2. 3' MIN. IN EVERY DIRECTION FROM ANY LOT LINE, ALLEY, AND STREET.
   - 1.3. EXTEND THROUGH THE VENT FLASHING, 6" MIN. ABOVE THE ROOF
2. MANOMETER SHALL BE PLACED AT LEAST 4' OFF THE GROUND AND SECURED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. MANOMETER SHALL BE EASILY ACCESSIBLE FOR MAINTENANCE STAFF.
3. THE PIPING OF THE VENTING SYSTEM SHALL BE TESTED WITH AIR IN ACCORDANCE WITH THE 2009 UNIFORM PLUMBING CODE.
4. THREADED HEX PLUG SHALL BE SEALED USING TEFLON TAPE OR ENGINEER-APPROVED EQUIVALENT.

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DRAWING NOT TO SCALE

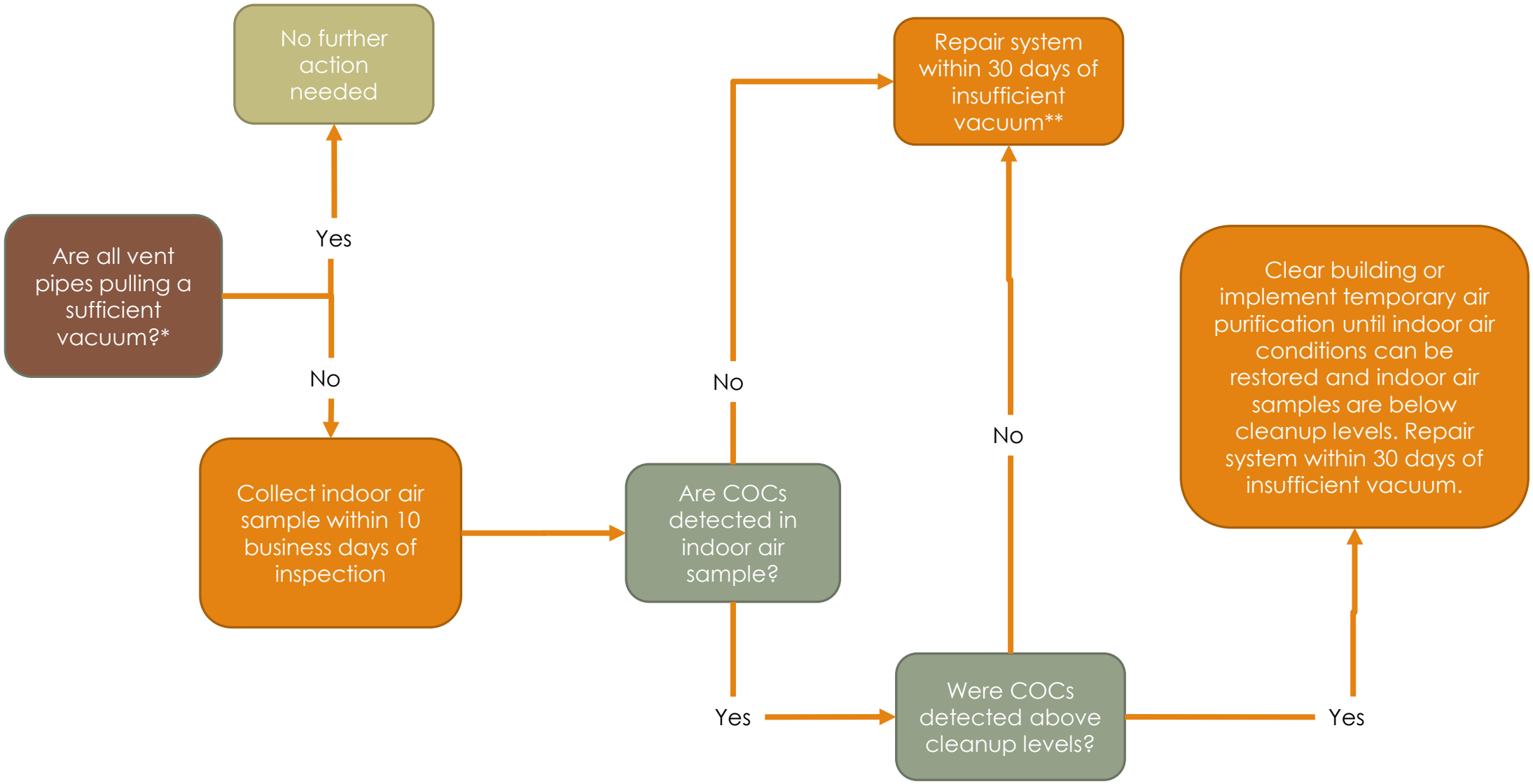
Figure 5-2
Vent Riser Detail

Northern State Multi Service Center
Sedro-Woolley, WA

PLOTTED ON: 2023-05-03 4:51 PM PLOTTED BY: Evelyn Lundeen FILENAME: G:\00_MFA Civil 3D\00_PROJECTS\0624.04 Port of Skagit\16_Interim Action\Design Detail.dwg

Figure 5-3. Quarterly Inspection Indoor Air Sampling Decision Tree

Northern State Multi Service Center
Sedro-Woolley, WA



Note
*Sufficient vacuum values will be established following the establishment of standard operating conditions as approved by the engineer, Ecology, and EPA after the first compliance monitoring event.
**System repair may include replacing fan, resealing joints, or restoring power to a fan. If an initial repair does not restore the vacuum, facility shall work to identify issue and correct within the original 30-day timeframe.
COCs = chemicals of concern.

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

NORTHERN STATE MULTI SERVICE CENTER
2070 NORTHERN STATE ROAD
SEDRO-WOOLLEY, WASHINGTON

Prepared for
PORT OF SKAGIT
August 24, 2023
Project No. M0624.04.016

Prepared by
Maul Foster & Alongi, Inc.
1329 N State Street, Suite 301, Bellingham WA 98225

MAUL
FOSTER
ALONGI

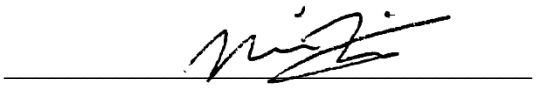
HEALTH AND SAFETY PLAN

NORTHERN STATE MULTI SERVICE CENTER
2070 NORTHERN STATE ROAD
SEDRO-WOOLLEY, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

Carolyn R. Wise, LHG
Project Hydrogeologist



Phil Wiescher, PhD
Principal Environmental Scientist

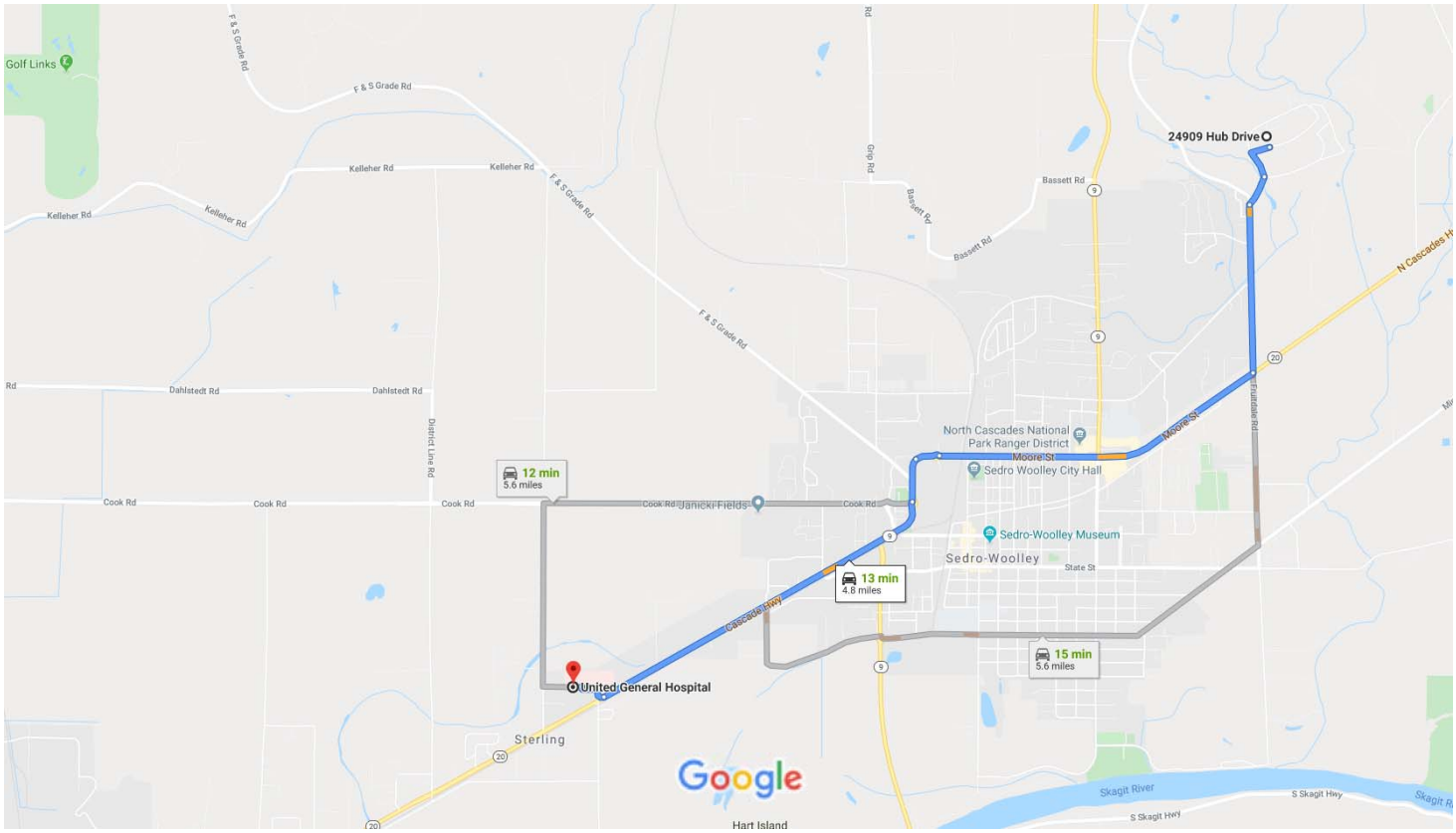
CONTENTS

CONTENTS (CONTINUED)

Google Maps

24909 Hub Dr, Sedro-Woolley, WA 98284 to United General Hospital, Sedro-Woolley, WA

Drive 4.8 miles, 13 min



Map data ©2019 Google 2000 ft

24909 Hub Dr

Sedro-Woolley, WA 98284

Take Fruitdale Rd to WA-20 W/Moore St

3 min (1.1 mi)

1. Head west on Hub Dr toward Thompson Dr

0.2 mi

2. Continue onto Thompson Dr

0.1 mi

3. Turn left onto Fruitdale Rd

0.8 mi

Follow Moore St and WA-20 W to Hospital Dr

8 min (3.5 mi)

4. Turn right onto WA-20 W/Moore St

1.5 mi

5. At the traffic circle, continue straight onto W Moore St

0.1 mi

6. Continue onto Bingham St/Borseth St
Continue to follow Borseth St

0.2 mi

7. At the traffic circle, continue straight onto WA-20 W/Borseth St
Continue to follow WA-20 W

1.7 mi

Drive to Hospital Dr in Sedro-Woolley

1 min (0.2 mi)

8. Turn right onto Hospital Dr

312 ft

9. Turn left toward Hospital Dr

367 ft

10. Turn right toward Hospital Dr

43 ft

11. Turn left onto Hospital Dr

213 ft

United General Hospital

Sedro Woolley, WA 98284

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

1 NEAREST HOSPITAL/EMERGENCY MEDICAL CENTER

1.1 Nearest Hospital

United General Hospital
2000 Hospital Drive
Sedro-Woolley, Washington 98284

Phone: (360) 856-6021

Distance: 4.7 miles

Travel Time: 11 minutes

1.2 Route to Hospital from Site

See map on first page of this document.

1.2.1 Driving Directions to Hospital from Site

1. Head west on Hub Drive toward Thompson Drive.
2. Continue straight onto Thompson Drive.
3. Turn left onto Fruitdale Road.
4. Turn right onto WA-20 West/East Moore Street.
5. At the traffic circle continue straight onto West Moore Street.
6. Continue onto WA-20 West/Bingham Street/Borseth Street.
7. At the traffic circle, continue straight onto WA-20.
8. Turn right onto Hospital Drive.

1.3 Emergency Phone Numbers

Ambulance, Police, Fire	**Dial 911**
Carolyn Wise Project Manager	Phone: (360) 594-6255 Cell: (360) 690-5982
Phil Wiescher Project Director	Phone: (360) 594-6267 Cell: (503) 407-1036
Andrew Vidourek Health and Safety Coordinator	Phone: (360) 433-0248 Cell: (541) 760-9692

2 PLAN SUMMARY

This health and safety plan (HASP) was developed to describe the procedures and practices necessary for protecting the health and safety of Maul Foster & Alongi, Inc. (MFA), employees conducting activities at the Northern State Multi Service Center (former Northern State Hospital) site (Site). This Site is generally located at the Sedro-Woolley Innovation for Tomorrow Center property at 2070 Northern State Road in Sedro-Woolley, Washington (the Property). Other employers, including contractors and subcontractors, are expected to develop and implement their own HASPs to manage the health and safety of their personnel.

MFA personnel conducting activities at the Site are responsible for understanding and adhering to this HASP. Before fieldwork begins, a site safety officer (SSO) who is familiar with health and safety procedures and with the Site will be designated by the on-site personnel. Safety deficiencies should be immediately communicated to the SSO and, if necessary, to MFA's health and safety coordinator (HSC).

All contractors and subcontractors have the primary responsibility for the safety of their own personnel on the Site. All personnel on the Site have "stop work" authority if they observe conditions that they believe create an imminent danger.

If MFA employees work on the Site for more than a year, this HASP will be reviewed at least annually. The plan will be updated as necessary to ensure that it reflects the known hazards, conditions, and requirements associated with the Site.

MFA personnel who will be working on the Site are required to read and understand this HASP. MFA personnel entering the work area must sign the Personnel Acknowledgment Sheet (Section 16), certifying that they have read and that they understand this HASP and agree to abide by it.

3 KEY PROJECT PERSONNEL

Name	Responsibility
Phil Wiescher	Project Director
Carolyn Wise	Project Manager
Amanda Bixby	Field Personnel
Evelyn Lundeen	Field Personnel/SSO
Andrew Vidourek	Health and Safety Coordinator

4 SITE DESCRIPTION AND BACKGROUND

4.1 Type of Site

The Site is located in sections 7, 8, 17, and 18 of township 35 north and range 5, east of the Willamette Meridian. The approximately 220-acre Property includes four tax parcels identified by the Skagit County Assessor: two rectangular-shaped parcels to the north with the same parcel number and a combined area of 143.23 acres (parcel number P38607); a square-shaped, 39.37-acre parcel (parcel number 39356) to the south; and two irregularly shaped parcels to the east (33.57-acre parcel number P100632 to the north and 9.81-acre parcel number P100646 to the south).

4.2 Buildings/Structures

The Site is currently zoned urban reserve public open space and is located within the Sedro-Woolley, Washington, city limits.

The Site currently comprises more than 80 buildings and structures. Several buildings have been demolished on the Site, and the debris from a few of the buildings, reportedly, has been buried and/or disposed of on-site, as determined through interviews with maintenance staff at the Site.

4.3 Topography

The Site is located on a small plateau with a slight downward topographic slope toward the east, south, and southwest toward Hansen Creek and Brickyard Creek.

4.4 General Geologic/Hydrologic Setting

According to the *Geologic Map of the Sedro-Woolley North and Lyman 7.5-minute Quadrangles, Western Skagit County, Washington*, the Site and vicinity are underlain by Quaternary glaciomarine drift.[1] The glaciomarine deposits typically consist of, "…poorly sorted, poorly compacted diamicton consisting of silty, sandy, gravelly clay to clayey gravel; moderately well- to well-sorted sandy silt, sandy clay, clayey silt, and clay…"[1]

Groundwater was encountered during previous investigations at depths between 6 and 18 feet bgs.[2] Groundwater across the northern portion of the Site was determined to flow toward the east. Due to the large size of the Site and the limited area represented by the monitoring wells, it is possible that the groundwater flow direction varies throughout the Site. It is inferred that groundwater in other areas of the Site flows either southeast, due to the gradual topographic slope of the area toward the Skagit River Valley; west towards Brickyard Creek; or east towards Hansen Creek, depending on the location at the Site.

4.5 Site Status

The Site is currently managed by the Port of Skagit County (the Port), with buildings leased to multiple tenants, including Cascade Job Corps, for on-site housing and educational services; and the Pioneer Center North, for a drug and alcohol treatment facility.

4.6 General Site History

The Site was developed in 1909 and operated as a treatment and residence facility and hospital for people with mental illness until its closure in 1973. The approximately 220-acre campus, which includes the former treatment and residence facility, hospital, and grounds, was designed to be self-sustaining and included on-site patient and staff housing, dedicated water supply reservoirs and an associated potable water treatment facility, a fueling station for on-site vehicles, maintenance and paint shops, and a laundry facility. After the facility's closure, the Site was transferred from the Washington State Department of Social and Health Services to the General Services Administration (known today as the Department of Enterprise Services). On July 1, 2018, the Port took title to the Property from the Department of Enterprise Services.

4.7 Areas of Concern

From the analytical results of prior investigations conducted on the Site, MFA identified environmental impacts associated with the following areas of concern (AOCs):[2]

---

[1] Dragovich et al. 1999. *Geologic Map of the Sedro-Woolley North and Lyman 7.5-minute Quadrangles, Western Skagit County, Washington.* Geology and Earth Resources, Washington Division.

[2] MFA. 2018. *Phase II Environmental Site Assessment Work Plan, Former Northern State Hospital, Sedro-Woolley, Washington.* Maul Foster & Alongi, Inc. Bellingham, Washington. October 29.

- **AOC 1:** Former Laundry Building—tetrachloroethene and associated breakdown products in shallow soil, groundwater, and soil gas near the former laundry building.
- **AOC 2:** Power House Building—heavy oil-range organics and carcinogenic polycyclic aromatic hydrocarbons in surface soil and heavy oils in groundwater in the area to the north and northeast of the Power House.
- **AOC 3:** Lead in Soil—lead in shallow soil adjacent to historical buildings and in the athletic field.
- **AOC 4:** Arsenic in Soil—arsenic in soil in the athletic field and near the former Ward building.
- **AOC 5:** Property-Wide Metals in Soil—slightly elevated and relatively consistent metals concentrations were detected in soil throughout the Site.
- **AOC 6:** Maintenance Building—benzene, toluene, ethylbenzene, and total xylenes and gasoline in subsurface soil and groundwater adjacent to the maintenance building.
- **AOC 7:** Lead and Arsenic in Groundwater—lead and arsenic in groundwater in the northeastern portion of the Site.

These AOCs are considered preliminary and may be refined through the development of, and screening to, cleanup levels and additional background assessment and/or site characterization.

5 HAZARD EVALUATION

5.1 Site Tasks and Operations

MFA has completed job hazard analyses (JHAs) for specific tasks that likely could be completed on the Site, depending on the scope of work. The JHAs for these tasks are provided in Appendix A. The following list generally summarizes planned tasks and operations:

- General work near heavy equipment
- Collecting indoor air, outdoor air, and sub-slab soil gas samples

The control measures that field personnel must use to eliminate or minimize these hazards, such as air monitoring, personal protective equipment (PPE), and decontamination procedures, are detailed in the JHAs and in subsequent sections of this plan.

5.2 Chemical Hazard Evaluation

Chemicals of concern on the Site are summarized in Appendix B. Air monitoring action levels and associated controls are specified in Appendix C.

5.3 Physical Hazards

The specific physical hazards and associated controls for work on the Site are described in Appendix A, JHAs.

5.3.1 Noise

In addition to interference with oral communication, job performance, and safety, the effects of noise on humans include physiological effects, particularly temporary and permanent hearing loss. The factors that affect the degree and extent of hearing loss are intensity or loudness of the noise, type of noise, period of exposure, and distance from the noise source. When working in close proximity to operating equipment or other loud noise sources, personnel should use hearing protection.

5.3.2 Heavy Equipment and Falling Loads

Working around heavy equipment potentially presents physical hazards. Always be aware that a large turning radius and the height of certain equipment create blind spots for the operator. Use of excavating equipment also poses overhead hazards when materials are lifted. Do not stand near heavy equipment. Other than the authorized equipment operator, personnel are prohibited from riding on equipment for any reason. Be alert for inattentive equipment operators at the job site and make eye contact with an equipment operator before approaching the work area. Be aware of the potential for falling objects or loads associated with heavy equipment. To reduce the risk associated with excavating, all personnel working around the excavator should wear a hard hat, steel-toed boots, eye protection, and, if needed, hearing protection. PPE should be worn in accordance with Section 7.1.

5.4 Utility Clearance

5.4.1 Underground Utilities

Whenever intrusive activities are conducted, the threat of encountering underground utilities exists. These include electrical, gas, and sewage utilities. Before the execution of any intrusive activities, a utility clearance must be completed and an assessment of the presence of underground utilities must be made. The utility clearance agency should be notified, and the utility companies should mark existing utilities. The clearance reference number should be recorded and kept current.

5.4.2 Overhead Utilities

Adequate clearance should be established and maintained for all overhead utilities. These include utilities crossing waterways in and around the site. Before work starts in the areas where overhead utilities exist, a field inspection should be conducted to verify that adequate distances will be maintained for all equipment intended for use in that location. Inclement Weather

Field personnel should be equipped for the normal range of weather conditions. The designated contractor SSO should be aware of current weather conditions and of the potential for those

conditions to pose a hazard to the field crew. The contractor SSO should observe the current weather conditions, both in the morning and again in the afternoon, and document them in the field notebook.

Heat, rain, cold, wind, snow, ice, flooding, and lightning are natural phenomena that complicate work activities and increase risk. The potential for physical hazards must be considered for tasks that expose personnel to inclement weather. Seasonal conditions must be considered during project planning. The following subsections present specific hazards and potential control measures for these hazards.

5.4.2.1 Lightning

Thunderstorms are more likely to develop during spring and summer but can occur year-round. Pay attention to the weather forecasts for the day and to early signs of thunderstorms: high winds, dark clouds, and darkening skies. Lightning can strike as far as 10 miles from the area where it is raining. If you can hear thunder, you could potentially be within striking distance. Seek safe shelter immediately.

Lightning tends to strike higher ground and prominent objects, especially materials that are good conductors of electricity, such as metal. The safest place to be in a thunderstorm is in a safe building. A safe building is one that is fully serviced and enclosed. The next best source of shelter is an enclosed metal car, truck, or van. When inside the vehicle during a lightning storm, it is recommended that you roll up the windows and sit with hands in lap, waiting out the storm. Do not touch any part of the metal frame or any wired device in the vehicle (including the steering wheel or plugged-in cellular phone). Be aware of any downed power lines that may be touching the vehicle.

If a shelter is not available, you can take shelter in low-lying areas, such as valleys or ditches, but watch for flooding. In a forest, seek shelter in a low-lying area under a thick growth of small trees or bushes. If you are caught in an area far from shelter and you feel your hair stand on end, lightning may be about to strike you. Crouch down on the balls of your feet immediately, with feet together; place your arms around your knees; and bend forward. Be the smallest target possible and minimize your contact with the ground. Do not lie flat on the ground.

Lightning-strike victims do not carry an electrical charge, are safe to touch, and need urgent medical attention.

5.4.2.2 Heat Stress Conditions

Heat stress is a significant potential hazard during summer months. An individual exhibiting signs of heat stress should be provided appropriate treatment immediately. Use of impermeable clothing reduces the cooling ability of the body because of evaporation reduction. This may lead to heat stress. To minimize the effects of heat stress, appropriate work-rest cycles should be maintained, and water or electrolyte-rich liquids should be available.

Never leave employees who are experiencing heat-related problems by themselves; if they do not respond quickly to cooling attempts, immediately call emergency medical services. If a coworker is having difficulty, do not hesitate to bring this to the attention of the supervisor or lead worker.

The following is a brief description of common heat-related conditions and their treatment.

5.4.2.2.1 Heat Exhaustion

Signs and symptoms of heat exhaustion include headache, nausea, vertigo, and weakness. This condition responds readily to prompt treatment, such as cooling and rehydration. Workers suffering from heat exhaustion should be removed from the environment and provided fluids and adequate rest.

5.4.2.2.2 Heat Stroke

The primary signs and symptoms of heat stroke are confusion and irrational behavior; loss of consciousness; hot, dry skin; and abnormally high body temperature. For any worker exhibiting heat stroke symptoms, professional medical treatment should be obtained immediately, as the body has lost its ability to cool itself. The worker should be placed in a cool area, and the outer clothing should be removed. The worker's skin should be cooled to the extent possible until emergency services arrive.

5.4.2.2.3 Cold Stress

Adverse climate conditions such as cold weather are important considerations in planning and conducting site activities. Potential hazards in cold environments include immersion (trench) foot, frostbite, and hypothermia, as well as slippery surfaces. The effects of low temperatures are further exacerbated by the proximity of the river.

When working in cold environments, the following specific steps should be taken to lessen the chances of cold-related injuries:

- Protect exposed skin surfaces with appropriate clothing (such as face masks, hand wear, and footwear)
- Shield the work area with windbreaks to reduce the cooling effects of the wind
- Have extra insulated clothing on site

5.4.2.2.4 Hypothermia

Hypothermia is an abnormal lowering of the core body temperature caused by exposure to a cold environment. When exposed to cold temperatures, the body begins to lose heat faster than it can be produced. The result is hypothermia. A body temperature that is too low affects the brain, making the victim unable to think clearly or move well. Wind chill, as well as wetness or water immersion, can play a significant role.

Typical early signs of hypothermia include shivering, fatigue, loss of coordination, confusion, and disorientation. Late symptoms of hypothermia include blue skin, no shivering, dilated pupils, slowed pulse and breathing, and loss of consciousness.

Body temperatures below 90 °F require immediate treatment to restore the temperature to normal. The following steps can be taken to treat personnel with hypothermia:

- Alert the SSO and request medical assistance.
- Move the victim into a warm room or shelter. If shelter is not available, a sleeping bag, blankets, and body heat from an individual can be used to help raise body temperature.
- Remove any wet clothing.
- Warm the center of the body first—chest, neck, head, and groin—using skin-to-skin contact under loose, dry layers of blankets, clothing, towels, or sheets.
- If the victim does not respond, begin cardiopulmonary resuscitation.

5.4.2.2.5 Frostbite

Frostbite is an injury to the body that is caused by freezing. Frostbite causes a loss of feeling and color in the affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes. Symptoms of frostbite include numbness; tingling or stinging; and bluish or pale, waxy skin.

The following steps can be taken to treat personnel with frostbite:

- Move into a warm area as soon as possible.
- Do not allow the person to walk on frostbitten feet, unless absolutely necessary.
- Do not rub or massage the frostbitten area; doing so may cause more damage.
- Do not use a heating pad or other heat source for warming. Affected areas are numb and can easily be burned.

5.4.2.2.6 Immersion (Trench) Foot

Trench foot is an injury of the feet resulting from prolonged exposure to wet and cold conditions. Trench foot can occur at temperatures as high as 60 °F if the feet are constantly wet. Injury occurs because wet feet lose heat 25 times faster than dry feet. Personnel suffering from trench foot should remove boots and wet socks, and then dry the feet. Avoid walking, as this may cause tissue damage.

6 HEALTH AND SAFETY TRAINING

MFA personnel working on site and who could be exposed to chemicals of potential concern will have completed training consistent with the hazardous waste operations and emergency response (HAZWOPER) requirements in 29 Code of Federal Regulations (CFR) 1910.120(e). The training will include the following:

- Identity of site safety and health personnel
- Safety and health hazards identified on the Site

- Proper use of required PPE
- Safe work practices required on the Site, e.g., fall protection, confined space entry procedures, hot work permits, general safety rules
- Safe use of engineering controls and equipment on the Site
- Medical surveillance requirements, including the recognition of signs and symptoms that might indicate overexposure to hazards
- The site emergency response plan/spill containment plan

The HSC will oversee training for site personnel. Training records, including an outline, sign-offs, and competency records, will be maintained by the HSC.

7 SAFETY EQUIPMENT

7.1 Personal Protective Equipment

PPE must be worn by individuals on the Site to protect against physical hazards. PPE required on the Site is modified Level D, which consists of the following:

- Type 1 hard hat
- High-visibility vest
- Work boots
- Safety glasses with side shields
- Nitrile gloves or equivalent when handling known or potentially impacted media
- Work gloves (if handling materials that that may have sharp edges, protrusions, or splinters)

Additional PPE may be necessary for specific tasks with additional hazards. The SSO will be responsible for designating additional PPE for specific tasks. Depending on the activity, additional PPE may include the following:

- Hearing protection (during high-noise tasks)
- Chemical-resistant clothing, e.g., Tyvek coveralls
- Chemical-resistant boots
- Chemical-resistant goggles
- Chemical-resistant gloves
- Face shield

- Respiratory protection

Additional PPE may be required if workers discover unexpected contamination. Characteristics of unexpected contamination could include unusual odors, discolored media, or a visible sheen. The SSO and, if necessary, the HSC will be contacted as soon as possible after the discovery of unexpected contamination, and the SSO and/or the HSC will determine the need for additional controls and/or training.

PPE used at the Site must meet the requirements of recognized consensus standards (e.g., American National Standards Institute, National Institute for Occupational Safety and Health), and respiratory protection shall comply with the requirements set forth in 29 CFR 1910.134.

Project personnel are not permitted to reduce the level of specified PPE without approval from the SSO or the HSC.

7.2 Safety Equipment

The SSO will be responsible for ensuring that the following safety equipment is available on site and is properly inspected and maintained:

- Soap and water for decontamination
- Caution tape, traffic cones, and/or barriers
- First-aid kit
- Fire extinguisher
- Fluids for hydration, e.g., drinking water or sports drink

7.3 Communications Equipment

MFA personnel should have a mobile phone or a radio available in case of emergency.

8 DECONTAMINATION PROCEDURES

8.1 Partial Decontamination Procedures

MFA employees will implement the following partial decontamination procedures when exiting the work zone but remaining on the Site.

- Remove outer gloves. Inspect and discard in a container labeled for disposable items if ripped or damaged.
- Wash hands and face with soap and water.

8.2 Full Decontamination Procedures

MFA employees will follow the full decontamination procedures listed below when exiting the exclusion zone and leaving the Site, e.g., at the end of the work shift.

- Remove work boots and put on street shoes. Place work boots in a plastic bag or container for later reuse.
- Remove inner gloves and deposit in a container labeled for disposable items.
- Wash hands and face with soap and water.
- Shower as soon after the work shift as practicable.

9 MEDICAL SURVEILLANCE

MFA will ensure that its employees who meet the following criteria are enrolled in a medical surveillance program consistent with 29 CFR 1910.120(f):

- The employees are, or may be, exposed to hazardous substances or health hazards at or above established permissible exposure limits for 30 or more days per year.
- The employees are required to wear a respirator for 30 or more days per year.

MFA employees who exhibit signs or symptoms consistent with overexposure to site contaminants will be offered medical surveillance consistent with Washington Administrative Code 296-843-21005.

MFA will ensure that its employees who are authorized to wear respirators are medically evaluated consistent with the respiratory protection standard (29 CFR 1910.134). The HSC or administrative designee (e.g., human resources manager) will maintain medical evaluation records.

10 AIR MONITORING

Based on site conditions, air monitoring is not anticipated. In the event that workers encounter conditions that indicate the presence of unexpected contamination, such as unusual odors, discolored media, or a visible sheen, workers will exit the area and contact the SSO and, as needed, the HSC. If necessary, MFA will use air monitoring equipment to evaluate the conditions and determine whether additional controls and/or training are required. Action levels and follow-up actions are provided in Appendix C.

Air monitoring, if conducted, must be performed by individuals familiar with the calibration, use, and care of the required instruments. Measurements shall be documented, and the records should include the following information:

- The name of the person conducting the measurements
- The identity of workers, if any, who have had exposure indicated by measurement result
- Information about the instrument, e.g., type, make, model, serial number
- The location of the measurement
- The measurement date and start/stop time
- Conditions represented by the measurement, including applicable activities, work practices, weather conditions, site conditions, and controls in place
- Measurement results
- Other relevant observations or notes

10.1 Air Monitoring Action Levels

If air monitoring is conducted, the results will be compared to the action levels provided in Appendix C. The air monitoring action levels are established to comply with Occupational Safety and Health Administration Permissible Exposure Levels, American Conference of Governmental Industrial Hygienists threshold limit values, and National Institute for Occupational Safety and Health recommendations for the chemicals that may be encountered on the Site. The action levels are also adjusted for the relative response of common photoionization detector instruments to motor-fuel vapors.

10.2 Explosion Hazard Action Levels

MFA employees working on site will take measurements when working near known or suspected sources of explosive gases or vapors. The instrument alarm should be set to sound at 10 percent of the lower explosive limit. When measurements exceed this level, MFA employees on site will do the following:

1. Extinguish ignition sources and shut down powered equipment in the work area.
2. Move personnel at least 100 feet away from the work area.
3. Contact the SSO and the HSC.
4. At the instruction of the HSC and after waiting 15 minutes for explosive gases to dissipate, the SSO may use the combustible gas meter to approach the work zone to measure combustible gases in the work zone. The SSO shall not enter (or allow any personnel to enter) any area where the combustible gas meter readings exceed the explosivity action level, nor shall the SSO approach if there is a potential for fire or explosion.

5. The SSO may authorize personnel to reenter the work area after the source of the combustible gases has been identified and controlled.

10.3 Instrument Calibrations

Instruments shall be calibrated consistent with manufacturers' recommendations. Calibrations shall be coordinated by the SSO. Calibration and monitoring records shall be maintained by the SSO and/or the project manager.

11 SITE CONTROL MEASURES

Access to the Site will be controlled as part of the site preparation. Control measures may include fencing, gates, and signs limiting access to everyone except authorized personnel. Work zones, exclusion zones, and contaminant reduction zones will be designated by the SSO at the start of on-site work.

MFA requires the "buddy system" if personnel conduct operations that may involve exposure to site hazards. The buddy system may involve working with non-MFA personnel.

12 EMERGENCY RESPONSE / SPILL CONTAINMENT / CONFINED SPACE

MFA employees on site will follow the emergency response, spill response, and confined space procedures described in the MFA Health and Safety Manual. Incidents will be documented on the incident report form included with Appendix D.

13 PRE-ENTRY BRIEFING

MFA employees on site will conduct pre-entry briefings, e.g., tailgate meetings, before starting work on the Site and/or as the scope of work changes throughout the project to ensure that employees are familiar with the HASP and that the plan is being followed (see Appendix E). Attendance and discussion topics will be documented on sign-in sheets, which will be maintained by the SSO.

14 PERIODIC EVALUATION

The project manager or designee will evaluate the effectiveness of this HASP. As part of the evaluation, the project manager or designee will track ongoing health and safety feedback from field personnel working on the project. This feedback will be reviewed and incorporated into either immediate or annual updates of the HASP. HASPs will be reviewed and updated at least annually. Updating the plan as necessary ensures that it reflects the known hazards, conditions, and requirements associated with the Site. MFA will maintain periodic evaluation records and will track all HASP revisions.

15 SAFE WORK PRACTICES

The following safe work practices are provided to supplement the other information included with this HASP.

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in areas with potentially contaminated materials.
2. Field personnel will, whenever practicable, remain upwind of drilling rigs, open excavations, and other site-disturbing activities.
3. Subsurface work shall not be performed at any location until the area has been confirmed by a utility-locator firm to be free of underground utilities or other obstructions.

16 ACKNOWLEDGMENT

MFA cannot guarantee the health or safety of any person entering the Site. Because of the potentially hazardous nature of visits to active sites, it is not possible to discover, evaluate, and provide protection against all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury and illness at the Site. The health and safety guidelines in this plan were prepared specifically for the Site and should not be used on any other site without prior evaluation by trained health and safety personnel.

MFA personnel who will work at the Site are to read, understand, and agree to comply with the specific practices and guidelines described in this HASP regarding field safety and health hazards.

This HASP has been developed for the exclusive use of MFA personnel. MFA may make this plan available for review by contracted or subcontracted personnel for information only. This plan does not cover the activities performed by employees of any other employer on the Site. All contracted or subcontracted personnel are responsible for implementing their own health and safety program, including generating and using their own plan.

I have read and I understand this HASP and all attachments, and agree to comply with the requirements described herein:

Name	Title	Date

HASP APPENDIX A

JOB HAZARD ANALYSES

Job Hazard Analysis

Task/Operation: Sub-Slab Vapor Sampling, Indoor, and Outdoor Air Sampling	
Project Number: M0624.04.016	**Location/Site where Task/Operation Performed:** *Northern State Multi Service Center* *Sedro-Woolley, Washington*
Date Prepared: 05/03/23	**Employee Preparing this Job Hazard Analysis (JHA):** Evelyn Lundeen
Date Reviewed: 05/03/23	**Employee Reviewing and Certifying this JHA:** Amanda Bixby

Job/Task Description
Employees will conduct work such as conducting sub-slab soil gas sampling, outdoor, and indoor air sampling. This will require occasional work in close proximity to drilling equipment and pressurized gases.

Physical Hazards		
Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Asphyxiation	Helium gas.	Do not place your head inside the helium shroud.
Eye injury	Construction debris coming into contact with eyes	Wear eye protection with side shields.
Physical stress	Heavy lifting of sampling equipment, compressed-gas cylinders, sample coolers; kneeling on hard or gravel surfaces.	Use proper bending/lifting techniques, i.e., bending and lifting with legs and not with back. Do not twist at the waist when turning. Use buddy system for heavy objects. Use knee pads or kneeling pad. Take breaks and rest as needed.
Accidents with equipment/tools	Sample-collection equipment/tools.	Verify you have the appropriate equipment/tools for your tasks. Use equipment/tools as intended by the manufacturer. Stow tools in vehicle properly; use appropriate cases and bags. Secure equipment in vehicle with netting and straps—do not leave loose—doing so can cause property damage or serious injuries to others or yourself.
Noise	Roto-hammer.	Wear proper ear protection.

Biological and Chemical Hazards		
Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Chemical	None specific to this JHA. Chemical hazards related to the site are described in the Chemical Hazards Summary Table (Appendix B of this health and safety plan).	None
Biological—Animals and Insects	Rodents and spiders.	Use nitrile gloves and a mask when working in enclosed areas where rodent droppings are present. Do not touch mouth, eyes, nose, or open wounds when working near rodent droppings.

Task/Operation: Sub-Slab Vapor Sampling, Indoor, and Outdoor Air Sampling
Additional Control Measures and Guidance
Engineering Controls: No engineering controls specified.
General Safe-Work Practices and Guidance: • Always wear nitrile gloves when handling samples and sampling equipment. • Do not eat or drink in the immediate area where sampling is conducted. • Wash hands and face before eating or drinking. • Used nitrile gloves should be disposed of in a container labeled for disposable items. • During transport and use, properly secure compressed-gas cylinders. • Attach regulator and hose to compressed-gas cylinder in as recommended by manufacturer. • Grasp or secure hose when in use—do not allow to whip. • Employees should use caution when working around rodent droppings. If possible, use a shop vac to remove rodent droppings before commencing work. • Secure equipment in vehicle with netting or straps; do not leave loose.
Personal Protective Equipment: Hard hat (if overhead hazard is present), work boots (if working near heavy equipment), high-visibility vest, safety glasses, disposable nitrile gloves, and hearing protection (i.e., earplugs or earmuffs) as needed.

Job Hazard Analysis

Task/Operation: Working Near Heavy Equipment		
Project Number: M0624.04.016		**Location/Site Where Task/Operation Performed:** *Northern State Multi Service Center* *Sedro-Woolley, Washington*
Date Prepared: 05/03/23	**Employee Preparing this Job Hazard Analysis (JHA):** Evelyn Lundeen	
Date Reviewed: 05/03/23	**Employee Reviewing and Certifying this JHA:** Amanda Bixby	

Job/Task Description
Employees will conduct work such as overseeing drilling operations and collecting soil and groundwater samples. This will require occasionally working in close proximity to drilling equipment.

Physical Hazards		
Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Bodily harm or death	Heavy equipment operating on site creates a potential for site workers to be struck, crushed, or impacted by moving parts.	Stay a safe distance from equipment and maintain eye contact with equipment operators. Wear a safety vest for enhanced visibility.
Eye injury	Construction debris (e.g., soil) coming into contact with eyes.	Wear eye protection with side shields.
Head injury	Heavy equipment and/or tools impacting the head.	Wear a hard hat.
Penetration of feet	Sharp objects that could be stepped on; large objects falling on feet.	Wear steel-toed boots with steel shank.
Hearing loss	Noise generated by heavy equipment/machinery.	Wear hearing protection such as earplugs or earmuffs.
Injury to bystanders	Pedestrians in the locality of work.	Use cones and caution tape to cordon off the immediate work area. Watch for and escort pedestrians away from work area. Pause work if necessary.
Hand injury	Pinch points.	Wear protective gloves whenever possible. Avoid placing hands near operating equipment.

Biological and Chemical Hazards		
Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
None	None specific to this JHA. Chemical hazards related to the site are described in the Chemical Hazards Summary Table (Appendix B of this health and safety plan).	None

Additional Control Measures and Guidance
Engineering Controls: No engineering controls specified.

Task/Operation: Working Near Heavy Equipment
General Safe-Work Practices and Guidance: Personnel should stay upwind and out of the impact area of the heavy equipment, if feasible. Cones, barrier tape, or other equivalent methods will be used to establish the impact area, if feasible. Work conducted in the impact area must be coordinated with the equipment operator using preestablished methods of communication, such as direct eye contact, hand signals, and/or verbal communication.
Personal Protective Equipment: Hard hat, steel-toed work boots, high-visibility safety vest or outer garment, safety glasses with side shields, nitrile gloves, and hearing protection, i.e., earplugs or earmuffs.

HASP APPENDIX B

CHEMICAL HAZARD SUMMARY

Table
Chemical Hazards Summary
Northern State Multi Service Center
Sedro-Woolley, Washington

Analyte	OSHA PEL (TWA)	ACGIH TLV (TWA)	NIOSH IDLH[(a)]	LEL (%)	IP (eV)	Other Hazard
VOCs						
1,1-Dichloroethane	100 ppm	100 ppm	3000 ppm	5.4	11.06	
1,2-Dichloroethane	50 ppm	NE	50 ppm	6.2	11.05	
cis-1,2-Dichloroethene	200 ppm	NE	1000 ppm	5.6	9.32	P
Tetrachloroethene	100 ppm	25 ppm	150 ppm	NA	9.32	C
Trichloroethylene	100 ppm	300 ppm	1,000 ppm	NA	9.45	C, P
Vinyl chloride	1 ppm	5 ppm	NA	3.6	9.99	C, F

Table
Chemical Hazards Summary
Northern State Multi Service Center
Sedro-Woolley, Washington

Notes

IDLH values taken from http://www.cdc.gov/niosh/idlh/intridl4.html.

ACGIH = American Conference of Governmental Industrial Hygienists. ®

C = carcinogen.

F = flammable.

IDLH = immediately dangerous to life and health.

IP (eV) = ionization potential.

LEL = lower explosive limit.

NA = not available.

NE = not established.

NIOSH = National Institute for Occupational Safety and Health.

OSHA = Occupational Safety and Health Administration.

P = poison.

PEL = permissible exposure level.

TLV = threshold limit value.

TWA = time-weighted average.

VOC = volatile organic compound.

Reference

NIOSH. Immediately Dangerous To Life or Health (IDLH) Values. National Institute for Occupational Safety and Health. Accessed June 27, 2022. https://www.cdc.gov/niosh/idlh/intridl4.html.

HASP APPENDIX C

AIR MONITORING PROCEDURES AND TOXICITY ACTION LEVELS

Air Monitoring Procedures and Toxicity Action Levels

Instrument	Action Level	Initial Action	Follow-Up Action
PID[a]	Detection of 1 ppm (above ambient) in breathing zone.	Move upwind of source and/or away from volatile concentrations and continue monitoring until concentrations recede. **If 10 ppm, see next row**.	Ventilate area, always work upwind.
PID[a]	Detection of 10 ppm (above ambient) in breathing zone.	Upgrade to Level C and continue to monitor breathing zone with Dräger tube. **If 50 ppm, leave exclusion zone**. Return only if levels decrease to below 50 ppm.	Ventilate area, always work upwind.
Dust Meter	0.05 milligrams per cubic meter of air	Dust suppression, e.g., misting.	Adjust operations.

Notes
PID = photoionization detector.
ppm = part per million.
[a]Some PIDs do not work in high (e.g., greater than 90 percent) humidity or rainy weather. Under these atmospheric conditions, only PIDs certified for use in high humidity should be used.

HASP APPENDIX D

INCIDENT REPORT FORM

MAUL FOSTER & ALONGI, INC. HEALTH & SAFETY INCIDENT REPORT

THIS REPORT MUST BE COMPLETED IN FULL AND SUBMITTED WITHIN 24 HOURS TO THE MFA HEALTH AND SAFETY COORDINATOR

Project Name: _____

Project Number: _____

Date of Incident: _____

Time of Incident: _____

Location: _____

Type of Incident (Check all applicable items)

- ☐ Illness
- ☐ Injury
- ☐ Property Damage
- ☐ Spill
- ☐ Health & Safety Infraction
- ☐ Fire, Explosion, Flash
- ☐ Unexpected Exposure
- ☐ Other (describe): _____
- ☐ Vehicular Accident
- ☐ Electric Shock
- ☐ Near Miss

DESCRIPTION OF INCIDENT

Describe what happened and the possible cause of the incident. If reporting a spill, include the quantity or estimated quantity. Identify individual(s) involved, witnesses, and their affiliations. Describe emergency or corrective action taken. Attach additional sheets, drawings, or photographs as needed.

INCIDENT REPORTER

_____	_____	_____
PRINT NAME	SIGNATURE	DATE

Site Safety Officer must deliver this report to the Health & Safety Coordinator within 24 hours. Reviewed by:

_____	_____	_____
MFA Health & Safety Coordinator PRINT NAME	MFA Health & Safety Coordinator SIGNATURE	DATE

HASP APPENDIX E

TAILGATE SAFETY MEETING CHECKLIST

Tailgate Safety Meeting Checklist

MAUL FOSTER ALONGI

Client Name:	Port of Skagit
Project No.:	M0624.04.016
Communicated By:	
Date:	

Yes	NA	Information Reviewed
☐	☐	Emergency Procedures and Site Evacuation Routes
☐	☐	Route to Hospital
☐	☐	HASP Review and Location
☐	☐	Key Project Personnel
☐	☐	Emergency Phone Numbers
☐	☐	Stop-Work Authority
☐	☐	General Site Description/History and Chemical Hazards
☐	☐	For Active Sites - Site Activities and Vehicular/Equipment Traffic
☐	☐	Site-Specific Physical Hazards
☐	☐	Required Personal Protective Equipment
☐	☐	Available Safety Equipment and Location
☐	☐	Daily Scope of Work (Reference JHAs as applicable)
☐	☐	Decontamination Procedures
☐	☐	Identify Work Zones, Exclusion Zones, and Decontamination Zones
☐	☐	Hazardous Atmospheres
☐	☐	Air Monitoring Equipment and Procedures
☐	☐	Identify Potential Site-Specific Slip, Trip, and Fall Hazards
☐	☐	Dust and Vapor Control
☐	☐	Confined Space(s)
☐	☐	Open Pits and Excavation
☐	☐	Extreme Temperatures
☐	☐	Incident Reporting
☐	☐	Other: _____

Suggestions to Improve HS Practices

Attendees		
Name	Signature	Company
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		

APPENDIX B

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN/ QUALITY ASSURANCE PROJECT PLAN

AOC 1: FORMER LAUNDRY BUILDING
NORTHERN STATE MULTI SERVICE CENTER
SEDRO-WOOLLEY, WASHINGTON

AGREED ORDER NO. DE 16309
CLEANUP SITE ID: 10048

Prepared for
PORT OF SKAGIT
August 24, 2023
Project No. M0624.04.016

Prepared by
Maul Foster & Alongi, Inc.
1329 N State Street, Suite 301, Bellingham, WA 98225

MAUL FOSTER ALONGI

SAMPLING AND ANALYSIS PLAN/QUALITY ASSURANCE PLAN

AOC 1: FORMER LAUNDRY BUILDING
NORTHERN STATE MULTI SERVICE CENTER
SEDRO-WOOLLEY, WASHINGTON

The material and data in this report were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

MAUL FOSTER & ALONGI, INC.
The material and data in this plan were prepared under the supervision and direction of the undersigned.

Carolyn Wise
Date: 8/24/2023
Carolyn Wise, LHG
MFA Project Manager

Mary Benzinger
Date: 8/24/2023
Mary Benzinger
MFA Quality Assurance Manager

WASHINGTON STATE DEPARTMENT OF ECOLOGY
The information in this plan was reviewed and accepted by the undersigned.

Chris DeBoer
Date: 8/28/23
Chris DeBoer, LHG
Ecology Site Manager

U.S. ENVIRONMENTAL PROTECTION AGENCY
The information in this plan was reviewed and accepted by the undersigned.

Amy Baker (Aug 29, 2023 11:44 PDT)
Date: 8/29/23
Amy Baker
EPA Remedial Project Manager

Karin Feddersen-Lethe
Karin Feddersen-Lethe (Aug 29, 2023 14:59 PDT)
Date: 08/29/2023
Karin Feddersen-Lethe
EPA Quality Assurance Manager

CONTENTS

TABLES AND ILLUSTRATION

FOLLOWING PLAN:

TABLES

FIGURE

ACRONYMS AND ABBREVIATIONS

AOC 1	former laundry building
COC	chain of custody
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
IAWP	Interim Action Work Plan
MFA	Maul Foster & Alongi, Inc.
Port	Port of Skagit
Property	Former Northern State Hospital property
QA	quality assurance
QAM	quality assurance manual
QC	quality control
RPD	relative percent difference
SAP/QAPP	sampling and analysis plan and quality assurance plan
SSAP	site-specific sampling and analysis plan
S2AVM	Stage 2A Validation Electronic and Manual

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA), has prepared this sampling and analysis plan/quality assurance project plan (SAP/QAPP) for the Port of Skagit (the Port) to guide field measurements and sample collection to support the interim remedial action of chlorinated volatile organic compounds in sub-slab material beneath the former laundry building, referred to as area of concern 1 (AOC 1), at the former Northern State Hospital (also known as the Sedro-Woolley Innovation for Tomorrow Center property [the Property]), located at 2070 Northern State Road in Sedro-Woolley, Washington (see Figure 1-1 of the Interim Action Work Plan [IAWP], to which this SAP/QAPP is an appendix). Historically, the Property operated as a self-sustaining mental hospital that included on-site patient and staff housing, laundry facilities, maintenance shops, a powerhouse, and a fueling station. The Property is now leased to multiple tenants, including the Cascade Job Corps, and the Pioneer Center North.

MFA prepared this SAP/QAPP consistent with the requirements of the Washington Administrative Code 173-340-820. The work described in this SAP/QAPP is being conducted under Agreed Order DE 16309 between the Port and the Washington State Department of Ecology (Ecology). The Port is the recipient of a U.S. Environmental Protection Agency (EPA) cleanup grant for interim remedial action activities at the Property. MFA prepared this SAP/QAPP on behalf of the Port, which will work in cooperation with EPA and Ecology.

This SAP/QAPP has been prepared consistent with the following guidance:

- Ecology
  - Ecology's Guidance on Sampling and Data Analysis Methods (Ecology 1995)
  - Guidance for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2004)
  - 1993 Model Toxics Control Act (Washington Administrative Code Chapter 173-340-820).
- EPA
  - Guidance for Quality Assurance Project Plans (EPA 2002)
  - Requirements for Quality Assurance Project Plans (EPA 2001)
  - Brownfield Grant Recipients' Road Map to Understanding Quality Assurance Project Plans (EPA 2012)
  - Quality Assurance Guidance for Conducting Brownfields Assessments, EPA 540-R-98-038 (EPA 1998)

1.1 SAP/QAPP Objectives

The purpose of this SAP/QAPP is to outline requirements for field sampling and laboratory analytical activities associated with the interim action at AOC 1. This SAP/QAPP is provided as an appendix to and supplements the IAWP for AOC 1, which provides Property-specific background information and defines the scope of the interim action to be completed under the EPA cleanup grant.

This SAP/QAPP is designed to ensure the following:

- The interim action meets goals and produces complete and accurate environmental data sets that have high precision and low bias.
- Environmental data can be shown to be representative of Property conditions.
- The quality assurance (QA) and quality control (QC) process allows for comparability of environmental data sets so that the Property can be characterized and assessed.

This SAP/QAPP describes methods that will be used for taking field measurements and sampling environmental media. It also includes procedures for collecting, analyzing, evaluating, and reporting useful data. This SAP/QAPP includes QA procedures for field activities, QC procedures, and data validation.

2 PROJECT AND TASK ORGANIZATION

2.1 Project Team Organization

This section provides the organizational structure, lines of authority, and responsibilities of key project individuals. Project activities will be performed within the framework of the organization and functions presented in this section. The organizational structure described in this SAP/QAPP provides lines of responsibility and authority based on the following objectives:

- Identify appropriate lines of communication and coordination.
- Monitor project schedules and performance of contractors.
- Coordinate support functions, such as laboratory analysis and data management.
- Provide progress QA reports.
- Provide corrective actions to rectify deficiencies.

This SAP/QAPP provides the general structure for environmental field sampling and laboratory analytical activities for the interim action at AOC 1. Table 2-1 provides the contact information for the personnel listed in the following sections. Table 2-1 will also act as a distribution list for this SAP/QAPP. An organizational chart is provided as the attached figure.

2.1.1 Port of Skagit Project Manager Responsibilities

Heather Rogerson is the project manager for the Port, which is the grant recipient. She is responsible for budget and schedule control, contracting, and coordination between the Port; the EPA; and the environmental consultant, MFA. She is responsible for preparing progress reports and final reporting as required by the grant agreement and Agreed Order DE 16309. Heather Rogerson is responsible for distributing the final approved SAP/QAPP to the project team.

2.1.2 EPA Project Manager Responsibilities

Amy Baker is the EPA project manager and is responsible for supporting the Port in its implementation of this interim remedial action. She is also responsible for reviewing and approving this SAP/QAPP and the IAWP. She is the primary EPA point of contact for the Port.

2.1.3 EPA Regional Quality Assurance Manager Responsibilities

Karin Feddersen-Lethe is the EPA Region 10 quality assurance manager and is responsible for reviewing the quality assurance plan.

2.1.4 Ecology Project Manager Responsibilities

Chris DeBoer is the Ecology site manager. Because the Property is currently under an agreed order, Ecology will provide formal review and approval of environmental documents. Ecology staff will provide recommendations and guidance to the Port and its consultant on conducting interim remedial action activities in accordance with State of Washington cleanup regulations and Ecology requirements. Recommendations and/or guidance provided by Ecology staff related to the work performed under the agreed order is considered to be formal direction from Ecology and is a required action.

2.1.5 MFA Program Manager Responsibilities

Phil Wiescher is the MFA program manager. He will be responsible for planning the technical and administrative components of work completed by the Port. He will oversee the following functions for the Port:

- Development of scope, schedule, and budget
- Administration of these assignments via contracts with service providers
- Management of data and products developed throughout the course of the work
- Reporting to the Port, the EPA, and Ecology

Phil Wiescher will be supported by Carolyn Wise, the MFA project manager. They will regularly communicate with the Port on progress and significant issues.

2.1.6 MFA Project Manager Responsibilities

Carolyn Wise will be the project manager for the interim remedial actions at the Property. She will be responsible for all aspects of implementation of assignments and will lead the interim action and development of the IAWP, this SAP/QAPP, and the completion report. Carolyn Wise will report to Phil Wiescher.

2.1.7 Field Team Leader/On-Site Safety Officer Responsibilities

Evelyn Lundeen will be the field team leader. She will be responsible for overseeing field activities and making sure that samples are collected properly; verifying that procedures for field activities related to characterization or remediation are properly executed; and ensuring that all activities are properly documented, the prescribed scope of work is completed, and communication protocols are met. Evelyn Lundeen will also act as the on-site safety officer and will be responsible for ensuring that the site-specific health and safety plan (HASP) is followed by MFA personnel working on site. Evelyn Lundeen will report directly to Carolyn Wise.

2.1.8 Project Scientist/Geologist

MFA scientists or geologists will be assigned based on availability and relevant skills and experience. The scientists or geologists will work under the field team leader and will be responsible for conducting investigation activities in accordance with the IAWP and this SAP/QAPP.

2.1.9 Quality Assurance Manager Responsibilities

Mary Benzinger of MFA has been identified as the quality assurance manager (QAM). She will provide QA oversight for both the field sampling and laboratory programs, ensuring that samples are collected and documented appropriately, coordinating with the analytical laboratories, ensuring data quality, overseeing data validation, and supervising project QA coordination. Mary Benzinger will report directly to the MFA project manager (i.e., Carolyn Wise).

2.1.10 Database Manager/Project Chemist Responsibilities

Mary Benzinger has also been identified as the database manager and project chemist. She will be responsible for uploading analytical results to the project EQuIS database and for ensuring that samples are documented appropriately. She will also coordinate with the analytical laboratories and oversee data validation. Mary Benzinger will also oversee the management and transfer of analytical, well, and boring logs; spatial analyses; and any other data generated during the project. Mary Benzinger will report directly to the MFA project manager (i.e., Carolyn Wise).

2.1.11 Procurement and Administrative Personnel

Heather Rogerson will be responsible for contract administration, including development and management of requests for proposals and bids and of contract documents for contractors providing

services to the Port. The contract administrator will be in close contact with the MFA project manager (i.e., Carolyn Wise).

2.1.12 Contractor Responsibilities

Contractors will perform work in strict compliance with this SAP/QAPP and the appropriate contract specifications. Contractors are responsible for implementation of work assignments under the direction of the project managers.

Friedman & Bruya, Inc. (FBI) is the laboratory contractor. The following describes the laboratory contractor's responsibilities:

- Performing the test methods described in this SAP/QAPP or the IAWP, including methods referenced for each analytical procedure
- Holding and maintaining accreditation for applicable analyses under the State of Washington Environmental Laboratory Accreditation Program
- Following documentation, custody, and sample logbook procedures
- Meeting all reporting and QA/QC requirements
- Providing electronic data files as specified
- Meeting turnaround times for deliverables as specified
- Allowing the QA/QC contractor to perform laboratory and data audits

2.2 Schedule

The project schedule is outlined in Section 4.2 of the IAWP.

2.3 Documents

2.3.1 Interim Action Work Plan

The IAWP and appendices (SAP/QAPP and HASP) prepared by MFA describe the project and conceptual site model used to inform the interim action design, goals of the remedial action, and data quality objectives (DQOs); provide health and safety information; and discuss the sampling and analysis approach, including analytical methods and matrices.

Following EPA and Ecology review of this draft IAWP, the document will be revised in response to EPA and Ecology comments to produce a draft IAWP for public review. Any comments received from the public will be taken into consideration when finalizing this document. The final IAWP will be submitted for EPA and Ecology review and approval before work activities begin.

2.3.2 Data Validation Memoranda

Data validation memoranda will be prepared by the MFA project chemist (i.e., Mary Benzinger). The contents of the data validation memoranda are discussed in Section 5. Data validation memoranda will be submitted by the Port to the EPA and Ecology with the final reports.

2.3.3 Final Reports

Following completion of the interim action described in this IAWP, an interim action completion report will be prepared summarizing the activities performed. The completion report will include information relevant to the installation of the sub-slab depressurization system and results obtained from the first post-installation sampling event as described in the IAWP. Field measurement data collected; investigative and QC samples collected; investigation results, including the location and extent of any contamination identified; a summary of any QA issues and corrective actions taken; and an interpretation of the analytical results will be incorporated into the completion report. Future sampling and/or monitoring events will be summarized in either technical memorandums or documented in quarterly reports to describe the ongoing performance monitoring/maintenance of the system. Quarterly progress reports are required for sites under agreed orders.

The Port will submit the completion report to EPA and Ecology for review. Subsequent quarterly progress reports will be submitted to Ecology and EPA as applicable.

3 SPECIAL TRAINING AND CERTIFICATIONS

All personnel performing work at the Property will be health- and safety-trained as specified in the HASP. The HASP describes the specialized training and certification required for personnel and the requisite documentation of this training. As described in Section 6 of the HASP, personnel working on the Property and who could be exposed to chemical hazards will have completed training consistent with the hazardous waste operations and emergency response (HAZWOPER) requirements in 29 Code of Federal Regulations 1910.120(e).

The training will include the following:

- Identity of site safety and health personnel
- Safety and health hazards identified on the site
- Proper use of required personal protective equipment
- Safe work practices required on the site, e.g., fall protection, confined space entry procedures, hot work permits, general safety rules
- Safe use of engineering controls and equipment on the site

- Medical surveillance requirements, including the recognition of signs and symptoms that might indicate overexposure to hazards
- The site emergency response plan/spill containment plan

Copies of required training certificates, current medical surveillance certificates, and respirator fit test records must be compiled by the MFA health and safety coordinator or administrative designee (e.g., human resources manager) before individual entry to the Property. Field personnel conducting sampling will be a qualified environmental scientist, geologist, or engineer trained in the standard operating procedures and familiar with environmental conditions present on the Site. The MFA project manager is responsible for ensuring technical training requirements are met for MFA field personnel. Training records associated with field sampling are compiled by the MFA program or project manager or administrative designee (e.g., human resources manager). For contractors' on-site personnel, this information will be made available to the Port of Skagit on request.

Laboratories shall be certified to provide analytical laboratory services for the specific methods and matrices, when applicable, under the State of Washington Environmental Laboratory Accreditation Program. Laboratories shall also be certified by an accrediting body under the National Environmental Laboratory Accreditation Conference Institute or another EPA-recognized accreditation organization (i.e., Department of Defense Environmental Laboratory Accreditation Program, International Organization for Standardization) to provide analytical services for the project-specific methods and matrices described in Section 4 of this SAP/QAPP. Where commercial laboratories with multiple locations are contracted, the specific laboratory facility receiving samples shall be accredited as appropriate for the matrix and methods or instrumentation identified in this SAP/QAPP.

4 DATA GENERATION AND ACQUISITION

4.1 Data Quality Objectives and Decision Criteria

The DQO process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study (EPA 2006). The seven steps of the DQO process outlined by the EPA are the following:

1. **State the problem**—Define the problem; identify members of the planning team; define the budget and schedule.
2. **Identify the goal of the study**—State how environmental data will be used to meet study objectives and solve the problem; identify study questions; define alternative outcomes.
3. **Identify information inputs**—Identify data and information needed to answer study questions.
4. **Define the boundaries of the study**—Specify target population and characteristics of interest; define spatial and temporal limits; define scale of inference.

5. **Develop the analytic approach**—Define parameters of interest; specify type of inference; develop logic for drawing conclusions from findings.
6. **Specify performance or acceptance criteria**—Specify criteria for new data collection (performance metrics) and decision making (probability limits).
7. **Develop the plan for obtaining data**—Develop the SAP/QAPP.

This SAP/QAPP for environmental data collection was developed using the DQO process and presents performance metrics for collection and analysis of indoor air and air emissions from the vent risers, the environmental mediums that will be sampled.

Screening and action levels include Ecology's Model Toxics Control Act cleanup levels. Applicable cleanup levels are presented in Section 3.2 of the draft IAWP, as required.

4.1.1 Data Precision

Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions, calculated as either the range or the standard deviation (EPA 2002). Precision is measured by making repeated analyses on the same analytical instrument (laboratory duplicates) or replicate collections of samples in the field (field duplicates). Precision criteria are expressed as the relative percent difference (RPD) between the primary and duplicate samples. The acceptance limits for the RPD are based on the sample matrix and the analytical method used.

The RPD is calculated using the following equation:

$$RPD = \frac{2(x_s - x_d)}{x_s + x_d} \times 100\%$$

Where:

x_s = result for primary sample.
x_d = result for duplicate sample.

4.1.2 Data Bias

Bias is defined as the systematic or persistent distortion of a measurement process that causes error in one direction (EPA 2002). Data bias is addressed in the field and the laboratory by calibrating equipment, collecting and analyzing QC blank samples, and analyzing QC standard samples.

4.1.3 Data Accuracy

Accuracy is defined as the measure of the overall agreement of a measurement to a known value and includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations (EPA 2002). Inasmuch as the "true" concentration of sampled media is not known, the degree of accuracy in the measurement is inferred from recovery data

determined by sample spiking and/or the analyses of reference standards. The criterion for accuracy is expressed as the percent recovery of the sample spiking. The acceptance limits for percent recovery are based on the analytical method used.

Percent recovery is calculated using the equation:

$$Percent\ Recovery = \frac{x_{ss} - x_s}{T} \times 100\%$$

Where:

x_{ss} = result for spiked sample.
x_s = result for sample.
T = true value of added spike.

4.1.4 Data Completeness

Data completeness is defined as a measure of the amount of valid data needed from a measurement system (EPA 2002). It is measured as the total number of samples collected, for which the valid analytical data are obtained, divided by the total number of samples collected, and multiplied by 100. Criteria for data completeness are provided in Table 4-1.

4.1.5 Data Comparability

Data comparability is a qualitative term that expresses the measure of confidence with which one data set can be compared to another and can be combined for decision-making purposes (EPA 2002). Data comparability will be achieved by using standard sampling and operating procedures and analytical methods. Data comparability will be assessed through documentation of QA/QC procedures.

4.1.6 Data Representativeness

Data representativeness is a qualitative term that expresses, "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition" (EPA 2002). Data representativeness is evaluated by assessing the accuracy and precision of the sampling program. The criterion for evaluating representativeness will be satisfied by confirming that the sample collection procedures are consistently followed. Sampling procedures are referenced in Section 5.4.1 of the draft IAWP.

4.1.7 Data Sensitivity

Data sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest (EPA 2002). The method reporting limits specified through the DQO process are provided in Table 4-1. Results measured between the reporting limits and the method detection limits will be reported for all analytes and assigned the appropriate qualifier.

4.2 Sampling Process Design

Work activities will begin following EPA and Ecology approval of the final IAWP.

The interim action described in the IAWP will include the collection and analysis of indoor air, ambient air samples. Air emissions from the vent pipes will also be sampled for analysis. Sample locations proposed in this SAP/QAPP may be adjusted as site conditions necessitate. Proposed sample locations, field parameters, associated analyses, and sample collection timing are discussed in the SSAP 2022-01 (Appendix A). Analytical methods for indoor air, ambient air, and vent riser emissions are shown in Table 4-1; specifics regarding sample handling in Table 4-2; a quality control sample summary is provided in Table 4-3. Indoor and ambient air samples as well as vent riser emission samples will be collected using procedures as described in the sections below.

The following subsections present the activities proposed to address the data needs for the project.

4.3 Sampling Methods

4.3.1 Sub-Slab Vapor Pin Pressure Readings

After the sub-slab depressurization system is installed, MFA will conduct four quarters of sub-slab pressure differential readings using differential pressure meter and the existing and proposed vapor pins installed in the building slab (SB01,SB02, and SB03). The meter will read the pressure differential between indoor air in the building and sub-slab. Field staff will connect a differential pressure meter (e.g., VelociCalc Multi-Function Ventilation Meter) to the vapor pin with tubing and observe the differential pressure measurement on the meter, wait until measurement has stabilized (approximately 5 to 10 minutes), and record pressure differential in the field notebook. Field staff will also record time, date, and any observations that may impact the readings, including open doors or windows, weather, and operation of an indoor heating or cooling system.

4.3.2 Vent Pipe Manometer Readings

A dedicated manometer will be installed on each vent riser associated with the sub-slab depressurization system. The manometer will read the pressure differential between indoor air in the building and vent pipe. Each quarter, Port staff will observe the vacuum measurement on each vent riser's manometer; ensure the measurement is stabilized; and record vacuum, date, time, and any other visual observations about the vent pipe in the field notebook. Manometer readings at the vent riser will depend on the fan model and operation conditions. Readings at the vent riser are expected to be between 0.5 and 1.75 inches of water; however, acceptance criteria thresholds are site-specific and will be refined after the system has been installed and the first quarterly monitoring period has been completed. The proposed threshold acceptance criteria will be provided in the completion report; and will include an updated decision flow chart figure. Ecology and EPA will review and approve the proposed threshold criteria values for the vent pipe manometer readings at that time. If the pressure differential is less than the value established in the field, additional coordination with EPA and/or Ecology to determine next steps will be conducted.

4.3.3 Indoor and Outdoor (Ambient) Air

After the sub-slab depressurization system is installed, MFA will conduct four quarters of air sampling. The first event will be conducted after one week of mitigation system operation to:

- Confirm that the installation process did not result in preferential pathways for vapor intrusion into the former laundry building,
- Confirm the effectiveness of the sub-slab depressurization system, and
- Confirm that indoor air quality was not impacted during system installation.

Indoor and outdoor air samples will be collected in 6-liter, stainless steel canisters (Summa canisters) with an eight-hour flow controller. Canisters will be placed 3 to 5 feet above the floor or ground surface, representative of the breathing zone. Detailed sampling procedures are provided in the standard operating procedure (see Appendix B). Sample plan alteration forms are included in Appendix C.

MFA will record field data before and after the sampling, including the sampling start and stop times, the initial and final canister vacuum readings, temperature, relative humidity, barometric pressure, wind speed and direction, and observations of conditions that may influence sampling results (e.g., industrial activities and presence or use of chemicals in the vicinity). The sample will be rejected if the initial canister pressure is not at least -25 inches of mercury or if the final canister pressure is greater than -0.3 inches of mercury. Sample container and preservation requirements for contaminants are listed in Table 4-2.

4.3.4 Vent Pipe Emissions Sampling

After the sub-slab depressurization system is installed, MFA will conduct one round of air emissions sampling during the subsequent wet and dry seasons to assess emissions concentrations from the vent risers. Air emissions sampling will be conducted at all five vent risers after the indoor air sampling event described in Section 4.3.3. The standard operating procedure for this sampling is generally consistent with the soil vapor standard operating procedure; however, helium shroud testing is considered not practicable for this sampling methodology and is not included (see Appendix B).

MFA will collect vent pipe emissions samples from the vent risers. The samples will be collected in 1-liter, stainless steel canisters (Summa© canisters). The sampling port from the vent riser will be connected to the ¼ turn Swagelok® ball valve (Valve #1—sampling valve), using appurtenant stainless steel or Tygon® tubing. The sampling valve is connected to a vacuum gauge, which is attached to the flow controller on the Summa canister.

At the flow controller, a Swagelok tee connection will be fitted to the canister and to a second ¼ turn Swagelok ball valve (Valve #2—purge valve) used to isolate the purging equipment during actual sampling. The canister has a built-in valve that allows isolation of the canister during purging and leak-checking activities. On the other side of the purge valve (#2), a vacuum pump will be connected to induce vacuum for purging and shut-in testing. With the canister valve closed, a sample of the air

emissions collected during purging (described below) will be contained in a Tedlar® bag. If a leak is detected, the sampling and purging train fittings will be tightened.

After the sampling train is purged and no leaks are detected in the sampling train, close the valve leading to the vacuum pump (Valve #2—purge valve), open the valve leading to the sampling port (Valve #1—sample valve), and then open the valve on the canister to collect the sample over a 30-minute period or the duration of time required for the specific test. The shut-in test was determined to be the best faith method for ensuring no leaks are present in the sampling train.

MFA will record field data before and after the sampling, including the sampling start and stop times, the initial and final canister vacuum readings, temperature, relative humidity, barometric pressure, wind speed and direction, and observations of conditions that may influence sampling results (e.g., industrial activities and presence or use of chemicals in the vicinity). The sample will be rejected if the initial canister pressure is not at least -25 inches of mercury or if the final canister pressure is greater than -3 inches of mercury. The final canister pressure is recommended at or near -5 inches of mercury for data QA/QC purposes.

4.4 Sample Handling and Custody

Field sampling personnel will be responsible for the collection, labeling, description, documentation, handling, packaging, storage, and shipping of investigative samples obtained in the field. Proper sample handling and custody procedures are required to retain sample integrity from collection in the field through laboratory analysis and data reporting.

4.4.1 Sample Identification

The field personnel will be responsible for labeling samples and establishing identification. All data will be keyed to the sample's unique sample designation, which will be used on sample containers and associated field data forms, as well as to key the sample identification in the project database.

The field personnel will clearly label each sample container, using permanent ink on a waterproof sample label, as soon as possible following collection. At a minimum, the following information will be written on the sample label:

- Unique sample identification code
- Time and date of collection
- Project number
- Preservative, if appropriate

In order to maintain sample identification consistency in the project database, the unique sample identification code will be assigned according to the following convention: unique sample number—matrix type—depth (if applicable).

Indoor air samples will be named by matrix, followed by location identification number and date in MMDDYY format. For example, an indoor air sample collected at location 01 on August 1, 2022, would be named "INAIR01-080122."

Outdoor air samples will be named by matrix, followed by location identification number and date in MMDDYY format. For example, an outdoor air sample collected at location 01 on August 1, 2022, would be named "OUTAIR01-080122."

Vent riser samples will be named by location identification and date in MMDDYY format. For example, a vent riser emission sample collected at vent 01 on August 1, 2022, would be names "VENT01-080122."

4.4.2 Sample Custody

The field sampling personnel and the analytical laboratory contractor will be responsible for following sample custody procedures during sampling and analysis, as well as for providing sample tracking. Sample custody procedures will be used to document the history of samples from the time of sample collection through shipment, analysis, and disposal. Samples and sample documentation will be maintained in the physical possession of authorized field personnel or under control in a secure location.

4.4.2.1 Sample Custody in the Field

The field sampling contractor personnel will be responsible for completing the chain-of-custody (COC) forms upon sample collection. Each COC form will contain, at a minimum, the following information:

- Project number
- Project name
- Project manager
- Unique sample identification code
- Time and date of collection
- Field personnel sampler's name
- Separate shipping papers
- Signature, printed name, organization name, date and time of transfer of all persons having custody of samples
- Sample matrix
- Quantity of sample containers
- Requested analyses for each sample

- Requested analytical turnaround time
- Any additional information on requested analysis such as holding time, etc.

4.4.2.2 Sample Packaging and Shipment

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations (with the exception of freight carriers).

Samples will be delivered to the laboratory by ground transportation (laboratory courier or field personnel), and the following custody procedures will be followed:

- Samples will be packed in the appropriate shipping containers.
- If transportation is by courier, the laboratory courier will retain a second copy of the COC and shipping forms to allow sample tracking. The top copy of the COC form will accompany the samples.
- If transported to the laboratory by field personnel, COCs will be signed and copies distributed at the time of sample delivery to the laboratory. The COC form will accompany the samples from point of release from the Site to the laboratory.

The laboratory will implement its in-house custody procedures, which begin when sample custody is transferred to laboratory personnel.

4.4.2.3 Sample Custody in the Laboratory

The analytical laboratory contractor's sample custodian will be responsible for the handling and documentation of samples received at the laboratory. The designated sample custodian will accept custody of the received samples and will verify that the COC form matches the samples received. The shipping container, or set of containers, will be given a laboratory identification number, and each sample will be assigned a unique sequential identification number.

4.4.3 Sample Documentation and Records

4.4.3.1 Field Logbooks and Forms

During interim remedial action implementation and compliance sampling, field personnel will be responsible for maintaining a daily record of significant events, observations, and measurements. Field records may be recorded in a bound logbook or on paper or electronic field data sheets. A separate entry will be made for each sample collected. Field logbooks and forms will be included in the project files at the end of field activities to provide a record of sampling.

4.4.3.2 Equipment Calibration Log

Field sampling personnel will be responsible for maintaining an equipment calibration log to record the calibration measurements and frequencies of equipment calibration, if applicable. This log may be

incorporated into the field logbook notes for a specific date and activity. Rented equipment will be calibrated immediately prior to the sampling event by the rental company.

4.4.3.3 Record Retention

All data collected will be stored on a server supported by MFA with minute-by-minute backups. Additionally, validated data will be uploaded to the Washington State Department of Ecology's Environmental Information Management database.

All project information will be stored for the duration of the project and 20 years, at minimum.

4.5 Analytical Methods

All analytical methods used will comply with relevant requirements of applicable state or federal programs or of other EPA- or Ecology-approved methods. A listing of Ecology-preferred methods for analytes is provided in Table 4-1.

4.6 Quality Control

The quality of data will be monitored and verified by maintenance logs, documentation of field activities, and collection and analysis of laboratory QC samples. Table 4-3 provides a summary of the QC samples along with the required assessment frequency.

4.6.1 Field Quality Control Samples

The field QC samples will be used to assess the accuracy and precision of the field sample collection and handling activities. The sample will be rejected if the initial canister pressure is not at least -25 inches of mercury or if the final canister pressure is less than 0.3 inches of mercury.

4.6.2 Laboratory Quality Control Samples

The laboratory QC samples will be used to assess the accuracy and precision of the field sample collection and handling activities. Laboratory QC samples will be analyzed at the required frequency described in Table 4-3, as applicable, based on analytical method and sample matrix.

4.6.2.1 Calibration Verification

Instruments will initially be calibrated at the start of the project or sample run, as required, and when any ongoing calibration does not meet control criteria. The number of points used in the initial calibration is defined in the analytical method. Calibration will be continued as specified in the analytical method to track instrument performance. If a continuing calibration does not meet control limits, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications. Any project samples analyzed while the instrument was outside control limits will be reanalyzed.

4.6.2.2 Surrogate Spikes

Surrogate spiking consists of adding reference compounds to samples before preparation of the samples for organic analysis. Surrogate compound spiking is used to assess method accuracy on a sample-specific basis. Surrogate compounds will be added to samples in accordance with the analytical method requirements. Surrogate spike percent recovery acceptance limits are determined by the analytical method. The surrogate spike percent recovery results will be reported by the laboratory.

4.6.2.3 Method Blanks

Method blanks are prepared using analyte-free (reagent) water and are processed with the same methodology (e.g., extraction, digestion) as the associated investigative samples. Method blanks are used to document contamination resulting from the laboratory's analytical process. A method blank will be prepared and analyzed for every analytical batch.

The method blank results are used to verify that reagents and preparation do not impart unacceptable bias to the investigative sample results. The presence of analytes in the method blank sample will be evaluated against method-specific thresholds. If analytes are present in the method blank above the method-specific threshold, corrective action will be taken to eliminate the source of contamination before proceeding with analysis. Investigative samples from an analytical batch associated with method blank results outside acceptance limits will be qualified as appropriate by the QAM.

4.6.2.4 Laboratory Control Samples

Laboratory control samples (LCSs) are prepared by spiking laboratory-certified, reagent-grade water with the analytes of interest or a certified reference material that has been prepared and analyzed. The result for percent recovery of the LCS is a data quality indicator of the accuracy of the analytical method and laboratory performance. The criteria for acceptable percent recovery of LCSs are presented in Table 4-1.

4.6.2.5 Laboratory Duplicate Samples

Laboratory duplicate samples (LDSs) are prepared by the laboratory by splitting an investigative sample into two separate aliquots and performing separate sample preparation and analysis on each aliquot. The results for RPD of the primary investigative sample and the respective LDS are used to measure precision in the analytical method and laboratory performance. For nonaqueous matrices, sample heterogeneity may affect the measured precision for the LDS. The criteria for acceptable RPD of LDSs are presented in Table 4-1.

4.7 Instrument and Equipment Testing, Inspection, and Maintenance

Instruments for field parameter measurements will follow this SAP/QAPP protocol and manufacturers' recommendations for testing, inspection, and maintenance. Field equipment used for obtaining samples will be decontaminated as required and stored in a clean and secure location.

Laboratory instruments and equipment will comply with the contracted laboratories' QA/QC procedures for testing, inspection, and maintenance. Laboratory instrument and equipment testing, inspection, and maintenance documentation will be provided to the QAM if requested.

4.8 Instrument and Equipment Calibration and Frequency

Instruments for field parameter measurements will follow manufacturers' recommendations for calibration. Calibration will be conducted at the beginning of each sampling event. Calibration checks will be conducted at the beginning of each sampling day. Calibration may be conducted again during a sampling event, as necessary, based on the results of the calibration check. Calibration records will be recorded in the field logbooks.

4.9 Inspection and Acceptance of Supplies and Consumables

The supplies and consumables that may be used during field operations include, although are not limited to, the following: decontamination fluids and equipment tubing. No materials will be used after the manufacturers' expiration dates. If contamination is visible in materials, the item will be discarded. In accordance with Section 4.10, nondedicated field equipment will be decontaminated prior to use.

The analytical laboratory will inspect supplies and consumables before their use in analysis. The materials description in the analytical methods will be used as a guideline for establishing acceptance criteria. Purity of reagents will be evaluated through analysis of LCSs and method blank samples. The laboratory shall maintain an inventory of supplies and consumables.

4.10 Nondirect Measurements

Nondirect measurements are defined as existing data obtained from nonmeasurement sources, such as literature files or existing databases. To assess data usability, historical data will be reviewed for accordance with project-specific DQOs and QA/QC criteria. Historical data that may be relied upon for this interim action is provided in Tables 3-1 and 3-2 of the IAWP, to which this plan is an appendix.

4.11 Data Management

4.11.1 Field Data

Field data may be recorded in a bound logbook or on paper or electronic field data sheets. Hard copies of all field data will be scanned and saved electronically. Field data collected on paper or electronic field data sheets may be imported into an EQuIS™ database. In the event that field data are entered by hand into an electronic format before they are imported into EQuIS™, the data will be reentered and reviewed for data entry errors by separate, qualified individuals.

4.11.2 Laboratory Data

The laboratory shall record the results of each analysis in a laboratory information management system in accordance with the contracted laboratory's QA plan. Data will be provided to MFA as electronic data deliverables, which will be imported directly into an EQuIS™ database used for data storage. Validated laboratory results will be exported and provided as part of the final report for each project.

5 DATA VALIDATION AND USABILITY

5.1 Data Review, Verification, and Validation

Data verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled (EPA 2001). Data verification is the process of evaluating the completeness, correctness, and compliance of a specific data set against the method, procedural, or contractual specifications (EPA 2002). Data validation is confirmation by examination and provision of objective evidence that the particular requirements for specific, intended use have been fulfilled (EPA 2001). Data validation is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to the analytical quality of a specific data set (EPA 2002).

5.2 Data Review, Verification, and Validation Methods

The specific data reduction, verification, and reporting procedures and assigned personnel will vary for each laboratory; however, all procedures will be completed in accordance with the laboratory's QA plan and standard operating procedures.

The laboratories will provide a level 2 laboratory report for Stage 2A (S2AVM) data validation. Refer to EPA (2009) guidance for S2AVM data validation and verification requirements.

5.2.1 Data Verification Methods

5.2.1.1 Laboratory Data Verification Methods

The laboratory will be responsible for the reduction of raw data generated at the laboratory bench and verification that data reduction performed by the laboratory instrument, or the laboratory information management system is correct.

QC checks for data verification that will be performed for all generated data are as follows:

- Verify that batch QC and field samples were analyzed at the specified frequency.
- Verify calibrations and calibration checks for compliance with laboratory criteria.

- Verify that holding times for extraction and analyses and sample preservation were met.
- Verify that the quantitation limits and method detection limits were met.
- Verify that all project and QC sample results were properly reported and flagged.
- Review COC documentation to verify completeness of the sample set for each data package submitted.
- Assess the impact of laboratory and field QC results.

These QC checks will be performed by laboratory analysts, the assigned laboratory project manager or supervisor, laboratory QC specialists, or a combination of these personnel. After the data reports have been reviewed and verified, the laboratory reports will be signed and released for distribution.

5.2.1.2 Field Data Verification Methods

Data collected during field activities will be evaluated for usability by conducting a QA review that consists of checking procedures used and comparing the data to previous measurements. Field QC samples will be evaluated to ensure that field measurements and sampling protocols have been observed and followed.

The field data verification process will be performed at two levels. The first level will be conducted at the time of collection and consists of following standard procedures and QC checks. The second level will be performed during compilation of field data and will include checks for data anomalies. Inconsistent data or anomalies will be resolved by seeking clarification from field personnel responsible for collecting the data, and the resolution will be documented during the data verification process.

5.2.2 Data Validation Methods

Validation of the analytical data produced under this SAP/QAPP will be performed by an MFA chemist (i.e., Mary Benzinger), independent of the analytical laboratory contractor(s) generating the data reports. The data validator will review laboratory performance criteria and sample-specific criteria.

The data validation review of sample-specific criteria will be performed on all data report packages for each analysis type generated by each analytical laboratory contractor. The independent data validation review will include review of the following items from the S2AVM laboratory data reports: consistency with the COC procedures, holding times, surrogate recoveries, matrix spike recoveries, field duplicate agreement, matrix spike duplicate and laboratory duplicate precision, and method blank analyses. Refer to EPA (2009) for S2AVM level data validation and verification requirements.

The purpose of this independent review will be to verify that the laboratory QC program is adequate, and that the laboratory met the performance criteria. The data validator will review data and assign data qualifiers to sample results, following parts of the EPA procedures for inorganic data (EPA 2017a), organic data (EPA 2017b), and method-specific guidelines.

Data qualifiers are used to classify sample data in terms of their conformance to QC requirements. The most common qualifiers are listed below:

- J—Estimate, qualitatively correct but quantitatively suspect.
- R—Reject, data not suitable for any purpose.
- U—Not detected at a specified detection limit.

Poor surrogate, blank contamination, or calibration problems, among other things, can require qualification of the sample data. The reasons for the qualifications will be stated in the data validation report. QC criteria not defined in the guidelines for evaluating analytical data are adopted, where appropriate, from the analytical method.

6 ASSESSMENT AND OVERSIGHT

6.1 Quality Assurance Assessment and Response Actions

The MFA project manager (Carolyn Wise) and QAM (Mary Benzinger) are responsible for developing and initiating corrective action if the data verification and validation identify unacceptable data or conditions. The project manager will notify the QAM if the project issues are significant.

Corrective action may include the following:

- Reanalyzing samples, if holding time criteria permit
- Resampling and analyzing
- Amending sampling procedures

Significant changes to this SAP/QAPP will be documented using a sample plan alteration form (Appendix B) and approved by the original signatories.

6.2 Quality Assurance Reports to Management

If significant QA issues arise, the MFA QAM will be responsible for completion of QA progress reports to provide a summary of the project performance and data quality. The QA progress reports will be submitted to the program and project managers on a situation-specific basis. These reports will focus on a summary of specific QA problems encountered and corrective actions implemented. The QA progress reports may include the following:

- QA issues requiring corrective actions; status of corrective actions
- Assessment of completeness of measurement data, including a summary of data qualified as rejected during data verification and validation

- Assessment of representativeness of measurement data and compliance with the project DQOs
- Results of performance audits

Submittal of QA progress reports will be conducted if QA problems occur during implementation of the interim remedial action. If needed, submittal of QA progress reports is not anticipated to exceed once a week. A summary of QA issues and implemented corrective actions will also be provided in the final report. A field sampling report will be generated, summarizing the investigative samples and QC samples collected. A data report that will summarize sampling and field measurement data, and results of the data verification and validation will also be generated.

LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

REFERENCES

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EPA. 2017a. *EPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Methods Data Review*. EPA 540-R-2017-001. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. Washington, DC. January.

EPA. 2017b. *EPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review*. EPA 540-R-2017-002. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. Washington, DC. January.

TABLES

Table 2-1
Contact List
Northern State Multi Service Center
Sedro-Woolley, Washington

Contact Name	Title	Organization	E-mail	Telephone
Heather Rogerson	Grant Recipient	Port of Skagit	heatherr@portofskagit.com	360-757-9828
Amy Baker	EPA Project Manager	EPA, Region 10	Baker.Amy@epa.gov	206-449-8139
Karin Feddersen-Lethe	EPA Quality Assurance Manager	EPA, Region 10	feddersen-lethe.karin@epa.gov	206-553-2712
Chris DeBoer	Ecology Site Manager	Ecology	chde461@ECY.WA.GOV	425-466-8732
Phil Wiescher	Program and Contract Administration Manager	MFA	pwiescher@maulfoster.com	503-407-1036
Carolyn Wise	Project Manager	MFA	cwise@maulfoster.com	360-594-6255
Evelyn Lundeen	Field Team Leader/On-Site Safety Officer	MFA	elundeen@maulfoster.com	206-556-2025
Mary Benzinger	Quality Assurance Manager/Database Management/Project Chemist	MFA	mbenzinger@maulfoster.com	503-501-5247

Notes

EPA = U.S. Environmental Protection Agency.

Ecology = Washington State Department of Ecology.

MFA = Maul Foster & Alongi, Inc.

Port of Skagit = Grant Recipients.

Table 4-1
Air: Preferred Analytical Methods and Performance Criteria
Northern State Multi Service Center
Sedro-Woolley, Washington

Analyte	Screening Criteria	MRL	Screening Criteria/ MRL Units	Preferred Analytical Method	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
1,1-Dichloroethene	91	0.4	ug/m^3	TO-15 SIM	20	70-130	90
1,2-Dichloroethane	0.096	0.04	ug/m^3	TO-15 SIM	20	70-130	90
cis-1,2-Dichloroethene	18	0.4	ug/m^3	TO-15 SIM	20	70-130	90
Tetrachloroethene (PCE)	9.6	6.8	ug/m^3	TO-15 SIM	20	70-130	90
trans-1,2-Dichloroethene	18	0.4	ug/m^3	TO-15 SIM	20	70-130	90
Trichloroethene (TCE)	0.33	0.27	ug/m^3	TO-15 SIM	20	70-130	90
Vinyl chloride	0.28	0.26	ug/m^3	TO-15 SIM	20	70-130	90

Notes

ug/m3 = micrograms per cubic meter.

LCS = laboratory control sample.

MRL = method reporting limit.

NV = no value.

RPD = relative percent difference.

TO-15 SIM = U.S. Environmental Protection Agency Method Toxic Organics-15 Selective Ion Monitoring.

Table 4-2
Containers, Preservation, and Holding Times
Northern State Multi Service Center
Sedro-Woolley, Washington

Matrix	Method	Analysis	Holding Temperature/ Preservative	Holding Time (Days)		Sample Container
				From: Field Collection To: Extraction	From: Preparation Extraction To: Determinative Analysis	
Air	TO-15 SIM	cVOCs	None	30	30	6 L Summa Canister

Notes

cVOCs = chlorinated volatile organic compounds.

EPA = U.S. Environmental Protection Agency.

L = liter.

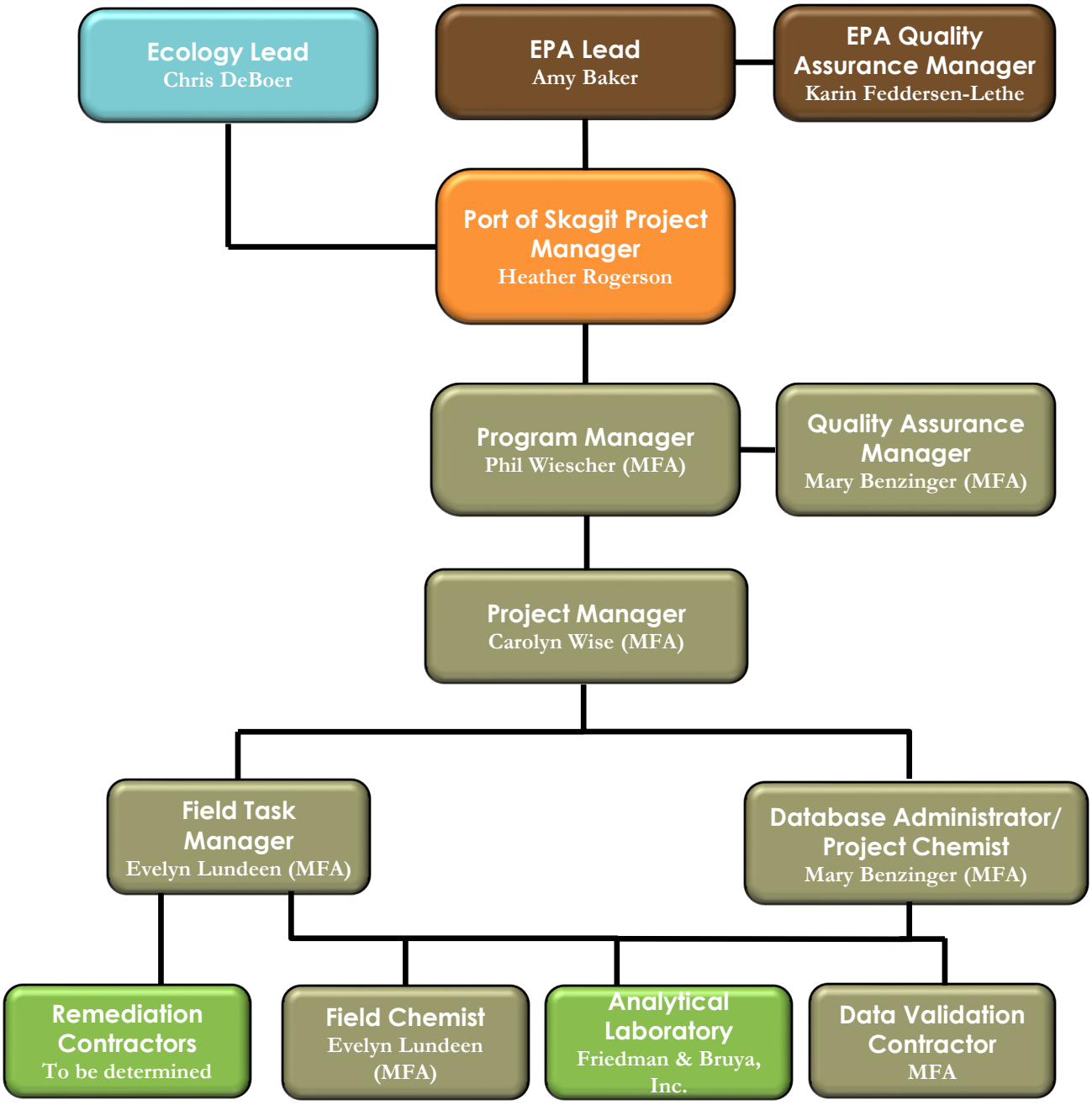
TO-15 SIM = U.S. Environmental Protection Agency Method Toxic Organics-15 Selective Ion Monitoring.

Table 4-3
Quality Control Sample Requirement Summary
Northern State Multi Service Center
Sedro-Woolley, Washington

Quality Control Check Sample	Frequency	Acceptance Criteria
Laboratory Control Sample	Each analytical batch of samples for every 20 (or fewer) samples received	Method-specific criteria will be followed
Laboratory Duplicate Sample	Each analytical batch of samples for every 20 (or fewer) samples received	Method-specific criteria will be followed

FIGURE

Figure
Organization Chart
AOC 1—Interim Action Work Plan



Legend

- Port of Skagit administration: program planning and tracking, agency interface, strategy, stakeholder outreach
- Technical program administration: remedial design, deliverables, schedules, budgets, subcontractor administration, information management, project implementation
- Contracted services
- U.S. Environmental Protection Agency
- Washington State Department of Ecology

SAP/QAPP
APPENDIX A
SITE-SPECIFIC SAMPLING AND ANALYSIS PLAN

SITE-SPECIFIC SAMPLING AND ANALYSIS PLAN
Interim Action Work Plan – AOC 1
PORT OF SKAGIT
SEDRO-WOOLLEY, WASHINGTON

SSAP Number: 2022-01

Project Schedule: Event Based

Site Background: Concentrations of chlorinated volatile organic compounds (cVOCs) have been detected in soil, groundwater, and sub-slab soil vapor above applicable Model Toxics Control Act cleanup levels and screening levels at the former laundry building (referred to as Area of Concern [AOC] 1) at the former Northern State Hospital (also known as the Sedro-Woolley Innovation for Tomorrow Center property [the Property]). The building is currently leased by the Cascade Job Corps and is used by student occupants and visitors. While indoor air samples have been non-detect for cVOCs, the slab may degrade over time, increasing the risk for vapor intrusion and resulting in potential inhalation exposure to human receptors.

Problem Statement: This interim action is intended to mitigate inhalation exposure risk for occupants and visitors of the Property associated with concentrations of cVOCs above applicable Model Toxics Control Act cleanup levels and screening levels. The planned remedial action (i.e., installation of a sub-slab depressurization system) is intended to reduce the risk of inhalation exposure.

SSAP Objectives: This Plan defines the approach to implement the interim cleanup action, involving confirmation indoor air sampling, ambient air sampling, and vent stack emissions sampling.

Plan Attachments: Figure 5-1 and Drawings of the Interim Action Work Plan.

Field Task Manager: Carolyn Wise **Email:** cwise@maulfoster.com **Phone:** 360-690-5982

Field Investigation Contractor: Maul Foster & Alongi, Inc.

Field Team Leader: Evelyn Lundeen **Email:** elundeen@maulfoster.com **Phone:** 206-665-5747

Site	Primary Site Type	Sample Type	Field Measurements	Analysis	Schedule	Predetermined Location	Notes
Former laundry building (sample nomenclature outlined in Section 4.3.3)	Indoor Air	Task Specific Data Collection	• Differential pressure readings from manometers affixed to vent pipes • Differential pressure readings from manometers affixed to sub slab vapor pins	cVOCs by TO-15 SIM	Event Timing: One week after installation of sub-slab depressurization system (anticipated January 2024), then quarterly for first year of system operation.	Yes ☒ No ☐ Specify: INAIR01 through INAIR03 in the former laundry building as noted on Figure 5-1 of the IAWP.	Depending on indoor air results at planned locations, MFA may choose to conduct additional sampling.

Site	Primary Site Type	Sample Type	Field Measurements	Analysis	Schedule	Predetermined Location	Notes
Former laundry building (sample nomenclature outlined in Section 4.3.3)	Ambient Air	Task Specific Data Collection	• Differential pressure readings from manometers affixed to vent pipes • Differential pressure readings from manometers affixed to sub slab vapor pins	cVOCs by TO-15 SIM	Event Timing: One week after installation of sub-slab depressurization system (anticipated January 2024), then quarterly for first year of system operation.	Yes ☒ No ☐ Specify: OUTAIR01 is located upwind of the former laundry building during indoor air collection sampling. The final location will be informed by weather conditions during sampling.	--
Former laundry building (sample nomenclature outlined in Section 4.3.3)	Air Emissions from Vent Stacks	Task Specific Data Collection	• Differential pressure readings from manometers affixed to vent pipes • Differential pressure readings from manometers affixed to sub slab vapor pins	cVOCs by TO-15 SIM	Event Timing: After installation of sub-slab depressurization system during wet and dry season (anticipated January and July 2024), for first year of system operation.	Yes ☒ No ☐ Specify: VENT01 through VENT05 in the former laundry building as noted on Figure 5-1 of the IAWP.	--

Samples for all analyses will be shipped to:
Friedman & Bruya, Inc.
3012 16th Avenue W
Seattle, Washington 98119

Sample Custody Notes: Samples will be analyzed on a standard turnaround time.

Notes

Analytical methods, performance criteria, and reporting limits as per Table 4-1.
Container, preservation, and holding time requirements as per Table 4-2.
Quality control samples to be collected as per Table 4-3.
cVOCs = chlorinated volatile organic compounds.
IAWP = Interim Action Work Plan.
MFA = Maul Foster & Alongi, Inc.
TO-15 SIM = U.S. Environmental Protection Agency Method Toxic Organics-15 Selective Ion Monitoring.

Carolyn Wise, LHG
Maul Foster & Alongi, Inc., Project Manager
Date: 08/24/2023

Mary Benzinger
Maul Foster & Alongi, Inc., Quality Assurance Manager
Date: 08/24/2023

SAP/QAPP
APPENDIX B
AIR SAMPLING STANDARD OPERATING PROCEDURE

MAUL FOSTER ALONGI

STANDARD OPERATING PROCEDURE

Soil Vapor Sampling

SOP Number: 16
Date: 3/9/2021
Revision Number: 0.1

SCOPE AND APPLICATION

This standard operating procedure (SOP) describes the methods for collecting soil vapor samples from temporary or permanent equipment installed in unsaturated subsurface soil. Sample collection may require drilling through concrete or asphalt to gain access to subsurface soils.

EQUIPMENT AND MATERIALS REQUIRED

The following materials are necessary for this procedure:

- Personal protective equipment (as specified in the health and safety plan)
- Measuring tape, Teflon™ tape, wrenches
- Laboratory-supplied sample canister (e.g., Summa), manifolds, and flow controllers
- Leak-detection equipment (helium tank, two-stage regulator, and gas-flow-control valve; and helium leak detector)
- Vacuum (purge) pump
- Laboratory chain-of-custody form
- Equipment decontamination supplies if vapor-sampling equipment[instruments?] will be reused between sample locations (see SOP 1 for equipment decontamination procedures)
- Soil vapor field sampling datasheet and notebook

METHODOLOGY

When the project-specific sampling and analysis plan (SAP) provides additional or different requirements for vapor sampling, it takes precedence over this SOP. In the absence of a SAP, the procedures in this SOP shall be used.

Complete the attached questionnaire before beginning vapor-sampling activities. The intent of this questionnaire is to document potential sources of vapors that could require the collection of vapor samples that are not representative of vapors present in subsurface soil.

General Sampling Procedure:

Sample collection from a temporary or permanent boring

- Installation of the sample point may be completed manually or by a drilling subcontractor. See SOPs 7 and 8 for drilling procedures.
- Vapor point construction details, including screen length and depth placement, annular material, and seal specifications, may be project-specific and should be described in the project SAP.
- Clear the ground surface of brush, root mat, grass, leaves, and other debris.
- Remove soil to the target depth, verify that the sample depth is correct, and record the depth in the field notebook and the boring log (see SOP 2).
- Assemble and attach the sampling equipment as described below. Before sampling, temporary sampling points must equilibrate for at least 30 minutes. Permanent points should equilibrate for at least 48 hours.

Sample collection from a subslab sample point

Subslab soil-gas sampling points consist of a Cox-Colvin & Associates, Inc. (Cox-Colvin) Vapor Pin™ system. The procedures developed by Cox-Colvin for installing and removing the Vapor Pin system, including the secure cover, are attached.

Assembly and attachment of sampling equipment

- Connect the sampling equipment as shown in the attached figure such that the equipment can be purged, leak tested, shut-in tested, and sampled in the field.
- The vapor pin installed in an asphalt or cement slab will be connected to the ¼ turn Swagelok® ball valve (Valve #1—sampling valve), using appurtenant stainless steel or Tygon® tubing. The sampling valve is connected to a vacuum gauge, which is attached to the flow controller.
- At the flow controller, a Swagelok tee connection will be fitted to the canister and to a second ¼ turn Swagelok ball valve (Valve #2—purge valve) used to isolate the purging equipment during actual sampling.
- The canister has a built-in valve that allows isolation of the canister during purging and leak-checking activities. On the other side of the purge valve (#2), a vacuum pump will be connected in order to induce vacuum for purging and shut-in testing.

Leak detection

- Helium will be contained around the sampling apparatus and sampling pin to serve as a leak-check compound. Helium will be released into a small structure (shroud) that is placed over the sampling pin and sampling train.
- With the canister valve closed, a sample of the soil gas collected during purging (described below) will be contained in a Tedlar® bag.
- A field helium detector will be used to sample the air purged through the sampling train to verify the presence or absence of helium. A helium concentration greater than 10 percent of the concentration in the containment structure indicates that a leak is occurring.
- If a leak is detected, the sampling and purging train fittings will be tightened and the leak check will be repeated.
- The absence of helium during the purging process verifies the integrity of the sampling system before the sample is collected.
- The canister will also be analyzed for helium by the analytical laboratory as a quality assurance measure.

Sampling

- After the sampling train is purged and no leaks are detected in the sampling train, close the valve leading to the vacuum pump (Valve #2—purge valve), open the valve leading to the sampling pin (Valve #1—sample valve), and then open the valve on the canister to collect the sample over a 30-minute period or the duration of time required for the specific test.
- Record field data during the sampling on the soil vapor field sampling datasheet, including the sampling start and stop times, the initial and final canister vacuum readings, and weather conditions.
- The sample will be rejected if the initial canister pressure is not at least -25 inch of mercury or if the final canister pressure is greater than -0.1 inch of mercury. The final canister pressure is recommended at or near -5 inch of mercury.

Data Recording
In a field log notebook and soil vapor field sampling datasheet, record the following:

- Project name, sample date, sampling location, canister serial number, initial vacuum reading, final pressure reading, and sampling time.
- Weather conditions during sampling (temperature, barometric pressure, humidity, sunny/cloud cover, wind).
- Date and amount of most recent prior rainfall.

Abandonment of Sampling Points

- Temporary Borings: Abandon each borehole in accordance with local and state regulations/procedures. See SOPs 7 and 8 for borehole abandonment procedures. The abandonment procedure typically consists of filling the boring with granular bentonite and hydrating the bentonite with water. Match the surface completion to the surrounding materials.
- Subslab Vapor Pin: The subslab vapor pin will be properly decommissioned consistent with the attached Cox-Colvin procedure. The slab borehole will be filled with grout and/or concrete. Surface restoration may include a follow-up visit for final sanding and finish work to restore the floor slab, and associated coverings, to their original condition as required.

QUESTIONNAIRE

Preparer's Name:_____

Date/Time Prepared: _____

Preparer's Affiliation:_____

1. OCCUPANT:

Last Name:_____First Name:_____

Building / Suite:_____

Number of occupants/persons at this location:_____

2. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. **Are petroleum-powered machines or vehicles stored in the building or attached garage?** (e.g., lawnmower, ATV, car) Y / N
   Please specify _____
b. **Has the building ever had a fire?** Y / N
   When?_____
c. **Is a kerosene or unvented gas space heater present?** Y / N
   Where & Type?_____
d. **Is there a workshop or hobby/craft area?** Y / N
   Where & Type?_____
e. **Is there smoking in the building?** Y / N
   Frequency?_____
f. **Have cleaning products been used recently?** Y / N
   When & Type?_____
g. **Have cosmetic products been used recently?** Y / N
   When & Type?_____
h. **Has painting/staining been done in the last 6 months?** Y / N
   Where & When? _____
i. **Is there new carpet, drapes, or other textiles?** Y / N
   Where & When?_____
j. **Have air fresheners been used recently?** Y / N
   When & Type?_____
k. **Is there a kitchen exhaust fan?** Y / N
   If yes, where vented?_____

QUESTIONNAIRE

l. **Is there a bathroom exhaust fan?** Y / N

If yes, where vented?_____

m. **Is there a clothes dryer?** Y / N

If yes, is it vented outside? Y / N

n. **Has there been a pesticide application?** Y / N

When & Type?_____

o. **Are there odors in the building?** Y / N

If yes, please describe:_____

p. **Do any of the building occupants use solvents or volatile chemicals at work?** (e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide applicator, cosmetologist, carpet installer) Y / N

If yes, what type of solvents are used? _____

If yes, are the occupants' clothes washed at work? Y / N

3. PRODUCT INVENTORY FORM

List specific products in the building that may contain petroleum hydrocarbons. Please note that MFA will visit the site to help complete the product inventory.

Location	Product Description	Size (units)	Condition*

***Describe the condition of the product containers as unopened, used, or deteriorated.**

Standard Operating Procedure Installation and Extraction of the Vapor Pin™

May 20, 2011

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™[1] for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the Vapor Pin™ for the collection of sub-slab soil-gas samples.

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve (Figure 1)];
- Hammer drill;
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8" x 22" #00206514 or equivalent);
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch diameter bottle brush;
- Wet/dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, as necessary;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel.

[1]Cox-Colvin & Associates, Inc., designed and developed the Vapor Pin™; a patent is pending.

Figure 1. Assembled Vapor Pin™.

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch diameter hole at least 1¾-inches into the slab.

4) Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the Vapor Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a

dead blow hammer (Figure 2). Make sure the extraction/installation tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

Figure 2. Installing the Vapor Pin™.

For flush mount installations, unscrew the threaded coupling from the installation/extraction handle and use the hole in the end of the tool to assist with the installation (Figure 3).

Figure 3. Flush-mount installation.

During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective cap on Vapor Pin™ to prevent vapor loss prior to sampling (Figure 4).

Figure 4. Installed Vapor Pin™.

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover.

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™ (Figure 5).

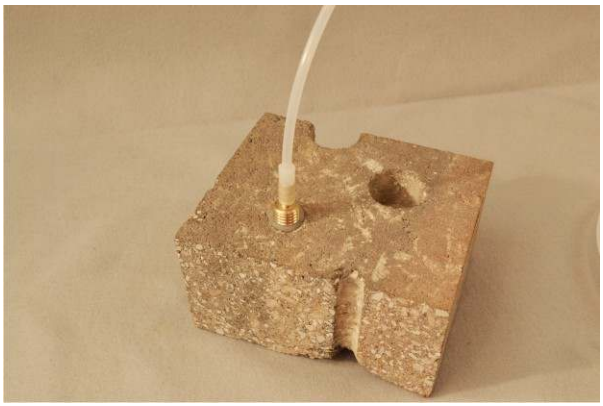


Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests [(e.g., real-time monitoring of oxygen levels on extracted sub-slab soil gas, or placement of a water

dam around the Vapor Pin™) Figure 6]. Consult your local guidance for possible tests.

Figure 6. Water dam used for leak detection.

11) Collect sub-slab soil gas sample. When finished sampling, replace the protective cap and flush mount cover until the next sampling event. If the sampling is complete, extract the Vapor Pin™.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the Vapor Pin™ (Figure 7). Continue turning the tool to assist in extraction, then pull the Vapor Pin™ from the hole (Figure 8).

Figure 7. Removing the Vapor Pin™.

Figure 8. Extracted Vapor Pin™.

2) Fill the void with hydraulic cement and smooth with the trowel or putty knife.

3) Prior to reuse, remove the silicone sleeve and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 130° C.

The Vapor Pin™ to designed be used repeatedly; however, replacement parts and supplies will be required periodically. These parts are available on-line at www.CoxColvin.com.

Replacement Parts:

Vapor Pin™ Kit Case - VPC001
Vapor Pins™ - VPIN0522
Silicone Sleeves - VPTS077
Installation/Extraction Tool - VPIE023
Protective Caps - VPPC010
Flush Mount Covers - VPFM050
Water Dam - VPWD004
Brush - VPB026

Standard Operating Procedure Use of the Vapor Pin™ Drilling Guide and Secure Cover

July 16, 2012

Scope:

This standard operating procedure (SOP) describes the methodology to use the Vapor Pin™ Drilling Guide and Secure Cover to install and secure a Vapor Pin™ in a flush mount configuration.

Purpose:

The purpose of this SOP is to detail the methodology for installing a Vapor Pin™ and Secure Cover in a flush mount configuration. The flush mount configuration reduces the risk of damage to the Vapor Pin™ by foot and vehicular traffic, keeps dust and debris from falling into the flush mount hole, and reduces the opportunity for tampering. This SOP is an optional process performed in conjunction with the SOP entitled "Installation and Extraction of the Vapor Pin™". However, portions of this SOP should be performed prior to installing the Vapor Pin™.

Equipment Needed:

- Vapor Pin™ Secure Cover (Figure 1);
- Vapor Pin™ Drilling Guide (Figure 2);
- Hammer drill;
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent);
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8" x 22" #00226514 or equivalent);
- assembled Vapor Pin™;
- #14 spanner wrench;
- Wet/Dry vacuum with HEPA filter (optional); and
- personal protective equipment (PPE).

Figure 1. Vapor Pin™ Secure Cover.

Figure 2. Vapor Pin™ Drilling Guide.

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) While wearing PPE, drill a 1½-inch diameter hole into the concrete slab to a

depth of approximately 1 3/4 inches. Pre-marking the desired depth on the drill bit with tape will assist in this process.

4) Remove cuttings from the hole and place the Drilling Guide in the hole with the conical end down (Figure 3). The hole is sufficiently deep if the flange of the Drilling Guide lies flush with the surface of the slab. Deepen the hole as necessary, but avoid drilling more than 2 inches into the slab, as the threads on the Secure Cover may not engage properly with the threads on the Vapor Pin™.

Figure 3. Installing the Drilling Guide.

5) When the 1½-inch diameter hole is drilled to the proper depth, replace the drill bit with a $^{5}/_{8}$-inch diameter bit, insert the bit through the Drilling Guide (Figure 4), and drill through the slab. The Drilling Guide will help to center the hole for the Vapor Pin™, and keep the hole perpendicular to the slab.

6) Remove the bit and drilling guide, clean the hole, and install the Vapor Pin™ in accordance with the SOP "Installation and Extraction of the Vapor Pin™.

Figure 4. Using the Drilling Guide.

7) Screw the Secure Cover onto the Vapor Pin™ and tighten using a #14 spanner wrench by rotating it clockwise (Figure 5). Rotate the cover counter clockwise to remove it for subsequent access.

Figure 5. Tightening the Secured Cover.

Limitations:

On slabs less than 3 inches thick, it may be difficult to obtain a good seal in a flush mount configuration with the Vapor Pin™.

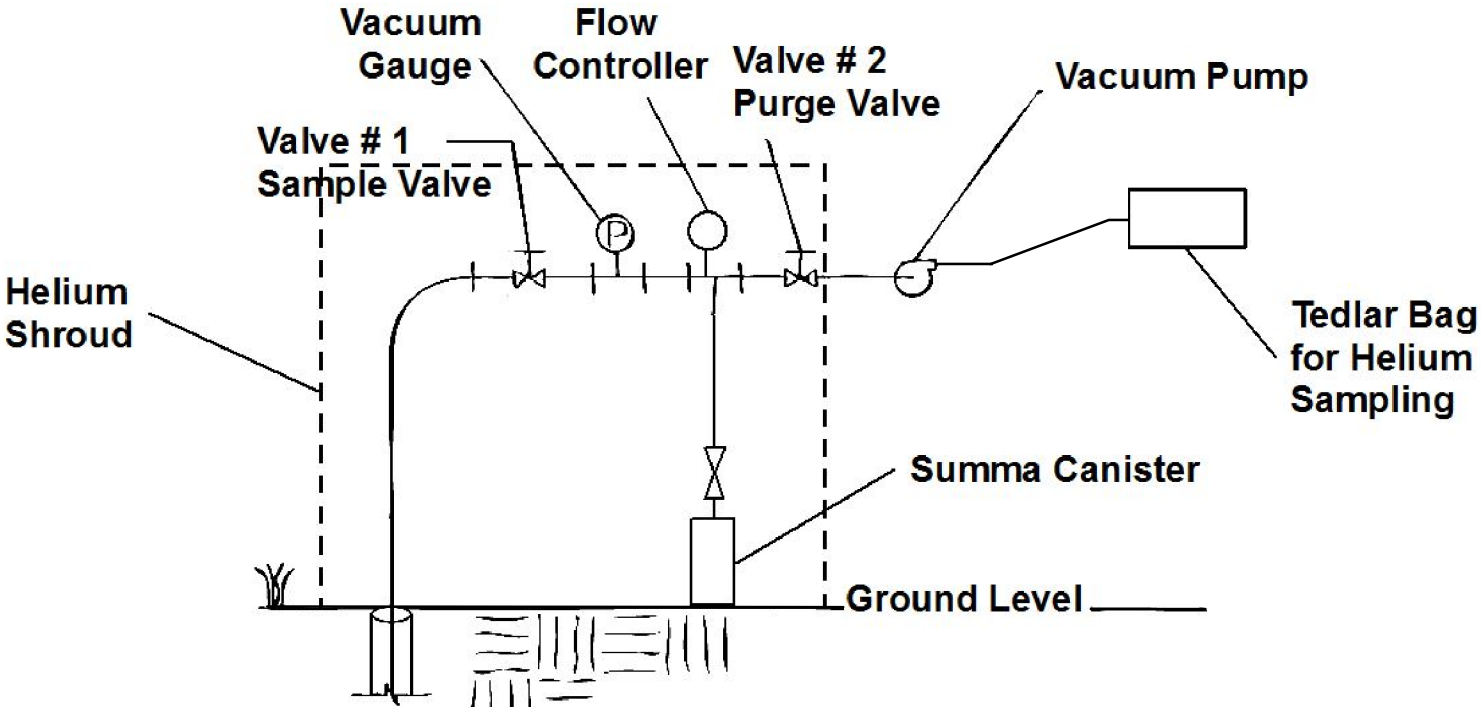


Figure
Sub-Slab Soil Gas Sampler System

Former Office Building
Port of Astoria
Astoria, Oregon

Source: CH2MHill, Corvallis Applied Sciences Laboratory

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STANDARD OPERATING PROCEDURE

Ambient Air Sampling

SOP Number: 17
Date: 3/9/2021
Revision Number: 0.1

SCOPE AND APPLICATION

This standard operating procedure (SOP) describes the methods for collecting ambient air samples, using laboratory-supplied canisters with flow controllers.

EQUIPMENT AND MATERIALS REQUIRED

The following materials are necessary for this procedure:

- Personal protective equipment (as specified in the health and safety plan)
- Measuring tape, Teflon™ tape, wrenches
- Identification placards to inform the public (as needed)
- Straps/chains to secure outdoor samples
- Laboratory-supplied sample canister (e.g., Summa) and flow controllers
- Laboratory chain-of-custody form
- Decontamination materials
- Field forms or notebook for documenting the sampling procedures

METHODOLOGY

When the project-specific sampling and analysis plan (SAP) specifies additional or different requirements for ambient air sampling, it takes precedence over this SOP. In the absence of a SAP, the procedures in this SOP shall be used.

Complete the attached questionnaire before beginning indoor ambient air sampling activities.

General Sampling Procedure:

- Identify potential sources of target or interfering compounds from inside the building or from the product inventory portion of the questionnaire; remove these before beginning sampling.
- Place sample containers for indoor sampling between 3 and 5 feet above the floor to represent sampling from a typical human breathing zone. Protect containers from disturbance for the duration of the sampling.
- Record field data before and after the sampling, including the sampling start and stop times, the initial and final canister vacuum readings, temperature, relative humidity, barometric pressure and observations of conditions that may influence sampling results (e.g., presence or use of petroleum products, open windows/doors). The sample will be rejected if the initial canister pressure is not at least -25 inch of mercury or if the final canister pressure is greater than -0.1 inch of mercury.
- Slowly open the control valve to allow collection of the sample. Return to the sampler before the programmed sample duration so that some vacuum remains in the container. Close the sample container valve and process the sampling container for shipment to the analytical laboratory.
- Other items to record in the field notebook/form include the sampling location, canister serial number, and weather conditions (temperature, barometric pressure, humidity, sunny/cloudy, wind).

QUESTIONNAIRE

Preparer's Name:_____

Date/Time Prepared: _____

Preparer's Affiliation:_____

1. OCCUPANT:

Last Name:_____First Name:_____

Building / Suite:_____

Number of occupants/persons at this location:_____

2. FACTORS THAT MAY INFLUENCE AIR QUALITY

a. **Are petroleum-powered machines or vehicles stored in the building attached garage?** (e.g., lawnmower, ATV, car) Y / N
   Please specify _____
b. **Has the building ever had a fire?** Y / N
   When?_____
c. **Is a kerosene or unvented gas space heater present?** Y / N
   Where & Type?_____
d. **Is there a workshop or hobby/craft area?** Y / N
   Where & Type?_____
e. **Is there smoking in the building?** Y / N
   Frequency?_____
f. **Have cleaning products been used recently?** Y / N
   When & Type?_____
g. **Have cosmetic products been used recently?** Y / N
   When & Type?_____
h. **Has painting/staining been done in the last 6 months?** Y / N
   Where & When? _____
i. **Is there new carpet, drapes, or other textiles?** Y / N
   Where & When?_____
j. **Have air fresheners been used recently?** Y / N
   When & Type?_____
k. **Is there a kitchen exhaust fan?** Y / N
   If yes, where vented?_____

QUESTIONNAIRE

l. **Is there a bathroom exhaust fan?** Y / N

If yes, where vented?_____

m. **Is there a clothes dryer?** Y / N

If yes, is it vented outside? Y / N

n. **Has there been a pesticide application?** Y / N

When & Type?_____

o. **Are there odors in the building?** Y / N

If yes, please describe:_____

p. **Do any of the building occupants use solvents or volatile chemicals at work?** (e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide applicator, cosmetologist, carpet installer) Y / N

If yes, what type of solvents are used? _____

If yes, are the occupants' clothes washed at work? Y / N

3. PRODUCT INVENTORY FORM

List specific products in the building that may contain petroleum hydrocarbons. Please note that MFA will visit the site to help complete the product inventory.

Location	Product Description	Size (units)	Condition*

***Describe the condition of the product containers as unopened, used, or deteriorated.**

SAP/QAPP
APPENDIX C
SAMPLE PLAN ALTERATION FORM

SAMPLE PLAN ALTERATION FORM

Project Name and Number:

Material to be Sampled:

Measurement Parameters:

Standard Procedure for Field Collection and Laboratory Analysis (cite references):

Reason for Change in Field Procedure or Analytical Variation:

Variation from Field or Analytical Procedure:

Special Equipment, Materials, or Personnel Required:

CONTACT, Title	APPROVED SIGNATURE	DATE
Initiator:		
Contractor PM:		
EPA PM:		
EPA QA Manager or designee:		

APPENDIX C
GEOLOGIC BORING LOGS

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.02	**GP8**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**08/19/14 to 08/19/14**	Northing	
Driller/Equipment	**ESN Northwest/SP30-Direct Push Stratoprobe**	Easting	
Geologist/Engineer	**H. Hirsch/C. Wise**	Hole Depth	**19.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**50**	**GP**					0.0 to 1.1 feet: GRAVELLY SAND (SW); light gray; 5% fines; 70% sand, fine to coarse; 25% gravel, fine, subangular; loose; trace woody debris; dry to moist.
2									@ 1.8 to 1.9 feet: coal fragments.
									1.1 to 2.0 feet: SILT (ML); light brown; 95% fines, medium plasticity; 5% sand; very stiff; trace organics; orange/gray mottles; moist.
3									2.0 to 4.0 feet: no recovery.
4			**85**	**GP**					4.0 to 7.4 feet: SILT (ML); light brown; 95% fines, medium plasticity; 5% sand; very stiff; trace organics; orange/gray mottles; moist.
5									
6									
7	▽			**GW**					
8									7.4 to 8.0 feet: no recovery.
9			**77.5**	**GP**					8.0 to 11.1 feet: SILT (ML); light brown; 95% fines, medium plasticity; 5% sand; soft; trace organics, orange/gray mottles; moist.
10									
11									11.1 to 12.0 feet: no recovery.
12			**100**	**GP**					12.0 to 14.1 feet: SILT (ML); light brown; 95% fines, medium plasticity; 5% sand; soft; trace organics; orange/gray mottles; moist.
13						**GP8-W-12.5**			@ 12.8 to 15.5 feet: lenses of medium to coarse sand with gravel.
14									14.1 to 14.7 feet: SILTY SAND (SM); dark gray; 30% fines, nonplastic; 70% sand, fine; medium dense; wet.
15									14.7 to 15.2 feet: CLAY (CL); dark gray; 100% fines, high plasticity; very soft; wet.
16			**100**	**GP**					15.2 to 16.0 feet: SILTY SAND (SM); dark gray; 30% fines, nonplastic; 70% sand, fine; medium dense; wet.
17									16.0 to 18.2 feet: CLAY (CL); dark gray; 100% fines, high plasticity; very soft; wet.
18									
19									18.2 to 19.0 feet: SILTY SAND (SM); dark gray; 30% fines, nonplastic; 70% sand, fine; medium dense; wet.

Total Depth = 19.0 feet below ground surface.

NOTES: *No soil samples collected. Groundwater sample collected (GP8-W-12.5). Temporary screen installed from 7.0 to 18.0 feet. Boring decommissioned with bentonite chips hydrated with potable water.*
GP = Geoprobe macrocore liner.
GW = groundwater sample.

▽ ***Water level prior to sampling.***

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.02	**GP8**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
									Borehole Completion Details: *0.0 to 19.0 feet: 2.25-inch borehole.* *0.0 to 19.0 feet: bentonite chips hydrated with potable water.*

NOTES: *No soil samples collected. Groundwater sample collected (GP8-W-12.5). Temporary screen installed from 7.0 to 18.0 feet. Boring decommissioned with bentonite chips hydrated with potable water.*
GP = Geoprobe macrocore liner.
GW = groundwater sample.

▽ ***Water level prior to sampling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP21**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/21/15 to 4/21/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**20.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**70**	**GP**		**GP21-S-0.5** **PID = 0.0 ppm**			*0.0 to 1.0 feet: SANDY SILT (ML); dark brown; 60% fines; 30% sand, poorly sorted, angular to subrounded; 10% gravel, angular; dry to moist.*
2									*1.0 to 3.5 feet: SILT (ML); yellowish gray; 90% fines, nonplastic; 10% sand, fine, subangular to subrounded; hard; dry.*
3									
4									*3.5 to 7.0 feet: no recovery.*
5			**60**	**GP**					
6									
7									*7.0 to 10.0 feet: SILT (ML); yellowish gray; 90% fines, nonplastic; 10% sand, fine, subangular to subrounded; hard; dry.*
8									
9									*@ 8.5 feet: 4 inches of black gravel with sand.*
10			**50**	**GP**					*10.0 to 13.0 feet: SILT (ML); yellowish gray; 90% fines, nonplastic; 10% sand, fine, subangular to subrounded; hard; dry.*
11									
12									
13									*13.0 to 15.0 feet: no recovery.*
14									
15			**100**	**GW** **GP**					*15.0 to 15.5 feet: SILT (ML); yellowish gray; 90% fines, nonplastic; 10% sand, fine, subangular to subrounded; hard; dry.*
16						**GP21-S-15.5** **PID = 0.0 ppm**			*15.5 to 18.5 feet: GRAVELLY SAND (SW); grayish black; 10% fines; 60% sand, medium to coarse, poorly sorted; 30% gravel, subrounded to subangular; trace woody debris; moist.*
17	▽								
18									
19						**GP21-W-19.0**			*18.5 to 19.5 feet: GRAVELLY SAND (SP); reddish brown; 20% fines; 50% sand, coarse, angular; 30% gravel, coarse, angular to subangular; wet.*
20									*@ 19.5 feet: brick piece.*

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP21**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
									19.5 to 20.0 feet: SILT (ML); blue to gray green; 90% fines, nonplastic to medium plasticity; 10% sand, fine, hard; trace gravel; wet.

Total Depth = 20.0 feet below ground surface.

Tempoary screen set at 15.0 to 20.0 feet below ground surface.

Borehole Completion Details:
0.0 to 20.0 feet: 2.25-inch borehole.
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP23**	**1 of 1**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/21/15 to 4/21/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**15.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**80**	**GP**					*0.0 to 0.4 feet: GRAVELLY SAND TO SANDY GRAVEL WITH SILT (SW-GW); gray; 20% fines; 40% sand, fine to coarse, subrounded to subangular; 40% gravel, fine to coarse, subrounded to subangular; dry.*
2									*0.4 to 4.1 feet: CLAY (CL); yellowish brown; 95% fines, medium plasticity; 5% sand, very fine; hard; dry to moist.*
3									
4						**GP23-S-4.0 PID = 0.0 ppm**			
5									*4.1 to 5.0 feet: no recovery.*
6			**100**	**GP**		**GP23-S-5.0 PID = 0.0 ppm**			*5.0 to 12.5 feet: CLAY (CL); yellowish brown; 85% fines, medium to high plasticity; 15% sand, fine to medium, subrounded to subangular; soft; moist.*
7									
8									
9									
10			**100**	**GP**					
11									
12									
13									*12.5 to 14.5 feet: CLAY (CL); blue gray; 100% fines, medium to high plasticity; very soft; moist to wet.*
14						**GP23-S-13.0 PID = 0.0 ppm**			
15						**GP23-S-15.0 PID = 0.0 ppm**			*14.5 to 15.0 feet: SAND (SP); gray; 20% fines; 80% sand, very fine to fine, subangular to subrounded, well sorted; moist to wet.*

Total Depth = 15.0 feet below ground surface.

Borehole Completion Details:
0.0 to 15.0 feet: 2.25-inch borehole.
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP24**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/21/15 to 4/21/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**20.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**100**	**GP**					*0.0 to 2.0 feet: SILTY SAND (SW); gray; 30% fines; 50% sand, poorly sorted, fine to coarse, subangular to angular; 20% gravel, angular to subangular; dry.*
2									
3						**GP24-S-2.0 PID = 0.0 ppm**			*2.0 to 14.5 feet: SILT (ML); reddish brown; 90% fines, hard, nonplastic to medium plasticity; 10% sand, fine; dry to moist.*
4									
5									
6			**100**	**GP**					
7									
8						**GP24-S-7.5 PID = 0.0 ppm**			
9									
10									
11			**100**	**GP**					
12									
13									
14	▽					**GP24-S-13.0 PID = 0.0**			
15									*14.5 to 15.5 feet: SAND WITH SILT (SP); gray; 20% fines; 80% sand, medium to fine, well sorted, subrounded to subangular; wet.*
16			**100**	**GW GP**					*15.5 to 20.0 feet: CLAY (CL); blue gray; 90% fines, medium to high plasticity; 10% sand, subrounded, fine; soft; wet.*
17									*@ 16.5 feet: minor sand lenses.*
18						**GP24-W-18.0**			*@ 18.0 feet: minor sand lenses.*
19									
20									

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP24**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Sample Data: Percent Recovery	Sample Data: Collection Method	Sample Data: Number	Sample Data: Name (Type)	Sample Data: Blows/6"	Lithologic Column	Soil Description

Total Depth = 20.0 feet below ground surface.

Temporary screen set at 15.0 to 20.0 feet below ground surface.

Borehole Completion Details:
0.0 to 20.0 feet: 2.25-inch borehole.
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP25**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/21/15 to 4/21/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**20.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**94**	**GP**		**GP25-S-1.0 PID = 0.0 ppm**			0.0 to 1.4 feet: GRAVELLY SAND TO SANDY GRAVEL WITH SILT (SW-SG); brownish black; 20% fines; 40% sand, medium to coarse, subangular to angular; 40% gravel, fine to coarse, subangular to angular; dry.
2						**GP25-S-1.8 PID = 0.0 ppm**			1.4 to 4.7 feet: SILT (ML); brown; 90% fines, low plasticity; 10% sand, very fine; stiff; moist.
3									
4									
5									4.7 to 5.0 feet: no recovery.
6			**100**	**GP**		**GP25-S-6.0 PID = 0.0 ppm**			5.0 to 12.5 feet: SILT (ML); brown; 90% fines, low plasticity; 10% sand, very fine; stiff; moist.
7									
8									
9									
10			**100**	**GP**		**GP25-S-10.0 PID = 0.0 ppm**			
11									
12									
13	▽			**GW**					12.5 to 15.0 feet: CLAY (CL); blue gray; 90% fines, medium to high plasticity; 10% sand, very fine to fine; very soft; intermittant thin lenses of 15% fine sand; wet.
14									
15			**80**	**GP**		**GP25-W-15.0**			15.0 to 19.0 feet: CLAY (CL); blue gray; 90% fines, medium to high plasticity; 10% sand, very fine to fine; very soft; wet.
16									
17									
18									
19									19.0 to 20.0 feet: no recovery.
20									

NOTES: (1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).

▽ **Water level observed at time of drilling.**

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Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP25**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Sample Data: Percent Recovery	Sample Data: Collection Method	Sample Data: Number	Sample Data: Name (Type)	Sample Data: Blows/6"	Lithologic Column	Soil Description

Total Depth = 20.0 feet below ground surface.

Temporary screen set at 13.0 to 18.0 feet below ground surface.

Borehole Completion Details:
0.0 to 20.0 feet: 2.25-inch borehole.
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP26**	**1 of 1**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/21/15 to 4/21/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**15.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**80**	**GP**		**GP26-S-0.5** **PID = 0.0 ppm**			*0.0 to 0.5 feet: SILT (ML); dark brown; 90% fines, nonplastic; 10% sand, fine to medium, subangular; hard; trace roots and gravel; dry.*
2									*0.5 to 4.0 feet: SILT WITH SAND (ML); yellowish brown; 70% fines, nonplastic; 20% sand, medium to fine, poorly sorted; 10% gravel, angular; medium hard; dry to moist.*
3									
4									
5									*4.0 to 5.0 feet: no recovery.*
6			**100**	**GP**		**GP26-S-5.5** **PID = 0.0 ppm**			*5.0 to 5.5 feet: SILT WITH SAND (ML); yellowish brown; 70% fines, nonplastic; 20% sand, medium to fine, 10% gravel, angular; medium hard; dry to moist.*
7						**GP26-S-6.0** **PID = 0.1 ppm**			*5.5 to 6.0 feet: SILTY SAND WITH GRAVEL (SP); grayish black; 30% fines, nonplastic; 50% sand, coarse to very coarse, subangular to subrounded; 20% gravel, angular to subrounded; wet.*
8									*6.0 to 13.0 feet: SILT WITH SAND (ML); yellowish gray; 80% fines, nonplastic to low plasticity; 20% sand, fine, subangular; trace gravel; mottled; moist to dry.*
9									*@ 8.5 feet: minor sand lense.*
10									*@ 9.5 feet: minor sand lense.*
11	▽		**100**	**GW** **GP**		**GP26-S-10.5** **PID = 0.4 ppm**			
12									
13						**GP26-W-12.5**			
14									*13.0 to 15.0 feet: SILT (ML); blue gray; 90% fines, nonplastic; 10% sand, fine, subrounded to subangular; soft; trace gravel; wet.*
15									

Total Depth = 15.0 feet below ground surface.

Tempoary screen set at 10.0 to 15.0 feet below ground surface.

Borehole Completion Details:
0.0 to 15.0 feet: 2.25-inch borehole.
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

GBLWC W:\GINT\GINTW\PROJECTS\0624.04.07\GP11 TO GP44.GPJ 6/30/15

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP27**	**1 of 1**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/22/15 to 4/22/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**15.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**50**	**GP**		**GP27-S-0.5** **PID = 0.0 ppm**			*0.0 to 0.9 feet: SANDY SILT (ML); gray; 50% fines, nonplastic; 40% sand, poorly sorted, fine to very coarse, subrounded to subangular; 10% gravel, angular to subrounded; dry.*
2									*0.9 to 2.5 feet: SILT WITH SAND (ML); yellowish brown with mottling; 80% fines, nonplastic; 20% sand, fine; hard; trace micas; dry.*
3						**GP27-S-2.0** **PID = 0.0 ppm**			*@ 2.5 feet: brick pieces.* *2.5 to 5.0 feet: no recovery.*
4									
5									
6			**100**	**GP**					*5.0 to 9.4 feet: SILT WITH SAND (ML); yellowish brown; 80% fines, nonplastic; 20% sand, fine; hard; trace micas; mottled; dry to wet.* *@ 5.4 feet: sand lense.*
7									
8	▽					**GP27-S-7.0** **PID = 0.0 ppm**			
9									
10									*9.4 to 10.6 feet: SILTY SAND (SM); 40% fines, nonplastic; 50% sand, poorly sorted, fine to very coarse, subrounded; 10% gravel; wet.*
11			**100**	**GW** **GP**		**GP27-W-10.0**			*@ 9.8 feet: brick piece.* *10.6 to 12.2 feet: CLAY (CH); yellowish brown; 95% fines, high plasticity; 5% sand; soft; trace amounts of micas; wet.*
12									
13									*12.2 to 15.0 feet: CLAY WITH SAND (CL); blue gray; 80% fines, high plasticity; 20% sand, fine, well sorted; soft; trace micas; wet.*
14									
15									

Total Depth = 15.0 feet below ground surface.

Temporary screen set at 10.0 to 15.0 feet below ground surface.

Borehole Completion Details:
0.0 to 15.0 feet: 2.25-inch borehole.
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

GBLWC W:\GINT\GINTW\PROJECTS\0624.04.07\GP11 TO GP44.GPJ 6/30/15

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP28**	**1 of 1**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/22/15 to 4/22/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**15.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**92**	**GP**		**GP28-S-0.5** **PID = 0.0 ppm**			*0.0 to 1.1 feet: SANDY SILT (ML); brown; 70% fines, nonplastic to low plasticity; 30% sand, very fine to fine; hard; trace rootlets and organics; moist.*
2									*1.1 to 4.6 feet: SILT WITH SAND (ML); yellowish brown with orange mottling; 80% fines, nonplastic; 20% sand, fine, subangular to angular; hard; dry to moist.*
3									
4									
5									*4.6 to 5.0 feet: no recovery.*
6			**100**	**GP**		**GP28-S-6.0** **PID = 0.0 ppm**			*5.0 to 10.0 feet: SILT WITH SAND (ML); yellowish brown with orange mottling; 80% fines, nonplastic; 20% sand, fine, subangular to angular; hard; moist to wet.*
7									
8									
9									
10									
11	▽		**100**	**GP** **GW**					*10.0 to 13.7 feet: SILT WITH SAND (ML); yellowish brown; 85% fines, low to medium plasticity; 15% sand, fine; soft; wet.*
12									
13						**GP28-W-13.0**			
14									*13.7 to 15.0 feet: CLAY WITH SAND (CH); blue gray; 80% fines, high plasticity; 20% sand, fine; soft; wet.*
15									

Total Depth = 15.0 feet below ground surface.

Tempoary screen set at 10.0 to 15.0 feet below ground surface.

Borehole Completion Details:
0.0 to 15.0 feet: 2.25-inch borehole.
0.0 to 15.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

GBLWC W:\GINT\GINTW\PROJECTS\0624.04.07\GP11 TO GP44.GPJ 6/30/15

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP29**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/22/15 to 4/22/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**K. Roslund and C. Wise**	Hole Depth	**20.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**90**	**GP**		**GP29-S-0.5** **PID = 0.0 ppm**			*0.0 to 0.5 feet: SANDY GRAVEL (GW); black; 20% sand, medium to coarse, angular to subangular; 80% gravel, fine to coarse, angular; dry.*
2									*0.5 to 4.5 feet: SILT (ML); yellowish brown; 90% fines, nonplastic; 10% sand, very fine to fine; hard; dry.*
3									
4									
5									*4.5 to 5.0 feet: no recovery.*
6			**100**	**GP**		**GP29-S-5.0** **PID = 0.0 ppm**			*5.0 to 13.0 feet: SILT (ML); yellowish brown; 90% fines, nonplastic; 10% sand, very fine to fine; hard; dry to moist.*
7									
8						**GP29-S-7.0** **PID = 0.0 ppm**			
9									
10									
11			**70**	**GP**					
12									
13									*13.0 to 13.5 feet: SILT (ML); blue gray with orange mottling; 90% fines, low plasticity; 10% sand, fine; soft; moist.*
14									*13.5 to 15.0 feet: no recovery.*
15	▽		**70**	**GW** **GP**		**GP29-W-19.0**			*15.0 to 16.0 feet: SANDY SILT (ML); brown; 60% fines, low to medium plasticity; 40% sand, medium to coarse, subangular to angular; soft; wet.*
16									*16.0 to 17.4 feet: SANDY GRAVEL WITH SILT (GW); brownish black; 20% fines; 30% sand, medium to coarse, angular; 50% gravel, fine to coarse, angular, poorly sorted; wet.*
17									
18									*17.4 to 18.5 feet: CLAY (CL); blue gray; 90% fines, medium plasticity; 10% sand, fine; soft; trace wood chips; wet.*
19									*18.5 to 20.0 feet: no recovery.*
20									

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

GBLWC W:\GINT\GINTW\PROJECTS\0624.04.07\GP11 TO GP44.GPJ 6/30/15

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**GP29**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Sample Data: Percent Recovery	Sample Data: Collection Method	Sample Data: Number	Sample Data: Name (Type)	Sample Data: Blows/6"	Lithologic Column	Soil Description

Total Depth = 20.0 feet below ground surface.

Temporary screen set at 15.0 to 20.0 feet below ground surface.

Borehole Completion Details:
0.0 to 20.0 feet: 2.25-inch borehole.
0.0 to 20.0 feet: Bentonite chips hydrated with potable water.

NOTES: *(1) GP = Geoprobe. (2) GW = groundwater. (3) PID = Photoionization detector, soil headspace reading in parts per million (ppm).*

▽ ***Water level observed at time of drilling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**MW01**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	**119.5**
Start/End Date	**6/8/15 to 6/8/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**C. Wise**	Hole Depth	**25.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**3.75-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**68**	**GP**					0.0 to 0.4 feet: ASPHALT; black; 10% fines; 30% sand, medium to coarse, angular; 60% gravel, fine, angular; dry.
									0.4 to 3.4 feet: SILT (ML); yellowish brown; 95% fines, hard, nonplastic; 5% sand, very fine; dry.
2									
3									
4									3.4 to 5.0 feet: no recovery.
5			**90**	**GP**					5.0 to 9.2 feet: SILT (ML); yellowish brown; 95% fines, hard, nonplastic; 5% sand, very fine; dry.
6									
7									
8									
9									
10			**48**	**GP**					9.2 to 9.5 feet: GRAVELLY SAND (SP); brownish black; 10% fines; 60% sand, medium to coarse, angular to subangular; 30% gravel, fine, angular to subangular; loose; dry.
									9.5 to 10.0 feet: no recovery.
11									10.0 to 10.8 feet: GRAVELLY SAND (SW); brownish black; 10% fines; 60% sand, medium to coarse, angular to subangular; 30% gravel, fine, angular to subangular; loose; dry.
12									10.8 to 12.0 feet: SILT (ML); yellowish brown; 95% fines, hard to stiff, nonplastic; 5% sand, very fine; moist.
13									12.0 to 12.4 feet: SILT (ML); blue gray; 90% fines, nonplastic; 10% sand, very fine; soft; moist to wet.
									12.4 to 15.0 feet: no recovery.
14									
15			**80**	**GP**					15.0 to 16.5 feet: SILTY SAND (SM); blue gray; 20% fines; 80% sand, very fine; medium dense; moist.
16									
17									16.5 to 18.0 feet: SILT (ML); blue gray; 90% fines, low plasticity; medium soft; 10% sand, very fine; moist.
18									
19	▽								18.0 to 19.0 feet: SILTY SAND (SM); blue gray; 20% fines; 80% sand, very fine, medium dense; moist to wet, wet at 18.5 feet.
									19.0 to 20.0 feet: no recovery.
20									

NOTES: *GP = Geoprobe macrocore liner.*

▽ ***Water level at time of drilling.***

GBLWC W:\GINT\GINTW\PROJECTS\0624.04.07\MW01 TO MW04.GPJ 6/30/15

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**MW01**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
21			**76**	**GP**					*20.0 to 20.5 feet: SILT (ML); blue gray; 95% fines, soft, medium plasticity; 5% sand, very fine; moist to wet.*
									20.5 to 21.3 feet: SILTY SAND (SM); blue gray; 20% fines; 80% sand, very fine, medium stiff; moist to wet.
22									*21.3 to 22.1 feet: SILT (ML); blue gray; 95% fines, soft, medium plasticity; 5% sand, very fine; moist to wet.*
									22.1 to 23.8 feet: SILTY SAND (SM); blue gray; 20% fines; 80% sand, very fine, medium stiff; moist to wet.
23									
24									*23.8 to 25.0 feet: no recovery.*
25									

Total Depth = 25.0 feet below ground surface.

Borehole Completion Details:
0.0 to 25.0 feet: 3.75-inch borehole.
0.0 to 1.0 feet: Concrete.
1.0 to 19.0 feet: Bentonite chips hydrated with potable water.
19.0 to 25.0 feet: 10x20 silica sand filter pack.

Monitoring Well Completion Details:
Washington State Department of Ecology Well Tag Number BIQ 042.
Traffic grade, flush-mounted, monitoring well vault.
0.0 to 19.8 feet: 2-inch diameter, schedule 40, polyvinyl chloride, riser pipe.
19.8 to 24.8 feet: 2-inch diameter, schedule 40, polyvinyl chloride, 0.010 machine slot, prepacked, well screen.
24.8 to 20.0 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: *GP = Geoprobe macrocore liner.*

▽ ***Water level at time of drilling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**MW02**	**1 of 2**

Project Name	**Northern State Hospital Property**	TOC Elevation (feet)	
Project Location	**24909 Hub Drive, Sedro-Woolley, Washington**	Surface Elevation (feet)	**113.3**
Start/End Date	**6/8/15 to 6/8/15**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe 7822DT**	Easting	
Geologist/Engineer	**C. Wise**	Hole Depth	**20.0-feet**
Sample Method	**Direct Push**	Outer Hole Diam	**3.75-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**72**	**GP**					0.0 to 0.3 feet: GRAVEL (GP); gray; 5% fines; 25% sand, medium to coarse, angular; 70% gravel, coarse, angular; dry. (FILL)
									0.3 to 0.6 feet: SILTY SAND (SM); black; 20% fines; 80% sand, medium, angular to subangular; dry.
2									0.6 to 3.6 feet: SILT (ML); yellowish brown; 85% fines, hard, nonplastic; 15% sand, very fine to fine; dry.
3									
4									3.6 to 5.0 feet: no recovery.
5			**80**	**GP**					5.0 to 7.2 feet: SILT (ML); yellowish brown; 85% fines, hard, nonplastic; 15% sand, very fine to fine; dry.
6									
7									
8									7.2 to 7.4 feet: SAND (SW); dark brown; 20% fines; 40% sand, medium to coarse, angular to subangular; 40% gravel, coarse, angular to subangular; dry.
									7.4 to 9.0 feet: SILT (ML); yellowish brown; 85% fines, hard, nonplastic; 15% sand, very fine to fine; dry.
9									9.0 to 10.0 feet: no recovery.
10			**48**	**GP**					10.0 to 12.4 feet: GRAVEL (GW); black; 5% fines; 25% sand, medium to coarse, angular; 70% gravel, fine to coarse, angular to subangular; dry to moist.
11									@ 11.0 feet: Unit becomes wet.
12									
13									12.4 to 15.0 feet: no recovery.
14									
15			**48**	**GP**					15.0 to 16.4 feet: SANDY GRAVEL (GW); black; 10% fines; 30% sand, medium to coarse, angular to subangular; 60% gravel, fine to medium, angular to subangular; moist.
16									
17	▽								16.4 to 16.8 feet: SANDY GRAVEL (GW); reddish orange; 10% fines; 40% sand, medium to coarse, angular; 50% gravel, fine to medium, angular; moist
									@ 16.8 feet: Unit becomes wet.
18									16.8 to 17.4 feet: SANDY GRAVEL (GWS); gray; 10% fines; 30% sand, fine to medium, angular; 60% gravel, medium to coarse, angular to subangular; wet.
19									17.4 to 20.0 feet: no recovery.
20									

NOTES: *GP = Geoprobe macrocore liner.*

▽ ***Water level at time of drilling.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.07	**MW02**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Sample Data: Percent Recovery	Sample Data: Collection Method	Sample Data: Number	Sample Data: Name (Type)	Sample Data: Blows/6"	Lithologic Column	Soil Description

Total Depth = 20.0 feet below ground surface.

Borehole Completion Details:
0.0 to 20.0 feet: 3.75-inch borehole.
0.0 to 1.0 feet: Concrete.
1.0 to 13.0 feet: Bentonite chips hydrated with potable water.
13.0 to 20.0 feet: 10x20 silica sand filter pack.

Monitoring Well Completion Details:
Washington State Department of Ecology Well Tag Number BIQ 041.
Traffic grade, flush-mounted, monitoring well vault.
0.0 to 14.0 feet: 2-inch diameter, schedule 40, polyvinyl chloride, riser pipe.
14.0 to 19.0 feet: 2-inch diameter, schedule 40, polyvinyl chloride, 0.010 machine slot, prepacked, well screen.
19.0 to 19.2 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: *GP = Geoprobe macrocore liner.*

▽ ***Water level at time of drilling.***

SoundEarth Strategies

Project: Port of Skagit
Project Number: 1303-003
Logged by: CJT
Date Started: 8/28/17
Surface Conditions: Concrete
Well Location N/S: 3' S of SW loading dock corner
Well Location E/W: 41' W of SW loading dock corner
Reviewed by: EBF
Date Completed: 8/28/17

BORING LOG | B05 MW06

Site Address: 2070 Northern State Road, Sedro-Woolley, Washington

Water Depth At Time of Drilling: 16 feet bgs
Water Depth After Completion: -- feet bgs

Depth (feet bgs)	Interval	Blow Count	% Recovery	PID (ppm)	Sample ID	USCS Class	Graphic	Lithologic Description	Well Detail/ Water Depth
0								**Concrete**	
								Crushed asphalt	
				0.3		SM-ML		**Moist SILT and fine SAND, trace organics, mottled tan/gray, no hydrocarbon odor (50-50-0).**	
			75						
				0.4					
					B05-04	ML		**Moist SILT with fine sand, trace clay, trace organics, mottled tan/gray, no hydrocarbon odor (85-15-0).**	
5				0.3					
			100						
				0.4					
					B05-08				
				0.4					
10			100						
				0.4					
					B05-12	ML		**Moist SILT with clay, gray, no hydrocarbon odor (100-0-0).**	
				0.3					
			100						
15				0.4					
					B05-16	SM		**Wet, silty SAND, gray, no hydrocarbon odor (40-60-0).**	
				0.2		ML		**Wet SILT and CLAY, trace sand, gray, no hydrocarbon odor (95-5-0).**	
			100						
				0.2		SM		**Wet, silty SAND, gray, no hydrocarbon odor (40-60-0).**	
20					B05-20				

Drilling Co./Driller:	Standard Probe/Russell		**Well/Auger Diameter:**	1/2	inches
Drilling Equipment:	GeoProbe Truck		**Well Screened Interval:**	10-20	feet bgs
Sampler Type:	Liner		**Screen Slot Size:**	0.010	inches
Hammer Type/Weight:	--	lbs	**Filter Pack Used:**	Colorado silica sand	
Total Boring Depth:	20	feet bgs	**Surface Seal:**	Concrete	
Total Well Depth:	20	feet bgs	**Annular Seal:**	Bentonite	
State Well ID No.:	BJP 715		**Monument Type:**	Flush mount	

Notes/Comments:

Boring terminated at 20 feet bgs. Completed as monitoring well MW06, screened from 10 to 20 feet bgs.

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.10	**MW09**	**1 of 2**

Project Name	**Swift Center - EPA Assessment**	TOC Elevation (feet)	**131.1042**
Project Location	**2070 Northern State Road, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/23/18 to 4/23/18**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe**	Easting	
Geologist/Engineer	**C. Wise**	Hole Depth	**30.0-feet**
Sample Method	**Direct-Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**62**	**GP**		**MW09-S-0.5**			0 to 0.2 feet: ASPHALT, black. dry.
						PID = 0.0 ppm			0.2 to 3.1 feet: SILT (ML); light brown; 95% fines, low plasticity; 5% sand, very fine to fine grained; very stiff; orange mottles; no odor; dry.
2						**PID = 0.9 ppm**			
3	▼								3.1 to 5.0 feet: no recovery.
4									
5			**100**	**GP**					5.0 to 9.4 feet: SILT (ML); light brown; 95% fines, low plasticity; 5% sand, very fine grained; very stiff; orange mottles; no odor; dry to moist.
6						**MW09-S-6.0**			
						PID = 0.0 pm			
7						**PID = 0.0 ppm**			
8									
9									
10	▽					**PID = 0.0 ppm**			9.4 to 10.0 feet: SILTY SAND (SM); light brown; 30% fines; 70% sand, very fine to fine grained; dense; no odor; moist.
			78	**GP**					10.0 to 11.6 feet: SILT with GRAVEL (ML); light brown; 90% fines, medium plasticity; trace sand; 10% gravel, fine size, angular to subangular; soft; no odor; wet.
11						**PID = 0.0 ppm**			
12									11.6 to 13.3 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; dense; no odor; wet.
13						**PID = 0.0 ppm**			
14						**PID = 0.0 ppm**			13.3 to 13.6 feet: SILT (ML); gray; 100% fines, medium plasticity; soft; no odor; moist.
									13.6 to 13.9 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; dense; no odor; wet.
15									13.9 to 15.0 feet: no recovery.
			86	**GP**					15.0 to 17.7 feet: SILT (MH); gray; 95% fines, high plasticity; 5% sand, very fine grained; soft; no odor; moist.
16									
17						**PID = 0.0 ppm**			
18						**PID = 0.0 ppm**			17.7 to 18.2 feet: SANDY SILT (ML); gray; 80% fines, medium plasticity; 20% sand, very fine to fine grained; soft; no odor; moist.
19						**MW09-S-19.0**			18.2 to 19.3 feet: SILT (ML); gray; 95% fines, high plasticity; 5% sand, very fine grained; soft; no odor; moist.
						PID = 0.0 ppm			
20									19.3 to 20.0 feet: no recovery.

NOTES: *1. bgs = below ground surface. 2. Depths are relative to feet bgs. 3. GW = temporary polyvinyl chloride screen. 4. PID = photoionization detector 5. ppm = parts per million. 6. WS = reconnaissance groundwater sample.*

▽ ***Water level at time of drilling.*** ▼ ***Water level prior to development.***

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.10	**MW09**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
21			**100**	**GP**					*20.0 to 24.6 feet: SILT (MH); gray; 95% fines, high plasticity; 5% sand, very fine grained; soft; no odor; moist to wet.*
22									
23									
24									
25			**100**	**GP**		**PID = 0.0 ppm**			*24.6 to 25.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; firm; no odor; moist.*
26									*25.0 to 30.0 feet: SANDY SILT (ML); gray; 70% fines, medium plasticity; 30% sand, very fine to fine grained; soft; no odor; wet.*
27									
28									
29									
30									

Total Depth = 30.0 feet bgs.

Borehole Completion Details:
0 to 30.0 feet: 3.75-inch borehole.
0 to 1.0 feet: Concrete.
1.0 to 18.2 feet: Bentonite chips hydrated with potable water.
18.2 to 30.0 feet: 10x20 silica sand filter pack.

Monitoring Well Completion Details:
Washington State Department of Ecology Well Tag Number: BKL-333
Traffic-grade, flush-mounted, monitoring well vault.
0 to 19.2 feet: 2-inch diameter, schedule 40, polyvinyl chloride, riser pipe.
19.2 to 29.2 feet: 2-inch diameter, schedule 40, polyvinyl chloride, 0.010 machine slot, prepacked well screen.
29.2 to 29.4 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: *1. bgs = below ground surface. 2. Depths are relative to feet bgs. 3. GW = temporary polyvinyl chloride screen. 4. PID = photoionization detector 5. ppm = parts per million. 6. WS = reconnaissance groundwater sample.*

▽ ***Water level at time of drilling.*** ▼ ***Water level prior to development.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.10	**MW10**	**1 of 2**

Project Name	**Swift Center - EPA Assessment**	TOC Elevation (feet)	**130.4096**
Project Location	**2070 Northern State Road, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/23/18 to 4/23/18**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe**	Easting	
Geologist/Engineer	**C. Wise**	Hole Depth	**30.0-feet**
Sample Method	**Direct-Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			100	GP		MW10-S-1.0 PID = 0.4 ppm			0 to 0.4 feet: CONCRETE; gray; no odor; dry. 0.4 to 1.4 feet: SILT (ML); dark brown; 95% fines, medium plasticity; 5% sand, very fine grained; very stiff; red and black fragments; orange mottles; no odor; dry.
2									1.4 to 5.0 feet: SILT (ML); light brown; 95% fines, medium plasticity; 5% sand, very fine grained; very stiff; no odor; dry.
3									
4	▼					PID = 0.7 ppm			
5	▽								
6			80	GP		PID = 0.0 ppm			5.0 to 6.2 feet: SILT with GRAVEL (ML); light brown; 90% fines, high plasticity; 10% gravel, fine grained, angular to subangular; stiff; no odor; wet.
7									6.2 to 9.0 feet: SILT (ML); light brown; 100% fines, high plasticity; very stiff; trace fine sand; no odor; moist.
8						PID = 0.0 ppm			
9									
10									9.0 to 10.0 feet: no recovery.
11			100	GP		PID = 0.1 ppm			10.0 to 11.3 feet: SILT with GRAVEL (ML); light brown; 90% fines, low plasticity; trace sand; 10% gravel, fine size, angular to subangular; soft; no odor; wet.
12									11.3 to 14.0 feet: SILT (MH); light brown; 100% fines, high plasticity; trace fine sand; firm; moist.
13						MW10-S-13.5 PID = 0.8 ppm			
14									@ 13.5 feet: color change to gray.
15						PID = 0.0 ppm			14.0 to 15.0 feet: SILTY SAND; gray; 30% fines; 70% sand, very fine to fine grained; medium dense; no odor; moist.
16			100	GP		PID = 0.0 ppm			15.0 to 16.8 feet: SANDY SILT (ML); gray; 60% fines, low plasticity; 40% sand, very fine grained; soft; no odor; wet.
17						PID = 0.1 ppm			16.8 to 17.5 feet: SILT (ML); gray; 100% fines, low plasticity; soft; no odor; moist.
18						PID = 0.0 ppm			17.5 to 18.3 feet: SILTY SAND (SM); gray; 30% fines, low plasticity; 70% sand, very fine to fine grained; medium dense; no odor; moist.
19						PID = 0.1 ppm			18.3 to 20.0 feet: SILT with SAND (ML); gray; 90% fines, high plasticity; 10% sand, very fine to fine grained; soft; no odor; moist.
20									

NOTES: *1. bgs = below ground surface. 2. Depths are relative to feet bgs. 3. GW = temporary polyvinyl chloride screen. 4. PID = photoionization detector 5. ppm = parts per million. 6. WS = reconnaissance groundwater sample.*

▽ ***Water level at time of drilling.*** ▼ ***Water level prior to development.***

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.10	**MW10**	**2 of 2**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
21			**100**	**GP**					*20.0 to 24.0 feet: SILT (ML); gray; 100% fines, high plasticity; soft; no odor; moist to wet.*
22						**PID = 0.1 ppm**			
23									
24						**MW10-S-24.5**			*24.0 to 25.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine; dense; sulfur-like odor; moist.*
25			**100**	**GP**		**PID = 0.0 ppm**			*25.0 to 29.0 feet: SANDY SILT (ML); gray; 70% fines, high plasticity; 30% sand, very fine to fine grained; soft; no odor; wet.*
26									
27						**PID = 0.0 ppm**			
28									
29									*29.0 to 30.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; firm; no odor; wet.*
30						**PID = 0.0 ppm**			

Total Depth = 30.0 feet bgs.

Borehole Completion Details:
0 to 30.0 feet: 3.75-inch borehole.
0 to 1.0 feet: Concrete.
1.0 to 23.0 feet: Bentonite chips hydrated with potable water.
23.0 to 30.0 feet: 10x20 silica sand filter pack.

Monitoring Well Completion Details:
Washington State Department of Ecology Well Tag Number: BKL-331
Traffic-grade, flush-mounted, monitoring well vault.
0 to 24.4 feet: 2-inch diameter, schedule 40, polyvinyl chloride, riser pipe.
24.4 to 29.4 feet: 2-inch diameter, schedule 40, polyvinyl chloride, 0.010 machine slot, prepacked well screen.
29.4 to 29.6 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: *1. bgs = below ground surface. 2. Depths are relative to feet bgs. 3. GW = temporary polyvinyl chloride screen. 4. PID = photoionization detector 5. ppm = parts per million. 6. WS = reconnaissance groundwater sample.*

▽ ***Water level at time of drilling.*** ▼ ***Water level prior to development.***

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.10	**MW11**	**1 of 2**

Project Name	**Swift Center - EPA Assessment**	TOC Elevation (feet)	**130.1546**
Project Location	**2070 Northern State Road, Sedro-Woolley, Washington**	Surface Elevation (feet)	
Start/End Date	**4/23/18 to 4/23/18**	Northing	
Driller/Equipment	**Holt Services, Inc./Geoprobe**	Easting	
Geologist/Engineer	**C. Wise**	Hole Depth	**30.0-feet**
Sample Method	**Direct-Push**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1			**100**	**GP**					*0 to 0.4 feet: CONCRETE; gray; dry.*
									0.4 to 5.0 feet: SILT (ML); light brown; 95% fines, low plasticity; 5% sand, very fine to fine grained; very stiff; orange mottles; expanding silt; no odor; dry.
3						**PID = 0.2 ppm**			
5			**100**	**GP**					*5.0 to 9.6 feet: SILT (ML); light brown; 95% fines, low plasticity; 5% sand, very fine to fine grained; very stiff; orange mottles; expanding silt; no odor; dry.*
8						**PID = 0.4 ppm**			
10			**100**	**GP**		**PID = 0.6 ppm**			*9.6 to 10.0 feet: SILTY SAND (SM); light brown; 30% fines; 70% sand, very fine to fine; dense; no odor; moist.*
11						**PID = 0.5 ppm**			*10.0 to 11.7 feet: SILT (ML); light brown; 95% fines, medium plasticity; 5% sand, very fine grained; trace gravel; very soft; no odor; wet.*
12									*11.7 to 13.5 feet: SILT (ML); gray; 100% fines, high plasticity; soft; no odor; moist.*
14						**PID = 0.1 ppm** **PID = 0.3 ppm**			*13.5 to 14.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; firm; no odor; moist.*
15						**PID = 0.0 ppm**			*14.0 to 15.0 feet: SILT (ML); gray; 100% fines, high plasticity; soft; no odor; moist.*
			100	**GP**					*15.0 to 17.5 feet: SILT (ML); gray; 95% fines, low plasticity; 5% sand, very fine grained; trace gravel; very soft; no odor; wet.*
16						**PID = 0.0 ppm**			
18						**PID = 0.1 ppm**			*17.5 to 18.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; medium dense; no odor; wet.*
19						**PID = 0.2 ppm**			*18.0 to 19.0 feet: SILT (ML); gray; 100% fines, high plasticity; soft; no odor; moist.*
20						**PID = 0.0 ppm** **PID = 0.0 ppm**			*19.0 to 19.5 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; dense; no odor; moist.* *19.5 to 20.0 feet: SILT (ML); gray; 100% fines, high plasticity; soft; no*

NOTES: *1. bgs = below ground surface. 2. Depths are relative to feet bgs. 3. GW = temporary polyvinyl chloride screen. 4. PID = photoionization detector 5. ppm = parts per million. 6. WS = reconnaissance groundwater sample.*

▽ ***Water level at time of drilling.*** ▼ ***Water level prior to development.***

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Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
0624.04.10	MW11	2 of 2

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
21			100	GP					odor; moist. 20.0 to 24.0 feet: SANDY SILT (ML); gray; 80% fines, low plasticity; 20% sand, very fine to fine grained; soft; no odor; wet.
22						PID = 0.0 ppm			
23									
24									24.0 to 25.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; dense; no odor; moist.
25						PID = 0.0 ppm			
			100	GP					25.0 to 27.2 feet: SANDY SILT (ML); gray; 60% fines, low plasticity; 40% sand, very fine to fine grained; soft; no odor; wet.
26						PID = 0.1 ppm			
27									27.2 to 29.1 feet: SILT (ML); gray; 100% fines, high plasticity; soft; no odor; moist.
28						PID = 0.0 ppm			
29									29.1 to 30.0 feet: SILTY SAND (SM); gray; 30% fines; 70% sand, very fine to fine grained; medium dense; no odor; moist.
30						PID = 0.0 ppm			

Total Depth = 30.0 feet bgs.

Borehole Completion Details:
0 to 30.0 feet: 3.75-inch borehole.
0 to 1.0 feet: Concrete.
1.0 to 16.0 feet: Bentonite chips hydrated with potable water.
16.0 to 28.0 feet: 10x20 silica sand filter pack.
28.0 to 30.0 feet: Slough.

Monitoring Well Completion Details:
Washington State Department of Ecology Well Tag Number: BKL-332
Traffic-grade, flush-mounted, monitoring well vault.
0 to 17.0 feet: 2-inch diameter, schedule 40, polyvinyl chloride, riser pipe.
17.0 to 27.0 feet: 2-inch diameter, schedule 40, polyvinyl chloride, 0.010 machine slot, prepacked well screen.
27.0 to 27.2 feet: 2-inch, schedule 40, polyvinyl chloride pipe end cap.

NOTES: 1. bgs = below ground surface. 2. Depths are relative to feet bgs. 3. GW = temporary polyvinyl chloride screen. 4. PID = photoionization detector 5. ppm = parts per million. 6. WS = reconnaissance groundwater sample.

▽ **Water level at time of drilling.** ▼ **Water level prior to development.**

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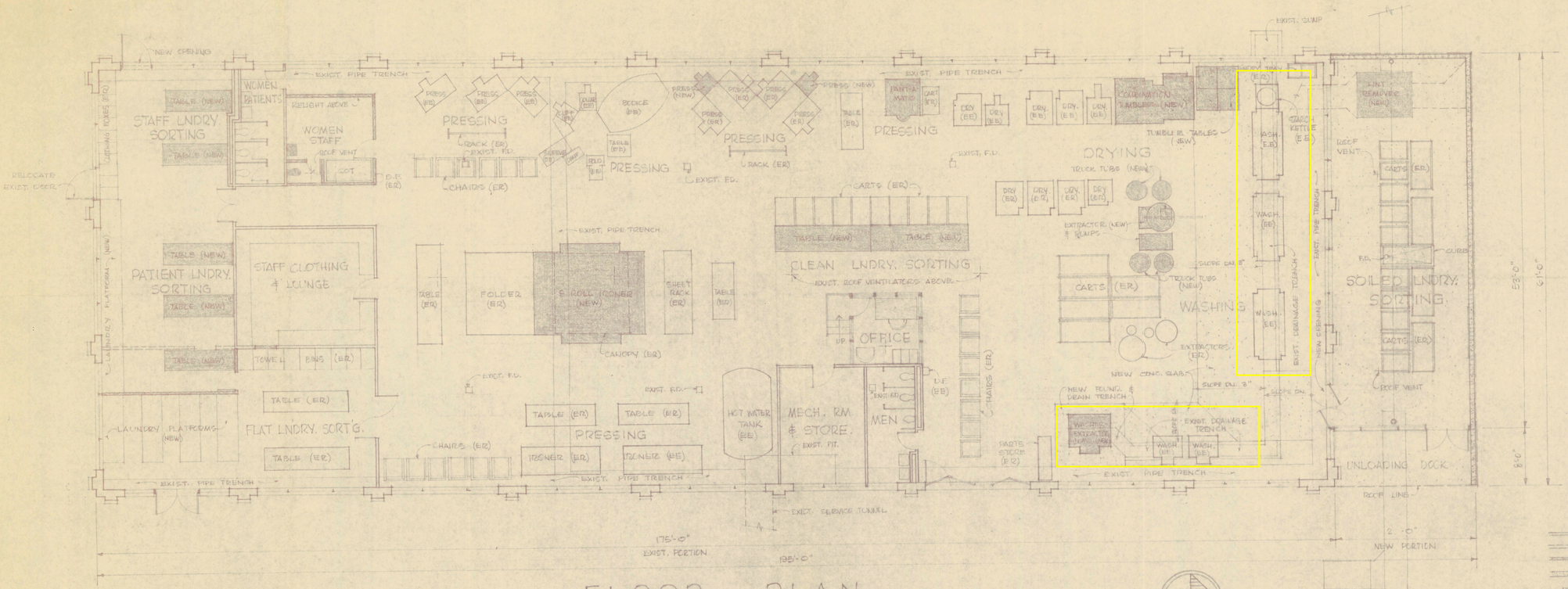
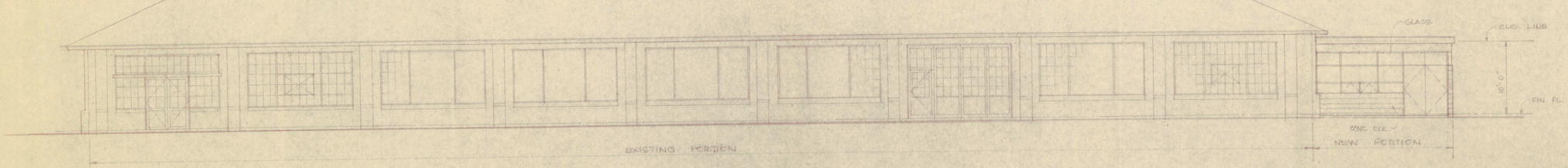
APPENDIX D

LAUNDRY BUILDING BLUEPRINT



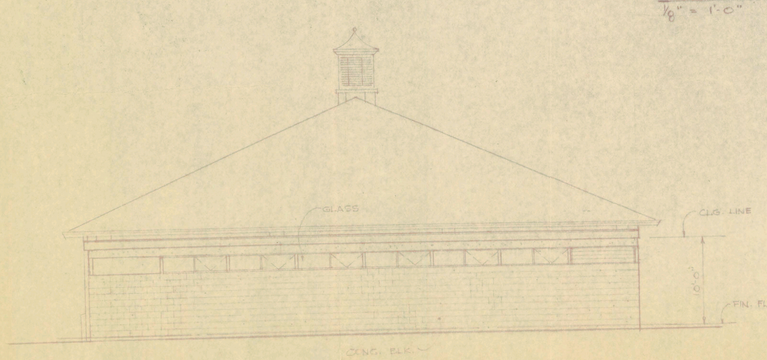
FLOOR PLAN

1/8" = 1'-0"



EAST ELEVATION

1/8" = 1'-0"



NORTH ELEVATION

1/8" = 1'-0"

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ROBERT W. HENSEL
LAUNDRY ADVISOR. - STATE OF WASHINGTON

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DIVISION OF ENGINEERING & ARCHITECTURE.

BUILDING & EQUIPMENT ADDITIONS & ALTERATIONS TO LAUNDRY AT NORTHERN STATE HOSPITAL

SEDRO WOOLEY WASHINGTON

BENJAMIN F. McADOO & ASSOCIATES
PAUL DELANEY & ASSOCIATES
SEATTLE

ARCHITECTS

WASHINGTON

11 JULY 52
6 JUNE 52
15 MAY 52

APPENDIX E

AIR EMISSIONS CALCULATIONS

Table E-1
Emissions Calculations - PCE
Northern State Multi Service Center
Sedro-Woolley, WA

WAC 173-460-150 Emissions Calculations Compound **Perchloroethylene (PCE)** CAS: 127-18-4	(lb/averaging period) **27**	Averaging Period **Year**	**Reference Notes:**
Average measured subslab PCE concentration in north half of AOC 1	610	ug/m^3	
	3.8E-08	lb/ft^3	(a)
Average measured subslab PCE concentration in south half of AOC 1	88	ug/m^3	
	5.5E-09	lb/ft^3	(a)
Estimated Maximum Fan rate	270	ft^3/min	(1)
Discharge per year	1.4E+08	ft^3/year/fan	(b)
Discharge mass (PCE) per year in north half of AOC 1	5.4E+00	lb/year/fan	(c)
Discharge mass (PCE) per year in south half of AOC 1	7.8E-01	lb/year/fan	(c)
Number of discharge points in north half of AOC 1	2	fans	(3)
Number of discharge points in south half of AOC 1	3	fans	(3)
System discharge in north half of AOC 1	1.1E+01	lb/year	(d)
System discharge in south half of AOC 1	2.3E+00	lb/year	(d)
Total system discharge per year	**1.3E+01**	**lb/year**	(d)

NOTES:

ft^3 = cubic feet.

g = gram.

lb = pound.

m^3 = cubic meter.

ug = micrograms.

(a) $lb/ft^3 = (ug/m^3) \times (g/10^6\ ug) \times (1\ lbs/453.6\ g) \times (1\ m^3/35.31\ ft^3)$

(b) $ft^3/year = (ft^3/min) \times (60\ min/hr) \times (24\ hr/1\ day) \times (365\ day/year)$

(c) $lb/year = (ft^3/year) \times (lb/ft^3)$

(d) total lb/year = (lb/year/fan) x (# of fans)

REFERENCES:

(1) MFA. 2022. *Draft AOC 1 Interim Action Work Plan, Sedro-Woolley, Washington* . Prepared for the Port of Skagit. Maul Foster & Alongi, Inc. Bellingham, Washington. September 12.

(2) There are 3 vent pipes with fans planned in the south half of the building.

(3) There are 2 vent pipes with fans planned in the north half the building.

Table E-1
Emissions Calculations - PCE
Northern State Multi Service Center
Sedro-Woolley, WA

CONVERSION FACTORS:			
1,000,000	ug	=	1 g
1	m^3	=	35.31 ft^3
453.6	g	=	1 lb

Table E-2
Emissions Calculations - TCE
Northern State Multi Service Center
Sedro-Woolley, WA

WAC 173-460-150 Emissions Calculations Compound **Trichloroethylene (TCE)** CAS: 79-01-6	(lb/averaging period) **34**	Averaging Period **Year**	**Reference Notes:**
Average measured subslab TCE concentration in north half of AOC 1	0.91	ug/m^3	
	5.7E-11	lb/ft^3	(a)
Average measured subslab TCE concentration in south half of AOC 1	0.50	ug/m^3	
	3.1E-11	lb/ft^3	(a)
Estimated Maximum Fan rate	270	ft^3/min	(1)
Discharge per year	1.4E+08	ft^3/year/fan	(b)
Discharge mass (TCE) per year in north half of AOC 1	8.0E-03	lb/year/fan	(c)
Discharge mass (TCE) per year in south half of AOC 1	4.4E-03	lb/year/fan	(c)
Number of discharge points in north half of AOC 1	2	fans	(3)
Number of discharge points in south half of AOC 1	3	fans	(3)
System discharge in north half of AOC 1	1.6E-02	lb/year	(d)
System discharge in south half of AOC 1	1.3E-02	lb/year	(d)
Total system discharge per year	**2.9E-02**	**lb/year**	(d)

NOTES:

For non-detect results, half the reporting limit was used to calculate the average concentration.

ft^3 = cubic feet.

g = gram.

lb = pound.

m^3 = cubic meter.

ug = micrograms.

(a) $lb/ft^3 = (ug/m^3) \times (g/10^6\ ug) \times (1\ lbs/453.6\ g) \times (1\ m^3/35.31\ ft^3)$

(b) $ft^3/year = (ft^3/min) \times (60\ min/hr) \times (24\ hr/1\ day) \times (365\ day/year)$

(c) $lb/year = (ft^3/year) \times (lb/ft^3)$

(d) total lb/year = (lb/year/fan) x (# of fans)

REFERENCES:

(1) MFA. 2022. *Draft AOC 1 Interim Action Work Plan, Sedro-Woolley, Washington* . Prepared for the Port of Skagit. Maul Foster & Alongi, Inc. Bellingham, Washington. September 12.

(2) There are 3 vent pipes with fans planned in the south half of the building.

(3) There are 2 vent pipes with fans planned in the north half the building.

Table E-2
Emissions Calculations - TCE
Northern State Multi Service Center
Sedro-Woolley, WA

CONVERSION FACTORS:		
1,000,000 ug	=	1 g
1 m^3	=	35.31 ft^3
453.6 g	=	1 lb