HALEY ALDRICH

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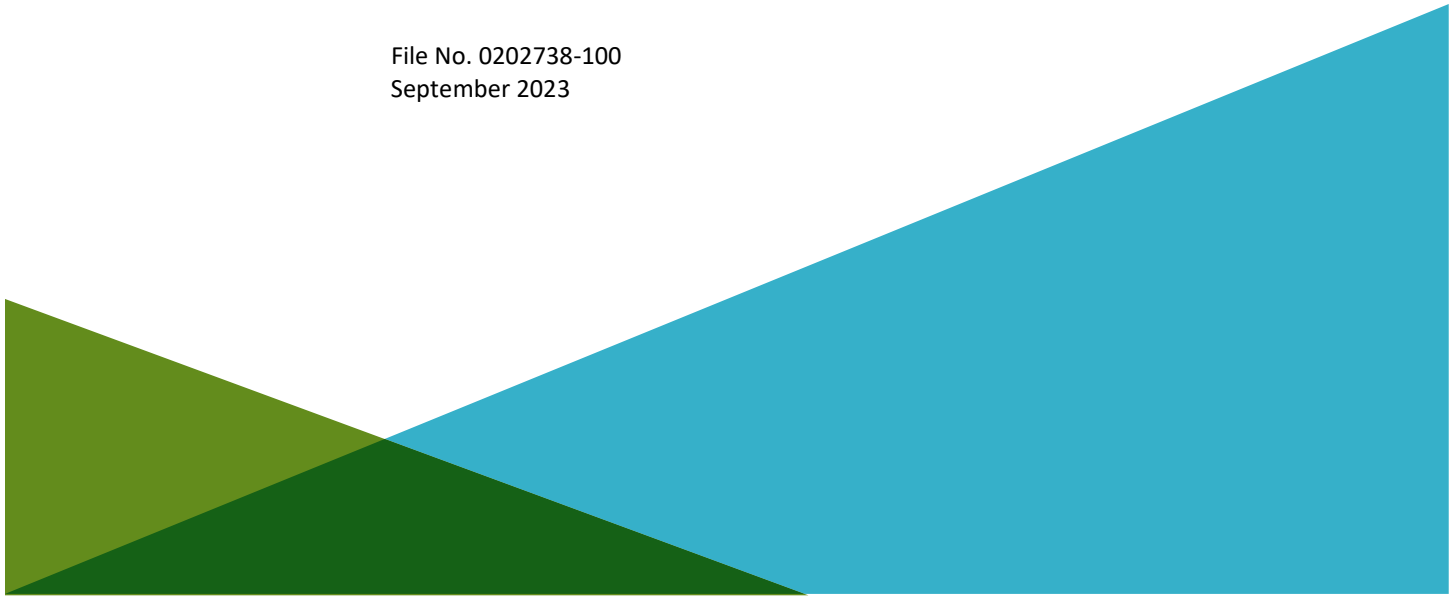
ENGINEERING DESIGN REPORT ON

SEATTLE DOT MERCER PARCELS SITE
800 MERCER STREET
SEATTLE, WASHINGTON

by
Haley & Aldrich, Inc.
Seattle, Washington

for
800 Mercer, LLC
Seattle, Washington

File No. 0202738-100
September 2023



HALEY & ALDRICH
3131 ELLIOTT AVENUE
SUITE 600
SEATTLE, WA 98121
206.324.9530

SIGNATURE PAGE FOR

ENGINEERING DESIGN REPORT ON SEATTLE DOT MERCER PARCELS SITE
800 MERCER STREET
SEATTLE, WASHINGTON

PREPARED FOR
800 MERCER, LLC
SEATTLE, WASHINGTON

PREPARED BY:

Marissa K. Goodman, P.E.
Senior Project Environmental Engineer
Haley & Aldrich, Inc.

REVIEWED AND APPROVED BY:

Julie K. W. Wukelic
Senior Principal Engineer
Haley & Aldrich, Inc.

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List of Abbreviations

Abbreviation	Definition
µg/L	micrograms per liter
American Linen Site	American Linen Supply Co Dexter Ave Site
bgs	below ground surface
BMP	best management practice
Broad Street Fill Site	Broad Street Alignment Contaminated Fill Site
CACR	Cleanup Action Completion Report
CAO	cleanup action objective
CAP	Cleanup Action Plan
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
CMMP	Contaminated Media Management Plan
COC	constituent of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSO	combined sewer overflow
CSWGP	Construction Stormwater General Permit
CUL	cleanup level
CVOC	chlorinated volatile organic compound
DNS	Determination of Non-Significance
DRO	diesel-range organics
EDR	Engineering Design Report
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
GRO	gasoline-range organics
HASP	Health and Safety Plan
HVAC	heating, ventilation, and air conditioning
KCIW	King County Industrial Waste
mg/kg	milligrams per kilogram
MIDP	Monitoring and Inadvertent Discovery Plan
MTCA	Model Toxics Control Act
MUP	Master Use Permit
NAVD88	North American Vertical Datum of 1988
PCE	tetrachloroethene
POC	point of compliance
PPCD	Prospective Purchaser Consent Decree
PSCAA	Puget Sound Clean Air Agency
QA/QC	quality assurance/quality control
RCW	Revised Code of Washington
RI	Remedial Investigation
ROW	right-of-way
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SDCI	Seattle Department of Construction and Inspections
SDOT	Seattle Department of Transportation

Abbreviation	Definition
SEPA	State Environmental Policy Act
Site	Seattle DOT Mercer Parcels site
SWPPP	Stormwater Pollution Prevention Plan
TCE	trichloroethene
TESC	Temporary Erosion and Sediment Control
VC	vinyl chloride
WAC	Washington Administrative Code

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) has prepared this *Engineering Design Report* (EDR) on behalf of 800 Mercer, LLC to document the engineering concepts and criteria used for design of the cleanup action at the Seattle DOT Mercer Parcels site (Site; Cleanup Site ID No. 14784) which is primarily located at 800 Mercer Street in Seattle, Washington (Property). The Property vicinity is shown on Figure 1-1. The Site includes the Property and any off-Property areas where contamination originating on or from the Property has come to be located.

This EDR was prepared in accordance with the requirements of Prospective Purchaser Consent Decree (PPCD) No. 22-2-02695-2 SEA between the State of Washington Department of Ecology (Ecology) and 800 Mercer, LLC and the Model Toxics Control Act (MTCA)—Washington Administrative Code (WAC) 173-340-400. This EDR was prepared to implement the cleanup action described in the Cleanup Action Plan (CAP; Ecology, 2022a) during and following redevelopment of the Property.

2. Site Description and Background

The following sections summarize the Property setting and history and the nature and extent of contamination at the Site and Property. The Remedial Investigation (RI) Report (Hart Crowser, 2022) includes more detail on the Site background, RI procedures, and analytical results.

2.1 SITE DESCRIPTION AND HISTORY

2.1.1 Location and Description

The Site is located in the South Lake Union neighborhood in Seattle, Washington. The Property consists of two King County tax parcels: 224900-0055 and 224900-0006. The Property encompasses approximately 2.35 acres and is bounded by Roy Street to the north, Mercer Street to the south, Dexter Avenue North to the west, and Ninth Avenue North to the east. The Property is relatively flat on the west side (elevation 58 feet[1]) and generally slopes down toward the east (elevation 36 feet on the east side) (Figure 2-1).

2.1.2 Subsurface Conditions

Soil on the Property consists of fill, glacial deposits, and non-glacial deposits consistent with other studies in the area (SoundEarth Strategies, 2013, 2016; PES Environmental, 2018, 2019). The fill comprises sand with silt, gravel, and cobbles and brick, concrete, and glass debris. In most areas, the fill is 12 to 18 feet deep, but it ranges up to 31 feet in some areas. In areas without fill, silt and/or clay with or without sand are present to a depth of 27 feet below ground surface (bgs). Below that is a layer of silty sand and silty gravel with varying degrees of gravel and cobbles to a depth of 73 feet bgs (refer to Figures 4-2a through 4-2f of the Remedial Investigation [RI] Report [Hart Crowser, 2022] for geological cross-sections).

The hydrogeology at the Site consists of four water-bearing zones. The Shallow zone is discontinuous and unconfined in fill, lacustrine deposits, and glacial deposits. The Intermediate zone is divided into two depth intervals called Intermediate A (upper, coarser zone) and Intermediate B (deeper, finer zone). The Deep zone consists of materials similar to those within the intermediate zones. Based on data collected and analyzed during the RI, groundwater generally flows eastward across the Property in all four zones (refer to Figures 4-3a and 4-3b of the RI Report for groundwater contour maps). The water table is generally at 25 feet bgs. From 2019 to 2021, the Shallow zone has ranged from approximately 16 to 38 feet bgs (elevations 40 to 7 feet), the Intermediate A zone has ranged from approximately 15 to 36 feet bgs (elevations 33 to 7 feet), the Intermediate B zone has ranged from approximately 19 to 45 feet bgs (elevations 30 to 7 feet), and the Deep zone has ranged from approximately 20 to 49 feet bgs (elevations 21 to 8 feet). Water levels at the Property have been influenced at times by temporary construction dewatering at nearby properties.

2.1.3 Historical Property Use

Prior to 1893, the southern shoreline of Lake Union extended onto the northeast corner of the Property (Figure 3-1 of the RI Report). By 1917, that area had been filled and the shoreline moved northward to

[1] All elevations in this EDR are referenced to the North American Vertical Datum of 1988 (NAVD88).

its current location. An estimated 17 feet of fill was brought in to raise the ground surface in the northeast corner of the Property to its current elevation.

Various rights-of-way (ROWs) divided the Property from approximately the end of the 19th century to 2012, including Broad Street, which formerly crossed the Property from the northeast to the southwest and then continued as an underpass approximately 20 feet below grade under the intersection of Dexter Avenue North and Mercer Street (herein referred to as the Broad Street 1958-2012 alignment; Figure 3-1 of the RI Report). From approximately 2012 to 2015, the Broad Street 1958-2012 alignment was filled in to match the existing grades of Mercer Street and Dexter Avenue North, and all roadways within the Property boundary were subsequently vacated as part of the City's Mercer Corridor Project.

Residential dwellings were present on the Property from approximately the end of the 19th century to the 1950s. The Property was also used for a variety of commercial businesses from approximately 1917 to 2010. In the 2010s and as recently as 2019, the Property was used for construction staging. Historical facilities and operations included the following (Figure 3-1 of the RI Report):

- A gasoline and service station that operated in the northwest corner of the Property from approximately 1929 to 1960.
- An automobile repair and service station that operated in the central area of the Property from approximately 1930 to 1955.
- Several auto wrecking businesses that occupied a building in the northeast corner of the Property from approximately 1930 to 1955, with a nearby large parking lot covering the southeast corner of the Property for the storage of wrecked cars.
- A soap and chemical works facility that operated in the north-central portion of the Property from 1925 to 1940.
- Retail painting stores and sign painting companies that operated in the north-central, south-central, and/or southwest portions of the Property from approximately 1925 to 1955 and 1975 to 1996.

2.1.4 Property Redevelopment

The Property is planned to be redeveloped with two 13-story towers—one on the western half and one on the eastern half of the Property—separated above grade by the vacated Eighth Avenue North ROW (Appendix A). The two separate towers will share a below-grade parking garage that will fully underlie the above-grade building footprint and a majority of the Property footprint. Four levels of below-grade parking are planned, resulting in a uniform lowest finished floor elevation of approximately 10.75 feet (approximately 23 to 48 feet bgs). The foundation for the buildings and garage will consist of a 3- to 8-foot-thick concrete mat, resulting in a bottom of excavation ranging from elevation 1.75 to 7.75 feet. The buildings are expected to be occupied by biotech and life science companies, with commercial space and public amenities on the ground level. Redevelopment is currently expected to begin in 2024 and be completed by 2027.

2.2 NATURE AND EXTENT OF CONTAMINATION

This section summarizes the nature and extent of contamination at the Site based on the results of the RI, which included evaluation of more than 300 soil and 150 groundwater samples collected from the Property and surrounding areas. Detailed information and analytical data are presented in the RI Report.

2.2.1 Constituents of Concern

Hazardous substances investigated during the RI were based on Property data and historical operations, and potential off-Property sources from surrounding sites. Concentrations of detected compounds were compared to screening levels protective of human health and the environment to determine constituents of concern (COCs).[2] Based on the evaluation and on sources of contamination, the following are COCs for the Site:

- Soil COCs:
  - Petroleum hydrocarbons as gasoline-range organics (GRO)
  - Lead
- Groundwater COCs:
  - GRO
  - Petroleum hydrocarbons as diesel-range organics (DRO)
  - Benzene

Other hazardous substances are present in soil and/or groundwater on the Property at concentrations that exceed screening levels but are not considered COCs for the Site. These substances include carcinogenic polycyclic aromatic hydrocarbons (cPAHs), arsenic, and chlorinated volatile organic compounds (CVOCs). These hazardous substances are associated with other listed contaminated sites that are being addressed by others under separate legal agreements with Ecology. These sites are discussed further in Section 2.2.5. The other hazardous substances associated with these sites will be managed during the cleanup action and development of the Property.

2.2.2 COC Sources

The petroleum impacts (GRO, DRO, and benzene) observed in soil and/or groundwater are attributed to historical fuel releases from the former gas and auto repair station that operated in the northwest corner of the Property from approximately 1929 to 1960.

Lead impacts in soil on the Property are relatively isolated in small areas and very limited in extent. The source of the isolated lead exceedances in soil is not known and appears to be anomalous, as further explained in Section 2.2.3.

2.2.3 Distribution of COCs in Soil

GRO concentrations in soil that exceed the cleanup level (Section 3.2) are limited to an area within the northwest corner of the Property, as illustrated on Figure 2-2. These impacts are present at depths ranging from 5 to 25 feet bgs, corresponding to elevations between approximately 48.7 and 29.8 feet. The GRO concentrations detected in this area range from 7.3 to 1,200 milligrams per kilogram (mg/kg),

[2] Screening levels for each medium and detected constituent reflect concentrations that are protective for the possible exposure pathways identified in the conceptual site model in the RI Report, including exposure via cross-media transport and natural background levels, where applicable. The RI Report used pre-calculated screening levels provided by Ecology via email on 17 November 2020.

compared to the cleanup level of 30 mg/kg. The lateral and vertical extents of GRO contamination in soil have been delineated and appear to be fully contained within the Property boundary.

Detections of lead in soil that exceed the cleanup level of 250 mg/kg (Section 3.2) are present in two areas of the Property, as illustrated on Figure 2-3. These impacts appear to be very limited in extent and include:

- A detected lead concentration of 591 mg/kg in fill material within the north-central portion of the Property at a depth of 10 feet bgs, corresponding to an elevation of approximately 40.5 feet.
- A detected lead concentration of 279 mg/kg in native material near the northeast corner of the Property at a depth of 22 feet bgs, corresponding to an elevation of approximately 17.1 feet.

Lead was also detected in other soil samples throughout the Property, but at concentrations generally consistent with background. The isolated occurrence of lead exceeding the cleanup level in the fill material was in an area without a known source of lead, and no other exceedances were reported in any other soil samples in the vicinity; therefore, this sample presents an anomalous lead-bearing hot spot within the fill material. The concentration of lead in native material exceeding the cleanup level was slightly above the cleanup level of 250 mg/kg. Neither sample was associated with high concentrations of GRO that might have indicated a leaded gasoline source. These isolated results do not support the existence of lead contamination in soils throughout the Property, and do not suggest any on-Property sources or releases of lead. The lateral and vertical extents of lead contamination in soil have been delineated and appear to be fully contained within the Property boundary.

2.2.4 Distribution of COCs in Groundwater

Petroleum-related impacts in groundwater that exceed cleanup levels (Section 3.2) are GRO, DRO, and benzene in a limited area in the northwest corner of the Property (Figure 2-4). These impacts are present in the Shallow zone (approximately 30 to 40 feet bgs or elevations 24 to 14 feet) at concentrations detected as high as 1,600 micrograms per liter (µg/L) for GRO (compared to the cleanup level of 800 µg/L), 650 µg/L for DRO (compared to the cleanup level of 500 µg/L), and 34 µg/L for benzene (compared to the cleanup level of 2.4 µg/L) in MBB-24 located on the western side of the Site.

The GRO, DRO, and benzene exceedances in the northwest corner of the Property are bounded by groundwater samples within the Property boundary that do not exceed cleanup levels, indicating that the petroleum-related impacts in groundwater are not migrating off the Property. The lateral extents of GRO, DRO, and benzene contamination in groundwater have been delineated, as further discussed in the RI Report and shown on Figure 2-4.

2.2.5 Contaminants from Other Sites

2.2.5.1 Broad Street Fill Site

The cPAH and arsenic impacts in shallow soil on the Property are outside of the area of petroleum contamination and are attributed to contaminated fill that was placed within the Broad Street 1958-2012 alignment. The contaminated fill was determined to be a separate site and has been listed by Ecology as the Broad Street Alignment Contaminated Fill Site (Broad Street Fill Site; Cleanup Site ID 15446). The Broad Street Fill Site has not completed the RI, feasibility study (FS), or CAP process and

cleanup levels have not been selected. The data was compared to pre-calculated screening levels provided by Ecology via email on 17 November 2020 for comparison purposes.

The cPAHs in soil at concentrations that exceed the screening levels are limited to two areas of the Property (Figure 2-5). These impacts are present in shallow fill material, primarily within the Broad Street 1958-2012 alignment, in and near the southwest corner of the Property and within the east-central area of the Property.

The lateral and vertical extents of cPAH contamination in soil are delineated within the Property boundary. However, the data indicate that cPAH contamination within the Broad Street 1958-2012 alignment fill material extends beyond the Property boundary to the southwest. The extent of off-Property cPAH contamination within the fill material is unknown.

Arsenic concentrations in soil that exceed the screening level of 7.3 mg/kg are primarily located within the Broad Street 1958-2012 alignment in the central and southwest portions of the Property (Figure 2-6). These exceedances are present in the fill material at depths ranging from 5 to 25 feet bgs (approximately elevations 54 to 34 feet). The arsenic concentrations detected in these areas range from 1.06 to 25.6 mg/kg. The lateral and vertical extents of arsenic contamination in soil are delineated within the Property boundary. The data indicate that arsenic contamination within the Broad Street 1958-2012 alignment fill material is co-located with cPAH contamination and may also extend beyond the Property boundary to the southwest.

2.2.5.2 American Linen Site

The CVOC detections in saturated soil and groundwater on the Property are attributed to chlorinated solvent releases from historical laundry and dry-cleaning operations on the American Linen Supply Co Dexter Ave Site (American Linen Site; Cleanup Site ID 12004), originating at 700 Dexter Avenue North. The chlorinated solvent contamination migrated through the groundwater and has come to be located beneath the Property. The American Linen Site is being addressed under a separate agreed order with Ecology (Agreed Order No. DE14302) and includes ongoing RI and FS activities, as well as an ongoing interim cleanup action. Since the American Linen Site has not completed the final CAP process, cleanup levels have not been selected. The data was compared to American Linen Site screening levels, defined in the *Final RI/FS Work Plan*, for comparison purposes (PES Environmental, 2019).

CVOCs detected above screening levels in saturated soil from the American Linen Site include, but are not limited to, tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC). These compounds have been detected in saturated soil at various locations on the Property at depths between approximately 25 and 50 feet bgs, corresponding to elevations between approximately 23 and -12 feet (Figure 2-7). These impacts are all present in saturated soil beneath the Site COCs areas of impacts.

CVOC contamination in groundwater from the American Linen Site is present in the Shallow, Intermediate, and Deep zones beneath the Property and adjacent areas (Figures 2-8, 2-9a, and 2-9b).

2.3 RECEPTORS AND EXPOSURE PATHWAYS

Current and potential future receptors at the Site include construction workers, workers and patrons of commercial and retail facilities, and area residents. Receptors and associated exposure pathways for contamination from the Site are:

- Any person that is in contact with contaminated soil.
- Any person that incidentally ingests contaminated soil.
- Any future building occupant breathing potentially contaminated air impacted from volatile compounds in vadose-zone soil and/or shallow groundwater.
- Any person ingesting shallow contaminated groundwater.

Terrestrial ecological receptors are not a concern for the Site based on the planned future land use, as discussed in more detail in the RI Report.

3. Cleanup Standards

Cleanup actions must comply with cleanup standards set forth in WAC 173-340-700 through 173-340-760. Cleanup standards include cleanup levels (CULs) for hazardous substances present at the Site, the location where these CULs must be met (i.e., point of compliance [POC]), and other regulatory requirements that apply to the Site because of the type of cleanup action and/or location of the Site (i.e., applicable state and federal laws). The following sections summarize the cleanup action objectives (CAOs) and cleanup standards for the Site, and additional detail is provided in the Ecology-prepared CAP.

3.1 CLEANUP ACTION OBJECTIVES

CAOs were developed to identify goals that should be accomplished by the cleanup action to meet the minimum requirements of the MTCA regulations and provide adequate protection of human health and the environment. The CAOs for soil and groundwater consider the applicable receptors and exposure pathways for those media (Section 2.3).

The CAOs for the Site COCs are:

1. Prevent any person from direct contact with contaminated soil.
2. Protect groundwater from being contaminated by impacted soil.
3. Mitigate the potential for future building indoor air to be impacted by contaminated soil and groundwater.
4. Prevent any person from ingesting contaminated groundwater.

Each CAO can be achieved through contaminant removal or treatment to meet constituent- and media-specific cleanup standards (cleanup levels at POCs) that are based on the specific exposure pathways, and preventing any potential residual exposure through containment/barrier with associated institutional controls.

3.2 CLEANUP LEVELS AND POINTS OF COMPLIANCE

CULs are concentrations of hazardous substances that are determined by Ecology to be protective of human health and the environment under specified exposure conditions. The MTCA regulations (WAC 173-340-350[9][a]) require that CULs be established for hazardous substances in each medium (soil and groundwater) and for each pathway where a release has occurred. For the Site, CULs have been developed for soil and groundwater COCs to address the exposure pathways identified in Section 2.3.

In general, standard MTCA Method B CULs have been selected for this Site, which are applicable to all sites and are developed with default formulas, assumptions, and procedures (WAC 173-340-705[1] and [2]). The minimum CUL (most protective) for all applicable exposure pathways was selected for each COC. Where appropriate, MTCA Method A Cleanup Levels for Groundwater and Method A Soil Cleanup Levels for Unrestricted Land Uses were used for groundwater and soil, respectively, for constituents that do not have Method B CULs. The CAP provides more detail on the CUL selection process.

The POC is the point or location on a site where CULs must be attained.

The soil and groundwater CULs, their basis, and associated POCs are listed below in Tables 3-1 and 3-2, respectively.

Table 3-1: Soil Cleanup Standards

COC	CUL (mg/kg)	Basis of CUL	POC
GRO	30	Protection of groundwater	Site-wide
Lead	250	Direct contact	0 to 15 feet bgs

Table 3-2: Groundwater Cleanup Standards

COC	CUL (µg/L)	Basis of CUL	POC
GRO	800	Protection of drinking water	Site-wide
DRO	500	Protection of drinking water	Site-wide
Benzene	2.4	Protection of indoor air	Site-wide

4. Selected Cleanup Action

The approved cleanup action for the Site COCs is shown on Figures 4-1 through 4-3 and consists of:

- Excavating contaminated soil within the planned redevelopment excavation required for construction of the new buildings to an approximate elevation of 7.75 feet (approximately 26 to 51 feet bgs) or lower.
- Performance compliance monitoring.

The approved cleanup action is a permanent cleanup action that will address Site COCs as defined in WAC 173-340-200. The justification for selecting the cleanup action is presented in the CAP.

4.1 CONSIDERATIONS RELATED TO OTHER SITES ON THE PROPERTY

The cleanup action and Property redevelopment plans take into consideration the ongoing and/or future investigations, cleanup actions, and monitoring related to the Broad Street Fill Site and the American Linen Site so as not to interfere with those efforts. Partial cleanup of these other sites' contaminants will be conducted during Property development in accordance with the *Contaminated Media Management Plan* (CMMP) (Haley & Aldrich, 2023).

Considerations related to the Broad Street Fill Site and the American Linen Site are summarized below:

- Groundwater management: CVOC-impacted groundwater discovered during excavation and associated construction dewatering will be appropriately managed, treated, and disposed (see Sections 5.5.3 and 5.5.4 for more details).
- Soil management: Fill soil within the excavation limits containing elevated cPAHs and arsenic from the Broad Street Fill Site will be appropriately managed and disposed (see Section 5.5 for more details).
- Soil management: CVOC-impacted soil from the American Linen Site discovered within the excavation limits will be managed and disposed of as non-dangerous solid waste at a Subtitle D landfill under a contained-in designation from Ecology and per the CMMP (see Section 5.5 for more details).
- Vapor intrusion mitigation: A vapor barrier will be installed beneath the slabs and along the below-grade walls of the new building structures at the Property as a mitigation measure to mitigate soil vapors containing CVOCs from migrating into the buildings.
- Environmental covenant: An environmental covenant will be filed for the Property to place limitations on the use of the Property (i.e., prohibit extraction and use of groundwater) and require that engineering controls (i.e., vapor barrier and protective cap) remain in-place and be monitored and maintained appropriately until the American Linen CVOC plume is remediated.

Detailed information on implementing the cleanup action and considerations previously noted is provided in the following sections and appendices of this EDR.

5. Cleanup Action Engineering Design

This section discusses in greater detail the engineering design, permitting requirements, and safety controls for the cleanup action at the Site.

5.1 REQUIRED PERMITS FOR CLEANUP ACTION IMPLEMENTATION

This section summarizes the permits associated with the cleanup action. Permits will be procured in a timely manner and prior to implementing the cleanup action, and copies of all permits will be kept at the job site office. The cleanup action has been designed to comply with all applicable local, state, and federal laws that were included in Section 3.3 of the CAP.

5.1.1 State Environmental Policy Act

A State Environmental Policy Act (SEPA) Checklist is required to identify and analyze environmental impacts associated with the cleanup action. A SEPA Checklist and Determination of Non-Significance (DNS) was issued by Ecology on 30 November 2021 for the cleanup action. The SEPA Checklist and DNS public comment period occurred concurrent with the RI, FS, CAP, and PPCD comment period in December 2021 and January 2022. No comments were received concerning the SEPA Checklist and DNS.

5.1.2 Master Use Permit (MUP)

A MUP is a land use application and will be required for Property redevelopment. The MUP is issued by the City of Seattle Department of Construction and Inspections (SDCI). The MUP application (No. 3035865-LU) is currently being reviewed by the City.

5.1.3 Shoring and Excavation Permit

A Shoring and Excavation Permit is required to install the shoring system and to conduct mass excavation near a public ROW. The Shoring and Excavation Permit is issued by SDCI, and the shoring design will also be reviewed by the Seattle Department of Transportation (SDOT). The Shoring and Excavation Permit application (No. 6763962-CN) is currently being reviewed by the City.

5.1.4 Street Use Permit

A Street Use Permit is required for work in the ROWs, including the loading and hauling of contaminated soil along Roy Street necessary for the cleanup action. The Street Use Permit is issued by SDOT. The Street Use Permit application (No. SUCONST0002865) is currently being reviewed by the City.

5.1.5 Construction Stormwater General Permit (CSWGP)

A CSWGP issued by Ecology is required because the project will disturb 1 acre or more of land where there is the possibility that stormwater could run off the site or enter a conveyance system that leads to surface waters. An Administrative Order (No. 21321) was issued in September 2022 in accordance with CSWGP No. WAR311290, permitting the discharge of treated stormwater and dewatering water to surface water, specifically Lake Union. The Administrative Order is presented in Appendix B.

5.1.6 King County Industrial Waste (KCIW) Program Discharge Authorization

A discharge authorization from the KCIW will be requested unless other contingency actions (e.g., off-Site disposal) are selected for disposal of discharge that may exceed CSWGP discharge limits. This KCIW discharge authorization will be used to discharge treated stormwater and dewatering discharge to the combined sewer system if effluent concentrations exceed the CSWGP discharge limits.

5.1.7 Side Sewer Permit

As required by the City of Seattle, a side sewer permit for temporary dewatering will be received prior to discharge of stormwater and dewatering effluent.

5.1.8 Puget Sound Clean Air Agency (PSCAA) Discharge Permit

If initial sampling of VC exceeds 30 µg/L, an air stripper may be added to the dewatering treatment system to extend the life of the carbon media. Regulations under the U.S. Clean Air Act (42 United States Code § 7401 et seq. and 40 Code of Federal Regulations [CFR] Part 50) and the Washington State Clean Air Act and Implementing Regulations (RCW 70A.15; Chapter 173-400 WAC) govern the discharge of airborne contaminants from point and non-point sources. For the Site, the applicable regulatory body for vapor discharge is PSCAA.

Remediation projects that emit less than 15 pounds per year of VC, less than 500 pounds per year of PCE, and less than 1,000 pounds per year of total toxic air contaminants are exempt from PSCAA regulations under Regulation I Section 6.03 (c)(94). If an air stripper is added to the dewatering treatment system and if the estimated concentrations are above these thresholds, the discharge of air stripper vapors will require that a Notice of Construction Application be prepared and submitted to PSCAA, and an Order of Approval received. This permit will require the treatment and sampling of vapor streams prior to discharge.

5.2 CULTURAL RESOURCES

The Site is within 200 feet of the historical Lake Union shoreline; thus, the archaeological significance of the Site was assessed in accordance with the Seattle Clarification of SEPA Historic Preservation Policy for Potential Archaeologically Significant Sites and Requirements for Archaeological Assessments (Director's Rule 2-98; Seattle Municipal Code Chapter 25.05.675 H). A Cultural Resources Assessment was prepared to evaluate the potential for archaeological resources to be present at the Site, and the assessment determined that the Site has a high potential to impact buried pre- and post-contact archaeological sites during excavation (Perteet, 2020; Appendix C).

The Cultural Resources Assessment recommended conducting excavations of portions of the Site under a project-specific Monitoring and Inadvertent Discovery Plan (MIDP). The cleanup action will proceed in accordance with the MIDP (Appendix C) prepared for the Site by Perteet. As noted in the MIDP, archaeological monitoring by a professional archaeologist will be conducted in excavation of:

- Historical fill on the west side of the Property until glacial till is fully exposed.
- The Broad Street 1958-2012 alignment, with intermittent monitoring check-ins only until the excavation reaches the base of modern fill. Below the modern fill, the excavation will be

monitored continuously until undisturbed glacial deposits are entirely exposed or the base of excavation is reached.

- The east portion of the Property until the glacially deposited dense sand deposit is fully exposed or the base of the excavation is reached.

The Washington State Department of Archaeology and Historic Preservation will be consulted on determining when monitoring can be terminated.

5.3 HEALTH AND SAFETY

A Health and Safety Plan (HASP) for Haley & Aldrich to perform excavation observation and environmental sampling activities was prepared in accordance with WAC 296-843, WAC 173-340-810, and 29 CFR 1910-120 (Appendix D).

The general contractor and each subcontractor are responsible for preparing and maintaining their HASP in accordance with WAC 296-843, WAC 173-340-810, and 29 CFR 1910-120 to identify potential physical and chemical hazards associated with their own work practices, and for conducting their work in accordance with the HASP.

Occupational Safety and Health Administration 40-hour Hazardous Waste Operations and Emergency Response training, with current annual 8-hour refresher, will be required for all on-Site workers that may be potentially exposed to contaminated media per 29 CFR 1910.120(e).

The main hazards associated with implementing the cleanup action include contact with contaminated soil and groundwater; inhalation of potentially contaminated air impacted from volatile compounds in soil or groundwater; and working around heavy equipment. The HASP discusses these and other potential hazards that may be encountered during implementation of the cleanup action, as well as mitigative measures to protect workers.

The HASP also summarizes air monitoring that will be conducted to provide worker exposure data for Haley & Aldrich Site workers. A separate Air Monitoring Plan summarizing perimeter air monitoring to provide community protection will be prepared and submitted to Ecology prior to construction.

5.4 MOBILIZATION AND PROJECT PREPARATION

The contractor shall mobilize to the Property all the necessary equipment, labor, and materials to perform the work required to implement the cleanup action. Project preparation shall include the activities discussed in the following sections.

5.4.1 Temporary Facilities and Access Controls

Temporary Site facilities and controls include worker facilities, a decontamination area, and site access controls.

Potable water, portable toilets, and a job site trailer(s) will be installed by the contractor. Portable toilets will be placed on Site for use by Site personnel in accordance with WAC 296-155-140.

A decontamination area will be established on Site for vehicle, equipment, and/or personnel decontamination. A truck wheel wash area may be established, as necessary, to allow for the washing and decontamination of equipment working in contaminated soil, and personnel will have a boot wash station to ensure proper decontamination procedures. Decontamination water will be contained and shall be processed through the construction dewatering system.

Site controls will be established to ensure the work zone is properly secured. The entire perimeter of the Property will be fenced, and points of ingress and egress will be clearly marked. The access points to the Property will be monitored by authorized personnel during construction activities and locked when not monitored.

5.4.2 Utility Locates and Protection

Prior to commencing any on-Site activities, all underground public and private lines shall be located and marked with paint. Utility companies shall be notified of the scheduled commencement of excavation with a "one-call" (i.e., 811) as required by law.

A King County underground combined sewer overflow (CSO) drop structure is located near the center of the northern boundary of the Property, and underground CSO overflow pipes extend west (Central Trunk CSO Pipeline), northeast (South Lake Union CSO Pipeline), and south (Lake Union Tunnel) from the structure. The underground CSO infrastructure also includes a large-diameter tunnel (Mercer Street Tunnel), which extends southwest from the drop structure, as shown on Figure 4-1. The CSO infrastructure is owned by King County via an easement and will remain on the Property after redevelopment. Measures will be taken for protection and monitoring of these utilities during construction.

5.4.3 Demolition

Above-ground Site features, such as asphalt and concrete, will be removed and Site grading and landscape grubbing will be conducted prior to the start of the excavation activities in an area. Existing storm drain, ditches, and culverts will also be abandoned, as shown on the Temporary Erosion and Sediment Control (TESC) Plans (Appendix E).

5.4.4 Erosion and Sediment Controls

TESC measures shall be installed by the contractor as part of the larger redevelopment project prior to any construction, grading, clearing, grubbing, or excavation, in accordance with regulations. TESC measures will include best management practices (BMPs) for construction activities as shown on the TESC Plans (Appendix E) and listed in the Stormwater Pollution Prevention Plan (SWPPP, Appendix F). Once all TESC measures are implemented in accordance with the TESC Plans and SWPPP, construction equipment and supplies will be mobilized to the Property. Relevant personnel shall meet with a representative of the City of Seattle prior to beginning excavation, and SDCI inspections will provide approval of TESC measures.

5.4.5 Monitoring Well Decommissioning

All monitoring wells within the excavation footprint and select monitoring wells adjacent to the Property boundary are expected to be decommissioned prior to shoring and excavation activities (Figure 5-1). Select monitoring wells adjacent to the Property boundary that require decommissioning due to

conflicts with the shoring system are expected to be re-installed in a nearby location prior to tieback installation. Injection wells on the Property associated with the interim action for the American Linen Site will also be decommissioned prior to excavation. Monitoring and injection wells will be decommissioned by a licensed well driller or under the supervision of a professional engineer in accordance with Ecology's Water Well Construction Act (1971), Revised Code of Washington (RCW) 18.104 (WAC 173-160-460). The required documentation will be submitted to Ecology following decommissioning.

5.5 SOIL EXCAVATION

The cleanup action involves excavating contaminated soil from the Property, including the GRO-contaminated soil in the northwest corner of the Property (Figure 2-2) and the two areas of lead-contaminated soil in the north-central and northeast areas of the Property (Figure 2-3), and transporting the excavated material off Property for land disposal. The estimated quantity of GRO- and lead-contaminated soil (i.e., soil with concentrations greater than CULs) to be removed during the cleanup action is approximately 2,300 and 300 bank cubic yards, respectively. The cleanup action will occur concurrently with Property redevelopment. The planned redevelopment excavation required for construction of the new buildings extends laterally across the vast majority of the Property, with the exception of the King County sewer overflow infrastructure and small areas in the northwest corner and along the southern Property boundary (Figure 4-1). The vertical excavation extent is to approximately elevation 7.75 feet (approximately 26 to 51 feet bgs), except for the shear wall cores, which will extend to approximately elevation 1.75 feet (approximately 32 to 57 feet bgs).

Soil excavation for Property redevelopment will also remove shallow contaminated soil on the Property from the Broad Street Fill Site (i.e., cPAHs and arsenic in the Broad Street 1958-2012 alignment [Figures 2-5 and 2-6]). The estimated quantity of cPAH- and arsenic- contaminated soil (i.e., soil above the RI screening levels) to be removed during Property redevelopment is approximately 1,100 and 4,700 bank cubic yards, respectively.

Soil excavation for Property redevelopment will also remove some CVOC-impacted saturated soil that has come to be located on the Property due to migration of contamination from the American Linen Site, primarily in the northern area of the Property (Figure 2-7). The estimated quantity of CVOC-impacted saturated soil (i.e., soil with detections requiring disposal as Class IV) to be removed during Property redevelopment is approximately 18,400 bank cubic yards.

Haley & Aldrich used analytical data from the RI to estimate these soil volumes based on our professional judgment. These volumes are subject to change based on field screening and soil sampling that may occur during construction.

Details on handling and disposing of contaminated soil from the Site are presented in the CMMP (Haley & Aldrich, 2023). The CMMP also discusses contingency actions to be conducted if unanticipated discoveries, including contaminated soil outside of the known areas, are encountered during excavation, as well as the management and cleanup of the other sites' impacted soil.

The following sections discuss the shoring and stormwater/construction dewatering conveyance and treatment system that shall be installed to facilitate the excavation of impacted and contaminated soil, as well as measures that may be taken to reduce nuisance odors and dust generated by soil excavation,

as needed.

5.5.1 Shoring

Shoring will be installed as the excavation proceeds to facilitate the safe excavation of contaminated soil to the required depth. Shoring will be installed around the perimeter of the excavation footprint and will consist of soldier and secant piles, tiebacks, soil nails, and/or lagging. Soldier piles will be installed along the perimeter of the approximate western two-thirds of the Property where dense low-permeability glacial till soils are present and dewatering flow rates are estimated to be minimal, while secant piles will be installed along the perimeter of the approximate eastern one-third of the Property where construction dewatering flow rates are expected to be higher in less dense soils. Additionally, a temporary soil berm will be left in-place along the northern excavation boundary until raker supports are installed. The preliminary shoring design is provided in the Temporary Shoring Wall Plans dated 21 January 2022 (Appendix G). Shoring will be designed and sealed by a qualified and licensed engineer in the State of Washington and will be included in the building and permitting plans where required.

Spoils generated from installation of the shoring elements will be managed in accordance with the CMMP (Haley & Aldrich, 2023).

5.5.2 Odor and Dust Control

If nuisance odors are detected during impacted or contaminated soil excavation activities, the contractor shall take measures to control odors. These measures may include but are not limited to:

- Sprinkle the Site with water as needed to minimize odor.
- Cover exposed areas with nuisance odors with plastic sheeting at the end of each day and when excavation activities are not being performed.
- Cover stockpiles with nuisance odors with plastic sheeting when not in use.

As noted in the SWPPP (Appendix F), dust controls will be implemented as required throughout the duration of the project, using BMP C140. These BMPs are noted in the Stormwater Management Manual for Western Washington (Ecology, 2019), and may include but are not limited to:

- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Sprinkle the Site with water until the surface is wet. Repeat as needed.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.

Additional information on dust monitoring requirements for Haley & Aldrich Site workers is presented in the HASP (Appendix D).

5.5.3 Stormwater Management

All appropriate TESC measures will be implemented by the general contractor during the excavation. All TESC measures and BMPs shall comply with the TESC Plans (Appendix E) and the SWPPP (Appendix F) and be properly maintained. Maintenance shall include regular inspections of all materials and inspections following storm events.

No construction site stormwater runoff shall drain as untreated surface runoff to Lake Union unless testing indicates treatment is not necessary. Stormwater resulting from construction activities is planned to be collected via sumps and pumps, treated, and discharged to the stormwater system under the approved discharge permit (Sections 5.1.5 and 5.1.6). The proposed treatment system includes sedimentation, chemically enhanced sand filtration, and granular activation carbon (GAC). The treatment system was designed for a flow rate of 250 gallons per minute (gpm). Discharge limits and sampling requirements are stipulated in Administrative Order No. 21321 issued in accordance with the discharge permit, as further discussed in Section 5.6.2. If effluent concentrations exceed the CSWGP discharge limits, contingency actions (e.g., off-Site disposal and KCIW discharge to the combined sewer system) will be evaluated. The SWPPP (Appendix F) and CMMP (Haley & Aldrich, 2023) provide additional details on handling, treating, and disposing of contaminated stormwater.

5.5.4 Construction Dewatering

Installation and operation of a temporary construction dewatering system on the Property will occur to remove water from the construction area during portions of the excavation activities. The temporary dewatering system will consist of approximately 30 dewatering wells around the perimeter of the western two-thirds of the excavation and approximately 12 dewatering wells in the interior of the excavation. Groundwater seepage, if any, will be collected in sumps and pumped out of the excavation. A localized vacuum wellpoint system may also be installed depending on soil conditions. The dewatering system design, including dewatering well construction details and proposed locations, is discussed further in Middour Construction LLC's Groundwater Control Plan (Appendix H and referenced cross-sections in Appendix I). All wells will be completed by a licensed well driller and comply with the requirements of WAC 173-160, Minimum Standards for Construction and Maintenance of Wells.

Upon completion of drilling and dewatering well installation activities, the wells will be developed, down-well pumps will be installed at the bottom of the well casings, and dewatering activities may commence. Water captured by the dewatering system will be treated prior to discharging to the stormwater system under the approved discharge permit (Sections 5.1.5 and 5.1.6). The proposed treatment system includes sedimentation, bag filters, and GAC. If initial sampling of vinyl chloride exceeds 30 µg/L, an air stripper may be added to the dewatering treatment system to extend the life of the carbon media. Vapors from the air stripper would be treated by GAC. The dewatering treatment system was designed for a flow rate of 250 gpm. The estimated dewatering discharge rates are presented in Middour's Groundwater Control Plan (Appendix H). Discharge limits and sampling requirements are stipulated in Administrative Order No. 21321 issued in accordance with the discharge permit, as further discussed in Section 5. 6.2. If effluent concentrations exceed the CSWGP discharge limits, contingency actions (e.g., off-Site disposal and KCIW discharge to the combined sewer system) will be evaluated. The SWPPP (Appendix F) and CMMP (Haley & Aldrich, 2023) provide additional details on handling, treating, and disposing of contaminated dewatering discharge.

5.6 COMPLIANCE MONITORING

This section describes the compliance monitoring requirements for the cleanup action, which will be performed in accordance with WAC 173-340-410. Compliance monitoring includes three types of monitoring—protection, performance, and confirmation. These are further discussed below.

5.6.1 Protection Monitoring

Protection monitoring will be performed during construction to confirm that human health and the environment are adequately protected. Protection monitoring will include dust monitoring and vapor monitoring during excavation. Additional details for monitoring of Haley & Aldrich Site workers are provided in the HASP (Appendix D).

5.6.2 Performance and Confirmation Monitoring

Performance monitoring following soil excavation will include collection and analysis of soil samples from the base and walls of the excavation to confirm that the CULs for Site COCs have been achieved, or to document the concentration of COCs and other hazardous substances that remain on the Site or Property, as necessary (e. g., existing data may be used as performance monitoring samples where appropriate).

Confirmational monitoring serves to confirm the long-term effectiveness of the cleanup action once cleanup standards and other performance standards have been attained. Confirmational monitoring is not anticipated because Site COCs are expected to meet compliance upon completion of the cleanup action and Property redevelopment. Final performance sampling results will serve as confirmation of meeting compliance with the CULs.

Discharge water monitoring will also be conducted during the project to monitor performance of the water treatment system and confirm that discharge limits are met for various water quality parameters prior to entering the stormwater system and Lake Union downstream. As noted in the Administrative Order, the discharge permit requires compliance with the Water Quality Standards for Surface Waters of the State of Washington (Water Quality Standards – 173-201A WAC) and prohibits any discharges of pollutants. Table 1 of the Administrative Order lists all pollutants and water quality parameters and their associated threshold limits (“Indicator Levels”) that must be met. Monitoring parameters include:

- Petroleum hydrocarbons (GRO, DRO, and heavy oil-range organics) and benzene, toluene, ethylbenzene, and xylenes
- Total metals (includes 11 metals)
- Volatile Organic Compounds (includes 23 compounds)
- Polycyclic aromatic hydrocarbons and cPAHs (includes 17 compounds)
- Total polychlorinated biphenyls (sum of congeners or isomers or homologs or Aroclors)
- Turbidity
- pH

Performance monitoring specifics, including monitoring procedures, locations, frequency, and analyses are presented in the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) in

Appendix J. Additional details concerning water monitoring are presented in the SWPPP and Administrative Order in Appendices F and B, respectively.

6. Vapor Intrusion Mitigation Design

As noted in the CAP, the cleanup action described in Section 4 for the Site is a permanent cleanup action that will address Site COCs. Site-related contamination is expected to be less than Site cleanup standards after implementation of the cleanup action. However, CVOCs associated with the American Linen Site are present in saturated soil and groundwater below excavation limits and below the future buildings on the Property.

Groundwater screening levels for protection of indoor air were calculated per Ecology guidance (Ecology, 2022b), and are 24 µg/L for PCE, 1.4 µg/L for TCE, 180 µg/L for cis-1,2-DCE, and 0.35 µg/L for VC. Numerous monitoring wells within and immediately adjacent to the footprint of the future buildings that are screened below the planned bottom of excavation have recent concentrations (2018 to 2022) of PCE, TCE, cis-1,2-DCE, and/or VC exceeding these groundwater screening levels (Figures 2-8, 2-9a, and 2-9b).

Vapor intrusion mitigation at the Property will be accomplished with three mitigation components detailed in this section. The three components are:

- A vapor barrier to be installed during building construction;
- The construction of an underground parking garage with a dedicated ventilation system beneath the footprint of the building; and
- Sealing and venting of sumps and drains located in the building/parking garage that may contain site groundwater.

6.1 VAPOR BARRIER

A vapor barrier shall be installed beneath the slab and along the below-saturated-grade walls of the new building structures, including elevator pits at the Property. This building is proposed to include a waterproofing barrier that can also function as a chemical vapor barrier. The location, design, details, and installation instructions for the waterproofing barrier must meet the objectives of vapor intrusion mitigation. This waterproofing barrier shall mitigate vapors containing CVOCs from migrating into the buildings. The proposed waterproofing material was evaluated for its effectiveness for CVOC vapor barrier purposes.

The proposed waterproofing material is Coreflex® 60 by CETCO. The Coreflex® 60 vapor barrier is a 60-mil nominal thermoplastic membrane reinforced with a 5-ounce weft inserted knit polyester fabric integrally bonded to an active polymer core. The barrier comes in two different widths, 54 feet (i.e., Coreflex® 60-54W) and 66 feet (i.e., Coreflex® 60-66W). Coreflex® product information is included in Appendix K. This vapor barrier creates a physical barrier between subsurface vapors and the building foundation. Based on discussion with CETCO, Coreflex® 60 has long-term resistance to CVOCs at Property concentrations received to date and will be confirmed if concentrations are higher than previously approved. Coreflex® 60 also presents a very low diffusion coefficient for CVOCs, such as PCE and TCE, similar to other vapor membranes on the market (see Appendix K for Coreflex® 60 diffusion coefficient results). If an alternative waterproofing barrier is selected by the contractor or property owner, the barrier will need to be reviewed by the owner's environmental consultant to document that

the alternative meets with objectives of vapor intrusion mitigation. This information will be provided to Ecology for review and approval prior to installing the alternative barrier material.

In coordination with the pouring of the foundation slab, the barrier shall be installed in accordance with the specifications and manufacturer's instructions in Appendix K, as well as final design drawings once the waterproofing membrane is selected. Application shall be by professional installation technicians certified by the manufacturer (if needed) to install the barrier. Vapor barrier penetrations, such as pipe penetrations and utility hangers, will be sealed in accordance with the vapor barrier manufacturer's instructions. Example penetrations details are included in Appendix K; however, specific details will be prepared once the waterproofing vapor membrane is selected. The owner's representative shall observe vapor barrier installation and quality control/quality assurance (QA/QC) activities. Proper QA/QC activities specific to the vapor barrier manufacturer will be completed and documented by the installation contractors and certified by an independent qualified third party. These activities may include, for example, coupon sampling (to measure thickness if the barrier has a spray applied component) and smoke testing. Smoke testing will be performed by using a smoke machine to force non-toxic smoke-filled air (fog) underneath the vapor barrier and observing whether there are leaks through the vapor barrier. Identified leaks will be repaired and smoke testing repeated until no leaks are observed. The smoke test will also be repeated immediately prior to the concrete pour, after rebar activities are completed, and additional identified leaks will be sealed. Information regarding installation of the vapor barrier and results of smoke testing will be included in the final Cleanup Action Completion Report (CACR).

6.2 UNDERGROUND PARKING GARAGE

The underground parking garage constructed beneath both towers of the planned future building will also serve to mitigate potential vapor intrusion for the occupied spaces of the building. The garage will provide a gap between continuously occupied spaces and the impacted groundwater. The parking garage will essentially act as a "vapor intrusion mitigation system by building design." The parking garage will consist of four sub-grade parking levels that will contain parking as well as utility areas, fire water storage, plumbing room, and pump room. The current design does not include continuously occupied space in the sub-grade parking levels. The parking garage will be designed and specified by others; however, it is general practice for parking garages to be sealed from other occupied spaces (e.g., utility penetrations, doors, windows, lighting fixtures, etc.) to mitigate the migration of car exhaust (e.g., carbon monoxide, nitrogen oxide) into occupied spaces.

In addition, enclosed parking garages are typically ventilated using a dedicated heating, ventilation, and air conditioning (HVAC) system such that minimum industry standard air exchange rates are achieved. The ventilation of parking garages is also typically set to maintain a negative pressure within the parking garage relative to the occupied areas above, mitigating the ability for air to move from the parking garage into the occupied space. Once available, the owner's environmental consultant will verify that the plans for the construction of and ventilation of the parking garage are consistent with mitigating potential vapor intrusion. The attenuation of potential sub-slab soil vapors across the designed vapor barrier as well as the additional attenuation and dilution from ventilated, depressurized, and sealed four levels of parking garage are sufficient to mitigate the potential for vapor intrusion within the planned buildings.

6.3 SUMPS AND DRAINS

The building design plans will include a method to manage groundwater that infiltrates into the parking garage levels located below the groundwater table. Groundwater will be collected in a drainage system that will include piping and sumps within the parking garage and may include water treatment. Vapor intrusion mitigation will consider this pathway and include necessary measures (e.g., sealing the sumps, providing check valves on connected floor drain piping).

7. Environmental Covenant

The cleanup action for the Site is a permanent cleanup action, and no residual contamination from the Site is expected to remain after implementation of the cleanup action. However, CVOC-impacted saturated soil and groundwater from the American Linen Site is present beneath the Property. Receptors at the Property (i.e., construction workers, workers and patrons of commercial and retail facilities, and area residents) may come in contact with on-Property American Linen Site impacts from the following exposure pathways:

- Breathing potentially CVOC-impacted air due to concentrations present in saturated soil and/or groundwater.
- Ingesting impacted groundwater.

To mitigate these exposure pathways and protect Property receptors from American Linen Site impacts, an environmental covenant will be filed to place limitations on the use of the Property and will require that engineering controls remain in place.

The environmental covenant is expected to prohibit extraction and use of groundwater and require that the vapor barrier and protective cap remain in place at the Property and be monitored and maintained appropriately. A draft environmental covenant is included in Appendix L. An environmental covenant will be filed in conjunction with the final CACR, as noted in Table 8-1.

8. Schedule and Reporting

8.1 IMPLEMENTATION SCHEDULE

Implementation of the cleanup action will occur in conjunction with Property redevelopment, scheduled to begin within 180 calendar days of Ecology's approval of this EDR or after permit acquisition in accordance with the CAP. The preliminary project schedule is provided in Table 8-1 below. Any revisions to the project schedule will be noted in the progress reports to Ecology, which are described in Section 8.2.

Table 8-1: Preliminary Implementation Schedule

Task	Schedule
Acquire Project Permits	First Quarter 2024
Site Preparation and Mobilization	First Quarter 2024
Monitoring Well Decommissioning	First Quarter 2024
Shoring, Perimeter Dewatering Well, and Drilled Shaft Installation	First – Second Quarter 2024
Excavation and Compliance Soil Sampling	First – Fourth Quarter 2024
Interior Dewatering Well Installation	Third Quarter 2024
Construction Dewatering	First Quarter 2024 – Third Quarter 2025
Vapor Barrier Installation[1]	Fourth Quarter 2024 – Second Quarter 2025
Submit Agency Review Draft CACR	180 calendar days following completion of cleanup action
Submit Final CACR	60 calendar days after receipt of Ecology's final comments
File Environmental Covenant[1]	In conjunction with Final CACR
Submit Monthly Progress Reports	15 calendar days after the end of each month[2]

Notes:

1) Required for other contaminated sites at the Property, rather than for cleanup of the Seattle DOT Mercer Parcels Site.

2) Upon mutual agreement by Ecology and 800 Mercer, LLC, the Progress Reports may be submitted quarterly, depending on the current activities at the Site.

8.2 PROGRESS REPORTS

Progress reports will be prepared monthly, in accordance with the requirements of the PPCD, and submitted to Ecology via email no later than the 15th day of each month.[3] The progress reports will document work completed in the previous month and planned for the upcoming month to implement the cleanup action and will also include all other information specified in Section XII of the PPCD.

[3] Upon mutual agreement by Ecology and 800 Mercer, LLC, the progress reports may be submitted quarterly, depending on the current activities at the Site.

8.3 CLEANUP ACTION COMPLETION REPORT

After completion of the cleanup action for the Site, a CACR will be prepared to meet the requirements of WAC 173-340-400(6)(b). The Agency Review Draft CACR will be submitted to Ecology no later than 180 calendar days following completion of the cleanup action, as noted in Table 8-1.

The CACR will document construction activities performed to complete the cleanup action described in this EDR. Deviations from this EDR, if any, shall be described in the CACR, as well as the rationale for deviations. The CACR shall include results from compliance sampling, a figure showing sample locations, and the total quantities of impacted and contaminated soil disposed of by soil classification.

Analytical data collected during the cleanup action shall be uploaded to Ecology's Environmental Information Management System in conjunction with submittal of the CACR.

References

1. Ecology, 2019. Stormwater Management Manual for Western Washington. Publication No. 19-10-021. Washington State Department of Ecology. July.

2. Ecology, 2022a. Cleanup Action Plan, Seattle DOT Mercer Parcels Site, Seattle, WA. Prepared by Washington Department of Ecology. 8 February.

3. Ecology, 2022b. Guidance for Evaluating Vapor Intrusion in Washington State, Investigation and Remedial Action. Publication No. 09-09-047. Washington State Department of Ecology, Olympia, WA. March.

4. Hart Crowser, 2022. Remedial Investigation, Seattle DOT Mercer Parcels, 800 Mercer Street, Seattle, Washington. Prepared by Hart Crowser, a division of Haley & Aldrich for 800 Mercer, LLC. 3 February.

5. Haley & Aldrich, 2023. Contaminated Media Management Plan on Seattle DOT Mercer Parcels Site, 800 Mercer Street, Seattle, Washington. Prepared by Haley & Aldrich, Inc. for 800 Mercer, LLC. September.

6. Perteet, 2020. Cultural Resources Overview for the Mercer Mega Block Project, Seattle, Washington. Prepared by Perteet for EA Engineering, Science and Technology. 13 October.

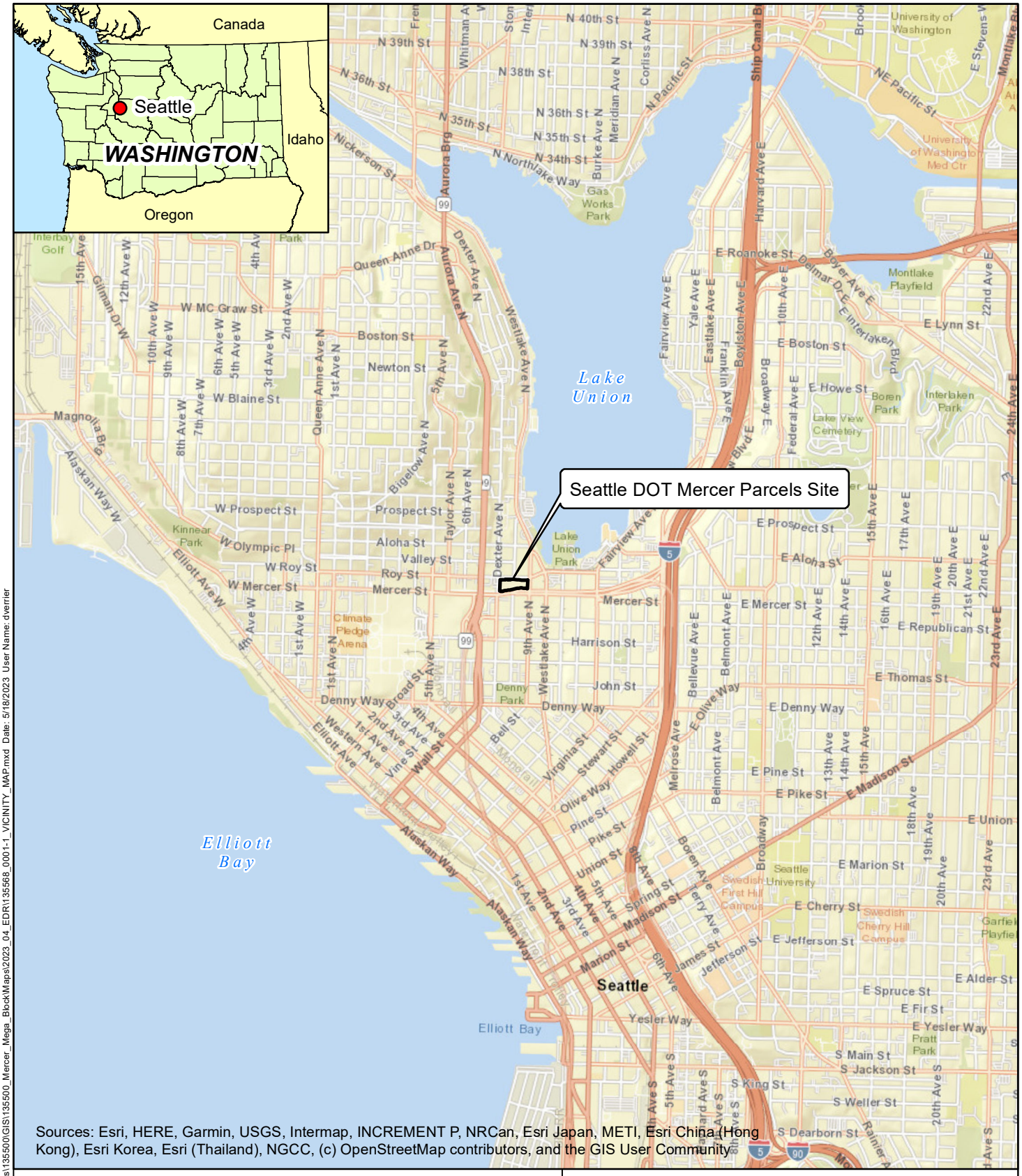
7. PES Environmental, 2018. Final Interim Action Work Plan, American Linen Co Dexter Ave Site., 700 Dexter Ave, Seattle, Washington. August.

8. PES Environmental, 2019. Final Remedial Investigation/Feasibility Study Work Plan, American Linen Supply Co-Dexter Avenue Site, 700 Dexter Avenue North, Seattle, Washington. Prepared for BMR-Dexter LLC. 4 December.

9. SoundEarth Strategies, 2013. Remedial Investigation Report, 700 Dexter Property, 700 Dexter Avenue North, Seattle, Washington [Draft]. Prepared for Frontier Environmental Management LLC. 15 July.

10. SoundEarth Strategies, 2016. Interim action work plan, 700 Dexter property, 700 Dexter Avenue North, Seattle, Washington [Draft]: Report prepared for Frontier Environmental Management LLC, Denver, Colo. 8 March.

FIGURES



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Seattle DOT Mercer Parcels Site
Seattle, Washington

Vicinity Map

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HALEY ALDRICH

Figure
1-1

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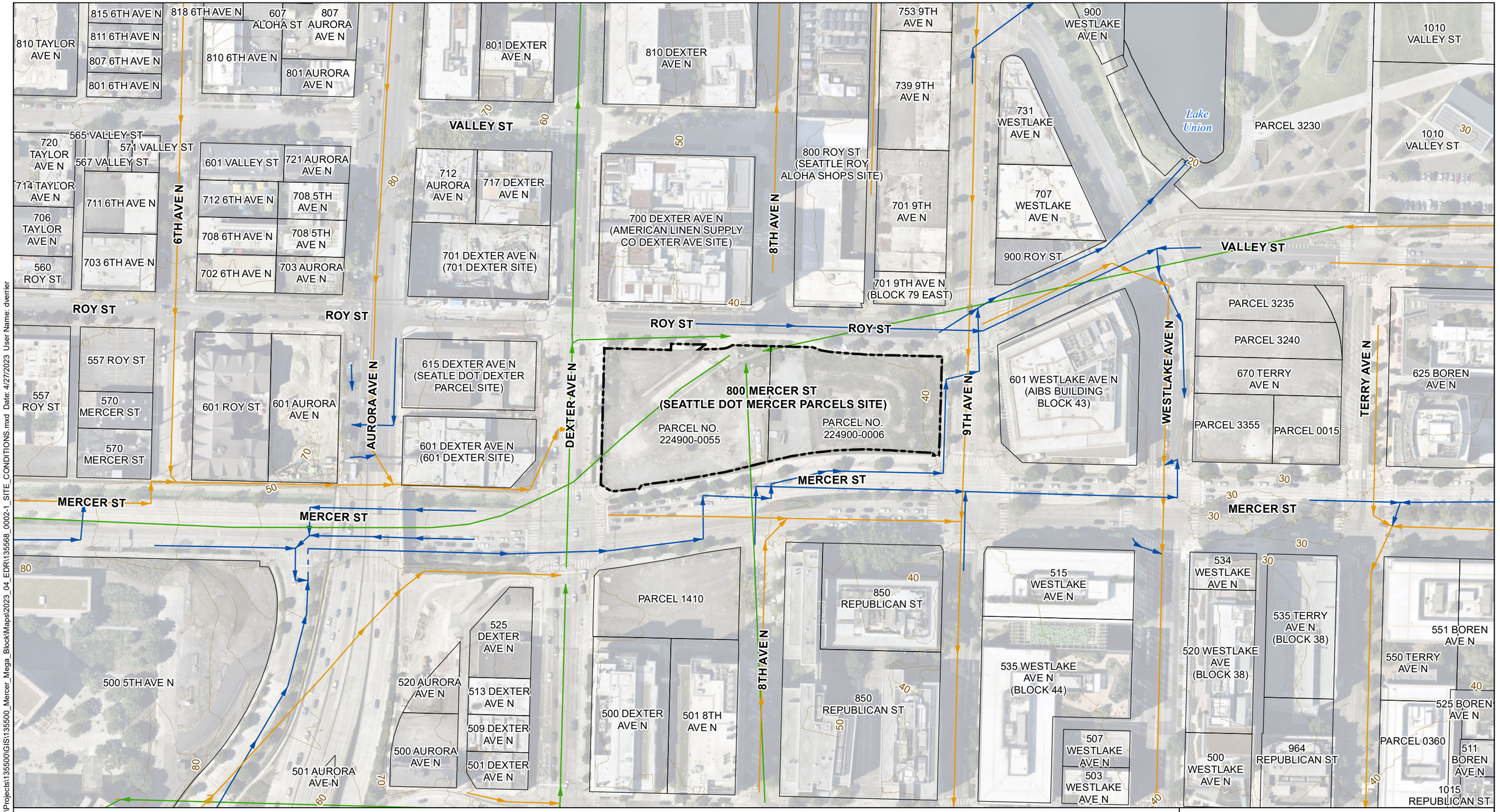

Legend

- Other Parcel Boundary
- Property Boundary

Underground Sewer Lines

- King County Main
- SPU Drainage Main
- SPU Combined Main

- King County Main Facility Structures
- Elevation Contour (King County LiDAR, 2016)

0 75 150 300 Feet

N

Sources: Aerial photograph provided by Nearmap, May 21, 2022. Address information obtained from King County GIS Open Data portal's Parcel Address Area shapefile, published April 4, 2019. Stormwater line data obtained from City of Seattle ArcGIS Online data, published August 6, 2019.

Seattle DOT Mercer Parcels Site
Seattle, Washington

Site Conditions Map

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HALEY ALDRICH

Figure **2-1**

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MBB-1	02/27/2020 5 ft el 50.02	02/27/2020 10 ft el 45.02	02/27/2020 15 ft el 40.02	02/27/2020 20 ft el 35.02	02/27/2020 25 ft el 30.02
GRO	5 U	5 U	7.7	570	5 U

MBGW-13	03/14/2019 5 ft el 49.47	03/14/2019 10 ft el 44.47	03/14/2019 15 ft el 39.47	03/14/2019 20 ft el 34.47
GRO	5 U	730 J	16	5 U

MBB-16	09/02/2020 5 ft el 48.7	09/02/2020 10 ft el 43.7	09/02/2020 15 ft el 38.7	09/02/2020 20 ft el 33.7
GRO	1200	200	20	5 U

HMW-18S	09/03/2020 5 ft el 52.61	09/03/2020 10 ft el 47.61	09/03/2020 15 ft el 42.61	09/03/2020 20 ft el 37.61	09/03/2020 25 ft el 32.61
GRO	5 U	45	5 U	5 U	5 U

MBB-3	02/27/2020 5 ft el 49.84	02/27/2020 10 ft el 44.84	02/27/2020 15 ft el 39.84	02/27/2020 20 ft el 34.84	02/27/2020 25 ft el 29.84
GRO	5 U	350	5 U	5 U	52

MBB-4	02/27/2020 5 ft el 49.61	02/27/2020 10 ft el 44.61	02/27/2020 15 ft el 39.61	02/27/2020 20 ft el 34.61	02/27/2020 25 ft el 29.61
GRO	5 U	5 U/7.3	5 U	210	5 U

GRO IN SOIL (mg/kg)
- ≥ 300
- ≥ 60 TO 300
- ≥ 30 TO 60
- ND/0 TO < 30
- NO DATA

SAMPLE DEPTH INTERVALS
- ≤ 5 FT BELOW GROUND SURFACE (BGS)
- 5 TO 10
- 10 TO 15
- 15 TO 20
- 20 TO 25
- > 25

EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT

PROPERTY BOUNDARY

APPROXIMATE LIMTS OF 2H:1V SOIL BERM THAT WILL BE EXCAVATED LAST

SOME SAMPLING LOCATIONS MAY HAVE BEEN SLIGHTLY OFFSET ON THIS MAP TO REDUCE SYMBOL OVERLAP

RED TEXT INDICATES EXCEEDANCE OF PROTECTIVE OF GROUNDWATER SCREENING LEVELS

SCREENING LEVELS PROVIDED BY ECOLOGY (NOVEMBER 17, 2020)

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88); EL. = GROUND SURFACE ELEVATION

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN

AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR ARSENIC IN SOIL (mg/kg)
All levels adjusted up to natural background

ZONE	PROTECTIVE OF GW
Vadose (0 to 25 ft bgs) and Saturated (>25 ft bgs)	7.3

Seattle DOT Mercer Parcels Site
Seattle, Washington

GRO Distribution in Soil

0202738-100 05/23

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Figure **2-2**

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MBB-5	03/02/2020 5 ft el 45.53	03/02/2020 10 ft el 40.53	03/02/2020 15 ft el 35.53	03/02/2020 20 ft el 30.53	03/02/2020 25 ft el 25.53
Lead	17.6	591	1.57	1.24	1.29

21417-MB9	05/11/2017 13 ft el 26.05	05/11/2017 22 ft el 17.05
Lead	19.3	279

ROY ST

8TH AVE N

DEXTER AVE N

MERCER ST

21417-MB1 EL 55.4
MBGW-12 EL 54.0
MBPP-7 EL 49.8
MBPP-5 EL 45.9
21417-MB8 EL 45.3
MBGW-1 EL 40.0
HMW-17S EL 57.7
MBB-1 EL 55.0
MBB-16 EL 53.7
MBB-7 EL 49.4
21417-MB6 EL 48.2
MBB-10 EL 49.7
MBB-20 EL 47.5
MBB-12 EL 33.7
MBGW-6 EL 52.5
MBGW-3 EL 47.8
MBGW-4 EL 47.3
MBB-23 EL 47.2
MBB-2 EL 55.5
MBB-4 EL 54.6
MBGW-5 EL 49.9
21417-MB9 EL 39.0
MBB-13 EL 36.0
HMW-18S EL 57.5
HMW-3IA EL 55.0
MBB-3 EL 54.8
MBB-5 EL 50.5
MBB-6 EL 50.3
MBGW-2 EL 46.1
MBB-11 EL 46.4
GP-9 EL 58.0
HMW-19S EL 58.4
MBB-24 EL 54.1
HMW-20S EL 53.6
MBB-8 EL 49.7
MBB-9 EL 47.5
HMW-2IB EL 47.4
MBB-22 EL 42.0
MBPP-1 EL 45.3
MBB-18 EL 51.3
21417-MB10 EL 38.1
MBGW-7 EL 53.8
MBPP-4 EL 48.3
HMW-5IB EL 58.4
HMW-9S EL 55.4
HMW-9IA EL 55.3
HMW-9D EL 55.3
GP-8 EL 58.3
HMW-9IB EL 55.4
MBB-19 EL 51.7
MBPP-3 EL 45.9
21417-MB11 EL 39.0
MBPP-8 EL 57.5
MBB-17 EL 54.9
MBGW-8 EL 47.1
MBPP-2 EL 44.5
HMW-11S EL 41.5
GP-7 EL 58.5
HMW-10S EL 48.2
HMW-10D EL 48.2
MBB-21 EL 47.6
MBGW-15 EL 40.9
HMW-11IB EL 39.7
HMW-8IB EL 58.0
HMW-6IA EL 58.6
HMW-6IB EL 58.7
HMW-6D EL 58.6
MBGW-9 EL 56.8
21417-MB4 EL 57.2
HMW-7IB EL 58.7
MBGW-10 EL 55.3
MBGW-11 EL 57.5

0 20 40 80 Feet

N

LEAD IN SOIL (mg/kg)
- ≥ 2,500
- ≥ 500 TO 2,500
- ≥ 250 TO 500
- ND/0 TO < 250
- NO DATA

SAMPLE DEPTH INTERVALS
- ≤ 5 FT BELOW GROUND SURFACE (BGS)
- 5 TO 10
- 10 TO 15
- 15 TO 20
- 20 TO 25
- > 25

- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY
- APPROXIMATE LIMTS OF 2H:1V SOIL BERM THAT WILL BE EXCAVATED LAST

SOME SAMPLING LOCATIONS MAY HAVE BEEN SLIGHTLY OFFSET ON THIS MAP TO REDUCE SYMBOL OVERLAP

RED TEXT INDICATES EXCEEDANCE OF DIRECT CONTACT OR PROTECTIVE OF GROUNDWATER SCREENING LEVELS

SCREENING LEVELS PROVIDED BY ECOLOGY (NOVEMBER 17, 2020)

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88); EL. = GROUND SURFACE ELEVATION

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN

AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR LEAD (mg/kg) IN SOIL		
ZONE	DIRECT CONTACT	PROTECTIVE OF GW
Vadose (0 to 25 ft bgs)	250	3000
Saturated (>25 ft bgs)	250	150

Seattle DOT Mercer Parcels Site
Seattle, Washington

Lead Distribution in Soil

0202738-100 04/23

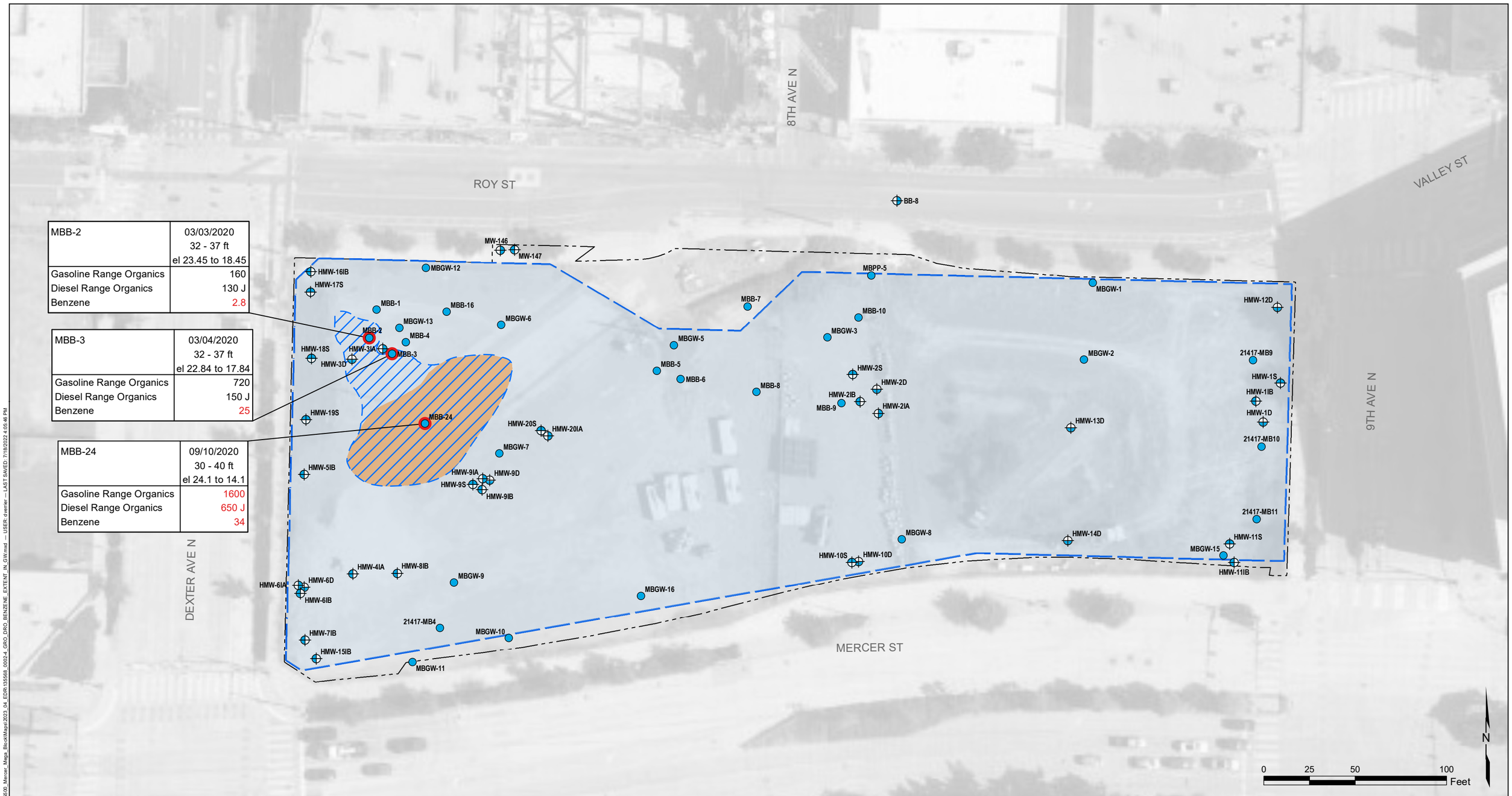
HALEY ALDRICH

Figure **2-3**

MBB-2	03/03/2020 32 - 37 ft el 23.45 to 18.45
Gasoline Range Organics	160
Diesel Range Organics	130 J
Benzene	2.8

MBB-3	03/04/2020 32 - 37 ft el 22.84 to 17.84
Gasoline Range Organics	720
Diesel Range Organics	150 J
Benzene	25

MBB-24	09/10/2020 30 - 40 ft el 24.1 to 14.1
Gasoline Range Organics	1600
Diesel Range Organics	650 J
Benzene	34



SAMPLE LOCATIONS ANALYZED FOR GRO, DRO, AND BENZENE (ALL LOCATIONS SHOWN HERE WERE SAMPLED FOR ALL THREE COMPOUNDS)

- SHALLOW ZONE MONITORING WELL
- INTERMEDIATE A ZONE MONITORING WELL
- INTERMEDIATE B ZONE MONITORING WELL
- DEEP ZONE MONITORING WELL
- SOIL BORING WITH GRAB GROUNDWATER SAMPLE
- GROUNDWATER SAMPLE LOCATION WITH EXCEEDANCE

- APPROXIMATE EXTENT OF **BENZENE** EXCEEDANCES IN GROUNDWATER ABOVE EXCAVATION DEPTH (NO EXCEEDANCES BELOW EXCAVATION DEPTH)
- APPROXIMATE EXTENT OF **GRO AND/OR DRO** EXCEEDANCES IN GROUNDWATER ABOVE EXCAVATION DEPTH (NO EXCEEDANCES BELOW EXCAVATION DEPTH)
- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY

RED TEXT INDICATES EXCEEDANCE OF PROTECTIVE OF DRINKING WATER OR PROTECTIVE OF INDOOR AIR SCREENING LEVELS

DATA SHOWN IS FROM 2018-2020; CONCENTRATIONS IN MICROGRAMS PER LITER (µg/L)

SCREENING LEVELS WERE PROVIDED BY ECOLOGY (NOVEMBER 17, 2020)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88)

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
- = ANALYTE WAS NOT ANALYZED/NOT APPLICABLE
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN

AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR GRO, DRO, AND BENZENE IN GROUNDWATER (µg/L)		
CONSTITUENT	PROTECTIVE OF DRINKING WATER	PROTECTIVE OF INDOOR AIR
Gasoline Range Organics (GRO)	800	-
Diesel Range Organics (DRO)	500	-
Benzene	5	2.4

Seattle DOT Mercer Parcels Site
Seattle, Washington

GRO, DRO, and Benzene Distribution in Groundwater

0202738-100 04/23

HALEY ALDRICH

Figure **2-4**

MBB-25	10/30/2020 5 ft el 53.63	10/30/2020 10 ft el 48.63	10/30/2020 15 ft el 43.63	10/30/2020 20 ft el 38.63	10/30/2020 25 ft el 33.63
cPAHs-TEQ	0.002 U	0.09	0.002 U	0.00041 U/0.00041 U	0.32

HMW-4IA	03/07/2019 7.5 ft el 51.2
cPAHs-TEQ	0.36

MBB-23	09/21/2020 5 ft el 42.18	09/21/2020 10 ft el 37.18	09/21/2020 15 ft el 32.18	09/21/2020 20 ft el 27.18	09/21/2020 25 ft el 22.18
cPAHs-TEQ	0.0097 U	2.4	0.0019 U	0.0019 U	0.0019 U

MBB-22	09/21/2020 5 ft el 37.05	09/21/2020 15 ft el 27.05	09/21/2020 20 ft el 22.05	09/21/2020 25 ft el 17.05
cPAHs-TEQ	0.42	0.0019 U	0.0019 U	0.0019 U

HMW-7IB	02/28/2020 5 ft el 53.69	02/28/2020 10 ft el 48.69	02/28/2020 15 ft el 43.69	02/28/2020 20 ft el 38.69	02/28/2020 25 ft el 33.69
cPAHs-TEQ	0.089	0.017	0.44	0.016	0.072

HMW-17S EL 57.7
MBB-1 EL 55.0
21417-MB2 EL 54.7
MBB-16 EL 53.7
MBB-2 EL 55.5
MBB-4 EL 54.6
MBB-3 EL 54.8
HMW-18S EL 57.5
HMW-19S EL 58.4
MBB-24 EL 54.1
HMW-20S EL 53.6
MBB-18 EL 51.3
HMW-5IB EL 58.4
MBB-19 EL 51.7
MBB-17 EL 54.9
MBB-21 EL 47.6
HMW-4IA EL 58.7
HMW-8IB EL 58.0
HMW-6IA EL 58.6
HMW-6IB EL 58.7
HMW-6D EL 58.6
21417-MB3 EL 58.6
MBB-25 EL 58.6
HMW-7IB EL 58.7
MBB-26 EL 58.8
MBGW-3 EL 47.8
MBB-20 EL 47.5
MBB-23 EL 47.2
MBGW-1 EL 40.0
MBGW-2 EL 46.1
MBB-22 EL 42.0
MBB-14 EL 47.1
MBB-15 EL 37.7

DEXTER AVE N
8TH AVE N
ROY ST
MERCER ST

N
0 20 40 80 Feet

cPAHs-TEQ IN SOIL (mg/kg)
- ≥ 1.90
- ≥ 0.38 TO 1.90
- ≥ 0.19 - 0.38
- ND/0 TO < 0.19
- NO DATA

SAMPLE DEPTH INTERVALS
- ≤ 5 FT BELOW GROUND SURFACE (BGS)
- 5 TO 10
- 10 TO 15
- 15 TO 20
- 20 TO 25
- > 25

- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY
- APPROXIMATE LIMTS OF 2H:1V SOIL BERM THAT WILL BE EXCAVATED LAST
- FORMER BROAD STREET 1958-2012

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN
CPAH = CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON
CPAHS-TEQ = CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON TOXIC EQUIVALENCY

SOME SAMPLING LOCATIONS MAY HAVE BEEN SLIGHTLY OFFSET ON THIS MAP TO REDUCE SYMBOL OVERLAP
RED TEXT INDICATES EXCEEDANCE OF DIRECT CONTACT OR PROTECTIVE OF GROUNDWATER SCREENING LEVELS
SCREENING LEVELS PROVIDED BY ECOLOGY (NOVEMBER 17, 2020)
CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)
DEPTH IN FEET BELOW GROUND SURFACE (BGS)
ELEVATION IN FEET (NAVD 88); EL. = GROUND SURFACE ELEVATION
AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR cPAHs-TEQ IN SOIL (mg/kg)		
ZONE	DIRECT CONTACT	PROTECTIVE OF GW
Vadose (0 to 25 ft bgs)	0.19	0.45
Saturated (>25 ft bgs)	0.19	0.022

Seattle DOT Mercer Parcels Site
Seattle, Washington

cPAH Distribution in Soil

0202738-100 04/23

HALEY ALDRICH

Figure **2-5**

GIS FILE PATH: \\haleyaldrich.com\share\CP\Projects\135500\GIS\135500_Mercer_Mega_Block\Maps\2023_04_EDR\135568_00MB_BB_SOIL_SMARTIES_EDR.mxd - USER: dwerier - LAST SAVED: 4/27/2023 4:17:57 PM

HMW-6D	03/02/2020 5 ft el 53.58	03/02/2020 10 ft el 48.58	03/02/2020 15 ft el 43.58	03/02/2020 25 ft el 33.58	03/02/2020 30 ft el 28.58
As	16.4	21.8	24.4	18	1.61/1.42

HMW-6IB	03/03/2020 5 ft el 53.67	03/03/2020 10 ft el 48.67	03/03/2020 15 ft el 43.67	03/03/2020 20 ft el 38.67	03/03/2020 25 ft el 33.67
As	13.4	15.9/14.9	22.2	25.6	2.23

MBPP-8	03/08/2019 15 ft el 42.52
As	16

MBB-5	03/02/2020 5 ft el 45.53	03/02/2020 10 ft el 40.53	03/02/2020 15 ft el 35.53	03/02/2020 20 ft el 30.53	03/02/2020 25 ft el 25.53
As	23.2	6.56	1.81	1.34	1.51

MBB-18	09/01/2020 5 ft el 46.33	09/01/2020 10 ft el 41.33	09/01/2020 15 ft el 36.33	09/01/2020 20 ft el 31.33
As	14.2	6.2	1.13	1.61

MBB-6	03/03/2020 5 ft el 45.33	03/03/2020 10 ft el 40.33	03/03/2020 15 ft el 35.33	03/03/2020 20 ft el 30.33	03/03/2020 25 ft el 25.33
As	21.2	9.18	1.84	2.08	1.6

MBB-8	02/26/2020 5 ft el 44.66	02/26/2020 10 ft el 39.66	02/26/2020 15 ft el 34.66	02/26/2020 20 ft el 29.66	02/26/2020 25 ft el 24.66
As	21.9	1.75	1.7/1.6	1.6	1.13

MBB-9	02/26/2020 5 ft el 42.55	02/26/2020 10 ft el 37.55	02/26/2020 15 ft el 32.55	02/26/2020 20 ft el 27.55	02/26/2020 25 ft el 22.55
As	9.58	1.94	1.72	1.7	1.27

21417-MB10	05/11/2017 28 ft el 10.08
As	7.75

HMW-6IA	03/02/2020 5 ft el 53.65	03/02/2020 10 ft el 48.65	03/02/2020 15 ft el 43.65	03/02/2020 20 ft el 38.65	03/02/2020 30 ft el 28.65
As	15.6	13.6	18.6	18.3	3.1

HMW-7IB	02/28/2020 5 ft el 53.69	02/28/2020 10 ft el 48.69	02/28/2020 15 ft el 43.69	02/28/2020 20 ft el 38.69	02/28/2020 25 ft el 33.69
As	15.3	13.8	19.9	25.6	8.13/8.49

HMW-9IB	02/28/2020 5 ft el 50.36	02/28/2020 13 ft el 42.36	02/28/2020 15 ft el 40.36	02/28/2020 20 ft el 35.36	02/28/2020 25 ft el 30.36
As	7.75	1.64	17.8	1.6	1.26

HMW-8IB	03/02/2020 5 ft el 52.97	03/02/2020 10 ft el 47.97	03/02/2020 15 ft el 42.97	03/02/2020 20 ft el 37.97	03/02/2020 25 ft el 32.97
As	21.4	19.5	17.1	4.86	1.12/1.06

HMW-9D	02/27/2020 5 ft el 50.32	02/27/2020 10 ft el 45.32	02/27/2020 15 ft el 40.32	02/27/2020 20 ft el 35.32	02/27/2020 25 ft el 30.32
As	1.78	1.38	15.3	2.55	1.46

HMW-9S	03/02/2020 5 ft el 50.39	03/02/2020 14 ft el 41.39	03/02/2020 17 ft el 38.39	03/02/2020 20 ft el 35.39	03/02/2020 25 ft el 30.39
As	2.64	14.5	17.7	1.3	1.36

ROY ST
8TH AVE N
DEXTER AVE N
MERCER ST
N
0 20 40 80 Feet

ARSENIC IN SOIL (mg/kg)
- ≥ 14.6 TO 73
- ≥ 7.3 TO 14.6
- ND/0 TO < 7.3
- NO DATA

SAMPLE DEPTH INTERVALS
- ≤ 5 FT BELOW GROUND SURFACE (BGS)
- 5 TO 10
- 10 TO 15
- 15 TO 20
- 20 TO 25
- > 25

- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY
- APPROXIMATE LIMTS OF 2H:1V SOIL BERM THAT WILL BE EXCAVATED LAST
- FORMER BROAD STREET 1958-2012

SOME SAMPLING LOCATIONS MAY HAVE BEEN SLIGHTLY OFFSET ON THIS MAP TO REDUCE SYMBOL OVERLAP

RED TEXT INDICATES EXCEEDANCE OF PROTECTIVE OF GROUNDWATER SCREENING LEVELS ADJUSTED UP TO NATURAL BACKGROUND

SCREENING LEVELS PROVIDED BY ECOLOGY (NOVEMBER 17, 2020)

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88); EL. = GROUND SURFACE ELEVATION

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN

AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR ARSENIC IN SOIL (mg/kg) All levels adjusted up to natural background	
ZONE	PROTECTIVE OF GW
Vadose (0 to 25 ft bgs) and Saturated (>25 ft bgs)	7.3

Seattle DOT Mercer Parcels Site
Seattle, Washington

Arsenic Distribution in Soil

0202738-100 04/23

HALEY ALDRICH

Figure **2-6**

GIS FILE PATH: \\haleyaldrich.com\share\CP\Projects\135000\GIS\135000_Mercer_Mega_Block\Maps\2023_04_EDR\135568_00MB_BB_SOIL_SMARTIES_EDR.mxd - USER: dverier - LAST SAVED: 4/27/2023 4:17:57 PM

MBB-28	05/25/2022 45 ft el 8.88
PCE	0.56
TCE	0.04
cis-1,2-DCE	1.3
VC	0.19

MBB-29	05/25/2022 34 ft el 17.43	05/25/2022 39 ft el 12.43	05/25/2022 44 ft el 7.43
PCE	0.22	2	4.5
TCE	0.027	0.18	0.53
cis-1,2-DCE	0.072	0.86	0.66
VC	0.05 U	0.089	0.05 U

MW-346	05/19/2021 41.5 ft el 10.28	05/19/2021 47 ft el 4.78
PCE	4.43	1.98
TCE	0.415	0.228
cis-1,2-DCE	0.661	0.148
VC	0.124	0.0149

MBGW-5	03/11/2019 45 ft el 4.87
PCE	3.4
TCE	0.47
cis-1,2-DCE	0.26
VC	0.05 U

MBB-38	06/01/2022 34 ft el 15.75	06/01/2022 39 ft el 10.75	06/01/2022 44 ft el 5.75
PCE	0.55	0.43 J/0.085 J	1.2
TCE	0.056	0.08 J/0.02 UJ	0.2
cis-1,2-DCE	0.05 U	0.05 U/0.05 U	0.064
VC	0.05 U	0.05 U/0.05 U	0.05 U

MBB-41	05/24/2022 29 ft el 18.84
PCE	0.03
TCE	0.02 U
cis-1,2-DCE	0.05 U
VC	0.05 U

21417-MB8	05/11/2017 27 ft el 18.28
PCE	0.0238
TCE	0.0152 U
cis-1,2-DCE	0.0152 U
VC	0.00152 U

MBB-40	06/02/2022 39 ft el 8.96
PCE	0.19/0.18
TCE	0.029/0.03
cis-1,2-DCE	0.05 U/0.05 U
VC	0.05 U/0.05 U

MW-345	05/20/2021 41 ft el 11.85	05/20/2021 47 ft el 5.85
PCE	0.275	0.0228 J/0.00622 J
TCE	0.0273	0.00257/0.00105 J
cis-1,2-DCE	0.984	0.0973/0.122
VC	0.189	0.181/0.136

MBGW-3	03/07/2019 25 ft el 22.77
PCE	0.074
TCE	0.02 U
cis-1,2-DCE	0.05 U
VC	0.05 U

MBB-23	09/21/2020 30 ft el 17.18
PCE	0.025 U
TCE	0.03 U
cis-1,2-DCE	0.014
VC	0.005 U

MBB-30	05/25/2022 44 ft el 10.1	05/25/2022 46 ft el 8.1
PCE	0.17	0.043
TCE	0.09	0.033
cis-1,2-DCE	0.52	0.05 U
VC	0.53	0.054

MBB-44	05/23/2022 34 ft el 12.2
PCE	0.12
TCE	0.031
cis-1,2-DCE	0.1
VC	0.05 U

IWS-03	03/21/2022 39 ft el 13.3
PCE	0.511 J-
TCE	0.736
cis-1,2-DCE	2.99 J-
VC	0.479

MBB-35	05/31/2022 39 ft el 13.49
PCE	0.22
TCE	0.039
cis-1,2-DCE	0.14
VC	0.05 U

IWS-02	03/22/2022 41.5 ft el 11.79
PCE	0.453 J-
TCE	0.0164
cis-1,2-DCE	1.53
VC	0.887

IWS-05	03/16/2022 46 ft el 8.69
PCE	0.28
TCE	0.0215
cis-1,2-DCE	0.913
VC	0.0948

IWS-01	03/16/2022 48.5 ft el 7.15
PCE	0.294
TCE	0.155
cis-1,2-DCE	1.77
VC	0.408

IWS-06	03/15/2022 45.5 ft el 8.72
PCE	6.06
TCE	0.444
cis-1,2-DCE	12.6
VC	0.888

IWS-09	03/24/2022 47 ft el 7.97
PCE	1.54
TCE	0.911
cis-1,2-DCE	5.05
VC	0.542

MW-349	05/17/2021 49 ft el 6.84
PCE	1.05
TCE	0.209
cis-1,2-DCE	0.572
VC	0.0752

IWS-10	03/23/2022 46 ft el 8.28
PCE	8.75
TCE	0.648
cis-1,2-DCE	1.93
VC	0.351

MW-348	05/18/2021 41 ft el 12.96
PCE	0.749
TCE	0.249
cis-1,2-DCE	6.55
VC	0.569

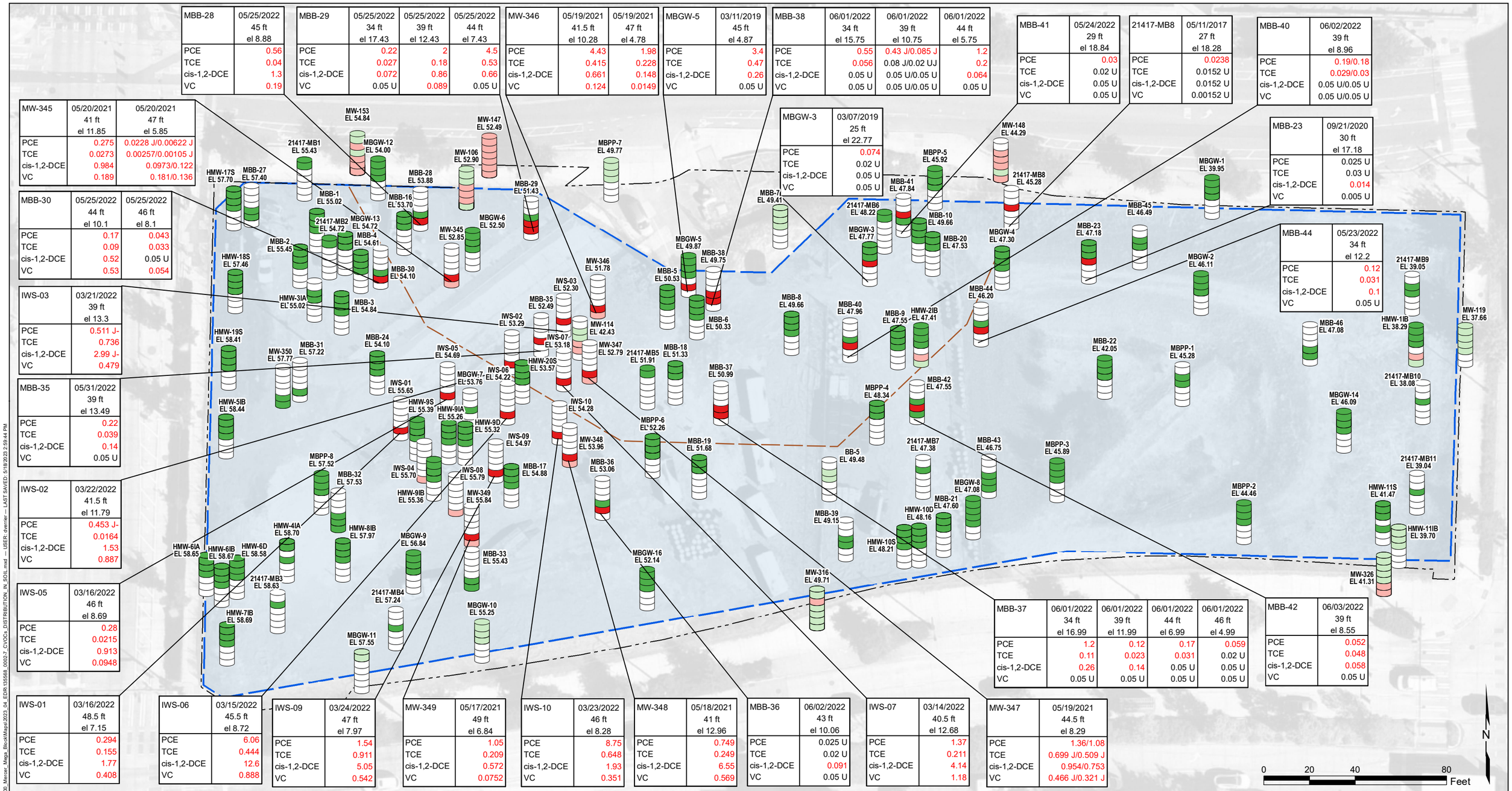
MBB-36	06/02/2022 43 ft el 10.06
PCE	0.025 U
TCE	0.02 U
cis-1,2-DCE	0.091
VC	0.05 U

IWS-07	03/14/2022 40.5 ft el 12.68
PCE	1.37
TCE	0.211
cis-1,2-DCE	4.14
VC	1.18

MW-347	05/19/2021 44.5 ft el 8.29
PCE	1.36/1.08
TCE	0.699 J/0.509 J
cis-1,2-DCE	0.954/0.753
VC	0.466 J/0.321 J

MBB-37	06/01/2022 34 ft el 16.99	06/01/2022 39 ft el 11.99	06/01/2022 44 ft el 6.99	06/01/2022 46 ft el 4.99
PCE	1.2	0.12	0.17	0.059
TCE	0.11	0.023	0.031	0.02 U
cis-1,2-DCE	0.26	0.14	0.05 U	0.05 U
VC	0.05 U	0.05 U	0.05 U	0.05 U

MBB-42	06/03/2022 39 ft el 8.55
PCE	0.052
TCE	0.048
cis-1,2-DCE	0.058
VC	0.05 U



CVOCs in SOIL

- CVOC DETECTION WITHIN EXCAVATION LIMITS
- CVOC NON-DETECT WITHIN EXCAVATION LIMITS
- CVOC DETECTION, PRE-2017 AND/OR OUTSIDE EXCAVATION LIMITS
- CVOC NON-DETECT, PRE-2017 AND/OR OUTSIDE EXCAVATION LIMITS
- NO DATA

SAMPLE DEPTH INTERVALS

- ≤ 10 FT BELOW GROUND SURFACE (BGS)
- 10 TO 20
- 20 TO 30
- 30 TO 40
- 40 TO 50
- > 50

- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY
- APPROXIMATE LIMTS OF 2H:1V SOIL BERM THAT WILL BE EXCAVATED LAST

CVOC = CHLORINATED VOLATILE ORGANIC COMPOUND
U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
J- = ESTIMATED VALUE, BUT THE RESULT MAY BE BIASED LOW
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN

CVOCs CONSIST OF:
PCE = TETRACHLOROETHENE
TCE = TRICHLOROETHENE
cis-1,2-DCE = cis-1,2-DICHLOROETHENE
VC = VINYL CHLORIDE

SOME SAMPLING LOCATIONS HAVE BEEN SLIGHTLY OFFSET ON THIS MAP TO REDUCE SYMBOL OVERLAP

RED TEXT INDICATES DETECTION OF CONSTITUENT(S)

DATA BOXES ARE ONLY SHOWN FOR SOIL SAMPLES WITH DETECTIONS OF CVOCs WITHIN EXCAVATION LIMITS. REFER TO THE REMEDIAL INVESTIGATION REPORT FOR ADDITIONAL SAMPLE RESULTS

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88); EL = GROUND SURFACE ELEVATION

EXCAVATION BOUNDARY SOURCE: DIGITIZED FROM PLAN TITLED "ARE - MERCER BLOCKS," NBBJ, 11 NOVEMBER 2020

AERIAL IMAGERY SOURCE: EAGLEVIEW

Seattle DOT Mercer Parcels Site
Seattle, Washington

CVOCs Distribution in Soil

0202738-100 05/23

HALEY ALDRICH

Figure
2-7

MW-154	04/30/2018 25 - 35 (ft) el 28.22 to 18.22	01/21/2019 25 - 35 (ft) el 28.22 to 18.22	04/24/2019 25 - 35 (ft) el 28.22 to 18.22	07/15/2019 25 - 35 (ft) el 28.22 to 18.22	10/14/2019 25 - 35 (ft) el 28.22 to 18.22	01/21/2020 25 - 35 (ft) el 28.22 to 18.22	04/30/2020 25 - 35 (ft) el 28.22 to 18.22	07/10/2020 25 - 35 (ft) el 28.22 to 18.22	11/09/2020 25 - 35 (ft) el 28.22 to 18.22	02/08/2021 25 - 35 (ft) el 28.22 to 18.22	05/10/2021 25 - 35 (ft) el 28.22 to 18.22
PCE	4.46	1.7	1.02	69.5	4.99	11.6	12.1	10.9	73.9	4.72 J	3.41
TCE	0.23 J	0.33 J	0.214 J	5.75	0.445 J	0.999	1.06	0.786	6.84	0.501	0.453
cis-1,2-DCE	1.77	2.03	1.76	2.55	1.4	2.26	2.58	1.83	1.77	0.203	0.134
VC	7.48	3.52	0.797	0.211 J	0.5 U	0.5 U	0.5 U	N/A	N/A	0.1 U	N/A

BB-8	04/11/2018 30 - 40 (ft) el 13.72 to 3.72	01/23/2019 30 - 40 (ft) el 13.72 to 3.72	04/23/2019 30 - 40 (ft) el 13.72 to 3.72	07/17/2019 30 - 40 (ft) el 13.72 to 3.72	10/22/2019 30 - 40 (ft) el 13.72 to 3.72	01/20/2020 30 - 40 (ft) el 13.72 to 3.72	05/12/2020 30 - 40 (ft) el 13.72 to 3.72	07/27/2020 30 - 40 (ft) el 13.72 to 3.72	11/17/2020 30 - 40 (ft) el 13.72 to 3.72	02/11/2021 30 - 40 (ft) el 13.72 to 3.72	06/07/2021 30 - 40 (ft) el 13.72 to 3.72
PCE	33.7 J	133	48.8	169	135 J	138	142	165	215	20.1	54.4
TCE	6.13 J	43.1	9.09	28.9	46.6	25.4	30.8	46.8	107 J+	3.83	12.3
cis-1,2-DCE	4.64	81.5	7.57	19.3	31.8 J	16.5	17.6	26.3	101	2.19	6.94
VC	0.5 U	0.618	0.5 UJK	0.5 U	0.162 J	0.5 U	0.5 U	N/A	0.302	0.1 U	0.079 J

MW-146	04/30/2018 39.8 - 49.8 (ft) el 13.06 to 3.06	01/22/2019 39.8 - 49.8 (ft) el 13.06 to 3.06	04/24/2019 39.8 - 49.8 (ft) el 13.06 to 3.06	07/19/2019 39.8 - 49.8 (ft) el 13.06 to 3.06	10/14/2019 39.8 - 49.8 (ft) el 13.06 to 3.06	01/24/2020 39.8 - 49.8 (ft) el 13.06 to 3.06	04/30/2020 39.8 - 49.8 (ft) el 13.06 to 3.06	07/09/2020 39.8 - 49.8 (ft) el 13.06 to 3.06	11/10/2020 39.8 - 49.8 (ft) el 13.06 to 3.06	02/08/2021 39.8 - 49.8 (ft) el 13.06 to 3.06	05/04/2021 39.8 - 49.8 (ft) el 13.06 to 3.06
PCE	3.56	2.29	1.5	3.08	2.03	21.1 J	50 U	0.781	0.21	0.704 J	N/A
TCE	48.4	21.6	12.4	14.4	6.77	50 U	50 U	3.17	2.8	3.52	N/A
cis-1,2-DCE	900	1080	257	257	1350	1460	2100	2750	3800	2690	536
VC	2100	1370	383	580	2830	3900	6040	8610	5200	3910	4310

MW-155	04/27/2018 20 - 30 (ft) el 24.47 to 14.47	01/21/2019 20 - 30 (ft) el 24.47 to 14.47	04/23/2019 20 - 30 (ft) el 24.47 to 14.47	07/23/2019 20 - 30 (ft) el 24.47 to 14.47	10/16/2019 20 - 30 (ft) el 24.47 to 14.47	01/20/2020 20 - 30 (ft) el 24.47 to 14.47	05/05/2020 20 - 30 (ft) el 24.47 to 14.47	08/03/2020 20 - 30 (ft) el 24.47 to 14.47	11/11/2020 20 - 30 (ft) el 24.47 to 14.47
PCE	3.48	3.72	14.6	92.7	121	98.3	140	63.4	119
TCE	0.334 J	0.581	4.75	19.9	27.6	21.8	27.3	28	26
cis-1,2-DCE	0.466 J	0.274 J	71.9	12.1	36.2	12.7	16.4	9.74	11.7
VC	0.447 J	0.5 U	6.54 K	0.35 J	0.5 U	0.5 U	0.5 U	N/A	0.19 J+

MBGW-12	03/19/2019 17.5 - 27.5 (ft) el 36.5 to 26.5
PCE	5.1
TCE	1
cis-1,2-DCE	1 U
VC	0.2 U

MBGW-1	03/06/2019 20 - 30 (ft) el 19.95 to 9.95
PCE	9.5
TCE	3.9
cis-1,2-DCE	19
VC	0.2 U

MW-344	06/01/2021 39.4 - 49.4 (ft) el 13.624 to 3.624	11/18/2022 39.4 - 49.4 (ft) el 13.624 to 3.624
PCE	0.092 J	0.1 U
TCE	0.094	0.7
cis-1,2-DCE	8.5	620
VC	9.95	942

MBB-10	02/27/2020 35 - 40 (ft) el 14.66 to 9.66
PCE	98
TCE	59
cis-1,2-DCE	130
VC	0.88

HMW-20S	09/18/2020 25 - 35 (ft) el 28.81 to 18.81
PCE	4.7
TCE	0.38
cis-1,2-DCE	1.4
VC	0.99

MBGW-3	03/07/2019 16 - 26 (ft) el 31.77 to 21.77
PCE	35
TCE	7.4
cis-1,2-DCE	4.8
VC	0.2 U

HMW-20IA	09/18/2020 41 - 51 (ft) el 12.83 to 2.83	06/02/2021 41 - 51 (ft) el 12.83 to 2.83
PCE	5.5	1.37
TCE	18	31.9
cis-1,2-DCE	840	6400
VC	520	5940

MBGW-15	03/15/2019 20 - 30 (ft) el 20.87 to 10.87
PCE	35
TCE	1 U
cis-1,2-DCE	1 U
VC	0.2 U

HMW-4IA	03/25/2019 50 - 60 (ft) el 8.7 to -1.3	03/10/2020 50 - 60 (ft) el 8.7 to -1.3
PCE	1 U	0.2 U
TCE	1 U	0.2 U
cis-1,2-DCE	1 U	0.2 U
VC	3.6	0.41

HMW-9IA	03/19/2020 36.7 - 46.7 (ft) el 18.56 to 8.56	06/02/2021 36.7 - 46.7 (ft) el 18.56 to 8.56
PCE	0.42	0.243
TCE	0.23	0.916
cis-1,2-DCE	3.7	136
VC	0.95	196

MBB-5	03/05/2020 32 - 37 (ft) el 18.53 to 13.53
PCE	130
TCE	37
cis-1,2-DCE	110
VC	7.7

MBB-6	03/05/2020 25 - 30 (ft) el 25.33 to 20.33
PCE	5.5
TCE	1.2
cis-1,2-DCE	3.4
VC	0.3

MBB-7	03/04/2020 27 - 32 (ft) el 22.41 to 17.41
PCE	9.4
TCE	1.9
cis-1,2-DCE	7.3
VC	0.2 U

HMW-2IA	03/25/2019 34.8 - 44.8 (ft) el 10.75 to 0.75	03/12/2020 34.8 - 44.8 (ft) el 10.75 to 0.75
PCE	240	210
TCE	74	65
cis-1,2-DCE	120	180
VC	1.2	1.1

ROY ST
8TH AVE N
VALLEY ST
WESTLAKE AVE N
DEXTER AVE N
9TH AVE N
AURORA AVE N
MERCER ST

MW-154 MW-146 MW-155 BB-8 MBPP-5 MBGW-1 MBGW-12 HMW-17S MBB-1 MBB-16 MBGW-6 MBB-2 MBGW-13 MW-344 MBB-4 HMW-3IA MBB-3 HMW-18S MBGW-5 MBB-5 MBB-6 MBB-7 MBB-10 MBGW-3 MBGW-2 MBB-8 HMW-2S HMW-1S MBB-9 HMW-2IA HMW-19S MBB-24 HMW-20S HMW-20IA MBGW-7 HMW-5IB HMW-9S HMW-9IA MBGW-8 HMW-11S HMW-10S MBGW-15 HMW-4IA HMW-6IA MBGW-9 HMW-6IB MBGW-16 MW-315 HMW-7IB MBGW-10 MBGW-11

0 40 80 160 Feet

N

SHALLOW ZONE MONITORING WELL
INTERMEDIATE A ZONE MONITORING WELL
INTERMEDIATE B ZONE MONITORING WELL
SOIL BORING WITH GRAB GROUNDWATER SAMPLE
GROUNDWATER SAMPLING LOCATION WITH EXCEEDANCE

EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
PROPERTY BOUNDARY

RED TEXT INDICATES EXCEEDANCE OF PROTECTIVE OF DRINKING WATER OR PROTECTIVE OF INDOOR AIR SCREENING LEVELS

DATA SHOWN IS FROM 2018-2022; CONCENTRATIONS IN MICROGRAMS PER LITER (µG/L)

SCREENING LEVELS PROVIDED BY ECOLOGY (NOVEMBER 17, 2020 AND JANUARY 2023 UPDATES)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88)

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
- = ANALYTE WAS NOT ANALYZED/NOT APPLICABLE
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K = REPORTED RESULT WITH UNKNOWN BIAS
CVOC = CHLORINATED VOLATILE ORGANIC COMPOUND

AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR CVOCs IN GROUNDWATER (µg/L)

CONSTITUENT	PROTECTIVE OF DRINKING WATER	PROTECTIVE OF INDOOR AIR
Tetrachloroethene (PCE)	5	24
Trichloroethene (TCE)	4	1.4
cis-1,2-Dichloroethene (cis-1,2-DCE)	16	180
Vinyl chloride (VC)	0.29	0.35

Seattle DOT Mercer Parcels Site
Seattle, Washington

CVOCs Distribution in Groundwater, Above 8 ft Elevation

0202738-100 05/23

HALEY ALDRICH

Figure
2-8

FMW-129	05/01/2019 84.2 - 89.2 (ft) el -45.56 to -50.56	07/16/2019 84.2 - 89.2 (ft) el -45.56 to -50.56	10/21/2019 84.2 - 89.2 (ft) el -45.56 to -50.56	11/12/2019 84.2 - 89.2 (ft) el -45.56 to -50.56	01/14/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	02/18/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	03/25/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	04/27/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	05/06/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	05/19/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	07/10/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	11/10/2020 84.2 - 89.2 (ft) el -45.56 to -50.56	02/10/2021 84.2 - 89.2 (ft) el -45.56 to -50.56	05/26/2021 84.2 - 89.2 (ft) el -45.56 to -50.56	08/12/2022 84.2 - 89.2 (ft) el -45.56 to -50.56	11/11/2022 84.2 - 89.2 (ft) el -45.56 to -50.56
PCE	101	159	114	79	130	110	88	74	34.6	18	10.8	6.43	2.42	91.1/97.2	1.4	1.17
TCE	166	84.1	198	130	170	170	140	88	61.9	42	27.1	22.3	4.97	197/201	3.45	4.01
cis-1,2-DCE	372	272	350	340	385	310	290	190	157	120	92.5	58.8	42.5	517/526	14.4	16.7
VC	2.5 U	0.296 J	0.259 J	2 U	2 U	2 U	2.6	1 U	14.2	6.5	0.43	8.49 J+	0.1 U	0.5 U/0.5 U	0.0273	0.1 UJ

HMW-12D	09/10/2020 82 - 92 (ft) el -48.48 to -58.48
PCE	0.2 U
TCE	0.2 U
cis-1,2-DCE	200
VC	3.9

MW-105	04/11/2018 130 - 140 (ft) el -84.41 to -94.41	01/23/2019 130 - 140 (ft) el -84.41 to -94.41	04/23/2019 130 - 140 (ft) el -84.41 to -94.41	07/17/2019 130 - 140 (ft) el -84.41 to -94.41	10/22/2019 130 - 140 (ft) el -84.41 to -94.41	01/20/2020 130 - 140 (ft) el -84.41 to -94.41	05/12/2020 130 - 140 (ft) el -84.41 to -94.41	07/27/2020 130 - 140 (ft) el -84.41 to -94.41	11/17/2020 130 - 140 (ft) el -84.41 to -94.41	02/11/2021 130 - 140 (ft) el -84.41 to -94.41	06/07/2021 130 - 140 (ft) el -84.41 to -94.41
PCE	0.5 U	0.79	0.5 U	0.5 U	0.5 U/0.5 U	0.208 J	0.5 U	0.324	0.553	0.335	0.128
TCE	0.5 U	0.317 J	0.5 U	0.5 U	0.5 U/0.5 U	0.348 J	1.02	2.12	4.95 J+	3.53	1.37
cis-1,2-DCE	1.67	1.51	0.917	0.891	0.945/0.72	1.38	0.805	1.56	4.83	6.78	11.5
VC	0.205 J	0.392 J	0.238 J	0.265 J	0.214 J/0.5 U	0.568	0.5 U	0.135	0.15	0.178	0.359

HMW-1IB	03/25/2019 54.3 - 64.3 (ft) el -16.01 to -26.01	03/10/2020 54.3 - 64.3 (ft) el -16.01 to -26.01
PCE	20	13
TCE	6.7	5.6
cis-1,2-DCE	22	16
VC	0.2 U	0.2 U

MW-148	05/01/2018 70 - 80 (ft) el -25.71 to -35.71	01/23/2019 70 - 80 (ft) el -25.71 to -35.71	04/26/2019 70 - 80 (ft) el -25.71 to -35.71	07/22/2019 70 - 80 (ft) el -25.71 to -35.71	10/16/2019 70 - 80 (ft) el -25.71 to -35.71	01/20/2020 70 - 80 (ft) el -25.71 to -35.71	04/30/2020 70 - 80 (ft) el -25.71 to -35.71	07/15/2020 70 - 80 (ft) el -25.71 to -35.71	11/11/2020 70 - 80 (ft) el -25.71 to -35.71
PCE	0.5 U/0.5 U	1.24	0.5 U	0.415 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TCE	0.5 U/0.5 U	0.347 J	0.5 U	0.5 U	0.5 U	0.163 J	0.5 U	0.5 U	0.5 U
cis-1,2-DCE	0.5 UJ/0.216	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VC	0.5 U/0.5 U	0.5 U	0.277 J	0.253 J	0.463 J	0.305 J	0.5 U	0.224	0.5 U

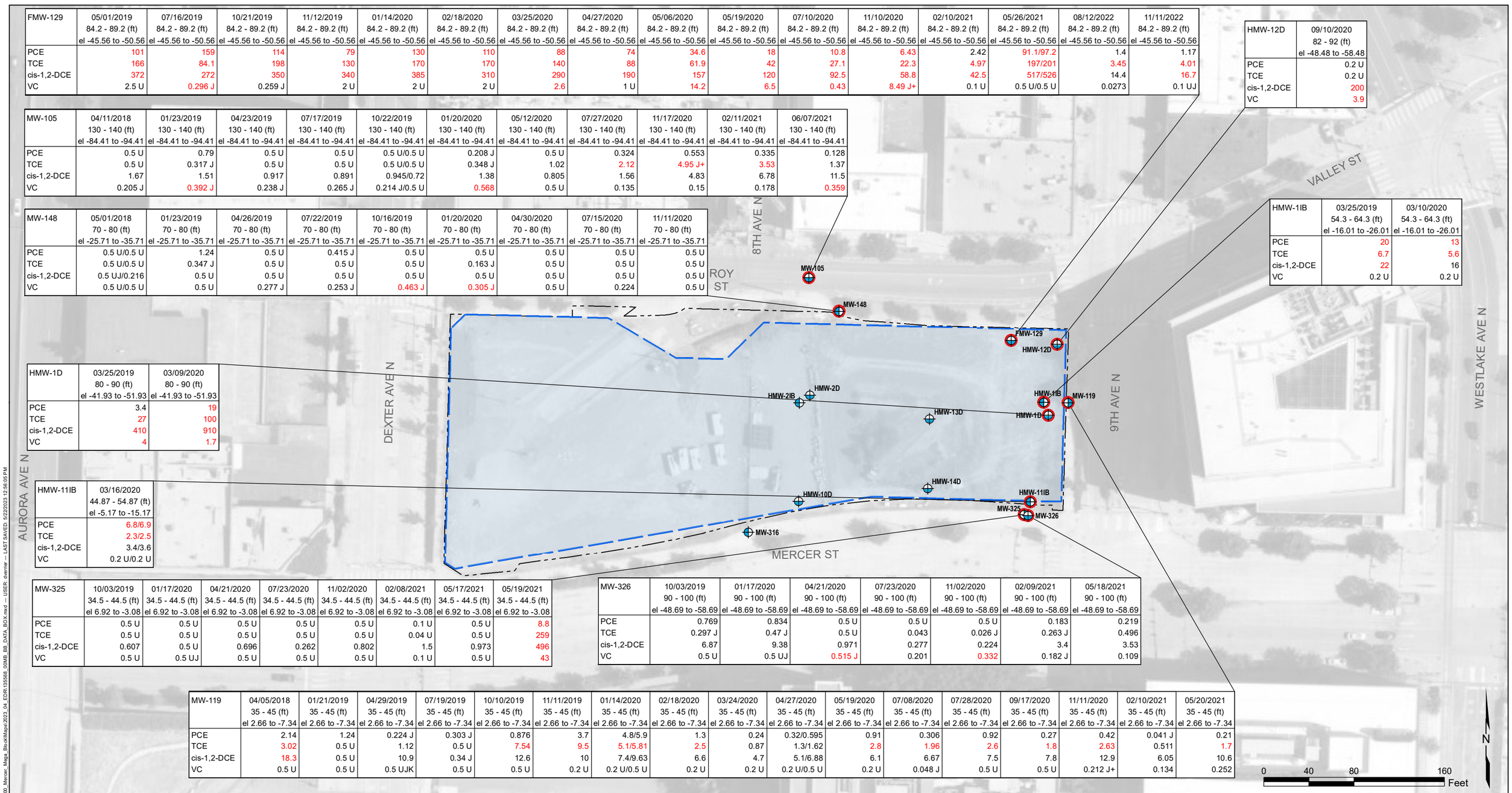
HMW-1D	03/25/2019 80 - 90 (ft) el -41.93 to -51.93	03/09/2020 80 - 90 (ft) el -41.93 to -51.93
PCE	3.4	19
TCE	27	100
cis-1,2-DCE	410	910
VC	4	1.7

HMW-11IB	03/16/2020 44.87 - 54.87 (ft) el -5.17 to -15.17
PCE	6.8/6.9
TCE	2.3/2.5
cis-1,2-DCE	3.4/3.6
VC	0.2 U/0.2 U

MW-325	10/03/2019 34.5 - 44.5 (ft) el 6.92 to -3.08	01/17/2020 34.5 - 44.5 (ft) el 6.92 to -3.08	04/21/2020 34.5 - 44.5 (ft) el 6.92 to -3.08	07/23/2020 34.5 - 44.5 (ft) el 6.92 to -3.08	11/02/2020 34.5 - 44.5 (ft) el 6.92 to -3.08	02/08/2021 34.5 - 44.5 (ft) el 6.92 to -3.08	05/17/2021 34.5 - 44.5 (ft) el 6.92 to -3.08	05/19/2021 34.5 - 44.5 (ft) el 6.92 to -3.08
PCE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 U	0.5 U	8.8
TCE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.04 U	0.5 U	259
cis-1,2-DCE	0.607	0.5 U	0.696	0.262	0.802	1.5	0.973	496
VC	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.1 U	0.5 U	43

MW-326	10/03/2019 90 - 100 (ft) el -48.69 to -58.69	01/17/2020 90 - 100 (ft) el -48.69 to -58.69	04/21/2020 90 - 100 (ft) el -48.69 to -58.69	07/23/2020 90 - 100 (ft) el -48.69 to -58.69	11/02/2020 90 - 100 (ft) el -48.69 to -58.69	02/09/2021 90 - 100 (ft) el -48.69 to -58.69	05/18/2021 90 - 100 (ft) el -48.69 to -58.69
PCE	0.769	0.834	0.5 U	0.5 U	0.5 U	0.183	0.219
TCE	0.297 J	0.47 J	0.5 U	0.043	0.026 J	0.263 J	0.496
cis-1,2-DCE	6.87	9.38	0.971	0.277	0.224	3.4	3.53
VC	0.5 U	0.5 UJ	0.515 J	0.201	0.332	0.182 J	0.109

MW-119	04/05/2018 35 - 45 (ft) el 2.66 to -7.34	01/21/2019 35 - 45 (ft) el 2.66 to -7.34	04/29/2019 35 - 45 (ft) el 2.66 to -7.34	07/19/2019 35 - 45 (ft) el 2.66 to -7.34	10/10/2019 35 - 45 (ft) el 2.66 to -7.34	11/11/2019 35 - 45 (ft) el 2.66 to -7.34	01/14/2020 35 - 45 (ft) el 2.66 to -7.34	02/18/2020 35 - 45 (ft) el 2.66 to -7.34	03/24/2020 35 - 45 (ft) el 2.66 to -7.34	04/27/2020 35 - 45 (ft) el 2.66 to -7.34	05/19/2020 35 - 45 (ft) el 2.66 to -7.34	07/08/2020 35 - 45 (ft) el 2.66 to -7.34	07/28/2020 35 - 45 (ft) el 2.66 to -7.34	09/17/2020 35 - 45 (ft) el 2.66 to -7.34	11/11/2020 35 - 45 (ft) el 2.66 to -7.34	02/10/2021 35 - 45 (ft) el 2.66 to -7.34	05/20/2021 35 - 45 (ft) el 2.66 to -7.34
PCE	2.14	1.24	0.224 J	0.303 J	0.876	3.7	4.8/5.9	1.3	0.24	0.32/0.595	0.91	0.306	0.92	0.27	0.42	0.041 J	0.21
TCE	3.02	0.5 U	1.12	0.5 U	7.54	9.5	5.1/5.81	2.5	0.87	1.3/1.62	2.8	1.96	2.6	1.8	2.63	0.511	1.7
cis-1,2-DCE	18.3	0.5 U	10.9	0.34 J	12.6	10	7.4/9.63	6.6	4.7	5.1/6.88	6.1	6.67	7.5	7.8	12.9	6.05	10.6
VC	0.5 U	0.5 U	0.5 UJK	0.5 U	0.5 U	0.2 U	0.2 U/0.5 U	0.2 U	0.2 U	0.2 U/0.5 U	0.2 U	0.048 J	0.5 U	0.5 U	0.212 J+	0.134	0.252



INTERMEDIATE A ZONE MONITORING WELL

INTERMEDIATE B ZONE MONITORING WELL

DEEP ZONE MONITORING WELL

GROUNDWATER SAMPLING LOCATION WITH EXCEEDANCE

EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT

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Seattle DOT Mercer Parcels Site
Seattle, Washington

CVOCs Distribution in Groundwater, Eastern Area, Below 8 ft Elevation

0202738-100 05/23

HALEY ALDRICH

Figure
2-9a

MW-147	05/12/2018 70 - 80 (ft) el -17.51 to -27.51	01/22/2019 70 - 80 (ft) el -17.51 to -27.51	04/23/2019 70 - 80 (ft) el -17.51 to -27.51	07/18/2019 70 - 80 (ft) el -17.51 to -27.51	10/14/2019 70 - 80 (ft) el -17.51 to -27.51	01/24/2020 70 - 80 (ft) el -17.51 to -27.51	04/29/2020 70 - 80 (ft) el -17.51 to -27.51	07/09/2020 70 - 80 (ft) el -17.51 to -27.51	11/10/2020 70 - 80 (ft) el -17.51 to -27.51	02/09/2021 70 - 80 (ft) el -17.51 to -27.51	05/04/2021 70 - 80 (ft) el -17.51 to -27.51
PCE	19.8	98.2	0.5 U	0.5 U/0.5 U	0.5 U	12.5 U	12.5 U	4.29	0.2 U/0.5 U	5 U	0.5 U
TCE	83.4	179	5.13	4.79/4.72	3.38	4.63 J	5.1 J	12.4	4.9/4.73	9.9	3 J
cis-1,2-DCE	399	1230	322	219/286	597	1100	2410	2220	3500/3740	1750	1300
VC	1150	738	499	446/425	1410	1340	3470	6970	7400/7290	3450 J	2200

MW-153	05/01/2018 120 - 130 (ft) el -65.16 to -75.16	01/22/2019 120 - 130 (ft) el -65.16 to -75.16	04/24/2019 120 - 130 (ft) el -65.16 to -75.16	07/22/2019 120 - 130 (ft) el -65.16 to -75.16	10/15/2019 120 - 130 (ft) el -65.16 to -75.16	01/21/2020 120 - 130 (ft) el -65.16 to -75.16	04/30/2020 120 - 130 (ft) el -65.16 to -75.16	07/15/2020 120 - 130 (ft) el -65.16 to -75.16	11/09/2020 120 - 130 (ft) el -65.16 to -75.16	02/09/2021 120 - 130 (ft) el -65.16 to -75.16	05/10/2021 120 - 130 (ft) el -65.16 to -75.16
PCE	0.756	0.5 U	0.5 U/0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 U	0.5 U
TCE	0.5 U	0.5 U	0.5 U/0.5 U	0.19 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.04 U	0.5 U
cis-1,2-DCE	0.612	1.41	1.07/0.975	0.384 J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.105	0.101
VC	9.56	15.9	2.69/1.66 J	0.235 J	0.5 U	0.5 U	0.5 U	0.5 U	0.333	2.42	1.15 J-

MW-346	06/02/2021 53.9 - 63.9 (ft) el -1.22 to -11.22	08/18/2021 53.9 - 63.9 (ft) el -1.22 to -11.22	03/31/2022 53.9 - 63.9 (ft) el -1.22 to -11.22	05/26/2022 53.9 - 63.9 (ft) el -1.22 to -11.22	08/02/2022 53.9 - 63.9 (ft) el -1.22 to -11.22	11/10/2022 53.9 - 63.9 (ft) el -1.22 to -11.22
PCE	25.3/25.1	1.58	0.228 J+	0.064 J+	0.028	0.1 U
TCE	6.09/6.16	0.646	1.04	0.921	0.498	0.57
cis-1,2-DCE	18.1/18.3	24.7	3.49	4.18	3.42	2.68
VC	1.9/1.93	1.11	1.04	2.08	2.47	1.54

MW-347	06/01/2021 54 - 64 (ft) el -1.21 to -11.21	08/19/2021 54 - 64 (ft) el -1.21 to -11.21	03/31/2022 54 - 64 (ft) el -1.21 to -11.21	05/26/2022 54 - 64 (ft) el -1.21 to -11.21	08/02/2022 54 - 64 (ft) el -1.21 to -11.21	11/10/2022 54 - 64 (ft) el -1.21 to -11.21
PCE	5.19	7.46	25.8 J+/27.2 J+	0.077 J	0.028	0.1 U
TCE	3.83	4.72	50.3/40.4	0.225	0.016	0.04 U
cis-1,2-DCE	123	100	290/280	148	30.6	15.8
VC	66.9	25.7	130/150	68	58.3	28.7

HMW-16IB	09/18/2020 55 - 65 (ft) el 2.02 to -7.98
PCE	0.2 U
TCE	0.2 U
cis-1,2-DCE	3.3
VC	15

MW-345	06/01/2021 54.4 - 64.4 (ft) el -1.15 to -11.15	11/18/2022 54.4 - 64.4 (ft) el -1.15 to -11.15
PCE	0.717	0.1 U
TCE	0.456	0.077
cis-1,2-DCE	13.9	2.12
VC	8.76	18.3

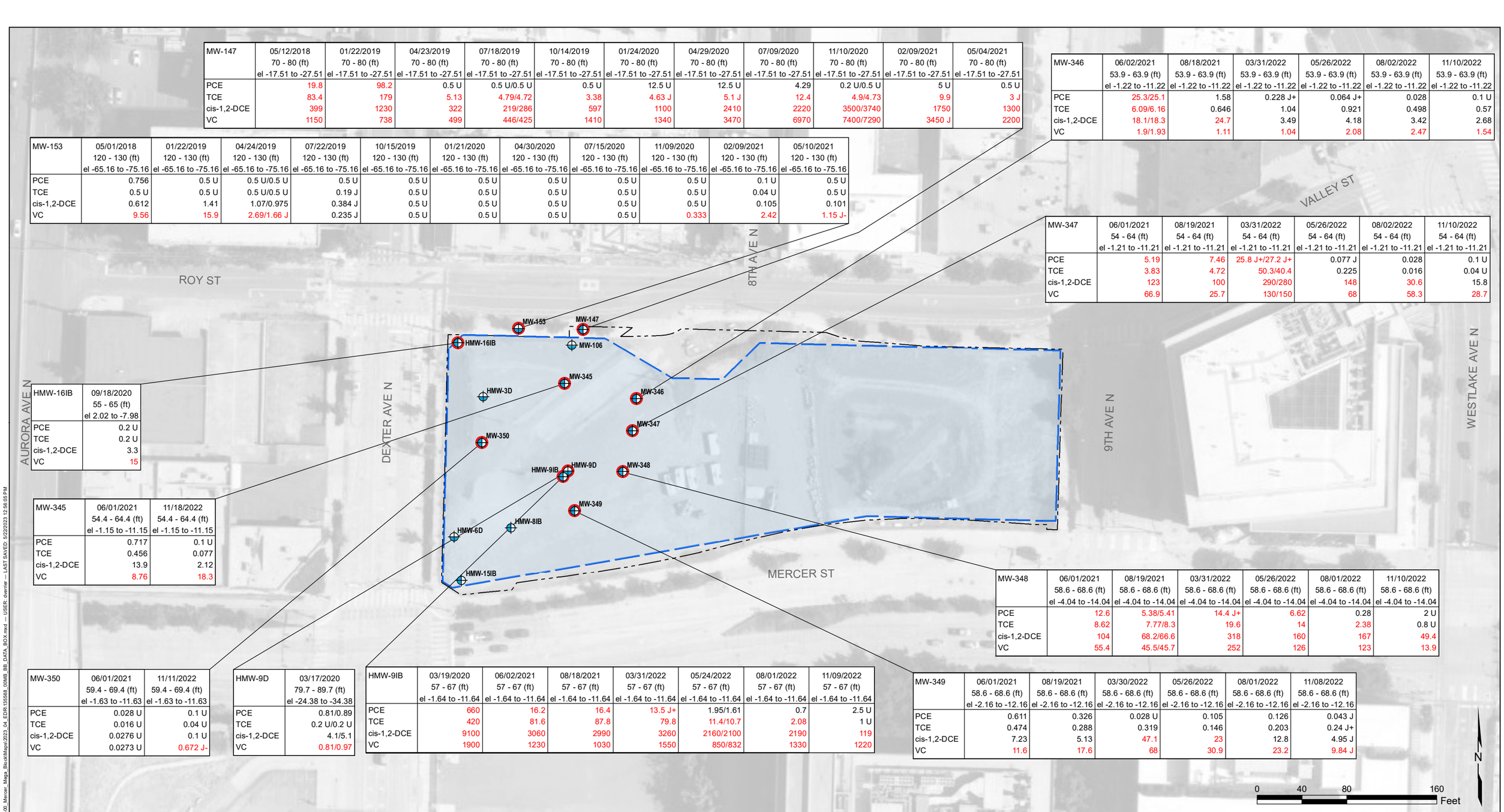
MW-348	06/01/2021 58.6 - 68.6 (ft) el -4.04 to -14.04	08/19/2021 58.6 - 68.6 (ft) el -4.04 to -14.04	03/31/2022 58.6 - 68.6 (ft) el -4.04 to -14.04	05/26/2022 58.6 - 68.6 (ft) el -4.04 to -14.04	08/01/2022 58.6 - 68.6 (ft) el -4.04 to -14.04	11/10/2022 58.6 - 68.6 (ft) el -4.04 to -14.04
PCE	12.6	5.38/5.41	14.4 J+	6.62	0.28	2 U
TCE	8.62	7.77/8.3	19.6	14	2.38	0.8 U
cis-1,2-DCE	104	68.2/66.6	318	160	167	49.4
VC	55.4	45.5/45.7	252	126	123	13.9

MW-350	06/01/2021 59.4 - 69.4 (ft) el -1.63 to -11.63	11/11/2022 59.4 - 69.4 (ft) el -1.63 to -11.63
PCE	0.028 U	0.1 U
TCE	0.016 U	0.04 U
cis-1,2-DCE	0.0276 U	0.1 U
VC	0.0273 U	0.672 J-

HMW-9D	03/17/2020 79.7 - 89.7 (ft) el -24.38 to -34.38
PCE	0.81/0.89
TCE	0.2 U/0.2 U
cis-1,2-DCE	4.1/5.1
VC	0.81/0.97

HMW-9IB	03/19/2020 57 - 67 (ft) el -1.64 to -11.64	06/02/2021 57 - 67 (ft) el -1.64 to -11.64	08/18/2021 57 - 67 (ft) el -1.64 to -11.64	03/31/2022 57 - 67 (ft) el -1.64 to -11.64	05/24/2022 57 - 67 (ft) el -1.64 to -11.64	08/01/2022 57 - 67 (ft) el -1.64 to -11.64	11/09/2022 57 - 67 (ft) el -1.64 to -11.64
PCE	660	16.2	16.4	13.5 J+	1.95/1.61	0.7	2.5 U
TCE	420	81.6	87.8	79.8	11.4/10.7	2.08	1 U
cis-1,2-DCE	9100	3060	2990	3260	2160/2100	2190	119
VC	1900	1230	1030	1550	850/832	1330	1220

MW-349	06/01/2021 58.6 - 68.6 (ft) el -2.16 to -12.16	08/19/2021 58.6 - 68.6 (ft) el -2.16 to -12.16	03/30/2022 58.6 - 68.6 (ft) el -2.16 to -12.16	05/26/2022 58.6 - 68.6 (ft) el -2.16 to -12.16	08/01/2022 58.6 - 68.6 (ft) el -2.16 to -12.16	11/08/2022 58.6 - 68.6 (ft) el -2.16 to -12.16
PCE	0.611	0.326	0.028 U	0.105	0.126	0.043 J
TCE	0.474	0.288	0.319	0.146	0.203	0.24 J+
cis-1,2-DCE	7.23	5.13	47.1	23	12.8	4.95 J
VC	11.6	17.6	68	30.9	23.2	9.84 J



- INTERMEDIATE B ZONE MONITORING WELL
- DEEP ZONE MONITORING WELL
- GROUNDWATER SAMPLING LOCATION WITH EXCEEDANCE
- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY

RED TEXT INDICATES EXCEEDANCE OF PROTECTIVE OF DRINKING WATER OR PROTECTIVE OF INDOOR AIR SCREENING LEVELS

DATA SHOWN IS FROM 2018-2022; CONCENTRATIONS IN MICROGRAMS PER LITER (µG/L)

SCREENING LEVELS PROVIDED BY ECOLOGY (NOVEMBER 17, 2020 AND JANUARY 2023 UPDATES)

DEPTH IN FEET BELOW GROUND SURFACE (BGS)

ELEVATION IN FEET (NAVD 88)

U = NON-DETECT AT DETECTION LIMIT AS INDICATED
J = ESTIMATED VALUE
- = ANALYTE WAS NOT ANALYZED/NOT APPLICABLE
/ = MULTIPLE RESULTS INDICATE THAT A FIELD DUPLICATE WAS TAKEN
K = REPORTED RESULT WITH UNKNOWN BIAS
CVOC = CHLORINATED VOLATILE ORGANIC COMPOUND

AERIAL IMAGERY SOURCE: EAGLEVIEW

SCREENING LEVELS FOR CVOCs IN GROUNDWATER (µg/L)

CONSTITUENT	PROTECTIVE OF DRINKING WATER	PROTECTIVE OF INDOOR AIR
Tetrachloroethene (PCE)	5	24
Trichloroethene (TCE)	4	1.4
cis-1,2-Dichloroethene (cis-1,2-DCE)	16	180
Vinyl chloride (VC)	0.29	0.35

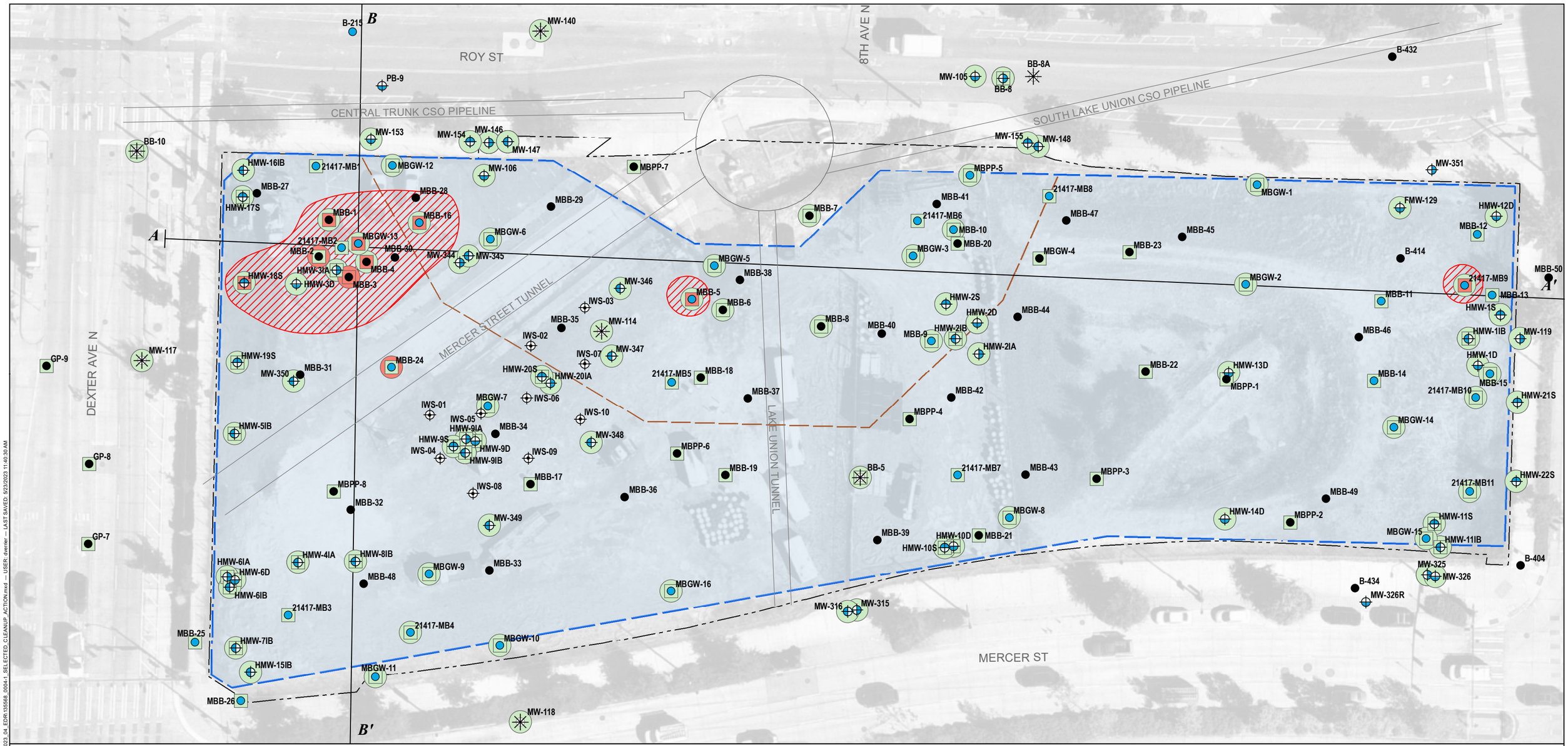
Seattle DOT Mercer Parcels Site
Seattle, Washington

CVOCs Distribution in Groundwater, Western Area, Below 8 ft Elevation

0202738-100 05/23

HALEY ALDRICH

Figure
2-9b



LEGEND

- SOIL BORING
- SOIL BORING WITH GRAB GROUNDWATER SAMPLE
- SHALLOW ZONE MONITORING WELL
- INTERMEDIATE A ZONE MONITORING WELL
- INTERMEDIATE B ZONE MONITORING WELL
- DEEP ZONE MONITORING WELL
- INJECTION WELL
- ABANDONED OR DECOMMISSIONED MONITORING WELL
- APPROXIMATE LIMTS OF 2H:1V SOIL BERM THAT WILL BE EXCAVATED LAST
- CROSS SECTION
- PROPERTY BOUNDARY

TESTING RESULTS

- SOIL TESTED, WITHOUT EXCEEDANCE OF CLEANUP LEVEL
- SOIL TESTED, WITH EXCEEDANCE OF CLEANUP LEVEL
- GROUNDWATER TESTED, WITHOUT EXCEEDANCE OF CLEANUP LEVEL
- GROUNDWATER TESTED, WITH EXCEEDANCE OF CLEANUP LEVEL
- ESTIMATED AREA OF COC-CONTAMINATED SOIL TO BE EXCAVATED AND DISPOSED OF OFF-SITE (COC = CONSTITUENT OF CONCERN)
- KING COUNTY MAIN FACILITY STRUCTURES
- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT

TESTING RESULTS ARE SHOWN FOR THESE CONSTITUENTS	SOIL (mg/kg)	GROUNDWATER (µg/L)
COCs	CLEANUP LEVEL	CLEANUP LEVEL
Gasoline Range Organics (GRO)	30	800
Lead	250	-
Diesel Range Organics (DRO)	-	500
Benzene	-	2.4

0 20 40 80 Feet

N

AERIAL IMAGERY SOURCE: NEARMAP, AUGUST 28, 2020

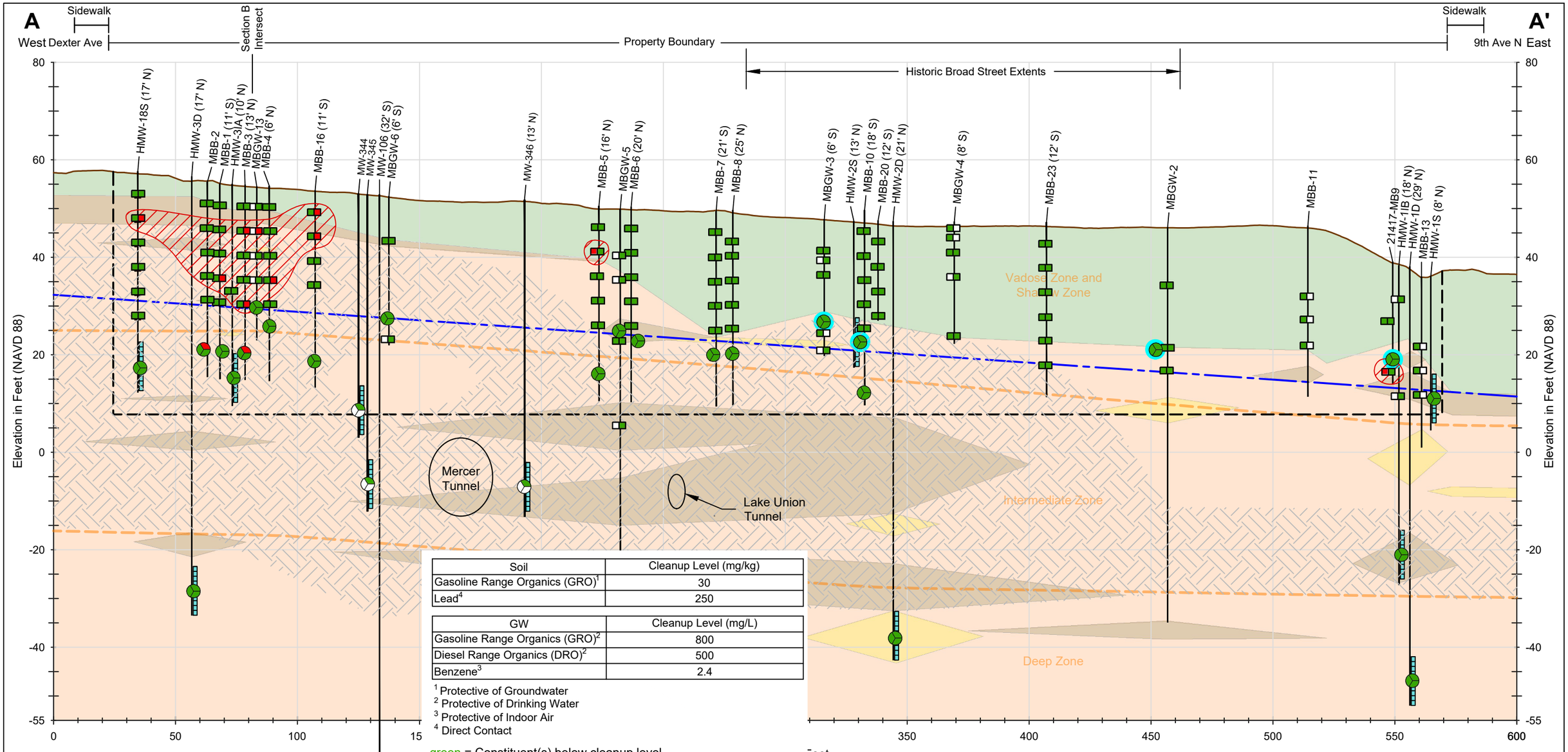
Seattle DOT Mercer Parcels Site
Seattle, Washington

Selected Cleanup Action

0202738-100 05/23

HALEY ALDRICH

Figure **4-1**



Soil	Cleanup Level (mg/kg)
Gasoline Range Organics (GRO)[1]	30
Lead[4]	250

GW	Cleanup Level (mg/L)
Gasoline Range Organics (GRO)[2]	800
Diesel Range Organics (DRO)[2]	500
Benzene[3]	2.4

[1] Protective of Groundwater
[2] Protective of Drinking Water
[3] Protective of Indoor Air
[4] Direct Contact

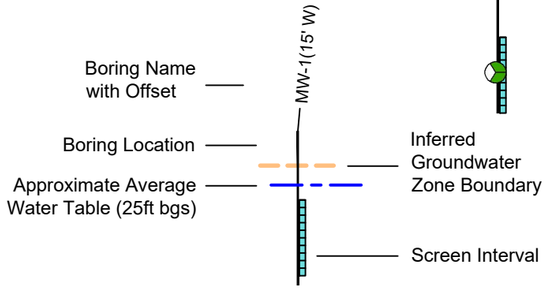
green = Constituent(s) below cleanup level

red = Constituent(s) above cleanup level

white = Constituent(s) not tested

Sample results shown from the most recent sampling event.

Legend

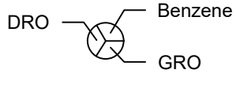


Geologic Units (Predominant Component)

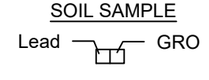
- Fill
- Clean Sand and/or Gravel
- Till
- Silty Sand and Silty Gravel
- Silt and/or Clay with or without Sand

Approximate Limits of Proposed Excavation and Vapor Barrier Area at Seattle DOT Mercer Parcels Site ("Schematic Design, ARE Mercer Blocks," NBBJ, 04/20/2020)

GROUNDWATER SAMPLE

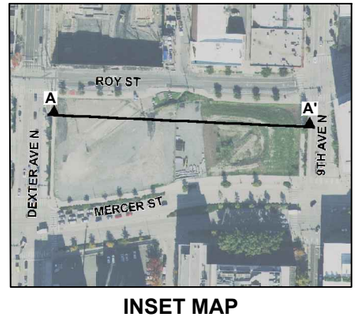


SOIL SAMPLE



= Estimated area of constituent of concern (COC)-contaminated soil to be excavated and disposed of off-site

= Perched groundwater



INSET MAP

Horizontal Scale in Feet
0 40 80
0 20 40
Vertical Scale in Feet
Vertical Exaggeration x 2

Explorations MBB-1, MBB-2, MBB-4, MBGW-13, HMW-2S and MBB-20 have been shifted horizontally for visual clarity.

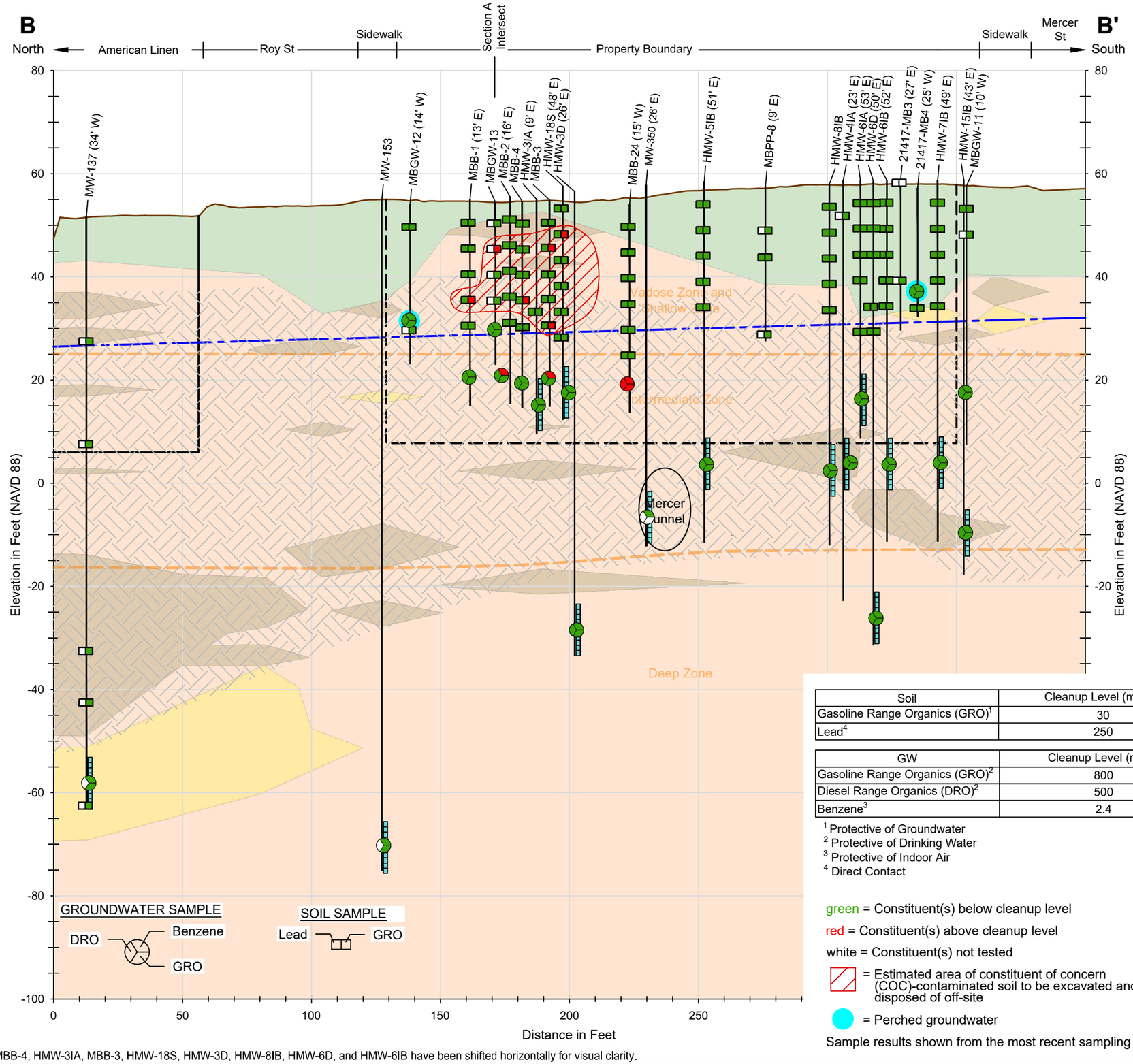
Seattle DOT Mercer Parcels Site
Seattle, Washington

Selected Cleanup Action Cross Section A-A'

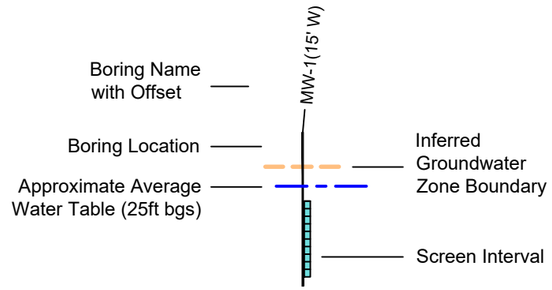
0202738-100 05/23

HALEY ALDRICH

Figure
4-2



Legend

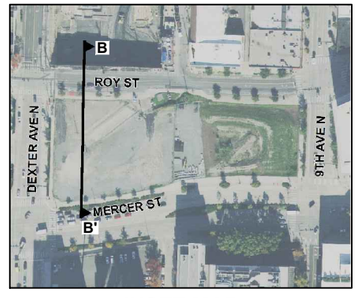


Approximate Limits of Proposed Excavation and Vapor Barrier Area at Seattle DOT Mercer Parcels Site ("Schematic Design, ARE Mercer Blocks," NBBJ, 04/20/2020)

Approximate Limits of 2020 Building Excavation at American Linen Site

Geologic Units (Predominant Component)

Fill
Clean Sand and/or Gravel
Till
Silty Sand and Silty Gravel
Silt and/or Clay with or without Sand



INSET MAP

Soil	Cleanup Level (mg/kg)
Gasoline Range Organics (GRO)[1]	30
Lead[4]	250

GW	Cleanup Level (mg/L)
Gasoline Range Organics (GRO)[2]	800
Diesel Range Organics (DRO)[2]	500
Benzene[3]	2.4

[1] Protective of Groundwater
[2] Protective of Drinking Water
[3] Protective of Indoor Air
[4] Direct Contact

green = Constituent(s) below cleanup level
red = Constituent(s) above cleanup level
white = Constituent(s) not tested
= Estimated area of constituent of concern (COC)-contaminated soil to be excavated and disposed of off-site
= Perched groundwater
Sample results shown from the most recent sampling event.

Horizontal Scale in Feet
0 40 80
0 20 40
Vertical Scale in Feet
Vertical Exaggeration x 2

Explorations MBB-4, HMW-3IA, MBB-3, HMW-18S, HMW-3D, HMW-8IB, HMW-6D, and HMW-6IB have been shifted horizontally for visual clarity.

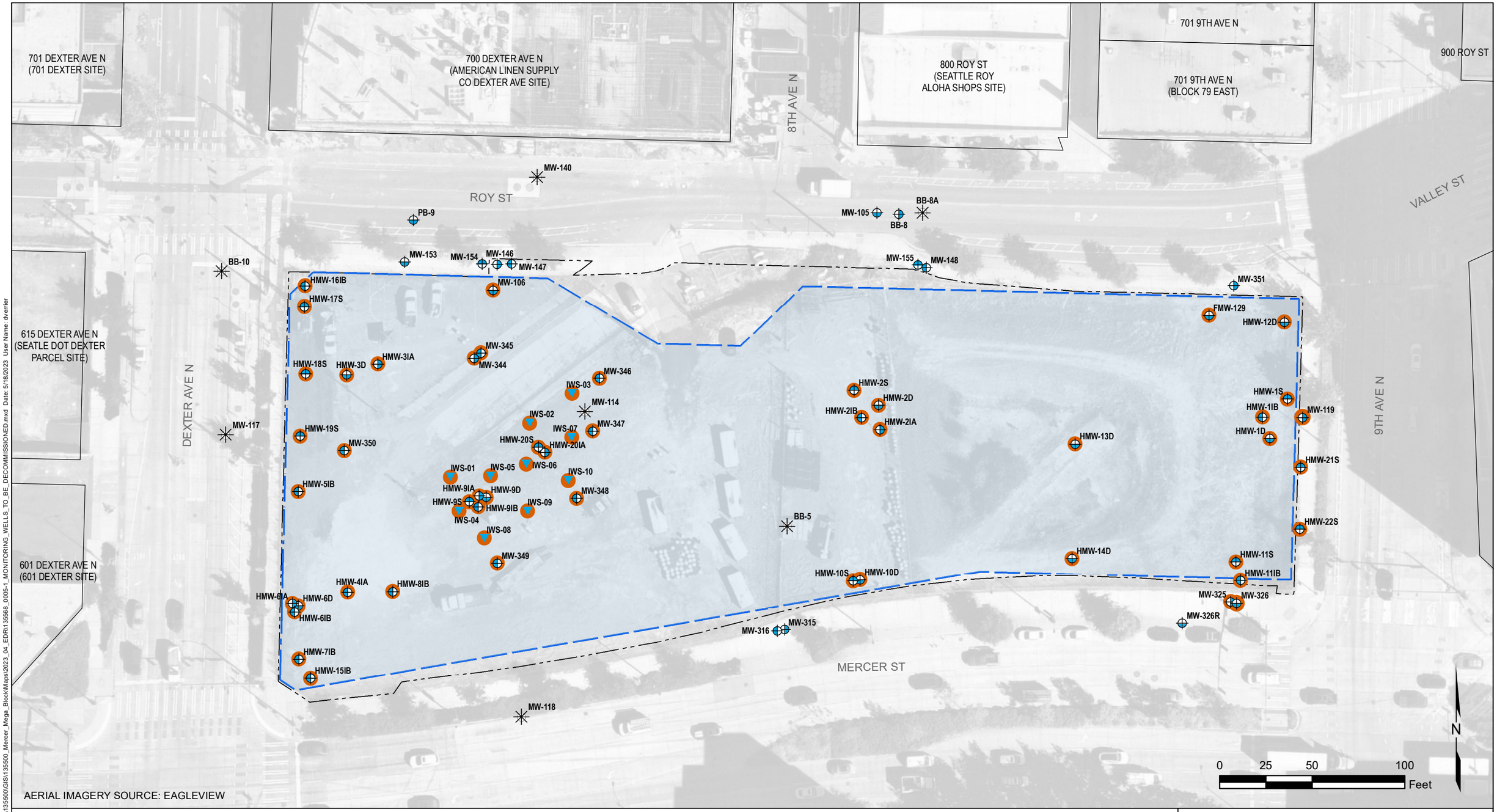
Seattle DOT Mercer Parcels Site
Seattle, Washington

Selected Cleanup Action Cross Section B-B'

0202738-100 05/23

HALEY ALDRICH

Figure
4-3



LEGEND

- SHALLOW ZONE MONITORING WELL
- INTERMEDIATE A ZONE MONITORING WELL
- INTERMEDIATE B ZONE MONITORING WELL
- DEEP ZONE MONITORING WELL
- ABANDONED OR DECOMMISSIONED MONITORING WELL
- INTERIM ACTION INJECTION WELL
- WELL TO BE DECOMMISSIONED
- EXCAVATION LIMITS; TO BE EXCAVATED TO ELEVATIONS RANGING FROM 7.75 TO 1.75 FT
- PROPERTY BOUNDARY
- OTHER PARCEL BOUNDARY

Seattle DOT Mercer Parcels Site
Seattle, Washington

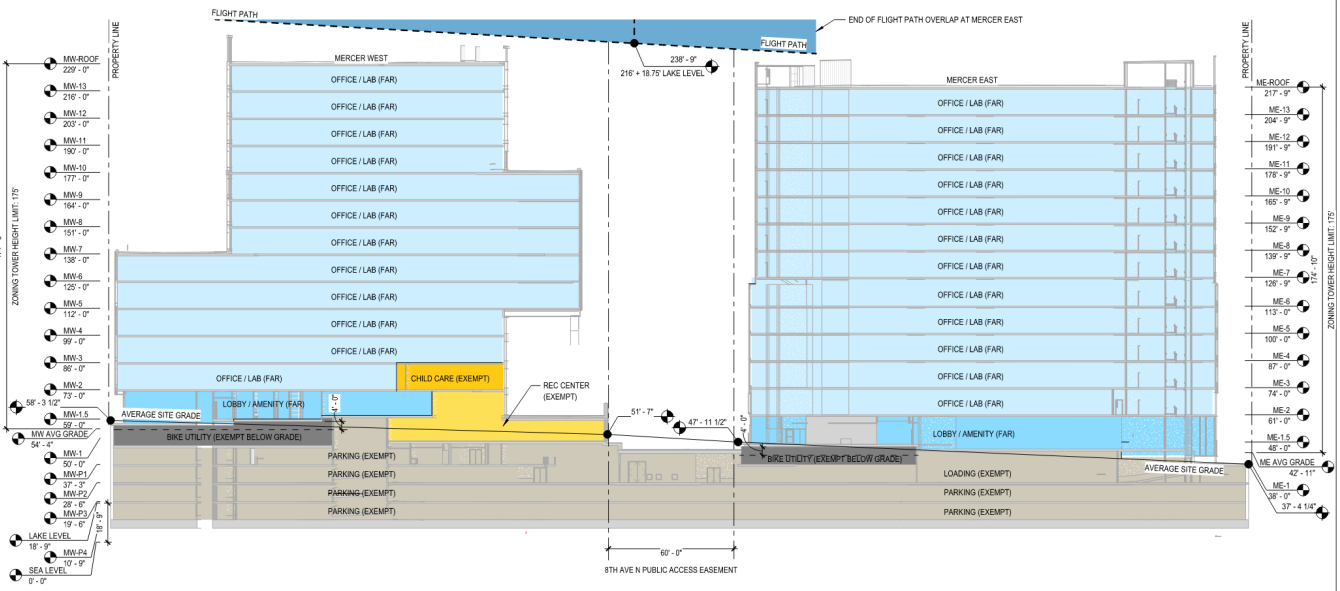
Monitoring and Injection Wells to be Decommissioned

0202738-100 05/23

HALEY ALDRICH

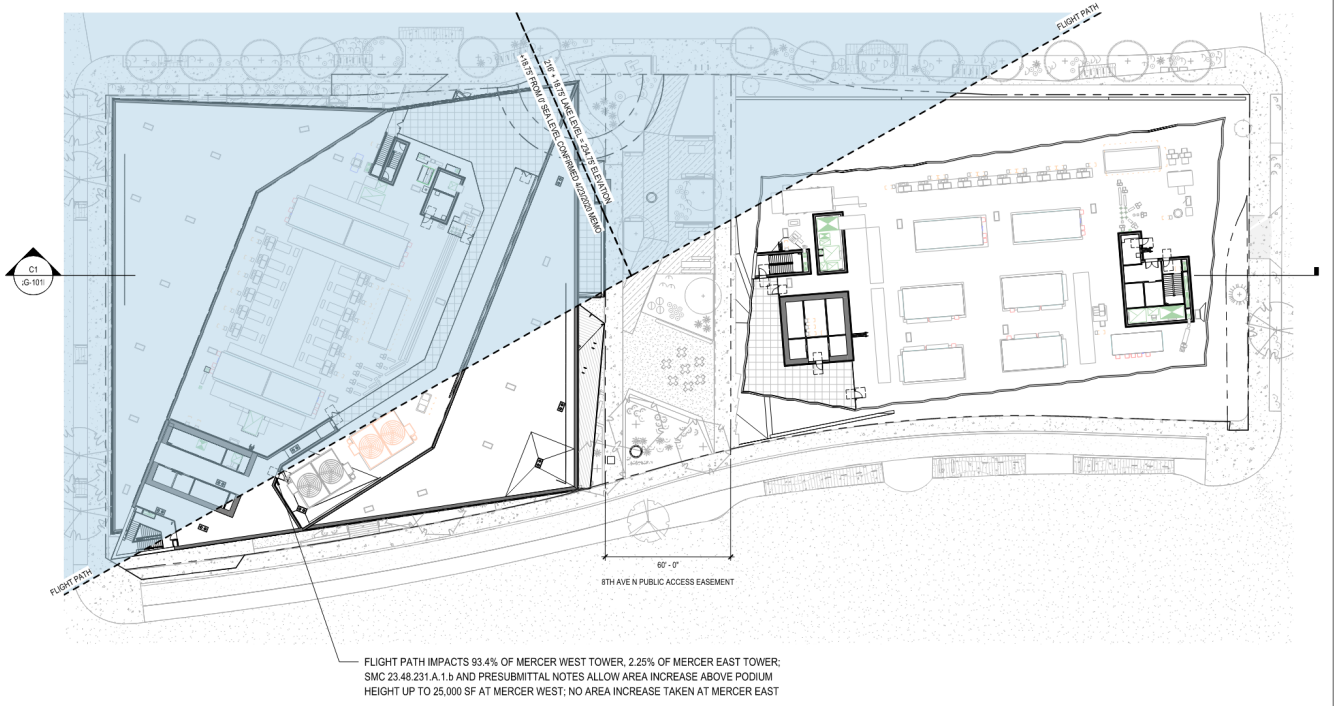
Figure **5-1**

APPENDIX A
Architectural Plans and Sections



C1 SITE SECTION DIAGRAM

1" = 30'-0"



A1 SITE PLAN DIAGRAM

1" = 30'-0"

APPENDIX B
Administrative Order No. 21321

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Region Office
PO Box 330316, Shoreline, WA 98133-9716 • 206-594-0000

September 1, 2022

Christian Gunter
Alexandria Real Estate Equities
400 Dexter Ave N Ste 200
Seattle, WA 98109-5094

Order Docket #	21321
Site Location	Project Name: 816 Mercer 816 Mercer Street Seattle, WA 98109

Re: Administrative Order

Dear Christian Gunter:

The Department of Ecology (Ecology) has issued the enclosed Administrative Order (Order) requiring Alexandria Real Estate Equities to comply with:

- Chapter 90.48 Revised Code of Washington (RCW) - State of Washington Water Pollution Control Act.
- Chapter 173-201A Washington Administrative Code (WAC) - Water Quality Standards for Surface Waters of the State of Washington.
- Construction Stormwater General Permit WAR311290: National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity.

If you have questions, please contact Charles Hackel at (425) 213-9832 or charles.hackel@ecy.wa.gov.

Sincerely,

Rachel McCrea
Water Quality Section Manager
Northwest Regional Office

Enclosures: Administrative Order Docket #21321
By certified mail 9171 9690 0935 0233 1612 47
ecc: James Murphy, Howard S Wright
PARIS Permit No. WAR311290

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

IN THE MATTER OF AN ADMINISTRATIVE ORDER AGAINST Alexandria Real Estate Equities Christian Gunter	)))))	ADMINISTRATIVE ORDER DOCKET #21321

To: Christian Gunter
Alexandria Real Estate Equities
400 Dexter Ave N Ste 200
Seattle, WA 98109-5094

Order Docket #	21321
Site Location	Project Name: 816 Mercer 816 Mercer Street Seattle, WA 98109

The Department of Ecology (Ecology) has issued this Administrative Order (Order) requiring Alexandria Real Estate Equities to comply with:

- Chapter 90.48 Revised Code of Washington (RCW) - State of Washington Water Pollution Control Act.
- Chapter 173-201A Washington Administrative Code (WAC) - Water Quality Standards for Surface Waters of the State of Washington.
- Construction Stormwater General Permit WAR311290: National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity.

This is an Administrative Order in accordance with General Condition G12 (Additional Monitoring) as set forth in the Construction Stormwater General Permit. Chapter 90.48.120(2) RCW authorizes Ecology to issue Administrative Orders to accomplish the purposes of Chapter 90.48 RCW.

ORDER TO COMPLY

Alexandria Real Estate Equities is subject to coverage under NPDES Construction Stormwater General Permit (CSGP) WAR311290 for construction activities associated with the construction site known as 816 Mercer (816 Mercer Street, Seattle, WA 98109). The project consists of 2.35 disturbed acres. The proposed project comprises of development of two vacant lots with existing surface related utilities and sewer infrastructure. Development will consist of building two 13-story commercial structures with 3 levels of below grade parking. The planned development is expected to encounter soil and groundwater from historical site operations, which included a gasoline and service station, auto repair, auto wrecking, soap manufacturing, and sign painting. Groundwater is expected to be encountered at approximated 20 to 30 feet below ground surface. Therefore, dewatering will be needed with planned excavations ranging from approximately 35 to 55 feet below ground surface.

The receiving waterbody following treatment is Lake Union. Ecology was notified of the presence of onsite groundwater and/or soil contamination, which has the potential to discharge in stormwater and dewatering water due to the proposed construction activity. The Construction Stormwater General Permit does not have water quality sampling or benchmarks for the known contaminants of concern, listed in Table 1, below; however, the permit requires compliance with the Water Quality Standards for Surface Waters of the State of Washington (Water Quality Standards – 173-201A WAC) and prohibits any discharges of pollutants.

The Order establishes Indicator Levels for the 816 Mercer project. Indicator Levels express a pollutant concentration used as a threshold, below which a pollutant is considered unlikely to cause a water quality violation, and above which it may. Indicator Levels in this Administrative Order were derived from WAC 173-201A and the analytical method's minimum quantitation level.

For these reasons and in accordance with RCW 90.48.120(2) it is ordered that Alexandria Real Estate Equities take the following actions. These actions are required at the location known as 816 Mercer, located at 816 Mercer Street, Seattle, WA 98109. In the event of a permit transfer to another Permittee, compliance with this Administrative Order and the actions listed below is required.

Alexandria Real Estate Equities must take the following actions to remain in compliance with NPDES Permit WAR311290:

- Install all pre-treatment and treatment systems prior to any discharge of dewatering water or contaminated construction stormwater to the receiving waterbody.
- Capture, contain, and treat all contaminated dewatering water or contaminated construction stormwater prior to discharge to the receiving waterbody.
- Use an Ecology-approved treatment system and media filtration to treat any contaminated dewatering water or contaminated construction stormwater. Ecology must be notified in advance if any changes in the treatment are made, with the exception of routine maintenance.
- All captured sediment from the treatment of the dewatering water or contaminated construction stormwater must be transported to an approved disposal facility based on the level of contamination.

The treatment system must have enough capacity to hold treated dewatering water or contaminated construction stormwater until it has been tested to determine if any of the Indicator Levels listed in Table 1 have been met. No dewatering water or contaminated construction stormwater may be discharged before it has been tested for the parameters listed in Table 1. If any of the Indicator Levels listed in Table 1 are exceeded, the treated dewatering water or contaminated construction stormwater must not be discharged to the receiving waterbody until it has been retested to determine that all parameters are equal to or below the Indicator Levels in Table 1. If any of the Indicator Levels are exceeded after being retested, Alexandria Real Estate Equities must modify the existing treatment to increase effectiveness, install an additional Ecology-approved treatment system, or truck the contaminated construction stormwater or groundwater off-site for disposal in an approved manner. Alexandria Real Estate Equities may also discharge to sanitary sewer with the approval of the proper sewer authority.

Once the effectiveness of the treatment system has been determined, Alexandria Real Estate Equities may revert to a flow-through treatment system after a minimum of two sampling and testing events and upon written approval from Ecology. The flow-through treatment system design and batch sampling results must be submitted to Ecology for review prior to use.

- If a flow-through treatment system is adopted, all dewatering water or contaminated construction stormwater must be sampled weekly while discharging and tested for the parameters listed in Table 1.
- When using a flow-through treatment system, if any of the Indicator Levels listed in Table 1 are exceeded, Alexandria Real Estate Equities must stop the discharge of treated dewatering water or contaminated construction stormwater to the receiving waterbody until it has been retested to determine that all parameters are equal to or below the Indicator Levels in Table 1. If any of the Indicator Levels are exceeded after being retested, Alexandria Real Estate Equities must modify the existing flow-through treatment system to increase its effectiveness, install an additional Ecology-approved treatment system, or truck the contaminated construction stormwater or dewatering water off-site for disposal in an approved manner. Alexandria Real Estate Equities may also discharge the treated water to sanitary sewer in accordance with the conditions of the discharge authorization from the proper sewer authority.
- Sampling for the contaminants listed in Table 1 must be reported on the required Discharge Monitoring Report (DMR) according to Permit Conditions (S5.B Discharge Monitoring Reports).
- If sampling is conducted more frequently than required by this Order, the results of this monitoring must be included in the calculation and reporting of the data that is submitted in the DMR.
- Any discharge to Waters of the State in exceedance of the contaminant Indicator Levels in Table 1 must be reported to the Department of Ecology according to Permit Condition S5.F, Noncompliance Notification as follows:
    - Immediately notify Ecology of noncompliance by calling the regional 24-hour Environmental Report Tracking System (ERTS) phone number (206) 594-0000 (note that this is a new phone number as of 5/17/2021).
    - Cease the discharge until Indicator Levels can be met.
    - Submit a detailed, written report to Ecology within five (5) days, unless requested earlier by Ecology. See Permit condition S5.F.3 for the full written report requirements.
    - For exceedances of the numeric benchmark for pH, refer to Special Condition S4.D.4 of the CSGP.
- All monitoring data must be prepared by a laboratory registered or accredited under the provisions of Accreditation of Environmental Laboratories, Chapter 137-50 WAC.
- All sampling data must be reported monthly on DMRs electronically using Ecology's secure online system WQWebDMR, in accordance to permit condition S5.B. If the measured concentration is below the detection level then Alexandria Real Estate Equities must report single analytical values below detection as "less than the detection level (DL)" by entering "<" followed by the numeric value of the detection level (e.g. "<0.1"). All other values above DL must be reported as the numeric value.

- Contaminated soils excavated during construction will be immediately hauled offsite without stock piling to an approved disposal facility based on the level of contamination. When it is not feasible to immediately haul soils offsite, the soils must be placed in a covered area to minimize contact with stormwater.
- Noncompliance with permit requirements or the provisions of this Order (such as exceedances of indicator levels) must be immediately reported to the Northwest Regional Office of the Department of Ecology in accordance with Permit Condition S5.F, Noncompliance Notification.
- The Stormwater Pollution Prevention Plan (SWPPP) prepared for 816 Mercer must be fully implemented and amended as needed for the duration of the project.
- If a modification of the Order is desired, a written request must be submitted to Ecology and if approved, Ecology will issue an amendment to this Order.

Ecology retains the right to make modifications to this Order through supplemental Order, or amendment to this Order, it if appears necessary to further protect the public interest.

This Order does not exempt Alexandria Real Estate Equities from any Construction Stormwater General Permit requirement. This Order automatically terminates when NPDES Construction Stormwater General Permit WAR311290 is terminated.

Table 1. Fresh Water Parameters

Alexandria Real Estate Equities must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for monitoring unless the method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136. If Alexandria Real Estate Equities uses an alternative method, not specified in the order and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report.

Pollutant & CAS No. (if available)	Sampling Frequency*	Sample Type	Indicator Level, µg/L unless otherwise noted	Required Analytical Protocol	Detection Level, µg/L unless otherwise noted	Quantitation Level, µg/L unless otherwise noted
PETROLEUM HYDROCARBONS						
BTEX (benzene, toluene, ethylbenzene and O,M,P xylenes)	Batch/Weekly	Grab	2.0 [a]	SW 846 8021/ 8260	1.0	2.0
Diesel and Oil-Range Hydrocarbons (NWTPH-Dx) [b]	Batch/Weekly	Grab	250 [a]	NWTPH-Dx	250	250
Gasoline-Range Hydrocarbons (NWTPH-Gx) [c]	Batch/Weekly	Grab	250 [a]	NWTPH-Gx	250	250
METALS						
Antimony, Total (7440-36-0)	Batch/Weekly	Grab	12.0 [h]	200.8	0.3	1.0
Arsenic, Total (7440-38-2)	Batch/Weekly	Grab	360 [d]	200.8	0.1	0.5
Beryllium, Total (7440-41-7)	Batch/Weekly	Grab	0.5 [a]	200.8	0.1	0.5
Cadmium, Total (7440-43-9)	Batch/Weekly	Grab	1.6 [d]	200.8	0.05	0.25
Chromium, Total (7440-47-3)	Batch/Weekly	Grab	15.0 [e]	200.8	0.2	1.0
Copper, Total (7440-50-8)	Batch/Weekly	Grab	8.2 [d]	200.8	0.4	2.0
Lead, Total (7439-92-1)	Batch/Weekly	Grab	27.47 [d]	200.8	0.1	0.5
Mercury, Total (7439-97-6)	Batch/Weekly	Grab	2.1 [d]	1631E	0.0002	0.0005
Nickel, Total (7440-02-0)	Batch/Weekly	Grab	733.79 [d]	200.8	0.1	0.5
Selenium, Total (7782-49-2)	Batch/Weekly	Grab	20.0 [d]	200.8	1.0	1.0
Zinc, Total (7440-66-6)	Batch/Weekly	Grab	59.3 [d]	200.8	0.5	2.5

Pollutant & CAS No. (if available)	Sampling Frequency*	Sample Type	Indicator Level, µg/L unless otherwise noted	Required Analytical Protocol	Detection Level, µg/L unless otherwise noted	Quantitation Level, µg/L unless otherwise noted
VOLATILE ORGANIC COMPOUNDS (VOCs), SEMI VOCs AND HALOGENATED VOCs						
Acetone (67-64-1)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
n-Butylbenzene (104-51-8)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
sec-Butylbenzene (135-98-8)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
tert-Butylbenzene (98-06-6)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
Carbon Disulfide (75-15-0)	Batch/Weekly	Grab	10 [a]	624.1	10	10
Chloroform (67-66-3)	Batch/Weekly	Grab	4.8 [a]	624.1 or SM6210B	1.6	4.8
1,1-Dichloroethane (75-34-3)	Batch/Weekly	Grab	14.1 [a]	624.1	4.7	14.1
1,2-Dichloroethane (107-06-2)	Batch/Weekly	Grab	8.4 [a]	624.1	2.8	8.4
2,2-Dichloropropane (594-20-7)	Batch/Weekly	Grab	1.0 [a]	624.1	0.19	1.0
Cis-1,2-Dichloroethene (156-59-2)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
Dibromochloromethane (124-48-1)	Batch/Weekly	Grab	9.3 [a]	624.1	3.1	9.3
Diisopropyl ether (108-20-3)	Batch/Weekly	Grab	1.0 [a]	624.1	0.1	1.0
Isopropylbenzene (98-82-8)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
p-Isopropyltoluene (99-87-6)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
Methyl Chloride (74-87-3)	Batch/Weekly	Grab	2.0 [a]	624.1	1.0	2.0
n-propylbenzene (103-65-1)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
Tetrachloroethylene (127-18-4)	Batch/Weekly	Grab	12.3 [a]	624.1	4.1	12.3
1,1,1-Trichloroethane (71-55-6)	Batch/Weekly	Grab	11.4 [a]	624.1	3.8	11.4
Trichloroethylene (79-01-6)	Batch/Weekly	Grab	5.7 [a]	624.1	1.9	5.7

Pollutant & CAS No. (if available)	Sampling Frequency*	Sample Type	Indicator Level, µg/L unless otherwise noted	Required Analytical Protocol	Detection Level, µg/L unless otherwise noted	Quantitation Level, µg/L unless otherwise noted
1,2,4 –Trimethylbenzene (95-63-6)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
1,3,5 –Trimethylbenzene (108-67-8)	Batch/Weekly	Grab	5.0 [a]	8260	5.0	5.0
trans-1,2-Dichloroethene (156-60-5)	Batch/Weekly	Grab	4.8 [a]	624.1	1.6	4.8
Vinyl chloride (75-01-4)	Batch/Weekly	Grab	2.0 [a]	624/SM6200B	1.0	2.0
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) AND CARCINOGENIC PAHs						
Acenaphthene (83-32-9)	Batch/Weekly	Grab	5.7 [a]	625.1	1.9	5.7
Acenaphthylene (208-96-8)	Batch/Weekly	Grab	10.5 [a]	625.1	3.5	10.5
Anthracene (120-12-7)	Batch/Weekly	Grab	5.7 [a]	625.1	1.9	5.7
Benzo(a)anthracene (56-55-3)	Batch/Weekly	Grab	23.4 [a]	625.1	7.8	23.4
Benzo(a)pyrene (50-32-8)	Batch/Weekly	Grab	7.5 [a]	610/625.1	2.5	7.5
Benzo(b)fluoranthene (205-99-2)	Batch/Weekly	Grab	14.4 [a]	610/625.1	4.8	14.4
Benzo(k)fluoranthene (207-08-9)	Batch/Weekly	Grab	7.5 [a]	610/625.1	2.5	7.5
Chrysene (218-01-9)	Batch/Weekly	Grab	7.5 [a]	610/625.1	2.5	7.5
Dibenzo(a-h)anthracene (53-70-3)	Batch/Weekly	Grab	7.5 [a]	625.1	2.5	7.5
Fluoranthene (206-44-0)	Batch/Weekly	Grab	6.6 [a]	625.1	2.2	6.6
Fluorene (86-73-7)	Batch/Weekly	Grab	5.7 [a]	625.1	1.9	5.7
Indeno(1,2,3-cd)pyrene (193-39-5)	Batch/Weekly	Grab	11.1 [a]	610/625.1	3.7	11.1
1-Methylnaphthalene (90-12-0)	Batch/Weekly	Grab	10 [a]	8270	10	10
2-Methylnaphthalene (91-57-6)	Batch/Weekly	Grab	10 [a]	8270	10	10

Pollutant & CAS No. (if available)	Sampling Frequency*	Sample Type	Indicator Level, µg/L unless otherwise noted	Required Analytical Protocol	Detection Level, µg/L unless otherwise noted	Quantitation Level, µg/L unless otherwise noted
Naphthalene (91-20-3)	Batch/Weekly	Grab	4.8 [a]	625.1	1.6	4.8
Phenanthrene (85-01-8)	Batch/Weekly	Grab	16.2 [a]	625.1	5.4	16.2
Pyrene (129-00-0)	Batch/Weekly	Grab	5.7 [a]	625.1	1.9	5.7
POLYCHLORINATED BIPHENYLS (PCBs)						
PCBs, Total [g]	Batch/Weekly	Grab	2.0 [d]	608.3	0.065	0.195
Construction Stormwater General Permit Benchmarks						
Parameter	**Sampling Frequency***	**Sample Type**	**Benchmark**		**Analytical Method**	
Turbidity	Batch/Weekly	Grab	25 NTU		SM2130 [f]	
pH	Batch/Weekly	Grab	6.5 - 8.5 SU		SM4500-H^+ B	

NOTES	
[a]	No applicable surface water criterion; value is laboratory quantitation level.
[b]	NWTPH-Dx = Northwest Total Petroleum Hydrocarbons – Semi-volatile ("diesel") for diesel range organics and heavy oils (includes jet fuels, kerosene, diesel-oils, hydraulic fluids, mineral oils, lubricating oils, and fuel oils).
[c]	NWTPH-Gx = Northwest Total Petroleum Hydrocarbons – Volatile petroleum products including aviation and automotive gasolines, mineral spirits, Stoddard solvent, and naphtha.
[d]	Acute – Freshwater Toxic Substances Criteria (WAC 173-201A-240). Based on Hardness of 46.0 mg/L for Hardness Dependent Metals. The Indicator Level for hardness dependent metals is expressed as a dissolved metal value. Meeting the Indicator Level using analytical protocol for total or dissolved metal values meets the intent of this order.
[e]	Indicator Level total chromium is actually for hexavalent chromium using Acute – Freshwater Toxic Substances Criteria (WAC 173-201A-240) because there is no water quality standard for total chromium.
[f]	Or equivalent.
[g]	Total PCBs are the sum of all congener or all isomer or homolog or Aroclor analyses.
[h]	An applicable surface water criterion does not exist for antimony. The indicator level for antimony is based on the human health criteria for consumption of organisms.
*	If permission is granted for flow through, sampling will then be weekly.

FAILURE TO COMPLY WITH THIS ORDER

Failure to comply with this Order may result in the issuance of civil penalties or other actions, whether administrative or judicial, to enforce the terms of this Order.

YOUR RIGHT TO APPEAL

You have a right to appeal this Order to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by Chapter 43.21B RCW and Chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do both of the following within 30 days of the date of receipt of this Order:

- File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Order on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in Chapter 43.21B RCW and Chapter 371-08 WAC.

Your appeal alone will not stay the effectiveness of this Order. Stay requests must be submitted in accordance with RCW 43.21B.320.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503 **Pollution Control Hearings Board** 1111 Israel Road SW STE 301 Tumwater, WA 98501	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608 **Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

CONTACT INFORMATION

Please direct all questions about this Order to:

Charles Hackel
Department of Ecology
Northwest Regional Office
PO Box 330316
Shoreline, WA 98133-9716

Phone: (425) 213-9832
Email: charles.hackel@ecy.wa.gov

MORE INFORMATION

- Pollution Control Hearings Board Website
  http://www.eluho.wa.gov/Board/PCHB
- Chapter 43.21B RCW - Environmental and Land Use Hearings Office – Pollution Control Hearings Board
  http://app.leg.wa.gov/RCW/default.aspx?cite=43.21B
- Chapter 371-08 WAC – Practice And Procedure
  http://app.leg.wa.gov/WAC/default.aspx?cite=371-08
- Chapter 34.05 RCW – Administrative Procedure Act
  http://app.leg.wa.gov/RCW/default.aspx?cite=34.05
- Ecology's Laws, rules, & rulemaking website
  https://ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking

SIGNATURE

Rachel McCrea — Sept. 1, 2022

Rachel McCrea
Water Quality Section Manager
Northwest Regional Office

Date

APPENDIX C
Cultural Resources Documents

Per RCW 42.56.300, information identifying the location of cultural resources and archaeological sites are exempt from public disclosure. As such, the contents of this appendix have been removed from the publicly-available report.

APPENDIX D
Health and Safety Plan

Health and Safety Plan

800 Mercer Street Investigation/Redevelopment

800 Mercer Street
Seattle, Washington
Date Prepared: February 13, 2020
Date Updated: May 23, 2023

EMERGENCY INFORMATION

SITE LOCATION	800 Mercer Street (city block bounded by Mercer Street, Dexter Avenue North, Roy Street and 9th Avenue North) Seattle, WA
NEAREST HOSPITALS	Harborview Medical Center 325 Ninth Avenue Seattle, WA (206) 744-3000 The route to the hospital is shown on Figure 1.
CONTACTS	**Haley & Aldrich, Inc.** Seattle Office……..(206) 324-9530 ►Project Manager, Marissa Goodman……(209) 312-0424 (C) ►Seattle Health & Safety Officer, Jessica Blanchette….(360) 720-1279 (C) **Alexandria Real Estate Equities** ►Senior Vice President, Christian Gunter..... …..(206) 408-1550 **Washington Department of Ecology Northwest Regional office** Site Manager, Tena Seeds…….. ……..(425) 457-3143 (C) Poison Control Center ……..(800) 222-1222
EMERGENCY RESPONDERS **Police, Fire, Ambulance**	**911**
IN EVENT OF EMERGENCY CONTACT 911 FOR HELP AS SOON AS POSSIBLE	Give the following information: ➔ **Where You Are** - address, cross streets, or landmarks ☎ **Phone Number** you are calling from ?? **What Happened** - type of injury, accident # **How many persons** need help ?? **What is being done** for the victim(s) !! **You hang up last** – let emergency dispatcher hang up first

EMERGENCY EVENT PROCEDURES

1 - ASSESS THE SCENE

- **STOP WORK**
- Review the situation and ascertain if it's safe to enter the area.
- Evacuate the site if the conditions are unsafe.

2 - EVALUATE THE EMERGENCY

- **Call 911, or designated emergency number, if required.**
- **Provide first aid for the victim if qualified and safe to do so.**
    - First aid will be addressed using the onsite first aid kit. *
        - If providing first aid, remember to use proper first aid universal precautions if blood or bodily fluids are present.
- **If exposure to hazardous substance is suspected, immediately vacate the contaminated area.**
    - Remove any contaminated clothing and/or equipment.
    - Wash any affected dermal/ocular area(s) with water for at least 15 minutes.
    - Seek immediate medical assistance if any exposure symptoms are present.

** Note: Haley & Aldrich employees are not required or expected to administer first aid / CPR to any Haley & Aldrich staff member, Contractor, or Civilian personnel at any time; it is Haley & Aldrich´s position that those who do are doing so on their own behalf and not as a function of their job.*

3 - SECURE THE AREA

- **Cordon off the incident area, if possible.**
    - Notify any security personnel, if required.
    - Escort all non-essential personnel out of the area, if able.

4 - REPORT ON-SITE ACCIDENTS / INCIDENTS TO PM / SSO

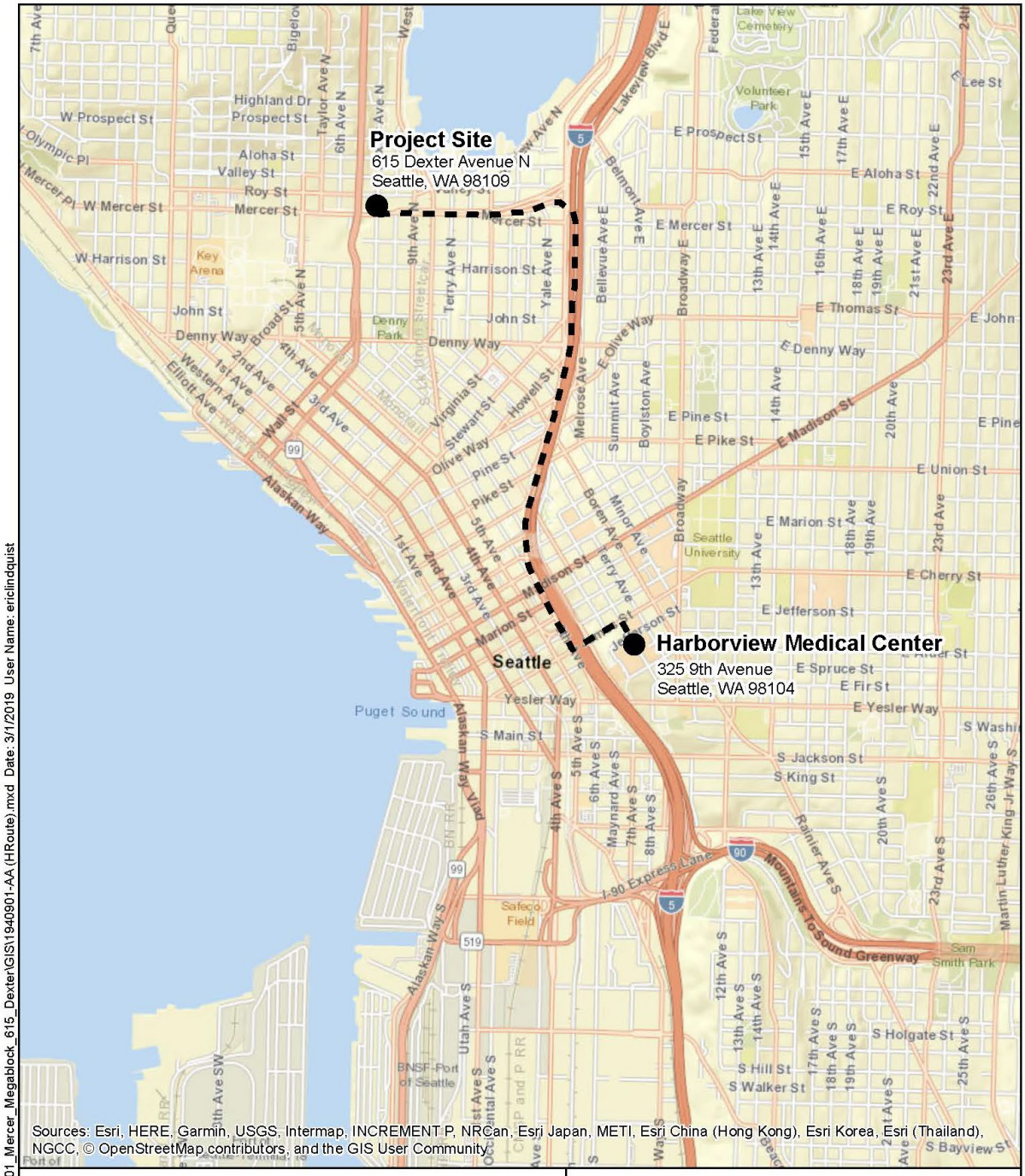
- **Notify the PM and SSO as soon as it is safe to do so.**
    - Assist PM and SSO in completing any additional tasks, as required.

5 - INVESTIGATE / REPORT THE INCIDENT

- **Record details of the incident for input to the Gensuite.**
    - Complete any additional forms as requested by the PM and SSO.

6 - TAKE CORRECTIVE ACTION

- **Implement corrective actions per the PM following root cause analysis.**
    - Complete Lessons Learned form.


Project Site
615 Dexter Avenue N
Seattle, WA 98109
Harborview Medical Center
325 9th Avenue
Seattle, WA 98104
Seattle
Puget Sound
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
0 1,000 2,000 4,000
Feet
Note: Feature locations are approximate.
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Mercer Mega Block Investigation
Seattle, Washington
Route to Hospital
19409-01
2/19
HALEY ALDRICH
Figure
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SITE HEALTH AND SAFETY PLAN SUMMARY

Location: 800 Mercer Street (city block bounded by Mercer Street, Dexter Avenue North, Roy Street, and 9th Avenue North), Seattle, Washington.

Proposed dates of activities: May to June 2022 and throughout construction starting in 2024.

Proposed activities: This work includes logging soil borings, installing monitoring wells, construction observation, and field screening and collecting soil and water samples.

Type of facility: Vacant lot and used for construction staging. Active construction site starting 2024.

Land use of area surrounding facility: Commercial.

Potential site contaminants: Heavy metals including arsenic and lead; gasoline- and diesel-range organics (GRO and DRO, respectively); volatile organic compounds (VOCs) including benzene and chlorinated solvents including tetrachloroethylene (PCE), trichloroethylene (TCE), cis- and trans-1,2-dichloroethylene (DCE), and vinyl chloride (VC); and polycyclic aromatic hydrocarbons (PAHs) including naphthalenes.

Routes of entry: Skin contact with soil and groundwater, inhalation of volatiles, and incidental ingestion of soil and groundwater.

Other specific safety hazards: Driving to and from the site; cold stress/hypothermia; heat related illness; noise; working around drill rigs; working around heavy equipment; heavy lifting; biological hazards; and slips, trips, and falls.

Protective measures: Safety glasses or goggles (if splash hazard exists), Class II high visibility safety vest or jacket, cut resistant gloves, nitrile gloves, long pants and shirt with minimum 4-inch sleeve, weather-appropriate gear, head protection (hard hat), hearing protection, and foot protection (e.g., steel-toed boots). A half-facepiece respirator will be available if air monitoring indicates levels warranting respiratory protection.

Air monitoring equipment: MultiRAE or MiniRAE photoionization detector (PID) with a 10.6 electron volt (eV) lamp. Dust will be monitored utilizing a dust dataram and engineering controls (wetting soil) will be implemented as necessary.

1.0 INTRODUCTION

1.1 Purpose and Regulatory Compliance

This site-specific Health and Safety Plan (HASP) provides information and procedures for protecting Haley & Aldrich, Inc. (Haley & Aldrich) personnel who handle or contact hazardous substances or may be exposed to physical hazards while conducting construction oversight (geotechnical and environmental), logging soil borings, field screening, or collecting soil and water samples at the 800 Mercer Street Site located in Seattle, Washington. The HASP is to be used by Haley & Aldrich personnel and is written for the specific site conditions, purposes, dates, and personnel specified herein; it will be amended if conditions change.

This HASP is to be used in conjunction with the Haley & Aldrich Corporate Health and Safety Manual, located on the Haley & Aldrich ATLAS. Together the Health and Safety Manual and this HASP constitute the health and safety plan for this site.

A field copy of this HASP is to be used by Haley & Aldrich personnel and must be available on site throughout the duration of the project. If site conditions, field activities, personnel, dates, or other conditions change over time, this HASP will be updated to address these changes as they occur. Haley & Aldrich personnel may make minor changes to the field copy by hand in ink (with date and initials). The signed HASP will be retained with the project files when the project is completed.

1.2 Distribution and Approval

This HASP will be made available to all Haley & Aldrich personnel working at the project site. Haley & Aldrich workers will read, sign, and return the form titled “Record of Health and Safety Communication” provided in Appendix A of this HASP to certify their agreement to comply with the minimum requirements of this HASP. The Haley & Aldrich project manager will route the signed Appendix A form to the project files upon completion of field activities covered under the HASP.

This HASP will be provided to subcontractors for informational purposes only. Subcontractors will sign the form titled “Record of Health and Safety Communication” and will be told clearly by the Field Health and Safety Manager that that this HASP represents minimum safety procedures for Haley & Aldrich workers and that subcontractors are responsible for their own safety while on the site. Nothing herein will be construed as granting rights to Haley & Aldrich subcontractors or any others working on this site to use or legally rely on this HASP.

This HASP has been approved by the Seattle Health and Safety Officer.

1.3 Chain of Command

The Haley & Aldrich chain of command for health and safety on this project includes the following individuals:

Seattle Health and Safety Officer: Jessica Blanchette

The Seattle Health and Safety Officer has overall responsibility for preparation and modification of this HASP. If health and safety issues arise during site operations, the officer will attempt to resolve them with the appropriate members of the project team.

Project Manager: Marissa Goodman

The Project Manager has overall responsibility for the successful outcome of the project. In consultation with the corporate health and safety director, the project manager makes final decisions about implementing this site-specific HASP. The project manager may delegate this responsibility and the accompanying authority to another project worker as needed.

Project Health and Safety Manager: Becca Dozier

The Project Health and Safety Manager has overall responsibility for health and safety on this project and will verify compliance with applicable requirements. This individual will communicate all relevant health and safety issues to Haley & Aldrich's workers.

Field Health and Safety Manager: Haley & Aldrich Field Staff

The Field Health and Safety Manager is responsible for implementing this HASP in the field and for maintaining it at the project site. This individual conducts safety briefings, observes workers to verify that they are following HASP procedures, and assures that proper personal protective equipment (PPE) is available and used correctly and that employees have knowledge of the local emergency response system. The field health and safety manager will see that the field HASP is updated as needed to address changes in field conditions or procedures.

1.4 Work Activities

Haley & Aldrich's work covered under this HASP includes investigation and geotechnical and environmental construction oversight during redevelopment of the site. This work includes logging soil borings, installing monitoring wells, and screening and collecting soil and water samples from the site on the 800 Mercer Street Site in accordance with the Sampling and Analysis Plan.

The investigation will be conducted during May and June 2022. The construction will start in 2024.

1.5 Site Description

The 800 Mercer Street site is located on the city block bounded by Mercer Street, Dexter Avenue North, Roy Street, and 9th Avenue North. The western portion of the site was used for parking and staging of construction equipment and stockpiles and is currently unoccupied. The eastern portion of the site is covered with grass and contains two temporary sediment ponds for site stormwater collection.

Historically, the site has been occupied by gasoline service stations, automotive wrecking yards, and a soap and chemical manufacturing plant. The soils contain fill material, and petroleum underground

storage tanks (USTs) may be on the site based on historical operations. A groundwater plume found on portions of the site has been impacted with dry cleaning solvents.

2.0 HAZARD EVALUATION AND CONTROL MEASURES

2.1 Hazardous Substances

Based on environmental investigations on the sites and adjoining properties, potential hazardous substances of concern include heavy metals (arsenic and lead); gasoline- and diesel-range organics (GRO and DRO, respectively); volatile organic compounds (VOCs) including benzene and chlorinated solvents including tetrachloroethylene (PCE), trichloroethylene (TCE), cis- and trans-1,2-dichloroethylene (DCE), and vinyl chloride (VC); and polycyclic aromatic hydrocarbons (PAHs) including naphthalenes.

The potential health hazards of these hazardous substances are discussed in individual fact sheets provided in Appendix F to this HASP. The fact sheets describe effects that might occur if acute (short-term) and/or chronic (occurring over a long period – more than 1 year) exposures were to happen. Inclusion of this information does not mean that these effects will occur during the work activities conducted by Haley & Aldrich.

In general, the hazardous substances that may be encountered during the investigation at the 800 Mercer site are not expected to be present at concentrations or in a form that could produce significant adverse health effects. The types of work activities to be conducted and the use of personal protective equipment (PPE) will limit potential exposure.

2.2 Potential Exposure Routes

Exposure to the hazardous substances listed above could occur by accidental inhalation of, direct contact with, or ingestion of potentially contaminated soil and groundwater. To prevent contact with potential contaminants, Haley & Aldrich staff will wear the personal protective equipment (PPE) specified in Section 3.0 while sampling and while decontaminating equipment.

Inhalation

Workers could be exposed by inhaling dust when soil is moved or through volatilization of chemicals from soil. Dust will be monitored visually, and dust-control measures such as soil wetting will be implemented as needed. Air monitoring and control measures specified in this plan will minimize the possibility for inhalation of volatile organic compounds (VOCs).

Direct Contact

Workers could be exposed if contaminated soil, dust, or groundwater contacts the skin, eyes, or clothing. Wearing protective clothing and safety glasses and performing decontamination activities specified in this plan will minimize the potential for skin and eye contact with hazardous substances.

Ingestion

Workers could be exposed if they eat, drink, or perform other hand-to-mouth activities while collecting soil and groundwater samples. Personal hygiene measures will be implemented to prevent inadvertent ingestion of contaminants; for example, workers will remove their gloves and wash their hands and faces before eating, drinking, or using tobacco.

2.3 Air Monitoring

For activities in areas where VOCs are known or suspected to be present, air quality will be monitored at the discretion of the field health and safety manager using a MultiRAE, MiniRAE, or QRAEII photoionization detector (PID) to determine whether VOCs are present and to check the adequacy of PPE (specifically, respiratory protection). The monitoring results may trigger actions, as summarized in Tables 1 and 2 and described in more detail below under "Action Levels". Action levels for VOCs are based on the volatile compounds with the lowest exposure limit: in this case, benzene and vinyl chloride have the same PEL of 1 ppm.

Table 1 – Exposure Limits

Contaminant of Concern	OSHA PEL (TWA)	STEL or cREL	IDLH
Benzene	1 ppm	5 ppm (15 minutes)	500 ppm
tetrachloroethylene (PCE)	100 ppm	200 ppm (5 minutes in any 3-hour period)	150 ppm
trichloroethylene (TCE)	100 ppm	300 ppm (5 minutes in any 3-hour period)	1000 ppm
cis- and trans-1,2-dichloroethylene (DCE)	200 ppm	--	1000 ppm
Vinyl chloride	1 ppm	5 ppm (15 minutes)	--
lead	0.05 mg/m3	--	100 mg/m3

Notes:
PEL: Permissible Exposure Limit
TWA: Time-Weighted Average (8-hour work day)
STEL: Short Term Exposure Limit
cREL: ceiling Recommended Exposure Limit (NIOSH)
IDLH: Immediately Dangerous to Life and Health

Table 2 – Air Monitoring Action Levels

Monitoring Device	Sensor	PEL	Result	Action Required	Notes
PID	VOC	1 ppm (8-hour TWA)	0.5 ppm	Continue monitoring.	a
			0.5-1.0 ppm	Implement additional control measures to reduce VOC concentration. Continue monitoring and prepare to stop work or upgrade PPE to include respirator use using a combination cartridge: Organic Vapors (OV) and particulates (P100)	a, b, c
			>1.0 ppm	Stop work if confirmed to be benzene or vinyl chloride; Contact Project Health and Safety Manager.	a, b
Combustible Gas Indictor/ Multi-Meter	Oxygen	<19.5% or > 22%	<19.5% or > 22%	Stop Work; Contact Corporate Health and Safety Director.	a, b, d
	Hydrogen sulfide	10 ppm	> 5 ppm	Immediate evacuation; Contact Project Health and Safety Manager.	e
	Combustible gases	10% LEL	0 to 5% LEL	Continue monitoring.	f
			5 to <10% LEL	Use caution and continue monitoring. Implement additional control measures to reduce combustible gas concentration.	f
			≥ 10 % LEL	Immediate Evacuation. Contact Project Health and Safety Manager and Corporate Health and Safety Director.	f
	Carbon monoxide	50 ppm TWA	< 25 ppm	Use caution and continue monitoring.	g
			25 to 50 ppm	Implement additional control measures to reduce combustible gas concentration. Be prepared to stop work or upgrade PPE to supplied air respirator use.	g
			>50 ppm	Immediate Evacuation. Contact Project Health and Safety Manager and Corporate Health and Safety Director.	

Notes:
a. Use appropriate lamp and calibrate unit.
b. Air-purifying respirators must be used only when use criteria are met and when appropriate cartridges are available.
c. Half-facepiece respirators generally acceptable up to 10 times the PEL.
d. Oxygen deficiency requires confined space entry procedures.
e. A PEL for hydrogen sulfide has not been set by OSHA. The National Institute for Occupational Safety and Health Recommended Exposure Limit (REL) is used in place of a PEL.
f. LEL refers to Lower Explosive Limit. Use caution to prevent all sources of ignition.
g. TWA refers to the 8-hour time weighted average.

Table 3 – Dust Monitoring Action Levels

Parameter/ Contaminant	Equipment	Action Level	Response Activity
Respirable Dust as Lead Surrogate	Respirable Air Monitors (RAM)	>5mg/m^3 for 1 minute 5 instances of >5mg/m^3 for 1 minute	Back away from the area, finding safe refuge upwind for a few minutes allowing dissipation. If levels still exist apply controls. If controls are ineffective contact FSM and PM **Stop Work; Reached the 8 hour TWA for Lead of 0.05 mg/m^3**
Zone Location and Monitoring Interval Breathing zone			

Air quality will be monitored at the discretion of the field health and safety manager by an individual trained to use the equipment. The project manager is responsible for ascertaining that each designated operator is properly trained in the use of the monitoring equipment. **Air monitoring measurements will be recorded on the "Air Monitoring Log" in Appendix B and actions taken based upon air monitoring results (e.g., changes to control measures or PPE) will be recorded on project notes.** Air monitoring should consist of approximately six to ten samples in an 8-hour day within the worker breathing zone. The results of air monitoring will be used to determine the need to upgrade personal protective equipment (PPE). The “Air Monitoring Log” and project notes describing actions taken based upon air monitoring results will be filed with the project records.

The equipment technician will calibrate, maintain, and repair each air monitoring equipment item, or arrange for these activities, which will be conducted in accordance with and at the frequency specified by the manufacturer or more frequently, as required by use conditions. The equipment technician will maintain calibration/repair records in the equipment log books.

The following sections describe the equipment and procedures that will be used to monitor VOCs and combustible gases.

MultiRAE or MiniRAE Photoionization Detector

Volatile Organic Compounds. A MultiRAE or MiniRAE photoionization detector (PID) will be used at locations where VOCs may be present during site activities. **This detector is non-specific**, meaning that it does not identify the chemicals present. In addition, since it is calibrated using only a single reference chemical, **the PID provides only an estimate of the actual vapor concentration present**. If chemical-specific information is necessary, other types of sampling equipment must also be used. If VOCs are detected above 0.5 ppm, colorimetric tubes such as Draeger tubes will be used to determine concentrations of benzene and vinyl chloride as both may be present.

Monitoring Procedures. At the discretion of the field health and safety manager, air quality will be monitored using a MultiRAE or MiniRAE PID or equivalent with 10.6 eV lamp to measure organic vapor concentrations during site work activities. The 10.6 eV lamp will be specified for general hydrocarbon survey measurements for chemicals having an ionization potential of up to 10.6 eV, such as benzene (9.24 eV).

The field health and safety manager or other designated project individual is responsible for verifying that the equipment is calibrated and working properly before on-site use. For the MultiRAE or MiniRAE, this will include zeroing the instrument before work begins. Records of these activities will be maintained in the "Air Monitoring Log". If there are any problems with the equipment, the item will be removed from use until repair or replacement can be coordinated with the equipment technician.

Action Levels. PID monitoring will be conducted before work begins at each individual work area where volatile chemicals may be present. Results may trigger actions, as summarized in Tables 1 and 2 and described below:

- If PID measurements are **less than 0.5 ppm** in the worker's breathing zones, work can proceed without respiratory protection, with monitoring repeated at 15- to 30-minute intervals, or more frequently if odors or signs of irritation are noted.

- If PID measurements are **between 0.5 and 1 ppm** in the worker's breathing zones for 5 consecutive minutes, exposed workers will use air purifying respirators as specified in Table 2, with monitoring repeated at least every 15 minutes, or more frequently if any odors or signs of irritation are noted.

- If PID measurements **exceed 1 ppm** in the worker's breathing zones, work will cease if confirmed to be benzene or vinyl chloride and employees will evacuate the work area pending reevaluation of the situation by the project manager and corporate health and safety director. Action will be taken, including plan modification if required, to address any situations where such results are observed.

Combustible Gases and Vapors. It is unlikely that combustible gases will be present during this project. However, the procedures described below address gas or vapor venting that could occur from a soil boring or any other source.

A MultiRAE PID will be used to monitor for combustible gases while advancing soil probes or borings and while observing excavation of areas suspected of containing impacted soils. All monitoring equipment will be properly calibrated and maintained as noted in the previous discussion of air monitoring procedures, and field monitoring results will be recorded on the "Air Monitoring Log".

The following actions will be taken in response to air monitoring results:

- If monitoring indicates there is **no combustible gas or vapor hazard**, work will be resumed and periodic testing will be continued.

- If combustible vapors are **less than 5 percent of the Lower Explosive Level (LEL)**, work will proceed, but monitoring will be repeated at 30-minute intervals, or sooner if any odors or signs of contamination are noted. Employees are never to continue to work in an area, even if LEL tests are acceptable, if they detect strange odors or experience symptoms of overexposure (such as nausea, dizziness, or tearing of the eyes). If this occurs, employees will stop work and leave the area pending further evaluation.

- If combustible vapors are **between 5 and 10 percent of the LEL**, workers may proceed with caution, but monitoring must be performed continuously and fans or other means must be used to disperse vapors. Monitoring results will be recorded at 15-minute intervals, or more frequently if any odors or signs of contamination are noted. Workers should consult with the corporate health and safety director to determine whether other types of monitoring are required to check whether exposure levels are within acceptable limits.

- If combustible vapors are **greater than 10 percent of the LEL**, workers must assume an explosion hazard exists. Site work will cease pending reevaluation of the situation by the project health and safety manager. Action will be taken, including plan modification if required. In general, field ventilation attempts will be continued only if the ventilation equipment is non-sparking and approved for use in flammable atmospheres. Work will not be resumed until testing shows the hazard has been eliminated. In some cases, this may be accomplished by allowing the gas to dissipate by natural or fan-forced ventilation. It may also be necessary or useful to inert a well or boring by introducing nitrogen or carbon dioxide through a non-conductive line. Water or drilling mud may be used to replace air in some bore holes and thereby eliminate the explosion risk. Work will be resumed only when testing shows the explosion hazard has been removed. Monitoring will continue at least every 15 to 30 minutes to check whether the atmosphere remains inert.

Oxygen Meter. Monitoring for oxygen content will be conducted whenever oxygen deficient or enriched conditions may be expected. A MultiRAE PID will be used to monitor for oxygen in situations such as confined space entry. Confined space entry by Haley & Aldrich workers is not anticipated for this project, and if needed, will be addressed by an amendment to this plan with special Confined Space Entry Procedures.

The oxygen sensor must be set to 20.9 percent prior to use. The alarm must also be enabled before use, and the pump inlet filter must be checked and replaced as necessary. All monitoring equipment

will be properly calibrated and maintained as noted in the previous discussion of air monitoring procedures, and field monitoring results will be recorded on the "Air Monitoring Log".

- **If oxygen level is < 19.5% or > 23%**, immediately stop work, evacuate the area, and contact the project manager and/or corporate health and safety director. When employees are involved in activities where oxygen deficiency could occur, monitoring must be performed continuously during the initial phase of the job and results must be recorded on the "Air Monitoring Log" at a minimum frequency of 15 minutes.

- If the oxygen level is normal, combustible vapors are absent, and there is no indication these conditions may change, monitoring may be discontinued after a 1-hour period where all readings are at background levels. Otherwise, monitoring must be continued as described above. If any indications of changing conditions are noted, monitoring must be resumed immediately. Action will be taken, including plan modification, if required, to address any situations where such results are observed.

Hydrogen Sulfide. MultiRAE monitoring for hydrogen sulfide (H_2S) content will be conducted during the soil boring investigations or where site conditions have the potential to generate H_2S. Records of these measurements will be recorded on the "Air Monitoring Log". As described below, the monitoring frequency will be determined by the results of the initial survey measurement. Action levels are shown in Table 2.

- **If hydrogen sulfide measurements are less than 5 ppm** in employee breathing zones, work can proceed without respiratory protection. In this case, monitoring will be repeated at 30-minute intervals, or sooner, if any odors or signs of respiratory irritation are noted. Monitoring may be discontinued when H_2S remains non-detectable for a 1-hour period.

- **If hydrogen sulfide measurements exceed 5 ppm** in employee breathing zones or if the rotten egg odor associated with H_2S is present, site work will cease and employees will evacuate the work area pending reevaluation of the situation by the Corporate Health and Safety Director. Action will be taken, including plan modification, if required, to address any situations where such results are observed. Approved self-contained breathing apparatus or airline respirator with escape SCBA are required when working in IDLH environments. Haley & Aldrich personnel are not trained to wear this equipment and should not work in these environments for any period of time.

Carbon monoxide. MultiRAE Lite or QRAEII monitoring for carbon monoxide (CO) content will be conducted where site conditions are poorly ventilated and have the potential to trap CO, such as confined spaces (unanticipated at this site). Records of these measurements will be recorded on the "Air Monitoring Log". As described below, the monitoring frequency will be determined by the results of the initial survey measurement. Action levels are shown in Table 2.

- **If CO measurements are less than 1 ppm** in employee breathing zones, work can proceed without respiratory protection. In this case, monitoring will be repeated at 30-minute intervals, or sooner,

if any odors or signs of respiratory irritation are noted. Monitoring may be discontinued when H_2S remains non-detectable for a 1-hour period.

- **If CO measurements exceed 9 ppm** in employee breathing zones or if the rotten egg odor associated with H_2S is present, site work will cease and employees will evacuate the work area pending reevaluation of the situation by the Corporate Health and Safety Director. Action will be taken, including plan modification, if required, to address any situations where such results are observed. Approved self-contained breathing apparatus or airline respirator with escape SCBA are required when working in IDLH environments. Haley & Aldrich personnel are not trained to wear this equipment and should not work in these environments for any period of time.

Calibration and Maintenance. The MultiRAE or MiniRAE PID will be calibrated and maintained according to the manufacturer instructions. If there are problems with the equipment, a completed "Notice of Returned Equipment" form or other notification indicating the equipment condition will accompany the PID returned to the equipment room. The equipment technician will perform maintenance/repair as required.

2.4 Physical Hazards

Potential physical hazards associated with the project include operating motor vehicles, doing heavy lifting, working around drill rigs, excavators, and other heavy equipment, noise, and suffering from cold stress, biological hazards (blood-borne pathogens [BBPs]), or slips, trips, and falls.

Operating Motor Vehicles

Haley & Aldrich personnel who operate motor vehicles are legally licensed to do so, will wear seat belts at all times when driving, and will obey all rules of the road while engaged in company business.

Haley & Aldrich employees will comply with all federal, state, and local regulations on use of cellular devices while driving. Under no circumstances is text messaging or any use of a keyboard allowed while operating a vehicle.

Heavy Lifting

Field work on this project will require some amount of heavy lifting, for instance, carrying coolers containing samples. Overexertion injuries to the back, shoulders, elbows, hands, or wrists can occur when a load is lifted or otherwise handled. Hands and wrists can be injured from grasping during lifting. Muscles in the forearm that are used for grasping attach to the elbow, so this joint can be injured when lifting. The shoulder can be injured by lifting any load and is especially at risk of injury from lifts done while reaching above the shoulder or away from the body. Frequent lifting and awkward lifting (i.e., above the shoulders, below the knees, at arms' length) can also result in injuries.

The best procedures for lifting vary depending on conditions and the size and shape of the object being lifted. A general rule for avoiding injuries is to assess the object and surrounding area before lifting, and never attempt to lift an object that is poorly packaged or too heavy. Before lifting, workers should make sure their path is dry and clear of obstacles that could cause a fall.

To lift heavy objects:

- Take a deep breath and relax your muscles.
- Approach the object, and in a slow, controlled movement, bend your knees (keeping your back straight) until you are squatting.
- Grip the object securely with both hands and, when ready, push up and extend your knees until reaching a standing position, with the object at chest level. Do not lift above your shoulders or below your knees.
- Do not twist your back or bend sideways.
- Walk slowly to the destination and put down the heavy object using the same slow, controlled movements, keeping your back relatively straight and bending your knees.
- Do not lift or lower with arms extended.
- Take a break between lifting each object if necessary.
- Never attempt to move any object that seems too heavy to manage alone. Get help from a co-worker as needed.

Workers who need to lift objects should be in good physical shape. Workers not accustomed to lifting or vigorous exercise should not be assigned difficult lifting or lowering tasks.

Heat-Related Illnesses

Weather conditions could range between 70°F and 80°F at times during the summer. At a minimum, personnel wearing non-breathable clothing (e.g. PPE like chemical-resistant suits) at temperatures greater than 70°F should take a break every one to two hours and drink plenty of fluids. An average of one quart of fluids per hour is recommended. When temperatures are over 70°F, water will be available at the site in a sufficient quantity for each worker to drink one quart per hour. A cool or shaded rest area should be used for breaks.

The body normally cools itself by sweating. People suffer heat-related illness when the body's temperature control system is overloaded. Several factors affect the body's ability to cool itself during extremely hot weather. For instance, sweat will not evaporate as quickly when humidity is high, and clothing type and amount can affect cooling. Impermeable clothing reduces the body's ability to cool with evaporating perspiration and may lead to heat stress. Outdoor work conducted in hot weather and direct sun also increases the risk of heat-related illness in exposed workers.

Heat related illnesses and their symptoms and first-aid measures are:

- ***Heat Rash.*** Raised red vesicles on affected areas and decreased ability to tolerate heat; exacerbated by clothes that chafe. Maintain good personal hygiene and use drying powders or lotions.

- ***Heat Cramps.*** Muscle spasms and pain in the extremities and abdomen. Rest in a cool area and drink plenty of fluids. If pain persists, seek medical attention.

- ***Heat Exhaustion.*** Pale, cool, moist, clammy skin; profuse sweating; shallow breathing; dizziness; lassitude; and fainting. Rest in a cool area and drink plenty of fluids. Get medical attention before returning to work.

- ***Heat Stroke.*** Red, hot, dry skin; no perspiration; nausea; dizziness; confusion; strong rapid pulse; and coma. Cool victim immediately with cool or cold water. Seek immediate medical attention.

Heat Stress

Heat stress may occur at any time work is being performed at elevated ambient temperatures. Because heat stress is one of the most common and potentially serious illnesses associated with outdoor work during hot seasons, regular monitoring and other preventative measures are vital. Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventative heat stress management.

Haley & Aldrich employees and their subcontractors should be aware of potential health effects and/or physical hazards of working when there are hot temperatures or a high heat index. Refer OP1015-Heat Stress for a discussion on hot weather hazards.

Cold Stress

Weather conditions during this investigation and cleanup action are expected to be cold and wet. Workers who are exposed to extreme cold or work outdoors in cold and wet environments may be at risk of cold stress, which can result when the core body temperature gets too low. The most common consequences of cold stress are hypothermia, frost bite, and trench foot; the latter two are not normally risks on Haley & Aldrich projects. Factors in cold stress include wetness, wind chill, tiredness, improper clothing, health conditions, and poor physical conditioning.

Near-freezing temperatures is a factor in cold stress. Project workers will dress appropriately for the weather conditions and pay attention to the signs and symptoms of hypothermia. When temperatures drop below normal and wind speed increases, heat can leave the body more rapidly. These weather-related conditions may lead to serious health problems.

Hypothermia

Causes. Hypothermia can result when the body loses heat faster than it can replace it, and temperature drops below 95°F. Wind chill and wetness can play a significant role in lowering core body temperature. It is important to understand that hypothermia can occur even when temperatures are not extremely cold, especially when water, wind, and/or pre-existing health conditions are involved.

Signs. Warning signs of hypothermia include shivering (only initially), confusion, loss of coordination, slurred speech, fumbling, inability to decide, disorientation, apathy, drowsiness, inability to stand or walk, dilated pupils, slowed pulse and breathing, and loss of consciousness. Confusion is a key symptom. With medium or advanced hypothermia, shivering is absent, and the person may not realize they have hypothermia. They may also be unwilling to call attention to themselves or seek help.

Treatment. Hypothermia victims should be immediately but not too rapidly re-warmed.

Rewarming involves:

- Moving the victim into a sheltered area.
- Removing any wet clothing.
- Wrapping the victim loosely with blankets or sleeping bag.
- Applying heat packs or warm containers to armpits, groin, head, neck, and chest.
- If core body temperature falls below 90°F and heated shelter is not available, using skin-to-skin contact with another individual.
- Providing warm beverages if the person is conscious.
- Getting medical help as soon as possible.

Rescue breaths and CPR for victims who are not breathing or who don't have a pulse are not covered in this HASP.

Noise

Heavy equipment may produce noise levels that exceed 85 decibels A scale (dBA) for personnel working in or around the job site. At this level or above, hearing protection must be worn. A general guideline is if people 3 to 4 feet apart cannot converse without raising voices, the noise levels are too high and hearing protection should be worn. Ear muffs or ear plugs with a noise reduction rating (NRR) of 29 or higher (the highest NRR is 33) will be used when noise levels are too high as determined by the above guideline or by sound level measurements.

Working Around Heavy Equipment

Various heavy equipment (e.g. excavators, loaders, backhoes, cranes, drill rigs, bulldozers, scrapers, dump trucks, rollers, graders) will be used at the job site. To work safely around heavy equipment, Haley & Aldrich on-foot workers will:

- Wear Class II high visibility vests;
- Stay out of the equipment's swing radius;

- Never position themselves in front of or behind a moving piece of equipment, or between two moving pieces of equipment;
- Maintain eye contact with the operator (never assume the operators sees an on-foot worker);
- Be aware of the back-up alarm signal associated with the equipment; use caution if wearing hearing protection; and
- Not operate heavy equipment unless the worker has the appropriate training and/or licenses.

Heavy equipment is typically powered by diesel engines which emit diesel exhaust, a mixture of gases and particulates. Short-term exposure to diesel exhaust can irritate the eyes, nose, and throat; and cause headaches and nausea. If workers experience short-term effects, they will move away from the diesel exhaust and notify the Project Health and Safety Manager or the Corporate Health and Safety Director. Exposure to diesel exhaust fumes may lead to other health problems such as lung diseases, heart diseases, asthma, lung damage and immune system problems. These problems typically occur in people with high rates of exposure and long-term exposure (e.g., heavy equipment operators, truck drivers). Existing asthma may be exacerbated by diesel exhaust.

Biological Hazards

Biological hazards include vector-borne diseases, insects, rodents and other wild or stray animals, snakes, and poisonous plants. Vector-borne diseases may be spread to workers by insects such as mosquitoes and ticks. When a mosquito or tick bites a worker, it may transfer a disease-causing agent, such as a parasite, bacteria, or virus. Examples of mosquito-borne diseases are West Nile virus and encephalitis. Lyme disease and Rocky Mountain spotted fever are tick-borne diseases. People are exposed to biological hazards through contact with people, insects, soil, water, bird or bat droppings, rodent droppings, or poisonous plants. COVID-19 is a risk we must manage as we perform project work. See Appendix E for the COVID-19 project planning instructions health and safety plan addendum.

Insects

Wearing long pants, socks, and long-sleeved shirts provides protection from insects. Using insect repellents that contain DEET or picaridin also provides protection from insects. Insect bites and stings can be treated with over-the-counter products that relieve pain and prevent infection.

Stinging insects include bees, wasps, hornets, and fire ants. Personnel can avoid attracting stinging insects by wearing light-colored clothing and avoiding perfumes or colognes. If such an insect approaches, do not wave wildly and swat blindly; instead, use a gentle pushing or brushing motion to deter them.

Bee stings can produce life-threatening allergic reactions. Symptoms include pain, swelling of the throat, redness or discoloration of the wound, itching, hives, decreased consciousness, and labored or

noisy breathing. Personnel who are allergic to insect stings should carry an anaphylactic shock kit prescribed by their physician.

Blood-Borne Pathogens

Workers responding to a first-aid incident could be exposed to blood-borne pathogens (BBPs), which are infectious microorganisms in blood and other body fluids that can cause disease in humans. Examples of these pathogens include hepatitis B virus, hepatitis C virus, and HIV. Workers exposed to BBPs are at risk for serious or life-threatening illnesses.

Universal precautions will be followed if BBP exposure is a concern. Universal precautions involve treating all human blood and other potentially infectious materials as a BBP and protecting oneself from exposure. The easiest way to protect oneself from blood and body fluids is to have the injured person treat their own wound if they are conscious and capable of doing so. If injured people are unable to take care of themselves, or they need help, workers should use disposable gloves and eye protection if there is a splash hazard.

If disposable gloves are not available, a plastic bag (trash, shopping, or sandwich) can be used to create a barrier. If performing CPR, always use a pocket mask equipped with a one-way valve. After removing PPE, wash hands or other affected body parts. Place PPE in a plastic bag, seal the bag, and contact the corporate health and safety director for further instructions.

If you are exposed to BBPs or other potentially infectious materials (i.e. , BBPs contact your eyes, mouth, nose, open wounds/sores, abrasions, sunburned areas, or acne), follow these steps:

- Flush the area of the body that was exposed with warm water, and then wash with soap and water. Vigorously scrub all areas. It is the abrasive action of scrubbing that removes the contamination from the skin.
- If you have an open cut, squeeze it gently to make it bleed, then wash with soap and water.
- Notify your project manager or the corporate health and safety director to document the incident. Identify the source of the exposure.
- Get medical counseling (i.e., get tested for BBPs, get vaccinated if needed).

Slips, Trips, and Falls

Haley & Aldrich workers will be careful to prevent slips on icy or wet walking surfaces and will look for and avoid tripping hazards such as loose rock or debris. Wear steel-toed safety boots with slip-resistant soles and walk carefully over icy surfaces.

Be aware of your surroundings. Keep pathways and work areas free of debris and supplies to prevent unsafe walking and working conditions. Changes in elevation such as ruts or holes present a trip hazard and should be marked if possible. Avoid leaving tools on the ground.

Plan what you would do if you start to slip or fall. During a fall, do not try to catch yourself; try to avoid landing on your hands, elbows, or knees. Landing on the side of your body is much safer. If you are walking on a slope and know you are going to slide, lower your center of gravity by sitting down and sliding on your feet and/or bottom. If sliding while standing up, keep your weight over your feet and bend your knees; do not lean backward or forward.

Hazards requiring fall protection are not expected at this site. A written Fall Protection Work Plan is required where fall hazards of 10 feet or more exist. Fall prevention or fall protection measures is required for any walking surface of 4 feet or higher, and when working within the affected area (the distance away from the edge of an excavation equal to the depth of the excavation up to a maximum distance of fifteen feet) of any excavation more than 10 feet deep. If there is a fall hazard of 4 feet or more on a hazardous slope (i.e., a slope where normal footing cannot be maintained without the use of devices because of the pitch of the surface, weather conditions, or surface material), a personal fall restraint system or positioning device system is required. Work will not be performed on slopes steeper than 75 percent or near vertical drop-offs without fall protection equipment.

2.5 Hazard Analysis and Applicable Safety Procedures by Task

Table 4 lists the tasks and associated hazards that may be anticipated during the work activities described in this HASP and associated control measures.

Table 4 – Hazard Analysis by Task

Work Task	Potential Hazards	Protective Measures
Construction oversight	Working around heavy equipment; noise; heat-related illness; and slips, trips, and falls	Level D PPE (see Section 3.0), hearing protection, hard hat, caution around moving equipment, high visibility safety vest or jacket, hearing protection, and hard hat.
Observing and logging soil borings	Working around drill rigs; slips, trips and falls; heavy lifting; noise; cold stress; inhalation of volatiles; and skin contact with contaminated media.	Modified Level D or Level C PPE (see Section 3.0), hard hat, high-visibility safety vest or jacket, caution around moving equipment and traffic, safe lifting practices, weather appropriate clothing, gloves, hearing protection, and air monitoring and respiratory protection (as needed).
Collecting soil and groundwater samples	Skin contact with contaminated media; working near heavy equipment; slips, trips and falls; inhalation of volatiles; cold stress; and heavy lifting.	Modified Level D or Level C PPE (see Section 3.0), caution around moving equipment and traffic, hearing protection, and air monitoring and respiratory protection (as needed).

3.0 PERSONAL PROTECTIVE EQUIPMENT AND HYGIENE

When fieldwork is performed in contaminated areas, the primary objective is to minimize worker exposure using engineering controls such as ventilating, working up-wind or away from contaminated materials, or wetting soil to reduce dust. If engineering controls are not feasible or may not provide adequate control, and before they are fully implemented, workers will wear specified personal protective equipment (PPE) to minimize potential exposure to hazardous substances.

The following minimum personal hygiene safeguards shall be adhered to:

- No smoking or tobacco products in any project work areas.
- No eating or drinking in areas if identified as an exclusion zone.
- It is required that personnel present on site wash hands before eating, smoking, taking medication, chewing gum/tobacco, using the restroom, or applying cosmetics and before leaving the site for the day.

It is recommended that personnel present on site shower or bathe at home at the end of each day of working on the site.

Contact with hazardous substances at harmful levels is not expected for this project; therefore, PPE is based on the Occupational Safety and Health Administration (OSHA) requirements, modified Level D and Level C. Conditions requiring Level A or B protection are not anticipated for this project. If they do occur, work will stop and the HASP will be amended as required before work is resumed.

Table 5 summarizes the minimum PPE requirements for Haley & Aldrich workers based on the potential routes of exposure and the potential hazardous substances.

Table 5 – Specific Personal Protection Level Requirements for this Site

Potential Route of Contact: Type of Contaminant	Required Protection Level	Safety Glasses	Hard Hat (b)	Steel-toed Safety Boots or shoes	Tyvek	Poly Tyvek	Nitrile Gloves	Cut Resistant Gloves	Respirator	
									Half-Face piece	Full-Face piece
None anticipated	Level D (a)	X	X	X				X		
Minor skin contact possible	Level D (a)	X	X	X	g		X	h		
Skin contamination possible: organics	Level C (c)	X	X	X		g	X	h		
Inhalation possible: organics	Level C (c)	X	X	X	g		X	h	d, e	f

Notes:

a. Level D protection required when atmosphere contains no known hazard and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

b. Hard hat required where risk of striking overhead objects exists.

c. Level C protection required when atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin; this assumes that the types of air contaminants have been identified, concentrations have been measured or modeled/estimated, an appropriate respirator cartridge is available, and all air-purifying respirator criteria are met.

d. Appropriate respirator cartridges include organic vapor (MSA GMA or equivalent), combination (MSA GMC-H or equivalent), and others as required for the particular contaminants (P100).

e. Half-facepiece respirator required when PID concentrations range from 0.5 to 1 ppm.

f. Full-facepiece respirators will not be used unless field representative has been properly fit-tested for a full-facepiece respirator.

g. Tyvek or protective clothing should be worn if body contact with impacted materials is likely.

h. Cut resistant gloves to be worn at all times unless writing, on the phone, or nitrile gloves needed instead for sampling activities.

3.1 Level D Activities

Level D protection will be used when the atmosphere contains no known hazards and Haley & Aldrich workers will not perform activities where skin contact with free-phase product or contaminated materials is likely to occur. These workers will wear regular work clothes (long pants, shirt with minimum 4-inch sleeve), eye protection (safety glasses or goggles), hand protection (nitrile or latex gloves or cut resistant gloves), foot protection (steel-toed boots or shoes), and head protection (hard hat).

3.2 Modified Level D Activities

Modified Level D protection will be used when the atmosphere contains no known hazards and there is a potential that Haley & Aldrich workers may have skin contact with hazardous substances. These

workers will wear regular work clothes (long pants, long-sleeved shirt, weather appropriate clothing), eye protection (safety glasses or goggles), hand protection (nitrile or latex gloves or cut resistant gloves), and foot protection (steel-toed boots or shoes), head protection (hard hat), and will supplement this equipment with chemical resistant outer clothing (e.g. , Tyvek or rain gear) and chemical resistant gloves. Workers will make sure the protective clothing and gloves are suitable for the types of chemicals that may be encountered on site.

3.3 Level C Activities

Workers performing site activities where skin contact with free product or contaminated materials is likely will wear chemical-resistant gloves (nitrile, neoprene, or other appropriate outer gloves, and surgical inner gloves) and polyethylene-coated Tyvek® or other chemical-resistant suits or rain gear. Workers will make sure the protective clothing and gloves are suitable for the types of chemicals that may be encountered on site. Workers will use face shields or goggles as necessary to avoid splashes in the eyes or face.

When performing activities in which inhalation of chemical vapors and dusts is a concern, workers will wear half-facepiece or full-facepiece air-purifying respirators as specified in Table 5. Cartridges used for this project should be combination cartridges: cartridges that include protection from both Organic Vapors (OV) and particulate matter (P100). If respirators are used, cartridges should be changed on a daily basis, at minimum. They should be changed more frequently if chemical vapors are detected inside the respirator or other symptoms of breakthrough are noted (respiratory irritation, dizziness, or breathing difficulty).

4.0 SAFETY SUPPLIES AND EQUIPMENT LIST

The following safety supplies and equipment must be available on site:

- Fire extinguisher – 3 to 4-pound ABC,
- First aid kit in a sturdy weatherproof carrying case,
- Bottled sterile hand-held eyewash solution,
- Mobile telephone,
- Class II high visibility safety vest or jacket,
- Weather appropriate clothing with minimum 4-inch sleeve,
- Head protection – hard hat,
- Hearing protection,
- Half-facepiece respirator with combination cartridges (as needed),

- Foot protection – steel-toed boots or shoes with slip-resistant soles,
- Hand protection – nitrile outer gloves/nitrile inner gloves or cut resistant gloves, and
- Eye protection – safety glasses or safety goggles if a splash hazard is present.

All non-disposable safety gear and PPE must be cleaned after use and stored securely to avoid damage. Avoid storing gear in direct sunlight or exposed to weather conditions. Safety equipment and PPE should be checked before use and damaged or worn-out gear should be disposed of and replaced.

5.0 SITE CONTROL

Site control is the responsibility of the general contractor (Howard S. Wright [HSW]).

6.0 DECONTAMINATION

Decontamination for this project is limited to decontaminating sampling equipment.

Haley & Aldrich workers will practice good hygiene by washing their hands and faces prior to taking rest breaks, drinking liquids, and so forth. They will also wash their hands and faces fully before eating, using tobacco, or as soon as possible upon leaving a work area.

7.0 SITE SECURITY

Site security during investigations is the responsibility of the field health and safety manager. Any security problems will be reported to the appropriate authorities and to the client.

Site security is the responsibility of the general contractor (HSW) during construction.

8.0 SPILL CONTAINMENT

Sources of bulk chemical subject to spillage are not expected for this project. Accordingly, a spill containment plan is not required for this project.

9.0 EMERGENCY RESPONSE PLAN

This Emergency Response Plan outlines the steps necessary for appropriate response to emergency situations that could reasonably occur during Haley & Aldrich's work at the 800 Mercer Street site. The following paragraphs summarize the key emergency responses for this project.

9.1 Plan Content and Review

The principal hazards addressed by this plan are fire, medical emergencies, and situations such as inadequate PPE for the hazards present. However, to help anticipate other potential emergency situations, field personnel will exercise caution and look for signs of potentially hazardous situations, including:

- General physical hazards (slippery or uneven surfaces, inclement weather, traffic, and working around heavy equipment);
- Underground pipelines or cables; and
- Live electrical wires or equipment.

These and other potential conditions should be anticipated, and steps should be taken to prevent problems before they occur.

This emergency response plan will be reviewed and rehearsed, as necessary, during the on-site health and safety briefing so all personnel will know what their duties are if an emergency occurs.

9.2 Plan Implementation

The field health and safety manager will evaluate the situation and act as the lead if an emergency occurs. That individual will determine the need to implement the emergency response, in concert with other resource personnel including client representatives, the project manager, and the corporate health and safety director. Other on-site field personnel will assist the field health and safety manager as needed during an emergency.

If the plan is implemented, the field health and safety manager or designee is responsible for alerting all personnel at the affected area by use of a signal device (such as a hand-held air horn) or visual or shouted instructions, as appropriate.

The general contractor will identify a safe assembly area for workers to gather if it is necessary to evacuate the area and will communicate this location to workers during the on-site health and safety briefing. The “buddy” system will be employed during evacuation to facilitate safe evacuation. The field health and safety manager is responsible for roll call at the assembly area to account for all personnel. If only one Haley & Aldrich worker will be on-site, a buddy system will be established with other contractors or subcontractors. Field staff will update the appropriate project manager or other designated Haley & Aldrich staff member once you have left the site for the day.

9.3 Emergency Response Contacts

Emergency contact information is provided in this HASP (see Page 1). A copy of this HASP will be maintained at the project site. Emergency information includes:

- Emergency telephone numbers,
- Route to nearest hospital (Figure 1), and
- Site description (Section 1.4).

A significant environmental release of contaminants is not likely to occur from work activities subject to this HASP. If it does, the field health and safety manager will contact the project manager or corporate health and safety director to make any required notifications.

If an emergency situation occurs requiring implementation of the emergency response plan (fire, serious injury, or inadequate personal protection equipment for the hazards present, for instance), Haley & Aldrich staff will cease all work immediately, pending approval from the field health and safety manager to restart work. The general emergency actions described below will be followed.

9.4 Fires

Haley & Aldrich personnel may attempt to control only very small fires. If the fire expands, or an explosion appears likely, Haley & Aldrich field workers will evacuate the area immediately. If a fire occurs that cannot be controlled with a 3 to 4-pound ABC fire extinguisher, immediate intervention by the local fire department or other appropriate agency is imperative. Use these steps:

- Immediately call **911**,
- Evacuate to a safe area away from the danger to a previously agreed upon upwind location, and
- Inform the project manager or field health and safety manager of the situation.

9.5 Medical Emergencies

Haley & Aldrich staff will call **911** immediately if a medical emergency (such as a serious injury or an unconscious worker) occurs. If workers are unsure about the severity of an accident or exposure, they will take a conservative approach and seek medical attention. The field health and safety manager will notify the project manager of the outcome of the medical incident as soon as possible.

No Haley & Aldrich employees are trained to perform rescue duties or medical duties beyond basic CPR and first aid. Haley & Aldrich employees certified in CPR and first aid may respond to work-related incidents requiring first aid services. First aid will be treatment for such things as minor cuts and bruises as needed. When rendering first aid, Haley & Aldrich workers will take necessary precautions to avoid exposure to BBPs. Section 2.4, Physical Hazards, provides information on BBPs and precautions for avoiding exposure.

9.6 Uncontrolled Contaminant Release

Work activities for this project do not present the potential for an uncontrolled contaminant release as defined by

Washington

- Chapter 296-24, Washington Administrative Code (WAC), General Safety and Health Standards.
- Chapter 296-62, WAC, General Occupational Health Standards.
- Chapter 296-155, WAC, Safety Standards for Construction Work.
- Chapter 296-800, WAC, Core Rules. Core Rules are the basic safety and health rules needed by most employers in Washington State.

Federal OSHA

- 29 Code of Federal Regulations (CFR) 1910, General Occupational Safety and Health Standards.
- 29 CFR 1926, Safety and Health Regulations for Construction.
- 29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses.

Haley & Aldrich staff are not trained as emergency responders as defined by federal and state regulations; therefore, they are not qualified to respond to hazardous material emergencies.

9.7 Potentially High Chemical Exposure Situations

Work activities for this project do not present the potential for high chemical exposure situations.

10.0 NOTIFICATION AND REPORTING

The project manager will be informed immediately if an emergency, accident, or injury occurs at the project location. The project manager will notify the client immediately. The field health and safety manager will notify the corporate health and safety director as soon as possible after the situation has been stabilized. The project manager or corporate health and safety director will notify the appropriate client contacts and regulatory agencies, if applicable. If an individual is injured or suffers a work-related illness, the field health and safety manager or designee will complete an injury/accident report and submit it to human resources or the corporate health and safety director within 24 hours. A blank report is provided as Appendix D.

The project manager, the field health and safety manager, and the corporate health and safety director will evaluate emergency response following the incident. The results of the evaluation will be used in follow-up training exercises to improve the emergency response plan.

11.0 MEDICAL SURVEILLANCE

Haley & Aldrich employees working on this project participate in a medical surveillance program as described in Section 7 of the Haley & Aldrich Corporate Health and Safety Manual.

12.0 SAFETY TRAINING REQUIREMENTS

Haley & Aldrich employees who work at sites where there is potential for exposure to hazardous substances, health hazards, or safety hazards will have completed 40 hours of hazardous waste operations and emergency response (HAZWOPER) training and 3 days of supervised field experience. In addition, employees will have completed an 8-hour annual refresher training within the past 12 months or will possess equivalent documented training by experience. Site supervisors will have completed 8 hours of HAZWOPER supervisor training. The project manager will ensure that all employees working on this site have completed required HAZWOPER training. The Haley & Aldrich safety records coordinator maintains employee health and safety training records.

Employees performing some tasks will require additional safety training on performing the task safely (without injury or property damage) and in compliance with safety regulations. Examples of these tasks include entering confined spaces, wearing a respirator, operating equipment or machinery, working at heights, handling or using hazardous substances, and working in excessive outdoor heat. Safety training requirements are specified in Haley & Aldrich Corporate Health and Safety Manual. Haley & Aldrich personnel will complete hazard-specific safety training as needed based on the tasks to be performed.

Before each work day starts, the field health and safety manager will review applicable health and safety issues with Haley & Aldrich employees. At these briefings the work to be accomplished will be reviewed and there will be an opportunity for questions to be asked. The "Daily COVID Self-Declaration and H&S Tailgate Meeting Form" (Appendix C) will be completed daily by the Haley & Aldrich field health and safety manager or designated individual.

13.0 REPORTING, REPORTS, AND DOCUMENTATION

All incidents (accidents, injuries, near-misses) that occur during field work on this project will be reported to the project manager immediately. The project manager will notify the client and the corporate health and safety director.

Air monitoring measurements will be recorded on the "Air Monitoring Log" in Appendix B and actions taken based upon air monitoring results (e.g., changes to control measures or PPE) will be recorded on project notes.

The field health and safety manager is responsible for maintaining records demonstrating that the provisions of this HASP are implemented throughout the course of this project.

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APPENDIX A
Record of Health and Safety Communication

Record of Health and Safety Communication

PROJECT NAME: 800 Mercer Street	**PROJECT NUMBER:** 0202738-100

SITE CONTAMINANTS: Heavy metals (arsenic and lead); gasoline- and diesel-range organics (GRO and DRO, respectively); volatile organic compounds (VOCs) including benzene and chlorinated solvents including tetrachloroethylene (PCE), trichloroethylene (TCE), cis- and trans-1,2-dichloroethylene (DCE), and vinyl chloride (VC); and polycyclic aromatic hydrocarbons (PAHs) including naphthalenes.

PPE REQUIREMENTS (check all that apply):

X	Eye protection	X	Gloves (specify)	Nitrile and/or cut resistant gloves
X	Foot protection	X	Clothing (specify)	Weather appropriate clothing, high visibility safety vest or jacket
X	Head protection	X	Respirator (specify)	Half-facepiece with combination cartridges.
		X	Other (specify)	Hearing protection

The following personnel have reviewed a copy of the site-specific HASP. By signing below, these personnel indicate they have read the plan, including all referenced information, and that they understand the requirements detailed for this project.

PRINTED NAME	SIGNATURE	PROJECT DUTIES	DATE

Project manager: please route a copy of this form to the job files when completed.

APPENDIX B
Air Monitoring Log

Air Monitoring Log

Meter Number 1, Type _____ Calibrated _____ Checked _____

Meter Number 2, Type _____ Calibrated _____ Checked _____

Background Reading: Meter 1 _____ Meter 2 _____

Time	Meter 1	Meter 2	Comments

APPENDIX C
Daily COVID Self-Declaration and H&S Tailgate Meeting Form

Daily COVID Self-Declaration and H&S Tailgate Meeting Form

Project:	Project No.:
Location:	Project Manager:
Subcontractor(s):	Date:
Site Safety & Health Officer (SSHO):	SSHO Contact Info:

Worker Acknowledgement

By signing here, I am stating the following:

1. I understand the hazards and risk control actions associated with each task I am about to perform.
2. I understand the permit to work requirements pertinent to the work I am about to perform (if applicable).
3. I certify that I will not undertake any tasks or work that has not been risk-assessed (is not included in the HASP or risk assessment document.
4. I am also aware of my obligation to implement 'Safe Work'.
5. I arrived and departed fit for duty.
6. I am physically and mentally fit for duty.
7. I am not under the influence of any type of medication, drugs, or alcohol that could affect my ability to work safely.
8. I am aware of my responsibility to bring any illness, injury (regardless of where or when it occurred), or fatigue issue I may have to the attention of the regional or corporate H&S manager.
9. I signed out uninjured unless I have otherwise informed the SSHO.

Name (print)	Company	Initials & Sign In/Out Time	
		In & Fit	Out & Fit

Visitor Log (*Site Visitors not involved in the work activities*)

Name (print)	Company	Initials & Sign In/Out Time	
		In & Fit	Out & Fit

Emergency Procedures

If an emergency occurs, follow procedure outlined in the HASP and contact numbers below. If non-life-threatening injury occurs, contact PM to report the incident. Seek first-aid treatment from the Occupational Health Center, as outlined in the HASP.

Emergency Dispatch phone number if other than 911:	
Local Hospital:	Local Hospital Phone #:
Evacuation/Muster Point:	Alt Evacuation/Muster Point:

Simultaneous Operations (SIMOPS)

SIMOPS or Multi-Crew Activity	☐ Yes	☐ No	If yes, describe SIMOPS:	
Has SIMOPS been communicated to all workforce?	☐ Yes	☐ No		
SIMOPS PIC:			**Phone Number:**	

Task Identification

Task	Responsible Company	Task Supervisor

Required Permits/Forms (*check all that apply*)

☐None	☐Lifting Plan	☐Other:
☐Confined Space Entry Permit	☐Hot Work Permit	☐Other:
☐Lock-out / Tag-out (LOTO)	☐Ground Disturbance Permit	☐Other:
☐Excavation Permit	☐Other:	☐Other:

Discussion of Work Hazards *(check all that apply)*

☐Chemical	☐Hazardous materials (lead, asbestos, etc.)	☐Radiological
☐Confined space	☐Hosting and rigging	☐Stored energy LOTO
☐Congested work area	☐Hot work	☐Traffic control
☐Elevated work	☐Material handling	☐Weather and/or temp extremes
☐Ergonomics	☐Noise pollution	☐Waste generation
☐Emergency egress	☐Oxygen deficiency	☐Other:

Required PPE *(check all that apply)*

										
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hearing Protection	Safety Eyewear	Hard Hat	Safety Toed Shoes	Leather or Palm Protective	Safety Vest	Protective Clothing	Respiratory Protection	PFD	Face Shield	Fall Protection

Tailgate Topic / Hazard Discussion

Item	Discussion

Management of Change (MoC)

Does the work activity require a MoC? If yes, has it been authorized by applicable management? ☐No ☐Yes
Has the safety information been updated to incorporate any change in product, equipment, material, or process? This information should include how to investigate accidents, audit compliance with safety procedures, and plan for emergency responses. ☐No ☐Yes
Have the procedures for a MoC been reviewed and evaluated? ☐No ☐Yes
Have all affected staff been informed and trained on the new equipment, process, or other changes? Health and safety hazards must be emphasized including processes/procedures in an emergency. The training must occur before any staff is allowed to operate the equipment or perform the job relating to the changes. ☐No ☐Yes
Have written procedures been put into place for the next time there is a change in safety management? ☐No ☐Yes

Best Practice(s) Observed? ☐ Yes ☐ No If yes, describe:	**H&S Observations/ Near Misses/ Incidents Reported?** ☐ Yes ☐ No If yes, describe:
Safe Work Interventions? ☐ Yes ☐ No If yes, describe:	**Have additional hazards and risk controls been identified for future work?** ☐ Yes ☐ No If yes, update appropriate job hazard analysis (JHA).

Site Safety & Health Officer Acknowledgement

At the conclusion of the day, I certify that the work site has been inspected and is being left in a safe and clean condition and any incidents have been properly reported.

Signature Date

All visitors and subcontractors must complete a self-declaration. All unvaccinated H&A staff must also complete a self-declaration prior to commencing work.

Gensuite EZ Scan®

H&A Gensuite Self Declaration

Subcontractor Self Declaration

APPENDIX D
Haley & Aldrich Incident/Accident Investigation Report

Haley & Aldrich Incident/Accident Investigation Report*

Haley & Aldrich Office: _____ Incident/Accident Site Location: _____ Address: _____ State: County:	Project number: _____ Date/time of occurrence: ___AM ___PM
Name(s) of Haley & Aldrich personnel involved in the incident/accident: Name(s) and Affiliation of any other personnel involved in the incident/accident:	
What happened? Describe cause and nature of incident, injury or illness.	
Was the incident/accident caused by actions of another individual: __Yes __No If yes, provide name, address, phone and details:	
Describe any unsafe action, equipment, conditions that contributed to the incident/accident:	
Was first aid given? **__Yes __No __ Unknown**	Was person referred to medical evaluation/treatment? **___Yes ___No ___ Unknown** If yes, indicate date, where and to whom:
Did the employee(s) receive medical treatment beyond first aid __Yes __No __ Unknown If yes, describe medical treatment given:	
Will lost time be involved? **__Yes __No __N/A**	Will restricted work days be involved? **__Yes __No __N/A**
If yes to either lost time or restricted work, complete the following: _____ Last normal work date _____ Date of return to normal work _____ Number of days lost time involved or expected _____ Number of days restricted work involved or expected	
What actions will be taken to prevent recurrence? Give responsibilities and expected completion dates for each action.	
Witnesses (Provide name, company, address, and phone number):	
Reported By: Date:	Reviewed by: Corporate health and safety director: Date: Employee(s) manager or supervisor: Date: Human resources: Date:
Will the work-related injury/illness results in a Workers' Compensation claim? __Yes __No ____N/A	If yes, provide claim number and date claim filed:
*The supervisor of the employee(s) involved in the incident/accident must ensure that this form is filled out within 24 hours of the incident/or accident and forwarded to Corporate Health and Safety Director. Attach additional sheets if necessary. If the incident is a recordable work-related injury or illness, OSHA Form 301 must be completed in addition to this form.	

APPENDIX E
COVID-19 Project Planning Instructions Health and Safety Plan Addendum

COVID-19 Project Planning Instructions

Safety
in everything we do

HEALTH & SAFETY FACTSHEET

COVID-19 is still a risk we must manage as we perform project work. Incorporate the following into project planning to protect field staff, business partners, clients, and the general public at project sites:

- If we are not the controlling employer, ensure we understand what the project is doing for COVID-19 mitigation methods prior to mobilization.
- **Many sites have a COVID-19 Plan. It is your duty to obtain a copy of that plan and ensure the project team understands the expectations.**

Fit for Duty –

- All subcontractors (if subcontracted to H&A), and visitors (if H&A is Controlling Employer) will sign the Self-Declaration form at the start of the project.
- Everyone must acknowledge the Fit for Duty of the Daily Tailgate form to affirm staff report fit for duty and symptom free each day.
- All staff working on a site controlled by another employer will follow site requirements.

ZERO TOLERANCE - Do not come to the site if you are sick, tested positive, or if you have been in close contact with someone with symptoms of COVID-19.

If others come to the site while sick, isolate yourself from them and ask them to leave or notify their supervisor.

You can reduce your risk by –

- Avoiding office trailers if possible and if you enter, follow all site requirements.
- Not congregating with others
  - Maintain a minimum distance of 6ft when possible, to avoid exposure.
  - Tailgates should be done at distance.
  - Bring food from home and avoid the food truck to reduce risk. Do not congregate with other at breaks and at the food trucks.
- Perform good hygiene practices for yourself and surfaces you touch.
- Do all you can to maintain your good health by getting adequate sleep, eating a healthy diet, avoid alcohol, and consuming plenty of fluids.

During times of high community level risk, All Staff

- Must wear a mask whenever they are working within 6ft of another individual.
- Must wear a mask whenever they enter an indoor environment for work.
- Must complete a COVID self-declaration prior to entering the work environment.

Please complete the following two pages for EACH project prior to beginning work.

The risk associated with potential exposure to COVID-19 will be considered as part of the project planning and HASP development cycle.

Have H&S review the HASP.

Unvaccinated staff must complete the Self-declaration Form.

Approved and appropriate Personal Protective Equipment and supplies are used as indicated by the HASP.

HALEY ALDRICH

COVID-19 Project Planning Instructions
HASP Addendum

Safety
in everything we do

HEALTH & SAFETY FACTSHEET

COVID-19 PROJECT SPECIFIC JOB HAZARD ANALYSIS

Does the client or Controlling Employer (if H&A is not controlling employer) have specific requirements related to COVID-19?

If yes, please attach the requirements. ☐ Yes ☐ No

Do we have the necessary supplies on hand? ☐ Yes ☐ No

(Supplies include surgical, KN95 or KF94 masks, disinfectant, hand washing stations or sanitizer, and PPE.)

The following **must** be onsite and/or communicated(☑ to acknowledge):

- ❑ Has the Tailgate Meeting Form been provided?
- ❑ Have unvaccinated staff completed the Gensuite self-declaration?
- ❑ Have unvaccinated sub-contractors signed the sub-contractor self-declaration on the tailgate form (leave blank if no subs on site)?
- ❑ Are there enough masks on site for those required to wear them?
- ❑ Is the site in a region that has less than 100 cases per 100k in population using the 7-day average? Use COVID Act Now to reference the rate for the county.
- ❑ If the region has more than 100 cases per 100k in population using the 7-day average, have you notified all staff they must comply with Haley & Aldrich's High-risk policy? (leave blank if the 7-day average case rate per 100k is below 100)
- ❑ Has the Project Shutdown/Suspension policy been provided?

Is there staff travel involved with this project? (If yes please answer the following questions) ☐ Yes ☐ No

Have they followed H&A's Travel Procedures? ☐ Yes ☐ No

Has their Travel been approved by their SM or the project PM? ☐ Yes ☐ No

❖ Complete the Job Hazard Analysis (JHA) on the following page and return to H&S for review.

- Be as **detailed as possible** when breaking down the task being performed into individual steps that will be performed.
  - Example Tasks: Traveling to site, Drilling, Sampling, Breaks, Tailgate meetings, Equipment Breakdown etc.
- Identify if any of the steps will require staff or subcontractors to break the 6-foot social distance, and if so, what is the duration of that step.
- Identify what control measures will be implemented for each step to prevent the potential spread of COVID-19. For projects involving numerous tasks, each with several steps, extra space is required to complete a thorough JHA.
  - Example control measure: Sanitize after use, Drive in separate cars, Do not use field trailer, Use gloves when handling, Eat/Drink away from others etc.
- Update the JHA when a new task is started or when a new unrecognized hazard has been identified.
- Review the JHA each morning prior to starting work.
- Use blank copies of the following page as needed.
- If staff have any questions or concerns when completing the JHA, please reach out to their Regional Health & Safety Manager or HealthSafetyHelp@HaleyAldrich.com for support.

HALEY ALDRICH

COVID-19 Project Planning Instructions
HASP Addendum

Safety
in everything we do

HEALTH & SAFETY FACTSHEET

COVID-19 PROJECT SPECIFIC JOB HAZARD ANALYSIS

Task and Associated Steps	6-ft Distance Achieved?	Task Time	What Procedures are going to be put in place?

PM Signature: _____ **Date:** _____

FSM Signature: _____ **Date:** _____

HALEY ALDRICH

APPENDIX F
SDS Sheets

Arsenic - ToxFAQs™

CAS # 7440-38-2

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

CAS # 7440-38-2

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Health and Human Services. Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Benzene - ToxFAQs™

CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHTLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,000 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries, but we do not know for certain that benzene caused the effects. It is not known whether benzene will affect fertility in men.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

ATSDR

CS249955-F

Benzene

CAS # 71-43-2

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the bloodforming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR) 2007. Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?

(Pronounced 1,2-dī-klôr′ ō-ĕth′ēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- 1,2-Dichloroethene evaporates rapidly into air.
- In the air, it takes about 5-12 days for half of it to break down.
- Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- In groundwater, it takes about 13-48 weeks to break down.
- There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high

levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AUTOMOTIVE GASOLINE
CAS # 8006-61-9

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about automobile gasoline. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to automotive gasoline most likely occurs from breathing its vapor at a service station while filling a car's fuel tank. At high levels, automotive gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Exposure to high levels may also cause harmful effects to the nervous system. Automotive gasoline has been found in at least 23 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is automotive gasoline?

(Pronounced ô′tə-mō′tĭv găs′ə-lēn′)

The gasoline discussed in this fact sheet is automotive used as a fuel for engines in cars. Gasoline is a colorless, pale brown, or pink liquid, and is very flammable.

Gasoline is a manufactured mixture that does not exist naturally in the environment. Gasoline is produced from petroleum in the refining process.

Typically, gasoline contains more than 150 chemicals, including small amounts of benzene, toluene, xylene, and sometimes lead. How the gasoline is made determines which chemicals are present in the gasoline mixture and how much of each is present. The actual composition varies with the source of the crude petroleum, the manufacturer, and the time of year.

What happens to automotive gasoline when it enters the environment?

- Small amounts of the chemicals present in gasoline evaporate into the air when you fill the gas tank in your car or when gasoline is accidentally spilled onto surfaces and soils or into surface waters.
- Other chemicals in gasoline dissolve in water after spills to surface waters or underground storage tank leaks into the groundwater.
- In surface releases, most chemicals in gasoline will probably evaporate; others may dissolve and be carried away by water; a few will probably stick to soil.
- The chemicals that evaporate are broken down by sunlight and other chemicals in the air.
- The chemicals that dissolve in water also break down quickly by natural processes.

How might I be exposed to automotive gasoline?

- Breathing vapors at a service station when filling the car's fuel tank is the most likely way to be exposed.
- Working at a service station.
- Using equipment that runs on gasoline, such as a lawn mower.
- Drinking contaminated water.
- Being close to a spot where gasoline has spilled or leaked into the soil.

How can automotive gasoline affect my health?

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mix-

ture, such as benzene and lead. Inhaling or swallowing large amounts of gasoline can cause death.

Inhaling high concentrations of gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Gasoline is also a skin irritant. Breathing in high levels of gasoline for short periods or swallowing large amounts of gasoline may also cause harmful effects on the nervous system.

Serious nervous system effects include coma and the inability to breathe, while less serious effects include dizziness and headaches.

There is not enough information available to determine if gasoline causes birth defects or affects reproduction.

How likely is automotive gasoline to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified automotive gasoline for carcinogenicity. Automotive gasoline is currently undergoing review by the EPA for cancer classification.

Some laboratory animals that breathed high concentrations of unleaded gasoline vapors continuously for 2 years developed liver and kidney tumors. However, there is no evidence that exposure to gasoline causes cancer in humans.

Is there a medical test to show whether I've been exposed to automotive gasoline?

Laboratory tests are available that can measure elevated blood or urine levels of lead (as an indication of exposure to leaded gasoline only), benzene, or other substances that may result from exposure to gasoline or other sources. These methods are sensitive enough to measure background levels and levels where health effects may occur. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has established many regulations to control air pollution. These are designed to protect the public from the possible harmful health effects of gasoline.

The American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 890 milligrams of gasoline per cubic meter of air (890 mg/m^3) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Crude petroleum: Petroleum that has not been processed.

Dissolve: To disappear gradually.

Evaporate: To change into a vapor or a gas.

Irritant: A substance that causes an abnormal reaction.

Mixture: A combination of two or more components.

Refining process: The process by which petroleum is purified to form gasoline.

Tumor: An abnormal mass of tissue.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for automotive gasoline. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Lead – ToxFAQs™

CAS # 7439-92-1

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- When lead is released to the air, it may travel long distances before settling to the ground.
- Once lead falls onto soil, it usually sticks to soil particles.
- Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
- Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
- Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
- Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high-levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

Lead

CAS # 7439-92-1

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

- Avoid exposure to sources of lead.
- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.
- If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.
- Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children.
- If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC has updated its recommendations on children's blood lead levels. Experts now use an upper reference level value of 97.5% of the population distribution for children's blood lead. In 2012-2015, the value to identify children with blood lead levels that are much higher than most children have, is 5 micrograms per deciliter (µg/dL). EPA limits lead in drinking water to 15 µg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

❏ Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.

❏ Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.

❏ Naphthalene can become weakly attached to soil or pass through soil into underground water.

❏ In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.

❏ Naphthalene does not accumulate in the flesh of animals or fish that you might eat.

❏ 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❏ Breathing low levels in outdoor air.

❏ Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.

❏ Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.

❏ Drinking water from contaminated wells.

❏ Touching fabrics that are treated with moth repellents containing naphthalene.

❏ Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❑ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❑ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❑ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❑ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

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CS249955-AD

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

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Tetrachloroethylene - ToxFAQs™

CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness headaches, sleepiness, incoordination confusion, nausea, unconsciousness, and even death. Tetrachloroethylene has been found in at least 945 of the 1,699 National Priorities List sites identified by U.S. Environmental Protection Agency (EPA).

What is tetrachloroethylene?

Tetrachloroethylene is a nonflammable colorless liquid. Other names for tetrachloroethylene include perchloroethylene, PCE, perc, tetrachloroethene, and perchlor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (1 ppm) or more.

Tetrachloroethylene is used as a dry cleaning agent and metal degreasing solvent. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products.

What happens to tetrachloroethylene when it enters the environment?

- Tetrachloroethylene can be released into air, water, and soil at places where it is produced or used.
- Tetrachloroethylene breaks down very slowly in the air and so it can be transported long distances in the air. Half of the amount in the air will degrade in approximately 100 days.
- Tetrachloroethylene evaporates quickly from water into air. It is generally slow to break down in water.
- Tetrachloroethylene may evaporate quickly from shallow soils or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it. You might also be exposed to tetrachloroethylene that is released into the air during showering and bathing.
- People residing near contaminated sites or dry cleaning locations may be exposed to higher levels than the general population.
- People working in the dry cleaning industries or using metal degreasing products may be exposed to elevated levels of tetrachloroethylene.

How can tetrachloroethylene affect my health?

Breathing high levels of tetrachloroethylene for a brief period may cause dizziness or drowsiness, headache, and incoordination; higher levels may cause unconsciousness and even death.

Exposure for longer periods to low levels of tetrachloroethylene may cause changes in mood, memory, attention, reaction time, and vision.

Studies in animals exposed to tetrachloroethylene have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

How likely is tetrachloroethylene to cause cancer?

Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma, but the evidence is not very strong.

Tetrachloroethylene

CAS # 127-18-4

In animals, tetrachloroethylene has been shown to cause cancers of the liver, kidney, and blood system.

EPA considers tetrachloroethylene likely to be carcinogenic to humans by all routes of exposure. The International Agency for Research on Cancer (IARC) considers tetrachloroethylene probably carcinogenic to humans. The Department of Health and Human Services (DHHS) considers tetrachloroethylene to be reasonable anticipated to be a human carcinogen.

How can tetrachloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of tetrachloroethylene.

A few studies in humans have suggested that exposure to tetrachloroethylene increased the numbers of babies with birth defects, but these studies were not large enough to clearly answer the question. Studies in animals exposed by inhalation or stomach tube have not shown clear evidence of specific birth defects.

How can families reduce the risks of exposure to tetrachloroethylene?

- Tetrachloroethylene has been found in low levels in some food. You can minimize the risk of your family's exposure by peeling and thoroughly washing fruits and vegetables before cooking.
- Use bottled water if you have concerns about the presence of tetrachloroethylene in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has tetrachloroethylene.
- Tetrachloroethylene is widely used as a scouring solvent that removes oils from fabrics, as a carrier solvent, as a fabric finish or water repellant, and as a metal degreaser/cleaner. Follow instructions on product labels to minimize exposure to tetrachloroethylene.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

Tetrachloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of tetrachloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because tetrachloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average permissible exposure limit of 100 ppm, an acceptable ceiling exposure limit of 200 ppm, and a maximum peak of 300 ppm (not to be exceeded for more than 5 minutes of any 3-hour period).

The National Institute for Occupational Safety and Health (NIOSH) recommends that workplace exposure to tetrachloroethylene be minimized due to concerns about its carcinogenicity.

References

This ToxFAQs™ information is taken from the 2014 Toxicological Profile for Tetrachloroethylene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services in Atlanta, GA

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636, FAX: 770-488-4178.

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Trichloroethylene - ToxFAQs™

CAS # 79-01-6

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

Agency for Toxic Substances and Disease Registry
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CS265956-A

Trichloroethylene

CAS # 79-01-6

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or gas.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

Solvent: A chemical that dissolves other substances.

References

This ToxFAQs™ information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOTAL PETROLEUM HYDROCARBONS (TPH)

Agency for Toxic Substances and Disease Registry ToxFAQs **August 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about total petroleum hydrocarbons (TPH). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: TPH is a mixture of many different compounds. Everyone is exposed to TPH from many sources, including gasoline pumps, spilled oil on pavement, and chemicals used at home or work. Some TPH compounds can affect your nervous system, causing headaches and dizziness. TPH has been found in at least 23 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are total petroleum hydrocarbons?

(Pronounced tōt′l pə-trō′lē-əm hī′drə-kär′bənz)

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site.

TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals.

Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

What happens to TPH when it enters the environment?

- TPH may enter the environment through accidents, from industrial releases, or as byproducts from commercial or private uses.
- TPH may be released directly into water through spills or leaks.
- Some TPH fractions will float on the water and form surface films.
- Other TPH fractions will sink to the bottom sediments.
- Bacteria and microorganisms in the water may break down some of the TPH fractions.
- Some TPH fractions will move into the soil where they may stay for a long time.

How might I be exposed to TPH?

- Everyone is exposed to TPH from many sources.
- Breathing air at gasoline stations, using chemicals at home or work, or using certain pesticides.
- Drinking water contaminated with TPH.
- Working in occupations that use petroleum products.
- Living in an area near a spill or leak of petroleum products.
- Touching soil contaminated with TPH.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

How can TPH affect my health?

Some of the TPH compounds can affect your central nervous system. One compound can cause headaches and dizziness at high levels in the air. Another compound can cause a nerve disorder called "peripheral neuropathy," consisting of numbness in the feet and legs. Other TPH compounds can cause effects on the blood, immune system, lungs, skin, and eyes.

Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

How likely is TPH to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Is there a medical test to show whether I've been exposed to TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds. Exposure to kerosene can be determined by its smell on the breath or clothing. Benzene can be measured in exhaled air and a breakdown product of benzene can be measured in urine. Other TPH compounds can be measured in blood, urine, breath, and some body tissues.

Has the federal government made recommendations to protect human health?

There are no regulations or advisories specific to TPH. The following are recommendations for some of the TPH fractions and compounds:

The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration has set an exposure limit of 500 parts of petroleum distillates per million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Immune system: Body organs and cells that fight disease.

Pesticides: Chemicals used to kill pests.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Vinyl Chloride - ToxFAQs™

CAS # 75-01-4

This fact sheet answers the most frequently asked health questions (FAQs) about vinyl chloride. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to vinyl chloride occurs mainly in the workplace. Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer. This substance has been found in at least 616 of the 1,662 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is vinyl chloride?

Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

What happens to vinyl chloride when it enters the environment?

- Liquid vinyl chloride evaporates easily. Vinyl chloride in water or soil evaporates rapidly if it is near the surface.
- Vinyl chloride in the air breaks down in a few days to other substances, some of which can be harmful.
- Small amounts of vinyl chloride can dissolve in water.
- Vinyl chloride is unlikely to build up in plants or animals that you might eat.

How might I be exposed to vinyl chloride?

- Breathing vinyl chloride that has been released from plastics industries, hazardous waste sites, and landfills.
- Breathing vinyl chloride in air or during contact with your skin or eyes in the workplace.
- Drinking water from contaminated wells.

How can vinyl chloride affect my health?

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold.

The effects of drinking high levels of vinyl chloride are unknown. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

Animal studies have shown that long-term exposure to vinyl chloride can damage the sperm and testes.

Vinyl Chloride

CAS # 75-01-4

How likely is vinyl chloride to cause cancer?

The U.S. Department of Health and Human Services (DHHS) has determined that vinyl chloride is a known carcinogen. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain, lung cancer, and some cancers of the blood have also been observed in workers.

How can vinyl chloride affect children?

It has not been proven that vinyl chloride causes birth defects in humans, but studies in animals suggest that vinyl chloride might affect growth and development. Animal studies also suggest that infants and young children might be more susceptible than adults to vinyl chloride-induced cancer.

How can families reduce the risk of exposure to vinyl chloride?

Tobacco smoke contains low levels of vinyl chloride, so limiting your family's exposure to cigarette or cigar smoke may help reduce their exposure to vinyl chloride.

Is there a medical test to determine whether I've been exposed to vinyl chloride?

The results of several tests can sometimes show if you have been exposed to vinyl chloride. Vinyl chloride can be measured in your breath, but the test must be done shortly after exposure. This is not helpful for measuring very low levels of vinyl chloride.

The amount of the major breakdown product of vinyl chloride, thiodiglycolic acid, in the urine may give some information about exposure. However, this test must be done shortly after exposure and does not reliably indicate the level of exposure.

Has the federal government made recommendations to protect human health?

Vinyl chloride is regulated in drinking water, food, and air. The EPA requires that the amount of vinyl chloride in drinking water not exceed 0.002 milligrams per liter (mg/L) of water.

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 part vinyl chloride per 1 million parts of air (1 ppm) in the workplace.

The Food and Drug Administration (FDA) regulates the vinyl chloride content of various plastics. These include plastics that carry liquids and plastics that contact food. The limits for vinyl chloride content vary depending on the nature of the plastic and its use.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Vinyl Chloride (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

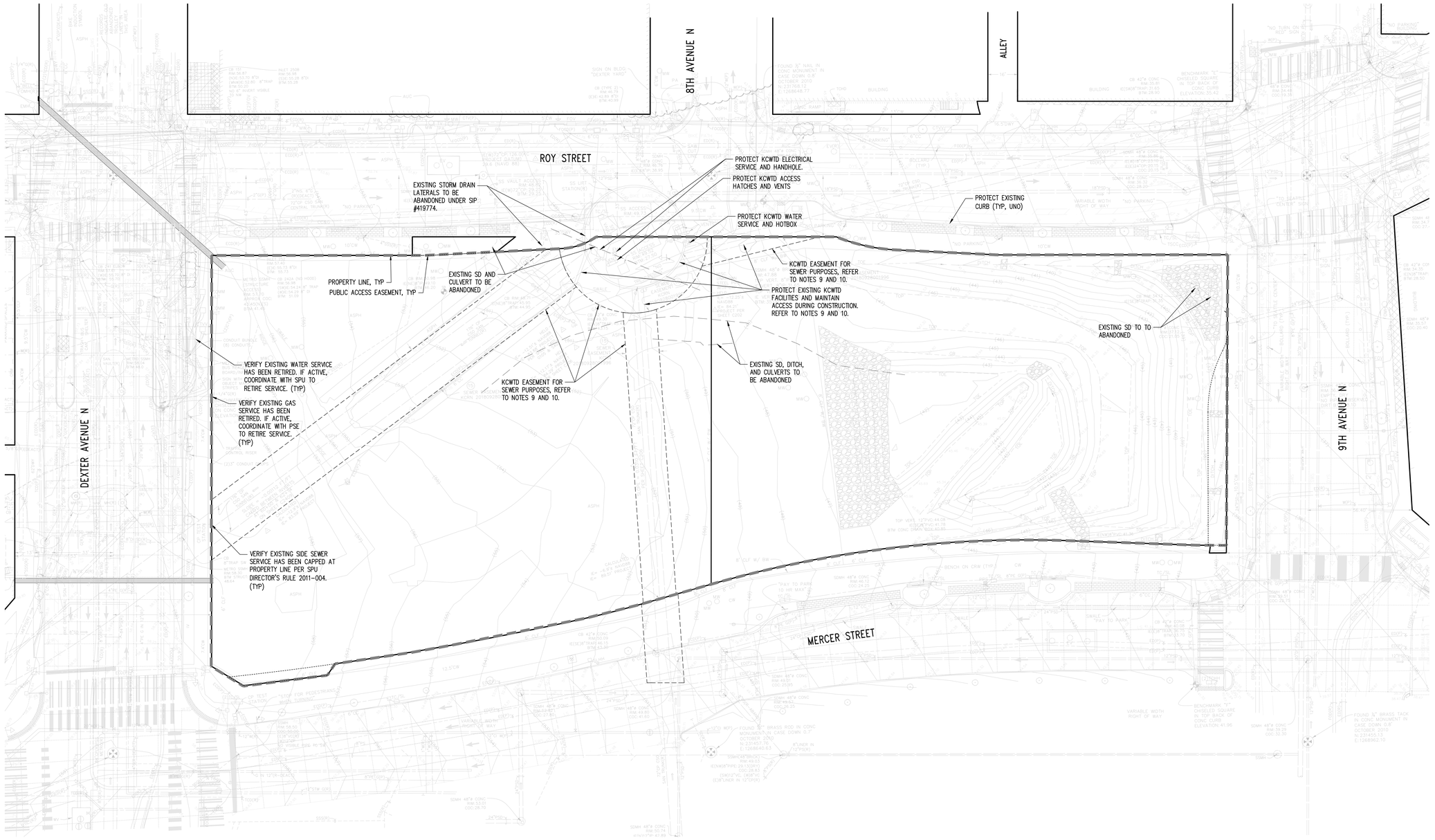
For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX E
Temporary Erosion and Sediment Control Plan



NOTES

1. ALL EXISTING SURFACE IMPROVEMENTS AND UNDERGROUND STRUCTURES/UTILITIES WITHIN THE ON-SITE DEMOLITION LIMITS SHALL BE DEMOLISHED, UNLESS OTHERWISE NOTED, AND DISPOSED OF OFF-SITE IN A LEGAL MANNER.
2. COORDINATE WITH PSE FOR ALL ABANDONING, CAPPING, AND REMOVAL/RELOCATION OF PSE'S GAS SERVICES AS INDICATED.
3. COORDINATE WITH SPU FOR ALL ABANDONING, RETIRING, CAPPING, AND REMOVAL OF SPU'S WATER SERVICES AS INDICATED.
4. PROTECT AND MAINTAIN UNINTERRUPTED UTILITY SERVICE TO EXISTING NEIGHBORING BUILDINGS DURING DEMOLITION AND CONSTRUCTION.
5. CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO DEMOLITION OR CONSTRUCTION ACTIVITIES. ALL EXISTING UTILITIES AND IMPROVEMENTS IN THE PUBLIC RIGHT-OF-WAY, ABOVE AND BELOW GRADE, SHALL BE PROTECTED UNLESS NOTED OTHERWISE.
6. MAINTAIN PEDESTRIAN AND VEHICULAR ACCESS FOR ADJACENT PROPERTIES THROUGHOUT CONSTRUCTION.
7. ALL DISTURBED PAVEMENT IN PUBLIC RIGHT-OF-WAY SHALL BE REPLACED PER COS STANDARD PLANS AND SDOT DIRECTOR'S RULE 01-2017 "RIGHT-OF-WAY OPENING AND RESTORATION RULES". REFER TO PROJECT STREET IMPROVEMENT PERMIT (SIP) PLANS FOR FINAL IMPROVEMENTS.
8. CONTRACTOR SHALL PERFORM PRE-CONSTRUCTION AND POST-CONSTRUCTION TELEVISION INSPECTION OF SPU MAINLINE SEWER AND STORM DRAINAGE PIPE LOCATED WITHIN TEN FEET (OR WITHIN TWENTY FEET IF MAINLINES ARE THIRTY FEET OR MORE FROM THE SITE PROPERTY LINE) OF ANY PROPOSED SHORING ELEMENT. TELEVISION INSPECTION SHALL CONFORM TO COS STANDARD SPECIFICATION 7-17.3(3)G. COPIES OF THE TELEVISION INSPECTIONS SHALL BE PROVIDED TO SPU PRIOR TO THE PRECONSTRUCTION MEETING.
9. KCWTD OWNS AND OPERATES FACILITIES LOCATED ON THE PROJECT PARCELS. THE KC DROP STRUCTURE, LOCATED JUST SOUTH OF THE ROY/8TH INTERSECTION, HAS SURFACE ELEMENTS THAT WILL BE PROTECTED IN PLACE AND BE INCORPORATED INTO THE PROPOSED SITE IMPROVEMENTS. KCWTD'S LARGE COMBINED SEWER OVERFLOW PIPES AND DROP STRUCTURE WILL BE PROTECTED DURING CONSTRUCTION OF THE BELOW GRADE STRUCTURE AND ASSOCIATED SHORING. THESE FACILITIES, CLEARANCES, MAINTENANCE, AND ACCESSIBILITY REQUIREMENTS ARE DOCUMENTED IN AN "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996. COORDINATE INSPECTION AND MONITORING REQUIREMENTS WITH KCWTD PRIOR TO BEGINNING EXCAVATION ACTIVITIES.
10. ALL CONSTRUCTION AND DEVELOPMENT ACTIVITIES SHALL COMPLY WITH THE TERMS OF THIS "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996.
11. CONTRACTOR, IN COORDINATION WITH PROJECT'S GEOTECHNICAL ENGINEER, SHALL PERFORM PRE-, DURING, AND POST-CONSTRUCTION INSPECTIONS AND MONITORING OF KCWTD'S LARGE COMBINED SEWER OVERFLOW PIPES AND DROP STRUCTURE, AS COORDINATED WITH KCWTD PRIOR TO BEGINNING EXCAVATION AND CONSTRUCTION ACTIVITIES

CONTRACTOR IS ALERTED TO THE FACT THAT WORK WILL BE ACCOMPLISHED AROUND ENERGIZED SEATTLE CITY LIGHT (SCL) AND ACTIVE PUGET SOUND ENERGY (PSE) FACILITIES THAT ARE SERVING EXISTING CUSTOMERS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO DETERMINE ANY REQUIRED CONSTRUCTION SEQUENCING, AND SHALL IMPLEMENT SAFETY PROCEDURES PER SCL AND PSE REQUIREMENTS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO PROVIDE FACILITIES THAT MAINTAIN SERVICES TO CUSTOMERS THROUGHOUT CONSTRUCTION.

LEGEND

- CONSTRUCTION FENCING AND COMPOST SOCK
- ON-SITE DEMOLITION LIMITS
- PROPERTY LINE
- KCWTD EASEMENT
- PUBLIC ACCESS EASEMENT

N

0 10 20 40

1 inch = 20 feet

811 Know what's below. Call before you dig.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

JOSEPH R. CLEVELAND — STATE OF WASHINGTON — 37799 — REGISTERED PROFESSIONAL ENGINEER — 7/20/2022

ARE 816 MERCER

MERCER WEST

STRUCTURAL PERMIT PHASE 1 CYCLE 3

7/20/2022

REVISIONS

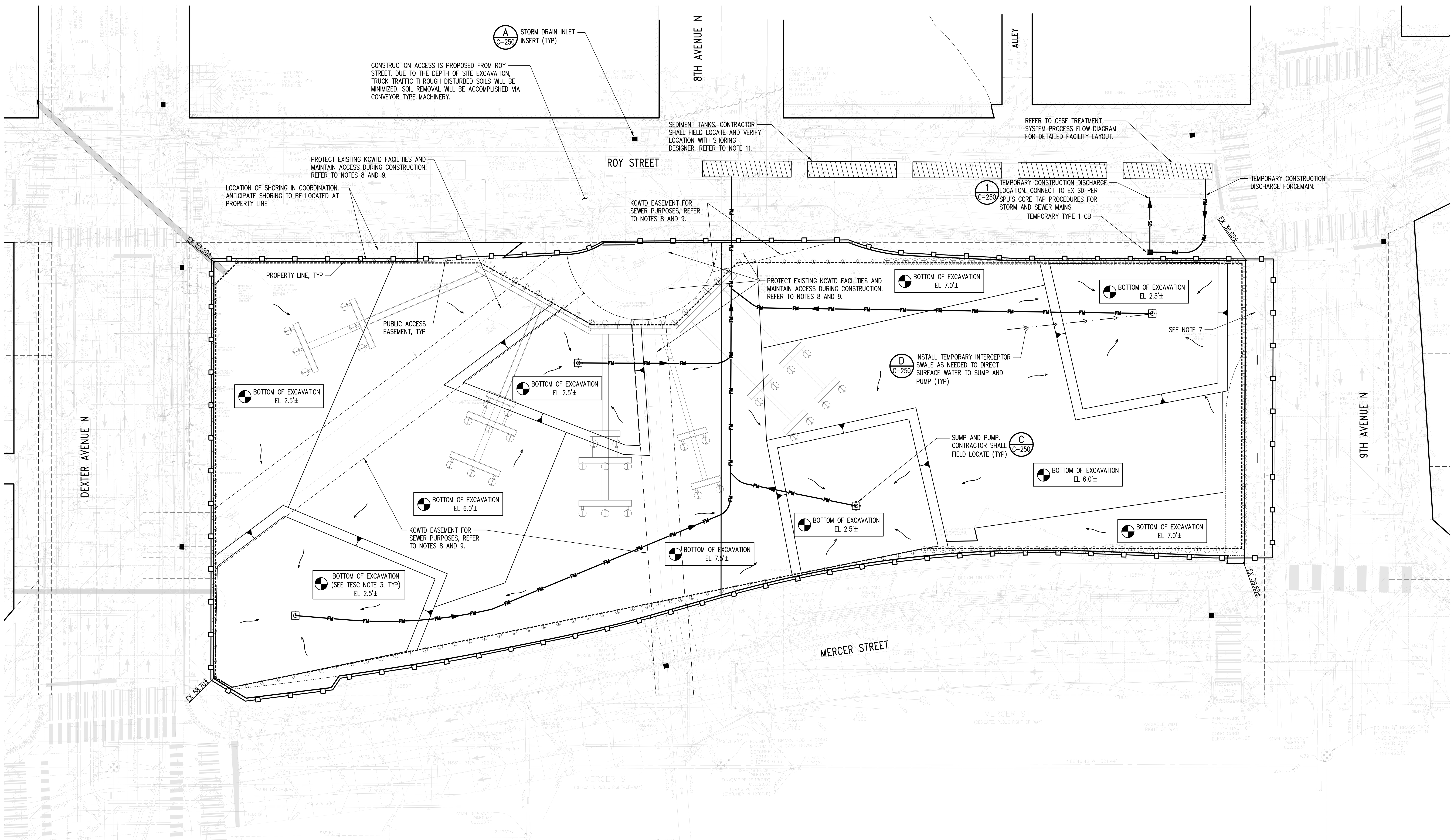
MARK	DATE	DESCRIPTION

SCALE	PROJECT ARCHITECT
REFER TO PLAN	JC/HL/SB

PROJECT NUMBER 102482.00

SHEET NAME
DEMOLITION PLAN

SHEET NUMBER
C-200



TESC NOTES:

1. CONTRACTOR SHALL COORDINATE WITH KING COUNTY INDUSTRIAL WASTE (KCIW), DEPARTMENT OF ECOLOGY (DOE), AND CITY OF SEATTLE PRIOR TO DISCHARGING CONSTRUCTION WATER FROM THIS SITE. CONTRACTOR IS RESPONSIBLE FOR OBTAINING DISCHARGE AUTHORIZATION LETTER AND SIDE SEWER PERMIT FOR TEMPORARY DEWATERING (SSPTD), AS REQUIRED BY KCIW, DOE, SDCI, AND SPU.

2. CONTRACTOR SHALL MONITOR FLOW RATE AND WATER QUALITY OF DISCHARGE INTO COMBINED KING COUNTY WASTEWATER TREATMENT DIVISION (KCWTD) SEWER OR PUBLIC STORM DRAIN SYSTEM. DISCHARGE SHALL COMPLY WITH DOE, SDCI, SPU, AND KCIW DISCHARGE REQUIREMENTS.

3. THE BOTTOM OF EXCAVATION ELEVATION SHOWN ON THIS PLAN IS AN APPROXIMATION OF THE SUBGRADE FOR THE PURPOSES OF THE TESC PLAN. REFER TO THE SHORING PLANS FOR THE LOCATION OF THE CRITICAL SUBGRADE/EXCAVATION ELEVATIONS AND SLOPES. REFER TO THE FOUNDATION PLANS FOR THE LOCATION OF THE FOUNDATION ELEMENTS, INCLUDING COLUMN FOOTINGS AND ELEVATOR PITS.

4. THIS PLAN IS INTENDED TO REFLECT THE MINIMUM EROSION AND SEDIMENTATION CONTROL MEASURES REQUIRED FOR THIS SITE. THE CONTRACTOR IS RESPONSIBLE FOR UPGRADING THESE MEASURES TO ACCOMMODATE SITE CONDITIONS, STORM EVENTS, AND TO PREVENT SEDIMENT AND SEDIMENT LADEN RUNOFF FROM LEAVING THE SITE.

5. CONTRACTOR IS RESPONSIBLE FOR DEWATERING OF THE EXCAVATION. CONTRACTOR SHALL ROUTE DEWATERING DISCHARGE TO THE ON-SITE SETTLEMENT AND TREATMENT SYSTEM TO MAINTAIN THE DISCHARGE BELOW REQUIRED TURBIDITY AND TREATMENT REQUIREMENTS.

6. AREAS OF EXPOSED SOILS SHALL BE STABILIZED TO PREVENT SEDIMENT FROM BEING TRACKED AROUND OR OFF THE SITE. STABILIZATION BMPS SHALL CONSIST OF, BUT NOT BE LIMITED TO, FILTER FENCES, PLASTIC COVERING, DUST CONTROL, AND/OR SODDING/SEEDING. THE CONTRACTOR IS RESPONSIBLE FOR UPGRADING THESE MEASURES TO ACCOMMODATE SITE CONDITIONS, STORM EVENTS, AND TO PREVENT SEDIMENT AND SEDIMENT LADEN RUNOFF FROM LEAVING THE SITE.

7. GROUNDWATER DEWATERING DISCHARGE TO COMBINED SEWERS SHALL BE METERED PRIOR TO DISCHARGE. CONTACT THE SPU SUBMETER PROGRAM OFFICE AT (206) 684-5089 TO DETERMINE THE REQUIRED METER TYPE, INSTALLATION LOCATION, BILLING INFORMATION, AND TO SCHEDULE AN INSPECTION OF THE METER AFTER INSTALLATION.

8. KCWTD OWNS AND OPERATES FACILITIES LOCATED ON THE PROJECT PARCELS. THE KC DROP STRUCTURE, LOCATED JUST SOUTH OF THE ROY/8TH INTERSECTION, HAS SURFACE ELEMENTS THAT WILL BE PROTECTED IN PLACE AND BE INCORPORATED INTO THE PROPOSED SITE IMPROVEMENTS. KCWTD'S LARGE COMBINED SEWER OVERFLOW PIPES AND DROP STRUCTURE WILL BE PROTECTED DURING CONSTRUCTION OF THE BELOW GRADE STRUCTURE AND ASSOCIATED SHORING. THESE FACILITIES, CLEARANCES, MAINTENANCE, AND ACCESSIBILITY REQUIREMENTS ARE DOCUMENTED IN AN "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996. COORDINATE INSPECTION AND MONITORING REQUIREMENTS WITH KCWTD PRIOR TO BEGINNING EXCAVATION ACTIVITIES.

9. ALL CONSTRUCTION AND DEVELOPMENT ACTIVITIES SHALL COMPLY WITH THE TERMS OF THIS "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996.

10. STORMWATER RUNOFF SHALL BE DIRECTED TO TEMPORARY PUMPS FOR CONVEYANCE TO TREATMENT SYSTEM. CONTRACTOR SHALL FIELD LOCATE AND SIZE PUMPS TO ACCOMMODATE FLOWS ENCOUNTERED. CONTRACTOR SHALL SUPPLY BACKUP PUMPS AS NEEDED.

11. PROJECT'S SWPPP IS BEING PREPARED BY THE DEWATERING SUBCONTRACTOR. CONTRACTOR SHALL FIELD LOCATE CONSTRUCTION STORMWATER FILTRATION SYSTEMS AND ASSOCIATED STORMWATER STORAGE VOLUME. SYSTEM CAPACITY SHALL BE RELATIVE TO DISTURBED AREA PER LOCAL AND STATE SIZING CRITERIA. FOR THE DISTURBED AREA ENCOMPASSED BY THE LIMITS OF WORK DEPICTED ON THESE PLANS, VOLUME OF STORAGE SHALL BE 90,828 GALLONS. DUE TO THE CHANGING SITE CONDITIONS, THE STORAGE VOLUME SHALL BE ADJUSTED AS NECESSARY BASED ON ACTUAL DISTURBED AREAS, WHICH MAY BE MORE OR LESS THAN THE VOLUME NOTED ABOVE. CONTRACTOR SHALL MONITOR FLOW RATE AND WATER QUALITY OF DISCHARGE INTO STORM DRAIN. INCLUDE STRUCTURAL FILTRATION OR OTHER APPROVED POST RETENTION STORMWATER QUALITY BMP, AS REQUIRED TO MEET STATE AND CITY DISCHARGE REQUIREMENTS. CONTRACTOR SHALL MONITOR DISCHARGE FLOW AND WATER QUALITY OF ALL AUTHORIZED DISCHARGES INTO SANITARY SEWER. INCLUDE SAND FILTERS AND ADDITIONAL SEDIMENTATION TANKS AS REQUIRED TO MEET KCIW DISCHARGE REQUIREMENTS. MAXIMUM DAILY DISCHARGE TO KCIW IS 25,000 GALLONS.

12. CONTRACTOR MAY ENCOUNTER CONTAMINATED OR IMPACTED GROUNDWATER AND CONSTRUCTION STORMWATER DURING DEWATERING OR EARTHWORK ACTIVITIES. COORDINATE WITH PROJECT'S ENVIRONMENTAL ENGINEER FOR DOE REQUIREMENTS AND LIST OF KNOWN CONTAMINANTS OF CONCERN. CONSTRUCTION STORMWATER MUST BE TESTED, TREATED, AND DISCHARGED AS REQUIRED BY DOE. REFER TO PROJECT SWPPP AND ENGINEERING DESIGN REPORT PREPARED BY HALEY ALDRICH FOR PROPOSED CONSTRUCTION STORMWATER COLLECTION AND WATER QUALITY TREATMENT REQUIREMENTS.

13. PROTECT PROPERTIES AND RECEIVING WATERS DOWNSTREAM FROM THE DEVELOPMENT SITES FROM EROSION DUE TO INCREASES IN THE VOLUME, VELOCITY, AND PEAK FLOW RATE OF DRAINAGE WATER FROM THE PROJECT SITE.

14. PREVENT EROSION AND SEDIMENT TRANSPORT FROM THE SITE BY VEHICLES. LIMIT CONSTRUCTION VEHICLE ACCESS, WHENEVER POSSIBLE, TO ONE LOCATION. STABILIZE ALL ACCESS POINTS. PROVIDE PERIODIC STREET CLEANING BY SWEEPING OR SHOVELING ANY SEDIMENT THAT MAY HAVE BEEN TRACKED OUT. PLACE SEDIMENT IN A SUITABLE DISPOSAL AREA WHERE IT WILL NOT ERODE ANY FURTHER.

15. A SIDE SEWER PERMIT FOR TEMPORARY DEWATERING IS REQUIRED FROM SDCI PRIOR TO ANY DEWATERING OPERATIONS. TEMPORARY DEWATERING MAY BE DISCHARGED TO STORM DRAIN IF JURISDICTIONAL WATER QUALITY REQUIREMENTS ARE MET. EFFLUENT THAT DOES NOT MEET WATER QUALITY REQUIREMENTS FOR STORMWATER DISCHARGE SHALL BE DISCHARGED TO PUBLIC COMBINED SEWER. IF CONTRACTOR IS UNABLE TO DISCHARGE TO STORM DRAIN PER CIVIL PLANS, THEY SHALL COORDINATE WITH SDCI AND SPU TO OBTAIN APPROVAL FOR SEWER DISCHARGE.

16. CONTROL DEWATERING. WHEN DEWATERING DEVICES DISCHARGE ON-SITE OR TO A PUBLIC DRAINAGE SYSTEM, DEWATERING DEVICES SHALL DISCHARGE INTO A SEDIMENT TRAP TO REMOVE SEDIMENT CONTAMINATION, OR OTHER SEDIMENT REMOVAL BMP. A SEPARATE DEWATERING PERMIT IS REQUIRED FOR: ONE ACRE OR GREATER DISTURBED AREA; CONTAMINATED SURFACE AND/OR GROUNDWATER; EXCAVATION GREATER THAN 12 FEET IN DEPTH; SIGNIFICANT VOLUME OF GROUNDWATER; OTHER SITE SPECIFIC CONDITIONS LEADING TO SIGNIFICANT DEWATERING.

17. IT IS ANTICIPATED THAT EXCAVATION WILL ENCOUNTER CONTAMINATED SOILS AND GROUNDWATER. HANDLING AND DISPOSAL OF THESE MATERIALS SHALL CONFORM TO THE PROJECT'S CLEANUP ACTION PLAN, PREPARED BY THE DEPARTMENT OF ECOLOGY, DATED FEBRUARY 8, 2022.

18. REFER TO SWPPP PREPARED BY CLEAR WATER SERVICES AND DATED MARCH 15, 2022 FOR CONSTRUCTION STORMWATER MANAGEMENT.

GRADING NOTES:

1. GRADE OPEN EXCAVATION TO DRAIN TO LOW POINTS AND SUMPS AS SHOWN.
2. REFER TO SHORING, STRUCTURAL AND ARCHITECTURAL PLANS FOR EXCAVATION OF BUILDING ELEMENTS.
3. REFER TO GEOTECH FOR TEMPORARY SLOPE AND SOIL PROTECTION PRACTICES.

CONTRACTOR IS ALERTED TO THE FACT THAT WORK WILL BE ACCOMPLISHED AROUND ENERGIZED SEATTLE CITY LIGHT (SCL) AND ACTIVE PUGET SOUND ENERGY (PSE) FACILITIES THAT ARE SERVING EXISTING CUSTOMERS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO DETERMINE ANY REQUIRED CONSTRUCTION SEQUENCING, AND SHALL IMPLEMENT SAFETY PROCEDURES PER SCL AND PSE REQUIREMENTS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO PROVIDE FACILITIES THAT MAINTAIN SERVICES TO CUSTOMERS THROUGHOUT CONSTRUCTION.

LEGEND:

- CONSTRUCTION FENCE AND COMPOST SOCK
- TEMPORARY SHORING AND LAGGING (PER SHORING PLANS)
- TEMPORARY INTERCEPTOR SWALE
- GENERAL DIRECTION OF RUNOFF
- STORM DRAIN INLET PROTECTION
- SUMP AND PUMP
- FORCE MAIN
- APPROXIMATE BOTTOM OF EXCAVATION ELEVATION
- SEDIMENT TANKS
- PROPERTY LINE
- KCWTD EASEMENT
- PUBLIC ACCESS EASEMENT

N

0 10 20 40
1 inch = 20 feet

811
Know what's below. Call before you dig.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

ARE 816 MERCER

MERCER WEST

STRUCTURAL PERMIT PHASE 1 CYCLE 3

7/20/2022

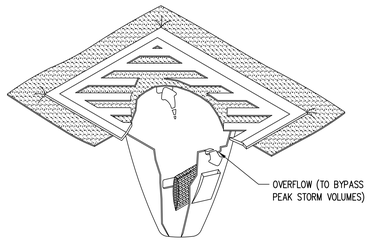
REVISIONS

MARK	DATE	DESCRIPTION

SCALE: REFER TO PLAN
PROJECT ARCHITECT: JC/HL/SB
PROJECT NUMBER: 102482.00

SHEET NAME: TESC PLAN

SHEET NUMBER: C-210

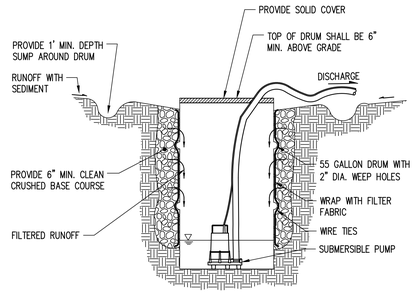


NOTES:

1. STORM DRAIN INLETS SHALL BE REMOVED AT THE END OF THE JOB.
2. STORM DRAIN INLETS SHALL ONLY BE INSTALLED IN DRAINAGE DEVICES PER THE MANUFACTURER'S RECOMMENDATIONS. CATCH BASIN INSERTS SHALL NOT BE INSTALLED IN CURB INLETS.
3. INSERTS SHALL BE INSPECTED AND MAINTAINED WHEN A 1/2 INCH RAIN ACCUMULATES WITHIN A 24 HOUR PERIOD. CLEAN AND/OR REPLACE INSERT WHEN HALF OF THE TRAP IS FILLED WITH SEDIMENTS.

STORM DRAIN INLET INSERT (A / C-210)

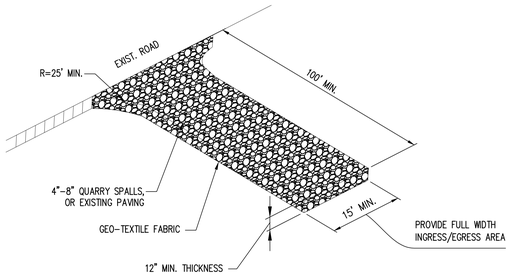
CITY OF SEATTLE DPD STANDARD DRAWING E3.30
NTS



NOTE:
PUMPS SHALL BE SUBMERSIBLE, CONTRACTOR IS RESPONSIBLE FOR SIZING PUMP BASED ON FIELD CONDITIONS.

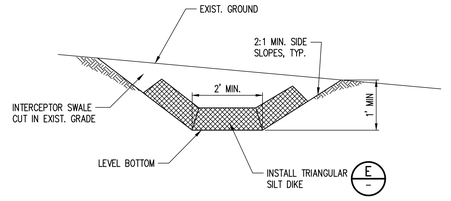
SUMP AND PUMP DETAIL (C / C-210)

NTS



TEMPORARY CONSTRUCTION ENTRANCE (B / C-200)

CITY OF SEATTLE DPD STANDARD DRAWING E2.10
NTS



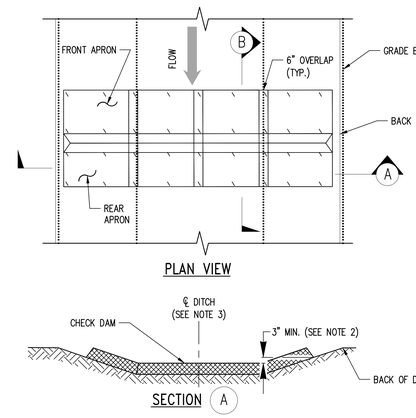
NOTE:
DAMAGE RESULTING FROM RUNOFF OR CONSTRUCTION ACTIVITY SHALL BE REPAIRED IMMEDIATELY.

TEMPORARY INTERCEPTOR SWALE (D / C-210)

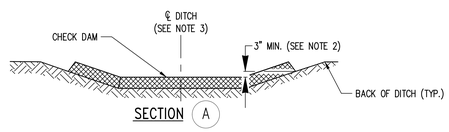
NTS

CONSTRUCTION STORMWATER CONTROL REQUIREMENTS (W/ MODIFICATIONS):

1. THE IMPLEMENTATION, CONSTRUCTION, MAINTENANCE, REPLACEMENT AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE APPLICANT/CONTRACTOR UNTIL ALL CONSTRUCTION IS APPROVED.
2. A FIRST GROUND DISTURBANCE INSPECTION IS REQUIRED PRIOR TO START OF WORK ON ALL SITES WITH LAND DISTURBING ACTIVITY.
3. SCHEDULE A FIRST GROUND DISTURBANCE INSPECTION FOR AN ISSUED BUILDING PERMIT AT 206-684-8900 OR ONLINE AT WWW.SEATTLE.GOV/DPD/PERMITS/INSPECTIONS/
4. THE APPLICANT/CONTRACTOR SHALL DESIGNATE AN EROSION AND SEDIMENT CONTROL (ESC) SUPERVISOR WHO SHALL BE RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMPS). FOR LARGE CONSTRUCTION PROJECTS, THE ESC SUPERVISOR SHOULD BE A CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL). PROVIDE THE NAME AND PHONE NUMBER OF THE ESC SUPERVISOR TO THE SITE INSPECTOR AT THE FIRST GROUND DISTURBANCE INSPECTION.
5. BMPS SHALL BE INSTALLED PRIOR TO STARTING CONSTRUCTION TO PREVENT SEDIMENT-LADEN WATER FROM LEAVING THE PROJECT SITE OR ENTERING ROADSIDE DITCHES, STORM DRAINS, SURFACE WATERS, OR WETLANDS. CONTRACTOR SHALL PROVIDE ADDITIONAL CONTROLS WHEN REQUIRED BY THE INSPECTOR OR OWNER'S REPRESENTATIVE WHEN MINIMUM CONTROLS ARE NOT SUFFICIENT TO PREVENT EROSION OR TRANSPORT OF SEDIMENT OR OTHER POLLUTANTS FROM THE SITE.
6. THE BMPS INCLUDED IN THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. THE APPLICANT IS RESPONSIBLE FOR INSTALLING, MODIFYING, AND MAINTAINING BMPS AS NEEDED FOR UNEXPECTED STORM EVENTS OR OTHER UNFORESEEN CIRCUMSTANCES, AND TO ACCOUNT FOR CHANGING SITE CONDITIONS.
7. ANY AREAS OF DISTURBED SOIL THAT WILL NOT BE WORKED FOR TWO CONSECUTIVE DAYS DURING THE WET SEASON (OCT 1 TO APRIL 30) OR SEVEN DAYS DURING THE DRY SEASON (MAY 1 TO SEPT 30) SHALL BE IMMEDIATELY STABILIZED WITH APPROVED BMPS METHODS (E.G. STRAW, MULCH, PLASTIC COVERING, COLD MIX, ETC.)
8. GRADING AND/OR SOIL DISTURBING ACTIVITIES MAY BE LIMITED OR PROHIBITED FOR CERTAIN SITES SUBJECT TO ECA STANDARDS (I.E. ECA STEEP SLOPES, LANDSLIDE PRONE AREAS, ETC.) BETWEEN OCTOBER 31ST AND APRIL 1ST. IF NOTED IN THE GEOTECHNICAL SPECIAL INSPECTIONS REQUIREMENTS, A GRADING SEASON EXTENSION LETTER (GSEL) ISSUED BY SDCI IS REQUIRED FOR ALL GRADING AND/OR SOIL DISTURBING ACTIVITIES DURING THIS PERIOD. THE GEOTECHNICAL SPECIAL INSPECTOR MUST SUBMIT ELECTRONIC APPLICATIONS FOR A GSEL USING THE SDCI PROJECT PORTAL. ALLOW FOUR TO SIX WEEKS FOR PROCESSING. FAILURE TO OBTAIN THE GSEL PRIOR TO OCTOBER 31 MAY RESULT IN A WORK STOPPAGE.
9. CITY STREETS AND SIDEWALKS SHALL BE KEPT CLEAN AT ALL TIMES. NO MATERIAL SHALL BE STORED ON CITY STREETS OR SIDEWALKS WITHOUT A STREET USE PERMIT FROM THE SEATTLE DEPARTMENT OF TRANSPORTATION (SDOT).
10. IMPLEMENT POLLUTION CONTROL MEASURES TO PREVENT LIQUID PRODUCTS OR CONTAMINATED WATER ENTERING ANY STORM DRAINAGE FACILITIES OR OTHERWISE LEAVING THE PROJECT SITE. ANY HAZARDOUS MATERIALS OR LIQUID PRODUCTS THAT HAVE THE POTENTIAL TO POLLUTE RUNOFF SHALL BE STORED AND DISPOSED OF PROPERLY.
11. WASHOUT FROM CONCRETE TRUCKS SHALL BE PERFORMED AT APPROPRIATE OFF-SITE FACILITIES OR IN DESIGNATED CONCRETE WASHOUT AREAS ONLY. DO NOT WASH OUT CONCRETE TRUCKS ONTO THE GROUND, OR TO STORM DRAINS OR OPEN DITCHES. DO NOT DUMP EXCESS CONCRETE ONSITE, EXCEPT IN DESIGNATED CONCRETE WASHOUT AREAS.
12. ALL AREAS OF DISTURBED SOIL SHALL BE FULLY STABILIZED WITH THE APPROPRIATE SOIL AMENDMENT AND COVER MEASURES AT COMPLETION OF THE PROJECT. TYPICAL COVER MEASURES INCLUDE LANDSCAPING OR HYDROSEED WITH MULCH.



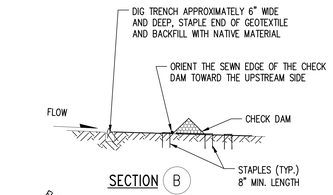
PLAN VIEW



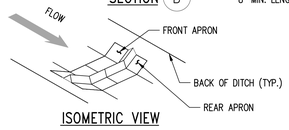
SECTION A

NOTES:

1. GEOTEXTILE ENCASED CHECK DAMS SHALL MEET THE REQUIREMENTS OF COS STANDARD SPECIFICATIONS 8-01.3(5)A AND 9-14.5(4).
2. INSTALL THE SLOPED ENDS OF THE CHECK DAM A MINIMUM OF 3" HIGHER THAN THE TOP OF THE CHECK DAM IN THE CHANNEL TO ENSURE THAT WATER FLOWS OVER THE DAM AND NOT AROUND IT.
3. FLAT BOTTOM DITCH DESIGN SHOWN, CHECK DAM INSTALLATION DETAILS ARE SIMILAR FOR "V" BOTTOM DITCHES.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH COS STANDARD SPECIFICATION 8-01.3(14).



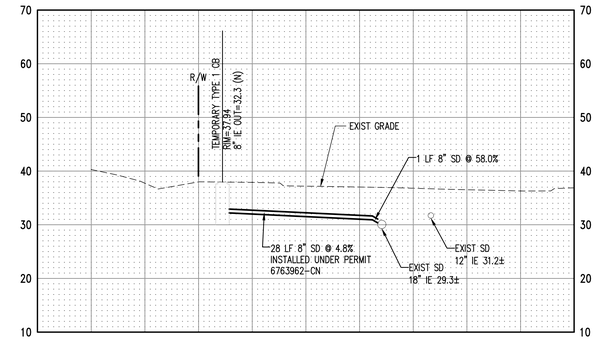
SECTION B



ISOMETRIC VIEW

TRIANGULAR SILT DIKE (E / -)

CITY OF SEATTLE DPD STANDARD DRAWING E2.60



TEMPORARY CONSTRUCTION DISCHARGE PROFILE (1 / C-210)

SCALE: 1" = 10'

Know what's below. Call before you dig.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

JOSHUA R. CHRISTIAN — STATE OF WASHINGTON — 22799 — REGISTERED PROFESSIONAL ENGINEER — 7/20/2022

ARE 816 MERCER

MERCER WEST

STRUCTURAL PERMIT PHASE 1 CYCLE 3

7/20/2022

REVISIONS

MARK	DATE	DESCRIPTION

SCALE: REFER TO PLAN
PROJECT ARCHITECT: JC/HL/SB

PROJECT NUMBER: 102482.00

SHEET NAME: TESC DETAILS

SHEET NUMBER: C-250

APPENDIX F
Stormwater Pollution Prevention Plan

STORMWATER POLLUTION PREVENTION PLAN 5/1/2023

The 816 Mercer project

816 Mercer
Seattle, WA 98109

Prepared for:
Howard S. Wright

Prepared by:
Clear Water Services

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

Prepared for:
Howard S. Wright
&**The Washington State Department of Ecology**
Northwest Regional Office

Permittee / Owner	Developer	Operator / Contractor
Christian Gunter	Alexandria Real Estate Equities	Howard S. Wright

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
James Murphy	Howard S. Wright	206-702-3030

SWPPP Prepared By

Name	Organization	Contact Phone Number
Nicholas Buckner	Clear Water Services	(425) 412-5700

SWPPP Preparation Date
5/18/2023

Project Construction Dates

Activity / Phase	Start Date	End Date
Excavation/Shoring	May 2024	December 2024
Concrete Pours	December 2024	October 2026
Building Completion/TCO	January 2027	June 2027

Table of Contents

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Appendix/Glossary

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
s.u.	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

1 Project Information

Project/Site Name: 816 Mercer
Street/Location: 816 Mercer St.
City: Seattle State: WA Zip code: 98109
Subdivsion:
Receiving waterbody: Lake Union (Washington Lake)

1.1 Existing Conditions

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage:	2.34
Disturbed acreage:	2.34
Existing structures:	All buildings were demolished, and the property is vacant.
Landscape\topography:	The project site slopes primarily from the southwest to the northeast with a total grade drop of approximately 24 feet over 600 feet. Mercer Street slopes approximately 3.6% to the east, Dexter Avenue North slopes approximately 0.5% to the north, 9th Avenue North slopes approximately 1.9% to the northeast, and Roy Street has a maximum slope of approximately 3.7% to the east.
Drainage patterns:	Surface runoff within Roy Street flows to the curb lines where it is collected by drainage inlets and flows east along Roy Street. These drainage structures then convey the runoff to catch basins prior to discharging to the existing 24” PS that runs northeast-southwest within Roy Street before discharging into another combined sewer system downstream near Westlake Avenue North. Surface runoff within Dexter Avenue North is collected in catch basins and picked up by a private side sewer before discharging into the 84” combined sewer within Dexter Avenue North. The sewer flows north and away from the site.
Existing Vegetation:	No existing vegetation associated with this project.
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes):	N/A

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: Lake Union is category 5 listed for:

(**Bacteria, Temperature**)

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
The site currently consists of two compacted lots with existing surface related utilities and deep regional sewer infrastructure utilities. This proposed improvements consist of the construction of two 13-story above ground commercial structures with three levels of below grade parking. The building footprint will remain within the property line on all edges.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
As part of the project, frontage improvements will consist of street improvements on Mercer Street, 9th Avenue North, Dexter Street, and Roy Street. Improvements along Dexter Street, Mercer Street, and 9th Avenue North will include protection of existing curb (except at existing curb cuts), new sidewalk, and new landscaping. On the south side of Roy Street, the street will be landscaped, partially re-paved and graded to remove the curb, and bicycle access will be added. On the north side of Roy Street, the street will be repaved and graded to match the existing curb.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

Soil Segregation During Mass Excavation. Soil in the Contaminated soil management must be segregated from the non-impacted and impacted soil to prevent commingling between categories. A representative will be onsite to assist with soil segregation by conducting field screening, which will consist of visual and olfactory inspection, sheen testing, and PID testing.

- Temporary Stockpiling Permitted. If needed and practical, it is permissible for Contaminated soil to be temporarily stockpiled on site prior to loading into trucks or containers for transport. Stockpile management requirements are as follows:
- All stockpiles must be separated from underlying soil if the underlying soil is within the impacted and non-impacted/clean soil. Materials used for separating stockpiles can include preserving pavement for stockpiling, lining with plastic sheeting of at least 10-mil minimum thickness, or steel plates.
- All stockpiles must be covered with plastic sheeting of 6-mil minimum thickness when not in use, including overnight, and the cover must be anchored to prevent it from being disturbed by wind.
- Loading and Transportation/Trucking. Soil excavated from the Contaminated soil management category will be loaded into trucks, roll-off bins, or similar container for transport to the selected treatment/disposal facility. A tracking procedure must be developed and implemented by the earthworks contractor and transportation and disposal manifests and weight tickets for every truck or container must be provided to Aspect (see Section 8.1).

 Disposal Facilities. Excavated and loaded Contaminated soil will be transported to the disposal facility identified by the general contractor and earthworks contractor. Facilities in the Seattle area that are permitted to accept contaminated soil include:
 Republic Services' Regional Roosevelt Landfill in Klickitat County, Washington. A transfer station for this landfill is in Seattle.
 Waste Management's Columbia Ridge Landfill in Arlington, Oregon. A transfer station for this landfill is in Seattle.
 CADMAN's landfill and thermal treatment facility located in Everett, Washington, (also known as CEMEX) as "Class 3 Petroleum Contaminated Soil".

Any potential groundwater encountered may require treatment prior to discharge and may require discharge authorizations issued by King County and/or the City of Seattle. It is the responsibility of the General Contractor to obtain discharge permits and ensure treatment is conducted so contaminant concentrations in groundwater meet the discharge criteria prior to discharge. See Appendix G for more information on historical contamination of the site.

- All site water will be captured and treated using a DOE approved CESF system with Granular Activated Carbon.

2 Construction Stormwater Best Management Practices (BMPs)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e., hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

- BMPs are consistent with the most current approved edition of the Stormwater Management Manual for Western Washington (SWMMWW) at sites west of the crest of the Cascade Mountains, at the time the NPDES CSWGP was issued.
- Location of each BMP on the project is noted on the TESC Plan map in Appendix A.
- Corresponding Ecology source control BMPs and runoff conveyance and treatment BMPs are included in Appendix B.

SWMMWW Volume II.
https://fortress.wa.gov/ecy/publications/SummaryPages/1410055.html

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

Construction fencing and High visibility silt fencing will be installed at the limits of the project site.

List and describe BMPs:

- BMP C103: High Visibility Fence will be installed at the boundaries of the site.

Installation Schedules: Prior to start of work

Inspection and Maintenance plan: High Visibility Fence will be inspected daily to verify compliance with BMP C103 and positioned to maintain an adequate boundary for safety and site delineation.

Responsible Staff: The contractor will be responsible for installation, inspection and maintenance of the High Visibility Fence. CESCL will also inspect fencing.

2.1.2 Element 2: Establish Construction Access

All material for export during the demo and excavation phase will be loaded directly from the site onto trucks on Roy Street. Uncontrolled dirt will be managed with mechanical street sweepers or manual push broom sweeping. Construction vehicle access and exit shall be limited to one route within project working areas. If sediment is tracked off site, the affected roadway will be swept thoroughly as needed to prevent track out. If track out cannot be effectively prevented with use of existing BMPs, BMP C106: wheel wash will be installed. Chain link fence will be used to restrict vehicle access to the designed locations.

List and describe BMPs:

- BMP C105: Stabilized Construction Entrance / Exit
- BMP C106: Wheel Wash if necessary

Installation Schedules: Prior to start of work

Inspection and Maintenance plan: The onsite, paved haul route and entrance will be swept as necessary to avoid track out. The Wheel Wash will be maintained as recommended by the manufacturer and inspected daily to ensure that it is compliance with BMP C106: wheel wash. Water from the wheel wash will be removed from the site and transported to a DOE approved disposal facility. The contractor and/or the CESCL will inspect the site entrance whenever work is scheduled.

Responsible Staff: The contractor will be responsible for the installation, inspection and maintenance of construction access, and the on-site haul route.

2.1.3 Element 3: Control Flow Rates

All on site stormwater will be collected and conveyed to stormwater treatment system meeting the requirements of BMP C250: Construction Stormwater Treatment, and BMP C251: Construction Stormwater Filtration. The stormwater treatment system will discharge to an approved City of Seattle catch basin. Stormwater structures downstream of the discharge point will be monitored to verify that the design capacity is not exceeded by discharge from the stormwater treatment system. BMP C233: Silt Fence and BMP C235: Wattles will be installed if necessary, to sheet flow velocity on the project site. Water will be allowed to collect in the Temporary Sediment Trap.

Will you construct stormwater retention and/or detention facilities?
☐Yes ☒No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?
☐Yes ☒ No

List and describe BMPs:

- BMP C250: Construction Stormwater Chemical Treatment
- BMP C251: Construction Stormwater Filtration
- BMP C200: Interceptor Swale, BMP C240 Sediment trap
- BMP C235: Wattles

Installation Schedules: BMP C250 Construction Stormwater Chemical Treatment, BMP C251 Construction Stormwater Filtration, BMP C200 Interceptor Swale, and BMP C240 Sediment trap will be installed prior to the start of work. BMP C233 Silt Fence and BMP C235 Wattled will be installed as required.

Inspection and Maintenance plan: The stormwater treatment system will be inspected daily or prior to each operational period to verify compliance with BMP C250 and BMP C251. BMP C200 Interceptor Swale, BMP C240 Sediment trap, BMP C233 Silt Fence and BMP C235 Wattles will be inspected daily to verify compliance with BMP specifications.

Responsible Staff: The contractor will retain a Washington State Department of Ecology certified CESF operator who will be responsible for the installation and operation of the stormwater treatment system. The contractor will be responsible for the installation, inspection, and maintenance of BMP C200 Interceptor Swale, BMP C240 Sediment trap.

2.1.4 Element 4: Install Sediment Controls

All dewatering and stormwater will be directed to a Construction Stormwater Treatment system meeting the requirements of BMP C250 Construction Stormwater Chemical Treatment and BMP 251 Construction Stormwater Filtration. BMP C200 interceptor swale will prevent sediment transport and reduce flow rates. BMP C240 sediment trap will be constructed to collect stormwater. BMP C235 Wattles and BMP C233 Silt Fence will be installed as necessary to limit sheet flow velocity on the project.

List and describe BMPs:

- BMP C250: Construction Stormwater Chemical Treatment
- BMP C251: Construction Stormwater Filtration
- BMP C200: Interceptor Swale
- BMP C240: Sediment trap
- BMP C235: Wattles
- BMP C233: Silt Fence

Installation Schedules: BMP C250 Construction Stormwater Chemical Treatment, BMP C251 Construction Stormwater Filtration, BMP C200 Interceptor Swale, and BMP C240 Sediment trap will be installed prior to the start of work. BMP C233 Silt Fence and BMP C235 Wattles will be installed as required.

Inspection and Maintenance plan: The stormwater treatment system will be inspected daily or prior to each operational period to verify compliance with BMP C250 and BMP C251. BMP C200 Interceptor Swale, BMP C240 Sediment trap, BMP C233: Silt Fence and BMP C235 Wattles will be inspected daily to verify compliance with BMP specifications.

Responsible Staff: The contractor will retain a Washington State Department of Ecology certified CESF operator who will be responsible for the installation and operation of the stormwater treatment system. The contractor will be responsible for the installation, inspection, and maintenance of BMP C200 Interceptor Swale, BMP C240 Sediment trap.

2.1.5 Element 5: Stabilize Soils

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: April 2024 End date: June 2027

Will you construct during the wet season?

☒ Yes ☐ No

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, excavation slopes will be stabilized as soon as possible, and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels. Construction activities shall be scheduled in a way that limits the amount of time soil is exposed throughout the duration of the project

List and describe BMPs:

- BMP C123: Plastic covering
- BMP C130: Surface Roughening

Installation Schedules: As required

Inspection and Maintenance plan: The CESCL will inspect soil stabilization BMPs weekly.

Responsible Staff: The contractor will be responsible for the installation and maintenance of plastic covering and surface roughening. The CESCL will inspect soil stabilization BMPs weekly and after rain events.

2.1.6 Element 6: Protect Slopes

The project area does not include any steep slopes. No work will take place near steep slopes.

Will steep slopes be present at the site during construction?
☐ Yes ☒ No

List and describe BMPs: N/A

Installation Schedules: N/A

Inspection and Maintenance plan: N/A

Responsible Staff: N/A

2.1.7 Element 7: Protect Drain Inlets

All operable storm drain inlets shall be protected to prevent unfiltered or untreated water from entering the drainage and conveyance system. Storm drain inlet protection utilizing catch basin inserts and fabric filter shall be serviced and maintained. Storm drain inlet protection (BMP C220) will be implemented for all drainage inlets that could potentially be impacted by sediment laden runoff on or near the project sited. Straw wattles may also be placed around catch basins to prevent larger debris and sediment from entering the storm drain system.

List and describe BMPs:

- BMP C220: Storm Drain Inlet Protection
- BMP C235: Wattles

Installation Schedules: BMP C220 Storm Drain Inlet Protection will be installed prior to the start of work and BMP C23: Wattles will be installed as required

Inspection and Maintenance plan: Catch basin inserts will be maintained as recommended by the manufacturer and inspected daily to verify compliance with BMP C220 Storm Drain Inlet Protection; free of physical damage and not impacted with sediment.

Responsible Staff: The contractor will be responsible for the installation, inspection and maintenance of BMP C220 Storm Drain Inlet Protection. CESCL will also inspect weekly and after rain events.

2.1.8 Element 8: Stabilize Channels and Outlets

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

List and describe BMPs:

- BMP C207: Rock Check Dams

Installation Schedules: As Required

Inspection and Maintenance plan: The CESCL will inspect stabilized channels and outlets BMPs weekly.

Responsible Staff: The contractor will be responsible for the installation and maintenance of Rock check damns. CESCL will inspect stabilized channels and outlets BMPs weekly and after rain events.

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutants (detected in Hart Crowser samples, see Appendix G)
COPCs in Soil- • cis-1,2-Dichloroethene • Methylene chloride • Tetrachloroethene • Trichloroethene • Vinyl chloride • Benzo(a)pyrene • cPAHs-TEQ • Gasoline Range Organics • Arsenic • Lead • Selenium COPCs in Groundwater • Benzene • 1,1-Dichloroethene • 1,2-Dichloroethane • cis-1,2-Dichloroethene • Methylene chloride • Tetrachloroethene • Trichloroethene • Vinyl chloride • 1-Methylnaphthalene • Gasoline Range Organics • Diesel Range Organics • Heavy Oils • Arsenic • Barium • Cadmium • Chromium • Lead • Mercury
Sediment from exposed soils
pH related to concrete work
Dust from excavating and grading activities
Fuel (in vehicles and equipment)
Hydraulic fluid (in heavy equipment)
Petroleum hydrocarbon
Diesel- and heavy oil-range
VOC’s
Metals

All pollutants, including waste materials and demolition debris, that are generated on site during construction activities shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well-organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Excavation dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, asphalt, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).
- Process water and slurry resulting from saw-cutting and surfacing operations will be prevented from entering the waters of the State by implementing Saw-cutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

List and describe BMPs:

- BMP C151: Concrete Handling
- BMP C153: Material Delivery, Storage and Containment
- BMP C140: Dust Control
- BMP C123: Plastic covering
- BMP C252: pH Control for High pH Water

Installation Schedules: As required

Inspection and Maintenance plan: BMPs will be inspected daily by the contractor and weekly by the CESCL.

Responsible Staff: The contractor will be responsible for monitoring sediment control and materials handling daily. The CESCL will inspect all BMPs weekly and after rain events.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?
☒ Yes ☐ No

Any fueling, repair, or maintenance of vehicles machinery, or equipment will take place over secondary containment. Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

List and describe BMPs:

- BMP C153: Material Delivery, Storage and Containment

Installation Schedules: As required/ Immediately

Inspection and Maintenance plan: The contractor will be responsible for creation and implementation of a Spill Prevention, Control, and Countermeasure Plan.

Responsible Staff: The contractor will be responsible for the safe handling, transportation and storage of any pollution generating sources on site.

Will wheel wash or tire bath system BMPs be used during construction?
☒ Yes ☐ No

List and describe BMPs:

- BMP C106: Wheel Wash

Installation Schedules: As Required

Inspection and Maintenance plan: The Wheel Wash will be maintained as recommended by the manufacturer and inspected daily to ensure that it is compliance with BMP C106: wheel wash. Water from the wheel wash will be removed from the site and transported to a DOE approved disposal facility.

Responsible Staff: The contractor will be responsible for the installation, inspection and maintenance of the wheel wash The CESCL will inspect all BMPs weekly and after rain events.

Will pH-modifying sources be present on-site?
☒ Yes ☐ No

Table 2 – pH-Modifying Sources

☐	None
☒	Bulk cement
☐	Cement kiln dust
☐	Fly ash
☐	Other cementitious materials
☒	New concrete washing or curing waters
☐	Waste streams generated from concrete grinding and sawing
☐	Exposed aggregate processes
☐	Dewatering concrete vaults
☒	Concrete pumping and mixer washout waters
☒	Recycled concrete
☐	Recycled concrete stockpiles
☐	Other (i.e., calcium lignosulfate) [please describe:]

List and describe BMPs:

- BMP C252 pH Control for High pH Water
- BMP C250 Construction Stormwater Treatment

Installation Schedules: As required

Inspection and Maintenance plan: control of pH modifying materials will take place as needed.

Responsible Staff: BMPs will be inspected daily by the contractor and weekly by the CESCL.

Adjust pH of stormwater if outside the range of 6.5 to 8.5 s.u.

Obtain written approval from Ecology before using chemical treatment with the exception of CO2 or dry ice to modify pH.

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

Will uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters?
☐ Yes ☒ No

List and describe BMPs: N/A

Installation Schedules: N/A

Inspection and Maintenance plan: N/A

Responsible Staff: N/A

2.1.10 Element 10: Control Dewatering

All stormwater and water produced from dewatering will be assumed to be contaminated. All site water will be directed to a Construction Stormwater Treatment system meeting the requirements of BMP C250 Construction Stormwater Chemical Treatment, and BMP C251 Construction Stormwater Filtration. The system will include additional adsorptive media filtration. Granular activated carbon will be installed, providing 10-minute of empty bed contact time. Construction Stormwater treatment and filtration will be used to meet permitted turbidity, pH limits for the sites discharge, and treat for contamination. The stormwater treatment system will discharge to an approved City of Seattle stormwater catch basin along Roy Street located at the northeast corner of the project site. Stormwater structures downstream of the discharge point will be monitored to ensure that the design capacity is not exceeded.

Table 3 – Dewatering BMPs

☐	Infiltration
☐	Transport off-site in a vehicle (vacuum truck for legal disposal)
☒	Ecology-approved on-site chemical treatment or other suitable treatment technologies
☐	Sanitary or combined sewer discharge with local sewer district approval (last resort)
☐	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

List and describe BMPs: All site water will be captured and treated using a DOE approved Chemically Enhanced Sand Filtration (CESF) system with Granular Activated Carbon.

Installation Schedules: Prior to the start of work

Inspection and Maintenance plan: control of pH modifying materials will take place inside the treatment system.

Responsible Staff: The stormwater treatment system will be inspected by a certified CESF operator.

Adjust pH of stormwater if outside the range of 6.5 to 8.5 su.

Obtain written approval from Ecology before using chemical treatment with the exception of CO2 or dry ice to modify pH.

2.1.11 Element 11: Maintain BMPs

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
    - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 4 – Management

☒	Design the project to fit the existing topography, soils, and drainage patterns
☒	Emphasize erosion control rather than sediment control
☒	Minimize the extent and duration of the area exposed
☒	Keep runoff velocities low
☒	Retain sediment on-site
☒	Thoroughly monitor site and maintain all ESC measures
☒	Schedule major earthwork during the dry season
☐	Other (please describe)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
Entire Project	BMP C103: High Visibility Fence	Before start of construction	Wet & Dry
Entire Project	BMP C105: Stabilized Construction Entrance	Before start of construction	Wet & Dry
Entire Project	BMP C107: Construction Road/Parking Area Stabilization	Before start of construction	Wet & Dry
Entire Project	BMP C235: Wattles	As required	Wet & Dry
Entire Project	BMP C220: Storm Drain Inlet Protection	Before start of construction	Wet & Dry
Concrete Pours	BMP C151: Concrete Handling	Prior to concrete work	Wet & Dry
Entire Project	BMP C153: Material Delivery, Storage and Containment	Before start of construction	Wet & Dry
Entire Project	BMP C123: Plastic covering	As required	Wet & Dry
Start of Excavation	BMP C250: Construction Stormwater Treatment System	Before start of Excavation	Wet & Dry
Start of Excavation	BMP C251: Construction Stormwater Filtration	Before start of Excavation	Wet & Dry
Start of Excavation	BMP C252: pH Control for high pH Water	As required	Wet & Dry
Entire Project	BMP C240: Sediment Trap	During Excavation	Wet & Dry
Entire Project	BMP C140: Dust Control	As required	Wet & Dry
Entire Project	BMP C200: Interceptor Swale	During Excavation	Wet & Dry

2.1.13 Element 13: Protect Low Impact Development (LID) BMPs

There is no plan for Low Impact Development BMPs to be implemented during this project for the purpose of stormwater control.

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	James Murphy	206-702-3030
Resident Engineer		
Emergency Ecology Contact	Charles Hackel	(425) 213-9832
Emergency Permittee/ Owner Contact	Christian Gunter	(206) 512-9088
Non-Emergency Owner Contact	Christian Gunter	(206) 512-9088
Monitoring Personnel	TBD	
Ecology Regional Office	Northwest Regional Office	(206) 594-0000

4 Monitoring and Sampling Requirements

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

The Ecology-provided sample monitoring form is included as Appendix D.

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

Based on the AO, no water from the treatment system can be discharged until it is sampled for all parameters and meets compliance with all of the indicator levels in AO Table 1. This should be done for the first two batches of accumulated water in the system. If samples from those first two batches comply, then a formal request will be made to Ecology for approval from WQP to begin continuous discharging and weekly sampling. During the batch sampling process all water from the treatment system will be re-routed to the treatment system tanks, until benchmark levels are met for surface water discharge.

Additional storage tanks will be mobilized if benchmark levels are not met for added storage capacity.

4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

Table 8 – Turbidity Sampling Method

☒	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
☐	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
3. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours.
    - **Central Region** (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/CRO_nerts_online.html
    - **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/ERO_nerts_online.html
    - **Northwest Region** (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (206) 594-0000 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/NWRO_nerts_online.html
    - **Southwest Region** (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/SWRO_nerts_online.html
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.

    - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
    - 1% - 10% over background turbidity, if background is 50 NTU or greater
- The discharge stops or is eliminated.

4.2.2 pH Sampling

pH monitoring is required for "Significant concrete work" (i.e., greater than 1000 cubic yards poured concrete over the life of the project). The use of recycled concrete or engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 s.u. using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH:

Table 9 – pH Sampling Method

☒	pH meter
☐	pH test kit
☐	Wide range pH indicator paper

5 Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies

5.1 303(d) Listed Waterbodies

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

☐ Yes ☒ No

List the impairment(s):

Lake Union

- Bacteria

5.2 TMDL Waterbodies

Waste Load Allocation for CWSGP discharges:

Not listed as a TMDL project

Discharges to TMDL receiving waterbodies will meet in-stream water quality criteria at the point of discharge.

The Construction Stormwater General Permit Proposed New Discharge to an Impaired Water Body form is included in Appendix F.

6 Reporting and Record Keeping

6.1 Record Keeping

6.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

6.1.2 Records Retention

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

6.2 Reporting

6.2.1 Discharge Monitoring Reports

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month. DMRs will be reported online through Ecology's WQWebDMR System.

6.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

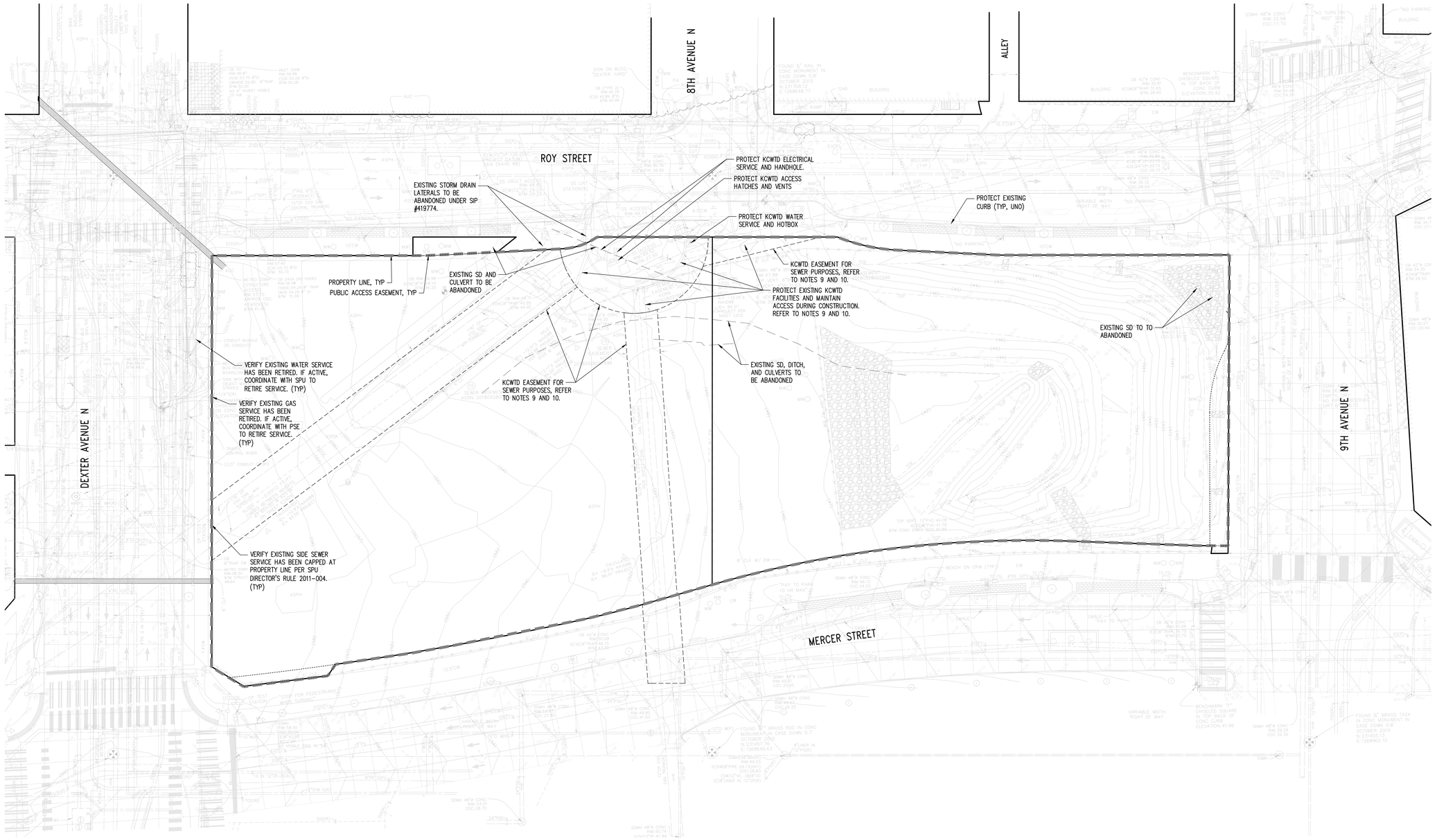
- **Central Region** at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County
- **Eastern Region** at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- **Northwest Region** at (206) 594-0000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- **Southwest Region** at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

A. Site Map
B. BMP Detail
C. Correspondence
D. Site Inspection Form
E. Construction Stormwater General Permit (CSWGP)
F. Discharge to an Impaired Water Body Form
G. Contaminated Site Information



NOTES

1. ALL EXISTING SURFACE IMPROVEMENTS AND UNDERGROUND STRUCTURES/UTILITIES WITHIN THE ON-SITE DEMOLITION LIMITS SHALL BE DEMOLISHED, UNLESS OTHERWISE NOTED, AND DISPOSED OF OFF-SITE IN A LEGAL MANNER.
2. COORDINATE WITH PSE FOR ALL ABANDONING, CAPPING, AND REMOVAL/RELOCATION OF PSE'S GAS SERVICES AS INDICATED.
3. COORDINATE WITH SPU FOR ALL ABANDONING, RETIRING, CAPPING, AND REMOVAL OF SPU'S WATER SERVICES AS INDICATED.
4. PROTECT AND MAINTAIN UNINTERRUPTED UTILITY SERVICE TO EXISTING NEIGHBORING BUILDINGS DURING DEMOLITION AND CONSTRUCTION.
5. CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF ALL UTILITIES PRIOR TO DEMOLITION OR CONSTRUCTION ACTIVITIES. ALL EXISTING UTILITIES AND IMPROVEMENTS IN THE PUBLIC RIGHT-OF-WAY, ABOVE AND BELOW GRADE, SHALL BE PROTECTED UNLESS NOTED OTHERWISE.
6. MAINTAIN PEDESTRIAN AND VEHICULAR ACCESS FOR ADJACENT PROPERTIES THROUGHOUT CONSTRUCTION.
7. ALL DISTURBED PAVEMENT IN PUBLIC RIGHT-OF-WAY SHALL BE REPLACED PER COS STANDARD PLANS AND SDOT DIRECTOR'S RULE 01-2017 "RIGHT-OF-WAY OPENING AND RESTORATION RULES". REFER TO PROJECT STREET IMPROVEMENT PERMIT (SIP) PLANS FOR FINAL IMPROVEMENTS.
8. CONTRACTOR SHALL PERFORM PRE-CONSTRUCTION AND POST-CONSTRUCTION TELEVISION INSPECTION OF SPU MAINLINE SEWER AND STORM DRAINAGE PIPE LOCATED WITHIN TEN FEET (OR WITHIN TWENTY FEET IF MAINLINES ARE THIRTY FEET OR MORE FROM THE SITE PROPERTY LINE) OF ANY PROPOSED SHORING ELEMENT. TELEVISION INSPECTION SHALL CONFORM TO COS STANDARD SPECIFICATION 7-17.3(3)G. COPIES OF THE TELEVISION INSPECTIONS SHALL BE PROVIDED TO SPU PRIOR TO THE PRECONSTRUCTION MEETING.
9. KCWTD OWNS AND OPERATES FACILITIES LOCATED ON THE PROJECT PARCELS. THE KC DROP STRUCTURE, LOCATED JUST SOUTH OF THE ROY/8TH INTERSECTION, HAS SURFACE ELEMENTS THAT WILL BE PROTECTED IN PLACE AND BE INCORPORATED INTO THE PROPOSED SITE IMPROVEMENTS. KCWTD'S LARGE COMBINED SEWER OVERFLOW PIPES AND DROP STRUCTURE WILL BE PROTECTED DURING CONSTRUCTION OF THE BELOW GRADE STRUCTURE AND ASSOCIATED SHORING. THESE FACILITIES, CLEARANCES, MAINTENANCE, AND ACCESSIBILITY REQUIREMENTS ARE DOCUMENTED IN AN "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996. COORDINATE INSPECTION AND MONITORING REQUIREMENTS WITH KCWTD PRIOR TO BEGINNING EXCAVATION ACTIVITIES.
10. ALL CONSTRUCTION AND DEVELOPMENT ACTIVITIES SHALL COMPLY WITH THE TERMS OF THIS "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996.
11. CONTRACTOR, IN COORDINATION WITH PROJECT'S GEOTECHNICAL ENGINEER, SHALL PERFORM PRE-, DURING, AND POST-CONSTRUCTION INSPECTIONS AND MONITORING OF KCWTD'S LARGE COMBINED SEWER OVERFLOW PIPES AND DROP STRUCTURE, AS COORDINATED WITH KCWTD PRIOR TO BEGINNING EXCAVATION AND CONSTRUCTION ACTIVITIES

CONTRACTOR IS ALERTED TO THE FACT THAT WORK WILL BE ACCOMPLISHED AROUND ENERGIZED SEATTLE CITY LIGHT (SCL) AND ACTIVE PUGET SOUND ENERGY (PSE) FACILITIES THAT ARE SERVING EXISTING CUSTOMERS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO DETERMINE ANY REQUIRED CONSTRUCTION SEQUENCING, AND SHALL IMPLEMENT SAFETY PROCEDURES PER SCL AND PSE REQUIREMENTS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO PROVIDE FACILITIES THAT MAINTAIN SERVICES TO CUSTOMERS THROUGHOUT CONSTRUCTION.

LEGEND

- CONSTRUCTION FENCING AND COMPOST SOCK
- ON-SITE DEMOLITION LIMITS
- PROPERTY LINE
- KCWTD EASEMENT
- PUBLIC ACCESS EASEMENT

N

0 10 20 40

1 inch = 20 feet

811 Know what's below. Call before you dig.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

JOELLE R. CHAMBERS
STATE OF WASHINGTON
30799
REGISTERED
PROFESSIONAL ENGINEER

NOT FOR CONSTRUCTION

ARE 816 MERCER

CAMPUS

GMP SET

6/6/2022

REVISIONS

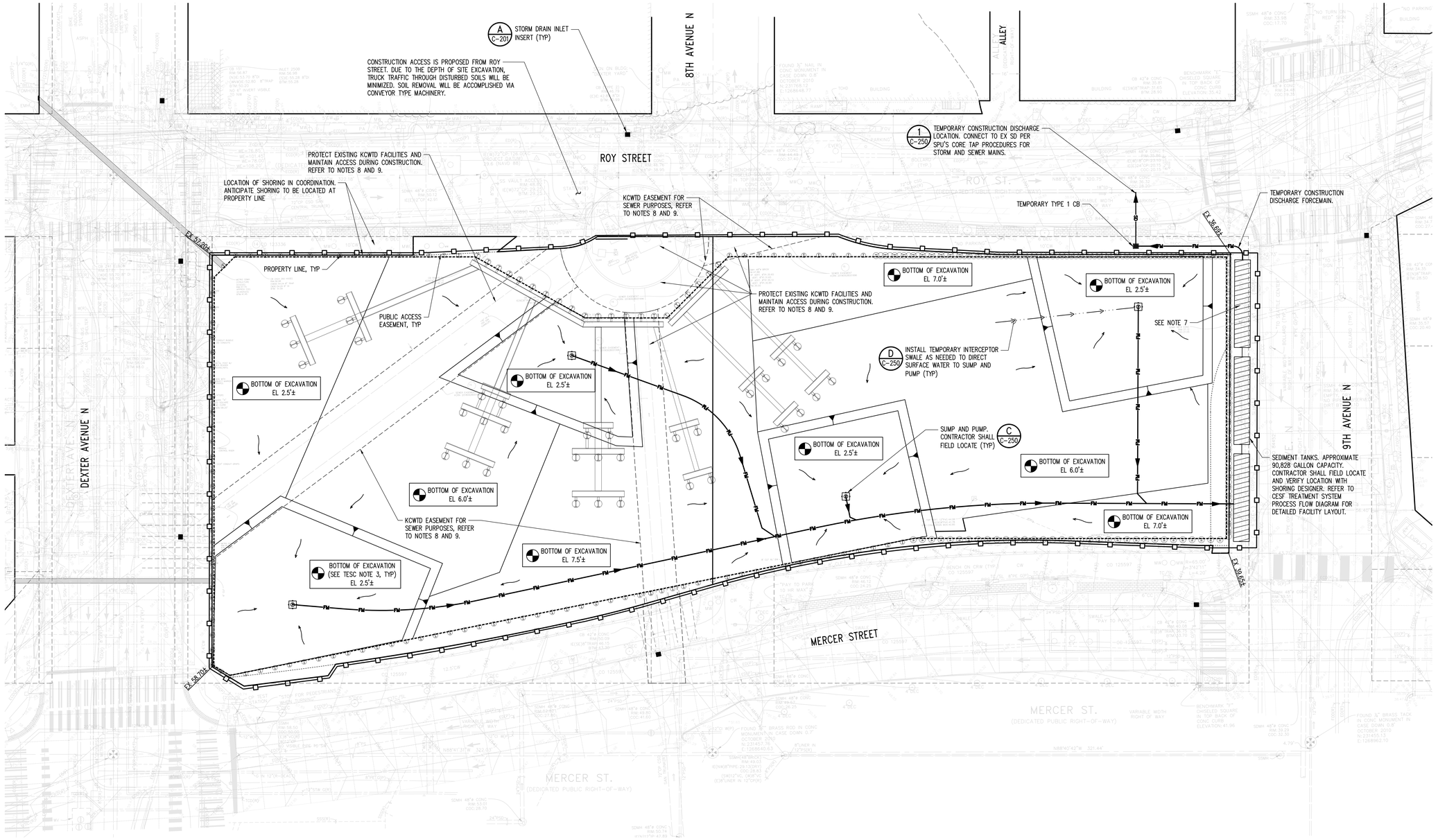
MARK	DATE	DESCRIPTION

SCALE	PROJECT ARCHITECT
REFER TO PLAN	JC/HL/SB

PROJECT NUMBER 102482.00

SHEET NAME
DEMOLITION PLAN

SHEET NUMBER
C-200



TESC NOTES:

1. CONTRACTOR SHALL COORDINATE WITH KING COUNTY INDUSTRIAL WASTE (KCIW), DEPARTMENT OF ECOLOGY (DOE), AND CITY OF SEATTLE PRIOR TO DISCHARGING CONSTRUCTION WATER FROM THIS SITE. CONTRACTOR IS RESPONSIBLE FOR OBTAINING DISCHARGE AUTHORIZATION LETTER AND SIDE SEWER PERMIT FOR TEMPORARY DEWATERING (SSPTD), AS REQUIRED BY KCIW, DOE, SDCI, AND SPU.
2. CONTRACTOR SHALL MONITOR FLOW RATE AND WATER QUALITY OF DISCHARGE INTO COMBINED KING COUNTY WASTEWATER TREATMENT DIVISION (KCWTD) SEWER OR PUBLIC STORM DRAIN SYSTEM. DISCHARGE SHALL COMPLY WITH DOE, SDCI, SPU, AND KCIW DISCHARGE REQUIREMENTS.
3. THE BOTTOM OF EXCAVATION ELEVATION SHOWN ON THIS PLAN IS AN APPROXIMATION OF THE SUBGRADE FOR THE PURPOSES OF THE TESC PLAN. REFER TO THE SHORING PLANS FOR THE LOCATION OF THE CRITICAL SUBGRADE/EXCAVATION ELEVATIONS AND SLOPES. REFER TO THE FOUNDATION PLANS FOR THE LOCATION OF THE FOUNDATION ELEMENTS, INCLUDING COLUMN FOOTINGS AND ELEVATOR PITS.
4. THIS PLAN IS INTENDED TO REFLECT THE MINIMUM EROSION AND SEDIMENTATION CONTROL MEASURES REQUIRED FOR THIS SITE. THE CONTRACTOR IS RESPONSIBLE FOR UPGRADING THESE MEASURES TO ACCOMMODATE SITE CONDITIONS, STORM EVENTS, AND TO PREVENT SEDIMENT AND SEDIMENT LADEN RUNOFF FROM LEAVING THE SITE.
5. CONTRACTOR IS RESPONSIBLE FOR DEWATERING OF THE EXCAVATION. CONTRACTOR SHALL ROUTE DEWATERING DISCHARGE TO THE ON-SITE SETTLEMENT AND TREATMENT SYSTEM TO MAINTAIN THE DISCHARGE BELOW REQUIRED TURBIDITY AND TREATMENT REQUIREMENTS.
6. AREAS OF EXPOSED SOILS SHALL BE STABILIZED TO PREVENT SEDIMENT FROM BEING TRACKED AROUND OR OFF THE SITE. STABILIZATION BMPS SHALL CONSIST OF, BUT NOT BE LIMITED TO, FILTER FENCES, PLASTIC COVERING, DUST CONTROL, AND/OR SODDING/SEEDING. THE CONTRACTOR IS RESPONSIBLE FOR UPGRADING THESE MEASURES TO ACCOMMODATE SITE CONDITIONS, STORM EVENTS, AND TO PREVENT SEDIMENT AND SEDIMENT LADEN RUNOFF FROM LEAVING THE SITE.
7. GROUNDWATER DEWATERING DISCHARGE TO COMBINED SEWERS SHALL BE METERED PRIOR TO DISCHARGE. CONTACT THE SPU SUBMETER PROGRAM OFFICE AT (206) 684-5089 TO DETERMINE THE REQUIRED METER TYPE, INSTALLATION LOCATION, BILLING INFORMATION, AND TO SCHEDULE AN INSPECTION OF THE METER AFTER INSTALLATION.
8. KCWTD OWNS AND OPERATES FACILITIES LOCATED ON THE PROJECT PARCELS. THE KC DROP STRUCTURE, LOCATED JUST SOUTH OF THE ROY/8TH INTERSECTION, HAS SURFACE ELEMENTS THAT WILL BE PROTECTED IN PLACE AND BE INCORPORATED INTO THE PROPOSED SITE IMPROVEMENTS. KCWTD'S LARGE COMBINED SEWER OVERFLOW PIPES AND DROP STRUCTURE WILL BE PROTECTED DURING CONSTRUCTION OF THE BELOW GRADE STRUCTURE AND ASSOCIATED SHORING. THESE FACILITIES, CLEARANCES, MAINTENANCE, AND ACCESSIBILITY REQUIREMENTS ARE DOCUMENTED IN AN "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996. COORDINATE INSPECTION AND MONITORING REQUIREMENTS WITH KCWTD PRIOR TO BEGINNING EXCAVATION ACTIVITIES.
9. ALL CONSTRUCTION AND DEVELOPMENT ACTIVITIES SHALL COMPLY WITH THE TERMS OF THIS "EASEMENT FOR SEWER PURPOSES", RECORDED WITH KING COUNTY AS INSTRUMENT NUMBER 20180928001996.
10. STORMWATER RUNOFF SHALL BE DIRECTED TO TEMPORARY PUMPS FOR CONVEYANCE TO TREATMENT SYSTEM. CONTRACTOR SHALL FIELD LOCATE AND SIZE PUMPS TO ACCOMMODATE FLOWS ENCOUNTERED. CONTRACTOR SHALL SUPPLY BACKUP PUMPS AS NEEDED.
11. PROJECT'S SWPPP IS BEING PREPARED BY THE DEWATERING SUBCONTRACTOR. CONTRACTOR SHALL FIELD LOCATE CONSTRUCTION STORMWATER FILTRATION SYSTEMS AND ASSOCIATED STORMWATER STORAGE VOLUME. SYSTEM CAPACITY SHALL BE RELATIVE TO DISTURBED AREA PER LOCAL AND STATE SIZING CRITERIA. FOR THE DISTURBED AREA ENCOMPASSED BY THE LIMITS OF WORK DEPICTED ON THESE PLANS, VOLUME OF STORAGE SHALL BE 90,828 GALLONS. DUE TO THE CHANGING SITE CONDITIONS, THE STORAGE VOLUME SHALL BE ADJUSTED AS NECESSARY BASED ON ACTUAL DISTURBED AREAS, WHICH MAY BE MORE OR LESS THAN THE VOLUME NOTED ABOVE. CONTRACTOR SHALL MONITOR FLOW RATE AND WATER QUALITY OF DISCHARGE INTO STORM DRAIN. INCLUDE STRUCTURAL FILTRATION OR OTHER APPROVED POST RETENTION STORMWATER QUALITY BMP, AS REQUIRED TO MEET STATE AND CITY DISCHARGE REQUIREMENTS. CONTRACTOR SHALL MONITOR DISCHARGE FLOW AND WATER QUALITY OF ALL AUTHORIZED DISCHARGES INTO SANITARY SEWER. INCLUDE SAND FILTERS AND ADDITIONAL SEDIMENTATION TANKS AS REQUIRED TO MEET KCIW DISCHARGE REQUIREMENTS. MAXIMUM DAILY DISCHARGE TO KCIW IS 25,000 GALLONS.
12. CONTRACTOR MAY ENCOUNTER CONTAMINATED OR IMPACTED GROUNDWATER AND CONSTRUCTION STORMWATER DURING DEWATERING OR EARTHWORK ACTIVITIES. COORDINATE WITH PROJECT'S ENVIRONMENTAL ENGINEER FOR DOE REQUIREMENTS AND LIST OF KNOWN CONTAMINANTS OF CONCERN. CONSTRUCTION STORMWATER MUST BE TESTED, TREATED, AND DISCHARGED AS REQUIRED BY DOE. REFER TO PROJECT SWPPP AND CLEAN-UP ACTION PLAN FOR PROPOSED CONSTRUCTION STORMWATER COLLECTION AND WATER QUALITY TREATMENT REQUIREMENTS.
13. PROTECT PROPERTIES AND RECEIVING WATERS DOWNSTREAM FROM THE DEVELOPMENT SITES FROM EROSION DUE TO INCREASES IN THE VOLUME, VELOCITY, AND PEAK FLOW RATE OF DRAINAGE WATER FROM THE PROJECT SITE.
14. PREVENT EROSION AND SEDIMENT TRANSPORT FROM THE SITE BY VEHICLES. LIMIT CONSTRUCTION VEHICLE ACCESS, WHENEVER POSSIBLE, TO ONE LOCATION. STABILIZE ALL ACCESS POINTS. PROVIDE PERIODIC STREET CLEANING BY SWEEPING OR SHOVELING ANY SEDIMENT THAT MAY HAVE BEEN TRACKED OUT. PLACE SEDIMENT IN A SUITABLE DISPOSAL AREA WHERE IT WILL NOT ERODE ANY FURTHER.
15. A SIDE SEWER PERMIT FOR TEMPORARY DEWATERING IS REQUIRED FROM SDCI PRIOR TO ANY DEWATERING OPERATIONS. TEMPORARY DEWATERING MAY BE DISCHARGED TO STORM DRAIN IF JURISDICTIONAL WATER QUALITY REQUIREMENTS ARE MET. EFFLUENT THAT DOES NOT MEET WATER QUALITY REQUIREMENTS FOR STORMWATER DISCHARGE SHALL BE DISCHARGED TO PUBLIC COMBINED SEWER. IF CONTRACTOR IS UNABLE TO DISCHARGE TO STORM DRAIN PER CIVIL PLANS, THEY SHALL COORDINATE WITH SDCI AND SPU TO OBTAIN APPROVAL FOR SEWER DISCHARGE.
16. CONTROL DEWATERING. WHEN DEWATERING DEVICES DISCHARGE ON-SITE OR TO A PUBLIC DRAINAGE SYSTEM, DEWATERING DEVICES SHALL DISCHARGE INTO A SEDIMENT TRAP TO REMOVE SEDIMENT CONTAMINATION, OR OTHER SEDIMENT REMOVAL BMP. A SEPARATE DEWATERING PERMIT IS REQUIRED FOR: ONE ACRE OR GREATER DISTURBED AREA; CONTAMINATED SURFACE AND/OR GROUNDWATER; EXCAVATION GREATER THAN 12 FEET IN DEPTH; SIGNIFICANT VOLUME OF GROUNDWATER; OTHER SITE SPECIFIC CONDITIONS LEADING TO SIGNIFICANT DEWATERING.
17. IT IS ANTICIPATED THAT EXCAVATION WILL ENCOUNTER CONTAMINATED SOILS AND GROUNDWATER. HANDLING AND DISPOSAL OF THESE MATERIALS SHALL CONFORM TO THE PROJECT'S CLEANUP ACTION PLAN, PREPARED BY THE DEPARTMENT OF ECOLOGY, DATED FEBRUARY 8, 2022.
18. REFER TO SWPPP PREPARED BY CLEAR WATER SERVICES AND DATED MARCH 15, 2022 FOR CONSTRUCTION STORMWATER MANAGEMENT.

GRADING NOTES:

1. GRADE OPEN EXCAVATION TO DRAIN TO LOW POINTS AND SUMPS AS SHOWN.
2. REFER TO SHORING, STRUCTURAL AND ARCHITECTURAL PLANS FOR EXCAVATION OF BUILDING ELEMENTS.
3. REFER TO GEOTECH FOR TEMPORARY SLOPE AND SOIL PROTECTION PRACTICES.

CONTRACTOR IS ALERTED TO THE FACT THAT WORK WILL BE ACCOMPLISHED AROUND ENERGIZED SEATTLE CITY LIGHT (SCL) AND ACTIVE PUGET SOUND ENERGY (PSE) FACILITIES THAT ARE SERVING EXISTING CUSTOMERS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO DETERMINE ANY REQUIRED CONSTRUCTION SEQUENCING, AND SHALL IMPLEMENT SAFETY PROCEDURES PER SCL AND PSE REQUIREMENTS. CONTRACTOR SHALL COORDINATE WITH SCL AND PSE TO PROVIDE FACILITIES THAT MAINTAIN SERVICES TO CUSTOMERS THROUGHOUT CONSTRUCTION.

LEGEND:

- CONSTRUCTION FENCE AND COMPOST SOCK
- TEMPORARY SHORING AND LAGGING (PER SHORING PLANS)
- TEMPORARY INTERCEPTOR SWALE
- GENERAL DIRECTION OF RUNOFF
- STORM DRAIN INLET PROTECTION
- SUMP AND PUMP
- FM FORCE MAIN
- APPROXIMATE BOTTOM OF EXCAVATION ELEVATION
- SEDIMENT TANKS
- PROPERTY LINE
- KCWTD EASEMENT
- PUBLIC ACCESS EASEMENT

N

0 10 20 40

1 inch = 20 feet

811 Know what's below. Call before you dig.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

NOT FOR CONSTRUCTION

ARE 816 MERCER

CAMPUS

GMP SET

6/6/2022

REVISIONS

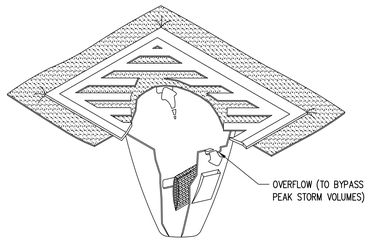
MARK	DATE	DESCRIPTION

SCALE	PROJECT ARCHITECT
REFER TO PLAN	JC/HL/SB

PROJECT NUMBER 102482.00

SHEET NAME
TESC PLAN

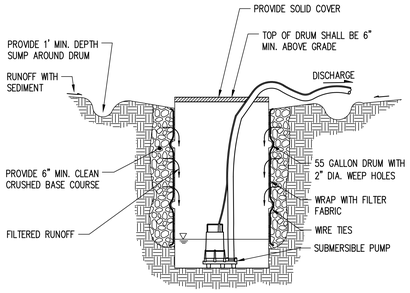
SHEET NUMBER
C-210



NOTES:

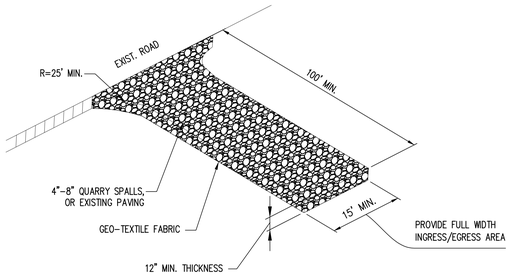
1. STORM DRAIN INLETS SHALL BE REMOVED AT THE END OF THE JOB.
2. STORM DRAIN INLETS SHALL ONLY BE INSTALLED IN DRAINAGE DEVICES PER THE MANUFACTURER'S RECOMMENDATIONS. CATCH BASIN INSERTS SHALL NOT BE INSTALLED IN CURB INLETS.
3. INSERTS SHALL BE INSPECTED AND MAINTAINED WHEN A 1/2 INCH RAIN ACCUMULATES WITHIN A 24 HOUR PERIOD. CLEAN AND/OR REPLACE INSERT WHEN HALF OF THE TRAP IS FILLED WITH SEDIMENTS.

STORM DRAIN INLET INSERT (A / C-210)
CITY OF SEATTLE DPD STANDARD DRAWING E3.30
NTS

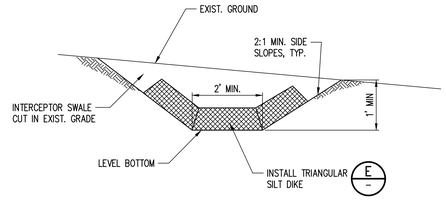


NOTE:
PUMPS SHALL BE SUBMERSIBLE, CONTRACTOR IS RESPONSIBLE FOR SIZING PUMP BASED ON FIELD CONDITIONS.

SUMP AND PUMP DETAIL (C / C-210)
NTS

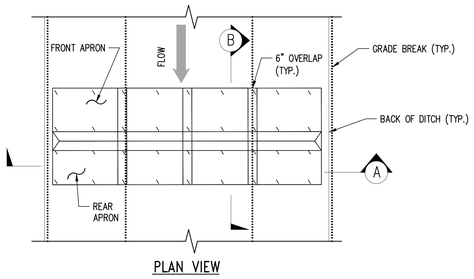


TEMPORARY CONSTRUCTION ENTRANCE (B / C-200)
CITY OF SEATTLE DPD STANDARD DRAWING E2.10
NTS

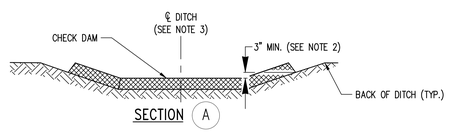


NOTE:
DAMAGE RESULTING FROM RUNOFF OR CONSTRUCTION ACTIVITY SHALL BE REPAIRED IMMEDIATELY.

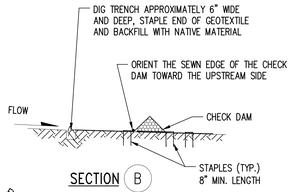
TEMPORARY INTERCEPTOR SWALE (D / C-210)
NTS



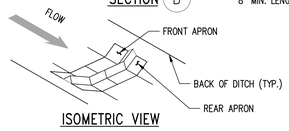
PLAN VIEW



SECTION A



SECTION B



ISOMETRIC VIEW

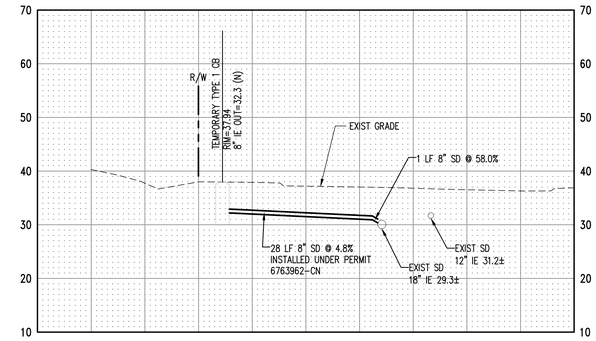
NOTES:

1. GEOTEXTILE ENCASED CHECK DAMS SHALL MEET THE REQUIREMENTS OF COS STANDARD SPECIFICATIONS 8-01.3(5)A AND 9-14.5(4).
2. INSTALL THE SLOPED ENDS OF THE CHECK DAM A MINIMUM OF 3" HIGHER THAN THE TOP OF THE CHECK DAM IN THE CHANNEL TO ENSURE THAT WATER FLOWS OVER THE DAM AND NOT AROUND IT.
3. FLAT BOTTOM DITCH DESIGN SHOWN, CHECK DAM INSTALLATION DETAILS ARE SIMILAR FOR "V" BOTTOM DITCHES.
4. PERFORM MAINTENANCE IN ACCORDANCE WITH COS STANDARD SPECIFICATION 8-01.3(14).

TRIANGULAR SILT DIKE (E / -)
CITY OF SEATTLE DPD STANDARD DRAWING E2.60

CONSTRUCTION STORMWATER CONTROL REQUIREMENTS (W/ MODIFICATIONS):

1. THE IMPLEMENTATION, CONSTRUCTION, MAINTENANCE, REPLACEMENT AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE APPLICANT/CONTRACTOR UNTIL ALL CONSTRUCTION IS APPROVED.
2. A FIRST GROUND DISTURBANCE INSPECTION IS REQUIRED PRIOR TO START OF WORK ON ALL SITES WITH LAND DISTURBING ACTIVITY.
3. SCHEDULE A FIRST GROUND DISTURBANCE INSPECTION FOR AN ISSUED BUILDING PERMIT AT 206-684-8900 OR ONLINE AT WWW.SEATTLE.GOV/DPD/PERMITS/INSPECTIONS/
4. THE APPLICANT/CONTRACTOR SHALL DESIGNATE AN EROSION AND SEDIMENT CONTROL (ESC) SUPERVISOR WHO SHALL BE RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMPS). FOR LARGE CONSTRUCTION PROJECTS, THE ESC SUPERVISOR SHOULD BE A CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL). PROVIDE THE NAME AND PHONE NUMBER OF THE ESC SUPERVISOR TO THE SITE INSPECTOR AT THE FIRST GROUND DISTURBANCE INSPECTION.
5. BMPS SHALL BE INSTALLED PRIOR TO STARTING CONSTRUCTION TO PREVENT SEDIMENT-LADEN WATER FROM LEAVING THE PROJECT SITE OR ENTERING ROADSIDE DITCHES, STORM DRAINS, SURFACE WATERS, OR WETLANDS. CONTRACTOR SHALL PROVIDE ADDITIONAL CONTROLS WHEN REQUIRED BY THE INSPECTOR OR OWNER'S REPRESENTATIVE WHEN MINIMUM CONTROLS ARE NOT SUFFICIENT TO PREVENT EROSION OR TRANSPORT OF SEDIMENT OR OTHER POLLUTANTS FROM THE SITE.
6. THE BMPS INCLUDED IN THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. THE APPLICANT IS RESPONSIBLE FOR INSTALLING, MODIFYING, AND MAINTAINING BMPS AS NEEDED FOR UNEXPECTED STORM EVENTS OR OTHER UNFORESEEN CIRCUMSTANCES, AND TO ACCOUNT FOR CHANGING SITE CONDITIONS.
7. ANY AREAS OF DISTURBED SOIL THAT WILL NOT BE WORKED FOR TWO CONSECUTIVE DAYS DURING THE WET SEASON (OCT 1 TO APRIL 30) OR SEVEN DAYS DURING THE DRY SEASON (MAY 1 TO SEPT 30) SHALL BE IMMEDIATELY STABILIZED WITH APPROVED BMPS METHODS (E.G. STRAW, MULCH, PLASTIC COVERING, COLD MIX, ETC.)
8. GRADING AND/OR SOIL DISTURBING ACTIVITIES MAY BE LIMITED OR PROHIBITED FOR CERTAIN SITES SUBJECT TO ECA STANDARDS (I.E. ECA STEEP SLOPES, LANDSLIDE PRONE AREAS, ETC.) BETWEEN OCTOBER 31ST AND APRIL 1ST. IF NOTED IN THE GEOTECHNICAL SPECIAL INSPECTIONS REQUIREMENTS, A GRADING SEASON EXTENSION LETTER (GSEL) ISSUED BY SDCI IS REQUIRED FOR ALL GRADING AND/OR SOIL DISTURBING ACTIVITIES DURING THIS PERIOD. THE GEOTECHNICAL SPECIAL INSPECTOR MUST SUBMIT ELECTRONIC APPLICATIONS FOR A GSEL USING THE SDCI PROJECT PORTAL. ALLOW FOUR TO SIX WEEKS FOR PROCESSING. FAILURE TO OBTAIN THE GSEL PRIOR TO OCTOBER 31 MAY RESULT IN A WORK STOPPAGE.
9. CITY STREETS AND SIDEWALKS SHALL BE KEPT CLEAN AT ALL TIMES. NO MATERIAL SHALL BE STORED ON CITY STREETS OR SIDEWALKS WITHOUT A STREET USE PERMIT FROM THE SEATTLE DEPARTMENT OF TRANSPORTATION (SDOT).
10. IMPLEMENT POLLUTION CONTROL MEASURES TO PREVENT LIQUID PRODUCTS OR CONTAMINATED WATER ENTERING ANY STORM DRAINAGE FACILITIES OR OTHERWISE LEAVING THE PROJECT SITE. ANY HAZARDOUS MATERIALS OR LIQUID PRODUCTS THAT HAVE THE POTENTIAL TO POLLUTE RUNOFF SHALL BE STORED AND DISPOSED OF PROPERLY.
11. WASHOUT FROM CONCRETE TRUCKS SHALL BE PERFORMED AT APPROPRIATE OFF-SITE FACILITIES OR IN DESIGNATED CONCRETE WASHOUT AREAS ONLY. DO NOT WASH OUT CONCRETE TRUCKS ONTO THE GROUND, OR TO STORM DRAINS OR OPEN DITCHES. DO NOT DUMP EXCESS CONCRETE ONSITE, EXCEPT IN DESIGNATED CONCRETE WASHOUT AREAS.
12. ALL AREAS OF DISTURBED SOIL SHALL BE FULLY STABILIZED WITH THE APPROPRIATE SOIL AMENDMENT AND COVER MEASURES AT COMPLETION OF THE PROJECT. TYPICAL COVER MEASURES INCLUDE LANDSCAPING OR HYDROSEED WITH MULCH.



TEMPORARY CONSTRUCTION DISCHARGE PROFILE (1 / C-210)
SCALE: 1" = 10'

Know what's below. Call before you dig.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

NOT FOR CONSTRUCTION

ARE 816 MERCER

CAMPUS

GMP SET

6/6/2022

REVISIONS

MARK	DATE	DESCRIPTION

SCALE: REFER TO PLAN
PROJECT ARCHITECT: JC/HL/SB
PROJECT NUMBER: 102482.00

SHEET NAME
TESC DETAILS

SHEET NUMBER
C-250

burying and smothering vegetation.

- Vegetative buffer zones for streams, lakes or other waterways shall be established by the local permitting authority or other state or federal permits or approvals.

Maintenance Standards

Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed. Replace all damaged flagging immediately. Remove all materials located in the buffer area that may impede the ability of the vegetation to act as a filter.

BMP C103: High-Visibility Fence

Purpose

High-visibility fencing is intended to:

- Restrict clearing to approved limits.
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
- Limit construction traffic to designated construction entrances, exits, or internal roads.
- Protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

High-visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high-visibility orange. The fence tensile strength shall be 360 lbs/ft using the ASTM D4595 testing method.

If appropriate install fabric silt fence in accordance with BMP C233: Silt Fence to act as high-visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.

Metal fences shall be designed and installed according to the manufacturer's specifications.

Metal fences shall be at least 3 feet high and must be highly visible.

Fences shall not be wired or stapled to trees.

Maintenance Standards

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

BMP C105: Stabilized Construction Access

Purpose

Stabilized construction accesses are established to reduce the amount of sediment transported onto paved roads outside the project site by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for project sites.

Conditions of Use

Construction accesses shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential subdivision construction sites, provide a stabilized construction access for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size and configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized accesses not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See Figure II-3.1: Stabilized Construction Access for details. Note: the 100' minimum length of the access shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').

Construct stabilized construction accesses with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction access stabilization because these products raise pH levels in stormwater and concrete discharge to waters of the State is prohibited.

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the standards listed in Table II-3.2: Stabilized Construction Access Geotextile Standards.

Table II-3.2: Stabilized Construction Access Geotextile Standards

Geotextile Property	Required Value
Grab Tensile Strength (ASTM D4751)	200 psi min.

Table II-3.2: Stabilized Construction Access Geotextile Standards (continued)

Geotextile Property	Required Value
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will be paved; this can be used as a stabilized access. Also consider the installation of excess concrete as a stabilized access. During large concrete pours, excess concrete is often available for this purpose.
- Fencing (see BMP C103: High-Visibility Fence) shall be installed as necessary to restrict traffic to the construction access.
- Whenever possible, the access shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction accesses should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction access must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Alternative Material Specification

WSDOT has raised safety concerns about the Quarry Spall rock specified above. WSDOT observes that the 4-inch to 8-inch rock sizes can become trapped between Dually truck tires, and then released off-site at highway speeds. WSDOT has chosen to use a modified specification for the rock while continuously verifying that the Stabilized Construction Access remains effective. To remain effective, the BMP must prevent sediment from migrating off site. To date, there has been no performance testing to verify operation of this new specification. Jurisdictions may use the alternative specification, but must perform increased off-site inspection if they use, or allow others to use, it.

Stabilized Construction Accesses may use material that meets the requirements of WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Section 9-03.9(1) (WSDOT, 2016) for ballast except for the following special requirements.

The grading and quality requirements are listed in Table II-3.3: Stabilized Construction Access Alternative Material Requirements.

Table II-3.3: Stabilized Construction Access Alternative Material Requirements

Sieve Size	Percent Passing
2½"	99-100

Table II-3.3: Stabilized Construction Access Alternative Material Requirements (continued)

Sieve Size	Percent Passing
2″	65-100
¾″	40-80
No. 4	5 max.
No. 100	0-2
% Fracture	75 min.

- All percentages are by weight.
- The sand equivalent value and dust ratio requirements do not apply.
- The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

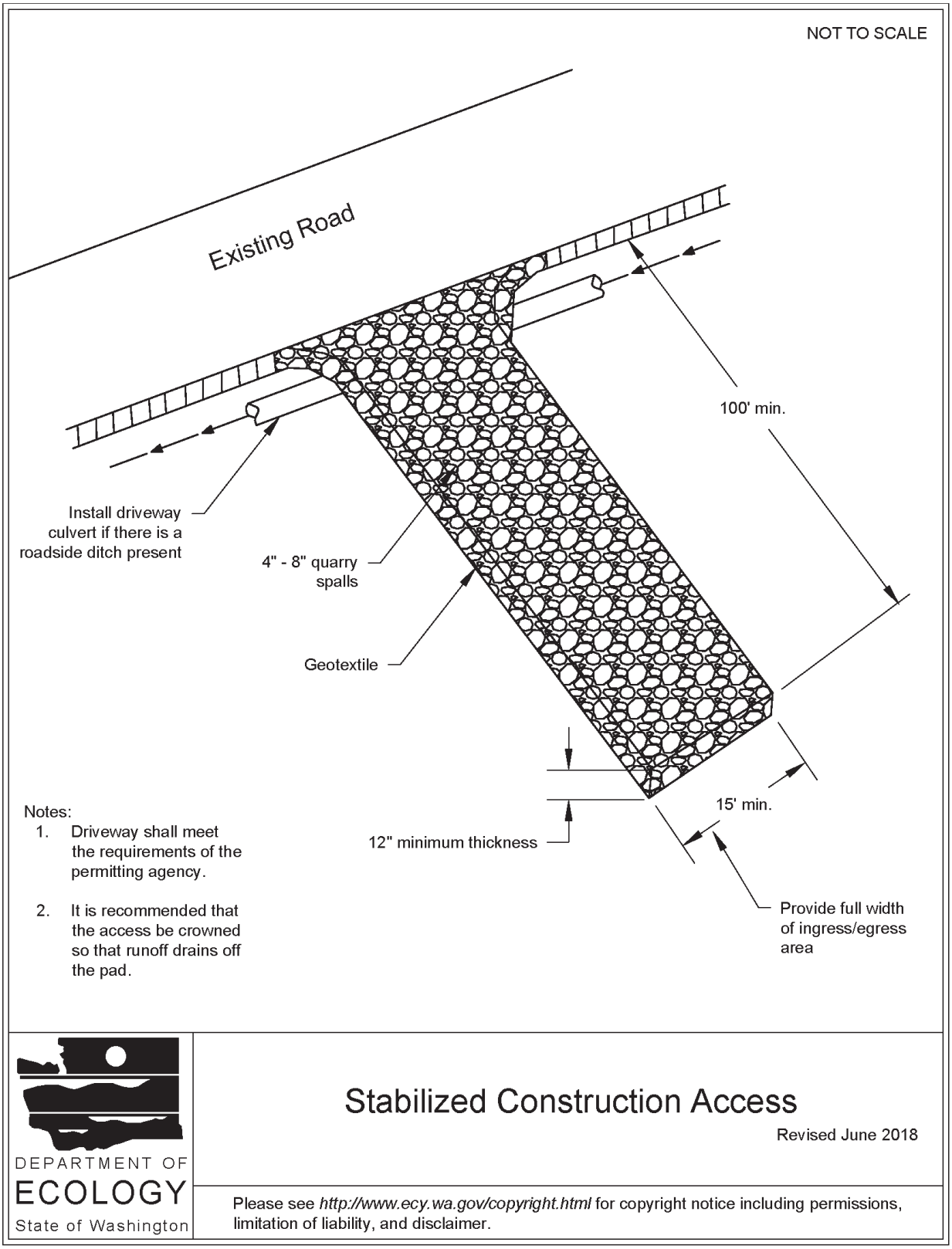
Maintenance Standards

Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the access is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the access, or the installation of BMP C106: Wheel Wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction access(es), BMP C103: High-Visibility Fence shall be installed to control traffic.

- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Figure II-3.1: Stabilized Construction Access



Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by washing dirt from the wheels of motor vehicles prior to the motor vehicles leaving the construction site.

Conditions of Use

- Use a wheel wash when BMP C105: Stabilized Construction Access is not preventing sediment from being tracked off site.
- Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.
- Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.
- Wheel wash wastewater is not stormwater. It is commonly called process water, and must be discharged to a separate on-site treatment system that prevents discharge to waters of the State, or to the sanitary sewer with local sewer district approval.
- Wheel washes may use closed-loop recirculation systems to conserve water use.
- Wheel wash wastewater shall not include wastewater from concrete washout areas.
- When practical, the wheel wash should be placed in sequence with BMP C105: Stabilized Construction Access. Locate the wheel wash such that vehicles exiting the wheel wash will enter directly onto BMP C105: Stabilized Construction Access. In order to achieve this, BMP C105: Stabilized Construction Access may need to be extended beyond the standard installation to meet the exit of the wheel wash.

Design and Installation Specifications

Suggested details are shown in Figure II-3.2: Wheel Wash. The Local Permitting Authority may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.

BMP C107: Construction Road / Parking Area Stabilization

Purpose

Stabilizing roads, parking areas, and other on-site vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or stormwater runoff.

Conditions of Use

Roads and parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.

BMP C103: High-Visibility Fence shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for roadbase stabilization, pH monitoring and BMP C252: Treating and Disposing of High pH Water is necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheetflows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation that water can flow through, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands or their buffers. If runoff is allowed to sheetflow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the drainage system (see BMP C220: Inlet Protection).

Maintenance Standards

Inspect stabilized areas regularly, especially after large storm events.

Crushed rock, gravel base, etc., shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

Perform street cleaning at the end of each day or more often if necessary.

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established.

Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.

Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.

Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See BMP T5.13: Post-Construction Soil Quality and Depth.

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. However, the relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for applications greater than six months.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- Although the plastic material is inexpensive to purchase, the cost of installation, maintenance, removal, and disposal add to the total costs of this BMP.
- Whenever plastic is used to protect slopes, install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner.
    - Pond liner in temporary sediment pond.
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
    - Emergency slope protection during heavy rains.
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.

3. Provide a minimum of 8-inch overlap at the seams.
4. On long or wide slopes, or slopes subject to wind, tape all seams.
5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.

- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C124: Sodding

Purpose

The purpose of sodding is to establish turf for immediate erosion protection and to stabilize drainage paths where concentrated overland flow will occur.

BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

Conditions of Use

Use dust control in areas (including roadways) subject to surface and air movement of dust where on-site or off-site impacts to roadways, drainage ways, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until the surface is wet. Repeat as needed. To prevent carryout of mud onto the street, refer to BMP C105: Stabilized Construction Access and BMP C106: Wheel Wash.
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection) added to water at a rate of 0.5 pounds per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may reduce the quantity of water needed for dust control. Note that the application rate specified here applies to this BMP, and is not the same application rate that is specified in BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection, but the downstream protections still apply.

  Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes

compliance with this BMP.

- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Techniques that can be used for unpaved roads and lots include:
    - Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
    - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
    - Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
    - Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
    - Encourage the use of alternate, paved routes, if available.
    - Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
    - Limit dust-causing work on windy days.
    - Pave unpaved permanent roads and other trafficked areas.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C150: Materials on Hand

Purpose

Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains. Having these materials on-site reduces the time needed to replace existing or implement new BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible

pipe, sandbags, geotextile fabric and steel “T” posts.

- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

- Clear Plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw Bales for mulching
- Quarry Spalls
- Washed Gravel
- Geotextile Fabric
- Catch Basin Inserts
- Steel "T" Posts
- Silt fence material
- Straw Wattles

Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials as needed.

BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the State.

Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction project components include, but are not limited to:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Disposal options for concrete, in order of preference are:

1. Off-site disposal
2. Concrete wash-out areas (see BMP C154: Concrete Washout Area)
3. De minimus washout to formed areas awaiting concrete

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.
    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.
- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.

- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

Check containers for holes in the liner daily during concrete pours and repair the same day.

BMP C152: Sawcutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that contains fine particles and high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created through sawcutting or surfacing from entering waters of the State.

Conditions of Use

Utilize these management practices anytime sawcutting or surfacing operations take place. Sawcutting and surfacing operations include, but are not limited to:

- Sawing
- Coring
- Grinding
- Roughening
- Hydro-demolition
- Bridge and road surfacing

Design and Installation Specifications

- Vacuum slurry and cuttings during cutting and surfacing operations.
- Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- Dispose of collected slurry and cuttings in a manner that does not violate ground water or surface water quality standards.
- Do not allow process water generated during hydro-demolition, surface roughening or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose of process water in a manner that does not violate ground water or surface water quality standards.
- Handle and dispose of cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.

Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and/or vacuum trucks.

BMP C153: Material Delivery, Storage, and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage. Minimize the storage of hazardous materials on-site, store materials in a designated area, and install secondary containment.

Conditions of Use

Use at construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g., Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds

- Hazardous chemicals such as acids, lime, adhesives, paints, solvents, and curing compounds
- Any other material that may be detrimental if released to the environment

Design and Installation Specifications

- The temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:

- 1-Water Resistant Nylon Bag
- 3-Oil Absorbent Socks 3”x 4’
- 2-Oil Absorbent Socks 3”x 10’
- 12-Oil Absorbent Pads 17”x19”
- 1-Pair Splash Resistant Goggles
- 3-Pair Nitrile Gloves
- 10-Disposable Bags with Ties
- Instructions

Maintenance Standards

- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Re-stock spill kit materials as needed.

BMP C154: Concrete Washout Area

Purpose

Prevent or reduce the discharge of pollutants from concrete waste to stormwater by conducting washout off-site, or performing on-site washout in a designated area.

Conditions of Use

Concrete washout areas are implemented on construction projects where:

- Concrete is used as a construction material
- It is not possible to dispose of all concrete wastewater and washout off-site (ready mix plant, etc.).
- Concrete truck drums are washed on-site.

  Note that auxiliary concrete truck components (e.g. chutes and hoses) and small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheel-barrows) may be washed into formed areas awaiting concrete pour.

At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of ground cover leaves a site vulnerable to erosion. Construction sequencing that limits land clearing, provides timely installation of erosion and sedimentation controls, and restores protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Minimize construction during rainy periods.
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

II-3.3 Construction Runoff BMPs

BMP C200: Interceptor Dike and Swale

Purpose

Provide a dike of compacted soil or a swale at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Use an interceptor dike or swale where runoff from an exposed site or disturbed slope must be conveyed to an erosion control BMP which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering the disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment BMP (e.g. BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary)).

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Steep grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at the top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Contributing area for an individual dike or swale should be one acre or less.
- Design the dike and/or swale to contain flows calculated by one of the following methods:
    - Single Event Hydrograph Method: The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm for the worst-case land cover condition.

      OR

    - Continuous Simulation Method: The 10-year peak flow rate, as determined by an approved continuous runoff model with a 15-minute time step for the worst-case land cover condition.

  Worst-case land cover conditions (i.e., producing the most runoff) should be used for analysis (in most cases, this would be the land cover conditions just prior to final landscaping).

Interceptor Dikes

Interceptor dikes shall meet the following criteria:

- Top Width: 2 feet minimum.
- Height: 1.5 feet minimum on berm.
- Side Slope: 2H:1V or flatter.
- Grade: Depends on topography, however, dike system minimum is 0.5%, and maximum is 1%.
- Compaction: Minimum of 90 percent ASTM D698 standard proctor.
- Stabilization: Depends on velocity and reach. Inspect regularly to ensure stability.
- Ground Slopes <5%: Seed and mulch applied within 5 days of dike construction (see BMP C121: Mulching).
- Ground Slopes 5 - 40%: Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap, or other measures to avoid erosion.
- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall

occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.

- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.
- See Table II-3.8: Horizontal Spacing of Interceptor Dikes Along Ground Slope for recommended horizontal spacing between dikes.

Table II-3.8: Horizontal Spacing of Interceptor Dikes Along Ground Slope

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

Interceptor Swales

Interceptor swales shall meet the following criteria:

- Bottom Width: 2 feet minimum; the cross-section bottom shall be level.
- Depth: 1-foot minimum.
- Side Slope: 2H:1V or flatter.
- Grade: Maximum 5 percent, with positive drainage to a suitable outlet (such as BMP C241: Sediment Pond (Temporary)).
- Stabilization: Seed as per BMP C120: Temporary and Permanent Seeding, or BMP C202: Riprap Channel Lining, 12 inches thick riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

Maintenance Standards

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.
- Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

thickness is 2 feet.

- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See BMP C122: Nets and Blankets.

- Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See I-2.11 Hydraulic Project Approvals.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table II-3.10: Storm Drain Inlet Protection lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding may occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

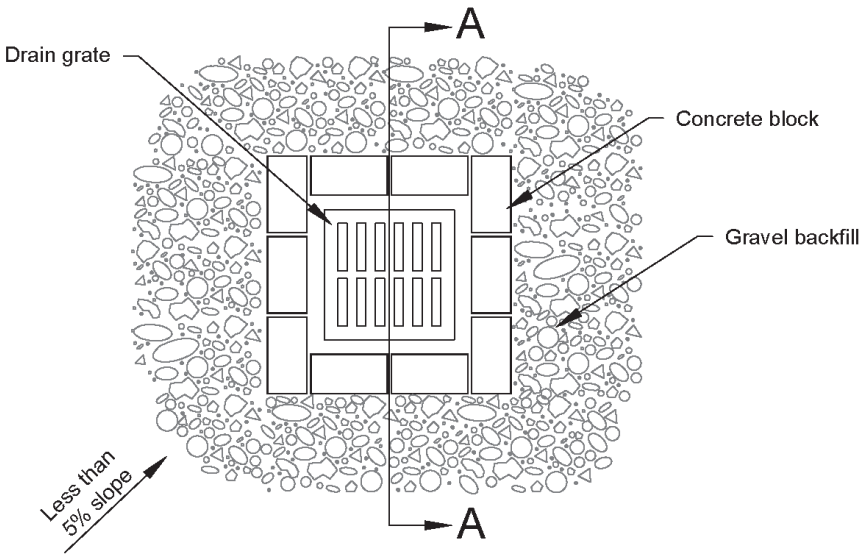
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

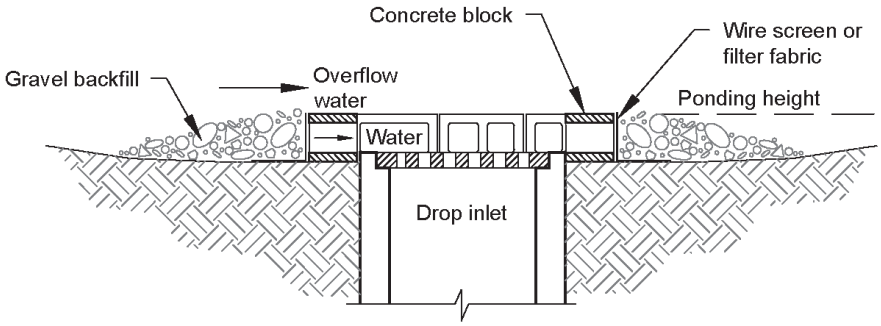
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
    - Provide a slope of 3H:1V on the upstream side of the berm.
    - Provide a slope of 2H:1V on the downstream side of the berm.
    - Provide a 1-foot wide level stone area between the gravel berm and the inlet.
    - Use stones 3 inches in diameter or larger on the upstream slope of the berm.
    - Use gravel ½- to ¾-inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-3.17: Block and Gravel Filter



Plan View



Section A-A

Notes:

1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

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Block and Gravel Filter

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Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with ½-inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
    - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

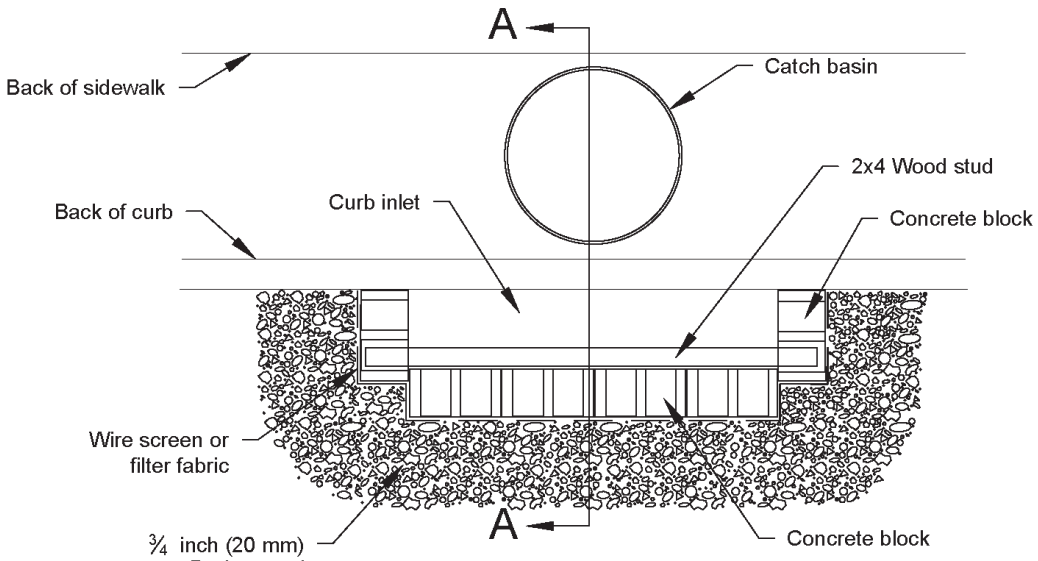
- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

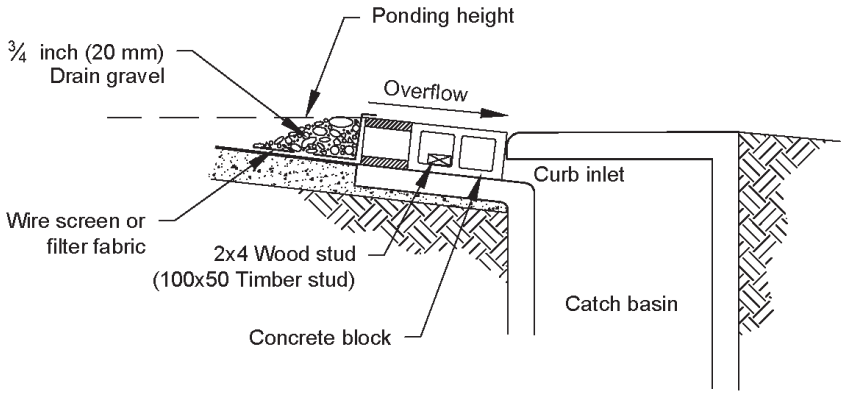
Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Figure II-3.18: Block and Gravel Curb Inlet Protection



Plan View



Section A-A

Notes:

1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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State of Washington

Block and Gravel Curb Inlet Protection

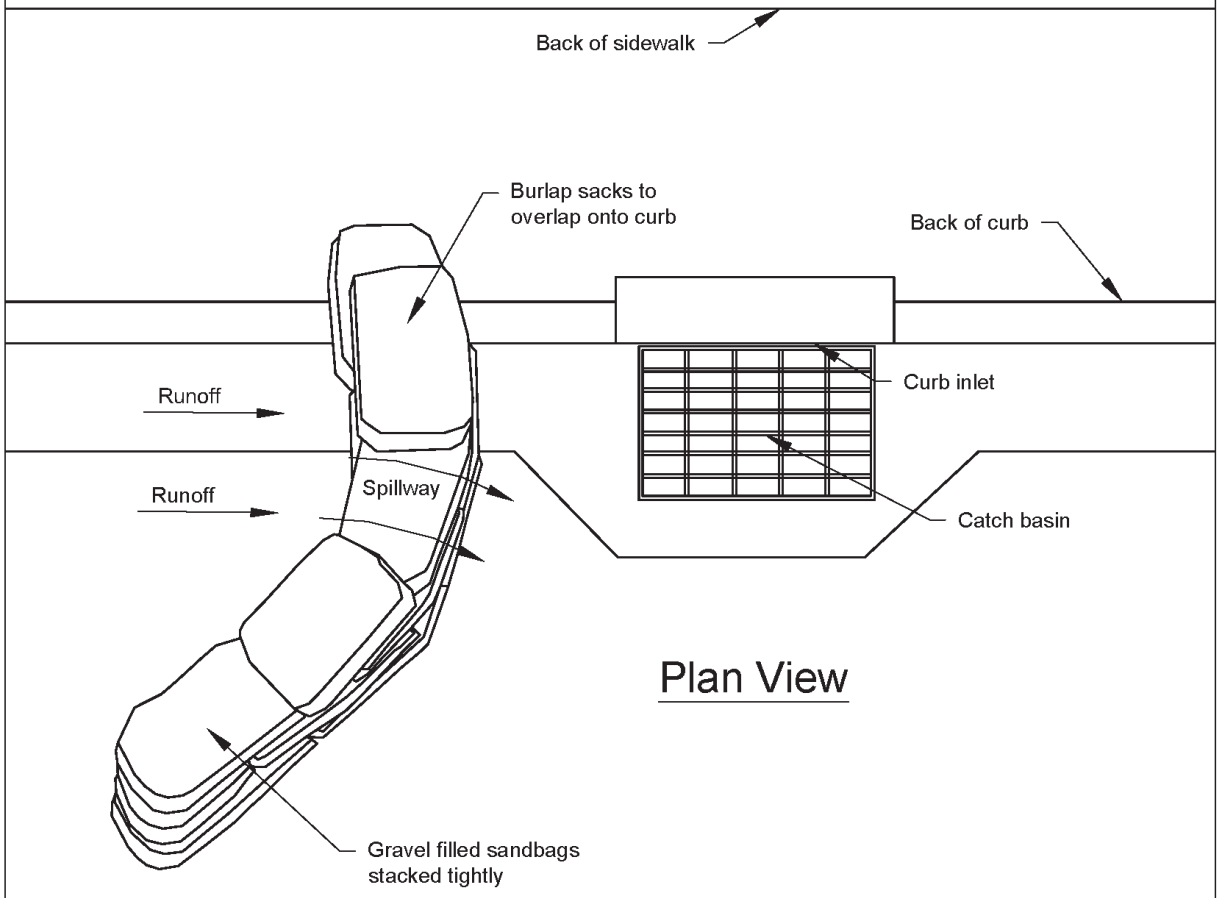
Revised June 2016

Curb and Gutter Sediment Barrier

Curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure II-3.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barrier include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure II-3.19: Curb and Gutter Barrier



Notes:

1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven 'geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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Curb and Gutter Barrier

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Maintenance Standards

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C231: Brush Barrier

Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Brush barriers may be used downslope of disturbed areas that are less than one-quarter acre.
- Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be directed to a sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a brush barrier, rather than by a sediment trapping BMP, is when the area draining to the barrier is small.
- Brush barriers should only be installed on contours.

Design and Installation Specifications

- Height: 2 feet (minimum) to 5 feet (maximum).
- Width: 5 feet at base (minimum) to 15 feet (maximum).
- Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.

Design and Installation Specifications

- The vegetated strip shall consist of a continuous strip of dense vegetation with topsoil for a minimum of a 25-foot length along the flowpath. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
- The slope within the vegetated strip shall not exceed 4H:1V.
- The uphill boundary of the vegetated strip shall be delineated with clearing limits.

Maintenance Standards

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.
- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
- If there are indications that concentrated flows are traveling across the vegetated strip, stormwater runoff controls must be installed to reduce the flows entering the vegetated strip, or additional perimeter protection must be installed.

BMP C235: Wattles

Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

Conditions of Use

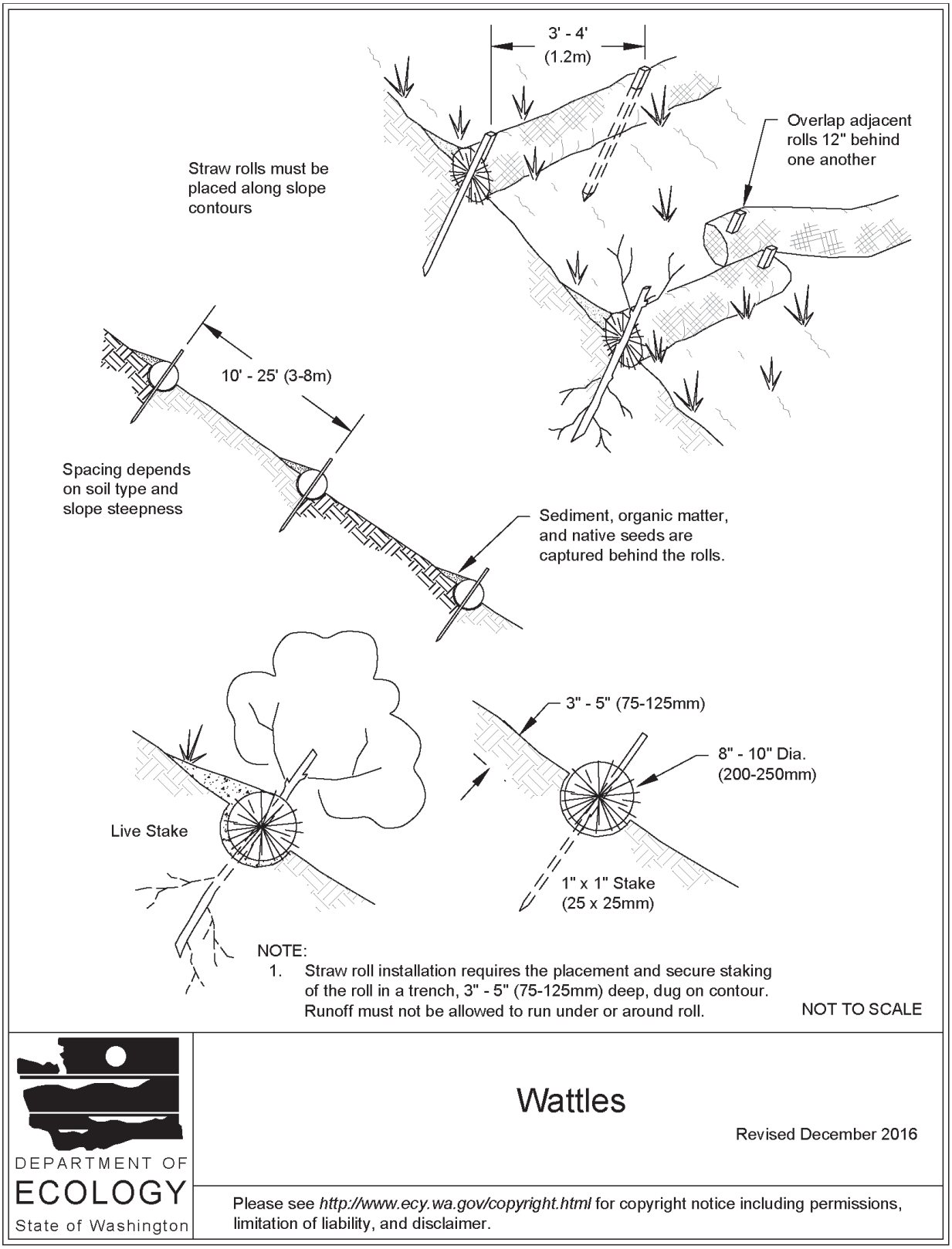
- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- Use wattles:
    - In disturbed areas that require immediate erosion protection.
    - On exposed soils during the period of short construction delays, or over winter months.
    - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.

- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

Design Criteria

- See Figure II-3.24: Wattles for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3- to 5-inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5- to 7- inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10- to 25-feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches min. Willow cuttings or 3/8-inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure II-3.24: Wattles



Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

BMP C236: Vegetative Filtration

Purpose

Vegetative filtration as a BMP is used in conjunction with detention storage in the form of portable tanks or BMP C241: Sediment Pond (Temporary), BMP C206: Level Spreader, and a pumping system with surface intake. Vegetative filtration improves turbidity levels of stormwater discharges by filtering runoff through existing vegetation where undisturbed forest floor duff layer or established lawn with thatch layer are present. Vegetative filtration can also be used to infiltrate dewatering waste from foundations, vaults, and trenches as long as runoff does not occur.

Conditions of Use

- For every five acres of disturbed soil use one acre of grass field, farm pasture, or wooded area. Reduce or increase this area depending on project size, ground water table height, and other site conditions.
- Wetlands shall not be used for vegetative filtration.
- Do not use this BMP in areas with a high ground water table, or in areas that will have a high seasonal ground water table during the use of this BMP.
- This BMP may be less effective on soils that prevent the infiltration of the water, such as hard till.
- Using other effective source control measures throughout a construction site will prevent the generation of additional highly turbid water and may reduce the time period or area need for this BMP.
- Stop distributing water into the vegetated filtration area if standing water or erosion results.

Maintenance Standards

- Monitor the spray field on a daily basis to ensure that over saturation of any portion of the field doesn't occur at any time. The presence of standing puddles of water or creation of concentrated flows visually signify that over saturation of the field has occurred.
- Monitor the vegetated spray field all the way down to the nearest surface water, or farthest spray area, to ensure that the water has not caused overland or concentrated flows, and has not created erosion around the spray nozzle(s).
- Do not exceed water quality standards for turbidity.
- Ecology recommends that a separate inspection log be developed, maintained and kept with the existing site logbook to aid the operator conducting inspections. This separate "Field Filtration Logbook" can also aid in demonstrating compliance with permit conditions.
- Inspect the spray nozzles daily, at a minimum, for leaks and plugging from sediment particles.
- If erosion, concentrated flows, or over saturation of the field occurs, rotate the use of branches or spray heads or move the branches to a new field location.
- Check all branches and the manifold for unintended leaks.

BMP C240: Sediment Trap

Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites during construction. Sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the drainage area.

Conditions of Use

- Sediment traps are intended for use on sites where the tributary drainage area is less than 3 acres, with no unusual drainage features, and a projected build-out time of six months or less. The sediment trap is a temporary measure (with a design life of approximately 6 months) and shall be maintained until the tributary area is permanently protected against erosion by vegetation and/or structures.
- Sediment traps are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated, emphasizing the need to control erosion to the maximum extent first.
- Projects that are constructing permanent Flow Control BMPs, or Runoff Treatment BMPs that use ponding for treatment, may use the rough-graded or final-graded permanent BMP footprint for the temporary sediment trap. When permanent BMP footprints are used as temporary sediment traps, the surface area requirement of the sediment trap must be met. If the surface area requirement of the sediment trap is larger than the surface area of the permanent BMP, then the sediment trap shall be enlarged beyond the permanent BMP footprint to comply with the surface area requirement.

- A floating pond skimmer may be used for the sediment trap outlet if approved by the Local Permitting Authority.
- Sediment traps may not be feasible on utility projects due to the limited work space or the short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.

Design and Installation Specifications

- See Figure II-3.26: Cross Section of Sediment Trap and Figure II-3.27: Sediment Trap Outlet for details.
- To determine the sediment trap geometry, first calculate the design surface area (SA) of the trap, measured at the invert of the weir. Use the following equation:

$$SA = FS(Q_2/V_s)$$

where

Q_2 =

  - Option 1 - Single Event Hydrograph Method:

    Q_2 = Peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 2-year, 24-hour frequency storm for the developed condition. The 10-year peak volumetric flow rate shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection.

  - Option 2 - For construction sites that are less than 1 acre, the Rational Method may be used to determine Q_2.

V_s = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm3 has been selected as the particle of interest and has a settling velocity (Vs) of 0.00096 ft/sec.

FS = A safety factor of 2 to account for non-ideal settling.

Therefore, the equation for computing sediment trap surface area becomes:

$$SA = 2 \times Q_2/0.00096$$

or

2080 square feet per cfs of inflow

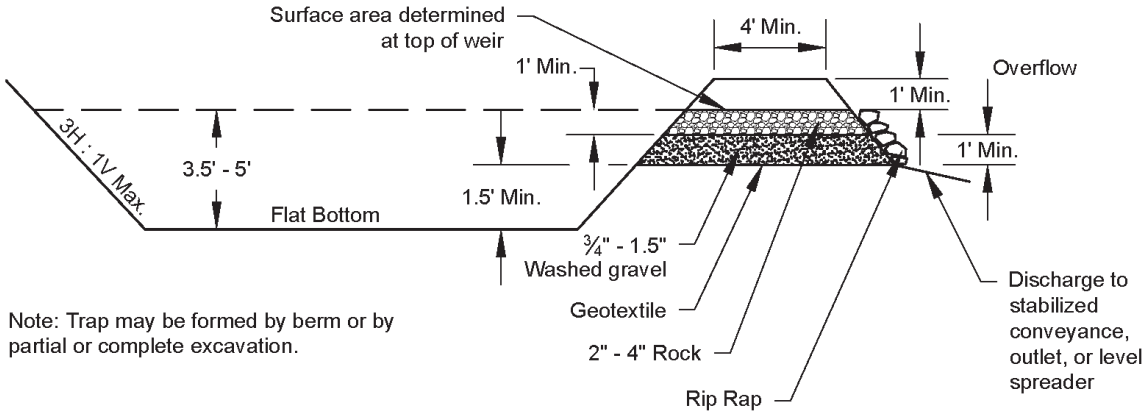
- Sediment trap depth shall be 3.5 feet minimum from the bottom of the trap to the top of the overflow weir.
- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1-foot above the bottom of the trap.

- Design the discharge from the sediment trap by using the guidance for discharge from temporary sediment ponds in BMP C241: Sediment Pond (Temporary).

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 1-foot in depth.
- Any damage to the trap embankments or slopes shall be repaired.

Figure II-3.26: Cross Section of Sediment Trap



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Cross Section of Sediment Trap

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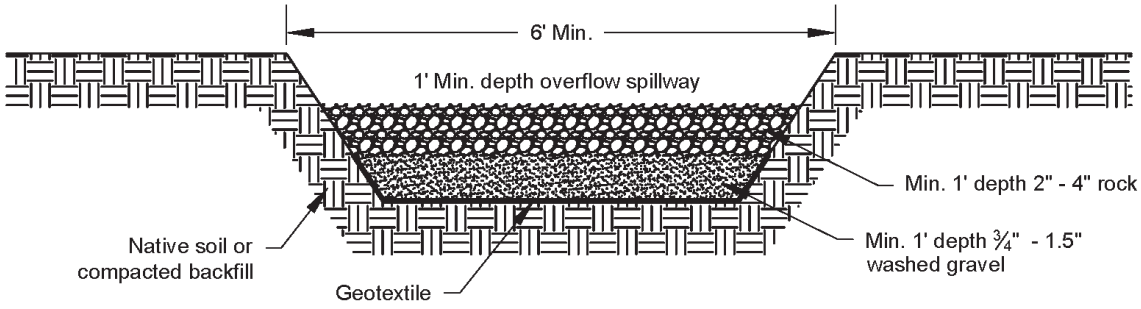
Figure II-3.27: Sediment Trap Outlet



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Sediment Trap Outlet

Revised June 2016

Maintenance Standards

- Remove sediment from the pond when it reaches 1 foot in depth.
- Repair any damage to the pond embankments or slopes.

BMP C250: Construction Stormwater Chemical Treatment

Purpose

This BMP applies when using chemicals to treat turbidity in stormwater by either batch or flow-through chemical treatment.

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. BMP C241: Sediment Pond (Temporary) is effective at removing larger particulate matter by gravity settling, but is ineffective at removing smaller particulates such as clay and fine silt. Traditional Construction Stormwater BMPs may not be adequate to ensure compliance with the water quality standards for turbidity in the receiving water.

Chemical treatment can reliably provide exceptional reductions of turbidity and associated pollutants. Chemical treatment may be required to meet turbidity stormwater discharge requirements, especially when construction proceeds through the wet season.

Conditions of Use

Formal written approval from Ecology is required for the use of chemical treatment, regardless of site size. See https://fortress.wa.gov/ecy/publications/SummaryPages/ecy070258.html for a copy of the Request for Chemical Treatment form. The Local Permitting Authority may also require review and approval. When authorized, the chemical treatment systems must be included in the Construction Stormwater Pollution Prevention Plan (SWPPP).

Chemically treated stormwater discharged from construction sites must be nontoxic to aquatic organisms. The Chemical Technology Assessment Protocol - Ecology (CTAPE) must be used to evaluate chemicals proposed for stormwater treatment. Only chemicals approved by Ecology under the CTAPE may be used for stormwater treatment. The approved chemicals, their allowable application techniques (batch treatment or flow-through treatment), allowable application rates, and conditions of use can be found at the Department of Ecology Emerging Technologies website:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

Background on Chemical Treatment Systems

Coagulation and flocculation have been used for over a century to treat water. The use of coagulation and flocculation to treat stormwater is a very recent application. Experience with the treatment of water and wastewater has resulted in a basic understanding of the process, in particular factors

that affect performance. This experience can provide insights as to how to most effectively design and operate similar systems in the treatment of stormwater.

Fine particles suspended in water give it a milky appearance, measured as *turbidity*. Their small size, often much less than 1 µm in diameter, give them a very large surface area relative to their volume. These fine particles typically carry a negative surface charge. Largely because of these two factors (small size and negative charge), these particles tend to stay in suspension for extended periods of time. Thus, removal is not practical by gravity settling. These are called stable suspensions. Chemicals like polymers, as well as inorganic chemicals such as alum, speed the settling process. The added chemical destabilizes the suspension and causes the smaller particles to flocculate. The process consists of three primary steps: *coagulation*, *flocculation*, and settling or *clarification*. Ecology requires a fourth step, *filtration*, on all stormwater chemical treatment systems to reduce floc discharge and to provide monitoring prior to discharge.

General Design and Installation Specifications

- Chemicals approved for use in Washington State are listed on Ecology's TAPE website, http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html, under the "Construction" tab.
- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. Stormwater that has been chemically treated must be filtered through BMP C251: Construction Stormwater Filtration for filtration and monitoring prior to discharge.
- System discharge rates must take into account downstream conveyance integrity.
- The following equipment should be located on site in a lockable shed:
    - The chemical injector.
    - Secondary containment for acid, caustic, buffering compound, and treatment chemical.
    - Emergency shower and eyewash.
    - Monitoring equipment which consists of a pH meter and a turbidimeter.
- There are two types of systems for applying the chemical treatment process to stormwater: the batch chemical treatment system and the flow-through chemical treatment system. See below for further details for both types of systems.

Batch Chemical Treatment Systems

A batch chemical treatment system consists of four steps: *coagulation*, *flocculation*, *clarification*, and polishing and monitoring via *filtration*.

Step 1: Coagulation

Coagulation is the process by which negative charges on the fine particles are disrupted. By disrupting the negative charges, the fine particles are able to flocculate. Chemical addition is one method of destabilizing the suspension, and polymers are one class of chemicals that are generally effective. Chemicals that are used for this purpose are called coagulants. Coagulation is complete

when the suspension is destabilized by the neutralization of the negative charges. Coagulants perform best when they are thoroughly and evenly dispersed under relatively intense mixing. This rapid mixing involves adding the coagulant in a manner that promotes rapid dispersion, followed by a short time period for destabilization of the particle suspension. The particles are still very small and are not readily separated by clarification until flocculation occurs.

Step 2: Flocculation

Flocculation is the process by which fine particles that have been destabilized bind together to form larger particles that settle rapidly. Flocculation begins naturally following coagulation, but is enhanced by gentle mixing of the destabilized suspension. Gentle mixing helps to bring particles in contact with one another such that they bind and continually grow to form "flocs." As the size of the flocs increase, they become heavier and settle.

Step 3: Clarification

The final step is the settling of the particles, or clarification. Particle density, size and shape are important during settling. Dense, compact flocs settle more readily than less dense, fluffy flocs. Because of this, flocculation to form dense, compact flocs is particularly important during chemical treatment. Water temperature is important during settling. Both the density and viscosity of water are affected by temperature; these in turn affect settling. Cold temperatures increase viscosity and density, thus slowing down the rate at which the particles settle.

The conditions under which clarification is achieved can affect performance. Currents can affect settling. Currents can be produced by wind, by differences between the temperature of the incoming water and the water in the clarifier, and by flow conditions near the inlets and outlets. Quiescent water, such as that which occurs during batch clarification, provides a good environment for settling. One source of currents in batch chemical treatment systems is movement of the water leaving the clarifier unit. Because flocs are relatively small and light, the velocity of the water must be as low as possible. Settled flocs can be resuspended and removed by fairly modest currents.

Step 4: Filtration

After clarification, Ecology requires stormwater that has been chemically treated to be filtered and monitored prior to discharge. The sand filtration system continually monitors the stormwater effluent for turbidity and pH. If the discharge water is ever out of an acceptable range for turbidity or pH, the water is returned to the untreated stormwater pond where it will begin the treatment process again.

Design and Installation of Batch Chemical Treatment Systems

A batch chemical treatment system consists of a stormwater collection system (either a temporary diversion or the permanent site drainage system), an untreated stormwater storage pond, pumps, a chemical feed system, treatment cells, a filtering and monitoring system, and interconnecting piping.

The batch treatment system uses a storage pond for untreated stormwater, followed by a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of chemically treated water in one cell, while other cells are being filled or emptied. Treatment cells may be ponds or tanks. Ponds with constructed earthen embankments greater than six feet high or which impound more than 10 acre-feet are subject to the Washington Dam Safety Regulations (Chapter 173-175 WAC).

See BMP D.1: Detention Ponds for more information regarding dam safety considerations for ponds.

Stormwater is collected at interception point(s) on the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area. The stormwater is stored until treatment occurs. It is important that the storage pond is large enough to provide adequate storage.

The first step in the treatment sequence is to check the pH of the stormwater in the untreated stormwater storage pond. The pH is adjusted by the application of carbon dioxide or a base until the stormwater in the untreated storage pond is within the desired pH range, 6.5 to 8.5. When used, carbon dioxide is added immediately downstream of the transfer pump. Typically sodium bicarbonate (baking soda) is used as a base, although other bases may be used. When needed, base is added directly to the untreated stormwater storage pond. The stormwater is recirculated with the treatment pump to provide mixing in the storage pond. Initial pH adjustments should be based on daily bench tests. Further pH adjustments can be made at any point in the process. See BMP C252: Treating and Disposing of High pH Water for more information on pH adjustments as a part of chemical treatment.

Once the stormwater is within the desired pH range (which is dependant on the coagulant being used), the stormwater is pumped from the untreated stormwater storage pond to a lined treatment cell as a coagulant is added. The coagulant is added upstream of the pump to facilitate rapid mixing.

The water is kept in the lined treatment cell for clarification. In a batch mode process, clarification typically takes from 30 minutes to several hours. Prior to discharge, samples are withdrawn for analysis of pH, coagulant concentration, and turbidity. If these levels are acceptable, the treated water is withdrawn, filtered, and discharged.

Several configurations have been developed to withdraw treated water from the treatment cell. The original configuration is a device that withdraws the treated water from just beneath the water surface using a float with adjustable struts that prevent the float from settling on the cell bottom. This reduces the possibility of picking up floc from the bottom of the cell. The struts are usually set at a minimum clearance of about 12 inches; that is, the float will come within 12 inches of the bottom of the cell. Other systems have used vertical guides or cables which constrain the float, allowing it to drift up and down with the water level. More recent designs have an H-shaped array of pipes, set on the horizontal.This scheme provides for withdrawal from four points rather than one. This configuration reduces the likelihood of sucking settled solids from the bottom. It also reduces the tendency for a vortex to form. Inlet diffusers, a long floating or fixed pipe with many small holes in it, are also an option.

Safety is a primary concern. Design should consider the hazards associated with operations, such as sampling. Facilities should be designed to reduce slip hazards and drowning. Tanks and ponds should have life rings, ladders, or steps extending from the bottom to the top.

Sizing Batch Chemical Treatment Systems

Chemical treatment systems must be designed to control the velocity and peak volumetric flow rate that is discharged from the system and consequently the project site. See Element 3: Control Flow Rates for further details on this requirement.

The total volume of the untreated stormwater storage pond and treatment cells must be large enough to treat stormwater that is produced during multiple day storm events. It is recommended that at a minimum the untreated stormwater storage pond be sized to hold 1.5 times the volume of runoff generated from the site during the 10-year, 24-hour storm event. Bypass should be provided around the chemical treatment system to accommodate extreme storm events. Runoff volume shall be calculated using the methods presented in III-2.3 Single Event Hydrograph Method. Worst-case land cover conditions (i.e., producing the most runoff) should be used for analyses (in most cases, this would be the land cover conditions just prior to final landscaping).

Primary settling should be encouraged in the untreated stormwater storage pond. A forebay with access for maintenance may be beneficial.

There are two opposing considerations in sizing the treatment cells. A larger cell is able to treat a larger volume of water each time a batch is processed. However, the larger the cell, the longer the time required to empty the cell. A larger cell may also be less effective at flocculation and therefore require a longer settling time. The simplest approach to sizing the treatment cell is to multiply the allowable discharge flow rate (as determined by the guidance in Element 3: Control Flow Rates) times the desired drawdown time. A 4-hour drawdown time allows one batch per cell per 8-hour work period, given 1 hour of flocculation followed by two hours of settling.

See BMP C251: Construction Stormwater Filtration for details on sizing the filtration system at the end of the batch chemical treatment system.

If the chemical treatment system design does not allow you to discharge at the rates as required by Element 3: Control Flow Rates, and if the site has a permanent Flow Control BMP that will serve the planned development, the discharge from the chemical treatment system may be directed to the permanent Flow Control BMP to comply with Element 3: Control Flow Rates. In this case, all discharge (including water passing through the treatment system and stormwater bypassing the treatment system) will be directed into the permanent Flow Control BMP. If site constraints make locating the untreated stormwater storage pond difficult, the permanent Flow Control BMP may be divided to serve as the untreated stormwater storage pond and the post-treatment temporary flow control pond. A berm or barrier must be used in this case so the untreated water does not mix with the treated water. Both untreated stormwater storage requirements, and adequate post-treatment flow control must be achieved. The designer must document in the Construction SWPPP how the permanent Flow Control BMP is able to attenuate the discharge from the site to meet the requirements of Element 3: Control Flow Rates. If the design of the permanent Flow Control BMP was modified for temporary construction flow control purposes, the construction of the permanent Flow Control BMP must be finalized, as designed for its permanent function, at project completion.

Flow-Through Chemical Treatment Systems

Background on Flow-Through Chemical Treatment Systems

A flow-through chemical treatment system adds a sand filtration component to the batch chemical treatment system's treatment train following flocculation. The coagulant is added to the stormwater upstream of the sand filter so that the coagulation and flocculation step occur immediately prior to the filter. The advantage of a flow-through chemical treatment system is the time saved by immediately filtering the water, as opposed to waiting for the clarification process necessary in a batch chemical

treatment system. See BMP C251: Construction Stormwater Filtration for more information on filtration.

Design and Installation of Flow-Through Chemical Treatment Systems

At a minimum, a flow-through chemical treatment system consists of a stormwater collection system (either a temporary diversion or the permanent site drainage system), an untreated stormwater storage pond, and a chemically enhanced sand filtration system.

As with a batch treatment system, stormwater is collected at interception point(s) on the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area. The stormwater is stored until treatment occurs. It is important that the holding pond be large enough to provide adequate storage.

Stormwater is then pumped from the untreated stormwater storage pond to the chemically enhanced sand filtration system where a coagulant is added. Adjustments to pH may be necessary before coagulant addition. The sand filtration system continually monitors the stormwater effluent for turbidity and pH. If the discharge water is ever out of an acceptable range for turbidity or pH, the water is returned to the untreated stormwater pond where it will begin the treatment process again.

Sizing Flow-Through Chemical Treatment Systems

Refer to BMP C251: Construction Stormwater Filtration for sizing requirements of flow-through chemical treatment systems.

Factors Affecting the Chemical Treatment Process

Coagulants

Cationic polymers can be used as coagulants to destabilize negatively charged turbidity particles present in natural waters, wastewater and stormwater. Polymers are large organic molecules that are made up of subunits linked together in a chain-like structure. Attached to these chain-like structures are other groups that carry positive or negative charges, or have no charge. Polymers that carry groups with positive charges are called cationic, those with negative charges are called anionic, and those with no charge (neutral) are called nonionic. In practice, the only way to determine whether a polymer is effective for a specific application is to perform preliminary or on-site testing.

Aluminum sulfate (alum) can also be used as a coagulant, as this chemical becomes positively charged when dispersed in water.

Polymers are available as powders, concentrated liquids, and emulsions (which appear as milky liquids). The latter are petroleum based, which are not allowed for construction stormwater treatment. Polymer effectiveness can degrade with time and also from other influences. Thus, manufacturers' recommendations for storage should be followed. Manufacturer's recommendations usually do not provide assurance of water quality protection or safety to aquatic organisms. Consideration of water quality protection is necessary in the selection and use of all polymers.

Application

Application of coagulants at the appropriate concentration or dosage rate for optimum turbidity removal is important for management of chemical cost, for effective performance, and to avoid aquatic toxicity. The optimum dose in a given application depends on several site-specific features. Turbidity of untreated water can be important with turbidities greater than 5,000 NTU. The surface charge of particles to be removed is also important. Environmental factors that can influence dosage rate are water temperature, pH, and the presence of constituents that consume or otherwise affect coagulant effectiveness. Laboratory experiments indicate that mixing previously settled sediment (floc sludge) with the untreated stormwater significantly improves clarification, therefore reducing the effective dosage rate. Preparation of working solutions and thorough dispersal of coagulants in water to be treated is also important to establish the appropriate dosage rate.

For a given water sample, there is generally an optimum dosage rate that yields the lowest residual turbidity after settling. When dosage rates below this optimum value (underdosing) are applied, there is an insufficient quantity of coagulant to react with, and therefore destabilize, all of the turbidity present. The result is residual turbidity (after flocculation and settling) that is higher than with the optimum dose. Overdosing, application of dosage rates greater than the optimum value, can also negatively impact performance. Like underdosing, the result of overdosing is higher residual turbidity than that with the optimum dose.

Mixing

The G-value, or just "G", is often used as a measure of the mixing intensity applied during coagulation and flocculation. The symbol G stands for “velocity gradient”, which is related in part to the degree of turbulence generated during mixing. High G-values mean high turbulence, and vice versa.

High G-values provide the best conditions for coagulant addition. With high G's, turbulence is high and coagulants are rapidly dispersed to their appropriate concentrations for effective destabilization of particle suspensions.

Low G-values provide the best conditions for flocculation. Here, the goal is to promote formation of dense, compact flocs that will settle readily. Low G's provide low turbulence to promote particle collisions so that flocs can form. Low G's generate sufficient turbulence such that collisions are effective in floc formation, but do not break up flocs that have already formed.

pH Adjustment

The pH must be in the proper range for the coagulants to be effective, which is typically 6.5 to 8.5. As polymers tend to lower the pH, it is important that the stormwater have sufficient buffering capacity. Buffering capacity is a function of alkalinity. Without sufficient alkalinity, the application of the polymer may lower the pH to below 6.5. A pH below 6.5 not only reduces the effectiveness of the polymer as a coagulant, but it may also create a toxic condition for aquatic organisms. Stormwater may not be discharged without readjustment of the pH to above 6.5. The target pH should be within 0.2 standard units of the receiving water's pH.

Experience gained at several projects in the City of Redmond has shown that the alkalinity needs to be at least 50 mg/L to prevent a drop in pH to below 6.5 when the polymer is added.

Maintenance Standards

Monitoring

At a minimum, the following monitoring shall be conducted. Test results shall be recorded on a daily log kept on site. Additional testing may be required by the NPDES permit based on site conditions.

- Operational Monitoring
    - Total volume treated and discharged.
    - Flow must be continuously monitored and recorded at not greater than 15-minute intervals.
    - Type and amount of chemical used for pH adjustment.
    - Type and amount of coagulant used for treatment.
    - Settling time.
- Compliance Monitoring
    - Influent and effluent pH, flocculent chemical concentration, and turbidity must be continuously monitored and recorded at not greater than 15-minute intervals.
    - pH and turbidity of the receiving water.
- Biomonitoring
    - Treated stormwater must be non-toxic to aquatic organisms. Treated stormwater must be tested for aquatic toxicity or residual chemicals. Frequency of biomonitoring will be determined by Ecology.
    - Residual chemical tests must be approved by Ecology prior to their use.
    - If testing treated stormwater for aquatic toxicity, you must test for acute (lethal) toxicity. Bioassays shall be conducted by a laboratory accredited by Ecology, unless otherwise approved by Ecology. Acute toxicity tests shall be conducted per the CTAPE protocol and Appendix G of *Whole Effluent Toxicity Testing Guidance and Test Review Criteria* (Marshall, 2016).

Discharge Compliance

Prior to discharge, treated stormwater must be sampled and tested for compliance with pH, flocculent chemical concentration, and turbidity limits. These limits may be established by the Construction Stormwater General Permit or a site-specific discharge permit. Sampling and testing for other pollutants may also be necessary at some sites. pH must be within the range of 6.5 to 8.5 standard units and not cause a change in the pH of the receiving water by more than 0.2 standard units. Treated stormwater samples and measurements shall be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water shall not be taken from the

treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training

Each project site using chemical treatment must have a trained operator who is certified for operation of an Enhanced Chemical Treatment system. The operator must be trained and certified by an organization approved by Ecology. Organizations approved for operator training are found at the following website:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Contaminated-water-on-construction-sites

Sediment Removal and Disposal

- Sediment shall be removed from the untreated stormwater storage pond and treatment cells as necessary. Typically, sediment removal is required at least once during a wet season and at the decommissioning of the chemical treatment system. Sediment remaining in the cells between batches may enhance the settling process and reduce the required chemical dosage.
- Sediment that is known to be non-toxic may be incorporated into the site away from drainages.

BMP C251: Construction Stormwater Filtration

Purpose

Filtration removes sediment from runoff originating from disturbed areas of the site.

Conditions of Use

Traditional Construction Stormwater BMPs used to control soil erosion and sediment loss from construction sites may not be adequate to ensure compliance with the water quality standard for turbidity in the receiving water. Filtration may be used in conjunction with gravity settling to remove sediment as small as fine silt (0.5 µm). The reduction in turbidity will be dependent on the particle size distribution of the sediment in the stormwater. In some circumstances, sedimentation and filtration may achieve compliance with the water quality standard for turbidity.

The use of construction stormwater filtration does not require approval from Ecology as long as treatment chemicals are not used. Filtration in conjunction with BMP C250: Construction Stormwater Chemical Treatment requires testing under the Chemical Technology Assessment Protocol – Ecology (CTAPE) before it can be initiated. Approval from Ecology must be obtained at each site where chemical use is proposed prior to use. See https://-fortress.wa.gov/ecy/publications/SummaryPages/ecy070258.html for a copy of the Request for Chemical Treatment form.

Design and Installation Specifications

Two types of filtration systems may be applied to construction stormwater treatment: rapid and slow.

Rapid filtration systems are the typical system used for water and wastewater treatment. They can achieve relatively high hydraulic flow rates, on the order of 2 to 20 gpm/sf, because they have automatic backwash systems to remove accumulated solids.

Slow filtration systems have very low hydraulic rates, on the order of 0.02 gpm/sf, because they do not have backwash systems. Slow filtration systems have generally been used as post construction BMPs to treat stormwater (see V-6 Filtration BMPs). Slow filtration is mechanically simple in comparison to rapid filtration, but requires a much larger filter area.

Filter Types and Efficiencies

Sand media filters are available with automatic backwashing features that can filter to 50 µm particle size. Screen or bag filters can filter down to 5 µm. Fiber wound filters can remove particles down to 0.5 µm. Filters should be sequenced from the largest to the smallest pore opening. Sediment removal efficiency will be related to particle size distribution in the stormwater.

Treatment Process and Description

Stormwater is collected at interception point(s) on the site and diverted to an untreated stormwater sediment pond or tank for removal of large sediment, and storage of the stormwater before it is treated by the filtration system. In a rapid filtration system, the untreated stormwater is pumped from the pond or tank through the filtration media. Slow filtration systems are designed using gravity to convey water from the pond or tank to and through the filtration media.

Sizing

Filtration treatment systems must be designed to control the velocity and peak volumetric flow rate that is discharged from the system and consequently the project site. See Element 3: Control Flow Rates for further details on this requirement.

The untreated stormwater storage pond or tank should be sized to hold 1.5 times the volume of runoff generated from the site during the 10-year, 24-hour storm event, minus the filtration treatment system flowrate for an 8-hour period. For a chitosan-enhanced sand filtration system, the filtration treatment system flowrate should be sized using a hydraulic loading rate between 6-8 gpm/ft^2. Other hydraulic loading rates may be more appropriate for other systems. Bypass should be provided around the filtration treatment system to accommodate extreme storm events. Runoff volume shall be calculated using the methods presented in III-2.3 Single Event Hydrograph Method. Worst-case land cover conditions (i.e., producing the most runoff) should be used for analyses (in most cases, this would be the land cover conditions just prior to final landscaping).

If the filtration treatment system design does not allow you to discharge at the rates as required by Element 3: Control Flow Rates, and if the site has a permanent Flow Control BMP that will serve the planned development, the discharge from the filtration treatment system may be directed to the permanent Flow Control BMP to comply with Element 3: Control Flow Rates. In this case, all discharge (including water passing through the treatment system and stormwater bypassing the treatment

system) will be directed into the permanent Flow Control BMP. If site constraints make locating the untreated stormwater storage pond difficult, the permanent Flow Control BMP may be divided to serve as the untreated stormwater storage pond and the post-treatment temporary flow control pond. A berm or barrier must be used in this case so the untreated water does not mix with the treated water. Both untreated stormwater storage requirements, and adequate post-treatment flow control must be achieved. The designer must document in the Construction SWPPP how the permanent Flow Control BMP is able to attenuate the discharge from the site to meet the requirements of Element 3: Control Flow Rates. If the design of the permanent Flow Control BMP was modified for temporary construction flow control purposes, the construction of the permanent Flow Control BMP must be finalized, as designed for its permanent function, at project completion.

Maintenance Standards

- Rapid sand filters typically have automatic backwash systems that are triggered by a pre-set pressure drop across the filter. If the backwash water volume is not large or substantially more turbid than the untreated stormwater stored in the holding pond or tank, backwash return to the untreated stormwater pond or tank may be appropriate. However, other means of treatment and disposal may be necessary.
- Screen, bag, and fiber filters must be cleaned and/or replaced when they become clogged.
- Sediment shall be removed from the storage and/or treatment ponds as necessary. Typically, sediment removal is required once or twice during a wet season and at the decommissioning of the ponds.
- Disposal of filtration equipment must comply with applicable local, state, and federal regulations.

BMP C252: Treating and Disposing of High pH Water

Purpose

When pH levels in stormwater rise above 8.5, it is necessary to lower the pH levels to the acceptable range of 6.5 to 8.5 prior to discharge to surface or ground water. A pH level range of 6.5 to 8.5 is typical for most natural watercourses, and this neutral pH range is required for the survival of aquatic organisms. Should the pH rise or drop out of this range, fish and other aquatic organisms may become stressed and may die.

Conditions of Use

- The water quality standard for pH in Washington State is in the range of 6.5 to 8.5. Stormwater with pH levels exceeding water quality standards may be either neutralized on site or disposed of to a sanitary sewer or concrete batch plant with pH neutralization capabilities.
- Neutralized stormwater may be discharged to surface waters under the Construction Stormwater General permit.
- Neutralized process water such as concrete truck wash-out, hydro-demolition, or saw-cutting slurry must be managed to prevent discharge to surface waters. Any stormwater

contaminated during concrete work is considered process wastewater and must not be discharged to waters of the State or stormwater collection systems.

- The process used for neutralizing and/or disposing of high pH stormwater from the site must be documented in the Construction Stormwater Pollution Prevention Plan.

Causes of High pH

High pH at construction sites is most commonly caused by the contact of stormwater with poured or recycled concrete, cement, mortars, and other Portland cement or lime containing construction materials. (See BMP C151: Concrete Handling for more information on concrete handling procedures). The principal caustic agent in cement is calcium hydroxide (free lime).

Calcium hardness can contribute to high pH values and cause toxicity that is associated with high pH conditions. A high level of calcium hardness in waters of the state is not allowed. Ground water standard for calcium and other dissolved solids in Washington State is less than 500 mg/l.

Treating High pH Stormwater by Carbon Dioxide Sparging

Advantages of Carbon Dioxide Sparging

- Rapidly neutralizes high pH water.
- Cost effective and safer to handle than acid compounds.
- CO_2 is self-buffering. It is difficult to overdose and create harmfully low pH levels.
- Material is readily available.

The Chemical Process of Carbon Dioxide Sparging

When carbon dioxide (CO_2) is added to water (H_2O), carbonic acid (H_2CO_3) is formed which can further dissociate into a proton (H+) and a bicarbonate anion (HCO_3-) as shown below:

$$CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H+ + HCO_3-$$

The free proton is a weak acid that can lower the pH. Water temperature has an effect on the reaction as well. The colder the water temperature is, the slower the reaction occurs. The warmer the water temperature is, the quicker the reaction occurs. Most construction applications in Washington State have water temperatures in the 50°F or higher range so the reaction is almost simultaneous.

The Treatment Process of Carbon Dioxide Sparging

High pH water may be treated using continuous treatment, continuous discharge systems. These manufactured systems continuously monitor influent and effluent pH to ensure that pH values are within an acceptable range before being discharged. All systems must have fail safe automatic shut off switches in the event that pH is not within the acceptable discharge range. Only trained operators may operate manufactured systems. System manufacturers often provide trained operators or training on their devices.

The following procedure may be used when not using a continuous discharge system:

1. Prior to treatment, the appropriate jurisdiction should be notified in accordance with the regulations set by the jurisdiction.
2. Every effort should be made to isolate the potential high pH water in order to treat it separately from other stormwater on-site.
3. Water should be stored in an acceptable storage facility, detention pond, or containment cell prior to pH treatment.
4. Transfer water to be treated for pH to the pH treatment structure. Ensure that the pH treatment structure size is sufficient to hold the amount of water that is to be treated. Do not fill the pH treatment structure completely, allow at least 2 feet of freeboard.
5. The operator samples the water within the pH treatment structure for pH and notes the clarity of the water. As a rule of thumb, less CO_2 is necessary for clearer water. The results of the samples and water clarity observations should be recorded.
6. In the pH treatment structure, add CO_2 until the pH falls into the range of 6.9-7.1. Adjusting pH to within 0.2 pH units of receiving water (background pH) is recommended. It is unlikely that pH can be adjusted to within 0.2 pH units using dry ice. Compressed carbon dioxide gas should be introduced to the water using a carbon dioxide diffuser located near the bottom of the pH treatment structure, this will allow carbon dioxide to bubble up through the water and diffuse more evenly.
7. Slowly discharge the water, making sure water does not get stirred up in the process. Release about 80% of the water from the pH treatment structure leaving any sludge behind. If turbidity remains above the maximum allowable, consider adding filtration to the treatment train. See BMP C251: Construction Stormwater Filtration.
8. Discharge treated water through a pond or drainage system.
9. Excess sludge needs to be disposed of properly as concrete waste. If several batches of water are undergoing pH treatment, sludge can be left in the treatment structure for the next batch treatment. Dispose of sludge when it fills 50% of the treatment structure volume.
10. Disposal must comply with applicable local, state, and federal regulations.

Treating High pH Stormwater by Food Grade Vinegar

Food grade vinegar that meets FDA standards may be used to neutralize high pH water. Food grade vinegar is only 4% to 18% acetic acid with the remainder being water. Food grade vinegar may be used if dosed just enough to lower pH sufficiently. Use a treatment process as described above for CO_2 sparging, but add food grade vinegar instead of CO_2.

This treatment option for high pH stormwater does not apply to anything but food grade vinegar. Acetic acid does not equal vinegar. Any other product or waste containing acetic acid must go through the evaluation process in Appendix G of *Whole Effluent Toxicity Testing Guidance and Test Review Criteria* (Marshall, 2016).

Disposal of High pH Stormwater

Sanitary Sewer Disposal

Local sewer authority approval is required prior to disposal via the sanitary sewer.

Concrete Batch Plant Disposal

- Only permitted facilities may accept high pH water.
- Contact the facility to ensure they can accept the high pH water.

Maintenance Standards

Safety and materials handling:

- All equipment should be handled in accordance with OSHA rules and regulations.
- Follow manufacturer guidelines for materials handling.

Each operator should provide:

- A diagram of the monitoring and treatment equipment.
- A description of the pumping rates and capacity the treatment equipment is capable of treating.

Each operator should keep a written record of the following:

- Client name and phone number.
- Date of treatment.
- Weather conditions.
- Project name and location.
- Volume of water treated.
- pH of untreated water.
- Amount of CO_2 or food grade vinegar needed to adjust water to a pH range of 6.9-7.1.
- pH of treated water.
- Discharge point location and description.

A copy of this record should be given to the client/contractor who should retain the record for three years.

CLEAR WATER SERVICES

Appendix C – Correspondence
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Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

Issuance Date: November 18, 2020
Effective Date: January 1, 2021
Expiration Date: December 31, 2025

CONSTRUCTION STORMWATER GENERAL PERMIT

National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Construction Activity

State of Washington
Department of Ecology
Olympia, Washington 98504

In compliance with the provisions of
Chapter 90.48 Revised Code of Washington
(State of Washington Water Pollution Control Act)
and
Title 33 United States Code, Section 1251 et seq.
The Federal Water Pollution Control Act (The Clean Water Act)

Until this permit expires, is modified, or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions that follow.

Vincent McGowan, P.E.
Water Quality Program Manager
Washington State Department of Ecology

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SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Special and General Conditions within this permit for additional submittal requirements. Appendix A provides a list of definitions. Appendix B provides a list of acronyms.

Table 1 Summary of Required Submittals

Permit Section	Submittal	Frequency	First Submittal Date
S5.A and S8	High Turbidity/Transparency Phone Reporting	As Necessary	Within 24 hours
S5.B	Discharge Monitoring Report	Monthly*	Within 15 days following the end of each month
S5.F and S8	Noncompliance Notification – Telephone Notification	As necessary	Within 24 hours
S5.F	Noncompliance Notification – Written Report	As necessary	Within 5 Days of non-compliance
S9.D	Request for Chemical Treatment Form	As necessary	Written approval from Ecology is required prior to using chemical treatment (with the exception of dry ice, CO_2 or food grade vinegar to adjust pH)
G2	Notice of Change in Authorization	As necessary	
G6	Permit Application for Substantive Changes to the Discharge	As necessary	
G8	Application for Permit Renewal	1/permit cycle	No later than 180 days before expiration
S2.A	Notice of Permit Transfer	As necessary	
G19	Notice of Planned Changes	As necessary	
G21	Reporting Anticipated Non-compliance	As necessary	

NOTE: *Permittees must submit electronic Discharge Monitoring Reports (DMRs) to the Washington State Department of Ecology monthly, regardless of site discharge, for the full duration of permit coverage. Refer to Section S5.B of this General Permit for more specific information regarding DMRs.

Table 2 Summary of Required On-site Documentation

Document Title	Permit Conditions
Permit Coverage Letter	See Conditions S2, S5
Construction Stormwater General Permit (CSWGP)	See Conditions S2, S5
Site Log Book	See Conditions S4, S5
Stormwater Pollution Prevention Plan (SWPPP)	See Conditions S5, S9
Site Map	See Conditions S5, S9

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

A. Permit Area

This Construction Stormwater General Permit (CSWGP) covers all areas of Washington State, except for federal operators and Indian Country as specified in Special Condition S1.E.3 and 4.

B. Operators Required to Seek Coverage Under this General Permit

1. Operators of the following construction activities are required to seek coverage under this CSWGP:

    a. Clearing, grading and/or excavation that results in the disturbance of one or more acres (including off-site disturbance acreage related to construction-support activity as authorized in S1.C.2) and discharges stormwater to surface waters of the State; and clearing, grading and/or excavation on sites smaller than one acre that are part of a larger common plan of development or sale, if the common plan of development or sale will ultimately disturb one acre or more and discharge stormwater to surface waters of the State.

        i. This category includes forest practices (including, but not limited to, class IV conversions) that are part of a construction activity that will result in the disturbance of one or more acres, and discharge to surface waters of the State (that is, forest practices that prepare a site for construction activities); and

    b. Any size construction activity discharging stormwater to waters of the State that the Washington State Department of Ecology (Ecology):

        i. Determines to be a significant contributor of pollutants to waters of the State of Washington.

        ii. Reasonably expects to cause a violation of any water quality standard.

2. Operators of the following activities are not required to seek coverage under this CSWGP (unless specifically required under Special Condition S1.B.1.b, above):

    a. Construction activities that discharge all stormwater and non-stormwater to groundwater, sanitary sewer, or combined sewer, and have no point source discharge to either surface water or a storm sewer system that drains to surface waters of the State.

    b. Construction activities covered under an Erosivity Waiver (Special Condition S1.F).

    c. Routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of a facility.

C. Authorized Discharges

1. ***Stormwater Associated with Construction Activity.*** Subject to compliance with the terms and conditions of this permit, Permittees are authorized to discharge stormwater associated with construction activity to surface waters of the State or to a storm sewer system that drains to surface waters of the State. (Note that "surface waters of the

State" may exist on a construction site as well as off site; for example, a creek running through a site.)

2. ***Stormwater Associated with Construction Support Activity.*** This permit also authorizes stormwater discharge from support activities related to the permitted construction site (for example, an on-site portable rock crusher, off-site equipment staging yards, material storage areas, borrow areas, etc.) provided:

    a. The support activity relates directly to the permitted construction site that is required to have an NPDES permit; and

    b. The support activity is not a commercial operation serving multiple unrelated construction projects, and does not operate beyond the completion of the construction activity; and

    c. Appropriate controls and measures are identified in the Stormwater Pollution Prevention Plan (SWPPP) for the discharges from the support activity areas.

3. ***Non-Stormwater Discharges.*** The categories and sources of non-stormwater discharges identified below are authorized conditionally, provided the discharge is consistent with the terms and conditions of this permit:

    a. Discharges from fire-fighting activities.

    b. Fire hydrant system flushing.

    c. Potable water, including uncontaminated water line flushing.

    d. Hydrostatic test water.

    e. Uncontaminated air conditioning or compressor condensate.

    f. Uncontaminated groundwater or spring water.

    g. Uncontaminated excavation dewatering water (in accordance with S9.D.10).

    h. Uncontaminated discharges from foundation or footing drains.

    i. Uncontaminated or potable water used to control dust. Permittees must minimize the amount of dust control water used.

    j. Routine external building wash down that does not use detergents.

    k. Landscape irrigation water.

The SWPPP must adequately address all authorized non-stormwater discharges, except for discharges from fire-fighting activities, and must comply with Special Condition S3. At a minimum, discharges from potable water (including water line flushing), fire hydrant system flushing, and pipeline hydrostatic test water must undergo the following: dechlorination to a concentration of 0.1 parts per million (ppm) or less, and pH adjustment to within 6.5 – 8.5 standard units (su), if necessary.

D. Prohibited Discharges

The following discharges to waters of the State, including groundwater, are prohibited:

1. Concrete wastewater

2. Wastewater from washout and clean-up of stucco, paint, form release oils, curing compounds and other construction materials.

3. Process wastewater as defined by 40 Code of Federal Regulations (CFR) 122.2 (See Appendix A of this permit).

4. Slurry materials and waste from shaft drilling, including process wastewater from shaft drilling for construction of building, road, and bridge foundations unless managed according to Special Condition S9.D.9.j.

5. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.

6. Soaps or solvents used in vehicle and equipment washing.

7. Wheel wash wastewater, unless managed according to Special Condition S9.D.9.

8. Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed according to Special Condition S9.D.10.

E. Limits on Coverage

Ecology may require any discharger to apply for and obtain coverage under an individual permit or another more specific general permit. Such alternative coverage will be required when Ecology determines that this CSWGP does not provide adequate assurance that water quality will be protected, or there is a reasonable potential for the project to cause or contribute to a violation of water quality standards.

The following stormwater discharges are not covered by this permit:

1. Post-construction stormwater discharges that originate from the site after completion of construction activities and the site has undergone final stabilization.

2. Non-point source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance, from which there is natural runoff as excluded in 40 CFR Subpart 122.

3. Stormwater from any federal operator.

4. Stormwater from facilities located on ***Indian Country*** as defined in 18 U.S.C.§1151, except portions of the Puyallup Reservation as noted below.

   Indian Country includes:

   a. All land within any Indian Reservation notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation. This includes all federal, tribal, and Indian and non-Indian privately owned land within the reservation.

   b. All off-reservation Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.

   c. All off-reservation federal trust lands held for Native American Tribes.

Puyallup Exception: Following the *Puyallup Tribes of Indians Land Settlement Act of 1989*, 25 U.S.C. §1773; the permit does apply to land within the Puyallup Reservation except for discharges to surface water on land held in trust by the federal government.

5. Stormwater from any site covered under an existing NPDES individual permit in which stormwater management and/or treatment requirements are included for all stormwater discharges associated with construction activity.

6. Stormwater from a site where an applicable Total Maximum Daily Load (TMDL) requirement specifically precludes or prohibits discharges from construction activity.

F. Erosivity Waiver

Construction site operators may qualify for an Erosivity Waiver from the CSWGP if the following conditions are met:

1. The site will result in the disturbance of fewer than five (5) acres and the site is not a portion of a common plan of development or sale that will disturb five (5) acres or greater.

2. Calculation of Erosivity "R" Factor and Regional Timeframe:

    a. The project's calculated rainfall erosivity factor ("R" Factor) must be less than five (5) during the period of construction activity, (See the CSWGP homepage http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html for a link to the EPA's calculator and step by step instructions on computing the "R" Factor in the *EPA Erosivity Waiver Fact Sheet*). The period of construction activity starts when the land is first disturbed and ends with final stabilization. In addition:

    b. The entire period of construction activity must fall within the following timeframes:

        i. For sites west of the Cascades Crest: June 15 – September 15.

        ii. For sites east of the Cascades Crest, excluding the Central Basin: June 15 – October 15.

        iii. For sites east of the Cascades Crest, within the Central Basin: no timeframe restrictions apply. The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches. For a map of the Central Basin (Average Annual Precipitation Region 2), refer to: http://www.ecy.wa.gov/programs/wq/stormwater/construction/resourcesguidance.html.

3. Construction site operators must submit a complete Erosivity Waiver certification form at least one week before disturbing the land. Certification must include statements that the operator will:

    a. Comply with applicable local stormwater requirements; and

    b. Implement appropriate erosion and sediment control BMPs to prevent violations of water quality standards.

4. This waiver is not available for facilities declared significant contributors of pollutants as defined in Special Condition S1.B.1.b or for any size construction activity that could

reasonably expect to cause a violation of any water quality standard as defined in Special Condition S1.B.1.b.ii.

5. This waiver does not apply to construction activities which include non-stormwater discharges listed in Special Condition S1.C.3.

6. If construction activity extends beyond the certified waiver period for any reason, the operator must either:

   a. Recalculate the rainfall erosivity "R" factor using the original start date and a new projected ending date and, if the "R" factor is still under 5 *and* the entire project falls within the applicable regional timeframe in Special Condition S1.F.2.b, complete and submit an amended waiver certification form before the original waiver expires; *or*

   b. Submit a complete permit application to Ecology in accordance with Special Condition S2.A and B before the end of the certified waiver period.

S2. APPLICATION REQUIREMENTS

A. Permit Application Forms

1. *Notice of Intent Form*

a. Operators of new or previously unpermitted construction activities must submit a complete and accurate permit application (Notice of Intent, or NOI) to Ecology.

b. Operators must apply using the electronic application form (NOI) available on Ecology's website (http://ecy.wa.gov/programs/wq/stormwater/construction/index.html). Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper NOI.

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, Washington 98504-7696

c. The operator must submit the NOI at least 60 days before discharging stormwater from construction activities and must submit it prior to the date of the first public notice (See Special Condition S2.B, below, for details). The 30-day public comment period begins on the publication date of the second public notice. Unless Ecology responds to the complete application in writing, coverage under the general permit will automatically commence on the 31st day following receipt by Ecology of a *completed* NOI, or the issuance date of this permit, whichever is later; unless Ecology specifies a later date in writing as required by WAC173-226-200(2). See S8.B for Limits on Coverage for New Discharges to TMDL or 303(d)-Listed Waters.

d. If an applicant intends to use a Best Management Practice (BMP) selected on the basis of Special Condition S9.C.4 ("demonstrably equivalent" BMPs), the applicant must notify Ecology of its selection as part of the NOI. In the event the applicant selects BMPs after submission of the NOI, the applicant must provide notice of the

selection of an equivalent BMP to Ecology at least 60 days before intended use of the equivalent BMP.

e. Applicants must notify Ecology if they are aware of contaminated soils and/or groundwater associated with the construction activity. Provide detailed information with the NOI (as known and readily available) on the nature and extent of the contamination (concentrations, locations, and depth), as well as pollution prevention and/or treatment BMPs proposed to control the discharge of soil and/or groundwater contaminants in stormwater. Examples of such detail may include, but are not limited to:

   i. List or table of all known contaminants with laboratory test results showing concentration and depth,

   ii. Map with sample locations,

   iii. Related portions of the Stormwater Pollution Prevention Plan (SWPPP) that address the management of contaminated and potentially contaminated construction stormwater and dewatering water,

   iv. Dewatering plan and/or dewatering contingency plan.

2. ***Transfer of Coverage Form***

The Permittee can transfer current coverage under this permit to one or more new operators, including operators of sites within a Common Plan of Development, provided:

   i. The Permittee submits a complete Transfer of Coverage Form to Ecology, signed by the current and new discharger and containing a specific date for transfer of permit responsibility, coverage and liability (including any Administrative Orders associated with the permit); and

   ii. Ecology does not notify the current discharger and new discharger of intent to revoke coverage under the general permit. If this notice is not given, the transfer is effective on the date specified in the written agreement.

When a current discharger (Permittee) transfers a portion of a permitted site, the current discharger must also indicate the remaining permitted acreage after the transfer. Transfers do not require public notice.

3. ***Modification of Coverage Form***

Permittees must notify Ecology regarding any changes to the information provided on the NOI by submitting an Update/Modification of Permit Coverage form in accordance with General Conditions G6 and G19. Examples of such changes include, but are not limited to:

   i. Changes to the Permittee's mailing address,

   ii. Changes to the on-site contact person information, and

   iii. Changes to the area/acreage affected by construction activity.

B. Public Notice

For new or previously unpermitted construction activities, the applicant must publish a public notice at least one time each week for two consecutive weeks, at least 7 days apart, in a newspaper with general circulation in the county where the construction is to take place. The notice must be run after the NOI has been submitted and must contain:

1. A statement that "*The applicant is seeking coverage under the Washington State Department of Ecology's Construction Stormwater NPDES and State Waste Discharge General Permit*."
2. The name, address, and location of the construction site.
3. The name and address of the applicant.
4. The type of construction activity that will result in a discharge (for example, residential construction, commercial construction, etc.), and the total number of acres to be disturbed over the lifetime of the project.
5. The name of the receiving water(s) (that is, the surface water(s) to which the site will discharge), or, if the discharge is through a storm sewer system, the name of the operator of the system and the receiving water(s) the system discharges to.
6. The statement: *Any persons desiring to present their views to the Washington State Department of Ecology regarding this application, or interested in Ecology's action on this application, may notify Ecology in writing no later than 30 days of the last date of publication of this notice. Ecology reviews public comments and considers whether discharges from this project would cause a measurable change in receiving water quality, and, if so, whether the project is necessary and in the overriding public interest according to Tier II antidegradation requirements under WAC 173-201A-320. Comments can be submitted to: Department of Ecology, PO Box 47696, Olympia, Washington 98504-7696 Attn: Water Quality Program, Construction Stormwater*.

S3. COMPLIANCE WITH STANDARDS

A. Discharges must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC), groundwater quality standards (Chapter 173-200 WAC), sediment management standards (Chapter 173-204 WAC), and human health-based criteria in the Federal water quality criteria applicable to Washington. (40 CFR Part 131.45) Discharges that are not in compliance with these standards are prohibited.

B. Prior to the discharge of stormwater and non-stormwater to waters of the State, the Permittee must apply All Known, Available, and Reasonable methods of prevention, control, and Treatment (AKART). This includes the preparation and implementation of an adequate SWPPP, with all appropriate BMPs installed and maintained in accordance with the SWPPP and the terms and conditions of this permit.

C. Ecology presumes that a Permittee complies with water quality standards unless discharge monitoring data or other site-specific information demonstrates that a discharge causes or contributes to a violation of water quality standards, when the Permittee complies with the following conditions. The Permittee must fully:

1. Comply with all permit conditions, including; planning, sampling, monitoring, reporting, and recordkeeping conditions.

2. Implement stormwater BMPs contained in stormwater management manuals published or approved by Ecology, or BMPs that are demonstrably equivalent to BMPs contained in stormwater management manuals published or approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate BMPs for on-site pollution control. (For purposes of this section, the stormwater manuals listed in Appendix 10 of the *Phase I Municipal Stormwater Permit* are approved by Ecology.)

D. Where construction sites also discharge to groundwater, the groundwater discharges must also meet the terms and conditions of this CSWGP. Permittees who discharge to groundwater through an injection well must also comply with any applicable requirements of the Underground Injection Control (UIC) regulations, Chapter 173-218 WAC.

S4. MONITORING REQUIREMENTS, BENCHMARKS, AND REPORTING TRIGGERS

A. Site Log Book

The Permittee must maintain a site log book that contains a record of the implementation of the SWPPP and other permit requirements, including the installation and maintenance of BMPs, site inspections, and stormwater monitoring.

B. Site Inspections

Construction sites one (1) acre or larger that discharge stormwater to surface waters of the State must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Sites less than one (1) acre may have a person without CESCL certification conduct inspections. (See Special Conditions S4.B.3 and B.4, below, for detailed requirements of the Permittee's CESCL.)

Site inspections must include all areas disturbed by construction activities, all BMPs, and all stormwater discharge points under the Permittee's operational control.

1. The Permittee must have staff knowledgeable in the principles and practices of erosion and sediment control. The CESCL (sites one acre or more) or inspector (sites less than one acre) must have the skills to assess the:

    a. Site conditions and construction activities that could impact the quality of stormwater; and

    b. Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges. The SWPPP must identify the CESCL or inspector, who must be present on site or on-call at all times. The CESCL (sites one (1) acre or more) must obtain this certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology. (See BMP C160 in the manual, referred to in Special Condition S9.C.1 and 2.)

2. The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. BMP effectiveness must be evaluated to

determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.

Based on the results of the inspection, the Permittee must correct the problems identified, by:

a. Reviewing the SWPPP for compliance with Special Condition S9 and making appropriate revisions within 7 days of the inspection.

b. Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs, within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

c. Documenting BMP implementation and maintenance in the site log book.

3. The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one (1) day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one (1) inspection is required that week.) Inspection frequency may be reduced to once every calendar month for inactive sites that are temporarily stabilized.

4. The Permittee must summarize the results of each inspection in an inspection report or checklist and enter the report/checklist into, or attach it to, the site log book. At a minimum, each inspection report or checklist must include:

   a. Inspection date and time.

   b. Weather information.

   c. The general conditions during inspection.

   d. The approximate amount of precipitation since the last inspection.

   e. The approximate amount of precipitation within the last 24 hours.

   f. A summary or list of all implemented BMPs, including observations of all erosion/sediment control structures or practices.

   g. A description of:

      i. BMPs inspected (including location).

      ii. BMPs that need maintenance and why.

      iii. BMPs that failed to operate as designed or intended, and

      iv. Where additional or different BMPs are needed, and why.

   h. A description of stormwater discharged from the site. The Permittee must note the presence of suspended sediment, turbidity, discoloration, and oil sheen, as applicable.

i. Any water quality monitoring performed during inspection.

j. General comments and notes, including a brief description of any BMP repairs, maintenance, or installations made following the inspection.

k. An implementation schedule for the remedial actions that the Permittee plans to take if the site inspection indicates that the site is out of compliance. The remedial actions taken must meet the requirements of the SWPPP and the permit.

l. A summary report of the inspection.

m. The name, title, and signature of the person conducting the site inspection, a phone number or other reliable method to reach this person, and the following statement: *I certify that this report is true, accurate, and complete to the best of my knowledge and belief.*

Table 3 Summary of Primary Monitoring Requirements

Size of Soil Disturbance[1]	Weekly Site Inspections	Weekly Sampling w/ Turbidity Meter	Weekly Sampling w/ Transparency Tube	Weekly pH Sampling[2]	CESCL Required for Inspections?
Sites that disturb less than 1 acre, but are part of a larger Common Plan of Development	Required	Not Required	Not Required	Not Required	No
Sites that disturb 1 acre or more, but fewer than 5 acres	Required	Sampling Required – either method[3]		Required	Yes
Sites that disturb 5 acres or more	Required	Required	Not Required[4]	Required	Yes

[1] Soil disturbance is calculated by adding together all areas that will be affected by construction activity. Construction activity means clearing, grading, excavation, and any other activity that disturbs the surface of the land, including ingress/egress from the site.

[2] If construction activity results in the disturbance of 1 acre or more, and involves significant concrete work (1,000 cubic yards of concrete or recycled concrete placed or poured over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer stormwater collection system that drains to other surface waters of the State, the Permittee must conduct pH sampling in accordance with Special Condition S4.D.

[3] Sites with one or more acres, but fewer than 5 acres of soil disturbance, must conduct turbidity or transparency sampling in accordance with Special Condition S4.C.4.a or b.

[4] Sites equal to or greater than 5 acres of soil disturbance must conduct turbidity sampling using a turbidity meter in accordance with Special Condition S4.C.4.a.

C. Turbidity/Transparency Sampling Requirements

1. Sampling Methods

    a. If construction activity involves the disturbance of five (5) acres or more, the Permittee must conduct turbidity sampling per Special Condition S4.C.4.a, below.

    b. If construction activity involves one (1) acre or more but fewer than five (5) acres of soil disturbance, the Permittee must conduct either transparency sampling *or* turbidity sampling per Special Condition S4.C.4.a or b, below.

2. Sampling Frequency

    a. The Permittee must sample all discharge points at least once every calendar week when stormwater (or authorized non-stormwater) discharges from the site or enters any on-site surface waters of the state (for example, a creek running through a site); sampling is not required on sites that disturb less than an acre.

    b. Samples must be representative of the flow and characteristics of the discharge.

    c. Sampling is not required when there is no discharge during a calendar week.

    d. Sampling is not required outside of normal working hours or during unsafe conditions.

    e. If the Permittee is unable to sample during a monitoring period, the Permittee must include a brief explanation in the monthly Discharge Monitoring Report (DMR).

    f. Sampling is not required before construction activity begins.

    g. The Permittee may reduce the sampling frequency for temporarily stabilized, inactive sites to once every calendar month.

3. Sampling Locations

    a. Sampling is required at all points where stormwater associated with construction activity (or authorized non-stormwater) is discharged off site, including where it enters any on-site surface waters of the state (for example, a creek running through a site).

    b. The Permittee may discontinue sampling at discharge points that drain areas of the project that are fully stabilized to prevent erosion.

    c. The Permittee must identify all sampling point(s) in the SWPPP and on the site map and clearly mark these points in the field with a flag, tape, stake or other visible marker.

    d. Sampling is not required for discharge that is sent directly to sanitary or combined sewer systems.

    e. The Permittee may discontinue sampling at discharge points in areas of the project where the Permittee no longer has operational control of the construction activity.

4. Sampling and Analysis Methods

   a. The Permittee performs turbidity analysis with a calibrated turbidity meter (turbidimeter) either on site or at an accredited lab. The Permittee must record the results in the site log book in nephelometric turbidity units (NTUs).

   b. The Permittee performs transparency analysis on site with a 1¾ inch diameter, 60 centimeter (cm)-long transparency tube. The Permittee will record the results in the site log book in centimeters (cm).

Table 4 Monitoring and Reporting Requirements

Parameter	Unit	Analytical Method	Sampling Frequency	Benchmark Value
Turbidity	NTU	SM2130	Weekly, if discharging	25 NTUs
Transparency	Cm	Manufacturer instructions, or Ecology guidance	Weekly, if discharging	33 cm

5. Turbidity/Transparency Benchmark Values and Reporting Triggers

   The benchmark value for turbidity is 25 NTUs. The benchmark value for transparency is 33 centimeters (cm). Note: Benchmark values do not apply to discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus; these discharges are subject to a numeric effluent limit for turbidity. Refer to Special Condition S8 for more information and follow S5.F – Noncompliance Notification for reporting requirements applicable to discharges which exceed the numeric effluent limit for turbidity.

   a. Turbidity 26 – 249 NTUs, or Transparency 32 – 7 cm:

      If the discharge turbidity is 26 to 249 NTUs; or if discharge transparency is 32 to 7 cm, the Permittee must:

      i. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs, and no later than 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

      ii. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.

      iii. Document BMP implementation and maintenance in the site log book.

   b. Turbidity 250 NTUs or greater, or Transparency 6 cm or less:

      If a discharge point's turbidity is 250 NTUs or greater, or if discharge transparency is less than or equal to 6 cm, the Permittee must complete the reporting and adaptive

management process described below. For discharges which are subject to a numeric effluent limit for turbidity, see S5.F – Noncompliance Notification.

i. Within 24 hours, telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) number (or through Ecology's Water Quality Permitting Portal [WQWebPortal] – Permit Submittals when the form is available), in accordance with Special Condition S5.A.

- **Central Region** (Okanogan, Chelan, Douglas, Kittitas, Yakima, Klickitat, Benton): (509) 575-2490
- **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400
- **Northwest Region** (Kitsap, Snohomish, Island, King, San Juan, Skagit, Whatcom): (425) 649-7000
- **Southwest Region** (Grays Harbor, Lewis, Mason, Thurston, Pierce, Clark, Cowlitz, Skamania, Wahkiakum, Clallam, Jefferson, Pacific): (360) 407-6300

These numbers and a link to the ERTS reporting page are also listed at the following website: http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html.

ii. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.

iii. Sample discharges daily until:

a) Turbidity is 25 NTUs (or lower); or

b) Transparency is 33 cm (or greater); or

c) The Permittee has demonstrated compliance with the water quality standard for turbidity:

1) No more than 5 NTUs over background turbidity, if background is less than 50 NTUs, or

2) No more than 10% over background turbidity, if background is 50 NTUs or greater; or

*Note: background turbidity in the receiving water must be measured immediately upstream (upgradient) or outside of the area of influence of the discharge.

d) The discharge stops or is eliminated.

iv. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within seven (7) days of the date the discharge exceeded the benchmark.

v. Document BMP implementation and maintenance in the site log book.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with permit benchmarks.

D. pH Sampling Requirements – Significant Concrete Work or Engineered Soils

If construction activity results in the disturbance of 1 acre or more, *and* involves significant concrete work (significant concrete work means greater than 1000 cubic yards placed or poured concrete or recycled concrete used over the life of a project) or the use of engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD], or fly ash), and stormwater from the affected area drains to surface waters of the State or to a storm sewer system that drains to surface waters of the State, the Permittee must conduct pH sampling as set forth below. Note: In addition, discharges to segments of water bodies on Washington State's 303(d) list (Category 5) for high pH are subject to a numeric effluent limit for pH; refer to Special Condition S8.

1. The Permittee must perform pH analysis on site with a calibrated pH meter, pH test kit, or wide range pH indicator paper. The Permittee must record pH sampling results in the site log book.

2. During the applicable pH monitoring period defined below, the Permittee must obtain a representative sample of stormwater and conduct pH analysis at least once per week.

    a. For sites with significant concrete work, the Permittee must begin the pH sampling period when the concrete is first placed or poured and exposed to precipitation, and continue weekly throughout and after the concrete placement, pour and curing period, until stormwater pH is in the range of 6.5 to 8.5 (su).

    b. For sites with recycled concrete where monitoring is required, the Permittee must begin the weekly pH sampling period when the recycled concrete is first exposed to precipitation and must continue until the recycled concrete is fully stabilized with the stormwater pH in the range of 6.5 to 8.5 (su).

    c. For sites with engineered soils, the Permittee must begin the pH sampling period when the soil amendments are first exposed to precipitation and must continue until the area of engineered soils is fully stabilized.

3. The Permittee must sample pH in the sediment trap/pond(s) or other locations that receive stormwater runoff from the area of significant concrete work or engineered soils before the stormwater discharges to surface waters.

4. The benchmark value for pH is 8.5 standard units. Anytime sampling indicates that pH is 8.5 or greater, the Permittee must either:

    a. Prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters of the state; *or*

    b. If necessary, adjust or neutralize the high pH water until it is in the range of pH 6.5 to 8.5 (su) using an appropriate treatment BMP such as carbon dioxide (CO_2) sparging, dry ice or food grade vinegar. The Permittee must obtain written approval from Ecology before using any form of chemical treatment other than CO_2 sparging, dry ice or food grade vinegar.

S5. REPORTING AND RECORDKEEPING REQUIREMENTS

A. High Turbidity Reporting

Anytime sampling performed in accordance with Special Condition S4.C indicates turbidity has reached the 250 NTUs or more (or transparency less than or equal to 6 cm), high turbidity reporting level, the Permittee must notify Ecology within 24 hours of analysis either by calling the applicable Ecology Region's Environmental Report Tracking System (ERTS) number by phone or by submitting an electronic ERTS report (through Ecology's Water Quality Permitting Portal (WQWebPortal) – Permit Submittals when the form is available). See the CSWGP website for links to ERTS and the WQWebPortal. (http://www.ecy.wa.gov/programs/wq/stormwater/construction/index.html) Also, see phone numbers in Special Condition S4.C.5.b.i.

B. Discharge Monitoring Reports (DMRs)

Permittees required to conduct water quality sampling in accordance with Special Conditions S4.C (Turbidity/Transparency), S4.D (pH), S8 (303[d]/TMDL sampling), and/or G12 (Additional Sampling) must submit the results to Ecology.

Permittees must submit monitoring data using Ecology's WQWebDMR web application accessed through Ecology's Water Quality Permitting Portal.

Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper copy DMR at:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

Permittees who obtain a waiver not to use WQWebDMR must use the forms provided to them by Ecology; submittals must be mailed to the address above. Permittees must submit DMR forms to be received by Ecology within 15 days following the end of each month.

If there was no discharge during a given monitoring period, all Permittees must submit a DMR as required with "no discharge" entered in place of the monitoring results. DMRs are required for the full duration of permit coverage (from the first full month following the effective date of permit coverage up until Ecology has approved termination of the coverage). For more information, contact Ecology staff using information provided at the following website: www.ecy.wa.gov/programs/wq/permits/paris/contacts.html.

C. Records Retention

The Permittee must retain records of all monitoring information (site log book, sampling results, inspection reports/checklists, etc.), Stormwater Pollution Prevention Plan, copy of the permit coverage letter (including Transfer of Coverage documentation) and any other documentation of compliance with permit requirements for the entire life of the construction project and for a minimum of five (5) years following the termination of permit coverage. Such information must include all calibration and maintenance records, and records of all data used to complete the application for this permit. This period of retention must be extended during

the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

D. Recording Results

For each measurement or sample taken, the Permittee must record the following information:

1. Date, place, method, and time of sampling or measurement.
2. The first and last name of the individual who performed the sampling or measurement.
3. The date(s) the analyses were performed.
4. The first and last name of the individual who performed the analyses.
5. The analytical techniques or methods used.
6. The results of all analyses.

E. Additional Monitoring by the Permittee

If the Permittee samples or monitors any pollutant more frequently than required by this permit using test procedures specified by Special Condition S4 of this permit, the sampling results for this monitoring must be included in the calculation and reporting of the data submitted in the Permittee's DMR.

F. Noncompliance Notification

In the event the Permittee is unable to comply with any part of the terms and conditions of this permit, and the resulting noncompliance may cause a threat to human health or the environment (such as but not limited to spills or fuels or other materials, catastrophic pond or slope failure, and discharges that violate water quality standards), or exceed numeric effluent limitations (see S8 – Discharges to 303(d) or TMDL Waterbodies), the Permittee must, upon becoming aware of the circumstance:

1. Notify Ecology within 24 hours of the failure to comply by calling the applicable Regional office ERTS phone number (refer to Special Condition S4.C.5.b.i, or go to https://ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue to find contact information for the regional offices.)
2. Immediately take action to prevent the discharge/pollution, or otherwise stop or correct the noncompliance, and, if applicable, repeat sampling and analysis of any noncompliance immediately and submit the results to Ecology within five (5) days of becoming aware of the violation (See S5.F.3, below, for details on submitting results in a report).
3. Submit a detailed written report to Ecology within five (5) days of the time the Permittee becomes aware of the circumstances, unless requested earlier by Ecology. The report must be submitted using Ecology's Water Quality Permitting Portal (WQWebPortal) – Permit Submittals, unless a waiver from electronic reporting has been granted according to S5.B. The report must contain a description of the noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Permittee must report any unanticipated bypass and/or upset that exceeds any effluent limit in the permit in accordance with the 24-hour reporting requirement contained in 40 C.F.R. 122.41(l)(6).

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply. Upon request of the Permittee, Ecology may waive the requirement for a written report on a case-by-case basis, if the immediate notification is received by Ecology within 24 hours.

G. Access to Plans and Records

1. The Permittee must retain the following permit documentation (plans and records) on site, or within reasonable access to the site, for use by the operator or for on-site review by Ecology or the local jurisdiction:

    a. General Permit

    b. Permit Coverage Letter

    c. Stormwater Pollution Prevention Plan (SWPPP)

    d. Site Log Book

    e. Erosivity Waiver (if applicable)

2. The Permittee must address written requests for plans and records listed above (Special Condition S5.G.1) as follows:

    a. The Permittee must provide a copy of plans and records to Ecology within 14 days of receipt of a written request from Ecology.

    b. The Permittee must provide a copy of plans and records to the public when requested in writing. Upon receiving a written request from the public for the Permittee's plans and records, the Permittee must either:

        i. Provide a copy of the plans and records to the requester within 14 days of a receipt of the written request; *or*

        ii. Notify the requester within 10 days of receipt of the written request of the location and times within normal business hours when the plans and records may be viewed; and provide access to the plans and records within 14 days of receipt of the written request; *or*

            Within 14 days of receipt of the written request, the Permittee may submit a copy of the plans and records to Ecology for viewing and/or copying by the requester at an Ecology office, or a mutually agreed location. If plans and records are viewed and/or copied at a location other than at an Ecology office, the Permittee will provide reasonable access to copying services for which a reasonable fee may be charged. The Permittee must notify the requester within 10 days of receipt of the request where the plans and records may be viewed and/or copied.

S6. PERMIT FEES

The Permittee must pay permit fees assessed by Ecology. Fees for stormwater discharges covered under this permit are established by Chapter 173-224 WAC. Ecology continues to assess permit fees until the permit is terminated in accordance with Special Condition S10 or revoked in accordance with General Condition G5.

S7. SOLID AND LIQUID WASTE DISPOSAL

The Permittee must handle and dispose of solid and liquid wastes generated by construction activity, such as demolition debris, construction materials, contaminated materials, and waste materials from maintenance activities, including liquids and solids from cleaning catch basins and other stormwater facilities, in accordance with:

A. Special Condition S3, Compliance with Standards.

B. WAC 173-216-110.

C. Other applicable regulations.

S8. DISCHARGES TO 303(d) OR TMDL WATERBODIES

A. Sampling and Numeric Effluent Limits For Certain Discharges to 303(d)-Listed Water Bodies

1. Permittees who discharge to segments of water bodies listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act for turbidity, fine sediment, high pH, or phosphorus, must conduct water quality sampling according to the requirements of this section, and Special Conditions S4.C.2.b-f and S4.C.3.b-d, and must comply with the applicable numeric effluent limitations in S8.C and S8.D.

2. All references and requirements associated with Section 303(d) of the Clean Water Act mean the most current listing by Ecology of impaired waters (Category 5) that exists on January 1, 2021, or the date when the operator's complete permit application is received by Ecology, whichever is later.

B. Limits on Coverage for New Discharges to TMDL or 303(d)-Listed Waters

Construction sites that discharge to a TMDL or 303(d)-listed waterbody are not eligible for coverage under this permit *unless* the operator:

1. Prevents exposing stormwater to pollutants for which the waterbody is impaired, and retains documentation in the SWPPP that details procedures taken to prevent exposure on site; *or*

2. Documents that the pollutants for which the waterbody is impaired are not present at the site, and retains documentation of this finding within the SWPPP; *or*

3. Provides Ecology with data indicating the discharge is not expected to cause or contribute to an exceedance of a water quality standard, and retains such data on site with the SWPPP. The operator must provide data and other technical information to Ecology that sufficiently demonstrate:

    a. For discharges to waters without an EPA-approved or -established TMDL, that the discharge of the pollutant for which the water is impaired will meet in-stream water quality criteria at the point of discharge to the waterbody; *or*

    b. For discharges to waters with an EPA-approved or -established TMDL, that there is sufficient remaining wasteload allocation in the TMDL to allow construction stormwater discharge and that existing dischargers to the waterbody are subject to compliance schedules designed to bring the waterbody into attainment with water quality standards.

    Operators of construction sites are eligible for coverage under this permit only after Ecology makes an affirmative determination that the *discharge will not cause or contribute to the existing impairment or exceed the TMDL.*

C. Sampling and Numeric Effluent Limits for Discharges to Water Bodies on the 303(d) List for Turbidity, Fine Sediment, or Phosphorus

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for turbidity, fine sediment, or phosphorus must conduct turbidity sampling in accordance with Special Condition S4.C.2 and comply with either of the numeric effluent limits noted in Table 5 below.

2. As an alternative to the 25 NTUs effluent limit noted in Table 5 below (applied at the point where stormwater [or authorized non-stormwater] is discharged off-site), Permittees may choose to comply with the surface water quality standard for turbidity. The standard is: no more than 5 NTUs over background turbidity when the background turbidity is 50 NTUs or less, or no more than a 10% increase in turbidity when the background turbidity is more than 50 NTUs. In order to use the water quality standard requirement, the sampling must take place at the following locations:

    a. Background turbidity in the 303(d)-listed receiving water immediately upstream (upgradient) or outside the area of influence of the discharge.

    b. Turbidity at the point of discharge into the 303(d)-listed receiving water, inside the area of influence of the discharge**.**

3. Discharges that exceed the numeric effluent limit for turbidity constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit must sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

Table 5 Turbidity, Fine Sediment & Phosphorus Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled	Unit	Analytical Method	Sampling Frequency	Numeric Effluent Limit[1]
• Turbidity • Fine Sediment • Phosphorus	Turbidity	NTU	SM2130	Weekly, if discharging	25 NTUs, at the point where stormwater is discharged from the site; ***OR*** In compliance with the surface water quality standard for turbidity (S8.C.2.a)

[1] Permittees subject to a numeric effluent limit for turbidity may, at their discretion, choose either numeric effluent limitation based on site-specific considerations including, but not limited to, safety, access and convenience.

D. Discharges to Water Bodies on the 303(d) List for High pH

1. Permittees who discharge to segments of water bodies on the 303(d) list (Category 5) for high pH must conduct pH sampling in accordance with the table below, and comply with the numeric effluent limit of pH 6.5 to 8.5 su (Table 6).

Table 6 pH Sampling and Limits for 303(d)-Listed Waters

Parameter identified in 303(d) listing	Parameter Sampled/Units	Analytical Method	Sampling Frequency	Numeric Effluent Limit
High pH	pH /Standard Units	pH meter	Weekly, if discharging	In the range of 6.5 – 8.5 su

2. At the Permittee's discretion, compliance with the limit shall be assessed at one of the following locations:

   a. Directly in the 303(d)-listed waterbody segment, inside the immediate area of influence of the discharge; *or*

   b. Alternatively, the Permittee may measure pH at the point where the discharge leaves the construction site, rather than in the receiving water.

3. Discharges that exceed the numeric effluent limit for pH (outside the range of 6.5 – 8.5 su) constitute a violation of this permit.

4. Permittees whose discharges exceed the numeric effluent limit must sample discharges daily until the violation is corrected and comply with the non-compliance notification requirements in Special Condition S5.F.

E. Sampling and Limits for Sites Discharging to Waters Covered by a TMDL or another Pollution Control Plan

1. Discharges to a waterbody that is subject to a Total Maximum Daily Load (TMDL) for turbidity, fine sediment, high pH, or phosphorus must be consistent with the TMDL. Refer to http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html for more information on TMDLs.

    a. Where an applicable TMDL sets specific waste load allocations or requirements for discharges covered by this permit, discharges must be consistent with any specific waste load allocations or requirements established by the applicable TMDL.

        i. The Permittee must sample discharges weekly, unless otherwise specified by the TMDL, to evaluate compliance with the specific waste load allocations or requirements.

        ii. Analytical methods used to meet the monitoring requirements must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136.

        iii. Turbidity and pH methods need not be accredited or registered unless conducted at a laboratory which must otherwise be accredited or registered.

    b. Where an applicable TMDL has established a general waste load allocation for construction stormwater discharges, but has not identified specific requirements, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    c. Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharges, but has not excluded these discharges, compliance with Special Conditions S4 (Monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL.

    d. Where an applicable TMDL specifically precludes or prohibits discharges from construction activity, the operator is not eligible for coverage under this permit.

S9. STORMWATER POLLUTION PREVENTION PLAN

The Permittee must prepare and properly implement an adequate Stormwater Pollution Prevention Plan (SWPPP) for construction activity in accordance with the requirements of this permit beginning with initial soil disturbance and until final stabilization.

A. The Permittee's SWPPP must meet the following objectives:

1. To identify best management practices (BMPs) which prevent erosion and sedimentation, and to reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. To prevent violations of surface water quality, groundwater quality, or sediment management standards.

3. To control peak volumetric flow rates and velocities of stormwater discharges.

B. General Requirements

1. The SWPPP must include a narrative and drawings. All BMPs must be clearly referenced in the narrative and marked on the drawings. The SWPPP narrative must include documentation to explain and justify the pollution prevention decisions made for the project. Documentation must include:

    a. Information about existing site conditions (topography, drainage, soils, vegetation, etc.).

    b. Potential erosion problem areas.

    c. The 13 elements of a SWPPP in Special Condition S9.D.1-13, including BMPs used to address each element.

    d. Construction phasing/sequence and general BMP implementation schedule.

    e. The actions to be taken if BMP performance goals are not achieved—for example, a contingency plan for additional treatment and/or storage of stormwater that would violate the water quality standards if discharged.

    f. Engineering calculations for ponds, treatment systems, and any other designed structures. When a treatment system requires engineering calculations, these calculations must be included in the SWPPP. Engineering calculations do not need to be included in the SWPPP for treatment systems that do not require such calculations.

2. The Permittee must modify the SWPPP if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is, or would be, ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The Permittee must then:

    a. Review the SWPPP for compliance with Special Condition S9 and make appropriate revisions within 7 days of the inspection or investigation.

    b. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible, addressing the problems no later than 10 days from the inspection or investigation. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when an extension is requested by a Permittee within the initial 10-day response period.

    c. Document BMP implementation and maintenance in the site log book.

    The Permittee must modify the SWPPP whenever there is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

C. Stormwater Best Management Practices (BMPs)

BMPs must be consistent with:

1. *Stormwater Management Manual for Western Washington* (most current approved edition at the time this permit was issued), for sites west of the crest of the Cascade Mountains; *or*

2. *Stormwater Management Manual for Eastern Washington* (most current approved edition at the time this permit was issued), for sites east of the crest of the Cascade Mountains; *or*

3. Revisions to the manuals listed in Special Condition S9.C.1 & 2, or other stormwater management guidance documents or manuals which provide an equivalent level of pollution prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230; *or*

4. Documentation in the SWPPP that the BMPs selected provide an equivalent level of pollution prevention, compared to the applicable stormwater management manuals, including:

    a. The technical basis for the selection of all stormwater BMPs (scientific, technical studies, and/or modeling) that support the performance claims for the BMPs being selected.

    b. An assessment of how the selected BMP will satisfy AKART requirements and the applicable federal technology-based treatment requirements under 40 CFR part 125.3.

D. SWPPP – Narrative Contents and Requirements

The Permittee must include each of the 13 elements below in Special Condition S9.D.1-13 in the narrative of the SWPPP and implement them unless site conditions render the element unnecessary and the exemption from that element is clearly justified in the SWPPP.

1. Preserve Vegetation/Mark Clearing Limits

    a. Before beginning land-disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.

    b. Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum degree practicable.

2. Establish Construction Access

    a. Limit construction vehicle access and exit to one route, if possible.

    b. Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking sediment onto roads.

    c. Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.

    d. If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pickup and transport of the sediment to a controlled sediment disposal area.

    e. Conduct street washing only after sediment removal in accordance with Special Condition S9.D.2.d.

    f. Control street wash wastewater by pumping back on site or otherwise preventing it from discharging into systems tributary to waters of the State.

3. Control Flow Rates

    a. Protect properties and waterways downstream of construction sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site, as required by local plan approval authority.

    b. Where necessary to comply with Special Condition S9.D.3.a, construct stormwater infiltration or detention BMPs as one of the first steps in grading. Assure that detention BMPs function properly before constructing site improvements (for example, impervious surfaces).

    c. If permanent infiltration ponds are used for flow control during construction, protect these facilities from sedimentation during the construction phase.

4. Install Sediment Controls

    The Permittee must design, install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, the Permittee must:

    a. Construct sediment control BMPs (sediment ponds, traps, filters, infiltration facilities, etc.) as one of the first steps in grading. These BMPs must be functional before other land disturbing activities take place.

    b. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.

    c. Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP, but must meet the flow control performance standard of Special Condition S9.D.3.a.

    d. Locate BMPs intended to trap sediment on site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.

    e. Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible.

    f. Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

5. Stabilize Soils

    a. The Permittee must stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include, but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion

control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base on areas to be paved, and dust control.

b. The Permittee must control stormwater volume and velocity within the site to minimize soil erosion.

c. The Permittee must control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.

d. Depending on the geographic location of the project, the Permittee must not allow soils to remain exposed and unworked for more than the time periods set forth below to prevent erosion.

West of the Cascade Mountains Crest
During the dry season (May 1 - September 30): 7 days
During the wet season (October 1 - April 30): 2 days

East of the Cascade Mountains Crest, except for Central Basin*
During the dry season (July 1 - September 30): 10 days
During the wet season (October 1 - June 30): 5 days

The Central Basin*, East of the Cascade Mountains Crest
During the dry Season (July 1 - September 30): 30 days
During the wet season (October 1 - June 30): 15 days

***Note: The Central Basin** is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches.

e. The Permittee must stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.

f. The Permittee must stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

g. The Permittee must minimize the amount of soil exposed during construction activity.

h. The Permittee must minimize the disturbance of steep slopes.

i. The Permittee must minimize soil compaction and, unless infeasible, preserve topsoil.

6. Protect Slopes

a. The Permittee must design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).

b. The Permittee must divert off-site stormwater (run-on) or groundwater away from slopes and disturbed areas with interceptor dikes, pipes, and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.

c. At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.

i. West of the Cascade Mountains Crest: Temporary pipe slope drains must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Temporary pipe slope drains must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

d. Place excavated material on the uphill side of trenches, consistent with safety and space considerations.

e. Place check dams at regular intervals within constructed channels that are cut down a slope.

7. Protect Drain Inlets

a. Protect all storm drain inlets made operable during construction so that stormwater runoff does not enter the conveyance system without first being filtered or treated to remove sediment.

b. Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

8. Stabilize Channels and Outlets

a. Design, construct and stabilize all on-site conveyance channels to prevent erosion from the following expected peak flows:

i. West of the Cascade Mountains Crest: Channels must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate indicated by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area."

ii. East of the Cascade Mountains Crest: Channels must handle the expected peak flow rate from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

b. Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches at the outlets of all conveyance systems.

9. Control Pollutants

Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The Permittee must:

a. Handle and dispose of all pollutants, including waste materials and demolition debris that occur on site in a manner that does not cause contamination of stormwater.

b. Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. Minimize storage of hazardous materials on-site. Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume of the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment.

c. Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.

d. Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland land application, or to the sanitary sewer with local sewer district approval.

e. Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.

f. Use BMPs to prevent contamination of stormwater runoff by pH-modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, recycled concrete stockpiles, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters. (Also refer to the definition for "concrete wastewater" in Appendix A – Definitions.)

g. Adjust the pH of stormwater or authorized non-stormwater if necessary to prevent an exceedance of groundwater and/or surface water quality standards.

h. Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete truck drums onto the ground, or into storm drains, open ditches, streets, or streams. Washout of small concrete handling equipment may be disposed of in a formed area awaiting concrete where it will not contaminate surface or groundwater. Do not dump excess concrete on site, except in designated concrete washout areas. Concrete spillage or concrete discharge directly to groundwater or surface waters of the State is

prohibited. At no time shall concrete be washed off into the footprint of an area where an infiltration BMP will be installed.

i. Obtain written approval from Ecology before using any chemical treatment, with the exception of CO_2, dry ice or food grade vinegar, to adjust pH.

j. Uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations may be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters. Prior to infiltration, water from water-only based shaft drilling that comes into contact with curing concrete must be neutralized until pH is in the range of 6.5 to 8.5 (su).

10. Control Dewatering

a. Permittees must discharge foundation, vault, and trench dewatering water, which have characteristics similar to stormwater runoff at the site, in conjunction with BMPs to reduce sedimentation before discharge to a sediment trap or sediment pond.

b. Permittees may discharge clean, non-turbid dewatering water, such as well-point groundwater, to systems tributary to, or directly into surface waters of the State, as specified in Special Condition S9.D.8, provided the dewatering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.

c. Other dewatering treatment or disposal options may include:

i. Infiltration

ii. Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.

iii. Ecology-approved on-site chemical treatment or other suitable treatment technologies (See S9.D.9.i, regarding chemical treatment written approval).

iv. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.

v. Use of a sedimentation bag with discharge to a ditch or swale for small volumes of localized dewatering.

d. Permittees must handle highly turbid or contaminated dewatering water separately from stormwater.

11. Maintain BMPs

a. Permittees must maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.

b. Permittees must remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

12. Manage the Project

    a. Phase development projects to the maximum degree practicable and take into account seasonal work limitations.

    b. Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with Special Condition S4.

    c. Maintain, update, and implement the SWPPP in accordance with Special Conditions S3, S4, and S9.

13. Protect Low Impact Development (LID) BMPs

    The primary purpose of on-site LID Stormwater Management is to reduce the disruption of the natural site hydrology through infiltration. LID BMPs are permanent facilities.

    a. Permittees must protect all LID BMPs (including, but not limited to, Bioretention and Rain Garden facilities) from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden facilities. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the facility must include removal of sediment and any sediment-laden bioretention/ rain garden soils, and replacing the removed soils with soils meeting the design specification.

    b. Permittees must maintain the infiltration capabilities of LID BMPs by protecting against compaction by construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

    c. Permittees must control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.

    d. Permittees must clean permeable pavements fouled with sediments or no longer passing an initial infiltration test using local stormwater manual methodology or the manufacturer's procedures.

    e. Permittees must keep all heavy equipment off existing soils under LID BMPs that have been excavated to final grade to retain the infiltration rate of the soils.

E. SWPPP – Map Contents and Requirements

The Permittee's SWPPP must also include a vicinity map or general location map (for example, a USGS quadrangle map, a portion of a county or city map, or other appropriate map) with enough detail to identify the location of the construction site and receiving waters within one mile of the site.

The SWPPP must also include a legible site map (or maps) showing the entire construction site. The following features must be identified, unless not applicable due to site conditions.

1. The direction of north, property lines, and existing structures and roads.

2. Cut and fill slopes indicating the top and bottom of slope catch lines.

3. Approximate slopes, contours, and direction of stormwater flow before and after major grading activities.

4. Areas of soil disturbance and areas that will not be disturbed.

5. Locations of structural and nonstructural controls (BMPs) identified in the SWPPP.

6. Locations of off-site material, stockpiles, waste storage, borrow areas, and vehicle/equipment storage areas.

7. Locations of all surface water bodies, including wetlands.

8. Locations where stormwater or non-stormwater discharges off-site and/or to a surface waterbody, including wetlands.

9. Location of water quality sampling station(s), if sampling is required by state or local permitting authority.

10. Areas where final stabilization has been accomplished and no further construction-phase permit requirements apply.

11. Location or proposed location of LID facilities.

S10. NOTICE OF TERMINATION

Partial terminations of permit coverage are not authorized.

A. The site is eligible for termination of coverage when it has met any of the following conditions:

1. The site has undergone final stabilization, the Permittee has removed all temporary BMPs (except biodegradable BMPs clearly manufactured with the intention for the material to be left in place and not interfere with maintenance or land use), and all stormwater discharges associated with construction activity have been eliminated; *or*

2. All portions of the site that have not undergone final stabilization per Special Condition S10.A.1 have been sold and/or transferred (per Special Condition S2.A), and the Permittee no longer has operational control of the construction activity; *or*

3. For residential construction only, the Permittee has completed temporary stabilization and the homeowners have taken possession of the residences.

B. When the site is eligible for termination, the Permittee must submit a complete and accurate Notice of Termination (NOT) form, signed in accordance with General Condition G2, to:

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

When an electronic termination form is available, the Permittee may choose to submit a complete and accurate Notice of Termination (NOT) form through the Water Quality Permitting Portal rather than mailing a hardcopy as noted above.

The termination is effective on the 31st calendar day following the date Ecology receives a complete NOT form, unless Ecology notifies the Permittee that termination request is denied because the Permittee has not met the eligibility requirements in Special Condition S10.A.

Permittees are required to comply with all conditions and effluent limitations in the permit until the permit has been terminated.

Permittees transferring the property to a new property owner or operator/Permittee are required to complete and submit the Notice of Transfer form to Ecology, but are not required to submit a Notice of Termination form for this type of transaction.

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit must be consistent with the terms and conditions of this general permit. Any discharge of any pollutant more frequent than or at a level in excess of that identified and authorized by the general permit must constitute a violation of the terms and conditions of this permit.

G2. SIGNATORY REQUIREMENTS

A. All permit applications must bear a certification of correctness to be signed:

1. In the case of corporations, by a responsible corporate officer.
2. In the case of a partnership, by a general partner of a partnership.
3. In the case of sole proprietorship, by the proprietor.
4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by Ecology (including NOIs, NOTs, and Transfer of Coverage forms) must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to Ecology.
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

C. Changes to authorization. If an authorization under paragraph G2.B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G2.B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section must make the following certification:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G3. RIGHT OF INSPECTION AND ENTRY

The Permittee must allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records are kept under the terms and conditions of this permit.

B. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.

C. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G4. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of Chapter 173-226 WAC. Grounds for modification, revocation and reissuance, or termination include, but are not limited to, the following:

A. When a change occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit.

B. When effluent limitation guidelines or standards are promulgated pursuant to the CWA or Chapter 90.48 RCW, for the category of dischargers covered under this permit.

C. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved, or

D. When information is obtained that indicates cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G5. REVOCATION OF COVERAGE UNDER THE PERMIT

Pursuant to Chapter 43.21B RCW and Chapter 173-226 WAC, the Director may terminate coverage for any discharger under this permit for cause. Cases where coverage may be terminated include, but are not limited to, the following:

A. Violation of any term or condition of this permit.

B. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

C. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

D. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

E. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.

F. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and Chapter 173-224 WAC.

G. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable.

The Director may require any discharger under this permit to apply for and obtain coverage under an individual permit or another more specific general permit. Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within ninety (90) days from the time of revocation and is submitted along with a complete individual permit application form.

G6. REPORTING A CAUSE FOR MODIFICATION

The Permittee must submit a new application, or a supplement to the previous application, whenever a material change to the construction activity or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application must be submitted at least sixty (60) days prior to any proposed changes. Filing a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit will be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee must apply for permit renewal at least 180 days prior to the specified expiration date of this permit. The Permittee must reapply using the electronic application form (NOI) available on Ecology's website. Permittees unable to submit electronically (for example, those who do not have an internet connection) must contact Ecology to request a waiver and obtain instructions on how to obtain a paper NOI.

Department of Ecology
Water Quality Program - Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

G9. REMOVED SUBSTANCE

The Permittee must not re-suspend or reintroduce collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater to the final effluent stream for discharge to state waters.

G10. DUTY TO PROVIDE INFORMATION

The Permittee must submit to Ecology, within a reasonable time, all information that Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology, upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G11. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to ten thousand dollars ($10,000) and costs of prosecution, or by imprisonment at the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G14. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in Special Condition S5.F, and; 4) the Permittee complied with any remedial measures required under this permit.

In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G15. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G16. DUTY TO COMPLY

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G17. TOXIC POLLUTANTS

The Permittee must comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G18. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this condition, punishment shall be a fine of not more than $20,000 per day of violation, or imprisonment of not more than four (4) years, or both.

G19. REPORTING PLANNED CHANGES

The Permittee must, as soon as possible, give notice to Ecology of planned physical alterations, modifications or additions to the permitted construction activity. The Permittee should be aware that, depending on the nature and size of the changes to the original permit, a new public notice and other permit process requirements may be required. Changes in activities that require reporting to Ecology include those that will result in:

A. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

B. A significant change in the nature or an increase in quantity of pollutants discharged, including but not limited to: a 20% or greater increase in acreage disturbed by construction activity.

C. A change in or addition of surface water(s) receiving stormwater or non-stormwater from the construction activity.

D. A change in the construction plans and/or activity that affects the Permittee's monitoring requirements in Special Condition S4.

Following such notice, permit coverage may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G20. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to Ecology, it must promptly submit such facts or information.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee must give advance notice to Ecology by submission of a new application or supplement thereto at least forty-five (45) days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of

operation and degradation of effluent quality, must be scheduled during non-critical water quality periods and carried out in a manner approved by Ecology.

G22. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER THE PERMIT

Any discharger authorized by this permit may request to be excluded from coverage under the general permit by applying for an individual permit. The discharger must submit to the Director an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons will fully document how an individual permit will apply to the applicant in a way that the general permit cannot. Ecology may make specific requests for information to support the request. The Director will either issue an individual permit or deny the request with a statement explaining the reason for the denial. When an individual permit is issued to a discharger otherwise subject to the construction stormwater general permit, the applicability of the construction stormwater general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G23. APPEALS

A. The terms and conditions of this general permit, as they apply to the appropriate class of dischargers, are subject to appeal by any person within 30 days of issuance of this general permit, in accordance with Chapter 43.21B RCW, and Chapter 173-226 WAC.

B. The terms and conditions of this general permit, as they apply to an individual discharger, are appealable in accordance with Chapter 43.21B RCW within 30 days of the effective date of coverage of that discharger. Consideration of an appeal of general permit coverage of an individual discharger is limited to the general permit's applicability or nonapplicability to that individual discharger.

C. The appeal of general permit coverage of an individual discharger does not affect any other dischargers covered under this general permit. If the terms and conditions of this general permit are found to be inapplicable to any individual discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G24. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

G25. BYPASS PROHIBITED

A. Bypass Procedures

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited for stormwater events below the design criteria for stormwater management. Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (1, 2, 3 or 4) is applicable.

1. Bypass of stormwater is consistent with the design criteria and part of an approved management practice in the applicable stormwater management manual.

2. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health.

3. Bypass of stormwater is unavoidable, unanticipated, and results in noncompliance of this permit.

   This bypass is permitted only if:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

   b. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.

   c. Ecology is properly notified of the bypass as required in Special Condition S5.F of this permit.

4. A planned action that would cause bypass of stormwater and has the potential to result in noncompliance of this permit during a storm event.

   The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

   a. A description of the bypass and its cause

   b. An analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.

   c. A cost-effectiveness analysis of alternatives including comparative resource damage assessment.

   d. The minimum and maximum duration of bypass under each alternative.

   e. A recommendation as to the preferred alternative for conducting the bypass.

   f. The projected date of bypass initiation.

   g. A statement of compliance with SEPA.

   h. A request for modification of water quality standards as provided for in WAC 173-201A-110, if an exceedance of any water quality standard is anticipated.

   i. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

5. For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above must be considered during

preparation of the Stormwater Pollution Prevention Plan (SWPPP) and must be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Ecology will consider the following before issuing an administrative order for this type bypass:

a. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.

b. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.

c. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve, conditionally approve, or deny the request. The public must be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under RCW 90.48.120.

B. Duty to Mitigate

The Permittee is required to take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

APPENDIX A – DEFINITIONS

AKART is an acronym for "**A**ll **K**nown, **A**vailable, and **R**easonable methods of prevention, control, and **T**reatment." AKART represents the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants and controlling pollution associated with a discharge.

Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus, which was completed and approved by EPA before January 1, 2021, or before the date the operator's complete permit application is received by Ecology, whichever is later. TMDLs completed after a complete permit application is received by Ecology become applicable to the Permittee only if they are imposed through an administrative order by Ecology, or through a modification of permit coverage.

Applicant means an *operator* seeking coverage under this permit.

Benchmark means a pollutant concentration used as a permit threshold, below which a pollutant is considered unlikely to cause a water quality violation, and above which it may. When pollutant concentrations exceed benchmarks, corrective action requirements take effect. Benchmark values are not water quality standards and are not numeric effluent limitations; they are indicator values.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control stormwater associated with construction activity, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer means an area designated by a local jurisdiction that is contiguous to and intended to protect a sensitive area.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Calendar Day A period of 24 consecutive hours starting at 12:00 midnight and ending the following 12:00 midnight.

Calendar Week (same as **Week**) means a period of seven consecutive days starting at 12:01 a.m. (0:01 hours) on Sunday.

Certified Erosion and Sediment Control Lead (CESCL) means a person who has current certification through an approved erosion and sediment control training program that meets the minimum training standards established by Ecology (See BMP C160 in the SWMM).

Chemical Treatment means the addition of chemicals to stormwater and/or authorized non-stormwater prior to filtration and discharge to surface waters.

Clean Water Act (CWA) means the Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; USC 1251 et seq.

Combined Sewer means a sewer which has been designed to serve as a sanitary sewer and a storm sewer, and into which inflow is allowed by local ordinance.

Common Plan of Development or Sale means a site where multiple separate and distinct construction activities may be taking place at different times on different schedules and/or by different contractors, but still under a single plan. Examples include: 1) phased projects and projects with multiple filings or lots, even if the separate phases or filings/lots will be constructed under separate contract or by separate owners (e.g., a development where lots are sold to separate builders); 2) a development plan that may be phased over multiple years, but is still under a consistent plan for long-term development; 3) projects in a contiguous area that may be unrelated but still under the same contract, such as construction of a building extension and a new parking lot at the same facility; and 4) linear projects such as roads, pipelines, or utilities. If the project is part of a common plan of development or sale, the disturbed area of the entire plan must be used in determining permit requirements.

Composite Sample means a mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increases while maintaining a constant time interval between the aliquots.

Concrete Wastewater means any water used in the production, pouring and/or clean-up of concrete or concrete products, and any water used to cut, grind, wash, or otherwise modify concrete or concrete products. Examples include water used for or resulting from concrete truck/mixer/pumper/tool/chute rinsing or washing, concrete saw cutting and surfacing (sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing). When stormwater comingles with concrete wastewater, the resulting water is considered concrete wastewater and must be managed to prevent discharge to waters of the State, including groundwater.

Construction Activity means land disturbing operations including clearing, grading or excavation which disturbs the surface of the land (including off-site disturbance acreage related to construction-support activity). Such activities may include road construction, construction of residential houses, office buildings, or industrial buildings, site preparation, soil compaction, movement and stockpiling of topsoils, and demolition activity.

Construction Support Activity means off-site acreage that will be disturbed as a direct result of the construction project and will discharge stormwater. For example, off-site equipment staging yards, material storage areas, borrow areas, and parking areas.

Contaminant means any hazardous substance that does not occur naturally or occurs at greater than natural background levels. See definition of “hazardous substance” and WAC 173-340-200.

Contaminated soil means soil which contains contaminants, pollutants, or hazardous substances that do not occur naturally or occur at levels greater than natural background.

Contaminated groundwater means groundwater which contains contaminants, pollutants, or hazardous substances that do not occur naturally or occur at levels greater than natural background.

Demonstrably Equivalent means that the technical basis for the selection of all stormwater BMPs is documented within a SWPPP, including:

1. The method and reasons for choosing the stormwater BMPs selected.
2. The pollutant removal performance expected from the BMPs selected.

3. The technical basis supporting the performance claims for the BMPs selected, including any available data concerning field performance of the BMPs selected.
4. An assessment of how the selected BMPs will comply with state water quality standards.
5. An assessment of how the selected BMPs will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment (AKART).

Department means the Washington State Department of Ecology.

Detention means the temporary storage of stormwater to improve quality and/or to reduce the mass flow rate of discharge.

Dewatering means the act of pumping groundwater or stormwater away from an active construction site.

Director means the Director of the Washington State Department of Ecology or his/her authorized representative.

Discharger means an owner or operator of any facility or activity subject to regulation under Chapter 90.48 RCW or the Federal Clean Water Act.

Domestic Wastewater means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such groundwater infiltration or surface waters as may be present.

Ecology means the Washington State Department of Ecology.

Engineered Soils means the use of soil amendments including, but not limited, to Portland cement treated base (CTB), cement kiln dust (CKD), or fly ash to achieve certain desirable soil characteristics.

Equivalent BMPs means operational, source control, treatment, or innovative BMPs which result in equal or better quality of stormwater discharge to surface water or to groundwater than BMPs selected from the SWMM.

Erosion means the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Erosion and Sediment Control BMPs means BMPs intended to prevent erosion and sedimentation, such as preserving natural vegetation, seeding, mulching and matting, plastic covering, filter fences, sediment traps, and ponds. Erosion and sediment control BMPs are synonymous with stabilization and structural BMPs.

Federal Operator is an entity that meets the definition of "Operator" in this permit and is either any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States, or another entity, such as a private contractor, performing construction activity for any such department, agency, or instrumentality.

Final Stabilization (same as **fully stabilized** or **full stabilization**) means the completion of all soil disturbing activities at the site and the establishment of permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See the applicable Stormwater Management Manual for more information on vegetative cover expectations and equivalent permanent stabilization measures.

Groundwater means water in a saturated zone or stratum beneath the land surface or a surface waterbody.

Hazardous Substance means any dangerous or extremely hazardous waste as defined in RCW 70.105.010 (5) and (6), or any dangerous or extremely dangerous waste as designated by rule under chapter 70.105 RCW; any hazardous sub-stance as defined in RCW 70.105.010(14) or any hazardous substance as defined by rule under chapter 70.105 RCW; any substance that, on the effective date of this section, is a hazardous substance under section 101(14) of the federal cleanup law, 42U.S.C., Sec. 9601(14); petroleum or petroleum products; and any substance or category of substances, including solid waste decomposition products, determined by the director by rule to present a threat to human health or the environment if released into the environment. The term hazardous substance does not include any of the following when contained in an underground storage tank from which there is not a release: crude oil or any fraction thereof or petroleum, if the tank is in compliance with all applicable federal, state, and local law.

Injection Well means a well that is used for the subsurface emplacement of fluids. (See **Well**.)

Jurisdiction means a political unit such as a city, town or county; incorporated for local self-government.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the State from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington State Department of Ecology.

Notice of Intent (NOI) means the application for, or a request for coverage under this general permit pursuant to WAC 173-226-200.

Notice of Termination (NOT) means a request for termination of coverage under this general permit as specified by Special Condition S10 of this permit.

Operator means any party associated with a construction project that meets either of the following two criteria:

- The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
- The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with a SWPPP for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWPPP or comply with other permit conditions).

Permittee means individual or entity that receives notice of coverage under this general permit.

pH means a liquid's measure of acidity or alkalinity. A pH of 7 is defined as neutral. Large variations above or below this value are considered harmful to most aquatic life.

pH Monitoring Period means the time period in which the pH of stormwater runoff from a site must be tested a minimum of once every seven days to determine if stormwater pH is between 6.5 and 8.5.

Point Source means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, and container from which pollutants are or may be discharged to surface waters of the State. This term does not include return flows from irrigated agriculture. (See the Fact Sheet for further explanation)

Pollutant means dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, domestic sewage sludge (biosolids), munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste. This term does not include sewage from vessels within the meaning of section 312 of the CWA, nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the CWA.

Pollution means contamination or other alteration of the physical, chemical, or biological properties of waters of the State; including change in temperature, taste, color, turbidity, or odor of the waters; or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare; or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Process Wastewater means any non-stormwater which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. If stormwater commingles with process wastewater, the commingled water is considered process wastewater.

Receiving Water means the waterbody at the point of discharge. If the discharge is to a storm sewer system, either surface or subsurface, the receiving water is the waterbody to which the storm system discharges. Systems designed primarily for other purposes such as for groundwater drainage, redirecting stream natural flows, or for conveyance of irrigation water/return flows that coincidentally convey stormwater are considered the receiving water.

Representative means a stormwater or wastewater sample which represents the flow and characteristics of the discharge. Representative samples may be a grab sample, a time-proportionate *composite sample*, or a flow proportionate sample. Ecology's Construction Stormwater Monitoring Manual provides guidance on representative sampling.

Responsible Corporate Officer for the purpose of signatory authority means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Sanitary Sewer means a sewer which is designed to convey domestic wastewater.

Sediment means the fragmented material that originates from the weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation means the depositing or formation of sediment.

Sensitive Area means a waterbody, wetland, stream, aquifer recharge area, or channel migration zone.

SEPA (State Environmental Policy Act) means the Washington State Law, RCW 43.21C.020, intended to prevent or eliminate damage to the environment.

Significant Amount means an amount of a pollutant in a discharge that is amenable to available and reasonable methods of prevention or treatment; or an amount of a pollutant that has a reasonable potential to cause a violation of surface or groundwater quality or sediment management standards.

Significant Concrete Work means greater than 1000 cubic yards placed or poured concrete or recycled concrete used over the life of a project.

Significant Contributor of Pollutants means a facility determined by Ecology to be a contributor of a significant amount(s) of a pollutant(s) to waters of the State of Washington.

Site means the land or water area where any "facility or activity" is physically located or conducted.

Source Control BMPs means physical, structural or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. A few examples of source control BMPs are erosion control practices, maintenance of stormwater facilities, constructing roofs over storage and working areas, and directing wash water and similar discharges to the sanitary sewer or a dead end sump.

Stabilization means the application of appropriate BMPs to prevent the erosion of soils, such as, temporary and permanent seeding, vegetative covers, mulching and matting, plastic covering and sodding. See also the definition of Erosion and Sediment Control BMPs.

Storm Drain means any drain which drains directly into a *storm sewer system*, usually found along roadways or in parking lots.

Storm Sewer System means a means a conveyance, or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains designed or used for collecting or conveying stormwater. This does not include systems which are part of *a combined sewer* or Publicly Owned Treatment Works (POTW), as defined at 40 CFR 122.2.

Stormwater means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.

Stormwater Management Manual (SWMM) or **Manual** means the technical Manual published by Ecology for use by local governments that contain descriptions of and design criteria for BMPs to prevent, control, or treat pollutants in stormwater.

Stormwater Pollution Prevention Plan (SWPPP) means a documented plan to implement measures to identify, prevent, and control the contamination of point source discharges of stormwater.

Surface Waters of the State includes lakes, rivers, ponds, streams, inland waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Temporary Stabilization means the exposed ground surface has been covered with appropriate materials to provide temporary stabilization of the surface from water or wind erosion. Materials include, but are not limited to, mulch, riprap, erosion control mats or blankets and temporary cover crops. Seeding alone is not considered stabilization. Temporary stabilization is not a substitute for the more permanent “final stabilization.”

Total Maximum Daily Load (TMDL) means a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations must include a "margin of safety" to ensure that the waterbody can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation must also account for seasonable variation in water quality.

Transfer of Coverage (TOC) means a request for transfer of coverage under this general permit as specified by Special Condition S2.A of this permit.

Treatment BMPs means BMPs that are intended to remove pollutants from stormwater. A few examples of treatment BMPs are detention ponds, oil/water separators, biofiltration, and constructed wetlands.

Transparency means a measurement of water clarity in centimeters (cm), using a 60 cm transparency tube. The transparency tube is used to estimate the relative clarity or transparency of water by noting the depth at which a black and white Secchi disc becomes visible when water is released from a value in the bottom of the tube. A transparency tube is sometimes referred to as a “turbidity tube.”

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTUs) and measured with a calibrated turbidimeter.

Uncontaminated means free from any contaminant. See definition of “contaminant” and WAC 173-340-200.

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

Waste Load Allocation (WLA) means the portion of a receiving water’s loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation (40 CFR 130.2[h]).

Water-Only Based Shaft Drilling is a shaft drilling process that uses water only and no additives are involved in the drilling of shafts for construction of building, road, or bridge foundations.

Water Quality means the chemical, physical, and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Waters of the State includes those waters as defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State and "waters of the State" as defined in Chapter 90.48 RCW, which include lakes, rivers, ponds, streams, inland waters, underground waters, salt

waters, and all other surface waters and water courses within the jurisdiction of the state of Washington.

Well means a bored, drilled or driven shaft, or dug hole whose depth is greater than the largest surface dimension. (See **Injection Well**.)

Wheel Wash Wastewater means any water used in, or resulting from the operation of, a tire bath or wheel wash (BMP C106: Wheel Wash), or other structure or practice that uses water to physically remove mud and debris from vehicles leaving a construction site and prevent track-out onto roads. When stormwater comingles with wheel wash wastewater, the resulting water is considered wheel wash wastewater and must be managed according to Special Condition S9.D.9.

APPENDIX B – ACRONYMS

AKART	All Known, Available, and Reasonable Methods of Prevention, Control, and Treatment
BMP	Best Management Practice
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
CKD	Cement Kiln Dust
cm	Centimeters
CPD	Common Plan of Development
CTB	Cement-Treated Base
CWA	Clean Water Act
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
FR	Federal Register
LID	Low Impact Development
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Unit
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
UIC	Underground Injection Control
USC	United States Code
USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code
WQ	Water Quality
WWHM	Western Washington Hydrology Model

DEPARTMENT OF ECOLOGY
State of Washington

Construction Stormwater General Permit
Proposed New Discharge to an Impaired Water Body

Part 1. Site Information

1a. Site or Project Name: 816 Mercer

1b. Site Address or Location Description:	City:	County:
816 Mercer	Seattle	King

1c. Impaired Water Body: Union Lake

1d. Impairment Pollutant(s): Bacteria, Temperature

Part 2. Discharge Certification

Ecology will not grant coverage under the Construction Stormwater General Permit (CSWGP) for new discharges to an impaired water body if the discharge will cause or contribute to a violation of water quality standards. An impaired water body may be a Category 4 (with an approved Total Maximum Daily Load [TMDL] plan or other pollution control plan), or a Category 5 (no approved TMDL in place). For Ecology to determine whether permit coverage is appropriate, the site operator (Permittee) must select one of the three options below, complete this form, and provide the required documentation to Ecology.

Select the one option below that most clearly applies to your site.* Additionally, submit documentation that supports the chosen option. This same documentation must also be included as part of your SWPPP and kept on site when the SWPPP is prepared.

☐ 2a. The pollutant(s) for which the water body is impaired is/are not present on the site. Documentation of this finding is contained within the SWPPP. (If the water body is impaired for more than one pollutant, check this box only if NONE of the impairment pollutants are present on site).

☒ 2b. Stormwater will not be exposed to the pollutant(s) for which the water body is impaired, and the SWPPP details procedures taken to prevent exposure on site. (This statement must be true for all pollutants for which the water body is impaired. If any impairment pollutant does not meet 2a or 2b, you must complete 2c).

☐ 2c. You don't expect the discharge to cause or contribute to an exceedance of a water quality standard. Provide Ecology with data to support this statement, and retain such data on site with the SWPPP. The operator must provide data and other technical information to Ecology that sufficiently demonstrates one of the following:

i. For discharges to waters without an EPA-approved or established TMDL (water cleanup plan), the discharge of the impairment pollutant(s) will meet in-stream water quality criteria at the point of discharge to the water body.

ii. For discharges to waters with an EPA-approved or established TMDL, there is sufficient remaining wasteload allocation in the TMDL to allow the construction stormwater discharge and that existing dischargers to the water body are subject to compliance schedules designed to bring the water body into attainment with water quality standards.

**If none of the above options apply to your site, your site will not be eligible for coverage under the permit.*

Part 3. Signature

3a. *"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

Printed Name / Company (Operator/Permittee only) — Title: SR. V.P.

Signature of Operator/Permittee* — Date: 3/17/22

* Federal regulations require this application is signed by one of the following:

A. For a corporation: By a principal executive officer of at least the level of vice president.
B. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively.
C. For a municipality, state, federal, or other public facility: By either a principal executive officer or ranking elected official.

Please sign and return this document to the following address:

Washington Department of Ecology - Stormwater
PO Box 47696
Olympia, WA 98504-7696

If you have questions, please call:

Location	Contact Name	Phone	E-mail
Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Skagit, Snohomish, Spokane, Stevens, Walla Walla, Whatcom, and Whitman counties	Shawn Hopkins	360-407-6442	shawn.hopkins@ecy.wa.gov
Island, King (except Seattle), and San Juan counties	Clay Keown	360-407-6048	clay.keown@ecy.wa.gov
City of Seattle and Kitsap, Pierce, and Thurston counties	Josh Klimek	360-407-7451	josh.klimek@ecy.wa.gov
Benton, Chelan, Clallam, Clark, Cowlitz, Douglas, Grays Harbor, Jefferson, Kittitas, Klickitat, Lewis, Mason, Okanogan, Pacific, Skamania, Wahkiakum, and Yakima counties	Joyce Smith	360-407-6858	joyce.smith@ecy.wa.gov

If you need this document in a format for the visually impaired, call the Water Quality Program at 360-407-6600. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

Directions for Completing the Impaired (303[d]-List) Water Body New Discharger Form

Part 1.

1a and 1b: Provide site information. This site information must be identical to the information provided on your notice of intent application form to obtain coverage under the Construction Stormwater General Permit.

1c: Write the name of the 303(d)-listed (also called *Category 5*) water body segment(s) to which your site drains or discharges into.

1d: List all pollutants (for example, temperature, fecal coliform, bacteria, etc.) for which the Category 5 water body is impaired. The following website can help you obtain this information: http://apps.ecy.wa.gov/wqawa2008/viewer.htm

Part 2.

If your site may discharge to an impaired water body or water body segment, you are required to select one of the three options (2a, 2b, or 2c) most appropriate to your site's situation in order to be eligible for coverage under the CSWGP. Please note that the examples below are NOT specific to the pollutants used in the examples. Any impairment pollutant may apply to any of the three options.

For the purpose of this requirement, Ecology is concerned with Category 4 and 5 water bodies (see http://www.ecy.wa.gov/programs/wq/303d/WQAssessmentCats.html for more information). Category 4 impaired water bodies are those that may have a TMDL plan, may have a pollution control program, or may be impaired by a "non-pollutant" such as a dam; Category 5 impaired water bodies are those on the Clean Water Act's "303(d) list" and do not yet have a completed TMDL.

Option 2a: Choose this option if the pollutant(s) of concern is not present on site.

For example:

- *The water body segment is impaired for fecal coliform bacteria, but there is no known source of fecal coliform bacteria (waste from animals or humans) contamination on the site.*
- *The water body is impaired for temperature, but due to site characteristics (soils, vegetation, drainage, etc.) and time of year that discharges are most likely to occur (Oct-April), there will not be a source of warm water that would cause an increase in the receiving water temperature.*
- *The water body sediments are impaired for PCBs and dioxin, but there are no known sources of these pollutants on the site.*

Option 2b: Choose this option when the pollutant(s) of concern is on site but stormwater will not come in contact with this pollutant.

For example:

- *The water body segment is impaired for phosphorus, high pH and low dissolved oxygen. Soil on the site contains phosphorus that may contribute to excessive plant growth, which in turn may cause high pH and low dissolved oxygen levels in water bodies. The SWPPP contains detailed plans to cover all exposed soils (with plastic sheets, straw mulch, etc.) to prevent stormwater from conveying soil/sediment (and the attached phosphorus) into the water body. Soil stabilization and revegetation will not include the use of phosphorus-containing fertilizers, compost or other products that could cause excess phosphorus or other nutrients to be discharged. In addition, sediment control measures (traps, ponds, silt fence, wattles, etc.) will be installed and maintained to ensure that sediment laden stormwater is not discharged during the construction activity.*
- *The water body sediment is impaired for total petroleum hydrocarbons (constituents of gasoline, diesel, oil and other petroleum-based products), but the SWPPP contains measures to ensure that all petroleum products (for example, fuel, lubricants) used during construction are covered and contained to prevent the discharge of petroleum hydrocarbons into the receiving water.*
- *The water body is impaired for dioxin, and the site's groundwater contains dioxin. However, the dioxin-contaminated groundwater will be pumped into tanks for off-site disposal and treatment, while preventing the groundwater (and dioxin) from co-mingling with stormwater.*

Option 2c: Choose this option when the pollutant(s) of concern is on site, will be exposed to stormwater, and will be discharged off site. You will need to document, in advance, how the pollutant will be controlled, minimized, and discharged to meet the in-stream water quality criteria for the water body. You will need to attach additional documents to fully meet the submittal requirements of this option (a copy or excerpt from the SWPPP, a brief narrative of pollution control methods, sampling data, etc.).

For example:

- *The receiving water body is impaired for turbidity and fine sediments. Mandatory BMPs (Best Management Practices) and erosion-control practices put in place by the permit will appropriately minimize the turbidity of the stormwater discharges. Additionally, retention ponds will allow for suspended solids to settle out before stormwater is discharged.*

The conditions of **2c.i** apply for discharges to water bodies without a TMDL and require providing data and other technical information to demonstrate that the discharge will not cause or contribute to a violation of the water quality standards at the point of discharge. This would typically involve pre-construction water quality sampling, or other site-specific investigation(s). You should contact Ecology to discuss the development of an appropriate sampling and/or site characterization plan. This option should only be pursued if Options 2a or 2b are not applicable to your site.

The conditions of **2c.ii** would only apply if your site discharges to a water body segment with an EPA-approved or EPA-established TMDL. If that is the case, contact your Ecology permit administrator – this person will help you determine whether there is sufficient remaining wasteload allocation to allow additional construction stormwater discharges and the existing discharges are subject to compliance schedules to bring the water body into compliance with the water quality standards.

Definitions

303(d) List: The term "303(d) list" is the list of impaired and threatened waters (stream/river segments, lakes, etc) that the Clean Water Act requires all states to submit for EPA approval every two years in even-numbered years. The states identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards, and establish priorities for development of "total maximum daily loads," or TMDLs (water cleanup plans), based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors (40C.F.R. §130.7[b][4]). States then provide a long-term plan for completing TMDLs within 8 to 13 years from first listing.

Impaired (303[d]-Listed) Water Body: Water bodies that do not meet water quality standards and are listed on the 303(d) list (see 303(d) List).

SWPPP: Stormwater pollution prevention plan. The Permittee's SWPPP is required to be maintained and updated on site, and must support the site operator's efforts to implement best management practices (BMPs) to prevent erosion and sedimentation and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity; to prevent violations of surface water quality, ground water quality, or sediment management standards; and to control peak volumetric flow rates and velocities of stormwater discharges. The SWPPP must include a narrative and drawings. The SWPPP narrative must include documentation to explain and justify the pollution prevention decisions made for the project. (All BMPs must be clearly referenced in the narrative and marked on the drawings)

TMDL: The TMDL (Total Maximum Daily Load or water cleanup plan) calculates the maximum amount of a pollutant allowed to enter a water body so that the water body will meet water quality standards for that particular pollutant. (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overviewoftmdl.cfm)

In addition, the identification of proposed COCs is documented in four sets of interrelated tables.

- **Table 7-1** presents the basis for the selection of screening levels for soil and groundwater.
- **Tables 7-2a through 7-2c**, provide a statistical summary of the soil and groundwater data from borings and wells located on the property and adjacent sidewalks and planting strips. The tables show which constituents were analyzed and which were detected. The tables also present the screening levels that were selected for each constituent based on the relevant exposure pathways identified by the CSM and indicate which constituents exceeded the lowest (most protective) screening level. Because the screening levels are different for vadose zone soil and saturated zone soil[17], data from each zone is presented in its own table.
- **Tables 7-3a through 7-3n**, presents the complete analytical results for each sample compared to screening levels, organized by medium and analyte group.
- **Tables 7-4a and 7-4b**, lists the constituents of potential concern (COPCs) for soil and groundwater, respectively, and summarize our evaluation of which COPC should be carried forward as proposed constituents of concern (COCs).

7.1.1 Identification of Detected Constituents

As discussed in Section 5.2, soil and groundwater samples were tested for a broad range of potential contaminants that were selected based on the history of the Property and adjacent properties and the results of previous environmental investigations. For this RI, we assembled all available soil and groundwater data, including data obtained by Hart Crowser in 2019 and 2020 as well as all data collected previously by others, from borings and wells located on the Property or the adjacent sidewalks.

Once assembled, we tabulated the soil and groundwater data and identified the constituents that were detected. Those constituents that were never detected were screened out from further consideration. Tables 7-2a through 7-2c and 7-3a through 7-3n present the results of all data considered for this RI and show the constituents detected in each sample.

7.1.1.1 Soil

The following constituents were detected in at least one soil sample:

Volatile Organic Compounds

- 1,1-Dichloroethene
- 1,2,4-Trimethylbenzene
- 1,3,5-Trimethylbenzene
- 2-Butanone (Methyl Ethyl Ketone)
- 2-Phenylbutane (sec-Butylbenzene)
- Acetone
- Benzene
- Carbon disulfide
- cis-1,2-Dichloroethene
- Cymene (p-Isopropyltoluene)
- Dibromochloromethane
- Ethylbenzene
- Hexane

[17] The justification for the depth distinguishing vadose zone and saturated zone soil is provided in Section 4.2.2.

- Isopropylbenzene (Cumene)
- Isopropyltoluene
- m,p-Xylenes
- Methyl Tert Butyl Ether
- Methylene chloride
- Naphthalene
- n-Butylbenzene
- n-Propylbenzene
- o-Xylene
- tert-Butylbenzene
- Tetrachloroethene
- Toluene
- trans-1,2-Dichloroethene
- Trichloroethene
- Vinyl chloride
- Xylene (total)

Semi-Volatile Organic Compounds

- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- Naphthalene
- Phenanthrene
- Pyrene

Total Petroleum Hydrocarbons

- Gasoline Range Organics
- Diesel Range Organics
- Heavy Oils

Inorganic Compounds

- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Selenium
- Zinc

PCBs

- Aroclor-1242
- Aroclor-1254

7.1.1.2 Groundwater

The following constituents were detected in at least one groundwater sample:

Volatile Organic Compounds

- 1,1,1-Trichloroethane
- 1,1-Dichloroethene
- 1,2,3-Trichlorobenzene
- 1,2,3-Trimethylbenzene
- 1,2,4-Trimethylbenzene
- 1,2-Dichloroethane
- 1,3,5-Trimethylbenzene
- 2,2-Dichloropropane
- 2-Butanone (Methyl Ethyl Ketone)
- 2-Phenylbutane (sec-Butylbenzene)
- Acetone
- Benzene
- Carbon disulfide
- Chloroethane
- Chloroform (Trichloromethane)
- Chloromethane (Methyl Chloride)
- cis-1,2-Dichloroethene
- Cymene (p-Isopropyltoluene)
- Diisopropyl ether (DIPE)
- Ethylbenzene
- Hexane

- Isopropylbenzene (Cumene)
- m,p-Xylenes
- Methylene chloride
- Naphthalene
- n-Butylbenzene
- n-Propylbenzene
- o-Xylene
- tert-Butylbenzene
- Tetrachloroethene
- Toluene
- trans-1,2-Dichloroethene
- Trichloroethene
- Vinyl chloride
- Xylene (total)

Semi-Volatile Organic Compounds

- Acenaphthene
- Fluorene
- 1-Methylnaphthalene
- 2-Methylnaphthalene
- Naphthalene
- Phenanthrene

Total Petroleum Hydrocarbons

- Diesel Range Organics
- Gasoline Range Organics
- Heavy Oils

Inorganic Compounds

- Antimony, Dissolved
- Antimony, Total
- Arsenic, Dissolved
- Arsenic, Total
- Barium, Dissolved
- Barium, Total
- Beryllium, Total
- Cadmium, Total
- Chromium, Dissolved
- Chromium, Total
- Copper, Dissolved
- Copper, Total
- Lead, Total
- Mercury, Total
- Nickel, Dissolved
- Nickel, Total
- Selenium, Total
- Zinc, Dissolved
- Zinc, Total

7.1.2 Identification of Constituents of Potential Concern

Identification of COPCs involved comparing the maximum concentrations of the detected constituents to conservative (protective), risk-based screening levels. Those constituents whose maximum concentration in any sample exceeded their corresponding screening levels were identified as COPCs.

7.1.2.1 Development of Screening Levels

Screening levels for each medium and detected constituent reflect concentrations that are protective for the possible exposure pathways identified in the CSM (Section 6.4), including exposure via cross-media transport and natural background levels, where applicable (Table 7-1). For this Site, we used pre-calculated screening levels provided by Ecology via email on November 17, 2020. Screening levels used are shown in Tables 7-2a through 7-2c and 7-3a through 7-3n.

Previous investigations have shown that the chlorinated solvent plume from the American Linen site extends beneath the Seattle DOT Mercer Parcels property (PES Environmental 2019). The sampling conducted as part of this RI shows that the contamination from sources on the Property is not comingled

with the American Linen site. Therefore, they are considered separate sites. The screening levels for chlorinated solvents that are applicable to the American Linen site are identified below. These were provided by Ecology and are strictly for the American Linen site. They are protective of the direct contact with soil and leaching pathways, for protection of groundwater as a drinking water source, and for protection of surface water. Screening levels used in this RI for CVOCs that have migrated onto the Property are at least as conservative (protective) as the ones that were developed for the American Linen site for the pathways applicable to the Seattle DOT Mercer Parcels Site.

American Linen Screening Levels for CVOCs

Compound	Soil		Groundwater	
	Screening Level	Basis	Screening Level	Basis
PCE	0.025 mg/kg	Saturated soil, leaching – adjusted to practical quantitation limit (PQL)	2.4 µg/L	Protection of surface water
TCE	0.03 mg/kg	Saturated soil, leaching – adjusted to PQL	1 µg/L	Protection of surface water, adjusted to PQL
Cis-1,2-Dichloroethene	0.05 mg/kg	Saturated soil, leaching – adjusted to PQL	16 µg/L	Protection of drinking water
Trans-1,2-Dichloroethene	0.05 mg/kg	Saturated soil, leaching – adjusted to PQL	100 µg/L	Protection of drinking water
Vinyl Chloride	0.05 mg/kg	Saturated soil, leaching – adjusted to PQL	0.2 µg/L	Protection of surface water, adjusted to PQL

Soil. For soil, we identified screening levels protective of direct contact by a future permanent, full-time site resident. These levels are from the direct contact values from the screening levels provided by Ecology. With the exceptions noted, the direct contact values represent the lower of the non-cancer or cancer levels calculated using MTCA Equations 740-1 and 740-2, respectively, using MTCA default assumptions for residential exposure (WAC 173-340-740[3][b][iii][B]).

For PCBs, the direct contact screening level is based on the federal Toxic Substances Control Act (TSCA) cleanup action level for PCBs in soil, which Ecology considers to be adequately protective for this pathway. For GRO, the direct contact screening level is based on Ecology's model remedy guidance for sites with petroleum contaminated soil (Ecology 2017). For total chromium, the direct contact screening level is based on protection from trivalent chromium since there are no historical operations on the Property that would suggest the previous use or release of hexavalent chromium. In cases where the natural background for soil is higher than the direct contact level, the background level is used as the screening level in accordance with WAC 173-340-740(5)(c). For this Site, this situation applies to arsenic where the background level of 7.3 mg/kg is used as the screening level for this pathway.

In accordance with the CSM, we also identified screening levels that considered cross-media migration, specifically the potential for soluble constituents to leach from soil to underlying groundwater. Screening levels for this pathway are protective of a full-time residential user of groundwater as a drinking water source. The soil screening levels for this pathway are from the vadose zone and saturated zone soil leaching values for protection of drinking water provided by Ecology. With the exceptions noted, these

values are developed using the fixed parameter three-phase partitioning model in accordance with WAC 173-340-747(4). For total petroleum hydrocarbons, the leaching values for protection of groundwater are based on the MTCA Method A listed values. For total chromium, the leaching values for protection of groundwater are based on protection from trivalent chromium since there are no historical operations on the Property that would suggest the previous use or release of hexavalent chromium. In cases where the natural background for soil is higher than the leaching level, the background level is used as the screening level in accordance with WAC 173-340-740(5)(c). For this Site, this situation applies to arsenic and cadmium where the respective background levels of 7.3 and 0.77 mg/kg are used as the screening levels for this pathway. In cases where the PQL is higher than the leaching level, the PQL is used as the screening level in accordance with WAC 173-340-740(5)(c). For this Site, this situation applies to 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethene, 1,2-dibromoethane, cis-1,3-dichloropropene, methylene chloride, trans-1,3-dichloropropene, vinyl chloride, and selenium where the PQLs are used as the screening levels for this pathway.

Groundwater. For groundwater, we identified screening levels protective of the resource as a potential future drinking water source. These screening levels were obtained from the drinking water protection values provided by Ecology. With the exceptions noted, the derivation of the groundwater screening levels for protection of potable water involved identifying maximum contaminant levels (MCLs) and calculating levels per MTCA Equations 720-1 and 720-2 (WAC 173-340-720[4][b][iii][A] and -720[4][b][iii][B]) using the toxicity values in Ecology's online cleanup levels and risk calculation (CLARC) database (Ecology 2019). The values that were derived from MCLs have been adjusted as follows:

If the ratio of the minimum MCL to the Equation 720-1 value does not exceed 1, then the hazard quotient associated with the MCL does not exceed 1 and the MCL requires no adjustment. If the ratio exceeds 1, the MCL is adjusted to the Equation 720-1 value to achieve a hazard quotient of 1. If the ratio of the minimum MCL to the Equation 720-2 value does not exceed 10, then the cancer risk associated with the MCL does not exceed 1E-5 and the MCL requires no adjustment. If the ratio exceeds 10, the MCL is adjusted to 10 times the Equation 720-2 value to achieve a cancer risk of 1E-5. If an MCL is available but no oral toxicity values are available to evaluate it (e.g., lead), the MCL is used without adjustment. If no MCL is available but an oral toxicity value is available, the minimum of the values from Equations 720-1 and 720-2 is used. If a chemical has no toxicity values and no MCL, there is no screening level for potable water. For total petroleum hydrocarbons, the screening levels for protection of drinking water are based on the MTCA Method A listed values. In cases where the natural background for groundwater is higher than the drinking water protection level, the background level is used as the screening level in accordance with WAC 173-340-720(7)(c). For this Site, this situation applies to arsenic where the background level of 8 µg/L is used as the screening level for this pathway. This value is based on the draft Ecology publication, *Natural Background Groundwater Arsenic Concentrations in Washington State,* dated May 2018 (Ecology 2018a), which found natural background arsenic concentrations in groundwater in the Puget Sound lowlands to be 8 µg/L. Since Ecology 2018a is a draft document, additional groundwater data were evaluated to verify that 8 µg/L is an appropriate background level for arsenic in the South Lake Union area. Available groundwater data found in Ecology's environmental information management (EIM) database for three

non-impacted[18] wells located near the Property indicate that arsenic background in groundwater in the South Lake Union area is consistent with 8 µg/L, as further discussed in Appendix F. In cases where the PQL is higher than the drinking water protection level, the PQL is used as the screening level in accordance with WAC 173-340-720(7)(c). For this Site, this situation applies to cPAHs-TEQ, 1,1,2,2-tetrachloroethane, 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane, acrylonitrile, cis-1,3-dichloropropene, and trans-1,3-dichloropropene where the PQLs are used as the screening levels for this pathway.

In accordance with the CSM, we also identified screening levels that considered cross-media migration, specifically volatilization of volatile constituents in groundwater to indoor air where they may be inhaled by future building occupants. These screening levels are based on the groundwater values for protection of indoor air provided by Ecology, which were calculated per Ecology guidance (Ecology 2018b and 2018c). In cases where the natural background for groundwater is higher than the level protective of indoor air, the background level is used as the screening level.

7.1.2.2 COPCs in Soil

Tables 7-2a and 7-2b show the comparisons of the maximum detected concentration for each constituent to the lowest (most protective) screening level and identifies those constituents where there is an exceedance. These constituents are identified as COPCs. The following constituents were identified as COPCs in soil:

Volatile Organic Compounds

- cis-1,2-Dichloroethene
- Methylene chloride
- Tetrachloroethene
- Trichloroethene
- Vinyl chloride

Semi-Volatile Organic Compounds

- Benzo(a)pyrene
- cPAHs-TEQ

Total Petroleum Hydrocarbons

- Gasoline Range Organics

Inorganic Compounds

- Arsenic
- Lead
- Selenium

7.1.2.3 COPCs in Groundwater

Table 7-2c shows the comparisons of the maximum detected concentration for each constituent to the lowest (most protective) screening level and identifies those constituents where there is an exceedance. These constituents are identified as COPCs. The following constituents were identified as COPCs in groundwater:

[18] The wells that were evaluated are located well outside the zone of contamination and represent groundwater in the South Lake Union area that is not impacted by petroleum (i.e., no detectable GRO, DRO, and HO in any of the wells, whose breakdown tends to affect groundwater geochemistry that mobilizes arsenic). See Appendix F for more information about the well locations and data evaluation.

Volatile Organic Compounds

- Benzene
- 1,1-Dichloroethene
- 1,2-Dichloroethane
- cis-1,2-Dichloroethene
- Methylene chloride
- Tetrachloroethene
- Trichloroethene
- Vinyl chloride

Semi-Volatile Organic Compounds

- 1-Methylnaphthalene

Total Petroleum Hydrocarbons

- Gasoline Range Organics
- Diesel Range Organics
- Heavy Oils

Inorganic Compounds

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Mercury

7.1.3 Identification of Constituents of Concern

For the purposes of this RI, Constituents of Concern (COCs) comprise the subset of COPCs that will be utilized for establishing cleanup requirements for the Site and evaluating cleanup alternatives in the Feasibility Study. Those COPCs that contribute little or nothing to the overall risk to human health and the environment are screened out from consideration and the remaining constituents are identified as proposed COCs for purposes of defining site cleanup requirements.

Factors that we considered when identifying proposed COCs included a constituent's toxicity, mobility in the environment, natural background concentration, and prevalence at the Site (e.g., frequency of detection). For this Site, we also considered the source of the constituent and whether it was considered part of a separate site. COPCs that were not screened out as part of this evaluation were retained as proposed COCs.

Tables 7-4a and 7-4b present the evaluations that resulted in the identification of proposed COCs in soil and groundwater, respectively. These evaluations are summarized below.

7.1.3.1 COCs in Soil

Of the COPCs identified in Section 7.1.2.2, the following constituents are not retained as proposed COCs for soil:

- Chlorinated solvents (PCE, TCE, cis-DCE, and VC)
- Methylene chloride
- Selenium

The following paragraphs discuss those COPCs that were not identified as proposed COCs and explain the rationale for each.

Chlorinated solvents. The solvent PCE and its environmental breakdown products, TCE, cis-DCE, and VC, were not retained as proposed COCs for soil for this Site. These constituents are part of the adjacent

American Linen site CVOC groundwater plume and are addressed separately under a separate Agreed Order.

The soil and groundwater sampling and analyses conducted across the Property demonstrates that there is no contribution of CVOCs from on-Property sources to the existing CVOC plume beneath the Property. The current distribution of CVOCs on the Property at elevations of approximately 23 to -12 feet in soil (Figure 7-2) and 37 to -58 feet in groundwater (Figures 7-3a and 7-3b[19]) is attributed to historical releases and migration of dry-cleaning solvents from the American Linen site and is shown in cross-section view on Figures 7-4a through 7-4f. This conclusion is based on the following lines of evidence:

- There are no known historical on-Property sources of PCE. PCE is the hallmark of releases from dry-cleaner sites and is the contaminant detected most frequently and with the highest CVOC concentration in groundwater on the Property. While chlorinated solvents may have been used for parts cleaning, metal degreasing, or paint stripping in the historical auto repair facilities and sign painting operations on the Property, the primary chlorinated solvent in these activities would have likely been TCE and methylene chloride with only minor, if any, PCE used.

- On-Property vadose-zone soil samples did not contain any detections of PCE or associated daughter products (including in vadose zone soil samples collected in native material lying below fill and above the water table). This provides additional evidence to conclude that there are no on-Property sources of CVOCs that contributed to the American Linen groundwater plume since on-Property sources to groundwater would be expected to have left residual CVOCs in shallow soil as they migrated downward to the water table.

- The nature and extent of CVOCs in groundwater on the Property (Figures 7-3a and 7-3b) is consistent with the distribution of the CVOC groundwater plume from the American Linen site. The American Linen plume has been investigated and documented by SES (2013; see Figures 18, 19, and 23) and PES (2019; see Figures 34 through 37). For example, based on existing data, a plume of PCE and TCE in intermediate-depth saturated soil (which reflects groundwater impacts) exceeding the American Linen screening levels of 0.025 mg/kg and 0.030 mg/kg, respectively, and extending southward from the known CVOC source area located to the north, were shown to extend southward well into the Property up to and beyond MW-114. A plume of VC exceeding the American Linen screening level of 0.2 µg/L in the intermediate groundwater bearing zone was also identified extending southward from the known source area extending across most of the northern one-quarter of the Property (PES 2019, Figures 22 and 35). The recently collected samples from soil borings at the Property and groundwater data presented in this RI, as well as data collected for the ongoing remedial investigation for the American Linen site, confirm these earlier studies and demonstrates that the estimated plume location extends somewhat farther to the south and east than previously shown.

[19] In order to provide context, the maps show CVOC concentrations separately in wells that are screened above and below the planned elevation of the bottom of the future building excavation, approximately 8 feet elevation.

- While the overall groundwater flow direction in the vicinity of the American Linen site and the Property is generally eastward, there are potential mechanisms that can account for the observed distribution southward and eastward.

    - DNAPL migration. Migration of DNAPL in the subsurface is driven by gravity and the geometry of more and less permeable strata. DNAPLs are known to migrate across and even against the general groundwater gradient where they may come to rest forming secondary sources of dissolved groundwater contamination. This mechanism could account for the historically elevated CVOC concentrations beneath Roy Street and the north margin of the Property and would tend to expand the dissolved CVOC plume well beyond the original source area. Evidence of this mechanism, such as the presence of DNAPL, has not been observed on the Property; however, it is being investigated as part of the ongoing American Linen RI (PES 2019).

    - Dewatering of construction sites in the vicinity. Construction dewatering systems have operated at nearby sites cross-gradient and downgradient of the American Linen site over the past 20 years. Dewatering systems have included the Block 38 West site (500 to 536 Westlake Avenue North) in 2020, Block 37 site (600/630 Westlake Avenue North) in 2017, 615 Westlake site in 2013 and 2014, Block 44 (535 Westlake Avenue North) in 2012 and 2013, and the 850 Republican site in 2008 to the south. These systems and other nearby construction sites could have enhanced migration of or redirected CVOCs from the American Linen site to the east and/or to the south. PES Environmental identified that data collected from dataloggers in wells R-MW3, MW-102, MW-105, MW-113, MW-116, MW-119, MW-122, FMW-129, and MW-130 for the American Linen site shows a change in groundwater flow immediately after the start of dewatering on the property located at Block 37 (600/630 Westlake Avenue North) (PES Environmental 2019).

    - Injections of amendments on the American Linen site. Multiple and ongoing phases of groundwater injections for in situ remediation at the adjacent American Linen site would likely have affected groundwater flow at the Seattle DOT Mercer Parcels Site. At least some of these injections induced extensive groundwater mounding, which would have caused southward, southeastward, and southwest groundwater flow. The injections we are aware of are summarized below and documented in SES (2016), including Appendix A to that document; PES Environmental (2018); PES Environmental (2019); and Progress Reports No. 1 through No. 40 (covering the period October 2017 through February 2021) for the American Linen site posted on Ecology's website for the American Linen site (https://apps.ecology.wa.gov/gsp/CleanupSiteDocuments.aspx?csid=12004).

        - Between November 3 and 4, 2015, over 11,000 gallons of emulsified vegetable oil (EVO) were injected into the intermediate aquifer via well IW-1, located near the east-central margin of the 700 Dexter property. SESE (2016) estimated that the injection induced at least a 1-foot head rise in the intermediate zone out to a radius of 130 feet from the injection well (see Appendix A, Figure 2 of SES 2016), and more than a foot of groundwater mounding in the shallow zone in a well located over 70 feet away from the

injection point. The injection forced groundwater discharge from an intermediate well located 25 feet from the injection well where the head rose to the equivalent of 74 feet above ground surface (32 pounds per square inch of shut-in pressure). The injection was documented to have induced reducing conditions, including up to a tenfold increase in total organic carbon concentration, within the aquifer in wells located some distance from the injection point.

- Between January 12 and 15, 2015, a total of almost 100,000 gallons of a dextrose solution was injected into six shallow and intermediate wells (IW-02 through IW-07), four of which were located along the north side of Roy Street, immediately across the street from the Seattle DOT Mercer Parcels Property. These injections induced groundwater mounding in the intermediate zone of almost 17 feet in a well 35 feet from the injection points; mounding equivalent to over 50 feet above ground surface (22 pounds per square inch shut-in pressure) in a well 70 feet away; and caused groundwater to come to the surface in wells located up to 185 feet away from the injection points. The injections also induced up to 11 feet of mounding in the shallow zone.

- If wells IW-02 through IW-07 had radii of influence similar to that documented for IW-01, these injections, performed in some of the most contaminated groundwater areas on the American Linen property, would have caused groundwater mounding whose effects would have reached far into the Seattle DOT Mercer Parcels Site.

- More recent injections, for which few details are available, include the following: Between September 2018 and January 2019, multiple rounds of chemical oxidation reagent were injected into 157 wells on the American Linen property. Subsequent injections of EVO occurred between February 12 and March 3, 2019, September 23 and 30, 2020, October 7 and 18, 2020, and February 16 and March 2021. Data were not available for review as of the date of this report regarding the nature (volume, pressure, location, etc.) of the injections and any observations in nearby wells regarding mounding and changes in geochemistry to evaluate any effects of these injections on the Seattle DOT Mercer Parcels Site.

Methylene chloride. Methylene chloride was identified as a COPC because its maximum concentration exceeded the soil screening level protective of groundwater as a drinking water source; however, it is not retained as a proposed COC in soil because it is a common laboratory contaminant in soil and likely a false positive. In addition, methylene chloride in the concentrations reported would not pose significant risk at the Site. It was seldom detected in groundwater (where it is also a common lab contaminant) at levels exceeding drinking water criteria, indicating that the soil-to-groundwater pathway is non- or only partially complete for this constituent. The next most restrictive soil screening level for methylene chloride is for the direct contact pathway, and the maximum detected concentration does not exceed that level.

Selenium. This constituent is not retained as a proposed COC because it does not pose an unacceptable risk at the site. Selenium was identified as a COPC because its maximum concentration exceeded the soil screening level protective of groundwater as a drinking water source. However, selenium was not detected in groundwater at levels exceeding drinking water criteria, indicating that the soil-to-groundwater pathway is not complete for this constituent. The next most restrictive soil screening level for selenium is for the direct contact pathway, and the maximum detected concentration does not exceed this level. In addition, there are no known historical sources or releases of selenium on the Property. The greatest proportion of selenium released to the environment is coal fly ash. Other anthropogenic emission sources of selenium include coal and oil combustion facilities, selenium refining factories, base metal smelting and refining factories, mining and milling operations, and end-product manufacturers (e.g., some semiconductor manufacturers) (ATSDR 2003). None of these activities are known or suspected of having taken place on the Property.

Based on the evaluations presented above, the proposed COCs for soil are:

- GRO
- Total cPAHs TEQ (including benzo(a)pyrene)
- Arsenic
- Lead

The lateral and vertical distribution of these COCs in soil are discussed below in Section 7.2 and illustrated on Figures 7-5a through 7-5d.

7.1.3.2 COCs in Groundwater

Of the COPCs identified in Section 7.1.2.3, the following constituents are not retained as proposed COCs for groundwater:

- Chlorinated solvents (PCE, TCE, cis-DCE, 1,1-dichloroethene, and VC)
- 1,2-Dichloroethane
- HO
- Methylene chloride
- 1-Methylnaphthalene
- Metals (arsenic, barium, cadmium, chromium, lead, and mercury)

The following paragraphs discuss those COPCs that were not identified as proposed COCs and explain the rationale for each.

Chlorinated solvents. The solvent PCE and its environmental breakdown products, TCE, cis-DCE, 1,1-dichloroethene, and VC, were not retained as proposed COCs for this Site. These constituents are part of the adjacent American Linen site CVOC plume and are being addressed separately under an Agreed Order with Ecology. This is discussed above in Section 7.1.3.1.

1,2-Dichloroethane. This constituent is not retained as a proposed COC because it does not pose a significant risk. This is based on the findings that it had a very low frequency of detection (detected in only one groundwater sample); a low exceedance factor (<1.7x the most stringent screening level); and the observation that it was never detected in soil at the Site.

Heavy oil. This constituent is not retained as a proposed COC because:

- It had a low frequency of detection (detected in only 5 out of 84 groundwater samples analyzed).
- It had a very low frequency of exceedance (exceeded in only one groundwater sample from boring 21417-MB10).
- It had a low exceedance factor (<1.9x the most stringent screening level).
- The detections appear to be biased high because all five detections were from turbid, unfiltered grab groundwater samples collected from soil borings. These do not reflect true "drinking water" conditions because grab samples often have elevated total suspended solids (TSS), indicating that elevated heavy oil concentrations in groundwater are likely associated with oil from the entrained sediment particles rather than the water itself. Four of the heavy oil detections were from samples collected from by Shannon & Wilson in 2017. No information on turbidity, TSS, or field observations of the groundwater samples was available; however, the grab groundwater samples were only purged for one minute prior to groundwater sampling, which is typically not enough time to reduce turbidity. The one heavy oil detection from a sample collected by Hart Crowser had a turbidity greater than 100 nephelometric turbidity units (NTUs). Another line of evidence that the grab groundwater samples are biased high is that the exceedance was not confirmed in a nearby monitoring well sample, which had a low turbidity of less than 5 NTUs.
- Heavy oil was not detected at or above laboratory reporting limits in a shallow-zone monitoring well sample (HMW-21S) collected approximately 15 feet from the exceedance (21417-MB10).
- Although heavy oil was not analyzed in soil samples collected from the boring with the exceedance, heavy oil was not detected at or above laboratory reporting limits in soil samples from nearby borings HMW-1IB, MBB-14, MBB-15, and MBGW-14. This indicates that the groundwater exceedance is not associated with a release from the Property, as an on-Property source to groundwater would be expected to have left residual heavy oil in shallow soil as it migrated downward to the water table.
- Based on this data and rationale, the one groundwater sample exceedance does not pose a significant risk and thus was not retained as a proposed COC.

Methylene chloride. This constituent is not retained as a proposed COC because it is a common laboratory contaminant and, even if present, would not pose a significant risk. This is based on the findings that it had a very low frequency of detection (detected in only one groundwater sample). The exceedance appears to be an anomaly as it was collected from a grab groundwater sample, and methylene chloride was not detected at or above laboratory reporting limits in two other grab groundwater samples from the same

boring and eight groundwater samples from the monitoring well that was subsequently installed in that boring. Additionally, methylene chloride was not detected at or above laboratory reporting limits in any of the soil samples collected from that boring (from 10 to 140 feet bgs or 42.9 to -87.1 feet elevation).

1-Methylnaphthalene. This COPC is a component of petroleum fuels and its presence at the Site is likely related to the known petroleum impacts in groundwater. MTCA cleanup levels for TPH include 1-methylnaphthalene as part of the mixture. Therefore, 1-methylnaphthalene is not retained as a proposed COC since any cleanup actions to address TPH impacts will also address 1-methylnaphthalene.

Metals. Barium, cadmium, chromium, lead, and mercury are not retained as proposed COCs in groundwater because the observed exceedances of screening criteria for these metals were all from turbid, unfiltered grab groundwater samples collected from soil borings during the 2019 field season. The total metals analytical results for these samples do not reflect true "drinking water" conditions because the samples contained high concentrations of TSS, and the elevated concentrations were associated with metals from the entrained sediment particles that were mobilized during sample digestion. This conclusion is supported by the observation that paired filtered samples from these borings for dissolved metals analyses had significantly lower concentrations of metals, which were below screening criteria. Similarly, where paired data exist, there is a clear, positive relationship between TSS and total metals concentrations, but no such relationship between TSS and dissolved concentrations (Figures 7-6a through 7-6f). This corroborates the conclusion that these total metals exceedances are due to the presence of suspended solids. This is further supported by the observed reduction in concentrations of these metals between the unfiltered total metals samples and filtered dissolved metals samples collected from the monitoring wells. While this relationship was also observed in most of the grab groundwater samples for arsenic, it was generally not observed in the well samples for arsenic. However, arsenic is not retained as a proposed COC for groundwater as discussed below.

Arsenic. Arsenic is not retained as a COC in groundwater because the observed concentrations in the monitoring well samples are consistent with naturally occurring background concentrations in the Puget Sound lowlands and do not appear to be associated with anthropogenic sources (i.e., releases of arsenic, releases of petroleum, or other human activities that can affect geochemistry and increase arsenic concentrations in groundwater).

- Total arsenic in the 37 wells at the Site range from non-detect (< 1 µg/L) to 14 µg/L. Similarly, dissolved arsenic concentrations, which were analyzed in 13 of the wells, range from 1.32 µg/L to 12.3 µg/L. These values fall entirely within the range of natural background levels in the Puget Sound lowlands of 0.8 to 76 µg/L and are statistically similar to the data set that was used to determine a natural background level of 8 µg/L (Ecology 2018a).

- The arsenic concentrations for the Site wells also fall within the range of concentrations observed in the representative background wells at the IRIS Site discussed in Section 7.1.2.1 and evaluated in Appendix F. Four quarters of monitoring data for the "background" wells indicate total arsenic concentrations ranging from 4.9 µg/L to 14 µg/L and dissolved concentrations ranging from non-detect (< 1.8 µg/L) to 9.3 µg/L. Statistically, both data sets are similar, with a difference in mean concentration approximately

north and south sides of the Broad Street 1958-2012 alignment in the southwest corner of the Property. A secondary street that followed the former Broad Street alignment and connected Roy Street to Dexter Avenue North was also constructed during this time. From approximately 2012 to 2015, the Broad Street 1958-2012 alignment was filled in to match the existing grades of Mercer Street and Dexter Avenue North, and all roadways within the boundaries of the Property were subsequently vacated as part of the City of Seattle's Mercer Corridor Project. The Mercer Corridor Project also included widening Mercer Street to its current extent, which moved the Mercer right-of-way northward onto the southeast corner of the Property. The fill encountered in borings in the southwest corner of the Property in the vicinity of the filled-in underpass is up to 30 feet thick.

3.2 Potential on-Property Contaminant Sources

Operations on the Property considered to be potential sources of contamination for the Site are listed below and shown on Figure 3-1.

- A gasoline and service station operated in the northwest corner of the Property from approximately 1929 to 1960. Leaks and spills from storage tanks and operations may have released gasoline along with possibly diesel fuel, waste oil, and solvents (petroleum-based or chlorinated). The most common hazardous substances in such releases would have likely been gasoline- through heavy-oil-range petroleum hydrocarbons,[1] lead (from leaded gasoline), aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and possibly chlorinated solvents used for degreasing (most commonly trichloroethene [TCE]).[2]

- An automobile repair and service station operated in the central area of the Property from approximately 1930 to 1955. Leaks and spills from operations may have released gasoline along with possibly diesel fuel, waste oil, and solvents (petroleum-based or chlorinated). The most common hazardous substances in any such releases would have likely been gasoline- through heavy-oil-range petroleum hydrocarbons, lead, aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), cPAHs, and possibly chlorinated solvents used for degreasing (most commonly TCE).

- Several auto wrecking businesses occupied a building on the northeast corner of the Property from approximately 1930 to 1955. A nearby large parking lot covered the southeast corner of the Property, which was used for the storage of wrecked cars. Leaks and spills from operations may have released

[1] "Gasoline- through heavy-oil-range hydrocarbons" refers to aliphatic hydrocarbons containing between 8 and 40 carbon atoms. As described in the MTCA regulations, (Table 830-1), gasoline-range hydrocarbons include automotive and aviation gasolines, mineral spirits, Stoddard solvents, and naphtha as well the lighter components of jet fuel, diesel No. 1, kerosene, and heating oil. Diesel-range hydrocarbons include diesel No. 2, fuel oil No. 2, and light oil (including some bunker oils), as well as the heavier components of jet fuel, diesel No. 1, kerosene, and heating oil. Heavy-oil-range hydrocarbons include motor oils, lube oils, hydraulic fluids, etc.

[2] As a solvent, TCE is primarily associated with metals degreasing, although it was also used in dry cleaning from the 1930s through mid-1950s when dry cleaners shifted to PCE. Conversely, PCE is primarily associated with dry cleaners with more limited application as a metal cleaner in vapor degreasers (WHO 2006, IARC 2014).

gasoline, diesel fuel, lube oil, and electrolyte from lead-acid batteries. The most common hazardous substances in such releases would have likely been gasoline- through heavy-oil-range petroleum hydrocarbons, lead, and aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes).

- The Riebe Chemical Works Inc. soap manufacturers/Riebe Continental Chemical Co. soap manufacturers/Riebe Soap & Chemical Wks. were listed at 801 Roy Street in the north-central portion of the Property from 1925 to 1940. Graves Bros sign painters and Erickson Painting and Dec Co. were listed at the same address from 1925 to 1930 and 1944 to 1955, respectively, and the Foley Sign Company was listed at the nearby 807 Roy Street address from 1951 to 1955. The 1950 Sanborn map indicates "some paints" in the 801 to 805 Roy Street building and "sign painting" in the 807 to 809 Roy Street building. A boiler room was noted in the building, suggesting the potential historical use of a heating oil UST. It is unknown what types of hazardous substances, if any, were used in the "soap and chemical works facility." Fuel oil would be the potential constituent of concern for the potential UST and boiler room. The painting business could have involved the use of paint, thinners, strippers, solvents (petroleum-based or chlorinated). The most common hazardous substances in any such releases would have been gasoline- through heavy-oil-range petroleum hydrocarbons, aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), and possibly chlorinated solvents (most commonly methylene chloride[3] and TCE).[4]

- A sign painting business operated in a building (800 Mercer Street) near the south-central portion of the Property from approximately 1975 to 1996. There is documentation of a 1,000-gallon diesel UST in the building, though no documentation was found during historical research indicating whether it had been removed. The UST may have contained diesel fuel, while the painting business could have involved use of thinners, strippers, and solvents. The most common hazardous substances in any related releases would have been gasoline- through heavy-oil-range petroleum hydrocarbons, lead (from leaded gasoline and lead paint), aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), cPAHs, chlorinated solvents (most commonly methylene chloride and TCE), and possibly polychlorinated biphenyls (PCBs) (to the extent utilized in specialty paints and coatings that may have been stored or sold on the Property).

- Retail painting stores operated in the southwest quadrant of the Property in 1950. Spills of product could have released paint, thinners, solvents or strippers to the soil. The most common hazardous substances in any such releases would have been non-dry-cleaning chlorinated solvents (most

[3] The main use of methylene chloride as a solvent is in paint strippers and removers, although it is also used in some aerosol degreasers (ATSDR 2000).

[4] It is possible that polychlorinated biphenyls (PCBs) may have been added to some specialty paints and coatings to improve their performance for use in industrial and/or military applications (e.g., paints manufactured to endure thermal stress, vibration or corrosivity) (EPA 2015). As discussed below, PCBs were examined as a potential constituent of concern for the Site.

commonly TCE and methylene chloride)[5] and possibly PCBs (to the extent utilized in specialty paints and coatings that may have been stored or sold on the Property).

- Several residences existed on the Property from at least the late 1800s to the 1950s. While no records of home heating oil tanks were listed in any documentation, heating oil was a typical source of heat at that time. Leaks or spills from storage tanks may have released some heating oil to the soil. The most common hazardous substances in such releases would have been diesel-range petroleum hydrocarbons, aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), and cPAHs.

- Fill material from unknown sources was used on the Property in the early 1900s when Lake Union occupied the northeast corner, and more recently in 2012 to fill a in a previous ramp to the Broad Street underpass. Potential contaminants in the fill could have included motor fuels, oils, demolition-related debris (asphalt, concrete), and metals. The most common hazardous substances in such material would have been gasoline- through heavy-oil-range petroleum hydrocarbons, aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), cPAHs, and heavy metals.

3.3 Potential off-Property Contaminant Sources

Operations in the vicinity of the Property considered to be potential sources of contamination for the Property are listed below and shown on Figure 3-1.

- To the west of the Property at 601 Dexter Avenue North, prior operations included a historical gas and service station from approximately 1930 to the 1940s, laundry facility (no evidence of dry cleaning) from approximately the late 1920s to 1940s, and USTs located in the alley to the north that were removed in 1997. A 1950 Sanborn map indicated that one or more of the USTs in the alley may have contained solvents. Archived tax assessor records indicate a boiler for the former laundry was installed in 1928. These historical operations potentially could have released gasoline, diesel fuel, waste oil, or solvents. The most common hazardous substances in such releases would have likely been gasoline- through heavy-oil-range petroleum hydrocarbons, lead (from leaded gasoline), aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), cPAHs, and possibly chlorinated solvents (e.g., TCE for degreasing and/or tetrachloroethene [PCE] if the laundry conducted dry-cleaning operations, although there is no evidence that dry cleaning occurred). This site is listed on Ecology's confirmed and suspected contaminated sites list as *601 Dexter* (Cleanup Site ID No. 15113).

- To the west of the Property at 615 Dexter Avenue North, prior operations included a historical gas and service station from approximately 1930 to the mid-1940s, coated wall board manufacturing from approximately 1940 to 1955, plastic mixing and storage potentially associated the coated wall board manufacturing in 1950, Seattle Hardwood Floor Co. from approximately 1935 to 1950, paint spray booth and woodworking shop from 1966 to 1969, and USTs located in the alley to the south that were removed in 1997. A 1950 Sanborn map indicated that one or more of the USTs in the alley may have

[5] The main use of methylene chloride as a solvent is in paint strippers and removers, although it is also used in some aerosol degreasers (ATSDR 2000).

contained solvents; these USTs are the same as those mentioned in the previous bullet. These historical operations potentially could have released gasoline, diesel fuel, waste oil, or solvents. The most common hazardous substances in such releases would have likely been gasoline- through heavy-oil-range petroleum hydrocarbons, lead (from leaded gasoline), aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), cPAHs, and chlorinated solvents (most commonly TCE and methylene chloride and/or potentially PCE if the "solvent" description for the USTs is accurate). An RI was recently completed for this site, which identified gasoline-range petroleum hydrocarbons as a proposed constituent of concern in soil and gasoline-range petroleum hydrocarbons, naphthalene, and 1,2,4-trimethylbenzene as proposed constituents of concern in groundwater in a RI report (Hart Crowser 2022). This site is listed on Ecology's confirmed and suspected contaminated sites list as *Seattle DOT Dexter Parcel* (Cleanup Site ID No. 14785).

- To the north of the Property at 700 Dexter Avenue North (700 Dexter), a large commercial dry cleaning and laundry (American Linen and Maryatt Electric Laundry) operated from approximately 1925 to the mid-1990s. Additionally, a gasoline station was present in the northwest corner of 700 Dexter in the 1930s and a pump island and USTs were present in the northeast corner of 700 Dexter in the 1960s. Four large diesel/fuel oil USTs used to fire a boiler were formerly located in the southwest quadrant of the property. The 700 Dexter property has documented releases of petroleum and chlorinated dry-cleaning solvents (PCE) that have caused a large PCE-contaminated groundwater plume extending to the east and south. This site is listed on Ecology's confirmed and suspected contaminated sites list as *American Linen Supply Co Dexter Ave* (Cleanup Site ID No. 12004), herein referred to as the American Linen site.

- To the northwest of the Property lies the 701 Dexter Avenue North parcel, which is currently occupied by a commercial office building constructed in 1984. A restaurant previously occupied the property from the 1930s to the 1980s. Prior to that time period, residences occupied the 701 Dexter Avenue North property from the late 1800s to the 1930s. While no records of home heating oil tanks were listed in any documentation, heating oil was a typical source of heat at that time. Leaks or spills from storage tanks may have released heating oil to the soil. The most common hazardous substances in such releases would have been diesel-range petroleum hydrocarbons, aromatic compounds (e.g., benzene, toluene, ethylbenzene, and xylenes), and cPAHs. A subsurface investigation on this site identified oil-range petroleum hydrocarbons and metals detected in soil, diesel-range petroleum hydrocarbons and chloroform detected in groundwater, and gasoline-range petroleum hydrocarbons and several volatile organic compounds (VOCs), including petroleum-related VOCs such as benzene and chlorinated VOCs[6], detected in soil vapor samples. This site is listed on Ecology's confirmed and suspected contaminated sites list as *701 Dexter* (Cleanup Site ID No. 15112).

[6] A note on terminology: for the purposes of this report, we use the term chlorinated VOCs (CVOCs) to refer to the volatile compound PCE and its degradation products, TCE, cis- and trans-1,2-dichloroethene, and vinyl chloride. We use the term BTEX to refer to the volatile aromatic compounds benzene, toluene, ethylbenzene, and xylenes. All other volatile organic compounds, including chlorinated compounds such as 1,1,1-trichloroethane and 1,1-dichloroethane, are referred to as VOCs.

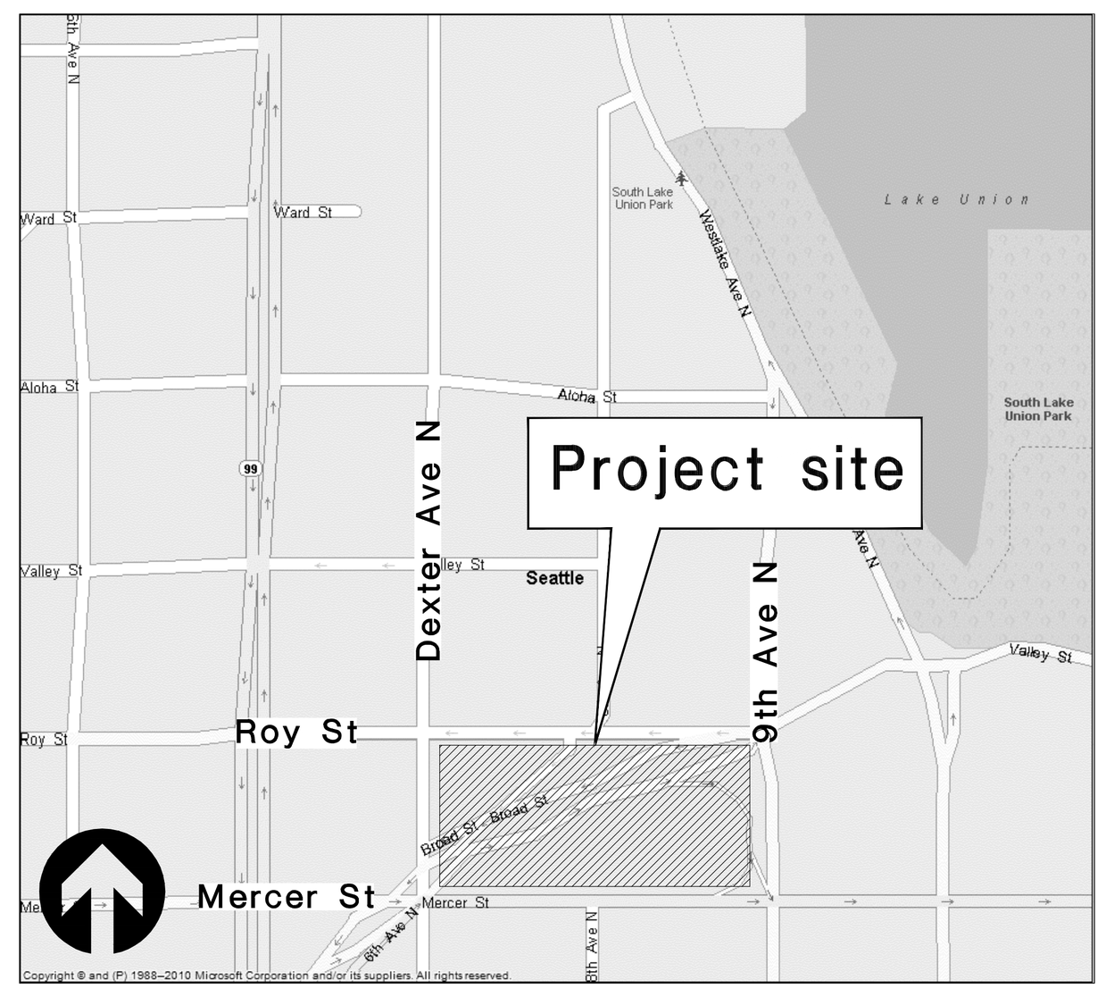
APPENDIX G
Temporary Shoring Wall Plans

MALCOLM DRILLING COMPANY INC.

800 MERCER STREET

SEATTLE, WA

TEMPORARY SHORING WALL PLANS



VICINITY MAP

GENERAL:

THE CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING DIMENSIONS AND SITE CONDITIONS, DETERMINING ACTUAL LOCATIONS OF ALL EXISTING UTILITIES SHOWN ON THE PLANS AND THOSE UTILITIES OR UNDERGROUND OBSTRUCTIONS NOT SHOWN ON THE PLANS, AND FOR REMOVAL OF ALL ABANDONED UTILITIES, OR OTHER UNDERGROUND OBSTRUCTIONS THAT INTERFERE WITH THE NEW CONSTRUCTION.

THE CONTRACTOR IS RESPONSIBLE FOR THE CONSTRUCTION PROCESS AND THE SAFETY OF THE WORKERS. THIS INCLUDES BUT IS NOT LIMITED TO, THE CONSTRUCTION SEQUENCE, TEMPORARY HANDRAILS, EXCAVATION ACCESS, AND BARRIERS. IT ALSO INCLUDES LIFTING OF MATERIALS AND CONSTRUCTION EQUIPMENT INTO AND OUT OF THE EXCAVATION, TEMPORARY BRACING OF FORMWORK, TEMPORARY SHORING OF EXCAVATIONS, AND STABILITY OF ALL TEMPORARY CUT SLOPES.

REFERENCE DATA:

THE EXISTING SITE, TOPOGRAPHICAL, AND UTILITY DATA; THE PROPOSED GRADES AND UTILITIES; THE DIMENSIONS AND DEPTHS OF THE PROPOSED FOUNDATIONS; AND THE PROPOSED SHORING WALL LOCATIONS ARE BASED ON THE FOLLOWING:

- THE PLAN SET TITLED "ARE MERCER BLOCKS, SEATTLE, WA ", DATED NOVEMBER 20, 2020, PREPARED BY NBBJ.
- FROM NBBJ, THE ELECTRONIC DRAWING FILE: "ARCH_MERCER BLOCK_CS_V21.RVT", DATED MAY 12, 2021.
- FROM KPFF, THE CIVIL ELECTRONIC DRAWING FILES: "C3D-800M-PROP-UTIL.DWG", "C3D-AED-PROP-UTIL.DWG", "X-800M-FRAN-CIVL.DWG", "X-800M-UTIL-CIVL.DWG", AND "X-AED-UTIL-CIVL.DWG", ALL DATED OCTOBER 27, 2020.
- FROM KPFF, THE STRUCTURAL ELECTRONIC DRAWING FILE: "STRU_MERCER BLOCK_CS_V21.RVT", DATED MAY 11, 2021.
- THE DRAWING TITLED: "TOPOGRAPHIC & BOUNDARY SURVEY, ALEXANDRIA REAL ESTATE EQUITIES, INC. - 800 MERCER STREET, CITY OF SEATTLE, KING COUNTY, WASHINGTON", DATED DECEMBER 22, 2021, PREPARED BY BUSH, ROED & HITCHINGS. (CAD FILE XS-SUR-04.DWG)
- SEATTLE.GOV SIDE SEWER CARDS 5545, 239, 240, 3881, 3881-1, AND 217.
- SEATTLE.GOV Seattle Public Utilities GIS ONLINE FRANCHISE MAPS, FOR WATER, SEWER, AND STORM.

BUILDING CODES, DESIGN MANUALS, AND SPECIFICATIONS:

2015 INTERNATIONAL BUILDING CODE (AS AMENDED BY THE CITY OF SEATTLE)

PUBLICATION NO. FHWA-IF-03-017, GEOTECHNICAL ENGINEERING CIRCULAR NO. 7, SOIL NAIL WALLS

PUBLICATION NO. FHWA-IF-99-015, GEOTECHNICAL ENGINEERING CIRCULAR NO. 4, GROUND ANCHORS AND ANCHORED SYSTEMS

DESIGN SURCHARGE LOADING:

FOR THE ENTIRE PROJECT PERIMETER, PRIOR TO INSTALLATION OF ANCHORS, WHEN PILES ARE SIMPLY CANTILEVERING; AND, AT ALL TIMES FOR THE CENTRAL AREA OF THE NORTH WALL, FROM PILES N17 TO N36, ADJACENT TO THE INTERNAL BRACING SYSTEM, THE DESIGN SURCHARGE CONSISTS OF A BASIC TRAFFIC AREAL SURCHARGE OF 250 PSF VERTICAL AND 75 PSF HORIZONTAL.

3

HOWEVER, FOR THE ENTIRE PROJECT PERIMETER, EXCEPT PILES N17-N36, WHEN PILES ARE RESTRAINED BY ANCHORS, THE DESIGN SURCHARGE IS ENHANCED TO A MODERATE CONSTRUCTION SURCHARGE OF 500 PSF VERTICAL AND 150 PSF HORIZONTAL. THIS ALLOWS FOR MOST THINGS LIKE LAYDOWN, TRUCKING, AND BAKER TANKS. AND ALSO OUTRIGGER LOADS FROM PUMP TRUCKS AND CRANES OF ABOUT 100 KIPS AT 7-FT FROM FACE OF WALL OR 200 KIPS AT 13-FT FROM FACE OF WALL PLACED ON DUNNAGE AND STEEL PLATES. BUT THINGS LIKE LARGE TOWER CRANE ERECTION CRANES NEAR THE WALL OR EXCAVATORS OPERATING ON THE WALL OR CONVEYORS HAVE NOT BEEN ACCOUNTED FOR IN THE DESIGN.

DESIGN CALCULATIONS:

THE TEMPORARY SHORING WALL DESIGN CALCULATIONS ARE CONTAINED IN THE LETTER REPORT TITLED: "TEMPORARY SHORING WALL DESIGN CALCULATIONS AND PLANS, 800 MERCER STREET, SEATTLE, WA", PREPARED BY GROUND SUPPORT PLLC FOR MALCOLM DRILLING COMPANY INC., DATED DECEMBER 18, 2020.

RESPONSES TO 1ST ROUND OF COMMENTS ARE CONTAINED IN THE LETTER REPORT TITLED: "RESPONSE TO FIRST ROUND OF REVIEW COMMENTS AND REVISION 1 TEMPORARY SHORING WALL DESIGN CALCULATIONS & PLANS, 816 MERCER STREET, SEATTLE, WA", PREPARED BY GROUND SUPPORT PLLC FOR MALCOLM DRILLING COMPANY INC., DATED JUNE 25, 2021.

SUBSURFACE DESIGN PARAMETERS:

THE SUBSURFACE DESIGN PARAMETERS AND SHORING WALL DESIGN CRITERIA ARE BASED UPON THE FOLLOWING PROJECT GEOTECHNICAL REPORT: "GEOTECHNICAL ENGINEERING DESIGN REPORT, 800 MERCER STREET, SEATTLE, WASHINGTON", PREPARED BY HART CROWSER, DATED DECEMBER 16, 2020. THE EARTH PRESSURE DIAGRAMS AND SHORING DESIGN CRITERIA ARE SHOWN ON THIS SET OF PLANS. IN ADDITION, THE FOLLOWING SOIL PROPERTIES WERE USED TO DESIGN THE SOIL NAIL WALLS:

SOIL UNIT	DEPTH RANGE (FT)	UNIT WEIGHT (PCF)	SOIL FRICTION (DEG)	SOIL COHESION (PSF)	DESIGN PULLOUT RESISTANCE (K/FT)
FILL	15 TO 20	130	35	0	1.5
GLACIAL SOILS	BELOW FILL	135	42	0	3.5

SDOT ADDITIONAL PERMIT NOTE:

THE PROPOSED TEMPORARY SHORING SYSTEM REQUIRES A SEPARATE PSM STREET USE PERMIT, AND THAT NUMBER IS XXXXXXXXX.

SOIL NAIL SHORING WALL STABILITY ANALYSES:

IN ACCORDANCE WITH THE REFERENCED FHWA PUBLICATION, THE FOLLOWING PARTIAL FACTORS OF SAFETY WERE USED IN THE ANALYSIS OF INTERNAL AND EXTERNAL SOIL NAIL SHORING WALL STABILITY:

DESIGN COMPONENT	PARTIAL F.O.S. (TEMP)	PARTIAL F.O.S. (PERM)	PARTIAL F.O.S. (SEISMIC)
SOIL FRICTION	1.35	1.50	1.10
SOIL COHESION	1.35	1.50	1.10
SOIL-GROUT ADHESION	2.00	2.00	1.50
NAIL BAR YIELD	1.82	1.82	1.35
FACING CAPACITY	1.35	1.50	1.10

FOR THE INTERIM CONSTRUCTION CONDITIONS WHERE EXCAVATION FOR A LIFT HAS OCCURRED YET THE CORRESPONDING NAIL ROW HAS NOT BEEN INSTALLED, THE REQUIRED PARTIAL FACTORS OF SAFETY FOR SOIL FRICTION AND SOIL COHESION ARE REDUCED TO 1.20 IN ACCORDANCE WITH THE REFERENCED FHWA MANUAL.

LEAN-MIX CONCRETE FOR SOLDIER PILES:

LEAN-MIX CONCRETE FOR SOLDIER PILES SHALL HAVE A MINIMUM OF 1-1/2 SACKS (141 LBS) OF CEMENT AND 200 LBS OF FLY ASH PER CUBIC YARD OF CONCRETE.

PORTLAND CEMENT SHALL BE TYPE I, II, OR III CONFORMING TO ASTM C150 / AASHTO M85. FLY ASH SHALL BE TYPE F CONFORMING TO ASTM C618.

SLUMP FOR ALL LEAN-MIX CONCRETE SHALL NOT BE LESS THAN 5 INCHES AND NO GREATER THAN 9 INCHES. ADMIXTURES SHALL CONFORM TO THE REQUIREMENTS OF ASTM C494 / AASHTO M194, SHALL BE USED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, AND SHALL BE APPROVED BY THE ENGINEER.

AGGREGATES SHALL CONFORM TO THE REQUIREMENTS OF ASTM C33 / AASHTO M6 FOR FINE AGGREGATES AND AASHTO M80, CLASS B FOR COARSE AGGREGATES.

LEAN-MIX CONCRETE FOR SECANT PILES:

IN ADDITION TO THE ABOVE REQUIREMENTS FOR SOLDIER PILES, LEAN-MIX CONCRETE FOR SECANT PILES SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 500 PSI (STONEWAY MIX 1123 OR EQUIVALENT).

STRUCTURAL CONCRETE FOR TOE PILES:

IN ADDITION TO THE ABOVE REQUIREMENTS FOR SOLDIER PILES, STRUCTURAL CONCRETE FOR TOE PILES SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3000 PSI.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE NONE

PROJECT ARCHITECT NBBJ

PROJECT NUMBER #20-46

SHEET NAME

TEMPORARY SHORING WALL COVER AND SHORING NOTES

SHEET NUMBER SH1.0

GROUNDWATER:

GROUNDWATER WAS ENCOUNTERED DURING THE SOILS INVESTIGATION TO VARYING DEGREES. ON THE WESTERN TWO-THIRDS OF THE SITE WHERE THE HARDER GLACIAL SOILS ARE WITHIN 10 TO 20 FEET BGS, THE WATER OCCURS AT VARYING DEPTHS AND IS PRIMARILY LOCALIZED PERCHED POCKETS OR STRINGERS OF WATER LOCATED ON TOP OF THE LESS PERMEABLE GLACIAL SOILS OR WITHIN SANDIER POCKETS OF THE GLACIAL SOILS. MOST OF THE SHORING IN THESE AREAS CONSISTS OF SOLDIER PILES WITH TIMBER LAGGING, WITH ONLY LIMITED AREAS OF SOIL NAILING.

HOWEVER, AS ONE MOVES EAST, OVER SAY THE EASTERN THIRD OF THE SITE, THE HARDER GLACIAL SOILS DIVE DOWN AND THE SOIL CONDITIONS MAINLY CONSIST OF FILL, MORE RECENT LACUSTRINE SILTS/CLAYS AND MEDIUM DENSE SAND, AND THESE SOIL UNITS CONTAIN A WATER TABLE WHICH IS LOCATED AT ABOUT ELEVATION 20 FEET FOR DESIGN. IN THIS AREA OF THE SITE A SECANT PILE WALL IS REQUIRED AND WATER PRESSURES FROM THE WATER TABLE ARE CONSIDERED IN THE DESIGN.

THEREFORE, FOR THE PURPOSES OF DESIGN OF THE SOLDIER PILE AND TIMBER LAGGING SHORING WALLS, OR SOIL NAIL WALLS, THE WATER TABLE HAS BEEN ASSUMED TO OCCUR BENEATH THE BASE OF THE EXCAVATION. NEVERTHELESS, LOCALIZED WET ZONES AND/OR PERCHED POCKETS AND STRINGERS OF WATER-BEARING SOILS MAY BE ENCOUNTERED AT ANY TIME.

THE WALL FACE EXCAVATION MUST PROCEED CAUTIOUSLY TO AVOID EXCESSIVE GROUND LOSS OR DISTURBANCE IN AREAS OF WATER BEARING SOILS. GAPS IN THE TIMBER LAGGING WILL PROVIDE A FREE-DRAINING FACE CONDITION AND SUMP PUMPS AND TRENCHES WILL BE REQUIRED AT THE EXCAVATION BASE TO CONTROL WATER INSIDE THE SITE.

FOR THE SOIL NAIL AND SHOTCRETE WALL PORTIONS, THESE AREAS MIGHT THEN REQUIRE SPECIAL ATTENTION TO DEWATERING USING METHODS SUCH AS INCREASED DRAIN BOARD COVERAGE, ADDITIONAL WEEP AND HEADER PIPES THROUGH THE SHOTCRETE WALL, AND SUMP PUMPS AS REQUIRED TO PREVENT THE WATER FROM CAUSING FACE INSTABILITY OR WATER PRESSURES FROM DEVELOPING BEHIND THE SHOTCRETE WALL DURING CONSTRUCTION. HOWEVER, THE CLOSELY-SPACED SOLDIER PILES WILL PROVIDE A LARGE DEGREE OF PRESUPPORT TO THE FACE SHOULD WATER BE ENCOUNTERED.

STRUCTURAL STEEL:

ALL STRUCTURAL STEEL WIDE FLANGE AND OTHER ROLLED SHAPES SHALL CONFORM TO ASTM A572 / AASHTO M270, GRADE 50. ALL STRUCTURAL STEEL PLATES SHALL CONFORM TO ASTM A36 / AASHTO M270 GRADE 36. ALL RECTANGULAR STEEL TUBE WALERS SHALL CONFORM TO ASTM A500, GRADE B, AND ALL PIPES SHALL HAVE FY=50 KSI (MIN), UNLESS SHOWN OTHERWISE ON THE PLANS, OR APPROVED OTHERWISE BY THE ENGINEER.

STRUCTURAL WELDING:

MINIMUM WELD SIZE 1/4" CONTINUOUS FILLET. MINIMUM WELD LENGTH 2 INCHES. ALL WELDING TO BE PERFORMED BY AWSD-CERTIFIED WELDERS PER AWS STANDARD SPECIFICATIONS. USE E70XX ELECTRODES.

HEADED STUDS:

ALL HEADED STUDS SHALL CONFORM TO ASTM A108 UNO. HEADED STUDS SHALL BE "NELSON STUDS" BY NELSON DIVISION OF TRW INC. OR AN APPROVED EQUAL, AUTOMATICALLY END WELDED.

SOIL NAIL THREADED BARS AND GROUT:

SOIL NAIL THREADED BARS SHALL CONFORM TO EITHER ASTM A615 / AASHTO M31, GRADE 75 OR ASTM A722 / AASHTO M275, GRADE 150, AS INDICATED ON THE PLANS.

SOIL NAIL GROUT SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3000 PSI, AND A MINIMUM 3-DAY COMPRESSIVE STRENGTH OF 1500 PSI. SOIL NAIL GROUT MAY BE NEAT-CEMENT GROUT OR READY-MIX SAND-CEMENT GROUT, SEE THE SPECIFICATIONS PLAN SHEETS FOR SPECIFIC REQUIREMENTS.

TYPE I, II, OR III PORTLAND CEMENT CONFORMING TO ASTM C150 / AASHTO M85 SHALL BE USED FOR SOIL NAIL GROUT. SUBMIT MIX DESIGNS IN ACCORDANCE WITH THE SPECIFICATIONS.

SHOTCRETE:

ALL SHOTCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4000 PSI, AND A MINIMUM 3-DAY COMPRESSIVE STRENGTH OF 2000 PSI. SEE THE SPECIFICATIONS PLAN SHEETS FOR SPECIFIC REQUIREMENTS.

TYPE I, II, OR III PORTLAND CEMENT CONFORMING TO ASTM C150 / AASHTO M85 SHALL BE USED FOR SHOTCRETE. SUBMIT MIX DESIGNS IN ACCORDANCE WITH THE SPECIFICATIONS.

TEMPORARY SHOTCRETE MAY BE LEFT WITH A SCREEDED FINISH. PERMANENT SHOTCRETE SHALL BE LEFT WITH A WOOD OR RUBBER FLOAT FINISH.

GEOCOMPOSITE WALL DRAINAGE BOARD:

ALL GEOCOMPOSITE WALL DRAINAGE BOARD SHALL BE AMERDRAIN 500, MIRAFI G100, OR AN APPROVED EQUAL.

REINFORCING STEEL:

ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615 / AASHTO M31, GRADE 60 FOR DEFORMED BARS, AND ASTM A185 / AASHTO M55 FOR WELDED WIRE FABRIC. ALL REINFORCING STEEL DETAILS IN ACCORDANCE WITH ACI 315 MANUAL OF STANDARD PRACTICE. ALL DEFORMED REINFORCING BAR LAPS SHALL BE CLASS B, IN ACCORDANCE WITH THE 2015 IBC, OR AS SUMMARIZED IN THE FOLLOWING TABLE:

BAR SIZE	TENSILE DEVELOP LENGTH (IN)	LAP SPLICE LENGTH (IN)
#4	12	16
#5	15	20
#6	22	28

WELDED WIRE FABRIC (WWF) LAPS SHALL BE 2 SQUARES. SEE THE PLANS FOR SPECIFIC STRUCTURAL DETAILS.

DRILLED SOLDIER/SECANT/TOE PILES:

THE MINIMUM REQUIRED STRUCTURAL STEEL W-SHAPES FOR THE PILES ARE INDICATED ON THE PLANS. ALTERNATIVE STEEL SECTIONS MAY BE USED PROVIDED THAT THE SECTION MODULUS OF EACH ALTERNATIVE STEEL SECTION ARE EQUAL TO OR GREATER THAN THE CROSS-SECTIONAL AREA AND SECTION MODULUS OF THE CORRESPONDING STEEL SECTION SHOWN ON THE PLANS, AND IS APPROVED BY THE SHORING DESIGNER.

SHAFTS SHALL BE CONSTRUCTED SO THAT THE CENTER AT THE TOP OF THE SHAFT IS WITHIN +/- 2 INCHES OF THE PLAN LOCATION. SHAFTS SHALL BE PLUMB. THE ELEVATION AT THE TOP OF SHAFT SHALL BE +/- 2 INCHES FROM THE PLAN LOCATION. DURING CONSTRUCTION FOR THE SHAFTS, THE CONTRACTOR SHALL MAKE FREQUENT CHECKS ON THE PLUMBNESS, ALIGNMENT, AND DIMENSIONS OF THE SHAFTS. ANY DEVIATION EXCEEDING THE ALLOWABLE TOLERANCES SHALL BE CORRECTED IMMEDIATELY.

THE STEEL PILES SHALL BE PLACED SO THAT THE CENTER OF THE PILE IS WITHIN +/- 1 INCH OF THE PLAN LOCATION AT THE TOP OF THE PILE, AND WITHIN 0.5% OF VERTICAL WITH DEPTH.

SHAFTS SHALL BE EXCAVATED TO THE REQUIRED DEPTH AS SHOWN ON THE PLANS. THE EXCAVATION SHALL BE COMPLETED IN A CONTINUOUS OPERATION USING EQUIPMENT CAPABLE OF EXCAVATING THROUGH THE TYPE OF MATERIAL EXPECTED TO BE ENCOUNTERED.

IF THE SHAFT EXCAVATION IS STOPPED WITH THE APPROVAL OF THE ENGINEER, THE SHAFT SHALL BE SECURED BY INSTALLATION OF A SAFETY COVER. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THE SAFETY OF THE SHAFT AND SURROUNDING SOIL AND THE STABILITY OF THE SIDE WALLS. A TEMPORARY CASING SHOULD BE USED IF NECESSARY TO ENSURE SUCH SAFETY AND STABILITY.

WHERE CAVING CONDITIONS ARE ENCOUNTERED, FURTHER EXCAVATION WILL NOT BE ALLOWED UNTIL THE CONTRACTOR SELECTS A METHOD TO PREVENT GROUND MOVEMENT. THE CONTRACTOR MAY ELECT TO PLACE A TEMPORARY CASING OR USE OTHER METHODS APPROVED BY THE ENGINEER.

THE CONTRACTOR SHALL USE APPROPRIATE MEANS (SUCH AS A CLEANOUT BUCKET), TO CLEAN THE BOTTOM OF THE EXCAVATION SUCH THAT NO MORE THAN 2 INCHES OF LOOSE OR DISTURBED MATERIAL IS PRESENT.

WHEN UNEXPECTED OBSTRUCTIONS, WHICH REQUIRE SPECIALIZED EQUIPMENT AND/OR LABOR ARE ENCOUNTERED, THE CONTRACTOR SHALL NOTIFY THE ENGINEER PROMPTLY AND THE OBSTRUCTIONS SHALL BE REMOVED AND THE EXCAVATION CONTINUED IN A MANNER APPROVED BY THE ENGINEER.

TEMPORARY CASINGS FOR THE SHAFTS SHALL BE REMOVED. A MINIMUM 5 FOOT HEAD OF CONCRETE MUST BE MAINTAINED TO BALANCE THE SOIL AND WATER PRESSURE AT THE BOTTOM OF THE CASING DURING REMOVAL. THE CASING SHALL BE SMOOTH.

SHAFT CONCRETE SHALL BE PLACED AS SHOWN ON THE PLANS AND SHALL COMMENCE WITHIN 2 HOURS AFTER COMPLETION OF THE EXCAVATION. SHAFT CONCRETE SHALL BE PLACED IN ONE CONTINUOUS OPERATION TO THE TOP OF THE SHAFT.

IF WATER IS NOT PRESENT, THE CONCRETE SHALL BE DEPOSITED BY A METHOD WHICH PREVENTS AGGREGATE SEGREGATION. THE CONTRACTOR'S METHOD FOR DEPOSITING CONCRETE SHALL HAVE APPROVAL OF THE ENGINEER PRIOR TO CONCRETE PLACEMENT.

IF WATER IS PRESENT, THE CONCRETE SHALL BE DEPOSITED BY TREMIE PLACEMENT METHODS.

SHORING REMOVAL:

ALL SHORING ELEMENTS (SOLDIER PILES, VERTICAL ELEMENTS, TIMBER LAGGING, SHOTCRETE, ETC.) WITHIN THE PUBLIC RIGHT-OF-WAY SHALL BE REMOVED TO A MINIMUM DEPTH OF 4 FEET BELOW FINISHED GRADE IN ACCORDANCE WITH CITY OF SEATTLE REQUIREMENTS ONCE THE BELOW-GRADE STRUCTURE IS COMPLETED AND THE SHORING IS NO LONGER FUNCTIONING AS EARTH SUPPORT.

SPECIAL INSPECTION OF THE SHORING WALLS:

IN ACCORDANCE WITH SECTION 1704 OF IBC (2015), SPECIAL INSPECTION IS REQUIRED FOR THE FOLLOWING SHORING ITEMS OR PROCESSES: SOLDIER/SECANT/TOE PILE INSTALLATION; SOIL NAIL INSTALLATION; SOIL NAIL TESTING; HEADED STUD AND ANCHOR BOLT INSTALLATION; SHOTCRETE PLACING/LAGGING MATERIALS TESTING AND PLACEMENT; GROUND ANCHOR INSTALLATION AND TESTING; AND WELDING/FABRICATION.

SDCI PRECONSTRUCTION MEETING:

A PRECONSTRUCTION MEETING IS REQUIRED BETWEEN THE OWNER'S REPRESENTATIVES (GEOTECHNICAL SPECIAL INSPECTOR, GENERAL CONTRACTOR, AND EXCAVATION CONTRACTOR), KING COUNTY WTD, AND THE SDCI SITE INSPECTOR. CONTACT 206-684-8860 TO ARRANGE THE MEETING.

SDOT PRECONSTRUCTION MEETING:

PRIOR TO INSTALLATION OF THE SHORING SYSTEM, A PRECONSTRUCTION MEETING IS REQUIRED WITH SDOT. ATTENDEES SHALL INCLUDE: AN OWNER'S REPRESENTATIVE, THE GENERAL CONTRACTOR, THE EXCAVATION AND SHORING SUBCONTRACTORS, THE GEOTECHNICAL ENGINEER, SURVEYOR, SHORING DESIGNER, KING COUNTY WTD, AND SDOT PERSONNEL.

INTERNAL BRACING REMOVAL SEQUENCE:

THE PILES AND BRACING HAVE BEEN DESIGNED SO THAT AFTER THE DECK LEVEL RIGHT BELOW THE WALERS IS ABLE TO TRANSFER LOAD, THE BRACING LEVEL ABOVE IT MAY BE REMOVED. THIS APPLIES TO THE P3 DECK (LEVEL B WALERS) AND THE P1 DECK (LEVEL A WALERS).

SDOT EXISTING SEWER/STORM NOTE:

ALL SEWER AND STORM LINES IN THE ROW WITHIN 10 FEET (OR WITHIN 20 FEET IF SUCH LINES ARE 30 FEET OR MORE OFF SITE PROPERTY LINE) OF ANY PROPOSED SHORING ELEMENT SHALL BE VIDEOTAPED OF PRE-PROJECT CONDITION AND A COPY SENT TO SPU AT SPU_DWA_PIPE_REHABS@SEATTLE.GOV PRIOR TO PRECONSTRUCTION MEETING. SIMILAR VIDEOTAPE OF POST-PROJECT CONDITION IS ALSO REQUIRED AND SENT TO SPU AT SAME EMAIL ADDRESS.

KING COUNTY EXISTING WASTEWATER FACILITIES NOTE:

ALL KING COUNTY EXISTING WASTEWATER FACILITIES WITHIN THE EXISTING PERMANENT EASEMENT AREAS SHALL BE VIDEOTAPED OF PRE-PROJECT CONDITION AND A COPY SENT TO LPA.TEAM.KINGCOUNTY.GOV.

TIMBER LAGGING:

ALL LAGGING BOARDS SHALL BE PRESSURE-TREATED, IN GOOD CONDITION, AND SHALL BE HEM-FIR NO. 2 OR BETTER, WITH AN ALLOWABLE FLEXURAL STRESS FB=1020 PSI (WHICH INCLUDES ALL APPLICABLE FLAT-USE AND SIZE FACTORS).

ALL LAGGING BOARDS SHALL BE PRESSURE-TREATED IN ACCORDANCE WITH AWPA STANDARD U14 (FOR END USE CLASSIFICATION 4B), TO A MINIMUM RETENTION OF 0.40 PCF, USING THE CCA PROCESS (COMMERCIAL PRODUCT NAME OSMOSE OR APPROVED EQUAL). ALTERNATIVE TREATMENT PROCESSES MAY BE SUBMITTED TO GROUND SUPPORT PLLC FOR APPROVAL.

THE CONTRACTOR SHALL EXCAVATE THE WALL FACE AND INSTALL THE LAGGING IN SUCH A MANNER AS TO MAINTAIN A SAFE WORK PLACE AND AVOID EXCESSIVE SLOUGHING AND OVERBREAK. BACKFILL BEHIND LAGGING BOARDS WITH A FREE-DRAINING GRANULAR MATERIAL, OR NATIVE SOILS IF APPROVED BY THE GEOTECHNICAL ENGINEER.

AS A MINIMUM, PRIOR TO PLACING THE SUBSEQUENT SET OF TIMBER LAGGING, DO NOT EXCAVATE MORE THAN 4 FEET BELOW THE CURRENT DEPTH OF LAGGED WALL FACE. ALONG ANCHORED WALLS, DO NOT EXCAVATE MORE THAN 2 FEET BELOW THE CURRENT LEVEL OF ANCHORS UNTIL THE THOSE ANCHORS ARE INSTALLED, CURED, TESTED, AND STRESSED.

INCLINOMETER NOTES:

THE GEOTECHNICAL ENGINEER HAS RECOMMENDED SIX INCLINOMETER CASINGS BE INSTALLED ALONG THE TEMPORARY SHORING WALLS TO MONITOR LATERAL DEFORMATIONS. THE LOCATIONS ARE SHOWN ON THE PLANS.

THE INCLINOMETER CASINGS ARE AFFIXED TO THE BACK OF A SOLDIER PILE WHERE PRESENT, OR THEY ARE DRILLED INTO PLACE A COUPLE FEET BEHIND THE SOIL NAILED WALL WHERE THERE ARE NO PILES. EACH INCLINOMETER SHOULD BE INSTALLED TO A DEPTH OF LEAST 10 FEET BEYOND THE FINAL EXCAVATION DEPTH.

AT LEAST ONE SET OF BASELINE READINGS SHOULD BE TAKEN AT EACH INCLINOMETER BEFORE EXCAVATION BEGINS. DURING SHORING CONSTRUCTION AND MASS EXCAVATION, THE INCLINOMETERS SHOULD BE READ AT LEAST ONCE A WEEK. AFTER THE TEMPORARY SHORING IS TOTALLY COMPLETED, AND DEFLECTIONS HAVE STABILIZED, THE INCLINOMETER READING FREQUENCY MAY BE REDUCED TO ONCE A MONTH. THESE ONCE-MONTHLY READINGS SHOULD CONTINUE UNTIL THE PERMANENT BASEMENT WALLS ARE COMPLETED.

SHORING SEQUENCE ALONG BRACED PORTION OF NORTH WALL:

THE SEQUENCE IS FAIRLY NATURAL AND OBVIOUS FROM THE DRAWINGS BUT IS DESCRIBED HERE FOR CLARITY:

1. INSTALL ALL OF THE NORTH WALL PILES AND LAG DOWN TO THE TOP OF THE LEVEL A BERM, WHICH IS EL. 38.5 PER THE CROSS-SECTION SHEETS.

2. INSTALL THE LEVEL A BRACING STANDOFFS AND WALERS TO THE WALL.

3. COMPLETE THE LEVEL A NATIVE BERM, 8-FT LEVEL OUT FROM WALL, AND DOWN AT 2H:1V, AS A MINIMUM.

4. INSTALL ALL THE TOE PILES TO WHICH THE WALL SHALL BE BRACED. ALL THESE SHALL ACHIEVE DESIGN STRENGTH.

5. INSTALL THE LEVEL A RAKER PIPES TO THE WALL WALERS, WHILE ALSO INSTALLING THE LOWER STANDOFFS AND WALERS TO THE TOE PILES.

6. PRELOAD THE RAKERS ONE AT A TIME TO THE LOADS INDICATED ON THE PLANS, WELDING THEM OFF WITH THE KNIFE PLATES WHEN COMPLETE, THEN REMOVING JACKING EQUIPMENT. THE TOE PILES SHALL BE MONITORED JUST PRIOR TO AND AFTER THE JACKING OPERATION TAKES PLACE AND IS COMPLETE.

7. EXCAVATE AND LAG DOWN TO THE TOP OF THE LEVEL B BERM, WHICH IS EL. 21.0 PER THE CROSS-SECTION SHEETS.

8. INSTALL THE LEVEL B BRACING STANDOFFS AND WALERS TO THE WALL.

9. COMPLETE THE LEVEL B NATIVE BERM, 8-FT LEVEL OUT FROM WALL, AND DOWN AT 2H:1V, AS A MINIMUM.

10. INSTALL THE LEVEL B RAKER PIPES TO THE WALL WALERS, WHILE ALSO INSTALLING THE LOWER STANDOFFS AND WALERS TO THE TOE PILES.

11. PRELOAD THE RAKERS ONE AT A TIME TO THE LOADS INDICATED ON THE PLANS, WELDING THEM OFF WITH THE KNIFE PLATES WHEN COMPLETE, THEN REMOVING JACKING EQUIPMENT. THE TOE PILES SHALL BE MONITORED JUST PRIOR TO AND AFTER THE JACKING OPERATION TAKES PLACE AND IS COMPLETE.

12. REMOVE THE REMAINING NATIVE BERM, SIMULTANEOUSLY LAGGING THE WALL.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS
Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 21833 — REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE
816
MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	5/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-46052-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING NOTES

SHEET NUMBER
SH1.1

TEMPORARY GROUND ANCHORS:

1. GENERAL:

1A. THE CONTRACTOR SHALL SELECT THE GROUND ANCHOR TYPE, THE INSTALLATION METHOD, THE ANCHOR DIAMETER, AND THE METHOD OF GROUTING, IN ORDER TO DEVELOP THE DESIGN LOADS INDICATED ON THE PLANS, AS VERIFIED IN ACCORDANCE WITH THE ANCHOR TESTING PROGRAM. REVISED PLANS SHALL BE SUBMITTED TO DPD FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION, IF THE CONTRACTOR DECIDES TO INSTALL GROUND ANCHORS DIFFERENT FROM THE GROUND ANCHORS SHOWN ON THIS PLAN SET. SEE THE GROUND ANCHOR SCHEDULES ON THE WALL ELEVATION SHEETS, AND SHEET SH5.2 FOR THE SPECIFIED ANCHOR DIAMETER AND STRAND REQUIREMENTS.

1B. HOWEVER, IF THE PROPOSED METHODS RESULT IN A LARGER DIAMETER, A LONGER ANCHOR LENGTH, OR A SUBSTANTIALLY GREATER GROUTING PRESSURE THAN INDICATED ON THE APPROVED PLANS, THEN THE CONTRACTOR MUST SUBMIT HIS PROPOSED INSTALLATION AND GROUTING METHODS TO GROUND SUPPORT AND DPD FOR APPROVAL PRIOR TO CONSTRUCTION. THE DETAILS ON SH5.4 MAY BE REFERENCED TO SEE WHAT IS GENERALLY ENVISASED AS FOR THE GROUND ANCHORS.

2. GROUND ANCHOR INSTALLATION:

2A. AT THE GROUND SURFACE, THE DRILLHOLE SHALL BE LOCATED WITHIN 4 INCHES OF THE LOCATION SHOWN ON THE PLANS. THE DRILLHOLE SHALL BE LOCATED SO THE LONGITUDINAL AXIS OF THE DRILLHOLE AND THE LONGITUDINAL AXIS OF THE TENDON ARE PARALLEL.

2B. AT THE ANCHOR WORK POINT ELEVATION SHOWN THE PLANS, THE GROUND ANCHOR DECLINATION AND SPLAY SHALL BE AS SHOWN ON THE PLANS. NO TOLERANCE IS PROVIDED TO CHANGE THESE VALUES. ANY PROPOSED CHANGES TO TIEBACK ANGLES MUST BE APPROVED BY GROUND SUPPORT AFTER POTENTIAL UTILITY CONFLICTS HAVE BEEN REVIEWED.

2C. WHEN CAVING CONDITIONS ARE ENCOUNTERED, THE CONTRACTOR SELECT SHALL A METHOD TO PREVENT GROUND MOVEMENT. THE CONTRACTOR MAY USE TEMPORARY CASING.

2D. THE TENDON SHALL BE INSERTED INTO THE DRILLHOLE TO THE DESIRED DEPTH WITHOUT DIFFICULTY. WHEN THE TENDON CANNOT BE COMPLETELY INSERTED, THE CONTRACTOR SHALL REMOVE THE TENDON FROM THE DRILLHOLE AND CLEAN OR REDRILL THE HOLE TO PERMIT INSERTION. PARTIALLY INSERTED TENDONS SHALL NOT BE DRIVEN OR FORCED INTO THE HOLE.

2E. THE CONTRACTOR SHALL USE A NEAT-CEMENT OR A SAND-CEMENT GROUT. THE CEMENT SHALL NOT CONTAIN LUMPS OR OTHER INDICATIONS OF HYDRATION. ADMIXTURES, IF USED, SHALL BE MIXED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

2F. THE GROUT EQUIPMENT SHALL PRODUCE A GROUT FREE OF LUMPS AND UNDISPERSED CEMENT. A POSITIVE DISPLACEMENT GROUT PUMP SHALL BE USED. THE PUMP SHALL BE EQUIPPED WITH A PRESSURE GAUGE TO MONITOR GROUT PRESSURES. THE PRESSURE GAUGE SHALL BE CAPABLE OF MEASURING PRESSURES OF AT LEAST 150 PSI OR TWICE THE ACTUAL GROUT PRESSURES USED BY THE CONTRACTOR, WHICHEVER IS GREATER. THE GROUTING EQUIPMENT SHALL BE SIZED TO ENABLE THE GROUT TO BE PUMPED IN ONE CONTINUOUS OPERATION. THE MIXER SHALL BE CAPABLE OF CONTINUOUSLY AGITATING THE GROUT.

2G. THE GROUT SHALL BE INJECTED FROM THE LOWEST POINT OF THE DRILLHOLE. THE GROUT MAY BE PUMPED THROUGH GROUT TUBES, CASING, OR DRILL RODS. THE GROUT CAN BE PLACED BEFORE OR AFTER INSERTION OF THE TENDON. THE QUANTITY OF THE GROUT AND THE GROUT PRESSURES SHALL BE RECORDED. THE GROUT PRESSURES AND GROUT TAKES SHALL BE CONTROLLED TO PREVENT EXCESSIVE HEAVE IN SOILS OR FRACTURING OF ROCK FORMATIONS.

2H. NO GROUT SHALL BE PLACED UNDER PRESSURE ABOVE THE BOND LENGTH DURING INITIAL GROUTING OF THE ANCHOR BOND LENGTH. THE GROUT AT THE TOP OF THE DRILLHOLE SHALL NOT CONTACT THE BACK OF THE STRUCTURE.

2I. AFTER GROUTING, THE TENDON SHALL NOT BE LOADED UNTIL THE GROUT HAS ATTAINED SUFFICIENT STRENGTH TO CARRY THE TEST LOAD.

3. ANCHOR GROUT:

3A. THE GROUT SHALL BE A NEAT OR SAND/CEMENT MIXTURE WITH A MINIMUM 3-DAY COMPRESSIVE STRENGTH OF 1500 PSI AND A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3000 PSI PER ASTM C109 / AASHTO T106.

3B. TYPE I-I CEMENT CONFORMING TO THE REQUIREMENTS OF ASTM C150 / AASHTO M85 SHALL BE USED.

3C. FINE AGGREGATES SHALL CONSIST OF CLEAN, NATURAL SAND, CONFORMING TO THE REQUIREMENTS OF ASTM C33 / AASHTO M6. MANUFACTURED SAND IS ACCEPTABLE PROVIDED IT IS SUITABLE FOR PUMPING IN ACCORDANCE WITH ACI 304, SECTION 4.2.2.

3D. ADMIXTURES SHALL BE IN ACCORDANCE WITH ASTM C494 / AASHTO M194. ADMIXTURES WHICH CONTROL BLEED, IMPROVE FLOW, REDUCE WATER CONTENT, AND RETARD SET MAY BE USED IN THE GROUT SUBJECT TO THE APPROVAL OF THE ENGINEER. EXPANSIVE ADMIXTURES SHALL ONLY BE ADDED TO THE GROUT USED FOR FILLING SEALED ENCAPSULATIONS, TRUMPETS AND ANCHORAGE COVERS. ACCELERATORS WILL NOT BE PERMITTED. ADMIXTURES SHALL BE COMPATIBLE WITH PRESTRESSING STEELS AND MIXED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION.

4. ANCHOR TENDONS:

4A. THE GROUND ANCHORS TENDONS SHALL CONSIST OF THE FOLLOWING:

1. SEVEN-WIRE, LOW-RELAXATION STRANDS WITH AN ULTIMATE TENSILE STRENGTH OF 270 KSI CONFORMING TO ASTM A416 / AASHTO M203.

4B. STRAND COUPLERS SHALL NOT BE ALLOWED.

5. BONDBREAKER:

5A. A BONDBREAKER MUST BE PROVIDED TO PREVENT THE TENDON FROM BONDING TO THE ANCHOR GROUT SURROUNDING THE UNBONDED LENGTH.

5B. THE BONDBREAKER SHALL BE FABRICATED FROM A SMOOTH PLASTIC TUBE OR PIPE HAVING THE FOLLOWING PROPERTIES:

1. RESISTANCE TO CHEMICAL ATTACK FROM AGGRESSIVE ENVIRONMENTS, GROUT OR GREASE.
2. RESISTANCE TO AGING BY ULTRAVIOLET LIGHT.
3. FABRICATED FROM MATERIAL NON-DETRIMENTAL TO THE TENDON.
4. CAPABLE OF WITHSTANDING ABRASION, IMPACT, AND BENDING DURING HANDLING AND INSTALLATION.
5. ENABLE THE TENDON TO ELONGATE DURING TESTING AND STRESSING.
6. ALLOW THE TENDON TO REMAIN UNBONDED AFTER LOCKOFF.

6. SPACERS AND CENTRALIZERS:

6A. SPACERS SHALL BE USED ALONG THE TENDON BOND LENGTH OF MULTI-ELEMENT TENDONS TO SEPARATE EACH OF THE INDIVIDUAL ELEMENTS OF THE TENDON SO THE PRESTRESSING STEEL WILL BOND TO THE GROUT.

6B. SPACERS SHALL BE POSITIONED SO THEIR CENTER-TO-CENTER SPACING DOES NOT EXCEED 10 FEET. IN ADDITION, THE UPPER SPACER SHALL BE LOCATED A MAXIMUM OF 5 FEET FROM THE TOP OF THE TENDON BOND LENGTH AND THE LOWER SPACER SHALL BE LOCATED A MAXIMUM OF 5 FEET FROM THE BOTTOM OF THE TENDON BOND LENGTH. SPACERS SHALL PERMIT GROUT TO FREELY FLOW UP THE DRILLHOLE. SPACERS SHALL BE FABRICATED FROM PLASTIC.

6C. CENTRALIZERS SHALL PERMIT FREE GROUT FLOW AND SHALL PROVIDE A MINIMUM OF 1 INCH OF COVER OVER THE TENDON BOND LENGTH.

6D. CENTRALIZERS SHALL BE SECURELY ATTACHED TO THE TENDON AND THE CENTER TO CENTER SPACING SHALL NOT EXCEED 10 FEET. THE UPPER CENTRALIZER SHALL BE LOCATED A MAXIMUM OF 5 FEET FROM THE TOP OF THE TENDON BOND LENGTH AND THE LOWER CENTRALIZER SHALL BE LOCATED A MAXIMUM OF 1 FOOT FROM THE BOTTOM OF THE TENDON BOND LENGTH. CENTRALIZERS SHALL BE FABRICATED FROM PLASTIC.

7. ANCHORAGE DEVICES:

7A. ANCHORAGE DEVICES SHALL BE CAPABLE OF DEVELOPING 95% OF THE MINIMUM SPECIFIED ULTIMATE TENSILE STRENGTH OF THE PRESTRESSING STEEL TENDON. THE ANCHORAGE DEVICES SHALL CONFORM TO THE STATIC STRENGTH REQUIREMENTS OF SECTION 3.1.6(1) AND SECTION 3.1.8(1) OF THE PTI "GUIDE SPECIFICATION FOR POST TENSIONING MATERIALS".

7B. THE BEARING PLATES SHALL BE STRUCTURAL STEEL CONFORMING TO ASTM A36/AASHTO M183. THE BEARING PLATES SHALL BE SIZED SO THE ALLOWABLE BENDING STRESSES IN THE PLATE PER AISC-ASD ARE NOT EXCEEDED WHEN THE DESIGN LOAD OF THE GROUND ANCHOR IS APPLIED.

8. ANCHOR TESTING:

8A. EACH GROUND ANCHOR SHALL BE TESTED. THE MAXIMM TEST LOAD SHALL NOT EXCEED 80% OF THE MINIMUM GUARANTEED ULTIMATE TENSILE STRENGTH (GUTS) OF THE TENDON. THE TEST LOAD SHALL BE SIMULTANEOUSLY APPLIED TO THE ENTIRE TENDON. STRESSING OF SINGLE ELEMENTS OF MULTI-ELEMENT TENDONS WILL NOT BE PERMITTED.

8B. THE TESTING EQUIPMENT SHALL CONSIST OF:

1. A DIAL GAUGE OR VERNIER SCALE CAPABLE OF MEASURING TO 0.001 INCHES SHALL BE USED TO MEASURE THE GROUND ANCHOR MOVEMENT. THE MOVEMENT-MEASURING DEVICE SHALL HAVE A MINIMUM TRAVEL EQUAL TO THE THEORETICAL ELASTIC ELONGATION OF THE TOTAL ANCHOR LENGTH AT THE MAXIMUM TEST LOAD PLUS 1 INCH. THE DIAL GAUGE OR VERNIER SCALE SHALL BE SUPPORTED INDEPENDENT OF THE JACKING SYSTEM AND RETAINED STRUCTURE AND SHALL BE ALIGNED SO THAT ITS AXIS IS WITHIN 5 DEGREES FROM THE AXIS OF THE GROUND ANCHOR.

2. A HYDRAULIC JACK AND PUMP SHALL BE USED TO APPLY THE TEST LOAD. THE JACK AND PRESSURE GAUGE SHALL BE CALIBRATED BY AN INDEPENDENT TESTING LABORATORY AS A UNIT. THE PRESSURE GAUGE SHALL BE GRADUATED IN 100 PSI INCREMENTS OR LESS. THE PRESSURE GAUGE WILL BE USED TO MEASURE THE APPLIED LOAD. THE RAM TRAVEL OF THE JACK SHALL NOT BE LESS THAN THE THEORETICAL ELASTIC ELONGATION OF THE TOTAL ANCHOR LENGTH AT THE MAXIMUM TEST LOAD PLUS ONE INCH. THE JACK SHALL BE INDEPENDENTLY SUPPORTED AND CENTERED OVER THE TENDON SO THAT THE TENDON DOES NOT CARRY THE WEIGHT OF THE JACK.

8C. VERIFICATION TESTS SHALL BE PERFORMED ON 2 ANCHORS PER SOIL TYPE ENCOUNTERED, ANCHOR TYPE USED, OR INSTALLATION METHOD USED. VERIFICATION ANCHORS CAN BE USED AS PRODUCTION ANCHORS IF THEY ARE ACCEPTABLE AS DEFINED BELOW. THE VERIFICATION TEST SHALL BE MADE BY INCREMENTALLY LOADING THE ANCHOR IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

LOAD	HOLD TIME	LOAD	HOLD TIME	LOAD	HOLD TIME
AL	UNTIL STABLE	0.25DL	UNTIL STABLE	0.75DL	UNTIL STABLE
0.25DL	UNTIL STABLE	0.50DL	UNTIL STABLE	1.00DL	UNTIL STABLE
AL	UNTIL STABLE	0.75DL	UNTIL STABLE	1.25DL	UNTIL STABLE
0.25DL	UNTIL STABLE	1.00DL	UNTIL STABLE	1.50DL	UNTIL STABLE
0.50DL	UNTIL STABLE	1.25DL	UNTIL STABLE	1.75DL	UNTIL STABLE
AL	UNTIL STABLE	AL	UNTIL STABLE	AL	UNTIL STABLE
0.25DL	UNTIL STABLE	0.25DL	UNTIL STABLE	0.25DL	UNTIL STABLE
0.50DL	UNTIL STABLE	0.50DL	UNTIL STABLE	0.50DL	UNTIL STABLE
0.75DL	UNTIL STABLE	0.75DL	UNTIL STABLE	0.75DL	UNTIL STABLE
AL	UNTIL STABLE	1.00DL	UNTIL STABLE	1.00DL	UNTIL STABLE
0.25DL	UNTIL STABLE	1.25DL	UNTIL STABLE	1.25DL	UNTIL STABLE
0.50DL	UNTIL STABLE	1.50DL	60 MINUTES	1.50DL	UNTIL STABLE
0.75DL	UNTIL STABLE	AL	UNTIL STABLE	1.75DL	UNTIL STABLE
1.00DL	UNTIL STABLE	0.25DL	UNTIL STABLE	2.00DL	UNTIL STABLE
AL	UNTIL STABLE	0.50DL	UNTIL STABLE	AL	UNTIL STABLE

THE ALIGNMENT LOAD (AL) SHOULD BE THE MINIMUM LOAD REQUIRED TO ALIGN THE TESTING APPARATUS AND SHOULD NOT EXCEED 0.05DL. DIAL GAUGES SHOULD BE SET AT "ZERO" AFTER THE ALIGNMENT LOAD HAS BEEN APPLIED.

A 10-MINUTE CREEP TEST SHALL BE PERFORMED AT THE 1.50 DL INCREMENT. THE LOAD-HOLD PERIOD SHALL START AS SOON AS THE MAXIMUM TEST LOAD IS APPLIED AND THE ANCHOR MOVEMENT SHALL BE MEASURED AND RECORDED AT 1, 2, 3, 5, 6, AND 10 MINUTES. IF THE ANCHOR MOVEMENT BETWEEN 1 AND 10 MINUTES EXCEEDS 0.04 INCHES, THE MAXIMUM TEST LOAD SHALL BE HELD AN ADDITIONAL 50 MINUTES. IF THE LOAD HOLD IS EXTENDED, THE ANCHOR MOVEMENTS SHALL BE RECORDED AT 20, 30, 50, AND 60 MINUTES. IF THE CREEP MOVEMENT EXCEEDS 0.08 INCHES BETWEEN THE 6 AND 60 MINUTE READINGS, THE ANCHOR HAS FAILED. RETESTING WILL NOT BE ALLOWED.

8D. PROOF TESTS SHALL BE PERFORMED ON ALL PRODUCTION ANCHORS BY INCREMENTALLY LOADING THE GROUND ANCHOR IN ACCORDANCE WITH THE FOLLOWING SCHEDULE. AT LOAD INCREMENTS OTHER THAN MAXIMUM TEST LOAD, THE LOAD SHALL BE HELD LONG ENOUGH TO OBTAIN A STABLE READING.

AL	1.00DL
0.25DL	1.25DL
0.50DL	1.33DL
0.75DL	

THE MAXIMM TEST LOAD SHALL BE HELD FOR 10 MINUTES. THE LOAD-HOLD PERIOD SHALL START AS SOON AS THE MAXIMM TEST LOAD IS APPLIED AND THE ANCHOR MOVEMENT SHALL BE MEASURED AND RECORDED AT 1, 2, 3, 5, 6, AND 10 MINUTES. IF THE ANCHOR MOVEMENT BETWEEN 1 AND 10 MINUTES EXCEEDS 0.04 INCHES, THE MAXIMM TEST LOAD SHALL BE HELD OFF AN ADDITIONAL 50 MINUTES. IF THE LOAD HOLD IS EXTENDED, THE ANCHOR MOVEMENTS SHALL BE RECORDED AT 20, 30, 50, AND 60 MINUTES. IF AN ANCHOR FAILS IN CREEP, RETESTING WILL NOT BE ALLOWED.

8E. A VERIFICATION OR PROOF TESTED GROUND ANCHOR WITH A 10 MINUTE LOAD HOLD CREEP TEST IS CONSIDERED ACCEPTABLE WHEN:

1. THE GROUND ANCHOR CARRIES THE MAXIMM TEST LOAD WITH LESS THAN 0.04 INCHES OF MOVEMENT BETWEEN THE 1 AND 10 MINUTE READINGS.
2. THE TOTAL MOVEMENT AT THE MAXIMM TEST LOAD EXCEEDS 80% OF THE THEORETICAL ELASTIC ELONGATION OF THE UNBONDED LENGTH.

8F. A VERIFICATION OR PROOF TESTED GROUND ANCHOR WITH A 60 MINUTE LOAD HOLD CREEP TEST IS CONSIDERED ACCEPTABLE WHEN:

1. THE GROUND ANCHOR CARRIES THE MAXIMM TEST LOAD WITH LESS THAN 0.08 INCHES OF MOVEMENT PER LOG CYCLE OF TIME AND THE CREEP RATE IS LINEAR OR DECREASING.
2. THE TOTAL MOVEMENT AT THE MAXIMM TEST LOAD EXCEEDS 80% OF THE THEORETICAL ELASTIC ELONGATION OF THE UNBONDED LENGTH.

IN ADDITION TO THE ABOVE, A VERIFICATION TESTED GROUND ANCHOR MUST NOT EXPERIENCE A PULLOUT FAILURE AT THE MAXIMM TEST LOAD. A PULLOUT FAILURE IS DEFINED AS THE LOAD AT WHICH ATTEMPTS TO INCREASE THE TEST LOAD RESULT IN CONTINUED PULLOUT MOVEMENT OF THE TEST ANCHOR.

8G. GROUND ANCHORS THAT HAVE A CREEP RATE GREATER THAN SPECIFIED CAN BE INCORPORATED IN THE FINISHED WORK AT A LOAD EQUAL TO ONE-HALF OF THE FAILURE LOAD. THE FAILURE LOAD IS THE MAXIMM LOAD CARRIED BY THE ANCHOR AFTER THE LOAD HAS BEEN ALLOWED TO STABILIZE FOR TEN MINUTES.

8H. WHEN A GROUND ANCHOR FAILS, THE CONTRACTOR SHALL MODIFY THE ANCHOR DESIGN, THE CONSTRUCTION PROCEDURES, OR BOTH. THESE MODIFICATIONS MAY INCLUDE, BUT ARE NOT LIMITED TO, INSTALLING REPLACEMENT GROUND ANCHORS, MODIFYING THE INSTALLATION METHODS, INCREASING THE BOND LENGTH, OR CHANGING THE GROUND ANCHOR TYPE.

8I. AFTER INTERNAL SUPPORT OF THE EXCAVATION IS PROVIDED BY THE SUBSURFACE PORTION OF THE STRUCTURE, ANCHORS MUST BE DETENSIONED. BASED ON THE CONSTRUCTION SEQUENCE OF THE PERMANENT BASEMENT WALLS AND FLOOR SLABS, THE GENERAL CONTRACTOR WILL COORDINATE WITH THE DESIGN TEAM AS TO WHEN ANCHOR DETENSIONING IS APPROPRIATE. ANCHOR DETENSIONING AND PATCHING OF THE BASEMENT WALLS WILL BE PERFORMED BY THE GENERAL CONTRACTOR.

SURVEY MONITORING:

SURVEY MONITORING OF THE SHORING WALLS, SHALL BE PERFORMED TO DETERMINE THE VERTICAL AND HORIZONTAL MOVEMENT OF THE MONITORING POINTS. THE MEASURING SYSTEM SHALL HAVE AN ACCURACY OF AT LEAST 0.01 FEET.

THE MONITORING PROGRAM SHALL BE DETERMINED BY THE GEOTECHNICAL SPECIAL INSPECTOR BUT, AT A MINIMUM, SHALL INCLUDE THE FOLLOWING:

(1) ESTABLISH SURVEY LINES NEAR THE TOP OF THE WALL ON ADJACENT CRITICAL STRUCTURES OR BUILDINGS WITHIN A DISTANCE EQUAL TO THE HEIGHT OF THE WALL, AND ALONG THE CURBLINE AND CENTERLINE OF ADJACENT ROADWAYS OR ALLEYS.

(2) SURVEY POINTS ALONG THE LINES INDICATED IN NOTE 1 ABOVE SHOULD BE SPACED NO MORE THAN EVERY 20-FEET ALONG THE WALL FOR SOLDIER PILES. PLACE MONITORING POINTS AT THE TOP OF AT LEAST EVERY OTHER SOLDIER PILE.

(2A) INSTALL INCLINOMETERS IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PROJECT GEOTECHNICAL ENGINEER, AT THE LOCATIONS SHOWN ON THE PLANS, AND TO A DEPTH OF AT LEAST 10-FT BELOW THE BOTTOM OF THE EXCAVATION.

(3) ESTABLISH A BASELINE READING OF MONITORING POINTS ON THE GROUND SURFACE AND SETTLEMENT-SENSITIVE STRUCTURES BEHIND THE SHORING WALL ALIGNMENT PRIOR TO DEWATERING, EXCAVATION, AND INSTALLATION OF THE SHORING SYSTEMS.

(4) A LICENSED SURVEYOR THAT IS NOT THE CONTRACTOR MUST PERFORM THE SURVEYING AT LEAST ONCE A WEEK, HOWEVER, THE SURVEYING MUST BE PERFORMED BY A LICENSED SURVEYOR A MINIMUM OF TWICE A WEEK, IN ACCORDANCE WITH THE MONITORING REQUIREMENTS ESTABLISHED IN THE PROJECT GEOTECHNICAL ENGINEERING REPORT.

(5) MONITORING POINTS ESTABLISHED ALONG THE CURBLINE AND CENTERLINE OF ADJACENT ROADWAYS NEED TO BE MONITORED WHEN TOTAL WALL MOVEMENTS REACH 0.5 INCH OR AT SDOT REQUEST.

(6) THE GEOTECHNICAL ENGINEER SHALL REVIEW SURVEY DATA AND PROVIDE AN EVALUATION OF WALL PERFORMANCE AND THE SURVEY DATA TO SDCI AND SDOT ON AT LEAST A WEEKLY BASIS, PER SDCI. THIS WEEKLY REVIEW MUST CONTAIN A GRAPHICAL PRESENTATION OF THE WALL MOVEMENT VERSUS TIME.

(7) IMMEDIATELY NOTIFY THE GEOTECHNICAL AND STRUCTURAL ENGINEERS, SHORING DESIGNER, SDCI, AND SDOT, IF 0.5 INCH OF MOVEMENT OCCURS BETWEEN TWO CONSECUTIVE READINGS AND WHEN TOTAL MOVEMENTS REACH 0.5 INCH.

(8) IF MOVEMENTS EXCEED 0.5 INCHES, THE ENGINEERS AND SHORING DESIGNER SHALL DETERMINE THE CAUSE OF DISPLACEMENT AND DEVELOP AND IMPLEMENT REMEDIAL MEASURES SUFFICIENT TO LIMIT TOTAL MOVEMENTS AT 1 INCH.

(9) ALL EARTHWORK AND CONSTRUCTION ACTIVITIES MUST BE DIRECTED TOWARD IMMEDIATE IMPLEMENTATION OF REMEDIAL MEASURES TO LIMIT DEFORMATIONS TO WHAT IS CONSIDERED AS ACCEPTABLE BY SDOT (1 INCH MAXIMUM).

(10) SURVEY FREQUENCY CAN BE DECREASED AFTER THE SHORING SYSTEM HAS BEEN INSTALLED AND THE EXCAVATION IS COMPLETE IF THE DATA INDICATES NO OR LITTLE ADDITIONAL MOVEMENT. SURVEYING MUST CONTINUE UNTIL THE PERMANENT STRUCTURE (INCLUDING FLOOR SLABS AS BRACES) IS COMPLETED UP TO STREET GRADES. THE SURVEY FREQUENCY WOULD BE DETERMINED BY THE GEOTECHNICAL ENGINEER, WITH APPROVAL BY BOTH SDCI AND SDOT, AND WOULD BE BASED ON THE SHORING PERFORMANCE.

ADDITIONAL SURVEY MONITORING REQUIREMENTS PER KING COUNTY:

(1) PROVIDE A WASHINGTON STATE LICENSED SURVEYOR TO VERIFY THE LOCATION OF THE SHORING ELEMENTS THAT ARE TO BE INSTALLED IN CLOSE PROXIMITY OF THE TUNNELS TO AVOID IMPACTS TO THE TUNNELS.

(2) PROVIDE A WASHINGTON STATE LICENSED SURVEYOR TO VERIFY, COORDINATE, AND OBSERVE THE INSTALLATION OF THE FOUNDATION ELEMENTS IN CLOSE PROXIMITY OF THE TUNNELS TO PREVENT IMPACTING THE TUNNELS.

ADDITIONAL EQUIPMENT LOADING RESTRICTIONS PER KING COUNTY - AND ANSWERED BY HALEY & ALDRICH.

WE DO NOT ANTICIPATE LOADS FROM CONSTRUCTION EQUIPMENT WILL IMPACT OR CAUSE DAMAGE TO THE TUNNEL. WE ARE CURRENTLY PERFORMING ANALYSIS BASED ON THE SPECIFIC EQUIPMENT THAT IS PLANNED TO BE USED IN THE EXCAVATION, WHICH WILL BE PRESENTED IN A FUTURE DESIGN MEMORANDUM WITH OUR RECOMMENDATIONS TO INCLUDE AS NOTES ON THE SHORING DRAWINGS. POSSIBLE MEASURES FOR THE CONTRACTOR TO TAKE TO MITIGATE THE IMPACTS DUE TO EQUIPMENT LOADS OVER THE TUNNELS DURING CONSTRUCTION COULD INCLUDE A MINIMUM AMOUNT OF SOIL COVER OVER THE TUNNEL PLATES/CRANE MAT TO DISTRIBUTE EQUIPMENT LOADS OVER THE TUNNEL, ETC.

3

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 21603 — REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

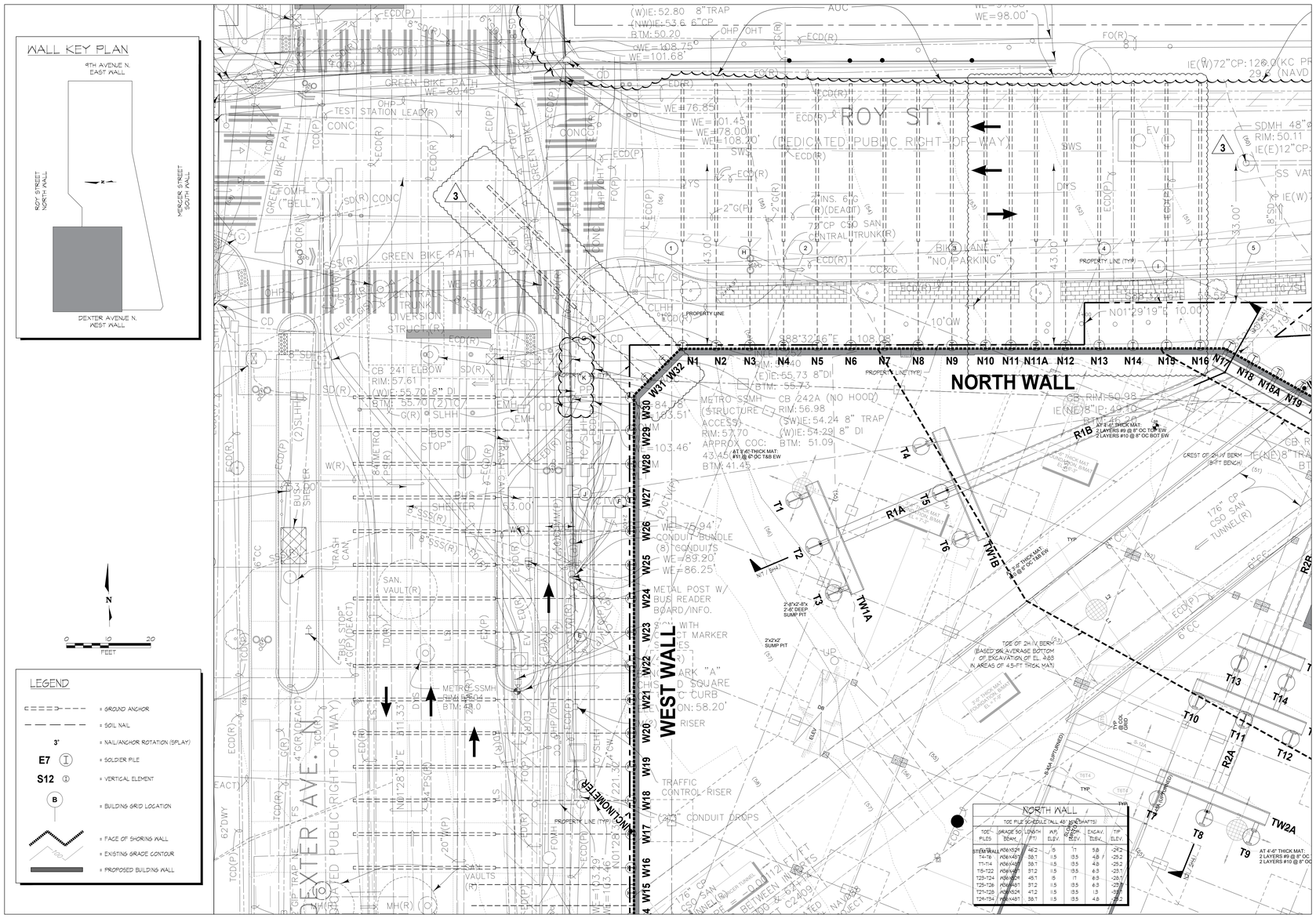
REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48652-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING NOTES

SHEET NUMBER
SH1.2



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS
Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

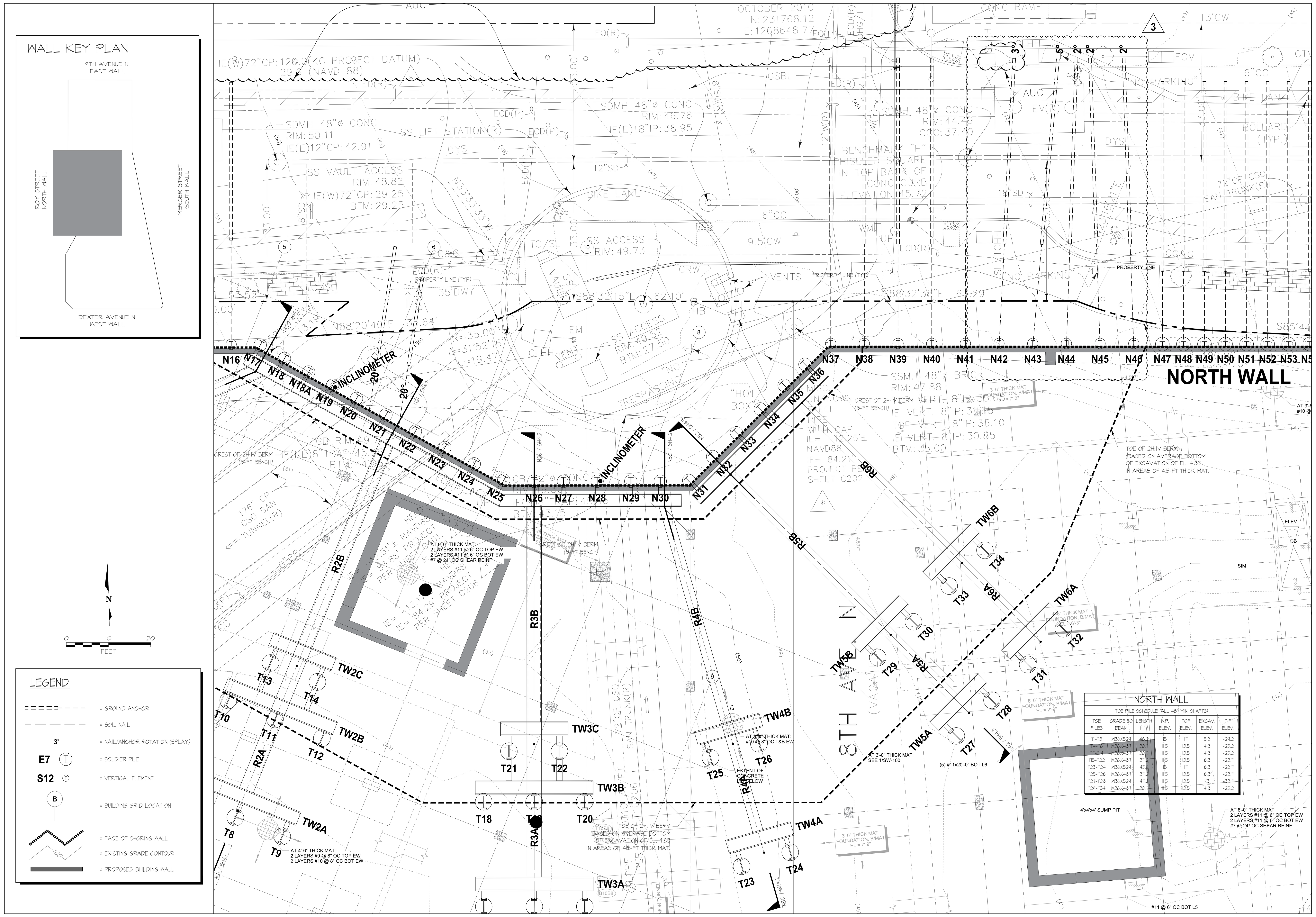
REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48062-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING PLAN

SHEET NUMBER
SH2.0



NORTH WALL

TOE PILE SCHEDULE (ALL 48" MIN. SHAFTS)

TOE PILES	GRADE 50 BEAM	LENGTH (FT)	W.P. ELEV.	TOP ELEV.	EXCAV. ELEV.	TIP ELEV.
T1-T3	W36X529	46.2	15	17	5.8	-29.2
T4-T6	W36X487	38.7	11.5	13.5	4.8	-25.2
T7-T14	W36X487	38.7	11.5	13.5	4.8	-25.2
T15-T22	W36X487	37.2	11.5	13.5	6.3	-23.7
T23-T24	W36X529	45.7	15	17	6.3	-28.7
T25-T26	W36X487	37.2	11.5	13.5	6.3	-23.7
T27-T28	W36X529	47.2	11.5	13.5	1.3	-33.7
T29-T34	W36X487	38.7	11.5	13.5	4.8	-25.2

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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

CHRIS J. WOLSCHLAG, STATE OF WASHINGTON, 34487 REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE 1" = 10'-0"
PROJECT ARCHITECT NBBJ
PROJECT NUMBER #20-46 ...62-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING PLAN

SHEET NUMBER
SH2.1

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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

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CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

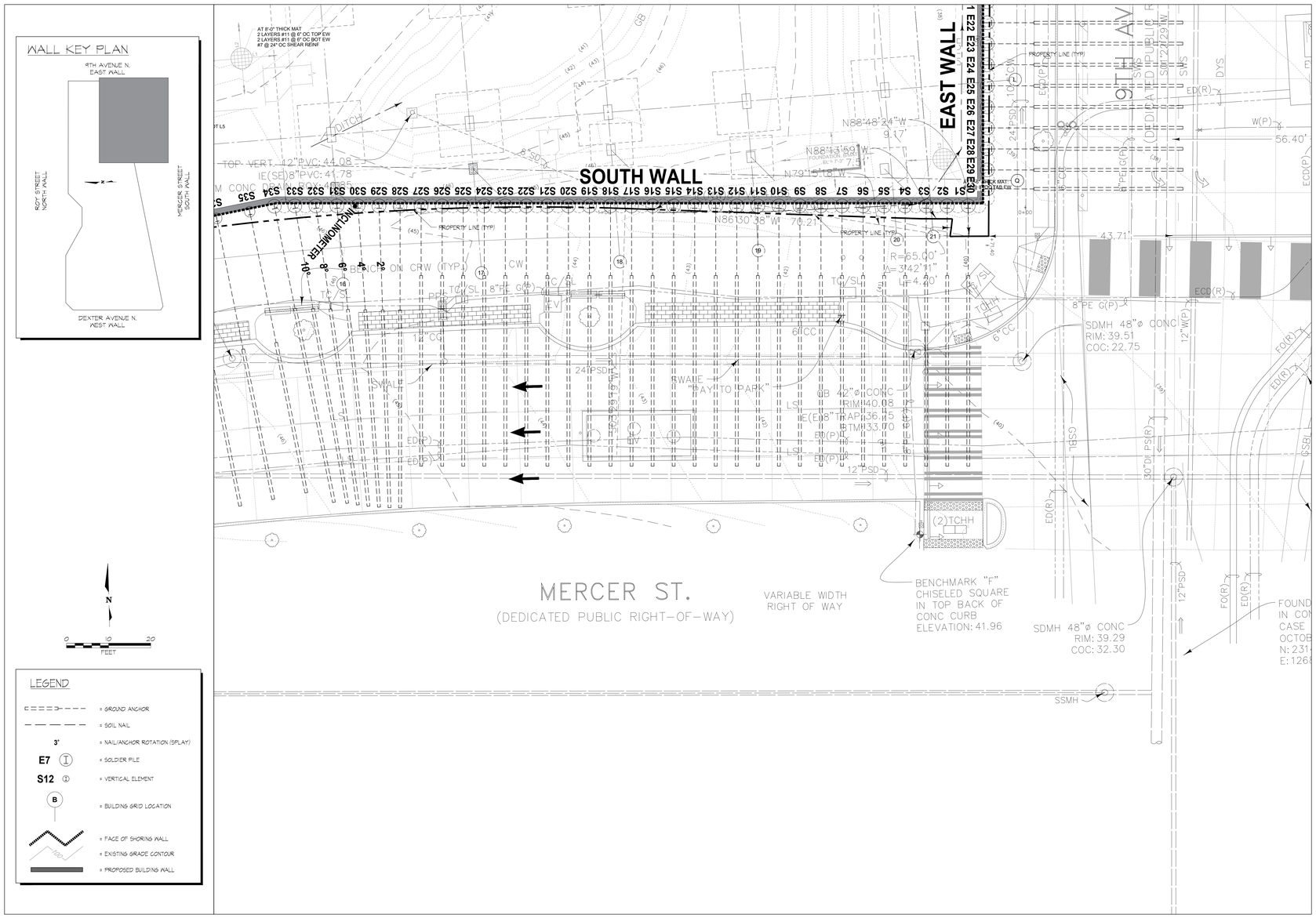
SCALE: 1" = 10'-0"

PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48052-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING PLAN

SHEET NUMBER
SH2.2



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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

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ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"

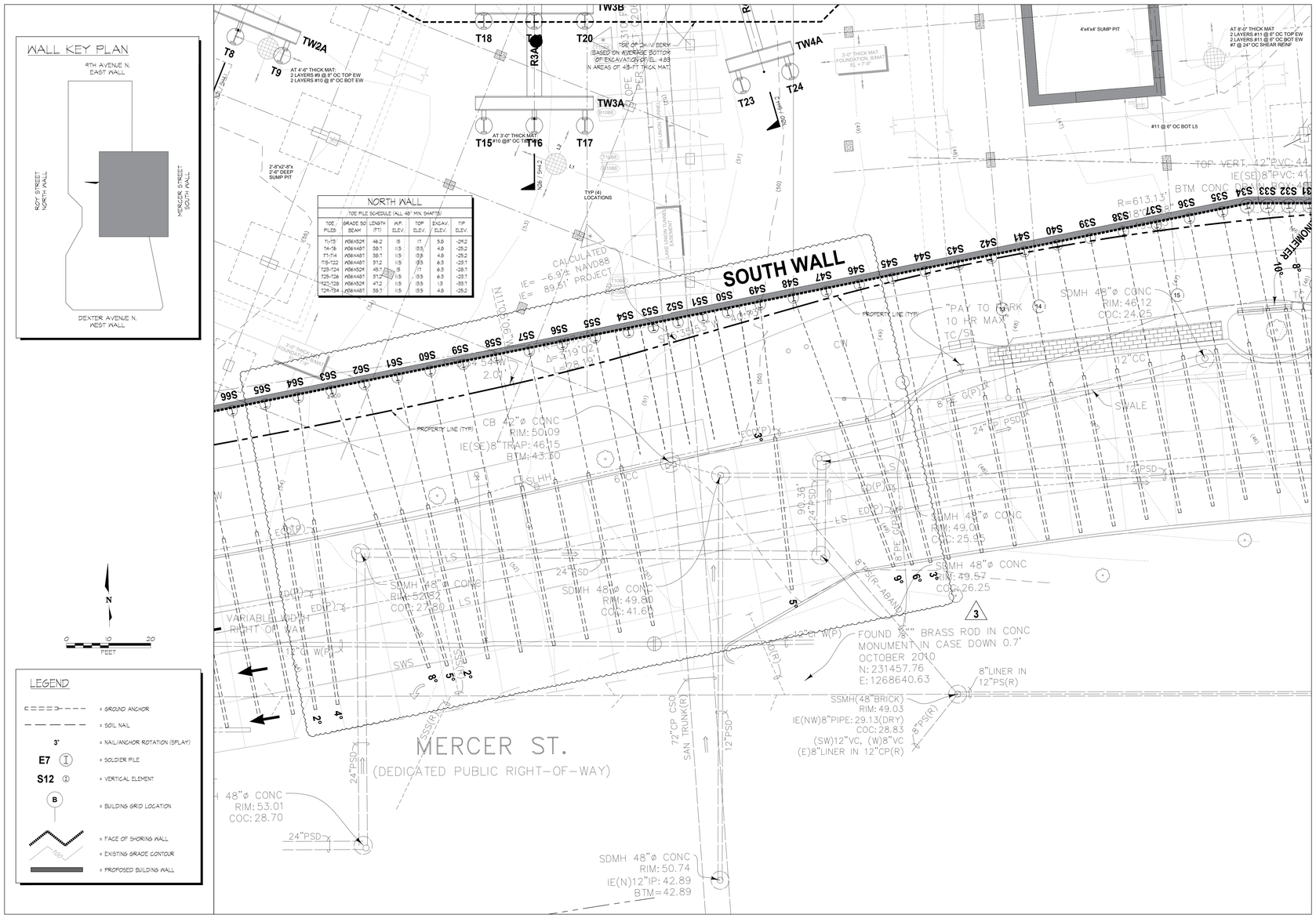
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: ~~#20-48~~ 52-CN

SHEET NAME

TEMPORARY SHORING WALL SHORING PLAN

SHEET NUMBER: SH2.3



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS
Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — REGISTERED PROFESSIONAL ENGINEER — STATE OF WASHINGTON — 8/22/22

ARE
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MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

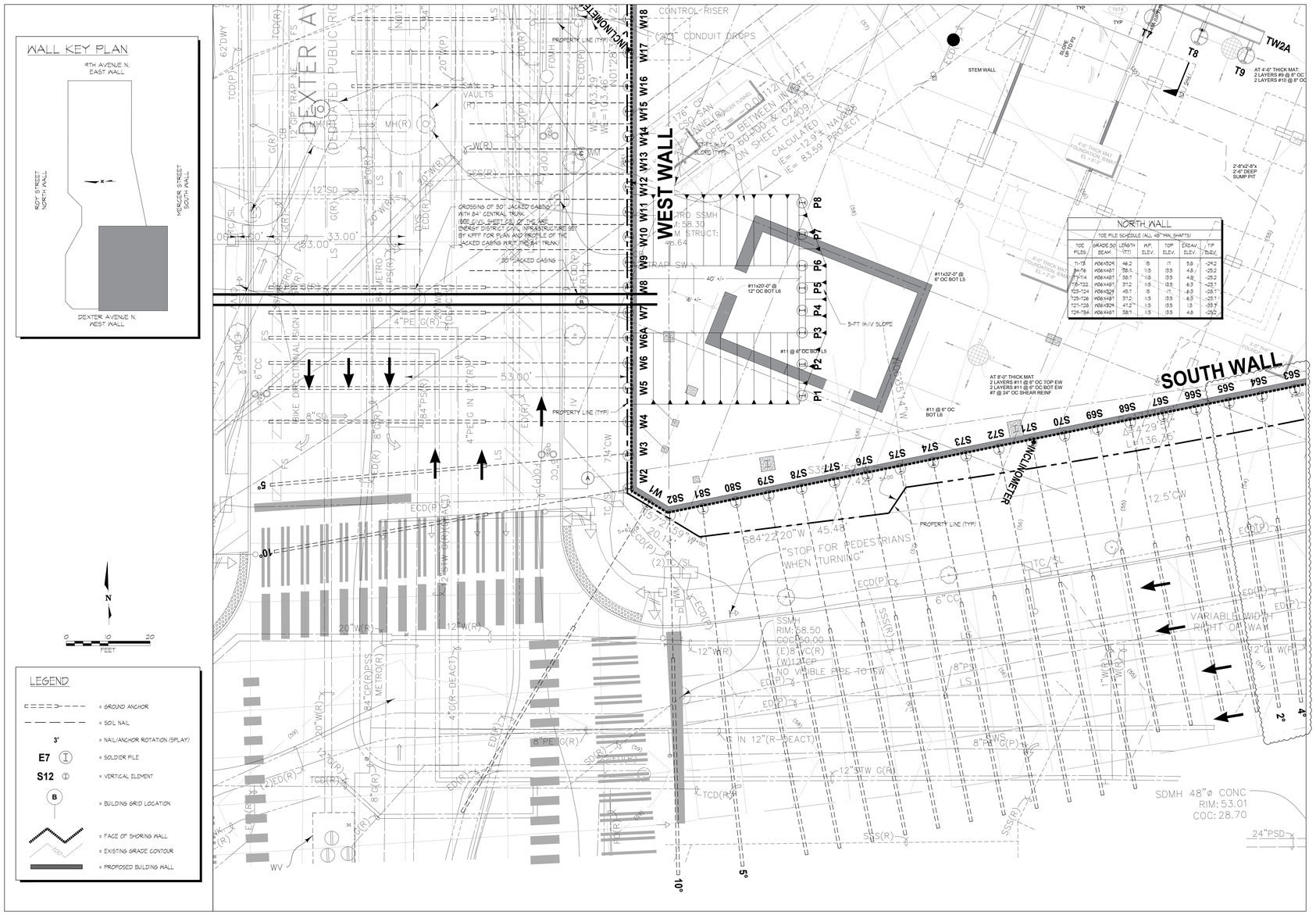
REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48652-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING PLAN

SHEET NUMBER
SH2.4



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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

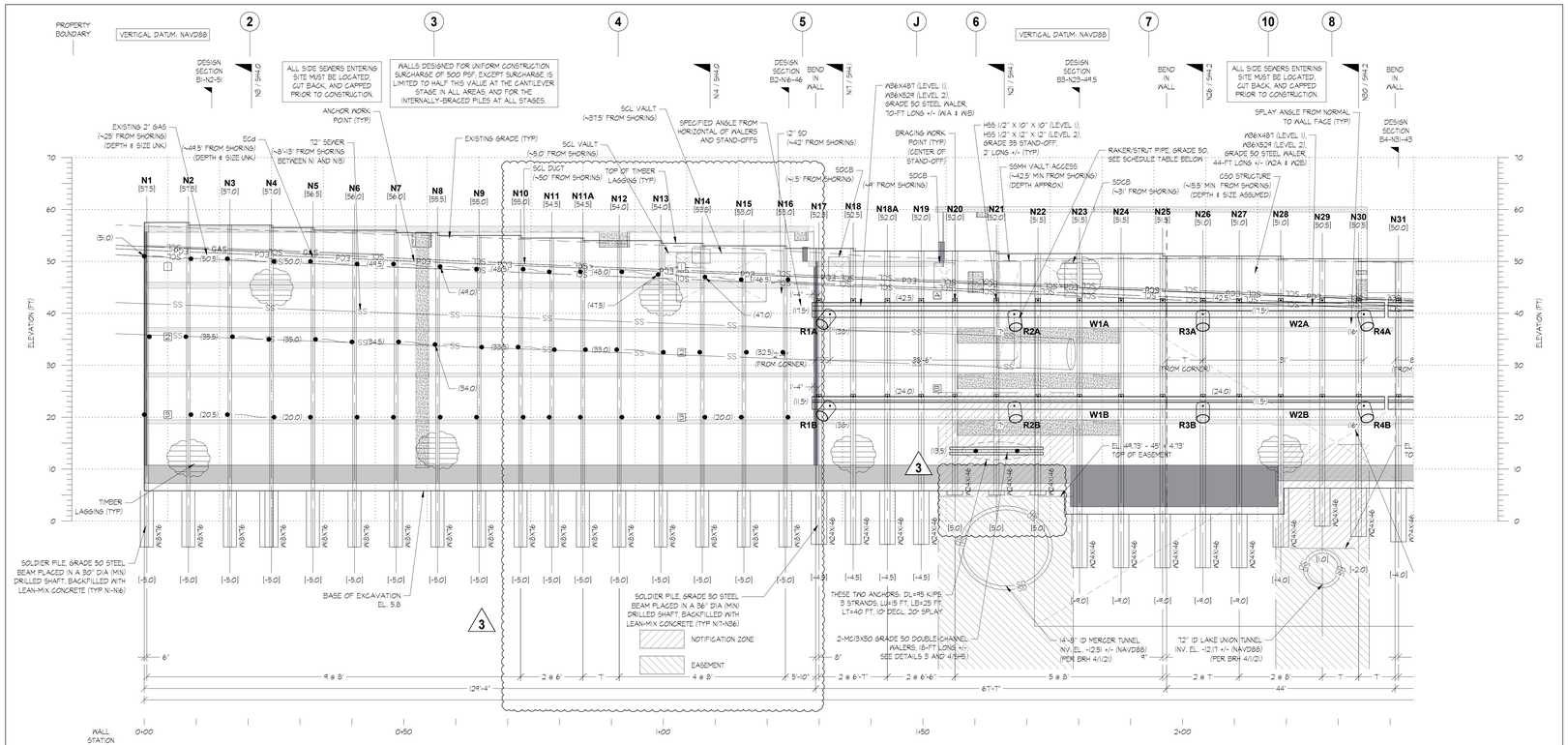
REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48652-CN

SHEET NAME
TEMPORARY SHORING WALL SHORING PLAN

SHEET NUMBER
SH2.5



NORTH WALL FACE AREA = 23,910 SF

NORTH WALL TIMBER AREA = 16,850 SF

NORTH WALL
ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DECLINATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
N-N6	1	12	64	26	38	4	125	125
	2	40	71	21	50	6	200	200
	3	35	67	19	48	6	190	190

0 10 20 FEET

NORTH WALL
LEVEL A - RAKER PIPE SCHEDULE (GRADE 50)

RAKER NO.	SIZE (IN)	L (FT)	DESIGN (KIPS)	PRELOAD (KIPS)	DECLINE (DEG)	SPLAY (DEG)
1A	42 X 3/4	100	900	450	14.1	38 L
2A	42 X 3/4	92	960	430	17.4	7 R
3A	42 X 3/4	91.3	960	430	17.5	0
4A	30 X 3/4	88	540	270	16.9	16 R
5A6A	30 X 1/2	78	490	245	20.0	0

NORTH WALL
LEVEL B - RAKER PIPE SCHEDULE (GRADE 50)

RAKER NO.	SIZE (IN)	L (FT)	DESIGN (KIPS)	PRELOAD (KIPS)	DECLINE (DEG)	SPLAY (DEG)
1B	36 X 3/4	66	1020	510	9.3	38 L
2B	36 X 3/4	51.5	1280	640	11.4	7 R
3B	36 X 3/4	51	1280	640	11.5	0
4B	30 X 1/2	59.3	710	355	11.1	16 R
5B6B	30 X 1/2	48.5	630	315	12.0	0

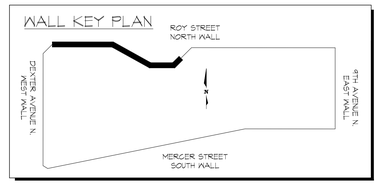
NORTH WALL FACE AREA = 23,910 SF

NORTH WALL TIMBER AREA = 16,850 SF

LEGEND

- [B] = NAIL ROW
- \+ = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- <38.0> = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / SH3 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_D = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- [94.5] = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- [61.0] = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"

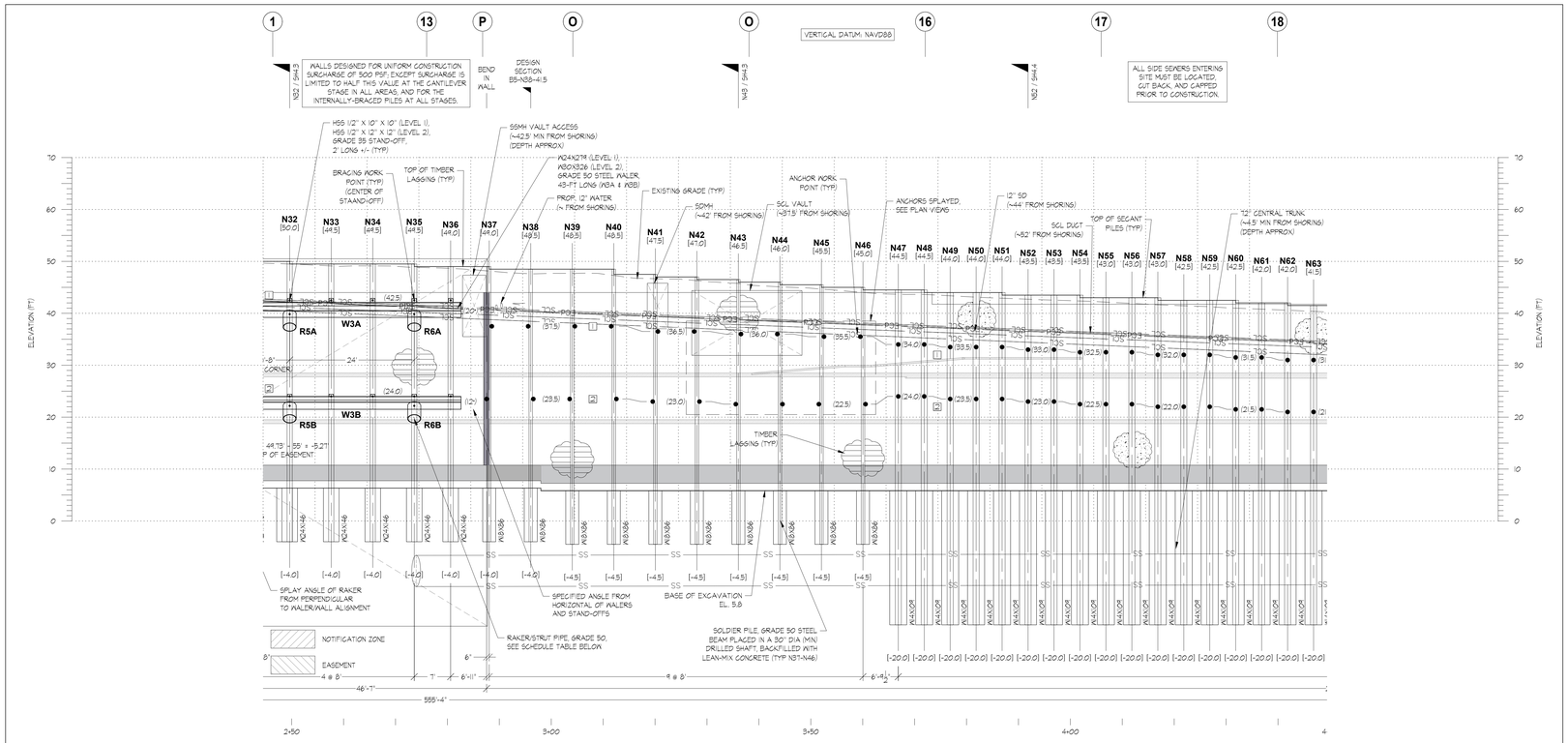
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: ~~#20-48~~ 62-CN

SHEET NAME

TEMPORARY SHORING WALL NORTH ELEVATION

SHEET NUMBER: SH3.0



NORTH WALL FACE AREA = 29,910 SF

NORTH WALL TIMBER AREA = 16,850 SF

NORTH WALL
ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DECLINATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
N37-N46	1	20	73	26	47	6	187	187
	2	20	68	18	50	6	211	211

NORTH WALL
ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DECLINATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
N47-N84	1	20	64	24	40	3	100	100
	2	20	67	19	48	4	120	120

NORTH WALL FACE AREA = 29,910 SF

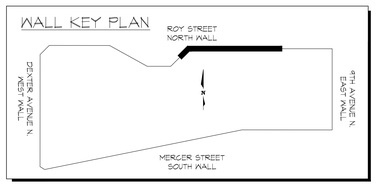
NORTH WALL TIMBER AREA = 16,850 SF

0 10 20 FEET

LEGEND

- [3] = NAIL ROW
- \+ = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- <38.0> = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / S40 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_p = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- 1 = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- [44.5] = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- [61.0] = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

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ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

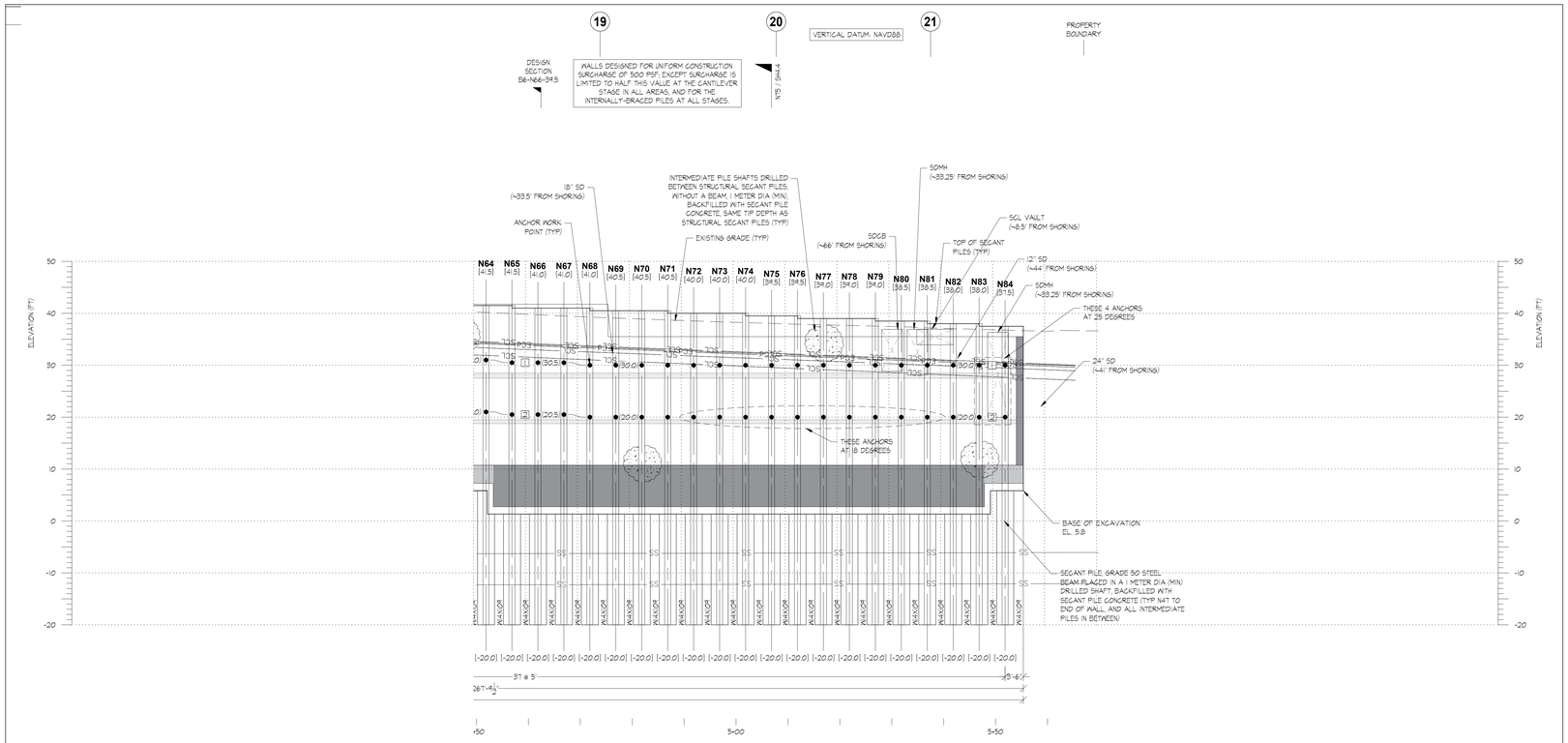
SCALE: 1" = 10'-0"

PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48662-CN

SHEET NAME: TEMPORARY SHORING WALL NORTH ELEVATION

SHEET NUMBER: SH3.1



NORTH WALL

ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DESIGNATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
N47-N84	1	20	64	24	40	3	100	100
	2	20	67	18	48	4	120	120

NORTH WALL FACE AREA = 23,410 SF

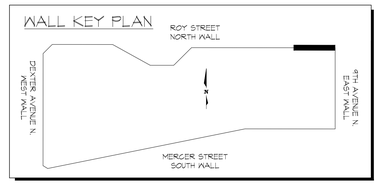
NORTH WALL TIMBER AREA = 6,850 SF

0 10 20 FEET

LEGEND

- [3] = NAIL ROW
- \+ = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- <38.0> = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / S4.0 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_p = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- 1 = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- [94.5] = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- [61.0] = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

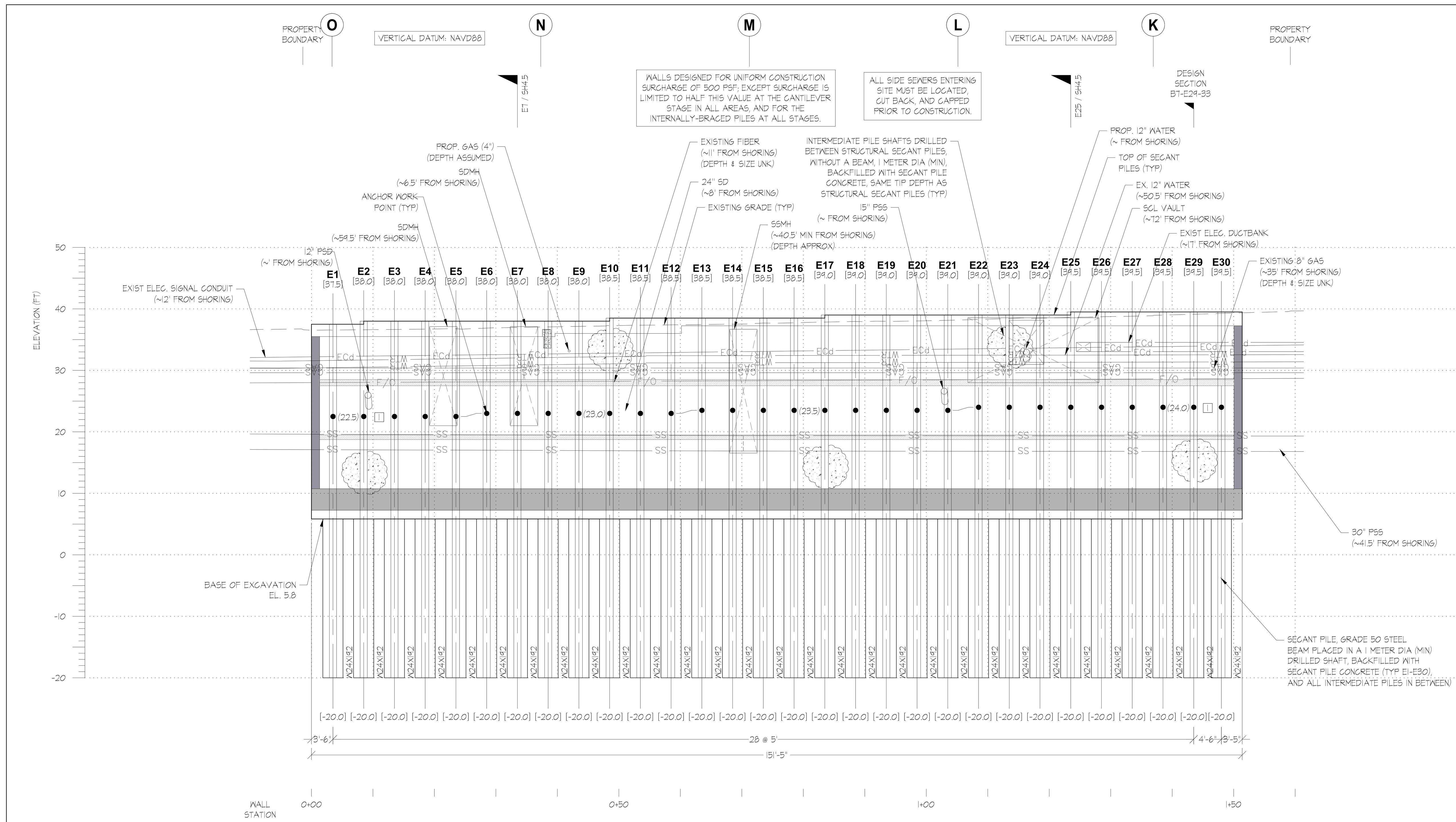
SCALE 1" = 10'-0"

PROJECT ARCHITECT NBBJ

PROJECT NUMBER #20-48062-CN

SHEET NAME
TEMPORARY SHORING WALL NORTH ELEVATION

SHEET NUMBER SH3.2



EAST WALL FACE AREA = 4,970 SF

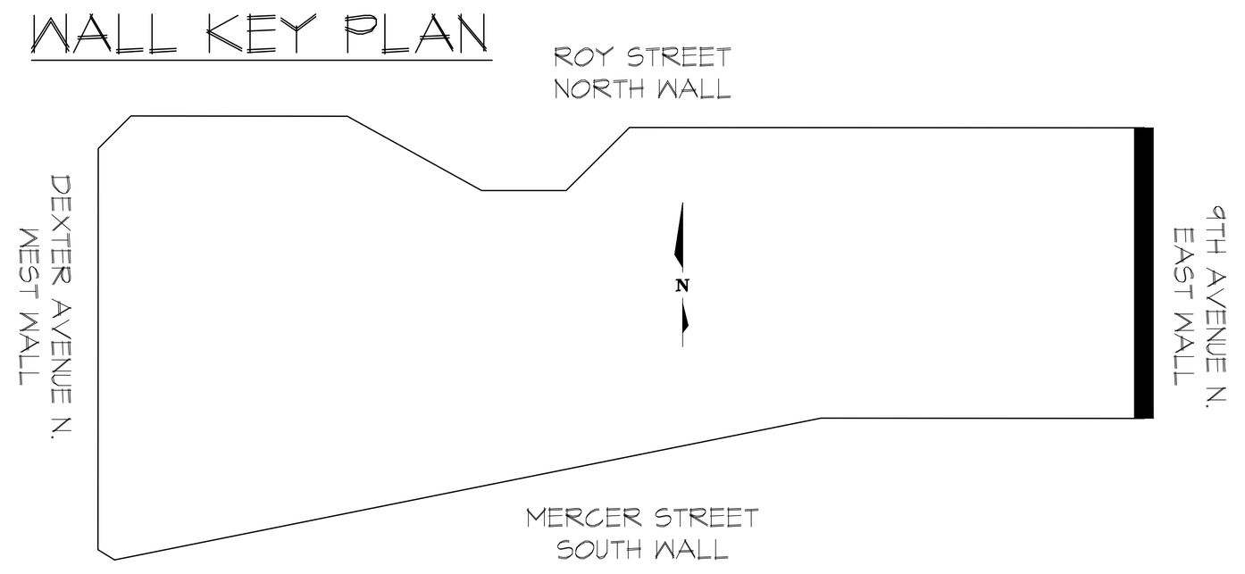
EAST WALL — ANCHOR SCHEDULE								
PILE(S)	ROW NUMBER	DECLI-NATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
E1-E30	1	45	67	17	50	6	186	186

0 10 20 FEET

LEGEND

- [3] = NAIL ROW
- + = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- ‹38.0› = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / SH4.0 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_p = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 PILE NUMBER
- [94.5] TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- [61.0] BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

CHRIS J. WOLSCHLAG — STATE OF WASHINGTON — 34487 REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

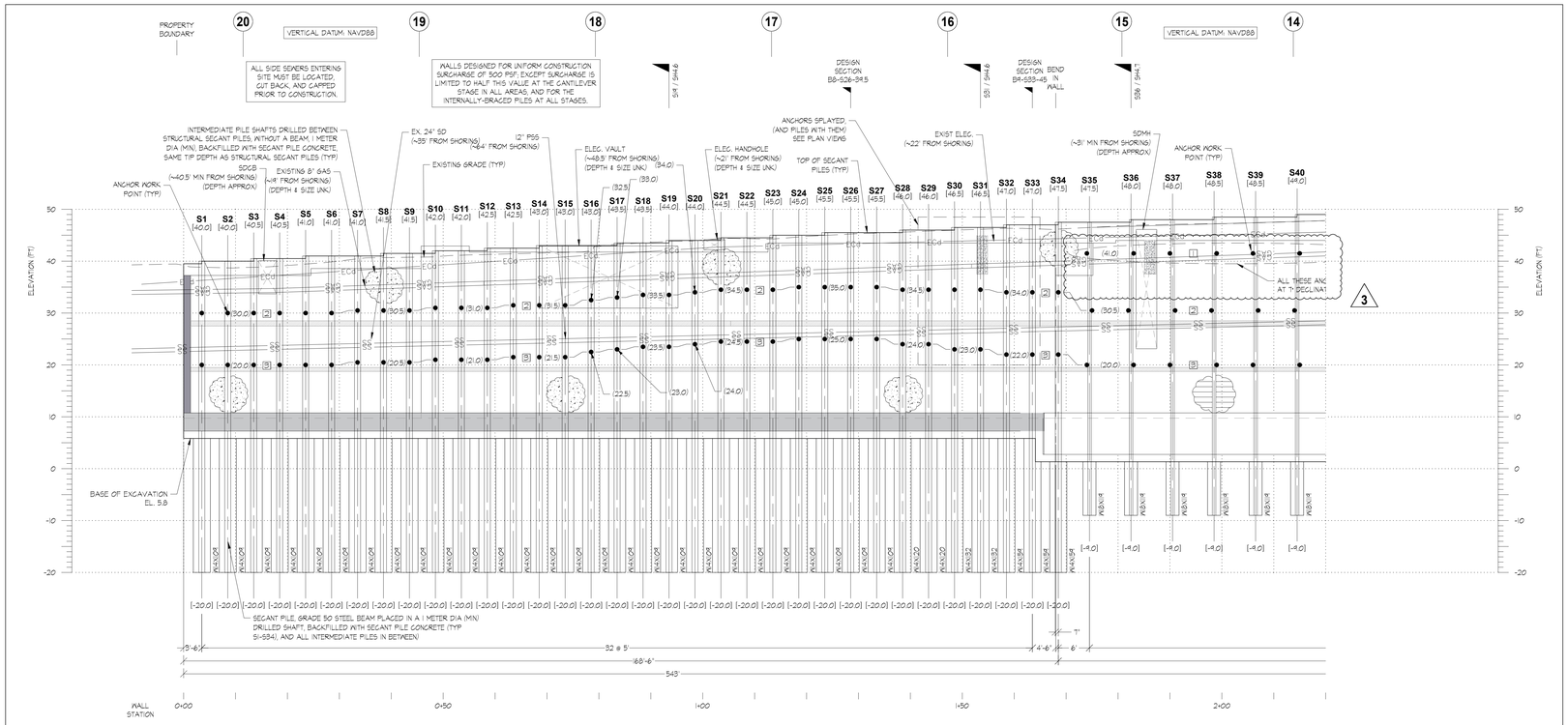
MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE 1" = 10'-0"
PROJECT ARCHITECT NBBJ
PROJECT NUMBER #20-46 ...62-CN

SHEET NAME
TEMPORARY SHORING WALL EAST ELEVATION

SHEET NUMBER SH3.3

1/11/2022 2:54:39 PM
BIM 360://102482.00 - ARE Mercer Blocks R21/ARCH_MERCER BLOCK_CS_V21.rvt



SOUTH WALL FACE AREA = 24800 SF

SOUTH WALL TIMBER AREA = 16820 SF

SOUTH WALL SHOTCRETE AREA = 1820 SF

SOUTH WALL
ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DECLI-NATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
SI-S27	2	25	64	24	40	3	100	100
	3	25	69	19	50	4	125	125
S28-S34	2	30	77	27	50	4	138	138
	3	30	71	21	50	5	162	162

SOUTH WALL FACE AREA = 24800 SF

SOUTH WALL TIMBER AREA = 16820 SF

SOUTH WALL SHOTCRETE AREA = 1820 SF

SOUTH WALL
ANCHOR SCHEDULE

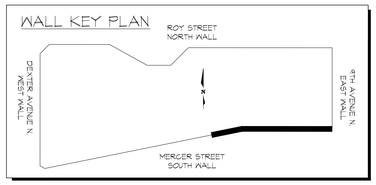
PILE(S)	ROW NUMBER	DECLI-NATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
S35-S48	1	10	70	33	37	5	145	145
	2	30	68	25	43	5	170	170
	3	25	75	20	55	7	250	250

0 10 20 FEET

LEGEND

- [3] = NAIL ROW
- \+ = NAIL
- (21.0) = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- <38.0> = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / SHT 6 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_D = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- 1 = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- (94.5) = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- (61.0) = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 24010 — REGISTERED PROFESSIONAL ENGINEER

8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
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3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"

PROJECT ARCHITECT: NBBJ

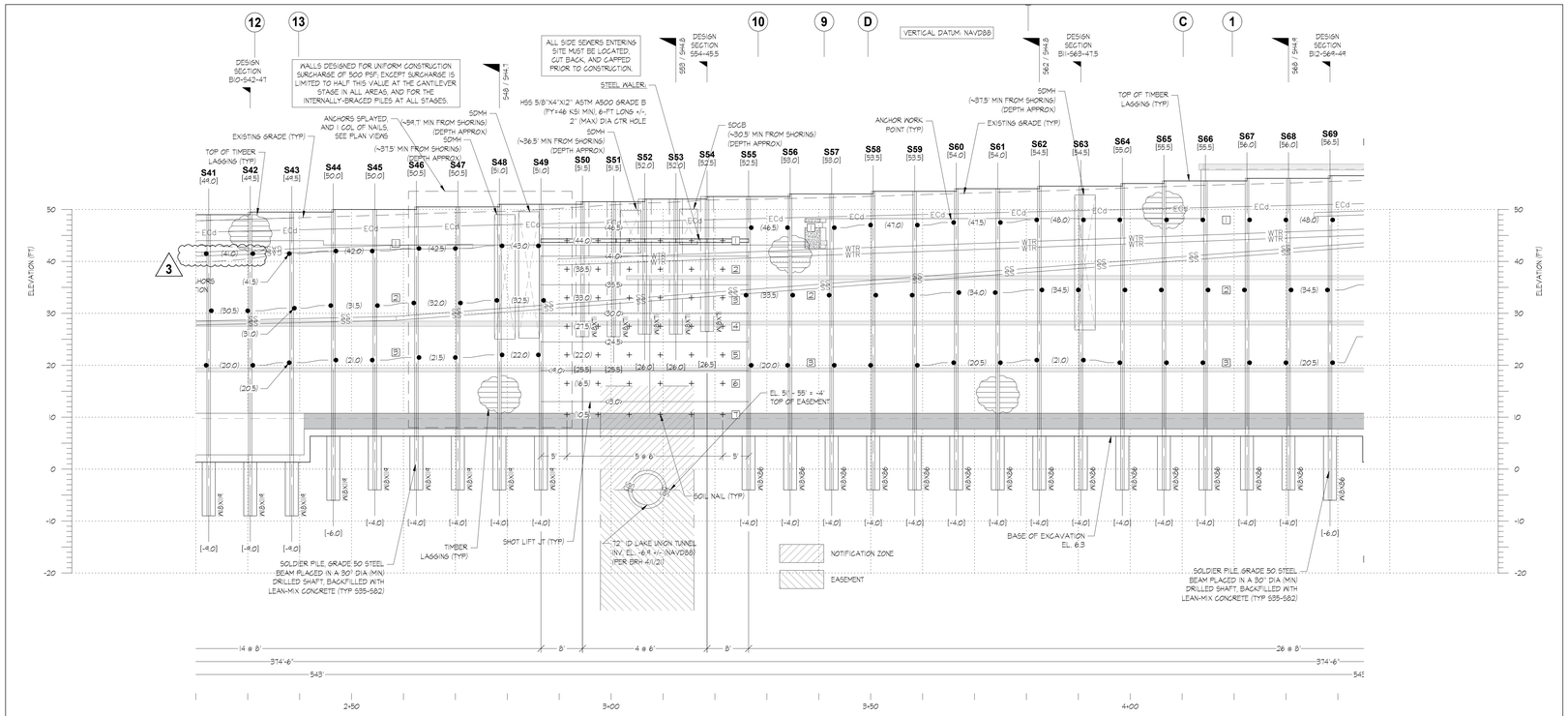
PROJECT NUMBER: #20-48652-CN

SHEET NAME

TEMPORARY SHORING WALL SOUTH ELEVATION

SHEET NUMBER

SH3.4



SOUTH WALL FACE AREA = 24,800 SF

SOUTH WALL TIMBER AREA = 16,620 SF

SOUTH WALL SHOTCRETE AREA = 1,820 SF

SOUTH WALL
SOIL NAIL SCHEDULE

ROW	BAR	GRADE	L (UNO)	α (UNO)	Q_D	FACING
1	#10	75	31	20	3.5	F65
2	#11	75	31	18	3.5	F65
3	#11	75	31	15	3.5	F65
4	#11	75	31	15	3.5	F65
5	#11	75	30	15	3.5	F65
6	#10	75	23	15	3.5	F65
7	#8	75	15	15	3.5	F65

SHOTCRETE FACING CONNECTION NOTES:

1. SHOTCRETE LIFTS WITHOUT SOIL NAILS, OR WITH SOIL NAILS CONNECTED BY STEEL WALERS, SHALL HAVE 1/2" DIA X 4" LONG (NOM) HEADED STUDS ATTACHED TO THE VERTICAL ELEMENTS, SPACED 12" O.C. VERTICALLY.

SOUTH WALL
ANCHOR SCHEDULE

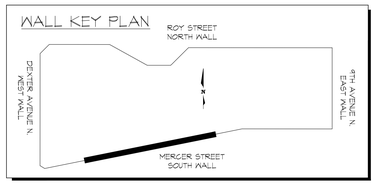
PILE(S)	ROW NUMBER	DECLINATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
555-563	1	15	73	33	40	5	160	160
	2	25	75	25	50	6	211	211
	3	20	68	18	50	6	211	211
564-569	1	20	74	32	47	6	185	185
	2	20	75	25	50	7	213	213
	3	20	68	18	50	7	217	217

0 10 20 FEET

LEGEND

- [3] = NAIL ROW
- \+ = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- <38.0> = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / S4.0 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_D = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- [94.5] = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- (61.0) = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

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ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

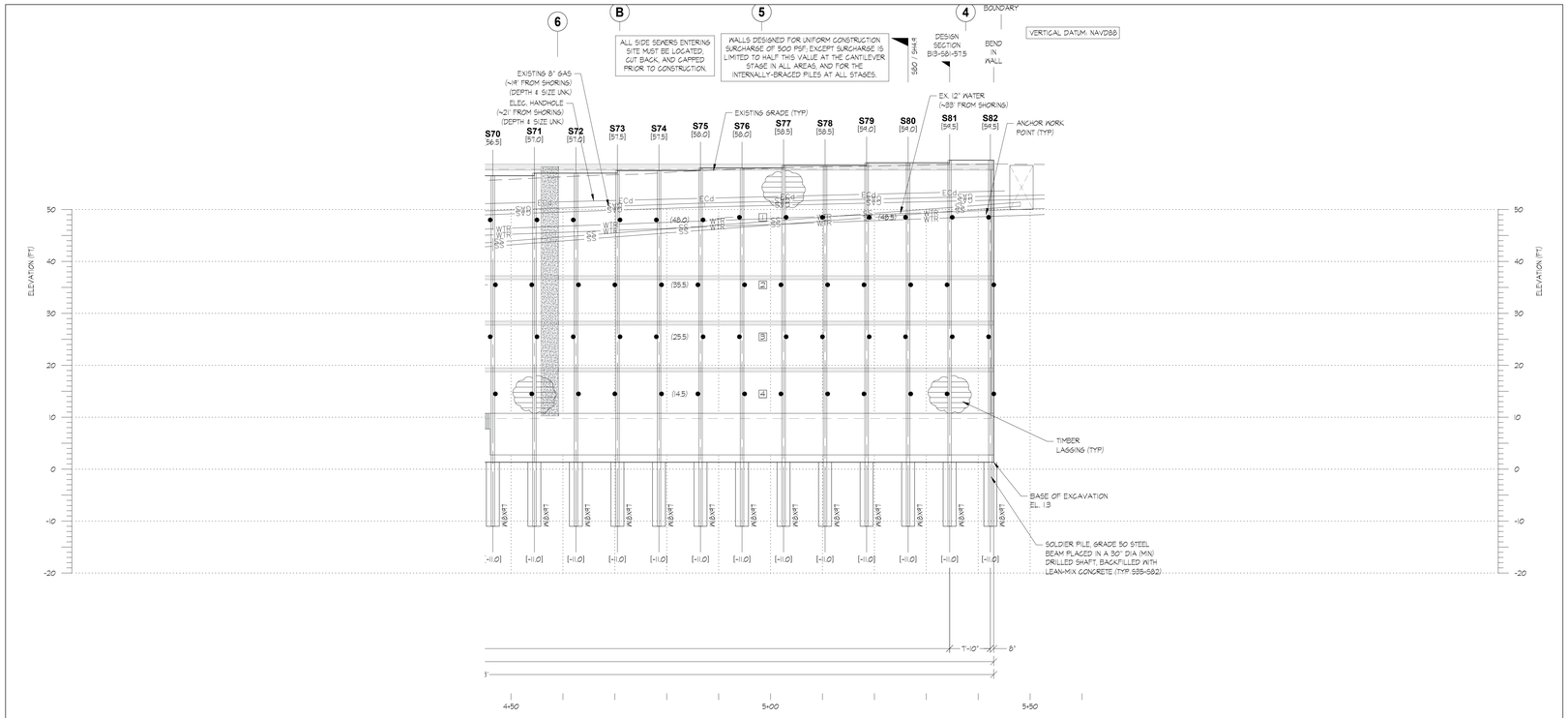
SCALE: 1" = 10'-0"

PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48652-CN

SHEET NAME: TEMPORARY SHORING WALL SOUTH ELEVATION

SHEET NUMBER: SH3.5



SOUTH WALL

ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DEGLI-NATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
S70-S82	1	20	42	37	55	7	241	241
	2	20	81	31	50	6	207	207
	3	20	74	26	48	6	184	184
	4	20	70	20	50	7	216	216

SOUTH WALL FACE AREA = 24,800 SF

SOUTH WALL TIMBER AREA = 16,820 SF

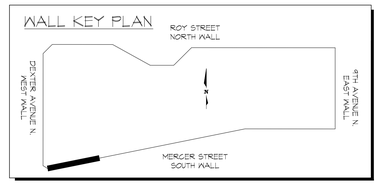
SOUTH WALL SHOTCRETE AREA = 1,820 SF

0 10 20
FEET

LEGEND

- [3] = NAIL ROW
- \+ = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- ‹38.0› = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / S4.0 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
- Q_p = DESIGN NAIL PULLOUT RESISTANCE (K/FT)
- 1 = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- [44.5] = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- [6.0] = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

ARTHUR J. WOLSCHLAG — STATE OF WASHINGTON — PROFESSIONAL ENGINEER

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

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2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"

PROJECT ARCHITECT: NBBJ

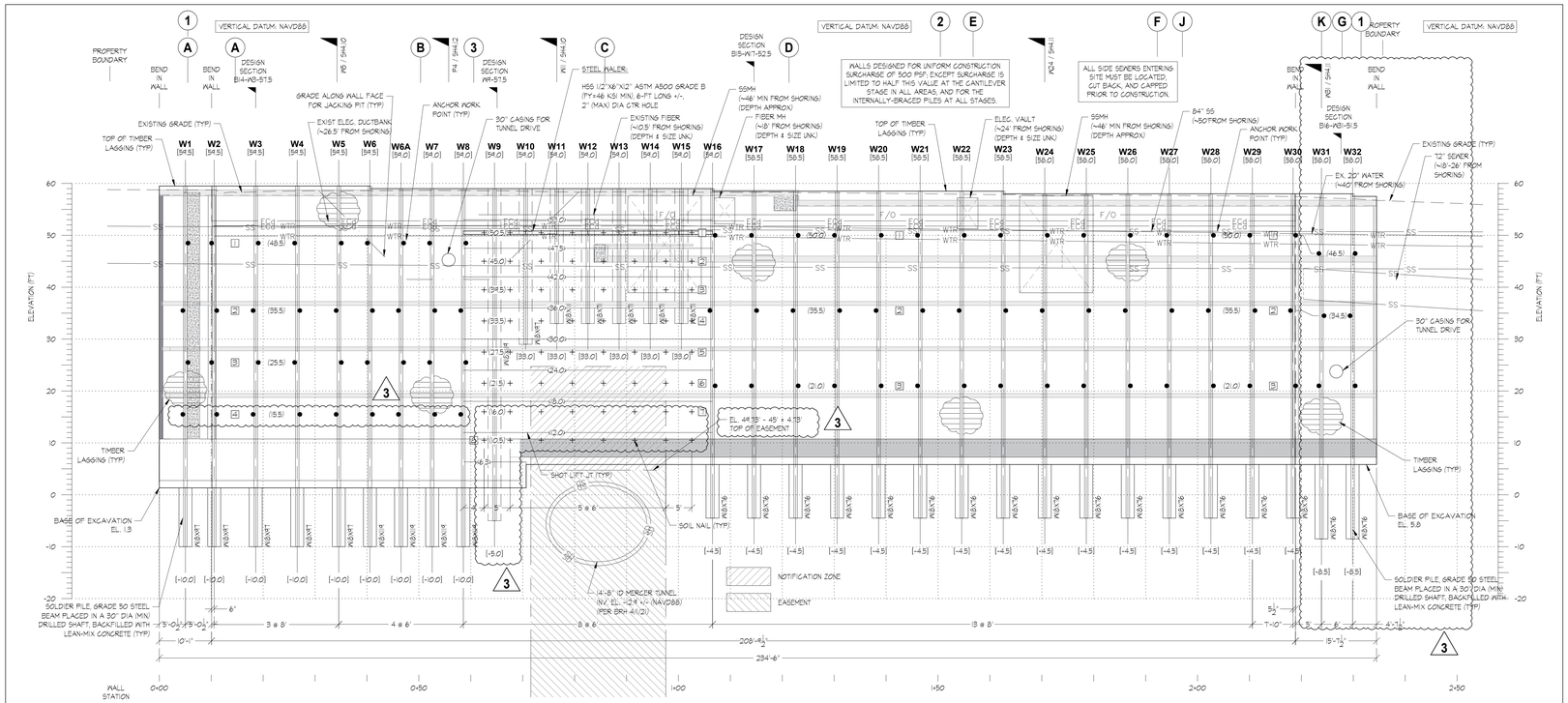
PROJECT NUMBER: ~~#20-48~~ 52-CN

SHEET NAME

TEMPORARY SHORING WALL SOUTH ELEVATION

SHEET NUMBER

SH3.6



WEST WALL
ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DEGLI-NATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
W1-W8	1	20	82	37	55	7	241	241
	2	15	81	31	50	6	202	202
	3	11	72	26	46	6	182	182
	4	7	71	21	50	6	206	206

WEST WALL
SOIL NAIL SCHEDULE

ROW	BAR	GRADE	L (IN0)	α (IN0)	Q_D	FACING
1	#10	75	40	20	1.5	F65
2	1"	150	40	18	3.5	F65
3	1-1/4"	150	40	15	3.5	F65
4	1-1/4"	150	40	15	3.5	F65
5	1-1/4"	150	34	15	3.5	F65
6	1-1/4"	150	37	12	3.5	F65
7	#11	75	29	10	3.5	F65
8	#10	75	22	8	3.5	F65

SHOTCRETE FACING CONNECTION NOTES:

1. SHOTCRETE LIFTS WITHOUT SOIL NAILS, OR WITH SOIL NAILS CONNECTED BY STEEL WALERS, SHALL HAVE 1/2" DIA X 4" LONG (NOM) HEADED STUDS ATTACHED TO THE VERTICAL ELEMENTS, SPACED 12" O.C. VERTICALLY.

WEST WALL FACE AREA = 12,700 SF

WEST WALL TIMBER AREA = 10,100 SF

WEST WALL SHOTCRETE AREA = 2,600 SF

WEST WALL
ANCHOR SCHEDULE

PILE(S)	ROW NUMBER	DEGLI-NATION (DEG)	TOTAL LENGTH (FT)	UNBOND LENGTH (FT)	BOND LENGTH (FT)	NO. OF STRANDS	DESIGN LOAD (K)	LOCKOFF LOAD (K)
W6-W30	1	20	71	35	36	5	143	143
	2	20	68	27	41	5	164	164
	3	20	63	20	43	5	172	172
W31-W32	1	40	57	32	25	3	100	100
	2	40	52	27	25	3	100	100
	3	35	46	16	30	4	120	120

LEGEND

- [B] = NAIL ROW
- \+ = NAIL
- [27.0] = GRADE ELEVATION
- (42.5) = NAIL ROW ELEVATION
- ‹38.0› = SHOTCRETE JOINT ELEVATION
- 20° = SPECIFIC NAIL DECLINATION
- A / SH4.0 = CROSS SECTION LOCATION AND IDENTIFICATION
- BAR = SIZE OF NAIL BAR
- GRADE = STEEL GRADE OF NAIL BAR
- L = MIN DRILLED LENGTH (FT)
- α = NAIL DECLINATION ANGLE FROM HORIZONTAL (DEGREES)
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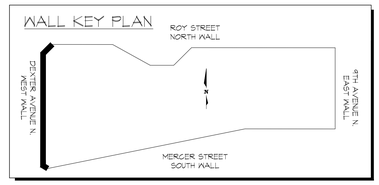
- 1 = ANALYSIS SECTION LOCATION AND IDENTIFICATION
- = VERTICAL ELEMENT
- B = BUILDING GRID LOCATION
- P1 = PILE NUMBER
- [44.5] = TOP OF SOLDIER PILE (FEET)
- SOLDIER PILE
- DRILLHOLE
- [61.0] = BOTTOM OF SOLDIER PILE (FEET)

WALL KEY PLAN



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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

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HOWARD S WRIGHT CONSTRUCTION
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3	8/22/2022	COMMENT RESPONSE

SCALE: 1" = 10'-0"

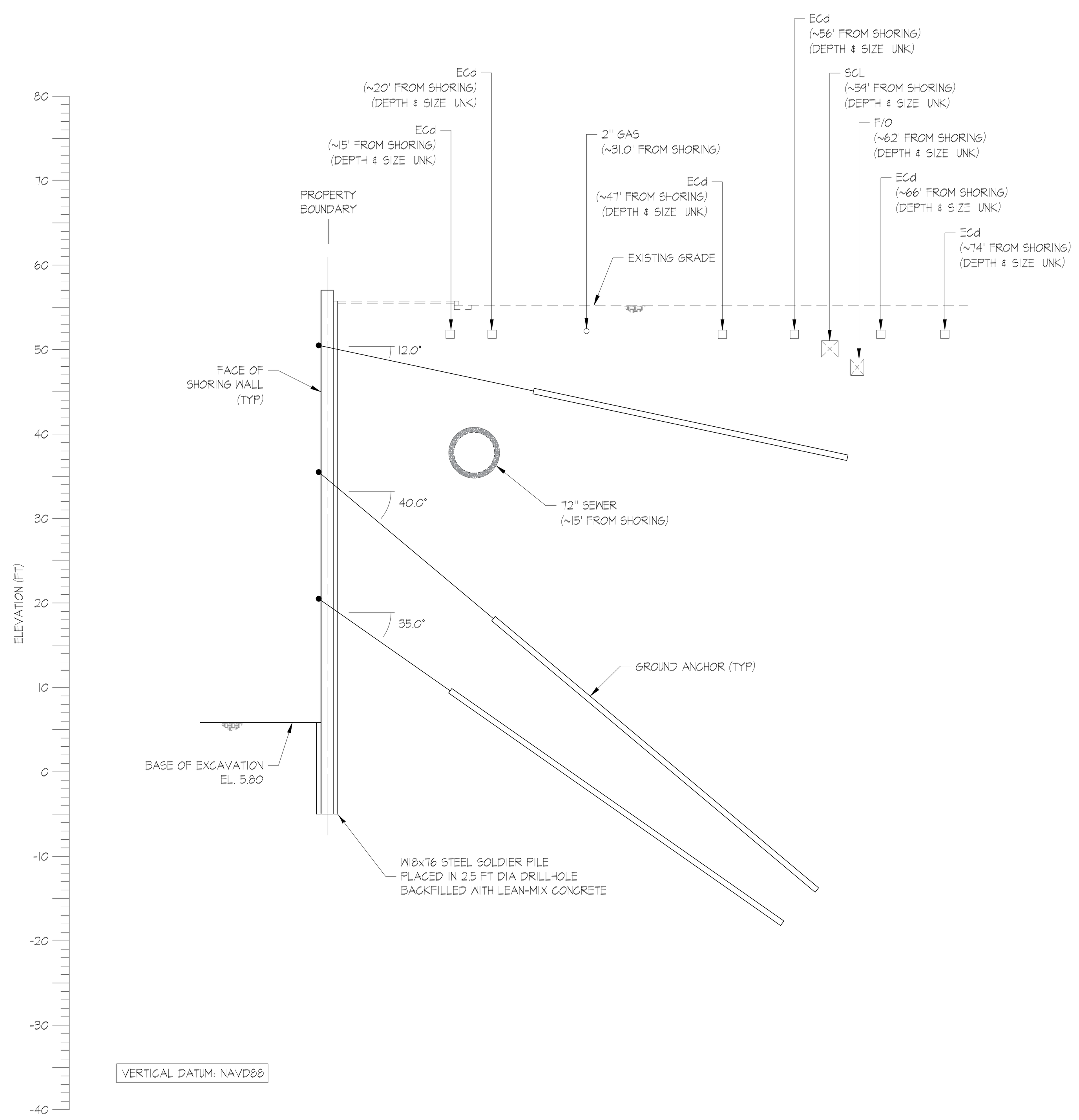
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48652-CN

SHEET NAME

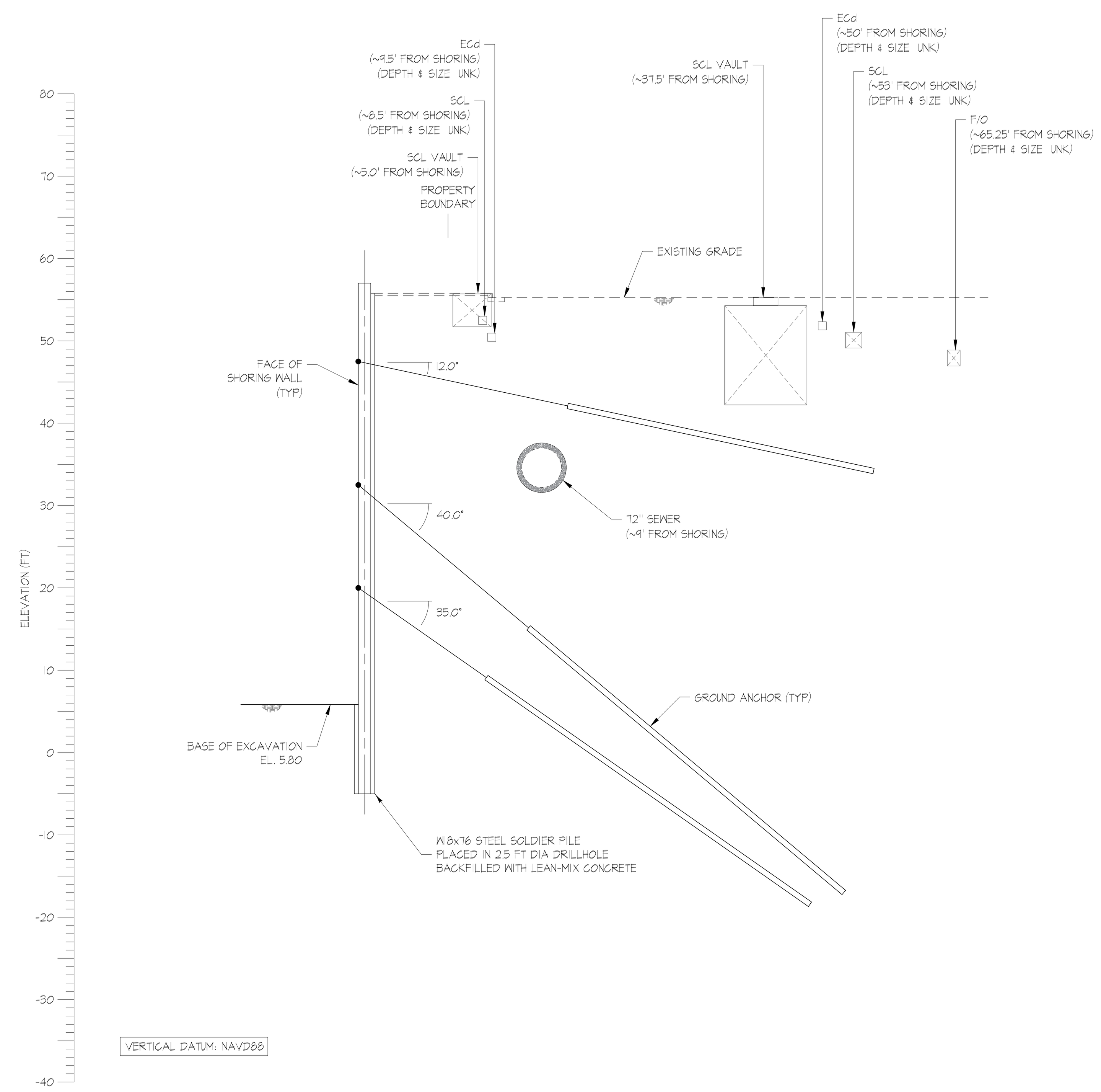
TEMPORARY SHORING WALL WEST ELEVATION

SHEET NUMBER: SH3.7



N8 / SH4.0 — NORTH WALL CROSS-SECTION AT PILE N8

0 10 FEET



N14 / SH4.0 — NORTH WALL CROSS-SECTION AT PILE N14

0 10 FEET

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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
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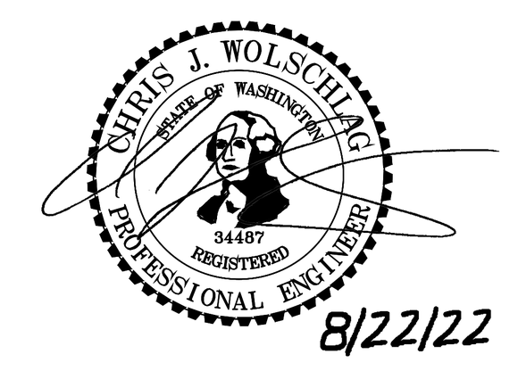

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

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MARK	DATE	DESCRIPTION
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3	8/22/2022	COMMENT RESPONSE

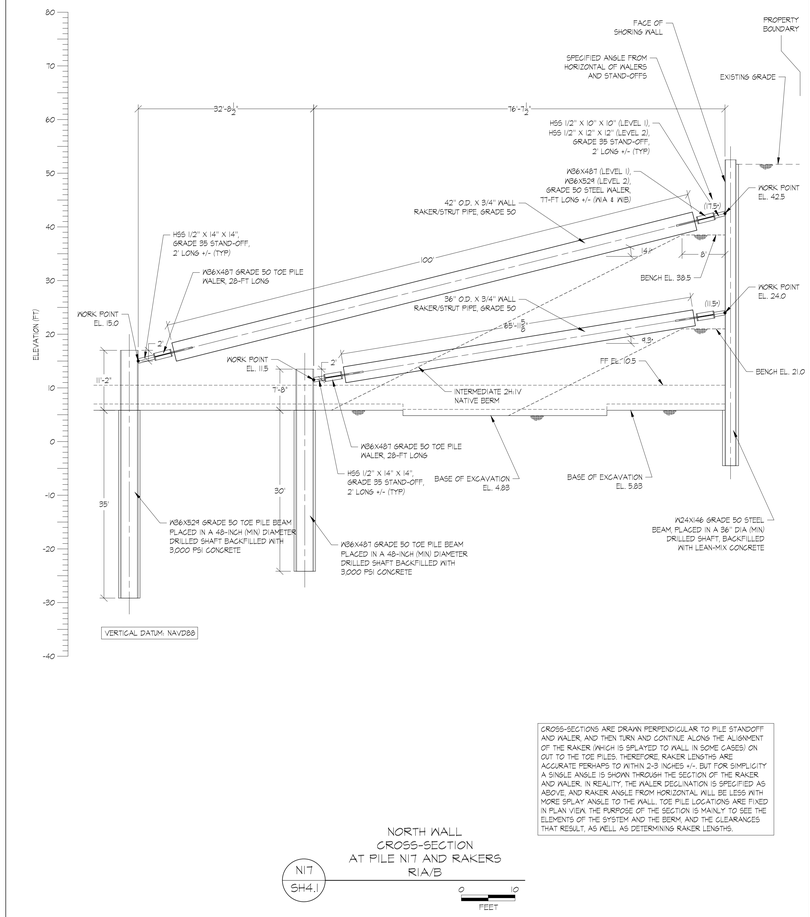
SCALE: NONE

PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-46 62–CN

SHEET NAME: TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER: SH4.0

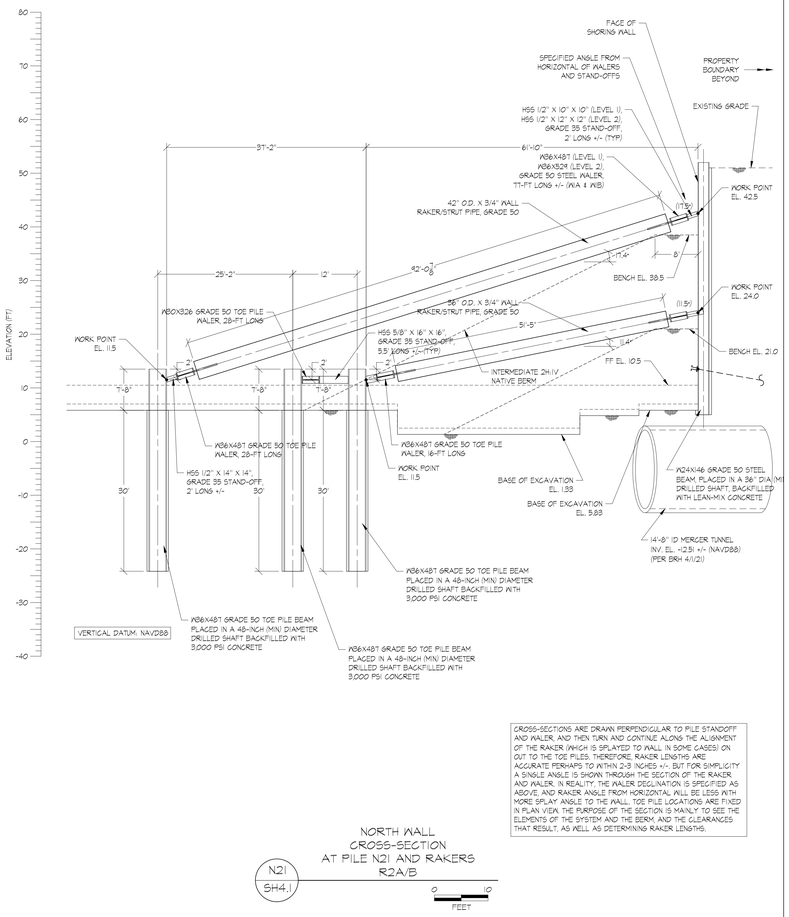


CROSS-SECTIONS ARE DRAWN PERPENDICULAR TO PILE STANDOFF AND WALER, AND THEN TURN AND CONTINUE ALONG THE ALIGNMENT OF THE RAKER (WHICH IS SPLAYED TO WALL IN SOME CASES) ON OUT TO THE TOE PILES. THEREFORE, RAKER LENGTHS ARE ACCURATE PERHAPS TO WITHIN 2-3 INCHES +/-. BUT FOR SIMPLICITY A SINGLE ANGLE IS SHOWN THROUGH THE SECTION OF THE RAKER AND WALER. IN REALITY, THE WALER DECLINATION IS SPECIFIED AS ABOVE, AND RAKER ANGLE FROM HORIZONTAL WILL BE LESS WITH MORE SPLAY ANGLE TO THE WALL. TOE PILE LOCATIONS ARE FIXED IN PLAN VIEW. THE PURPOSE OF THE SECTION IS MAINLY TO SEE THE ELEMENTS OF THE SYSTEM AND THE BERM, AND THE CLEARANCES THAT RESULT, AS WELL AS DETERMINING RAKER LENGTHS.

NORTH WALL
CROSS-SECTION
AT PILE N17 AND RAKERS
R1A/B

N17 / SH4.1

0 10
FEET



CROSS-SECTIONS ARE DRAWN PERPENDICULAR TO PILE STANDOFF AND WALER, AND THEN TURN AND CONTINUE ALONG THE ALIGNMENT OF THE RAKER (WHICH IS SPLAYED TO WALL IN SOME CASES) ON OUT TO THE TOE PILES. THEREFORE, RAKER LENGTHS ARE ACCURATE PERHAPS TO WITHIN 2-3 INCHES +/-. BUT FOR SIMPLICITY A SINGLE ANGLE IS SHOWN THROUGH THE SECTION OF THE RAKER AND WALER. IN REALITY, THE WALER DECLINATION IS SPECIFIED AS ABOVE, AND RAKER ANGLE FROM HORIZONTAL WILL BE LESS WITH MORE SPLAY ANGLE TO THE WALL. TOE PILE LOCATIONS ARE FIXED IN PLAN VIEW. THE PURPOSE OF THE SECTION IS MAINLY TO SEE THE ELEMENTS OF THE SYSTEM AND THE BERM, AND THE CLEARANCES THAT RESULT, AS WELL AS DETERMINING RAKER LENGTHS.

NORTH WALL
CROSS-SECTION
AT PILE N21 AND RAKERS
R2A/B

N21 / SH4.1

0 10
FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS
Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 24000 — REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE
816
MERCER
CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48062-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.1

1/11/2022 2:54:39 PM
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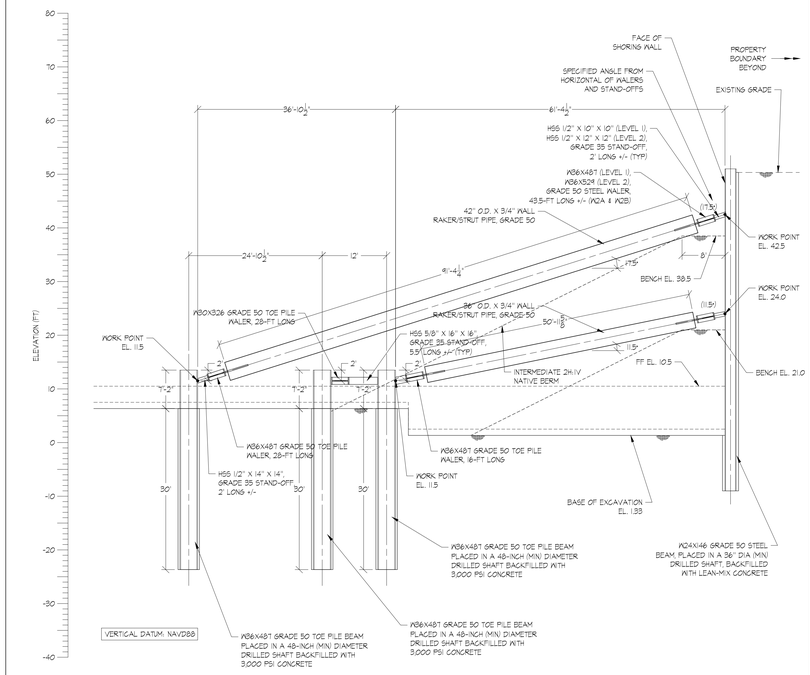

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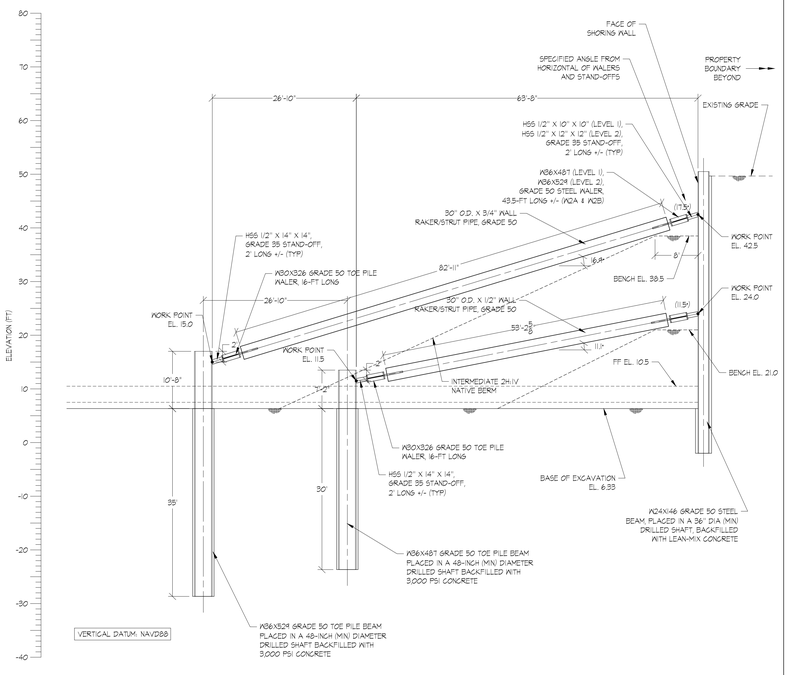
NORTH WALL
CROSS-SECTION
AT PILE N26 AND RAKERS
R3A/B

N26
SH4.2

0 10
FEET



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NORTH WALL
CROSS-SECTION
AT PILE N30 AND RAKERS
R4A/B

N30
SH4.2

0 10
FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 502-1501

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MERCER

CAMPUS

SHORING PERMIT –
CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-10652-CN

SHEET NAME
TEMPORARY
SHORING WALL
CROSS-SECTIONS

SHEET NUMBER
SH4.2

1/11/2022 2:54:39 PM
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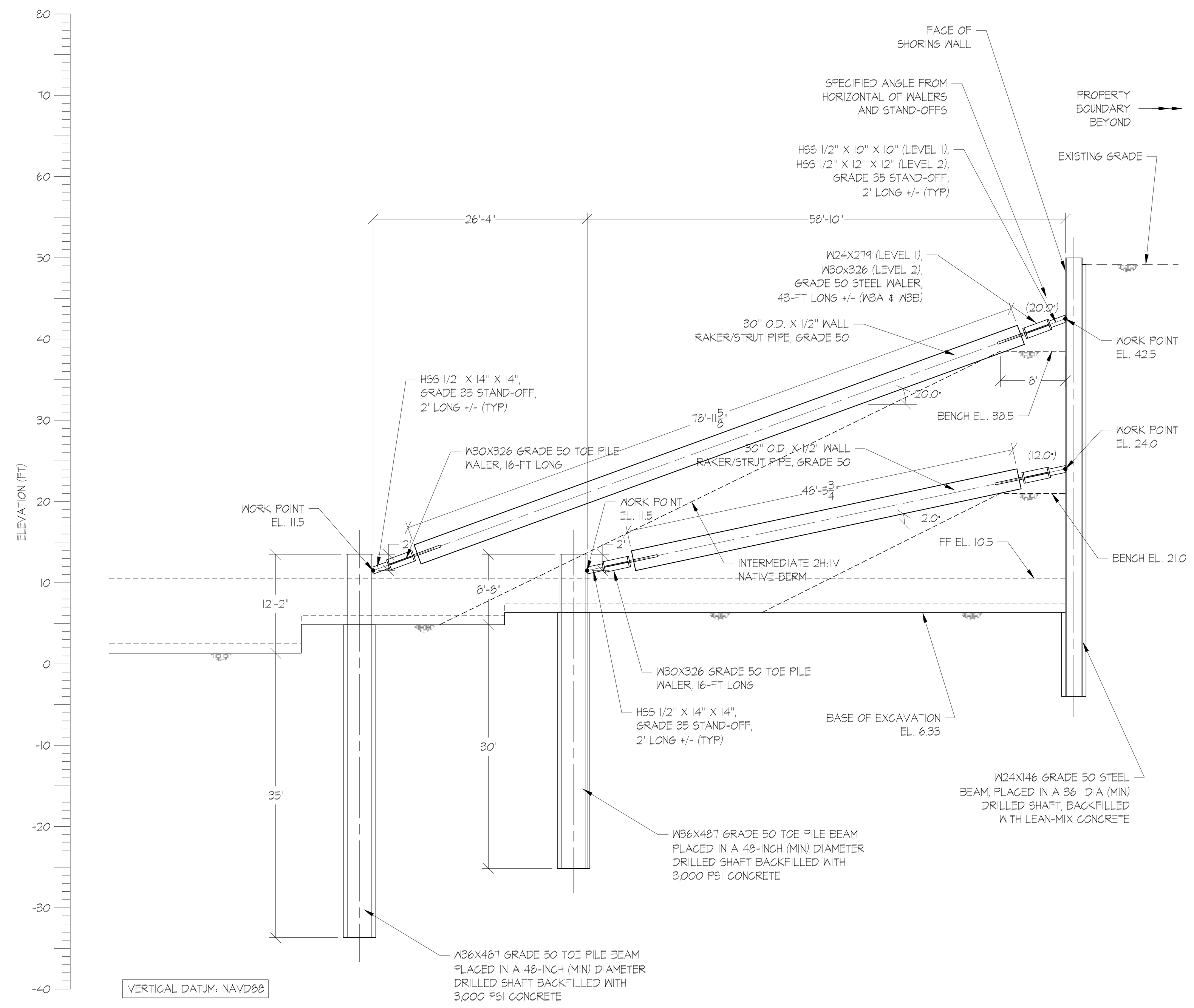
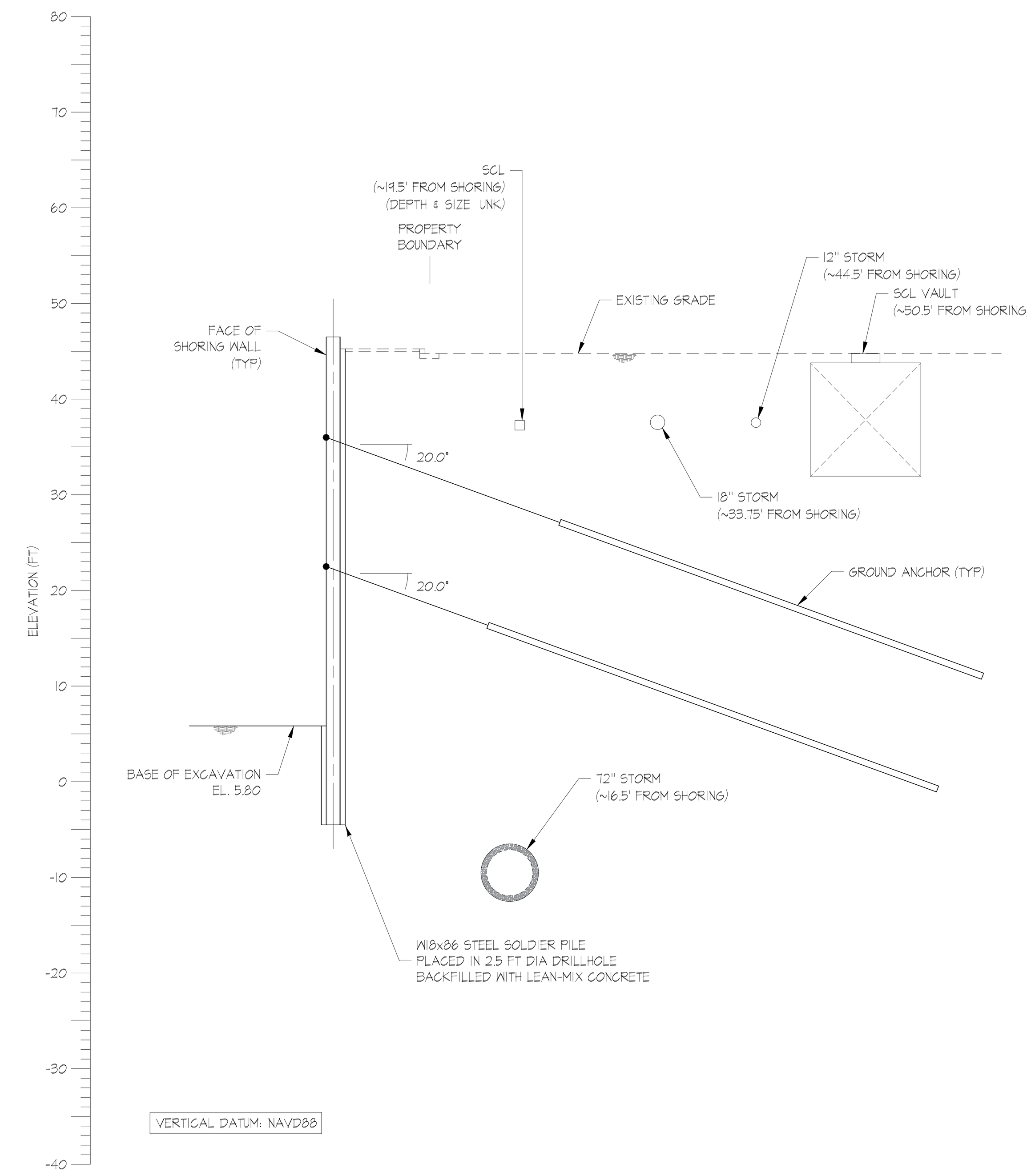


CROSS-SECTIONS ARE DRAWN PERPENDICULAR TO PILE STANDOFF AND WALER, AND THEN TURN AND CONTINUE ALONG THE ALIGNMENT OF THE RAKER (WHICH IS SPLAYED TO WALL IN SOME CASES) ON OUT TO THE TOE PILES. THEREFORE, RAKER LENGTHS ARE ACCURATE PERHAPS TO WITHIN 2-3 INCHES +/-. BUT FOR SIMPLICITY A SINGLE ANGLE IS SHOWN THROUGH THE SECTION OF THE RAKER AND WALER. IN REALITY, THE WALER DECLINATION IS SPECIFIED AS ABOVE, AND RAKER ANGLE FROM HORIZONTAL WILL BE LESS WITH MORE SPLAY ANGLE TO THE WALL. TOE PILE LOCATIONS ARE FIXED IN PLAN VIEW. THE PURPOSE OF THE SECTION IS MAINLY TO SEE THE ELEMENTS OF THE SYSTEM AND THE BERM, AND THE CLEARANCES THAT RESULT, AS WELL AS DETERMINING RAKER LENGTHS.

N32 / SH4.3

NORTH WALL CROSS-SECTION AT PILE N32 AND RAKERS R5A/B

0 10 FEET



N43 / SH4.3

NORTH WALL CROSS-SECTION AT PILE N43

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

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ARE 816 MERCER

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SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE

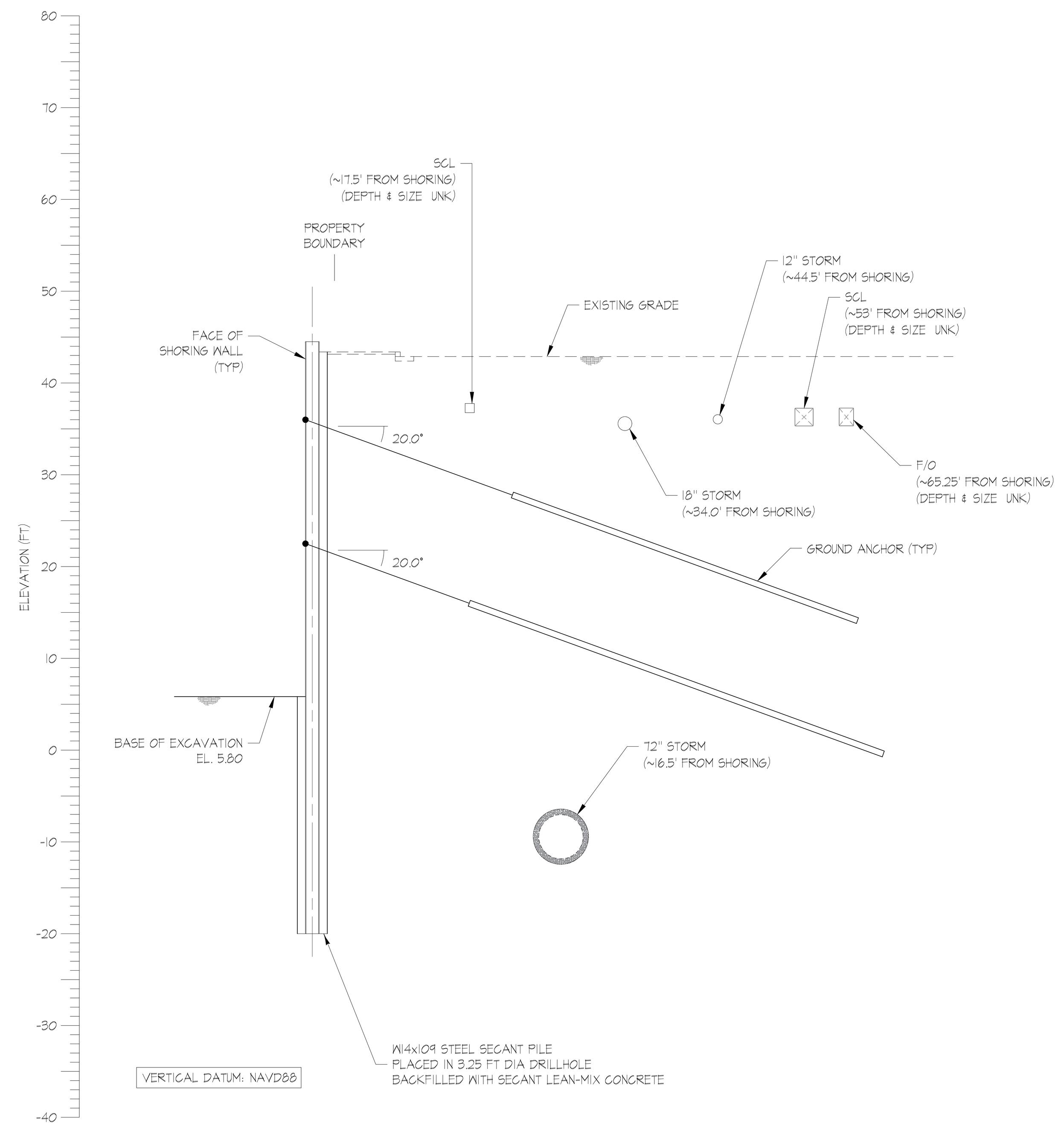
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-46

SHEET NAME

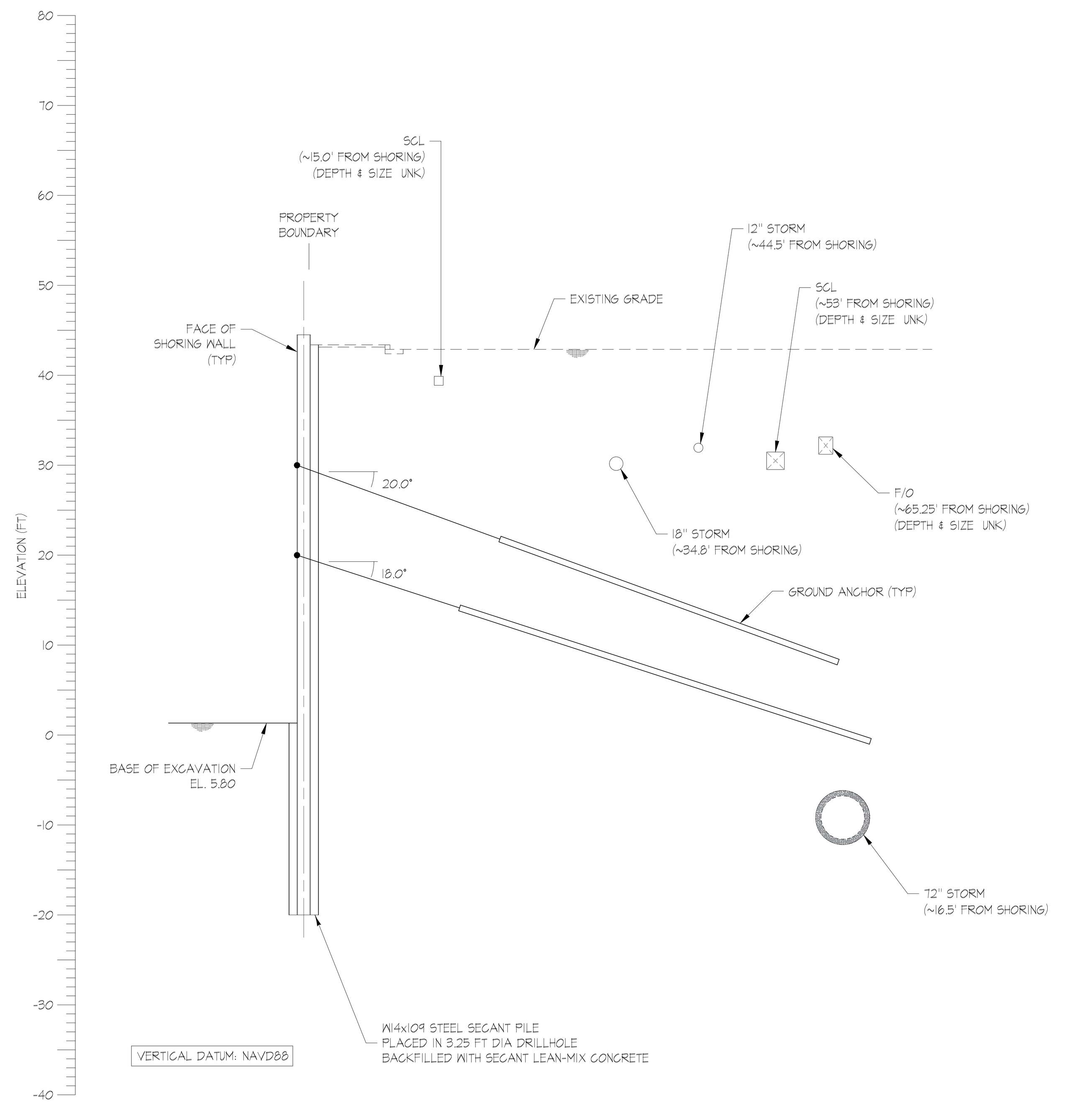
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER SH4.3



N52 / SH4.4 — NORTH WALL CROSS-SECTION AT PILE N52

0 10 FEET



N75 / SH4.4 — NORTH WALL CROSS-SECTION AT PILE N75

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N. EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S. WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

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CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-4662-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.4

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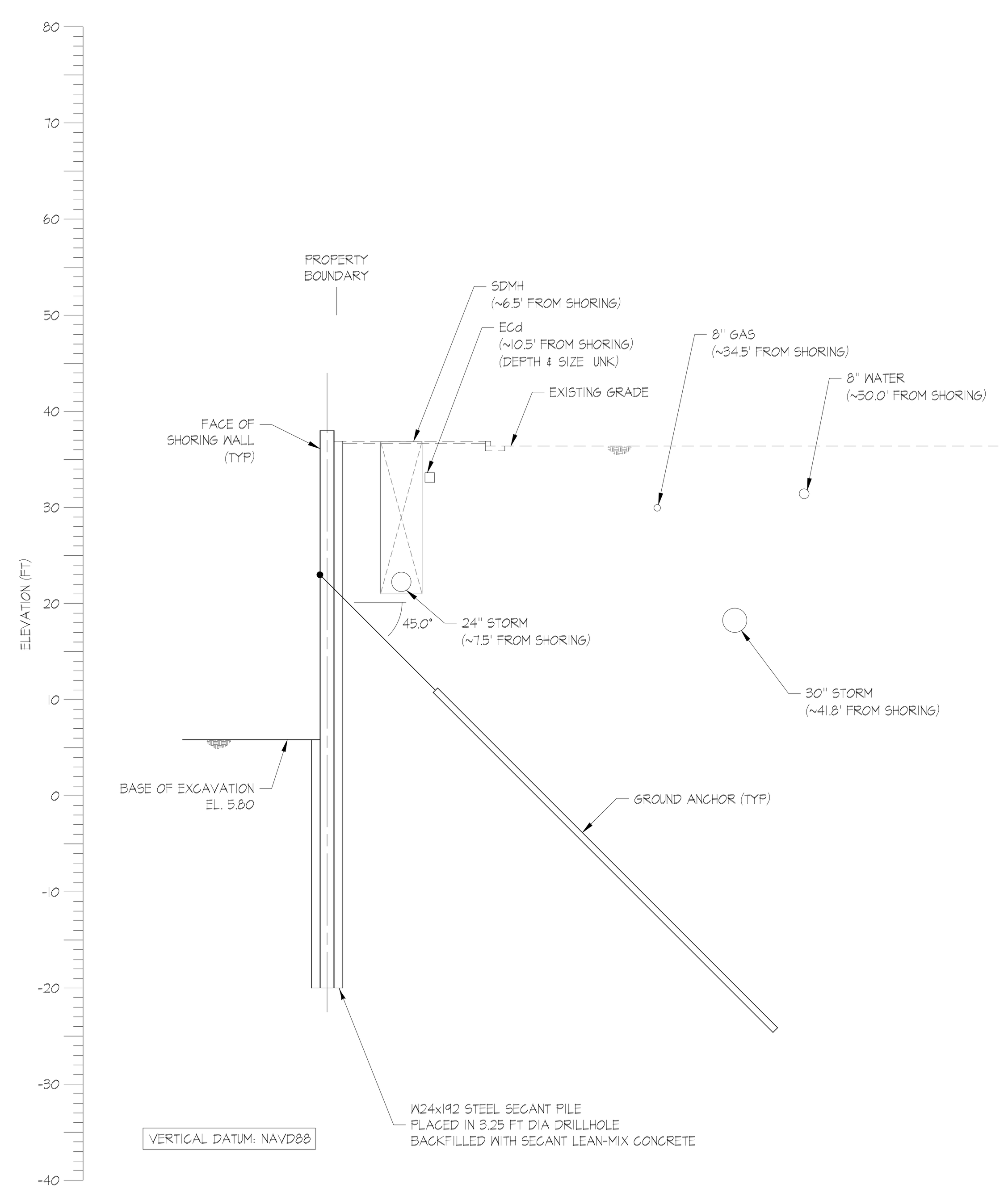
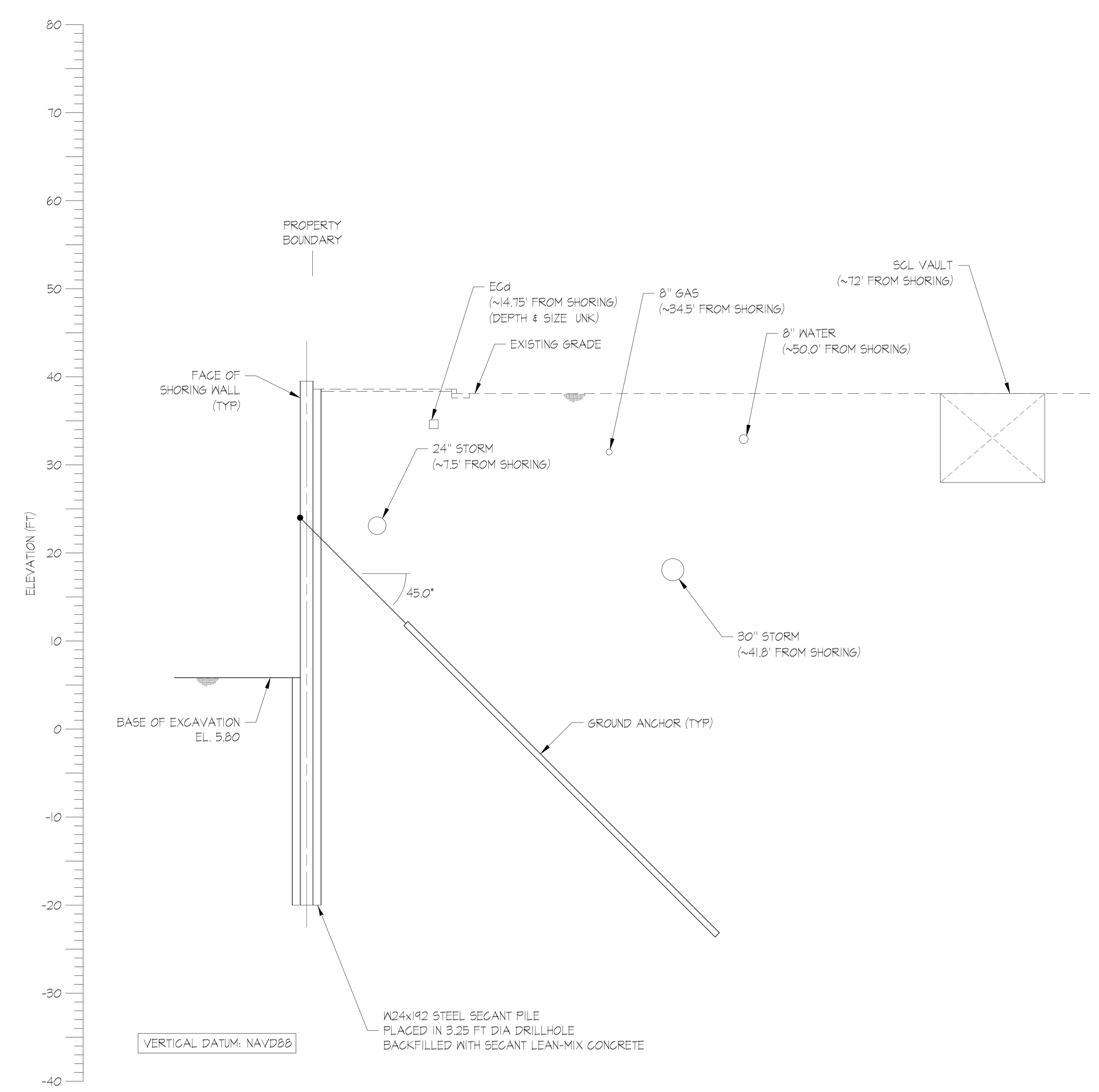


E7 / SH4.5 — EAST WALL CROSS-SECTION AT PILE E7

0 10 FEET



E25 / SH4.5 — EAST WALL CROSS-SECTION AT PILE E25

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE 816 MERCER

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SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE NONE

PROJECT ARCHITECT NBBJ

PROJECT NUMBER #20-4862-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER SH4.5

1/11/2022 2:54:39 PM
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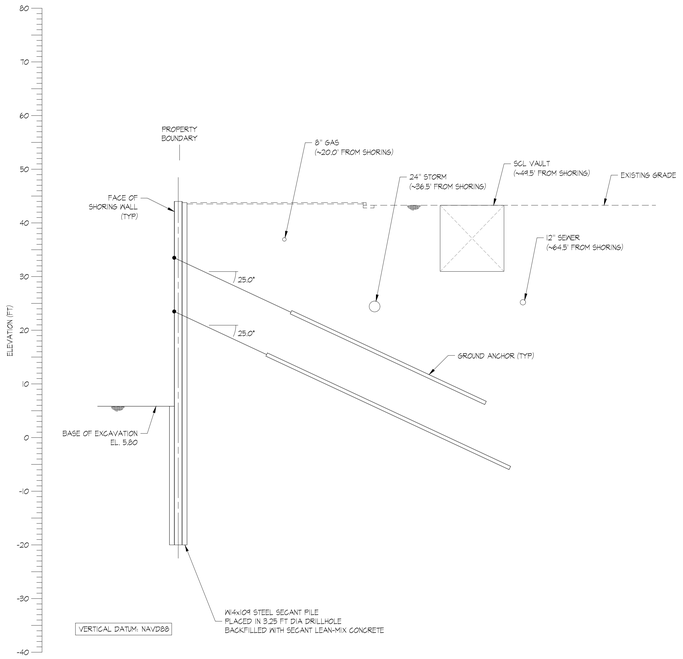
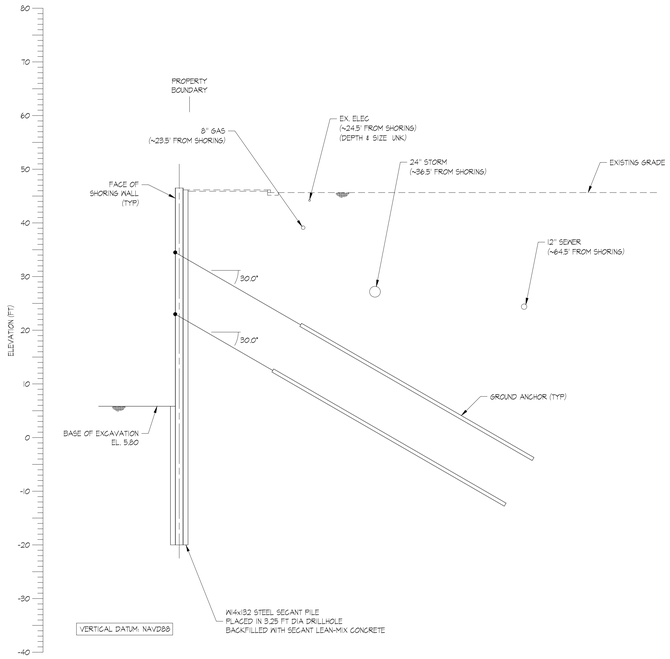


S19 / SH4.6 SOUTH WALL CROSS-SECTION AT PILE S19

0 10 FEET



S31 / SH4.6 SOUTH WALL CROSS-SECTION AT PILE S31

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

CHRISTOPHER J. WOLSCHLAG — STATE OF WASHINGTON — 21600 — REGISTERED PROFESSIONAL ENGINEER

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE	PROJECT ARCHITECT
NONE	NBBJ

PROJECT NUMBER #20-48062-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.6

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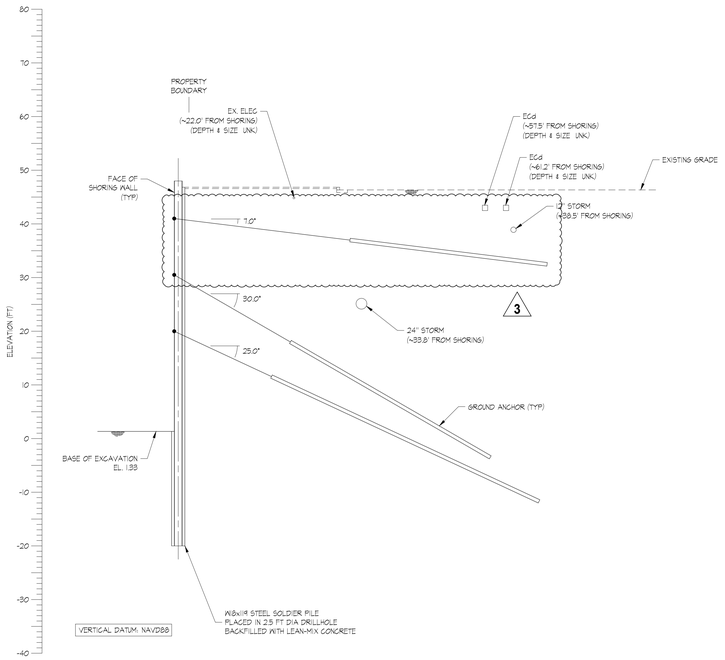
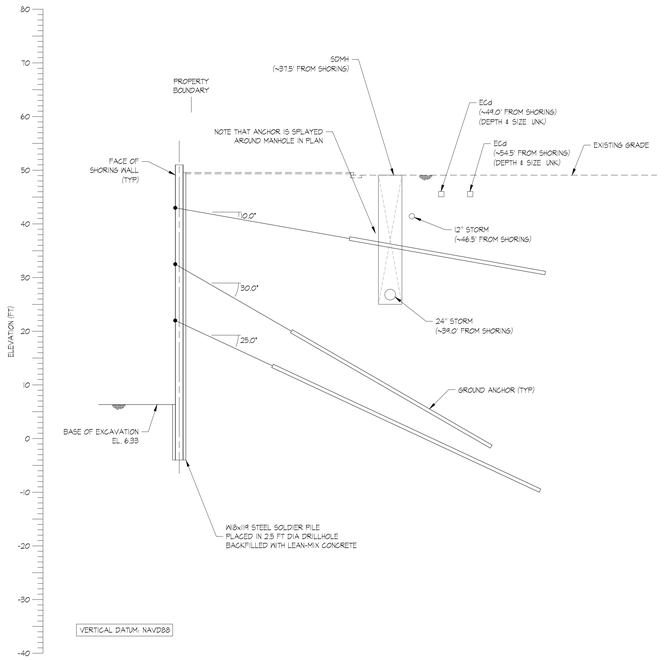


S36 / SH4.7 SOUTH WALL CROSS-SECTION AT PILE S36

0 10 FEET



S48 / SH4.7 SOUTH WALL CROSS-SECTION AT PILE S48

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE
816
MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48052-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.7

1/11/2022 2:54:39 PM
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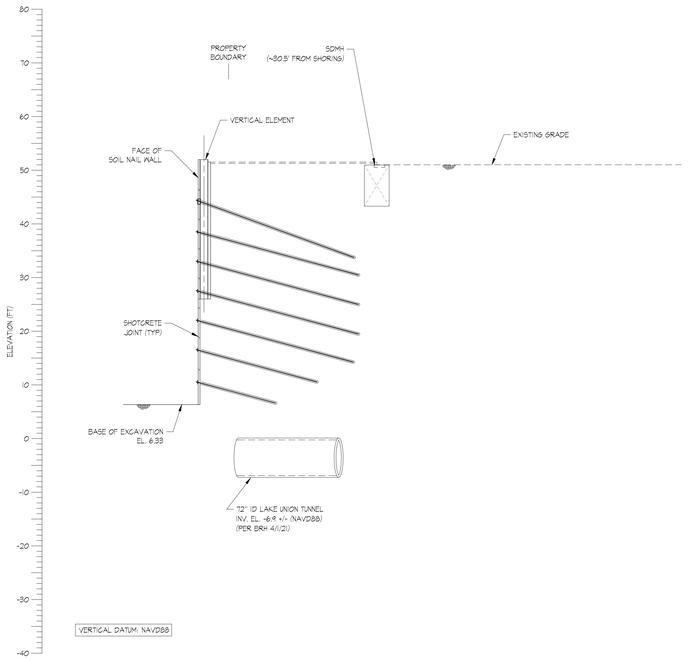
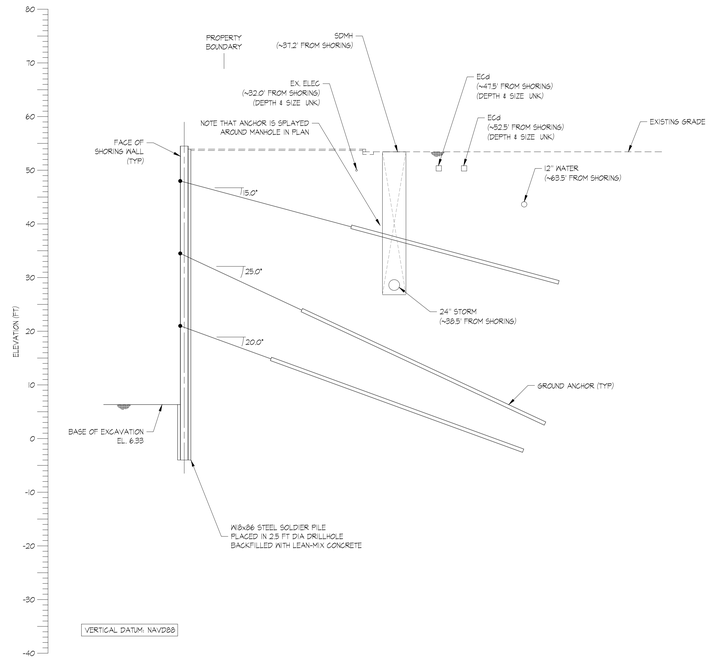


S53 / SH4.8 SOUTH WALL CROSS-SECTION AT PILE S53

0 10 FEET



S62 / SH4.8 SOUTH WALL CROSS-SECTION AT PILE S62

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

JAMES J. WOLSCHLAG — STATE OF WASHINGTON — PROFESSIONAL ENGINEER — REGISTERED

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

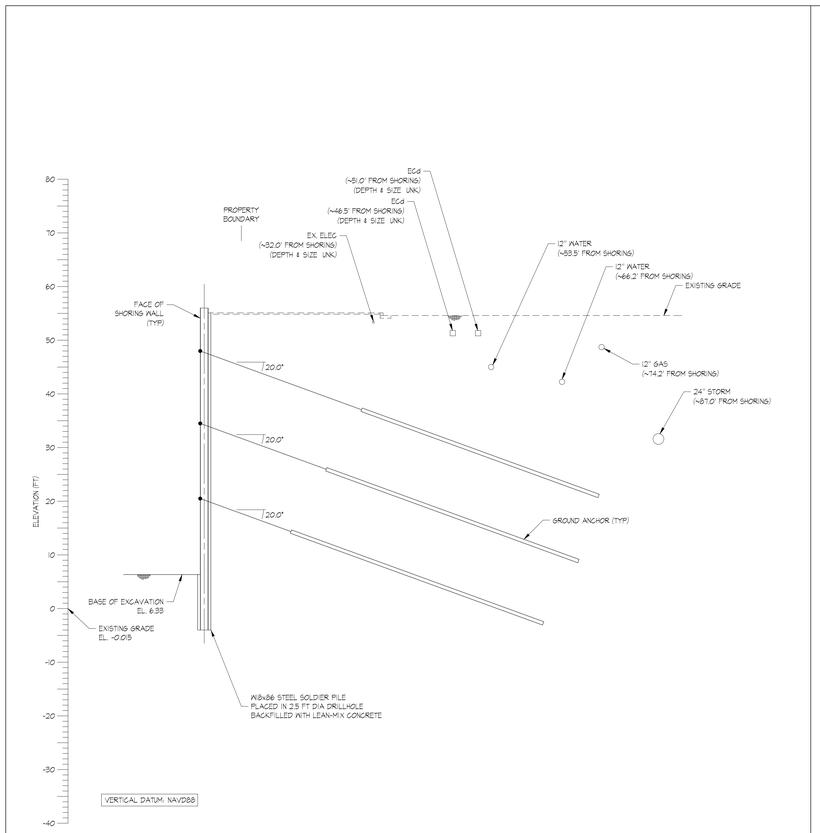
MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: ~~#20-48~~ 62-CN

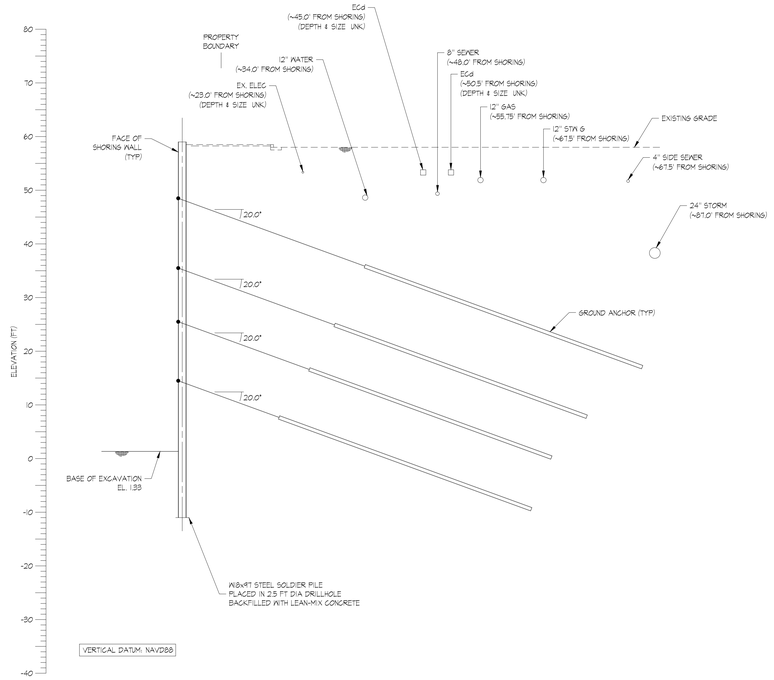
SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.8



S6B / SH4.9 SOUTH WALL CROSS-SECTION AT PILE S6B

0 10 FEET



S8O / SH4.9 SOUTH WALL CROSS-SECTION AT PILE S8O

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — PROFESSIONAL ENGINEER — REGISTERED

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

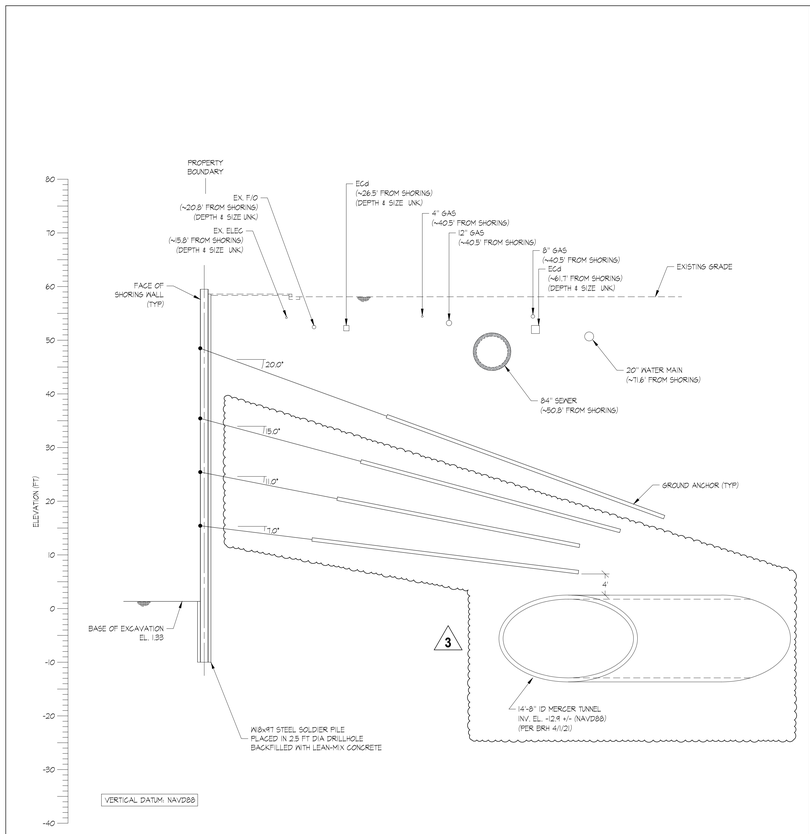
REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48062-CN

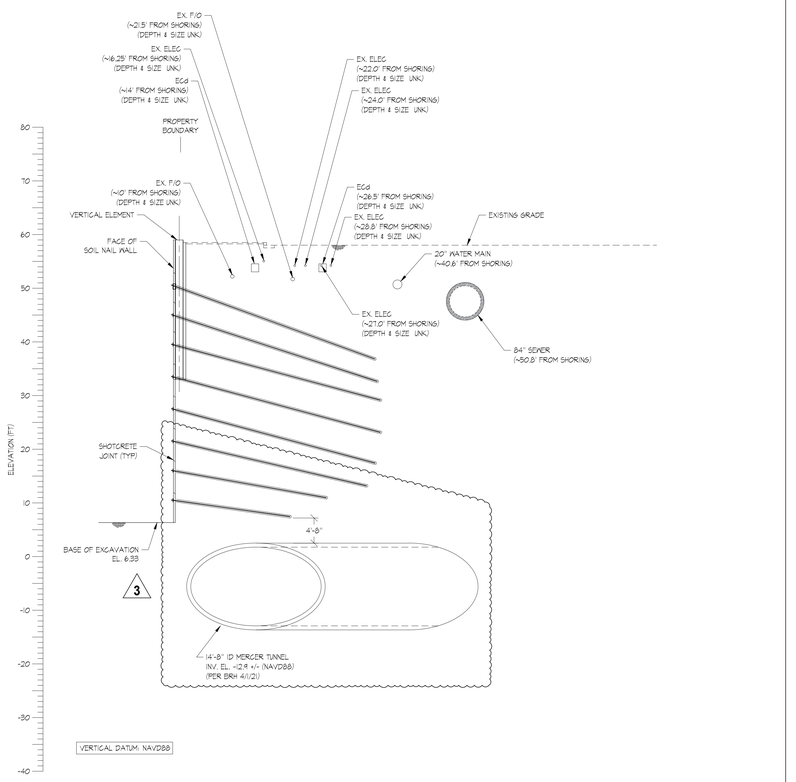
SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.9



W5 / SH4.10 WEST WALL CROSS-SECTION AT PILE W5

0 10 FEET



W11 / SH4.10 WEST WALL CROSS-SECTION AT PILE W11

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 502-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 24000 — REGISTERED PROFESSIONAL ENGINEER

8/22/22

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CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

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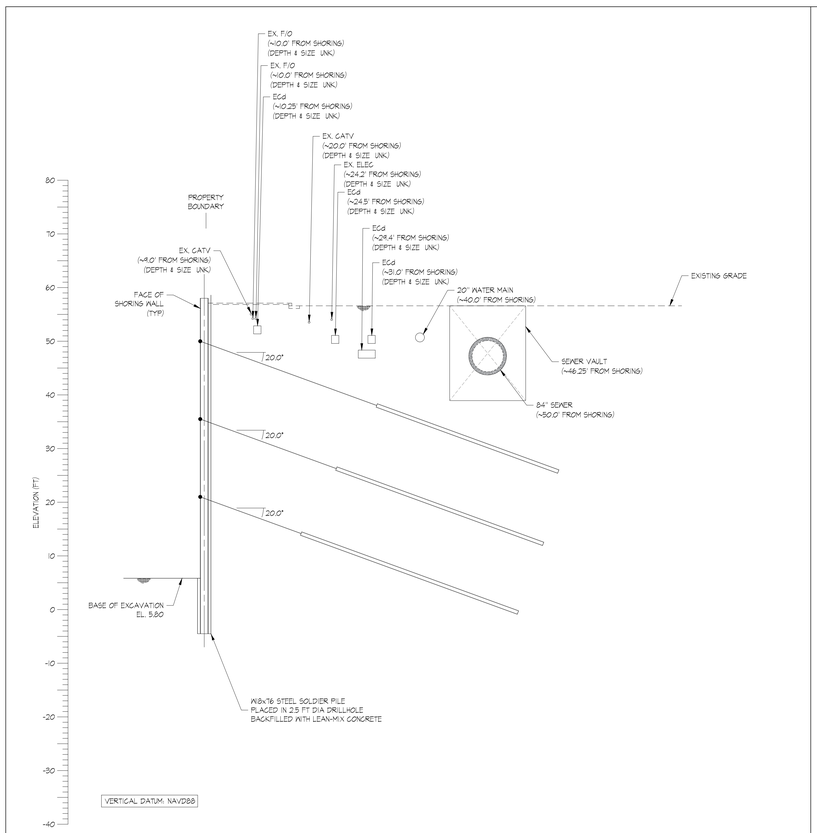
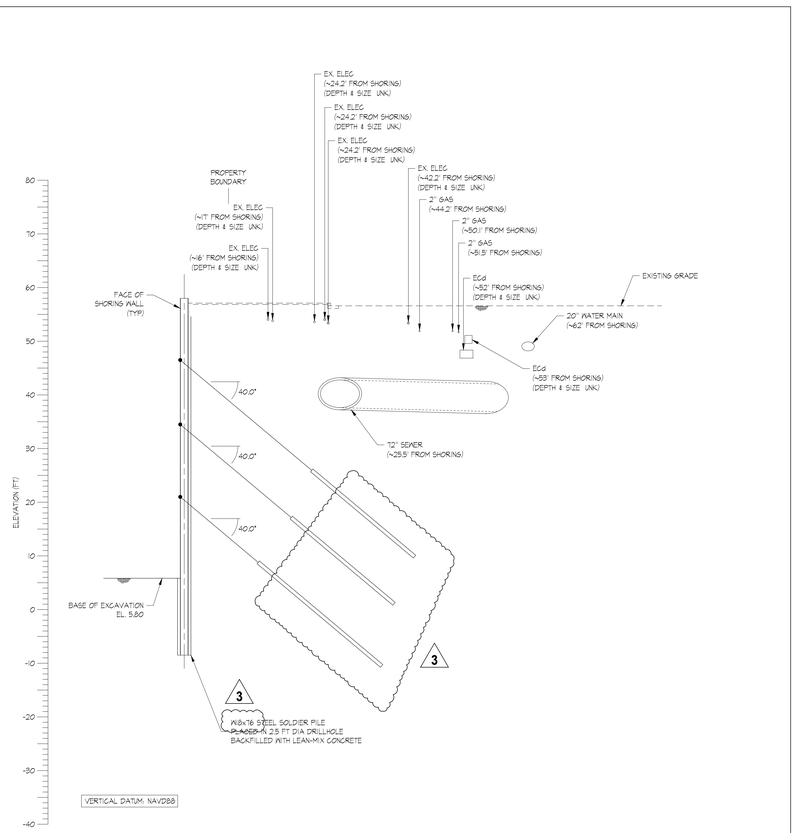
MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: ~~#20-48~~ 62-CN
SHEET NAME: TEMPORARY SHORING WALL CROSS-SECTIONS
SHEET NUMBER: SH4.10



W24 / SH4.11 WEST WALL CROSS-SECTION AT PILE W24

0 10 FEET



W31 / SH4.11 WEST WALL CROSS-SECTION AT PILE W31

0 10 FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

JAMES J. WOLSCHLAG — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER

8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

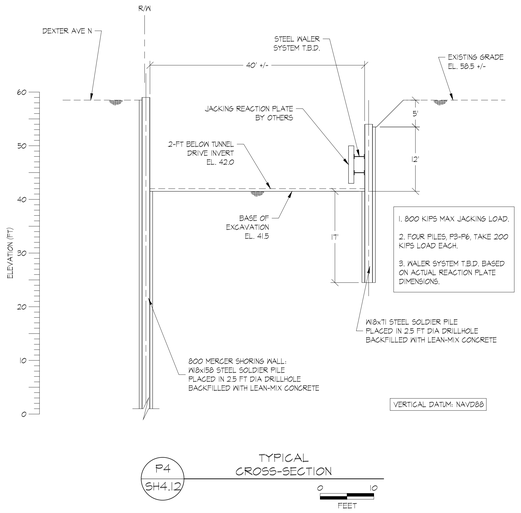
MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48052-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.11



P4
SH4.12

TYPICAL CROSS-SECTION

0 10
FEET

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

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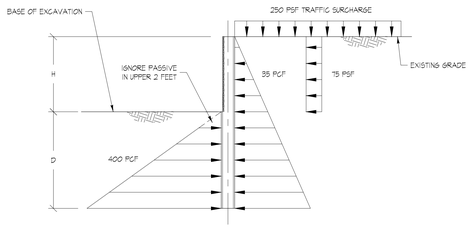
SCALE: NONE
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: ~~#20-40~~ 62-CN

SHEET NAME
TEMPORARY SHORING WALL CROSS-SECTIONS

SHEET NUMBER
SH4.12



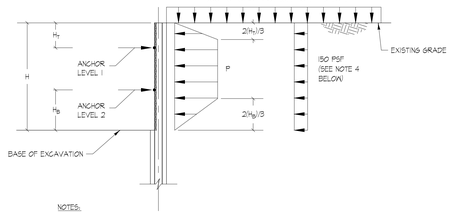
NOTES:

1) BELOW THE EXCAVATION BASE, ACTIVE AND PASSIVE PRESSURES ARE APPLIED TO AN EFFECTIVE PILE WIDTH EQUAL TO 1 AND 2 PILE DIAMETERS, RESPECTIVELY.

2) TOE EMBEDMENT IS DETERMINED BY ACHIEVING FORCE AND MOMENT BALANCE THROUGHOUT TOE OF PILE.

3) THE 400 PCF PASSIVE VALUE REPRESENTS DRY VERY DENSE SOILS WHICH ARE ENCOUNTERED IN THE TOE REGION OF THE UPPER CANTILEVER OF THE SOLDIER PILE WALLS IN THE WESTERN TWO-THIRDS OF THE SITE. FOR THE SECANT PILES IN THE EASTERN THIRD OF THE SITE, A VALUE OF 250 PCF WAS USED. FOR THE NATIVE BERM IN FRONT OF THE BRACED PILES OF THE NORTH WALL, A VALUE OF 215 PCF WAS USED, PER CONVERSATIONS WITH HART CROWSER.

1 / SH5.0 — SHORING DESIGN DIAGRAM
CANTILEVERED PILES
NOT TO SCALE



NOTES:

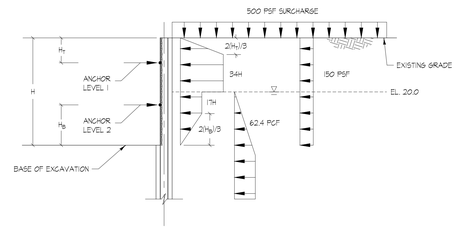
1. PEAK EARTH PRESSURE, 'P', EQUAL TO 31H PSF FOR AT-REST CONDITIONS IN THE INTERNALLY-BRACED REGION OF PILES N6-N36, WHERE THE GROUND CONDITIONS ARE PRIMARILY GLACIAL TILL. ALTHOUGH THERE IS SOME SURFICIAL FILL, THE FACT THAT THE SLIVER OF SOIL RETAINED AROUND THE DROP STRUCTURE IS RELATIVELY NARROW, MEANS THERE IS JUSTIFICATION FOR NOT GOING ABOVE 31H.

2. PEAK EARTH PRESSURE, 'P', EQUAL TO 22H PSF FOR ACTIVE CONDITIONS IN THE ANCHORED SOLDIER PILE REGION OF PILES N1-N15 AND W1-W32, WHERE THE GROUND CONDITIONS ARE PRIMARILY GLACIAL TILL.

3. PEAK EARTH PRESSURE, 'P', EQUAL TO 34H PSF FOR ACTIVE CONDITIONS IN THE ANCHORED SOLDIER PILE REGION OF PILES S35-S82 AND W-W8, WHERE ESSENTIALLY THE UPPER HALF OF THE WALL IS IN FILL.

4. FOR THE INTERNALLY BRACED PILES N6-N36, WHICH FORM THE RESTRAINT AROUND THE DROP-STRUCTURE, IT IS ASSUMED THAT LARGE CONSTRUCTION LOADS WOULD NOT BE APPLIED THERE, AND SO THE SURCHARGE WAS LEFT AT TRAFFIC LEVELS, 250 PSF.

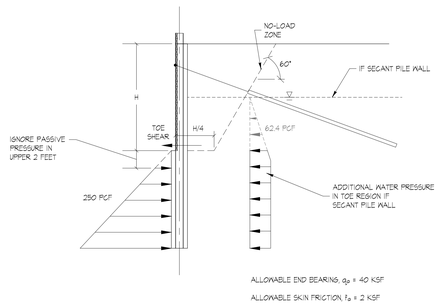
2 / SH5.0 — SHORING DESIGN DIAGRAM
MULTIPLE-ANCHORED
SOLDIER PILES & TIMBER LAGGING
NOT TO SCALE



NOTES:

1. BECAUSE OF THE RELATIVE VALUES OF THE EARTH PRESSURES ABOVE AND BELOW THE GWT, 34H AND 17H AND, THE LOCATION OF THE WATER TABLE RELATIVE TO THE WALL HEIGHT (AT OR SLIGHTLY BELOW THE MID-HEIGHT), IT IS ACTUALLY MORE CONSERVATIVE AND SIMPLER TO TAKE THE 34H EARTH PRESSURE STRAIGHT DOWN TO THE BASE OF EXCAVATION, WITH NO BOTTOM TRUNCATION, INSTEAD OF APPLYING THE WATER LOAD AND BUOYANT VALUES ABOVE THE BASE OF EXCAVATION. THIS IS WHAT WE DID IN THE ANALYSIS. HOWEVER, WE STILL INCLUDED THE UNBALANCED WATER LOAD IN THE PASSIVE DETERMINATION.

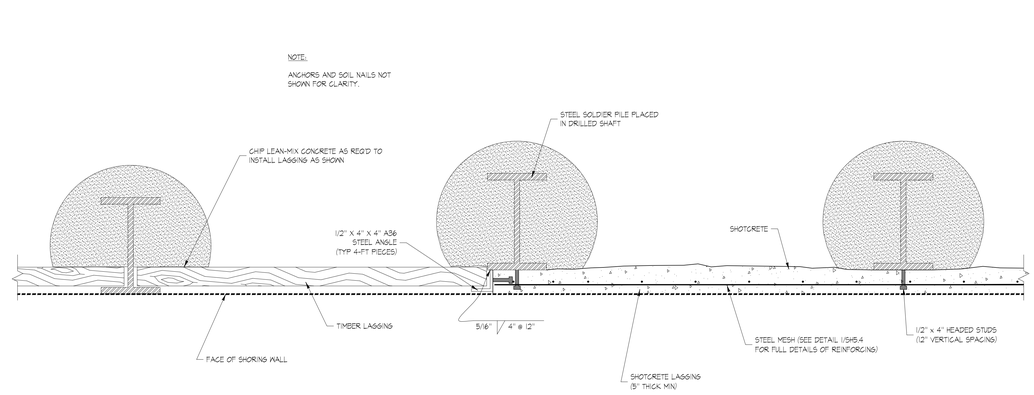
3 / SH5.0 — SHORING DESIGN DIAGRAM
MULTIPLE-ANCHORED
SECANT PILE WALL
NOT TO SCALE



NOTE:

TOE EMBEDMENT DETERMINED BY APPLYING TOE SHEAR AND APPLYING PASSIVE LOAD OVER 2 PILE DIAMETERS, AND ADJUSTING DEPTH TO BALANCE LATERAL LOADS.

4 / SH5.0 — NO-LOAD ZONE &
TOE EMBEDMENT DIAGRAM
NOT TO SCALE



5 / SH5.0 — TIMBER TO SHOTCRETE
TRANSITION DETAIL
NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 21800 — REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE
816
MERCER

CAMPUS

SHORING PERMIT –
CYCLE 3 RESPONSE

8/22/2022

REVISIONS

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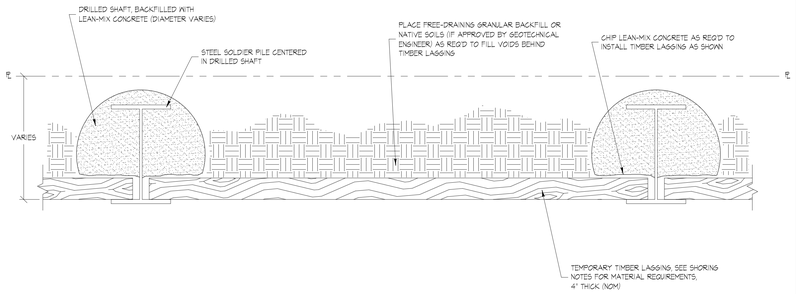
SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: ~~#20-48~~ 62-CN

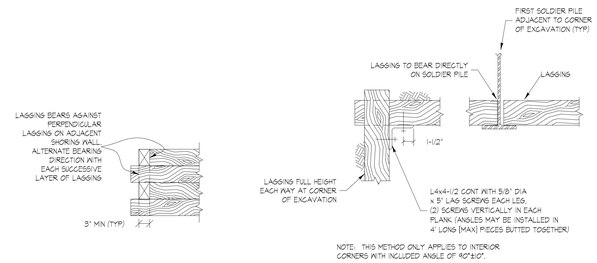
SHEET NAME
TEMPORARY SHORING WALL DETAILS

SHEET NUMBER
SH5.0



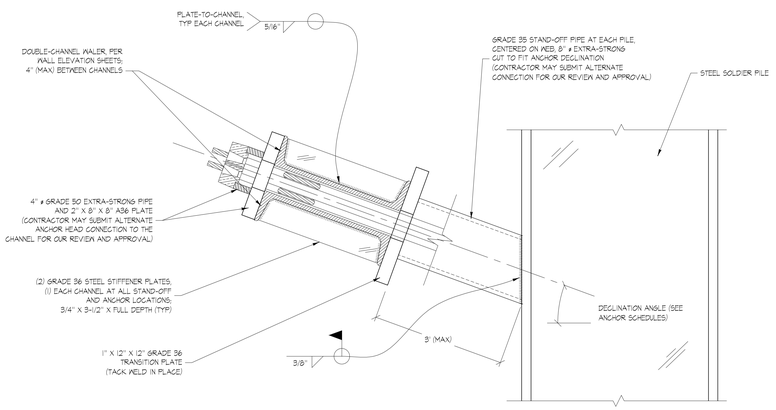
1 SH5.1 PILE / SHAFT / TIMBER LAGGING PLACEMENT DETAIL

NOT TO SCALE



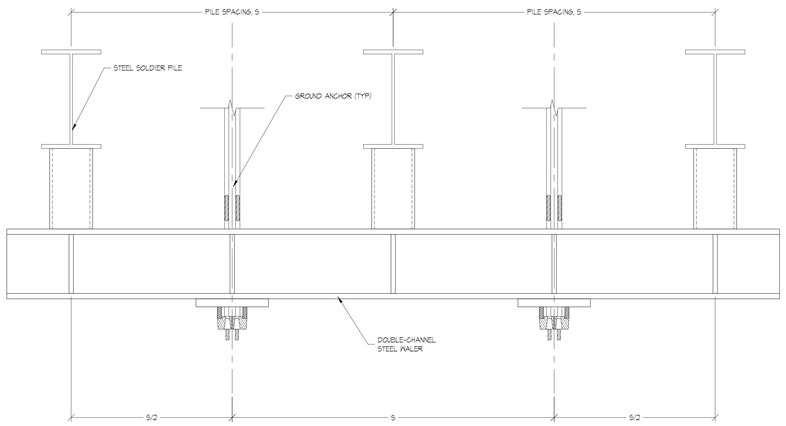
2 SH5.1 INTERIOR CORNER TIMBER LAGGING SUPPORT DETAIL

NOT TO SCALE



3 SH5.1 DOUBLE-CHANNEL WALER CONNECTION DETAIL (SIDE VIEW)

NOT TO SCALE



4 SH5.1 DOUBLE-CHANNEL WALER ANCHOR LAYOUT DETAIL (TOP VIEW)

NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 21603 — REGISTERED PROFESSIONAL ENGINEER

8/22/22

ARE
816
MERCER

CAMPUS

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8/22/2022

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SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: ~~#20-48~~62-CN

SHEET NAME
TEMPORARY SHORING WALL DETAILS

SHEET NUMBER
SH5.1

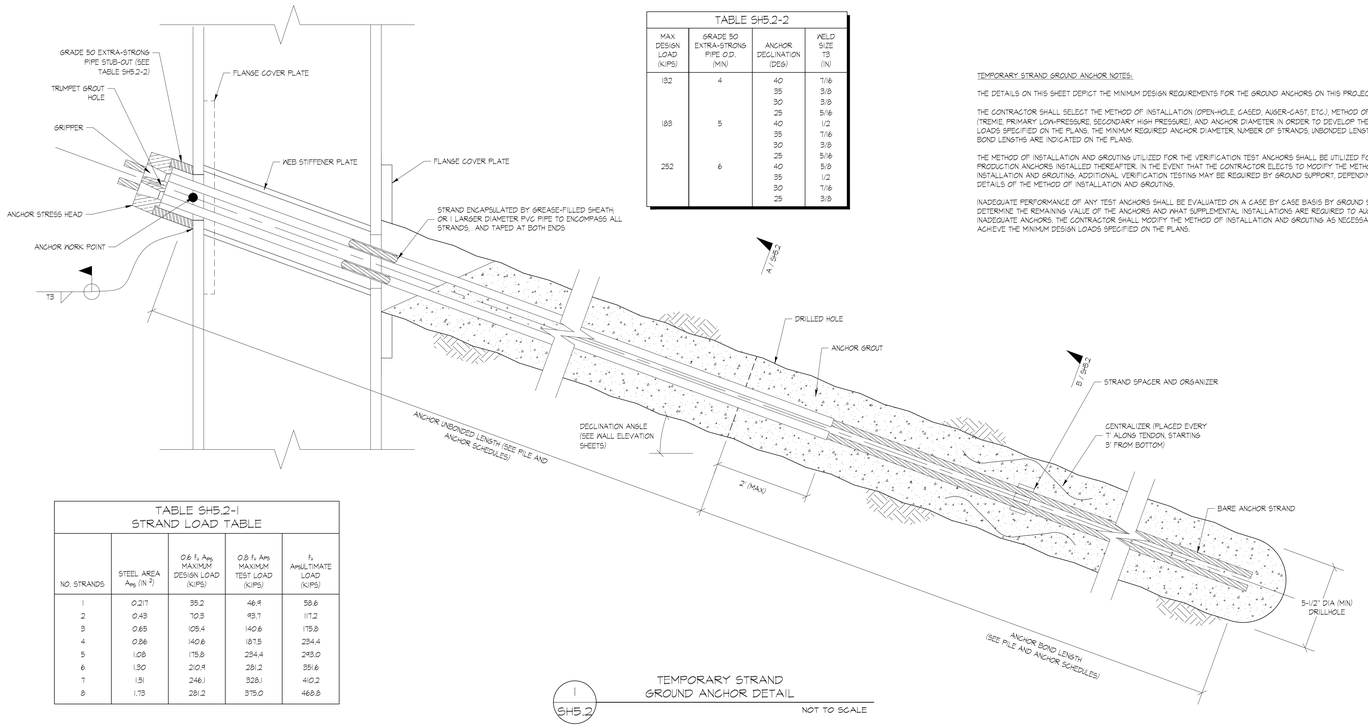


TABLE SH5.2-2

MAX. DESIGN LOAD (KIPS)	GRADE 50 EXTRA-STRONG PIPE O.D. (MIN)	ANCHOR DECLINATION (DEG)	WELD SIZE TB (IN)
132	4	40	7/16
		35	3/8
		30	3/8
		25	5/16
188	5	40	1/2
		35	7/16
		30	3/8
		25	5/16
252	6	40	5/8
		35	1/2
		30	7/16
		25	3/8

TABLE SH5.2-1
STRAND LOAD TABLE

NO. STRANDS	STEEL AREA A_{ps} (IN^2)	0.6 f, A_{ps} MAXIMUM DESIGN LOAD (KIPS)	0.8 f, A_{ps} MAXIMUM TEST LOAD (KIPS)	f_s ANULTIMATE LOAD (KIPS)
1	0.217	35.2	46.9	58.6
2	0.43	70.3	93.7	117.2
3	0.65	105.4	140.6	175.8
4	0.86	140.6	187.5	234.4
5	1.08	175.8	234.4	293.0
6	1.30	210.9	281.2	351.6
7	1.51	246.1	328.1	410.2
8	1.73	281.2	375.0	468.8

TEMPORARY STRAND GROUND ANCHOR NOTES:

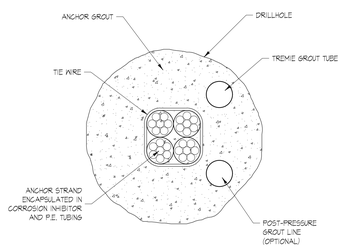
THE DETAILS ON THIS SHEET DEPICT THE MINIMUM DESIGN REQUIREMENTS FOR THE GROUND ANCHORS ON THIS PROJECT.

THE CONTRACTOR SHALL SELECT THE METHOD OF INSTALLATION (OPEN-HOLE, CASED, AUGER-CAST, ETC.), METHOD OF GROUTING (TREMIE, PRIMARY LOW-PRESSURE, SECONDARY HIGH PRESSURE), AND ANCHOR DIAMETER IN ORDER TO DEVELOP THE DESIGN LOADS SPECIFIED ON THE PLANS. THE MINIMUM REQUIRED ANCHOR DIAMETER, NUMBER OF STRANDS, UNBONDED LENGTHS, AND BOND LENGTHS ARE INDICATED ON THE PLANS.

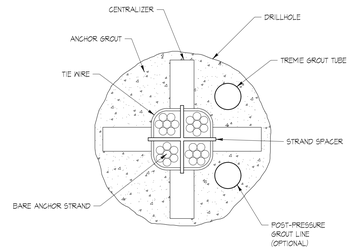
THE METHOD OF INSTALLATION AND GROUTING UTILIZED FOR THE VERIFICATION TEST ANCHORS SHALL BE UTILIZED FOR ALL PRODUCTION ANCHORS INSTALLED THEREAFTER. IN THE EVENT THAT THE CONTRACTOR ELECTS TO MODIFY THE METHOD OF INSTALLATION AND GROUTING, ADDITIONAL VERIFICATION TESTING MAY BE REQUIRED BY GROUND SUPPORT, DEPENDING ON THE DETAILS OF THE METHOD OF INSTALLATION AND GROUTING.

INADEQUATE PERFORMANCE OF ANY TEST ANCHORS SHALL BE EVALUATED ON A CASE BY CASE BASIS BY GROUND SUPPORT TO DETERMINE THE REMAINING VALUE OF THE ANCHORS AND WHAT SUPPLEMENTAL INSTALLATIONS ARE REQUIRED TO AUGMENT THE INADEQUATE ANCHORS. THE CONTRACTOR SHALL MODIFY THE METHOD OF INSTALLATION AND GROUTING AS NECESSARY TO ACHIEVE THE MINIMUM DESIGN LOADS SPECIFIED ON THE PLANS.

1 / SH5.2 TEMPORARY STRAND GROUND ANCHOR DETAIL
NOT TO SCALE



A / SH5.2 UNBONDED ZONE TYPICAL SECTION
NOT TO SCALE



B / SH5.2 BONDED ZONE TYPICAL SECTION
NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

JAMES J. WOLSCHLAG — STATE OF WASHINGTON — REGISTERED — PROFESSIONAL ENGINEER
8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

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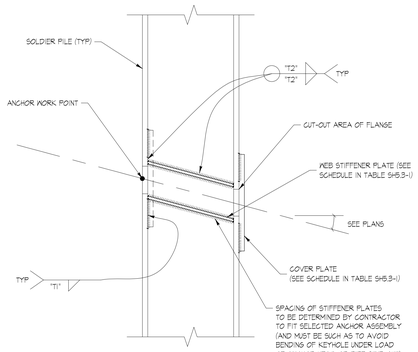
SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48652-CN

SHEET NAME
TEMPORARY SHORING WALL DETAILS

SHEET NUMBER
SH5.2

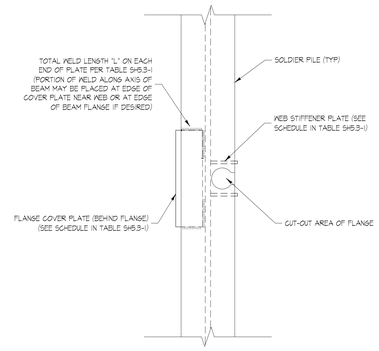


NOTE:

THE CONTRACTOR SHALL SUBMIT A SHOP DRAWING OF THE PROPOSED ANCHOR TO PILE CONNECTION TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION.

1 / SH5.3 — SIDE POCKET CONNECTION DETAIL (SIDE VIEW)

NOT TO SCALE



NOTE:

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2 / SH5.3 — SIDE POCKET CONNECTION DETAIL (FRONT VIEW)

NOT TO SCALE

TABLE SH5.3-1
SIDE POCKET CONNECTION SCHEDULE

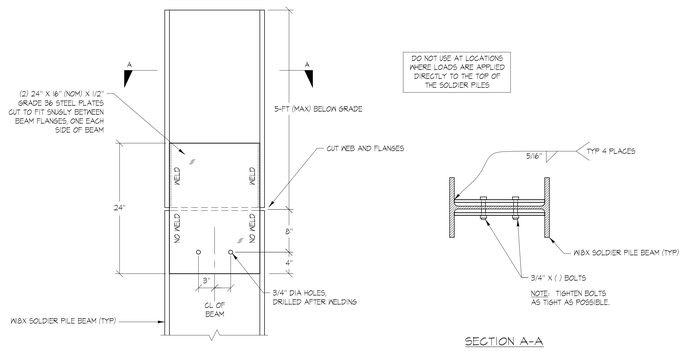
PILE SECTION	GRADE 50 COVER PLATE DIMENSIONS (IN)	COVER PLATE WELD LENGTH L (IN)	COVER PLATE WELD SIZE T1 (IN)	GRADE 50 WEB STIFFENER PLATE DIMENSIONS (IN)	WEB STIFFENER PLATE WELD SIZE T2 (IN)
W18X76	1 X 5 X 42	22	3/8	3/4 x 5 X FULL HT	5/16
W18X86	1 X 5 X 42	22	7/16	3/4 x 5 X FULL HT	5/16
W18X97	1 X 5 X 42	22	1/2	3/4 x 5-1/2 X FULL HT	5/16
W18X119	1 X 6 X 42	22	5/8	3/4 x 5-1/2 X FULL HT	5/16

NOTE:

WEB STIFFENER PLATES ARE FULL DEPTH, ARE FLUSH AT LOAD END, AND WELDED FULL LENGTH AND ALONG LOAD END, AND ON BOTH SIDES OF STIFFENER.

3 / SH5.3 — SIDE POCKET CONNECTION SCHEDULE

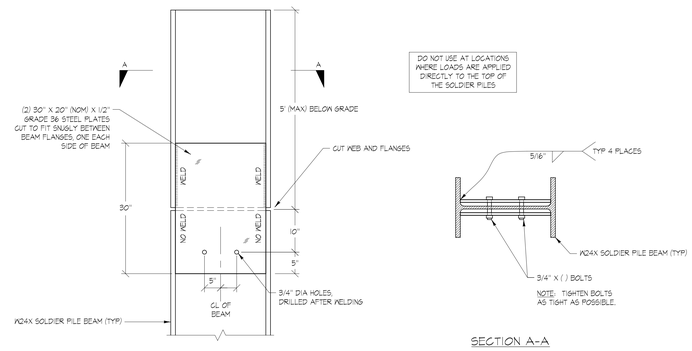
NOT TO SCALE



SECTION A-A

4 / SH5.3 — TYPICAL REMOVABLE TOP CONNECTION DETAIL (W18X SOLDIER PILES)

NOT TO SCALE



SECTION A-A

5 / SH5.3 — TYPICAL REMOVABLE TOP CONNECTION DETAIL (W24X SOLDIER PILES)

NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 21016 — REGISTERED PROFESSIONAL ENGINEER

8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

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SCALE: AS NOTED

PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48652-CN

SHEET NAME: TEMPORARY SHORING WALL DETAILS

SHEET NUMBER: SH5.3

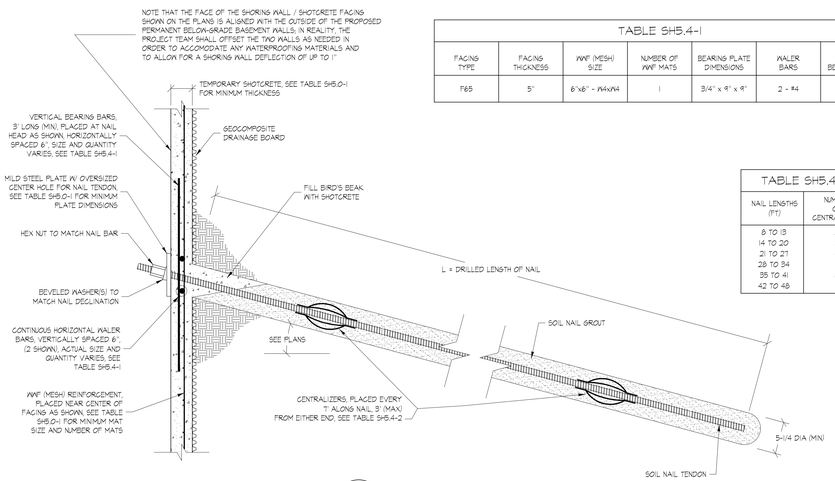


TABLE SH5.4-1

FACING TYPE	FACING THICKNESS	WWF (MESH) SIZE	NUMBER OF WWF MATS	BEARING PLATE DIMENSIONS	WALER BARS	VERTICAL BEARING BARS
F65	5"	6"x6" - W4xW4	1	3/4" x 9" x 9"	2 - #4	2 - #4

TABLE SH5.4-2

NAIL LENGTHS (FT)	NUMBER OF CENTRALIZERS
8 TO 13	2
14 TO 20	3
21 TO 27	4
28 TO 34	5
35 TO 41	6
42 TO 48	7

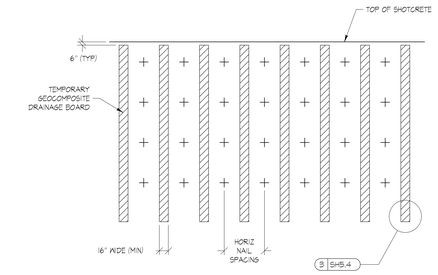
1 SH5.4 SOIL NAIL AND FACING DETAIL
NOT TO SCALE

NOTES:

1. THE GEOCOMPOSITE WALL DRAINAGE SYSTEM SHOWN ON THE PLANS IS A TEMPORARY-ONLY SYSTEM, THAT HAS BEEN DESIGNED BY GROUND SUPPORT TO ADDRESS SUBSURFACE GROUNDWATER ENCOUNTERED DURING CONSTRUCTION ONLY.

2. THE PERMANENT BELOW-GRADE WALL DRAINAGE SYSTEM SHALL BE DESIGNED BY THE PROJECT CIVIL ENGINEER.

3. SURFACE WATER SHALL BE DIVERTED AND/OR CAPTURED BY THE GENERAL CONTRACTOR SO AS TO NOT ALLOW SIGNIFICANT INFILTRATION BEHIND THE TOP OF THE SHORING WALL AND OVERLOAD THE TEMPORARY DRAINAGE BOARD, OR CREATE FACE STABILITY ISSUES DUE TO WATER RUNNING DOWN THE FACE OF THE EXCAVATION.



2 SH5.4 TEMPORARY WALL DRAINAGE DETAIL
NOT TO SCALE

NOTES:

1. THE GEOCOMPOSITE WALL DRAINAGE SYSTEM SHOWN ON THE PLANS IS A TEMPORARY-ONLY SYSTEM, THAT HAS BEEN DESIGNED BY GROUND SUPPORT TO ADDRESS SUBSURFACE GROUNDWATER ENCOUNTERED DURING CONSTRUCTION ONLY.

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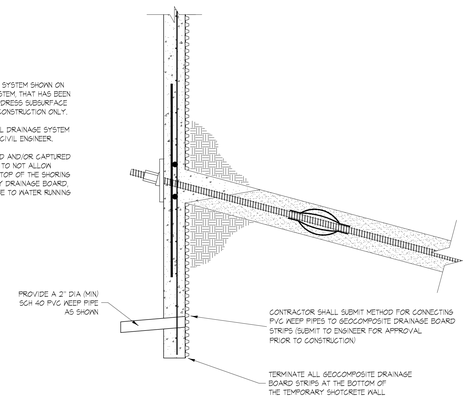
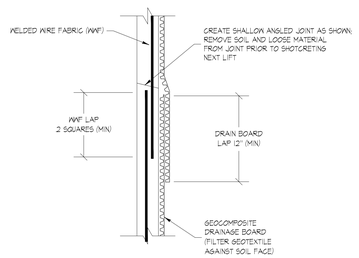


3 SH5.4 TEMPORARY WALL DRAINAGE DETAIL
NOT TO SCALE



4 SH5.4 TEMPORARY SHOTCRETE WALL JOINT AND LAP DETAIL
NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — 21615 — REGISTERED PROFESSIONAL ENGINEER
8/22/22

ARE 816 MERCER CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

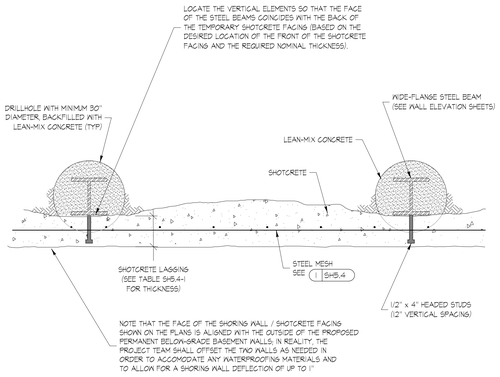
REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48062-CN

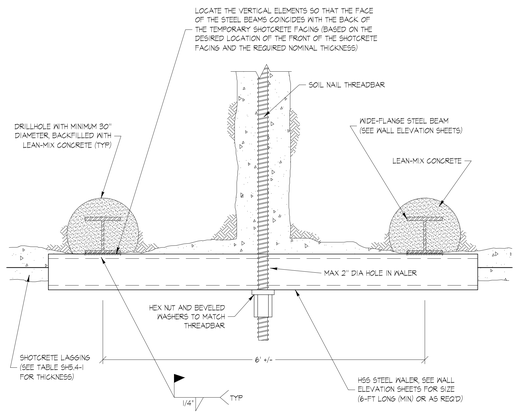
SHEET NAME: TEMPORARY SHORING WALL DETAILS

SHEET NUMBER: SH5.4



1 SH5.5 — VERTICAL ELEMENT & SHOTCRETE LAGGING DETAIL (LIFTS WITHOUT NAILS ONLY)

NOT TO SCALE



2 SH5.5 — SOIL NAIL WALL STEEL WALER DETAIL

NOT TO SCALE

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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

JAMES J. WOLSCHLAG — STATE OF WASHINGTON — 21833 — REGISTERED PROFESSIONAL ENGINEER

8/22/22

ARE
816
MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

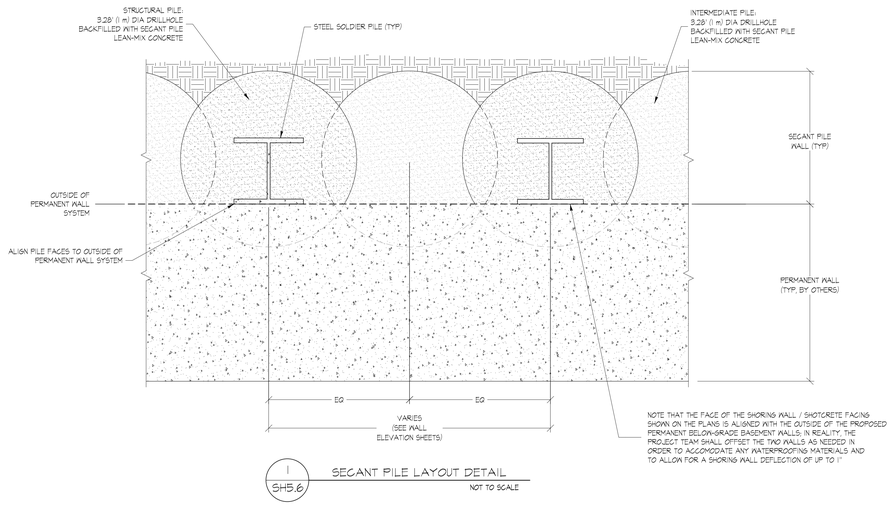
MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	5/22/2022	COMMENT RESPONSE

SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ

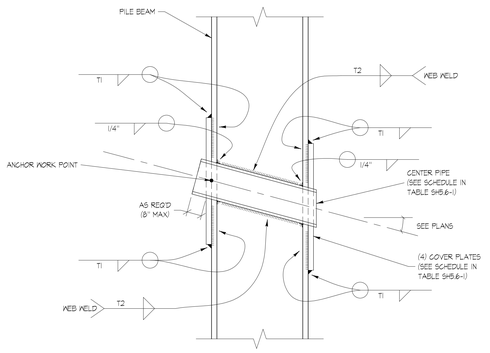
PROJECT NUMBER: #20-48052-CN

SHEET NAME
TEMPORARY SHORING WALL DETAILS

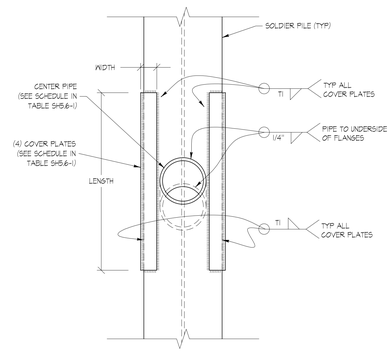
SHEET NUMBER
SH5.5



1 / SH5.6 SECANT PILE LAYOUT DETAIL
NOT TO SCALE



3 / SH5.6 CENTER POCKET CONNECTION DETAIL (CENTER VIEW)
NOT TO SCALE



4 / SH5.6 CENTER POCKET CONNECTION DETAIL (FRONT VIEW)
NOT TO SCALE

TABLE SH5.6-1
CENTER POCKET CONNECTION SCHEDULE

PILE SECTION	GRADE 50 COVER PLATE DIMENSIONS (IN)	COVER PLATE WELD SIZE T1 (IN)	CENTER PIPE OD X WALL (IN)	CENTER PIPE TO WEB WELD SIZE T2 (IN)
W14X109	1-1/2 X 3 X 40	5/16	8-5/8 X 1/2	3/8
W14X120	1-1/2 X 3 X 40	5/16	8-5/8 X 1/2	3/8
W14X132	1-1/2 X 3 X 40	3/8	8-5/8 X 1/2	3/8
W14X159	2 X 3 X 40	7/16	8-5/8 X 1/2	3/8
W24X162	2 X 3 X 40	1/2	8-5/8 X 1/2	3/8

5 / SH5.6 CENTER POCKET CONNECTION SCHEDULE
NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER
8/22/22

ARE
816
MERCER

CAMPUS

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CYCLE 3 RESPONSE

8/22/2022

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SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-48062-CN

SHEET NAME
TEMPORARY
SHORING WALL
DETAILS

SHEET NUMBER
SH5.6

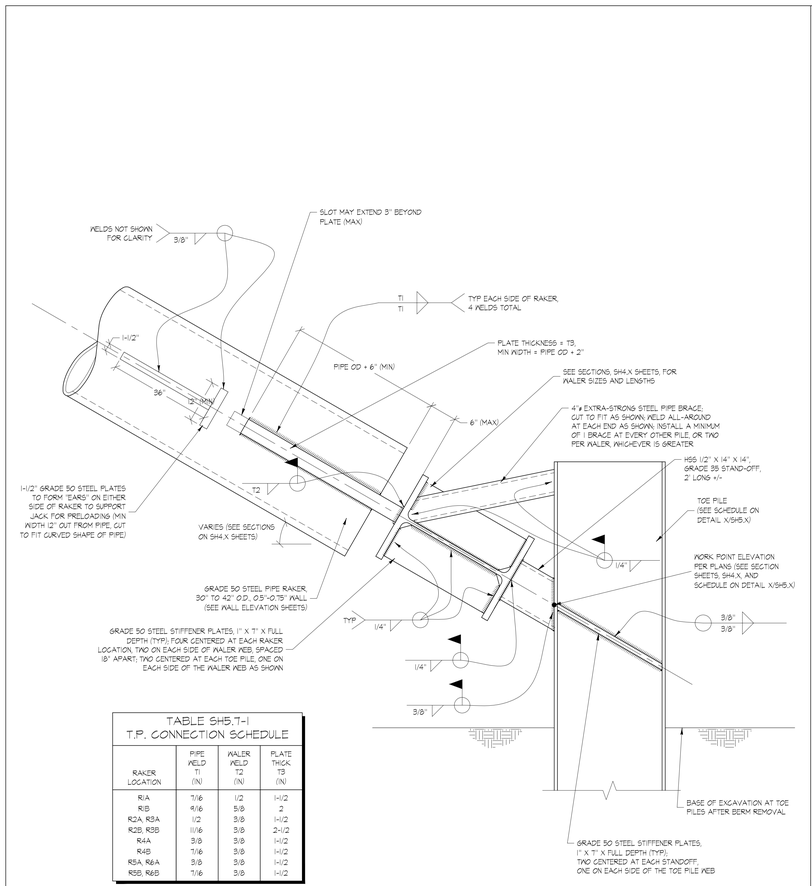

TABLE SH5.7-1
T.P. CONNECTION SCHEDULE

RAKER LOCATION	PIPE WELD T1 (IN)	WALER WELD T2 (IN)	PLATE THICK T3 (IN)
R1A	7/16	1/2	1-1/2
R1B	9/16	5/8	2
R2A, R3A	1/2	3/8	1-1/2
R2B, R3B	11/16	3/8	2-1/2
R4A	3/8	3/8	1-1/2
R4B	7/16	3/8	1-1/2
R5A, R6A	3/8	3/8	1-1/2
R5B, R6B	7/16	3/8	1-1/2

1 SH5.7 — PIPE / WALER / STAND-OFF / PILE CONNECTION DETAIL
NOT TO SCALE

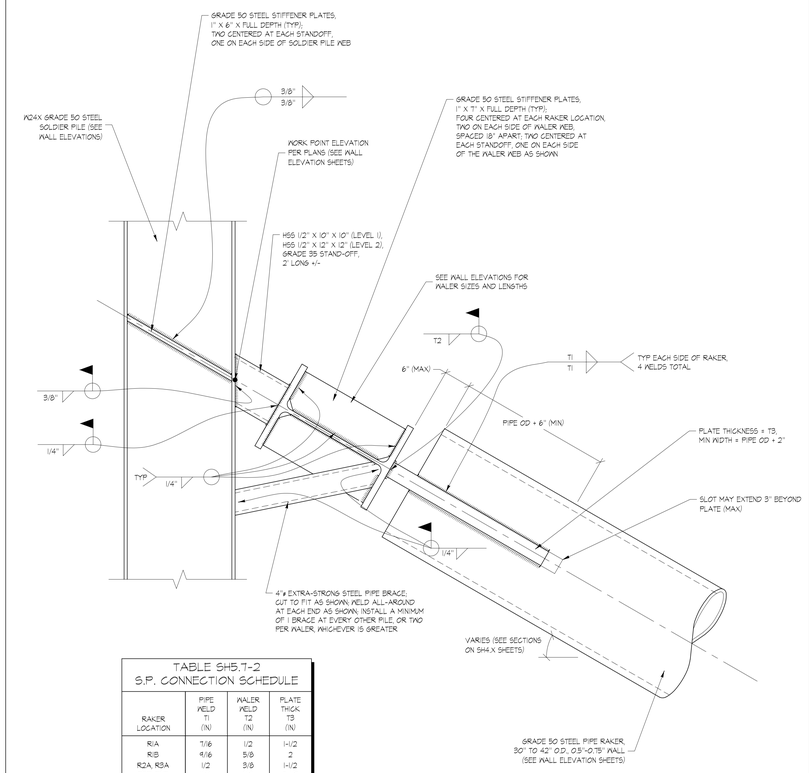

TABLE SH5.7-2
S.P. CONNECTION SCHEDULE

RAKER LOCATION	PIPE WELD T1 (IN)	WALER WELD T2 (IN)	PLATE THICK T3 (IN)
R1A	7/16	1/2	1-1/2
R1B	9/16	5/8	2
R2A, R3A	1/2	3/8	1-1/2
R2B, R3B	11/16	3/8	2-1/2
R4A	3/8	3/8	1-1/2
R4B	7/16	3/8	1-1/2
R5A, R6A	3/8	3/8	1-1/2
R5B, R6B	7/16	3/8	1-1/2

2 SH5.7 — PIPE / WALER / STAND-OFF / PILE CONNECTION DETAIL
NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

MATTHEW J. WOLSCHLAG — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER
8/22/22

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SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

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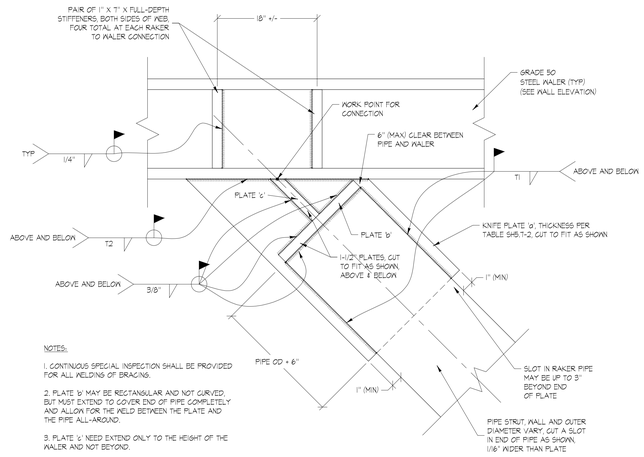
3	8/22/2022	COMMENT RESPONSE

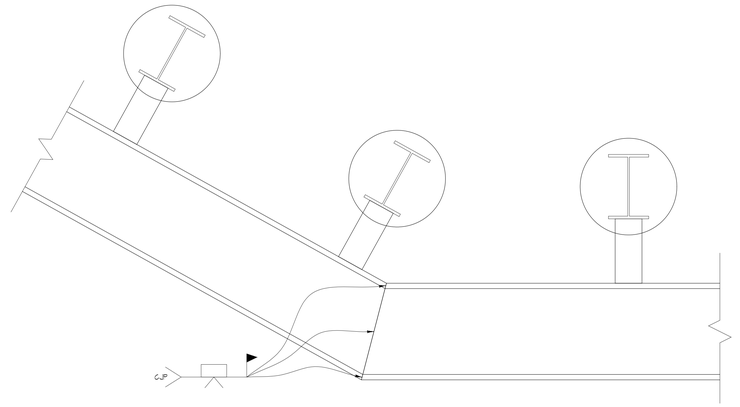
SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48652-CN

SHEET NAME
TEMPORARY SHORING WALL DETAILS

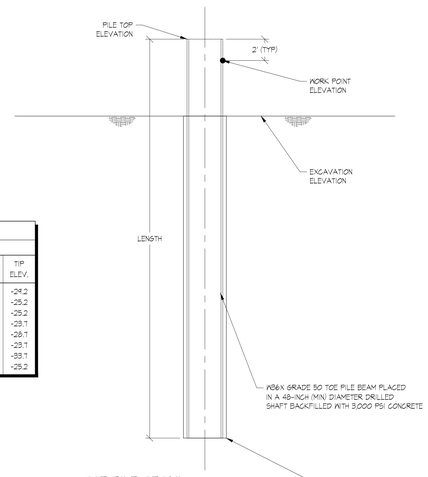
SHEET NUMBER
SH5.7



1 SH5.8 RAKER 1A/B CONNECTION DETAIL (PLAN VIEW)
NOT TO SCALE



2 SH5.8 WALER CONNECTION DETAIL
NOT TO SCALE



NORTH WALL

TOE PILE SCHEDULE (ALL 48" MIN. SHAFTS)

TOE PILES	GRADE 50 BEAM	LENGTH (FT)	W.P. ELEV.	TOP ELEV.	EXC.AV. ELEV.	TIP ELEV.
T1-T3	W36X328	46.2	15	17	5.8	-29.2
T4-T6	W36X485	38.7	11.5	13.5	4.8	-25.2
T7-T14	W36X485	38.7	11.5	13.5	4.8	-25.2
T15-T22	W36X485	37.2	11.5	13.5	6.3	-23.7
T23-T24	W36X328	45.7	15	17	6.3	-28.7
T25-T26	W36X485	37.2	11.5	13.5	6.3	-23.7
T27-T28	W36X328	47.2	11.5	13.5	1.3	-33.7
T29-T34	W36X485	38.7	11.5	13.5	4.8	-25.2

3 SH5.8 TOE PILE DETAIL AND SCHEDULE
NOT TO SCALE

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OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

JAMES J. WOLSCHLAG — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER
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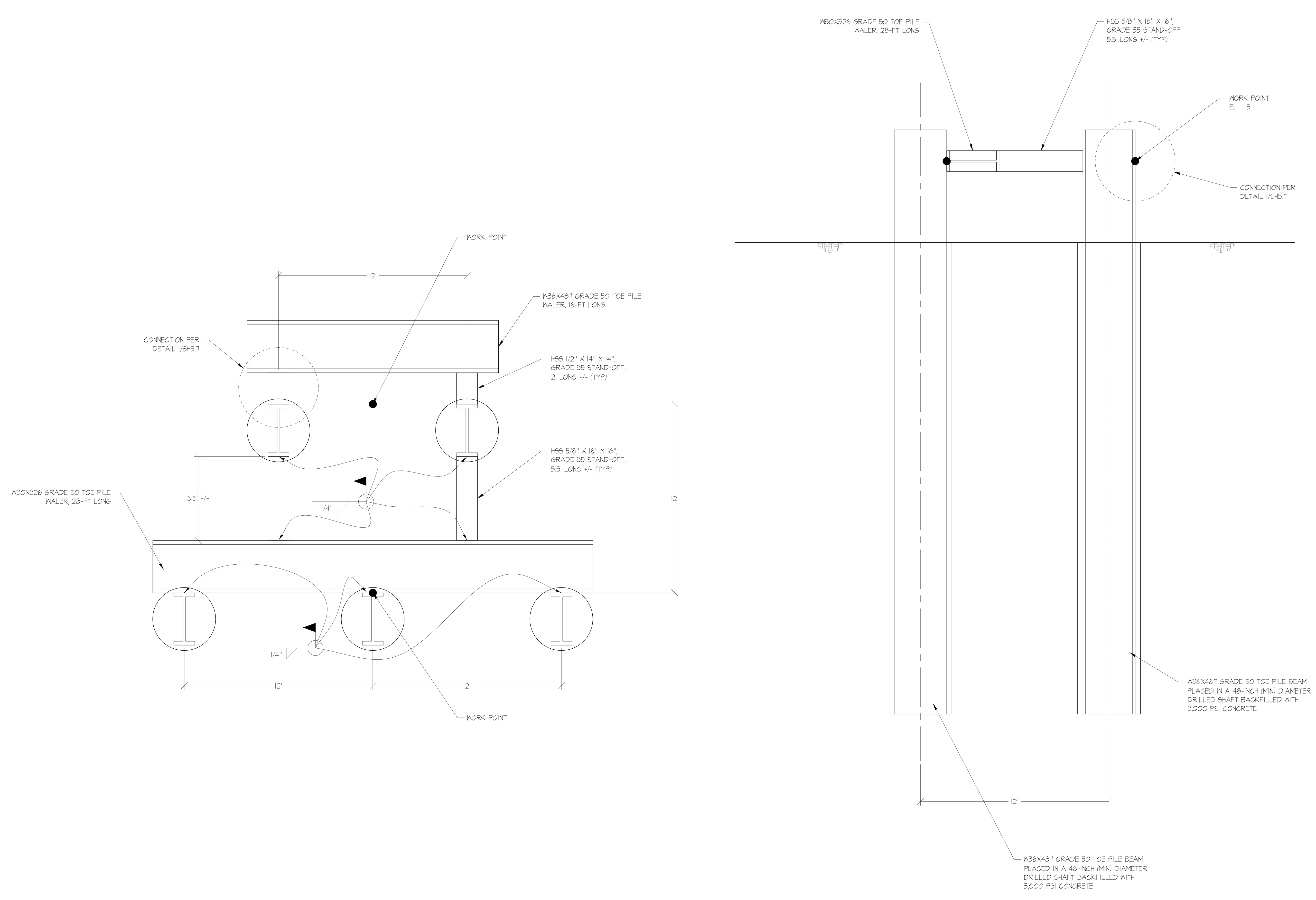
SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48062-CN

SHEET NAME: TEMPORARY SHORING WALL DETAILS

SHEET NUMBER: SH5.8



1 / SH5.9 TOE PILE GROUP DETAIL
RAKERS 2B AND 3B
NOT TO SCALE

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

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3	8/22/2022	COMMENT RESPONSE

SCALE: AS NOTED
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-4662-CN

SHEET NAME
TEMPORARY SHORING WALL DETAILS

SHEET NUMBER SH5.9

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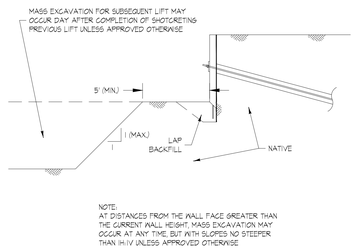
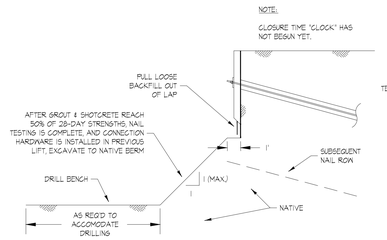
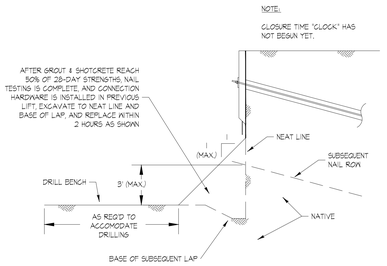


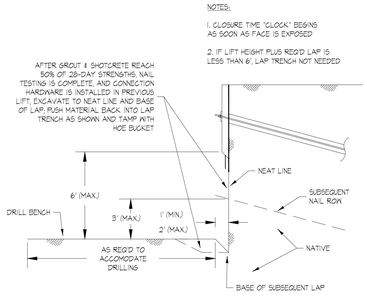
1 / SH6.0 STEP 1
MASS EXCAVATION FOR SUBSEQUENT LIFT
NOT TO SCALE



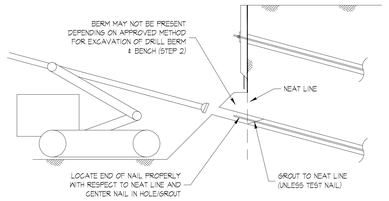
2-A / SH6.0 STEP 2
EXCAVATION FOR DRILL BENCH AND BERM
METHOD A - NATIVE BERM
NOT TO SCALE



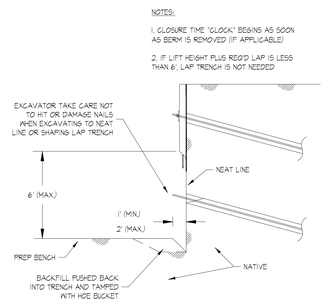
2-B / SH6.0 STEP 2
EXCAVATION FOR DRILL BENCH AND BERM
METHOD B - SOFT/FILL BERM
NOT TO SCALE



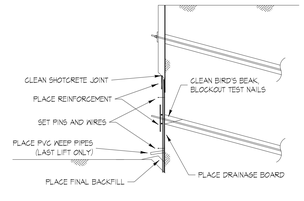
2-C / SH6.0 STEP 2
EXCAVATION FOR DRILL BENCH AND BERM
METHOD C - NEAT CUT
NOT TO SCALE



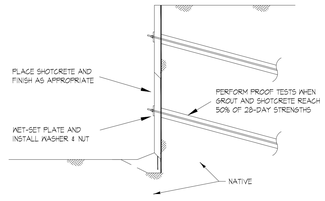
3 / SH6.0 STEP 3
DRILL AND GROUT NAILS
NOT TO SCALE



4 / SH6.0 STEP 4
EXCAVATE NEAT LINE AND PREP BENCH
NOT TO SCALE



5 / SH6.0 STEP 5
PREPARE WALL FACING COMPONENTS
NOT TO SCALE



6 / SH6.0 STEP 6
SHOTCRETE, WET SET CONNECTION, TEST NAILS
NOT TO SCALE

CONSTRUCTION NOTES:

BASED ON THE REFERENCED GEOTECHNICAL REPORT, THE SUBSURFACE CONDITIONS IN THE SOIL NAILED AREAS AT THE PROJECT SITE GENERALLY CONSIST OF IS TO 20 FEET OF MEDIUM DENSE TO DENSE FILL UNDERLAIN BY VERY DENSE SILTY SAND WITH GRAVEL, I.E. GLACIAL TILL.

FOR STEP 2, IF LESS COMPETENT SOILS ARE ENCOUNTERED, ONLY METHOD A IS APPROVED BY THE ENGINEER.

FOR STEP 2, FOR THE UPPERMOST LIFT ALONG ANY WALL, WHEN VERY DENSE NATIVE SOIL IS ENCOUNTERED, METHOD B IS APPROVED BY THE ENGINEER.

FOR STEP 2, FOR LIFTS OTHER THAN THE UPPERMOST LIFT ALONG ANY WALL, WHEN VERY DENSE NATIVE SOIL IS ENCOUNTERED, METHOD C IS APPROVED BY THE ENGINEER, BUT METHOD B IS HIGHLY RECOMMENDED.

IF AT ANY TIME DURING CONSTRUCTION, THE SOIL FACE APPEARS TO BE DISTRESSED IN SUCH A WAY AS TO CAUSE POTENTIAL FOR SLOUGHING, FALLOUT, OR LARGE OVERBREAKS, THEN EITHER METHOD A OR B WILL BE REQUIRED BY THE OWNER'S REPRESENTATIVE AS NECESSARY TO LIMIT SOIL DISTURBANCE AT THE FACE.

CLOSURE TIME, DEFINED AS THE TIME DURATION BETWEEN EXCAVATION OF THE NEAT CUT FACE AND PLACEMENT OF SHOTCRETE, SHALL BE NO GREATER THAN A SINGLE WORKSHIFT UNLESS APPROVED OTHERWISE BY THE ENGINEER OR THE OWNER'S REPRESENTATIVE.

METHODS OF CONSTRUCTION AND CLOSURE TIMES THAT ARE APPROVED BY THE ENGINEER OR THE OWNER'S REPRESENTATIVE DO NOT RELIEVE THE CONTRACTOR OF ALL RESPONSIBILITY FOR STABILITY OF THE TEMPORARY CUT FACE UNTIL IT IS CLOSED WITH HARDENED SHOTCRETE AND THE NAIL CONNECTION IS COMPLETELY INSTALLED.

SEE THE SOIL NAIL SHORING WALL SPECIFICATION SHEETS FOR SPECIFIC REQUIREMENTS FOR MATERIALS AND CONSTRUCTION.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

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SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: #20-48652-CN

SHEET NAME
TEMPORARY SHORING WALL CONSTRUCTION STEPS

SHEET NUMBER
SH6.0

SECTION 02350 - SOIL NAIL SHORING WALL

TABLE OF CONTENTS

1. GENERAL

1.1 DESCRIPTION

A. THE GENERAL CONTRACTOR AND SUBCONTRACTORS (HEREAFTER REFERRED TO COLLECTIVELY AS THE CONTRACTOR UNLESS INDICATED OTHERWISE) ARE RESPONSIBLE FOR THE CONSTRUCTION MEANS AND METHODS AND CONTROL THE PROCESS OF THE WORK. THIS INCLUDES THE CONSTRUCTION SEQUENCE, THE SAFETY OF THE WORKERS, TEMPORARY HANDRAILS, EXCAVATION ACCESS, BARRIERS, LIFTING OF MATERIALS AND CONSTRUCTION EQUIPMENT INTO AND OUT OF THE EXCAVATION, TEMPORARY BRACING OF FORMWORK, AND THE STABILITY OF ALL TEMPORARY CUT SLOPES.

B. THE SOIL NAIL SHORING WALL IS A SYSTEM OF SHORING DESIGNED TO SUPPORT THE EXCAVATION SIDEWALLS ONCE THE COMPONENTS OF THE SOIL NAILS AND FACING SYSTEM ARE COMPLETELY INSTALLED FOR ALL LIFTS UP TO AND INCLUDING THE CURRENT EXCAVATION LIFT. THE STABILITY OF INTERIM TEMPORARY FACE CUTS THAT EXIST PRIOR TO INSTALLATION OF THE WALL FACING IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

C. THE WORK SHALL CONSIST OF INSTALLING SOIL NAILS, WALL DRAINAGE, AND WALL FACING AS SPECIFIED HEREIN AND SHOWN ON THE PLANS. THE WORK SHALL ALSO INCLUDE EXCAVATING IN ACCORDANCE WITH THE STAGED LIFTS SHOWN ON THE PLANS, INSTALLING SOIL NAILS TO THE SPECIFIED MINIMUM LENGTH AND ORIENTATION INDICATED ON THE PLANS, PLACING THE WALL DRAINAGE ELEMENTS AND FACING, AND PERFORMING SOIL NAIL PULLOUT TESTING. THE CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, AND EQUIPMENT REQUIRED FOR COMPLETING THE WORK.

1.2 PRECONSTRUCTION MEETING

A. A PRECONSTRUCTION MEETING SHALL BE HELD PRIOR TO THE START OF THE WORK AND SHALL BE ATTENDED BY THE OWNER'S REPRESENTATIVES, THE ENGINEER, THE GENERAL CONTRACTOR, THE EXCAVATION SUBCONTRACTOR, AND THE SOIL NAIL SPECIALTY SUBCONTRACTOR. THE PRECONSTRUCTION MEETING SHALL BE CONDUCTED TO CLARIFY THE REQUIREMENTS FOR THE WORK, TO COORDINATE THE CONSTRUCTION ACTIVITIES, AND TO IDENTIFY CONTRACTUAL RELATIONSHIPS AND RESPONSIBILITIES.

B. KING COUNTY REPRESENTATIVES SHALL BE NOTIFIED OF AND ATTEND THE PRECONSTRUCTION MEETING.

3

1.3 EXISTING SITE CONDITIONS, UTILITIES, AND UNDERGROUND OBSTRUCTIONS

A. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO ANY CONSTRUCTION ACTIVITIES FOR THE PURPOSE OF OBSERVING AND DOCUMENTING THE PRECONSTRUCTION CONDITION OF ALL STRUCTURES, INFRASTRUCTURE, SIDEWALKS, ROADWAYS, AND ALL OTHER FACILITIES ADJACENT TO THE SITE. DURING CONSTRUCTION, THE CONTRACTOR SHALL OBSERVE THE CONDITIONS ABOVE THE SOIL NAIL WALL ON A DAILY BASIS FOR SIGNS OF GROUND OR BUILDING MOVEMENTS. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATIVE AND THE ENGINEER IF SIGNS OF MOVEMENT SUCH AS NEW CRACKS, INCREASED SIZE OF OLD CRACKS OR SEPARATION OF JOINTS IN STRUCTURES, FOUNDATIONS, STREETS OR PAVED AND UNPAVED SURFACES ARE OBSERVED. THE CONTRACTOR SHALL PROVIDE THE ENGINEER WRITTEN DOCUMENTATION OF THE OBSERVED CONDITIONS WITHIN 24 HOURS OF INITIAL OBSERVATION.

B. THE CONTRACTOR MUST VERIFY ALL EXISTING DIMENSIONS AND SITE CONDITIONS. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING ACTUAL LOCATIONS OF ALL EXISTING UTILITIES SHOWN ON THE PLANS AND THOSE UTILITIES OR UNDERGROUND OBSTRUCTIONS NOT SHOWN ON THE PLANS, THAT MAY IMPACT OR CONFLICT WITH THE SOIL NAIL WALL.

C. BASED ON THE AS-BUILT LOCATIONS OF SIDE SEWERS, WATER SERVICE AND GAS OR POWER SERVICE LINES, THE CONTRACTOR SHALL SEEK APPROVAL OF THE ENGINEER TO SHIFT NAIL LOCATIONS TO AVOID CONFLICTS WITH THESE UTILITIES.

D. THE CONTRACTOR IS RESPONSIBLE FOR ANY REMOVAL OF ABANDONED UTILITIES, OR OTHER UNDERGROUND OBSTRUCTIONS THAT INTERFERE WITH THE SOIL NAIL WALL.

1.4 SPECIAL INSPECTION

A. IN ACCORDANCE WITH THE LOCAL BUILDING CODE, SPECIAL INSPECTION SHALL BE PROVIDED BY THE OWNER FOR ALL SOIL NAIL INSTALLATION AND TESTING AND FOR ALL SHOTCRETE WORK. SUCH INSPECTION SHALL INCLUDE OBSERVATION AND TESTING OF TEST PANELS AND PLACEMENT OF REINFORCING STEEL AND SHOTCRETE.

B. THE OWNER'S REPRESENTATIVE PROVIDING THE SPECIAL INSPECTION SHALL BE A QUALIFIED GEOTECHNICAL ENGINEER OR HIS REPRESENTATIVE WITH EXPERIENCE MONITORING SOIL NAIL WALL CONSTRUCTION. ACCURATE RECORDS DOCUMENTING THE SOIL NAIL WALL CONSTRUCTION SHALL BE MAINTAINED BY THE OWNER'S REPRESENTATIVE. THE CONTRACTOR SHALL ASSIST THE OWNER'S REPRESENTATIVE AS NECESSARY TO OBTAIN THE AS-BUILT NAIL LOCATIONS, TOP OF WALL ELEVATIONS, AND ALL OTHER INFORMATION AS REQUIRED BY THE OWNER AND ENGINEER. SPECIAL INSPECTION AND TESTING OF THE SHOTCRETE WORK SHALL BE PROVIDED BY A QUALIFIED MATERIALS TESTING AGENCY APPROVED BY THE ENGINEER.

C. ALL SHOTCRETE AND SOIL NAIL GROUT SHALL BE TESTED, AND SOIL NAIL DESIGN ADHESIONS VERIFIED, IN ACCORDANCE WITH THESE SPECIFICATIONS.

2. CONSTRUCTION SITE DRAINAGE

A. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING CONSTRUCTION SITE DRAINAGE, BOTH BEHIND AND IN FRONT OF THE SOIL NAIL WALL, THAT IS INDEPENDENT OF THE WALL DRAINAGE SYSTEM.

B. AT LEAST 15 DAYS PRIOR TO INITIATING THE WORK, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR REVIEW AND APPROVAL A DETAILED CONSTRUCTION SITE DRAINAGE PLAN ADDRESSING ALL ELEMENTS NECESSARY TO DIVERT, CONTROL, AND DISPOSE OF SURFACE WATER. AMONG OTHER MEANS, CONTROL OF SURFACE WATER FROM BEHIND THE WALL MAY BE ACCOMPLISHED BY GRADING AWAY FROM THE WALL, TRENCHES AND SUMPS, OR A SHOTCRETED GUTTER SYSTEM. IN ADDITION, THE EXCAVATION SHOULD BE GRADED SO AS TO DIRECT SURFACE WATER AWAY FROM THE TOE OF THE SOIL NAIL WALL AND TO PREVENT THE PONDING OF WATER.

C. EXISTING SUBSURFACE DRAINAGE FEATURES ENCOUNTERED DURING THE EXCAVATION SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE OWNER'S REPRESENTATIVE. WORK IN THESE AREAS SHALL BE SUSPENDED UNTIL REMEDIAL MEASURES MEETING THE APPROVAL OF THE OWNER'S REPRESENTATIVE ARE IMPLEMENTED BY THE CONTRACTOR. REMEDIAL MEASURES FOR EXISTING SUBSURFACE DRAINAGE FEATURES ENCOUNTERED DURING THE WORK, WHICH WERE NOT IDENTIFIED ON THE PLANS, WILL BE PAID FOR AS EXTRA WORK PER THE CONTRACT DOCUMENTS.

D. THE CONTRACTOR IS RESPONSIBLE FOR THE CONDITION AND MAINTENANCE OF ANY PIPE OR CONDUIT USED TO CONTROL SURFACE WATER DURING CONSTRUCTION. UPON SUBSTANTIAL COMPLETION OF THE WORK, SURFACE WATER CONTROL PIPES OR CONDUITS SHALL BE REMOVED FROM THE SITE. ALTERNATIVELY, PIPES OR CONDUITS THAT ARE LEFT IN PLACE WITH THE APPROVAL OF THE OWNER'S REPRESENTATIVE SHALL BE FULLY GROUTED (ABANDONED) OR LEFT IN A MANNER THAT PROTECTS THE STRUCTURE AND ALL ADJACENT FACILITIES FROM GROUND LOSS ASSOCIATED WITH MIGRATION OF FINES THROUGH THE PIPE OR CONDUIT.

3. CONSTRUCTION METHODS AND SEQUENCE

A. AT LEAST 15 DAYS PRIOR TO INITIATING THE WORK, THE CONTRACTOR SHALL SUBMIT THE PROPOSED CONSTRUCTION METHODS AND SEQUENCE TO THE ENGINEER FOR REVIEW AND APPROVAL.

B. THE CONSTRUCTION SEQUENCE SHALL BE AS SHOWN ON THE PLANS, OR IN ACCORDANCE WITH THE APPROVED SUBMITTAL, UNLESS APPROVED OTHERWISE BY THE ENGINEER. NO EXCAVATIONS STEEPER OR HIGHER THAN THOSE SPECIFIED HEREIN OR ON THE PLANS SHALL BE MADE ABOVE OR BELOW THE SOIL NAIL WALL WITHOUT WRITTEN APPROVAL OF THE ENGINEER.

C. TENTATIVELY APPROVED CONSTRUCTION METHODS, SEQUENCE, AND FACE CLOSURE TIMES ARE INDICATED ON THE PLANS. HOWEVER, CONSTRUCTION METHODS, SEQUENCE OR CLOSURE TIMES THAT ARE EITHER INDICATED ON THE PLANS OR APPROVED OTHERWISE BY THE ENGINEER DO NOT RELIEVE THE CONTRACTOR OF ALL RESPONSIBILITY FOR STABILITY OF THE TEMPORARY CUT FACE UNTIL IT IS CLOSED AND STABILIZED WITH HARDENED SHOTCRETE AND THE NAIL HEAD CONNECTION IS COMPLETELY INSTALLED.

D. WHERE THE CONTRACTOR'S CONSTRUCTION SEQUENCING RESULTS IN A DISCONTINUOUS LIFT ALONG ANY NAIL ROW, THE ENDS OF THE LIFT SHALL EXTEND BEYOND THE ENDS OF THE NEXT LOWER LIFT BY AT LEAST 10 FEET. A SOIL BERM SHALL BE CONSTRUCTED IMMEDIATELY BENEATH THESE STEPPED LIFTS TO PREVENT SLOUGHING OR FAILURE THAT WOULD RESULT IN LOSS OF GROUND AT THE FACE.

4. EXCAVATION

A. AT LEAST 15 DAYS PRIOR TO INITIATING THE WORK, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR REVIEW AND APPROVAL EXCAVATION EQUIPMENT TYPES AND METHODS OF EXCAVATING TO THE STAGED LIFTS INDICATED ON THE PLANS.

B. FOR DISTANCES AWAY FROM THE SHOTCRETE WALL FACE GREATER THAN THE CURRENT SHOTCRETE WALL HEIGHT OR 10 FEET, WHICHEVER IS MORE, MASS EXCAVATION MAY OCCUR AT ANY TIME, BUT WITH SLOPES NO STEEPER THAN 1H:1V, UNLESS APPROVED OTHERWISE BY THE ENGINEER.

C. MASS EXCAVATION OF THE DRILL BENCH FOR THE NEXT ROW OF SOIL NAILS MAY OCCUR ANY TIME THE DAY AFTER SHOTCRETING THE PRECEDING LIFT, PROVIDED SUCH EXCAVATION OCCURS NO CLOSER THAN 5 FEET FROM THE FACE OF THE SHOTCRETE.

D. MASS EXCAVATION BENEATH A PRECEDING SHOTCRETE LIFT, CLOSER THAN 5 FEET FROM THE SHOTCRETE WALL FACE, SHALL NOT OCCUR UNTIL: (1) NAIL GROUT AND SHOTCRETE ON THE PRECEDING LIFT SHALL HAVE REACHED 50% OF THEIR SPECIFIED 28-DAY COMPRESSIVE STRENGTHS; AND (2) INSTALLATION OF CONNECTION HARDWARE AND NAIL TESTING FOR THE PRECEDING LIFT ARE COMPLETE AND ACCEPTABLE TO THE OWNER'S REPRESENTATIVE. MASS EXCAVATION CLOSER THAN 5 FEET TO THE SHOTCRETE FACE MUST BE IN ACCORDANCE WITH THE DRILL BERM REQUIREMENTS DESCRIBED BELOW AND SHOWN ON THE PLANS, UNLESS APPROVED OTHERWISE BY THE ENGINEER.

E. DURING MASS EXCAVATION OF THE DRILL BENCH FOR THE NEXT ROW OF SOIL NAILS, THE CONTRACTOR SHALL MAINTAIN A BENCH OF MATERIAL TO SERVE AS A PLATFORM FOR THE DRILLING EQUIPMENT AND AS A STABILIZING BERM FOR THE WALL EXCAVATION FACE (NEAT LINE). IN ACCORDANCE WITH THE PLANS OR AS APPROVED BY THE ENGINEER, THE STABILIZING BERM MAY BE EITHER (1) A NATIVE BERM, (2) A FILL BERM, OR (3) NEAT CUT. IN ALL THREE CASES, THE DRILL BENCH SHALL BE ESTABLISHED NOT MORE THAN 3-1/2 FEET BELOW THE ROW OF NAILS TO BE INSTALLED AND SHALL EXTEND OUT FROM THE WALL FACE A MINIMUM DISTANCE NECESSARY TO PROVIDE A SAFE WORKING BENCH FOR THE DRILL EQUIPMENT AND WORKERS.

F. EXCAVATION TO THE NEAT LINE SHALL BE DONE USING PROCEDURES THAT PREVENT OVEREXCAVATION OR LOOSENING, MINIMIZE DEGRADATION OF THE SOIL BEARING SUPPORT BELOW THE OVERLYING PORTIONS OF THE SOIL NAIL WALL AND BELOW THE SOIL NAILS CURRENTLY BEING INSTALLED, MINIMIZE LOSS OF SOIL MOISTURE, AND PREVENT GROUND FREEZING.

G. THE DURATION OF TIME BETWEEN FINAL EXCAVATION TO THE NEAT LINE AND THE APPLICATION OF SHOTCRETE IS REFERRED TO AS THE CLOSURE TIME. THE CLOSURE TIME FOR ALL WALL EXCAVATION FACES SHALL BE LESS THAN A SINGLE WORK SHIFT, BUT MAY BE EXTENDED TO 24 HOURS IF APPROVED BY THE ENGINEER.

H. THE CLOSURE TIME MAY BE EXTENDED TO 24 HOURS IF APPROVED BY THE ENGINEER IF THE CONTRACTOR DEMONSTRATES THAT THE EXTENSION OF CLOSURE TIME WILL NOT ADVERSELY AFFECT THE EXCAVATION FACE STABILITY.

I. METHODS OF REMOVAL OF FACE PROTRUSIONS (E.G. COBBLES, BOULDERS, RUBBLE, OR OTHER OBJECTS) TO ACCOMPLISH THE CONSTRUCTION SHALL BE DETERMINED BY THE CONTRACTOR. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF THE PROPOSED METHOD FOR MITIGATION OF FACE PROTRUSIONS PRIOR TO INITIATION OF THE WORK. SHOULD THE REMOVAL OF FACE PROTRUSIONS RESULT IN VOIDS BEYOND THE NEAT LINE, THE CONTRACTOR SHALL DETERMINE THE APPROPRIATE METHOD OF BACKFILLING AND SHALL SUBMIT TO THE ENGINEER SUCH METHOD(S) PRIOR TO INITIATING THE WORK.

5. TEMPORARY SOIL NAILS

5.1 GENERAL

A. AT LEAST 15 DAYS PRIOR TO INITIATING THE WORK, THE CONTRACTOR SHALL SUBMIT THE FOLLOWING TO THE ENGINEER FOR REVIEW AND APPROVAL:

1. DRILLING METHODS AND EQUIPMENT INCLUDING DRILL RIG TYPE, USE OF CASED OR OPEN-HOLE METHODS, PROPOSED DRILLHOLE DIAMETER, AND METHOD OF CUTTINGS REMOVAL TO ACHIEVE THE SPECIFIED PULLOUT RESISTANCE.
2. NAIL GROUT MIX DESIGN INCLUDING: BRAND AND TYPE OF PORTLAND CEMENT; SOURCE, GRADATION, AND QUALITY OF ALL AGGREGATES; PROPORTIONS OF MIX BY WEIGHT AND WATER-CEMENT RATIO; MANUFACTURER AND BRAND NAME OF ALL ADMIXTURES; AND COMPRESSIVE STRENGTH TEST RESULTS (PER ASTM C109 / AASHTO T106) VERIFYING THE SPECIFIED MINIMUM 3 AND 28 DAY GROUT STRENGTHS.
3. NAIL GROUT PLACEMENT PROCEDURES AND EQUIPMENT.
4. NAIL TESTING METHODS AND EQUIPMENT INCLUDING DETAILS OF THE JACKING FRAME AND APPURTENANT BRACING, METHODS OF ISOLATING TEST NAILS DURING SHOTCRETE APPLICATION, AND METHODS OF GROUTING THE UNBONDED LENGTH OF TEST NAILS AFTER TESTING.
5. IDENTIFICATION NUMBERS AND CERTIFIED CALIBRATION RECORDS FOR EACH TEST JACK AND PRESSURE GAUGE PAIR TO BE USED. CALIBRATION RECORDS SHALL INCLUDE THE DATE TESTED, DEVICE IDENTIFICATION NUMBER, AND THE CALIBRATION TEST RESULTS AND SHALL BE CERTIFIED FOR AN ACCURACY OF AT LEAST 2 PERCENT OF THE APPLIED CERTIFICATION LOADS BY A QUALIFIED INDEPENDENT TESTING LABORATORY WITHIN 90 DAYS PRIOR TO SUBMITTAL.
6. ONCE AVAILABLE, CERTIFIED MILL TEST RESULTS FOR NAIL BARS FROM EACH HEAT SPECIFYING THE ULTIMATE STRENGTH, YIELD STRENGTH, ELONGATION AND COMPOSITION.
7. MANUFACTURER CERTIFICATIONS FOR THE SOIL NAIL CENTRALIZERS AND SOIL NAIL BAR COUPLERS.

5.2 MATERIALS

A. MATERIALS FOR CONSTRUCTION OF SOIL NAIL WALLS SHALL BE FURNISHED NEW AND WITHOUT DEFECTS. DEFECTIVE MATERIALS REJECTED BY THE OWNER'S REPRESENTATIVE SHALL BE REMOVED BY THE CONTRACTOR. THE MATERIALS SHALL CONSIST OF THE FOLLOWING:

1. CENTRALIZERS SHALL BE CONSTRUCTED OF SCHEDULE 40 PVC, SHALL BE SECURELY ATTACHED TO THE NAIL BAR, SIZED TO POSITION THE NAIL BAR WITHIN 1 INCH OF THE CENTER OF THE DRILLHOLE, SIZED TO ALLOW TREMIE PIPE INSERTION TO THE BOTTOM OF THE DRILLHOLE, AND SIZED TO ALLOW GROUT TO FLOW FREELY UP THE DRILLHOLE.
2. NAIL GROUT SHALL BE A NEAT CEMENT OR SAND-CEMENT MIXTURE WITH A MINIMUM 3-DAY COMPRESSIVE STRENGTH OF 1500 PSI AND A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 3000 PSI PER ASTM C109 / AASHTO T106.
3. CEMENT SHALL CONFORM TO ASTM C150 / AASHTO M85, TYPE I.
4. FINE AGGREGATE SHALL CONFORM TO ASTM C33 / AASHTO M6.
5. NAIL BARS SHALL CONFORM TO ASTM A615 / AASHTO M31, GRADE 60 OR 75 OR ASTM A722 / AASHTO M275, GRADE 150.
6. BAR COUPLERS SHALL DEVELOP THE ULTIMATE TENSILE STRENGTH OF THE BAR AS CERTIFIED BY THE MANUFACTURER.

B. CEMENT SHALL BE ADEQUATELY STORED TO PREVENT MOISTURE DEGRADATION AND PARTIAL HYDRATION. CEMENT THAT HAS BECOME CAKED OR LUMPY SHALL NOT BE USED.

C. ALL NAIL BARS SHALL BE CAREFULLY HANDLED AND SHALL BE STORED ON SUPPORTS TO KEEP THE STEEL FROM CONTACT WITH THE GROUND. STEEL BARS SHALL BE PICKED UP IN SUCH A WAY AS TO PREVENT OVERSTRESSING. DAMAGE TO THE NAIL STEEL AS A RESULT OF OVERSTRESSING, ABRASION, CUTS, NICKS, WELDS, AND WELD SPLATTER SHALL BE CAUSE FOR REJECTION BY THE OWNER'S REPRESENTATIVE. GROUNDING OF WELDING LEADS TO THE NAIL STEEL SHALL NOT BE ALLOWED. NAIL STEEL SHALL BE PROTECTED FROM AND SUFFICIENTLY FREE OF DIRT, RUST, AND OTHER DELETERIOUS SUBSTANCES PRIOR TO INSTALLATION. HEAVY CORROSION OR PITTING OF NAILS SHALL BE CAUSE FOR REJECTION BY THE OWNER'S REPRESENTATIVE. LIGHT RUST THAT HAS NOT RESULTED IN PITTING IS ACCEPTABLE.

5.3 NAIL INSTALLATION

A. FOR EACH DIFFERENT METHOD OF NAIL INSTALLATION, TWO SUCCESSFUL VERIFICATION TESTS SHALL BE PERFORMED IN EACH SOIL UNIT IDENTIFIED ON THE PLANS, PRIOR TO STARTING INSTALLATION OF PRODUCTION NAILS IN THE VARIOUS SOIL UNITS. THE VERIFICATION TEST LOCATIONS ARE DETERMINED BY THE CONTRACTOR AND APPROVED BY THE OWNER'S REPRESENTATIVE.

B. NAILS SHALL BE INSTALLED AT THE LOCATIONS AND TO THE LENGTHS INDICATED ON THE PLANS. THE ENGINEER MAY ADD, ELIMINATE, OR RELOCATE NAILS TO ACCOMMODATE ACTUAL FIELD CONDITIONS.

C. THE CONTRACTOR SHALL SELECT THE DRILLING EQUIPMENT AND METHODS SUITABLE FOR THE GROUND CONDITIONS DESCRIBED IN THE GEOTECHNICAL REPORT. THE DRILLHOLE DIAMETER SHALL BE SELECTED TO PROVIDE THE MINIMUM SPECIFIED GROUT COVER OVER THE NAIL BAR AND TO DEVELOP THE SPECIFIED PULLOUT RESISTANCE. WATER, DRILLING MUDS, OR OTHER FLUIDS USED TO ASSIST IN CUTTING REMOVAL SHALL NOT BE ALLOWED FOR UNCASED DRILLHOLES. UNCASED DRILLHOLES SHALL BE OBSERVED FOR CLEANLINESS PRIOR TO INSERTION OF THE NAIL BAR. IN CAVING GROUND, THE CONTRACTOR SHALL USE CASED OR AUGERCAST DRILLING METHODS TO SUPPORT THE SIDES OF THE DRILLHOLE.

D. THE CONTRACTOR SHALL IMMEDIATELY SUSPEND DRILLING OPERATIONS IF GROUND SUBSIDENCE IS OBSERVED, IF THE SOIL NAIL WALL IS ADVERSELY AFFECTED, OR IF ADJACENT STRUCTURES ARE DAMAGED AS A RESULT OF THE DRILLING OPERATION. THE ADVERSE CONDITIONS SHALL BE STABILIZED IMMEDIATELY AND THE ENGINEER SHALL BE NOTIFIED OF SUCH CONDITIONS WITHIN 24 HOURS.

E. NAIL BARS SHALL BE INSERTED INTO THE DRILLHOLE TO THE REQUIRED LENGTH WITHOUT DIFFICULTY AND IN SUCH A MANNER AS TO PREVENT DAMAGE TO THE DRILLHOLE. NAIL BARS THAT CANNOT BE FULLY INSERTED TO THE DESIGN DEPTH SHALL BE REMOVED FROM THE DRILLHOLE AND THE DRILLHOLE SHALL BE CLEANED SUFFICIENTLY TO ALLOW UNOBSTRUCTED INSTALLATION OF THE BAR.

F. IF THE NAIL BAR IS INSTALLED USING CASED OR AUGERCAST METHODS, CENTRALIZERS ARE NOT REQUIRED PROVIDED THE INSTALLATION METHOD ENSURES THAT THE BAR WILL REMAIN IN THE CENTRAL PORTION OF THE GROUT. IN SUCH SITUATIONS, SLUMP SHALL NOT EXCEED 8 INCHES.

5.4 NAIL GROUTING

A. GROUT EQUIPMENT SHALL PRODUCE A UNIFORMLY MIXED GROUT FREE OF LUMPY AND UNDISPERSED CEMENT. A POSITIVE DISPLACEMENT GROUT PUMP SHALL BE USED. THE PUMP SHALL BE EQUIPPED WITH A PRESSURE GAUGE THAT CAN MEASURE AT LEAST TWICE BUT NO MORE THAN THREE TIMES THE INTENDED GROUT PRESSURE. THE GROUTING EQUIPMENT SHALL BE SIZED TO ENABLE THE ENTIRE NAIL TO BE GROUTED IN ONE CONTINUOUS OPERATION. THE MIXER SHALL BE CAPABLE OF CONTINUOUSLY AGITATING THE GROUT DURING USAGE.

B. UNCASED DRILLHOLES SHALL BE GROUTED AFTER INSTALLATION OF THE NAIL BAR. GROUTING PRIOR TO INSERTION OF THE NAIL BAR MAY BE ALLOWED PROVIDED NEAT CEMENT GROUT IS USED AND THE NAIL BAR IS IMMEDIATELY INSERTED THROUGH THE GROUT TO THE SPECIFIED LENGTH WITHOUT DIFFICULTY. NO PORTION OF THE NAIL HOLE SHALL BE LEFT OPEN FOR MORE THAN 1 HOUR PRIOR TO GROUTING UNLESS APPROVED OTHERWISE BY THE ENGINEER. THE GROUT SHALL BE INJECTED AT THE LOWEST POINT OF EACH DRILLHOLE THROUGH A TREMIE PIPE, HOLLOW-STEM AUGER, OR DRILL RODS WITH THE DRILLHOLE FILLED IN ONE CONTINUOUS OPERATION. COLD JOINTS IN THE GROUT PLACEMENT ARE ALLOWED FOR CONSTRUCTION OF TEST NAILS. THE CONDUIT DELIVERING THE GROUT SHALL BE KEPT BELOW THE SURFACE OF THE GROUT AS THE CONDUIT IS WITHDRAWN. THE GROUTING CONDUIT SHALL BE WITHDRAWN AS THE NAIL HOLE IS FILLED IN A MANNER WHICH PREVENTS THE CREATION OF VOIDS. THE QUANTITY OF GROUT AND THE GROUTING PRESSURES SHALL BE RECORDED FOR EACH SOIL NAIL. GROUT PRESSURES SHALL BE CONTROLLED TO PREVENT EXCESSIVE GROUND HEAVE OR FRACTURING.

C. DURING CASING REMOVAL FOR DRILLHOLES ADVANCED BY EITHER CASED OR AUGERCAST METHODS, THE GROUT SURFACE WITHIN THE CASING SHALL BE CONTINUALLY MONITORED FOR MAINTENANCE OF "HEAD" SUFFICIENT TO OFFSET THE EXTERNAL GROUNDWATER/SOIL PRESSURE.

D. NAIL GROUT SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI IN 3 DAYS AND 3000 PSI IN 28 DAYS. NAIL GROUT SHALL BE TESTED BY A TESTING AGENCY UNDER CONTRACT WITH THE OWNER IN ACCORDANCE WITH ASTM C109 / AASHTO T106 AT A FREQUENCY OF NO LESS THAN ONE TEST FOR EVERY 50 CUBIC YARDS OF GROUT PLACED OR ONCE PER WEEK, WHICHEVER IS FIRST.

E. TEMPORARY UNBONDED LENGTHS SHALL BE PROVIDED FOR EACH TEST NAIL. THE TEST NAIL BAR SHALL BE ISOLATED FROM THE WALL FACING AND THE REACTION FRAME DURING TESTING. SATISFACTORY TEST NAILS MAY BE INCORPORATED IN THE WORK PROVIDED THE TEMPORARY TEST UNBONDED LENGTH IS FULLY GROUTED SUBSEQUENT TO TESTING.

5.5 NAIL TOLERANCES

A. FOR THIS PROJECT, THE UTILITY CLEARANCES ARE CRITICAL. SO THERE ARE NO TOLERANCES ALLOWED FOR THE SOIL NAILS. THEY MUST BE INSTALLED AT THE LOCATION AND ANGLES SHOWN ON THE PLANS WITHOUT EXCEPTION. ANY PROPOSED CHANGES MUST BE APPROVED BY GROUND SUPPORT AFTER CAREFUL REVIEW OF THE UTILITY CLEARANCES.

5.6 NAIL TESTING

5.6.1 GENERAL

A. VERIFICATION TESTS SHALL BE PERFORMED AT THE LOCATIONS SELECTED BY THE CONTRACTOR AND APPROVED BY THE ENGINEER. PROOF TESTS SHALL BE PERFORMED AT THE LOCATIONS SELECTED BY THE OWNER'S REPRESENTATIVE. ALL TEST DATA SHALL BE RECORDED BY THE OWNER'S REPRESENTATIVE, UNLESS APPROVED OTHERWISE. PULLOUT TESTING OF NAILS SHALL NOT BE PERFORMED UNTIL THE NAIL GROUT AND WALL FACING HAVE ATTAINED AT LEAST 50 PERCENT OF THEIR SPECIFIED 28-DAY COMPRESSIVE STRENGTHS.

B. WHERE TEMPORARY CASING OF THE UNBONDED LENGTH OF TEST NAILS IS PROVIDED, THE CASING SHALL BE INSTALLED TO PREVENT ANY REACTION BETWEEN THE CASING AND THE GROUTED BOND LENGTH OF THE NAIL AND/OR THE STRESSING APPARATUS.

C. TESTING EQUIPMENT SHALL INCLUDE TWO DIAL GAUGES, A DIAL GAUGE SUPPORT, JACK AND PRESSURE GAUGE, A PUMP, AND A REACTION FRAME.

D. A MINIMUM OF TWO DIAL GAUGES CAPABLE OF MEASURING TO 0.001-INCH SHALL BE AVAILABLE AT THE SITE TO MEASURE THE NAIL MOVEMENT. THE DIAL GAUGES SHALL BE ALIGNED WITHIN 5 DEGREES OF THE AXIS OF THE NAIL AND SHALL BE SUPPORTED INDEPENDENT OF THE JACKING SETUP AND THE WALL. A HYDRAULIC JACK, PRESSURE GAUGE, AND PUMP SHALL BE USED TO APPLY AND MEASURE THE TEST LOAD.

E. THE JACK AND PRESSURE GAUGE SHALL BE CALIBRATED BY AN INDEPENDENT TESTING LABORATORY AS A UNIT. THE PRESSURE GAUGE SHALL BE GRADUATED IN 100 PSI INCREMENTS OR LESS AND SHALL HAVE A RANGE NOT EXCEEDING TWICE THE ANTICIPATED MAXIMUM PRESSURE DURING TESTING UNLESS APPROVED OTHERWISE BY THE ENGINEER. THE RAM TRAVEL OF THE JACK SHALL BE SUFFICIENT TO ENABLE THE TEST TO BE PERFORMED WITHOUT RESETTING THE JACK.

F. THE JACK SHALL BE INDEPENDENTLY SUPPORTED AND CENTERED OVER THE NAIL SO THAT THE NAIL DOES NOT CARRY THE WEIGHT OF THE JACK. THE STRESSING EQUIPMENT SHALL BE PLACED OVER THE NAIL IN SUCH A MANNER THAT THE JACK, BEARING PLATES, AND STRESSING ANCHORAGE ARE IN ALIGNMENT. THE JACK SHALL BE POSITIONED AT THE BEGINNING OF THE TEST SUCH THAT UNLOADING AND REPOSITIONING OF THE JACK DURING THE TEST WILL NOT BE REQUIRED.

G. THE TEST REACTION FRAME SHALL BE SUFFICIENTLY RIGID AND OF ADEQUATE DIMENSION SUCH THAT EXCESSIVE DEFORMATION OF THE TEST APPARATUS REQUIRING REPOSITIONING OF ANY COMPONENTS DOES NOT OCCUR DURING TESTING. WHERE THE REACTION FRAME BEARS DIRECTLY ON THE WALL, THE REACTION FRAME SHALL BE DESIGNED TO PREVENT DAMAGE OR CRACKING OF THE WALL FACING.

5.6.2 VERIFICATION TESTING OF SACRIFICIAL NAILS

A. VERIFICATION TESTING IN EACH SOIL UNIT SHALL BE PERFORMED IN THAT UNIT TO VERIFY THE CONTRACTOR'S INSTALLATION METHODS, NAIL PULLOUT CAPACITY, AND DESIGN ASSUMPTIONS. THE NAILS USED FOR THE VERIFICATION TESTS MAY BE INCORPORATED AS PRODUCTION NAILS. PAYMENT FOR ADDITIONAL VERIFICATION TEST NAILS REQUIRED DUE TO DIFFERING SITE CONDITIONS, AS DETERMINED BY THE ENGINEER, SHALL BE PER THE CONTRACT UNIT PRICE.

B. TEST NAILS SHALL BE CONSTRUCTED USING THE SAME EQUIPMENT, METHODS, AND HOLE DIAMETER AS PLANNED FOR THE PRODUCTION NAILS. CHANGES IN THE DRILLING OR INSTALLATION METHOD MAY REQUIRE ADDITIONAL NAIL TESTING AS DETERMINED BY THE ENGINEER.

C. THE UNBONDED LENGTH OF TEST NAILS SHALL BE AT LEAST 3 FEET UNLESS APPROVED OTHERWISE BY THE ENGINEER. THE BOND LENGTH OF TEST NAILS SHALL BE DETERMINED BY THE OWNER'S REPRESENTATIVE SUCH THAT THE ALLOWABLE BAR LOAD IS NOT EXCEEDED BUT SHALL NOT BE LESS THAN 10 FEET. THE BAR LOAD DURING TESTING SHALL NOT EXCEED 80% OF THE STEEL ULTIMATE STRENGTH FOR GRADE 150 BARS OR 90% OF THE STEEL YIELD STRENGTH FOR GRADE 60 AND GRADE 75 BARS.

D. THE DESIGN TEST LOAD (DTL) DURING TESTING SHALL BE DETERMINED BY MULTIPLYING THE BOND LENGTH OF THE NAIL TIMES THE DESIGN PULLOUT RESISTANCE. VERIFICATION TEST NAILS SHALL BE INCREMENTALLY LOADED AND UNLOADED IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

LOAD	HOLD TIME
AL	1 MINUTE
0.25DL	10 MINUTES
0.50DL	10 MINUTES
0.75DL	10 MINUTES
1.00DL	10 MINUTES
1.25DL	10 MINUTES
1.50DL	60 MINUTES
1.75DL	10 MINUTES
2.00DL	10 MINUTES

E. THE ALIGNMENT LOAD (AL) SHOULD BE THE MINIMUM LOAD REQUIRED TO ALIGN THE TESTING APPARATUS AND SHOULD NOT EXCEED 0.05DTL. DIAL GAUGES SHOULD BE ZEROED AFTER THE ALIGNMENT LOAD IS APPLIED.

F. EACH LOAD INCREMENT SHALL BE HELD FOR AT LEAST 10 MINUTES. THE VERIFICATION TEST NAIL SHALL BE MONITORED FOR CREEP FOR 60 MINUTES AT THE 1.50 DTL LOAD INCREMENT. NAIL MOVEMENTS DURING THE CREEP PORTION OF THE TEST SHALL BE MEASURED AND RECORDED AT 1, 2, 3, 5, 6, 10, 20, 30, 50, AND 60 MINUTES.

5.6.3 PROOF TESTING OF PRODUCTION NAILS

A. PROOF TESTING SHALL BE PERFORMED ON APPROXIMATELY 5 PERCENT OF THE PRODUCTION NAILS AS DETERMINED BY THE OWNER'S REPRESENTATIVE. IF NAIL INSTALLATION METHODS ARE SUBSTANDARD ON ANY PARTICULAR NAIL OR SERIES OF NAILS, ADDITIONAL TESTS MAY BE REQUIRED.

B. THE UNBONDED LENGTH OF TEST NAILS SHALL BE AT LEAST 3 FEET UNLESS APPROVED OTHERWISE BY THE ENGINEER. THE BOND LENGTH OF TEST NAILS SHALL BE DETERMINED BY THE OWNER'S REPRESENTATIVE SUCH THAT THE ALLOWABLE BAR LOAD IS NOT EXCEEDED BUT SHALL NOT BE LESS THAN 10 FEET. THE BAR LOAD DURING TESTING SHALL NOT EXCEED 80% OF THE STEEL ULTIMATE STRENGTH FOR GRADE 150 BARS OR 90% OF THE STEEL YIELD STRENGTH FOR GRADE 60 AND GRADE 75 BARS.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

CHRIS J. WOLSCHLAG
STATE OF WASHINGTON
34487
REGISTERED
PROFESSIONAL ENGINEER
8/22/22

ARE 816 MERCER

CAMPUS

SHORING PERMIT – CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE

PROJECT ARCHITECT: NBBJ

PROJECT NUMBER: #20-46

SHEET NAME: TEMPORARY SHORING WALL SPECIFICATIONS

SHEET NUMBER: SH7.0

C. PROOF TEST NAILS SHALL BE INCREMENTALLY LOADED IN 0.25DTL INCREMENTS TO A MAXIMUM LOAD OF 1.50DTL IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:

AL	1.00DL
0.25DL	1.25DL
0.50DL	1.50DL
0.75DL	

D. THE ALIGNMENT LOAD (AL) SHOULD BE THE MINIMUM LOAD REQUIRED TO ALIGN THE TESTING APPARATUS AND SHOULD NOT EXCEED 0.05DTL. DIAL GAUGES SHOULD BE ZEROED AFTER THE ALIGNMENT LOAD IS APPLIED.

E. DEPENDING ON PERFORMANCE, EITHER A 10 MINUTE OR 60 MINUTE CREEP TEST SHALL BE PERFORMED AT 1.50DTL. NAIL MOVEMENT SHALL BE MEASURED AND RECORDED AT 1, 2, 3, 5, 6, AND 10 MINUTES. WHERE THE NAIL MOVEMENT BETWEEN 1 MINUTE AND 10 MINUTES EXCEEDS 0.04 INCHES, THE MAXIMUM TEST LOAD SHALL BE MAINTAINED AN ADDITIONAL 50 MINUTES AND MOVEMENTS SHALL BE RECORDED AT 20, 30, 50, AND 60 MINUTES.

9.6.4 TEST NAIL ACCEPTANCE

A. A TEST NAIL SHALL BE CONSIDERED ACCEPTABLE WHEN:

1. FOR VERIFICATION TESTS, A CREEP RATE LESS THAN 0.08 INCHES PER LOG CYCLE OF TIME BETWEEN THE 6 AND 60 MINUTE READINGS IS OBSERVED DURING CREEP TESTING, AND THE RATE IS LINEAR OR DECREASING THROUGHOUT THE CREEP TEST LOAD HOLD PERIOD;
2. FOR PROOF TESTS, A CREEP RATE LESS THAN 0.04 INCHES PER LOG CYCLE OF TIME BETWEEN THE 1 AND 10 MINUTE READINGS IS OBSERVED OR A CREEP RATE LESS THAN 0.08 INCHES PER LOG CYCLE OF TIME BETWEEN THE 6 AND 60 MINUTE READINGS, AND THE CREEP RATE IS LINEAR OR DECREASING THROUGHOUT THE CREEP TEST LOAD HOLD PERIOD;
3. THE TOTAL MOVEMENT AT THE MAXIMUM TEST LOAD EXCEEDS 80% OF THE THEORETICAL ELASTIC ELONGATION OF THE UNBONDED LENGTH
4. A PULLOUT FAILURE DOES NOT OCCUR DURING TESTING. PULLOUT FAILURE IS DEFINED AS THE LOAD AT WHICH ATTEMPTS TO INCREASE THE TEST LOAD SIMPLY RESULT IN CONTINUED PULLOUT MOVEMENT OF THE TEST NAIL.

B. AT THE CONTRACTOR'S OPTION, SUCCESSFUL PROOF TEST NAILS MEETING THE ABOVE TEST ACCEPTANCE CRITERIA MAY BE INCORPORATED AS PRODUCTION NAILS PROVIDED THAT (1) THE UNBONDED TEST LENGTH OF THE NAIL HOLE HAS NOT COLLAPSED DURING TESTING, (2) THE MINIMUM REQUIRED HOLE DIAMETER HAS BEEN MAINTAINED, AND (3) THE TEST NAIL LENGTH AND BAR SIZE ARE EQUAL TO OR GREATER THAN THE SCHEDULED PRODUCTION NAIL LENGTH AND BAR SIZE. TEST NAILS MEETING THESE REQUIREMENTS SHALL BE COMPLETED BY SATISFACTORILY GROUTING THE DESIGNATED TEST LENGTH, MAINTAINING THE TEMPORARY UNBONDED TEST LENGTH FOR SUBSEQUENT GROUTING IS THE CONTRACTOR'S RESPONSIBILITY.

C. THE ENGINEER SHALL EVALUATE THE RESULTS OF EACH VERIFICATION TEST. NAIL INSTALLATION METHODS THAT DO NOT SATISFY THE NAIL TESTING REQUIREMENTS SHALL BE CONSIDERED INADEQUATE. THE CONTRACTOR SHALL PROPOSE ALTERNATIVE METHODS AND INSTALL REPLACEMENT VERIFICATION TEST NAILS.

D. THE ENGINEER MAY REQUIRE THAT THE CONTRACTOR REPLACE SOME OR ALL OF THE PRODUCTION NAILS REPRESENTED BY INADEQUATE PROOF TESTS.

6. TEMPORARY SHOTCRETE

6.1 GENERAL

A. ALL SHOTCRETE SHALL COMPLY WITH THE REQUIREMENTS OF ACI 506.2-95 EXCEPT AS SPECIFIED OTHERWISE HEREIN. THE OWNER SHALL CONTRACT AN INDEPENDENT TESTING LABORATORY TO CORE AND TEST SHOTCRETE PANELS AND INSPECT ALL SHOTCRETE AND STEEL REINFORCEMENT PLACEMENT IN ACCORDANCE WITH ACI 506.4R-94.

B. ALL WORKERS, INCLUDING FOREMAN, NOZZLEMEN, FINISHERS AND DELIVERY EQUIPMENT OPERATORS, SHALL BE FULLY QUALIFIED TO PERFORM THE WORK. QUALIFICATION OF THE NOZZLEMEN SHALL BE BASED ON THE RESULTS OF TEST PANELS AS REQUIRED HEREIN, UNLESS APPROVED OTHERWISE BY THE ENGINEER.

C. AT LEAST 15 DAYS PRIOR TO INITIATING THE WORK, THE CONTRACTOR SHALL SUBMIT THE FOLLOWING TO THE ENGINEER FOR REVIEW AND APPROVAL:

1. WRITTEN DOCUMENTATION OF THE NOZZLEMENS QUALIFICATIONS AND PROPOSED METHOD OF SHOTCRETE PLACEMENT.
2. SHOTCRETE MIX DESIGN INCLUDING: BRAND AND TYPE OF PORTLAND CEMENT, SOURCE, GRADATION, AND QUALITY OF AGGREGATES, MIX PROPORTIONS BY WEIGHT; PROPOSED ADMIXTURES AND THEIR MANUFACTURER, DOSAGE, AND TECHNICAL LITERATURE; AND COMPRESSIVE STRENGTH TEST RESULTS FROM THE SUPPLIER NO OLDER THAN 6 MONTHS VERIFYING THE 28-DAY COMPRESSIVE STRENGTH.
3. ONCE AVAILABLE, CERTIFIED MILL TESTS FOR ALL REINFORCING STEEL FROM EACH HEAT SPECIFYING THE MINIMUM ULTIMATE STRENGTH, YIELD STRENGTH, ELONGATION, AND COMPOSITION.
4. SPECIFICATION AND DATA FOR REVIEW ON EQUIPMENT PROPOSED FOR THE PROJECT INCLUDING SHOTCRETING AND COMPRESSED AIR EQUIPMENT, PROPOSED ACCESS ARRANGEMENTS, AND CAPACITIES.
5. METHODS OF CONTROLLING THE LOCATION OF THE FINISH FACE AND DETERMINING SHOTCRETE THICKNESS.

6.2 MATERIALS

A. ALL MATERIALS FOR SHOTCRETE SHALL CONFORM TO THE FOLLOWING REQUIREMENTS.

1. CEMENT SHALL CONFORM TO ASTM C150 / AASHTO M85, TYPE I.
2. FINE AGGREGATE SHALL CONFORM TO ASTM C33 / AASHTO M6.
3. COARSE AGGREGATE SHALL CONFORM TO AASHTO M-80, CLASS B.
4. WATER SHALL BE POTABLE, CLEAN, AND FREE FROM SUBSTANCES DELETERIOUS TO CONCRETE AND STEEL, OR THAT WOULD CAUSE STAINING.

5. ACCELERATOR SHALL BE THE FLUID TYPE, APPLIED AT NOZZLE, AND MEET THE REQUIREMENTS HEREIN.
6. WATER-REDUCER AND SUPER-PLASTICIZER SHALL CONFORM TO ASTM C494 / AASHTO M194, TYPE A, D, F, G.
7. AIR-ENTRAINING AGENT SHALL CONFORM TO ASTM C260 / AASHTO M154.
8. FLY ASH SHALL CONFORM TO ASTM C618 / AASHTO M295, TYPE F OR G. CEMENT REPLACEMENT UP TO 35% BY WEIGHT OF CEMENT.
9. SILICA FUME SHALL CONFORM TO ASTM C1240, 90% MINIMUM SILICON DIOXIDE SOLIDS CONTENT, NOT TO EXCEED 12% BY WEIGHT OF CEMENT.
10. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185 / AASHTO M55.
11. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615 / AASHTO M31, GRADE 60. ALL REINFORCING STEEL DETAILS SHALL CONFORM TO ACI 315.
12. CURING COMPOUNDS SHALL CONFORM TO AASHTO M148, TYPE 1D OR TYPE 2.
13. FILM PROTECTION FOR CURING SHALL CONFORM TO AASHTO M171 OR POLYETHYLENE FILM.

B. SHOTCRETE ADMIXTURES SHALL NOT BE USED UNLESS APPROVED BY THE ENGINEER. ADMIXTURES USED TO ENTRAIN AIR, TO REDUCE WATER-CEMENT RATIO, TO RETARD OR ACCELERATE SETTING TIME, OR TO ACCELERATE THE DEVELOPMENT OF STRENGTH, SHALL BE THOROUGHLY MIXED INTO THE SHOTCRETE AT THE RATE SPECIFIED BY THE MANUFACTURER UNLESS SPECIFIED OTHERWISE. ACCELERATING ADDITIVES SHALL BE COMPATIBLE WITH THE CEMENT USED. BE NON-CORROSIVE TO STEEL AND SHALL NOT PROMOTE OTHER DETRIMENTAL EFFECTS SUCH AS CRACKING OR EXCESSIVE SHRINKAGE. THE MAXIMUM ALLOWABLE CHLORIDE ION CONTENT OF ALL INGREDIENTS SHALL NOT EXCEED 0.10 PERCENT WHEN TESTED PER AASHTO T260.

C. MATERIALS SHALL BE DELIVERED, STORED AND HANDLED TO PREVENT CONTAMINATION, SEGREGATION, CORROSION OR DAMAGE. LIQUID ADMIXTURES SHALL BE STORED TO PREVENT EVAPORATION AND FREEZING.

D. AGGREGATES FOR SHOTCRETE SHALL MEET THE STRENGTH AND DURABILITY REQUIREMENT OF AASHTO M80 AND SHALL MEET THE FOLLOWING GRADATION REQUIREMENTS:

SIEVE SIZE	PERCENT PASSING BY WEIGHT	SIEVE SIZE	PERCENT PASSING BY WEIGHT
1/2 INCH	100	NO. 16	35-55
3/8 INCH	90-100	NO. 30	20-35
NO. 4	70-85	NO. 50	8-20
NO. 8	50-70	NO. 100	2-10

E. CEMENT CONTENT SHALL BE AT LEAST 600 POUNDS PER CUBIC YARD. THE WATER REQUIREMENT SHALL NOT BE GREATER THAN 0.45. FOR WET-MIX SHOTCRETE EXPOSED TO FREEZING AND THAWING, THE AIR CONTENT AT THE TRUCK SHALL BE BETWEEN 7 TO 10 PERCENT WHEN TESTED IN ACCORDANCE WITH ASTM C231 / AASHTO T152.

F. SHOTCRETE SHALL BE PROPORTIONED TO ATTAIN A COMPRESSIVE STRENGTH OF 2000 PSI IN 3 DAYS AND 4000 PSI IN 28 DAYS. THE AVERAGE COMPRESSIVE STRENGTH OF EACH SET OF THREE CORES EXTRACTED FROM TEST PANELS OR WALL FACE MUST BE EQUAL TO OR EXCEED 85%, WITH NO INDIVIDUAL CORE LESS THAN 75% OF THE SPECIFIED COMPRESSIVE STRENGTH IN ACCORDANCE WITH ACI 506.2.

G. AGGREGATE AND CEMENT MAY BE BATCHED BY WEIGHT OR BY VOLUME IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM C94 / AASHTO M157. MIXING EQUIPMENT SHALL BE CAPABLE OF THOROUGHLY MIXING THE MATERIALS IN SUFFICIENT QUANTITY TO MAINTAIN PLACING CONTINUITY. READY-MIX SHOTCRETE SHALL BE DELIVERED AND PLACED WITHIN 1-1/2 HOURS OF THE BATCH TIME UNLESS APPROVED OTHERWISE BY THE ENGINEER.

6.3 PRODUCTION TEST PANELS

A. PRODUCTION TEST PANELS SHALL NOT BE DISTURBED OR MOVED WITHIN THE FIRST 24 HOURS AFTER SHOOTING. SHOTCRETING AND CORING OF TEST PANELS SHALL BE PERFORMED BY QUALIFIED PERSONNEL IN THE PRESENCE OF THE OWNER'S REPRESENTATIVE.

B. THE CONTRACTOR SHALL FURNISH AT LEAST ONE PRODUCTION TEST PANEL OR, IN LIEU OF PRODUCTION TEST PANELS, SIX 3-INCH DIAMETER CORES FROM THE SHOTCRETE FACE DURING THE FIRST APPLICATION OF SHOTCRETE AND HENCEFORTH FOR EVERY FIFTH APPLICATION OF SHOTCRETE, OR EVERY 3000 SQUARE FEET, OR 50 CUBIC YARDS OF SHOTCRETE PLACED, WHICHEVER IS LESS. THE PRODUCTION TEST PANELS SHALL BE CONSTRUCTED SIMULTANEOUSLY WITH THE SHOTCRETE FACING INSTALLATION AT TIMES DESIGNATED BY THE OWNER'S REPRESENTATIVE. THE PRODUCTION TEST PANELS SHALL HAVE MINIMUM DIMENSIONS OF 18 INCHES X 18 INCHES X 6 INCHES.

C. SHOTCRETE WILL BE ACCEPTED BASED ON THE 28-DAY STRENGTH OF CORES TAKEN FROM THE PRODUCTION TEST PANELS. THE FREQUENCY SPECIFIED FOR THE PRODUCTION TEST PANELS IS APPROXIMATE. A GREATER NUMBER OF PANELS MAY BE REQUIRED BY THE ENGINEER.

D. AT LEAST SIX CORES WILL BE CUT FROM EACH PRODUCTION TEST PANEL FOR COMPRESSIVE STRENGTH TESTING. CORES SHALL BE SOAKED IN WATER FOR AT LEAST 40 HOURS IN ACCORDANCE WITH AASHTO T24 OR ACI 506.2. CORES SHALL BE AT LEAST 3 INCHES IN DIAMETER AND SHALL HAVE A MINIMUM LENGTH TO DIAMETER RATIO OF ONE. WHEN THE LENGTH OF A CORE IS LESS THAN TWICE THE DIAMETER, APPLY THE CORRECTION FACTORS GIVEN IN ASTM C42 TO OBTAIN THE COMPRESSIVE STRENGTH OF INDIVIDUAL CORES. THREE CORES SHALL BE TESTED AT 3-DAYS, AND THREE CORES SHALL BE TESTED AT 28-DAYS FOR COMPRESSIVE STRENGTH. CORE HOLES IN THE WALL SHALL BE FILLED WITH PATCHING MORTAR AFTER CLEANING AND THOROUGH DAMPENING.

6.4 EXECUTION OF PRODUCTION SHOTCRETE WORK

6.4.1 ALIGNMENT CONTROL

A. ALIGNMENT WIRES AND/OR THICKNESS CONTROL PINS SHALL BE PROVIDED AS NECESSARY TO ESTABLISH AND MAINTAIN THE MINIMUM SHOTCRETE THICKNESS SHOWN ON THE PLANS. THE MAXIMUM DISTANCE BETWEEN THE WIRES AND/OR THICKNESS CONTROL PINS ON ANY SURFACE SHALL BE EQUAL TO THE VERTICAL NAIL SPACING. THE CONTRACTOR SHALL ENSURE THAT ALIGNMENT WIRES ARE TIGHT, TRUE TO LINE, AND PLACED TO ALLOW FURTHER TIGHTENING.

6.4.2 SURFACE PREPARATION

A. PRIOR TO SHOTCRETING THE UNGROUTED ZONE ABOVE THE NAIL GROUT AT THE EXCAVATION CUT FACE (BIRDS BEAK), THE CONTRACTOR SHALL REMOVE ALL LOOSE MATERIALS FROM THE SURFACE OF THE GROUT.

B. THE CONTRACTOR SHALL REMOVE ALL LOOSE MATERIALS AND LOOSE DRIED SHOTCRETE FROM PREVIOUS PLACEMENT OPERATIONS AND FROM ALL RECEIVING SURFACES BY METHODS ACCEPTABLE TO THE OWNER'S REPRESENTATIVE. THE REMOVAL SHALL BE ACCOMPLISHED IN SUCH A MANNER AS NOT TO LOOSEN, CRACK, OR SHATTER THE SURFACES TO RECEIVE THE SHOTCRETE. ANY SURFACE MATERIAL THAT, IN THE OPINION OF THE OWNER'S REPRESENTATIVE, IS SO LOOSENED OR DAMAGED SHALL BE REMOVED TO SUFFICIENT DEPTH TO PROVIDE A BASE THAT IS SUITABLE TO RECEIVE THE SHOTCRETE. MATERIAL THAT LOOSENS AS THE SHOTCRETE IS APPLIED SHALL BE REMOVED. SHOTCRETE SHALL NOT BE PLACED ON FROZEN SURFACES.

6.4.3 DELIVERY AND APPLICATION

A. A CLEAN, DRY, OIL-FREE SUPPLY OF COMPRESSED AIR SUFFICIENT FOR MAINTAINING ADEQUATE NOZZLE VELOCITY FOR ALL PARTS OF THE WORK AND FOR SIMULTANEOUS OPERATION OF A BLOW PIPE FOR CLEANING AWAY REBOUND SHALL BE MAINTAINED AT ALL TIMES. THE EQUIPMENT SHALL BE CAPABLE OF DELIVERING THE PREMIXED MATERIAL ACCURATELY, UNIFORMLY, AND CONTINUOUSLY THROUGH THE DELIVERY HOSE.

B. THE SHOTCRETE SHALL BE APPLIED FROM THE LOWER PART OF THE WORK AREA UPWARDS TO PREVENT ACCUMULATION OF REBOUND ON UNCOVERED SURFACES. THICKNESS, METHODS OF SUPPORT, AIR PRESSURE, AND RATE OF PLACEMENT OF SHOTCRETE SHALL BE CONTROLLED TO PREVENT SAGGING OR SLOUGHING OF FRESHLY APPLIED SHOTCRETE. WHERE SHOTCRETE IS USED TO FILL THE BIRD'S BEAK, THE NOZZLE SHALL BE POSITIONED INTO THE MOUTH OF THE DRILLHOLE TO COMPLETELY FILL THE VOID. REBOUND SHALL NOT BE WORKED BACK INTO THE PLACEMENT NOR SHALL THE REBOUND BE SALVAGED. REBOUND THAT DOES NOT FALL CLEAR OF THE WORKING AREA SHALL BE REMOVED. THE NOZZLE SHALL BE HELD AT A DISTANCE AND AT AN ANGLE APPROXIMATELY PERPENDICULAR TO THE WORKING FACE SO THAT REBOUND WILL BE MINIMAL AND COMPACTION WILL BE MAXIMIZED. THE NOZZLE SHOULD BE ROTATED STEADILY IN A SMALL CIRCULAR PATTERN.

C. SHOTCRETE PLACEMENT SHALL BE BY THE BENCH GUNNING METHOD WHEN THE THICKNESS OF THE SHOTCRETE LAYER IS 6 INCHES OR GREATER. THE GUNNING METHOD SHALL CONSIST OF BUILDING UP A THICK LAYER OF SHOTCRETE FROM THE BOTTOM OF THE LIFT AND MAINTAINING THE TOP SURFACE AT APPROXIMATELY A 45-DEGREE SLOPE.

6.4.4 VISUAL OBSERVATION

A. A CLEARLY DEFINED PATTERN OF CONTINUOUS HORIZONTAL OR VERTICAL RIDGES OR DEPRESSIONS AT THE REINFORCING ELEMENTS AFTER THEY ARE COVERED WILL BE CONSIDERED INDICATION OF INSUFFICIENT COVER OF REINFORCEMENT OR POOR APPLICATION AND PROBABLE VOID. IN THIS CASE, THE WORK SHALL BE IMMEDIATELY SUSPENDED AND THE WORK CAREFULLY INSPECTED BY THE OWNER'S REPRESENTATIVE. THE CONTRACTOR SHALL IMPLEMENT AND COMPLETE CORRECTIVE MEASURES PRIOR TO RESUMING THE SHOTCRETE OPERATIONS.

B. THE SHOTCRETING PROCEDURE MAY BE CORRECTED BY ADJUSTING THE NOZZLE DISTANCE AND ORIENTATION PERPENDICULAR TO THE SURFACE, ADJUSTING THE WATER CONTENT OF THE SHOTCRETE MIX, OR OTHER MEANS ACCEPTABLE TO THE OWNER'S REPRESENTATIVE. ALL OVERSPRAY AND REBOUND SHALL BE REMOVED FROM THE SURFACE.

C. SURFACE DEFECTS SHALL BE REPAIRED AS SOON AS POSSIBLE AFTER INITIAL PLACEMENT OF SHOTCRETE. ALL SHOTCRETE THAT LACKS UNIFORMITY, EXHIBITS SEGREGATION, SAGGING, HONEYCOMBING, OR LAMINATION, OR CONTAINS ANY VOIDS OR SAND POCKETS SHALL BE REMOVED AND REPLACED WITH FRESH SHOTCRETE BY THE CONTRACTOR TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE.

6.4.5 ATTACHMENT OF THE NAIL HEAD CONNECTION HARDWARE

A. FOR BEARING PLATE CONNECTIONS, THE PLATE SHALL BE WET-SET WHILE THE SHOTCRETE IS PLASTIC TO ASSURE FULL SHOTCRETE BEARING BEHIND THE PLATE. HOWEVER, THE RETENTION NUT SHALL ONLY BE HAND TIGHTENED SUCH THAT FULL BEARING IS ACHIEVED WITHOUT EXCESSIVELY SQUEEZING FRESH SHOTCRETE OUT FROM UNDER THE PLATE.

6.4.6 CONSTRUCTION JOINTS

A. CONSTRUCTION JOINTS SHALL BE TAPERED TOWARD THE EXCAVATION FACE OVER A MINIMUM DISTANCE EQUAL TO THE THICKNESS OF THE SHOTCRETE LAYER. THE SURFACE OF THE JOINTS SHALL BE ROUGH AND CLEANED OF ALL LAITANCE AND FOREIGN SUBSTANCES PRIOR TO SHOTCRETE PLACEMENT.

6.4.7 FINISHING AND CURING REQUIREMENTS

A. TEMPORARY SHOTCRETE MAY BE LEFT WITH AN AS-SHOT GUN FINISH.

B. THERE ARE NO SPECIFIC CURING REQUIREMENTS FOR TEMPORARY SHOTCRETE.

6.4.8 WEATHER LIMITATIONS

A. SHOTCRETE SHALL NOT BE PLACED IN COLD WEATHER UNLESS ADEQUATELY PROTECTED WHEN THE AMBIENT TEMPERATURE IS BELOW 40° F AND FALLING AND/OR WHEN THE SHOTCRETE IS LIKELY TO BE SUBJECTED TO FREEZING TEMPERATURES BEFORE REACHING A MINIMUM STRENGTH OF 750 PSI. COLD WEATHER PROTECTION SHALL BE MAINTAINED UNTIL THE STRENGTH OF THE SHOTCRETE IS GREATER THAN 750 PSI. COLD WEATHER PROTECTION SHALL INCLUDE HEATING UNDER TENTS, BLANKETS OR OTHER MEANS ACCEPTABLE TO THE OWNER'S REPRESENTATIVE. THE TEMPERATURE OF THE SHOTCRETE, WHEN DEPOSITED, SHALL BE NOT LESS THAN 50° F NOR MORE THAN 80° F. THE AIR IN CONTACT WITH SHOTCRETE SURFACES SHALL BE MAINTAINED AT TEMPERATURES ABOVE 32° F FOR A MINIMUM OF 7 DAYS.

B. SHOTCRETE APPLICATION SHALL ALSO BE SUSPENDED DURING HIGH WINDS AND HEAVY RAINS WHEN IN THE OPINION OF THE OWNER'S REPRESENTATIVE THE QUALITY OF THE APPLICATION IS NOT ACCEPTABLE. NEWLY-PLACED SHOTCRETE EXPOSED TO RAIN THAT WASHES OUT CEMENT OR OTHERWISE MAKES THE SHOTCRETE UNACCEPTABLE TO THE OWNER'S REPRESENTATIVE SHALL BE REMOVED AND REPLACED. THE CONTRACTOR SHALL PROVIDE ADEQUATELY SECURED POLYETHYLENE SHEETING OR EQUIVALENT WHEN ADVERSE EXPOSURE TO WEATHER IS ANTICIPATED.

6.4.9 TOLERANCES

A. THE TOLERANCES FOR SHOTCRETE FACINGS SHALL BE AS FOLLOWS:

1. THE VERTICAL LOCATION OF A HORIZONTAL SHOTCRETE JOINT SHALL BE WITHIN 1 FOOT OF THE ELEVATION SHOWN ON THE PLANS.
2. THE SHOTCRETE WALL THICKNESS SHALL BE NO LESS THAN THAT SHOWN ON THE PLANS MINUS 0.5 INCHES.
3. THE HORIZONTAL AND VERTICAL LOCATIONS OF REINFORCING BARS SHALL BE WITHIN 1 INCH OF THE LOCATIONS SHOWN ON THE PLANS.
4. REINFORCING BAR LAP LENGTHS SHALL BE NO LESS THAN THAT SHOWN ON THE PLANS MINUS 1 INCH.
5. REINFORCING BAR SPACING SHALL NOT EXCEED THAT SHOWN ON THE PLANS PLUS 1 INCH.

7. NAIL HEAD CONNECTION HARDWARE

A. DEPENDING ON THE CONNECTION DETAIL SHOWN ON THE PLANS, THE NAIL HEAD CONNECTION HARDWARE MAY CONSIST OF ONE OR MORE OF THE FOLLOWING: EMBEDDED OR BEARING STEEL PLATES PER ASTM A709 / AASHTO M270, GRADE 36; NUTS & WASHERS PER AASHTO M291, GRADE B; HEXAGONAL FITTED WITH BEVELED WASHER OR SPHERICAL SEAT TO PROVIDE UNIFORM BEARING; AND HEADED STUDS PER ASTM A307 OR APPROVED EQUAL.

B. STEEL PLATE DIMENSIONS SHALL BE WITHIN 0.25 INCHES OF THAT SHOWN ON THE PLANS. HEADED STUDS SHALL BE LOCATED ON THE PLATES WITHIN 0.25 INCHES OF THAT SHOWN ON THE PLANS.

nbbj

OWNER
800 MERCER LLC
26 N EUCLID AVENUE
PASADENA, CA 91101
206.408.1550

ARCHITECT
NBBJ
223 YALE AVE N
SEATTLE, WA 98109
206.223.5555

CONTRACTOR
HOWARD S WRIGHT CONSTRUCTION
415 1ST AVE N #400
SEATTLE, WA 98109
206.447.7715

GS
Ground Support PLLC
16932 Woodinville Redmond Rd NE, #210
Woodinville, WA 98072
Ph: (425) 922-1501

8/22/22

ARE
816
MERCER

CAMPUS

SHORING PERMIT –
CYCLE 3 RESPONSE

8/22/2022

REVISIONS

MARK	DATE	DESCRIPTION
1	6/25/2021	COMMENT RESPONSE
2	1/21/2022	COMMENT RESPONSE
3	8/22/2022	COMMENT RESPONSE

SCALE: NONE
PROJECT ARCHITECT: NBBJ
PROJECT NUMBER: ~~#20-48~~62-CN

SHEET NAME
TEMPORARY SHORING WALL SPECIFICATIONS

SHEET NUMBER
SH7.1

APPENDIX H
Groundwater Control Plan

Groundwater Control Plan
800 Mercer Street
Seattle, Washington

August 23, 2021

Revised: May 15, 2023

Prepared for

Malcolm Drilling Company, Inc.

8701 South 192nd Street

Kent, WA 98031

MIDDOUR CONSULTING LLC

14241 NE Woodinville Duvall Rd, PMB 226
Woodinville, WA 98072
(425) 864-2719

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LIST OF FIGURES

INTRODUCTION

This Groundwater Control Plan (GWCP) has been prepared by Middour Consulting LLC for the exclusive use of Malcolm Drilling Company, Inc. (MDCI) for their proposed work on the 800 Mercer Street project in Seattle Washington. We understand that Howard S. Wright Construction (HSW) has subcontracted MDCI to provide shoring and dewatering services. Our understanding of the excavation and shoring methods is based on documents from the project team design consultants. We understand that temporary construction dewatering will be required to excavate, install the shoring system, and construct the foundation.

SITE AND PROJECT DESCRIPTION

The project site is located at 800 Mercer Street in the South Lake Union area of Seattle, Washington. The project site is bordered by Roy Street to the north, 9th Avenue N. to the east, Mercer Street to the south, and Dexter Avenue N. to the west. The site is currently occupied by gravel surface parking lots but was previously developed. The existing ground surface slopes down from about elevation 59 feet in the southwest corner to about elevation 38 feet in the northeast corner. As with most urban projects, buried utilities in the streets near the project site are anticipated.

The project consists of constructing a 13-story, two-tower, mixed-use development over a three- to four-level below-grade parking structure. The excavation for the parking structure will extend about 55 to 35 feet below existing grade and will be retained using solider pile and lagging, soil nails, and secant pile shoring methods in conjunction with tiebacks. The shoring system for the western two thirds of the excavation will predominately consist of soldier pile and lagging but the sections above the Mercer and Lake Union tunnels will be retained by soil nailing. The shoring system for about the eastern third of the excavation will consist of secant piles extending down to elevation -20 feet. For the purposes of this plan, the secant pile walls are considered watertight though the piles have some degree of permeability; no maximum hydraulic conductivity was specified in the shoring plans. The main excavation subgrade ranges from elevations 1.75 to 7.75 feet depending on location.

King County has buried combined sewer overflow (CSO) infrastructure near the project site. Two pipelines, identified as the Lake Union and Mercer Street tunnels, join at the CSO drop structure which is adjacent to the north central property line. The Lake Union and Mercer Street tunnels are located below

the proposed parking structure and will locally require additional drawdown beyond the proposed drawdown of 2 feet below the main excavation to counteract buoyancy. We understand the portion of the excavation proximate to the Mercer Street tunnel will need to have the groundwater level lowered down to at least elevation -6 feet. The Lake Union tunnel is deeper and smaller diameter than the Mercer Street tunnel and doesn't require additional drawdown.

The geotechnical and hydrogeological information for the project was provided in the December 16, 2020, Geotechnical Engineering Design Report prepared by Hart Crowser. Temporary shoring plans for the excavation were prepared by Ground Support. We understand the excavation is scheduled to begin in late 2023 / early 2024 and continuous construction dewatering will be required until enough structural weight of the building is constructed to counteract buoyancy.

SOIL AND GROUNDWATER CONDITIONS

The geotechnical report provides a discussion of the soil and groundwater conditions as determined from numerous soil borings performed by Hart Crowser and previous investigations. The soil borings were advanced about 30 to 150 feet below existing grade. The subsurface profiles in the geotechnical report (Figures 3 through 6) graphically depict the soil and groundwater conditions at the project site.

SOIL CONDITIONS

The soils vary considerably west to east across the project site. The western two thirds of the excavation will encounter fill soils and glacially consolidated granular soils whereas the eastern third of the excavation will encounter fill soils underlain by recent deposits consisting of fine-grained and granular soils. The recent deposits in the eastern third of the excavation are underlain by glacially consolidated granular soils but they occur below the excavation subgrade.

The fill soils encountered in the soil borings range from well compacted sand and gravel with varying amounts of silt to loose, silty sand to clean sand reclaimed from Lake Union along the eastern margins of the site. Depending on location, the fill soils were encountered to a depth of 20 to 25 feet below existing grade.

The recent deposits consist of fine-grained soils (silt and clay) and medium dense to dense clean to silty sands. The base of the fine-grained soils was encountered at about elevation 10 feet for most of

the east side of the site but dips down to about elevation 0 feet near the northeast corner of the site. The base of the recent granular soils was encountered between elevations -10 to -20 feet and these deposits also dip downward to about elevation -25 feet near the northeast corner of the site. With respect to groundwater control, the recent granular deposits are interpreted to be water bearing.

The glacially consolidated soils underlying the project site have been classified as glacial till which is underlain by very dense sand which we interpret to be like glacial outwash deposits. Glacial till was encountered below the fill soils for about the western two thirds of the site and appears to terminate at about elevations -20 to -45 feet in the two soil borings that explored below these elevations. The glacial till appears to dip steeply to the east in the eastern third of the site. The glacial till was not encountered until about elevations -10 to -20 feet and was only about 10 to 15 feet thick. The glacial till is very dense and consists of silty sand with gravel and variable layers of silt, gravel, and clean sand. Although groundwater was encountered within clean granular layers within the glacial till, the glacial till is not interpreted to be water bearing.

The outwash deposits underlying the glacial till are very dense and consist of silty to clean sand with variable gravel content. With respect to groundwater control, the outwash deposits are interpreted to be water bearing.

GROUNDWATER CONDITIONS

Groundwater levels measured in observation wells constructed in the various soil types varied considerably across the project site. Groundwater levels measured in observation wells with well screens constructed in glacial till ranged from about elevation 30 to 10 feet, about elevation 20 feet for well screens constructed in the outwash deposits, and about elevation 5 feet for well screens constructed in recent granular deposits.

Based on our experience in the South Lake Union area, groundwater in the recent granular soils forms an unconfined aquifer which in some locations is hydraulically connected to the permeable glacially consolidated granular soils where the glacial till and/or fine-grained soils are absent. The local groundwater table in the recent and glacially consolidated outwash deposits is likely around elevation 20 feet assuming no dewatering systems are active in the surrounding area.

SOIL HYDRAULIC PROPERTIES

The geotechnical investigation did not perform any on site testing to characterize the hydraulic properties of the unconfined aquifer soils. Hart Crowser performed twenty gradation tests on soil samples collected below the water table. We analyzed the gradation data by numerous methods to estimate the hydraulic conductivity of the aquifer soils. The geometric mean for the various estimation methods for each gradation test classified as a SM provided maximum and minimum hydraulic conductivities of $7.26x10^{-3}$ and $1.38x10^{-3}$ ft/min. Similarly, the geometric mean for the various estimation methods for each gradation test classified as glacial till (SM) provided maximum and minimum hydraulic conductivities of $8.25x10^{-3}$ and $4.39x10^{-4}$ ft/min. The geometric mean for the various estimation methods for each gradation test classified as a SP-SM, SP, SW-SM, or GW-GM provided maximum and minimum hydraulic conductivities of $5.94x10^{-2}$ and $2.01x10^{-2}$ ft/min. Based on our experience in the South Lake Union area, a hydraulic conductivity of $3.0x10^{-2}$ ft/min for the unconfined aquifer has been used in the design of numerous dewatering systems in the surrounding area.

CONCEPTUAL GROUNDWATER CONTROL APPROACH

Dewatering excavations or controlling groundwater proximate to excavations is typically performed by passive or active groundwater control measures. Passive measures such as sump pumping, and French drains passively allow water to drain by gravity from the surrounding soil to sumps or trenches constructed at a lower elevation. Water collected in the sumps/trenches is extracted by pumping to maintain a hydraulic low point or sink for continued drainage. Active groundwater control measures such as standard dewatering wells and vacuum wellpoint systems involve installing wells into the aquifer and/or water bearing layers prior to starting the excavation and pumping the wells to lower the groundwater level prior to excavating.

Determining the most appropriate groundwater control approach depends on multiple factors such as shoring methods, excavation size and shape, access limitations, aquifer properties, depth of excavation, and the amount of aquifer thickness beneath the excavation subgrade. With respect to groundwater control, the proposed excavation will encounter glacial till that contains saturated lenses and layers of clean sand in about the western two thirds of the excavation. The eastern third of the excavation will encounter an unconfined aquifer in the recent granular deposits with a maximum

groundwater elevation of about 20 feet. Based on the varying hydrogeologic conditions and the different shoring methods we have divided the excavation into two sections to discuss the different groundwater control approaches.

WEST EXCAVATION RETAINED BY SOLDIER PILE AND LAGGING

Most of the west excavation will be retained by solider pile and lagging which is permeable and will allow groundwater to seep between the lagging boards if not controlled. This section of the excavation will encounter predominately glacial till which typically isn't considered water bearing but can contain zones of saturation and/or saturated clean sand lenses/layers. The groundwater encountered in the clean sand lenses/layers is typically confined to some degree and may or may not require control depending on its connection to a recharge source. Designing or calculating a system to "dewater" clean sand lenses/layers within glacial till isn't feasible using standard well hydraulic equations as the sand lenses/layers violate most of the governing assumptions of well hydraulic equations. As such, groundwater control measures are implemented to reduce the amount of groundwater encountered during the excavation. The degree of groundwater reduction is based on how effectively the sand lenses/layers are intersected by the groundwater control measures. Typically experience and costs are the primary factors in determining how many wells or vacuum wellpoints are implemented.

Based on the subsurface conditions anticipated for the west excavation, a system of vacuum wellpoints or a system of small diameter wells (4-inch well casing) positioned around the perimeter of the excavation are appropriate systems for controlling groundwater along the shoring wall. Passive groundwater control measures and/or additional interior wells or vacuum wellpoints will likely be required to reduce the amount of groundwater encountered during excavation of the interior soils. Given the depth of the excavation, soil/groundwater conditions, and the vertical lift limit of about 18 feet for vacuum wellpoints, implementing vacuum wellpoints would require one system to be installed through the shoring wall slightly above the static groundwater level and a second wellpoint system, installed in a similar manner, located about 16 to 18 feet below the first wellpoint system. Implementing a system of small diameter wells would involve installing the wells behind the shoring wall around the perimeter of the excavation.

EAST EXCAVATION RETAINED BY SECANT PILES

The east excavation will be retained by secant piles on the north, east, and south sides. Secant piles have a very low hydraulic conductivity and are considered watertight as their hydraulic conductivity is typically several orders of magnitude lower than the aquifer soils. The secant piles will terminate at elevation -20 feet which appears to coincide with glacial till per Hart Crowser's geologic profiles. The western portion of the excavation will encounter glacial till as such, the east excavation is bound on all sides and the bottom by relatively low permeable materials thereby cutting off the excavation from lateral and vertical groundwater seepage. Controlling groundwater in this excavation involves extracting a finite volume of water bound by the shoring walls and glacial till until it is below subgrade which can be accomplished by a system of interior dewatering wells.

DEWATERING SYSTEM DESIGN CALCULATIONS

Dewatering system design calculations were performed to estimate potential discharge rates, the number of wells, and the spacing between wells required to lower the groundwater level a minimum of 2 feet below the main excavation subgrade.

WEST EXCAVATION RETAINED BY SOLDIER PILE AND LAGGING

Dewatering system design calculations were not performed for the west excavation due to the discontinuous and limited nature of the clean sand lenses/layers within the glacial till. Standard well hydraulic equations are based upon thick and laterally extensive aquifers as such, applying these equations to discontinuous sand layers of limited thickness yields unreliable results. The lateral and vertical distribution of the saturated sand layers are not fully understood as such, the system of wells will aid in controlling the groundwater but will not likely completely dewater the clean sand lenses/layers within the glacial till.

Dewatering Discharge

As discussed above, calculations to estimate potential discharge rates, the number of wells, and the spacing between wells were not performed due to the discontinuous and limited nature of the clean sand lenses/layers within the glacial till. Based on our experience with excavations in similar subsurface conditions, we estimate the total active and passive dewatering discharge rate for the west excavation to be less than 75 gpm.

EAST EXCAVATION RETAINED BY SECANT PILES

Dewatering calculations were performed using a computer spreadsheet model that accounts for well interference among multiple pumping wells and aquifer boundary conditions using the principle of superposition and image well theory. The spreadsheet model calculates the net drawdown from all pumping and image wells through a predetermined section of the aquifer by solving the Theis non-equilibrium equation for drawdown using the radius associated with each pumping and image well.

Soil and groundwater parameters used in the dewatering design calculations were derived from the project geotechnical reports or were estimated from previous experience if not contained in the geotechnical report and are listed below:

- The aquifer is unconfined.
- Static groundwater level elevation of 20 feet at the tower crane excavation
- Average aquifer hydraulic conductivity of $3.0x10^{-2}$ ft/min
- Specific yield is 0.15 (unitless)
- Target dewatering elevation of -1.0 feet; deepest main subgrade elevation of 1.3 feet.

Design calculations using the soil and groundwater parameters listed above indicate 6 dewatering wells installed within the secant pile shoring walls at the locations shown on Figure 1 lowers the groundwater level from elevation 20 feet down to at least 2 feet below the deepest subgrade elevation of 1.3 feet. Figure 2 provides a north to south drawdown profile between the secant pile shoring walls.

Dewatering Discharge

Based on the soil profiles in the geotechnical report, we estimate 890,000 gallons of water will need to be extracted from the recent granular soils east of the glacial till and between the secant pile shoring system. Assuming leakage from the glacial till and through and/or beneath the secant piles is negligible, we estimate dewatering wells DW-12 through DW-17 can extract this water and lower the groundwater level below subgrade after 2 to 3 weeks of operation. Discharge rates per well will likely be less than 30 gpm which should quickly decline after the first day of operation as the saturated thickness of the unconfined aquifer is reduced within the secant pile shoring walls.

DRAWDOWN ANALYSIS

Drawdown outside the excavation limits for the east excavation is not anticipated due to the secant pile shoring walls and glacial till located to the west and beneath this portion of the excavation which should effectively cut off lateral and vertical groundwater seepage.

Operation of the dewatering wells in the west portion of the excavation and/or allowing the clean sand lenses/layers within the glacial till to seep through the lagging wall (passive drainage) will lower groundwater levels within the sand lenses/layers which may cause drawdown beneath subsurface and above ground structures proximate to the soldier pile and lagging wall. However, calculating the drawdown/cone of depression in the sand lenses/layers using standard well hydraulic equations is inaccurate as the equations are based on thick laterally extensive aquifer conditions. As such, Middour Consulting has not assessed the potential for dewatering induced settlement or mobilization of groundwater contaminate plumes nor has Middour Consulting or MDCI implemented any engineering controls to limit the amount of drawdown besides the prescribed secant pile shoring system for the east portion of the excavation. Middour Consulting's scope of work did not include these evaluations and Middour Consulting assumes no liability for impacts due to lowering of groundwater levels. We recommend geotechnical engineering and environmental disciplines review this plan to evaluate potential adverse effects due to lowering of groundwater levels.

GROUNDWATER MONITORING

We recommend installing four observation wells within the west excavation footprint to monitor groundwater levels along the Mercer and Lake Union tunnel alignments as well as assess the piezometric level below subgrade prior to installing the rat slab and waterproofing system. The four observation wells should be constructed in a similar manner as the small diameter wells for the west excavation in the event additional dewatering wells are required.

If the general contractor and/or the Owner would like to monitor groundwater levels outside the excavation in other areas of concern, observation wells should be installed in these areas; Hart Crowser should determine the location and construction of observation wells located outside the excavation footprint.

We recommend measuring water levels in the interior observation wells daily at least a month prior to the excavation reaching the final subgrade. Groundwater monitoring data should be reported to

Middour Consulting and Hart Crowser. If the observation wells are instrumented with pressure transducers to measure and record groundwater levels, the data should be downloaded a minimum of once a week and provided to Middour Consulting and Hart Crowser.

GROUNDWATER CONTROL CONSTRUCTION RECOMMENDATIONS

Below we provide our groundwater control recommendations for the west and east excavations. Well construction elevations and details are provided on Table 1 and Figure 3.

WEST EXCAVATION RETAINED BY SOLDIER PILE AND LAGGING

As discussed in the groundwater control approach section, the amount of groundwater and level of effort to control groundwater within the clean sand lenses/layers within the glacial till is very difficult to predict, as such we initially recommend planning to install the dewatering wells at the locations shown on Figure 1. However, the subsurface data collected during solider pile installation may warrant refinement of our initial recommendations.

We recommend monitoring the soldier pile drilling/installation to further refine the presence/absence of the saturated zones within the glacial till and to evaluate the need for controlling these zones. Upon reviewing the soldier pile installation data, Middour Consulting will adjust dewatering well locations if necessary and provide further recommendations if justified. Implementing this observational approach will require drilling/installing the wells after the soldier piles have been installed which may impact the project schedule and/or logistics.

Due to the apparent discontinuous nature of the saturated zones and sand layers/lenses within the glacial till, some amount of groundwater seepage past the system of wells should be anticipated. As such, excavation/lagging lifts may need to be reduced to control seepage and reduce running soil conditions. Installation of filter fabric or other filtering media may be required to direct seepage to gaps in the lagging and/or horizontal drains/well screen installed through the lagging. Groundwater seepage entering the excavation should be collected in sumps and pumped out of the excavation. Due to high turbidity, we recommend segregating the sump water from the dewatering well discharge. If running soils are encountered and cannot be controlled, a localized vacuum wellpoint system may need to be installed. We recommend securing the materials and equipment to install a minimum of 100 lineal feet of a vacuum wellpoint system, assuming one wellpoint positioned between a pair of soldier piles.

Based on our current understanding of the subsurface conditions beneath the west section of the excavation, we recommend installing a system of 30 small diameter dewatering wells around the perimeter of the excavation and 6 small diameter wells inside the excavation along the Mercer and Lake Union tunnel alignments. The well spacing should be between every fourth pair of soldier piles or about 32 feet on-center. The proposed locations of the dewatering wells are shown on Figure 1 and well construction details are provide on Figure 3. If utilities and/or construction methods prevent installation of certain dewatering wells, the new locations should be reviewed by Middour Consulting.

EAST EXCAVATION RETAINED BY SECANT PILES

The east excavation will be retained by secant piles on the north, east, and south sides. The secant piles will terminate at elevation -20 feet which appears to coincide with glacial till. The western portion of the excavation will encounter glacial till as such, the east excavation is bound on all sides and below by relatively low permeable materials thereby cutting off the excavation from lateral and vertical groundwater seepage. We recommend installing a system of 6 small diameter dewatering within the east excavation to lower the groundwater below subgrade. The proposed locations of the six interior dewatering wells (DW-12 through DW-17) are shown on Figure 1.

DEWATERING WELL SYSTEM COMPONENTS

Dewatering Wells: Boreholes shall be drilled using rotary wash or sonic drilling methods and shall be a minimum of 8-inch-diameter. Drilling additives and/or slurry to maintain borehole wall stability shall not be used; maintaining a water head and/or casing the borehole are appropriate methods. Well casings and screen shall be 4-inch diameter Schedule 40 PVC. Refer to Table 1 for bottom of well elevations and well screen lengths. Based on the visual soil descriptions from the soil borings, gradation tests, and previous experience in the area, well screens shall consist of 30-slot screen size. *Note the installation of the interior dewatering and observation wells along the tunnel alignments can possibly be installed after the excavation has advanced downward but Hart Crowser will need to establish how deep the excavation can advance prior to installing and operating the wells without impacting the Mercer Street tunnel.*

We recommend that Middour Consulting monitor the initial drilling, well construction, and well development to verify site conditions. Subsequent wells shall be logged and sampled by the driller. The

driller shall notify Middour Consulting if subsurface conditions differ from those described in this report and/or those observed during drilling the first dewatering well.

Sand Pack: The available data indicate a dewatering well sand pack consisting of Cal Portland 8700 or Cadman Granulithic shall optimize retention of the formation and well yield. The gradation of the proposed sand pack is listed in the table on Figure 3. Well and seal construction shall be consistent with WAC 173-160.

Development: Development is important to improve the hydraulic connection with the aquifer and provide a clean dewatering effluent with time. Each dewatering well shall be developed immediately upon completion. Development methods shall utilize flow-surging and over-pumping until the discharge requirement is achieved. Development data shall be documented to demonstrate that additional development would produce limited improvement.

Pumps: Pumps that can operate in dry well conditions shall be provided in each dewatering well. The pumps for DW-12 through DW-7 shall be capable of providing up to 40 gpm under 60 feet of total dynamic head (TDH) and the remaining pumps should be capable of providing up to 15 gpm under 60 to 80 feet of TDH to discharge at existing grade. Additional TDH may be required depending on the height and location of the discharge outfall.

Header and Conveyance Piping: The main header and conveyance piping shall be constructed using a minimum of 6-inch-diameter PVC or HDPE pipe. The piping configuration shall be coordinated with the general to minimize the potential for damage during excavation.

GENERAL SYSTEM REQUIREMENTS

Power Supply: A continuous main power supply from portable generators or line power is required for all dewatering systems. We recommend that a backup power source is available on site in the event of a power failure from the main power supply.

Operation: The dewatering system shall operate a minimum of two weeks prior to excavation below the static groundwater level. However, if the hydraulic conductivity of the soils is at the low end of the assumed range, a month of operation may be required to achieve the target drawdown. Visual observations of the discharge shall be made several times a day during excavation, to monitor for increased turbidity levels. Middour Consulting shall be contacted if the performance of the dewatering system changes significantly. This may include pumping rates that differ significantly from rates presented

in this report, the occurrence of a sudden change in pumping rates or groundwater levels, or the occurrence of turbidity levels that exceed discharge limits.

The dewatering system shall be operated continuously until sufficient structural weight, as determined by the resident structural engineer, is constructed to counteract groundwater lateral and uplift forces.

System Performance and Water Level Monitoring: Groundwater levels in the dewatering wells and observation wells should be measured daily for the first week of operation and reported to Middour Consulting to assess the system performance. Upon achieving the target dewatering elevation, groundwater levels in the observation wells should be monitored daily to ensure excessive drawdown is not occurring; the monitoring frequency can be reduced once a stable cone of depression is established.

Discharge Water Quality: Development water and dewatering discharge shall be pumped to a settling tank prior to discharging to the outfall location. We understand water quality treatment will be performed by others and documented in a separate plan.

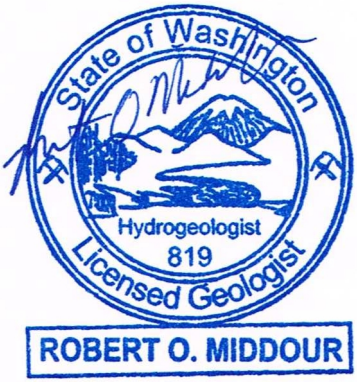
Well Decommissioning: The dewatering wells shall be decommissioned in accordance with WAC 173-160 upon completion of dewatering activities.

LIMITATIONS

This Groundwater Control Plan has been prepared for the exclusive use of Malcolm Drilling Company, Inc. for their proposed work on the 800 Mercer Street project in Seattle, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Middour Consulting LLC. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Middour Consulting, shall be at the user's sole risk. Middour Consulting warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

MIDDOUR CONSULTING LLC

Robert O. Middour, L.HG.
Principal Hydrogeologist

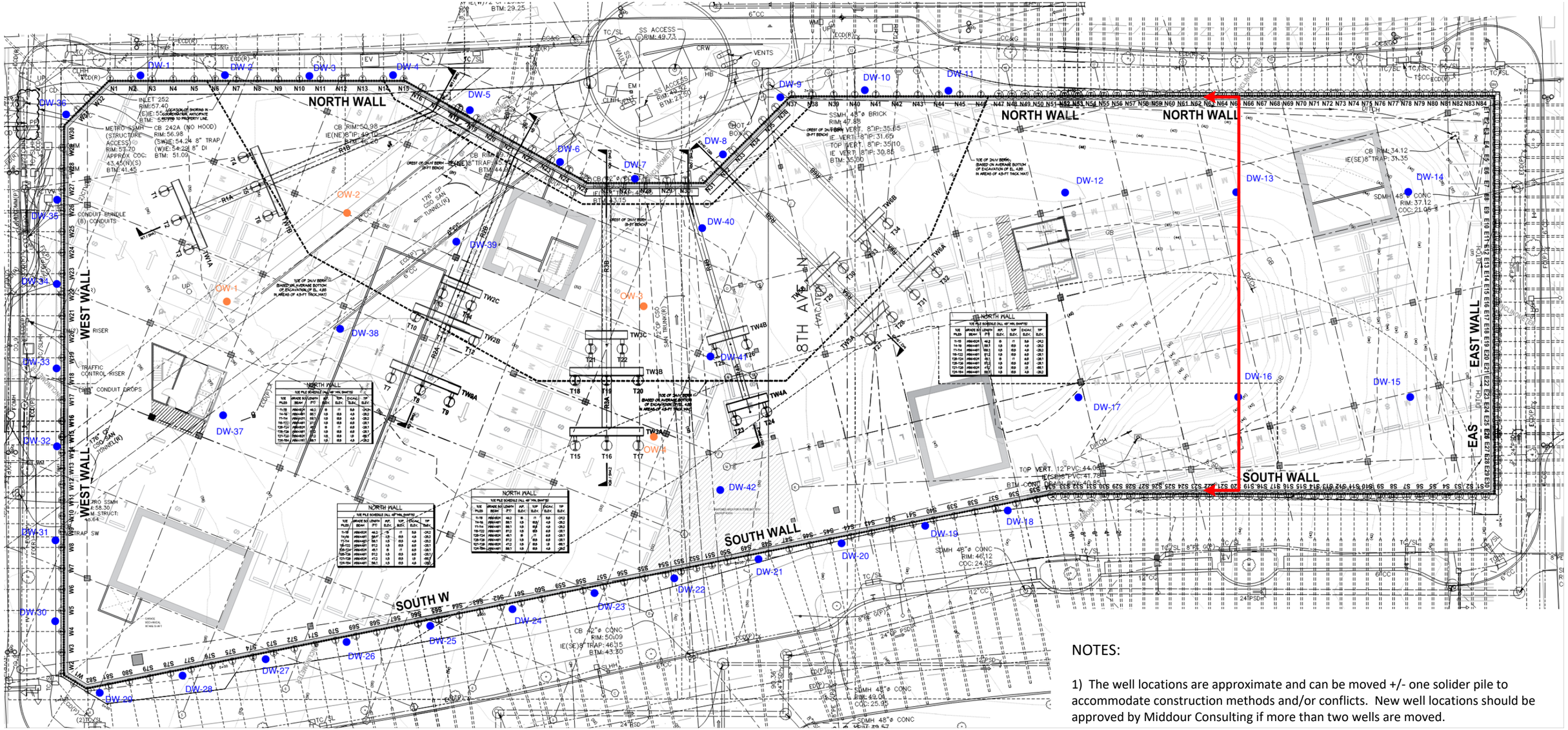


Well ID	Approximate Pile Location	Ground Surface Elevation (ft)	Bottom Well Elevation (ft)	Well Depth (ft)	Screen Length (ft)
DW-1	N2 / N3	56	-15	71	40
DW-2	N6 / N7	55	-15	70	40
DW-3	N10 / N11	54	-15	69	40
DW-4	N14 / N15	53	-15	68	40
DW-5	N18 / N19	50	-15	65	40
DW-6	N23 / N24	51	-15	66	30
DW-7	N27 / N28	51	-15	66	30
DW-8	N32 / N33	50	-15	65	30
DW-9	N36 / N37	50	-15	65	30
DW-10	N40 / N41	48	-15	63	30
DW-11	N44 / N45	46	-15	61	30
DW-12	E. Interior	44	-15	59	30
DW-13	E. Interior	42	-15	57	30
DW-14	E. Interior	42	-15	57	30
DW-15	E. Interior	42	-15	57	30
DW-16	E. Interior	44	-15	59	30
DW-17	E. Interior	46	-15	61	30
DW-18	S36 / S37	47	-15	62	30
DW-19	S40 / S41	49	-15	64	30
DW-20	S44 / S45	50	-15	65	30
DW-21	S48 / S49	51	-15	66	30
DW-22	S53 / S54	52	-15	67	30
DW-23	S57 / S58	53	-15	68	30
DW-24	S61 / S62	54	-15	69	40
DW-25	S65 / S66	55	-15	70	40
DW-26	S69 / S70	56	-15	71	40
DW-27	S73 / S74	58	-15	73	40
DW-28	S77 / S78	58	-15	73	40
DW-29	S81 / S82	59	-15	74	40

Well ID	Approximate Pile Location	Ground Surface Elevation (ft)	Bottom Well Elevation (ft)	Well Depth (ft)	Screen Length (ft)
DW-30	W4 / W5	58	-15	73	40
DW-31	W8 / W9	58	-15	73	40
DW-32	W14 / W15	58	-15	73	40
DW-33	W18 / W19	58	-15	73	40
DW-34	W22 / W23	58	-15	73	40
DW-35	W26 / W27	57	-15	72	40
DW-36	W30 / W31	56	-15	71	40
DW-37	W. Interior	TBD	-30	TBD	30
DW-38	W. Interior	TBD	-30	TBD	30
DW-39	W. Interior	TBD	-30	TBD	30
DW-40	W. Interior	TBD	-30	TBD	30
DW-41	W. Interior	TBD	-30	TBD	30
DW-42	W. Interior	TBD	-30	TBD	30
OW-1	W. Interior	TBD	-30	TBD	30
OW-2	W. Interior	TBD	-30	TBD	30
OW-3	W. Interior	TBD	-30	TBD	30
OW-4	W. Interior	TBD	-30	TBD	30

Notes:

1) All dewatering wells and observation wells drilled and constructed in a similar manner; refer to Figure 3 for construction details.



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groundwater control for underground construction

DEWATERING WELL LOCATIONS

OBSERVATION WELL LOCATIONS

DRAWDOWN PROFILE (see Figure 2)

FIGURE 1
Dewatering Well Layout Plan

800 MERCER STREET GWCP | Seattle, WA
Project No. 21001139.01 | August 20, 2021

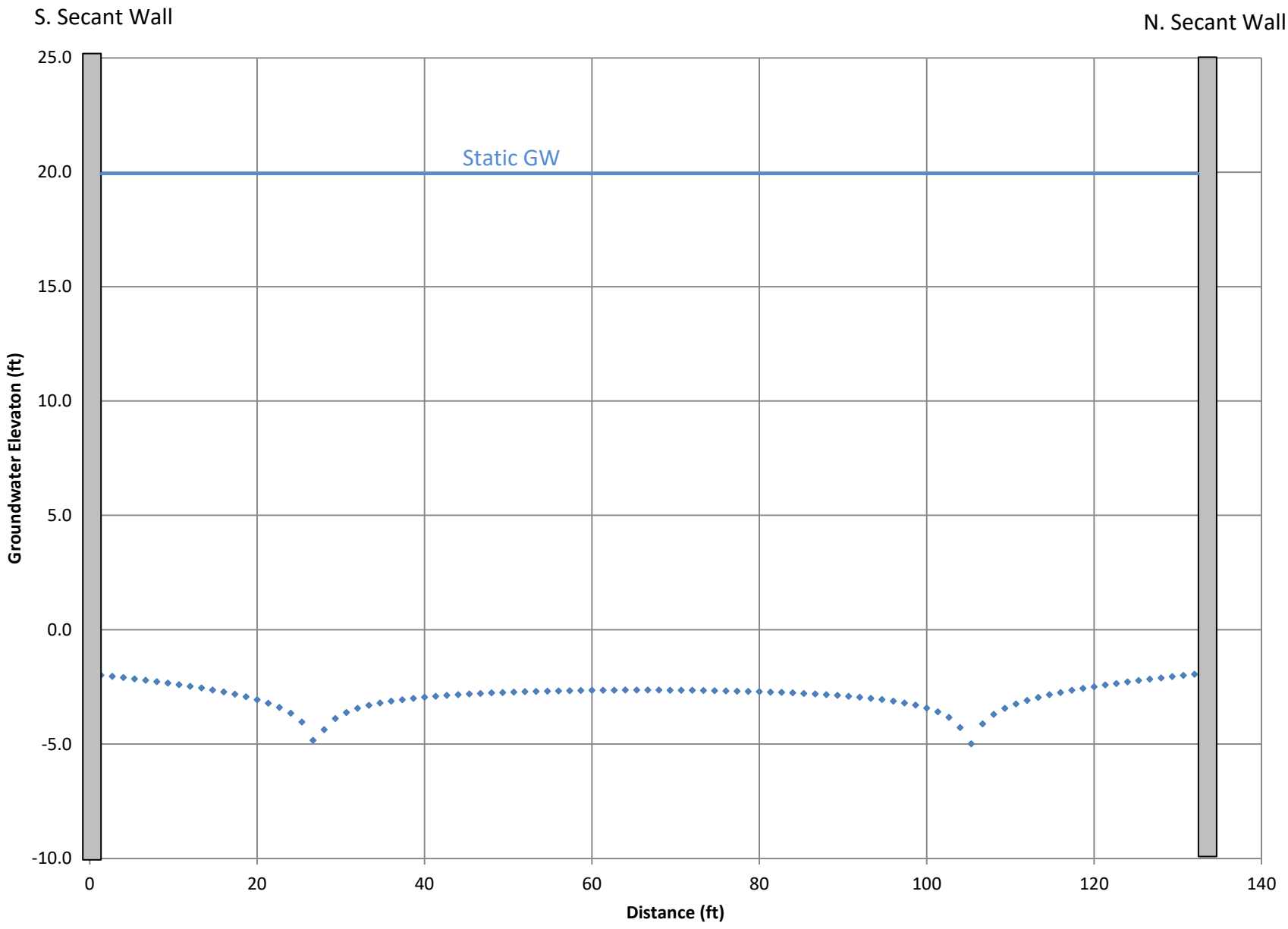

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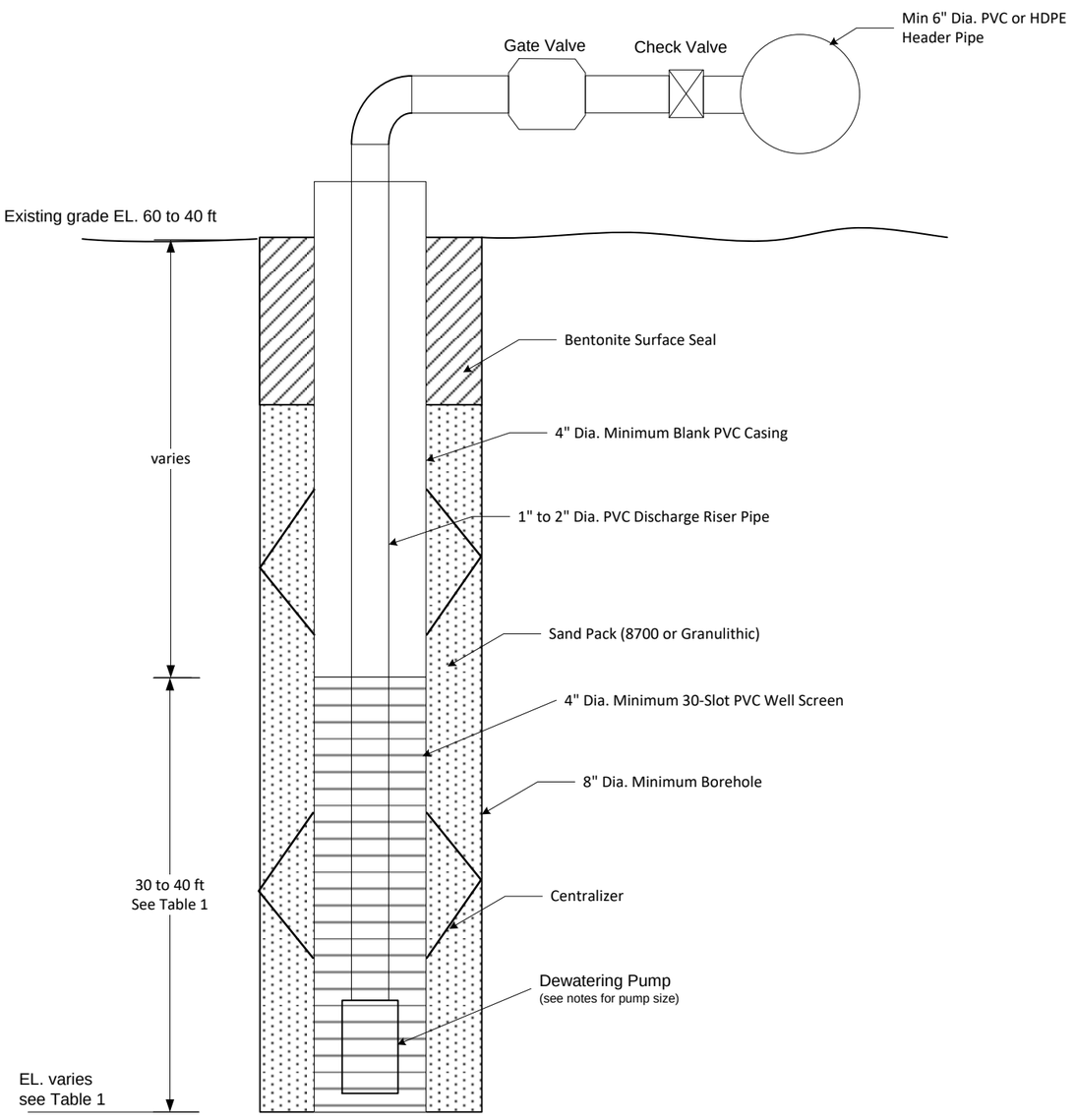
FIGURE 2
North-South Secant Pile Excavation Drawdown Profile
800 MERCER STREET GWCP | Seattle, WA
Project No. 21001139.01 | August 20, 2021



Not to Scale

NOTES:

Dewatering Wells: Boreholes shall be drilled using rotary wash or sonic drilling methods and shall be a minimum of 8-inch-diameter. Drilling additives and/or slurry to maintain borehole wall stability shall not be used; maintaining a water head and/or casing the borehole are appropriate methods. Well casings and screen shall be 4-inch diameter Schedule 40 PVC. Refer to Table 1 for bottom of well elevations and well screen lengths. Based on the visual soil descriptions from the soil borings, gradation tests, and previous experience in the area, well screens shall consist of 30-slot screen size. Note the installation of the interior dewatering and observation wells along the tunnel alignments can possibly be installed after the excavation has advanced downward but Hart Crowser will need to establish how deep the excavation can advance prior to installing and operating the wells. We recommend that Middour Consulting monitor the initial drilling, well construction, and well development to verify site conditions. Subsequent wells shall be logged and sampled by the driller. The driller shall notify Middour Consulting if subsurface conditions differ from those described in this report and/or those observed during drilling the first dewatering well.

Sand Pack: The available data indicate a dewatering well sand pack consisting of Cal Portland 8700 or Cadman Granulithic shall optimize retention of the formation and well yield. The gradation of the proposed sand pack is listed in the table below . Well and seal construction shall be consistent with WAC 173-160.

Development: Development is important to improve the hydraulic connection with the aquifer and provide a clean dewatering effluent with time. Each dewatering well shall be developed immediately upon completion. Development methods shall utilize flow-surging and over-pumping until the discharge requirement is achieved. Development data shall be documented to demonstrate that additional development would produce limited improvement.

Pumps: Pumps that can operate in dry well conditions shall be provided in each dewatering well. The pumps for DW-12 through DW-7 shall be capable of providing up to 40 gpm under 60 feet of total dynamic head (TDH) and the remaining pumps should be capable of providing up to 15 gpm under 60 to 80 feet of total dynamic head (TDH) to discharge at existing grade. Additional TDH may be required depending on the height and location of the discharge outfall.

Header and Conveyance Piping: The main header and conveyance piping shall be constructed using a minimum of 6-inch-diameter PVC or HDPE pipe. The piping configuration shall be coordinated with the general to minimize the potential for damage during excavation.

Power Supply: A continuous main power supply from portable generators or line power is required for all dewatering systems. We recommend that a backup power source is available on site in the event of a power failure from the main power supply.

System Performance and Water Level Monitoring: Groundwater levels in the dewatering wells and observation wells shall be measured daily for the first week of operation and reported to Middour Consulting to assess the system performance. Upon achieving the target dewatering elevation, groundwater levels in the observation wells shall be monitored daily to ensure excessive drawdown is not occurring; the monitoring frequency can be reduced once a stable cone of depression is established.

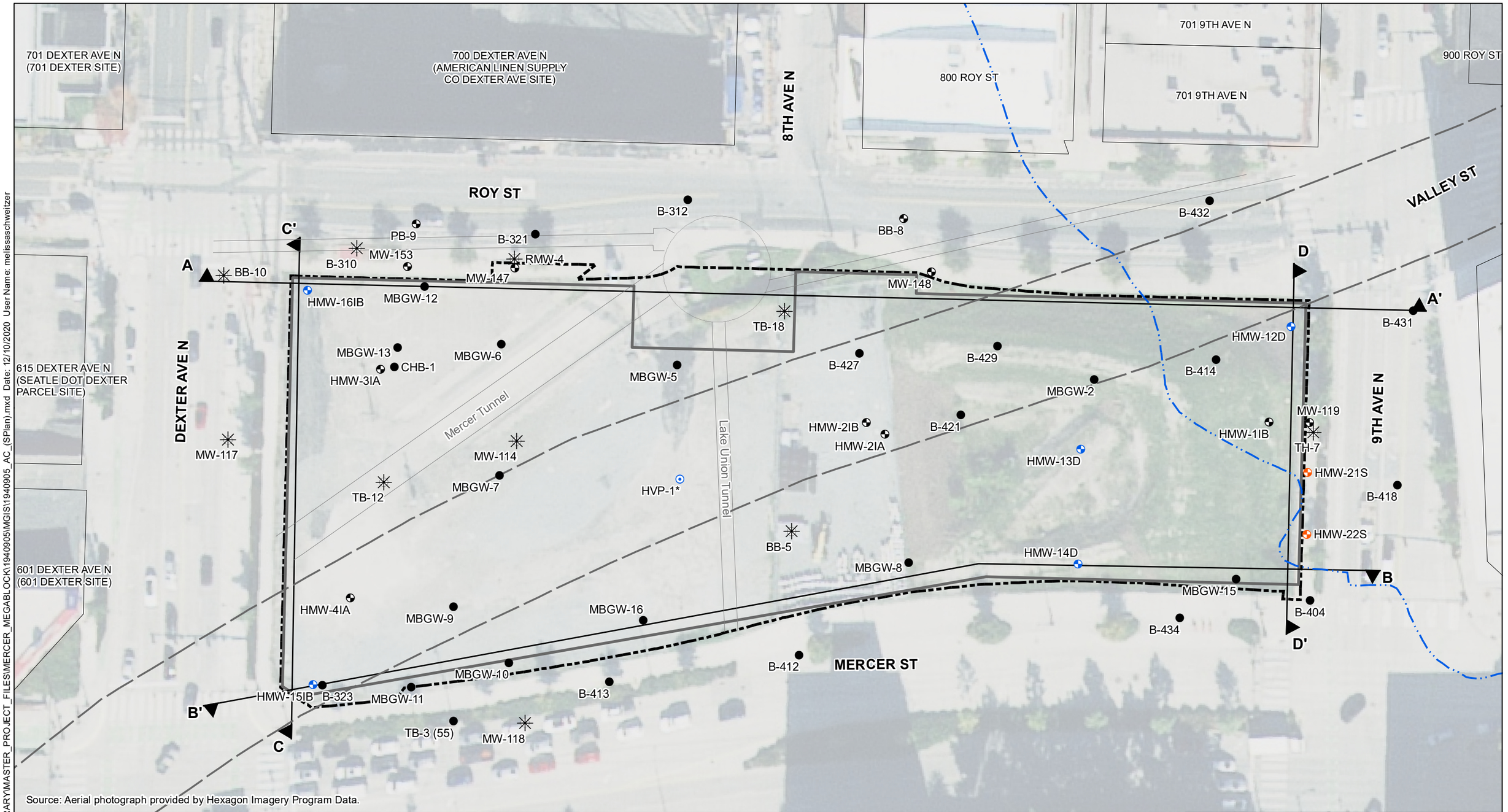
Operation: The dewatering system shall operate a minimum of two weeks prior to excavation below the static groundwater level. However, if the hydraulic conductivity of the soils is at the low end of the assumed range, a month of operation may be required to achieve the target drawdown. Visual observations of the discharge shall be made several times a day during excavation, to monitor for increased turbidity levels. Middour Consulting shall be contacted if the performance of the dewatering system changes significantly. This may include pumping rates that differ significantly from rates presented in this report, the occurrence of a sudden change in pumping rates or groundwater levels, or the occurrence of turbidity levels that exceed discharge limits. The dewatering system shall be operated continuously until sufficient structural weight, as determined by the resident structural engineer, is constructed to counteract groundwater lateral and uplift forces.

Well Decommissioning: The dewatering wells shall be decommissioned in accordance with WAC 173-160 upon completion of dewatering activities.

Sand Pack Gradations

Sieve Size	Grain Size		Cal Portland (8700)		Cadman Granulithic	
No.	(mm)	(thousandths)	% Finer	% Retained	% Finer	% Retained
3/8	9.51	374.4	100	0	100	0
1/4	6.35	250.0	96	4	98.4	1.6
No. 4	4.75	187.0	65.6	34.4	73.4	26.6
No. 6	3.36	132.3	17.3	82.7		
No. 8	2.38	93.7	3.2	96.8	10.1	89.9
No. 10	2	78.7	1.6	98.4		
No. 16	1.19	46.9	0.8	99.2	3.8	96.2
No. 30	0.595	23.4	0.2	99.8	0.2	99.8

APPENDIX I
Geotechnical Report Cross-Sections



Legend

- Monitoring Well (Hart Crowser, October 2020)
- Monitoring Well (Hart Crowser, July 2020)
- Boring with Vibrating Wire Piezometer (Hart Crowser, July 2020)
- Boring
- Monitoring Well
- Abandoned or Decommissioned Monitoring Well
- Cross Section
- * Shear Wave Velocity Testing Performed
- Proposed Building
- King County Main Facility Structures
- Other Parcel Boundary
- Property Boundary
- Former Edge of Lake Union (1905 Sanborn)
- Historical Broad Street Extents

0 25 50 100 Feet

Feature locations are approximate.

N

800 Mercer
Seattle, Washington

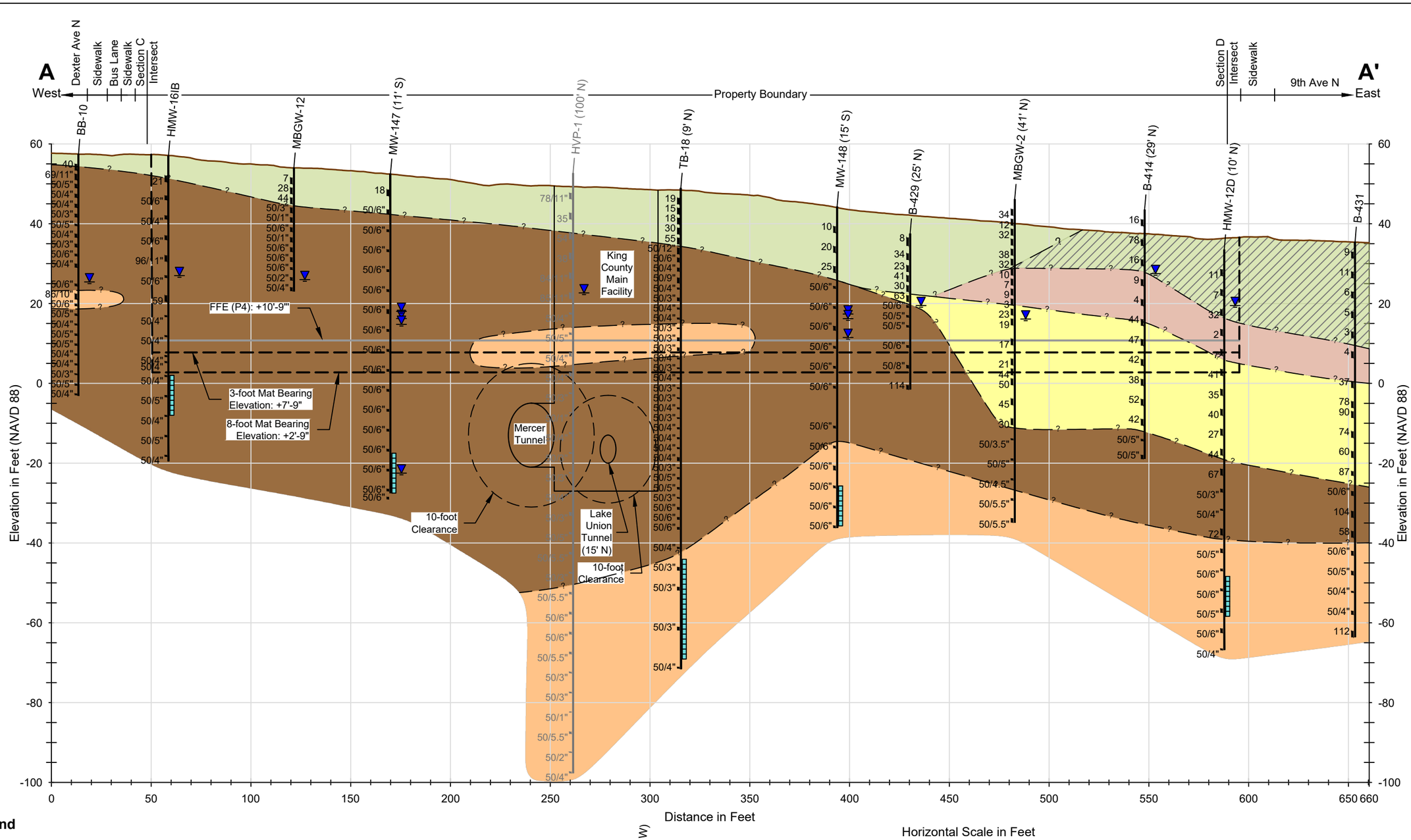
Site and Exploration Plan

19409-05 12/20

HARTCROWSER

Figure 2

Document Path: G:\GEOSPATIAL_LIBRARY\MASTER_PROJECT_FILES\MERCER_MEGABLOCK\1940905\MGIS\1940905_AC_(SPlan).mxd Date: 12/10/2020 User Name: melissaschweitzer



Legend

- Approximate FFE (P4)
- Approximate excavation limits at 800 Mercer (Base of Excavation Elevation Varies with Mat Thickness)
- Compacted Fill
- Loose Fill
- Lacustrine (Layered loose Sand and soft to medium stiff Silt/Clay, with organics)
- Stiff to Very stiff Silt/Clay
- Medium Dense to Dense Sand
- Very Dense Sand
- Glacial Till (Very dense Silty Sand and Gravel)

Boring Name with Offset — DMW-3IA (15' W)

Boring Location

N-Value — 22 — Water Level

Screen Interval

Grayed out boring used only for interpretation of deep soil stratigraphy.

Horizontal Scale in Feet
0 50 100
0 25 50
Vertical Scale in Feet
Vertical Exaggeration x 2

NOTE

This subsurface profile is generalized from materials observed in soil borings. Variations may exist between profile and actual conditions.

800 Mercer
Seattle, Washington

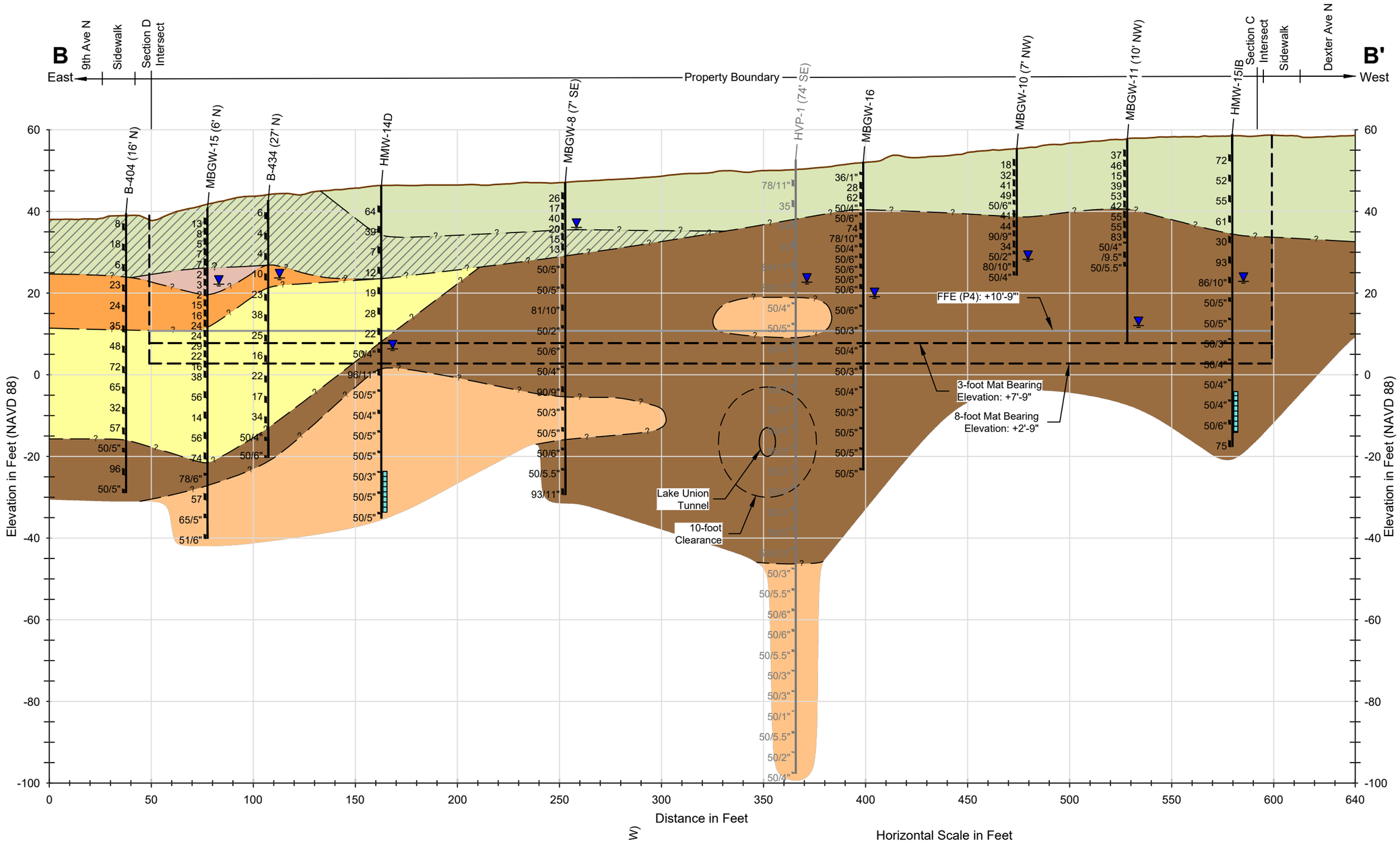
Subsurface Cross Section A-A'

19409-05 12/20

HARTCROWSER

Figure 3

File: L:\Notebooks\1940905_800_Mercer_Geotech_Conceptual_Design\CAD\1940905-001 (XSec).dwg Layout:SectionA Date: 12-14-2020 Author: melissaschweitzer



Legend

- Approximate FFE (P4)
- Approximate excavation limits at 800 Mercer (Base of Excavation Elevation Varies with Mat Thickness)
- Compacted Fill
- Loose Fill
- Lacustrine (Layered loose Sand and soft to medium stiff Silt/Clay, with organics)
- Stiff to Very stiff Silt/Clay
- Medium Dense to Dense Sand
- Very Dense Sand
- Glacial Till (Very dense Silty Sand and Gravel)

Boring Name with Offset — DMW-3IA (15' W)

Boring Location

N-Value — 22

Water Level

Screen Interval

Grayed out boring used only for interpretation of deep soil stratigraphy.

Horizontal Scale in Feet
0 50 100
0 25 50
Vertical Scale in Feet
Vertical Exaggeration x 2

NOTE

This subsurface profile is generalized from materials observed in soil borings. Variations may exist between profile and actual conditions.

800 Mercer
Seattle, Washington

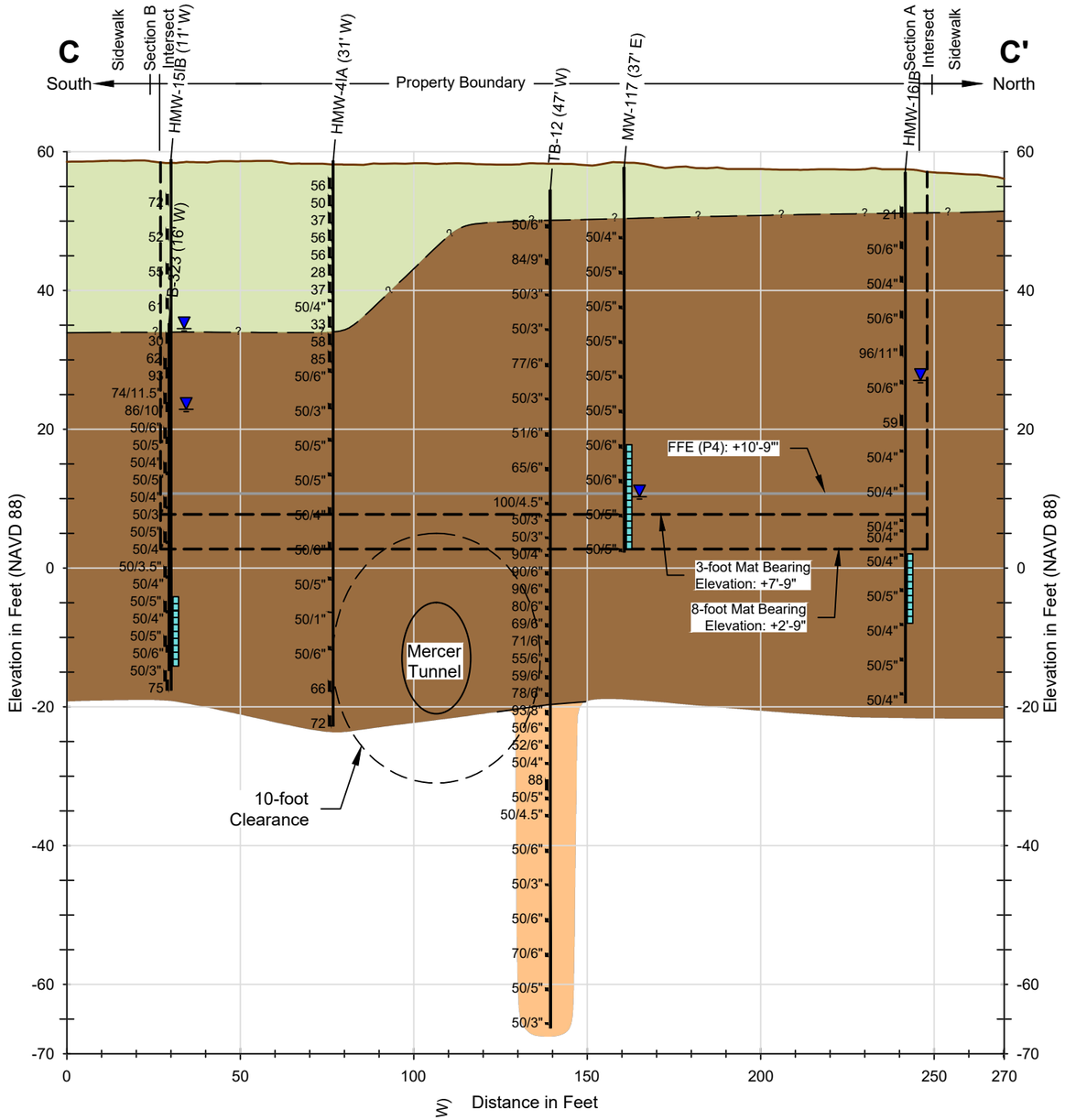
Subsurface Cross Section B-B'

19409-05 12/20

HARTCROWSER

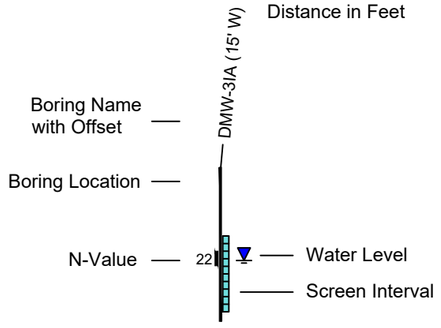
Figure 4

File: L:\Notebooks\1940905_800_Mercer_Geotech_Conceptual_Design\CAD\1940905-001 (XSec).dwg Layout:SectionB Date: 12-14-2020 Author: melissaschweitzer



Legend

- Approximate FFE (P4)
- Approximate excavation limits at 800 Mercer (Base of Excavation Elevation Varies with Mat Thickness)
- Compacted Fill
- Loose Fill
- Lacustrine (Layered loose Sand and soft to medium stiff Silt/Clay, with organics)
- Stiff to Very stiff Silt/Clay
- Medium Dense to Dense Sand
- Very Dense Sand
- Glacial Till (Very dense Silty Sand and Gravel)



Horizontal Scale in Feet
0 40 80
0 20 40
Vertical Scale in Feet
Vertical Exaggeration x 2

NOTE

This subsurface profile is generalized from materials observed in soil borings. Variations may exist between profile and actual conditions.

800 Mercer
Seattle, Washington

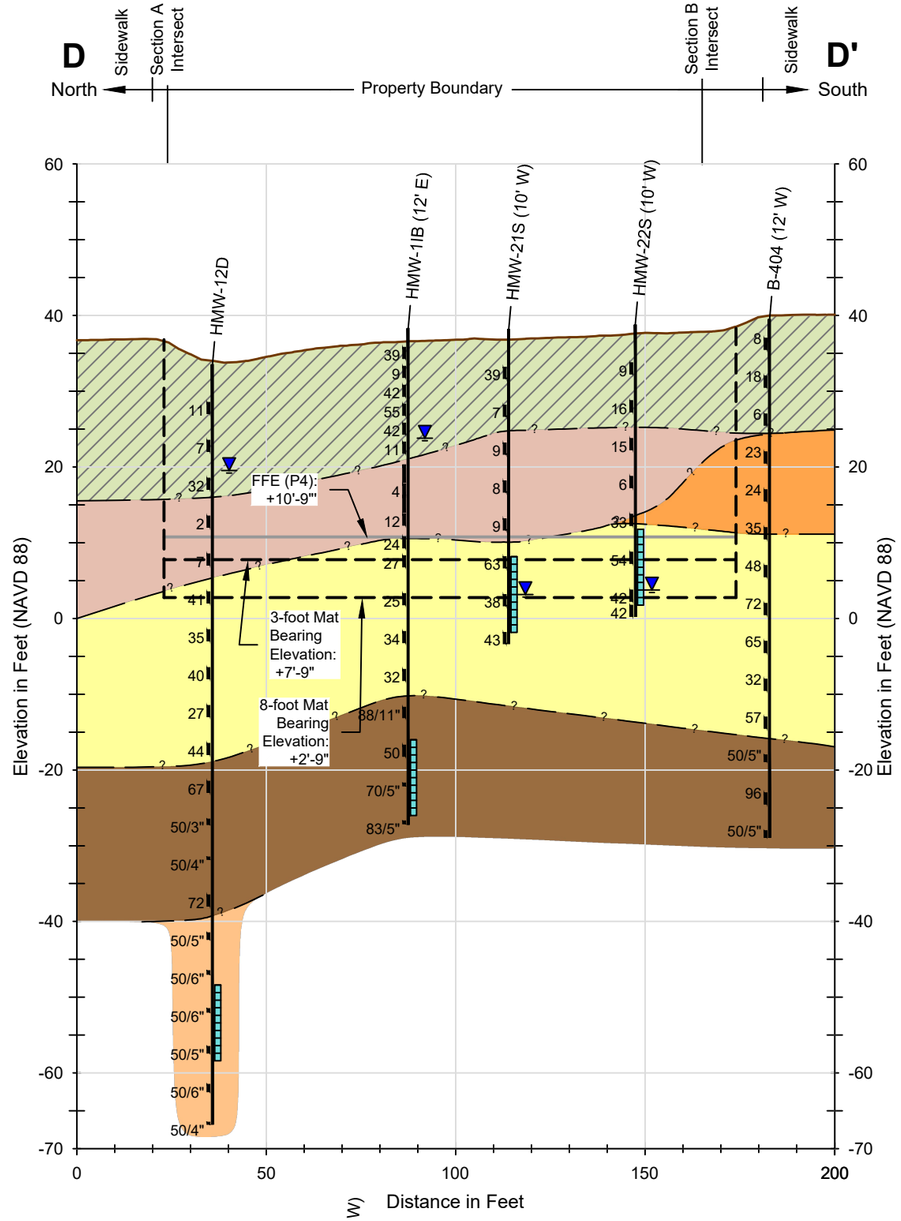
Subsurface Cross Section C-C'

19409-05 12/20

HARTCROWSER

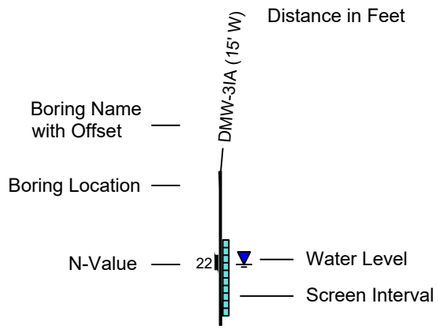
Figure 5

File: L:\Notebooks\1940905_800_Mercer_Geotech_Conceptual_Design\CAD\1940905-001 (XSec).dwg Layout:SectionC Date: 12-14-2020 Author: melissaschweitzer



Legend

- Approximate FFE (P4)
- Approximate excavation limits at 800 Mercer (Base of Excavation Elevation Varies with Mat Thickness)
- Compacted Fill
- Loose Fill
- Lacustrine (Layered loose Sand and soft to medium stiff Silt/Clay, with organics)
- Stiff to Very stiff Silt/Clay
- Medium Dense to Dense Sand
- Very Dense Sand
- Glacial Till (Very dense Silty Sand and Gravel)



Horizontal Scale in Feet
0 40 80
0 20 40
Vertical Scale in Feet
Vertical Exaggeration x 2

NOTE

This subsurface profile is generalized from materials observed in soil borings. Variations may exist between profile and actual conditions.

800 Mercer
Seattle, Washington

Subsurface Cross Section D-D'

19409-05 12/20

HARTCROWSER

Figure
6

File: L:\Notebooks\1940905_800_Mercer_Geotech_Conceptual_Design\CAD\1940905-001 (XSec).dwg Layout:SectionD Date: 12-14-2020 Author: melissaschweitzer

APPENDIX J
Sampling and Analysis Plan/Quality Assurance Project Plan

HALEY ALDRICH

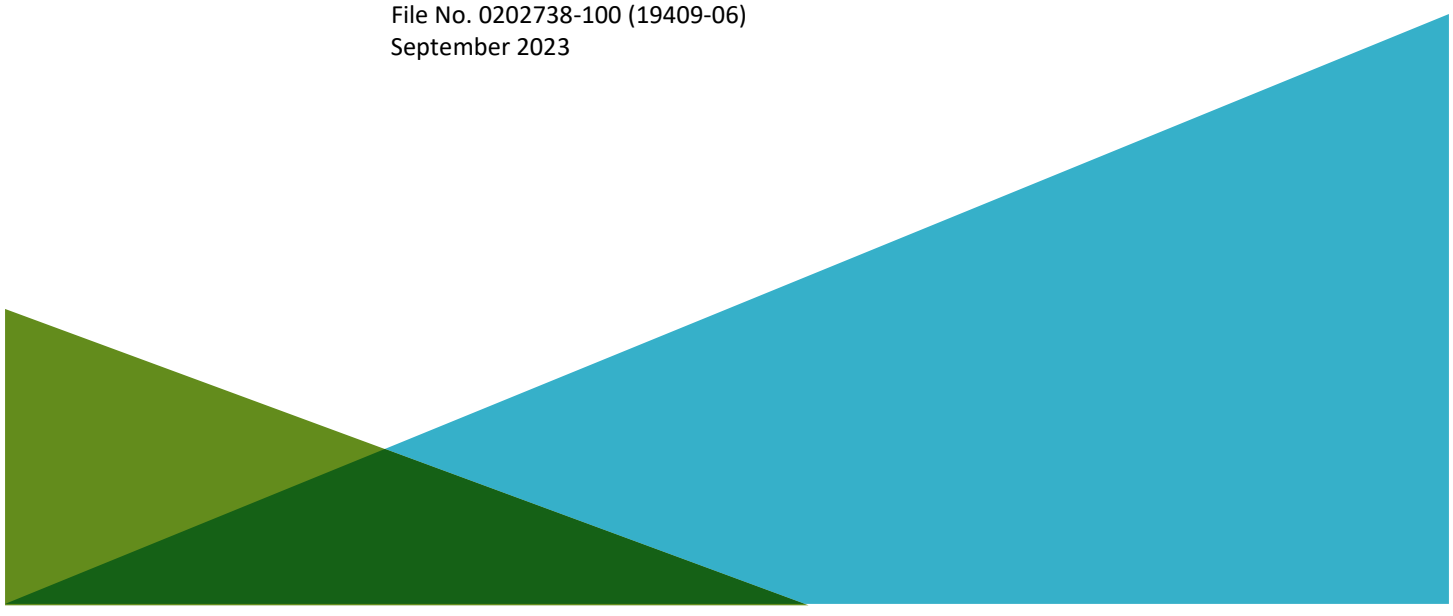
www.haleyaldrich.com

SAMPLING AND ANALYSIS PLAN/QUALITY ASSURANCE PROJECT PLAN ON
SEATTLE DOT MERCER PARCELS SITE
800 MERCER STREET
SEATTLE, WASHINGTON

by
Haley & Aldrich, Inc.
Seattle, Washington

for
800 Mercer, LLC
Seattle, Washington

File No. 0202738-100 (19409-06)
September 2023



HALEY & ALDRICH, INC.
3131 ELLIOTT AVENUE
SUITE 600
SEATTLE, WA 98121
206.324.9530

SIGNATURE PAGE FOR

SAMPLING AND ANALYSIS PLAN/QUALITY ASSURANCE PROJECT PLAN ON
SEATTLE DOT MERCER PARCELS SITE
800 MERCER STREET
SEATTLE, WASHINGTON

PREPARED FOR
800 MERCER, LLC
SEATTLE, WASHINGTON

PREPARED BY:

Marissa K. Goodman, P.E.
Senior Project Environmental Engineer
Haley & Aldrich, Inc.

REVIEWED AND APPROVED BY:

Julie K. W. Wukelic
Senior Principal Engineer
Haley & Aldrich, Inc.

Table of Contents

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List of Abbreviations

Abbreviation	Definition
BTEX	Benzene, toluene, ethylbenzene, xylenes
CESF	Chemically enhanced sand filtration
CMMP	Contaminated Media Management Plan
COC	Chain of custody
cPAHs	Carcinogenic polycyclic aromatic hydrocarbons
CSWGP	Construction Stormwater General Permit
CVOCs	Chlorinated volatile organic compounds
DFR	Daily field report
DRO	Diesel-range organics
EDR	Engineering Design Report
EPA	Environmental Protection Agency
GAC	Granular activated carbon
GRO	Gasoline-range Organics
MS	Matrix spike
MSD	Matrix spike duplicate
pH	Power of hydrogen
PID	Photoionization detector
QA/QC	Quality assurance/quality controls
RPD	Relative percent difference
SAP	Sampling and Analysis Plan
SWPPP	Stormwater Pollution Prevention Plan
TPH	Total petroleum hydrocarbons
VOA	Volatile organic analysis
VOC	Volatile organic compound

1. Sampling and Analysis Plan

This Sampling and Analysis Plan (SAP) presents the proposed soil and stormwater and dewatering discharge sample collection procedures, analytical testing program, and field and laboratory quality assurance/quality controls (QA/QC) to be used while implementing the cleanup action at the Seattle DOT Mercer Parcels site (Site), which is primarily located at 800 Mercer Street in Seattle, Washington (Property). The SAP also discusses soil and stormwater and dewatering discharge sample collection procedures, analytical testing, and field and lab QA/QC that will occur during Property redevelopment that removes impacted soil and groundwater from two separate sites (American Linen Supply Co Dexter Ave Site [American Linen Site] and Broad Street Alignment Contaminated Fill Site [Broad Street Fill Site]) that are also located on the Property. These sites are being addressed by others under separate legal agreements with the Washington State Department of Ecology (Ecology) and have not completed the Remedial Investigation, Feasibility Study, or Cleanup Action Plan process including the selection of cleanup levels. Please refer to the attached Engineering Design Report (EDR) for a more detailed description of the project and relevant background information on the Site, American Linen Site, and Broad Street Fill Site.

This SAP does not include perimeter air monitoring, which will be discussed in a separate Air Monitoring Plan to be submitted to Ecology for review prior to construction. If stormwater and dewatering discharge effluent concentrations do not meet discharge limits, an air stripper may be added to the dewatering treatment system as a polishing step. If an air stripper is added to the dewatering treatment system and if the estimated concentrations are above specified thresholds (see Section 5.1.8 of the EDR), the discharge of air stripper vapors will require a discharge permit from the Puget Sound Clean Air Agency (PSCAA). This permit will require the treatment and sampling of vapor streams prior to discharge. If the PSCAA permit is required and air discharge samples will be collected, the SAP/QAPP will be updated in accordance with the permit.

1.1 SAMPLE COLLECTION LOCATIONS AND FREQUENCY

1.1.1 Soil Samples

Soil samples will be collected during mass excavation as part of performance monitoring to confirm soil classification changes laterally and vertically, to confirm cleanup standards have been attained, and/or to document the concentration of constituents of concern or other hazardous substances that remain on the Property above cleanup or screening levels, as necessary. Field screening (i.e., visual and olfactory observations and photoionization detector [PID] readings), as discussed further in the Contaminated Media Management Plan (CMMP, Haley & Aldrich, 2022), and existing data will be used to help identify the limits of impacted soil areas. When excavation side wall and bottom field screening measurements indicate that the impacted soil has been removed (or a physical limitation to excavation is reached), performance soil samples will be collected, as appropriate, unless the excavation limit coincides with appropriate existing data (e.g., below cleanup or screening levels or within the applicable soil classification). Soil will be sampled for performance monitoring in accordance with professional judgement. In excavation areas of Site COCs above cleanup levels, performance samples will be collected approximately every 20 feet horizontally along the sidewalls and approximately one sample for every 400 square feet of exposed bottom (i.e., one sample for every 20-foot by 20-foot bottom area) (Ecology 2016).

If unanticipated soil impacts are encountered during Property redevelopment (i.e., potentially hazardous material discovered outside of the known areas via field screening or visual characteristics as discussed in the CMMP), soil samples will be collected and analyzed to characterize the soil for appropriate off-site disposal. If unanticipated soil impacts are stockpiled or placed into plastic-lined roll-off bins, soil samples will be collected and analyzed from the stockpile/roll-off bin in accordance with a visual estimation of stockpile volume and the corresponding number of samples shown in Table 1-1.

Table 1-1. Stockpile Sampling Summary

Cubic Yards of Soil	Typical Number of Samples for Chemical Analysis
0 to 100	3
101 to 500	5
501 to 1,000	7
1,001 to 2,000	10
> 2,000	10 + 1 for each additional 500 cubic yards

Source: Ecology 2016 Guidance for Remediation of Petroleum Contaminated Soil

This table presents general guidelines for the number of soil samples to be collected and analyzed from stockpiles. Other factors that could influence the number of samples necessary to characterize a stockpile include: 1) historical knowledge of the source of the stockpiled soils; 2) variability of the field screening tests; and 3) ultimate disposition of the soil.

1.1.2 Stormwater and Construction Dewatering Samples

All stormwater and water produced from dewatering shall be collected and treated using a chemically enhanced sand filtration (CESF) system and/or granular activated carbon (GAC) to meet permitted limits for turbidity, pH, and potential pollutants (Clear Water Services, 2023). Discharge samples shall be collected from all discharge points in accordance with the Construction Stormwater General Permit (CSWGP) and Administrative Order No. 21321. Discharge sampling shall initially be performed in batches to confirm all discharge parameters meet applicable indicator levels prior to discharging. After a minimum of two batch sampling and analysis events and upon written approval from Ecology, a flow-through treatment system may be implemented with discharge samples collected and analyzed once per calendar week.

See the Stormwater Pollution Prevention Plan (SWPPP) by Clear Water Services (2023) for more detailed information.

1.2 SAMPLE COLLECTION PROCEDURES

1.2.1 Soil Samples

Soil samples from the excavation sidewalls or bottom will be collected using an excavator bucket, shovel, or hand auger. Soil samples will be collected from the middle of the scooped material, to the extent possible, to minimize volatilization and contact with the excavator bucket. If using a hand auger, the corer shall be pressed into the soil with a smooth continuous motion. The auger shall be twisted and withdrawn in a single smooth motion.

Stockpile samples shall be collected with hand tools 6 to 12 inches beneath the surface of the stockpile. These samples shall be collected from locations where field screening indicates contamination is most likely to be present. If field screening does not indicate contamination, the stockpile shall be divided into sections and each section shall be sampled, with the total number of samples being what is listed in Table 1-1.

Field staff will put on clean nitrile gloves (or equivalent) for each sample. Soil samples for volatile organic compound (VOC) analysis will be collected first using U.S. Environmental Protection Agency (EPA) Method 5035 procedures, by placing a 5-gram soil plug in a laboratory-supplied 40-milliliter volatile organic analysis (VOA) bottle. Soil samples for non-VOC analysis will then be transferred to labeled, pre-cleaned glassware provided by the sample receiving laboratory. Each soil sample will be transferred using a stainless-steel sampling spoon or disposable sampling equipment.

1.2.2 Stormwater and Construction Dewatering Samples

Stormwater and construction dewatering discharge samples will be collected directly from sample ports located inside the control units prior to the discharge and recirculation valves and after GAC treatment, and will be placed into labeled, pre-cleaned glassware provided by the sample receiving laboratory. VOA containers will be filled leaving no headspace. Once capped, the VOA containers will be inverted and tapped to check for headspace/air presence (bubbles). If air is present the sample container will be discarded and re-collected until free of air. Field staff will put on clean nitrile gloves (or equivalent) for each sample.

1.3 SAMPLE COLLECTION SCHEDULE

The sampling described in this SAP will take place concurrently with redevelopment, which is expected to begin in 2024. The preliminary implementation schedule with additional estimated information on the schedule for major milestones related to implementing the cleanup action is provided in the EDR.

1.4 PROJECT TEAM

This section outlines the individuals directly involved with this project and their specific responsibilities.

Property Owner (800 Mercer, LLC): Christian Gunter. Mr. Gunter is the representative for the Property owner and is responsible for overall project coordination and implementation.

General Contractor (Howard S. Wright): Ahren Boettger. Mr. Boettger is the representative for the general contractor. Howard S. Wright will be responsible for all aspects of the construction including installation of the shoring, excavation, dewatering, and construction of the building, including obtaining access to sampling locations during construction.

Ecology Site Manager: Tena Seeds. Ms. Seeds is the Ecology Site Manager and is responsible for reviewing and approving project deliverables and providing regulatory oversight and approval of activities associated with the cleanup action to ensure it is completed in accordance with the Prospective Purchaser Consent Decree[1].

[1] Prospective Purchaser Consent Decree No. 22-2-02695-2 SEA, between Ecology and 800 Mercer, LLC; effective as of March 18, 2022.

Environmental Consultant (Haley & Aldrich, Inc. [Haley & Aldrich]) Project Principal: Julie Wukelic. Ms. Wukelic will maintain primary responsibility for project quality, schedule, and budget; provide final review of all project deliverables; and serve as a technical resource throughout the project.

Environmental Consultant (Haley & Aldrich) Project Manager: Marissa Goodman. Ms. Goodman will provide assistance in problem resolution and technical matters and review and prepare project deliverables. Ms. Goodman will also monitor project QA procedures to ensure compliance with this SAP, and, if any problems or deficiencies are observed, she will facilitate appropriate corrective actions.

Environmental Consultant (Haley & Aldrich) Task Manager: Becca Dozier. Ms. Dozier will oversee impacted soil excavation and sampling activities, manage and coordinate field staff, and prepare project deliverables.

Environmental Consultant (Haley & Aldrich) Data Manager: Victoria Pehlivan. Ms. Pehlivan will be responsible for uploading data to Ecology's Environmental Information Management (EIM) database and the Environmental Consultant's database.

Environmental Consultant (Haley & Aldrich) Data Validation Manager: Katherine Miller. Ms. Miller will QA review data and coordinate with the laboratory on QA problems as needed.

Analytical Laboratory (Friedman & Bruya, Inc.): Eric Young. Mr. Young will oversee chemical analysis of samples and QA review data.

Water Treatment Subconsultant (Clear Water Services): Nick Buckner. Mr. Buckner is the representative for the water treatment subconsultant. Clear Water Services is responsible for implementation and monitoring of the stormwater and construction dewatering treatment system.

1.5 SAMPLE MANAGEMENT

Clean sample containers will be provided by the analytical laboratory ready for sample collection, including preservative, if required (see Table 1-2). Specific container requirements for samples that will undergo multiple analyses will be discussed with the analytical laboratory prior to sample collection. Soil samples for VOC analyses will be collected specifically using the EPA Method 5035 sampling method.

A sample label will be affixed to each container before sample collection. All containers will be marked with the project number, a sample number, date and time of collection, sampler's initials, and preservation type. Each sample will have a unique identification number that will be referenced by entry into field notes. Soil samples collected from the excavation, whether for performance monitoring or characterization purposes, will be labeled with an "S" followed by the order the sample was collected and the alphanumeric grid shown on CMMP figures 2-7A through 2-7K from which it was collected (e.g., S-1-A1, S-2-D3). Stockpile samples will be labeled according to the stockpile number and the order the sample was collected from the stockpile (e.g., SP-1-1). Stormwater discharge samples will be labeled with "816 Mercer_Surface_Discharge" followed by the batch number and the date (e.g., 816 Mercer_Surface_Discharge_Batch_#1_01_01_2024). Construction dewatering discharge samples will be labeled with "816 Mercer_Well_Discharge" followed by the batch number and the date (e.g., 816 Mercer_Well_Discharge_Batch_#1_01_01_2024).

Chain of custody (COC) forms will be used to document the collection, custody, and transfer of samples from their initial collection location to the laboratory. An example blank COC form is included in Attachment 1. Each sample will be entered on the custody form immediately after it is collected.

Sample custody procedures shall be followed to provide a record that can accompany a sample as it passes from collection through analysis. A sample is considered to be in custody if it meets at least one of the following conditions:

- It is in someone's physical possession or view.
- It is secured to prevent tampering (i.e., custody seals).
- It is locked or secured in an area restricted to authorized personnel.

A COC form shall be completed in the field as samples are packaged. At a minimum, the information on the custody form will include the sample number, date and time of sample collection, sampler, analysis, and number of containers. A copy of the custody form will be placed in the cooler with its respective samples before the container is sealed for delivery to the laboratory. Another copy shall be retained and placed in the project files after review by the project manager. Custody seals will be placed on each cooler containing samples so the package cannot be opened without breaking the seals.

After sample containers have been filled, they will be stored in a cooler cooled with ice or blue ice to no more than 4 degrees Celsius (^{o}C). The coolers will be transferred to the laboratory for chemical analysis. Chain of custody shall be maintained and documented at all times, from commencement in the field until delivery of the samples to the analytical laboratory, as discussed previously. Specific procedures are:

- Individual sample containers will be packaged to prevent breakage.
- Custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Signed and dated custody seals will be placed on all coolers before shipping.
- Samples will be hand-delivered to the laboratory by Environmental Consultant personnel or courier.
- When sample possession is transferred to the laboratory, the custody form will be signed by the persons transferring custody of the coolers.
- Upon receipt of samples at the laboratory, the shipping container custody seal will be broken, and the sample-receiving custodian will compare samples with information on the COC form and record the condition of the samples received.

1.6 LABORATORY ANALYSES

1.6.1 Soil Samples

Performance soil samples will be analyzed by Friedman & Bruya, Inc. or another environmental laboratory accredited by Ecology for the appropriate analyses based upon historical source locations, previous soil sampling data, and field screening. Performance soil samples will be analyzed for one or more of the constituents of concern for the Site and/or other hazard substances present in soil on the Property at concentrations that exceed Remedial Investigation (Hart Crowser, 2022) screening levels

from the American Linen Site and Broad Street Fill Site. These analytes and their associated laboratory methods include:

- Gasoline-range organics (GRO) by Ecology Method NWTPH-Gx (Site constituent of concern).
- Lead (Site constituent of concern) and arsenic (Broad Street Fill Site hazardous substance) by EPA Method 6020.
- CVOCs by EPA Method 8260D (American Linen Site hazardous substance).
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by EPA Method 8270E SIM (Broad Street Fill Site hazardous substance).

Soil samples analyzed for characterization purposes outside of known impacted areas will be analyzed for the appropriate analyses based upon historical source locations, previous soil sampling data, field screening, and disposal facility requirements. Characterization soil samples will be analyzed for one or more of the analytes using the following analytical methods:

- GRO by Ecology Method NWTPH-Gx.
- Diesel- and heavy oil-range organics (DRO and HO) by Ecology Method NWTPH-Dx.
- VOCs by EPA Method 8260D.
- Metals by EPA Method 6020.
- cPAHs by EPA Method 8270E SIM.

Samples will frequently be analyzed on a same day turnaround time. Cleanup levels and reporting limit goals for soil samples are presented in Table 1-3.

1.6.2 Stormwater and Construction Dewatering Discharge Samples

Stormwater and construction dewatering discharge samples will be analyzed by Friedman & Bruya, Inc. or another environmental laboratory accredited by Ecology for parameters listed in Administrative Order No. 21321 issued in accordance with the discharge permit. These analytes, their associated laboratory methods, and reporting limit goals for stormwater and construction dewatering discharge samples are listed in Table 1-4.

1.7 DECONTAMINATION PROCEDURES

To prevent cross contamination between sampling events, clean dedicated sampling equipment (e.g., disposable gloves) will be used for each sample location and discarded after use.

Non-disposable sampling equipment and reusable materials that contact the soil or water will be decontaminated on site before and after use at each sampling location. Decontamination will consist of the following:

- Tap-water rinse (may consist of an equivalent high-pressure or hot-water rinse). Visible soil to be removed by scrubbing.
- Non-phosphate detergent wash, consisting of a dilute mixture of Liqui-Nox® (or equivalent) and tap water.
- Distilled-water rinse.

Decontamination fluids will be transferred to the construction dewatering system for treatment and discharge.

1.8 DOCUMENTATION

Observations such as field screening results, sampling activities, and sample identification numbers and collection times shall be documented in field notes and forms. A Daily Field Report (DFR) shall be prepared to summarize each day's events. An example blank DFR form is included in Attachment 2. At a minimum, the DFR shall include the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, and activities performed.

2. Quality Assurance Project Plan

Soil and dewatering discharge samples shall be collected and analyzed in accordance with this SAP. The general QA objectives for this project are to develop and implement procedures for obtaining and evaluating data of a specified quality that can be used to confirm the cleanup action for the Site has attained cleanup standards; document the concentration of other hazardous substances that remain on the Property; and/or appropriately profile soil and discharge water for disposal. To collect such information, analytical data should have an appropriate degree of accuracy and reproducibility, samples collected should be representative of actual field conditions, and samples should be collected and analyzed using unbroken chain of custody procedures.

2.1 DATA QUALITY INDICATORS

The overall QA objectives for field sampling, field measurements, and laboratory analysis are to produce data of known and appropriate quality. The procedures and QC checks specified herein shall be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the objectives for accuracy and precision for measurement data. These goals are primarily expressed in terms of acceptance criteria for the QC checks performed.

2.1.1 Precision

Precision is the degree of reproducibility or agreement between independent or repeated measurements. Analytical variability will be expressed as the relative percent difference (RPD) between laboratory replicates and between matrix spike (MS) and matrix spike duplicate (MSD) analyses. RPD will be used to measure precision for this investigation and is defined as follows:

$$RPD = \frac{(D_1 - D_2)}{(D_1 - D_2)/2} \times 100$$

Where
D_1 = sample value
D_2 = duplicate sample value

Precision will be screened against the acceptance criteria in Tables 2-1 through 2-5.

2.1.2 Accuracy

Accuracy is the agreement between a measured value and its true or accepted value. While it is not possible to determine absolute accuracy for environmental samples, analysis of standards and spiked samples provides an indirect assessment of accuracy.

Laboratory accuracy will be assessed as the percent recovery of MSs, MSDs, surrogate spiked compounds (for organic analyses), and laboratory control samples. Accuracy will be defined as the percentage recovery compared with the true or accepted value and is defined as follows:

$$\%\ Recovery = \frac{(SSR - SR)}{SA} \times 100$$

Where
SSR = spiked sample result
SR = sample results (not applicable for surrogate recovery)
SA = amount of spike added

Accuracy will be screened against the percent recovery criteria in Tables 2-1 through 2-5.

2.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. The sampling program will be designed carefully to see that sample locations are selected properly, sufficient numbers of samples are collected to accurately reflect conditions at the site, and samples are representative of sample locations. A sufficient sample volume will be collected at each sampling point to minimize bias or errors associated with sample particle size and heterogeneity.

2.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. So that results are comparable, samples will be analyzed using standard EPA methods and protocols as described in Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (EPA 2022). Data will also be reviewed to verify that precision and accuracy criteria have been achieved and, if not, that data have been appropriately qualified.

Field personnel shall collect samples in a consistent manner at sampling locations so that data collected as part of this study are comparable. Comparability is attained by careful adherence to standardized sampling and analytical procedures, based on rigorous documentation of sample locations (including depth, time, and date).

2.1.5 Completeness

Completeness is the percentage of measurements made that are judged to be valid. Completeness will be calculated separately for each analytical group (e.g., total petroleum hydrocarbons [TPHs] and VOCs). For results to be considered complete, all QC check analyses required to verify precision and accuracy must have been performed. Data qualified as estimated during the validation process will be considered complete. Results that are rejected during the validation review or samples for which no analytical results were obtained will be considered non-valid measurements. Completeness will be calculated for each analysis using the following equation:

$$Completeness = \frac{valid\ data\ points\ obtained}{total\ data\ points\ planned} \times 100$$

The target goal for completeness is a minimum of 95 percent.

2.2 DATA QUALITY ASSURANCE

This section presents the QA/QC checks that will be conducted in the laboratory and in the field to confirm that data is of an appropriate quality.

2.2.1 Laboratory Quality Control

The laboratory shall perform QC analyses (e.g., matrix spikes and method blanks). See Tables 2-1 through 2-5 for Friedman & Bruya, Inc. QC procedures, criteria, and corrective actions for GRO, metals, CVOCs and benzene, cPAHs, and DRO analyses, respectively. Reporting limits will be consistent with industry standards and, when practicable, below or comparable to promulgated regulatory standards, unless raised due to high analyte concentrations in the sample or matrix effects. The reporting limits listed in Tables 1-3 and 1-4 are the expected reporting limits, based upon laboratory calculations and experience.

The laboratory data reports will include the following QA/QC information:

- Case narrative with a description of any problems or exceedance of quality control criteria and corrective action taken. The laboratory manager or a designee must sign the narrative.
- Copy of COC forms for all samples included in the analytical batch.
- Tabulated sample analytical results with data qualifiers, dilution factor, laboratory batch and sample number, and dates sampled, received, extracted, and analyzed all clearly specified.
- Summary of calibration results.
- Blank summary results indicating samples associated with each blank.
- MS/MSD result summaries with calculated percent recovery and relative percent differences.
- Laboratory control sample results, when applicable, with calculated percent recovery.

2.2.2 Field Quality Control

QA/QC will be practiced throughout the field activities. All sampling equipment will be decontaminated or disposed of between sample locations to minimize or eliminate cross-contamination. Laboratory sample containers, including QC samples (discussed below), shall be marked with the project number, a unique sample identification number, the date and time of collection, the sampler's initials, and preservative type (if used). Each sample container will be packed in a cooled ice chest for field storage and transport. Standard chain of custody protocols will be followed at all times. Prior to shipment, custody seals will be placed on coolers.

During the field activities, QA/QC field samples will be collected to serve as a check on laboratory quality as well as on potential variability in the sampling method and the sample matrix. Duplicate soil samples will be selected for appropriate analysis (see Section 1.6) at a rate of at least one duplicate for every 20

soil samples analyzed (i.e., 5 percent frequency). Containers for the primary and duplicate samples will be alternately filled. The field duplicate results will be compared to the primary sample to assess the precision of the sampling and analytical methods. This comparison can be expressed as the RPD between the original and duplicate samples.

A trip blank will be prepared by the laboratory and accompany the sample containers to serve as a check that the containers and their contents had not been contaminated during the course of sampling and transportation to and from the laboratory. A trip blank will be analyzed with each cooler of soil samples submitted for analysis of VOCs. The trip blank will also be analyzed for VOCs.

2.3 DATA QUALITY REVIEW

The Environmental Consultant will independently review the quality of the chemical analytical results provided by the laboratory to ensure conformance with project standards, provide additional data qualifications as appropriate, and verify that the data are acceptable for the purposes of the project. The data quality report will assess the adequacy of the reported detection limits in achieving the project cleanup levels; the precision, accuracy, representativeness, and completeness of the data; and the usability of the analytical data for project objectives. The data quality review also includes reviewing holding times, method blanks, surrogate recoveries, laboratory duplicate RPDs, calibration criteria (as provided), spike blank/spike blank duplicate recoveries, and MS/MSD recoveries. Exceedances of analytical control limits will be summarized and evaluated.

A data evaluation review will be performed on an all results using QC summary sheet results provided by the laboratory for each report. Data evaluation reviews are based on the QC requirements previously described and follow the format of the EPA National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2020), modified to include specific criteria of individual analytical methods. The laboratory will be contacted to obtain raw data (instrument tuning, calibrations, instrument printouts, bench sheets, and laboratory worksheets) if any problems or discrepancies are discovered during the routine evaluation. The results of the data quality review will be presented in an appendix to the Cleanup Action Completion Report (CACR).

The data evaluation review will verify:

- That sample numbers and analyses match the chain of custody request.
- Sample preservation and holding times.
- That instrument tuning, calibration, and performance criteria were achieved.
- That laboratory blanks were analyzed at the proper frequency and that no analytes were present in the blanks.
- That laboratory duplicates, MSs, surrogate compounds, and laboratory control samples were run at the proper frequency and that control limits were met.
- That required detection limits were achieved, unless raised due to high analyte concentrations in the sample or matrix effects.

Data qualifier flags, beyond any applied by the laboratory, will be added to sample results that fall outside the quality control acceptance criteria. Typical data qualifiers are:

U	The compound was analyzed for but was not detected above the reporting limit. The associated numerical value is the sample reporting limit.
J	The associated numerical value is an estimated quantity because quality control criteria were slightly exceeded.
UJ	The compound was analyzed for, but not detected. The associated numerical value is an estimated reporting limit because quality control criteria were not met.
T	The associated numerical value is an estimated quantity because reported concentrations were less than the practical quantitation limit (lowest calibration standard).
R	Data are not usable because of significant exceedance of quality control criteria. The analyte may or may not be present; resampling and/or reanalysis is necessary for verification.

2.4 DATA MANAGEMENT

Once validated, laboratory data will be uploaded to Environmental Consultant's database. Validated laboratory data will also be submitted to Ecology's EIM database by the Environmental Consultant Data Manager concurrent with submittal of the CACR. Field data, such as DFRs, will be reviewed by the Environmental Consultant Task Manager and stored in the project folder.

References

1. Clear Water Services 2023. Stormwater Pollution Prevention Plan. Prepared for Howard S. Wright, 1 May 2023.

2. Ecology 2016. Guidance for Remediation of Petroleum Contaminated Sites. Prepared by Washington State Department of Ecology, Toxics Cleanup Program, Olympia, WA. Publication No. 10-09-057, Revised June 2016.

3. Ecology 2022. Cleanup Action Plan, Seattle DOT Mercer Parcels Site, Seattle, WA. Prepared by Washington Department of Ecology, February 8, 2022.

4. EPA 2022. Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846. Environmental Protection Agency.

5. EPA 2020. National Function Guidelines for Organic Superfund Methods Data Review, OLEM 9355.0-136, EPA-540-R-2017-002. Washington, DC. November 2020.

6. Haley & Aldrich, Inc. 2023. Contaminated Media Management Plan on Seattle DOT Mercer Parcels Site, 800 Mercer Street, Seattle, Washington. Prepared by Haley & Aldrich, Inc. for 800 Mercer, LLC, September 2023.

7. Hart Crowser, a division of Haley & Aldrich 2022. Remedial Investigation, Seattle DOT Mercer Parcels, 800 Mercer Street, Seattle, Washington. February 3, 2022.

TABLES

TABLE 1-2
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES
SEATTLE DOT MERCER PARCELS SITE
SEATTLE, WASHINGTON

Analysis (Method)	Sample Matrix	Preservation and Storage	Holding Time[a]	Container
Gasoline-range organics (NWTPH-Gx)	Soil	Cool to 4°C for up to 48 hours; freeze to -7 °C	14 days	5035 Kit - 4 x pre-tared 40 mL VOA vial[b]
	Water	HCl; Cool to 4°C		3 x 40 mL VOA vial
Diesel- and heavy oil-range organics (NWTPH-Dx)	Soil	Cool to 4°C	14 days to extraction; 40 days to analysis	1 x 4 ounce WMG jar[c]
	Water	HCl; Cool to 4°C		1 x 500 mL amber glass jar
VOCs (EPA 8260D)	Soil	Cool to 4°C for up to 48 hours; freeze to -7 °C	14 days	5035 Kit - 4 x pre-tared 40 mL VOA vial[b]
	Water	HCl; Cool to 4°C		3 x 40 mL VOA vial
Total metals (EPA 6020)	Soil	Cool to 4°C	6 months; 28 days for Hg	1 x 4 ounce WMG jar[c]
cPAHs (EPA 8270E SIM)	Soil	Cool to 4°C	14 days to extraction; 40 days to analysis	1 x 4 ounce WMG jar[c]

Notes:
The methods and number and type of required sample containers will be determined and supplied by the analytical laboratory.
a. Holding times are from date of sample collection.
b. VOCs and gasoline-range organics can be combined into 4 x pre-tared VOA vials with a 5 to 10 gram soil core in each.
c. Diesel- and heavy oil-range organics, metals, and cPAHs can be combined into one 4-ounce glass jar.
VOCs = Volatile Organic Compounds
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
EPA = Environmental Protection Agency
HCl = Hydrochloric Acid
VOA = Volatile Organic Analysis
WMG = wide-mouth glass
mL = millilter

TABLE 1-3
CLEANUP LEVELS AND REPORTING LIMIT GOALS FOR SOIL SAMPLES
SEATTLE DOT MERCER PARCELS SITE
SEATTLE, WASHINGTON

Method	Analyte	Cleanup Levels [mg/kg]	Laboratory Reporting Limit Goal [mg/kg]
BTEX and HVOCs by EPA 8260D	Benzene[b]	0.03	0.005
	Toluene[b]	7	0.005
	Ethylbenzene[b]	6	0.005
	Xylenes[b]	9	0.06
	Chloromethane[b]	--	0.5
	Vinyl chloride[b]	0.67	0.05
	Chloroethane[b]	--	0.1
	Trichlorofluoromethane[b]	24,000	0.5
	1,1-Dichloroethene[b]	4,000	0.05
	Methylene Chloride[b]	0.02	0.02
	trans-1,2-Dichloroethene[b]	1,600	0.05
	1,1-Dichloroethane[b]	180	0.005
	2,2-Dichloropropane[b]	--	0.05
	cis-1,2-Dichloroethene[b]	160	0.05
	Chloroform[b]	32	0.05
	1,1,1-Trichloroethane[b]	2	0.005
	Carbon tetrachloride[b]	14	0.05
	1,1-Dichloropropene[b]	--	0.05
	Trichloroethene[b]	0.03	0.02
	1,2-Dichloropropane[b]	27	0.05
	Bromodichloromethane[b]	16	0.05
	1,1,2-Trichloroethane[b]	18	0.05
	Tetrachloroethene[b]	0.05	0.025
	1,3-Dichloropropane[b]	1,600	0.05
	Dibromochloromethane[b]	12	0.05
	Chlorobenzene[b]	1,600	0.05
	1,1,1,2-Tetrachloroethane[b]	38	0.05
	1,2,3-Trichloropropane[b]	0.0063	0.005
	1,1,2,2-Tetrachloroethane[b]	5	0.05
	2-Chlorotoluene[b]	1,600	0.05
	4-Chlorotoluene[b]	--	0.05
	1,3-Dichlorobenzene[b]	--	0.05
	1,4-Dichlorobenzene[b]	190	0.05
	1,2-Dichlorobenzene[b]	7,200	0.5
	1,2-Dibromo-3-Chloropropane[b]	0.23	0.005
	1,2,4-Trimethylbenzene[b]	800	0.05
	Hexachloro-1,3-butadiene[b]	1.7	0.25
Gasoline-Range Organics by NWTPH-Gx	Gasoline-range Organics[a]	30	5
Diesel-Range Organics by NWTPH-Dx	Diesel-range Organics[b]	2,000	50
	Heavy oil-range Organics[b]	2,000	250
cPAHs by EPA 8270E SIM	Benzo(a)anthracene[b]		0.01
	Chrysene[b]		0.01
	Benzo(b)fluoranthene[b]		0.01
	Benzo(k)fluoranthene[b]		0.01
	Benzo(a)pyrene[b]	0.1	0.01
	Indeno(1,2,3-cd)pyrene[b]		0.01
	Dibenzo(ah)anthracene[b]		0.01
	cPAHs-TEQ[b]	0.1	0.01
Total Metals by EPA 6020	Arsenic[b]	20	1
	Cadmium[b]	2	1
	Chromium[b]	--	1
	Lead[a]	250	1
	Mercury[b]	2	1

Notes:
mg/kg = milligram per kilogram
Actual reporting limits may be above the laboratory reporting limit goals due to high analyte concentrations in the sample or matrix effects.
CAP = Cleanup Action Plan
CVOCs = Chlorinated Volatile Organic Compounds
HVOCs = Halogenated Volatile Organic Compounds
BTEX = Benzene, toluene, ethylbenzene, and xylenes
COC = Constituent of Concern
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
EPA = Environmental Protection Agency
GRO = Gasoline-range Organics
a. Cleanup levels for Seattle DOT Mercer Parcels Site COCs (GRO and lead in soil) were selected in the CAP (Ecology 2022).
b. Cleanup levels for the hazardous substances on the Property from the American Linen Site (CVOCs in soil) and Broad Street Fill Site (arsenic and cPAHs in soil) have not been selected since these sites have not finalized their CAPs. We selected MTCA Method A cleanup levels (or MTCA Method B if there was not a MTCA Method A cleanup level) for these constituents and other hazardous substances that may be present outside of known impacted areas to compare concentrations to criteria based on the appropriate pathways for disposal purposes (i.e., direct contact).

TABLE 1-4
DEWATERING DISCHARGE PARAMETERS AND REPORTING LIMIT GOALS
SEATTLE DOT MERCER PARCELS SITE
SEATTLE, WASHINGTON

Method	Analyte	Indicator Levels (µg/L)	Detection Levels (µg/L)	PQLs (µg/L)	Laboratory Reporting Limit Goal[b] (µg/L)
VOCs by EPA 8260D/624MOD	Benzene	2[a]	1	2	0.2
	Toluene				0.2
	Ethylbenzene				0.2
	Xylenes				0.4
	Acetone	5[a]	5	5	5
	n-Butylbenzene[g]	5[a]	5	5	5
	sec-Butylbenzene	5[a]	5	5	1
	tert-Butylbenzene	5[a]	5	5	1
	Carbon Disulfide[g]	10[a]	10	10	10
	Chloroform	4.8[a]	1.6	4.8	1
	1,1-Dichloroethane	14.1[a]	4.7	14.1	1
	1,2-Dichlroroethane	8.4[a]	2.8	8.4	0.2
	2,2-Dichloropropane	1[a]	0.19	1	1
	cis-1,2-Dichloroethene	5[a]	5	5	1
	Dibromochloromethane	9.3[a]	3.1	9.3	0.5
	Diisopropyl ether	1[a]	0.1	1	1
	Isopropylbenzene	5[a]	5	5	1
	p-Isopropyltoluene	5[a]	5	5	1
	Methyl Chloride	2[a]	1	2	2
	n-Propylbenzene	5[a]	5	5	1
	Tetrachloroethene	12.3[a]	4.1	12.3	1
	1,1,1-Trichloroethane	11.4[a]	3.8	11.4	1
	Trichloroethene	5.7[a]	1.9	5.7	0.5
	1,2,4-Trimethylbenzene	5[a]	5	5	1
	1,3,5-Trimethylbenzene	5[a]	5	5	1
	trans-1,2-Dichloroethene	4.8[a]	1.6	4.8	1
	Vinyl chloride	2[a]	1	2	0.02
Gasoline-Range Organics by NWTPH-Gx	Gasoline-range Organics	250[a]	250	250	100
Diesel- and Heavy Oil-Range Organics by NWTPH-Dx	Diesel-range Organics	250[a]	250	250	50
	Heavy Oil-range Organics				200
PAHs by EPA 8270E/625MOD	Acenaphthene	5.7[a]	1.9	5.7	0.02
	Acenaphthylene	10.5[a]	3.5	10.5	0.02
	Anthracene	5.7[a]	1.9	5.7	0.02
	Benzo(a)anthracene	23.4[a]	7.8	23.4	0.02
	Benzo(a)pyrene	7.5[a]	2.5	7.5	0.02
	Benzo(b)fluoranthene	14.4[a]	4.8	14.4	0.02
	Benzo(k)fluoranthene	7.5[a]	2.5	7.5	0.02
	Chrysene	7.5[a]	2.5	7.5	0.02
	Dibenzo(ah)anthracene	7.5[a]	2.5	7.5	0.02
	Fluoranthene	6.6[a]	2.2	6.6	0.02
	Fluorene	5.7[a]	1.9	5.7	0.02
	Indeno(1,2,3-cd)pyrene	11.1[a]	3.7	11.1	0.02
	1-Methylnaphthalene	10[a]	10	10	0.2
	2-Methylnaphthalene	10[a]	10	10	0.2
	Naphthalene	4.8[a]	1.6	4.8	0.2
	Phenanthrene	16.2[a]	5.4	16.2	0.02
	Pyrene	5.7[a]	1.9	5.7	0.02
Total Metals by EPA 200.8 or 1631E	Antimony	12[d]	0.3	1	1
	Arsenic	360[c]	0.1	0.5	0.5
	Beryllium	0.5[a]	0.1	0.5	0.5
	Cadmium	1.6[c]	0.05	0.25	0.2
	Chromium	15[e]	0.2	1	1
	Copper	8.2[c]	0.4	2	2
	Lead	27.47[c]	0.1	0.5	0.5
	Mercury	2.1[c]	0.0002	0.0005	0.0007
	Nickel	733.79[c]	0.1	0.5	0.5
	Selenium	20[c]	1	1	1
	Zinc	59.3[c]	0.5	2.5	2.5
PCBs by EPA 8082/608MOD	Total PCBs[f]	2[c]	0.065	0.195	0.09

Method	Analyte	Benchmark (Units)	Laboratory Reporting Limit Goal[b] (Units)
Turbidity by EPA 180.1	Turbidity	25 NTU	0.5 NTU
pH by EPA 150.2	pH	6.5 - 8.5 SU	0.1 SU

Notes:
a. Value based on PQL as there is no applicable surface water criterion.
b. Actual reporting limits may be above the laboratory reporting limit goals due to high analyte concentrations in the sample or matrix effects.
c. Meeting the Indicator Level using analytical protocol for total or dissolved metal values meets the intent of the Administrative Order.
d. Indicator Level based on human health criteria for consumption of organisms as there is no applicable surface water criterion.
e. Indicator Level based on hexavalent chromium because there is no water quality standard for total chromium.
f. Total PCBs are the sum of all congener or all isomer or homolog or Aroclor analyses.
g. Analyzed by Tentatively Identified Compounds.
µg/L = microgram per liter
PAHs = Polycyclic Aromatic Hydrocarbons
EPA = Environmental Protection Agency
VOC = Volatile Organic Compound
PCB = Polychlorinated Biphenyl
PQL = Practical Quantitation Limit
NTU = Nephelometric Turbidity Unit
SU = Standard Unit

TABLE 2-1

LABORATORY AND FIELD QUALITY CONTROL PROCEDURES, CRITERIA, AND CORRECTIVE ACTIONS FOR GASOLINE ANALYSIS

SEATTLE DOT MERCER PARCELS SITE

SEATTLE, WASHINGTON

Laboratory and Field Quality Control: NWTPH-Gx (GC/FID)			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 5 x blank level
Initial calibration	Minimum 5-point external calibration before sample analysis	< 20% difference from true value, correlation coefficient $\geq$ 0.99	Recalibrate instrument
Continuing calibration	Beginning and end of instrument run	NWTPH-Gx $\leq$ 20% difference from initial calibration.	Recalibrate instrument and re-analyze affected samples
Surrogates	Every lab and field sample	80-120% recovery	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Field duplicate	1 for every 20 or fewer samples	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80-120% recovery	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	80-120% recovery	Evaluate data for usability
Matrix spike (MS) sample	1 per batch of 20 or fewer samples if sufficient sample	80-120% recovery	Evaluate data for usability
Matrix spike duplicate (MSD)	1 per batch of 20 or fewer samples if sufficient sample	80-120% recovery	Evaluate data for usability

Notes:

RPD = relative percent difference

This table is specific to Friedman & Bruya, Inc and may be subject to change based on the laboratory used.

TABLE 2-2

LABORATORY AND FIELD QUALITY CONTROL PROCEDURES, CRITERIA, AND CORRECTIVE ACTIONS FOR METALS ANALYSIS

SEATTLE DOT MERCER PARCELS SITE

SEATTLE, WASHINGTON

Laboratory and Field Quality Control: Total Metals – EPA 6020			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial calibration verification	Daily or each time instrument is set up	90 to 110% of initial calibration	Recalibrate instrument
Initial calibration blank	After each instrument calibration	All analytes < reporting limit	Correct source of contamination
Continuing calibration verification	Every 10 analytical samples and at the beginning and end of each run	90 to 110% of initial calibration	Correct instrument calibration and re-analyze affected samples
Continuing calibration blank	After each continuing calibration verification	All analytes < reporting limit	Correct source of contamination
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 3 times the blank level
Matrix spike (MS)	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Matrix spike duplicate (MSD)	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Field duplicate	1 per 20 or fewer samples	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Laboratory control sample duplicate	1 per batch of 20 or fewer samples if no MS/MSD	80 to 120% recovery	Evaluate data for usability

Notes:

RPD = relative percent difference

This table is specific to Friedman & Bruya, Inc and may be subject to change based on the laboratory used.

TABLE 2-3

LABORATORY AND FIELD QUALITY CONTROL PROCEDURES, CRITERIA, AND CORECTIVE ACTIONS FOR CVOCs AND BENZENE ANALYSIS

SEATTLE DOT MERCER PARCELS SITE

SEATTLE, WASHINGTON

Laboratory and Field Quality Control: CVOCs/Benzene – EPA 8260			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Instrument tuning	Before initial calibration	See EPA Method 8260	Retune and recalibrate instrument
Initial calibration	See EPA Method 8260	< 20% relative percent difference	Laboratory to recalibrate and re-analyze affected samples
Continuing calibration verification	Every 12 hours	See EPA Method 8260	Laboratory to recalibrate if correlation coefficient or response factor does not meet method requirements
		< 20% percent difference	
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Laboratory to eliminate or greatly reduce laboratory contamination due to glassware or reagents or analytical system; re-analyze affected samples
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Field duplicate	1 for every 20 or fewer samples	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Matrix spike (MS) sample	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Matrix spike duplicate (MSD)	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Surrogates	Added to every lab and field sample	80 to 120% recovery	Evaluate data for useability

Notes:

RPD = relative percent difference

This table is specific to Friedman & Bruya, Inc and may be subject to change based on the laboratory used.

TABLE 2-4

LABORATORY AND FIELD QUALITY CONTROL PROCEDURES, CRITERIA, AND CORRECTIVE ACTIONS FOR cPAHs ANALYSIS

SEATTLE DOT MERCER PARCELS SITE

SEATTLE, WASHINGTON

Laboratory and Field Quality Control: cPAHs – EPA 8270E			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Instrument tuning	DFTPP; Before initial calibration	See EPA Method 8270	Retune and recalibrate instrument; reanalyze affected samples
Initial calibration	See EPA Method 8270	≤ 20% relative percent difference	Laboratory to recalibrate and re-analyze affected samples
Continuing calibration verification	Every 12 hours	See EPA Method 8270 ≤ 20% percent difference	Recalibrate instrument and reanalyze affected samples
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Re-extract and reanalyze associated samples unless sample concentrations are >5x blank level or are undetected
Internal Standards	Every sample and calibration standard mix	Areas with -50% to +100% of initial calibration	Reanalyze affected samples
Field duplicate	1 for every 20 or fewer samples	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Matrix spike (MS) sample	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Matrix spike duplicate (MSD)	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Surrogates	Added to every lab and field sample	80 to 120% recovery	Evaluate data for useability

Notes:

RPD = relative percent difference

This table is specific to Friedman & Bruya, Inc and may be subject to change based on the laboratory used.

TABLE 2-5

LABORATORY AND FIELD QUALITY CONTROL PROCEDURES, CRITERIA, AND CORRECTIVE ACTIONS FOR DIESEL ANALYSIS

SEATTLE DOT MERCER PARCELS SITE

SEATTLE, WASHINGTON

Laboratory and Field Quality Control: NWTPH-Dx (GC/FID)			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 5 x blank level
Initial calibration	Minimum 5-point external calibration prior to sample analysis	< 20% difference from true value, correlation coefficient > 0.99	Recalibrate instrument
Continuing calibration	Beginning, end, and every 10 samples with mid-range standard	% difference < 20% of initial calibration	Recalibrate instrument and re-analyze affected samples
Surrogates	Every lab and field sample	80 to 120% recovery	Evaluate data for usability
Laboratory duplicate	1 per batch of 10 or fewer samples if no MS/MSD	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Field duplicate	1 per 20 or fewer samples	RPD <30% (aqueous), RPD <50% (solid)	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Matrix spike (MS) sample	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability
Matrix spike duplicate (MSD)	1 per batch of 20 or fewer samples if sufficient sample	80 to 120% recovery	Evaluate data for usability

Notes:

RPD = relative percent difference

This table is specific to Friedman & Bruya, Inc and may be subject to change based on the laboratory used.

ATTACHMENT 1
Chain of Custody

HALEY ALDRICH

Haley & Aldrich, Inc.
3131 Elliott Ave.,
Suite 600,
Seattle, WA 98121

CHAIN OF CUSTODY RECORD

Phone (206) 324-9530

Page of

H&A FILE NO.		LABORATORY		DELIVERY DATE	
PROJECT NAME		ADDRESS		TURNAROUND TIME	
H&A CONTACT		CONTACT		PROJECT MANAGER	

Sample No.	Date	Time	Depth	Type	Analysis Requested	Number of Containers	Comments (special instructions, precautions, additional method numbers, etc.)

Sampled and Relinquished by	Received by
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time
Relinquished by	**Received by**
Sign	Sign
Print	Print
Firm	Firm
Date Time	Date Time

LIQUID	
	VOA Vial
	Amber Glass
	Plastic Bottle
	Preservative
	Volume

SOLID	
	VOA Vial
	Amber Glass
	Clear Glass
	Preservative
	Volume

PRESERVATION KEY

A	Sample chilled	**C**	NaOH	**E**	H_2SO_4	**G**	Methanol
B	Sample filtered	**D**	HNO_3	**F**	HCL	**H**	Water/NaHSO4 (circle)

Sampling Comments

Evidence samples were tampered with? YES NO

If YES, please explain in section below.

Presumptive Certainty Data Package (Laboratory to use applicable DEP CAM methods)

If Presumptive Certainty Data Package is needed, initial all sections:

_____ The required minimum field QC samples, as designated in BWSC CAM-VII have been or will be collected, as appropriate, to meet the requirements of Presumptive Certainty.

_____ Matrix Spike (MS) samples for MCP Metals and/or Cyanide are included and identified herein.

_____ This Chain of Custody Record (specify) _____includes _____does not include samples defined as Drinking Water Samples.

_____ If this Chain of Custody Record identifies samples defined as Drinking Water Samples, Trip Blanks and Field Duplicates are included and identified and analysis of TICs are required, as appropriate. Laboratory should (specify if applicable)_____analyze

Required Reporting Limits and Data Quality Objectives

- ☐ RC-S1
- ☐ RC-S2
- ☐ RC-GW1
- ☐ RC-GW2
- ☐ S1
- ☐ S2
- ☐ S3
- ☐ GW1
- ☐ GW2
- ☐ GW3

WHITE - Laboratory **CANARY** - Project Manager **PINK** - Haley & Aldrich Laboratory

FEBRUARY 2016

Form 3003

WATER AND WASTEWATER METHODS			Solid	Liquid	
Analysis Description	**Method No.**	**Preservative**	**Sample Volume/Container**		**Holding Time**
Alkalinity	310	Cool 4° C	N/A	250 mL HDPE	14 days
Amenable Cyanide	Std. Mth. 412 F.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Ammonia	350	pH<2 H2SO4, Cool 4° C	N/A	1 L HDPE	28 days
Base/Neutral & Acid Extractables	625	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Biochemical Oxygen Demand (BOD)	405.1	Cool 4° C	N/A	2 L HDPE	48 hours
Chemical Oxygen Demand (COD)	410	pH<2 H2SO4, Cool 4° C	N/A	125 mL HDPE	28 days
Chloride	300.0, 325	None Required	N/A	125 mL HDPE	28 days
Chromium, Hexavalent	3500D, 218.4/5	None Required	N/A	1 L HDPE	24 hours
Fluoride	300.0, 340	None Required	N/A	500 mL HDPE	28 days
Hardness, Total (as CaCO3)	130	pH<2 H2SO4, Cool 4° C	N/A	250 mL HDPE	6 Months
Nitrate	300.0, 352.1	Cool 4° C	N/A	250 mL HDPE	48 Hours
Nitrite	300.0, 354.1	Cool 4° C	N/A	125 mL HDPE	48 Hours
Orthophosphate	300.0, 365	Filter, Cool 4° C	N/A	125 mL HDPE	48 Hours
PCBs	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Pesticides	608	Cool 4° C	N/A	1 L Amber	7 days Ext/40 days Analyze
Physiologically Available Cyanide	MADEP draft	pH>12 NaOH, 4° C	N/A	1 L HDPE	14 days
Priority Pollutant Metals (13 Metals)	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Purgeable Halocarbons & Aromatics	8021	pH 2 HCI, Cool 4° C	N/A	40 mL Glass Vial	14 days
RCRA Metals (8 Metals)	200.7/AA, 200 Series	pH<2 HNO3, 4° C	N/A	1 L HDPE	28 days (Hg), 6 mos. (others)
Sulfate	300.0, 375	Cool 4° C	N/A	250 mL HDPE	28 days
Sulfide	376	pH>9 NaOH, Zn Acetate, Cool 4° C	N/A	1 L HDPE	7 days
Sulfite	377.1	None Required	N/A	125 mL HDPE	Analyze Immediately
Total Cyanide	335	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
Total Dissolved Solids (TDS)	209	Cool 4° C	N/A	250 mL HDPE	7 days
Total Organic Carbon (TOC)	415	pH<2 HCI or H2SO4, Cool 4° C, Dark	N/A	40 mL Amber	28 days
Total Organic Halogen (TOX)	506	pH<2 HNO3, 4° C	N/A	1 L Amber	check with lab
Total Phenolics	420.1	pH<2 H2SO4, Cool 4° C	N/A	1 L Amber	28 days
Total Phosphorus	365	pH<2 H2SO4, Cool 4° C	N/A	125 mL HDPE	28 days
Total Solids (TS)	160.3	Cool 4° C	N/A	250 mL HDPE	7 days
Total Suspended Solids (TSS)	160.2	Cool 4° C	N/A	250 mL HDPE	7 days
Volatile Organics	624	pH 2 HCI, Cool 4° C	N/A	40 mL Glass Vial	14 days
Weak and Dissociable Cyanide	Std. Mth. 412 H.	pH>12 NaOH, Cool 4° C	N/A	1 L HDPE	14 days
DRINKING WATER ANALYSIS					
Volatile Organics	502.2 or 524.2	pH 2 HCI, Cool 4° C	N/A	40 mL Glass Vial	14 days
MICROBIOLOGY					
Fecal Coliform	STDMTH	Cool 4° C	N/A	sterile, 125 mL	6 hours
Standard Plate Count	STDMTH	Cool 4° C	N/A	sterile, 125 mL	6 hours
Total Coliform	STDMTH	Cool 4° C	N/A	sterile, 125 mL	6 hours

SOIL/SEDIMENTS/WATER		Solids (S) / Liquids (L)	Solid	Liquid	
Analysis Description	**Method No.**	**Preservative**	**Sample Volume/Container**		**Holding Time**
Acid Extractables/Base/Neutral Extractables	8270	S/L: Cool 4° C	8 oz. CWM	1 L Amber	S:14 days Ext / L:7 days Ext
Amenable Cyanide	-	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Chromium, Hexavalent - Soil	3060A/7196	Cool 4° C	8 oz. CWM	-	S:30 days Ext / L:7 days Ext
Chromium, Hexavalent - Liquid	7196	Cool 4° C	-	1 L HDPE	24 hours
Herbicides	8150	S/L: Cool 4° C	8 oz. CWM	1 L Amber	S:14 days Ext / L:7 days Ext
MCP Metals	6010, 7470, 7471	S/L: Cool 4° C	8 oz. CWM	1 L HDPE	28 days (Hg), 6 mos. (others)
PAH (low level)	8310 or GC/MS SIM	S/L: Cool 4° C	8 oz. AWM	1 L Amber	S:14 days Ext / L:7 days Ext
Paint Filter Liquids Test	9095	S: Cool 4° C	8 oz. CWM	1 L Amber	Analyze ASAP
PCBs	8082	S/L: Cool 4° C	8 oz. CWM	1 L Amber	S:14 days Ext / L:7 days Ext
Pesticides	8081	S/L: Cool 4° C	8 oz. CWM	1 L Amber	S:14 days Ext / L:7 days Ext
Physiologically Available Cyanide	MADEP	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Priority Pollutant Metals(13 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L HDPE	28 days (Hg), 6 mos. (others)
RCRA Metals (8 Metals)	6010&7000	S: 4° C / L: pH<2 HNO3, 4° C	8 oz. CWM	1 L HDPE	28 days (Hg), 6 mos. (others)
Total Cyanide	9014	S: 4° C / L: pH>12 NaOH, 4° C	4 oz. CWM	1 L HDPE	14 days
Volatile Organics	8260B, 8021	S: methanol/$NaHSO_4$, 4° C / L: pH<2 HCI, 4° C	4 oz. CWM	40 mL Glass Vial	14 days
RCRA HAZARDOUS WASTE CHARACTERIZATION					
Corrosivity (pH only)	SW846-7.2	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Ignitability/Flashpoint	SW846-7.1	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
Reactivity (CN-/S2-)	SW846-7.3	S: Cool 4° C	4 oz. CWM	check with lab	Analyze ASAP
TCLP (RCRA 8) Metals	1311	S: Cool 4° C	16 oz. CWM	check with lab	6 mos. Ext/6 mos. Analyze
TCLP Pesticides/Herbicides	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Semivolatiles	1311	S: Cool 4° C	16 oz. CWM	check with lab	14 days Ext/40 days Analyze
TCLP Volatiles	1311	S: Cool 4° C	8 oz. CWM	check with lab	14 days Ext/14 days Analyze
HYDROCARBON OIL & GREASE ANALYSIS					
MADEP EPH Method	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP EPH Method (C-Ranges only)	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
MADEP VPH Method	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCI, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP VPH Method (C-Ranges only)	MADEP REV. 0	S: methanol, 4° C / L: pH<2 HCI, 4° C	40 mL+2 oz. CWM.	40 mL Glass Vial	S: 28 days / L: 14 days
MADEP EPH Method - with selected PAHs (including acenaphthene, naphthalene, 2-methylnaphthalene, and phenanthrene)	MADEP REV. 0	S: Cool 4° C / L: pH<2 HCl, 4° C	4 oz. Amber	1 L Amber	S:7 days Ext / L:14 days Ext
Petroleum Identification	ASTM D3328				
Quantitative (include Chromatograms)		S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days
Total Petroleum Hydrocarbons (Infrared)	418.1	S: Cool 4° C / L: pH<2 H_2SO_4, 4° C	4 oz. CWM	1 L Amber	S: 7 days / L: 28 days

MCP METALS

Antimony (Sb)	Barium (Ba)	Cadmium (Cd)	Lead (Pb)	Nickel (Ni)	Silver (Ag)	Vanadiun (V)
Arsenic (As)	Beryllium (Be)	Chromium (Cr)	Mercury (Hg)	Selenium (Se)	Thalliun (Tl)	Zinc (Zn)

This table is offered for informational purposes only and is intended to be followed and used by persons having related technical skills and at their own discretion and risk. Since conditions and the manner of use are outside of Haley & Aldrich's control,

ATTACHMENT 2
Daily Field Report

HALEY ALDRICH

DAILY FIELD REPORT

Report No.

Project/Address:				**Date:**	
Client:				**Weather:**	
H&A Rep. / Ph.:				**H&A PM:**	
H&A Rep Arrival:		**H&A Rep Departure:**		**File No:**	
Contractor / Rep. / Ph.:					
Subcontractor / Rep. / Ph.:					
Purpose:					

ATTACHMENTS

DAILY OBSERVATIONS

Time:	Observations:

OUTSTANDING ISSUES LIST

Issue No.:	Date:	Issue/Resolution:	Date Resolved:

Note: Resolved items will remain on list for at least 1 day, then will be marked with a strike-through for at least 1 day, and then will be removed.

SAMPLE COLLECTION SUMMARY

Sample ID:	Soil Description and Field Screening Results:	Sample Time, Location, Depth/El.:

PLANNED ACTIVITIES/SCHEDULING

Project: **Date:**

PHOTOS

Photo #1

Photo #2

APPENDIX K
Vapor Barrier Details and Specifications

COREFLEX® 60-54W

THERMOPLASTIC WATERPROOFING MEMBRANE WITH ACTIVE POLYMER CORE

DESCRIPTION

COREFLEX 60-54W is a 1.5 mm (60 mil) nominal thermoplastic membrane reinforced with a 5.0 oz weft inserted knit polyester fabric integrally bonded to an Active Polymer Core (APC). COREFLEX 60-54W offers the ultimate in waterproofing barrier protection technology. The barrier performance starts with a thermoplastic membrane with welded seams providing a monolithic watertight barrier layer. The thermoplastic membrane is reinforced with a weft inserted knit polyester reinforcement fabric and is produced with DuPont's Elvaloy-KEE® (Keytone Ethylene Ester), a solid phase high molecular weight ethylene interpolymer.

Unlike traditional liquid PVC plasticizers, the Elvaloy-KEE does not experience phase separation and migrate out; thus the membrane properties are maintained for long term performance. Elvaloy-KEE also provides superior chemical resistance properties. The Active Polymer Core layer is integrally bonded to the Elvaloy-KEE thermoplastic membrane. The APC layer is designed to activate with water to swell and form a positive seal. Thereby, at any unforeseen puncture or installation defect, the APC layer reacts at the breach, self-sealing to stop the water ingress. COREFLEX 60-54W is the only welded thermoplastic membrane composite with this reactive, self-sealing performance feature.

APPLICATIONS

The COREFLEX 60-54W waterproofing system provides waterproofing protection for structural concrete surfaces. Below grade applications include backfilled cast-in-place concrete and masonry block foundation walls as well as plaza deck waterproofing conditions. The membrane can be continued under the floor slab and up onto a horizontal deck to provide a continuous, uniform waterproofing system. COREFLEX 60-54W can be used to waterproof structures under continuous or intermittent hydrostatic pressure. COREFLEX 60-54W applications include: Plaza Decks, Split-Slab Deck Construction, Foundation Walls, Earth-Covered Structures, Tunnels and Greenroofs.

INSTALLATION

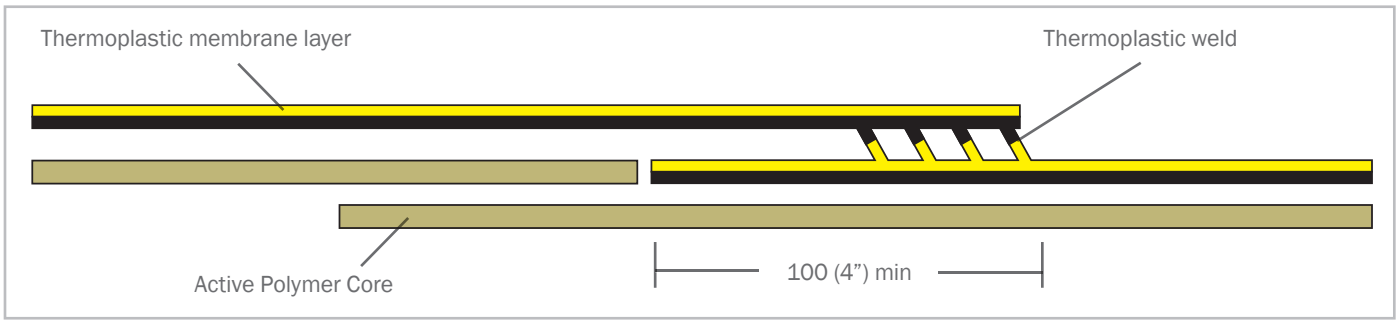
General: Install COREFLEX 60-54W Waterproofing System in strict accordance with the manufacturer's installation guidelines and details using accessory products, protection and drainage layers, and overburden as specified or required. Install COREFLEX 60-54W with the grey APC geotextile side directly in contact with the concrete to be waterproofed. Division 3 Concrete Work should include WATERSTOP-RX® installed in all applicable horizontal and vertical concrete construction joints and around penetrations.

PACKAGING

COREFLEX 60-54W is available in 1.4 m x 15 m (54" x 50') rolls; 54" wide thermoplastic membrane with APC layer offset by 150 mm (6") along the long roll edge.

QUALITY ASSURANCE PROGRAM

Rely on quality waterproofing products and the HydroShield Quality Assurance Program from CETCO. This program is designed to protect your building and its contents from water leaks through pre-installation planning, experienced craftsmanship, and onsite inspection backed by the strongest warranty in the industry. If it's worth building, it's worth protecting.



Typical COREFLEX® 60-54W membrane overlap assembly with continuousthermoplastic weld

COREFLEX® 60-54W

THERMOPLASTIC WATERPROOFING MEMBRANE WITH ACTIVE POLYMER CORE

TECHNICAL DATA		
PROPERTY	TEST METHOD	TYPICAL VALUE
Membrane Composite Thickness	ASTM D751	3.8 mm (150 mil)
Hydrostatic Pressure Resistance (min 1 hr @ 100 psi)	ASTM D5385	70 m (231 ft)
Puncture Resistance	ASTM D4833	996 N (224 lbs)
Tensile Strength ASTM D751	ASTM D751	2,442 N (549 lbs)
Bonded Seam Strength	ASTM D751	3,136 N (705 lbs)
Peel Adhesion to Concrete	ASTM D903 (mod)	1,751 N/m (10 lbs/in)
Methane Permeability	ASTM D1434	25 mL (STP)/m^2/day
Oil Resistance	ASTM D543	Passed
Microorganism Resistance	ASTM D4068-88	Passed
Enviromental Stress Cracking	ASTM D1693	Passed
Hydrostatic Resistance (Procedure A)	ASTM D751	754 psi (5.2 mPa)
Water Vapor Retarder	ASTM E1745	Class A
Water Vapor Transmission	ASTM E96	0.1 perms (0.036 gr/m/hr)
Tensile Strength	ASTM E154	68 kN/m (387 lbf/in)
Puncture Resistance	ASTM D1709	5,500 grams (12.0 lbs)

North America: 847.851.1800 | 800.527.9948 | www.cetco.com

UPDATED: SEPTEMBER 2017

FORM: TDS_COREFLEX_60-54W_AM_EN_201901_V4

COREFLEX® 60-66W

THERMOPLASTIC WATERPROOFING MEMBRANE WITH ACTIVE POLYMER CORE

DESCRIPTION

COREFLEX 60-66W is a multi-component membrane consisting of an Active Polymer Core (APC) between a geotextile and a 1.5 mm (60 mil) nominal thermoplastic membrane reinforced with a 5.0 oz weft inserted knit polyester fabric. COREFLEX 60-66W offers the ultimate in waterproofing barrier protection technology. The barrier performance starts with a thermoplastic membrane with welded seams providing a monolithic watertight barrier layer. The thermoplastic membrane is reinforced with a weft inserted knit polyester reinforcement fabric and is produced with DuPont's Elvaloy-KEE® (Keytone ethylene ester), a solid phase high molecular weight ethylene interpolymer.

Unlike traditional liquid PVC plasticizers, the Elvaloy-KEE does not experience phase separation and migrate out; thus the membrane properties are maintained for long term performance. Elvaloy-KEE also provides superior chemical resistance properties. The Active Polymer Core layer is integrally bonded to the Elvaloy-KEE thermoplastic membrane. The APC layer is designed to activate with water to swell and form a positive seal. Thereby, at any unforeseen puncture or installation defect, the APC layer reacts at the breach, self-sealing to stop the water ingress. COREFLEX 60-66W is the only welded thermoplastic membrane composite with this reactive, self-sealing performance feature.

APPLICATIONS

The COREFLEX 60-66W waterproofing system provides waterproofing protection for structural concrete surfaces. Below grade applications include under slab waterproofing and property line shoring walls such as soldier pile and lagging. The membrane can be continued under the floor slab and up onto a horizontal deck to provide a continuous, uniform waterproofing system. COREFLEX 60-66W can be used to waterproof structures under continuous or intermittent hydrostatic pressure. COREFLEX 60-66W applications include: Property-line Construction, Under Slab, and Tunnel Work where the product will be installed in a blind-side condition. For all other applications, refer to the COREFLEX 60 Product Manual.

INSTALLATION

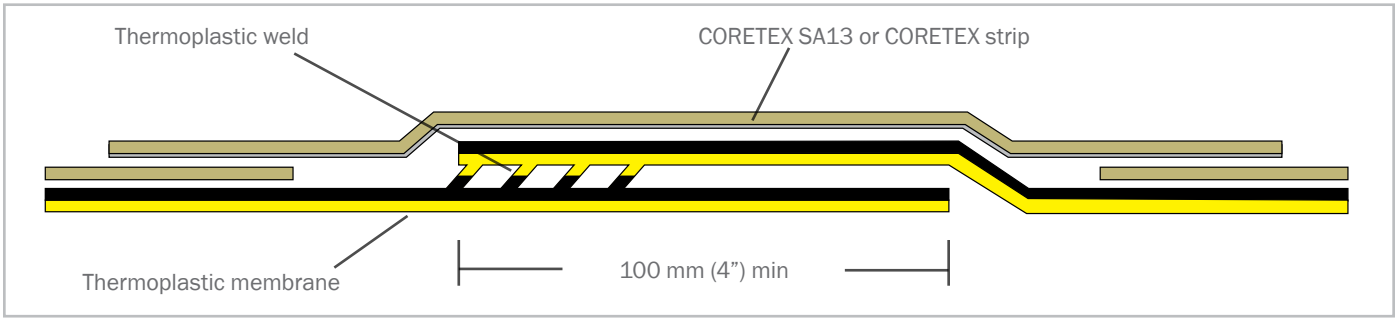
General: Install COREFLEX 60-66W Waterproofing System in strict accordance with the manufacturer's installation guidelines and details using accessory products, protection and drainage layers, and overburden as specified or required. Install COREFLEX 60-66W with the tan geotextile side facing the concrete to be poured. Division 3 Concrete Work should include WATERSTOP-RX® installed in all applicable horizontal and vertical concrete construction joints and around penetrations.

PACKAGING

COREFLEX 60-66W is available in 1.68 m x 15 m (66" x 50') rolls; 66" wide thermoplastic membrane with APC layer offset by 150 mm (6") along both long roll edges.

QUALITY INSURANCE PROGRAM

Rely on quality waterproofing products and the HydroShield Quality Assurance Program from CETCO. This program is designed to protect your building and its contents from water leaks through pre-installation planning, experienced craftsmanship, and onsite inspection backed by the strongest warranty in the industry. If it's worth building, it's worth protecting.



Typical COREFLEX 60-66W membrane overlap assembly with continuous thermoplastic weld

COREFLEX® 60-66W

THERMOPLASTIC WATERPROOFING MEMBRANE WITH ACTIVE POLYMER CORE

TECHNICAL DATA		
PROPERTY	TEST METHOD	TYPICAL VALUE
Membrane Composite Thickness	ASTM D751	3.8 mm (150 mil)
Hydrostatic Pressure Resistance (min 1 hr @ 100 psi)	ASTM D5385	70 m (231 ft)
Puncture Resistance	ASTM D4833	996 N (224 lbs)
Tensile Strength ASTM D751	ASTM D751	2,442 N (549 lbs)
Bonded Seam Strength	ASTM D751	3,136 N (705 lbs)
Peel Adhesion to Concrete	ASTM D903 (mod)	1,751 N/m (10 lbs/in)
Methane Permeability	ASTM D1434	25 mL (STP)/m²/day
Oil Resistance	ASTM D543	Passed
Microorganism Resistance	ASTM D4068-88	Passed
Enviromental Stress Cracking	ASTM D1693	Passed
Hydrostatic Resistance (Procedure A)	ASTM D751	754 psi (5.2 mPa)
Water Vapor Retarder	ASTM E1745	Class A
Water Vapor Transmission	ASTM E96	0.1 perms (0.036 gr/m/hr)
Tensile Strength	ASTM E154	68 kN/m (387 lbf/in)
Puncture Resistance	ASTM D1709	5,500 grams (12.0 lbs)

North America: 847.851.1800 | 800.527.9948 | www.cetco.com

UPDATED: AUGUST 2018

FORM: TDS_COREFLEX_60-66W_AM_EN_201808_V1

COREFLEX®

WELDABLE THERMOPLASTIC WATERPROOFING WITH ACTIVE POLYMER CORE FOR CAST-IN-PLACE CONCRETE AND SHOTCRETE APPLICATIONS

COREFLEX®
THERMOPLASTIC WATERPROOFING WITH AN ACTIVE LAYER

CONTENTS

THIS MANUAL CONTAINS THE INSTALLATION GUIDELINES FOR THE COREFLEX 60 AND COREFLEX XP WATERPROOFING SYSTEMS FOR BOTH CAST-IN-PLACE CONCRETE AND SHOTCRETE APPLICATIONS, INCLUDING UNDERSLAB, PROPERTY LINE WALLS, BACKFILLED FOUNDATION WALLS, AND TUNNELS. FOR APPLICATIONS NOT COVERED IN THIS MANUAL, CONTACT CETCO FOR SPECIFIC INSTALLATION GUIDELINES. BEFORE INSTALLATION, READ THIS MANUAL TO GAIN FAMILIARITY WITH SPECIFIC PROCEDURES AND APPLICATIONS.

PLEASE NOTE: ALL REFERENCES TO “COREFLEX“, APPLY TO BOTH THE COREFLEX 60 AND THE COREFLEX XP WATERPROOFING SYSTEMS. ALL REFERENCES TO “WATERSTOP-RX/XP” APPLY TO WATERSTOP-RX OR WATERSTOP XP.

LIMITATIONS

COREFLEX is designed for waterproofing applications where the product is properly covered and confined. COREFLEX should only be installed after substrate preparation has been properly completed and is suitable to receive the waterproofing system. COREFLEX should be used with structural grade reinforced cast-in-place concrete with conventional forms that produce a smooth surface. Use COREFLEX with reinforced shotcrete walls conforming to ACI 506 Core Grade 1 or 2; minimum 200 mm (8”) thick, applied from the bottom up in their full wall structural design thickness in a single application per shotcrete lift. Consult CETCO for guidelines for stay-in-place concrete forms.

COREFLEX should not be installed in standing water or over ice. Site groundwater samples should be submitted to CETCO for compatibility testing. COREFLEX is designed for use under reinforced concrete slabs 150 mm (6”) thick or greater with a mud slab substrate. COREFLEX is capable of bridging typical shrinkage cracks in concrete up to 1.5 mm (1/16”).

COREFLEX membranes are not designed to waterproof expansion joints. Consult with CETCO regarding all expansion joint applications and limitations.

North America: +1 847.851.1800 | +1 800.527.9948 | www.cetco.com

PRODUCTION DESCRIPTION

COREFLEX 60

A dual component waterproofing membrane system that combines a modified PVC reinforced thermoplastic membrane with an Active Polymer Core (APC) layer into one high performance, easy to use product. This composite membrane provides both a fully welded thermoplastic membrane with an integrally bonded self-sealing active waterproofing layer to assure optimal performance. No other product fits the range of installation conditions that COREFLEX does; including underslab, property line walls, backfilled foundation walls, tunnels, earth covered structures, new and restoration plaza decks, split-slab construction and greenroofs.

COREFLEX XP

A dual-component waterproofing membrane system that combines a modified PVC reinforced thermoplastic membrane with an XP technology core layer in to one high performance, easy to use product. COREFLEX XP offers the same installation and performance benefits as COREFLEX 60, but features XP technology, the latest innovation in active waterproofing. This advanced polymer technology provides exceptional performance in a wide range of ground contaminates, including high-salinity conditions. ***COREFLEX XP should be used with other XP detailing products: CORETEX XP, SEAL-X XP, and WATERSTOP XP.***

ACCESSORIES

ADHESIVE SB-100: Adhesive for securing CoreFlash membranes to various substrates, including cured concrete, wood, metal and cementitious boards.

AKWASWELL®: Hydrophilic polyurethane caulk used for detail work including pipe penetrations.

CETSEAL®: A multipurpose UV stable single component polyether moisture cure sealant/adhesive. Primary applications are grade termination sealant, membrane lap sealant and waterstop adhesive.

CORECAP® TIE-BACK COVERS: Preformed non-reinforced thermoplastic flashings, designed to provide a welded thermoplastic cover over tie-back heads on property line shoring walls; three preformed sizes available. CoreCap(s) used in conjunction with same size rigid TB-Boot.

CORECLAD®: 24 ga. stainless steel sheet laminated on one side with thermoplastic polymeric coating for flashing applications and termination details.

COREDISC®: CoreDisc is a nominal 100 mm (4") round x 1.5 mm (60 mil) non-reinforced thermoplastic disc. CoreDiscs are used for T-joint patches and to repair small punctures in the PVC membrane.

COREFLASH: 1.5 mm (60 mil) thick reinforced thermoplastic membrane (yellow top coat and black bottom coat) used for non-exposed detail and flashing applications including curbs, walls, field wraps, butt-joints and patches.

COREFLASH NR: 1.5 mm (60 mil) thick UV stable non-reinforced extruded white thermoplastic membrane used for detail and flashing applications including curbs, walls, field wraps and patches.

COREFLASH UV: 1.5 mm (60 mil) thick UV stable reinforced thermoplastic membrane (white top coat and black bottom coat) used for flashing applications exposed to direct UV and or weathering conditions including curbs, walls, field wraps and patches

CORETEX®: APC polymer impregnated geotextile for transition details, corners, butt-joints and protection from rough edges and surfaces.

CORETEX XP®: Used with COREFLEX XP, CORETEX XP is a polymer impregnated geotextile featuring XP technology for transition details, corners, butt-joints and protection from rough edges and surfaces. Herein refered to in this manual as CORETEX.

INDUCTION WELDING PLATE: 80 mm (3 1/4") diameter nominal metal plate with thermoplastic coating for attachement of COREFLEX membrane to shoring with induction welding machine.

PF-150: Molded non-reinforced thermoplastic flashings, specially designed for round penetrations 50 mm (2") or less in diameter.

PF-340: Pre-fabricated factory welded thermoplastic pipe penetration sleeve with open cut side for simple installation around 75 mm (3") to 100 mm (4") pipe penetrations; comprised of a non-reinforced 60 mil membrane stack and a 60 mil reinforced membrane base flange.

SEAL-X XP: SEAL-X XP is trowel-grade detailing mastic designed for a variety of surface preparation and detailing work. It swells upon contact with water to form a watertight barrier, even in high-saline water conditions.

TW-ANCHOR: Specially designed anchors that allow for rebar to be tied into and supported without creating membrane penetrations.

UNIVERSAL CORNER: Molded non-reinforced thermoplastic flashings used to seal inside and outside corner details. Universal Corners come as one piece and are trimmed to fit the appropriate corner condition.

ASSOCIATED PRODUCTS

AQUADRAIN®: Foundation drainage composite consisting of a molded profile core and a filter fabric. System includes sheet drainage and base drain collection. CXJ-200/CXJ-400 EXPANSION JOINTS: Extruded thermoplastic dual-cell center gland expansion joint with integrated side flashings that are welded to the COREFLEX membrane for sealing expansion joints in below grade applications. Available in 50 mm (2") and 100 mm (4") wide joint glands.

WATERSTOP-RX®: Hydrophilic, swelling concrete joint waterstop used around penetrations and applicable concrete joints. WATERSTOP-RX swells upon hydration to form a positive seal in concrete cold pour joints.

WATERSTOP® XP: Featuring XP technology, WATERSTOP XP is proven effective in a wide range of environments including high-saline conditions. Effective for both horizontal and vertical joints, it expands upon contact with water to form a positive seal to stop water ingress through cast-in-place concrete construction joints and around pipe penetrations.

COREFLEX®
THERMOPLASTIC WATERPROOFING WITH AN ACTIVE LAYER

SECTION 1
MEMBRANE WELDING PROCEDURES & EQUIPMENT

1.1 GENERAL MEMBRANE ORIENTATION AND OVERLAPS

All COREFLEX membrane overlaps require that both the thermoplastic membrane and the APC/XP layers (active layers) overlap a minimum 100 mm (4”) with all thermoplastic membrane edges continuously welded per CETCO guidelines.

Membrane overlaps shall be oriented to shed water (shingle style) wherever possible. Specific equipment, especially wedge welders, may require greater overlap dimensions to facilitate welding.

Welding equipment shall be approved by CETCO. Contact your local CETCO representative for an updated list of suitable welding equipment. CETCO recommends that the installer tests all new welding equipment with COREFLEX prior to purchase or prior to using it at the project site.

All welding shall be performed by CETCO Approved Applicator staff that have successfully completed a two day course of instruction provided by CETCO prior to project work. Successful course participants are provided a CETCO COREFLEX Certified Welder ID Card that is required to be in their possession on site while welding. For information on CETCO’s COREFLEX Training Class, contact your local CETCO representative.

The use of automated welding equipment is recommended for all COREFLEX and CoreFlash membrane overlap seams exceeding 3 m (10’) in length.

All thermoplastic welds shall be continuous and without interruption or defect.

Along the long roll edges, COREFLEX is produced with the active layer offset 150 mm (6”) from the PVC membrane layer to facilitate thermoplastic welding. Overlap the adjacent membrane edges, PVC to PVC, and maintain a uniform minimum overlap width of 100 mm (4”) for both the PVC layer and the active layer. Dependent on the membrane orientation for an application, COREFLEX may be welded with either the yellow thermoplastic side or the active layer side oriented toward the installer. In all applications the thermoplastic side shall be oriented outward, relative to the interior of the structure.

When welding with the active layer side up, it will be necessary to fold the Active layer selvedge edge back so that it is out of the way prior to running the welding equipment. Depending on the angle of the tip assembly, some welding equipment may scorch the edge of the folded acitve layer. In this orientation adjust the equipment so that the tip assembly is positioned slightly shallower in the overlap to avoid scorching the folded active layer.

In an application with the active layer side up, once the thermoplastic welding process is complete, fold back the active layer selvedge edge to its original position, whereas it overlaps the adjacent membrane active layer a minimum 100 mm (4”). Adhere the overlapped active layer selvedge edge in place with dabs of CETSEAL maximum 300 mm (12”) on center or a continuous bead of CETSEAL within the active layer overlap.

To facilitate thermoplastic welding along roll butt end edges or field cut roll dimensions where the active layer and PVC are trimmed flush at the edge, cut the ends straight and at a right angle to a long roll edge.

Place the butt ends (or field cut dimensions) of adjacent rolls aligned 25 mm (1”) of each other to accommodate a single welding pass. Best practice is to trim adjacent roll ends to form a common edge alignment. Sequencing of the welding and placement of the Coretex strip will depend on the orientation of the COREFLEX membrane. Both the PVC membrane and active layer will need to be spliced. Cut strips, a minimum of 225 mm (9”) of CoreFlash and Coretex respectively.

When working with the active layer side up, the welding of the CoreFlash strip is typically carried out first (maintaining a minimum 100 mm (4”) overlap) followed by the placement of the Coretex strip. Overlap the COREFLEX 100 mm (4”) onto the CoreFlash strip at the butt ends of the rolls and create a continuous thermoplastic weld between the CoreFlash strip and the COREFLEX membrane. Repeat on the other side of the butt end or cut edge. Once welds are completed and verified on both edges place the 225 mm (9”) Coretex strip, centered, over the welded butt end splice and secure with dabs of CETSEAL maximum 300 mm (12”) on center or a continuous bead of CETSEAL.

When working with PVC thermoplastic side up, the 225 mm (9”) Coretex strip must be placed first with each adjacent COREFLEX edge overlapping the Coretex strip a minimum 100 mm (4”). In this instance it is not required to secure the Coretex strip with CETSEAL as the weight of the membrane will keep the Coretex strip in place.

Depending on site and detail specific conditions, alternate membrane overlap/weld methods may be required or desired. Consult CETCO for alternate membrane installation techniques, procedures, and details to properly provide a 100 mm (4”) membrane overlap with a continuous thermoplastic weld. Strictly adhere to CETCO’s membrane welding guidelines. All welds shall be continuous and without interruption or defect. All surfaces to be welded shall be clean and dry. No adhesives shall be present within the areas of the weld. Do not use chemical cleaners to remove dirt and debris. Use cotton rags to clean membrane; do not use synthetic rags.

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1.2 HAND WELDING

1.2.1 APPROPRIATE HOT-AIR HAND WELDER TEMPERATURE CALIBRATION

COREFLEX, CoreFlash and CoreFlash NR all require different temperature settings in order to weld the products efficiently. Other factors that can have an affect on temperature setting include, but are not limited to, power, ambient temperature, membrane storage and weather. In order to ensure that the hot-air hand welder is set to the correct temperature, each type of membrane shall be tested prior to installing field material for that day.

COREFLEX: COREFLEX is a composite membrane consisting of an active layer and PVC layer rather than COREFLASH, which is just a PVC membrane. Due to the inclusion of the active layer, the welding process will be slower than welding COREFLASH and the temperature setting of the hot-air hand welder will need to be set lower. Set the hot-air hand welder to a setting of approximately 400° C (750° F) If using an analog model consult hot-air welder manufacture as to which temperature setting corresponds to 400° C (750° F). Using a scrap piece of COREFLEX, approximately 100 mm (4") x 100 mm (4"), hold the nozzle tip of the hot-air hand welder 12 mm (1/2") from the membrane face for a period of 8–10 seconds. At the end of the 8–10 seconds, remove the heat source and immediately press the handle edge of the silicon roller into the heated area and attempt to displace the heated PVC creating a visible displacement (smear) in the top surface of the PVC. This visible displacement of PVC confirms that the temperature of the hot-air hand welder is sufficient for welding the membrane together. There should be little to no discoloration of the membrane. If brown to black discoloration is present after removing the heat source, the temperature is too high and can cause burning of the membrane within the overlap when completing the welding process. If there is no visible displacement (smear) of the PVC membrane surface with the handle edge of the silicon roller after 8 – 10 seconds, then the temperature is too low. Increase or decrease the temperature of the hot-air hand welder until an appropriate temperature setting is reached.

COREFLASH: Set the hot-air hand welder to a setting of approximately 427° C (800° F). If using an analog model consult hot-air welder manufacturer as to which temperature setting corresponds to 427° C (800° F). Using a scrap piece of CoreFlash approximately 100 mm (4") x 100 mm (4"), hold the nozzle tip of the hot-air hand welder 13 mm (1/2") from the membrane face for a period of approximately 5 seconds. At the end of the 5 seconds, remove the heat source, using the handle edge of the silicon roller immediately press into the heated area and attempt to displace or smear the molten PVC creating a visible displacement. This movement of PVC membrane allows the user to confirm that the temperature of the hot-air hand welder is sufficient for welding the membrane together. Upon removing the heat after 5 seconds there should be little to no discoloration of the membrane. If brown to black discoloration is present after removing the heat source, the temperature is too high and can cause burning of the membrane within the overlap when conducting the welding process. Should there be no movement of the PVC membrane with the handle edge of the silicon roller after 5 seconds then the temperature is too low. Increase or decrease the temperature of the hot-air hand welder until an appropriate temperature setting is reached.

COREFLASH NR: CoreFlash NR is a non-reinforced membrane. This membrane can be welded at a lower temperature setting than both COREFLEX and CoreFlash, therefore a lower temperature should be utilized for CoreFlash NR. Set the hot-air hand welder to a setting of approximately 343° C (650° F). If using an analog model consult hot-air welder manufacture as to which temperature setting corresponds to 343° C (650° F). Using a gloved hand and a scrap piece of CoreFlASH NR, approximately 100 mm (4") x 100 mm (4"), quickly fold this scrap piece in half over the nozzle tip of the hot-air hand welder, pinch the membrane against either side of the nozzle tip and draw the piece of CoreFlash NR down the tip. This should transfer a white coating of PVC on the front and back flat areas of the nozzle tip. The PVC coating on the nozzle tip should maintain a white appearance for approximately 30 seconds. If the coating turns brown or burns within the 30 second period, the temperature is too high; decrease the temperature setting on the hot-air welder and retest. The 30-second period will allow for the scrap piece of CoreFlash NR to cool as well. Once the CoreFlash NR is cool, attempt to pull the welded sample apart; the membrane should tear around the welded area rather than separate at the weld. If the weld is pulled apart increase the temperature of the hot-air hand welder and retest.

1.2.2 HAND WELDING PROCESS

Once the temperature setting has been accurately tested, welding membrane overlap seams with a hot-air hand welder shall be completed per the following three step process:

STEP 1. TACK WELD

STEP 1. Tack Welding

Overlap the COREFLEX membrane ensuring that the PVC selvedge edge is overlapping the adjacent sheets' PVC layer a minimum of 100 mm (4"). Tack weld the overlap to hold both thermoplastic membranes together to maintain the minimum 100 mm (4") wide overlap by inserting the nozzle tip of the hand welder into the overlap seam approximately 50 mm – 75 mm (2"–3") depth. Apply pressure with 1 or 2 fingers over the nozzle tip, when you feel warmth telegraphing through the membrane pull out the nozzle and press firmly down on the membrane to set the tack weld. Repeat this tack weld process intermittently along the membrane overlap while maintaining the minimum 100 mm (4") overlap.

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STEP 2. PRE-WELD

STEP 2. Pre Weld Placement

Insert the nozzle tip into the membrane overlap seam approximately 40 mm (1–1/2”) with the nozzle tip parallel to the sheet edge. Using a silicon roller, press both membranes together at the end of the membrane overlap to trap the hot-air and seal off the start of the pre-weld. Then using the crease in the nozzle as a depth guide, create a thin, continuous pre-weld approximately 25 mm (1”) inside the membrane overlap seam. Form a continuous thin pre-weld by moving the hand held hot-air welder while simultaneously pressing both membranes together just in front of the hot-air welding tip with the silicon roller for the length of the weld. The pre-weld will prevent the loss of hot-air and concentrate heat along the seam edge of the overlap during the final weld.

STEP 3. FINAL WELD

STEP 3. Final Weld Placement

Insert the nozzle tip of the hand welder into the membrane overlap seam at a 45°angle relative to the membrane edge.

When welding COREFLEX/CoreFlash (overlaying layer) to COREFLEX (underlying layer) with the yellow PVC membrane side up (facing the installer) the hot-air hand welder should be held up at a 45° angle to the membrane, directing more heat to the underlying membrane to properly heat the underlying COREFLEX to a temperature sufficient to form a thermoplastic weld.

When welding COREFLEX (overlaying layer) to COREFLEX/CoreFlash (underlaying layer) with the active layer side up (facing the installer) hot-air hand welder should be held at the lowest angle possible, directing heat to the top membrane to properly heat the top COREFLEX-60 membrane to a temperature sufficient to form a thermoplastic weld.
With either of the above welding orientation conditions, once the proper welding temperature has been reached and the thermoplastic membrane surface begins to “flow”, apply light pressure with a hand roller, by rolling across the overlap seam with the hand roller running parallel to the nozzle tip (at an approximate 45° angle across the membrane overlap). As rolled, a small bead of molten material should extrude out of the seam edge.
When welding transitions from one plane to another (as in the horizontal to vertical plane change from slab to wall applications) begin the weld at the corner transition then work outward on both surfaces. Weld a COREDISC or COREFLASH NR patch over the seam at the transition.

STEP 4. WELD WIDTH VERIFICATION

STEP 4. Weld width verification

Verify the weld width: Refer to Section 1.5 for weld testing procedures.

1.3 MANUAL WELDING EQUIPMENT

HAND HELD HOT-AIR WELDERS

For all straight field seams use a 40 mm (1–1/2”) wide nozzle to create a nominal 40 mm (1–1/2”) wide homogeneous thermoplastic weld without interruption or defect. Use a minimum 20 mm (3/4”) wide nozzle for corners, T-joints, patches and other field detailing, maintaining a nominal 20 mm (3/4”) wide homogeneous thermoplastic weld. Some semi-automatic welding equipment utilize a 30 mm (1–1/4”) wide nozzle; which is also acceptable.

1.4 MACHINE WELDING

AUTOMATED HOT-AIR WELDERS

Use a 40 mm (1–1/2”) wide nozzle to create a nominal 40 mm (1–1/2”) wide homogeneous thermoplastic weld without interruption or defect. In the absence of a working mud slab, a sheet metal or plywood substrate “track” should be placed under the membrane in order to run the welding equipment successfully. The width of the track will depend on the configuration and size of the welding equipment being used. The track can be either sacrificial or pulled out and leap-frogged in front of the welding equipment to provide a solid welding substrate for the entire length of overlap being welded. Welds shall be continu-

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ous and without interruption or defect. Some automatic welding equipment utilize a 30 mm (1–1/4") wide nozzle; which is also acceptable.

AUTOMATED WEDGE WELDERS

Automated hot-air welder

Use a minimum 50 mm (2") wide, solid wedge to create a nominal 50 mm (2") wide homogeneous thermoplastic weld without interruption or defect. Membrane overlap width may need to be increased according to the requirements of the equipment. Prior to wedge welding in an underslab application, fold the active layer selvedge edge of the bottom sheet back under and out of the way in order for the thermoplastic membrane of the bottom sheet to make contact with the wedge. After completing a thermoplastic weld, unfold the active layer selvedge edge to provide minimum 100 mm (4") active layer to active layer overlap at the membrane overlap assembly and apply a continuous bead of CETSEAL within the active layer. If the membrane is oriented yellow side up, lift up membrane or fold it back revealing the overlap in order to unfold the active layer selvedge edge. When using automated wedge welders, never tack weld membranes together prior to machine welding.

Automated wedge welder

1.5 QUALITY CONTROL/INSPECTION OF WELDED SEAMS

1.5.1 COREFLEX TRAINED INSTALLERS

All installers welding the COREFLEX system membranes must be in possession of a Certified CoreFlex Welder ID Card issued by CETCO. This card must be current and on the person welding. The card indicates that the individual welding the CoreFlex membrane has successfully completed the required CoreFlex training class. Individuals without a current Certified CoreFlex Welder ID Card may still assist with CoreFlex, but are not allowed to weld membranes on warranty eligible projects. Individuals without an active Certified CoreFlex Welder ID Card that are observed welding CoreFlex membrane may jeopardize the issuance and eligibility of the CETCO Warranty on that project. Contact your local CETCO sales representative with inquiries regarding the CoreFlex Training Class.

1.5.2 INSPECTING SEAMS

All welds shall be inspected by the waterproofing applicator's job foreman and/or supervisor on a daily basis. Inspection should take place only after the weld has had time to cool; probing a warm seam can damage the membrane. Weld continuity inspection shall include, but not be limited to, the probing of all field welds with a rounded flat head screwdriver or other dull pointed instrument (cotter pin puller). Drag the blunted tool along the cooled edge of the seam while applying gentle pressure. If any void or defect is found, immediately mark it so that it can be easily located and repaired. Prolonged use of a probing tool can restore an edge to the tool, so it will be necessary to occasionally re-round (dull) the probing tool.

Ensure that all aspects of the installation (sheet layout, attachment, welding, flashing details, etc.) are in strict accordance with current CETCO installation guidelines and details. Excessive patching of field seams due to poor workmanship will not be accepted at time of FINAL INSPECTION FOR WARRANTY ACCEPTANCE. Deviations from the specification and/or details must be authorized in writing by CETCO, prior to execution. Deviations from this procedure may result in forfeiture of warranty eligibility.

1.5.2 DAILY CALIBRATING OF WELDING EQUIPMENT

The daily process of calibrating welding equipment and an applicator's technique for the day's conditions is part of quality assurance. This step should be performed on a scrap piece of the same type of membrane that you are intending to install/weld. Ambient conditions should also be similar (test outside if you will be welding outside) to the field welding conditions. Repeat the calibration process as many times as necessary to dial the welding equipment in to achieve a proper, successful weld. Additional tests should be performed if the equipment sits idle for long periods of time and has been cooled or if weather conditions change during the day.

Testing shall be conducted on each piece of equipment, each day, and after each cool down (morning, after break, after lunch, etc.) on the project. Adjust equipment speed and or heat/power settings as necessary to achieve a proper weld. Poor weld results may also indicate an inadequate power source. It may be necessary to change to a different power source in order to achieve acceptable weld results.

1.5.3 COREFLASH NR

CoreFlash NR is a non-reinforced product that must be seam tested in a slightly different manner than COREFLEX. Inspect CoreFlash NR only after the welded area has cooled; inspecting while the membrane is still warm may lead to damage of the seam or membrane. Once

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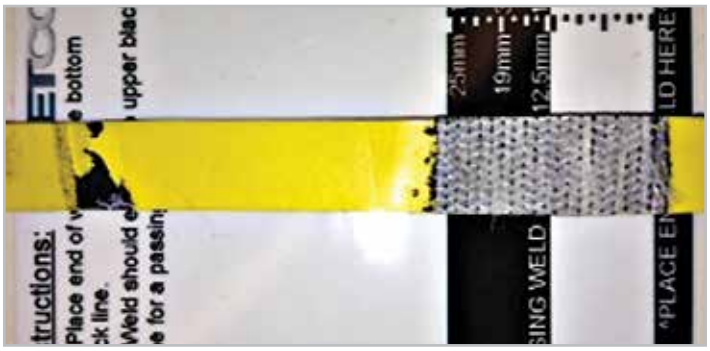
cool, use a blunt instrument or finger to attempt to gently roll the edge of the CoreFlash NR away from the CoreFlash or COREFLEX that it is welded to. When welded appropriately, CoreFlash NR will not peel up or separate from the underlying membrane. If the CoreFlash NR peels up, apply additional heat and repeat the welding procedure to ensure a proper weld. After conducting the edge roll technique, still probe the entire weld with a blunt instrument to confirm weld continuity.

1.5.6 PROJECT TEST STRIPS AND DOCUMENTATION OF WELD

Each day, for each piece of equipment, cut out and retain a 50 mm–100 mm (2”–4”)wide welded seam sample; date it and retain for the independent inspector/owners representative. Additionally a successful test strip, already pulled for verification of the weld process must be included. Similarly date and submit a successful test “pull strip” for the independent inspector. The independent inspector for the project will photo document the test strips for submittal to the CETCO Field Services Unit. Further test strips may be required as conditions change during the day, as problems arise, or at the independent inspector/owners representative discretion.



Weld needs to be greater than 12 mm

Taking samples of completed waterproofing should be avoided whenever possible. If a test cut is conducted on installed membrane, it must be patched properly. Test cuts shall be filled with Coretex extending 100 mm (4”) beyond the edges of the cut opening (in order to provide a flush surface and replace the piece removed with the test sample. Next, patch the cut with CoreFlash extending 100 mm (4”) beyond the edges of the cut opening and completed with a continuous thermoplastic weld.

1.6 INSTALLATION

In plaza deck or back-filled insallation, install COREFLEX over properly prepared substrate with the active layer oriented in direct contact with the structural concrete. In a property-line wall/underslab application the active layer shall be facing the installer and the yellow thermoplastic portion of the COREFLEX membrane should be oriented down against the substrate. Overlap all adjoining edges a minimum of 100 mm (4”). All overlaps (factory long roll dimension edges, butt or short roll dimensions, and cut edges) require a minimum 100 mm (4”) overlap of both the thermoplastic membrane and the active layer. COREFLEX overlaps must be assembled by fabricating a minimum 12 mm (1/2”) wide continuous thermoplastic weld. (See Section 1.1 Membrane Welding Procedures for detailed instructions) If the slab is poured in sections, COREFLEX should extend a minimum 300 mm (12”) beyond the slab edge. This enables COREFLEX to be properly overlapped for subsequent slab section pours. WATERSTOP-RX/XP should be installed in all applicable slab construction joints.

1.6.1 T-JOINT WELDING

Multiple thermoplastic membrane edge overlaps:

A CoreDisc or circular cut piece of CoreFlash NR with a minimum 100 mm (4”) diameter is required, centered and hot-air welded at the T-Joint intersection using the following steps (COREFLASH, COREFLASH UV and COREFLEX are not acceptable T-Joint Patching materials.) CoreDiscs and CoreFlash NR conform better to the change in plane and efficiently seal the pinhole typically created when three reinforced membranes come together to form a T-Joint.

While hand welding the CoreDisc, use the edge of the hand roller to press in and conform the CoreDisc completely to the thermoplastic membrane overlaps.

SECTION 2
DETAILING

2.1 LARGE PENETRATIONS DETAIL SEQUENCING

PROPERTY-LINE/UNDERSLAB:
Install field sheet followed by CORETEX AFTER completing the following details.

BACK-FILLED WALLS/PLAZA DECK:
Install CORETEX followed by field sheet BEFORE completing the following details.

STEP 1: CUT & PLACE TARGET PIECE

STEP 1A. Cut target piece

Cut a square target piece of CoreFLASH that will extend a minimum 200 mm (8") radius around the penetration. Then cut an opening in the center of the target piece to fit tightly around the penetration.

STEP 1B. Place target piece

Slide the opening down the penetration to the substrate. The opening should be tight fitting and the COREFLASH will actually neck up onto the penetration approximately 6 mm (1/4").

STEP 2: CUT & POSITION NR

Cut a piece of CoreFlash NR wide enough to wrap around the penetration with an additional 50 mm (2") of overlap. Ideally the CoreFlash NR piece should be tall enough to extend a minimum of 200 mm (8") up the penetration from the substrate and flare out approximately 25 mm (1") onto the CoreFlash target piece.Therefore a minimum sizing of a CoreFlash NR piece to wrap a 200 mm (4") O.D. pipe will be approximately 375 mm x 225 mm (15" x 9").Next round the two corners on bottom edge of the CoreFlash NR with a pair of scissors. With a handheld welder, heat the bottom edge of the CoreFlash NR to the point where it starts to curl towards the heat.

STEP 2A. Heat edge and stretch NR

Heat a 200–300 mm (4–6") section of the membrane. Stretch the membrane by pulling the edge of the CoreFlash NR in opposite directions along the heated edge of the membrane. Continue until the entire bottom edge of the CoreFlash NR and 75 mm (3") up the vertical edges of the CoreFlash NR is stretched. When done properly, the stretched edge should have a scalloped appearance

STEP 2B. Scalloped edge

This scalloped edge will form the flange against the CoreFlash target piece. Wrap the CoreFlash NR around the pipe so that it fits tightly and has a 50 mm (2") overlap running vertically on the penetration and a 25 mm (1") flange on the CoreFlash target piece on the substrate.

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STEP 3: TACK WELD NR

STEP 3. Tack weld NR

With a handheld welder (fitted with a 20 mm (3/4”) tip) place a tack weld at the back of the 50 mm (2”) overlap in two or three spots to hold the CoreFlash NR in place on the penetration. Be sure to keep the lowest tack weld up high enough to allow detailing the flange on the CoreFlash target piece first.

STEP 4: WELD NR TO TARGET PATCH

STEP 4. Final weld NR to target piece

Insert the tip of the welder at the base of the penetration between the CoreFlash NR flange and the COREFLASH target piece. Weld the flange to the target piece going around the base of the penetration until the entire flange is welded in place. Stretch the CoreFlash NR membrane slowly and gently in order not to tear it (may require 2–3 revolutions around the pipe.)

STEP 5: WELD VERTICAL NR STACK

STEP 5. Weld Vertical NR to target piece

Once the entire flange is welded in place, weld the vertical overlap seam up the penetration. Let the CoreFlash NR cool completely then probe the weld to verify the quality of the weld.

STEP 6: INSTALL LOWER HOSE CLAMP

STEP 6. Install lower clamp

Install a stainless steel hose clamp around the penetration 50 mm (2”) down from the top edge of the CoreFlash NR and tighten it in place.

STEP 7: APPLY AKWASWELL BEAD

STEP 7. Install AKWASWELL bead

Insert a 9 mm (3/8”) bead of AkwaSwell between the penetration and the CoreFlash NR tight to the stainless steel hose clamp.

STEP 8: INSTALL SECOND HOSE CLAMP

STEP 8. Install second clamp

Install a second stainless steel hose clamp above the first clamp and flush with the top of the AkwaSwell bead; and tighten it in place.

STEP 9: TRIM NR ABOVE TOP CLAMP

STEP 9. Trim NR above top clamp

With a utility knife trim the CoreFlash NR membrane tight to the top edge of the stainless steel hose clamp.

STEP 10: APPLY CETSEAL BEAD

STEP 10. Install CETSEAL termination

To finish the detail place a 6 mm (1/4”) tooled bead of CETSEAL along the top edge of the CoreFlash NR.

STEP 11: PLACE AKWASWELL BEAD

Lift the COREFLASH target piece and place a bead of AkwaSwell, minimum 9 mm (3/8”), tight to the base of the penetration.

STEP 12: WELD TARGET PIECE

Weld the COREFLASH target piece to the COREFLEX field sheet with a minimum 12 mm (1/2”) wide continuous weld.

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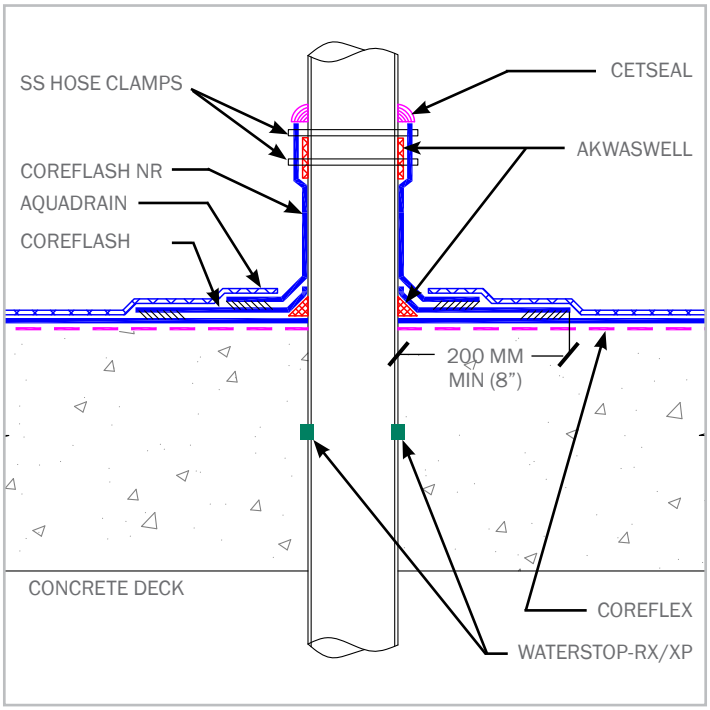
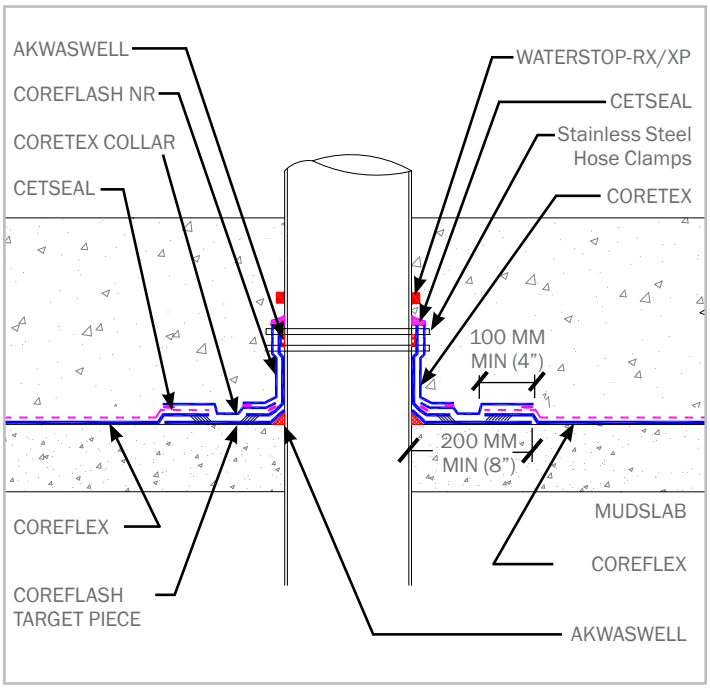


2.1.1 LARGE PENETRATION – PLAZA DECK/BACKFILLED WALL



2.1.2 LARGE PENETRATION – UNDERSLAB/PROPERTY LINE WALL

2.2 ROUND PENETRATIONS

Use PF-340 for penetrations between 75 mm – 100 mm (3" – 4") diameter

Ensure the pipe is secured in its final position and is clean and free of dirt, debris, mastics and other items that may inhibit an efficient detailing process.

DETAIL SEQUENCING

PROPERTY-LINE/UNDERSLAB:

Install field sheet followed by CORETEX AFTER completing the following details.

BACK-FILLED WALLS/PLAZA DECK:

Install CORETEX followed by field sheet BEFORE completing the following details.

STEP 1: PLACE PF340 AROUND PIPE

Place the PF-340 tight around the pipe penetration with the base flange against the substrate.

STEP 1. Place PF340 around penetration

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STEP 2: TACK WELD BASE FLANGE

STEP 2. Tack weld PF340 to fit penetration

Tack-weld the base flange overlap. Move to the non-reinforced stack and tack weld the overlap in place. If any adjustments need to be made in order to get a tighter fit around the penetration, do so prior to beginning the pre-weld in the overlap.

STEP 3: WELD PF-340

STEP 3. Weld PF340 overlap at base flange

With the reinforced base flange flush to the substrate complete a pre-weld and final continuous weld over the entire overlap seam of the PF-340 with a hot-air welder.

STEP 4: WELD OVERLAP UP STACK

STEP 4. Weld vertical overlap seam up stack

Weld the vertical overlap seam of PF-340 with a hot-air welder.

STEP 5: INSTALL FIRST HOSE CLAMP

STEP 5. Install lower clamp

Place the first stainless steel hose clamp around the pipe 50 mm (2”) from the top of the non-reinforced stack and tighten in place. Non-reinforced stack flashing height and hose clamp placement is dependent upon the thickness of the slab/wall to be poured and can be decreased as applicable.

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STEP 6: APPLY AKWASWELL BEAD

STEP 6. Install AKWASWELL bead

Insert tip of AkwaSwell caulk tube between the non-reinforced stack and the pipe, placing a 9 mm (3/8”) diameter ring of AkwaSwell continuously around the pipe tight to the stainless steel hose clamp.

STEP 7: INSTALL SECOND HOSE CLAMP

STEP 7. Install second hose clamp

Place a second stainless steel hose clamp over the non-reinforced stack and push the second stainless steel hose clamp down against the visible AkwaSwell bead and tighten the top hose clamp.

STEP 8: TRIM EXCESS

STEP 8. Trim excess membrane flush with top edge of clamp

Use a utility knife to trim any excess non-reinforced stack membrane flush with the top edge of the top hose clamp.

STEP 9: APPLY CETSEAL BEAD

STEP 9. Apply CETSEAL bead at termination

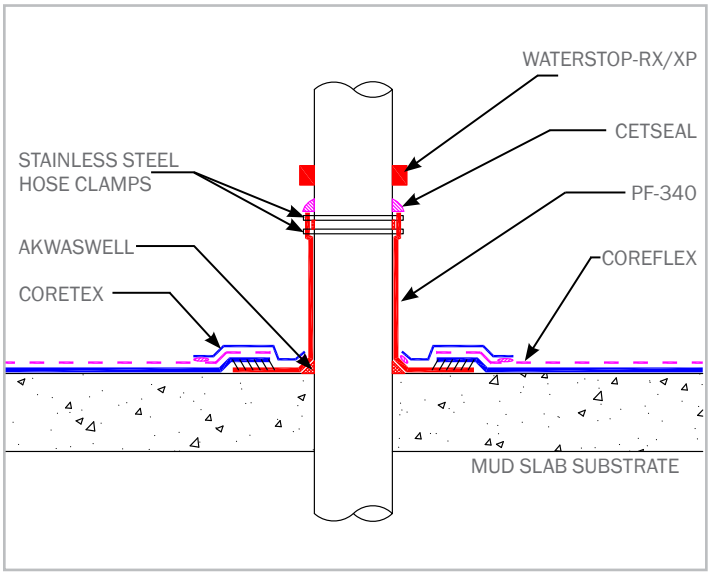
Place a 6 mm (1/4”) tooled bead of CETSEAL where the top of the stainless steel hose clamp and non-reinforced stack meet.

STEP 10: APPLY AKWASWELL BEAD

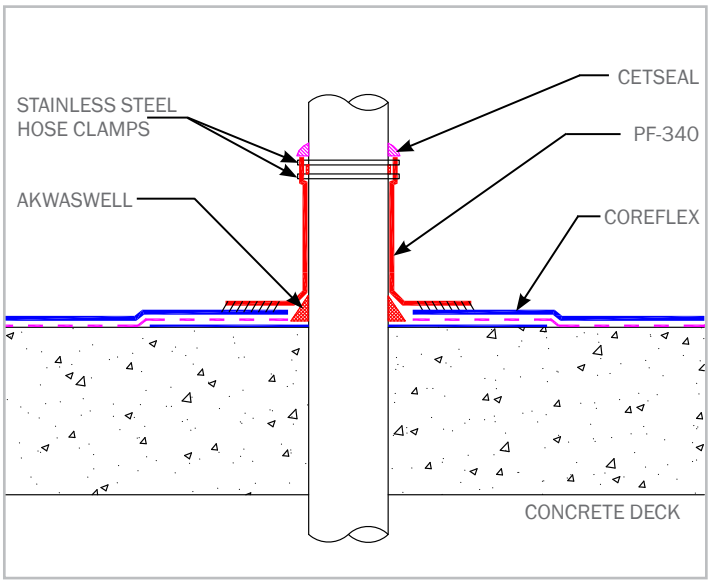
When the overlap is completely welded, apply a 9 mm (3/8”) bead of AkwaSwell under the reinforced base flange directly around the penetration at the substrate surface.

STEP 11: WELD TARGET PIECE

Weld the COREFLASH target piece to the COREFLEX field sheet with a minimum 12 mm (1/2”) wide continuous weld.



2.2.1 ROUND PENETRATION – UNDERSLAB/PROPERTY LINE WALL



2.2.2 ROUND PENETRATION – PLAZA DECK/BACK FILLED WALL

2.3 ROUND PENETRATIONS

Use PF-150 for round penetrations 50 mm (2") diameter or smaller

Use the PF-150 pre-molded penetration flashing for round penetrations with a diameter less than or equal to 50 mm (2") (small diameter pipes, nelson studs, rebar, all-threaded rod, etc). The PF-150 incorporates a molded stepped profile that is sized for round penetrations 9 mm (3/8") to 50 mm (2") penetrations. Ensure that the penetration to be flashed is clean and free of debris.

DETAIL SEQUENCING

PROPERTY-LINE/UNDERSLAB:
Install field sheet followed by CORETEX AFTER completing the following details.

BACK-FILLED WALLS/PLAZA DECK:
Install CORETEX followed by field sheet BEFORE completing the following details.

STEP 1: INSTALL TARGET PIECE

STEP 1. Install COREFLASH target piece

Begin by placing a CoreFlash target piece over the element to be flashed; pushing the CoreFlash target piece flush with the substrate (shoring system, mudslab, etc). CoreFlash Target piece should be a minimum of 250 mm x 250 mm (10" x 10") to ensure a 100 mm (4") overlap of PVC to PVC with the COREFLEX field sheet.

STEP 2: AKWASWELL PLACEMENT

STEP 2. AKWASWELL placement

For penetrations smaller than 38 mm (1–1/2") place a bead of AkwaSwell on the first pre-molded "shelf" inside of the PF-150. Take care to keep the bead of AkwaSwell on this shelf only and not on the PF-150 flange that will be hot-air welded. For penetrations larger than 38 mm (1 1/2") place bead of AkwaSwell around the base of the element to be flashed.

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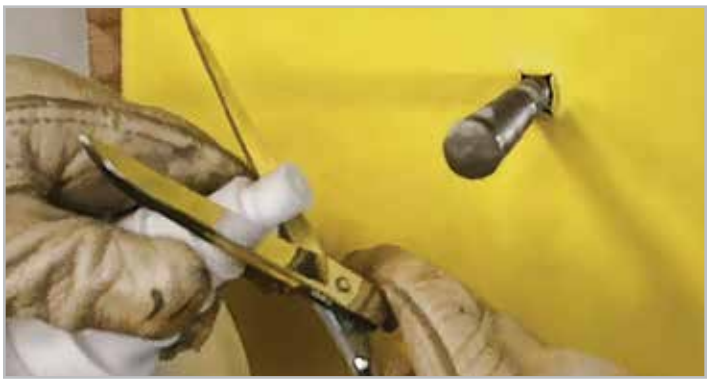
STEP 3: CUT PF150



STEP 3. Cut PF150 to size

Using a pair of scissors, cut the PF-150 at the appropriate pre-molded stepped shelf (one segment smaller than the diameter of the element to be flashed).

STEP 4: HEAT AND PLACE PF150

STEP 4A. Heat trimmed PF-150 cut end

With a hot-air hand welder heat the cut end of the PF-150 slightly and then slide the PF-150 over the protruding penetration until the flat flange is flush with the CoreFlash target piece.

STEP 4B. Placement of PF-150

Keep the PF-150 centered and AkwaSwell intact on interior shelf during placement.

STEP 5: TACK WELD PF-150 TO FLANGE

STEP 5. Tack weld PF-150 flange

With a hot-air hand welder, tack weld the PF-150 flange to the Core-Flash target piece at the interior of the flange.

STEP 6: LOOSLY PLACE HOSE CLAMP

STEP 6. Hose Clamp Loosely Installed

Place stainless steel hose clamp around the cut-end of the PF-150 and tighten the hose clamp to achieve a loose fit.

STEP 7: APPLY HEAT AND COLLAPSE

STEP 7. Hot-air applied to stepped stack

With a hot-air hand welder, apply heat uniformly around the exterior surface of the PF-150 stepped stack. Gently push the heated stack of the PF-150 towards the base flange causing the PF-150 to collapse upon itself.

STEP 8: SECURE THE HOSE CLAMP

STEP 8. Tightly secure hose clamp

Secure the hose clamp tightly not allowing the collapsed PF-150 to slide back out to original position.

STEP 9: WELD PF-150 TO COREFLASH

STEP 9. Weld the PF-150 flange to the COREFLASH

Working from the interior to the exterior of the flange edge, utilizing a hand held welder and silicon roller, weld the PF-150 flange to the CoreFlash target piece.

STEP 10: APPLY CETSEAL BEAD

STEP 10. Apply CETSEAL at termination

Then tool a bead of CETSEAL around the cut end of the PF-150; covering the cut end and terminating onto the penetrating element.

STEP 11: WELD TO COREFLEX

Weld the COREFLASH target piece to the COREFLEX field sheet with a minimum 12 mm (1/2”) wide continuous weld.

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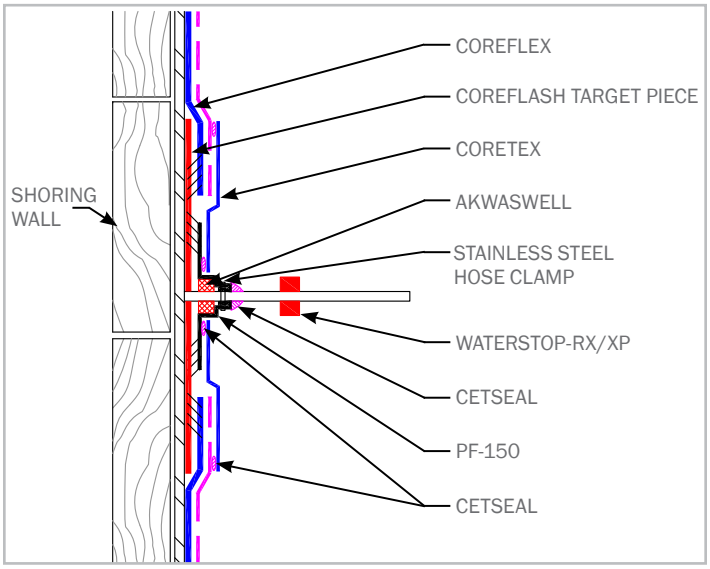
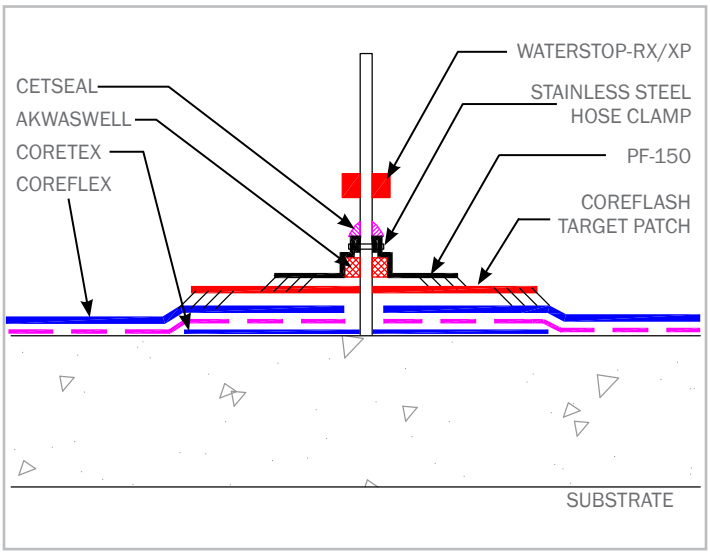


2.3.1 ROUND PENETRATION – UNDERSLAB/PROPERTY LINE WALL



2.3.2 ROUND PENETRATION – PLAZA DECK/BACK FILLED WALL

2.4 SQUARE/RECTANGULAR PENETRATIONS

DETAIL SEQUENCING

PROPERTY-LINE/UNDERSLAB:

Install field sheet followed by CORETEX AFTER completing the following details.

BACK-FILLED WALLS/PLAZA DECK:

Install CORETEX followed by field sheet BEFORE completing the following details.

STEP 1: TARGET FLASHING

STEP 1. Target flashing

Cut a target piece of CoreFlash that is a minimum 400 mm (16”) wide and long enough to entirely wrap the perimeter of the square penetration and overlap upon itself a minimum of 100 mm (4”). Wrap the CoreFlex target piece extending 200 mm (8”) up the square penetration. Slit the membrane, from each corner of the square penetration, perpendicular to the long edge, allowing for the Coreflash to extend onto the substrate.

STEP 2: TACK WELD TARGET FLASHING

STEP 2. Target flashing tack weld

With the target piece of CoreFlash now extending 200 mm (8”) up the penetration and the remaining 200 mm (8”) onto the substrate, create an overlap a minimum 100 mm (4”). Tack weld the target piece in place, and form a continuous thermoplastic weld for the entirety of the seam.

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STEP 3: PLACE CORNER TARGET PATCH

STEP 3. Place corner target patch

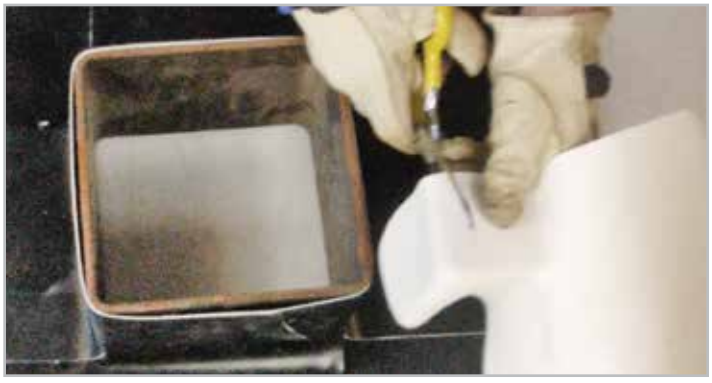
Cut four CoreFlash “L” shaped target patch pieces large enough to fill in the corners of the flanges so that there is a continuous flange around the penetration 300 mm (12”) from the base of the penetration out onto the substrate.

STEP 4: WELD ALL OVERLAP SEAMS

STEP 4. Weld target patch in place

Weld all overlaps of COREFLASH flashing piece and “L” shaped target piece.

STEP 5: PLACE UNIVERSAL CORNERS



STEP 5A. Cut inside outside corner to fit

Place a Universal Corner Cut to fit the outside corner at each corner of the penetration (5a) and secure with a continuous thermoplastic weld (5b).

STEP 5B. Fully Weld Performed Corners to fit

STEP 6: REPEAT STEP 5 AT FOUR CORNERS

STEP 6. Install at all four corners

STEP 7: APPLY AKWASWELL

Place a 9 mm (3/8”) bead of AkwaSwell 25 mm (1”) in from the edge of the CoreFlash; between the CoreFlash and the penetration.

STEP 8: SECURE TERMINATION BAR

Secure the termination bar by fastening 200 mm (8”) OC so that the fasteners penetrate the membrane over the bead of AkwaSwell.

STEP 9: APPLY CETSEAL

Place a 6 mm (1/4”) tooled bead of CETSEAL at the outer edge of the termination bar.

STEP 10: CUT WINDOW AND PLACE

Cut a window in the CoreFlex that will fit over the penetration flashing overlapping the CoreFlash Flanges 100 mm (4”). Weld the COREFLEX to the CoreFlash flashing membrane with a thermoplastic weld. Install COREDISCs at all T-Joints. Cut a piece of Coretex and four square patches of Coretex the same dimensions as the pieces of CoreFlash described above and wrap it around the penetration securing it in place with beads of CETSEAL and as applicable wire ties.

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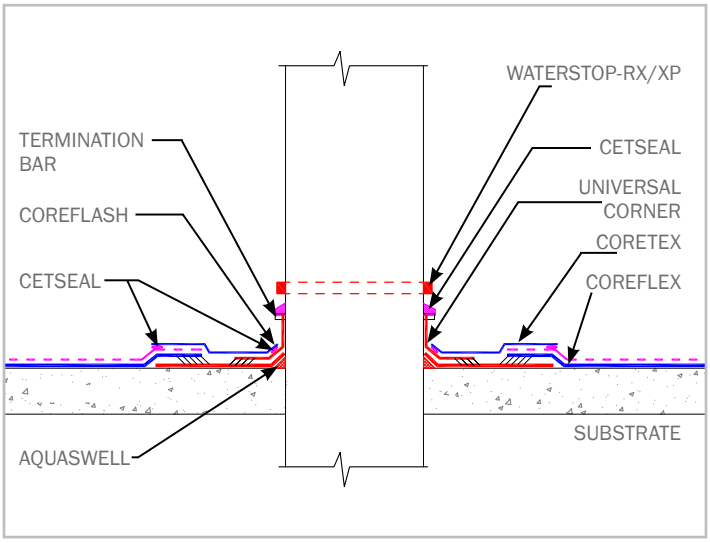
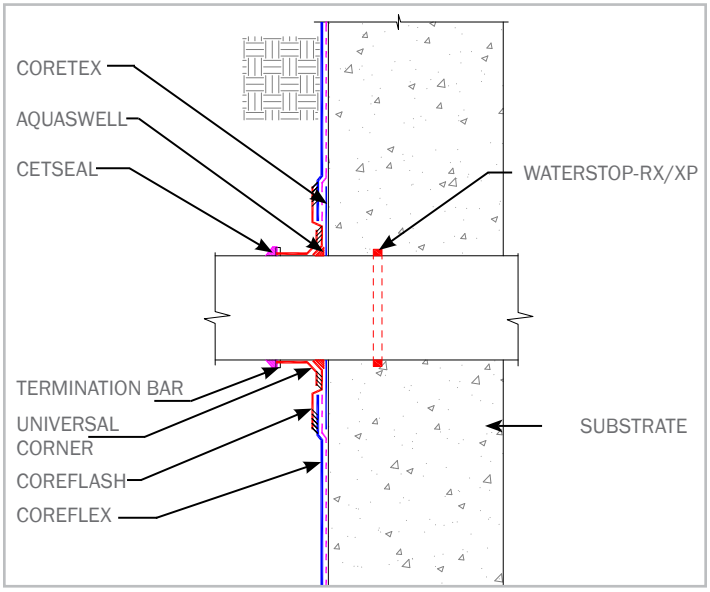


2.4.1 SQUARE PENETRATION – UNDERSLAB/PROPERTY LINE WALL

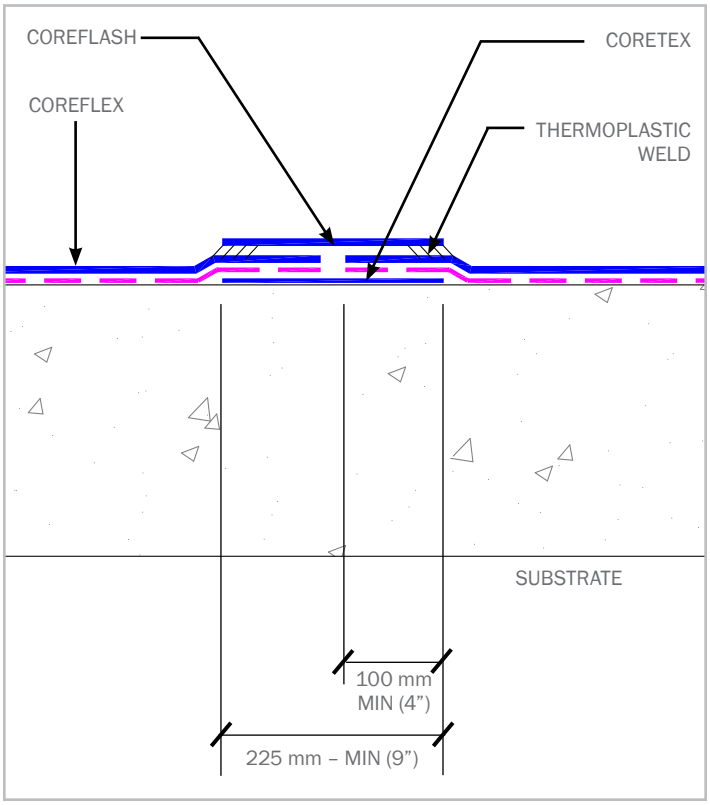


2.4.2 SQUARE PENETRATION – PLAZA DECK/BACKFILLED WALL

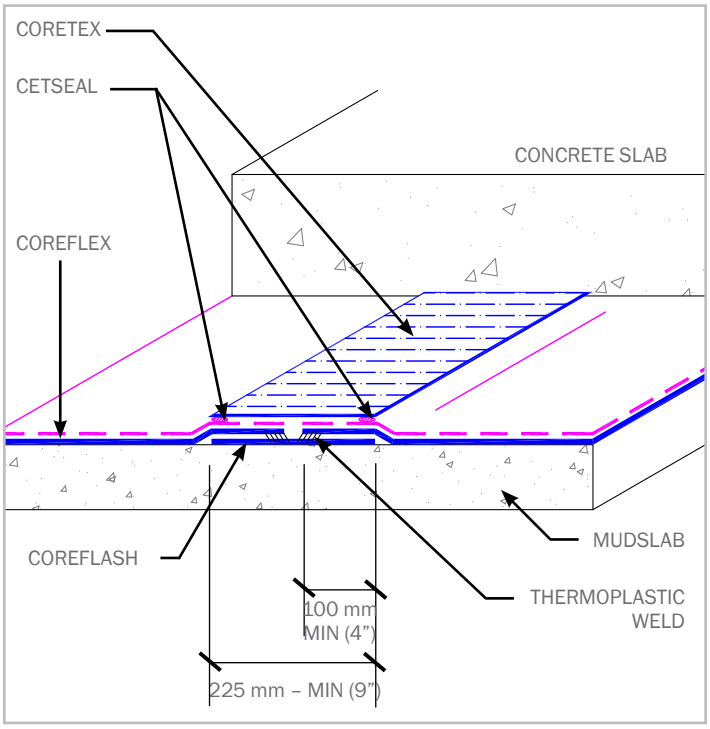
2.5 BUTT-JOINT DETAILING

BACK FILLED WALLS/PLAZA DECK: When joining two roll ends or cut ends of CORELEX membrane a butt splice constructed with COREFLASH and CORETEX is required. At both COREFLEX roll ends, install a minimum 450 mm (9”) wide strip of Coretex extending up the face of the concrete wall from top of the footing to the grade elevation detail. Tuck edge of Coretex strip a minimum 100 mm (4”) behind the trimmed/aligned COREFLEX roll edges and secure Coretex strip with washer-head fasteners along both edges maximum 900 mm (36”) on center. **Do not secure Coretex strip fastened through COREFLEX membrane.** As applicable, overlap Coretex strip edges a minimum 100 mm (4”) to provide continuous strip. Install adjacent COREFLEX membrane sheets overlapping exposed Coretex strip a minimum 100 mm (4”); leaving approximately 25 mm (1”) of exposed Coretex between the two stacks of COREFLEX roll ends. Closely match roll ends to 25 mm (1”) of adjacent COREFLEX roll end. Secure COREFLEX roll ends with washer-head fasteners placed through the Coretex strip. Install minimum 450 mm (9”) wide strip of CoreFlash flashing over the COREFLEX centered along the Coretex strip detail (yellow side facing installer). Hot-air weld both edges of the CoreFlash strip to the COREFLEX; both continuous welds must be outside of all fasteners (no exposed fasteners). CoreFlash strip shall extend a minimum 100 mm (4”) over both COREFLEX membrane edges. Finish CoreFlash strip by hot-air welding a CoreDisc or CoreFlash NR patch over all T-Joints.

Underslab/Property Line Walls:
Repeat the procedure outlined for backfilled walls/plaza deck; first install the COREFLASH with thermoplastic welds then adhere CORETEX with continuous beads of CETSEAL.



2.5.1 BUTT-JOINT DETAIL PLAZA DECK/BACKFILLED WALL



2.5.2 BUTT-JOINT DETAIL UNDERSLAB/PROPERTY LINE WALL

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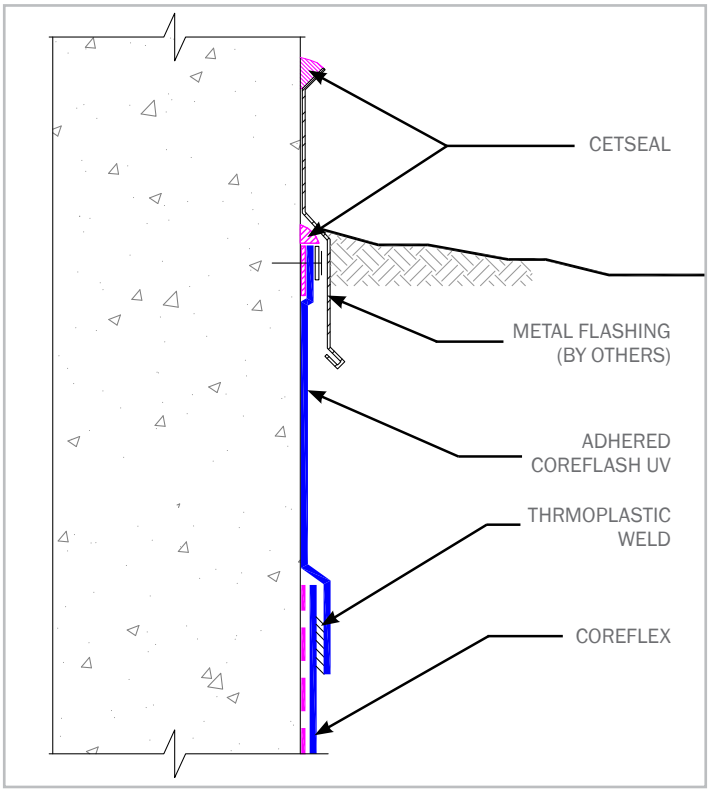
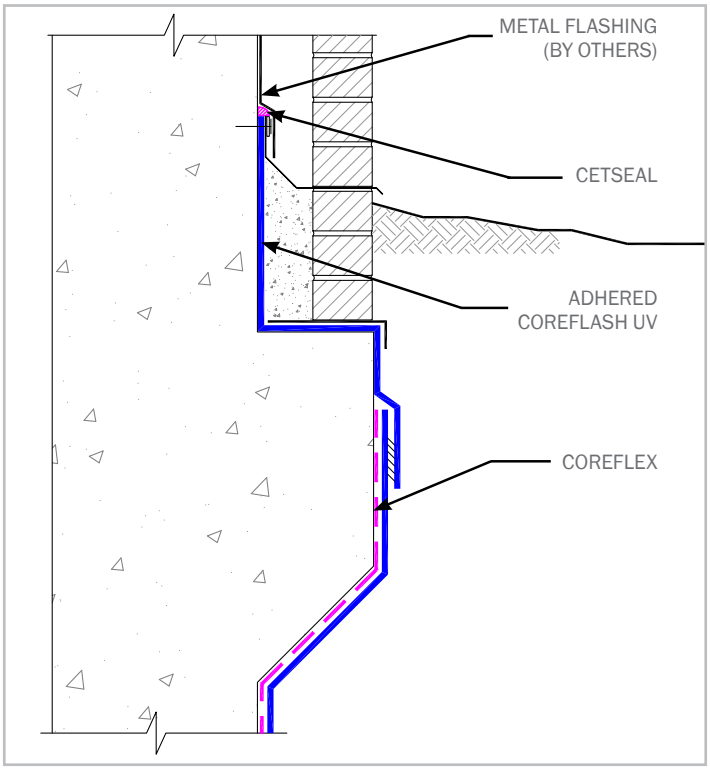
2.6 GRADE TERMINATION

Coordinate work with excavation and backfill operations conducted by others to remove the top elements of the shoring retention wall per local building code or as specified in the contract documents. Identify and repair any waterproofing and/or drainage sheet damaged by excavation and removal of the top shoring retention wall elements. Fasten top edge of COREFLEX membrane 300 mm (12”) below finished grade elevation with washer-head fasteners maximum 300 mm (12”) on center. Install CoreFlash UV grade flashing membrane with bottom edge overlapping COREFLEX membrane a minimum 100 mm (4”); use Adhesive SB-100 to adhere CoreFlash UV flashing membrane continuously to substrate (except for top 50 mm (2”)). Roller apply Adhesive SB-100 to both the black side of the CoreFlash UV and the substrate area at a coverage rate of 1.2 m²/liter (50 ft² per gallon). This equates to 1.2 m²/0.5 liter (50 ft² per 1/2 gal.) to the substrate and 1.2 m²/0.5 liter (50 ft² per 1/2 gal) to the membrane. Actual adhesive coverage depends upon the porosity and smoothness of the surface and workmanship. To insure proper application and curing of the adhesive, outside air temperature should be 4 °C (40 ˚F) and rising. Roll or trowel a smooth, even coat of the adhesive over the black bottom side of the CoreFlash UV and the area of the substrate to receive the flashing, ensuring 100% coverage. Allow the adhesive to set to the point that the adhesive becomes stringy to the touch. When sufficiently set, carefully place the adhesive coated side of the CoreFlash UV membrane onto the adhesive coated substrate. Roll or hand press membrane to substrate to ensure full contact and a continuous bond. Secure bottom edge CoreFlash UV to COREFLEX with a continuous thermoplastic weld. Overlap adjacent CoreFlash UV roll ends a minimum 100 mm (4”) and seal with continuous thermoplastic weld. Terminate top edge of CoreFlash UV flashing membrane at elevation per project details and specifications. Apply CETSEAL 50 mm (2”) wide x 2.3 mm (90 mil) thick behind the top, non-adhered edge of CoreFlash UV grade flashing. Then secure top edge of CoreFlash UV with termination bar fastened into substrate maximum 300 mm (12”) on center. Complete grade termination detail with tooled bead of CETSEAL along the top edge and at all penetrations through the flashing. Counter flash or cover the termination per project specifications.

Backfill should consist of compactable soils, pea gravel, or crushed stone (19 mm (3/4”) or less). Avoid backfill with aggregate larger than 40 mm (1.5”). Backfill should be added in 150–300 mm (6” to 12”) lifts and compacted to a minimum 85% Modified Proctor density. If gravel backfill, specify angular aggregate <19 mm (3/4”) with fines.



2.6.1 GRADE TERMINATION – STANDARD



2.6.2 GRADE TERMINATION – THRU-WALL FLASHING

2.7 PROPERTY LINE SHORING WALL TO SLAB TRANSITION

SLAB TO WALL TRANSITION:

Where property line retaining walls, such as soldier pile and lagging, are used as the outside form, it is very important to extend the waterproofing a minimum 300 mm (12”) above the top of the slab since there is no access to the outer edge of the slab after it is poured.

SLAB TO WALL CORNER TRANSITION:

Install COREFLEX sheet horizontally oriented (active layer side facing installer), membrane PVC selvedge edge up with a minimum 300 mm (12”) of the sheet extending out onto the horizontal substrate. These dimensions may be increased to allow for securement of the COREFLEX membrane to fall outside of gaps in the lagging or to allow room for use of automated welding equipment.

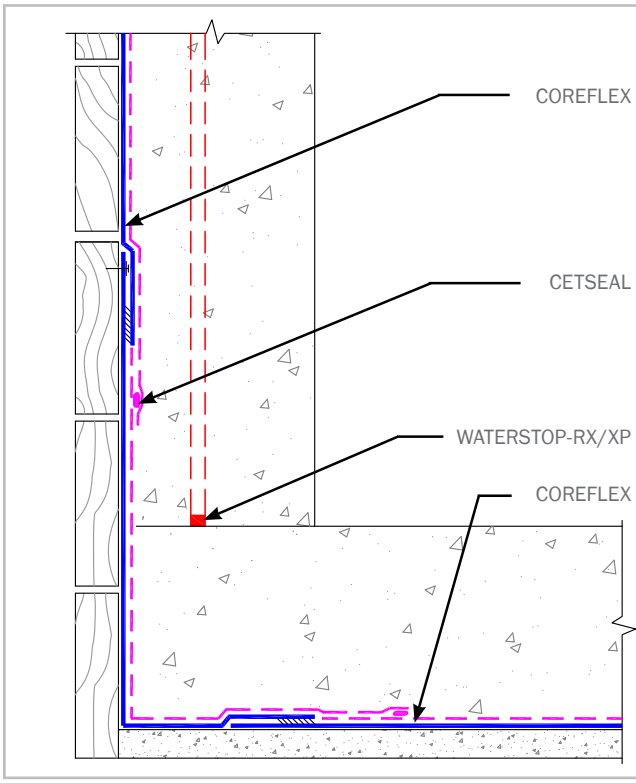
Install COREFLEX sheet to shoring wall along the top edge of the thermoplastic selvedge edge, secure with washer-headed fasteners approximately 25 mm (1”) from the top edge of the membrane; maximum 900 mm (3’) on center. Adjacent edges of COREFLEX sheets should be overlapped and detailed per guidelines in Section 1.1 Membrane Welding Procedures.

If the slab thickness is greater than 750 mm (30”) install a second full sheet of COREFLEX, horizontally oriented, to meet the 300 mm (12”) requirement above the slab. Overlap top edge of previous sheet and edges of adjacent sheets for both the thermoplastic membrane and active layer a minimum of 10 mm (4”).

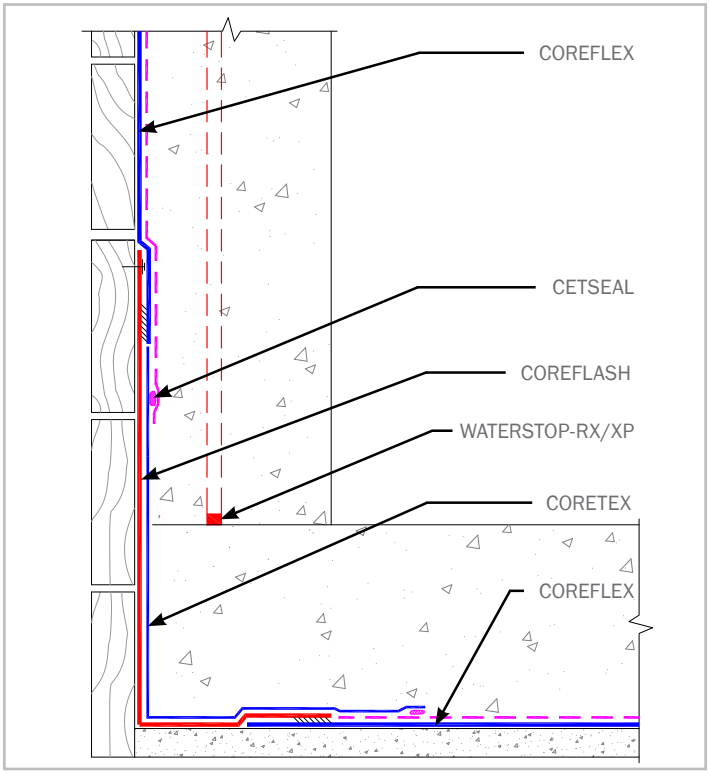
SLAB TO WALL CORNER TRANSITION (ALTERNATIVE INSTALLATION METHOD):

Install a strip of COREFLASH horizontally oriented, with a minimum of 300 mm (12”) of the sheet extending out onto the horizontal substrate. These dimensions may be increased to allow for the securement of the membrane to fall outside of gaps in the lagging or two allow room for use of automated welding equipment. Place and secure the COREFLASH into the corner transition. Place COREFLEX on the horizontal substrate allowing for a minimum overlap of 100 mm (4”) over the horizontal flap of COREFLASH. Secure the COREFLEX to the COREFLASH with a continuous thermoplastic weld. Then secure COREFLEX, either vertically or horizontally, to the shoring wall so that it overlaps the COREFLASH a minimum of 100 mm (4”). Secure the top edge COREFLEX fastened to the shoring wall to the top edge of COREFLASH with a continuous thermoplastic weld.

To complete the slab to wall transistion, install CORETEX over all COREFLASH transition strips; overlap active layer of COREFLEX a minimum of 100 mm (4”) and secure CORETEX edges and sheet with continuous beads of CETSEAL.



2.7.1 SLAB TO WALL TRANSITION – PROPERTY LINE WALL



2.7.2 ALTERNATIVE METHOD SLAB TO WALL TRANSITION

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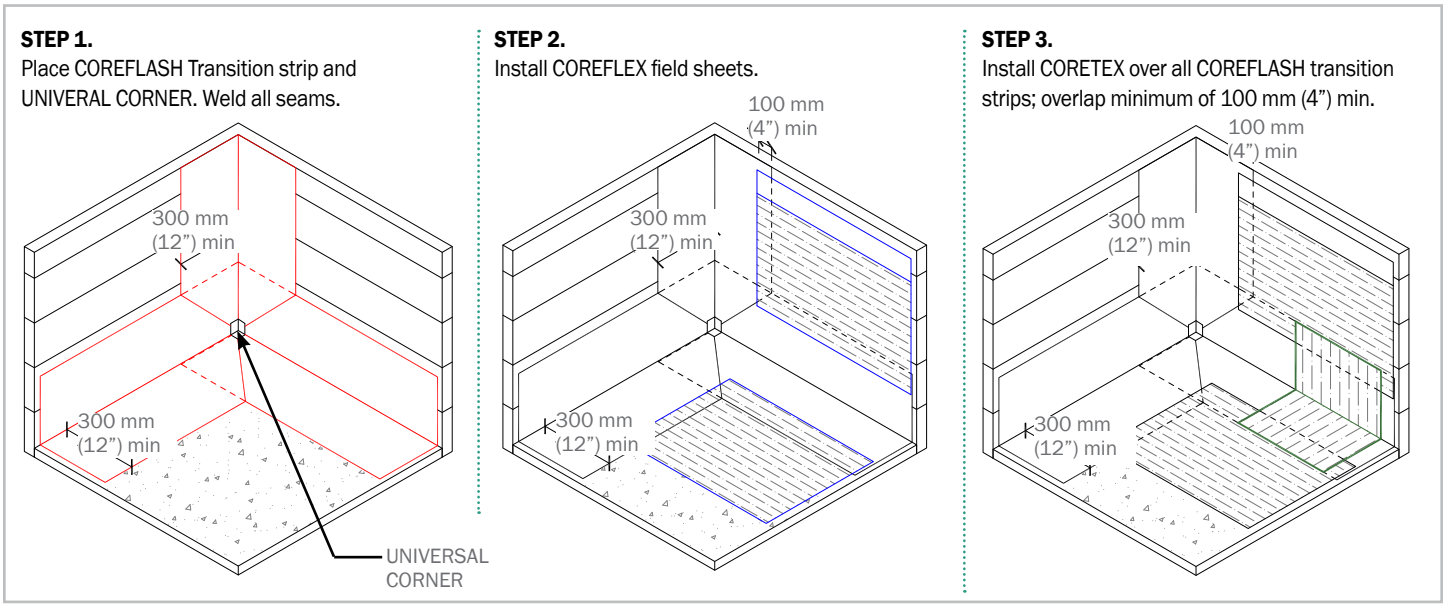
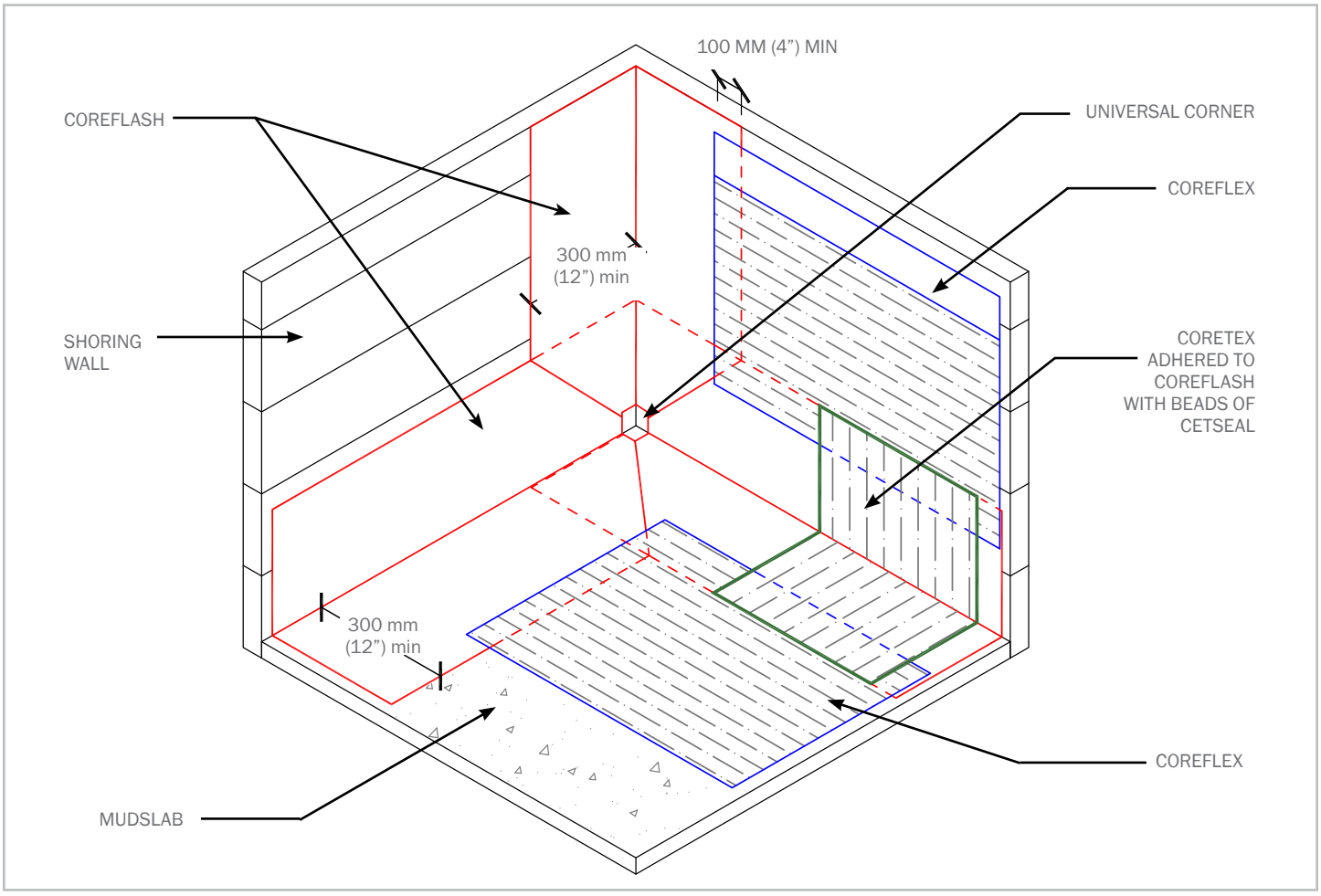


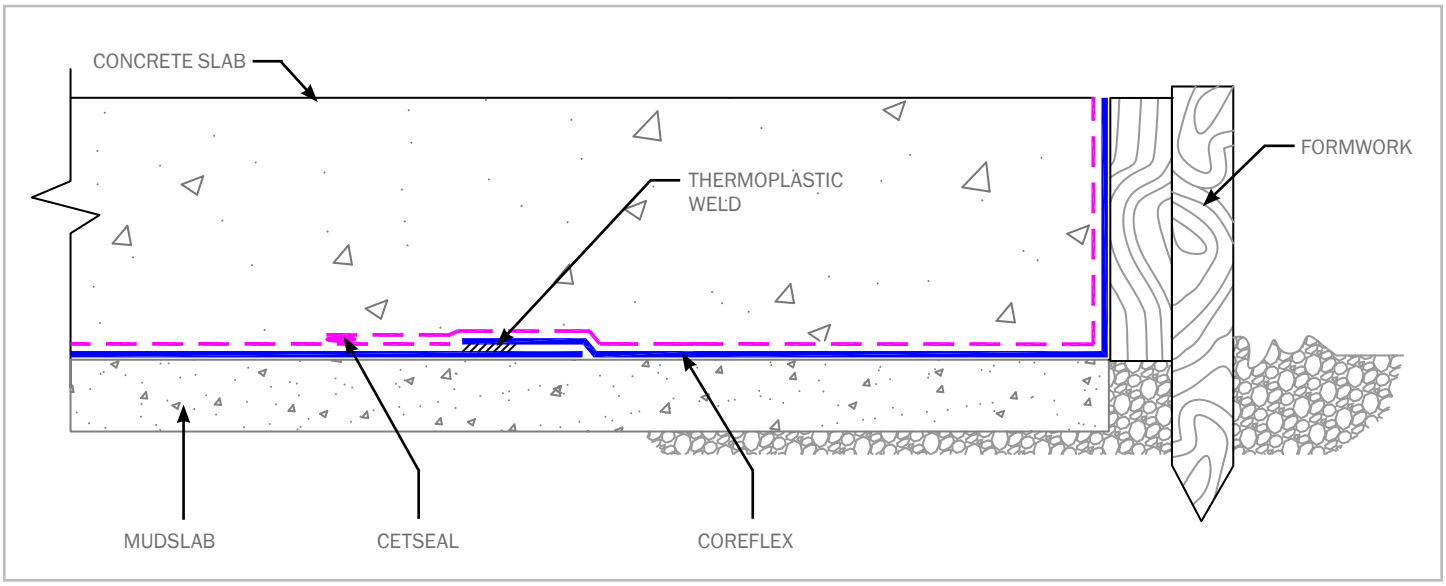
2.7.3A SLAB TO WALL TRANSITION – ALTERNATIVE METHOD SEQUENCING



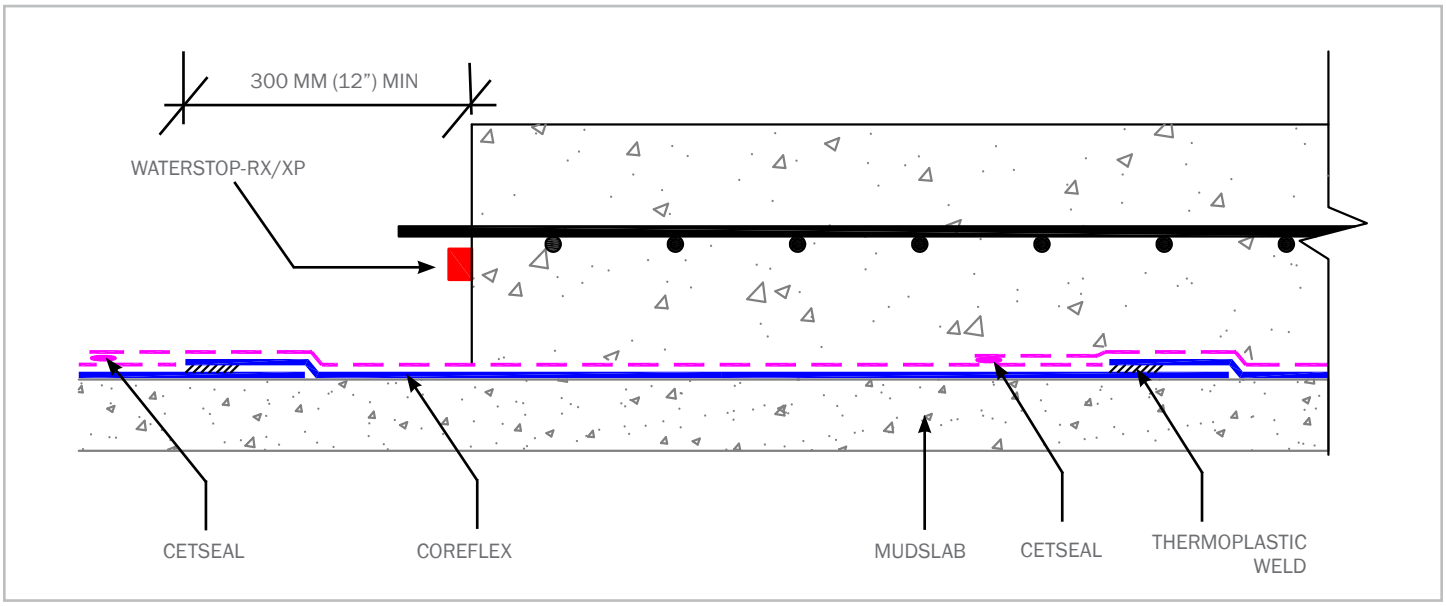
2.7.3B SLAB TO WALL TRANSITION – ALTERNATIVE COMPOSITE

2.8 BACK FILLED WALL – EDGE OF SLAB

When the installation reaches the edge of the slab, extend the COREFLEX sheet out the top of the form a minimum of 300 mm (12”). At the slab edge, COREFLEX should remain in contact with the substrate and the inside surface of the concrete form conforming tightly to the change in plane. After concrete placement, position COREFLEX membrane to top of footing and secure with washer headed fasteners maximum 200 mm (8”) on center. Damaged material outside the form should be patched or cut off and disposed. Install SEAL-X XP cant at wall-to-footing transition prior to installing COREFLEX wall waterproofing overlapping the secured COREFLEX edge on top of the footing a minimum 100 mm (4”); secure with a continuous thermoplastic weld.



2.8.1 PERIMETER SLAB EDGE



2.8.2 SLAB SECTION TIE-IN

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SECTION 3
UNDERSLAB INSTALLATION METHODS

3.1 GENERAL

Best practice is to install COREFLEX on a smooth concrete mud slab with a float finish to provide a planar surface; without sharp angular depressions, voids or raised features. The COREFLEX system is intended for use under reinforced concrete slabs 150 mm (6") thick or greater with a mud slab substrate. COREFLEX can be used under reinforced concrete slabs 100 mm (4") thick or greater with a compacted earth/gravel substrate. For installation over compacted earth or gravel substrates, consult CETCO for additional steps required for the field fabrication of welded overlap seams. For hydrostatic conditions, install COREFLEX under footings and grade beams. For non-hydrostatic conditions, COREFLEX should be installed around footings and grade beams and completed with a termination bar and a tooled bead of CETSEAL.

Prior to installing COREFLEX the substrate must be properly prepared. Complete all required elevator pit, sump pit, cistern, grade beam and piling work prior to installing COREFLEX under the slab area. These areas shall be correctly tied into the underslab COREFLEX to form a monolithic system. How these items are formed, poured and finished are critical to proper detailing. Penetrations should be placed and secured in their final position prior to installing COREFLEX membrane so that they may be properly detailed. All corrective actions required to provide a suitable substrate must be completed prior to the installation of the COREFLEX waterproofing membrane and components.

3.2 SUBSTRATE PREPARATION

The preferred substrate is a working mud slab, but may also be compacted earth, sand, or crushed stone. Earth and sand substrates should be compacted to a minimum 85% Modified Proctor density. Crushed stone should be no larger than 19 mm (3/4") in size. Substrate should be smooth and without sharp deflections or pockets. Substrates other than a working mud slab require additional steps and components to properly complete the welded overlap assembly (See Section 1 Membrane Welding Procedures for detailed instructions). Earth formed elevator pits, grade beams and footers require soils that are stable enough to support the COREFLEX membrane and provide for adequate confinement. For piles, detailing is required prior to pouring the pile caps. When earth formed, the topmost 200 mm (8") minimum of the pile should be formed with a round cardboard tube type form to provide a smooth concrete surface for detailing.

3.3 GRADE BEAMS, FOOTINGS AND ELEVATOR PITS

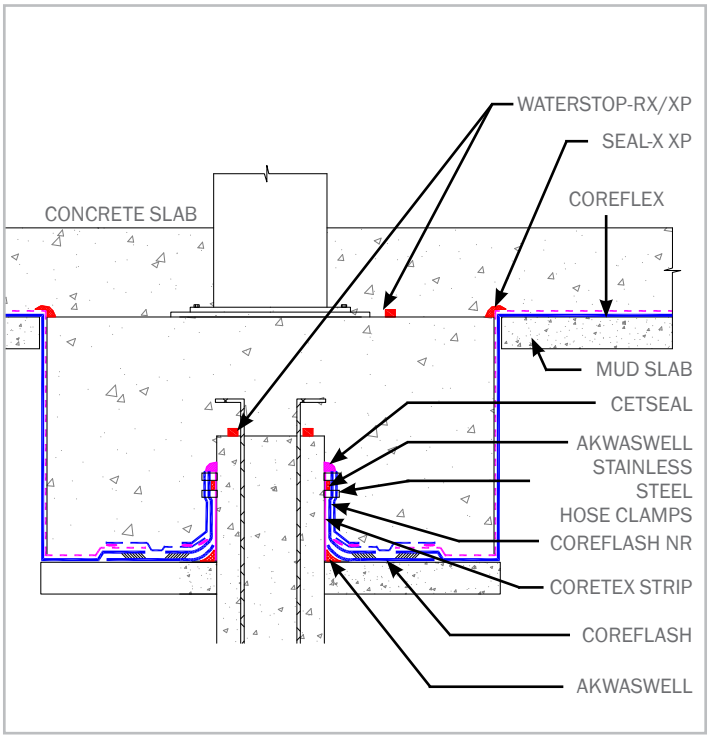
Grade beams, footings and elevator pits are typically lined and poured prior to pouring the working mud slab. Any unstable or non-compatible soils should be contained with a retaining wall. COREFLEX should be installed on the vertical surfaces and on the substrate below the slab to form a continuous envelope around the grade beam or elevator pit. Install COREFLEX membrane directly against the retaining wall. Substrate requirements for grade beams, footings and elevator pits are identical to the requirements for suitable substrate for all other surfaces to receive COREFLEX membrane waterproofing. The surface must be smooth and planar, and ridged enough to provide for proper confinement. The substrate must also provide adequate fastening grip, to support the membrane. Place the membrane into the grade beam, footing or elevator pit so that the active layer is facing the installer. In corners, apply the waterproofing using CoreFlash and Coretex separately then adhering them together with CETSEAL after welding the CoreFlash. This will allow for tighter conformity of the waterproofing to the changes in plane. It will also provide for easier welding, negating the need to peel the active layer from the thermoplastic membrane. Alternately, pre-fabricating a COREFLEX membrane liner, off-site or on-site but on a slab or other ridged planar substrate should be considered. Prefabricated pieces should then be placed and assembled in the grade beam, footing or elevator pit, greatly reducing the number of welds made on a compacted fill, sand or gravel surface requiring the use of a metal or wood track to accommodate the welding equipment.

Field prefabrication can be accomplished by building a mockup of the same dimensions of the grade beam, footing or elevator pit and constructing it so that the COREFLEX is placed on the outside of the mockup allowing the welding to be completed on the yellow thermoplastic side of the membrane. The prefabricated piece then can be pulled off the mockup and placed into the grade beam, footing or elevator pit. When transitioning to a mud slab, allow a long enough membrane (tails) to extend out onto the mud slab and tie into the underslab COREFLEX membrane; typically 300 mm (12").

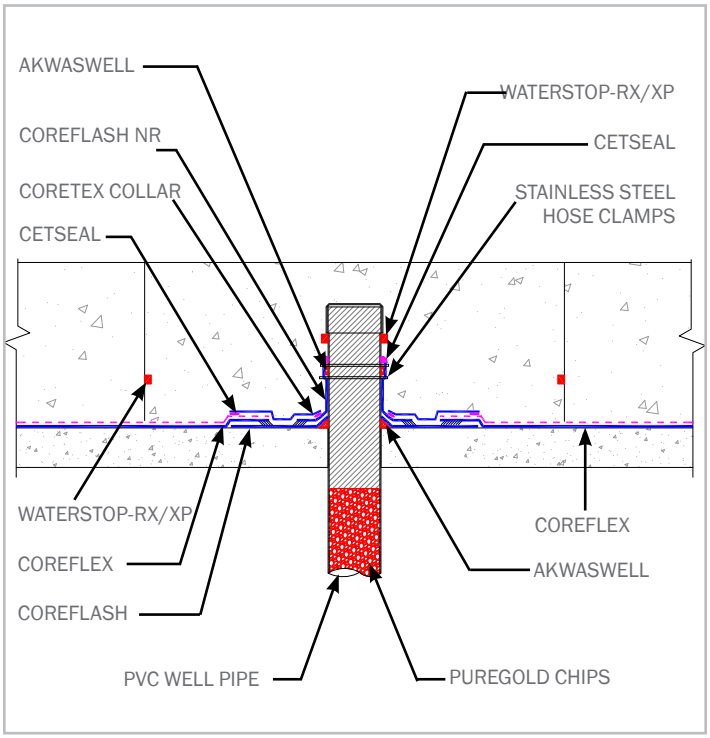
When tying into a column from a grade beam, it is necessary to wrap the COREFLEX membrane coming up the sides of the grade beam and onto the top of the grade beam bringing the COREFLEX membrane up to and cut tight to the column. Flash the corners per the site specific detail at the juncture of the grade beam to the column. A secondary (upside down) flashing at the corners needs to be placed prior to pouring the mud slab in order to flash the underslab COREFLEX membrane to the column flashing membrane. Due to various elevator piston plunger designs, consult CETCO for specific installation and detailing recommendations for piston plungers that penetrate the pit slab.

3.4 PILE CAPS

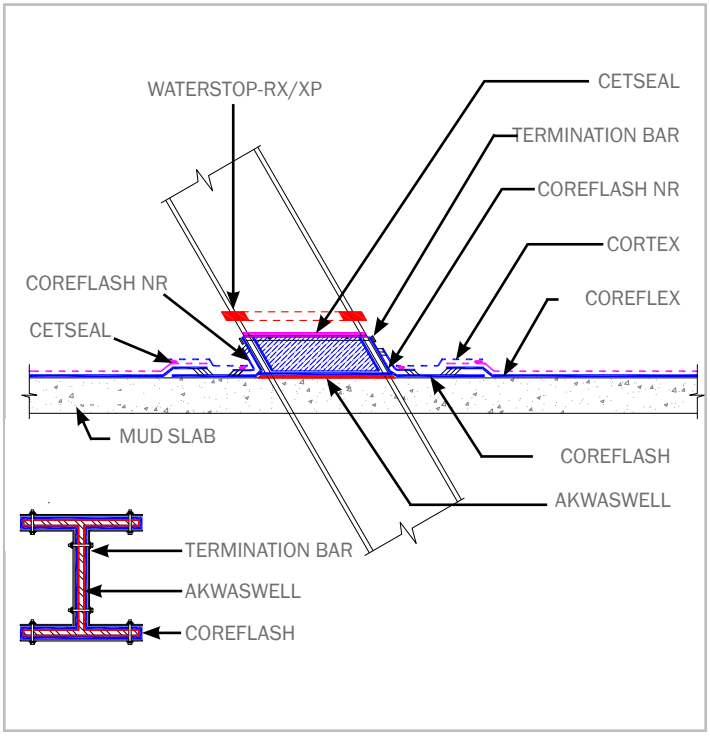
The pile portion of a pile cap is typically earth formed and may not provide a suitable smooth substrate to install the flashing components. When earth formed, the top 200 mm (8") minimum portion of the pile should be formed with a round cardboard tube form in order to provide a smooth substrate for detailing. This top, smooth portion of the pile is then detailed as a round or square penatration per section 2.



3.1.1 UNDERSLAB GENERAL – PILE CAP



3.1.2 UNDERSLAB GENERAL – WELLPOINT BOX OUT



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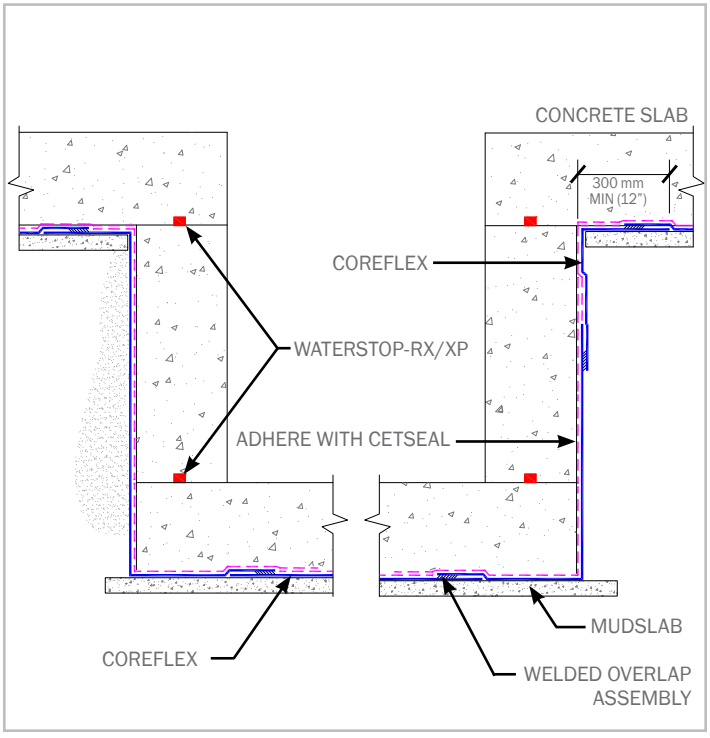

3.3.4 UNDERSLAB GENERAL – ELEVATOR PIT

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SECTION 4
PROPERTY LINE CONSTRUCTION

4.1 GENERAL

The use of construction techniques described in this section allow the exterior building dimensions to coincide with a shoring wall at the property line, thereby maximizing use of available land for building. COREFLEX has been proven to be one of the most effective means for waterproofing property line construction. Property line construction methods include soldier pile & lagging, metal sheet piling, earth formed shotcrete retention walls, and auger cast caisson walls.

For all property line construction methods, install COREFLEX with the APC/XP layer (active layer) side oriented inward (facing the installer) so that the concrete will be poured against the active layer side.
Aquadrain sheet and 100BD base drain composite system should be connected to an operative water discharge system (sump pump or gravity to daylight discharge).

Protect waterproofing products from damage before material is contained with concrete or backfill. After any precipitation, standing water should be pumped off of the waterproofing as soon as possible.

4.2 SHORING WALL PREPARATIONS

Excavation work should provide a shoring wall in good condition to receive waterproofing system. Appropriate preparation can vary per shoring wall type. Verify the substrate preparation work has been completed for the applicable shoring wall system. Then install COREFLEX following the “Property Line Wall Installation” Guidelines in Section 4.3.

4.2.1 SOLDIER PILE & LAGGING SHORING WALL

Gaps between wood lagging timbers should be no wider than 25 mm (1”). If the gaps between lagging timbers are in excess of 25 mm (1”), the gaps should be completely filled with cementitious grout, wood, extruded polystyrene 0.138 MPa (20 psi) min. spray foam or compacted soil. If water is flowing through the lagging, thin polyethylene sheeting can be installed over the area before COREFLEX is installed.

In areas with large gaps of up to 63 mm (2–1/2”) between lagging, Aquadrain sheet drainage composite can be installed over the lagging to provide a uniform surface to mount COREFLEX. Securely fasten Aquadrain to the lagging surface with washer-head fasteners before installing COREFLEX. Gaps larger than 63 mm (2–1/2”) between lagging should be completely filled with grout, wood, extruded polystyrene 0.138 MPa (20 psi) minimum spray foam or compacted soil even if Aquadrain is installed prior to COREFLEX. Do not use plywood or other surface treatment over large lagging gaps that leave the cavity void. Wood lagging shoring should extend to the lowest level of the waterproofing installation without any voids or cavities exterior of or underneath the lagging filled with compacted soil or cementitious grout. Voids or cavities at tie-backs should be filled with grout or compacted soil prior to COREFLEX installation.

SOLDIER PILE STRIPPING: Install a protective material strip of CoreFlash over all soldier piles with raised lagging hanger bolts, form tie rods, or other irregular surfaces to provide a suitable substrate that will not puncture the COREFLEX. The CoreFlash strip should extend a minimum 100 mm (4”) to both sides of the piling.

CEMENTITIOUS BOARD: Prior to installing membrane to Grade Termination detail at finished grade, install 12 mm (1/2”) thick cementitious wall board centered over steel soldier pile from finished grade elevation to past thespecified depth that the top of steel soldier pile and wood lagging will be removed.

4.2.2 METAL SHEET PILING SHORING WALL

PLYWOOD OR CEMENTITIOUS WALL BOARD METHOD (RECOMMENDED METHOD)
Use 12 mm (1/2”) plywood or cementitious wall board fastened to the sheet piling to create a flat surface upon which COREFLEX can be installed. All void spaces between the plywood/cement board and sheet piling must be filled with compacted earth or concrete.

Installation of COREFLEX directly to and contouring the sheet metal piling requires special knurled powder-actuated fasteners to secure COREFLEX to the metal sheet piling. All fasteners must be positioned to be outside of all thermoplastic welds.

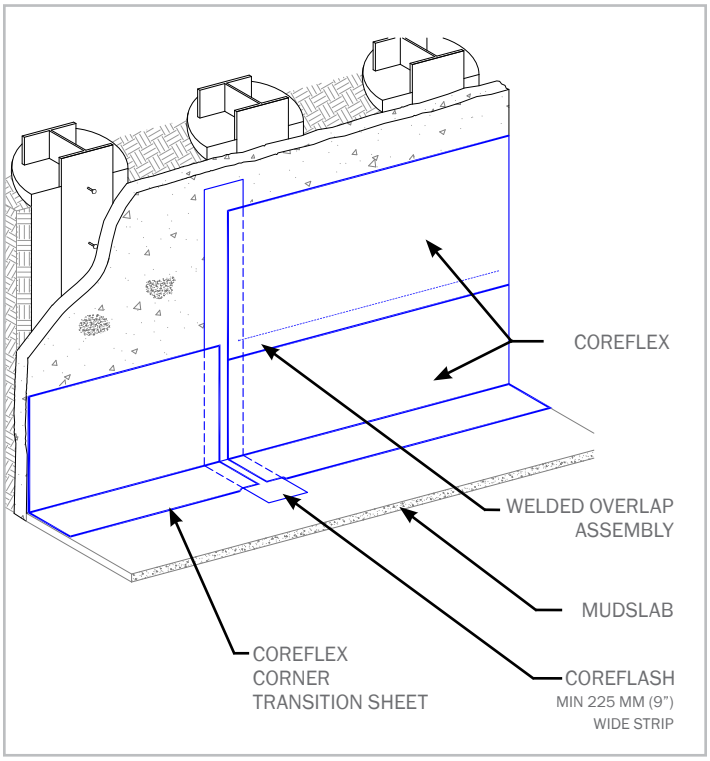
Fill voids or cavities at tieback plates with cementitious grout or compacted soils. If excessive water is penetrating the sheet piling knuckles, Bentogrout can be injected to the outside of the knuckle to stop water flow. Consult CETCO for Bentogrout application and installation guidelines.

For metal sheet pile shoring wall place a continuous band of cementitious board at the point where the sheet pile and or piles are to be burned off. The cementitious board should extend a minimum 450 mm (18”) below the point where the sheet pile and or piles are to be burned off.

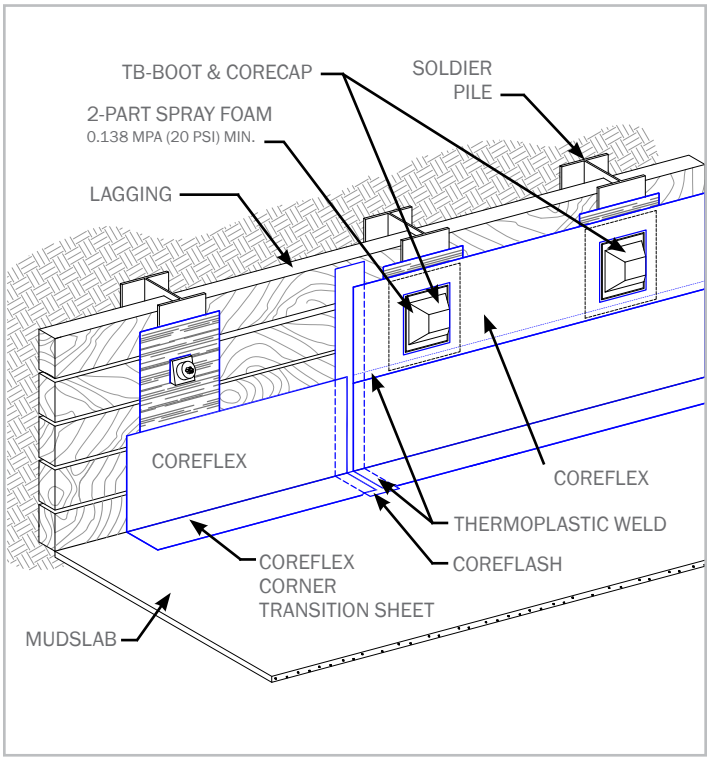
4.2.3 EARTH-FORMED DIAPHRAGM SHORING WALL

The surface of the earth-formed diaphragm wall must be sufficiently planar to provide an adequately smooth surface to apply COREFLEX. COREFLEX can be applied over large, relatively shallow indentations. The surface should not contain voids or sharp protrusions in excess of 25 mm (1”). Fill all voids with cementitious grout or shotcrete and remove protrusions prior to installing COREFLEX.

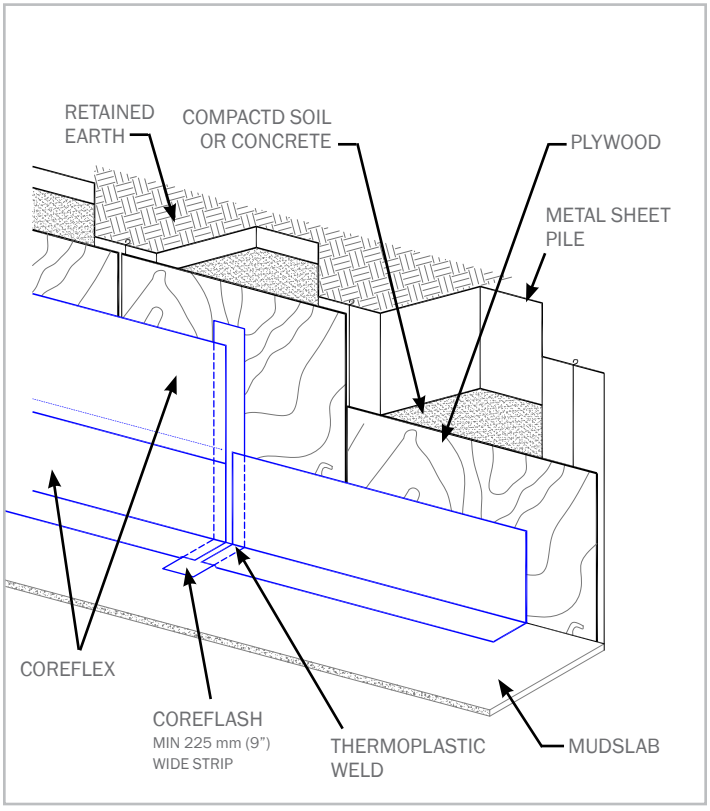
Shotcrete must be well consolidated and contain no honeycombed areas or voids. These types of defects must be corrected prior to installing the COREFLEX membrane.



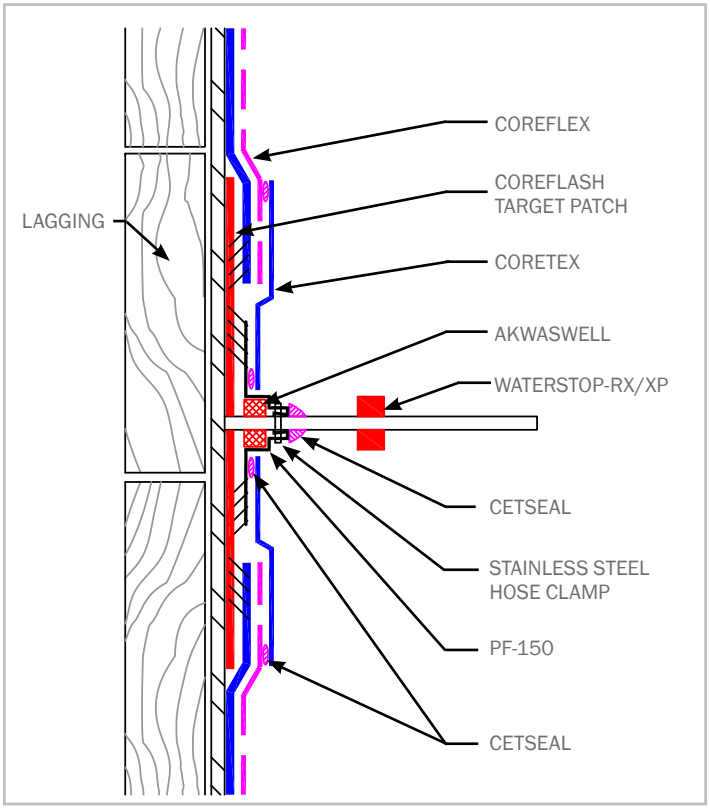
4.2.4 PROPERTY LINE WALL – AUGER CAST CAISSON



4.2.4 PROPERTY LINE WALL – SOLDIER PILE & LAGGING



4.2.4 PROPERTY LINE WALL – SHEET PILE



4.2.4 PROPERTY LINE WALL – NELSON STUD FLASHING

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4.2.4 AUGER CAST CAISSON AND CUT ROCK EXCAVATION SHORING WALLS

The surface of auger cast caisson and cut rock excavation walls must be sufficiently planar to provide a proper substrate surface to apply COREFLEX. Auger cast caisson and cut rock excavation walls typically require shotcrete or grout work to provide planar surface to install COREFLEX. COREFLEX can be applied over large, relatively shallow indentations in plane where it can conform tight against the surface. The surface should not contain sharp surface depressions or protrusions in excess of 25 mm (1”). Fill all large recesses between caissons or cut rock with cementitious grout or shotcrete prior to installing COREFLEX.

An alternative substrate correction method is to construct a planar substrate surface such as a plywood wall erected over irregular caisson or cut rock walls. Any erected walls shall be approved by project engineer and meet all safety and building code requirements. Any void space between the erected substrate wall and the caisson or cut rock excavation wall shall be completely filled with compacted backfill, concrete, or engineered fill per project requirements.

Employ construction methods to stop water from flowing through the shoring wall prior to waterproofing installation. If only water seepage, install thin polyethylene sheeting over the seepage area prior to installing COREFLEX. Polyethylene sheeting should extend from seepage elevation to base of wall to protect entire waterproofing installation at that area.

4.3 PROPERTY LINE WALL INSTALLATION

At base of the shoring wall, install a COREFLEX corner transition sheet horizontally oriented and placed at the corner transition from underslab to shoring wall with the PVC thermoplastic membrane offset edge placed on the shoring wall (active layer inward, facing installer; yellow side toward shoring wall), or install in place corner transition with COREFLASH and Coretex. Position the bottom PVC membrane edge extending out onto the horizontal substrate a minimum 300 mm (12”). Approximately 25 mm (1”) down from the top edge, secure the thermoplastic membrane offset to the shoring wall with washer-head mechanical fasteners spaced a maximum of 900 mm (36”) on center; refrain from placing a fastener within 150 mm (6”) of each roll end. Install adjacent membrane sheets with both the thermoplastic membrane and active layers overlapped a minimum 100 mm (4”). Assemble and weld laps, secure any loose active layer material with dabs of CETSEAL maximum 200 mm (8”) on center or a continuous bead of CETSEAL. When welding the PVC overlap seams on the corner transition sheet start the weld at the corner and work outward from the corner along both seams. Any T-Joints created require a welded CoreDisc or CoreFlash NR patch.

Once the corner transition sheet has been installed, COREFLEX sheets can be installed either vertically or horizontally oriented on the wall. Fasten the COREFLEX into position with washer-head fasteners maximum 900 mm (36”) on center; 25 mm (1”) from the top of the thermoplastic membrane selvedge edge. Overlap adjacent sheet edges a minimum 100 mm (4”). (Note: Shingle lap seams so that the bottom edge of the upper sheet is over and inward of the top fastened edge of the lower sheet to facitate welding that results with all fasteners positioned outside of the welds). Continue installation up wall until 300 mm (12”) below finished grade elevation. Terminate at grade detail as described in section 2.6 to complete the waterproofing membrane installation. This may require the removal of soldier piles and lagging after the concrete wall is poured, see section 4.2.1 or instructions for installing cementitious board, and grade termination detail installation instructions.

Apply COREFLEX membrane in standard roll size or longest workable cut length. Install COREFLEX sheets horizontally oriented with the thermoplastic membrane offset edge side up (active layer side inward facing installer; yellow side toward shoring wall). Approximately 25 mm (1”) down from the top edge, secure the thermoplastic membrane offset to the shoring wall with washer-head mechanical fasteners spaced maximum 900 mm (36”) on center; refrain from placing a fastener within 150 mm (6”) of each roll end. Install subsequent COREFLEX sheets in vertical sequence up wall with membrane roll ends matched to within 25 mm (1”); trim roll ends as applicable to meet the 25 mm (1”) alignment. Assemble and weld membrane overlap; secure any loose active layer material with bead of CETSEAL. Extend membrane installation minimum 300 mm (12”) above concrete pour joints to provide access.

Alternately, install COREFLEX sheets vertically oriented (active layer side inward facing installer; yellow side toward shoring wall). Approximately 25 mm (1”) from the edge, secure the thermoplastic membrane offset to the shoring wall with washer-head mechanical fasteners spaced maximum 900 mm (36”) on center; refrain from placing a fastener within 150 mm (6”) of each roll end. Install subsequent COREFLEX sheets in vertical sequence along wall. Trim roll ends as applicable to meet the 100 mm (4”) overlap onto the membrane selvedge edge of the horizontal transition sheet. Assemble and weld membrane overlaps; secure any loose active layer material with dabs of CETSEAL maximum of 200 mm (8”) on center or a continuous bead of CETSEAL. Extend membrane installation minimum 300 mm (12”) above concrete pour joints to provide access. Detail all T-Joints with a CoreDisc or CoreFlash NR welded patch. Secure any loose or peeled active layer material with continuous bead of CETSEAL. Continue membrane installation up shoring wall to project grade detail elevation. Secure top membrane edge with washer-head mechanical fasteners maximum 300 mm (12”) on center.

Inside and outside corner transitions can also be constructed using CoreFlash and Coretex rather than installing COREFLEX membrane through these changes in plane. Cut and install CoreFlash extending on both substrates of the corner a minimum 300 mm (12”); maintain a minimum 100 mm (4”) overlap of all adjacent PVC membrane sheets for proper welded seam. After welding all PVC seams install a cut sheet of Coretex that covers all the installed CoreFlash in the corner and extends a minimum 100 mm (4”) overlapping the active layer of all adjacent COREFLEX sheet. Adhere the cut Coretex sheet to both the CoreFlash and the adjacent active layers with continuous beads of CETSEAL placed throughout the area of installation to tightly secure the Coretex.

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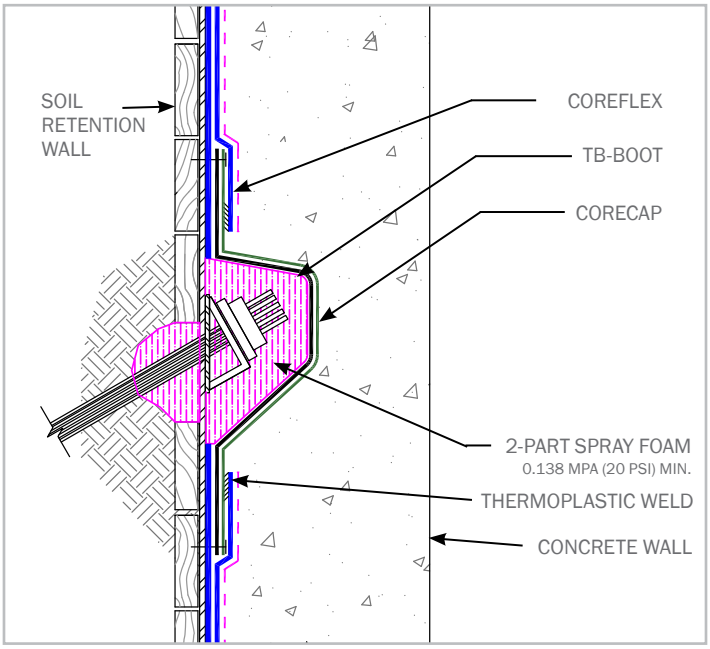
4.4 REBAR SUPPORTS

CETCO recommends non-penetrating reinforcement systems. When that is not possible use the TW-ANCHOR with weldable flange to support the rebar on concrete/shotcrete shoring walls or on sheet pile with a plywood facing that is backfilled with lean-mix concrete. The TW-ANCHOR can be installed prior to placement of the COREFLEX membrane. The TW-ANCHOR must be installed in sound substrates. Installation requires the drilling of a 28 mm (1 1/8") diameter by 225 mm (9") deep hole, appropriate clean out measures, and epoxying into place. Field verification with the site specific substrate is necessary to determine maximum allowable loads per each unique site condition. Drill a 28 mm (1–1/8") diameter by 225 mm (9") deep hole into the substrate. Care should be taken during the drilling process to eliminate lateral movement of the drill bit, as this will create an oversized hole which can reduce the pull-out load capacity of the installed TW-ANCHOR. Clean out the hole with a long reach air gun to blow debris out of, and away from, the hole. Brush the inside of the hole with 32 mm (1–1/4") stiff bristled pipe brush. After brushing in the hole, repeat blowing out debris with air gun a second time. Repeat this process, as needed, until all dust and debris has been removed from the hole. Starting at the bottom/back of the hole, fill 125 mm (5") of the hole with CETCO approved epoxy. Insert the TW-ANCHOR; twist the anchor into place rather than pushing straight into the hole; back pressure can prevent full insertion if air gets trapped behind the threads. Twisting the TW-ANCHOR during installation also promotes full epoxy coverage around the TW-ANCHOR and hole perimeter. The TW-ANCHOR MUST BE FULLY EMBEDDED; back surface of the rigid flange must be flush against substrate.

Secure the TW-ANCHOR in place until epoxy reaches its initial set. Once the TW-ANCHOR is in place allow for the epoxy to set for the recommended cure time (typically 24 hours, consult epoxy manufacturer if hot, cold or wet conditions exist as this will affect cure time). Thread allthread rod (M16 x 20) into the rigid PVC sleeve until full threaded depth of 196 mm (7 3/4") is achieved. Install COREFLEX waterproofing membrane by cutting around the rigid PVC sleeve base; take care to not cut the flexible TW-ANCHOR membrane flange. With a hot-air hand welder and a 20 mm (3/4") tip, weld the COREFLEX membrane (yellow thermoplastic side) to the TW-ANCHOR flexible membrane flange. Complete the entire weld and test for continuity with a mechanical probing device (blunt tip screwdriver or similar). Cut a round 500 mm (20") patch of Coretex with a 16 mm (5/8") hole in the center and place over the all-thread rod. Use dabs of CETSEAL maximum of 200 mm (8") on center or a continuous bead of CETSEAL adhere the Coretex in place.

4.5 TIE-BACKS

Select the appropriate size TB-Boot and CoreCap weldable thermoplastic flange to fit over tieback plate and allow proper concrete coverage per project requirements.The TB-Boot is a rigid backing piece (white) and the CoreCap is a flexible, weldable PVC component (black). TB-Boot should fit entirely over tie-back head without the tie-back plate or cables in direct contact with the TB-Boot. Prior to TB-Boot installation, fill voids in retention wall substrate and tie-back head assembly



4.5 TIE-BACK BOOT

with spray foam, 0.138 MPa (20 psi) minimum or non-shrink grout. Fill pre-formed shape of the rigid TB Boot with 2-part urethane foam 0.138 MPa (20 psi) minimum and place over the tie-back head before foam sets up. Overlay the CoreCap weldable PVC component over the TB-Boot. With the CoreCap PVC component nested over the TB-Boot, secure both components to the soil retention wall using washer head fasteners along the outside edge of the flat flange base. Begin by placing two fasteners at the top two corners. Then fasten the two bottom corners and follow up by placing a fastener at each midpoint of the 4 edges. All fasteners should be placed a within 75 mm (3") of the TB-BOOT perimeter edge. Once the TB Boot and CoreCap are secured to the soil retention wall cut a window in COREFLEX membrane so that it overlaps the CoreCap weldable flange 100 mm (4") on all four sides. Weld the COREFLEX to the CoreCap on the flat flange with a continuous thermoplastic weld around the tie-back head; all fasteners shall be located outside of the weld. Weld should be verified for continuity to ensure a complete continuous weld. For soil nail rod and plate assemblies, install applicable TB-Boot & CoreCap (typically the TB-Boot 6SN & CoreCap 6) over assembly and fasten to shoring wall and install COREFLEX per TB-Boot & CoreCap installation guidelines herein.

NOTE:
For irregular or oversize tie-back heads, site specific field fabricated stainless steel CoreClad covers may be required in lieu of TB-BOOTs and CORECAPS. CoreClad field fabricated covers per project design will need to be used over large tie-back heads and where irregular (non-planar) shoring wall conditions exist. Consult CETCO for alternate detail for specific project condition(s).

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SECTION 5
BACKFILLED WALLS

5.1 SURFACE PREPARATION

The wall surface must be properly prepared before COREFLEX is installed. Cast-in-place concrete to receive waterproofing shall be of sound structural grade with a smooth finish, free of debris, oil, grease, laitance, dirt, dust, or other foreign matter which will impair the performance of the waterproofing. Form fins, ridges, and other protrusions over 6 mm (1/4") shall be made level and smooth with concrete surface. Honeycombing, aggregate pockets, tie-rod holes and other voids shall be completely filled with non-shrink cementitious grout and level with concrete surface. Concrete work should include completely filling taper-tie holes with non-shrink cementitious grout and a piece of WATERSTOP-RX/XP centered in the wall. Apply CETSEAL or Bentoseal over exterior grouted surface of all form tie holes.

Footings should be swept clean of dirt, rocks and debris to provide COREFLEX with direct contact to the concrete.

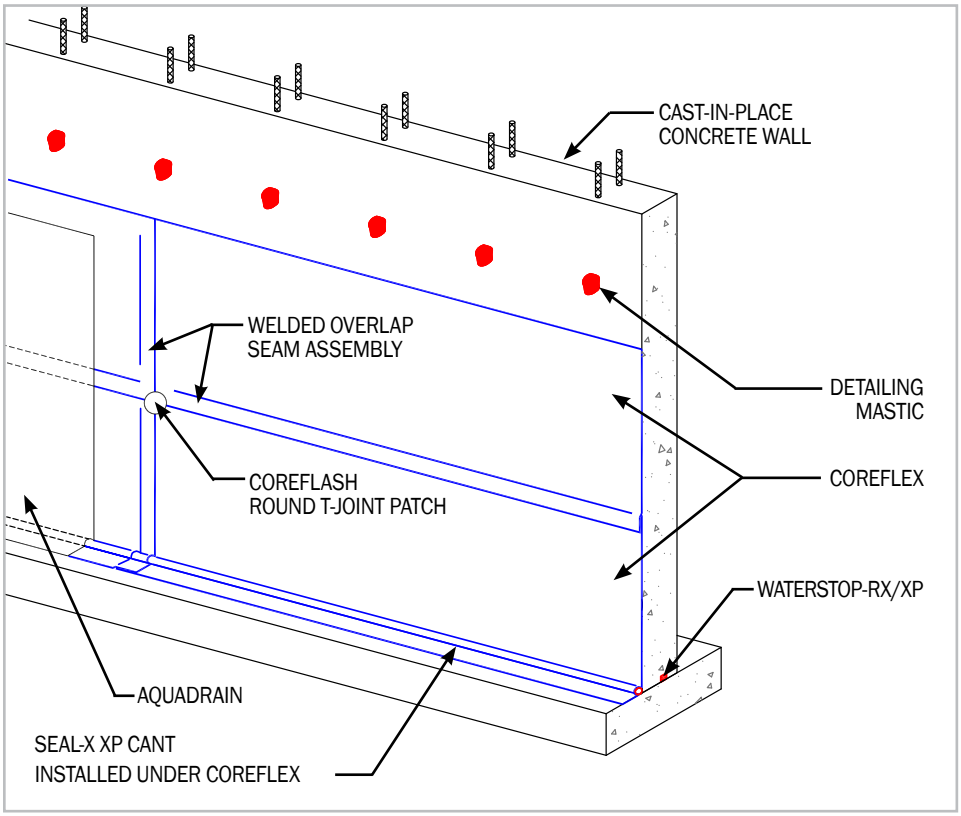
5.2 INSTALLATION

5.2.1 FOOTING TO WALL CORNER TRANSITION

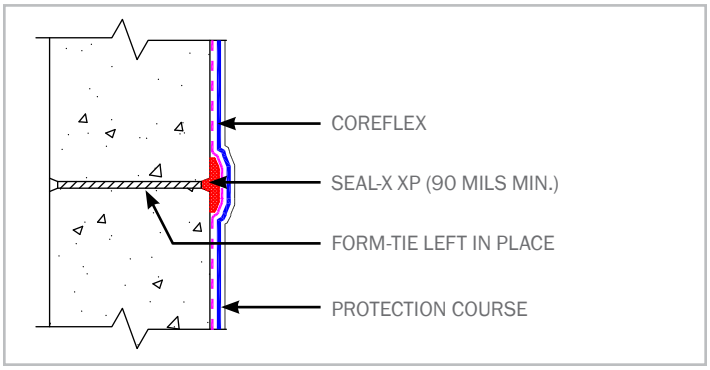
At the wall/footing intersection, install continuous line of SEAL-X XP cant prior to the placement of the COREFLEX membrane. At any vertical inside corners, apply a 19 mm (3/4") cant of SEAL-X XP prior to the placement of the COREFLEX membrane. Apply COREFLEX membrane in standard roll size or longest workable cut length. Install membrane in a flat, relaxed position avoiding wrinkles and stretching. Install bottom course of COREFLEX membrane horizontally oriented (active layer side against concrete; yellow side facing installer); with the active layer selvedge edge at the top and with the bottom edge extending out onto the footing minimum 200 mm (8") or further as required to overlap leading edge of COREFLEX membrane previously installed under the footing as part of underslab work a minimum 100 mm (4") or to allow for membrane termination detail. Approximately 25 mm (1") down from the top edge of the yellow thermoplastic membrane mechanically attach membrane to the concrete wall with washer-head fasteners spaced maximum 900 mm (36") on center; refrain from placing a fastener within 150 mm (6") of each roll end. 75 mm – 100 mm (3"– 4") intermittent dabs of CETSEAL may be used to adhere the 150 mm (6") active layer selvedge edge to the concrete. Install subsequent COREFLEX sheets in horizontal orientation sequenced up wall with membrane roll ends matched to within 25 mm (1"); trim roll ends as applicable to meet the 25 mm (1") alignment. Assemble and weld membrane overlaps and secure any loose active layer material with bead of CETSEAL.

ALTERNATE MEMBRANE INSTALLATION:

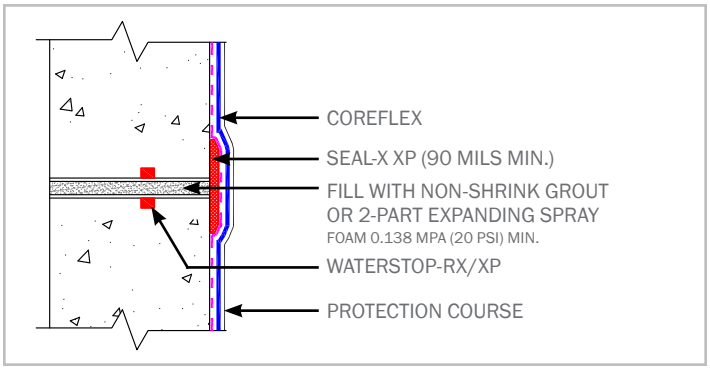
Install COREFLEX membrane sheets vertically oriented. Approximately 25 mm (1") from the edge, secure the thermoplastic membrane offset to the concrete wall with washer-head mechanical fasteners spaced maximum 900 mm (36") on center; refrain from placing a fastener within 150 mm (6") of each roll end. Install subsequent COREFLEX sheets in vertical sequence along wall. Trim roll ends to meet the 100 mm (4") overlap onto the PVC membrane of the horizontal oriented corner transition sheet. As applicable, install a minimum 450 mm (9") wide strip of Coretex extending a minimum 100 mm (4") over the active layer on the horizontal corner transition sheet active layer selvedge edge and behind the trimmed vertical courses of COREFLEX on the wall. Install adjacent COREFLEX membrane sheets overlapping Coretex strip with rolls ends closely matched to 25 mm (1") of adjacent COREFLEX roll end. Install minimum 450 mm (9") wide strip of CoreFlash centered over Coretex strip detail (yellow side facing installer). The bottom of the vertically oriented CoreFlash strip should overlap 100 mm (4") the horizontally oriented corner transition sheet and extend 100 mm (4") on the ends of the vertically oriented rolls of COREFLEX that continue up the wall. Hot-air weld the termination strip of CoreFlash to the COREFLEX; both continuous welds must be outside of all fasteners (no exposed fasteners). Finish CoreFlash strip by hot-air welding a CoreDisc or CoreFlash NR patch over all T-Joints. Assemble and weld all COREFLEX overlaps and secure any loose active layer material with bead of CETSEAL. Continue membrane installation up concrete wall to project grade detail elevation.



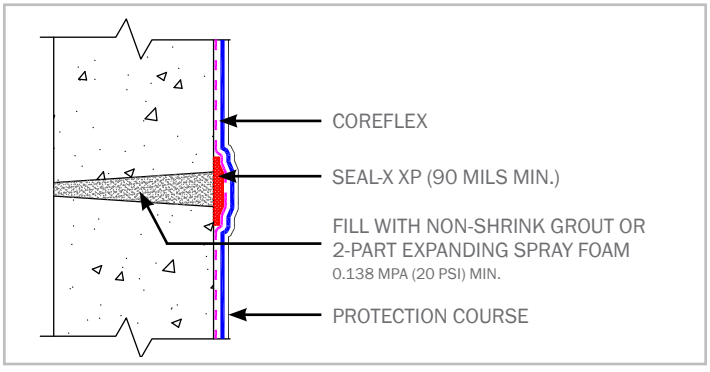
5.2.1 GENERAL INSTALLATION LAYOUT



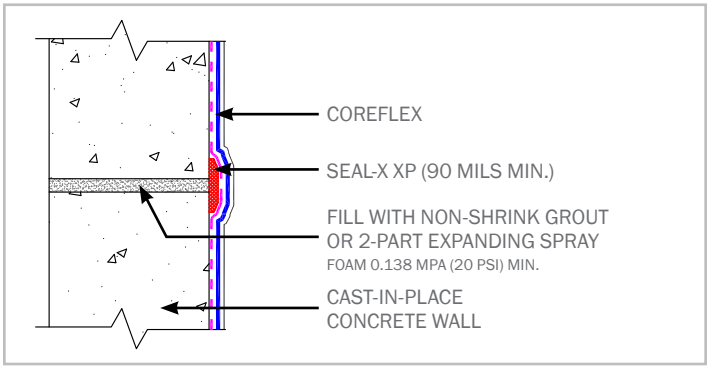
SNAP TIE



PVC SLEEVE



TAPER TIE



ALL-THREAD ROD

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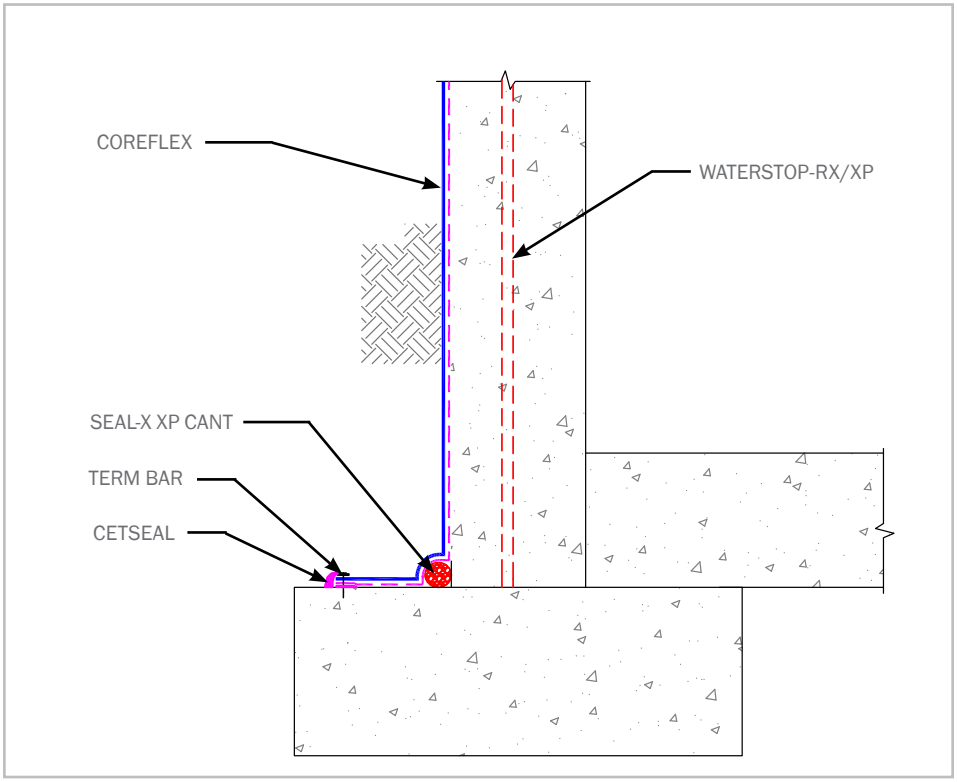
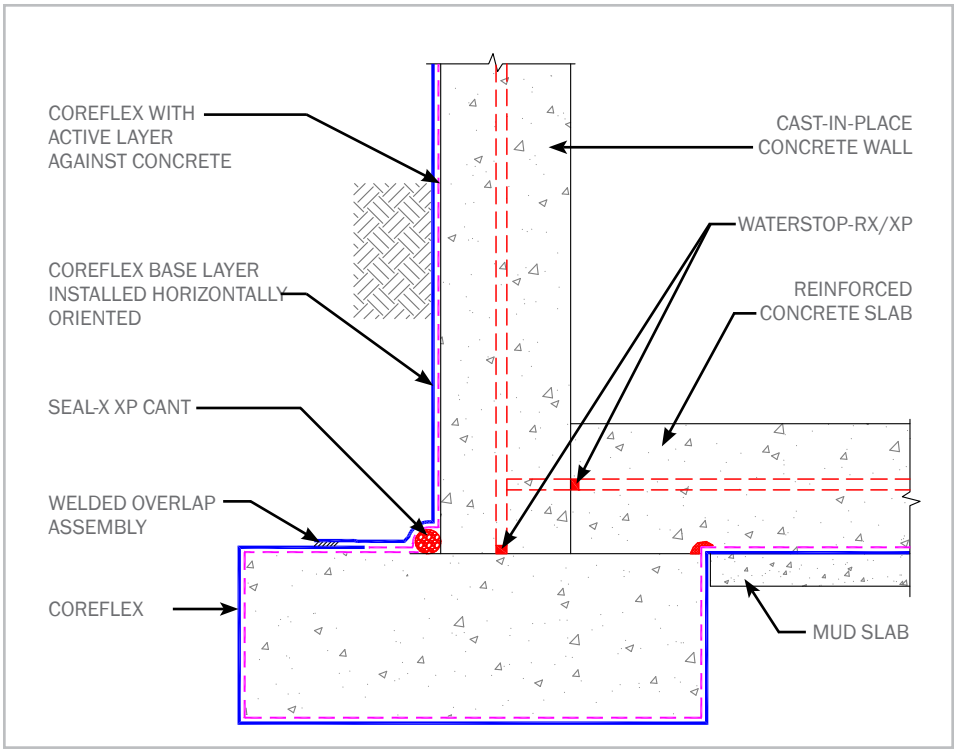
5.2.2 GRADE TERMINATIONS
SEE SECTION 2.6 GRADE TERMINATIONS.



5.2.2 SLAB EDGE TERM AT FOOTER (NON-HYDROSTATIC CONDITION)



5.2.3 SLAB EDGE (HYDROSTATIC CONDITION)

SECTION 6
SPECIAL CONDITIONS

6.1 PRECAST CONCRETE CONSTRUCTION

Consult CETCO regarding recommended products and special installation guidelines for precast concrete plank decks, precast earth covered roofs, and precast wall construction.

6.2 CONTAMINATED CONDITIONS

For compatibility testing, provide two (2) liter sample of site groundwater in a clean, unbreakable container. Ship water sample to: CETCO 2870 Forbs Avenue, Hoffman Estates, IL 60192, ATTN: BMG Field Services. Upon analysis, CETCO will provide a written report evaluating the water's compatibility with COREFLEX.

6.3 HYDROSTATIC/ NON-HYDROSTATIC CONDITIONS

Hydrostatic conditions exist when the elevation of the below-grade foundation is lower than the project site ground water level or historical high water table. Hydrostatic conditions are typically continual but may be intermittent with the fluctuation of the natural ground water table.

Non-hydrostatic conditions exist when site soil testing has determined that no ground water table exists or the elevation of the below-grade foundation is above the expected historical high water table elevation. Intermediate temporary hydrostatic pressure conditions may exist after precipitation or irrigation but is not a continual or prolonged condition.

6.4 EXPANSION JOINTS

COREFLEX membrane is not designed for waterproof expansion joints. Consult with CETCO regarding all expansion joint applications and limitations.

6.5 MISCELLANEOUS

Use CoreFlASH UV where membrane will be exposed to prolonged direct sunlight at grade terminations. Plywood or cementitious wall board may be used to provide a flat surface mount for installation of the COREFLEX membrane. For underslab or on property line shoring walls, install COREFLEX so that the active layer side is in direct contact with the concrete to be waterproofed. Use WATERSTOP-RX/XP at all (horizontal and vertical) cold concrete joints.

6.6 IMPORTANT NOTICE

FOR PRECAST CONCRETE, AND OTHER APPLICATIONS NOT COVERED IN THIS MANUAL, CONTACT CETCO FOR TECHNICAL ASSISTANCE AND INSTALLATION GUIDELINES.

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UPDATED: SEPTEMBER 2015

FORM: PM_COREFLEX_AM_EN_201509_V2

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CETCO

Laboratory Services Report

P CoreFlex Concentrated Organic Vapor Diffusion Testing: PCE, TCE, and Benzene
C Product Evaluation
C **B**: Jason Logsdon
R **B**: Michael Donovan, Ph.D.
D: July 28, 2017

T **D**

The vapor diffusion rate of three common organic compounds through CoreFlex 60 membrane was conducted over a minimum 900 day period. The three organic vapors that were studied were trichloroethylene (TCE), perchloroethylene (PCE) and benzene (B N). The testing was done in specially designed borosilicate glass chamber cells under atmospheric conditions to allow the organic vapors to come in contact with the membrane. The CoreFlex 60 membrane was tested in a separate test chamber for each of the three organic compounds; three test chambers in total. The CoreFlex 60 membrane was exposed to a constant vapor concentration by maintaining a saturated solution of the organic compound in water held in the bottom chamber section of the testing chamber. The saturated solutions were regulated by the solubility limits of each organic compound in water with excess organic compound present in the bottom chamber section. As the organic compound volatilized from the solution into the air space underneath the waterproofing membrane, the excess organic compound immediately dissolved into the water to maintain the saturated concentration in the bottom chamber section. The generated vapor concentration in the air space of bottom chamber section simulates a very high vapor exposure concentration that could be encountered in the field.

O Determine the solvent vapor diffusion coefficient against the following organic chemical vapors:

1. Trichloroethylene (TCE) at 524 ppm in DI water
2. Perchloroethylene (PCE) at 120 ppm in DI water
3. Benzene (B N) at 450 ppm in DI water

S **I**

1. CoreFlex 60

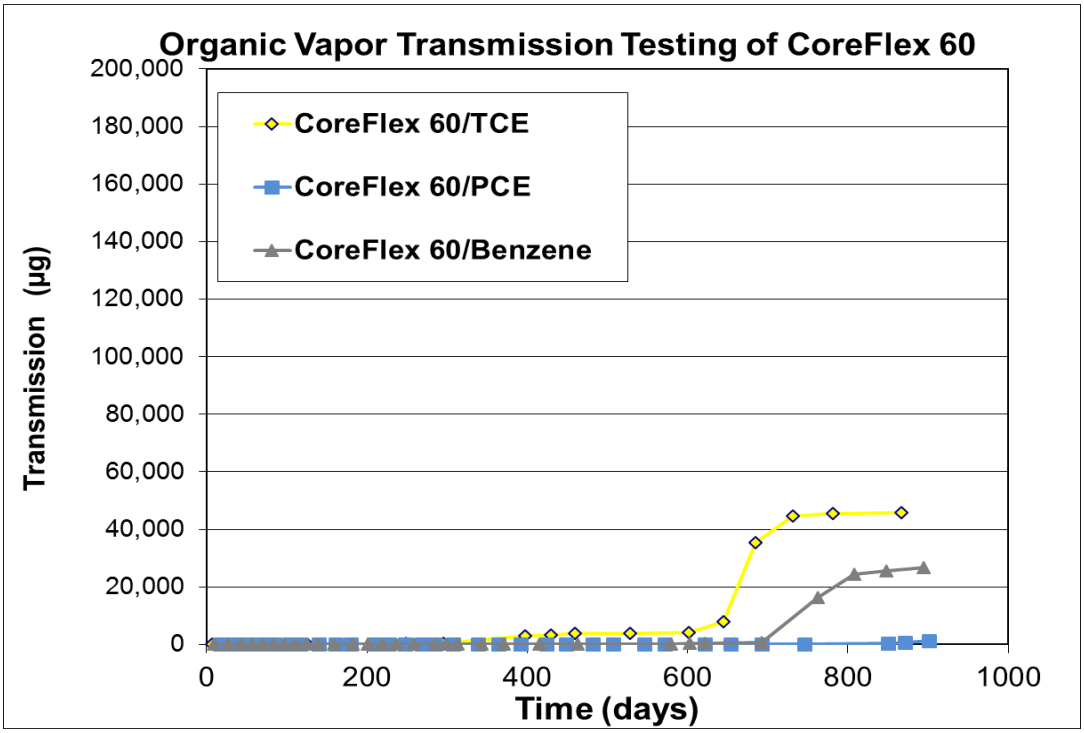
T **P**

1. Solvent Vapor Diffusion Rate Testing – CETCO Internal Method (See Figure 4 for a schematic)
   - 6 inch diameter membrane sample
   - Organic vapor entrapped by granulated activated carbon (GAC) filters
   - The vapor was collected in the GAC under atmospheric pressure
   - Organic vapors quantified by desorbing GAC filters then Gas Chromatography
   - Tested against the following individual contaminates:
     - TCE 524 ppm in DI Water
     - PCE 120 ppm in DI Water
     - Benzene 450 ppm in DI Water

T□□□R□□□□□

The vapor diffusion rates of the TCE, PCE and benzene through the CoreFlex 60 were estimated by prolonged (multi-year) testing. For both CoreFlex 60 membranes, it took at least 200 days to measure a flux due to an initial equilibration regime in which very little flux was observed (see Figure 1 for CoreFlex 60). Once a flux was observed, the solvent diffusion rate was estimated for CoreFlex 60 in the following manner. The CoreFlex data exhibited a step function, therefore the average diffusion rate (expressed as □g/day) was conservatively estimated by summing the total solvent permeation and dividing by the days of testing which provided a best fit curve to the upper limit of data. The diffusion rate data was then used to estimate the solvent diffusion coefficients (expressed as m^2/s) for CoreFlex 60. The data is tabulated below in Table 1 for CoreFlex 60.

For CoreFlex 60, as the exposure duration increased, the rate of solvent permeation changed in a step-like transition. The highest diffusion coefficient was observed for TCE at $3.8x10^{-13}$ m^2/sec, whereas PCE showed the lowest diffusion coefficient $1.3x10^{-14}$ m^2/sec.



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Material	Test Conditions	Days Exposed	Contaminate Vapor Conc. (ug/m3)	Avg. Solvent Diffusion Rate (ug/day)	Calculated Diffusion Coefficient (m2/s)
CoreFlex 60	Benzene 450 mg/l	944	4.50E 08	30.3	8.56E-14
CoreFlex 60	TCE 524 mg/l	867	5.24E 08	155.7	3.78E-13
CoreFlex 60	PCE 120 mg/l	901	1.20E 08	1.2	1.31E-14

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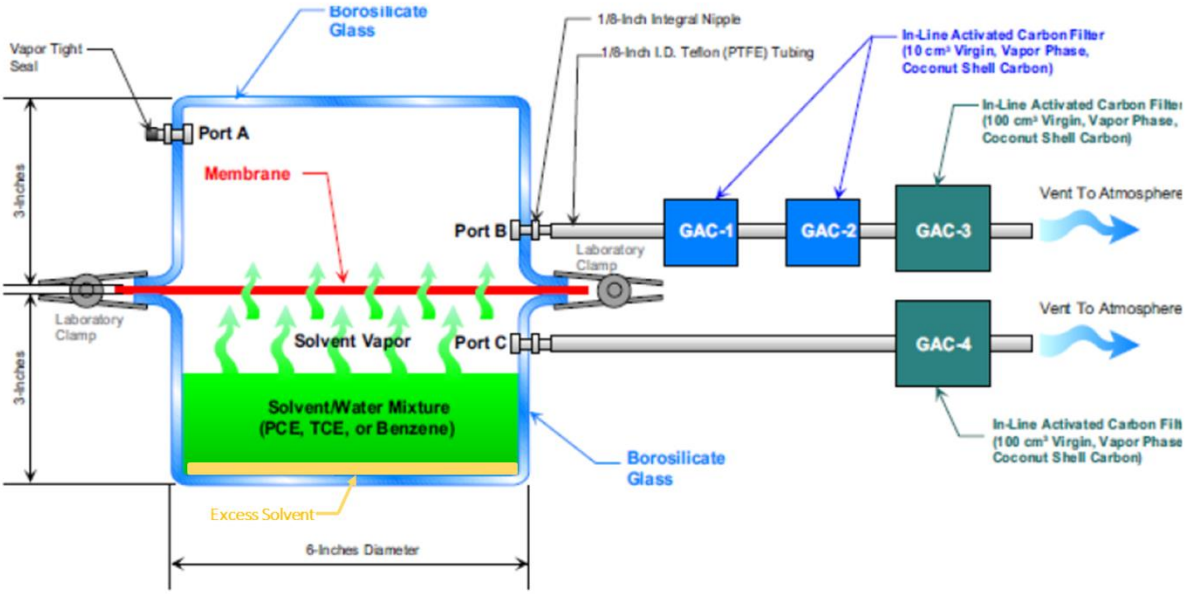

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SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vertical applied sheet waterproofing.

B. Horizontal applied sheet waterproofing.
   1. Horizontally applied product may be used as a vapor barrier.

1.02 RELATED REQUIREMENTS

A. 01 43 39 - Mockups: For mockup requirements.

B. 01 35 15 - LEED Certification Procedures: For additional requirements of LEED Certification.

C. 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

D. 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.

1.03 SUBMITTALS

A. Qualification Data: For installer and manufacturer.

B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. LEED Submittals: For components of this section submit the following in compliance with Section 01 35 15 - LEED Certification Procedures.
   1. Materials and Resources Submittals:
      a. MR Credit BPDO - Material Ingredients, Option 1: Documentation disclosing a manufacturer inventory in accordance with Section 01 35 15 - LEED Certification Procedures.

E. Manufacturer's Installation Instructions: Indicate special preparation of substrate, installation and attachment methods, and perimeter conditions requiring special attention.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the manufacture of work specified in this section with minimum 5 years of experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.05 MOCKUPS

A. Refer to Section 01 43 39 - Mockups for requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. As required by the manufacturer for a warrantable installation of the installed products to meet the Performance and Design Criteria.

1.07 WARRANTY

A. Installation Warranty: Contractor shall correct defective Work within a 2 year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

B. Manufacturer Warranty: Provide five year warranty for waterproofing failing to resist penetration of water.

1. Exception: Where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN CRITERIA

A. Provide materials the meet the guidelines in Section 01 35 15 - LEED Certification Procedures.
   1. MR Credit BPDO - Environmental Product Declarations (EPD), Option 1: LCA or EPD reports or compliant summary for each product in this section with a compliant evaluation.

2.02 SHEET WATERPROOFING

A. Basis of Design: Coreflex 60 by CETCO.

B. Performance Criteria:
   1. Hydrostatic Pressure Resistance: ASTM D5385, 231ft (70m)

C. Puncture Resistance: ASTM D4833, 228 lbf (1014N)
   1. Breaking Yield Strength: ASTM D751, 318 lbf/in (62.2 N/mm)
   2. Low Temperature Flexibility: (-30°F), ASTM D2136, Pass
   3. Water Vapor Retarder: ASTM E17475, Class A
   4. Water Vapor Transmission: ASTM E96, 0.1 perms (0.036 gr/m/hr)
   5. Tensile Strength: ASTM E154, 387 lbf/in (68 kN/m)
   6. Puncture Resistance: ASTM D1709, 12 lbs (5500 grams)

D. Features:
   1. Material: Elvaloy KEE based thermoplastic membrane, with reinforced fabric integrally bonded to an Active Polymer Core (APC).
   2. Thickness: 60 mil (1.5 mm) nominal
   3. Reinforcing Fabric: 5.0 oz. weft inserted knit polyester fabric
   4. Designed for use on backfilled walls.
   5. Width: 54-inches

2.03 DRAINAGE PANELS

A. Composite Drainage Panels: Drainage panel acceptable to waterproofing manufacturer and consisting of a nonbiodegradable core of fused, entangled filaments or a three-dimensional drainage net; with a geotextile facing on both sides.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cetco; Aquadrain 15X.
      b. Fabric Flow Rate: 150 gpm/ft2 per ASTM D 4491
      c. Fabric Permeability: 0.20 cm/second per ASTM D 4491

2.04 ACCESSORIES

A. All accessory materials required by the manufacturer for a warrantable installation of the installed products in a manner that meets the Performance and Design Criteria.

B. Manufacturer's optional accessories required by the project:
   1. Waterstops: Refer to Section 03 30 00 - Cast-in-Place Concrete.
   2. Seaming Materials:
      a. As recommended by membrane manufacturer.
   3. Membrane Sealant: As recommended by membrane manufacturer.
      a. As recommended by membrane manufacturer.
   4. Termination Bars: Stainless steel.
      a. Stainless steel; compatible with membrane and adhesives.
   5. Surface Conditioner:
      a. Type, compatible with membrane.

6. Adhesives:
   a. As recommended by membrane manufacturer.
7. Thinner and Cleaner:
   a. As recommended by adhesive manufacturer, compatible with sheet membrane.
8. Protection Board:
   a. Type capable of preventing damage to waterproofing due to backfilling and construction traffic.
9. Waterstop:
   a. Cetco; RX Waterstop.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions meet the manufacturer's requirements before starting work.

3.02 PREPARATION

A. Prepare surfaces to receive work in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. General: Install all materials in accordance with manufacturer's instructions based on conditions present.

3.04 FIELD QUALITY CONTROL

A. Prior to placing concrete slab over the vapor barrier and verify smoke testing.

B. Prior to placing concrete slab over the vapor barrier, contact Engineer to observe vapor barrier installation.

C. Verify vapor control barrier in installed accordance with the drawings and specifications.

D. Do not proceed with slab pour without written certification the successful installation of the vapor control barrier, signed by Contractor and Engineer.

3.05 PROTECTION

A. Protect installed work as required by the manufacturer to maintain product performance, design criteria, and warranty.

3.06 CLEANING

A. Dispose of all waste material in compliance with project’s Waste Management Plan in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

END OF SECTION 07 13 00

APPENDIX L
Draft Environmental Covenant

After Recording, Return
Original Signed Covenant to:

Tena Seeds P.E.
Toxics Cleanup Program
Department of Ecology
Northwest Regional Office
PO Box 330316
Shoreline, WA 98133-9716

Environmental Covenant

Grantor: 800 Mercer, LLC

Grantee: State of Washington, Department of Ecology (hereafter "Ecology")

Brief Legal Description: Parcels A and B, City of Seattle Lot Boundary, Adjustment Number 3033220-LU, recorded under Recording No. 20190524900001

Parcel A, City of Seattle Lot Boundary Adjustment Number 3033220-LU, recorded under Recording No. 20190524900001

Parcel B, City of Seattle Lot Boundary Adjustment Number 3033220-LU, recorded under Recording No. 20190524900001

Tax Parcel Nos.: 2249000055 and 2249000006

Cross Reference: Prospective Purchaser Consent Decree No. 22-2-02695-2 SEA and all Exhibits attached thereto

RECITALS

a. This document is an environmental (restrictive) covenant (hereafter "Covenant") executed pursuant to the Model Toxics Control Act ("MTCA"), chapter 70A.305 RCW, and Uniform Environmental Covenants Act ("UECA"), chapter 64.70 RCW.

b. The Property that is the subject of this Covenant is part or all of a site commonly known as Seattle DOT Mercer Parcels, Cleanup Site ID #14784, Facility Site ID #27913. The Property is legally described in Exhibit A, and illustrated in Exhibit B, both of which are attached (hereafter

"Property"). If there are differences between these two Exhibits, the legal description in Exhibit A shall prevail.

c. The Property is the subject of remedial action conducted under MTCA. This Covenant is required because residual contamination remains on and beneath the Property after completion of remedial actions. Specifically, the following principal contaminants remain on and beneath the Property:

Medium	Principal Contaminants Present
Soil	Chlorinated Volatile Organic Compounds (CVOCs) including tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC)
Groundwater	CVOCs including PCE, TCE, cis-1,2-DCE, and VC
Soil Gas	CVOCs including PCE, TCE, cis-1,2-DCE, and VC
Surface Water/Sediment	N/A

d. It is the purpose of this Covenant to restrict certain activities and uses of the Property to protect human health and the environment and the integrity of remedial actions conducted at the site. Records describing the extent of residual contamination and remedial actions conducted are available through Ecology or can be found online at https://apps.ecology.wa.gov/cleanupsearch/site/14784, including:

- Final Remedial Investigation Report – February 3, 2022
- Final Focused Feasibility Study Report – February 3, 2022
- Final Cleanup Action Plan – February 8, 2022
- Final Engineering Design Report - _____, 2023
- Final Environmental Media Management Plan - _____, 2023
- Cleanup Action Report - _____, 20__

e. This Covenant grants Ecology certain rights under UECA and as specified in this Covenant. As a Holder of this Covenant under UECA, Ecology has an interest in real property, however, this is not an ownership interest which equates to liability under MTCA or the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9601 *et seq.* The rights of Ecology as an "agency" under UECA, other than its right as a holder, are not an interest in real property.

COVENANT

800 Mercer, LLC, as Grantor and fee simple owner of the Property hereby grants to the Washington State Department of Ecology, and its successors and assignees, the following covenants. Furthermore, it is the intent of the Grantor that such covenants shall supersede any prior interests the Grantor has in the property and run with the land and be binding on all current and future owners of any portion of, or interest in, the Property.

Section 1. General Restrictions and Requirements.

The following general restrictions and requirements shall apply to the Property:

a. Interference with Remedial Action. The Grantor shall not engage in any activity on the Property that may impact or interfere with the remedial action and any operation, maintenance, inspection or monitoring of that remedial action without prior written approval from Ecology.

b. Protection of Human Health and the Environment. The Grantor shall not engage in any activity on the Property that may threaten continued protection of human health or the environment without prior written approval from Ecology. This prohibition includes, but is not limited to, any activity that results in the release of residual contamination that was contained as a part of the remedial action or that exacerbates or creates a new exposure to residual contamination remaining on the Property.

c. Continued Compliance Required. Grantor shall not convey any interest in any portion of the Property without providing for the continued adequate and complete operation, maintenance and monitoring of remedial actions and continued compliance with this Covenant.

d. Leases. Grantor shall restrict any lease for any portion of the Property to uses and activities consistent with this Covenant and notify all lessees of the restrictions on the use of the Property.

e. Preservation of Reference Monuments. Grantor shall make a good faith effort to preserve any reference monuments and boundary markers used to define the areal extent of coverage of this Covenant. Should a monument or marker be damaged or destroyed, Grantor shall have it replaced by a licensed professional surveyor within 30 days of discovery of the damage or destruction.

Section 2. Specific Prohibitions and Requirements.

In addition to the general restrictions in Section 1 of this Covenant, the following additional specific restrictions and requirements shall apply to the Property.

a. Containment of Contamination.

The Grantor shall not alter or remove the existing structures on the Property in any manner that would expose contaminated soil or groundwater, result in a release to the environment of contaminants, or create a new exposure pathway, without prior written approval of Ecology. Should the Grantor propose to remove all or a portion of the existing structures illustrated in Exhibit C so that access to the underlying contamination is feasible, Ecology may require treatment or removal of the underlying contaminated soil or groundwater.

The Grantor covenants and agrees that it shall annually, or at another time as approved in writing by Ecology, inspect the building and report within thirty (30) days of the inspection the condition of the building and any changes to the building that would impair its performance.

b. Vapor/gas controls.

The residual contamination on the Property includes volatile constituents that may generate harmful vapors. As such, the following restrictions shall apply on the Property to minimize the potential for exposure to these vapors:

- No building or other enclosed structure shall be constructed on the Property unless approved by Ecology.

- If a building or other enclosed structure is approved, it shall be constructed with a sealed foundation and a vapor/gas control system that is operated and maintained to prevent the

migration of vapors/gas into the building or structure, unless an alternative approach is approved by Ecology.

c. Stormwater Facilities

To minimize the potential for mobilization of contaminants remaining in the soil or groundwater on and beneath the Property, no stormwater infiltration facilities or ponds shall be constructed on the Property. All stormwater catch basins, conveyance systems, and other appurtenances located within the Property shall be of water-tight construction.

d. Groundwater Use

The groundwater beneath the Property remains contaminated and shall not be extracted for any purpose other than temporary construction dewatering, investigation, monitoring or remediation. Drilling of a well for any water supply purpose is strictly prohibited. Groundwater extracted from the Property for any purpose shall be considered potentially contaminated and any discharge of this water shall be done in accordance with state and federal law.

Section 3. Access.

a. The Grantor shall maintain clear access to all remedial action components necessary to construct, operate, inspect, monitor and maintain the remedial action.

b. The Grantor freely and voluntarily grants Ecology and its authorized representatives, upon reasonable notice, the right to enter the Property at reasonable times to evaluate the effectiveness of this Covenant and associated remedial actions, and enforce compliance with this Covenant and those actions, including the right to take samples, inspect any remedial actions conducted on the Property, and to inspect related records.

c. No right of access or use by a third party to any portion of the Property is conveyed by this instrument.

Section 4. Notice Requirements.

a. Conveyance of Any Interest. The Grantor, when conveying any interest in all of or a portion of the Property**,** including but not limited to title, easement, leases, and security or other interests, must:

i. Provide written notice to Ecology of the intended conveyance at least thirty (30) days in advance of the conveyance. This notice requirement does not apply to the lease of space for commercial uses within the buildings located on the Property. Waiver of this advance notice to Ecology for these transactions does not constitute waiver of this notice for the entire Property nor a waiver of the requirement in Section 4.a.ii. to include a notice in any document conveying interest in the Property.

ii. Include in the conveying document a notice in substantially the following form, as well as a complete copy of this Covenant:

NOTICE: THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL COVENANT GRANTED TO THE WASHINGTON STATE DEPARTMENT OF ECOLOGY ON [DATE] AND RECORDED WITH THE [COUNTY] COUNTY AUDITOR UNDER RECORDING NUMBER [RECORDING NUMBER]. USES AND ACTIVITIES ON THIS PROPERTY MUST COMPLY WITH THAT

COVENANT, A COMPLETE COPY OF WHICH IS ATTACHED TO THIS DOCUMENT.

iii. Unless otherwise agreed to in writing by Ecology, provide Ecology with a complete copy of the executed document within thirty (30) days of the date of execution of such document.

b. Reporting Violations. Should the Grantor become aware of any violation of this Covenant, Grantor shall promptly report such violation in writing to Ecology.

c. Emergencies. For any emergency or significant change in site conditions due to Acts of Nature (for example, flood or fire) resulting in a violation of this Covenant, the Grantor is authorized to respond to such an event in accordance with state and federal law. The Grantor must notify Ecology in writing of the event and response actions planned or taken as soon as practical but no later than within 24 hours of the discovery of the event.

d. Notification procedure. Any required written notice, approval, reporting or other communication shall be personally delivered or sent by first class mail to the following persons. Any change in this contact information shall be submitted in writing to all parties to this Covenant. Upon mutual agreement of the parties to this Covenant, an alternative to personal delivery or first class mail, such as e-mail or other electronic means, may be used for these communications.

Christian Gunter Darya Saber 800 Mercer, LLC 400 Dexter Avenue North Suite 200 Seattle, WA 98109 cgunter@are.com dsaber@are.com	Environmental Covenants Coordinator Washington State Department of Ecology Toxics Cleanup Program P.O. Box 47600 Olympia, WA 98504 – 7600 (360) 407-6000 ToxicsCleanupProgramHQ@ecy.wa.gov

Section 5. Modification or Termination.

a. Grantor must provide written notice and obtain approval from Ecology at least sixty (60) days in advance of any proposed activity or use of the Property in a manner that is inconsistent with this Covenant. For any proposal that is inconsistent with this Covenant and permanently modifies an activity or use restriction at the site:

i. Ecology must issue a public notice and provide an opportunity for the public to comment on the proposal; and

ii. If Ecology approves of the proposal, the Covenant must be amended to reflect the change before the activity or use can proceed.

b. If the conditions at the site requiring a Covenant have changed or no longer exist, then the Grantor may submit a request to Ecology that this Covenant be amended or terminated. Any amendment or termination of this Covenant must follow the procedures in MTCA and UECA and any rules promulgated under these chapters.

c. By signing this agreement, per RCW 64.70.100, the original signatories to this agreement, other than Ecology, agree to waive all rights to sign amendments to and termination of this Covenant.

Section 6. Enforcement and Construction.

a. This Covenant is being freely and voluntarily granted by the Grantor.

b. Within ten (10) days of execution of this Covenant, Grantor shall provide Ecology with an original signed Covenant and proof of recording and a copy of the Covenant and proof of recording to others required by RCW 64.70.070.

c. Ecology shall be entitled to enforce the terms of this Covenant by resort to specific performance or legal process. All remedies available in this Covenant shall be in addition to any and all remedies at law or in equity, including MTCA and UECA. Enforcement of the terms of this Covenant shall be at the discretion of Ecology, and any forbearance, delay or omission to exercise its rights under this Covenant in the event of a breach of any term of this Covenant is not a waiver by Ecology of that term or of any subsequent breach of that term, or any other term in this Covenant, or of any rights of Ecology under this Covenant.

d. The Grantor shall be responsible for all costs associated with implementation of this Covenant. Furthermore, the Grantor, upon request by Ecology, shall be obligated to pay for Ecology's costs to process a request for any modification or termination of this Covenant and any approval required by this Covenant.

e. This Covenant shall be liberally construed to meet the intent of MTCA and UECA.

f. The provisions of this Covenant shall be severable. If any provision in this Covenant or its application to any person or circumstance is held invalid, the remainder of this Covenant or its application to any person or circumstance is not affected and shall continue in full force and effect as though such void provision had not been contained herein.

g. A heading used at the beginning of any section or paragraph or exhibit of this Covenant may be used to aid in the interpretation of that section or paragraph or exhibit but does not override the specific requirements in that section or paragraph.

The undersigned Grantor warrants that it holds the title to the Property and has authority to execute this Covenant.

EXECUTED this _____ day of _____, 20___.

_____

By: _____

Title: _____

CORPORATE ACKNOWLEDGMENT

STATE OF _____

COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the _____ of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

_____
Notary Public in and for the State of Washington
Residing at _____
My appointment expires _____

The Department of Ecology**,** hereby accepts the status as GRANTEE and HOLDER of the above Environmental Covenant.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

_____

By: _____

Title: _____

Dated: _____

Exhibit A

LEGAL DESCRIPTION

Exhibit B

PROPERTY MAP

Exhibit C

MAP ILLUSTRATING LOCATION OF RESTRICTIONS

While a map illustrating the location of the restrictions is required, the grantor has the option of creating a separate map or including this information in Exhibit B.

More than one map may be necessary to illustrate the area subject to restrictions. For example, the area encompassing a soil cap may be different than the area where vapor or groundwater contamination is a concern.

The area subject to the restrictions, if less than the entire property, should be a contiguous area with even boundaries that follow physical features on the site so the boundary can be easily discerned in the field.